C-1-10

TM 55-1520-202-34

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD MAINTENANCE MANUAL

ARMY MODELS
CH-34A AND CH-34C AIRCRAFT

(SIKORSKY)

HEADQUARTERS, DEPARTMENT OF THE ARMY
JANUARY 1964

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *20 January 1964*

TM 55-1520-202-34 is published for the use of all concerned.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31 requirements for field maintenance instructions for CH-34 aircraft.

☆U. S. GOVERNMENT PRINTING OFFICE: 1964—700928/197

This manual supersedes TM 55-1520-202-34, 29 January 1962, including Changes 1, 6 September 1962.

DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL
ARMY MODELS CH-34A AND CH-34C AIRCRAFT

TM 55-1520-202-34
Changes No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *16 July 1964*

TM 55-1520-202-34, 20 January 1964, is changed as follows:

	Remove page	Insert page
Chapter 2, section II	2-25 and 2-26	2-25 thru 2-26A
section III	3-33 thru 3-36	3-33 thru 3-34A
		3-35 thru 3-36A
	3-81 and 3-82	3-81 thru 3-82A
section IV	4-15 thru 4-22	4-15 thru 4-18A
		4-19 thru 4-22
section VII	7-25 thru 7-30	7-25 thru 7-26B
		7-27 thru 7-30A
Chapter 3, section III	3-1 and 3-2	3-1 thru 3-2A
	3-13 and 3-14	3-13 and 3-14
section VI	6-7/6-8	6-7

By Order of the Secretary of the Army:

HAROLD K. JOHNSON
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31 requirements for direct and general support maintenance instructions for CH-34 aircraft.

☆U. S. GOVERNMENT PRINTING OFFICE: 1964—750921/20

TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

SECTION I
SCOPE

1–1. Parts III and IV (TM 55-1520-202-34) of the multiple part manual, issued expressly for Field Maintenance personnel (3rd and 4th echelon) is the official document for Army Model CH-34A and CH-34C Helicopters, serial No. 53-4475 through 53-4554, 54-882 through 54-937, 54-2860 through 54-2914, 54-2995 through 54-3050, 55-4462 through 55-4504, 56-4284 through 56-4342, 57-1684 through 57-1770, and 58-1721. The information contained in this manual, coupled with information contained in Parts I and II (TM 55-1520-202-10 and TM 55-1520-202-20) comprises the complete maintenance instructions for Field Maintenance activities. A table of contents for Parts III and IV of the multiple part manual is provided at the front of this manual to assist in determining the chapter in the manual in which individual functions are covered. The study and use of this manual will enable a maintenance crew to perform the assigned functions with maximum efficiency.

1–2. The technically accurate information contained herein will be maintained in a current status by manufacturer coordination with the Transportation Material Command. Such changes, additions, and/or deletions will be made as improvements in the product are made and as improved service methods or procedures are developed.

1–3. Distribution and revision of pages contained in this technical manual is accomplished in accordance with AR 310-1.

1–4. Throughout this manual, reference is made to Notes, Cautions, and Warnings to emphasize important and critical instructions. The Notes, Cautions, and Warnings are used, as applicable, for the following conditions:

Note

An operating procedure, condition, etc., which is essential to highlight.

CAUTION

Operating procedures, practices, etc, which if not strictly observed, will result in damage to or destruction of equipment.

WARNING

Operating procedures, practices, etc, which will result in personnel injury or loss of life if not correctly followed.

1–5. Authorization for issue of this technical manual will be made in accordance with AR 310-3.

1–6. The direct reporting of errors, omissions, and recommendations for improving this manual by the individual user is authorized and encouraged. DA Form 2028 will be used for reporting these improvements. This form may be completed, using pencil, pen, or typewriter. DA Form 2028 will be completed in triplicate and forwarded by the individual using the manual. The original and one copy will be forwarded directly to Commanding General, U. S. Army Aviation and Surface Materiel Command, P.O. Box 209, Main Office, St. Louis, Missouri, 63166. One information copy will be provided to the individual's immediate supervisor (e.g., officer, noncommissioned officer, supervisor, etc.).

1–7. Do not destroy any pages in this manual unless the data contained thereon has been replaced, superseded, or included in the manual by a revision or reissue.

SECTION II

GENERAL

2–1. The Field Maintenance Manual is divided into five chapters, four appendices, and an index. Each chapter and appendix and the index is described, as follows:

2–2. CHAPTER 1. INTRODUCTION. This chapter notes the intent of Part III and IV of the family of publications, signifies the responsibilities for maintaining the information contained therein, briefly describes each chapter, and lists maintenance forms required.

2–3. CHAPTER 2. FIELD MAINTENANCE. This chapter contains all information necessary for personnel to accomplish Army field maintenance on the complete airframe, its components and systems with functions and related functions of the same general scope and magnitude as prescribed for field maintenance activities in the Maintenance Allocation Chart in TM 55-1520-202-20, Appendix II.

2–4. CHAPTER 3. FIELD MAINTENANCE STRUCTURAL REPAIR. This chapter contains instructions for repairing the structure of the helicopter. It is intended for use in conjunction with the Maintenance Engineering Manual for Structural Repair, TM 55-405-4, and will be used at the field maintenance level. This chapter does not include information which is beyond the scope of field maintenance activities. When repairs covered in the general manual are acceptable for this helicopter, a statement to that effect will be made in the appropriate section(s) of this chapter.

2–5. CHAPTER 4. REPAIR MATERIALS. This chapter contains a list of repair materials for use on the helicopter.

2–6. CHAPTER 5. STORAGE OF AIRCRAFT. The storage of aircraft will be found in TM 55-1520-202-20, Chapter 4.

2–7. INDEX. The index contains a list, in alphabetical order, of every important subject significant to field maintenance.

2–8. APPENDIX I. REFERENCES. This appendix lists references required by and available to using units for the performance of prescribed operations.

2–9. APPENDIX II. MAINTENANCE ALLOCATION CHART. The maintenance allocation chart will be found only in TM 55-1520-202-20, Appendix II. This chart reflects the maintenance functions to be performed at each echelon of maintenance.

2–10. APPENDIX III. REPAIR PARTS AND SPECIAL TOOLS LIST. (TM 55-1520-202-34P). This appendix catalogues repair parts and special tools that are required by and available to using units.

2–11. APPENDIX IV. WEIGHT AND BALANCE. This appendix contains data specifically applicable to the CH-34A and CH-34C helicopter. Sufficient data is provided so that field maintenance has the necessary instructions to perform their phase of this maintenance operation.

2–12. LIST OF MAINTENANCE FORMS.

2–13. DA FORM 2406. EQUIPMENT STATUS AND DEADLINE REPORT. This form provides a record of deadlined equipment and reason deadlined, of parts required.

2–14. DA FORM 2408-5. EQUIPMENT MODIFICATION RECORD. This form provides a record of each modification required, date of modification work request, date of completion, and organization affecting modification.

2–15. DA FORM 2408-6. EQUIPMENT MAINTENANCE RECORD (SUPPORT ECHELONS – FIELD & DEPOT). This form provides a record of repairs and services accomplished, parts used, and organization accomplishing repairs.

2–16. DA FORM 2408-16. COMPONENT INSTALLATION AND REMOVAL RECORD. This form provides a record of equipment installed in aircraft in addition to maintenance history of installed equipment.

2–17. DA FORM 2409. EQUIPMENT MAINTENANCE LOG (CONSOLIDATED). This form consists of four sections which provide a record of general information, maintenance inspection, repair and cost, and modification record.

2–18. DA FORM 2410. COMPONENT REMOVAL. REPAIR AND OVERHAUL RECORD. This form provides a record of components removed from aircraft, reason for removal, and repair or overhaul information.

CHAPTER 2
FIELD MAINTENANCE INSTRUCTIONS

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. The purpose of this chapter is to provide essential information for maintenance personnel to accomplish field maintenance on the complete airframe, components, systems, and assemblies to support each individual function requirement of other chapters of this manual. Included within this chapter are descriptions and instructions for the handling and use of ground support equipment. Where required, illustrations demonstrating the use of some of the ground support equipment are also included.

1-3. GROUND HANDLING.

1-4. HOISTING HELICOPTER. (See figure 1-1.) 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, 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.

1-5. HOISTING PYLON. (See figure 1-2.) The tail rotor pylon can be supported during removal or

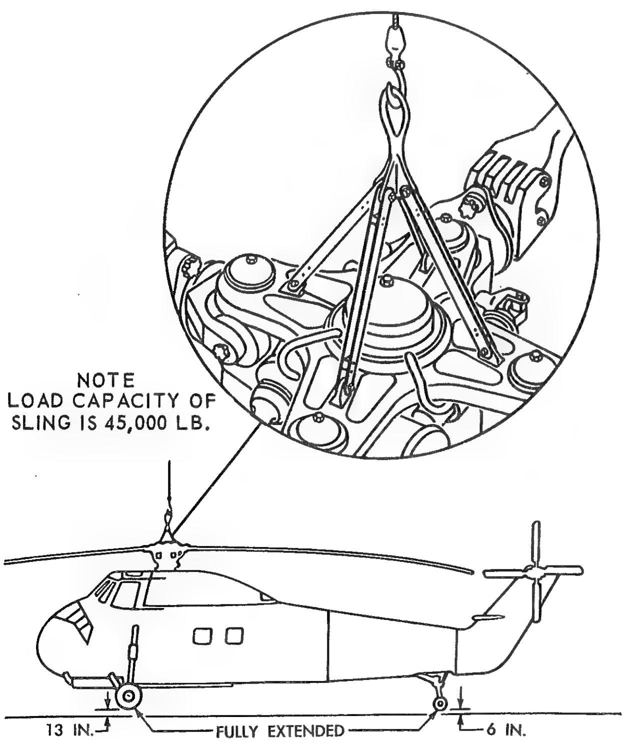


Figure 1-1. Hoisting Helicopter

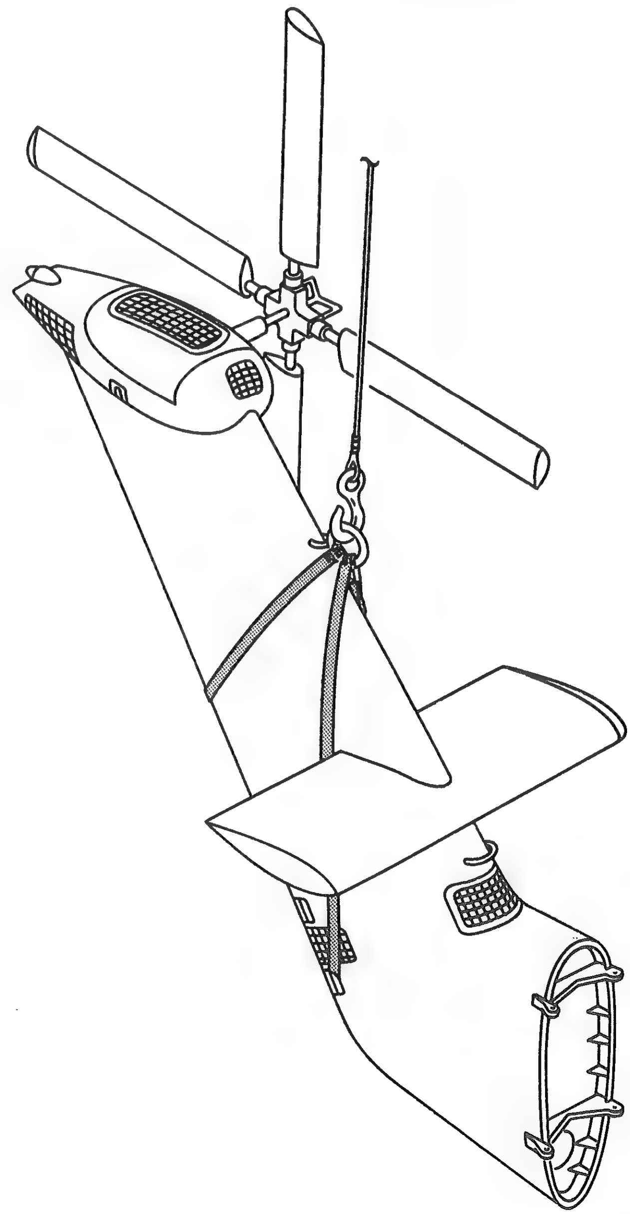


Figure 1-2. Hoisting Pylon

installation by using the pylon hoisting sling, part No. S1670-10449 or S1670-10449-4.

CAUTION

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

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

b. Attach hoist to ring.

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

d. Support weight of pylon with hoist while removing or installing attaching parts of pylon.

1–6. MAGNETIC AND FLUORESCENT INSPECTION.

1–7. DESCRIPTION. For information and instructions on magnetic particle inspection of parts to detect discontinuities or defects, refer to Magnetic Particle Inspection, Military Specification MIL-I-6868. For information and instructions on fluorescent inspection of parts to detect discontinuities or defects, refer to Penetrant Method of Inspection, Military Specification MIL-I-6866.

1–8. ACRYLIC SHEET PLASTIC.

1–9. DESCRIPTION. Acrylic sheet plastic is used for all transparent panel area in the fuselage of the helicopter except for the pilot's windshield which is of laminated glass.

1–10. REPAIR OF ACRYLIC SHEET PLASTICS. Complete information on the repair and surface refinishing of acrylic sheet plastics can be found in the Maintenance Engineering Manual for Structural Repair, TM 55-405-4. Any damage which impairs the pilot's vision will necessitate replacement of the laminated glass windshield panel.

1–11. HEAT TREAT AND HARDNESS TEST.

1–12. DESCRIPTION. For instructions on heat treating and hardness testing, refer to the Maintenance Engineering Manual for Structural Repair, TM 55-405-4.

1–13. SPECIAL TOOLS AND EQUIPMENT.

1–14. For the list of special tools and ground support equipment, with illustrations, refer to TM 55-1520-202-20P, Chapter 3, and TM 55-1520-202-34P, Chapter 3.

SECTION II

AIRFRAME AND LANDING GEAR

2–1. DESCRIPTION.

2–2. The airframe portion of Models CH-34A and CH-34C helicopters consists of three main sections, with each section detachable from the other. The sections are identified as the forward fuselage section, the tail cone (aft fuselage) section, and the folding pylon section. The landing gear consists of two main landing gear assemblies and a tail wheel assembly. Emergency flotation gear is provided as an attachment to the landing gear. Also covered in this section are such related items as the cargo sling, windshield wiper motor, and wheel brake assemblies.

2–3. FORWARD FUSELAGE SECTION.

2–4. The forward fuselage section is comprised of the engine compartment in the nose which is accessible through two large clamshell-type doors, the cockpit located aft and partially above the engine compartment, the cabin located aft of the engine compartment and below the cockpit, and the electrical and electronics compartment aft of the cabin.

2–5. NOSE DOORS.

2–6. REMOVAL. (See figure 2–1.)

a. Disconnect fire detector cable quick-disconnects (1).

b. Disconnect radio antenna wire disconnect plugs (2).

c. On helicopters serial No. 56-4316, 56-4320, 57-1684, and subsequent, disconnect nose door dampers (3).

d. Remove hinge bolts, washers, nuts, and cotter pins (4) from hinges (5).

e. Remove doors (6).

2–7. INSTALLATION. (See figure 2–1.)

a. Install doors (6).

b. Install hinge bolts, washers, nuts, and cotter pins (4).

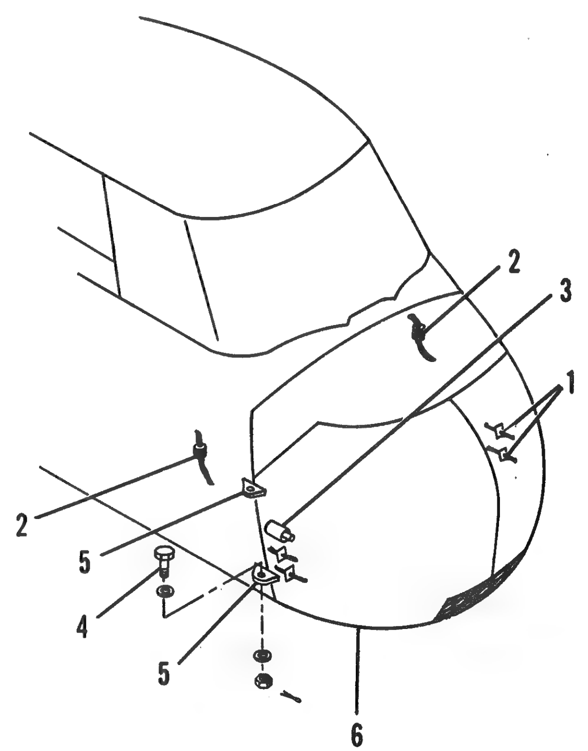
c. On helicopters serial No. 56-4316, 56-4320, 57-1684, and subsequent, connect nose door dampers (3).

d. Connect radio antenna wire disconnect plugs (2).

e. Connect fire detector cable quick-disconnects (1).

2–8. COCKPIT CANOPY ASSEMBLY.

2–9. CRITERIA FOR LIMITS AND TOLERANCES OF CANOPY DEFECTS. For the limit and tolerance standards governing defects of cockpit transparent panels, refer to TM 55-1520-202-20, Chapter 2, Section III.



1. Quick-Disconnect
2. Disconnect Plug
3. Nose Door Damper
4. Hinge Bolt, Washers, Nuts, Cotter Pin
5. Hinge
6. Nose Door

Figure 2–1. Nose Door Removal

2–10. REMOVAL.

a. Remove cockpit sliding windows. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

b. Remove screen assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

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

CAUTION

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

d. Remove service platforms. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

e. Remove pilot's and copilot's seats. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

f. Remove bolt that holds windshield wiper arm assembly to shaft of converter. Remove arm assembly.

g. Remove bolts which secure converter bracket to canopy skeleton.

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

i. Remove pitot tube. (Refer to paragraph 8–5.) Disconnect lower end of pitot tubing from union below window opening. Remove clamps that secure tubing to cockpit canopy and canted bulkhead. Remove tubing.

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

WARNING

Make sure that switches identified as BATT and GENERATOR are off and that external power is disconnected.

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

l. Remove power supply cables from overhead control panel. (Refer to paragraph 9–40.)

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

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

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

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

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

r. Within cockpit canopy assembly, remove bolts and washers that secure auxiliary servo and mixer and upper cover supporting panels to canted bulkhead. Remove cover from servo and mixer assembly and from lower cover.

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

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

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

v. Unfasten canted bulkhead from transmission attaching fitting, located at each forward corner of transmission deck.

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

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

CAUTION

Care must be exercised when removing cockpit canopy from transmission attaching fittings to prevent nicking or scratching the fittings. For repair of fittings, refer to Chapter 3, paragraph 4–26.

Note

Components removed in steps y through *am* are not furnished with new cockpit canopy and should be retained with helicopter.

y. Remove nuts, screws, and washers that secure two electrical receptacles to forward right-hand side of canted bulkhead. Remove overhead control panel with receptacles and wiring attached. (Refer to paragraph 9–40.)

z. Remove R-11A loop antenna. (Refer to TM 55-1520-202-20, Chapter 2, Section XIV.)

aa. Remove rotor brake master cylinder. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

ab. Remove accumulator. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

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

ad. Disconnect wiring at back of standby compass.

ae. Remove standby compass. (Refer to TM 55-1520-202-20, Chapter 2, Section X.)

af. Remove free-air thermometer. (Refer to TM 55-1520-202-20, Chapter 2, Section X.)

ag. Remove map case and flight report holder. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

ah. Remove data case. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

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

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

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

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

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

2–11. INSTALLATION.

Note

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

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

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

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

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

e. Install data case. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

f. Install map case and flight report holder. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

g. Install free-air thermometer. (Refer to TM 55-1520-202-20, Chapter 2, Section X.)

h. Install standby compass. (Refer to TM 55-1520-202-20, Chapter 2, Section X.)

i. Connect wiring at back of standby compass.

j. Install accumulator. (Refer to TM 55-1520-202-20, Chapter 2, Section IV.)

k. Install rotor brake master cylinder. (Refer to TM 55-1520-202-20, Chapter 2, Section IV.)

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

m. Install R-11A loop antenna. (Refer to TM 55-1520-202-20, Chapter 2, Section XIV.)

n. Install overhead control panel with receptacles and wiring attached. (Refer to paragraph 9–41.)

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

p. Position cockpit canopy assembly on helicopter, using suitable sling and hoist.

CAUTION

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

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

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

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

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

u. Within cockpit canopy assembly, bolt auxiliary servo and mixer upper cover supporting panels to canted bulkhead. Install cover on servo and mixer assembly and on lower cover.

v. Remove plug and connect tubing to accumulator that extends from rotor brake. Secure and clamp tubing to canted bulkhead. Bleed rotor system. (Refer to TM 55-1520-202-20, Chapter 2, Section IV.)

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

x. Push power supply cables and small bundle of wiring through canted bulkhead openings and connect cables to overhead control panel.

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

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

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

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

ac. Install pitot tube. (Refer to paragraph 8–3.) Connect lower end of pitot tubing to union below window opening. Install clamps that secure tubing to cockpit canopy and canted bulkhead.

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

ae. Bolt arm assembly to converter shaft. Secure bolt with lock wire.

af. Install pilot's and copilot's seats. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

ag. Install service platforms. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

CAUTION

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

ab. Secure fairing installation to canted bulkhead with screws.

ai. Install screen assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

aj. Install cockpit sliding windows. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

2–12. TAIL CONE AFT FUSELAGE SECTION.

2–13. TAIL CONE.

2–14. DESCRIPTION. The tail cone is bolted to the rear of the forward fuselage section at fuselage station 316. The tail cone supports the pylon (folding tail section) and the tail landing gear. Access to the tail cone attachment bolts, tail rotor flight and tail landing gear lock controls, and 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 2–2.)

2–15. REMOVAL.

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

b. Disconnect tail rotor flight controls at turnbuckles, located in forward portion of tail cone. (Refer to paragraph 7–132.)

Figure 2–2. Pylon Folding Hinge Lock

c. Remove pylon quick-change unit. (Refer to paragraph 2–29.)

CAUTION

Extreme care must be exercised when removing tail cone or pylon sections to avoid nicks, scratches, or other damage to tail cone pylon hinge assemblies. For repair information, refer to Chapter 3, Sections III and IV.

d. Remove heater components located aft of plenum duct assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section XI.)

e. Disconnect and remove fourth section of tail rotor drive shaft. (Refer to paragraph 4–114.)

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

CAUTION

To avoid crushing skin, do not place supporting cradles between bulkheads or frames. Use sponge-type rubber between structure and supporting cradles to avoid marring skin. For repair information, refer to Chapter 3, Sections III and IV.

g. Remove tail landing gear. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

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

i. Remove pylon folding hinge lock and pin signal flag. (Refer to paragraph 2–20.)

j. Remove tail rotor flight control components located in tail cone. (Refer to paragraph 7–129.)

2–16. REPAIR. (Refer to Chapter 3, Section IV.)

2–17. INSTALLATION.

Note

In the event sponge weather stripping loosens at tail cone frame aft of hinge bulkhead, apply cement EC-711, manufactured by Minnesota Mining and Manufacturing Company, to refasten stripping to frame and intercostal angle and to tail cone skin. Check and trim sponge ends to eliminate interference at skin cutouts.

a. Install pylon folding hinge lock and pin signal flag. (Refer to paragraph 2–21.)

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

CAUTION

To avoid crushing skin, do not place supporting cradles between bulkheads or frames. Use sponge-type rubber between structure and supporting cradles to avoid marring skin. For repair information, refer to Chapter 3, Sections III and IV.

c. Install tail landing gear. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

d. Install fourth section of tail rotor drive shaft. (Refer to paragraph 4–119.)

e. Install heater components located aft of plenum duct assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section XI.)

f. Install tail rotor flight controls in tail cone. (Refer to paragraph 7–129.)

g. Install pylon quick-change unit. (Refer to paragraph 2–32.)

CAUTION

Extreme care must be exercised when installing tail cone or pylon sections to avoid nicks, scratches, or other damage to tail cone and pylon hinge assemblies. For repair information, refer to Chapter 3, Sections III and IV.

h. Connect aft end of wire antenna to mast.

2–18. PYLON FOLDING HINGE LOCK AND PIN SIGNAL FLAG.

2–19. DESCRIPTION. (See figure 2–2.) 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 jackpin nuts, two collars, two receptacles, two jackscrew pins, a ratchet wrench, and a sleeve. A jackpin nut is fastened to each end of the torque tube. The torque tube and jackpin 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 jackscrew pin is threaded into each jackpin nut and extends into the hinge receptacle. The ratchet wrench is installed over the hexagonal shoulder of the upper jackpin 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 jackpin nuts turn, causing the jackscrew pins to move through the receptacles and into the hinges, thus locking the pylon to the tail cone. When the upper jackscrew 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.

2–20. REMOVAL.

a. Fold pylon. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

b. Actuate ratchet wrench (8, figure 2–3) to lock jackscrew pins (4 and 17) tightly in locked position.

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

d. Remove screws and lockwashers (3 and 19) which secure collars (7 and 14) at hinge receptacles (2 and 18.) Unscrew collars (7 and 14) from hinge receptacles (2 and 18).

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

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

g. Remove hinge receptacles (2 and 18) from hinges by removing screws and lockwashers (5 and 16).

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

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

2–21. INSTALLATION. (See figure 2–3.)

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

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

Note

With flag in PIN OUT position, tension on spring should be 1-3/4 ± 1/8 pounds.

c. Install hinge receptacles (2 and 18) on upper hinge (1) and lower hinge (20) with screws and lockwashers (5 and 16).

d. Pack hinge receptacles (2 and 18) with grease, Military Specification MIL-G-3278. Work jackscrew pins (4 and 17) into hinge receptacles (2 and 18) and upper and lower hinges (1 and 20).

e. Pack jackpin nuts (6 and 15) with grease, Military Specification MIL-G-3278. Assemble collar (7) and ratchet wrench (8) on jackpin nut (6). Position jackpin nut (6) in torque tube (12) and slide sleeve (11) up and over torque tube (12) and jackpin nut (6).

f. Assemble collar (14) and jackpin nut (15) at bottom end of torque tube (12).

g. Position assembled parts between upper and lower hinges (1 and 20). Screw jackpin nuts (6 and 15) onto jackscrew pins (4 and 17).

h. Screw collars (7 and 14) onto hinge receptacles (2 and 18) until they are fingertight and one of scallops on collar lines up with hole in side of each receptacle. Install screws and lockwashers (3 and 19) to secure collars.

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

Note

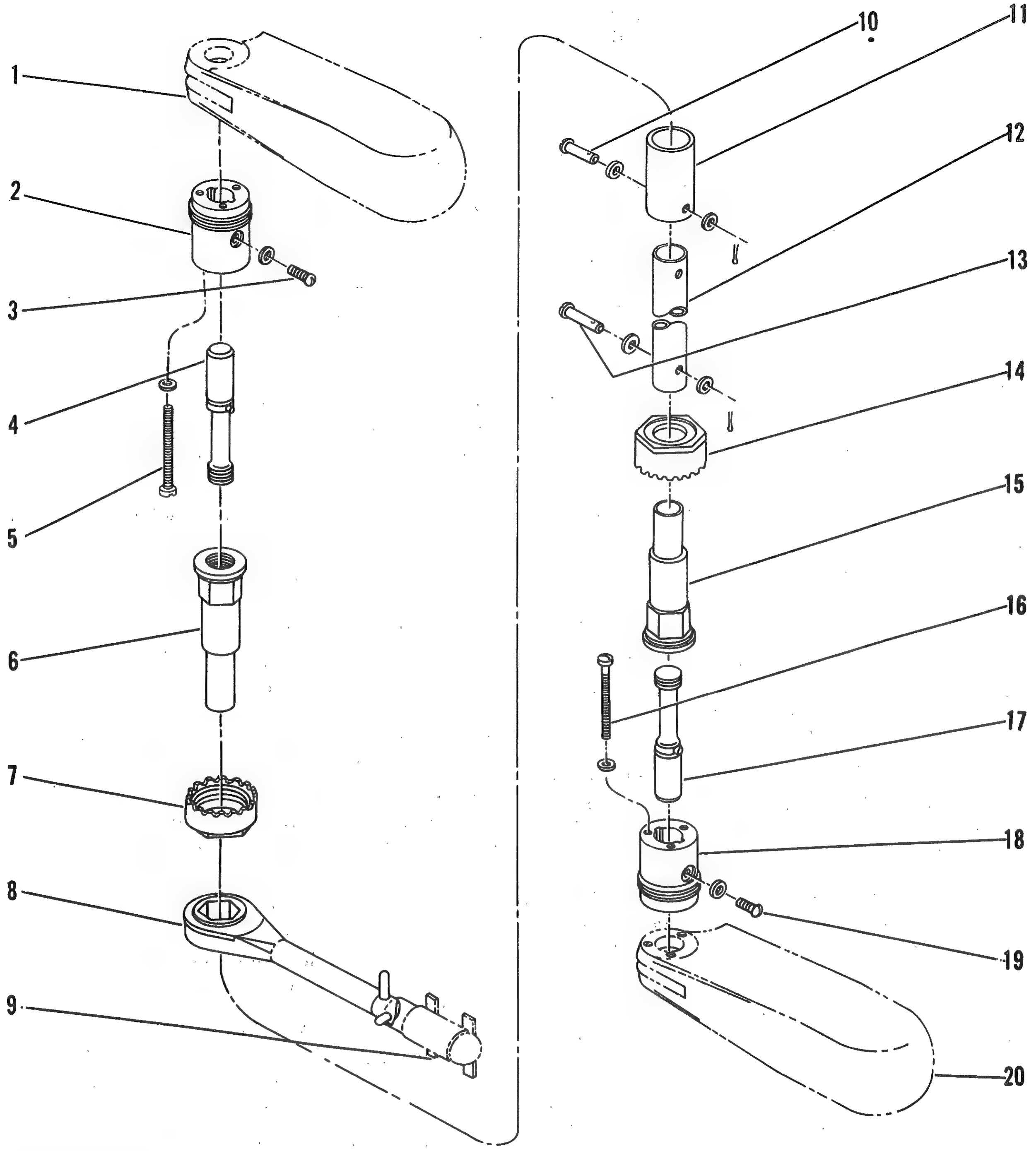
If new torque tube, jackpin nut, or sleeve is being installed, fully retract jackscrew pins (4 and 17) into jackpin nuts (6 and 15). Check and adjust, if necessary, jackpin nuts (6 and 15) to obtain flush position against hinge receptacles (2 and 18). Drill a No. 12 (0.189-inch diameter) hole to accommodate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

j. Unfold pylon. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

2–22. PYLON (FOLDING TAIL SECTION).

2–23. PYLON.

2–24. DESCRIPTION. The pylon supports the tail rotor assembly and associated transmission equipment and the stabilizer. Completely built-up pylons (pylon quick-change unit) may be maintained ready as a time saving expedient. The pylon is



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

Figure 2–3. Pylon Folding Hinge Lock Disassembled 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 2–2), 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. 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 pylon folding instructions in TM 55-1520-202-20, Chapter 2, Section II.) Handholes 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, which is screened for ventilation, provides access to the disconnect coupling, the disconnect shaft assembly, and intermediate gear box. The upper and lower stabilizer fairings provide access to the stabilizer turnbuckle assembly. The screened openings on each side of the pylon between the handholes provide ventilation for the intermediate gear box. The intermediate gear box panel, on the right side of the pylon, provides access to the intermediate gear box. The support bearing panel, 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 rubber coupling panel provides access to the rubber coupling, located at the tail rotor gear box. A top fairing grill and a tail rotor gear box fairing cover are installed at the top of the pylon. The yellow position light is installed at the top of the pylon. For specific location of pylon fairings, panels, and covers refer to access and inspection provisions, TM 55-1520-202-20, Chapter 2, Section II.

2–25. REMOVAL.

CAUTION

Use extreme care when removing pylon to avoid nicking, scratching, or damaging tail cone and pylon hinge assemblies. For repair information, refer to Chapter 3, Sections III and IV.

Note

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

a. Remove tail rotor and tail rotor gear box assemblies. (Refer to paragraph 4–163.)

b. Remove pylon drive shaft. (Refer to paragraph 4–155.)

c. Remove intermediate gear box and disconnect shaft assemblies from pylon. (Refer to paragraphs 4–138 and 4–144.)

d. Remove tail rotor drive shaft disconnect coupling. (Refer to paragraph 4–133.)

e. Remove pylon tail rotor flight control system components. (Refer to paragraph 7–129.)

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

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

h. Unfasten and remove terminal block from pylon structure.

Note

On helicopters serial No. 54-3026 and subsequent, a quick disconnect has been installed in electrical lead to pylon. Unplug disconnect and remove cable clamp when removing pylon.

i. Replace all pylon access panels and fairings.

j. Support pylon with hoisting sling, part No. S1670-10449 or part No. S1670-10449-4. (Refer to paragraph 1–5.)

CAUTION

Two handles on leading edge of pylon must never be used to support or hoist pylon.

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

Note

On helicopters serial No. 53-4512 and subsequent, pins are installed in place of bolts and nuts in upper and lower hinge assemblies.

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

2–26. INSTALLATION.

Note

In event sponge weather stripping loosens from pylon hinge fairing forward of hinge bulkhead, apply cement EC847, manufactured by Minnesota Mining and Manufacturing Company, to refasten stripping to hinge fairing angle and to pylon plating. Check and trim sponge ends to eliminate interference at fairing cutouts.

CAUTION

Use extreme care when installing pylon to avoid nicking, scratching, or damaging tail cone and pylon hinge assemblies. For repair information, refer to Chapter 3, Sections III and IV.

a. Lift pylon from padded cradle with hoisting sling, part No. S1670-10449 or S1670-10449-4. (Refer to paragraph 1–5.) Work left side of upper and lower hinge assemblies into tail cone hinge assemblies. Install hinge bolts, washers, nuts, and cotter pins.

CAUTION

Two handles on leading edge of pylon must never be used to support or hoist pylon.

Note

On helicopters serial No. 53-4512 and subsequent, pins are installed in place of bolts and nuts in upper and lower hinge assemblies.

Note

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

b. Remove all pylon access panels and fairing.

c. Position and secure position light wiring terminal block on pylon structure.

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

Note

On helicopters serial No. 54-3026 and subsequent, a quick disconnect has been installed in electrical lead to pylon. Position wiring and install cable clamp with screws, washers, and nuts. Plug in disconnect.

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

f. Install pylon tail rotor flight control system components. (Refer to paragraph 7–129.)

g. Install tail rotor drive shaft disconnect coupling. (Refer to paragraph 4–134.)

h. Install intermediate gear box and disconnect shaft assemblies. (Refer to paragraphs 4–139 and 4–150.)

i. Install pylon drive shaft. (Refer to paragraph 4–159.)

j. Install tail rotor gear box and tail rotor assemblies. (Refer to paragraph 4–169.)

k. Service intermediate and tail rotor gear boxes. (Refer to servicing instructions, TM 55-1520-202-20, Chapter 2, Section II.)

l. Inspect disconnect coupling for proper compression. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

m. Rig tail rotor flight controls. (Refer to paragraph 7–167.)

n. Replace all pylon access panels and fairings.

2–27. PYLON QUICK-CHANGE UNIT.

2–28. 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, tail rotor disconnect coupling and shaft, intermediate and tail rotor gear boxes, pylon drive shaft, tail rotor assembly, flight control rods, and yellow position light and wiring.

2–29. REMOVAL.

CAUTION

Use extreme care when removing pylon quick-change unit to avoid nicking, scratching, or damaging tail cone and pylon hinge assemblies. For repair information, refer to Chapter 3, Sections III and IV.

a. Fold pylon. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

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

Note

On helicopters serial No. 54-3026 and subsequent, a quick disconnect has been installed in electrical lead to pylon. Unplug disconnect and remove cable clamp when removing pylon.

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

d. Support pylon with hoisting sling, part No. S1670-10449 or S1670-10449-4. (Refer to TM 55-1520-202-20, Chapter 2, Section I.)

CAUTION

Two handles on leading edge of pylon must never be used to support or hoist pylon.

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

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

2–30. PREPARATION FOR STORAGE OR SHIPMENT.

a. Remove tail rotor blades, with spindles attached, from hub assembly. (Refer to paragraph 6–13.) Pack blades, with spindles attached, in padded rack of shipping container with leading edge down.

b. Tie blade attaching parts together and wrap in barrier material, Military Specification MIL-B-121. Place wrapped blade attaching parts in between layers of cushioning material in tail rotor blade rack.

c. Remove drain plugs and drain intermediate and tail rotor gear boxes. Replace plugs and fill gear boxes with mixture of three parts lubricating oil, Military Specification MIL-L-21260, Grade 2, and one part corrosion preventive, Military Specification MIL-C-6529. Rotate tail rotor hub by hand to circulate mixture throughout gear boxes. Remove plug and drain mixture from gear boxes. Replace plugs.

d. Coat all exposed machined surfaces with petrolatum, Federal Specification VV-P-236, and wrap with barrier material, Military Specification MIL-B-121.

e. Tie links to pitch change beam and counterweight assembly and wrap tail rotor hub pitch change beam, counterweight assembly, and links with barrier material, Military Specification MIL-B-121.

f. With hoisting sling, part No. S1670-10449 or S1670-10449-4 (paragraph 1–5), position pylon quick-change unit in cradle support assembly of shipping container, Ludwig Honold Manufacturing Company part No. E-3-10673. Leading edge of pylon must be placed downward in cradle support assembly. Remove hoisting sling.

g. Secure padded cap over trailing edge of pylon.

h. Secure pylon hinge container frame assembly.

i. Place metal straps with attached coil springs over padded cap on trailing edge of pylon and secure straps to saddle fittings of cradle support assembly.

j. Place 800 units of desiccant, Military Specification MIL-D-3464, in desiccant bracket.

k. Check for and remove any loose or foreign material from container.

l. Place cover on container and bolt two halves together.

m. Pressurize container to 3.5 psi. Allow container to stand for a minimum of 12 hours. Take a pressure reading. Permissible pressure drop is not to exceed 0.1 psi. If pressure drop is in excess of 0.1 psi, check all sealing surfaces. Open air valve and release air pressure. Close air valve.

2–31. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove cover from shipping container, Ludwig Honold Manufacturing Company part No. E-3-10673.

b. Remove blades, with spindles attached, and attaching parts.

c. Remove metal straps with attached coil springs that secure pylon to saddle.

d. Remove padded cap from pylon trailing edge.

e. Unbolt pylon hinges from container frame assembly.

f. Hoist pylon from shipping container with hoisting sling, part No. S1670-10449 or S1670-10449-4. (Refer to paragraph 1–5.)

CAUTION

Two handles on leading edge of pylon must never be used to support or hoist pylon.

g. Carefully swing pylon clear of shipping container and place in padded cradle. Remove hoisting sling.

h. Remove barrier material from exposed machined surfaces and clean corrosion-preventive compound from all surfaces with dry-cleaning solvent, Federal Specification P-S-661.

i. Remove barrier material from tail rotor hub, pitch change beam, counterweight assembly, and links, and clean parts with dry-cleaning solvent, Federal Specification P-S-661. Untie links from counterweight assembly and pitch change beam.

j. Flush intermediate and tail rotor gear boxes with lubricating oil, Military Specification MIL-L-21260, Grade 2. Service gear boxes. (Refer to servicing instructions, TM 55-1520-202-20, Chapter 2, Section II.)

k. Remove barrier material from tail rotor blade attaching parts and clean corrosion-preventive compound from all surfaces with dry-cleaning solvent, Federal Specification P-S-661.

l. Install tail rotor blades, with spindles attached, to hub assembly. (Refer to paragraph 6–24.)

2–32. INSTALLATION.

CAUTION

Use extreme care when installing pylon quick-change unit to avoid damaging tail cone and pylon hinge assemblies.

a. Remove pylon quick-change unit from padded cradle, using hoisting sling, part No. S1670-10449 or S1670-10449-4. (Refer to paragraph 1–5.)

CAUTION

Two handles on leading edge of pylon must never be used to support or hoist pylon.

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

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

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

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

Note

On helicopters serial No. 54-3026 and subsequent, a quick disconnect has been installed in electrical lead to pylon. Position wiring and install cable clamp with screws, washers, and nuts. Plug in disconnect.

f. Unfold and secure pylon. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

g. Inspect disconnect coupling for proper compression. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

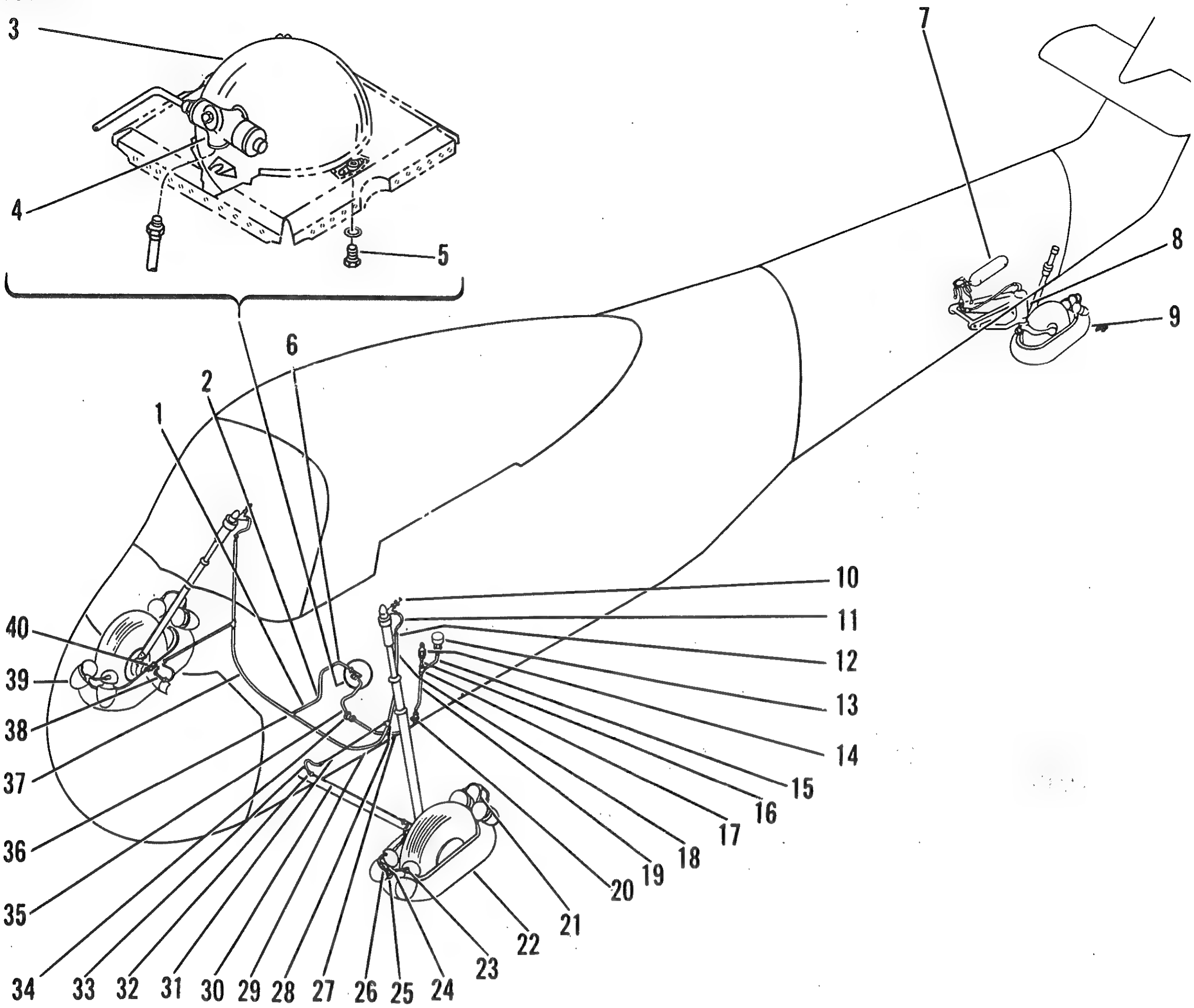
h. Check tail rotor flight control rigging. (Refer to paragraph 7–167.)

2–33. EMERGENCY FLOTATION GEAR INSTALLATION.

2–34. DESCRIPTION. (See figures 2–4 and 2–5.) On helicopters serial No. 56-4316, 56-4320, 57-1684, and 57-1697, the emergency flotation gear installation consists primarily of two main wheel floats, a tail wheel float, a compressed air sphere, an air cylinder installation, a swivel installation, and the necessary valves, tubing, wiring, and brackets. The system is armed by the ARM SW arming switch located on the instrument panel next to the pilot's rate-of-climb indicator. The EMER FLOT WARN light goes on to indicate that the system is armed. The system is activated by the EMER FLOT switch on the pilot's cyclic control stick which activates the solenoid valves on the air containers. Provisions are made for a switch on the copilot's cyclic control stick. In operation, high pressure air is fed through lines to the Inflatairs on the floats. Some of the compressed air is routed into the shock struts to extend them to their maximum length. The passage of air through the venturi in the Inflatairs causes the floats to inflate with atmospheric air. Operation of the helicopter with floats inflated is restricted to emergency landing on water. Power for the emergency flotation circuit is provided by the primary bus through the circuit breaker, marked EMER FLOT, on the overhead control panel.

2–35. MAIN WHEEL FLOATS.

2–36. DESCRIPTION. (See figures 2–6 and 2–7.) On helicopters serial No. 56-4316, 56-4320, 57-1684, and 57-1697, two donut-type emergency flotation bags are installed on the two main landing gear wheels. The flotation bags are of rubberized construction, and when inflated are capable of supporting a helicopter landing on water. The flotation bags are normally carried folded and secured by covers against cages surrounding each main wheel. Air to initiate inflation of the bags with atmospheric air by venturi action is discharged from the sphere located in the helicopter bottom structure and passed through lines to the Inflatairs. Each bag is divided into four airtight compartments.



1. Tube Assembly
2. Elbow
3. Compressed Air Sphere
4. Solenoid Valve
5. Bolt, Washer
6. Tube Assembly
7. Air Cylinder Installation
8. Swivel Installation
9. Tail Wheel Float
10. Bolt, Gasket, Elbow, Gasket
11. Hose Assembly
12. Reducer, Elbow, Check Valve, Gaskets
13. Gage, Fitting, Nut
14. Valve, Fitting, Nut
15. Tube Assembly
16. Tube Assembly
17. Tee
18. Tube Assembly
19. Tube Assembly
20. Nut, Union, Filler, Doubler
21. Tube Assembly
22. Main Wheel Float Installation, LH
23. Elbow, Nut, Gasket, Ring
24. Tube Assembly
25. Tube Assembly
26. Tee
27. Tube Assembly
28. Reducer, Tee
29. Tube Assembly
30. Tube Assembly, LH
31. Tube Assembly
32. Union
33. Hose Assembly
34. Nut, Washer, Union
35. Tube Assembly
36. Tee
37. Tube Assembly
38. Tube Assembly, RH
39. Main Wheel Float Installation, RH
40. Tee

Figure 2–4. Emergency Flotation Gear Installation

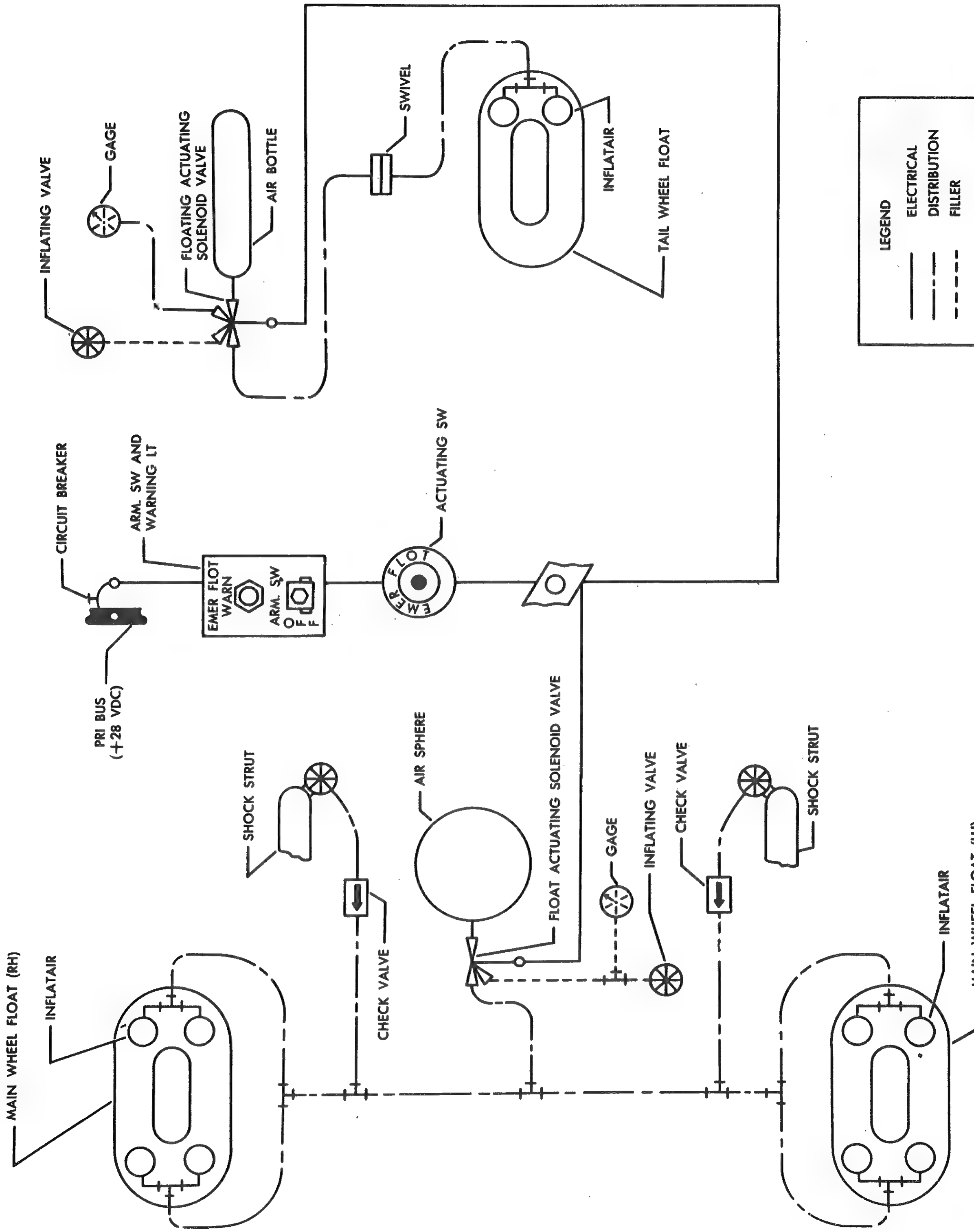


Figure 2–5. Emergency Flotation Gear System Schematic

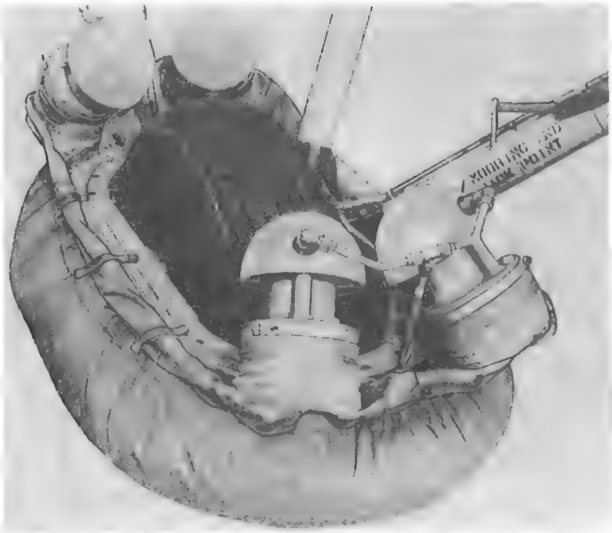


Figure 2-6. Main Wheel Float Installed

2-37. REMOVAL. (See figures 2-4 and 2-7.)

Note

Flotation bags must be deflated prior to removal from helicopter. To deflate bags, open drain valves on Inflatairs. Close valves when deflation is completed.

Note

Removal and installation are the same for either main wheel float.

a. Disconnect and remove air lines at union (32, figure 2-4) and at Inflatairs (26, figure 2-7).

b. Disconnect shock strut assembly from universal assembly on axle. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

WARNING

Air pressure in strut must be released before disconnecting strut assembly.

c. Remove main landing gear assembly with flotation gear as unit. (Refer to paragraph 2-58.)

d. Support float assembly and remove bolts and washers (18, figure 2-7) which secure outboard fitting (17) and shim (16) to cage (14).

e. Remove bolts that secure inboard fitting (19) to axle. Remove float bag (7), Inflatairs (26), and cage (14) as a unit.

f. Remove remaining bolts, washers, and nuts (24) from axle and outboard fitting (17). Pull out outboard fitting. Slide off lockwasher (23).

g. Remove bolts that secure Inflatairs (26) to Inflatair brackets (9).

h. Remove clamps (5) which secure Inflatairs (26) to float bag (7) and remove Inflatairs.

i. Unfasten snaps and remove external straps.

j. Remove bolts (2 and 10), bolts and washers (1 and 13), and washer strips (3, 4, and 11) which attach float bag (7) to cage (14). Remove float bag. Peel off cover (12).

k. Remove bolts, washers, and nuts (15, 20, and 21) which attach inboard fitting (19) to cage (14). Remove inboard fitting.

l. Remove bolts and washers (18) which attach Inflatair brackets (9) to cage (14). Remove brackets.

m. Unbuckle strap and remove fairing (25) covering tiedown ring.

Note

If helicopter is to be moved before flotation gear is reinstalled, proceed to step *n*.

n. Install main landing gear assembly as unit. (Refer to paragraph 2-59.)

o. Connect strut assembly to universal on axle. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

p. Apply anti-seize compound, Federal Specification TT-A-580, to all threads and connect air lines at union (32, figure 2-4) and at Inflatairs (26, figure 2-7).

2-38. INSTALLATION.

a. Position and buckle the fairing (25, figure 2-7) over tiedown ring.

b. Bolt Inflatair brackets (9) to cage (14).

c. Bolt inboard fitting (19) to cage (14).

d. Attach float bag (7) and cover (12) to cage (14) with bolts (2 and 10), bolts and washers (1 and 13), and washer strips (3, 4, and 11).

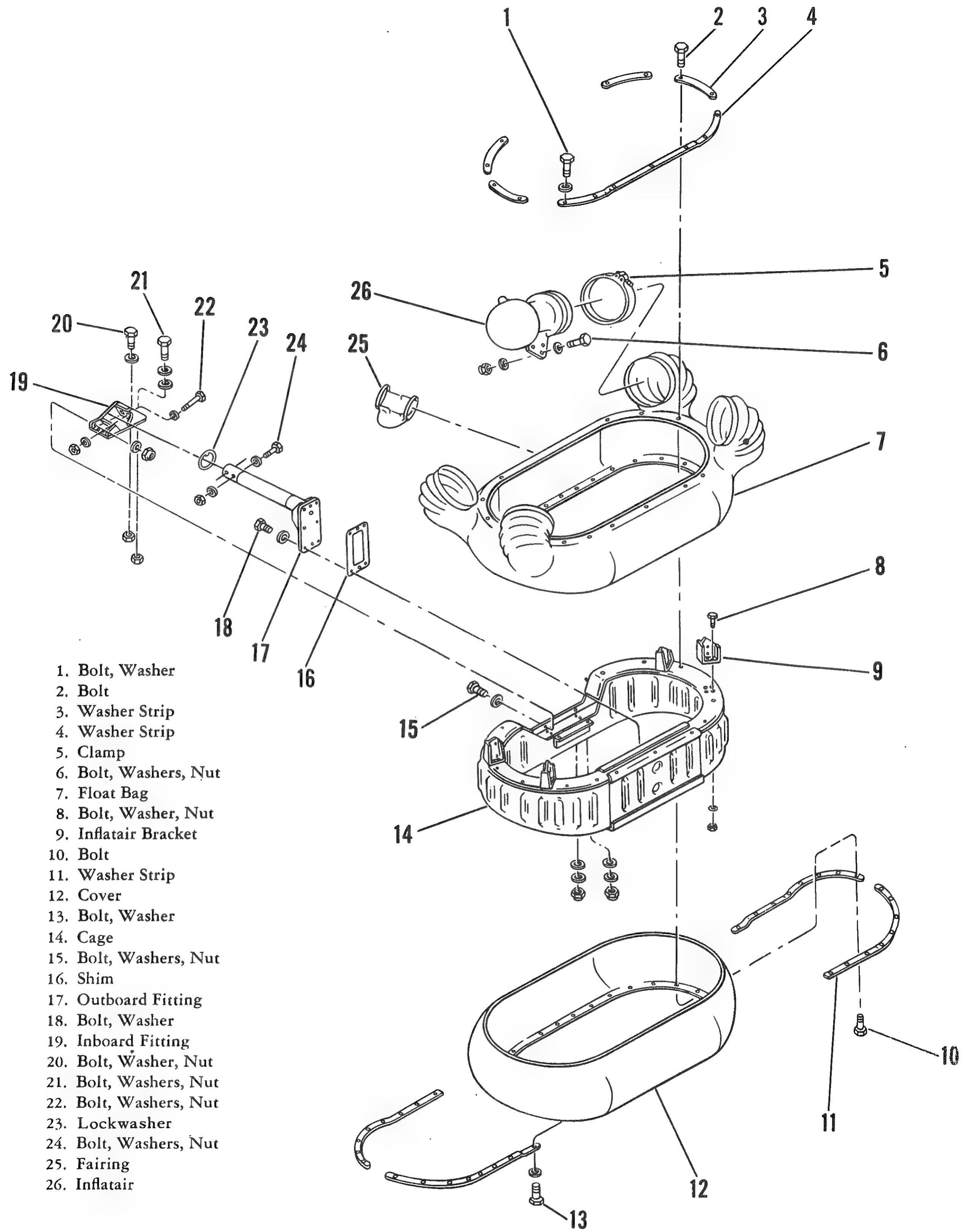
e. Install Inflatairs (26) in float bag (7) and secure with clamps (5).

Note

To facilitate installation, apply a very light coat of castor oil, Federal Specification JJJ-C-86, around neck of Inflatair and on packing in sleeve of float. When properly installed, Inflatair is free to rotate in packing.

CAUTION

Prevent castor oil from dripping into float as this will cause serious deterioration.



1. Bolt, Washer
2. Bolt
3. Washer Strip
4. Washer Strip
5. Clamp
6. Bolt, Washers, Nut
7. Float Bag
8. Bolt, Washer, Nut
9. Inflatair Bracket
10. Bolt
11. Washer Strip
12. Cover
13. Bolt, Washer
14. Cage
15. Bolt, Washers, Nut
16. Shim
17. Outboard Fitting
18. Bolt, Washer
19. Inboard Fitting
20. Bolt, Washer, Nut
21. Bolt, Washers, Nut
22. Bolt, Washers, Nut
23. Lockwasher
24. Bolt, Washers, Nut
25. Fairing
26. Inflatair

Figure 2–7. Main Wheel Float Removal and Disassembly

CAUTION

Care should be exercised to see that packing is not cut when Inflatair is being installed into bag.

f. Bolt Inflatairs (26), to Inflatair brackets (9).

g. Pack float bag (7). (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

Note

If helicopter is not moved after removal of flotation gear, omit steps *h* and *i*.

h. Remove main landing gear assembly as a unit. (Refer to paragraph 2–58, steps *b*, *d*, and *e*.)

i. Disconnect shock strut assembly from universal assembly on axle. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

WARNING

Air pressure in strut must be released before disconnecting strut.

j. Install outboard fitting (17) in axle with lockwasher (23) riding on axle. Position tang on lockwasher (23) in keyway. Align holes in fitting and axle and install bolt, washers, and nut (24) through outboard hole.

k. Position and support flotation gear and align outboard hole in inboard fitting (19) with remaining hole in axle and outboard fitting (17). Bolt inboard fitting (19) to axle, and outboard fitting (17) and shim (16) to cage (14).

l. Install main landing gear with flotation gear as a unit. (Refer to paragraph 2–59.)

m. Connect strut assembly to universal on axle. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

n. Apply anti-seize compound, Federal Specification TT-A-580, to all threads and connect air lines at union (32, figure 2–4) and at Inflatairs (26, figure 2–7.)

Note

Blow all lines clear at installation.

o. Test for leakage.

2–39. TESTING FOR AIR LEAKAGE.

a. Floats must clear ground. Hoist entire helicopter. (For hoisting instructions, refer to TM 55-1520-202-20, Chapter 2, Section II.)

Note

If there is no available means of hoisting or jacking helicopter, hover helicopter with a qualified pilot at controls.

b. Arm system by activating ARM SW switch on instrument panel. The EMER FLOT WARN light will go on to indicate system is armed.

c. Inflate floats by activating EMER FLOT switch on cyclic control stick.

d. Inspect floats visually for puncture, chafing, or deterioration.

CAUTION

If float damage is discovered, lower or land helicopter. Replace damaged float immediately. To replace main wheel float, refer to paragraphs 2–37 and 2–38. To replace tail wheel float, refer to paragraphs 2–42 and 2–43. After replacement of damaged float, start testing procedure from step *a*.

e. Lower or land helicopter.

f. Use an external source of air pressure to increase pressure within floats 1-1/2 psi. Check pressure after 3 hours have elapsed. Pressure drop during this time should be no greater than 1/2 psi.

Note

If pressure drop is not greater than 1/2 psi, omit steps *g* through *i*. If pressure drop exceeds 1/2 psi, proceed to step *g*.

g. Remove domes from Inflatairs and pour small amount of clean water on top of valve in throat. Watch for air bubbles as an indication of leakage. If air bubbles are present, replace valve and repeat step *g*.

h. Test for leakage at points where sleeve of float bag clamps to neck of Inflatairs by applying solution of mild soap and water. If leakage is indicated, tighten Inflatair clamps and repeat step *h*.

i. If leakage is still indicated, replace clamps, Inflatairs, or float bag as required.

j. Test any suspected area on float bag for leakage by applying solution of mild soap and water. If leakage is detected, replace float bag. To replace main wheel float, refer to paragraphs 2–37 and 2–38. To replace tail wheel float, refer to paragraphs 2–42 and 2–43.

CAUTION

If leakage was detected as result of the procedure in steps *h* and *i* and necessary corrective measures have been taken, repeat step *f*, then proceed to step *j*.

1. Washer Strip
2. Bolt, Washer
3. Clamp
4. Inflatair
5. Air Lines
6. Bolt, Washers, Nut
7. Static Ground Cable Fitting
8. Nut
9. Bolt, Washers
10. Static Ground Cable
11. Fitting, LH
12. Bolt, Washer, Nut
13. Inflatair Bracket
14. Aft Scuff Guard
15. Washer Strip
16. Bolt, Washer
17. Float Cover
18. Bolt, Washer
19. Cage Assembly
20. Bolt, Washer
21. Fitting, RH
22. Bolt, Washers, Nut
23. Float Bag

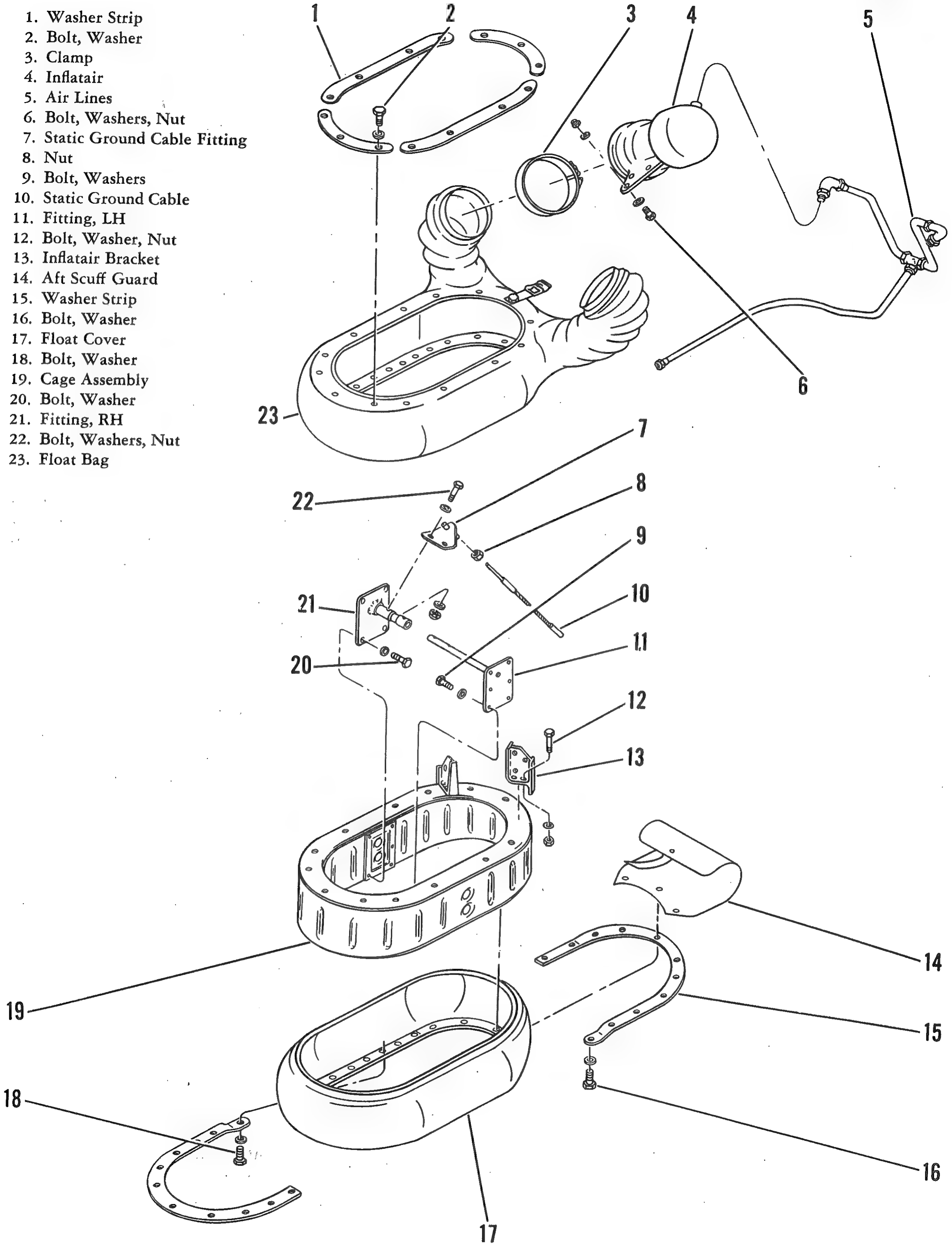


Figure 2–8. Tail Wheel Float Removal and Disassembly

2–40. TAIL WHEEL FLOAT.

2–41. DESCRIPTION. (See figure 2–8.) On helicopters serial No. 56-4316, 56-4320, 57-1684, and 57-1697, a donut-type emergency floating bag, divided into two airtight compartments, is installed on the tail wheel. The float is inflated by means of a compressed air bottle installed in the tail cone of the helicopter, venturi in the Inflatairs on the float, and the connecting air lines. When the EMER FLOT switch on either cyclic control stick is activated, the solenoid valve on the air bottle operates to discharge compressed air through the air lines to the Inflatairs. Venturi action within the Inflatairs induces atmospheric air to inflate the float.

2–42. REMOVAL.

Note

Float bag (23, figure 2–8) must be deflated prior to removal from helicopter. To deflate bag, open drain valves on Inflatairs (4). Close drain valves when deflation is completed.

a. Remove yoke and fork assembly with flotation gear as unit. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

b. Disconnect air lines (5) to Inflatairs (4).

c. Remove bolts and washers (9 and 20) which secure cage assembly (19) to left- and right-hand fittings (11 and 21).

d. Remove float bag (23), Inflatairs (4), and cage assembly (19) as unit.

e. Back off nut (67, figure 2–9) and slide wheel away from axle boss on fork assembly (51).

f. Remove bolts, washers, and nuts (22, figure 2–8) which pass through fittings, axle, and fork assembly. Remove right-hand fitting (21).

g. Remove nut (8) which secures static ground cable (10) to static ground cable fitting (7).

h. Remove left-hand fitting (11). Reinstall bolts, washers, and nuts (22) through axle and fork assembly.

Note

If helicopter is to be moved before flotation gear is reinstalled, proceed to step *i.*

i. Slide wheel back to axle boss on fork assembly (51, figure 2–9) and secure wheel to axle with nut (67).

Note

Tighten nut just enough to remove end play and bend one edge of washer over nut.

j. Install yoke and fork assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

k. Remove bolts, washers, and nuts (6, figure 2–8) which secure Inflatairs (4) to Inflatair brackets (13). Remove clamps (3) which secure Inflatairs (4) to sleeves of float bag (23), and remove Inflatairs (4).

l. Remove bolts and remove Inflatair brackets (13) from cage assembly (19).

m. Remove aft scuff guard (14). Remove bolts and washers (2, 16, and 18) and washer strips (1 and 15) which secure float bag (23) to cage assembly (19) and remove bag. Remove float cover (17).

2–43. INSTALLATION.

a. Bolt Inflatair brackets (13, figure 2–8) to cage assembly (19).

1. Bolt
2. Washer
3. Cap
4. Collar
5. Upper Cam
6. ***Swivel Fitting
7. ***Gasket
8. ***Pneumatic Swivel Joint
9. ***Gasket
10. Yoke Assembly
11. **Lockpin
12. **Retaining Ring
13. **Retainer
14. **Spring
15. **Bushing
16. **Housing
17. Jack Pad
18. Washer
19. Bolt
20. *Retaining Ring
21. *Retainer
22. *Spring
23. *Lockpin
24. *Housing
25. ***Elbow
26. ***Ring
27. ***Gasket
28. Bolt
29. ***Nut
30. Washer
31. Washer
32. Nut (***Bolt)
33. ***Tube Assembly
34. Lower Cam
35. Key
36. Retainer
37. Spring
38. Nut
39. Washer
40. Bearing Cone
41. Bearing Cup
42. Lockpin Assembly
43. Retaining Ring
44. Bearing Cup
45. Bearing Cone
46. Seal
47. Shaft
48. Lower Retainer
49. Bolt
50. Washer
51. Fork Assembly
52. Washer
53. Nut
54. ***Clamp
55. ***Nut
56. ***Washer
57. ***Clamp
58. ***Washer
59. ***Screw
60. Bolt
61. Washer
62. Nut
63. Bushing
64. Axle
65. ***Spacer
66. ***Washer
67. ***Nut

*Helicopters serial No. prior to 57-1715
**Helicopters serial No. 57-1715 and subsequent
***Helicopters serial No. 56-4316, 56-4320, 57-1684, and 57-1697

Figure 2–9. Yoke and Fork Assembly (Sheet 1 of 2)

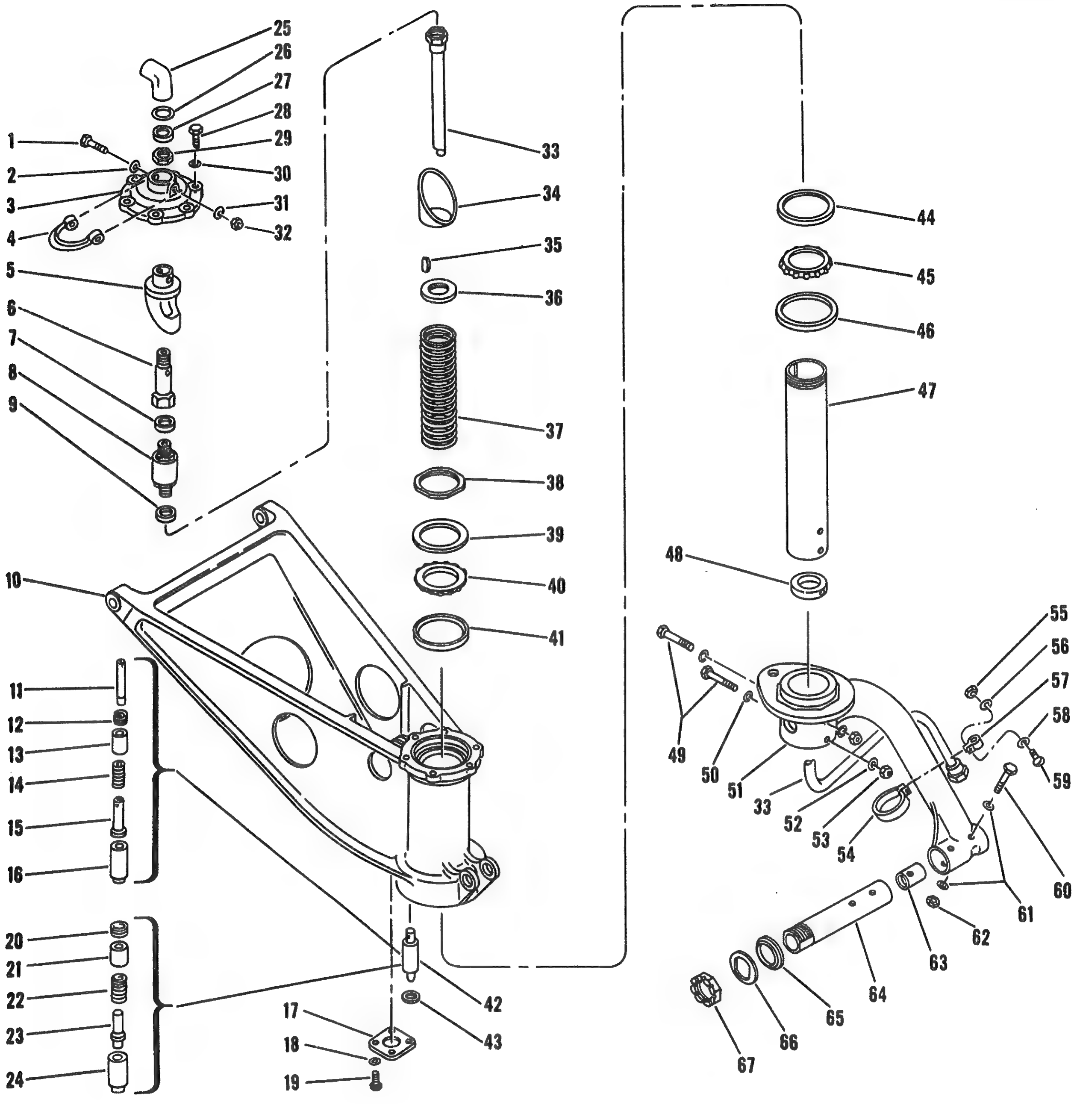


Figure 2-9. Yoke and Fork Assembly (Sheet 2 of 2)

b. Secure float bag (23) and float cover (17) to cage assembly (19) with bolts and washers (2, 16, and 18) and washer strips (1 and 15). Install aft scuff guard (14).

c. Install Inflatairs (4) in float bag (23) and secure with clamps (3).

Note

To facilitate installation, apply a very light coat of castor oil, Federal Specification JJJ-C-86, around neck of Inflatair and on the packing in sleeve of float. When properly installed, Inflatair is free to rotate in packing.

CAUTION

Prevent castor oil from dripping into float as this will cause serious deterioration.

CAUTION

Care should be exercised to see that packing is not cut when Inflatair is being installed into bag.

d. Bolt Inflatairs (4) to Inflatair brackets (13).

Note

If helicopter is not moved after removal of flotation gear, omit steps *e*, *f*, and *g*.

e. Remove yoke and fork assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

f. Bend up tang of washer (66, figure 2–9) and back off nut (67).

g. Slide wheel away from axle boss on fork assembly (51).

h. Remove bolts, washers, and nuts (22, figure 2–8) which secure axle to fork assembly.

i. Install left- and right-hand fittings (11 and 21) and static ground cable fitting (7) in fork assembly and axle. Align holes in fork, axle, and fittings and secure with bolts, washers, and nuts (22).

j. Secure static ground cable (10) to static ground cable fitting (7) with nut (8).

k. Support packed float assembly and install bolts and washers (9 and 20) which secure cage assembly (19) to static ground cable fitting (7) and left- and right-hand fittings (11 and 21).

Note

If new axle, cage, or fitting has been installed, ascertain that, with tail wheel float positioned, distance between center line of tire and outer edge of right-hand fitting is 5-15/16 inches. If this dimension cannot be attained with holes of both fittings aligned, remove left-hand fitting and install new fitting. Establish dimension of 5-15/16 inches, pick up existing holes, and line drill through left-hand fitting to 0.3750 ± 0.0005 inch diameter.

l. Apply anti-seize compound, Federal Specification TT-A-580, to all threads and connect air lines (5), to Inflatairs (4).

Note

Blow all lines clear at installation.

m. Slide wheel back to axle boss on yoke assembly (10, figure 2–9) and secure wheel to axle with nut (67), washer (66), and spacer (65).

Note

Tighten nut just enough to remove end play and bend one edge of lockwasher over nut.

n. Install yoke and fork assembly with flotation gear as unit. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

o. Test for leakage. (Refer to paragraph 2–39.)

2–44. PREPARATION FOR STORAGE.

2–45. REMOVAL OF FLOTATION GEAR. (Refer to paragraphs 2–37 and 2–42.)

2–46. DEFLATING AND REPACKING. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

2–47. COMPRESSED AIR SPHERE.

2–48. DESCRIPTION. On helicopters serial No. 56-4316, 56-4320, 57-1684, and 57-1697, a spherical pressure vessel is installed beneath the cabin floor in the center of the helicopter just aft of the clutch access door. The installation consists primarily of the sphere, a solenoid valve mounted on the sphere, a gage and an inflating valve mounted on the cabin wall aft of the forward bulkhead, and the related wiring and tubing. On helicopters with the passenger accommodations installed, the gage and inflating valve are mounted outside and beneath the helicopter, forward of the compressed air sphere. When the solenoid valve on the sphere is activated, compressed air is released to the Inflatairs on the main wheel floats, inducing a venturi effect which inflates the float bags with atmospheric air.

2–49. REMOVAL. (See figure 2–4.)

WARNING

Drain compressed air sphere (3) before attempting removal. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

a. Support compressed air sphere (3) from beneath helicopter.

b. Remove bolts and washers (5) which secure lugs of compressed air sphere (3) to support. Lower compressed air sphere enough to allow accessibility for wiring and tubing connections.

c. Disconnect wiring and tubing from solenoid valve (4) on compressed air sphere (3) and remove compressed air sphere.

2–50. INSTALLATION. (See figure 2–4.)

Note

Blow all lines clear at installation.

WARNING

Make certain compressed air sphere is drained before installation. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

a. Position compressed air sphere (3) to allow for wiring and tubing connections.

b. Secure wiring and tubing connections to solenoid valve (4) on compressed air sphere (3).

c. Apply anti-seize compound, Federal Specification TT-A-580, to all thread connections and connect tubing and wiring to solenoid valve (4).

Note

Blow all tubing clear at installation.

d. Raise and position compressed air sphere (3) to support. Secure lugs of compressed air sphere to support with bolts and washers (5).

2–51. AIR CYLINDER INSTALLATION.

2–52. DESCRIPTION. (See figure 2–10.) On helicopters serial No. 56-4316, 56-4320, 57-1784, and 57-1697, a cylindrical pressure vessel is installed in the tail cone, approximately over the tail landing gear yoke and fork assembly. The installation consists primarily of the air bottle, a swivel installation, a solenoid valve mounted outside the helicopter on a support attached to the bottom structure, and the related wiring and tubing. When the solenoid valve on the bottle is activated, compressed air is released only to the Inflatairs on the tail wheel float, inducing a venturi effect which inflates the float bag with atmospheric air.

2–53. REMOVAL. (See figure 2–10.)

Note

Drain air cylinder before removal. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

a. Disconnect wiring and tubing from solenoid valve (33) on bottle (7).

b. Open toggle of clamps (9 and 12) and remove bottle (7).

c. Remove bolts, washers, and nuts (10 and 11) that secure seats (8 and 13) and clamps (9 and 12) to support. Lift out seats and clamps.

2–54. INSTALLATION. (See figure 2–10.)

a. Position clamps (9 and 12) and seats (8 and 13) on support and secure with bolts, washers, and nuts (10 and 11).

b. Position bottle (7) on seats (8 and 13) and secure in place by connecting toggles of clamps (9 and 12).

c. Apply anti-seize compound, Federal Specification TT-A-580, to all thread connections and connect tubing and wiring to solenoid valve (33).

Note

Blow all tubing clear at installation.

d. Fill air cylinder. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

2–55. SWIVEL INSTALLATION.

2–56. DESCRIPTION. On helicopters serial No. 56-4316, 56-4320, 57-1684, and 57-1697, a swivel installation is installed as an integral part of the tail landing gear yoke and fork assembly. The swivel installation consists primarily of a pneumatic swivel joint and related fittings and tubing. The pneumatic swivel joint makes it possible for airtight integrity of the tail float inflation system to be maintained with the tail wheel free to caster normally. (For removal and installation of the swivel fitting, refer to TM 55-1520-202-20, Chapter 2, Section III.)

2–57. MAIN LANDING GEAR ASSEMBLY.

2–58. REMOVAL. (See figures 2–4 and 2–11.)

a. On helicopters serial No. 56-4316, 56-4320, 57-1684, and 57-1697, disconnect hose to Inflatairs at union (32, figure 2–4) and hose to elbow, and remove main landing gear with floats installed.

b. Lock and chock tail wheel. Jack helicopter at jack pad on landing gear fitting. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

c. Release air pressure and remove main shock strut assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

d. Disconnect brake hydraulic line (1, figure 2–11) from fuselage at quick disconnect coupling (2). Rotate leg and axle assembly (3), with wheel attached, aft and upward and pull leg and axle assembly out of fuselage fitting (6).

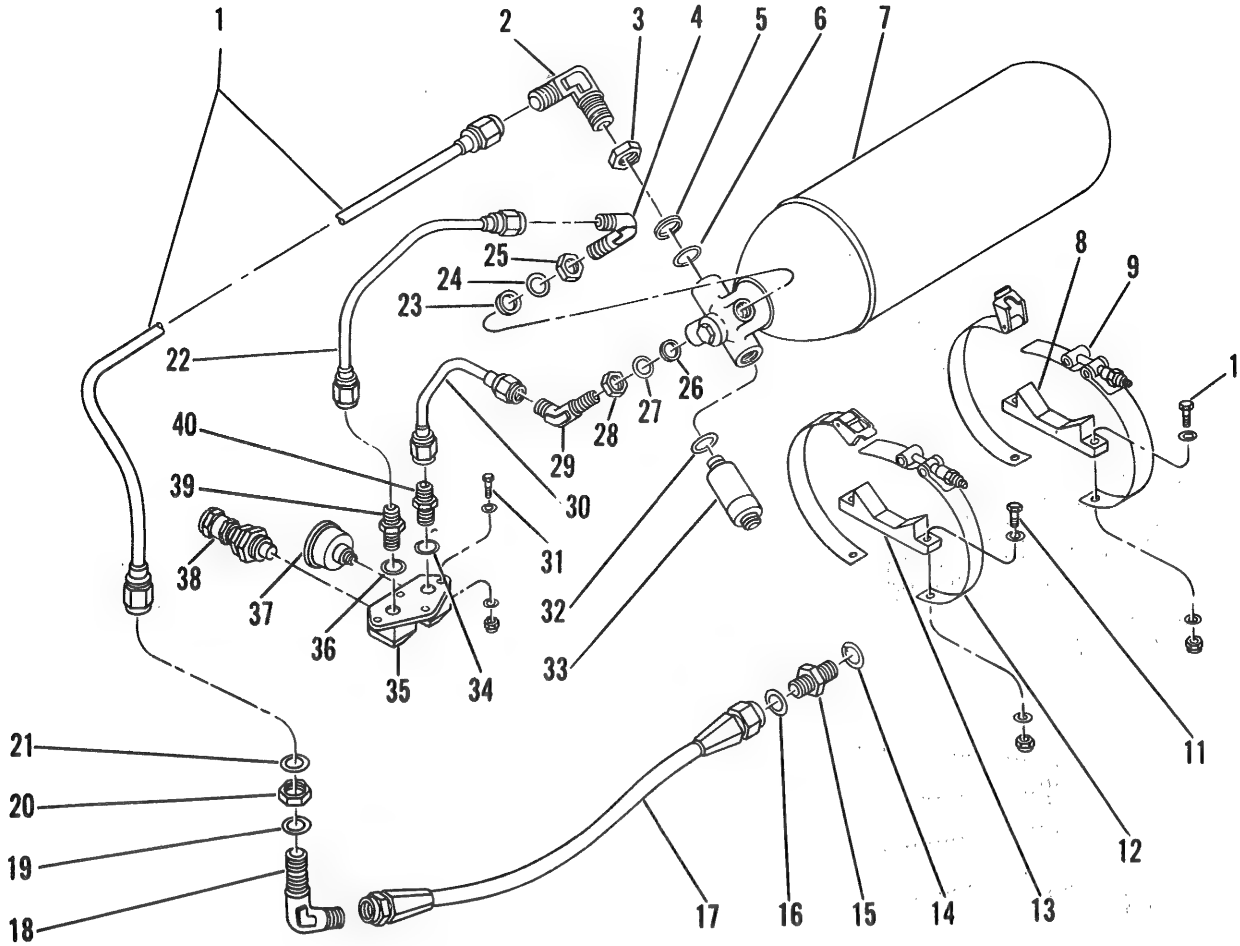
e. Remove lock ring (4) and scraper (5) from fuselage fitting (6).

2–59. INSTALLATION. (See figures 2–4 and 2–11.)

Note

On helicopters serial No. 56-4316, 56-4320, 57-1684, and 57-1697, install main landing gear assembly with flotation gear as unit and connect air lines at elbow (10, figure 2–4) and at union (32) on the Inflatairs.

a. Install scraper (5, figure 2–11) in fuselage fitting (6), and secure it with lock ring (4).



1. Tube Assembly	11. Bolt, Washers, Nut	21. Washer	31. Bolt, Washers, Nut
2. Elbow	12. Clamp	22. Tube Assembly	32. Gasket
3. Nut	13. Seat	23. Gasket	33. Solenoid Valve
4. Elbow	14. Gasket	24. Ring	34. Gasket
5. Gasket	15. Union	25. Nut	35. Fitting
6. Ring	16. Gasket	26. Gasket	36. Gasket
7. Bottle	17. Hose Assembly	27. Ring	37. Gage
8. Seat	18. Elbow	28. Nut	38. Inflating Valve
9. Clamp	19. Washer	29. Elbow	39. Union
10. Bolt, Washers, Nut	20. Nut	30. Tube Assembly	40. Union

Figure 2–10. Air Cylinder Installation

b. Insert leg and axle assembly (3) into fuselage fitting (6), and turn it down and forward. Connect brake hydraulic line (1) at quick disconnect coupling (2).

c. Install main shock strut assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

d. Remove support from helicopter.

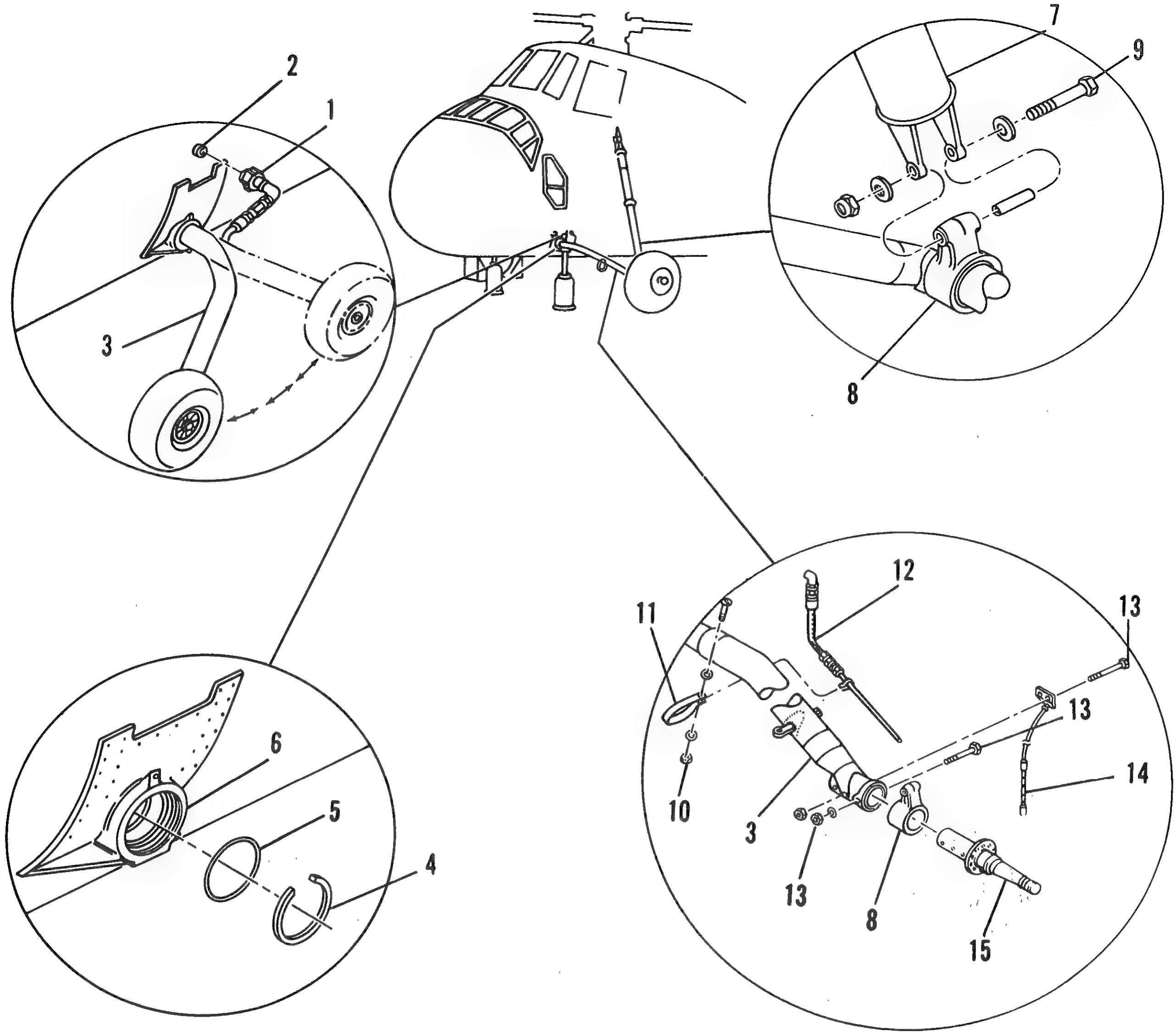
e. Check fluid level and inflate strut assembly in accordance with instructions given on nameplate and in TM 55-1520-202-20, Chapter 2, Section III.

CAUTION

Release tail wheel lock control before moving helicopter.

2–60. MAIN SHOCK STRUT ASSEMBLY.

2–61. REMOVAL. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)



1. Brake Hydraulic Line
2. Quick Disconnect Coupling
3. Leg and Axle Assembly
4. Lock Ring
5. Scraper
6. Fuselage Fitting
7. Strut Assembly
8. Universal Assembly
9. Bolt, Washers, Spacer, Nut
10. Screw, Washers, Nut
11. Clamp
12. Brake Hydraulic Hose
13. Bolts, Washers, Nuts
14. Static Ground Assembly
15. Axle

Figure 2–11. Main Landing Gear Assembly Removal and Disassembly

2–62. REPLACEMENT OF PARTS. (See figure 2–12.)

a. Disconnect universal (5) from oleo assembly by removing bolt and nut (6), spacer (4), and clips (3).

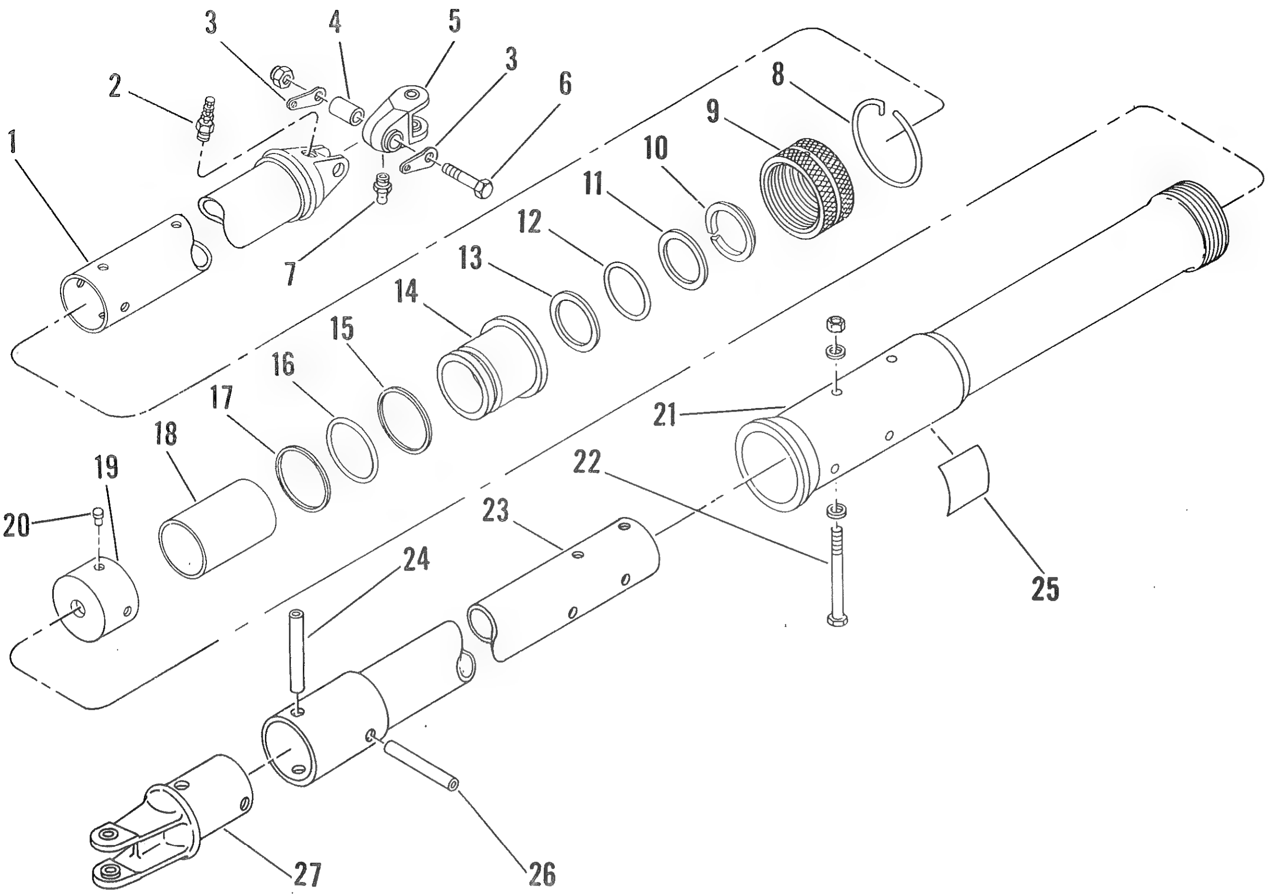
b. Separate tube (23) from oleo assembly by removing bolts, washers, and nuts (22).

c. Peel off nameplate (25) from cylinder (21). Remove rivets (24 and 26) from tube (23), and separate fitting assembly (27) from tube.

Note

Disassembly of oleo assembly is covered in steps *d* through *h*.

d. Release air pressure in oleo assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section III.) Un-



1. Rod Assembly
2. Air Valve
3. Clip
4. Spacer
5. Universal
6. Bolt, 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
24. Rivet
25. Nameplate
26. Rivet
27. Fitting Assembly

Figure 2–12. Main Shock Strut Disassembled

screw and remove air valve (2, figure 2–12) from top of rod assembly (1). Drain hydraulic oil from oleo through air valve opening.

WARNING

Release air pressure in oleo assembly and remove air valve before disassembling oleo assembly.

e. Remove oleo nut lock ring (8) from bearing retaining nut (9).

f. Unscrew bearing retaining nut (9) and remove rod assembly (1) from cylinder (21).

g. Remove four pins (20) that secure orifice (19) to rod assembly (1) and remove orifice (19) and spacer (18).

h. Remove bearing (14), scraper (10), and bearing retaining nut (9) from rod assembly (1). Remove rings (11, 13, 15, and 17), gasket (16), and packing (12) from bearing (14).

Note

Assembly of oleo assembly alone is covered in steps *i* through *m*.

i. To reassemble, screw air valve (2) into upper end of rod assembly (1) and tighten nut to a torque of 100 to 110 inch-pounds. Secure nut with lock wire.

j. Install new rings (11, 13, 15, and 17), gasket (16), and packing (12) in bearing (14), and position bearing retaining nut (9), scraper (10), and bearing (14) on rod assembly (1).

k. Replace spacer (18) and orifice (19) on rod assembly (1) and secure orifice in place with pins (20).

l. Position rod assembly (1) inside cylinder (21) and tighten bearing retaining nut (9).

m. Install lock ring (8) on bearing retaining nut.

n. Install universal (5), with lubrication fitting (7) on opposite side from air valve (2), in fork on end of oleo assembly and secure with bolt and nut (6), spacer (4), and clips (3).

o. Insert fitting assembly (27) on tube (23) and rivet together.

p. Replace nameplate (25) on cylinder (21).

q. Slide tube (23) into oleo assembly and secure with bolts, washers, and nuts (22).

Note

Dip bolts in zinc chromate primer, Military Specification MIL-P-8585, prior to assembly. Touch up bolts after assembly.

r. Test assembled strut assembly.

s. Fill and bleed strut assembly in accordance with instructions given in TM 55-1520-202-20, Chapter 2, Section III.

2–63. TESTING.

a. Connect hose from hydraulic test stand to air valve port.

b. Apply 1000 psi hydraulic pressure for at least 2 minutes and check for leakage at weld on rod assembly (1, figure 2–12) at areas around scraper (10) and at bearing retaining nut (9). No external leakage should occur.

2–64. INSTALLATION. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

2–65. LEG AND AXLE ASSEMBLY.

2–66. REMOVAL. (See figure 2–11.)

a. Lock and chock tail wheel. Jack helicopter at fuselage jack pad on main landing gear fitting. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

b. Remove wheel assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

c. Release air from strut assembly. (Refer to instructions for servicing shock strut in TM 55-1520-202-20, Chapter 2, Section II.)

WARNING

Air pressure in strut assembly must be released before removing leg and axle assembly.

d. Disconnect strut assembly (7) from universal assembly (8) on axle by removing bolt, washers, spacer, and nut (9).

e. Disconnect brake hydraulic line (1) from fuselage at quick disconnect coupling (2). Rotate leg and axle assembly (3) aft and upward, and pull leg and axle assembly out of fuselage fittings.

f. Remove screw, washers, and nut (10) from clamp (11) and remove clamp and brake hydraulic hose (12).

2–67. REPLACEMENT OF PARTS.

Note

If alignment and replacement of parts of leg and axle assembly are required, they must be performed at fourth echelon.

a. To disassemble leg and axle assembly, remove bolts, washers, and nuts (13, figure 2–11). Remove static ground assembly (14) from leg and axle assembly (3). Pull axle (15) out of leg and axle assembly. Slide universal assembly (8) off axle.

b. To reassemble leg and axle assembly, slide universal assembly (8) onto axle (15) with upper grease fitting facing inboard. Insert axle (15) into leg and axle assembly (3) and secure with bolts, washers, and nuts (13). Tighten outboard nut to a torque of 60 to 75 inch-pounds.

Note

Maximum allowable play between axle (15) and universal assembly (8) is 0.010 inch provided the ID of the universal does not exceed 2.505 inches and OD of axle is not less than 2.495 inches.

Note

Secure static ground assembly (14) to leg and axle assembly (3) beneath heads of two inboard bolts. Do not install washers with these bolts.

CAUTION

If new axle is being installed, axle must be inserted all the way into leg. Pick up three holes in leg and line drill and line ream 0.4390 to 0.4375 inch. Use caution when reaming axle to prevent enlargement of the holes in leg.

Note

If new leg is being installed, new axle must also be installed so close tolerance of bolt holes can be maintained.

c. Tighten lubrication fitting on lower part of universal until it points upward.

Note

Do not tighten nut beyond point where ring may be moved freely.

d. If new axle is being installed, press guide into hole at upper end of leg assembly and press phenolic plug in hole at opposite end of tiedown ring. If plastic-nylon plug is used, cement it in place with adhesive cement EC-1357, manufactured by Minnesota Mining and Manufacturing Company.

Note

If new axle is being installed, flush inside of axle with engine cleaning compound, Military Specification MIL-C-5546.

2–68. INSTALLATION. (See figure 2–11.)

a. Insert leg and axle assembly (3) into fuselage fitting and rotate it forward and down.

b. Install wheel assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

CAUTION

Do not remove support from helicopter.

c. Connect brake hydraulic line (1) to quick disconnect coupling (2) on fuselage. Secure line to leg and axle assembly (3) with clamps, screws, washers, and nuts.

d. Connect strut assembly (7) to universal assembly (8) on axle with bolt, washers, spacer, and nut (9).

e. Remove support and remove chocks.

f. Check fluid level and inflate strut assembly in accordance with instructions on nameplate and instructions for servicing shock strut in TM 55-1520-202-20, Chapter 2, Section II.

g. Lubricate universal fitting at each end of strut assembly. (See lubrication chart in TM 55-1520-202-20, Chapter 2, Section II.)

CAUTION

Release tail wheel lock control before moving helicopter.

2–69. TAIL LANDING GEAR ASSEMBLY.

2–70. TAIL WHEEL STRUT ASSEMBLY.

2–71. REPLACEMENT OF PARTS. (See figure 2–13.)

a. To disassemble tail wheel strut assembly, remove universals (3 and 22) from each end of oleo assembly by removing bolts, washers, and nuts (5 and 24) and spacers (2 and 23).

b. Drain hydraulic oil from oleo assembly through air valve hose opening.

Note

To disassemble oleo assembly, proceed as follows:

c. Remove lock ring (7) from bearing retaining nut (8).

d. Unscrew bearing retaining nut (8) and remove nut and rod assembly (1) from cylinder assembly (20).

e. Remove pins (18) that secure orifice (19) to rod assembly (1) and remove orifice (19) and spacer (17).

f. Remove bearing (13), scraper (9), and bearing retaining nut (8) from rod assembly (1). Remove rings (10, 12, 14, and 16), gasket (15), and packing (11) from bearing (13).

g. Press out bushings (21).

Note

Soak all packings and gaskets in hydraulic fluid, Military Specification MIL-H-5606, for 5 minutes before assembly.

h. Replace bushings (21). After pressing, line ream 0.3125 to 0.3140 inch.

i. Install new rings (10, 12, 14, and 16), gasket (15), and packing (11) on bearing (13), and position bearing retaining nut (8), scraper (9), and bearing (13) on rod assembly (1).

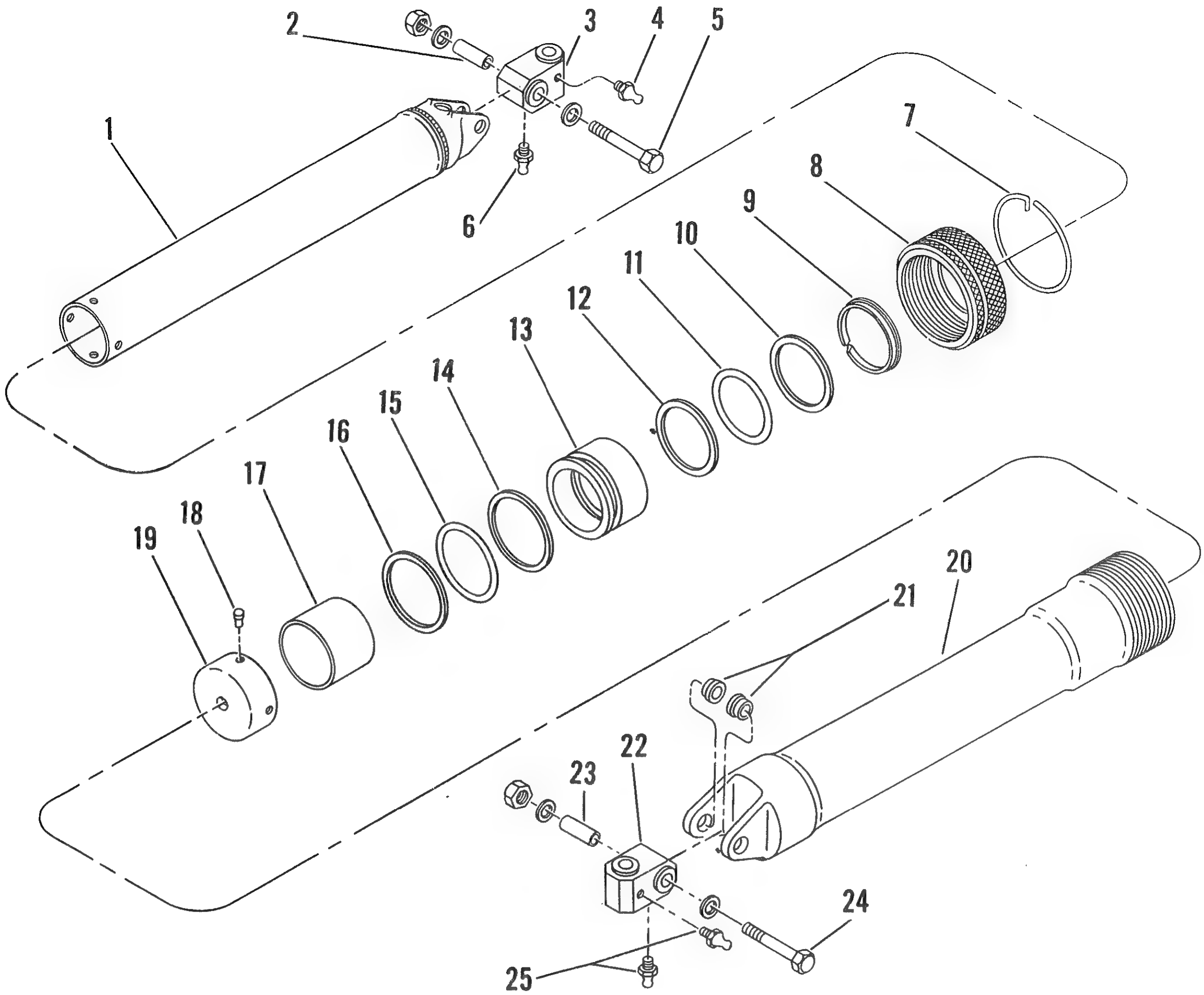
j. Replace spacer (17) and orifice (19) on rod assembly (1) and secure orifice in place with pins (18).

k. Position rod assembly (1) inside cylinder assembly (20) and tighten bearing retaining nut (8).

l. Install lock ring (7) on bearing retaining nut (8).

m. Install universals (3 and 22) on each end of oleo assembly with bolts, washers, and nuts (5 and 24) and spacers (2 and 23).

n. Pressure test assembled tail wheel strut assembly.



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. Bushings
22. Universal
23. Spacer
24. Bolt, Washers, Nut
25. Lubrication Fittings

Figure 2–13. Tail Wheel Strut Assembly Disassembled

o. Fill and bleed strut assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

2–72. TESTING.

a. Connect hose from hydraulic test stand to air valve port.

b. Apply 1000 psi hydraulic pressure for at least 2 minutes and check for leakage at weld on rod assembly (1, figure 2–13) and at areas around scraper (9) and bearing retaining nut (8). No external leakage should occur. If leakage occurs, replace rings and packings and retest. If leakage still occurs, replace cylinder.

2–73. YOKE AND FORK ASSEMBLY.

2–74. REPLACEMENT OF PARTS (HELICOPTERS SERIAL NO. EXCLUDING 56-4316, 56-4320, 57-1684, AND 57-1697).

a. To disassemble helicopter tail wheel yoke and fork assembly, remove tail wheel assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

b. Remove bolt (1, figure 2–9), washers (2 and 31), and nut (32) from cap (3) at top of yoke assembly (10). Cut lock wire and remove bolts (19) and washers (30). Lift off cap (3) and remove upper cam (5), lower cam (34), key (35), retainer (36), and spring (37).

Note

Use care when removing bolts (28) that secure cap (3). Spring tension will force components up. Release tension on spring gradually.

c. Remove washer (39), nut (38), bearing cone (40), and bearing cup (41).

d. Pull shaft (47) and fork assembly (51) out of yoke assembly (10) as a unit. Remove seal (46), bearing cone (45), and bearing cup (44) from yoke assembly.

e. Remove bolts (49), washers (50 and 52), and nuts (53) from fork assembly (51) and remove shaft (47). Push lower retainer (48) out of shaft.

f. Remove bolts (60), washers (61), and nuts (62) from fork assembly (51) and pull axle (64) out of fork assembly. Remove bushing (63) from axle.

g. Remove retaining ring (43) and pull lockpin assembly (42) from bottom of yoke assembly (10). Disassemble lockpin assembly by removing retaining ring (20) from housing (24) and separating retainer (21), spring (22), lockpin (23), and housing (24).

h. Disassemble lockpin assembly on helicopter serial No. 57-1715 and subsequent as follows: Remove lockpin (11) from lockpin assembly (42). Removing retaining ring (12) from housing (16) and separate retainer (13), spring (14), bushing (15), and housing (16).

Note

To replace broken or bent lockpin without removing yoke and fork assembly, refer to removal instructions for tail wheel lock control system in TM 55-1520-202-20, Chapter 2, Section III.

i. Remove bolts (19) and washers (18) and remove jack pad (17) from yoke assembly (10).

j. To reassemble tail wheel yoke and fork assembly, secure jack pad (17) to yoke assembly (10) with bolts (19) and washers (18). Secure bolts with lock wire.

k. Apply light coat of graphite grease, Military Specification MIL-G-7187, to lockpin (23) and spring (22) of lockpin assembly (42). Insert lockpin, spring, and retainer (21) into housing (24) and secure with retaining ring (20). Install lockpin assembly (42) in yoke assembly (10) and secure with retaining ring (43).

l. To assemble lockpin assembly on helicopters serial No. 57-1715 and subsequent, apply light coat of graphite grease, Military Specification MIL-G-7187, to bushing (15) and spring (14) of lockpin assembly (42). Insert bushing, spring, and retainer (13) into housing (16) and secure with retaining ring (12). Insert lockpin (11) in bushing (15). Install lockpin assembly (42) in yoke assembly (10) and secure with retaining ring (43).

m. Place bushing (63) in axle (64). Insert axle into fork assembly (51), and install bolts (60), washers (61), and nuts (62). Tighten nuts to a torque of 50 to 55 inch-pounds.

n. Position lower retainer (48) inside shaft (47). Slide shaft into fork assembly (51) and secure retainer, shaft, and fork assembly with bolts (49), washers (50 and 52), and nuts (53).

Note

The upper of the two bolts (49) secures lower retainer (48) inside shaft (47).

o. Install bearing cup (44) in yoke assembly (10). Handpack bearing cup (44) and bearing cone (45) with grease, Military Specification MIL-G-3545, and install bearing cone. Install seal (46).

p. Insert shaft (47) through bearing cone (45) and push it up into position. Carefully work shoulder of fork assembly (51) into seal (46).

q. Install bearing cup (41). Pack bearing cup (41) and bearing cone (40) with grease, Military Specification MIL-G-3278, and install bearing cone on shaft (47). Install washer (39) and nut (38). Tighten nut (38) until bearings start to drag. Back off nut until shaft rotates freely with no end play. Secure nut with lock wire in two places so that it cannot move in either direction.

r. Pack spring (37) lightly with graphite grease, Military Specification MIL-G-7187. Coat surfaces of retainer (36), upper cam (5), and lower cam (34) with graphite grease, Military Specification MIL-G-7187.

s. Install spring (37) and retainer (36) inside shaft (47). Place key (35) in lower cam (34) and install cam and key in shaft. Set upper cam (5) on lower cam (34) and set cap (3) on lower cam (34). Compress unit and, with cap positioned to allow installation of bolt (1), bolt cap (3) to yoke assembly (10) with bolts (28) and washers (30). Secure bolts with lock wire in sets of three.

Note

If new upper cam (5) or cap (3) is installed, position fork in its static fore-and-aft position, pick up pilot hole or old hole in cap (3), and line drill a 0.250-inch hole through upper cam (5) and cap (3) for bolt (1).

t. Install bolt (1), washers (2 and 31), and nut (32).

u. Pack wheel bearings with high temperature grease, Military Specification MIL-G-3545. Install wheel assembly on axle and secure with spacer, lockwasher, and nut. Tighten axle nut just enough to remove end play. Bend washer over nut.

2–75. REPLACEMENT OF PARTS (HELICOPTERS SERIAL NO. 56-4316, 56-4320, 57-1684, AND 57-1697).

a. To disassemble tail wheel yoke and fork assembly, remove wheel assembly and tire from axle. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

b. Remove bolts (1 and 32, figure 2–9), washers (2 and 31), and collar (4) from top of cap (3).

c. Remove elbow (25), nut (29), gasket (27), and ring (26) from swivel installation.

d. Remove bolts (28) and washers (30) which secure cap (3). Remove cap.

Note

With bolts tight, cap is under some pressure from spring. Loosen bolts evenly until spring is fully extended.

e. Remove bolts (49), washers (50 and 52), and nuts (53) which pass through fork assembly (51) and shaft (47) housed in yoke assembly (10).

f. Pull swivel fitting (6), pneumatic swivel joint (8), gaskets (7 and 9), and tube assembly (33) as unit through bottom of fork assembly (51). Disconnect lines from fitting, if necessary.

Note

Split phenolic clamp in bottom of fork assembly will be forced out by tube fittings as swivel installation is withdrawn.

g. Lift out upper cam (5), lower cam (34), key (35), retainer (36), and spring (37).

h. Remove nut (38) from top of shaft (47). Lift out washer (39), bearing cup (41), and bearing cone (40).

i. Pull shaft and fork assembly out of yoke as unit. Remove seal (46), bearing cup (44), and bearing cone (45) from yoke.

j. Remove shaft from fork and remove lower retainer (48) from shaft.

k. Remove bolts (60), washers (61), and nuts (62) from fork assembly (51). Pull axle (64) from fork assembly (51). Remove bushing (63), nut (67), washer (66), and spacer (65) from axle (64).

l. Remove retaining ring (43) and pull lockpin assembly (42) out of yoke assembly (10). Disassemble lockpin assembly by removing remaining retaining ring (20) from housing (24) and separating retainer (21), spring (22), lockpin (23), and housing (24).

Note

Release spring tension gradually when removing retaining ring (20) from housing (24).

m. Remove bolts (19) and washers (18) which secure jack pad (17) to yoke assembly. Remove jack pad.

n. To reassemble tail wheel yoke and fork assembly, bolt jack pad (17) to yoke assembly (10) with bolts (19) and washers (18). Secure bolts (19) with lock wire.

Note

Coat all threads with anti-seize compound, Federal Specification TT-A-580.

Note

Blow all lines clear at installation.

o. Assemble components of lockpin assembly (42, figure 2–9). Coat lockpin (23) and spring (22) with graphite grease, Military Specification MIL-G-7187, before assembly. Secure components in position by installing retaining ring (20) in housing (24). Place assembled lockpin assembly in yoke assembly (10) and secure in position with retaining ring (43).

p. Place lower retainer (48) in shaft (47). Position shaft (47) in fork assembly (51), and temporarily install bolt (49) to secure shaft, fork assembly, and lower retainer together.

q. Install bearing cup (44) in yoke assembly (10). Handpack bearing cup (44) and bearing cone (45) with grease, Military Specification MIL-G-3545, and install bearing cone (45) in position. Apply light coat of Garlock sealing compound No. 101, manufactured by Garlock Packing Company, to inner diameter of yoke assembly (10) in area in which seal (46) is to be placed.

r. Install shaft (47) of assembled shaft and fork assembly through bearing cone (45) and push it up into position. Lightly coat shoulder of fork assembly (51) with petrolatum, Federal Specification VV-P-236. Work shoulder of fork assembly (51) into yoke assembly (10), being careful not to damage seal (46).

s. Install remaining bearing cup (41). Hand-pack bearing cone (40) and bearing cup (41) with grease, Military Specification MIL-G-3545, and install bearing cone on shaft (47). Tighten nut (38) until bearing cone (40) starts to drag. Back off nut (38) slightly until shaft (47) rotates freely with no end play. Secure nut (38) with lock wire in two places so that it cannot move in either direction.

t. Lightly coat spring (37), retainer (36), upper cam (5), and lower cam (34) with graphite grease, Military Specification MIL-G-7187.

u. Install spring (37) and retainer (36) in shaft (47). Position key (35) in lower cam (34) and install cam and key. Install upper cam (5).

v. With fork assembly (51) in tail wheel centered position, position cap (3) so that holes in cap align with holes in upper cam (5). Loosely install bolts (28) and washers (30) which secure cap (3) to yoke assembly (10).

Note

Do not tighten bolts enough to compress spring (37).

w. Remove bolt (49) which was temporarily installed through fork assembly (51). Insert assembled swivel fitting (6), pneumatic swivel joint (8), gaskets (7 and 9), and tube assembly (33) through internal components of yoke and fork assembly.

x. Install bolts (49), washers (50 and 52), and nuts (53) which secure fork assembly (51) to shaft (47).

y. Tighten nuts which secure cap (3) to yoke and fork assembly and secure with lock wire in sets of three.

z. Align holes in cap (3) and upper cam (5) with depressions in upper fitting of swivel, and install bolts (1 and 32), washers (2 and 31), and collar (4). Secure bolts with lock wire. Install elbow (25), ring (26), gasket (27), and nut (29).

aa. Secure tubing from swivel fitting (6) to leg of fork assembly (51) with clamps (54 and 57), screw (59), washers (56 and 58), and nut (55). Snap split phenolic block into place at bottom of fork assembly.

ab. Position axle (64) with bushing (63) in fork assembly and secure with bolts (60), washers (61), and nuts (62).

Note

Tighten nuts (62) to a torque of 50 to 55 inch-pounds.

ac. Pack wheel bearings with grease, Military Specification MIL-G-3545. Install wheel assembly, spacer (65), washer (66), and nut (67) on axle (64). Tighten nut just enough to remove end play. Bend one edge of washer over nut.

2–76. CARGO SLING INSTALLATION.

2–77. DISASSEMBLY – 4000-POUND CAPACITY CARGO RELEASE HOOK (FOURTH ECHELON).

a. Remove cargo release hook. (Refer to TM 55-1520-202-20, Chapter 2, Section X).

b. Remove screws and washers (13, figure 2–14) that secure receptacle (12) to case (5) and cover (26) of cargo release hook.

c. Remove screws and washers (18) that secure cable attaching access door (19) to case (5) and cover (26).

d. Remove manual cable entry adapter (9) from top of case.

e. Remove internal wrenching bolts (27) that secure cover (26) to case (5).

f. Pry cover from case.

Note

Do not lose actuator pin located in lower flange of cover.

Note

Steps *g* through *j* cover removal of solenoid (6).

g. Remove pin and cotter pin (15) from end of plunger arm (14). Swing links (16) clear of plunger arm to avoid damaging them when removing solenoid.

h. Remove screws and washers (7) that secure solenoid (6) to case (5).

i. Lift solenoid (6) from its position to gain access to wire leading from solenoid to terminal of touchdown switch and safety switch (22). Disconnect wire and pull it through clamp.

j. Remove solenoid (6) from case (5).

k. Remove plunger (11), outer spring retainer, spring (10), and inner spring retainer (8) from solenoid (6).

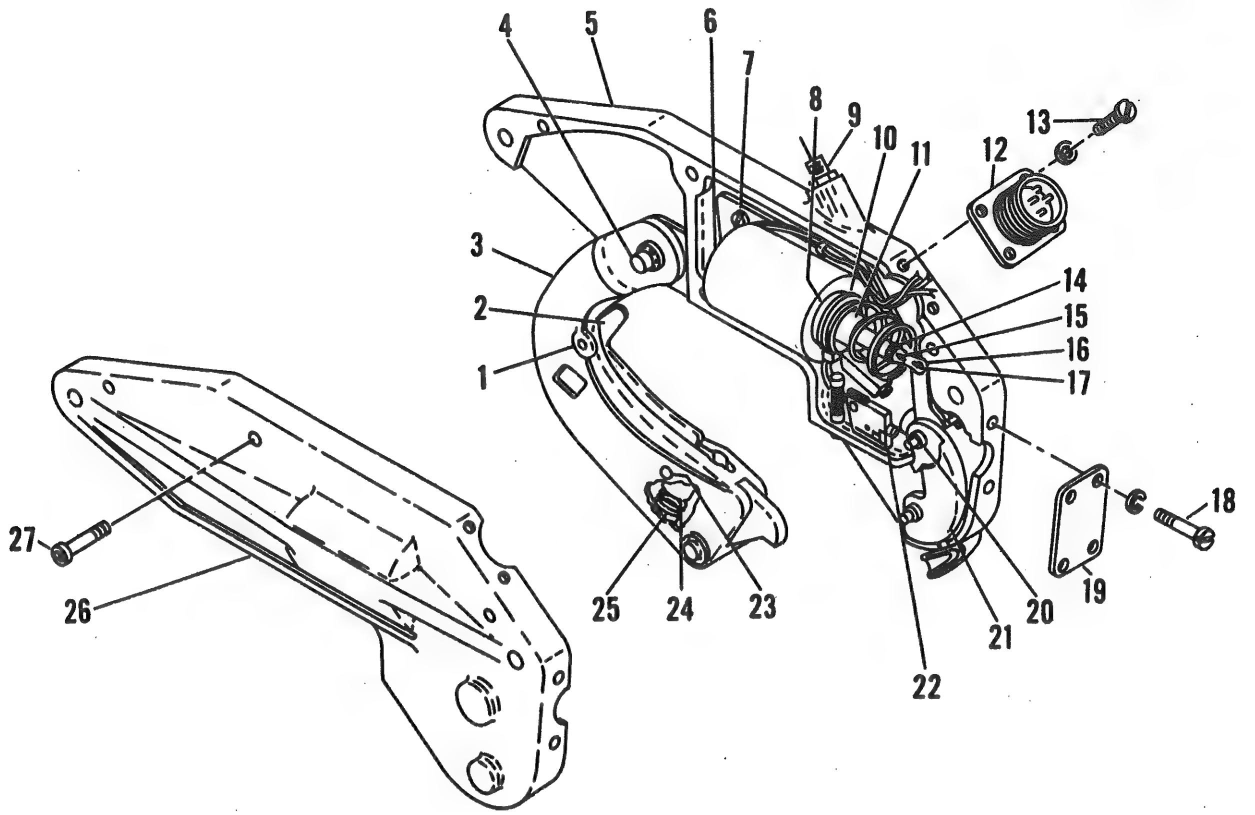
l. Remove plunger (11) from plunger arm (14) by removing rollpin.

Note

Steps *m* through *o* cover removal of touchdown switch and safety switch (22).

m. Remove screws and washers that secure touchdown switch and safety switch (22) to case (5).

n. Twist switches slightly and disconnect electrical wiring. Remove switches.



1. Pin	10. Spring	19. Cable Attaching Access Door
2. Trigger	11. Plunger	20. Latch Shaft
3. Load Beam	12. Receptacle	21. Latch
4. Load Beam Shaft	13. Screw, Washer	22. Touchdown Switch and Safety Switch
5. Case	14. Plunger Arm	23. Rollpin
6. Solenoid	15. Pin, Cotter Pin	24. Plunger
7. Screw, Washer	16. Link	25. Spring
8. Inner Spring Retainer	17. Pin, Cotter Pin	26. Cover
9. Manual Cable Entry Adapter	18. Screw, Washer	27. Internal Wrenching Bolt

Figure 2–14. Cargo Release Hook (4000-Pound)

o. Remove screws and washers that secure bus bar to switches. Separate switches, actuators, pin guides, and phenolic spacer.

p. Lift latch (21) and latch shaft (20) from needle bearing in case (5).

q. Remove pin and cotter pin (17) and links (16) from upper end of latch (21).

r. Lift load beam (3) and load beam shaft (4) from case (5).

s. Remove rollpin (23), located above aft end of trigger (2).

t. Press out pin (1) that secures forward end of trigger (2).

u. Remove trigger (2), plunger (24), and spring (25).

2–78. ASSEMBLY – 4000-POUND CAPACITY CARGO RELEASE HOOK (FOURTH ECHELON).

a. Position spring (25, figure 2–14) and plunger (24) in round hole in load beam (3).

b. Position trigger (2) in load beam (3) and depress plunger (24) and spring (25). Insert rollpin (23) above aft end of trigger. Press pin (1) into place to secure forward end of trigger.

c. Position links (16) on upper end of latch (21) and secure with pin and cotter pin (17).

d. Insert latch shaft (20) into needle bearing. Install latch (21) on latch shaft.

Note

Steps *e* through *g* cover installation of touchdown switch and safety switch (22).

e. Position following parts, in the order given, on rectangular pad below aft end of solenoid (6): pin guide, actuator, touchdown switch, phenolic spacer, pin guide, actuator, and solenoid safety switch.

Note

Position each switch with actuator pin down. Position each pin guide with pin and spring forward of switches. Check that touchdown switch actuator pin is installed in lower flange of case (5).

f. Install screws and washers that secure switches, pin guides, actuators, and spacer to case (5).

Note

Step *f* should be accomplished after step *g* if solenoid (6) was not removed.

g. Position bus bar on terminal on top of each switch. Connect bus bar and electrical wiring to switches.

Note

Steps *h* through *k* cover installation of solenoid (6).

h. Place plunger arm (14) in plunger (11) and secure with rollpin.

i. Place outer spring retainer, spring (10), and inner spring retainer (8) over plunger (11). Insert plunger in solenoid (6).

j. Draw end of long wire leading from solenoid through wiring clamp and connect it to safety switch.

k. Position solenoid in case (5) with leg of clamp under solenoid. Secure solenoid to case with screws and washers (7).

l. Connect links (16) to plunger arm (14) with pin and cotter pin (15).

m. Position load beam shaft (4) in case (5).

n. Install load beam (3) on load beam shaft (4).

o. Carefully coat edge of case (5) with zinc chromate primer, Military Specification MIL-P-8585. Install cover (26) on case.

Note

Before installing cover, assure that solenoid safety switch actuator pin, which extends through lower flange of cover, moves freely and is in down position.

CAUTION

Do not attempt to force cover and case together. If proper assembly procedures have been followed, the two parts need only to be firmly pressed together.

p. Insert internal wrenching bolts (27) through cover (26) and secure cover to case (5).

q. Screw manual cable entry adapter (9) into hole at top of case.

r. Secure cable attaching access door (19) to case and cover with screws and washers (18).

s. Secure receptacle (12) to case and cover with screws and washers (13).

t. Install cargo release hook. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

2–79. DISASSEMBLY – 5000-POUND CAPACITY CARGO RELEASE HOOK (FOURTH ECHELON).

a. Remove cargo release hook. (Refer to TM 55-152Q-202-20, Chapter 2, Section III.)

b. Remove manual cable entry adapter (5, figure 2–15) from top of case (17).

c. Remove bolt, washer, and nut (23) from forward end of cargo release hook.

d. Remove washer (25), nut (26), and cotter pin (27) from bolt (2) at aft end of cargo release hook. Do not remove bolt.

e. Pry cover (1) up about 1/8 inch. Insert small screwdriver at bottom of opening between cover and case (17), and hold latch and lever (4) in position. Remove cover.

Note

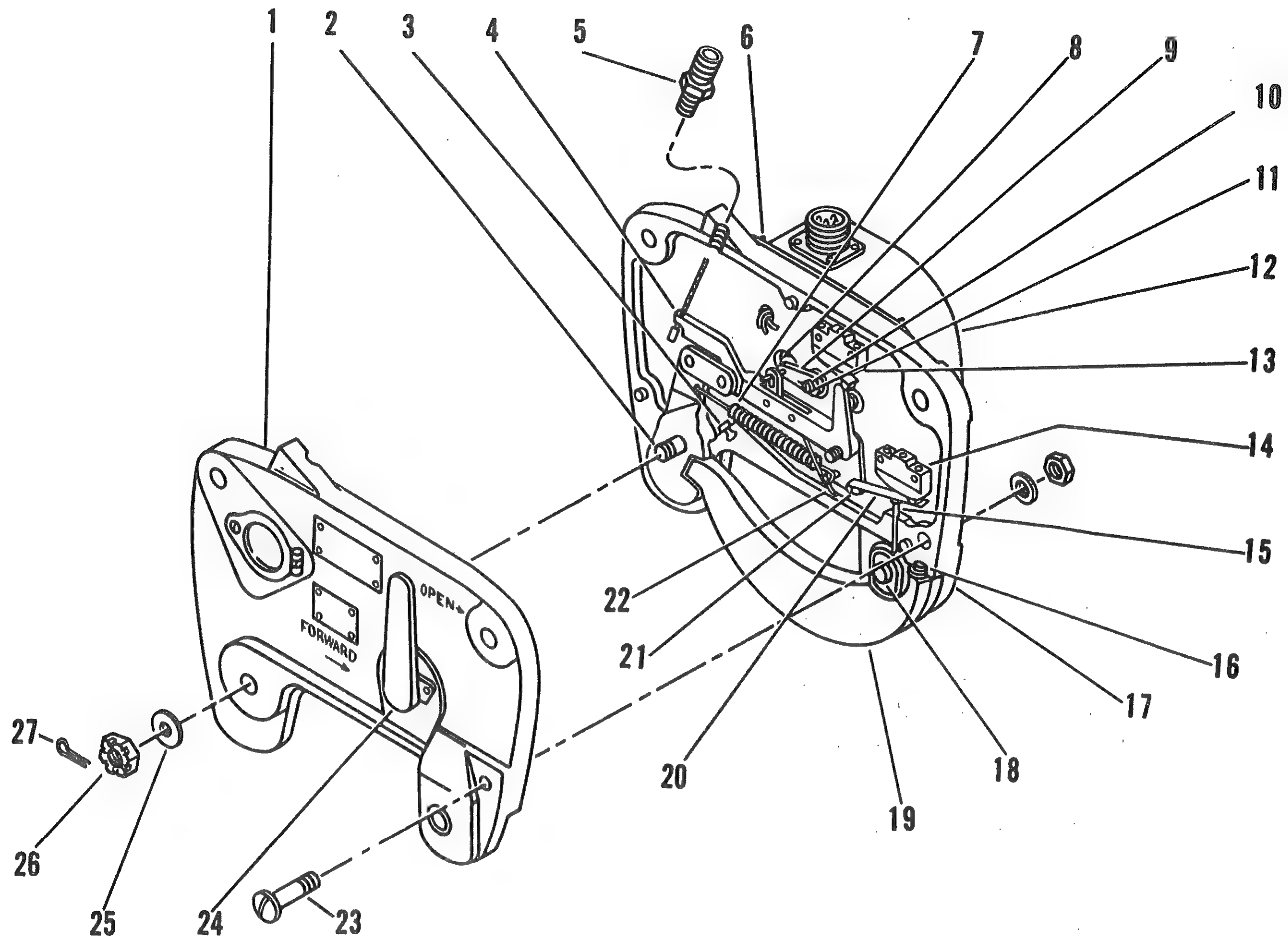
Manual release lever (24) may be removed by removing rollpin at bottom of lever.

f. Lift load beam (19) from trunnion (18).

WARNING

Trunnion houses spring-loaded plunger that is released when load beam is removed.

g. Remove trunnion, spring, and plunger (18) from case (17).



1. Cover
2. Bolt
3. Latch Bumper
4. Latch and Lever
5. Manual Cable Entry Adapter
6. Screw, Washer
7. Latch Spring
8. Solenoid Bushing
9. Solenoid Arm
10. Solenoid
11. Cotter Pin
12. Solenoid Cover
13. Safety Switch
14. Touchdown Switch
15. Touchdown Switch Actuator Pin
16. Load Beam Bumper
17. Case
18. Trunnion, Spring, Plunger
19. Load Beam
20. Touchdown Switch Actuator Spring
21. Touchdown Switch Actuator
22. Lever Spring
23. Bolt, Washer, Nut
24. Manual Release Lever
25. Washer
26. Nut
27. Cotter Pin

Figure 2–15. Cargo Release Hook (5000-Pound)

h. Remove lever spring (22). Unhook forward end of latch spring (7) from pivot pin. Lift latch and lever (4) from case (17). Unhook latch spring (7) from latch. Remove bolt (2).

i. Remove cotter pin (11) and remove solenoid arm (9) from solenoid (10).

j. Pry safety switch (13) and touchdown switch (14) gently from pins on which they are mounted. Disconnect electrical wiring from each switch and remove switches.

k. Remove touchdown switch actuator (21) and touchdown switch actuator spring (20) from pin on which they pivot. Remove touchdown switch actuator pin (15) from flange of case (17).

l. Remove screws and washers (6) that secure solenoid cover (12) to case (17). Remove solenoid bushings (8) that secure solenoid (10) to case. Remove solenoid cover, solenoid, and electrical wiring.

m. Remove load beam bumper (16) and latch bumper (3).

2–80. ASSEMBLY – 5000-POUND CAPACITY CARGO RELEASE HOOK (FOURTH ECHELON).

a. Position solenoid (10, figure 2–15) against exterior surface of case (17) and secure with solenoid bushings (8). Route electrical wiring through hole in case.

b. Coat edge of solenoid cover (12) with zinc chromate primer, Military Specification MIL-P-8585. Install cover over solenoid and secure with screws and washers (6).

c. Install touchdown switch actuator pin (15) in flange of case (17). Install touchdown switch actuator spring (20) on pivot pin nearest actuator pin, with short end of spring bearing against flange of case. Install touchdown switch actuator (21) on pivot pin, with long end of actuator spring bearing against top surface of actuator.

d. Connect electrical wiring to safety switch (13) and touchdown switch (14). Position each switch on its mounting pins and press gently into place.

CAUTION

Depress touchdown switch actuator (21) while installing touchdown switch (14) to avoid damaging roller on switch.

e. Position solenoid arm (9) on solenoid (10) with pin in arm engaged in slot in solenoid and arm pointing away from touchdown switch (14). Secure arm to solenoid with cotter pin (11).

f. Install bolt (2) through hole near lower aft corner of case (17).

g. Hook long end of latch spring (7) through small hole in latch portion of latch and lever (4). Position latch and lever in case (17) with latch pivoting on bolt (2) and pin on forward end of lever in hole in case.

CAUTION

Depress actuator on safety switch (13) so that it will clear actuator arm on lever. Position pin on solenoid arm (9) in slotted link on top of lever.

h. Hook short end of latch spring (7) over aft pivot pin. Install lever spring (22) on same pivot pin, with long end of spring inside lever portion of latch and lever (4) and on top of forward rollpin. Short end of lever spring should bear against flange of case (17).

CAUTION

Latch spring (7) must be installed on pivot pin before lever spring (22) is installed. Touchdown switch actuator spring (20) must be installed with short end of spring between short end of lever spring and surface of case. Lever spring must be installed with short end pointing forward and down so that it crosses short end of actuator spring.

i. Position spring in trunnion (18). Position plunger over spring. Install trunnion in hole near lower forward corner of case (17) with plunger facing up.

j. Depress plunger (18) and install load beam (19).

k. Install load beam bumper (16) and latch bumper (3).

l. Coat edge of case (17) with zinc chromate primer, Military Specification MIL-P-8585.

CAUTION

Avoid placing primer near slot in which touchdown switch actuator pin (15) is installed to prevent restricting movement of pin.

m. Guide pilot pins on case (17) into holes in cover (1). Install cover on case. Engage shaft of manual release lever (24) with slot in shaft on forward end of latch and lever (4) as cover is installed.

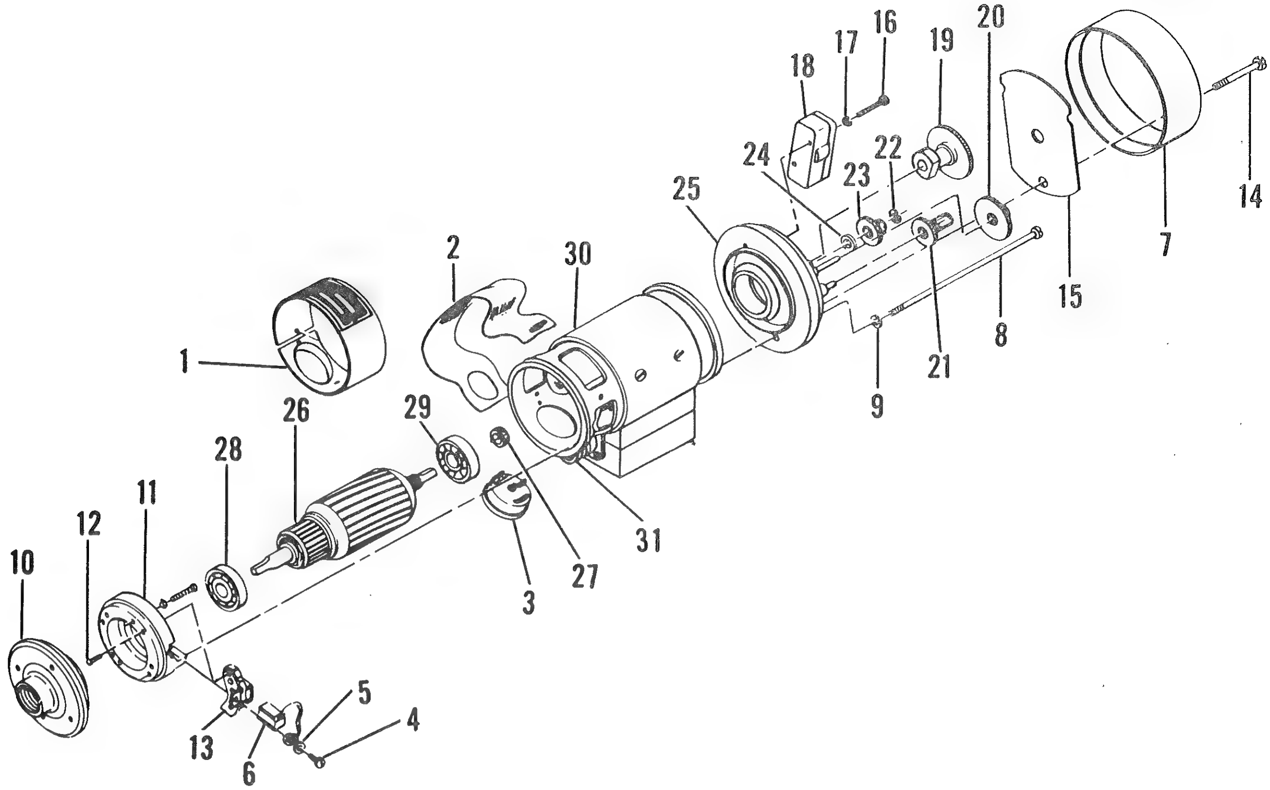
CAUTION

Cover should close with only finger pressure applied. Before installing cover, check to see that pin on solenoid arm (9) is in slotted link on top of lever; that latch, touchdown switch actuator, and lever springs (7, 20, and 22) are properly installed; that touchdown switch actuator pin (15) is properly seated; that switch actuators are in their proper positions; and that latch and load beam bumpers (3 and 16) are in place.

n. Install washer (25), nut (26), and cotter pin (27) on bolt (2).

o. Install bolt, washer, and nut (23) at forward end of hook.

p. Screw manual cable entry adapter (5) into hole at top of case (17).



1. Band
2. Insulator
3. Thermoprotector
4. Screw
5. Lockwasher
6. Brush And Clip Assembly
7. Case Assembly
8. Bolt
9. Lockwasher
10. Bell Assembly
11. Ring
12. Screw
13. Brush Holder
14. Screw
15. Insulator
16. Screw
17. Lockwasher
18. Parking Switch
19. Cam Assembly
20. Gear Assembly
21. Gear Assembly
22. Ring
23. Gear Assembly
24. Washer
25. End Plate
26. Armature
27. Gear
28. Bearing
29. Bearing
30. Barrel Assembly
31. Connector

Figure 2–16. XW20173 Motor

q. Install cargo release hook. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

2–81. WINDSHIELD WIPER MOTOR. (See figure 2–16.)

2–82. DESCRIPTION. Power to drive the windshield wiper blades is supplied by a Type XW20173 electric motor operating on dc current from the aircraft electrical system.

2–83. REMOVAL. (Refer to TM 55-1520-202-20, Chapter 2, Section XI.)

2–84. DISASSEMBLY.

a. Remove band (1, figure 2–16) and insulator (2).

b. Remove thermoprotector (3).

c. Remove screw (4), lockwasher (5), and brush and clip assembly (6).

d. Remove case assembly (7).

e. Remove bolts (8) and lockwashers (9).

f. Remove bell assembly (10) and ring (11).

g. Remove screws (12) and brush holders (13).

h. Remove screws (14) and insulator (15).

i. Remove screws (16), lockwashers (17), and parking switch (18).

j. Remove cam assembly (19), gear assembly (20), gear assembly (21), ring (22), gear assembly (23), and washer (24).

k. Remove end plate (25).

l. Remove armature (26) from barrel assembly (30).

Note

Armature (26), bearings (28 and 29) and gear (27) are removed as a unit.

n. Remove connector (31).

m. Remove bearings (28 and 29) and gear (27).

2–85. CLEANING.

a. Clean all metal parts, with the exception of armature (26, figure 2–16) and brush and clip assembly (6), with dry-cleaning solvent, Federal Specification P-S-661.

b. Carefully dry with compressed air or clean lint-free cloth.

c. Armature (26), particularly the commutator, should be cleaned with a dry brush. Commutator should be wiped clean to remove any film deposit.

2–86. INSPECTION.

a. Visually inspect all parts for obvious defects or excessive wear. Particular attention should be given to gear and pinion teeth and gear posts and bores.

b. Check bearings for freedom of movement. Bearing fits should be snug but not tight at room temperature.

c. Check windings on armature (26) and starter windings of barrel assembly (30) for broken leads and frayed insulation.

d. Check commutator for excessive wear and make sure surfaces are smooth and clean.

e. Check brushes on brush and clip assembly (6) and discard if excessively worn. Check brush holder (13) to assure that spring pressure is adequate for positive contact.

f. Check parking switch (18) by pressing in and releasing switch actuating plunger. Switch action should be positive acting, and a distinct click should be audible each time plunger is pressed in or released. Reject switch if switch action is slow or terminals are loose. Cam assembly (19) should be rejected if sufficiently worn to prevent positive contact with switch plunger.

2–87. OVERHAUL.

a. Resolder any loose connections where necessary.

b. Replace worn or defective parts at reassembly.

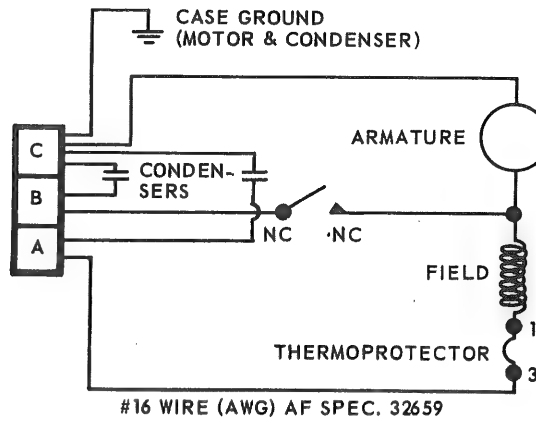


Figure 2–17. XW20173 Motor Schematic

2–88. REASSEMBLY.

a. Rewire motor in accordance with wiring schematic. (See figure 2–17.) Soft solder all terminal connections.

b. Assemble thermoprotector (3, figure 2–16) to barrel assembly (30), then solder leads to thermoprotector.

c. Attach brush holder (13) to ring (11) with screws (12).

Note

Do not install brush and clip assembly (6) at this time.

d. Assemble bell assembly (10) to ring (11), and attach electrical connectors which also attach to parking switch (18). Thread leads through barrel assembly (30).

e. Move assembled bell assembly (10) and ring (11) to barrel assembly (30) and hold in position by wrapping with masking tape.

f. Install bearings (28 and 29) on shaft of armature (26).

g. Install gear (27) on driven end of armature shaft.

h. Move armature (26) and related items into mounting end of barrel assembly (30) so that bearing on end of armature shaft seats properly in bell assembly (10).

i. Attach parking switch (18) to end plate (25) with screw (16) and lockwasher (17).

j. Fit end plate (25) to barrel assembly (30) and secure all units with bolts (8) and lockwashers (9).

k. Make electrical connections to parking switch (18).

l. Install gear assemblies (20, 21, and 23) and cam assembly (19) on shafts of end plate (25) in correct relationship, and hold all reduction gears in position by installing insulator (15) and case assembly (7). Install screws (14).

m. Install insulator (2) and band (1).

n. Install connector (31).

2–89. LUBRICATION. Place one drop of light oil on gear posts during reassembly.

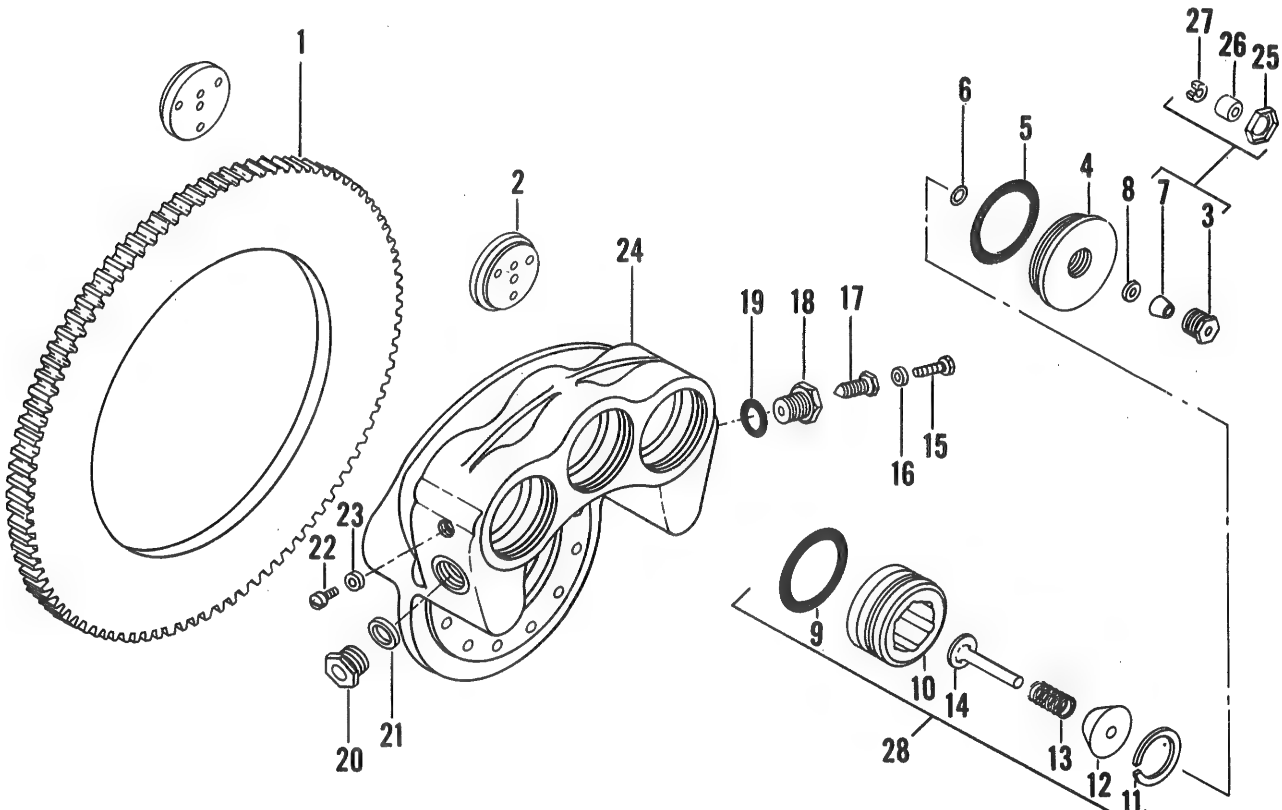
2–90. INSTALLATION. (Refer to TM 55-1520-202-20, Chapter 2, Section XI.)

2–91. BRAKE ASSEMBLY.

2–92. DESCRIPTION. Brakes on the CH-34 helicopter are the single-disc type, installed on each of the main wheels and operated individually by the toe of the pilot's tail rotor control pedals.

2–93. REMOVAL. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

2–94. DISASSEMBLY. (See figure 2–18.) The primary objective in the disassembly is to free the disc, the linings, and the piston subassemblies.



1. Brake Disc
2. Brake Lining
3. Adjusting Pin Nut
4. Cylinder Head
5. O-Ring Gasket
6. O-Ring Packing
7. Adjusting Pin Grip
8. Washer
9. O-Ring Packing
10. Piston
11. Internal Retainer Ring
12. Spring Guide
13. Brake Release Spring
14. Adjusting Pin
15. Screw
16. Washer
17. Bleeder Valve
18. Bleeder Adapter
19. Gasket
20. Inlet Bushing
21. Gasket
22. Bleeder Screw
23. Washer
24. Cylinder Housing
25. Palnut
26. Bushing
27. Grip
28. Piston Subassembly

Figure 2–18. Brake Assembly

The principal fastening parts are the bolts which secure the backplate and the cylinder housing to the aircraft axle torque flange.

a. Slide brake disc (1) from between brake linings (2) and remove disc and linings from housing (24).

b. Remove adjusting pin nut (3).

c. Remove cylinder head (4), using wrench adapter, part No. 43193, then remove adjusting pin grip (7) and washer (8).

d. Remove O-ring packing (6) and O-ring gasket (5) from cylinder head (4).

e. Push piston subassembly (28) from cylinder housing (24).

f. Remove O-ring packing (9) from piston (10).

g. Place piston subassembly (28) in an arbor press to compress spring guide (12) and brake release spring (13), and remove internal retainer ring (11).

h. Release arbor press.

i. Remove spring guide (12), brake release spring (13), and adjusting pin (14) from piston (10).

j. Remove screw (15) releasing washer (16). Unscrew bleeder valve (17), then remove bleeder adapter (18) and gasket (19).

k. Unscrew inlet bushing (20) releasing gasket (21). Complete the disassembly by removing bleeder screw (22), releasing washer (23).

2–95. CLEANING.

a. Blow dirt and foreign matter out of brake housing with compressed air.

b. Clean all metal parts by washing in dry-cleaning solvent, Federal Specification P-S-661.

c. Wash all rubber parts in denatured alcohol or clean hydraulic fluid, Military Specification MIL-H-5606.

CAUTION

Never wash O-ring packings or gaskets with dry-cleaning solvent as it will damage the rubber.

2–96. INSPECTION.

a. Inspect all parts for wear or damage.

b. Examine brake housing for cracks or distortion. Replace housing if either condition is found.

c. Inspect brake disc and replace if disc is worn below 0.300-inch thickness. Brake discs which have dished enough to cause brake drag, or which have shrunk to a point where very little clearance remains between inside diameter and housing, should be repaired or replaced.

d. Inspect cylinder housing walls for wear or damage.

e. Inspect brake linings for wear.

f. Inspect adjusting pins for wear or depressions. Nicks 0.003 inch or less in the sealing surface are permissible; however, raised metal from nicks shall be removed by polishing. Inspect grip holding surface of adjusting pins for taper or reduction of diameter throughout operating length. Replace pin if variations of 0.005 inch or more are found.

2–97. REPAIR AND REPLACEMENT. A disc which is not worn below 0.360 inch in thickness may be stretched or straightened with special tools of local manufacture (see figure 2–19) in accordance with steps *a* and *b*.

a. Place guide ring on base of hydraulic press. (See figure 2–20.)

b. Place dished or shrunken disc on guide ring (convex surface of disc up). Insert stretching cone and apply sufficient pressure to force disc through the horizontal position.

c. If brake disc requires only straightening (figure 2–21), place dishing plate on disc and apply sufficient pressure to force disc through the horizontal plane far enough so that when pressure is released the disc will return to a flat condition.

Note

Check flatness of disc by placing a straight edge across the diameter of the disc.

d. If disc requires both stretching and straightening, follow procedures given in steps *a* through *c*.

e. If disc lining wear face is rough or nicked, disc may be surface-ground providing resulting thickness is not less than 0.360 inch. Sharp edges or burrs should be removed. All reworked discs shall be magnetic-particle-inspected and restamped with original part number.

f. If housing cylinder walls are worn or damaged, they may be polished up to a diameter of 2.136 inches and reassembled with standard pistons and parts.

g. If polishing cylinder walls, as described in step *f*, does not restore housing to a condition suitable for reuse, the cylinder cavities may be

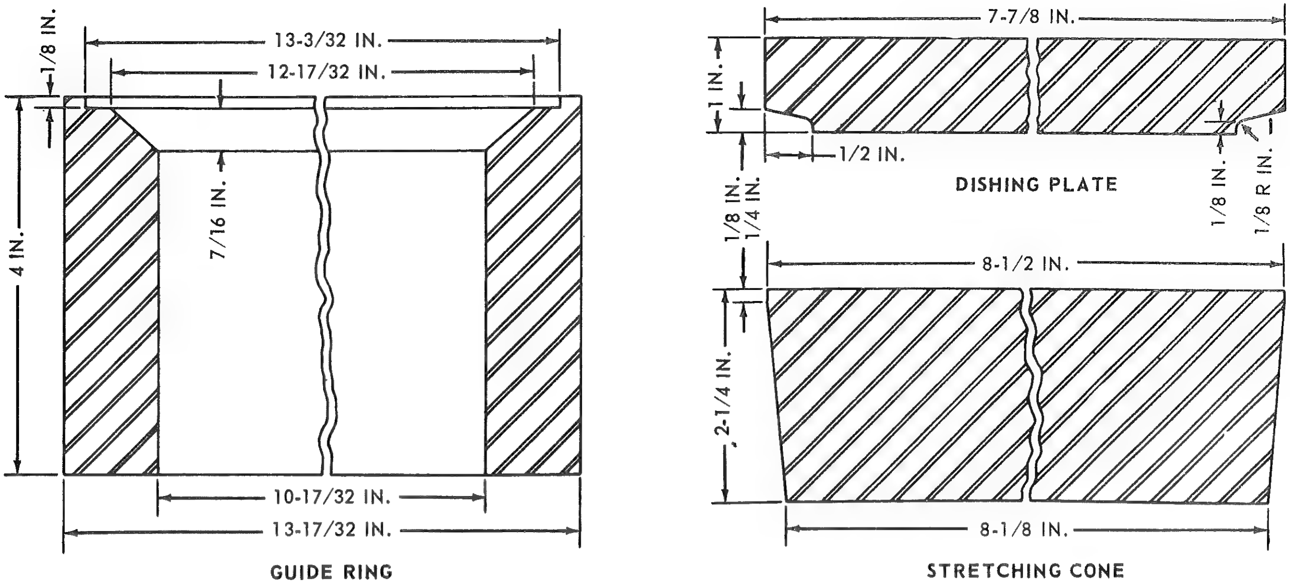


Figure 2–19. Brake Disc Repair Tool

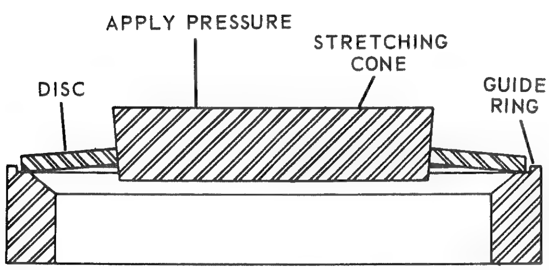


Figure 2–20. Stretching Disc

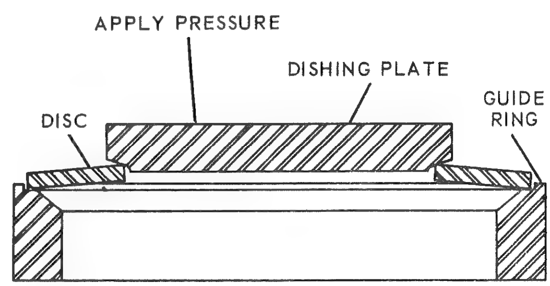


Figure 2–21. Straightening Disc

machined to 2.175 ± 0.001 inches in diameter; then oversized pistons, part No. 9522145, may be installed at reassembly.

Note

Working surfaces of the cylinder walls must be polished and free from pits and other imperfections. The recommended surface finish is 15 rms. Concentricity with the cylinder head threads must be maintained.

h. Treat machined surfaces and repaint housing as originally manufactured. Metal stamp the letter R after assembly number to indicate that oversize pistons have been installed and must be used for future replacement.

i. Lining wear in this brake assembly may be determined by applying the brake and measuring the distance between face of brake disc and flat surface of housing that parallels disc. (See figure 2–22.) If this distance is 0.438 inch or greater, linings should be replaced as the anvil lining is worn below limits.

Note

This measurement should be made near the center of the disc face.

j. If the above dimension is less than 0.438 inch, visually check thickness of piston linings and, if any one is worn to a thickness of less than 1/16 inch, replace all linings.

CAUTION

Excessively worn brake linings must be replaced. Always replace complete set of brake linings in a brake. Never mix new and used linings.

k. REPLACEMENT. Replace O-ring packings and gaskets at each overhaul.

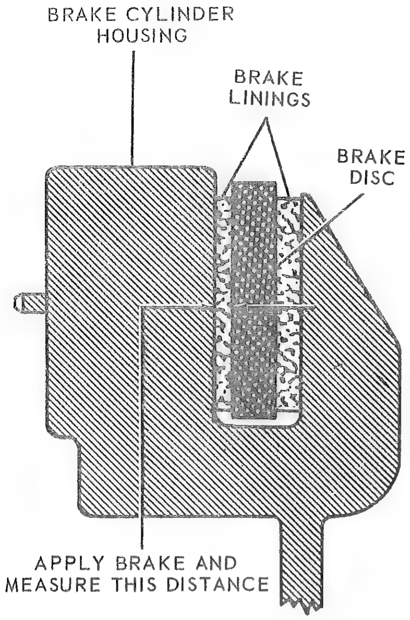


Figure 2–22. Checking Brake Lining Wear

2–98. LUBRICATION.

a. Lubricate housing cylinder walls and contacting surfaces of pistons and their O-ring grooves with a thin coat of grease, Military Specification MIL-G-7711.

b. Lubricate cylinder head O-ring packing grooves and threads with a thin coat of grease, Military Specification MIL-G-7711.

c. Lubricate housing bolt threads and all bearing surfaces of bolt heads, washers, and nuts at each assembly with anti-seize thread compound, Military Specification MIL-T-5544.

d. Dip adjusting pin grips in hydraulic fluid, Military Specification MIL-H-5606, before installation in brake.

2–99. REASSEMBLY OF BRAKE ASSEMBLY. (See figure 2–18.)

a. Insert adjusting pin (14) into piston (10).

b. Place brake release spring (13) and spring guide (12) over adjusting pin (14).

c. Place in an arbor press and compress spring guide (12) and brake release spring (13) until they bottom. Hold in compression until internal retainer ring (11) is installed.

d. Release arbor press.

e. Coat cylinder walls contacting piston surfaces and O-ring packing grooves with grease, Military Specification MIL-G-7711. Coat O-ring packing (6), O-ring gasket (5), and O-ring packing grooves and threads of cylinder head (4) with grease, Military Specification MIL-G-7711.

f. Mount O-ring packing (9) in groove on piston (10) and install in cylinder housing (24).

g. Insert O-ring gasket (5) and O-ring packing (6) in grooves on cylinder head (4).

h. Place cylinder head (4) over adjusting pin (14) and screw into position in cylinder housing (24). Tighten cylinder head (4) to a torque of 75 foot-pounds using cylinder wrench adapter, part No. 43193, and torque wrench, part No. TQ-602A.

i. Place washer (8), adjusting pin grip (7), and adjusting pin nut (3) over adjusting pin (14) and screw into position, but do not tighten.

j. Push piston subassembly (28) toward cylinder head (4) as far as possible.

k. Mount gasket (19) on bleeder adapter (18) and screw into position in cylinder housing (24).

l. Screw bleeder valve (17) into bleeder adapter (18).

m. Mount washer (16) on screw (15) and screw into bleeder valve (17).

n. Mount washer (23) on bleeder screw (22) and screw into cylinder housing (24). Then mount gasket (21) on inlet bushing (20) and screw into cylinder housing (24).

o. Insert brake lining (2) into lining cavity on backplate and into lining recess of piston subassembly (28).

p. Position brake disc (1) between brake linings (2).

q. Move brake disc (1) laterally to insure that pistons are in complete OFF position. Then tighten adjusting pin nut (3) evenly. Tighten adjusting pin nut (3) to a torque of 25 foot-pounds. Use torque wrench, part No. TQ-150.

Note

It is advisable to tighten and loosen adjusting pin nut (3) several times prior to applying final torque to permit all parts to seat properly.

Note

Palnut (25), bushing (26), and grip (27) comprise the alternate nontorquing adjustment, providing a self-adjusting mechanism which does not require torquing.

r. To install nontorquing adjustment, place washer (8) and grip (27) in cylinder head (4).

s. Screw bushing (26) in cylinder head (4) until it contacts grip (27), but do not tighten.

t. Install O-ring packing (6) in groove of cylinder head (4).

u. Assemble piston subassembly (28) and place adjusting pin (14) through cylinder head (4), O-ring packing (6), and washer (8), and align with hole in grip (27).

v. Place assembly in vise equipped with soft metal jaws or protectors. Then tighten vise, forcing adjusting pin (14) through grip (27) and bushing (26).

w. Open vise and place a large socket wrench over bushing (26). Then tighten vise to force piston against cylinder head (4).

x. Install piston and cylinder head assembly into brake housing.

y. Screw palnut (25) onto threaded bushing (26) against cylinder head (4). Then tighten one-third turn to lock.

z. Install brake linings (2) in lining recesses in piston and anvil side of housing.

aa. Position brake disc (1) between brake linings.

2–100. FINAL TEST AFTER OVERHAUL.

a. Connect brake assembly to hydraulic pressure supply. Bleed brake and apply pressure of 800 psi.

b. Hold pressure for 2 minutes while checking for hydraulic leaks.

c. Apply and release pressure ten times to be sure that brake functions properly.

d. Brake disc should be free when hydraulic pressure is released.

e. Allow brake to stand for 2 minutes with pressure released, and check for static fluid leaks.

SECTION III

POWER PLANT AND RELATED SYSTEMS

3–1. GENERAL.

3–2. This section covers organizational and field maintenance requirements for the power plant and related systems of the CH-34A and CH-34C helicopters.

3–3. POWER PLANT.

3–4. DESCRIPTION.

3–5. The power plant used in the CH-34A and CH-34C helicopter is the R1820-84 or R1820-84A nine cylinder, supercharged, radial, air-cooled engine which is mounted on a special engine mount. The power plant includes the hydromechanical clutch and fan assembly, cooling system, exhaust collector assembly, engine mount, engine accessories, engine controls, ignition system, engine components, fuel system, and lubrication system. (See figure 3–1.)

3–6. Since certain differences exist among the power plants covered by this section, interchangeability of the power plant must be considered.

Table 3–1. Power Package Differences and Usage

COMPONENT	IDENTIFICATION	EFFECTIVE ON SERIAL NO.	PARAGRAPH
ENGINE CONTROLS (RODS)	Two control rods extend up along left side of air intake duct. (See figure 3–13.)	Prior to 55-4462	3–33, steps *a* and *b*
ENGINE CONTROLS (CABLES)	Four control cable assemblies extend out of top of control assembly located adjacent to the intake duct. (See figure 3–14.)	55-4462 and Subsequent	3–13, step *o*
SYNCHRONIZING-BREAKER	Synchronizing-breaker installed on right tachometer drive pad. (See figure 3–17.)	55-4489 and Subsequent	3–40
WELL ASSEMBLY	Consists of two small rectangular cavities for engine control rods.	Prior to 55-4462	3–33
WELL ASSEMBLY	Consists of one large rectangular cavity for engine control rods.	55-4462 and Subsequent	3–33
ACCESSORY COMPARTMENT COVER ASSEMBLY	Right panel has no sump. Left panel has channel spot-welded on lower right corner. Channel has two riveted nut plates.	All except 56-4315, 56-4316, 56-4320, 57-1684, and 57-1697	3–31
ACCESSORY COMPARTMENT COVER ASSEMBLY	Right panel has circular sump riveted to lower left corner. Left panel has channel riveted on lower right corner. Channel has three riveted nut plates.	56-4315, 56-4316, 56-4320 57-1684, and 57-1697	3–31
EXHAUST COLLECTOR ASSEMBLY (LOW STACK)	A tail pipe section attached to cylinders No. 4 and 5. (See figure 3–10.)	All except 56-4315, 56-4316, 56-4320, 57-1684, and 57-1697	3–25
EXHAUST COLLECTOR ASSEMBLY (HIGH STACK)	Section assemblies are attached to cylinders No. 4 and 5. (See figure 3–11.)	56-4315, 56-4316, 56-4320, 57-1684, and 57-1697	3–28
FIRE EXTINGUISHER RING AND TUBE INSTALLATION	A rear ring assembly (9, figure 3–28) is installed inside shroud cover of engine mount and a ring assembly comprised of mated halves is installed on rear of contravane assembly. (See figure 3–47.)	56-4315, 56-4316, 56-4320, 57-1684, and 57-1697	3–148 and 3–92, step *k*

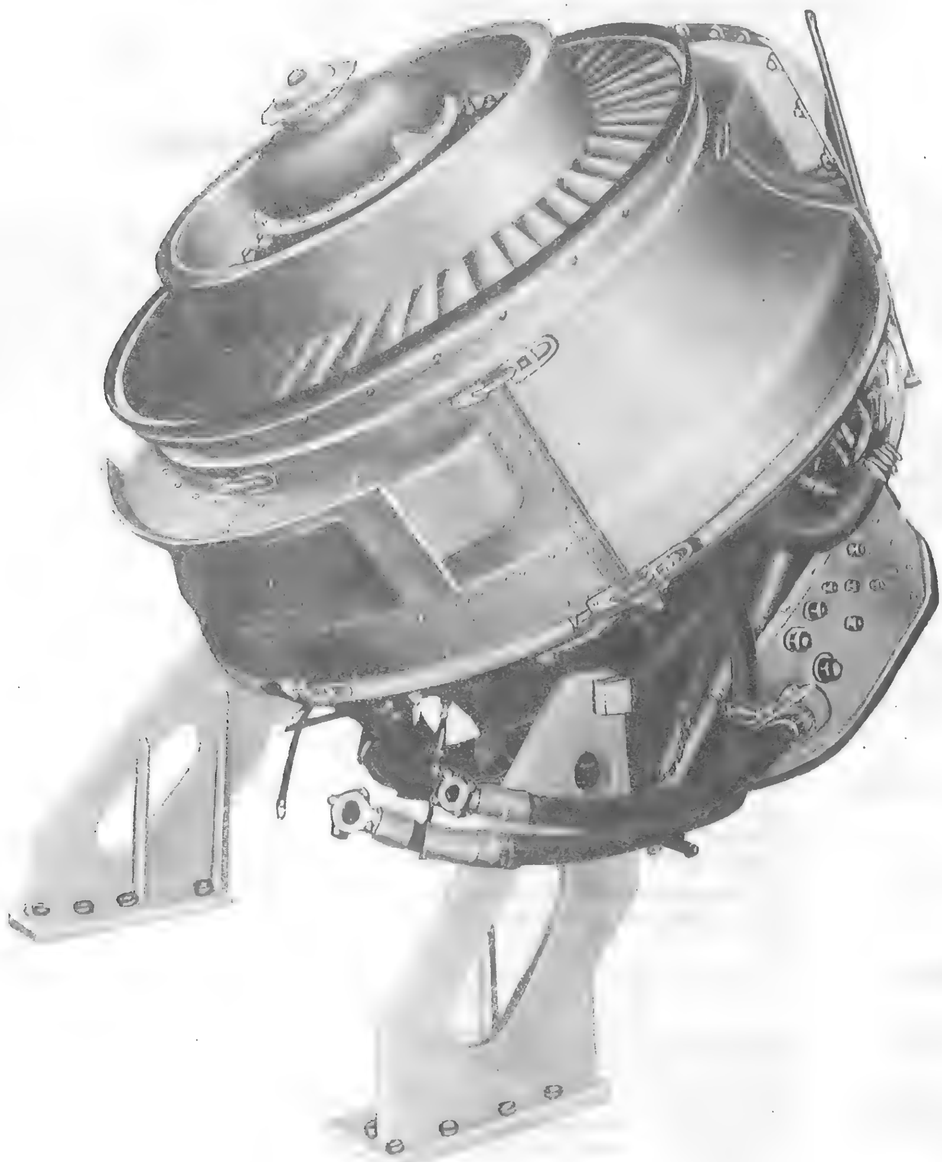


Figure 3–1. Three-Quarter View of Power Plant

Table 3–I lists only those components that affect interchangeability of the power plants among the various Model CH-34 helicopters.

3–7. The terms, right and left, clockwise and counterclockwise, upper and lower, front and rear, and similar directional references used herein apply to the engine when viewed from its rear with the crankshaft in the horizontal position and with cylinder No. 1 at top of the engine. The cylinders are numbered consecutively in a clockwise direction. (See figure 3–2.)

3–8. Disconnect points on the helicopter for the power plant are located as follows: Ignition conduit, start cable, and main electrical plug disconnects are on left forward bulkhead in the engine compartment; fuel, instrument, and hydraulic line disconnects are at the accessory compartment shroud panel on left side of the power plant; oil line disconnects are near the oil cooler, with the exception of the oil vent line disconnect which is at the slanted bulkhead on right side of the helicopter; engine control rod disconnects (serial No. 53-4475 through 54-3050) are near the top of the canted bulkhead; engine control cable disconnects (serial No. 55-4462 and subsequent) are to the left of the air intake duct.

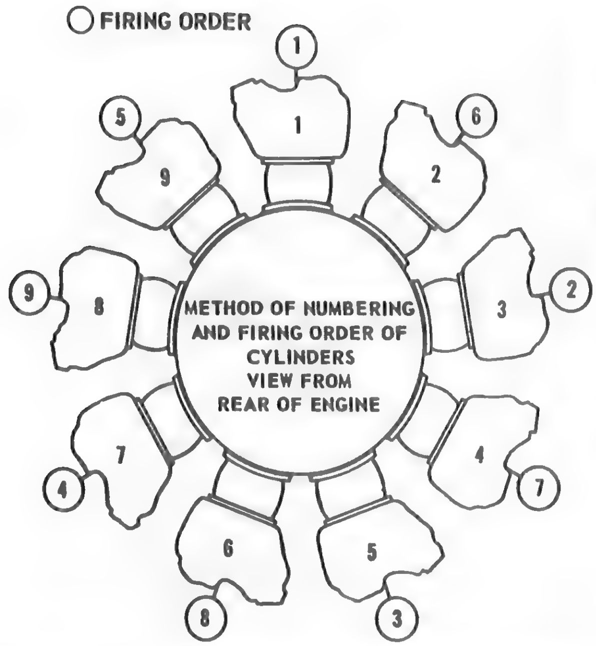


Figure 3–2. Cylinder Numbering and Firing Order

3–9. The maintenance presented in this section will first cover the following requirements relating to the power plant: Engine test, removal of power plant from helicopter, breakdown of power plant, preparation for storage, buildup of power plant, and power plant installation. Following the power plant portion will be the maintenance covering the related systems.

3–10. ENGINE TEST.

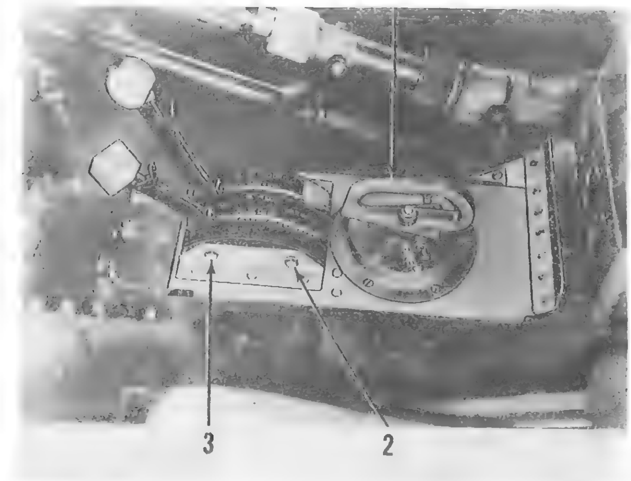
3–11. The engine operational check, system analysis, and inspection procedures will be performed as outlined in TM 55-1520-202-20, Chapter 2, Section IV, and TM 55-405-5.

3–12. REMOVAL OF POWER PLANT FROM HELICOPTER.

3–13. Removal of the power plant is a maintenance operation tailored to shorten helicopter out-of-commission time. The power plant is removed as a unit and broken down as scheduled. This permits the helicopter to have a serviceable power plant installed and to be returned to service without imposing the delay of power plant breakdown and buildup.

WARNING

Make certain all electrical power is OFF prior to removing power plant.



1. Fuel Selector Valve Control Handle
2. Bolt, Washer, Nut
3. Bolt, Washer, Nut

Figure 3–3. Control Quadrant and Fuel Selector Valve Control Handle

Note

Prior to removing the power plant, perform preservation of the engine. (Refer to TM 55-405-5.)

a. Open nose doors.

b. Place fuel selector valve control handle (1, figure 3–3) in OFF position.

c. Drain both oil cells at valve (1, figure 3–4) into a suitable container.

d. On helicopters serial No. 56-4315, 56-4316, 56-4320, 57-1684, and 57-1697, disconnect fire extinguisher tube at oil cooler.

e. On helicopters serial No. 56-4315, 56-4316, 56-4320, 57-1684, and 57-1697, disconnect each fire extinguisher hose from weld assembly at canted bulkhead.

f. Remove starter cable (3) from left forward engine bulkhead. Remove lock wire and remove ignition conduit (2) and main electrical plug (4).

WARNING

Disconnecting ignition conduit (2) has the same electrical effect as placing the ignition switch in the L, R, or BOTH position.

g. Disconnect hoses (5).

h. Loosen wing nut (6) and open hose support assembly and free hose lines.

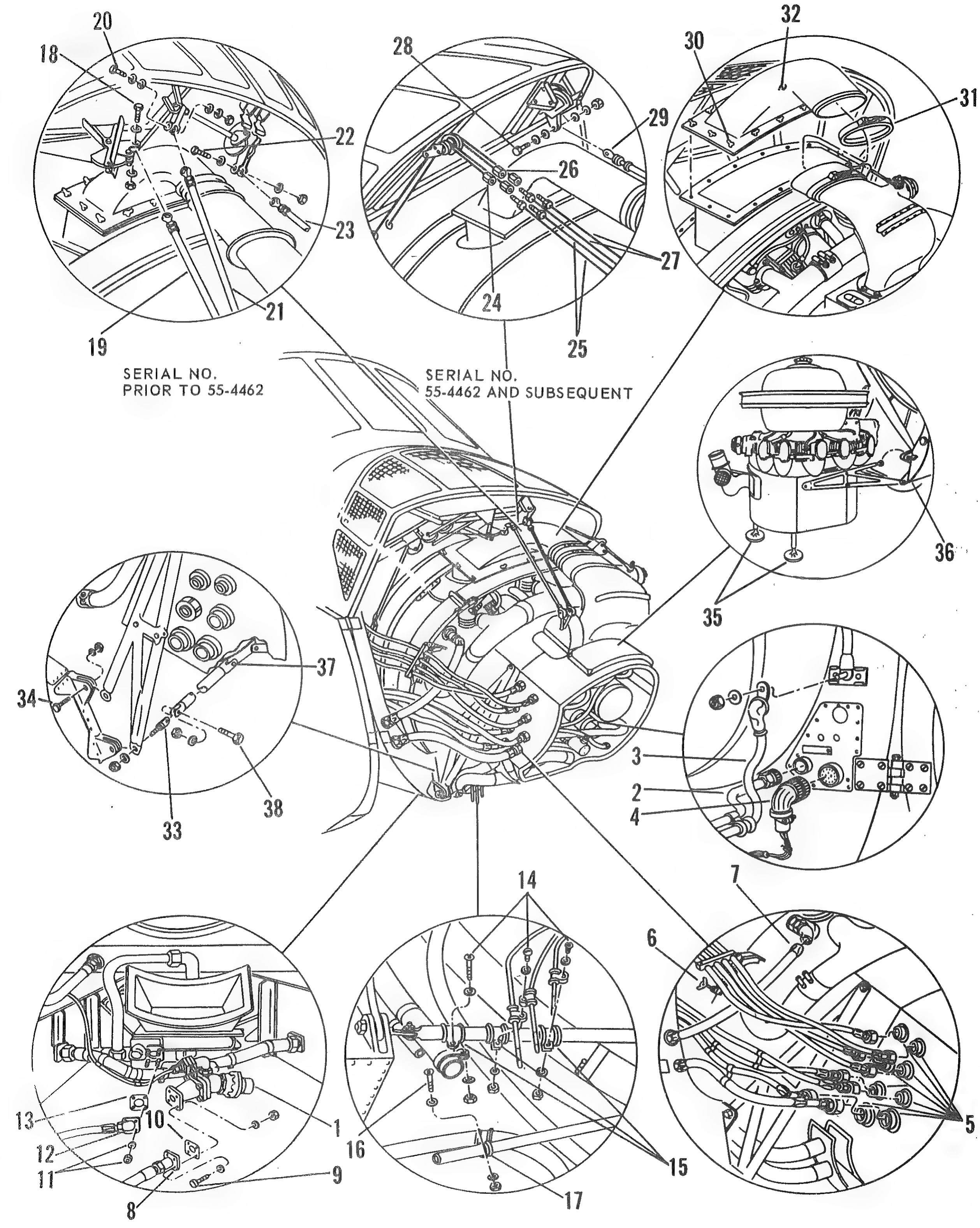


Figure 3–4. Power Package Removal – Installation (Sheet 1 of 2)

1. Valve	11. Nut, Washer	21. Control Rod	31. Marman Clamp
2. Ignition Conduit	12. Flange	22. Bolt, Washers, Nut	32. Cold Air Elbow
3. Starter Cable	13. Gasket	23. Control Rod	33. Eyebolt, Washer, Nut
4. Main Electrical Plug	14. Bolt, Washers, Nut	24. Disconnect	34. Bolt, Washer, Nut
5. Hose	15. Clamp	25. Control Cable	35. Support Stand
6. Wing Nut	16. Bolt, Washers, Nut	26. Disconnect	36. Hinge Points
7. Hose	17. Clamp	27. Control Cable	37. Bolt, Washer, Nut
8. Flange	18. Bolt, Washers, Nut	28. Bolt, Washers, Nut	38. Bolt, Washer, Nut
9. Bolt, Washers, Nut	19. Control Rod	29. Control Rod	
10. Gasket	20. Bolt, Washers, Nut	30. Dzus Fastener	

Figure 3–4. Power Package Removal – Installation (Sheet 2 of 2)

i. Disconnect hose (7).

j. Loosen nuts securing flange (8); after oil has completely drained at flange connections, remove bolts, washers, and nuts (9). Remove flange (8) and gasket (10). Discard gasket.

k. Loosen nuts securing flange (12); after oil has completely drained at flange connections, remove nuts and washers (11). Remove flange (12) and gasket (13). Discard gasket.

l. Remove bolts, washers, and nuts (14) from clamps (15) at three places.

m. Remove bolts, washers, and nuts (16) from clamp (17).

n. On helicopters serial No. prior to 55-4462, remove bolt, washers, and nut (18) from control rod (19); remove bolt, washers, and nut (20) from control rod (21); remove bolt, washers, and nut (22) from control rod (23).

Note

Install bolt, washers, and nut (18) in upper end of control rod (19) after performing step *n*.

o. On helicopters serial No. 55-4462 and subsequent, remove lock wire and open quick disconnects on throttle control and mixture control cables (25) and (27). Remove guides and slide sleeve up each cable. Loosen and open disconnects (24) of control cables (25); loosen and open disconnects (26) of control cables (27); remove bolt, washers, and nut (28) from control rod (29).

p. Loosen marman clamp (31) securing rubber boot to cold air elbow (32) and disconnect Dzus fasteners (30). Remove cold air elbow (32). Disconnect and remove preheat duct if installed. (Refer to TM 55-1520-202-20, Chapter 2, Section XI.)

q. Disconnect clamps of cowl panels (1, 2, and 11, figure 3–5). Remove cowl panels from engine.

r. Remove clutch access door from cabin forward bulkhead. Remove cable from clip (21, figure 3–6) on clutch housing; remove oil hose from elbow (22); remove bolts, washers, gasket and fitting (24) from hydromechanical clutch assembly (9). Drain lubricant from clutch into a suitable container.

Note

If hydromechanical clutch and fan assembly are to be replaced, remove and retain elbow (22), and nut and gasket (23). These items are not furnished with new or overhauled units.

s. Remove bolts, washers, and nuts (19) securing flange (14) to main drive shaft (18). Remove bolts, washers, and nuts (17) securing spacers (15 and 16), flange (14), and spacer (13) to coupling (12). Remove flange and spacers.

t. Remove bolts, washers, and nuts (10) securing coupling (12) to top base of the hydromechanical clutch assembly (9). Remove coupling (12) and bonding jumper (11).

u. Attach fitting and bolts (3 and 6, figure 3–7) of sling hoist assembly to the forward surface of intake rocker box on cylinders No. 2 and 9. Attach fitting and bolts (4 and 5) to forward surface of intake rocker box on cylinders No. 4 and 7. Attach sling assembly to hoist of at least 2-ton capacity.

v. Raise sling assembly with hoist to apply a slight lift to the power plant. Relieve torque on two eyebolts (33, figure 3–4).

Note

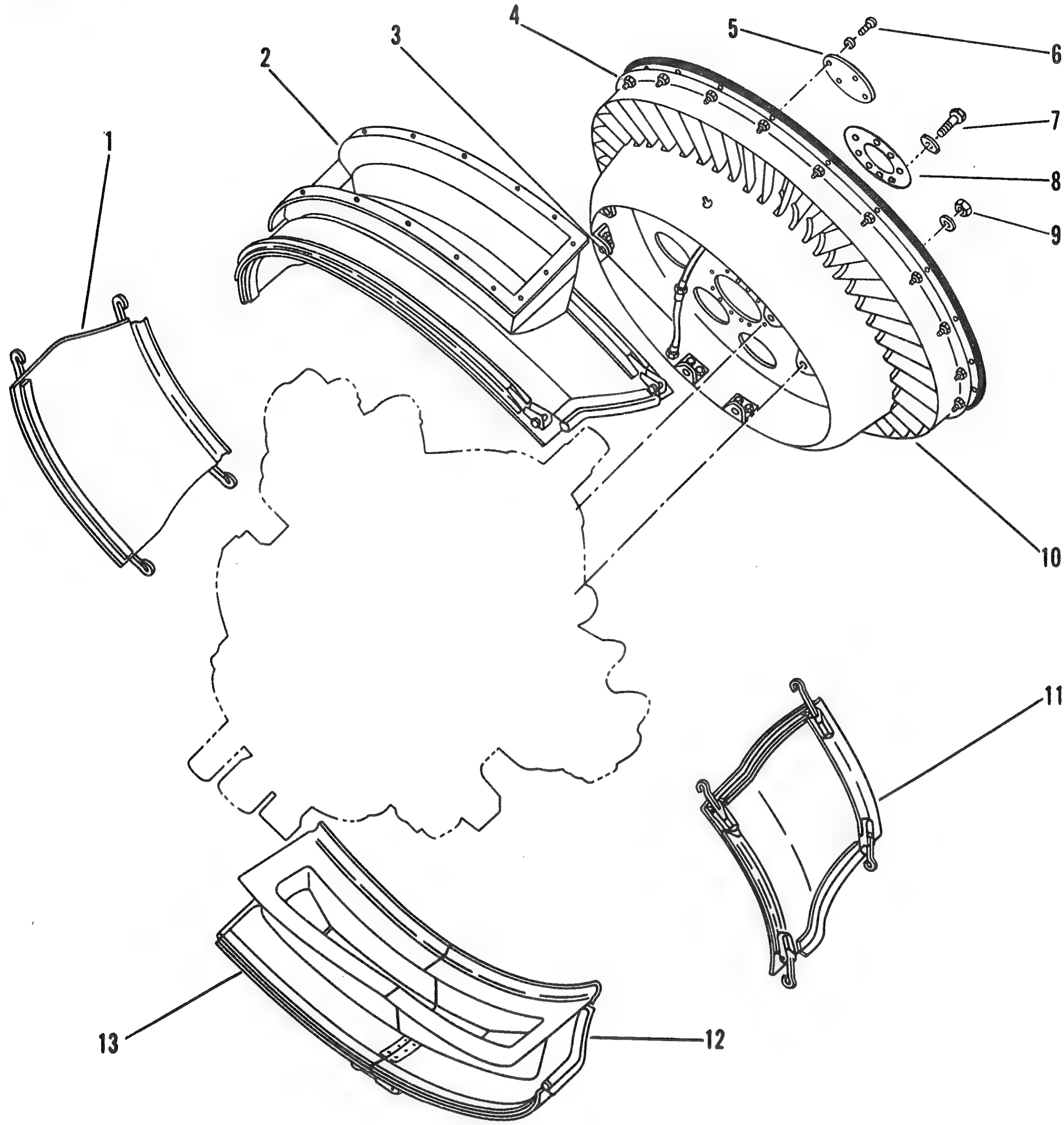
Nut on each eyebolt (33) must be loosened before bolts, washers, and nuts (34) can be removed.

w. Relieve torque on bolts, washers, and nuts (37). Remove bolts, washers, and nuts (38) from eyebolts (33). Swing end of sway brace away from eyebolt.

x. Remove bolts, washers, and nuts (34) and eyebolts, washers, and nuts (33).

CAUTION

Remove bolts (34) and eyebolts (33) with a rubber mallet and a brass drift pin.



1. Cowl Panel
2. Cowl Panel
3. Tube Assembly
4. Bolt, Washer, Nut
5. Access Cover
6. Screw, Washer
7. Bolt, Washer
8. Spacer
9. Nut, Washer
10. Contravane Assembly
11. Cowl Panel
12. Cowl Panel
13. Cowl Panel

Figure 3–5. Engine Cooling System

y. Apply lift with hoist and remove power plant from helicopter.

z. Mount power plant on suitable stand. Remove sling assembly.

Note

If power plant is to be disassembled, leave sling assembly attached.

3-14. BREAKDOWN OF POWER PLANT.

3-15. GENERAL. The breakdown of the power plant isolates the components which make up the power plant so each item may be classified as to serviceability and reused or replaced according to its particular high time requirements.

Note

When it is necessary to remove accessory items or do minor maintenance in the accessory section of an engine to be retained in service and while engine is installed in helicopter, top overhaul stands are provided and their use is described in paragraph 3-288.

3-16. HYDROMECHANICAL CLUTCH AND FAN ASSEMBLY.

3-17. DESCRIPTION. The hydromechanical clutch and fan assembly, consisting primarily of a hydromechanical clutch unit and fan, is used on the engine. The fan is splined to the engine propeller shaft and is secured by an engine shaft nut. A lockpin assembly is used to safety the engine shaft nut. The hydromechanical clutch is positioned over studs on the fan hub and is secured with washers and nuts.

3-18. REMOVAL.

a. Remove nuts and washers (25 and 26, figure 3-6) from studs of fan assembly hub securing hydromechanical clutch assembly (9) to fan assembly (3). Remove clamping ring halves (8 and 27) and shim halves (7 and 28). Lift hydromechanical clutch assembly (9) from fan assembly (3).

b. Remove lockpin assembly (6) from engine propeller shaft (1). Position housing, Kell Strom part No. KS-2172, or HSP-5003, or equivalent, on flange adapter S1570-10377-4 (2, figure 3-8), with two keys on bottom of housing meshed in with two slots on upper surface of flange adapter. Secure flange adapter to housing (3) with screws that are furnished with housing.

c. Position flange adapter and housing on fan assembly (3, figure 3-6) so nuts and washers (25 and 26) that secure clamping ring halves (8 and 27) and fan disc to hub protrude through large holes in flange of adapter.

d. Position wrench, S1670-10383, inside housing so teeth on bottom of wrench mesh with wrench slots in engine shaft nut (5). Position drive cylinder, 1570-10190-2, inside housing so short splines on small end of cylinder mesh with splines on inside of wrench.

e. Position ball arm sleeve (5, figure 3-8), Kell Strom part No. KS-2187, or KS-2069, revision "C" or later, or equivalent, on upper end of drive cylinder (1) with ball as far in clockwise direction as it will go.

WARNING

Do not, under any circumstances, use welded ball arm sleeve, Kell Strom part No. KS-2069, revision "A" or "B." Use only forged ball arm sleeve, Kell Strom part No. KS-2069, revision "C" or later, KS-2187, or equivalent.

f. Remove protective cage from dial end of a Hydra-Pak ram and gage assembly (4), Kell Strom part No. HSP-ST5006, or equivalent. Thread end of ram gage assembly into one of ears of housing so piston inside ram and gage assembly will operate in counterclockwise direction.

Note

Sweeney part No. SWE-8100 powerwrench, SWE-8108 powerwrench, and SWE-81048 adapter, or equivalent, may be used as an alternate set.

g. Check to see that valve handle is closed. Insert pump handle in pump arm. Operate pump until piston has pushed ball arm sleeve (5) enough to loosen engine shaft nut (5, figure 3-6).

h. Remove special tools and engine shaft nut (5) from engine propeller shaft (1).

i. Remove upper split cone (4) from engine propeller shaft (1). Slide fan assembly off engine propeller shaft (1) and remove lower cone (2).

Note

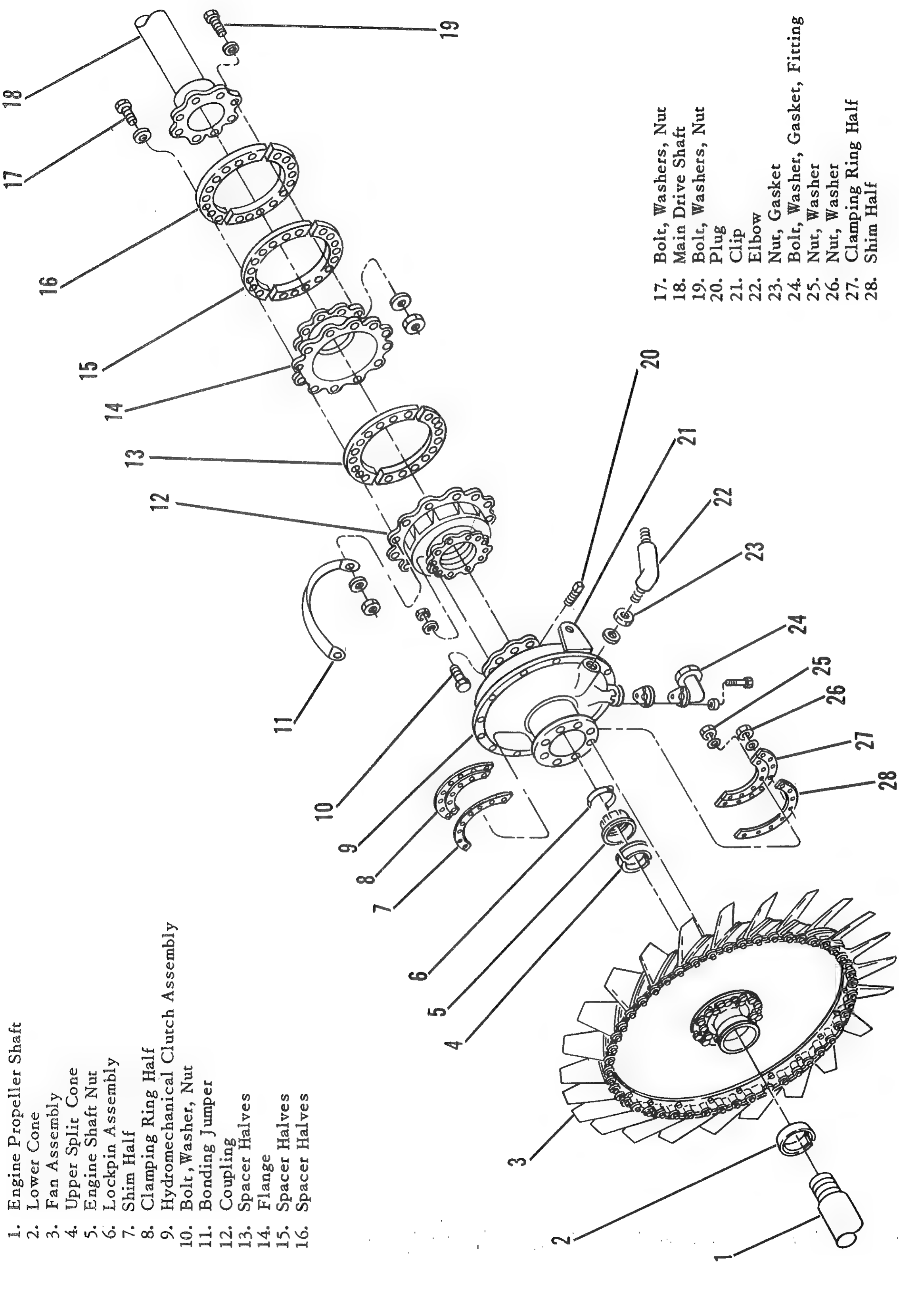
Upper split cone is a matched set. Mating halves must be kept together.

j. Replace clamping ring halves (8 and 27) and shim halves (7 and 28) on fan assembly (3) and install washers and nuts (26 and 25).

k. Loosen nut (23). Remove threaded elbow (22) and nut and gasket (23).

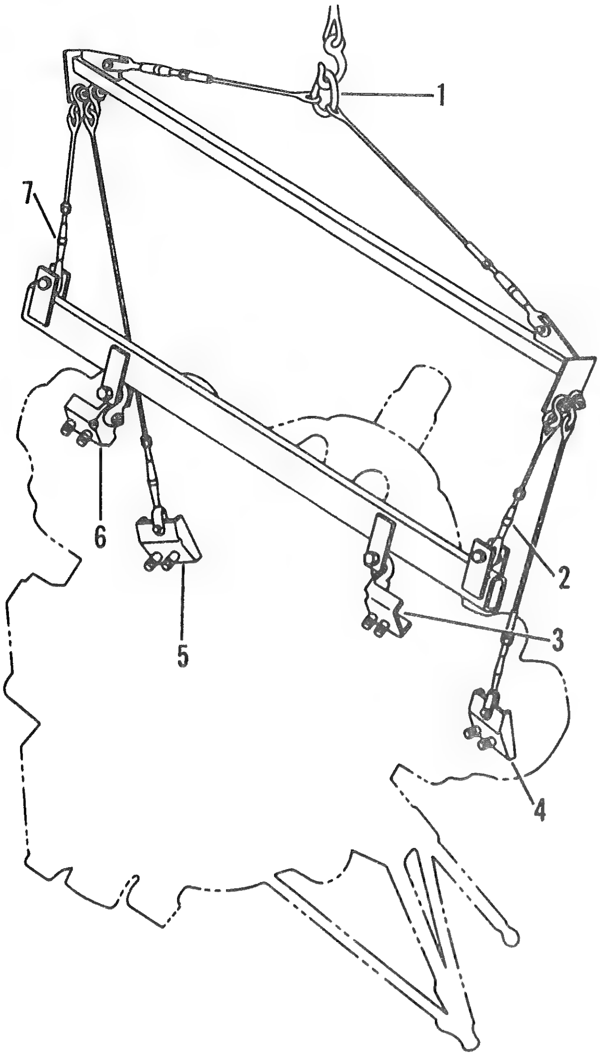
3-19. CONTRAVANE AND FAN SHROUD ASSEMBLY.

3-20. DESCRIPTION. The contravane and fan shroud assembly is installed on the crankcase front



1. Engine Propeller 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. Hydromechanical Clutch Assembly
10. Bolt, Washer, Nut
11. Bonding Jumper
12. Coupling
13. Spacer Halves
14. Flange
15. Spacer Halves
16. Spacer Halves
17. Bolt, Washers, Nut
18. Main Drive Shaft
19. Bolt, Washers, Nut
20. Plug
21. Clip
22. Elbow
23. Nut, Gasket
24. Bolt, Washer, Gasket, Fitting
25. Nut, Washer
26. Nut, Washer
27. Clamping Ring Half
28. Shim Half

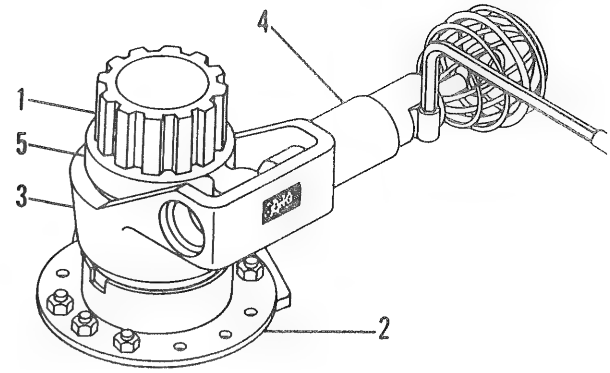
Figure 3–6. Removal of Hydromechanical Clutch and Fan Assembly



1. Ring Fitting
2. Turnbuckle
3. Fitting, Bolts
4. Fitting, Bolts
5. Fitting, Bolts
6. Fitting, Bolts
7. Turnbuckle

Figure 3–7. Hoist Sling Assembly on Engine

section of the engine and supports the forward edge of five cowl assemblies, or panels, and encloses the hydromechanical clutch and fan, thereby directing flow of cooling air from fan. Vanes inside the contravane and fan shroud assembly straighten the flow of air from the fan to reduce turbulence of air inside the cowling. Six removable access covers installed on upper web of contravane and fan shroud assembly provide access to studs to which contravane and fan shroud assembly is secured and to tubes and hose lines which are routed inside contravane and fan shroud assembly.



1. Drive Cylinder
2. Flange Adapter
3. Housing
4. Ram and Gage Assembly
5. Ball Arm Sleeve

Figure 3–8. Use of Special Tools on Engine Shaft Nut

3–21. REMOVAL.

a. Remove screws and washers (6, figure 3–5) securing access covers (5) to contravane web assembly. Remove covers.

b. Reach through access hole over union of oil breather line and disconnect upper tube (3) from union and from elbow in cover on oil separator pad.

c. Disconnect lower tube (3) from elbow in intercylinder air deflector between cylinders No. 7 and 8.

d. Disconnect hose from fitting in upper right side of inner cowl.

e. Reach through access holes and remove nuts and washers (9) securing contravane assembly (10) to crankcase front section attaching studs.

f. Remove lock wire and remove bolts and washers (7) securing contravane around engine shaft. Remove spacer (8).

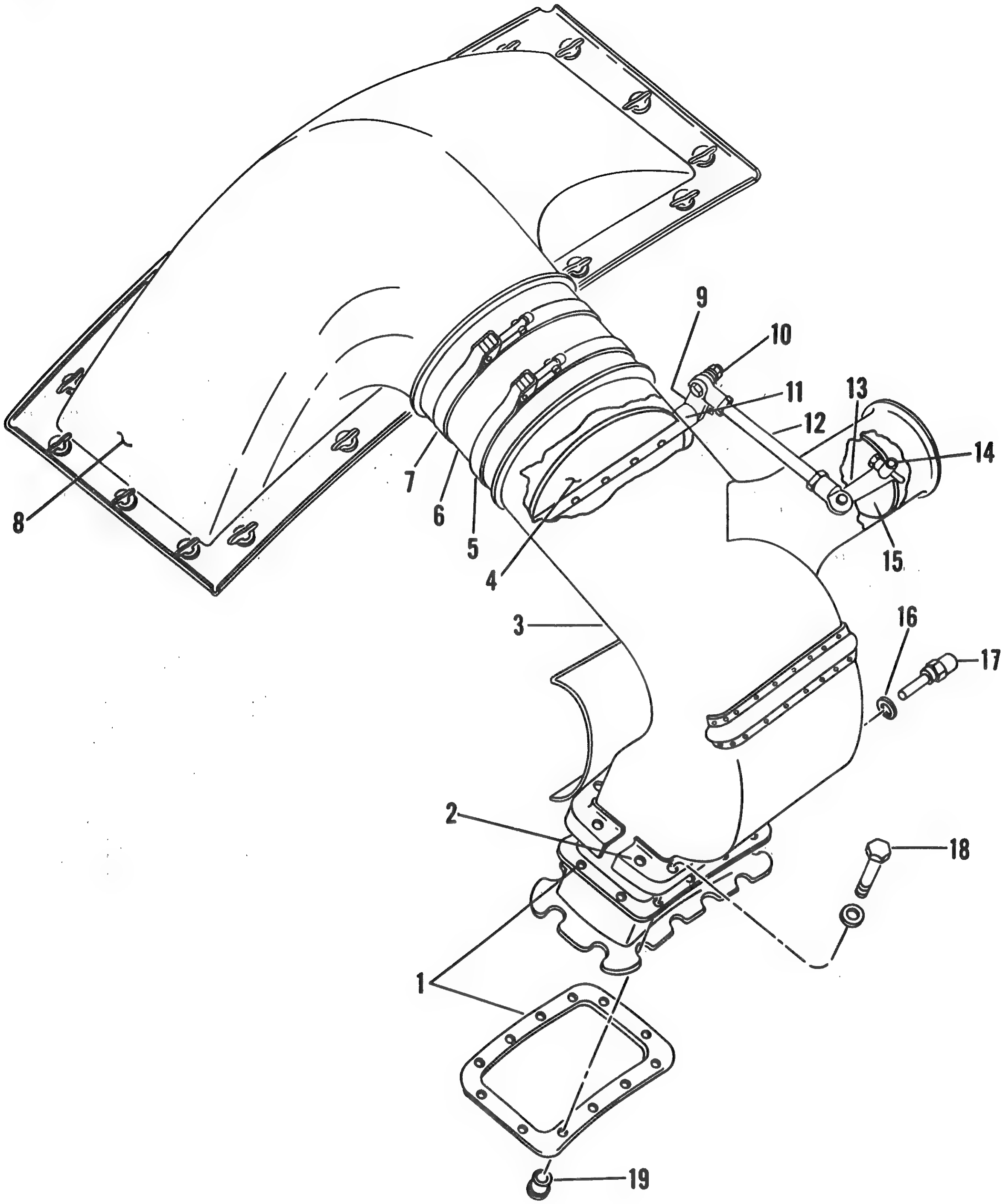
g. Lift contravane assembly (10) from engine.

Note

Replace spacer (8) and secure it with bolts and washers (7) immediately after removing contravane assembly.

3–22. CARBURETOR AIR INDUCTION SYSTEM.

3–23. DESCRIPTION. The carburetor air induction system consists of a carburetor air temperature bulb (17, figure 3–9), an air intake duct (3), a cold air elbow (8), and components for attaching the cold air elbow to the carburetor and the engine cooling system. The carburetor air temperature bulb is installed in the lower right end of the air intake duct. The air intake duct is attached to the upper deck of the carburetor. The cold air elbow is attached to



1. Cushion
2. Cushion Retainer Half
3. Air Intake Duct
4. Door
5. Marman Clamp
6. Rubber Boot
7. Marman Clamp
8. Cold Air Elbow
9. Bell Crank
10. Bolt, Washers, Nut
11. Shaft
12. Control Rod
13. Bell Crank
14. Shaft
15. Door
16. Crush Washer
17. Carburetor Air Temperature Bulb
18. Bolt, Washer
19. Spacer

Figure 3–9. Carburetor Air Induction System the air intake duct and the filter support section of the upper cowl panel (2, figure 3–5). An air filter is installed in the filter support section of the panel. Cold air from the engine cooling system is supplied to the cold air entrance of the mixing section through the cold air elbow (8, figure 3–9). An entrance on the right side of the air intake duct over the exhaust collector supplies warm air to the air intake duct (3). Doors (4 and 15) 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 (9 and 13) that control these doors are connected by a control rod (12) in such a manner that the movement of each door is synchronized; when one door is opening the other is closing. Provisions are made for the installation of an engine preheat duct on the warm air intake duct. (Refer to TM 55-1520-202-20, Chapter 2, Section XI for preheat duct system.)

3–24. REMOVAL. The cold air elbow (8, figure 3–9) and clamp (7) were removed in paragraph 3–13, step *p*. Instructions for preheat duct removal are provided in TM 55-1520-202-20, Chapter 2, Section XI.

WARNING

Insure all electrical power is turned off.

a. Remove lock wire and disconnect electrical wiring at carburetor air temperature bulb (17, figure 3–9).

b. Remove bolt, washers, and nut (10) and free lower end of carburetor air temperature control rod (23, figure 3–4) on helicopters serial No. prior to 55-4462, or (29) on helicopters serial No. 55-4462 and subsequent, from bell crank (9, figure 3–9). Replace bolt, washers, and nut (10) on bell crank (9).

c. Remove lock wire, bolts, and washers (18) securing air intake duct (3), cushion retainer halves (2), cushions (1), and spacers (19) to carburetor deck.

d. Remove air intake duct (3), cushion retainer (2), cushions (1), and spacers (19).

e. Position screen and two gaskets on carburetor top deck and install protective cover.

Note

Omit installation of bolt securing engine control support assembly.

3–25. EXHAUST COLLECTOR ASSEMBLY (LOW STACK).

3–26. DESCRIPTION. (See figure 3–10.) The exhaust collector assembly (low stack) consists of a collector assembly and seven sleeve-type clamps. The collector assembly contains seven welded sections and one tail pipe section. The nine ring-type clamps which secure the welded sections to the engine are furnished with the engine.

3–27. REMOVAL.

a. Remove bolt, washer, and nut (1, figure 3–10) from ring-type clamp (2) joining cylinder end of section assembly (5) and exhaust port of cylinder No. 7.

b. Remove bolts, washers, and nuts (3) from sleeve-type clamp (4) at connection of section assemblies (5 and 7).

c. Slide section assembly (5) from end of section assembly (7) and swing inlet end of section assembly (5) from exhaust port of cylinder No. 7. Remove section assembly (5).

Note

Working toward tail pipe section (6), remove succeeding section assemblies as outlined in steps *a* through *c*.

d. Remove bolt, washer, and nut (1) from ring-type clamp (2) at inlet end of section assembly (8) and exhaust port of cylinder No. 6.

e. Remove bolts, washers, and nuts (3) from sleeve-type clamp (4) at connection of section assembly (8) and tail pipe section (6).

f. Slide section assembly (8) from end of tail pipe section (6) and swing section assembly (8) away from exhaust port of cylinder No. 6.

g. Remove bolt, washer, and nut (1) from ring-type clamp (2) at cylinder connections of tail pipe section (6) and exhaust ports of cylinders No. 4 and 5.

h. Lift tail pipe section (6) from engine.

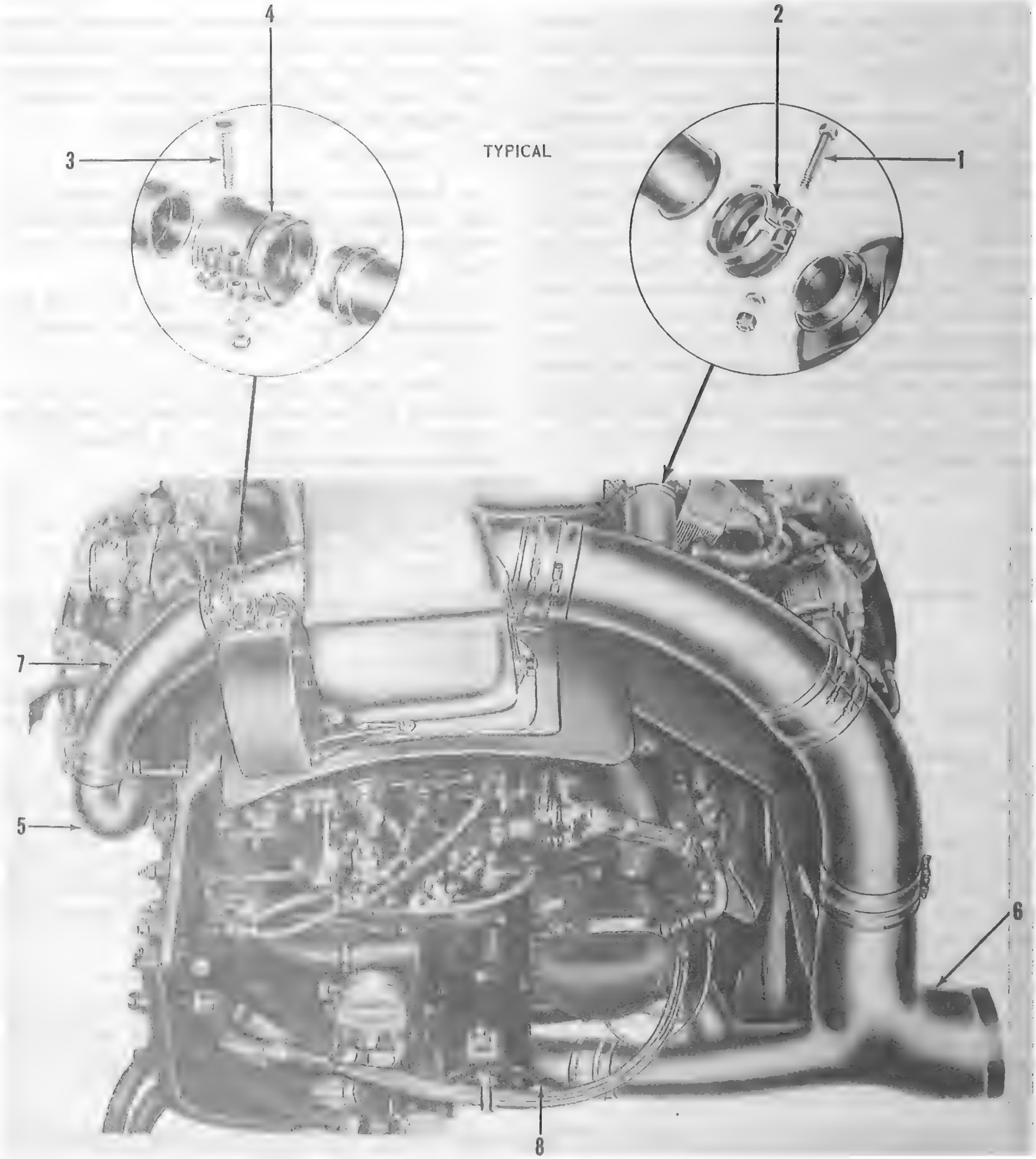
i. Install bolts, washers, and nuts (1) and ring-type clamp (2) at exhaust port of each cylinder.

3–28. EXHAUST COLLECTOR ASSEMBLY (HIGH STACK).

3–29. DESCRIPTION. (See figure 3–11.) The exhaust collector assembly (high stack) consists of a collector assembly and eight sleeve-type clamps. The collector assembly contains eight welded section assemblies and one tail pipe section. The nine ring-type clamps which secure the welded sections to the engine are furnished with the engine.

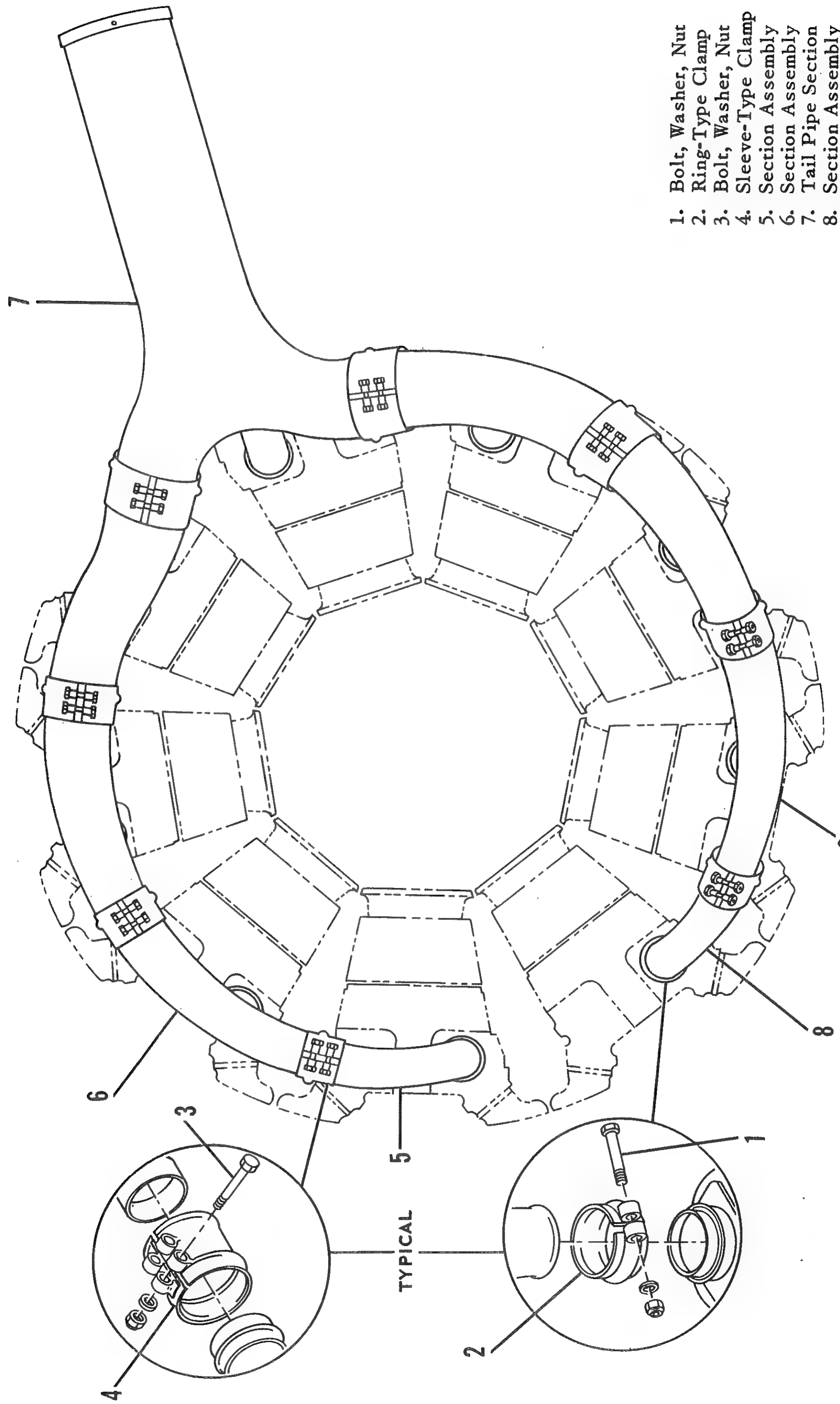
3–30. REMOVAL.

a. Remove bolt, washer, and nut (1, figure 3–11) from ring-type clamp (2) at cylinder end of section assembly (5) and exhaust port of cylinder No. 8.



1. Bolt, Washer, Nut
2. Ring-Type Clamp
3. Bolt, Washer, Nut
4. Sleeve-Type Clamp
5. Section Assembly
6. Tail Pipe Section
7. Section Assembly
8. Section Assembly

Figure 3–10. Exhaust Collector Assembly (Low Stack)



1. Bolt, Washer, Nut
2. Ring-Type Clamp
3. Bolt, Washer, Nut
4. Sleeve-Type Clamp
5. Section Assembly
6. Section Assembly
7. Tail Pipe Section
8. Section Assembly
9. Section Assembly

Figure 3–11. Exhaust Collector Assembly (High Stack)

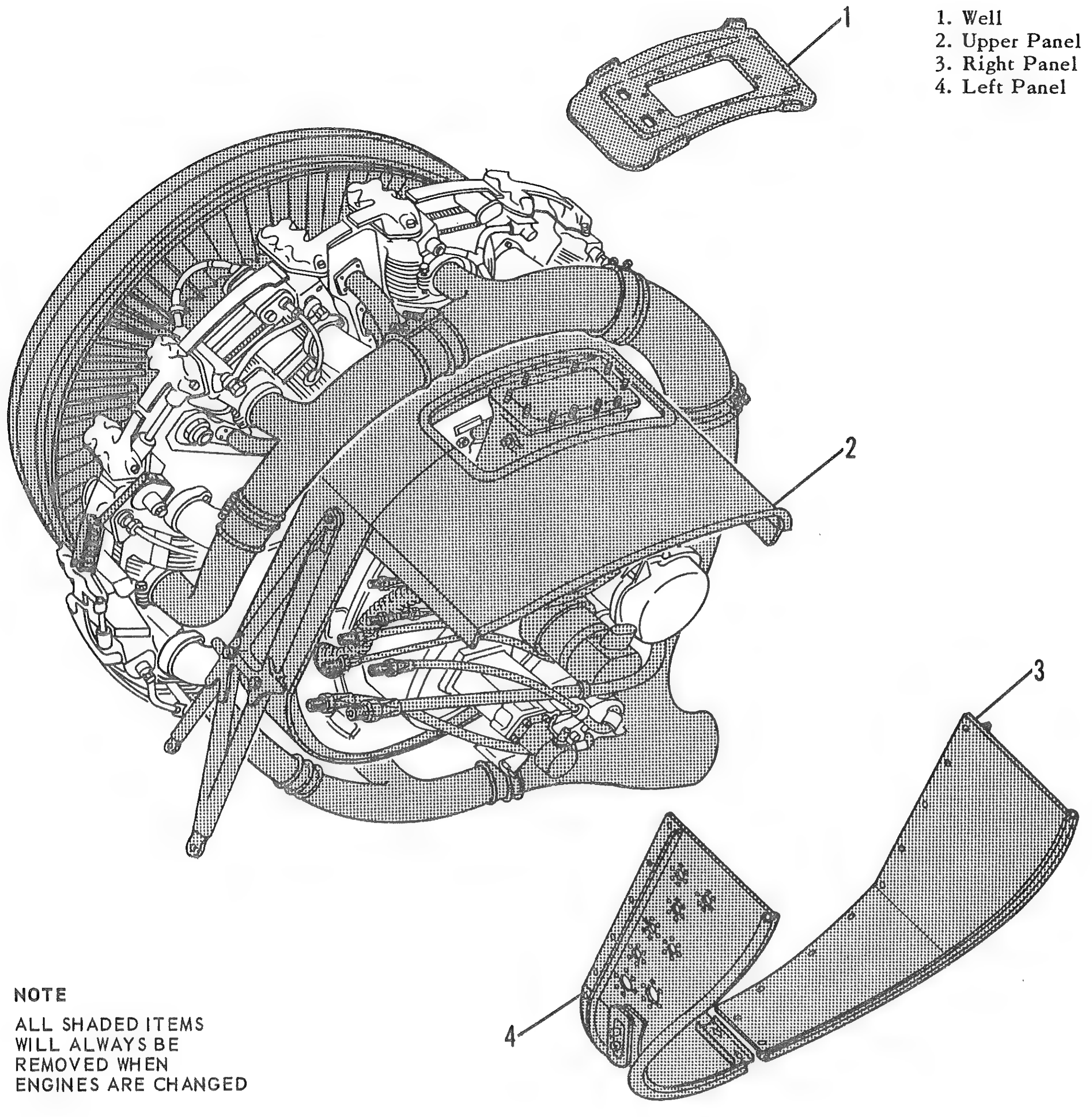


Figure 3–12. Accessory Compartment Cover Assembly

b. Remove bolts, washers, and nuts (3) from sleeve-type clamp (4) at connection of section assembly (5) and section assembly (6).

c. Slide section assembly (5) from end of section assembly (6) and swing inlet end of section assembly (5) from exhaust port of cylinder Nol 8. Remove section assembly (5).

Note

Working toward tail pipe section (7), remove succeeding section assemblies as outlined in steps *a* through *c*.

d. Remove bolt, washer, and nut (1) from ring-type clamp (2) at cylinder end of section assembly (8) and exhaust port of cylinder No. 7.

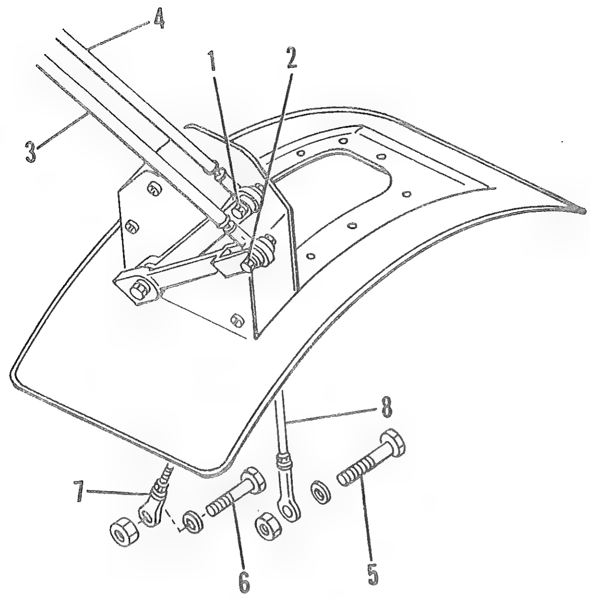
e. Remove bolts, washers, and nuts (3) from sleeve-type clamp (4) at connection of section assembly (8) and section assembly (9).

f. Slide section assembly (8) from end of section assembly (9) and swing inlet end of section assembly (8) from exhaust port of cylinder No. 7. Remove section assembly (8).

Note

Working toward tail pipe section (7), remove succeeding section assemblies as outlined in steps *d* through *f*.

g. Remove bolt, washer, and nut (1) from ring-type clamp (2) at cylinder end of tail pipe section (7) and exhaust port of cylinder No. 3.



1. Bolt, Washers, Nut
2. Bolt, Washers, Nut
3. Control Rod
4. Control Rod
5. Bolt, Washer, Nut
6. Bolt, Washer, Nut
7. Control Rod
8. Control Rod

Figure 3–13. Engine Controls (Serial No. Prior to 55-4462)

h. Lift tail pipe section (7) from engine.

i. Install bolt, washer, and nut (1) and ring-type clamp (2) at exhaust port of each cylinder.

3–31. ACCESSORY COMPARTMENT COVER ASSEMBLY.

3–32. DESCRIPTION. (See figure 3–12.) The accessory compartment cover assembly consists of an upper panel, a well, a right panel, and a left panel.

3–33. REMOVAL.

a. Remove bolts, washers, and nuts (1 and 2, figure 3–13) and remove control rods (3 and 4) on helicopters serial No. prior to 55-4462.

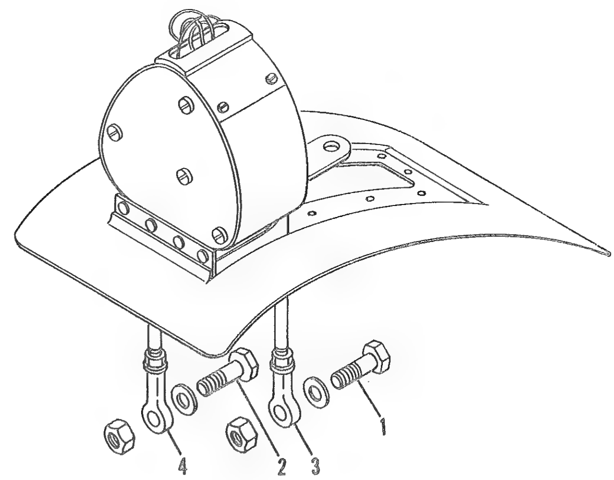
b. Remove bolts, washers, and nuts (5 and 6) connecting control rods (7 and 8) to carburetor.

c. Remove bolts, washers, and nuts (1 and 2, figure 3–14) connecting control rods (3 and 4) to carburetor on helicopters serial No. 55-4462 and subsequent.

d. Disconnect and remove well (1, figure 3–12) from upper panel (2).

e. Disconnect and remove upper panel (2).

f. Disconnect and remove right panel (3).



1. Bolt, Washer, Nut
2. Bolt, Washer, Nut
3. Control Rod
4. Control Rod

Figure 3–14. Engine Controls (Serial No. 55-4462 and Subsequent)

g. Disconnect hoses at quick disconnects and disconnect and remove left panel (4).

Note

Retain accessory compartment cover panels. These items are not furnished with replacement engine.

3–34. CARBURETOR.

3–35. DESCRIPTION. (See figures 3–15 and 3–16.) A Bendix Model PD12R1 carburetor with an adapter is mounted on a studded pad at the top of the supercharger rear housing. The carburetor meters fuel according to throttle manipulation, injecting fuel into the air stream moving into the internal blower. In this manner, the carburetor regulates fuel flow to the engine. The priming system is a part of the carburetor and consists of a priming tube (1, figure 3–15) connected to a priming solenoid valve (2) and to a fitting on the left side of the carburetor adapter.

3–36. REMOVAL.

a. Disconnect following from carburetor: Fuel inlet line (3, figure 3–15), fuel pressure line (4), fuel vapor return line (5), and fuel line (7).

b. Remove nuts (1, figure 3–16) and spherical washers (2) from eight carburetor mounting studs. Remove carburetor and gasket.

c. Install protective cover around carburetor mounting studs and over carburetor port pad of supercharger housing. Secure with nuts and spherical washers removed in step *b.*

1. Priming Tube
2. Priming Solenoid Valve
3. Fuel Inlet Line
4. Fuel Pressure Line
5. Fuel Vapor Return Line
6. Altitude Compensator Line
7. Fuel Line

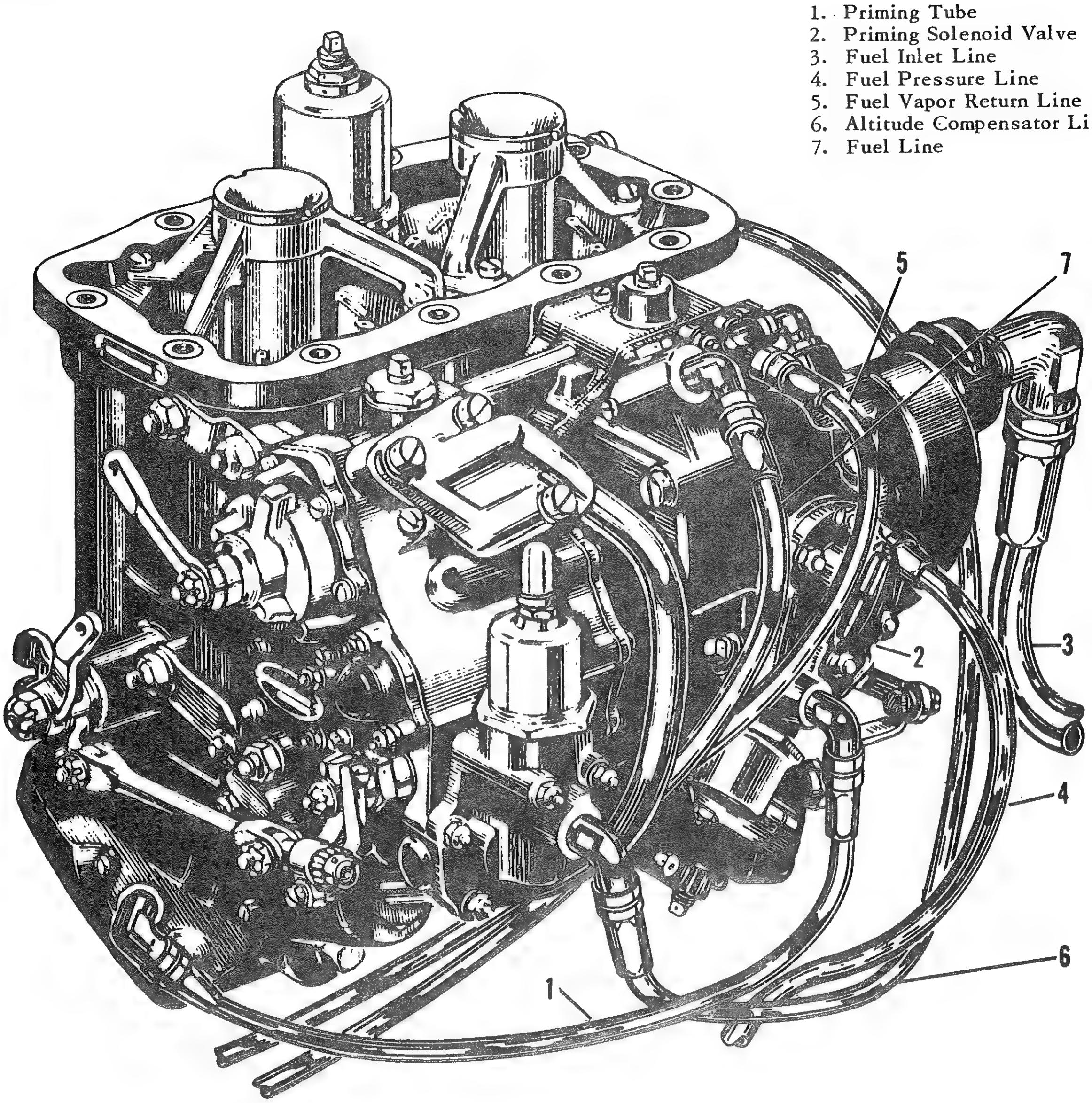


Figure 3–15. Carburetor and Fuel Lines

3–37. STARTER.

3–38. DESCRIPTION. A 28-volt, direct cranking starter (12, figure 3–17) is mounted on the starter drive pad located directly below the main oil pressure transmitter flange of supercharger rear cover. 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. For a complete description of the starter system, refer to TM 55-1520-202-20, Chapter 2, Section IV.

3–39. REMOVAL. (See figure 3–18.)

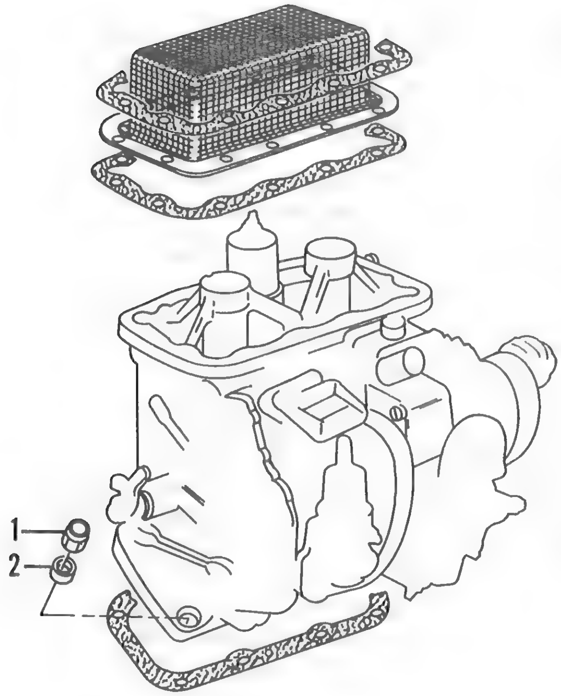
a. Remove lock wire and screws (1) and lift off guard cover (2).

b. Remove nut and washer (3) from terminal post (4).

c. Loosen knurled nut (5) and slide along starter cable (6) away from terminal guard (7).

d. Slide washer (8) along starter cable (6).

e. Remove split bushing (9) from hole in terminal guard (7).



1. Nut
2. Spherical Washer

Figure 3–16. Carburetor and Air Inlet Screen

f. Lift starter cable (6) from terminal post (4) and withdraw from terminal guard (7).

g. Remove nuts and washers (10) from studs on engine accessory section and carefully remove starter (11) and gasket by moving in straight rearward direction.

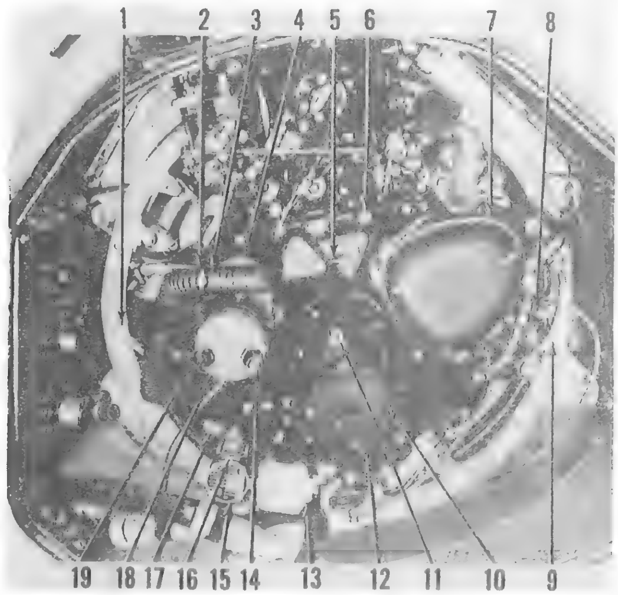
3–40. SYNCHRONIZING-BREAKER.

3–41. DESCRIPTION. A flange mounted synchronizing-breaker (13, figure 3–17) is installed on the right tachometer-generator substituting mounting pad on the rear oil pump, directly below the hydraulic pump. The synchronizing-breaker is used on helicopters serial No. 55-4489 and subsequent.

3–42. REMOVAL. The synchronizer-breaker is secured to the mounting pad with four nuts and washers on hex studs which extend through flange of synchronizer-breaker housing. Remove as follows:

a. Remove lock wire and disconnect electrical plug.

b. Remove nuts and washers from mounting studs. Lift synchronizing-breaker from mounting pad. Remove gasket.



1. Bonding Jumper
2. Clamp
3. Flexible Tube
4. Elbow
5. Restrictor
6. Restrictor
7. Magneto
8. Fuel Pump
9. Bonding Jumper
10. Screw
11. Terminal Post
12. Starter
13. Synchronizing-Breaker
14. Reducer
15. Tachometer-Generator
16. Electrical Receptacle
17. Bracket
18. Hydraulic Pump
19. Reducer

Figure 3–17. Engine Accessories

3–43. TACHOMETER-GENERATOR.

3–44. DESCRIPTION. A tachometer-generator (15, figure 3–17) is installed on the left rear tachometer-generator drive pad on the rear oil pump, directly below the hydraulic pump.

3–45. REMOVAL.

a. Remove lock wire and disconnect electrical plug from tachometer-generator.

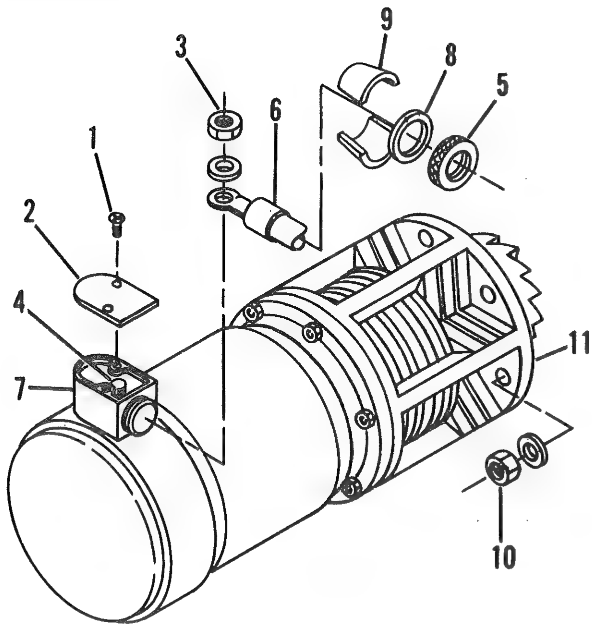
b. Remove nuts and washers from mounting studs. Lift tachometer-generator from mounting pad. Remove gasket.

3–46. FUEL PUMP.

3–47. DESCRIPTION. A vane-type, engine driven, fuel pump (8, figure 3–17) is installed on the fuel pump drive pad located to the right of the magneto. The fuel pump must be set to deliver 23 to 25 psi at the fuel inlet port of the carburetor.

3–48. REMOVAL.

a. Disconnect main inlet and outlet fuel lines from elbows on fuel pump.



1. Screw
2. Guard Cover
3. Nut, Washer
4. Terminal Post
5. Knurled Nut
6. Starter Cable
7. Terminal Guard
8. Washer
9. Split Bushing
10. Nut, Washer
11. Starter

Figure 3-18. Starter

b. Disconnect drain lines.

c. Remove lock wire, nuts, and washers from mounting studs. Lift fuel pump from drive pad. Remove gasket.

3-49. HYDRAULIC PUMP.

3-50. DESCRIPTION. A hydraulic pump (18, figure 3-17) is installed on the fluid pump drive adapter at the upper left side of the supercharger rear cover. This pump supplies hydraulic pressure for the main rotor auxiliary and tail rotor servo system.

3-51. REMOVAL.

a. Disconnect inlet and outlet fluid lines from hydraulic pump. Disconnect vent lines.

b. Remove nuts and washers from mounting studs. Lift pump from drive adapter. Remove gasket.

3-52. OIL TEMPERATURE BULB.

3-53. DESCRIPTION. The oil temperature bulb is a metal finger-like container enclosing an electrical resistor. The metal finger (bulb) is threaded with standard pipe thread to facilitate installation into and removal from the oil inlet line which incorporates a threaded boss for the oil temperature bulb. An electrical connection is provided at the exposed end of the bulb to simplify connection with the electrical instrument circuit.

3-54. REMOVAL.

a. Remove lock wire and disconnect electrical connector from oil temperature bulb.

b. Remove lock wire from oil temperature bulb.

c. Remove oil temperature bulb and gasket.

d. Install a plug in threaded boss to prevent foreign matter from entering engine.

3-55. CYLINDER TEMPERATURE BULB.

3-56. DESCRIPTION. The cylinder temperature bulb is a permanently sealed metal capsule containing an electrical resistance and having facilities for insertion into an electrical circuit. Two electrical conductors of uneven length, fastened to the sealed metal capsule, are approximately 11 inches long and are protected by a metal braid. The complete unit incorporates a knurled metal cap which is slotted to mate with an adapter installed in a cavity near the cylinder intake valve, thus providing the elements for fast bayonet-type installation.

3-57. REMOVAL.

a. Disconnect electrical wiring at terminals.

b. Turn metal cap counterclockwise and pull cylinder temperature bulb out of its mounting adapter.

3-58. MISCELLANEOUS ENGINE ITEMS.

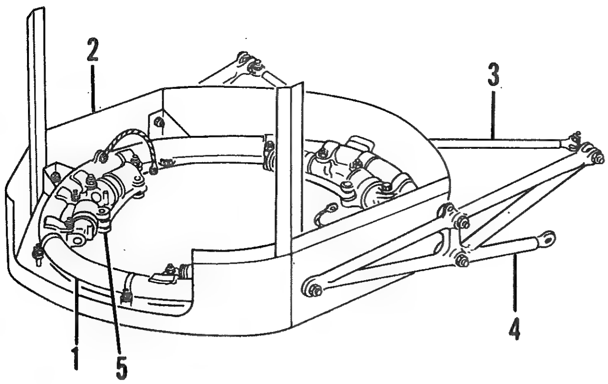
3-59. DESCRIPTION. The miscellaneous engine items consist of tubes, hoses, lines, fittings, and electrical cables which serve as conveyors for hydraulic fluid, air, fuel, and electrical currents between the engine, its accessories, and/or other parts of the helicopter. In many cases, tubes, hoses, lines, fittings, and electrical cables may be clamped or lashed together to prevent vibration; in such cases, it may be advisable that items remain secured for use during engine buildup. If adapters or other attaching devices are used, these items must be retained for use during engine buildup. Any item not already identified must be identified with color coded tape or an equivalent method before losing its identity during removal.

3-60. REMOVAL.

a. Check for identification of items and identify items not properly identified.

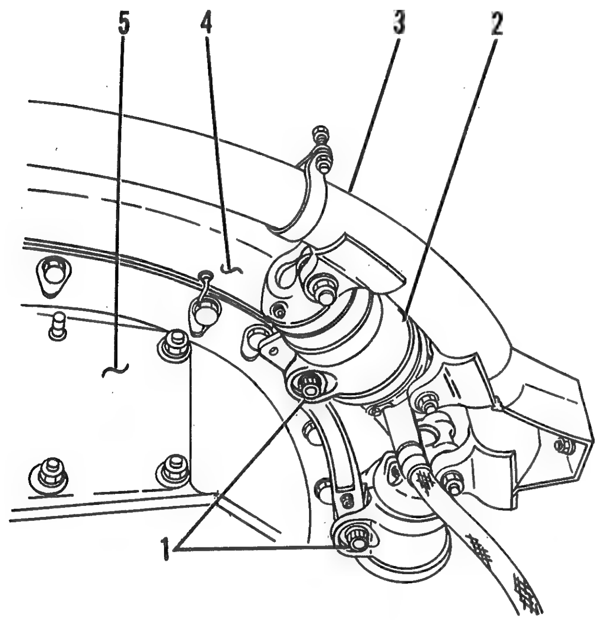
b. Disconnect and remove all tubes, hoses, lines, fittings, and electrical cables from each engine accessory.

c. Do not separate items lashed together unless necessary.



1. Welded Ring
2. Shroud Cover
3. Sway Brace
4. Support Arm
5. Double Brackets

Figure 3–19. Engine Mount



1. Internal Wrenching Bolt
2. Double Brackets
3. Welded Ring
4. Shroud Cover
5. Carburetor Adapter Cover

Figure 3–20. Double Bracket Assembly Installed

3–61. ENGINE MOUNT.

3–62. DESCRIPTION. (See figure 3–19.) The engine mount consists of a welded ring, a shroud cover, sway braces, support arms, and double brackets. The engine mount is secured to the engine by internal wrenching bolts from the double brackets to the rear of supercharger housing.

3–63. REMOVAL. An engine hoist eye, Wright part No. 803485, or equivalent, or hoist sling assembly (figure 3–7) is used to lift the engine from the engine stand.

a. Install engine hoist sling assembly on engine. (Refer to paragraph 3–13, step *u.*)

b. Attach chain hoist of at least 2-ton capacity to hoist sling assembly eye lifting ring. Take up slack on hoist chain until slight strain is placed on chain hoist sling assembly.

c. Carefully transfer weight of engine from engine stand to hoist sling assembly.

d. Remove lock wire and disconnect lead elbow (7, figure 3–25) from magneto.

e. Remove bolts, washers, and nuts (5, figure 3–27) securing double bar (4) to double brackets (3). Remove double bar.

Note

Remove double bar from only double brackets located at bottom and upper right of engine mounting ring.

f. Remove lock wire and internal wrenching bolts (1, figure 3–20) from all double brackets (2) on engine mount.

CAUTION

While one man is removing internal wrenching bolts, two men, one on both sides, should support engine mount.

g. Remove engine mount.

3–64. FIRE SEAL.

3–65. DESCRIPTION. (See figure 3–21.) A fire seal is installed against the rear of the supercharger housing. The fire seal consists of section assemblies (2, 5, and 10) secured to each other with screws and washers. Flanges (1, 6, and 8) are spot welded on the section assemblies to provide attachment points for accessory compartment cooling tubes. Cutouts are provided in the section assemblies for the engine mount, cooling tubes, ignition lead, and oil sump tube.

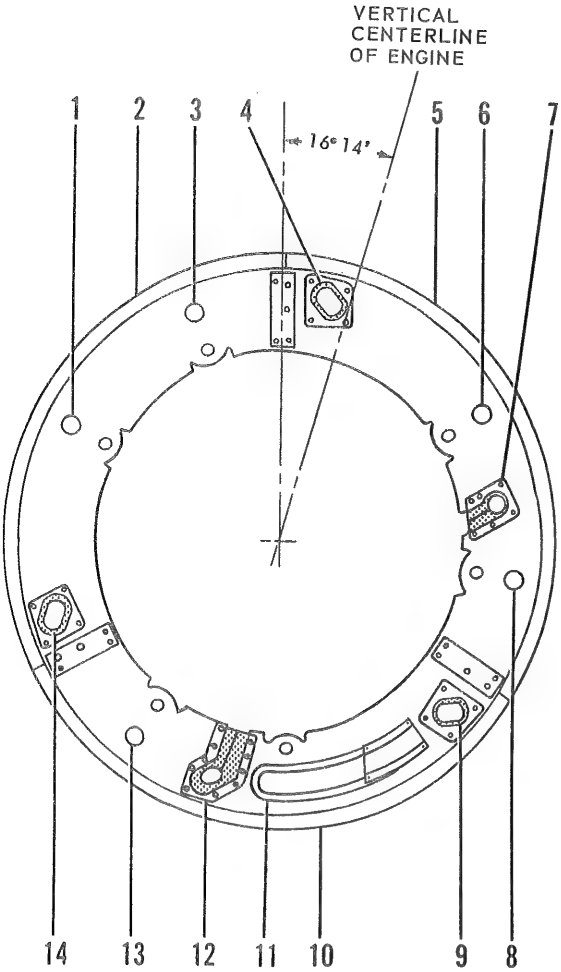
3–66. REMOVAL

a. Remove lock wire, bolts, and washers securing fire seal to supercharger housing.

b. Remove fire seal.

3–67. ACCESSORY COMPARTMENT COOLING TUBES AND ENGINE MOUNT COOLING TUBES.

3–68. DESCRIPTION. (See figure 3–22.) Eight cooling tubes are installed on the power plant to



1. Flange
2. Section Assembly
3. Flange
4. Seal
5. Section Assembly
6. Flange
7. Seal
8. Flange
9. Seal
10. Section Assembly
11. Bead
12. Seal
13. Flange
14. Seal

Figure 3–21. Fire Seal and Cut-Outs (Typical)

provide cooling air to the accessory compartment and to the double brackets on the engine mount. The cooling tubes are made of stainless steel with a stainless steel flange welded to the forward end. The flanges are secured to the intercylinder air deflectors. The aft end of five cooling tubes are secured to flanges on the fire seal with collars. The aft end of the three remaining cooling tubes are supported by the asbestos seals of the fire seal. Two flexible tubes (3, figure 3–17) which direct cooling air to the magneto, are mounted on the accessory side of the fire seal.

3–69. REMOVAL.

a. Remove screws, washers, and nuts (1 and 4, figure 3–22).

b. Remove large cooling tube (2) and small cooling tube (5) from all intercylinder air deflectors (3).

3–70. PREPARATION OF POWER PLANT FOR STORAGE.

3–71. Refer to TM 55-405-5, Section VII.

3–72. BUILDUP OF POWER PLANT.

3–73. DESCRIPTION. Power plant buildup consists of assembling the engine and all of its accessories and related items into a single unit which can be installed on the helicopter with the greatest saving of time. The buildup sequence as presented should not be violated unless some maintenance advantage is achieved. All parts and components which make up the power plant are either new or overhauled items so that the complete power plant is considered a serviceable item. Certain items must be removed from containers especially designed for transportation and protection of the enclosed item. Certain items of the power plant must go through the process of removal from storage before being incorporated into the power plant.

3–74. REMOVAL OF ENGINE FROM METAL SHIPPING CONTAINER.

a. Under the cover, labled ENGINE RECORD, remove DA Form 2410. DA Form 2410 must remain with engine.

b. Remove cover, labeled AIR VALVE, depress valve to release all air pressure.

c. Remove bolts, lockwashers, and nuts from flange securing top and bottom sections of metal shipping container together.

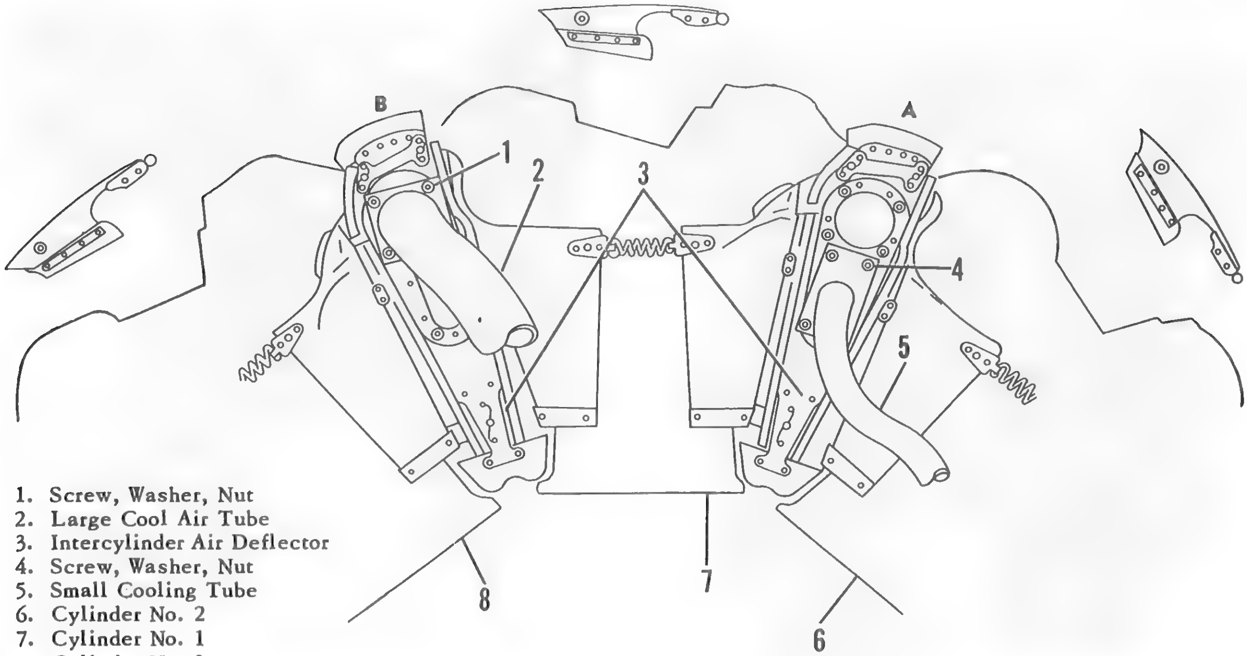
WARNING

Do not remove nuts from bolts securing top and bottom sections of metal shipping container together, until AIR PRESSURE reaches 0 psi (gage pressure).

d. Attach hoist to lifting rings of top section. Lift top section from bottom section.

CAUTION

Guide the top section straight up during removal to prevent damage to engine.



1. Screw, Washer, Nut
2. Large Cool Air Tube
3. Intercylinder Air Deflector
4. Screw, Washer, Nut
5. Small Cooling Tube
6. Cylinder No. 2
7. Cylinder No. 1
8. Cylinder No. 9

Figure 3–22. Typical Installation of Accessory Compartment and Engine Mount Cooling Tubes

e. Remove nuts and washers securing cover on metal cage (5, figure 3–23) located on mounting assembly (4). The mounting assembly is secured to rocker box of each of three adjacent cylinders and to composition sleeve (2) around propeller shaft.

f. Remove spark plugs, exhaust ring-type clamps, dehydrating plugs, triangular gaskets, threaded bushing, and splined drive shaft coupling from metal cage (5).

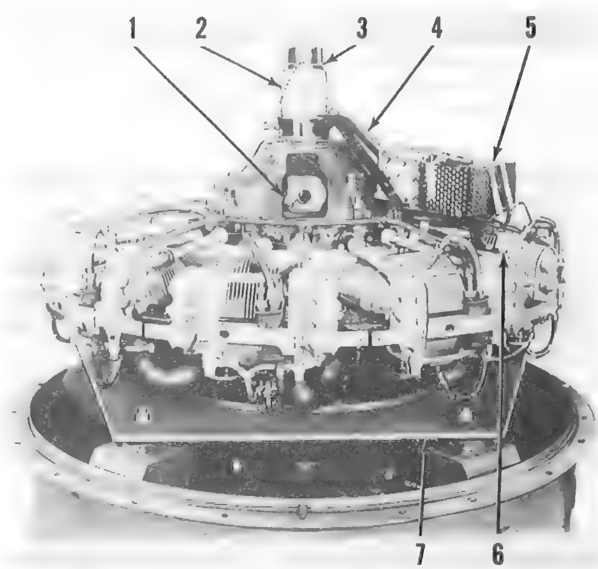
g. Remove capscrews (6) securing legs of mounting assembly (4) to intake rocker boxes. Remove thread protector (3) and gland nut from propeller drive shaft. Lift mounting assembly and composition sleeve from engine.

h. Replace thread protector with engine hoist eye. Attach chain hoist of at least 2-ton capacity to engine hoist eye.

i. Remove bolts securing three adapter plates to large plate (7) of metal shipping container. Lift engine from metal shipping container.

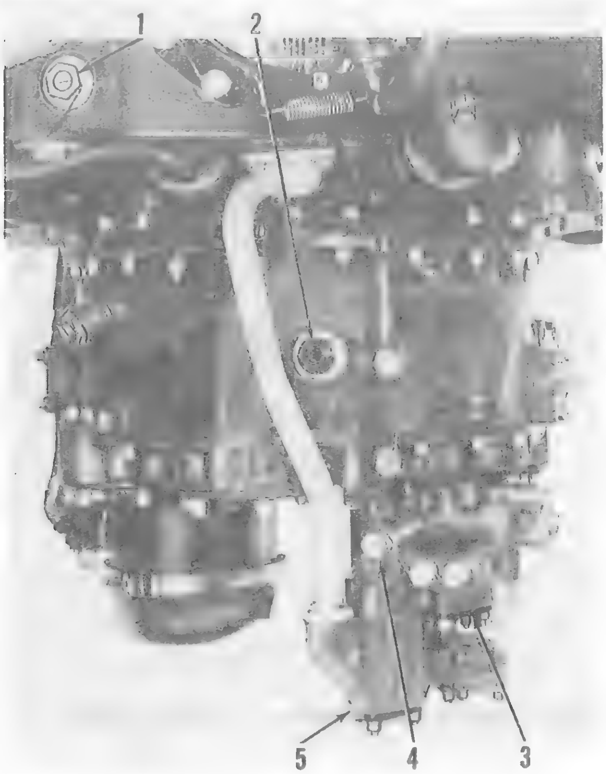
j. Remove bags of dehydrating agent from exterior of engine. Retain two of these bags for use during later procedure.

k. Remove oil separator cover plug from cloth bag (1). Discard bag.



1. Cloth Bag
2. Composition Sleeve
3. Thread Protector
4. Mounting Assembly
5. Metal Cage
6. Capscrew
7. Plate

Figure 3–23. Engine in Shipping Container



1. Magnetic Plug
2. Breather Plug
3. Cover
4. Plug
5. Cover

Figure 3–24. Supercharger Rear Section – Bottom View

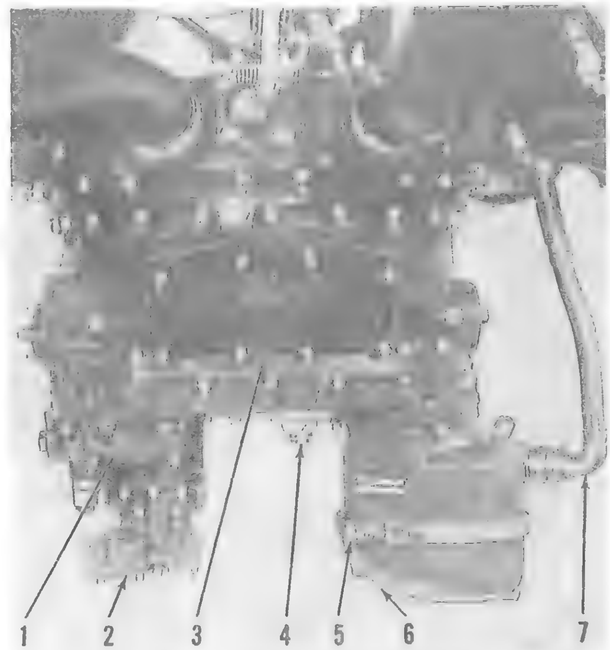
l. Remove and retain small cloth bag containing spare magnetic plug, for possible use later if original should become damaged, at bottom of front sump below propeller drive shaft.

m. Remove bolts securing adapter plates to engine. Remove adapter plates and spacers and attach adapter plates and spacers to large plate (7) in metal shipping container with bolts removed in step *i.*

n. Place bolts, removed in step *m,* threaded bushing, removed in step *f,* capscrews and gland nut, removed in step *g,* in metal cage. Retain thread protector (3) and triangular gaskets for use in later procedures.

o. Replace cover on metal cage (5) with nuts and washers removed in step *e.* Place mounting assembly (4) with metal cage (5) in metal shipping container.

p. Install top section on metal container and secure with bolts, lockwashers, and nuts removed in step *c.*



1. Adapter
2. Cover
3. Cover
4. Flange
5. Band Clamp Assembly
6. Magneto Cover
7. Lead Elbow

Figure 3–25. Supercharger Rear Section – Top View

3–75. DEPRESERVATION PROCEDURE.

3–76. DESCRIPTION. The depreservation procedure consists of draining the corrosion preventive mixture from the engine, cleaning all parts as necessary, and preparing for buildup of the power plant. Instructions in paragraph 3–77 through paragraph 3–78 should be accomplished while engine is hanging on the hoist chain.

3–77. REMOVAL OF COVERS AND INTERIOR PRESERVATIVE AGENTS.

CAUTION

Under no circumstances should the propeller drive shaft be turned until the corrosion preventive mixture has been drained from the engine.

a. Place oil drain pan under engine.

b. Remove plug from spark plug inserts of each cylinder.

c. Remove magnetic plug (1, figure 3–24) from bottom of front sump and pump. Examine magnetic plug for metallic chips which, if present, indicate defect within engine.

d. Remove hardware securing covers (3 and 5). Remove covers.

e. Remove caps from each exhaust port.

f. Remove hardware securing starter drive cover located below flange (4, figure 3–25). Remove cover.

g. Remove hardware securing cover (3). Remove cover.

h. Remove hardware securing fuel pump drive adapter pad cover and gasket. Remove cover and gasket.

i. Remove breather plug from oil strainer in bottom of supercharger rear housing.

CAUTION

Be extremely careful to insure that nothing enters openings of the engine.

j. Allow corrosion preventive mixture to drain into drain pan. When draining has stopped, wipe corrosive preventive mixture from each opening.

CAUTION

Be sure that no lint or cotton waste remains in or around openings.

k. Remove magnetic plug and packing ring from cloth bag. (Refer to paragraph 3–74, step *l.*) Install magnetic plug and packing ring in oil strainer in bottom of supercharger rear housing. Tighten plug to a torque of 125 to 150 inch-pounds and secure with lock wire.

l. Replace magnetic plug (1, figure 3–24) in bottom of front pump and sump. Tighten plug to a torque of 300 to 325 inch-pounds and secure plug with lock wire.

m. Reinstall all covers and gaskets.

3–78. CYLINDER BORES.

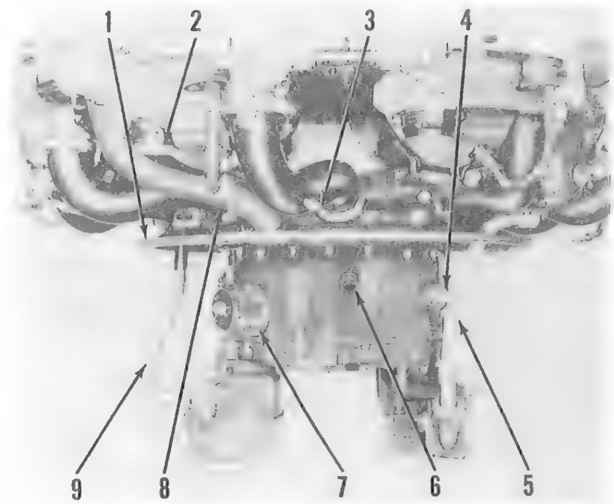
a. Remove excess corrosion preventive mixture from cylinder bores with hand pump.

b. Install dehydrating plug in forward spark plug insert of each cylinder.

3–79. BLOWER SECTION. The blower section of the engine will be drained when the engine is mounted on the engine buildup stand. (Refer to paragraph 3–96, steps *i* through *k.*)

3–80. ASSEMBLY OF POWER PLANT UNITS.

3–81. GENERAL. Instructions for the assembly of power plant units provide the necessary information for rework and installation of various engine accessories and related items. All lock wire not identified by a part No. is 0.041-inch diameter stainless steel wire.



1. Fire Seal
2. Exhaust Port Cap
3. Cylinder Drain
4. Magnetic Plug
5. Oil Tube
6. Supercharger Drain Valve
7. Cover
8. Accessory Compartment and Engine Mount Cooling Tube
9. Magneto Lead

Figure 3–26. Crankcase Front Section (Bottom View)

Note

When applying antiseize compound, Military Standard MS35496, use only enough to form a light coating. An excess amount of compound could get into the system causing stoppage or plugging of the system.

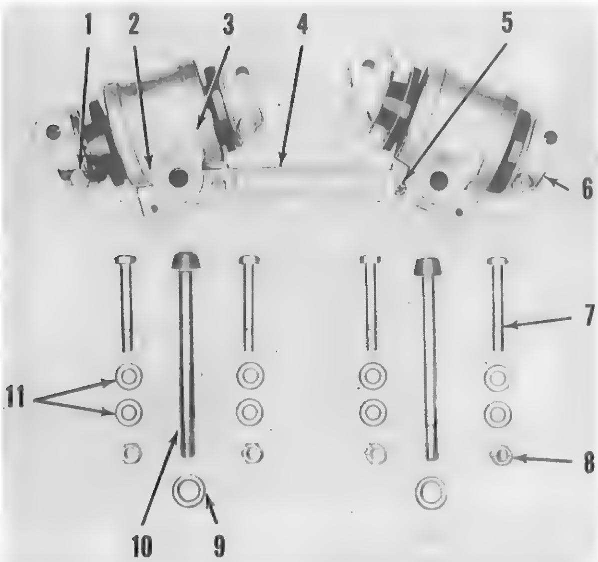
3–82. FIRE SEAL.

3–83. INSTALLATION.

Note

Figure 3–21 illustrates the approximate cutout that must be made in each of the five asbestos seals for the fire seal. Only seals (7 and 12) are cut during installation of fire seal. The remaining seals are cut during installation of two accessory compartment cooling tubes, and engine mount cooling tubes.

a. Cut seal (7, figure 3–21) of section assembly (5) as shown. Place section assembly so lead (9, figure 3–26) will fit in seal (7, figure 3–21). Position section assembly (5) against rear of supercharger housing. Trim seal (7) as necessary to obtain snug



1. Bolt, Washer, Nut
2. Pin
3. Double Bracket
4. Double Bar
5. Bolt, Washers, Nut
6. End Plate
7. Bolt
8. Nut
9. Spherical Washer
10. Bolt
11. Washer

Figure 3–27. Double Bracket Assembly

fit. Align section assembly over engine mount lugs and install two bolts through section assembly to engine mount lugs to maintain alignment during remainder of fire seal installation.

CAUTION

Each seal must be cut and trimmed carefully to insure a tight seal of the asbestos around the object that passes through the seal. There must be a minimum of 1/8-inch asbestos seal around the object after installation.

b. Cut seal (12, figure 3–21) of section assembly (10) as shown. Position section assembly against rear of supercharger housing with seal around oil tube (5, figure 3–26). Trim seal and align section assembly. Install bolts as outlined in step *a.*

c. Position and align section assembly (2, figure 3–21). Install bolts as outlined in step *a.*

d. Secure each section assembly (2, 5, and 10) to each other at mating points with screws and washers. Tighten screws firmly.

e. Secure fire seal assembly to supercharger housing with bolts and washers through holes near inner edge of each section assembly. Secure bolts with lock wire.

f. Remove bolts installed during steps *a*, *b*, and *c*.

3–84. DOUBLE BRACKETS.

3–85. DESCRIPTION. (See figure 3–27.) Flexible mounting for the engine is provided by three cored-out-type, dynafocal double brackets attached to lugs on welded ring of the engine mount. The double brackets are attached to the welded ring with bolts (7). Each double bracket can be installed on the welded ring of the engine mount without disassembly of the double bracket (3). However, the double bar (4) will have to be removed when installing engine mount to the engine.

3–86. INSTALLATION. Refer to paragraph 3–92, step *d* through *f* for complete installation procedure.

3–87. FIRE EXTINGUISHER TUBE.

3–88. DESCRIPTION. A fire extinguisher tube assembly is installed on the inside surface of the shroud cover of the engine mount.

3–89. INSTALLATION. Refer to paragraph 3–92, step *k*, for complete installation procedure.

3–90. ENGINE MOUNT.

3–91. DESCRIPTION. (See figure 3–28.) The support arms are secured to welded brackets on outside of ring with a shroud cover positioned between the ring and support arms. The double brackets and bonding jumpers are secured to lugs on the inside of ring. The inboard end of sway braces are secured to the welded plate of ring.

3–92. BUILDUP.

a. Position mounting ring (1, figure 3–28) on bench with lugs (3) of mounting ring facing down.

1. Mounting Ring
2. Double Bracket
3. Lug
4. Bonding Jumper
5. Lug
6. Bolt, Washers, Nut
7. Shroud Cover
8. Panel
9. Rear Ring Assembly
10. Clamp
11. Bolt, Washer, Nut
12. Plate
13. Button
14. Support Arm
15. Bracket
16. Bolt, Washers, Nut
17. Bracket
18. Bolt, Washer, Nut
19. Support Arm
20. Clamp
21. Spacer
22. Bolt, Washer, Nut
23. Eyebolt, Washer, Nut
24. Sway Brace
25. Bolt, Washers, Nut
26. Bolt, Washer, Nut
27. Bolt, Washers, Nut

Figure 3–28. Buildup of Engine Mount (Sheet 1 of 2)

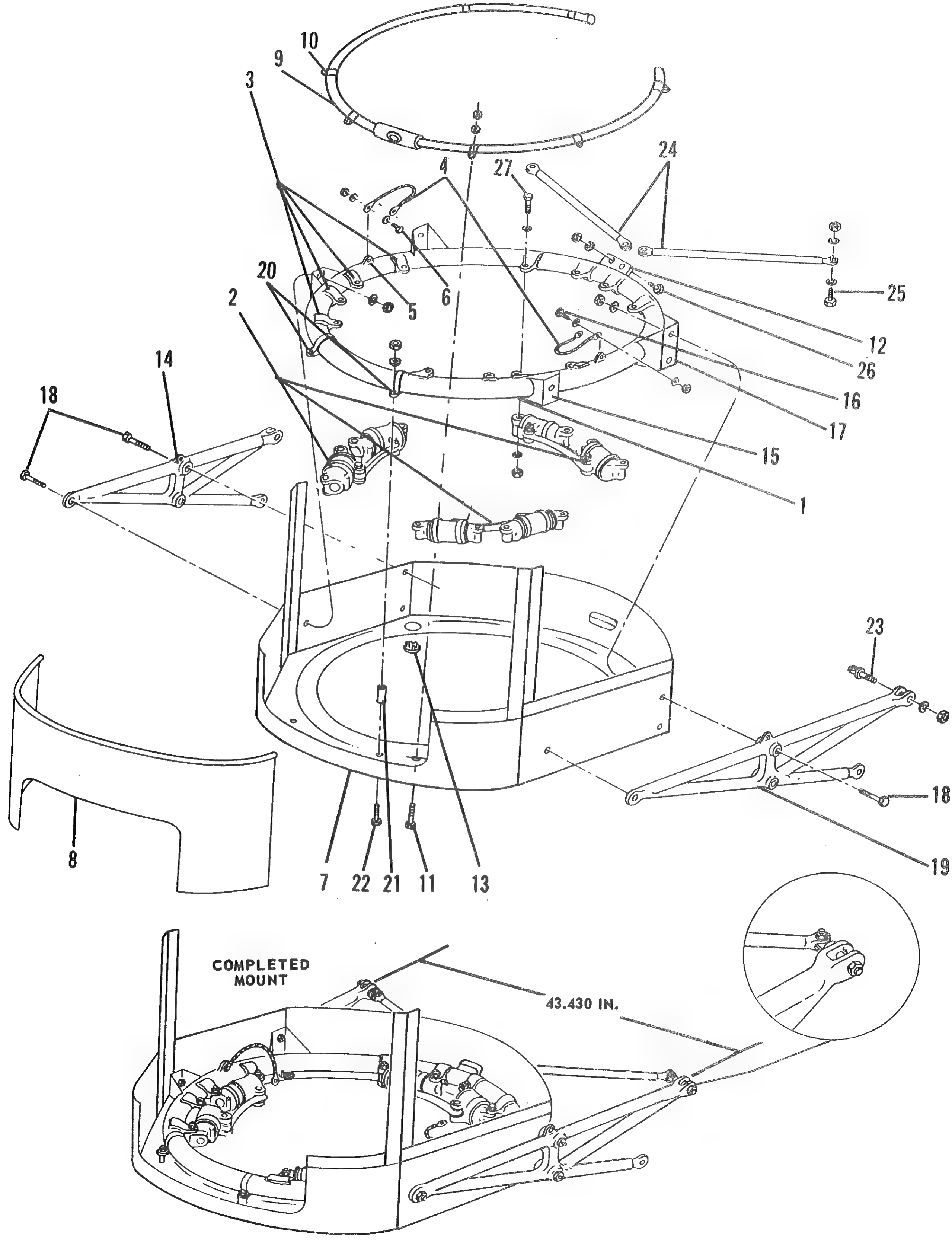


Figure 3–28. Buildup of Engine Mount (Sheet 2 of 2)

b. Remove double brackets (3, figure 3–27) from shipping carton.

Note

Each double bracket is assembled in package ready for mounting. However, bolts (5 and 1) are not tightened. Tighten bolts to a torque of 60 to 80 inch-pounds.

c. Remove from shipping carton bolts (10), and cloth bag containing bolts (7), spherical washers (9), washers (11), and nuts (8).

d. Position double brackets (2, figure 3–28) at each of the lugs (3) on mounting ring (1) so that spherical recess in each of double brackets is facing down. Place washer (11, figure 3–27) under head of bolts (7). Insert bolts through holes in end plates (6) of double brackets then through hole in each lug (3, figure 3–28).

Note

Coat each bolt with antiseize compound, Military Standard MS35496, prior to installation.

e. Follow procedure of step *d* for installation of each remaining double bracket.

f. Install remaining washers (11, figure 3–27) and nuts (8) on bolts (7) for each double bracket as in steps *d* and *e*. Tighten nuts to a torque of 375 to 450 inch-pounds.

g. Turn mounting ring (1, figure 3–28) over so lugs (3) are pointing up.

h. With head of bolts on inboard side of lugs (5), secure bonding jumpers (4) against inboard surface of each lug (5) with bolts, washers, and nuts (6 and 16).

Note

Clean surface of each side of the bonding jumpers (4) end to insure proper electrical bonding.

Note

Secure each bonding jumper (4) in a parallel position to mounting ring (1) so loose end of bonding jumper points clockwise around the ring.

i. Wrap tape, Minnesota Mining and Mfg. Co. No. 360, or equivalent, around mounting ring (1) approximately 2 inches to left of double bracket located at 2-o'clock position.

j. Lay shroud cover (7) on bench with flat surface down. Loosen cam-lock fasteners and remove panel (8) from shroud cover.

k. Install fire extinguisher tube and rear ring as follows:

(1) Refer to table 3–I for applicable information.

(2) Position rear ring assembly (9) so that clamp (10) will align with holes in outer cover (7).

(3) Secure rear ring assembly (9) to cover (7) with bolts, washers, and nuts (11).

l. Position mounting ring (1) inside shroud cover (7) with lugs (3) pointing up.

Note

The lower, or rear skirt of shroud cover (7) contains a horizontal slot covered by an asbestos tire seal, through which plate (12) must be positioned.

m. Measure length of plate (12) and cut slit in asbestos fire seal exact length of plate. Move mounting ring into position and work plate (12) through slit in seal.

CAUTION

Extreme care should be used in performing step *m* to obtain a tight fit of asbestos fire seal around plate, thus maintaining fire seal qualities of the fit.

n. Remove button (13) from each small access hole in shroud cover (7). Position support arm (14) against right side of shroud cover with lug on support arm pointing up. Align hole in upper end of support arm with holes in cover and with forward bracket (15) on ring mounting (1). Insert bolt (18). Align holes at center of support arm with holes in shroud cover (7) and bracket (17) on mounting ring and insert remaining bolts (18) through each hole. Install washer and nut on bolts (18). Tighten nuts to a torque of 320 to 390 inch-pounds.

Note

Coat each bolt (18) with antiseize compound, Military Standard MS35496, prior to installation.

o. Position support arm (19) against left side of shroud cover (7) and secure with bolts, washers, and nuts in accordance with instructions of step *n*. Install button (13) in each small access hole in forward surface of cover.

p. The upper skirt of shroud cover (7) contains two 7/32-inch diameter holes located 6 inches from each side of vertical center line of cover. Position clamps (20) around top of mounting ring (1) at each of these holes with eye of each clamp next to inner surface of upper skirt. Install spacer (21) between each clamp and upper skirt. Align hole in each

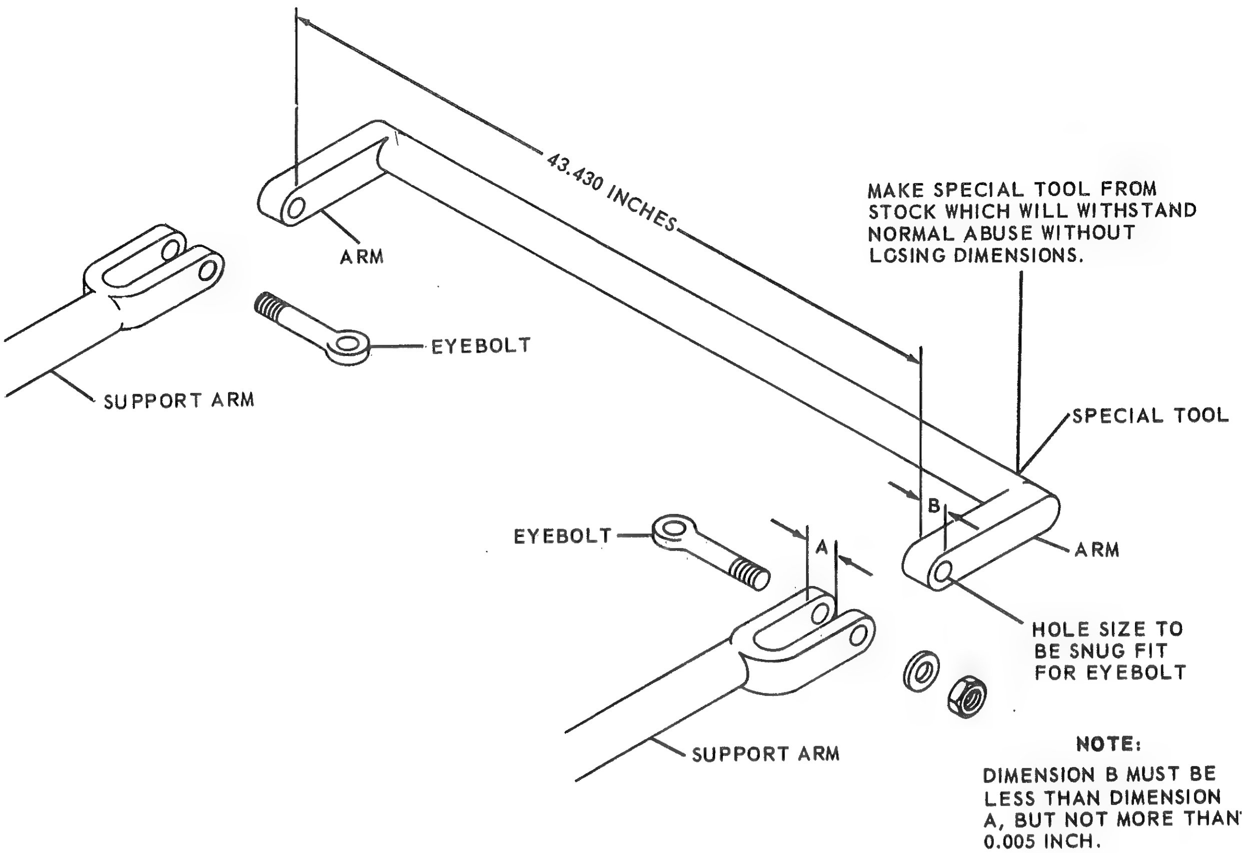


Figure 3–29. Manufacture and Application of Special Tool

clamp and spacer with hole in upper skirt. Secure shroud cover to each clamp with bolt, washer, and nut (22). Install nut against clamp.

q. Install eyebolt (23), with head inboard, into forked fitting at each end of long tube of support arms (14 and 19). Secure each eyebolt loosely with washer and nut.

r. Position forked end of sway braces (24), that contains larger hole, to eyebolt (23) in each support arm (14 and 19). Secure each sway brace to eyebolts with bolt, washers, and nut (25).

Note

Install each bolt with head toward fitting on end of short tube of each support arm.

s. With a pencil, scribe a line 1/2-inch from long outboard edge of plate (12) that extends through seal of cover (7). Position fork on inboard end of each sway brace (24) over plate (12). Tighten nuts of eyebolts (23) finger tight.

t. Hold forked end of each support arm (14 and 19) rigidly with locally manufactured special tool as indicated in figure 3–29.

CAUTION

The measurement of 43.430 inches must be accurately maintained until sway braces are secured firmly to plate.

u. Center 1/8-inch pilot hole in inboard end of each sway brace over pencil mark of plate (12, figure 3–28) on mounting ring (1). Clamp each sway brace to plate. Drill for reaming through each sway brace over plate. Line ream each hole to 0.3125 to 0.3140 diameter. Deburr each hole.

v. Secure each sway brace to plate (12) with bolt, washer, and nut (26). Tighten nuts only finger tight.

3–93. INSTALLATION.

a. Remove bolts, washers, and nuts (5, figure 3–27) securing double bars (4) to double brackets (3), located at bottom and upper right position of engine mounting ring.

b. Remove bolts, washers, and nut (25, figure 3–28) securing each outboard end of sway brace

(24) to eyebolts (23). Swing sway brace away from support arms (14 and 19). Remove eyebolts, washers, and nuts (23) from support arms (14 and 19) and wire eyebolts, washers, and nuts to support arms.

c. Remove safety wire and disconnect lead elbow (7, figure 3–25) from magneto.

d. Position engine mount under engine so support arms (14 and 19, figure 3–28) extend from engine as viewed from cylinder No. 6 of engine and flat surface of shroud cover (7) of engine mount mates face of fire seal (1, figure 3–26).

e. Raise engine mount into position against fire seal.

f. Position spherical washer (9, figure 3–27) under head of each bolt (10). Insert bolts through holes of double brackets located at upper left and upper right positions of engine mount so bolts align with holes through fire seal and with mount lugs on engine.

g. Insert bolts (10) in double brackets at bottom position and install in accordance with instructions in step *f.* Tighten each bolt (10) installed in steps *f* and *g* to a torque of 800 to 1000 inch-pounds.

h. Position double bars (4) on double brackets located at upper right and bottom positions of engine mount and secure with bolts, washers, and nuts (5). Tighten nuts to a torque of 60 to 80 inch-pounds.

i. Secure each bolt (10) to pin (2) with lock wire.

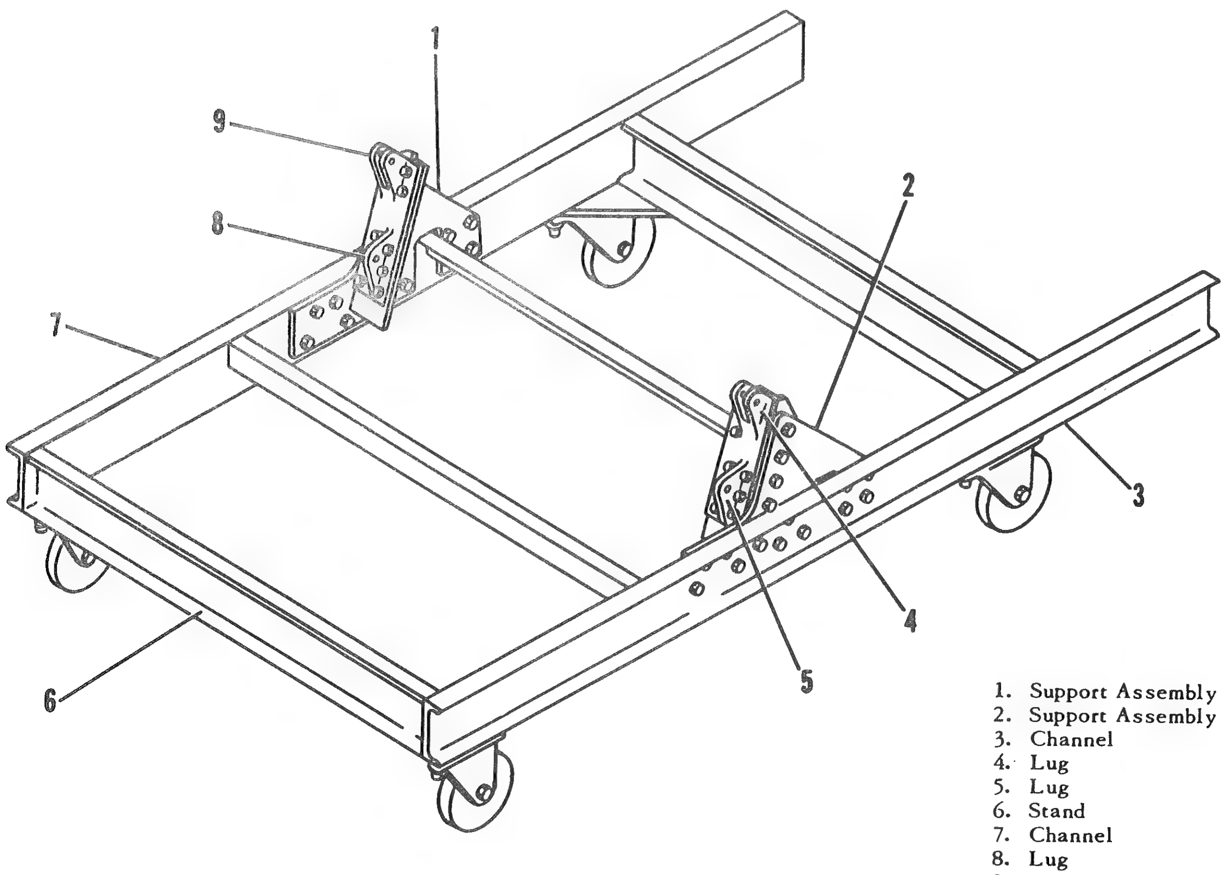
j. Connect lead elbow (7, figure 3–25) to magneto as shown. Secure with lock wire.

3–94. ENGINE BUILDUP STAND.

3–95. DESCRIPTION. (See figure 3–30.) The engine buildup stand is used to support the engine during buildup. The engine buildup stand consists of support assemblies (1 and 2) secured to the side channels (3 and 7).

3–96. MOUNTING THE ENGINE. An engine hoist sling assembly is used to remove the engine from the chain hoist and transfer it to the engine buildup stand.

a. Install hoist sling assembly to engine. (Refer to paragraph 3–13, step *u.*) Attach ring of hoist sling assembly to hoist of at least 2-ton capacity.



1. Support Assembly
2. Support Assembly
3. Channel
4. Lug
5. Lug
6. Stand
7. Channel
8. Lug
9. Lug

Figure 3–30. Engine Buildup Stand

Table 3–II. Location of Accessory Compartment and Engine Mount Cooling Tubes

TUBE	INTERCYLINDER DEFLECTOR	FIRE SEAL	FITTING ON FIRE SEAL
S1630-80365-4	Between cylinders No. 2 and 3	1 o'clock	Flange
S1630-80365-4	Between cylinders No. 3 and 4	3 o'clock	Flange
S1630-80366	Between cylinders No. 3 and 4	4 o'clock	Seal
†S1630-80365-4	Between cylinders No. 6 and 7	7 o'clock	Flange
S1630-80370	Between cylinders No. 6 and 7	8 o'clock	Seal
S1630-80365-4	Between cylinders No. 8 and 9	10 o'clock	Flange
S1630-80365-4	Between cylinders No. 9 and 1	11 o'clock	Flange
S1630-80370	Between cylinders No. 9 and 1	12 o'clock	Seal

†S1630-80369-1 collar is positioned on this tube.

b. Take up slack on hoist until slight strain is placed on hoist sling assembly. Shift weight of engine by slowly slacking hoist chain attached to propeller drive shaft and by taking up slack on hoist attached to hoist sling assembly.

c. When entire weight of engine is on hoist sling assembly, remove hoist chain from propeller drive shaft.

d. Wheel the engine buildup stand into position under engine. Align engine support arms (14 and 19, figure 3–28) with support assemblies (1 and 2, figure 3–30) of engine buildup stand.

e. Adjust turnbuckles (2 and 7, figure 3–7) to assist in aligning the support assemblies (1 and 2, figure 3–30) to support arms (14 and 19, figure 3–28).

f. Install eyebolts (23) through holes in long end of support arms and through lower holes in support assemblies (1 and 2, figure 3–30). Install bolt, washer, and nut in upper holes of support arms (14 and 19, figure 3–28) and upper holes in support assemblies (1 and 2, figure 3–30).

g. Remove hoist sling assembly from engine.

h. Remove hoist eye from propeller drive shaft and replace it with thread protector (3, figure 3–23).

i. With crankshaft in normal operating position, corrosion preventive mixture must drain into lower intake pipes for at least 24 hours at minimum room temperature of 15.6°C (60°F).

j. Remove lock wire and hex-head plug from cylinder drain (3, figure 3–26) located in each intake pipe for cylinders No. 4, 5, 6, and 7 to allow corrosion preventive mixture to drain from each pipe.

k. After 24 hours, install hex-head plugs removed in step *j*.

3–97. ACCESSORY COMPARTMENT COOLING TUBES AND ENGINE MOUNT COOLING TUBES.

WARNING

Use extreme caution not to extend turnbuckles enough to weaken thread grip to the extent engine weight cannot be supported.

3–98. INSTALLATION. (Refer to table 3–11.)

a. Remove screws, washers, and nuts and remove outboard covers of the air ports from intercylinder air deflectors between cylinders No. 6 and 7, 9 and 1, and 3 and 4. Remove screws, washers, and nuts and remove inboard covers of air ports from intercylinder air deflectors between cylinders No. 6 and 7, 8 and 9, 9 and 1, 2 and 3, and 3 and 4.

b. Position cylindrical end of small cooling tubes to fire seal (figure 3–21) so that small cooling tubes are inserted in flanges (1, 3, 6, 8, and 13). Position flanged ends of small cooling tubes to inboard side of intercylinder air deflectors (3, figure 3–22) at positions indicated by A and table 3–II. Secure small cooling tubes to intercylinder air deflectors with screws, washers, and nuts (4) which were removed in step *a*.

c. Cut seals (4, 9, and 14, figure 3–21).

Note

Each seal must be cut and trimmed carefully so the asbestos will form a tight seal around the cooling tubes.

d. Position cylindrical ends of large cooling tubes (2, figure 3–22) to fire seal (figure 3–21) so large cooling tubes are inserted into seals (4, 9, and 14). Position flanged ends of large cooling tubes to intercylinder air deflectors (3, figure 3–22) at positions indicated by B and table 3–II. Secure large cooling tubes to intercylinder air deflectors with screws, washers, and nuts (4) removed in step *a.*

Note

The large cooling tubes are secured to the outboard side of the intercylinder air deflector.

3–99. TUBE AND HOSE LINE FITTINGS.

3–100. DESCRIPTION. Paragraphs 3–101 through 3–109 contain instructions for installing all fuel, oil, instrument, fire extinguisher, and hydraulic line fittings on the power plant. For installation of all tubes, lines, and hoses, refer to paragraph 3–150.

3–101. INTAKE PIPE DRAIN LINE FITTINGS.

a. Remove hex-head plug from cylinder drain (3, figure 3–26) in intake pipe of cylinders No. 4, 5, 6, and 7.

b. Apply antiseize compound, Military Standard MS35496, to pipe thread end of two elbows (2, figure 3–31). Install an elbow in cylinder drain in intake pipe of cylinders No. 4 and 5 with open end of elbow pointing down and forward.

c. Apply antiseize compound, Military Standard MS35496, to pipe thread end of two nipples (3). Install nipple in cylinder drain (3, figure 3–26) in intake pipe of cylinders No. 6 and 7.

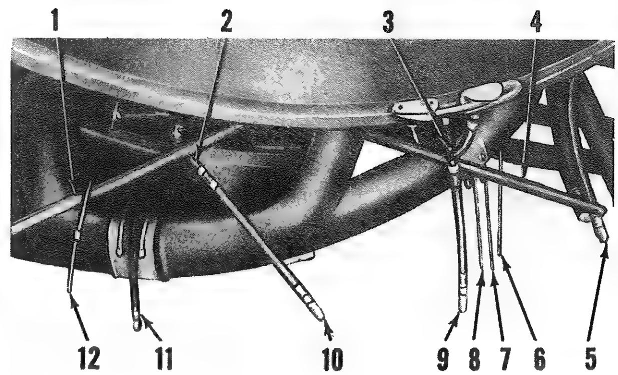
3–102. SUPERCHARGER DRAIN LINE FITTINGS.

a. Remove hex-head plug from supercharger drain valve (6, figure 3–26). Discard plug.

b. Screw nut, part No. AN924-5, on long leg of elbow, part No. AN833-5. Apply antiseize compound, Military Standard MS35496, to long leg of elbow.

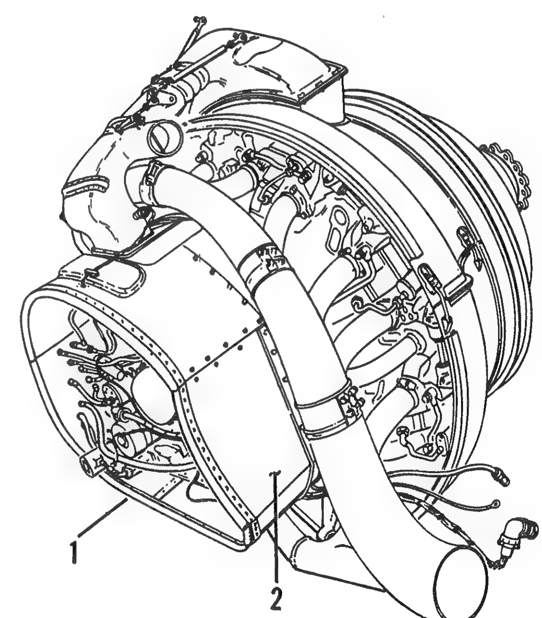
c. Position gasket, part No. MS29512-5, on supercharger drain valve. Install elbow in supercharger drain valve so open end points down and to left. Secure elbow with nut.

d. Locate three holes to left of center in left shroud panel (1, figure 3–32) of accessory compartment shroud cover. Locate 1/2-inch supercharger drain hole. Install elbow, part No. AN837-5, (8, figure 3–33) in this hole with washer, part No. AN960PD516L, between flange of elbow pointing to right. Secure elbow with washer and nut, part No. AN924-5.



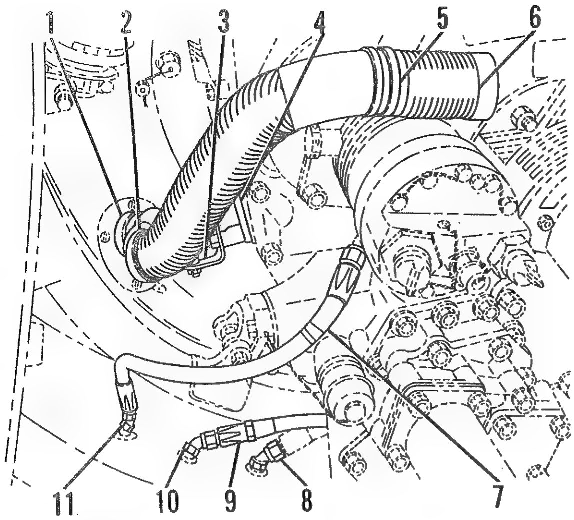
1. Right Engine Mount Sway Brace
2. Elbow
3. Nipple
4. Left Engine Mount Sway Brace
5. Hose Assembly
6. Tube Assembly
7. Tube Assembly
8. Tube Assembly
9. Hose Assembly
10. Hose Assembly
11. Hose Assembly
12. Tube Assembly

Figure 3–31. Intake Pipe Drain Lines



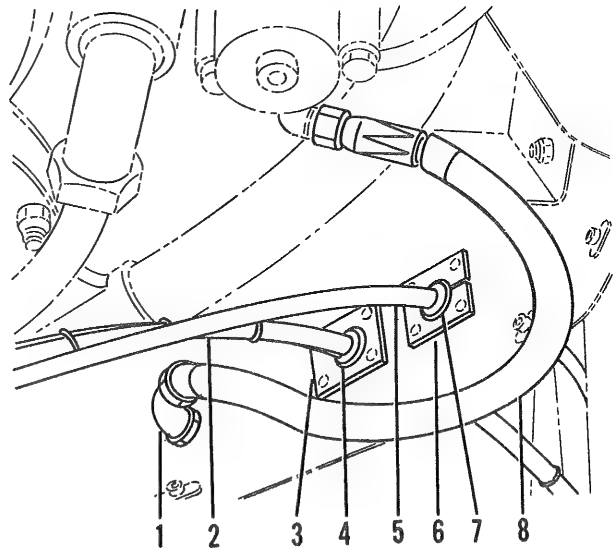
1. Left Shroud Panel
2. Right Shroud Panel

Figure 3–32. Shroud Panel Assembly



1. Clamp
2. Clamp
3. Bracket
4. Main Oil Pressure Strainer Pad
5. Clamp
6. Flexible Tube
7. Hose Assembly
8. Elbow
9. Hose Assembly
10. Elbow
11. Elbow

Figure 3–33. Drain Lines Installed



1. Elbow
2. Wiring Harness
3. Support
4. Grommet
5. Conduit Assembly
6. Support
7. Grommet
8. Hose Assembly

Figure 3–34. Fuel Pump Vent Line Installed

3–103. FUEL PUMP DRAIN AND VENT LINE FITTINGS.

Note

All fittings on fuel pump are installed during buildup of fuel pump.

a. Locate 7/16-inch hole of three holes to left of center in left shroud panel (1, figure 3–32) used for fuel pump drain line fitting. Install elbow, part No. AN837-4, (10, figure 3–33) in this hole with washer, part No. AN960PD416L, between flange of elbow and upper surface of left shroud panel with open end of elbow pointing to right and slightly to rear. Secure elbow with washer and nut, part No. AN924-4.

b. Locate 7/16-inch hole to right of center in right shroud panel (2). Install elbow, part No. AN837-4, (1, figure 3–34) in this hole with flange of elbow against upper surface of right shroud panel (2) and open end of elbow pointing to right and 45 degrees to rear. Secure elbow with washer, part No. AN960PD416L, and nut, part No. AN924-4.

3–104. CARBURETOR FITTINGS. The carburetor fittings are installed during buildup of carburetor.

3–105. OIL PRESSURE LINE FITTING.

a. Remove lock wire and hex-head plug from flange (4, figure 3–25).

b. Apply antiseize compound, Military Standard MS35496, to threads of restrictor, part No. SS4015-2S16S (5, figure 3–17). Secure restrictor with nut, part No. AN924-4.

c. Position gasket, part No. AN6290-4, on flange (4, figure 3–25) and install restrictor so open end points to left and slightly above horizontal position. Secure restrictor with nut.

3–106. OIL VENT FITTINGS.

a. Remove lock wire and plug from flange (6, figure 3–35). Discard plug.

b. Apply antiseize compound, Military Standard MS35496, to threads of elbow (7) and to pipe thread end of elbow (8). Install elbow (7) into flange (6) so open end points to rear. Install elbow (8) into elbow (7) so open end also points to rear and outboard.

c. Remove and retain screws, washers, and nuts securing square cover over outboard hole in intercylinder air deflector between cylinders No. 8 and 9. Position cover, part No. S1630-80502, (10) over hole on forward surface of intercylinder air deflector and secure with screws, washers, and nuts.

d. Install washer, part No. AN960PD2116, on long leg of elbow, part No. AN837-16D, (9) through hole in cover (10) then through intercylinder air deflector. Secure elbow with washer, part No. AN960PD2116, and nut, part No. AN924-16D, against rear surface of intercylinder air deflector.

Note

Elbow (9) and elbow (8) must point directly toward each other.

3–107. OIL BREATHER LINE FITTINGS.

a. Remove and retain hardware securing cover on pad (3, figure 3–35). Remove and discard cover and gasket.

Note

If cover is marked part No. AN5025-1, remove breather plug and use cover for step *b.*

b. Position gasket, part No. MS100009, and cover, part No. AN5025-1, on pad (3). Secure cover with hardware removed in step *a.*

c. Apply antiseize compound, Military Standard MS35496, to thread of elbow (5) and to pipe thread of elbow (4).

d. Install elbow (5) in cover so open end points up. Install elbow (4) in elbow (5) so open end points forward and 45 degrees to left.

e. Install washer, part No. AN960PD2116, on long leg of elbow, part No. AN833-16D, (12). Insert long leg of elbow through hole in cover (11) then through intercylinder air deflector. Secure elbow with washer, part No. AN960PD2116, and nut, part No. AN924-16D, to rear surface of intercylinder air deflector so open end of elbow points to center of engine.

3–108. HYDRAULIC PUMP DRAIN LINE FITTINGS.

Note

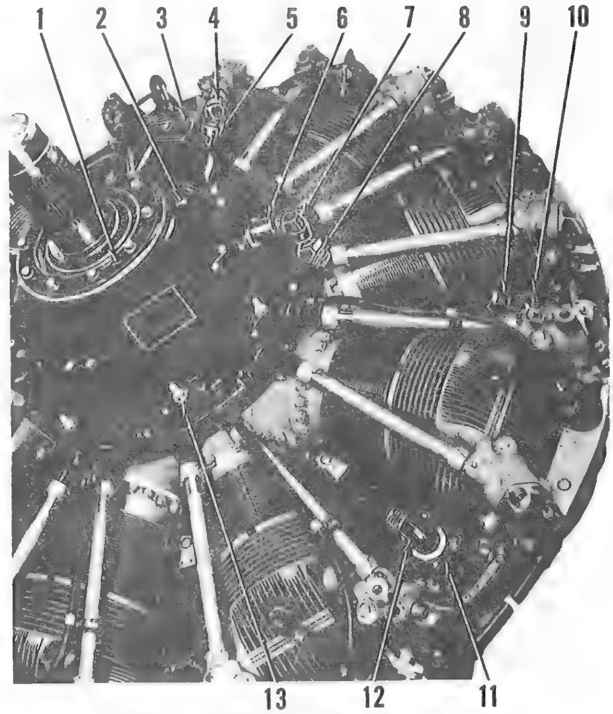
All fittings for hydraulic pump are installed during hydraulic pump buildup.

a. Locate left 7/16-inch hole on left shroud panel (1, figure 3–32) to left of center. Position elbow (11, figure 3–33) in this hole so open end of elbow points to right and 45 degrees to rear.

b. Secure elbow to skirt with washer, part No. AN960PD716, and nut, part No. AN924-4.

3–109. MANIFOLD PRESSURE LINE FITTING.

a. Remove hex-head plug from manifold pressure port which is located in supercharger rear cover.



1. Crankcase Front Section Flange Spacer
2. Anti-Corrosion Injection Fitting
3. Pad
4. Elbow
5. Elbow
6. Flange
7. Elbow
8. Elbow
9. Elbow
10. Cover
11. Cover
12. Elbow
13. Stud-Type Bolt

Figure 3–35. Oil Breather and Oil Vent Line Fittings

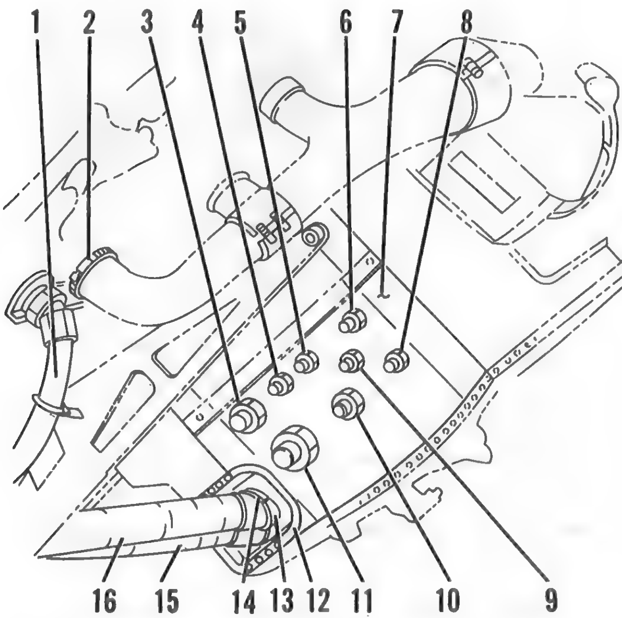
b. Apply antiseize compound, Military Standard MS35496, to the pipe thread of restrictor (6, figure 3–17). Install restrictor in the manifold pressure port.

3–110. DISCONNECT COUPLING FITTING HALVES. Eight coupling halves are installed on the power plant to provide quick disconnect in fuel, instrument, and hydraulic lines. These coupling halves are installed in the left accessory compartment shroud panel assembly.

Note

Each coupling half is installed with flange against outer surface of shroud panel assembly and screws inserted from outboard side.

a. Install left accessory compartment shroud panel. (Refer to paragraph 3–199.)



1. Hose Assembly
2. Ring-Type Clamp
3. Coupling Half
4. Coupling Half
5. Coupling Half
6. Coupling Half
7. Shroud Panel Assembly
8. Coupling Half
9. Coupling Half
10. Coupling Half
11. Coupling Half
12. Retainer
13. Half Slide
14. Half Slide
15. Hose Assembly
16. Hose Assembly

Figure 3–36. Disconnect Coupling Halves

b. Secure coupling half (6, figure 3–36) in upper forward hole of panel with screws, washers, and nuts.

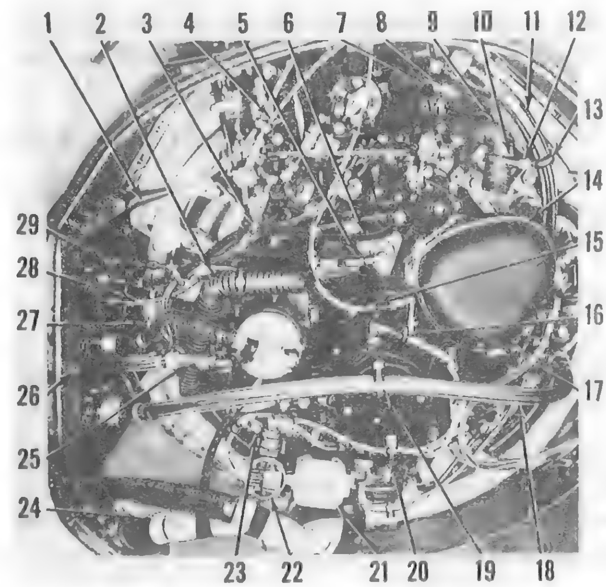
c. Screw nut, part No. AN924-6, on inboard end of coupling half (6). Install gasket, part No. AN6290-6, on inboard end of coupling half and on large end of two reducers, part No. AN919-6. Apply antiseize compound, Military Standard MS35496, to threads on inboard end of coupling half and to large end of each reducer.

d. Install reducer and gasket in short leg and in one end of long leg of tee (29, figure 3–37). Install tee on inboard end of coupling half (6, figure 3–36) so short leg of tee points to rear and up at approximately 45-degree angle. Tighten nut and gasket against tee.

Note

The fittings installed in steps *b* through *d* are for vapor return lines.

e. Secure coupling half (5) in second hole from top at forward side of shroud panel with screws and nuts. This fitting is for oil pressure line.



1. Hose Assembly
2. Flexible Tube
3. Clamp
4. Hose Assembly
5. Hose Assembly
6. Hose Assembly
7. Clamp
8. Clamp
9. Flexible Tube
10. Clamp
11. Carburetor Main Inlet Hose Assembly
12. Screw, Washer, Nut
13. Clamp
14. Magneto
15. Clamp
16. Nipple
17. Conduit Assembly
18. Fuel Pump Inlet Hose Assembly
19. Clamp
20. Clamp
21. Synchronizing-Breaker
22. Tachometer-Generator
23. Bracket
24. Hose Assembly
25. Hose Assembly
26. Left Shroud Panel
27. Hose Assembly
28. Hose Assembly
29. Tee

Figure 3–37. Hoses and Wiring

f. Secure coupling half (4) in third hole from top at forward side of shroud panel with screws and nuts. This fitting is for hydraulic pump bypass line.

g. Secure coupling half (3) in lower forward hole of shroud panel with screws and nuts. This fitting is for hydraulic pump inlet line.

h. Secure coupling half (8) in upper rear hole of shroud panel with screws and nuts. This fitting is for manifold pressure line.

i. Secure coupling half (10) in center rear hole of shroud panel with screws and nuts. This fitting is for hydraulic pump outlet line.

j. Secure coupling half (11) in lower rear hole of shroud panel with screws, washers, and nuts. This fitting is for fuel pump inlet line.

k. Secure coupling half (9) in hole that is located just below and between two upper holes with screws, washers, and nuts. This fitting is for fuel pressure line.

l. Install a protective dust cap on outboard end of each fitting.

3–111. FIRE EXTINGUISHER WELD ASSEMBLY. (Refer to table 3–I.)

3–112. INSTALLATION.

a. Drill a 1-1/8 (1.125) inch diameter hole in upper cover of intercylinder air deflector between cylinders No. 1 and 2.

b. Insert flanged end of weld assembly through this hole from rear of deflector with small curved tube facing to right. Secure weld assembly with washer and nut.

3–113. STARTER.

3–114. INSTALLATION.

a. Remove and discard nuts and washers that secure cover on starter drive pad which is located directly below flange (4, figure 3–25) on supercharger rear cover. Remove cover and gasket.

b. Wipe starter drive flange clean and inspect mating surfaces for dents, marks, or abrasions.

c. Position new gasket on starter drive pad, being careful not to tear or bruise gasket.

d. Position starter (12, figure 3–17) on starter drive pad and secure with washers and nuts. Using wrenches, Wright part No. 801081, or equivalent, and Airesearch Mfg. Co. part No. 84654, or equivalent, and a torque wrench, tighten nuts to a torque of 280 to 300 inch-pounds.

Note

Lightly coat internal splines of engine accessory drives and mating male splines of accessory with aircraft general purpose grease, Military Specification MIL-G-7711.

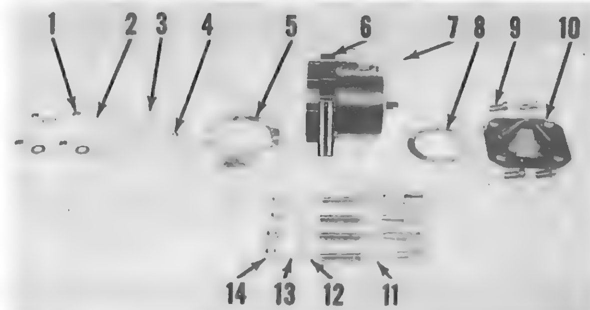
Note

The starter must be installed with terminal post (11) pointing up as shown.

3–115. SYNCHRONIZING-BREAKER.

3–116. INSTALLATION. (See figures 3–17 and 3–37.)

a. Remove nuts and washers that secure cover on right tachometer-generator drive pad. Remove cover and gasket.



1. Nut
2. Washer
3. Cover
4. Hole
5. Gasket
6. Syrchronizing-Breaker
7. Electrical Outlet
8. Gasket
9. Screw
10. Cover
11. Hex Studs
12. Washer
13. Lockwasher
14. Hex Nut

Figure 3–38. Synchronizing – Breaker Assembly

b. Remove synchronizing-breaker from its shipping container. Remove cloth bag containing washers, lockwashers, and elastic stop nuts.

c. Remove and discard screws (9, figure 3–38) that secure cover (10) to drive end of synchronizing-breaker housing. Remove cover and gasket (8).

d. Remove and retain washers (2) and nuts (1) that secure cover (3) and gasket (5) to synchronizing-breaker (6). Remove hex studs (11).

e. Install one hex stud (11) on each of right tachometer-generator drive pad studs and tighten securely.

f. Wipe tachometer-generator drive pad clean and inspect surfaces for dents, marks, or abrasions.

g. Place gasket (8) over pilot of synchronizing-breaker (6). Position synchronizing-breaker on hex studs (11) with electrical outlet (7) pointing to right and forward.

Note

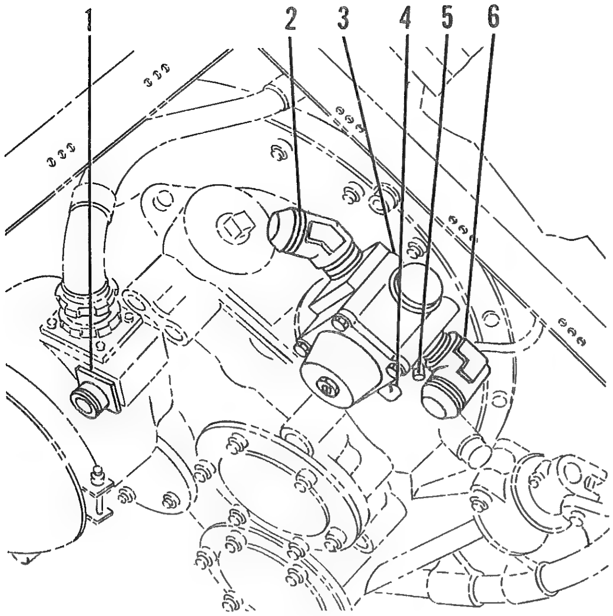
Lightly coat internal splines of engine accessory drives and mating male splines of accessory with aircraft general purpose grease, Military Specification MIL-G-7711.

Note

Insure that synchronizing-breaker is seated squarely against tachometer-generator drive pad.

b. Install, in order given, washers (12), lockwashers (13), and hex nuts (14) on hex studs extending through elongated holes in flange of synchronizing-breaker housing. Do not tighten hex nuts (14) at this time.

i. Position gasket (5) and cover (3) on synchronizing-breaker. Secure loosely with washers (2) and nuts (1). Do not tighten nuts at this time.



1. Ignition Switch and Booster Connection
2. Elbow
3. Fuel Pump
4. Restrictor
5. Elbow
6. Elbow

Figure 3–39. Fuel Pump

Note

Position gasket (5) and cover (3) on synchronizing-breaker housing so extensions of gasket and cover are pointing to right. The cutouts on each side of gasket should mate with raised dots on housing, and dots on housing should extend through holes (4) in cover.

3–117. TACHOMETER-GENERATOR.

3–118. INSTALLATION. The tachometer-generator (15, figure 3–17) is installed on left tachometer-generator drive pad.

a. Remove and retain nuts and washers securing cover (2, figure 3–25) on left tachometer-generator drive pad. Remove cover and gasket.

b. Wipe drive pad clean. Position gasket, furnished with tachometer-generator, on drive pad.

c. Position tachometer-generator (15, figure 3–17) on drive pad with electrical receptacle (16) pointing up. Position bracket (17) on upper left-hand stud.

Note

Lightly coat internal splines of engine accessory drives and mating male splines of accessory with aircraft general purpose grease, Military Specification MIL-G-7711.

d. Secure tachometer-generator to studs with hardware removed in step *a.*

e. Tighten nuts to a torque of 50 to 70 inch-pounds.

f. Place protective cover or masking tape over electrical receptacle.

3–119. FUEL PUMP.

3–120. BUILDUP.

Note

At installation, coat threads of all fittings lightly with antiseize compound, Military Standard MS35496.

a. Remove lock wire and plug from vent port in lower section of cover located at back of fuel pump (3, figure 3–39).

b. Install restrictor (4) in this port with open end of restrictor pointing to right and slightly to rear.

c. Remove lock wire and plug from seal drain port near drive gear bracket of pump. Install elbow (5) in this port with open end of elbow pointing down and slightly to left.

d. Install elbow (6) in inlet port of pump.

e. Install elbow (2) in outlet port of pump.

f. Place a protective cover or masking tape over open end of each elbow.

3–121. INSTALLATION.

a. Remove nuts and washers securing cover (7, figure 3–26) on fuel pump drive pad. Remove cover and gasket.

b. Wipe drive pad clean and inspect mating surfaces for dents, marks, or abrasions.

c. Position new gasket on drive pad, being careful not to tear or bruise gasket.

d. Position fuel pump (3, figure 3–39) on drive pad so pressure relief setscrew is pointing to rear of supercharger housing.

Note

Lightly coat internal splines of engine accessory drives and mating male splines of accessory with aircraft general purpose grease, Military Specification MIL-G-7711.

e. Secure loose end of left bonding jumper (1, figure 3–17) to one stud of left gun synchronizer pad cover with nut and washer.

f. Remove washer and nut from lower forward fuel pump mounting stud. Position loose end of right bonding jumper (9) on this stud and secure with washer and nut.

g. Tighten nuts that secure fuel pump on pad to a torque of 150 to 170 inch-pounds.

3–122. TEMPERATURE BULBS.

3–123. The cylinder temperature bulb is installed in the thermocouple port located in the rear of cylinder No. 7. The oil inlet temperature bulb is installed in a recess in bottom of rear oil pump.

3–124. INSTALLATION.

a. Insert cylinder temperature bulb in thermocouple port in rear of cylinder No. 7 and turn clockwise to secure it in position.

b. Remove lock wire plug (4, figure 3–24), and gasket. Discard plug and gasket.

c. Position new gasket on oil inlet temperature bulb. Install oil inlet temperature bulb in port from which plug (4) was removed.

d. Secure bulb and two remaining plugs with lock wire.

3–125. HYDRAULIC PUMP.

3–126. BUILDUP.

Note

Lightly coat threads of all fittings at installation with antiseize compound, Military Standard MS35496.

a. Screw nut, part No. AN6289-6, on long leg of elbow, part No. AN833-6, (4, figure 3–17). Install backup ring, part No. AN6291-6, on elbow against nut. Install gasket, part No. AN6290-6, against backup ring. Install elbow in bypass port at top of hydraulic pump (18) so open end of elbow points to left. Secure elbow with nut.

b. Screw nut, part No. AN6289-4, on long leg of elbow, part No. AN837-4. Install backup ring, part No. AN6291-4, on elbow against nut. Install gasket, part No. AN6290-4, against ring. Remove plug from port in bottom of pump mounting flange. Install elbow in this port so open end of elbow points down and to left. Secure elbow with nut.

Note

This port is directly opposite bypass port.

c. Install reducer, part No. AN919-20D, (19) and gasket, part No. AN6290-12, in the IN port of hydraulic pump.

d. Install reducer, part No. AN919-15D, (14) and gasket, part No. AN6290-10, in OUT port of pump.

e. Install a protective cover or masking tape over open end of each fitting.

3–127. INSTALLATION.

a. Remove nuts and washers securing cover on adapter (1, figure 3–25) at upper left of supercharger rear cover. Remove cover and gasket.

b. Wipe drive adapter clean and inspect mating surfaces for dents, marks, or abrasions.

c. Position new gasket on drive adapter. Install splined end of drive shaft coupling in fluid coupling drive shaft located inside drive adapter.

Note

The drive shaft coupling was packed in mounting assembly (4, figure 3–23) and was removed when the engine was unpacked.

d. Position hydraulic pump (18, figure 3–17) drive adapter with bypass port up. Position bracket, part No. S1630-80227-2, on the upper left stud. Secure pump and bracket with washers and nuts.

Note

Lightly coat internal splines of engine accessory drives and mating male splines of accessory with aircraft general purpose grease, Military Specification MIL-G-7711.

Note

The short leg of bracket should be secured to stud and long leg should be pointing up and directly aft.

3–128. MAGNETO COOLING TUBES.

3–129. INSTALLATION. Two flexible tubes are installed to provide cooling air to magneto.

a. Remove nut and washer from bottom stud of main oil pressure strainer pad (4, figure 3–33). Position bracket (3) on stud, with long leg of bracket pointing down and to left, and secure with nut and washer.

b. Position clamp (1) on flexible tube (6). Push flexible tube over accessory compartment cooling tube that extends through fire seal in 8-o'clock position. Secure flexible tube to cooling tube with clamp.

c. Route flexible tube up and to right over hydraulic pump.

d. Position clamp (2) around flexible tube. Secure clamp to bracket on main oil pressure strainer pad with screw, washer, and nut.

e. Position clamp (5) around flexible tube near hydraulic pump. Secure clamp to bracket on upper left stud of hydraulic pump, as shown, with screw, washer, and nut.

f. Position clamp (7, figure 3–37) around engine mounting ring.

Note

Position clamp (7) around tape placed on engine mounting ring during engine mount buildup.

g. Position clamp (8) on flexible tube (9). Push tube over accessory compartment cooling tube that extends through fire seal directly forward of carburetor position. Secure flexible tube to cooling tube with clamp (8).

h. Route flexible tube (9) to right as shown.

i. Position a 1-1/2 inch clamp around flexible tube and secure to clamp (7) on engine mounting ring with screw, washer, and nut.

3–130. CARBURETOR.

3–131. BUILDUP. (See figure 3–40.) The buildup of carburetor consists of installation of fittings for fuel line from fuel pump, fuel pressure line, fuel vapor return line, and altitude compensator line.

Note

At installation, coat threads of all fittings lightly with antiseize compound, Military Standard MS35496.

Note

When the carburetor is installed, the same directional reference applies as that of the engine.

3–132. CARBURETOR INLET AND FUEL PRESSURE LINE FITTINGS.

a. Remove large plug (5, figure 3–40) from fuel inlet connection of carburetor.

b. Install pipe thread end of elbow (7, figure 3–41) in inlet connection with open end of elbow pointing down.

c. Remove lock wire and plug (2, figure 3–40) from fuel pressure connection in pressure regulator pad below primer pump.

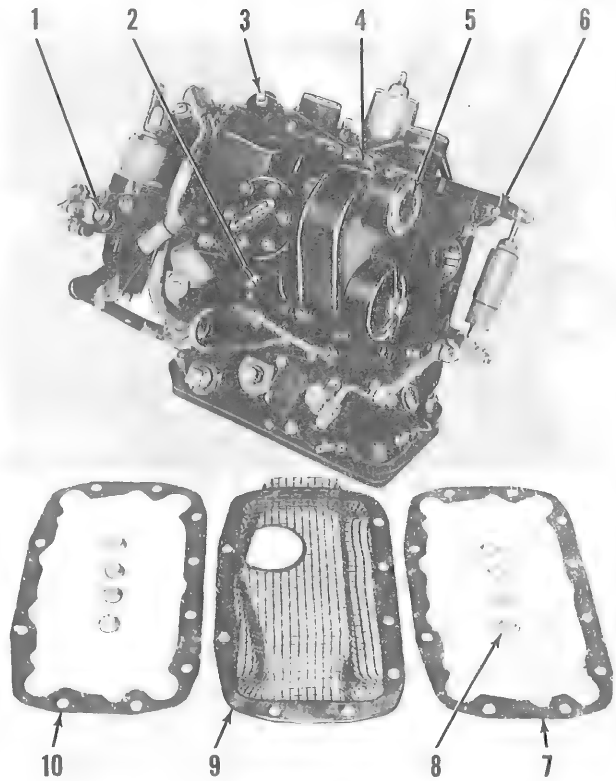
d. Install pipe thread end of restrictor (13, figure 3–41) in fuel pressure connection with open end of restrictor pointing down and slightly to left.

3–133. FUEL VAPOR RETURN LINE FITTINGS.

a. Remove lock wire and plug from vapor vent connection (4, figure 3–40) in top of float vent seat.

b. Install elbow (6, figure 3–41) in vapor vent connection (4, figure 3–40) with open end of elbow pointing to rear.

c. Install pipe thread end of elbow (5, figure 3–41) in open end of elbow (6) with open end of elbow (5) pointing down and 45 degrees to left.



1. Plug
2. Plug
3. Plug
4. Connection
5. Plug
6. Plug
7. Gasket
8. Spherical Washer
9. Screen
10. Gasket

Figure 3–40. Carburetor

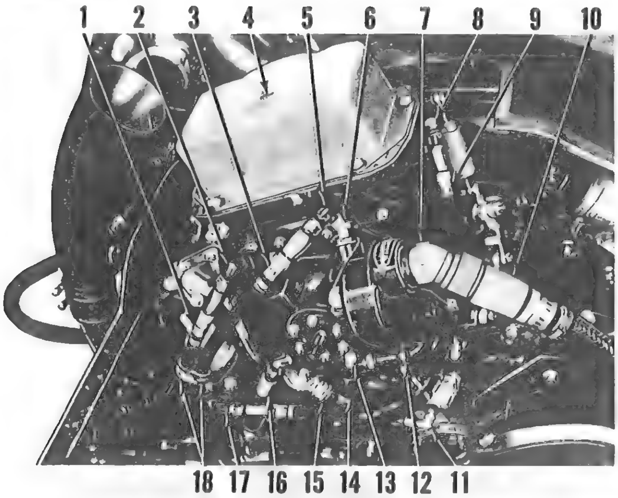
d. Remove plug (3, figure 3–40) from vapor vent connection in circular boss at top rear of carburetor, just to right of upper end of large stainless steel tube and approximately 7 inches directly above electrical receptacle on primer valve.

e. Install pipe thread end of elbow (2, figure 3–41) in vapor vent connection with open end of elbow pointing down and 45 degrees to left.

3–134. ALTITUDE COMPENSATOR LINE FITTINGS.

a. Remove lock wire and plug (6, figure 3–40) from manometer connection in right edge of upper deck of carburetor.

b. Install pipe thread end of elbow (8, figure 3–41) in manometer connection with open end of elbow pointing straight down.



1. Hose Assembly
2. Elbow
3. Hose Assembly
4. Cover
5. Elbow
6. Elbow
7. Elbow
8. Elbow
9. Hose Assembly
10. Carburetor Main Inlet Hose Assembly
11. Restrictor
12. Clamp
13. Restrictor
14. Hose Assembly
15. Electrical Receptacle
16. Hose Assembly
17. Elbow
18. Clamp

Figure 3–41. Carburetor and Lines

c. Remove lock wire and plug (1, figure 3–40) from altitude compensator vent connection in circular boss on rear surface of fuel control unit housing.

d. Install pipe thread end of elbow (17, figure 3–41) in compensator vent connection with open end of elbow pointing to right.

3–135. CARBURETOR INSTALLATION.

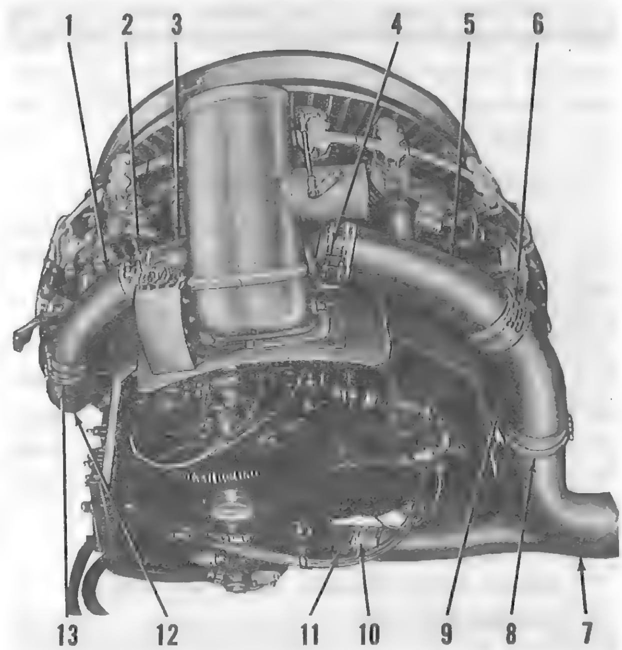
a. Remove nuts and washers securing cover (3, figure 3–25) and remove cover. Retain nuts. Insure that no foreign material is in impeller chamber.

b. Wipe mating surfaces clean and inspect surfaces for dents, marks, or abrasions.

c. Position new carburetor gasket on carburetor mounting pad.

d. Set carburetor in position on mounting studs. (See figure 3–41.)

e. Tilt carburetor toward rear and install a spherical washer (8, figure 3–40) and nut on stud



1. Section Assembly
2. Sleeve-Type Clamp Assembly
3. Sleeve-Type Section Assembly
4. Sleeve-Type Clamp Assembly
5. Section Assembly
6. Sleeve-Type Clamp Assembly
7. Tail Pipe Assembly
8. Sleeve-Type Clamp Assembly
9. Section Assembly
10. Sleeve-Type Clamp Assembly
11. Section Assembly
12. Section Assembly
13. Sleeve-Type Section Assembly

Figure 3–42. Low Stack Exhaust Collector Assembly

located at each of two forward corners of mounting flange.

f. Tighten nuts enough to allow carburetor adapter to seat squarely on carburetor mounting pad.

g. Install remaining spherical washers and nuts. Tighten nuts evenly and firmly.

CAUTION

When carburetor is installed on engine, it is very important that carburetor be filled with gasoline and allowed to stand for at least 8 hours preceding first starting of engine. This softens diaphragms within carburetor to proper working condition.

3–136. EXHAUST COLLECTOR ASSEMBLY (LOW STACK).

3–137. INSTALLATION. (See figure 3–42.)

Note

Ring-type clamps (2, figure 3–36) are furnished with the engine.

a. Remove exhaust port cap (2, figure 3–26) from each cylinder exhaust port.

b. Position ring-type clamp (2, figure 3–36) on each inlet port of tail pipe assembly (7, figure 3–42).

c. Install tail pipe assembly at cylinder exhaust port of cylinders No. 4 and 5. Secure loosely with ring-type clamps.

Note

Tighten nut on each ring-type clamp only enough to hold tail pipe in position.

d. Position sleeve-type clamp assemblies (8 and 10) on tail pipe assembly (7). (Refer to table 3-III for clamp assembly arrangement.)

e. Position sleeve-type clamp assembly on end of each section assembly as listed in table 3–IV.

f. Position ring-type clamp on exhaust port connection of each section assembly (1, 3, 5, 9, 11, and 12) and secure each section assembly to proper cylinder exhaust port as listed in table 3–IV. Tighten nuts only enough to hold section assemblies in place.

Note

The recess in each ring-type clamp must be aligned with top recess on cylinder exhaust port.

Note

Do not install section assembly (3), until engine control support assembly has been installed.

g. After assembly of each section assembly listed in step *f,* tighten nuts that secure the ring-type clamps to a torque of 100 to 120 inch-pounds.

h. Secure each sleeve-type clamp assembly (2, 4, 6, 8, 10, and 13) with bolts, washers, and nuts.

CAUTION

Do not, under any circumstances, tighten nuts so as to bend clamp assembly, lugs, or bolts.

Table 3–III. Location of S1630-80900-3 Exhaust Collector Assembly Clamp Assemblies

CLAMP ASSEMBLY NUMBER	AT JOINT BETWEEN SECTION
S1630-80903-26	S1630-80901-45 and -46
S1630-80903-26	S1630-80901-50 and -51
S1630-80903-27	S1630-80901-46 and -47
S1630-80903-27	S1630-80901-49 and -50
S1630-80903-28	S1630-80901-46 and -40
S1630-80903-29	S1630-80901-40 and -48
S1630-80903-30	S1630-80901-48 and -49

Table 3–IV. Location of S1630-80900-3 Exhaust Collector Assembly Section Assemblies

SECTION NUMBER	CYLINDER NUMBER
S1630-80901-40	2
S1630-80901-45	8
S1630-80901-46	9
S1630-80901-47	1
S1630-80901-48	3
S1630-80901-50	6
S1630-80901-51	7

Note

Tighten nuts at each sleeve-type clamp assembly until sleeve-type clamp assembly cannot be rotated around pipe axis by lightly tapping bolt heads.

i. Loosen nuts alternately at each sleeve-type clamp assembly until sleeve-type clamp assembly can be rotated around pipe axis by lightly tapping bolt heads.

Note

After the first 1 to 2 hours of engine operation, sleeve-type clamp assemblies should be checked as outlined in steps *h* and *i.* Tighten or loosen as required.

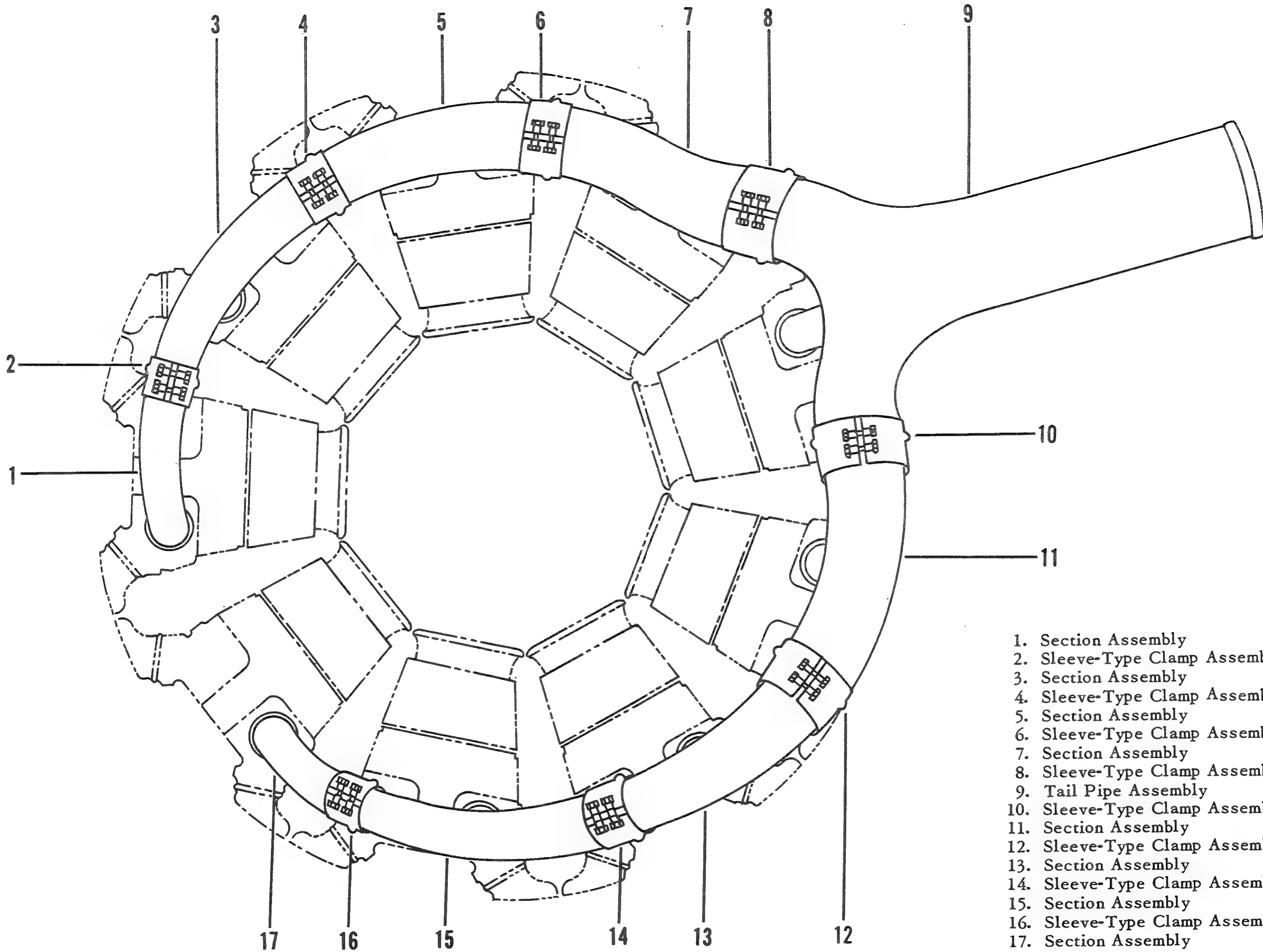
j. Place two bags of dehydrating agent in exhaust port of tail pipe assembly (7). Seal port with tape, Federal Specification PPP-T-60.

3–138. EXHAUST COLLECTOR ASSEMBLY (HIGH STACK).

3–139. INSTALLATION. (See figure 3–43.)

Note

The ring-type clamps (2, figure 3–36) are furnished with the engine.



1. Section Assembly
2. Sleeve-Type Clamp Assembly
3. Section Assembly
4. Sleeve-Type Clamp Assembly
5. Section Assembly
6. Sleeve-Type Clamp Assembly
7. Section Assembly
8. Sleeve-Type Clamp Assembly
9. Tail Pipe Assembly
10. Sleeve-Type Clamp Assembly
11. Section Assembly
12. Sleeve-Type Clamp Assembly
13. Section Assembly
14. Sleeve-Type Clamp Assembly
15. Section Assembly
16. Sleeve-Type Clamp Assembly
17. Section Assembly

Figure 3–43. Exhaust Collector (Part No. S1630-80965) *a.* Remove exhaust port cap (2, figure 3–26) from each cylinder exhaust port.

b. Position ring-type clamp (2, figure 3–36) on inlet port of tail pipe assembly (9, figure 3–43).

c. Install tail pipe assembly (9) to exhaust port of cylinder No. 3. Secure loosely with ring-type clamp.

Note

Tighten nut of ring-type clamp only enough to hold tail pipe assembly in position.

d. Position sleeve-type clamp assemblies (8 and 10) on tail pipe assembly (9). (Refer to table 3–V for clamp assembly arrangement.)

e. Position sleeve-type clamp assemblies on end of each section as listed in table 3–VI.

f. Position ring-type clamp on exhaust port connection of each section assembly (1, 3, 5, 7, 11, 13, 15, and 17) and secure each section assembly to proper cylinder exhaust port as listed in table 3–VI. Tighten nuts of ring-type clamps only enough to hold section assemblies in position.

Note

The recess in each ring-type clamp must be aligned with top recess on exhaust connection at each cylinder exhaust port.

Note

Do not install section assembly (5, figure 3–43) until engine control support assembly has been installed.

g. After installation of each section assembly listed in step *f,* tighten nuts that secure the ring-type clamps to a torque of 100 to 120 inch-pounds.

h. Secure each sleeve-type clamp assembly (2, 4, 6, 8, 10, 12, 14, and 16) with bolts, washers, and nuts.

CAUTION

Do not, under any circumstances, tighten nuts so as to bend clamp assemblies, lugs, or bolts.

Note

Tighten nuts on each sleeve-type clamp assembly until sleeve-type clamp assembly cannot be rotated around pipe axis by lightly tapping bolt heads.

Table 3–V. Location of S1630-80965 Exhaust Collector Assembly Clamp Assemblies

CLAMP ASSEMBLY NUMBER	AT JOINT BETWEEN SECTIONS
S1630-80903-26	S1630-80901-45 and S1630-80901-46
S1630-80903-26	S1630-80901-50 and S1630-80901-51
S1630-80903-27	S1630-80901-46 and S1630-80901-47
S1630-80903-27	S1630-80966-4 and S1630-80901-50
S1630-80903-28	S1630-80901-47 and S1630-80966-1
S1630-80903-29	S1630-80966-1 and S1630-80966-2
S1630-80903-29	S1630-80966-3 and S1630-80966-4
S1630-80953-1	S1630-80966-2 and S1630-80966-3

Table 3–VI. Location of S1630-80965 Exhaust Collector Assembly Section Assemblies

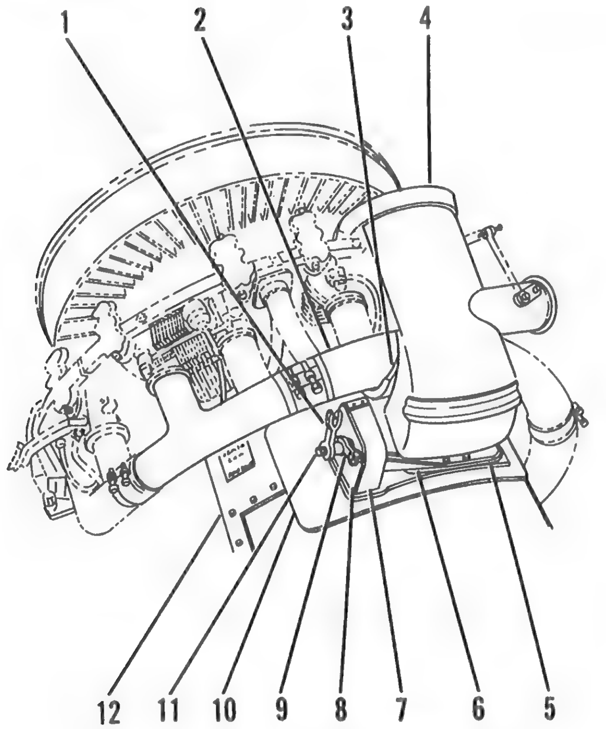
SECTION NUMBER	CYLINDER NUMBER
S1630-80901-45	8
S1630-80901-46	9
S1630-80901-47	1
S1630-80901-50	6
S1630-80901-51	7
S1630-80966-1	2
S1630-80966-2	3
S1630-80966-3	4
S1630-80966-4	5

i. Loosen nuts alternately at each sleeve-type clamp assembly until sleeve-type clamp assembly can be rotated around pipe axis by lightly tapping bolt heads.

Note

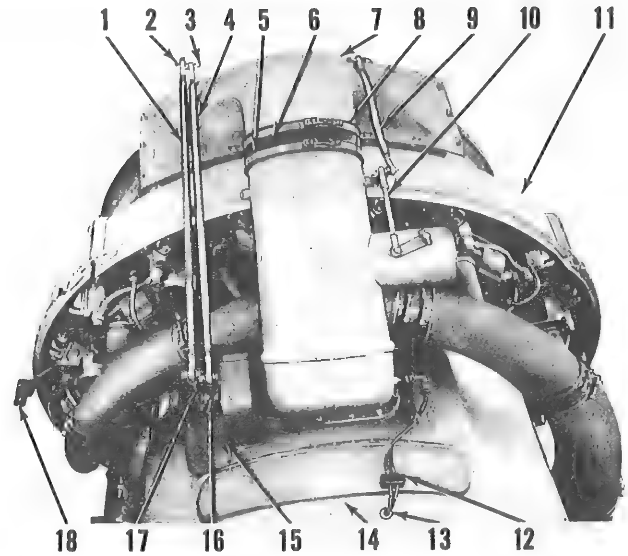
After the first 1 to 2 hours of engine operation, sleeve-type clamp assemblies should be checked as outlined in steps *h* and *i.* Tighten or loosen as required.

j. Place two bags of dehydrating agent in the exhaust port of tail pipe assembly (9). Seal port with tape, Federal Specification PPP-T-60.



1. Lever
2. Section Assembly
3. Shield Assembly
4. Air Intake Duct
5. Retainer
6. Bracket
7. Cover Assembly
8. Control Support Assembly
9. Lever
10. Well Assembly
11. Bolt
12. Cover Assembly

Figure 3–44. Air Intake Duct and Well Assembly



1. Rod Assembly
2. Bolt, Washers, Nut
3. Bolt, Washers, Nut
4. Rod Assembly
5. Marman Clamp
6. Rubber Boot
7. Elbow Assembly
8. Marman Clamp
9. Rod Assembly
10. Rod Assembly
11. Upper Cowl Assembly
12. Protective Cover
13. Grommet
14. Shroud Panel
15. Control Support Assembly
16. Lever
17. Lever
18. Hose Support Assembly

Figure 3–45. Engine Controls (Rods)

3–140. AIR INTAKE DUCT AND WELL ASSEMBLY.

3–141. INSTALLATION. (See figure 3–44.)

a. Remove lock wire, bolts, and washers that secure cover (4, figure 3–41). Remove cover.

b. Position well assembly (10, figure 3–44) on top of carburetor and cover assembly (12).

c. Position control rods (7 and 8, figure 3–13) to carburetor and secure with bolts, washers, and nuts (5 and 6) (helicopters serial No. prior to 55-4462).

d. Position control rods (3 and 4, figure 3–14) to carburetor and secure with bolts, washers, and nuts (1 and 2) (helicopters serial No. 55-4462 and subsequent).

e. Position one-half the length of rubber boot (6, figure 3–45) over end of air intake duct (4, figure 3–44). Secure rubber boot (6, figure 3–45) with Marman clamp (5). Fold back loose end of boot over Marman clamp.

f. Position cushion (upper) (1, figure 3–9) on top surface of flange at lower end of air intake duct (3). Insert spacer (19) into cushion (lower) (1) and position cushion against the bottom surface of flange on air intake duct; position spacers next to flange cutouts on air intake duct.

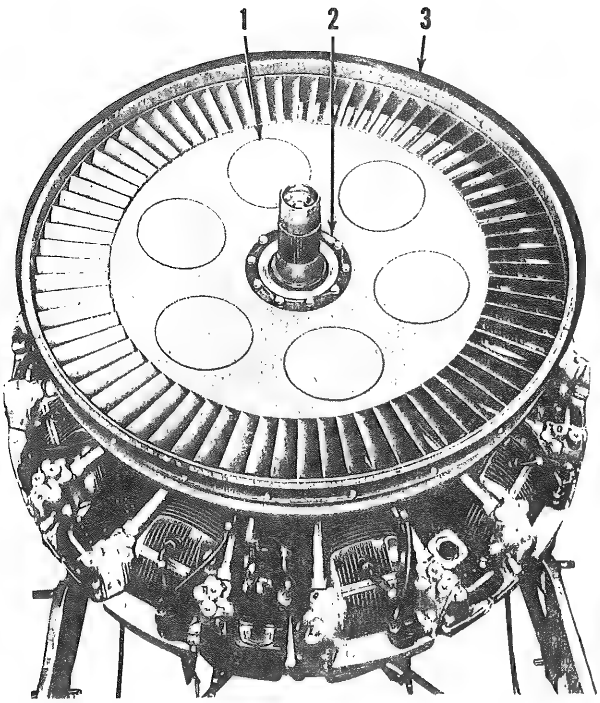
g. Position both cushion retainer halves (2) on cushion (upper) with flange of retainer pointing down.

h. Align gaskets (7 and 10, figure 3–40) and screen (9) over holes in top deck of carburetor.

i. Align holes of both cushion retainer halves (2, figure 3–9) and cushions (1) with holes of well assembly (10, figure 3–44).

j. Position air intake duct (4, figure 3–44) on well assembly (10).

k. Position washer under head of bolts (18, figure 3–9). Install bolts through holes in the assemblies of steps *f* through *j*. Secure complete assem-



1. Access Cover
2. Crankcase Front Section Flange Spacer
3. Contravane and Fan Shroud Assembly

Figure 3–46. Contravane and Fan Shroud Assembly

bly to top of carburetor. Secure bolts with lock wire.

3–142. CONTRAVANE AND FAN SHROUD ASSEMBLY.

3–143. INSTALLATION.

Note

To facilitate installation of oil vent line and tube (3, figure 3–5) portion of oil breather line, a temporary installation of each should be made at this time so that elbows can be aligned.

a. Install oil vent line, but tighten connections only enough to insure alignment of elbows. (Refer to paragraph 3–161, steps *a* and *b.*)

b. Install the two tube assemblies of oil breather line, but tighten connections only enough to insure alignment of the elbows. (Refer to paragraph 3–162, steps *a* through *e.*)

c. Remove oil vent line and oil breather line tubes.

d. Remove anti-corrosion injection fitting (2, figure 3–35) located next to crankcase front section flange spacer (1) at approximately the 1-o'clock position.

e. Apply antiseize compound, Military Standard MS35496, to pipe thread end of nipple, part No. AN816-3, and install nipple in the anti-corrosion injection port.

f. Apply antiseize compound, Military Standard MS35496, to threads of anti-corrosion injection fitting (2). Install anti-corrosion injection fitting into fitting which is riveted to side of contravane and fan shroud assembly (3, figure 3–46).

g. Remove lock wire, bolts, and washers that secure crankcase front section flange spacer (1). Remove crankcase front section flange spacer and thread protector (3, figure 3–23).

h. Install contravane fire extinguisher ring. (Refer to paragraph 3–148.)

i. Position contravane and fan shroud assembly (3, figure 3–46) on crankcase front section of engine.

Note

The eight fittings at bottom of contravane assembly fit over the eight stud-type bolts (13, figure 3–35) that secure crankcase front section. Rectangular cutouts are provided at bottom of contravane assembly for pad (3) and flange (6).

j. Position crankcase front section flange spacer (2, figure 3–46) on upper web of contravane assembly. Align holes and secure crankcase front section flange spacer and contravane assembly with hardware removed in step *g.* Tighten bolts to a torque of 350 to 400 inch-pounds. Secure screws in pairs with lock wire.

Note

The bolts should be cleaned with dry cleaning solvent, Federal Specification P-S-661, and then lubricated with engine oil, Military Specification MIL-L-6082, prior to installation.

k. Secure each fitting at bottom of contravane assembly to stud-type bolts with washers and nuts. Tighten nuts to a torque of 300 to 375 inch-pounds.

l. Replace thread protector (3, figure 3–23).

m. Apply one layer of chafing strip coated with rubber adhesive cement, No. EC1022, manufactured by Minnesota Mining and Mfg. Co., over head of contravane assembly.

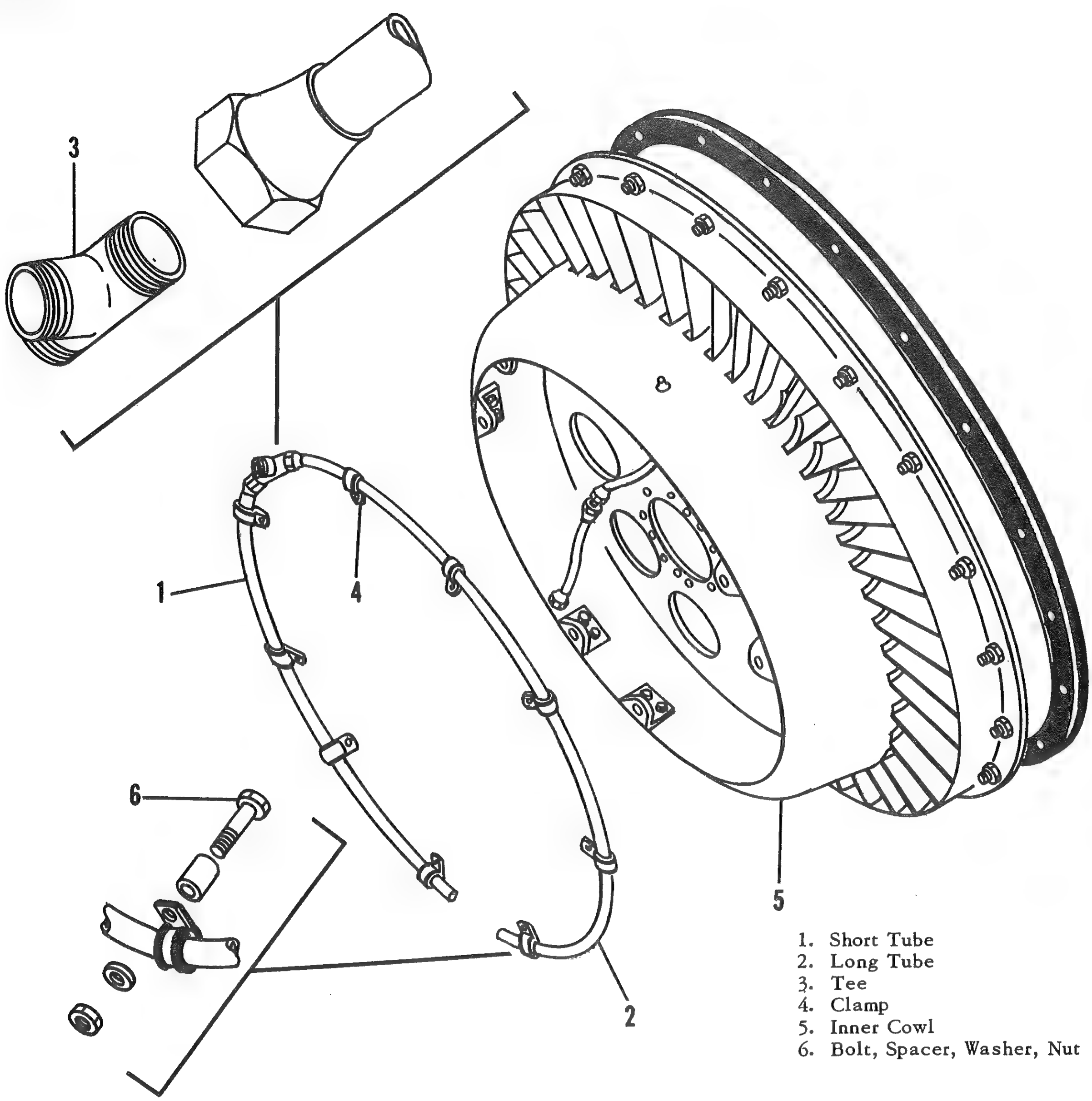


Figure 3–47. Fire Extinguisher Ring Assembly

3–144. CONTRAVANE MOUNTING ACCESS COVERS.

3–145. INSTALLATION.

a. Position cover (1, figure 3–46) over each access hole in upper web of contravane assembly.

b. Secure each cover with screws and washers.

Note

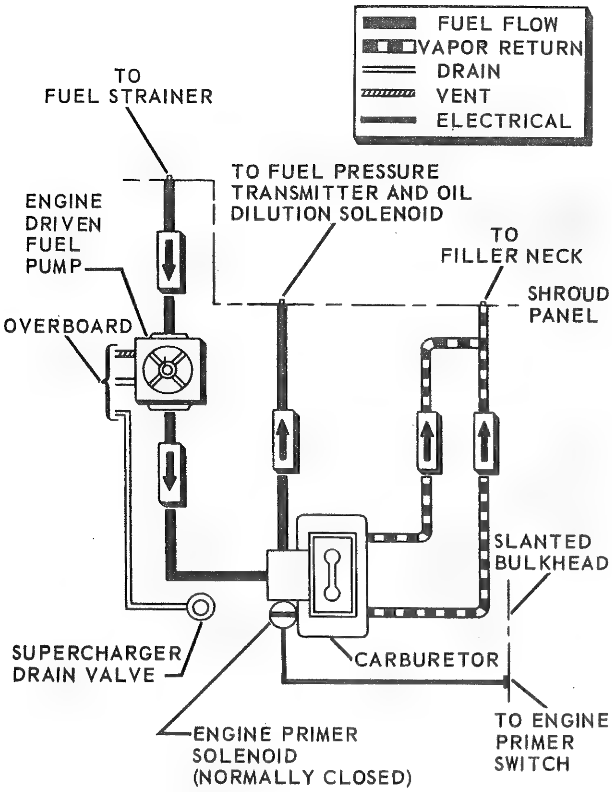
The covers for access holes at the 1-and 3-o'clock positions should be installed loosely at this time. These holes must be used during later procedures.

3–146. FIRE EXTINGUISHER RING (CONTRAVANE).

3–147. DESCRIPTION. A fire extinguisher ring is mounted on the rear portion of contravane inner cowl. The ring is connected to the fire extinguisher system and emits streams of fire extinguisher agent in a rearward direction when the system is activated by controls in pilots' compartment.

3–148. INSTALLATION. (See figure 3–47.)

a. Attach short tube (1) and long tube (2) to tee (3).



FUEL SYSTEM–EQUIPMENT COMPONENTS

CARBURETOR
PUMP, ENGINE-DRIVEN FUEL
SUPPORT ASSEMBLY
TUBE ASSEMBLY
HOSE ASSEMBLY
COUPLING HALF
RESTRICTOR

Figure 3–48. Fuel System Schematic Diagram

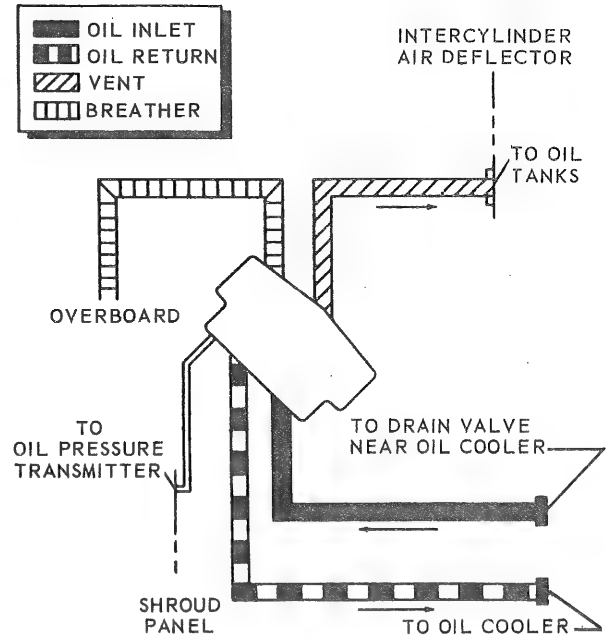
b. Slide clamps (4) on both short and long tubes (1 and 2).

c. Position complete assembly to contravane inner cowl (5) and slide clamps (4) along short and long tubes (1 and 2) so that holes in clamps align with holes in inner cowl (5) and install bolt, spacer, washer, and nut (6) to secure each clamp.

CAUTION

Ring must be installed so that emission holes in tubes and open port of tee (3) are directed toward accessory section of engine. Be sure that clamps do not obstruct emission holes in tubes.

d. Tighten attaching hardware so ring is properly secured.



LUBRICATION SYSTEM–EQUIPMENT COMPONENTS

BULB
TUBE ASSEMBLY
HOSE ASSEMBLY
COVER

Figure 3–49. Lubrication System Schematic Diagram

3–149. TUBES, HOSES, CONDUIT, AND CLAMPS.

3–150. INSTALLATION. (See figures 3–48 and 3–49.)

Note

The installation instructions are grouped by systems as follows: Fuel, lubrication, instrument, hydraulic, and fire extinguisher.

Note

Coat all connections lightly with anti-seize compound, Military Standard MS35496.

CAUTION

Blow all tube and hoses clear before installation with dry, compressed air.

3–151. INTAKE PIPE DRAIN LINES.

a. Secure hose assembly (11, figure 3–31) to elbow in intake pipe drain of cylinder No. 4.

b. Secure hose assembly (10) to elbow in intake pipe drain of cylinder No. 5.

c. Secure hose assembly (9) to nipple in intake pipe drain of cylinder No. 6.

d. Secure hose assembly (5) to nipple in intake pipe drain of cylinder No. 7.

e. Position a 5/16-inch clamp around upper end of each hose assembly. Attach a 1-1/4 inch clamp to each 5/16-inch clamp with screw, washer, and nut.

3–152. SUPERCHARGER DRAIN LINE.

a. Secure one end of hose assembly to elbow (8, figure 3–33) in right hole in left side of left shroud panel (1, figure 3–32). Route hose assembly under engine and secure other end to elbow in supercharger drain valve (6, figure 3–26).

b. Secure tube assembly (8, figure 3–31) to lower end of elbow (8, figure 3–33). Insure lower portion of tube assembly is vertical and positioned as near engine mount sway brace as possible.

3–153. FUEL PUMP DRAIN LINE.

a. Secure one end of hose assembly (9, figure 3–33) to elbow (10). Route hose assembly under engine and secure other end of hose assembly (7, figure 3–50) to elbow (5, figure 3–39).

b. Secure tube assembly (7, figure 3–31) to lower end of elbow (10, figure 3–33). Position tube assembly so that long straight portion will be vertical and as near engine mount sway brace as possible.

c. Position 1/2-inch clamp around tube assembly (8, figure 3–31) at point approximately 6 inches from end. Position 5/16-inch clamp around hose assembly (9). Secure these clamps to each other with screw, washer, and nut.

d. Position 5/16-inch clamp around tube assembly (8) at point above left engine mount sway brace (4).

e. Position 1/4-inch clamp around tube assembly (7).

f. Secure two clamps of steps *d* and *e* to each other and to 11/16-inch clamp with screw, washer, and nut.

Note

Secure clamps of steps *d* through *f* loosely. The 11/16-inch clamp will be installed around the left engine mount sway brace (4) in later procedure.

1. Carburetor Main Inlet Hose Assembly
2. Elbow
3. Elbow
4. Hose Assembly
5. Restrictor
6. Hose Assembly
7. Hose Assembly

Figure 3–50. Fuel Pump and Lines

3–154. FUEL PUMP VENT LINE.

a. Secure one end of hose assembly (8, figure 3–34) to elbow (1) in hole in right side of right shroud panel of accessory compartment shroud cover assembly. Rotate hose assembly to right and up and secure other end of hose assembly (4, figure 3–50) to restrictor (5) in vent port of fuel pump.

b. Secure tube assembly (12, figure 3–31) to lower end of elbow (1, figure 3–34) in right shroud panel. Position tube assembly so long, straight portion points down and slightly forward.

c. Position 5/16-inch clamp around tube assembly (12, figure 3–31) as near to shroud cover assembly as possible. Attach a 1-1/4 inch clamp loosely to 5/16-inch clamp with screw, washer, and nut.

Note

These clamps will be used to secure the tube assembly when the power plant is installed in the helicopter.

d. Wrap waterproof, asbestos tape, Military Specification MIL-T-4117, around the entire length of tube assembly and clamps.

3–155. FUEL PUMP INLET LINE.

a. Secure one end of hose assembly (6, figure 3–50) to elbow (3). Route hose assembly (18, figure 3–37) across rear of accessory section and secure other end to coupling half (11, figure 3–36) in lower rear hole of left shroud panel (26, figure 3–37).

b. Remove upper screw from rear of starter. Use this screw to secure clip to starter with flange of clip up. Position 1-1/16 inch clamp (19) around fuel pump inlet hose assembly (18) with flat side of clamp up. Secure clamp to clip with screw, washer, and nut.

3–156. CARBURETOR MAIN INLET LINE.

a. Secure one end of carburetor main inlet hose assembly (1, figure 3–50) to elbow (2) in outlet port of fuel pump.

b. Secure other end of carburetor main inlet hose assembly (10, figure 3–41) to elbow (7) in fuel inlet connection of carburetor.

c. Position clamp (13, figure 3–37) around carburetor inlet hose (11). Position clamp (10) around flexible tube (9). Secure clamps (10 and 13) to each other with screw, washer, and nut (12).

3–157. VAPOR RETURN LINES.

a. Secure one end of hose assembly (3, figure 3–41) to elbow (5) in top of float vent seat on carburetor.

b. Secure other end of this hose assembly (4, figure 3–37) to reducer in long leg of tee (29).

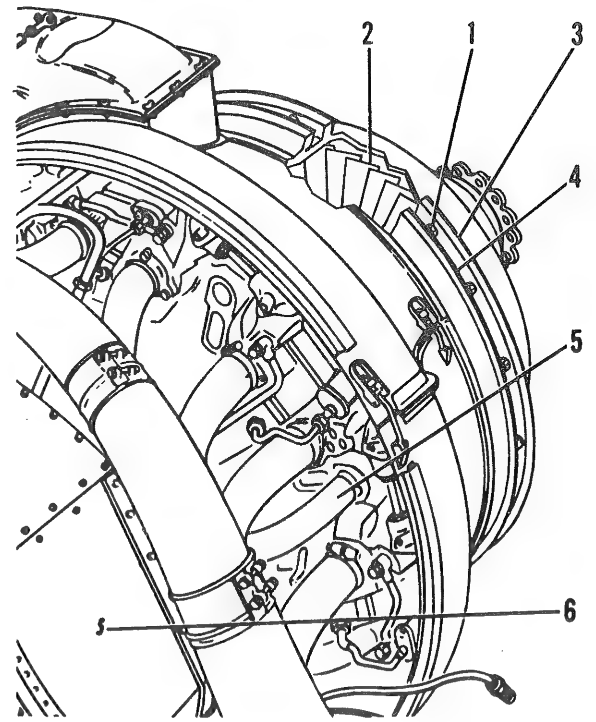
c. Secure one end of hose assembly (1, figure 3–41) to elbow (2) in circular boss at top rear of carburetor just to right of upper end of large, stainless steel tube.

d. Secure other end of this hose assembly (1, figure 3–37) to reducer in short leg of tee (29).

e. Position one 5/16-inch clamp (18, figure 3–41) around each hose assembly (1 and 3) at a point approximately 4 inches below fitting on upper end of hose assembly (1). Secure clamps together with screw, washers, and nut.

3–158. ALTITUDE COMPENSATOR LINE.

a. Secure one end of hose assembly (9, figure 3–41) to the elbow (8) installed in manometer



1. Bolt
2. Blade
3. Fan Shroud Assembly
4. Outer Cowl Ring Assembly
5. Tube Assembly
6. Shroud Panel Assembly

Figure 3–51. Clutch and Fan Assembly

connection in right side of upper deck of carburetor.

b. Route hose assembly down in front of carburetor inlet line then across rear of carburetor.

c. Secure other end of hose assembly to elbow (17) in altitude compensator vent connection in circular boss on rear surface of fuel control unit housing.

d. Position 5/16-inch clamp (12) around curved tube at lower right corner of carburetor. Position 1/2-inch clamp around hose assembly (9) adjacent to tube. Secure clamps to each other with screw, washer, and nut.

3–159. OIL INLET LINE.

a. Remove nuts and washers securing protective cover (3, figure 3–24) over oil inlet port. Remove cover.

b. Remove screws securing retainer (12, figure 3–36) to shroud panel assembly (7). Remove retainer and half slides (13 and 14).

c. Insert 90-degree elbow end of hose assembly (15) through hole in shroud panel assembly (6, figure 3–51).

d. Install one of three triangular gaskets furnished with engine to oil inlet pad. (Refer to step *f*, paragraph 3–74.) Position fitting on end of hose assembly to pad and secure with washers and nuts.

Note

To assist in installation of half slides (13 and 14) and retainer (12), the installation of the washers and nuts may be delayed until the half slides and retainer are secured to panel in later procedure.

e. Position new gasket on flange of 45-degree fitting of hose assembly (15). Insert bolts through flange and gasket. Position two washers on each bolt and secure only finger tight with nuts. Install a protective cover over flange, gasket, bolts, washers, and nuts.

f. Position 7/8-inch clamp around hose assembly (15) near left engine mount sway brace (4, figure 3–31). Secure an additional 1-11/16 inch clamp to 7/8-inch clamp with screw, washer, and nut.

3–160. OIL OUTLET LINE.

a. Remove nuts and washers securing protective cover (5, figure 3–24) over oil outlet port.

b. Insert 90-degree elbow end of hose assembly (16, figure 3–36) through hole in shroud panel assembly (7).

Note

Hose assembly (16) is positioned above hose assembly (15).

c. Install second of three triangular gaskets furnished with engine on oil outlet pad. (Refer to step *f*, paragraph 3–74.) Position fitting on end of hose assembly (16) on pad.

d. Remove and retain hardware securing two half slides (13 and 14) to each other. Position half slides around hose assemblies (15 and 16) and against outer surface of shroud panel assembly (7). Secure half slides to each other with hardware retained.

e. Position retainer (12) against shroud panel assembly so it secures half slides to shroud panel assembly. Secure retainer to panel assembly with screws removed in paragraph 3–159, step *b*.

f. Secure fitting on end of hose assembly (16) to oil outlet pad with nuts and washers. Secure fitting on end of hose assembly (15) to oil inlet pad if not secured previously. (Refer to paragraph 3–159, step *d*.)

g. Position gasket on flange of 45-degree fitting on forward end of hose assembly (16). Insert bolts through flange and gasket. Position two washers on each bolt and secure only finger tight with nuts. Install protective cover over flange, gasket, bolts, washers, and nuts.

h. Position 1-7/16 inch clamp around hose assembly (16) near left engine mount sway brace. Position a 1-11/16 inch clamp to the 1-7/16 inch clamp and secure clamps together with screw, washer, and nut.

3–161. OIL VENT LINE.

a. Position tube assembly between elbow (9, figure 3–35) in intercylinder air deflector between cylinders No. 8 and 9 and elbow (8) in oil tank vent flange. Secure tube assembly to each elbow.

b. Install a protective cover on open end of elbow in intercylinder air deflector.

3–162. OIL BREATHER LINE.

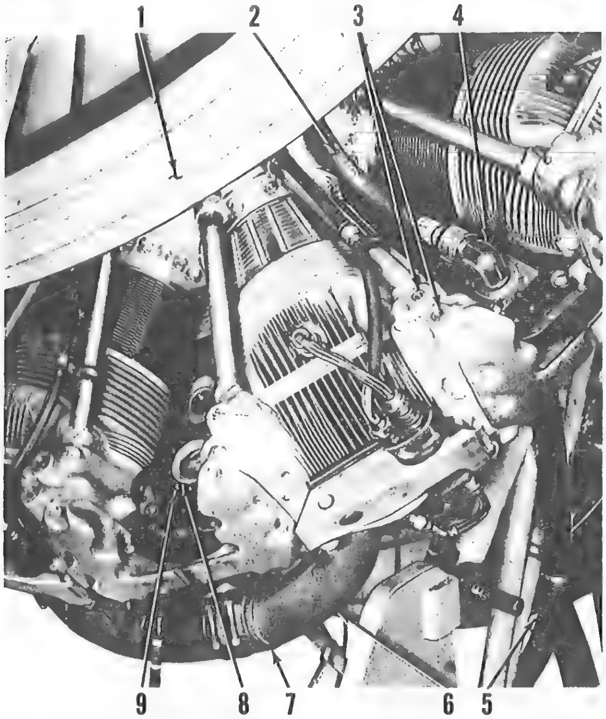
a. Each end of upper tube assembly (3, figure 3–5) is bent at an angle to center portion of tube. One of the bent ends is longer than other end. Install union in long end of tube assembly.

b. Reach through access hole near top of contravane and fan shroud assembly (3, figure 3–46) and connect short end of tube assembly (3, figure 3–5) loosely to elbow (4, figure 3–35).

c. Each end of lower tube assembly (2, figure 3–52) is bent at an angle to center portion of tube. One of the bent ends is slightly shorter than other end. Insert short end of tube assembly (2) through 2-inch diameter hole located at approximately 4-o'clock position in upper web of contravane assembly and secure end of tube assembly to previously installed union. (Refer to step *a* above.)

d. Position tube assemblies (2 and 5) and connect outboard end of tube assembly (2) loosely to elbow (4) in intercylinder air deflector between cylinders No. 7 and 8. Change positioning of elbows at either end of oil breather line, if necessary, to assist in aligning and connecting tube assemblies.

e. When tube assemblies and elbows are aligned properly, secure each tube assembly to elbow. Check to see that tube assembly (2) is not touching edge of hole in lower web of contravane assembly.



1. Contravane Assembly
2. Tube Assembly
3. Tapped Holes
4. Elbow
5. Hose Assembly
6. Section Assembly
7. Sleeve-Type Clamp Assembly
8. Flange
9. Screw

Figure 3–52. Oil Breather Line

f. Position 1-inch clamp around tube assembly (2). Align 1/4-inch diameter hole of a clip with hole in clamp. Secure clip to clamp with screw, washer, and nut.

g. Slide clamp, with clip, up tube assembly and align elongated hole in clip with hole in lower web of contravane assembly. Secure clip to lower web with bolt, washer, and nut. Tighten nut securing clip to clamp.

h. Secure hose assembly (1, figure 3–36) to aft end of elbow (4, figure 3–52) in intercylinder air deflector between cylinders No. 7 and 8. Route hose assembly down along outboard side of engine mount support arm.

Note

The beveled surface of hose ends should be facing forward.

i. Position 1-1/4 inch clamp approximately 6 inches from end of upper tube of engine mount support arm adjacent to hose assembly. Position second 1-1/4 inch clamp around hose assembly. Secure clamps to each other with screw, washer, and nut.

3–163. ANTI-CORROSION INJECTION LINE.

a. Reach through access holes located at 1 and 3-o'clock position in upper web of contravane and fan shroud assembly (3, figure 3–46) and position hose assembly inside contravane assembly.

b. Secure inboard end of hose assembly to nipple, on anti-corrosion injection fitting (2, figure 3–35) on crankcase front section. Secure outboard end of hose to fitting in side of contravane assembly at approximately the 1-o'clock position.

c. Install two access covers on contravane assembly. (Refer to paragraph 3–145.)

3–164. FUEL PRESSURE LINE.

a. Secure one end of hose assembly (14, figure 3–41) to restrictor (13) in pressure regulator pad below primer pump of carburetor.

b. Route hose assembly (28, figure 3–37) to left and down; secure it to coupling half (9, figure 3–36) located just below and between two upper holes in left shroud panel (26, figure 3–37).

3–165. OIL PRESSURE LINE.

a. Secure one end of hose assembly (5, figure 3–37) to restrictor (5, figure 3–17).

b. Route hose assembly to left and down and secure it to coupling half (5, figure 3–36) in second hole from top at forward side of left shroud panel (26, figure 3–37).

3–166. MANIFOLD PRESSURE LINE.

a. Secure one end of hose assembly (6, figure 3–37) to restrictor in manifold pressure port directly above main oil pressure transmitter flange.

b. Route hose assembly to left and down; secure hose assembly to coupling half (8, figure 3–36) in upper rear hole in left shroud panel (26, figure 3–37).

c. Position 5/16-inch clamp (3) around hose assembly (6) at point slightly to right of center of hose. Position one 1/2-inch clamp around fuel pressure hose assembly (14, figure 3–41), hose assembly (3), and hose assembly (16) on carburetor. Secure four clamps to each other with screw, washer, and nut.

3–167. HYDRAULIC PUMP DRAIN LINE.

a. Secure end of hose assembly (7, figure 3–33) to elbow in bottom of hydraulic pump mounting flange. Secure other end of hose assembly to elbow (11) in left hole in left side of lower skirt of left shroud panel of shroud cover assembly.

b. Secure tube assembly (6, figure 3–31) to lower end of elbow (11, figure 3–33) in shroud cover assembly. The lower portion of this tube assembly should be vertical and positioned as near engine mount sway brace as possible.

c. Position 1/4-inch clamp around tube assembly (6, figure 3–31) at point near left sway brace. Secure 7/8-inch clamp to 5/8-inch clamp with screw, washer, and nut.

3–168. HYDRAULIC PUMP INLET LINE.

a. Secure one end of hose assembly (25, figure 3–37) to the reducer (19, figure 3–17) in inlet port of hydraulic pump.

b. Route hose assembly to left and secure it to coupling half (3, figure 3–36) in lower forward hole in left shroud panel (26, figure 3–37).

3–169. HYDRAULIC PUMP OUTLET LINE.

a. Secure one end of hose assembly (27, figure 3–37) to reducer (14, figure 3–17) in outlet port of hydraulic pump.

b. Route hose assembly to left and over inlet hose assembly (25, figure 3–37) and secure it to coupling half (10, figure 3–36) in center rear hole in left shroud panel (26, figure 3–37).

3–170. HYDRAULIC PUMP BYPASS LINE.

a. Secure one end of hose assembly (2, figure 3–37) to elbow (4, figure 3–17) in bypass port at top of hydraulic pump.

b. Route hose assembly to left and down and secure it to coupling half (4, figure 3–36) in third hole from top at forward side of left shroud panel (26, figure 3–37).

3–171. FIRE EXTINGUISHER TUBES AND HOSES. (Refer to table 3–I.)

a. Position support (1, figure 3–53) over two tapped holes just above intake pipe of cylinder No. 2. Secure support to cylinder with bolts and washers.

b. Remove and retain rear nut and washer from rocker box cover at exhaust side of cylinder No. 3. Secure short leg of support (2) to stud on rocker box cover with washer and nut.

c. Secure one end of hose assembly (3) to curved end of weld assembly (4) installed between cylinders No. 1 and 2.

d. Route hose assembly down and to rear. Secure hose assembly (3) to outer ring assembly (5) installed on forward surface of shroud cover assembly.

e. Secure curved end of tube assembly (6) to fitting on weld assembly (4) protruding through intercylinder air deflector between cylinders No. 1 and 2.

f. Secure other end of tube assembly (6) to ring assembly (7) installed on contravane assembly.

g. Secure curved fitting of hose assembly (8) to weld assembly (4) between cylinders No. 1 and 2. Route hose assembly (8) over the support (1) installed on cylinder No. 2.

h. Position clamp (9) on hose assembly (8) just above support (1). Secure clamp to support (1) with screw, washer, and nut.

i. Secure hose assembly (10) to elbow (11) installed in forward surface of shroud cover assembly. Route hose assembly over support (2) installed on cylinder No. 3.

j. Position clamp (12) on hose assembly (10) just above support (2). Secure clamp (12) to support (2) with screw, washer, and nut.

k. Route hose assembly (8) and hose assembly (10) forward and position clamp (13) on hose assembly (10) just forward of cylinder No. 3.

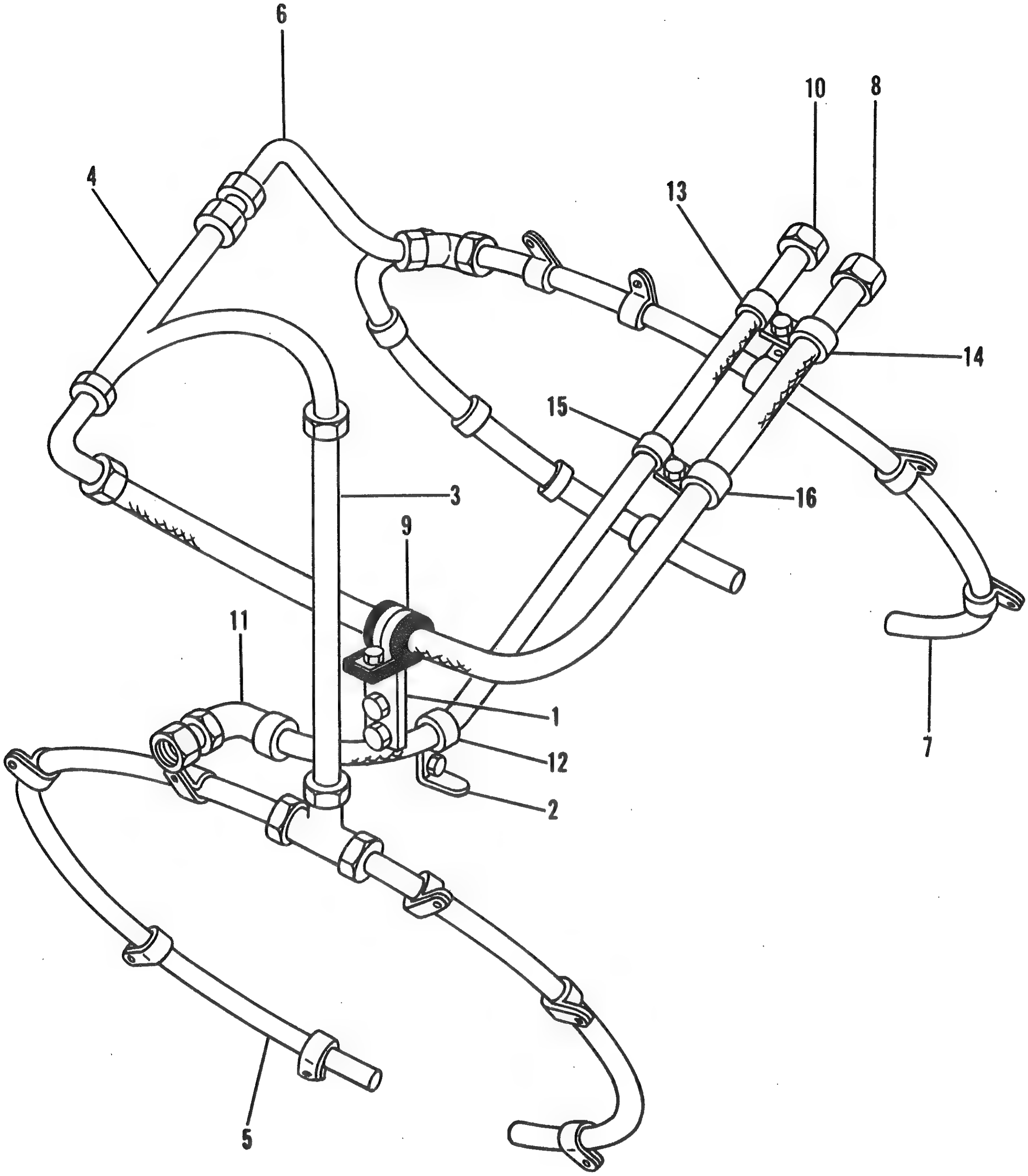
l. Position clamp (14) on hose assembly (8) parallel to clamp (13). Secure clamps together with screw, washer, and nut.

m. Position clamp (15) on hose assembly (10) approximately 14 inches forward of clamps installed in steps *k* and *l*.

n. Position clamp (16) parallel to clamp (15). Secure clamps together with screw, washer, and nut.

3–172. FUEL AND OIL LINES SUPPORT ASSEMBLY.

a. Position support assembly (18, figure 3–45) over two tapped holes (3, figure 3–52) in intake rocker box of cylinder No. 8.



1. Support
2. Support
3. Hose Assembly
4. Weld Assembly
5. Ring Assembly
6. Tube Assembly
7. Ring Assembly
8. Hose Assembly
9. Clamp
10. Hose Assembly
11. Elbow
12. Clamp
13. Clamp
14. Clamp
15. Clamp
16. Clamp

Figure 3–53. Engine Fire Extinguisher Tubes and Hoses *b.* Secure support assembly to rocker box with bolts and washers. Secure with lock wire.

3–173. ELECTRICAL WIRING.

3–174. DESCRIPTION. (See figure 3–54.) The electrical wiring consists of an ignition conduit assembly and a tied wiring harness.

3–175. IGNITION CONDUIT ASSEMBLY.

3–176. INSTALLATION.

a. Insert end of conduit assembly (1, figure 3–54), to which plug (15) is secured through upper hole in lower right skirt of accessory compartment shroud cover assembly.

b. Route conduit assembly (17, figure 3–37) to the left and up between fuel pump inlet hose assembly (18) and magneto (14). Remove protective tape from ignition switch and booster connection (1, figure 3–39) on magneto. Apply antiseize compound, Military Standard MS35496, to threads of connection. Secure plug (1, figure 3–55) to connection and secure with lock wire.

c. Align four No. 40 (0.098-inch diameter) pilot holes in support (6, figure 3–34) and shroud cover assembly skirt. Drill through each hole with a No. 15 (0.180-inch diameter) drill. Position grommet (7) and support (6) on conduit assembly (5). Secure support (6) to inner surface of cover assembly skirt with screws, washers, and nuts.

Note

For installation of clamps on conduit assembly, refer to paragraph 3–187.

3–177. WIRING HARNESS.

3–178. INSTALLATION.

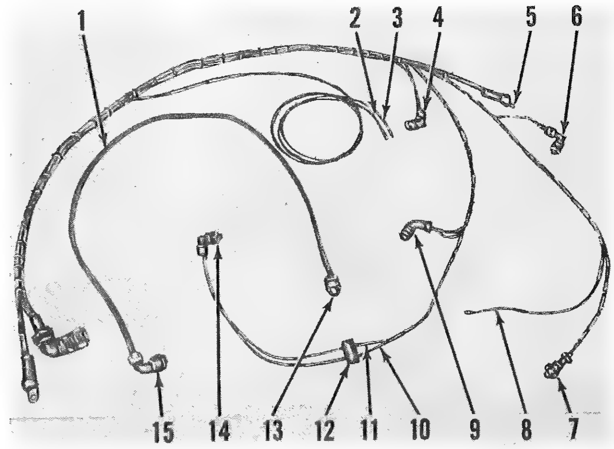
a. Insert terminal (5, figure 3–54) on inboard end of starter cable (6, figure 3–18) and plugs (6, 7, and 9, figure 3–54) and wires (8, 10, and 11) through the lower hole in lower right skirt of accessory compartment shroud cover assembly.

b. Pull wiring harness through hole to point where wires (2, and 3) branch off from the tied wiring harness.

3–179. STARTER (WITHOUT TERMINAL CAP)

a. Remove cotter pin, castellated nut, lockwasher, and washer from terminal post (11, figure 3–17) of starter (12).

b. Slide nipple (16, figure 3–37) over terminal (5, figure 3–54) on inboard end of starter cable



1. Conduit Assembly
2. Wire
3. Wire
4. Plug
5. Terminal
6. Plug
7. Plug
8. Wire
9. Plug
10. Wire
11. Wire
12. Terminal Block
13. Plug
14. Plug
15. Plug

Figure 3–54. Ignition Conduit Assembly and Tied Wiring Harness

(6, figure 3–18). Position terminal on starter terminal post and secure it with washer, lockwasher, and castellated nut. Secure nut with cotter pin.

3–180. STARTER (WITH TERMINAL CAP).

a. Remove large knurled nut (5, figure 3–18), washer (8), and split bushing (9) from starter terminal guard (7). Remove two fillister-head screws (1) and remove guard cover (2).

b. Remove any corrosion preventive mixture from interior of cap with a soft lint-free cloth.

c. Remove cotter pin, castellated nut, and lockwasher from terminal post and starter.

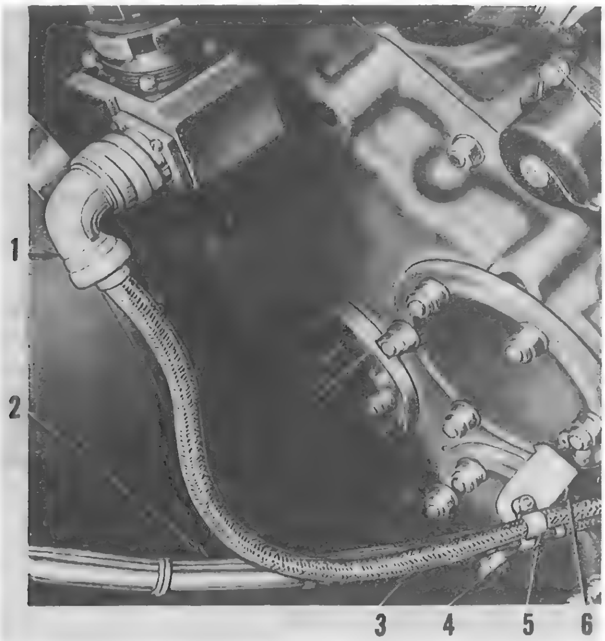
d. Slide knurled nut (5) and washer (8) over starter cable (6) on inboard end. Position starter cable on starter terminal post (4) and secure with nut and washer (3). Secure nut with cotter pin.

e. Position split bushing (9) around starter cable (6) within end of starter terminal cap. Replace washer (8) and knurled nut (5).

f. Replace guard cover (7) and secure with fillister-head screws (1). Secure with lock wire.

3–181. OIL INLET TEMPERATURE BULB.

a. Remove protective covering from oil inlet temperature bulb in bottom of oil pump housing.



1. Plug
2. Wiring Harness
3. Ignition Conduit Assembly
4. Clamp
5. Clamp
6. Bracket

Figure 3–55. Ignition Conduit

b. Wires E119K18N and E121D18 terminate at plug (7, figure 3–54). Attach this plug to oil inlet temperature bulb and secure with lock wire.

3–182. TACHOMETER-GENERATOR.

a. Wires E124A18, E126A18, and E127A18N terminate at plug (6, figure 3–54). Attach plug to receptacle on tachometer-generator and secure with lock wire.

b. Remove nut from lower left stud on which tachometer-generator (22, figure 3–37) is mounted. Place terminal on end of wire E127A18N on stud and secure with washer and nut. Tighten nut to a torque of 50 to 70 inch-pounds.

3–183. SYNCHRONIZING-BREAKER.

a. Remove protective cap from synchronizing-breaker (21, figure 3–37).

b. Wire M763A18 terminates at plug (4, figure 3–54). Attach plug (4) to synchronizing-breaker and secure with lock wire.

3–184. ENGINE PRIMER SOLENOID VALVE.

a. Remove cap (15, figure 3–41) from solenoid valve receptacle on carburetor.

b. Wire Q82D18 terminates at plug (9, figure 3–54). Attach this plug to solenoid valve receptacle and secure with lock wire.

3–185. CARBURETOR AIR TEMPERATURE BULB. (See figure 3–9.)

a. Remove protective cover from carburetor air temperature bulb (17).

b. Wires E118E18 and E119J18N terminate at plug (14, figure 3–54). Secure plug to carburetor air temperature bulb (17, figure 3–9) and secure with lock wire.

3–186. CYLINDER TEMPERATURE BULB. (Refer to paragraph 3–55.)

a. Route wires (2 and 3, figure 3–54) to left against outer surface of lower skirt of accessory compartment shroud cover. Connect these wires to wires on cylinder temperature bulb in cylinder No. 7.

b. Tape each connection separately with friction tape. Federal Specification HH-T-101. Place taped connections together and bind with several layers to tape. Apply coat of shellac, Federal Specification TT-S-271, over taped area.

3–187. CLAMPING.

a. Remove nut and washer from upper left stud to which hose assembly (24, figure 3–37) is secured. Position bracket (23) on stud and secure with washer and nut.

Note

The flange of bracket (23) should be positioned to the left.

b. Position 1/8-inch clamp around wires leading to oil inlet temperature bulb. Secure clamp to bracket (23) with screw, washer, and nut.

c. Position 1/4-inch clamp around wires leading to oil inlet temperature bulb. Secure clamp to bracket (23) with screw, washer, and nut.

d. Remove lock wire, screw, and washer, located in 6-o'clock position, from starter. Position bracket (20) on starter and secure with screw and washer. Secure with lock wire.

e. Position 5/16-inch clamp around wires leading to oil inlet temperature bulb and tachometer-generator. Secure clamp to bracket (20) with screw, washer, and nut.

f. Remove nut and washer from stud located just forward of starter terminal post at joint between two halves of starter housing. Position bracket (15) on stud and secure with washer and nut.

g. Position 3/16-inch clamp around wires leading to engine primer solenoid valve and carburetor air inlet temperature bulb. Secure clamp to bracket (15) with screw, washer, and nut.

h. Remove screw and washer, located in 3-o'clock position of starter end housing. Position bracket on starter and replace screw and washer.

i. Position 3/8-inch clamp around starter cable and wires leading to engine primer solenoid valve and carburetor air inlet temperature bulb. Secure clamp to bracket installed in step *h* with screw, washer, and nut.

j. Remove washer and nut from lower stud of accessory drive pad located just below magneto. Position bracket (6, figure 3–55) on stud, as shown, and secure with washer and nut.

k. Position clamp (5) around ignition conduit assembly (3). Position 1/2-inch clamp (4) around wiring harness (2). Secure both clamps to bracket (6) with screw, washer, and nut.

Note

Do not leave unnecessary slack in either the ignition conduit assembly or the wiring harness when installing clamps.

l. There are three 0.193-inch diameter holes in lower skirt of accessory compartment shroud cover assembly. One hole is located 14-1/2 inches to right of the vertical center line of engine; second hole is located on vertical center line of engine; and third hole is located 11-inches to left of vertical center line of engine. Position 5/16-inch clamp around wires to cylinder temperature bulb at latter hole. Position 3/16-inch clamp around wires at each hole. Secure each clamp to cover assembly skirt with screw, washer, and nut.

m. Align four No. 40 (0.098-inch diameter) pilot holes in support (3, figure 3–34) and cover assembly skirt. Drill through each hole with a No. 15 (0.180-inch diameter) drill. Position grommet (4) and support (3) on wiring harness (2). Secure support (3) to inner surface of cover assembly skirt with screws, washers, and nuts.

Note

Leave no unnecessary slack in wiring harness when installing support.

n. Position 3/8-inch clamp around ignition conduit assembly at point approximately 5-inches from plug (13, figure 3–54) on outboard end of conduit assembly. Position 3/16-inch clamp around wiring harness. Secure clamps to each other with screw, washer, and nut.

Note

The conduit assembly and wiring harness should be parallel.

o. Install another pair of clamps as outlined in step *n* at a point 5-inches inboard of clamps installed in step *n.*

p. Route outboard end of both conduit assembly and wiring harness through right engine support arm between upper tube and center tube of support arm. Position 1-1/4 inch clamp around upper tube and 3/8-inch clamp around conduit assembly. Secure clamps to each other with screw, washer, and nut.

3–188. HYDROMECHANICAL CLUTCH AND FAN ASSEMBLY.

3–189. DEPRESERVATION.

a. Remove hydromechanical clutch and fan assembly from shipping container. Remove all protective paper and covers from parts.

b. Peel protective wax carefully from cones (3 and 5, figure 3–56), engine shaft nut (4), and lockpin assembly (2).

CAUTION

Care must be taken not to scratch or mark cones in any way when removing protective wax.

Note

The two piece upper split cone (3) is a matched set. The mating halves, which are identified by identical serial numbers, must be kept together and not mixed with halves from other cones.

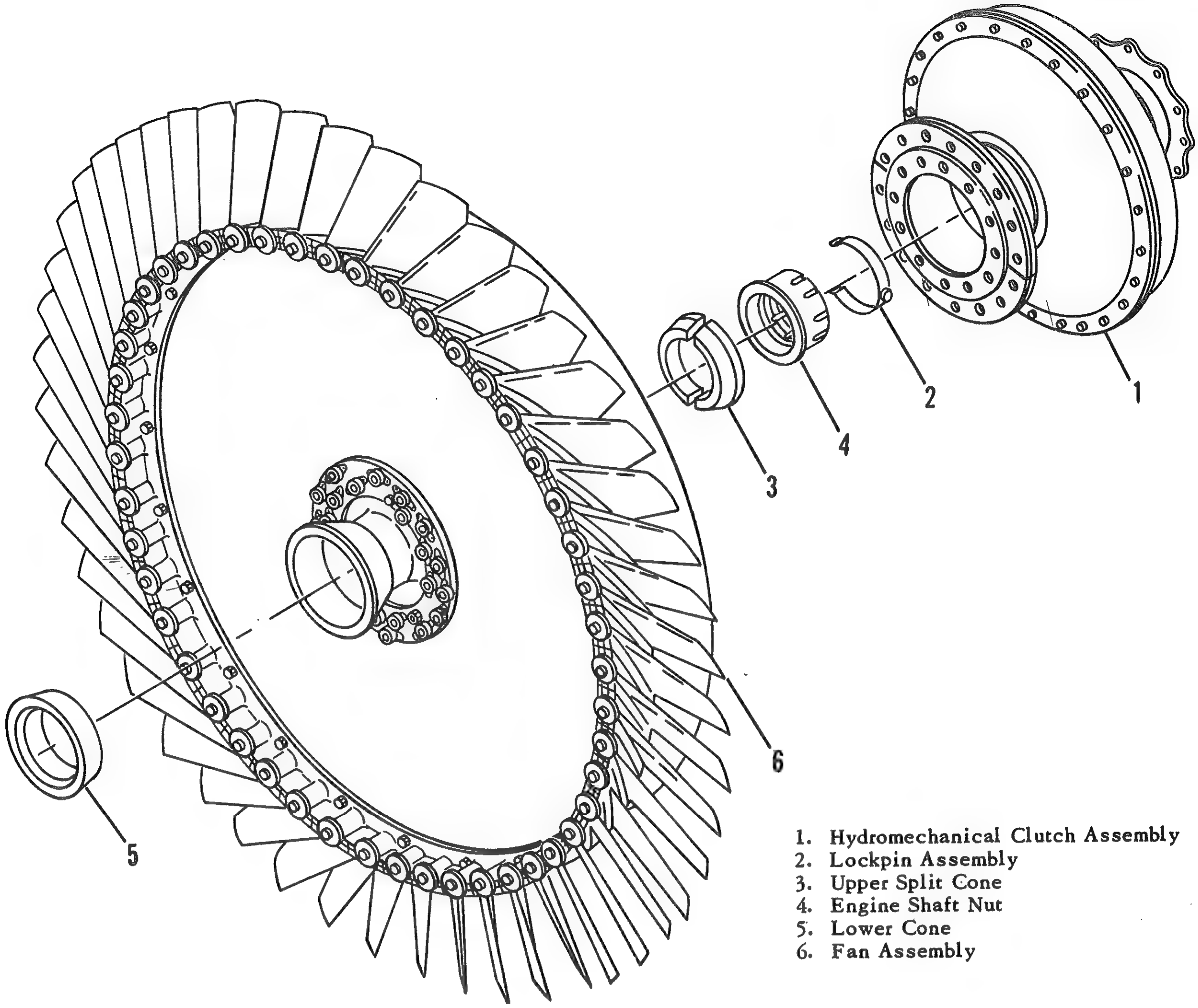
c. Remove corrosion preventive petrolatum from all external machined surfaces with dry cleaning solvent, Federal Specification P-S-661.

d. Index two piece clamping ring to fan disc with chalk.

Note

The clamping ring is located under the 23 nuts near center of fan assembly.

e. Remove 23 nuts at center of fan assembly (6), and remove two piece clamping ring and shim. Lift hydromechanical clutch assembly (1) from fan assembly. Replace shim and two piece clamping ring on fan disc. Install nuts on alternate outer bolts to secure clamping ring and fan disc to hub.



1. Hydromechanical Clutch Assembly
2. Lockpin Assembly
3. Upper Split Cone
4. Engine Shaft Nut
5. Lower Cone
6. Fan Assembly

Figure 3–56. Hydromechanical Clutch and Fan Assembly

f. Remove lock wire and remove two plugs below splined flange of hydromechanical clutch assembly (1). Drain corrosion preventive compound from drive housing of hydromechanical clutch.

g. Thoroughly rinse inside of hydromechanical clutch assembly with gear lubricant, Military Specification MIL-L-2105. After rinsing with gear lubricant, drain hydromechanical clutch.

3–190. INSTALLATION.

a. Remove thread protector (3, figure 3–23).

b. Remove corrosion preventive compound from propeller drive shaft of engine. Clean shaft thoroughly with dry-cleaning solvent, Federal Specification P-S-661.

c. Apply antiseize compound, Military Standard MS35496, to splines and threads of propeller drive shaft.

d. Install lower cone (5, figure 3–56) on propeller drive shaft with broad edge of cone bottomed on propeller drive shaft thread bearing nut.

e. Position fan assembly (6) on propeller drive shaft. Align splines and seat fan assembly on lower cone.

f. Install engine shaft nut (4) on propeller drive shaft and turn it part way down. Position each half of upper split cone (3) on flange of engine shaft nut. Hold upper split cone in position and turn engine shaft nut until upper split cone seats against inner surface of fan assembly hub.

g. Install special tools on engine shaft nut (4). (Refer to paragraph 3–18, step *c* and figure 3–8.)

h. Operate ram and gage assembly of special tool (figure 3–8) to tighten engine shaft nut (4) to a torque of 800 to 1000 foot-pounds.

i. Remove special tools. Strike flange of fan assembly hub with rawhide mallet. Replace special tools and recheck torque of engine shaft nut (4, figure 3–56). Repeat this procedure until there is no decrease in torque after striking hub.

j. Remove special tools.

k. Insert stud of lockpin assembly (2) in hole in propeller drive shaft aligned with one of wrench slots in engine shaft nut (4). Compress ends of lockpin spring, position ends inside shaft, and release spring. Bent ends of spring will fall into two other holes in propeller drive shaft.

l. Remove nuts that secure two-piece clamping ring and fan disc to hub. Remove clamping ring and shim.

m. Clean mating surface of flange coupling on bottom of hydromechanical clutch (1), hub of fan assembly (6), fan disc, and two-piece clamping ring.

n. Position hydromechanical clutch (1) on fan assembly (6). Install two-piece clamping ring on upper surface of flange coupling. Install nut on each of nine inner bolts to secure clamping ring. Tighten nuts to a torque of 360 to 385 inch-pounds.

o. Measure gap between clamping ring and fan disc at point directly outboard of center nut of each three-nut group. Peel laminations from two-piece shims until thickness of shims are within ±0.003-inch of measured gap. Apply light coat of primer, Military Specification MIL-P-8585, to both surfaces of shim. Remove clamping ring; install shims on fan disc, and replace clamping ring and nut.

CAUTION

Be sure to peel same number of laminations from each half of shim.

Note

A new shim is 0.062-inch thick. Each lamination is 0.003-inch thick.

p. Install nut on each of 14 outer bolts. Tighten nuts to a torque of 360 to 385 inch-pounds.

q. Install gasket and nut (23, figure 3–6), elbow (22), and bolt, washer, gasket, and fitting (24) in position on hydromechanical clutch assembly (9).

r. Install plug in one of two holes located just below the splined flange at the top of hydromechanical clutch assembly. Position the outer hole at 2-o'clock position. Fill drive housing on hydromechanical clutch assembly to level of this hole with gear lubricant, Military Specification MIL-L-2105. Install second plug and secure both plugs with lock wire.

3–191. OPERATIONAL TOLERANCES.

Note

Information contained in this paragraph are requirements in excess of requirements covered in applicable manual listed in Appendix I.

a. Check track and concentricity of fan blades.

Note

Components needed for this operation are furnished in fan track and concentricity check kit, Marvel Manufacturing Co. part No. 7HEL055. The following steps contain instructions for assembly of check kit components.

(1) Position base to a surface plate or other firmly supported surface.

(2) Install end of arbor in pilot hole of base. Check to insure firm bottoming and free rotation of arbor.

(3) Position one of two cones on the arbor with hub of cone approximately 1/4-inch above top of base surface. Lock cone in this position with cone setscrew.

(4) Position fan assembly on arbor and make sure fan assembly hub is squarely seated on cone.

(5) Install the other cone over the arbor with hub of cone facing upward. Seat cone firmly in seat of fan assembly hub. Lock cone in this position with cone setscrew.

(6) Position kit dial indicator pointer 1/2-inch in from the end of fan blade tip to check blade track.

(7) Rotate fan and arbor and check that total indicator reading does not exceed 0.100-inch.

(8) Position dial indicator at end position of blade tip to check blade concentricity.

(9) Rotate fan and arbor and check that total indicator reading does not exceed 0.020-inch.

(10) If indicator readings exceed maximum allowable tolerances given in steps 7 and 9, replace fan blade. (Refer to applicable manual listed in Appendix I.)

b. Establish clearance between fan blades and fan shroud assembly.

Note

The 24 holes in fan shroud assembly (3, figure 3–51) and outer cowl ring assembly (4) of contravane assembly are larger than bolts (1) that secure the two assemblies. This permits adjusting position of fan shroud assembly in relation to fan blades.

(1) Loosen nut on each of 24 bolts (1) securing fan shroud assembly (3) to outer cowl ring assembly (4) of contravane assembly.

(2) Use feeler gages to establish clearance of 0.052 to 0.103-inch between tip of each fan blade (2) and inner surface of fan shroud assembly (3).

Note

For field maintenance, minimum allowable clearance may be reduced to 0.040 inch, as long as no chafing exists between fan and fan shroud assembly.

(3) When clearance has been established at each fan blade, tighten each of 24 bolts (1) to a torque of 18 to 23 inch-pounds.

CAUTION

To prevent movement of and resultant damage to fan shroud assembly, each nut must be tightened to proper torque.

(4) Check balance at each fan blade. Readjust if necessary.

Note

On reinforced plastic contravanes, perform following steps *c* and *d*.

c. Using a No. 11 (0.1910-inch diameter) drill, drill 24 holes, equally spaced between holes securing fan shroud assembly to outer cowl ring assembly.

d. Insert bolts, with two washers under head of each bolt, through drilled holes. Secure with washers and nuts. Tighten all nuts to a torque of 18 to 23 inch-pounds.

3–192. INSTALLATION OF POWER PLANT.

3–193. INSTALLATION.

CAUTION

Check identifying features of each new power plant before installation to insure it is designed for the helicopter into which it is to be installed. (Refer to table 3–I.)

Note

Refer to paragraph 3–7 for directional references.

a. Install contravane and fan shroud assembly. (Refer to paragraph 3–143.)

b. Install hydromechanical clutch and fan assembly. (Refer to paragraph 3–190.)

Note

If replacement unit for power plant, step *b*, is being installed, follow instructions as outlined in paragraph 3–190, step *q*.

c. Install hoist sling assembly (figure 3–7) on engine. (Refer to paragraph 3–13.) Attach sling to hoist of at least 2-ton capacity.

d. Remove power package from engine building stand and position it at front of helicopter.

e. Align lower attachment hole in each engine mount support arm with corresponding hole in bracket on fuselage bottom structure. Install eyebolts, washers, and nuts (33, figure 3–4).

Note

Install each eyebolt from inboard side of bracket.

f. Support weight of power package with hoist. Check to see that nut on each lower attachment eyebolt is loose. Position lower engine cowl panel on engine. Raise power package to installed position, using lower attachment eyebolts (33) as hinge points.

g. Align upper attachment holes in each engine mount support arm with corresponding hole in bracket on fuselage bottom structure. Install upper attachment bolts, washers, and nuts (34).

Note

Install bolt with head of bolt outboard.

Note

To assist in aligning upper attachment holes, disconnect cable fitting from cylinders No. 4 and 7. The holes may then be aligned by raising upper cable assembly.

h. Tighten nut on each upper attachment bolt (34) to torque of 400 to 460 inch-pounds. Install cotter pin.

i. Position outboard end of each sway brace over corresponding lower attachment eyebolt (33). Secure each sway brace to eyebolt with bolt, washer, and nut (38). Tighten nuts to a torque of 50 to 55 inch-pounds. Tighten nut (37) at inboard end of each sway brace to a torque of 50 to 55 inch-pounds.

j. Tighten nut (33) to a torque of 400 to 460 inch-pounds.

Note

On helicopters serial No. prior to 55-4501, tighten nuts in step *i* to a torque of 35 to 45 inch-pounds. Tighten nuts in step *j* to a torque of 115 to 125 inch-pounds.

k. Remove hoist sling assembly from engine.

l. Position coupling (12, figure 3–6) on splined flange of hydromechanical clutch assembly (9) and secure with bolts, washers, and nuts (10). Tighten nuts to a torque of 275 to 325 inch-pounds; connect clutch restraining cable to clip (21); connect clutch oil inlet line to elbow (22); and connect clutch outlet line to fitting (24).

m. Install clamp (17, figure 3–4) securing intake pipe drain line of cylinders No. 4, 5, and 6 to oil cell interconnecting tube.

n. Install clamps (15) securing engine oil inlet, fuel pump drain, hydraulic pump drain, and supercharger drain lines to left engine mount sway brace.

CAUTION

Make certain that clamps do not compress the lines.

o. Install new gasket (13) and secure flange (12) to inlet port with washers and nuts (11).

p. Install new gasket (10) on flange (8) of ' ousing at drain valve just forward of oil cooler. Secure fla ge (8) to fitting with b lts, washers, and nuts (9).

CAUTION

To eliminate possible chafing, make certain oil inlet hose is outboard of drain line.

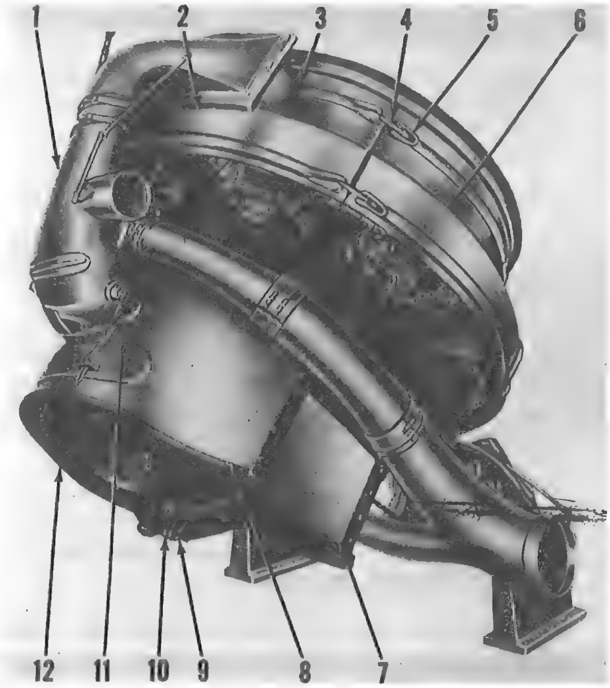
q. Connect hose (7) to elbow in intercylinder air deflector between cylinders No. 8 and 9.

r. Connect eight hoses (5) at outboard side of left accessory compartment shroud panel.

s. Secure fuel and oil hose support assembly around manifold pressure, oil pressure, fuel pressure, and vapor return hoses at intake rocker box at cylinder by means of wing nut (6).

WARNING

Check to insure all electrical control switches are in the OFF position before step *t* is accomplished.



1. Air Intake Duct
2. Upper Cowl Assembly
3. Filter Support
4. Hook
5. Handle
6. Intermediate Cowl Assembly
7. Shroud Panel Assembly
8. Upper Shroud Panel Assembly
9. Clamp
10. Clamp
11. Well
12. Shroud Panel Assembly

Figure 3–57. Engine Cowling and Shroud Panels

t. Connect ignition conduit (2), starter cable (3), and main electrical plug (4) at left forward bulkhead in engine compartment. Secure ignition conduit and main electrical plug with lock wire.

u. On helicopters serial No. 56-4315, 56-4316, 56-4320, 57-1684, and 57-1697, connect fire extinguisher hose to weld assembly at canted bulkhead.

v. Close valve (1). Fill oil cells.

CAUTION

Do not overfill. Overfilling reduces necessary foaming space.

w. On helicopters serial No. 56-4315, 56-4316, 56-4320, 57-1684, and 57-1697, connect fire extinguisher tube to weld assembly at canted bulkhead.

x. On helicopters serial No. prior to 55-4462, position control rods (3 and 4, figure 3–13) to control supports and secure with bolts, washers and nuts (1 and 2).

y. Position control rods (19 and 21, figure 3–4) to control bracket at canted bulkhead with bolts, washers, and nuts (18 and 20).

z. Position control rod (23) to control bracket at canted bulkhead and secure with bolt, washers, and nut (22).

aa. Position spacer halves (13, figure 3–6) with flange (14), spacer halves (15), and bonding jumper (11) to coupling (12) and secure with bolts, washers, and nuts (17).

ab. Align flange (14) with end of main drive shaft (18) and secure with bolts, washers, and nuts (19).

ac. Place fuel selector valve control handle (figure 3–3) in ON position. Check all fuel system lines and fittings for leakage with the booster pump switch in ON position.

ad. Install engine cowling. (Refer to paragraph 3–195.)

3–194. ENGINE COWLING.

3–195. INSTALLATION. (See figure 3–57.)

a. Position upper cowl assembly (2, figure 3–57) over the upper cylinders of engine as shown. Align red stripe on upper cowl assembly with red stripe on bend of contravane assembly.

Note

Each cowl assembly has a bend at forward edge which must mate with bead on contravane assembly. The rear edge of each cowl assembly must fit against cowl seal channel assembly located on each cylinder between intake and exhaust rocker boxes.

b. Position intermediate cowl assembly (6) over cylinders at each side of engine. Secure each intermediate cowl assembly to upper cowl assembly (2) by positioning each of the two hooks (4) on end of one cowl assembly over corresponding pin on adjacent cowl assembly. Press handle (5), to which each hook is attached, down flat against the panel to hook cowl assemblies together.

c. Position lower cowl assemblies and secure to intermediate cowl assembly (6) with hooks as outlined in step *b*.

3–196. FILTER AND COLD AIR ELBOW.

3–197. INSTALLATION. (See figure 3–45.)

a. Position filter assembly inside filter support of upper cowl assembly (11).

b. Position elbow assembly (7) and secure with Dzus fasteners.

c. Fold loose end of rubber boot (6) forward over end of elbow assembly. Secure boot to elbow assembly with marman clamp (8).

3–198. ACCESSORY COMPARTMENT COVER ASSEMBLIES.

3–199. INSTALLATION. (See figure 3–57.)

a. Position upper shroud panel assembly (8) on shroud cover assembly with forward edge of panel under well (11) and secure to each other with camlock fasteners.

b. Position shroud panel assembly (12) against left side of shroud cover assembly and secure with screws.

c. Position shroud panel assembly (7) against right side of shroud cover assembly and secure with screws.

3–200. PROTECTIVE FINISHES AND CORROSION CONTROL. If, during installation, the protective finish on any area has been marred or damaged, renew protective finish by applying a coat of zinc-chromate primer, Military Specification MIL-P-8585.

3–201. ENGINE CONTROL SYSTEM.

3–202. DESCRIPTION. The engine control system is an arrangement of such items as control rods, bell cranks, pulleys, pulley bracket, cables, and levers into a compatible relationship in order that certain engine units may be operated from the pilots' compartment by the pilot. The complete engine control system provides separate controls for throttle, fuel-air mixture, and carburetor air temperature. Figures 3–58 and 3–59 present typical installations of the control system. When figures 3–58 and 3–59 are used in conjunction with specific parts of the text, instructions are provided for maintenance personnel to perform any work required on the system.

3–203. COMMON ITEMS. The common items used in the engine control system are items which are normally found in all types of aircraft and are simple to the point that maintenance instructions will be presented in a manner considered typical. Control rods (sometimes referred to as push-pull rods), bell cranks, control cables, and pulleys are the items considered common.

3–204. CONTROL RODS.

3–205. DESCRIPTION. Control rods are a link in the system which transmit push-pull straight line motion from one point to another. The rod-end

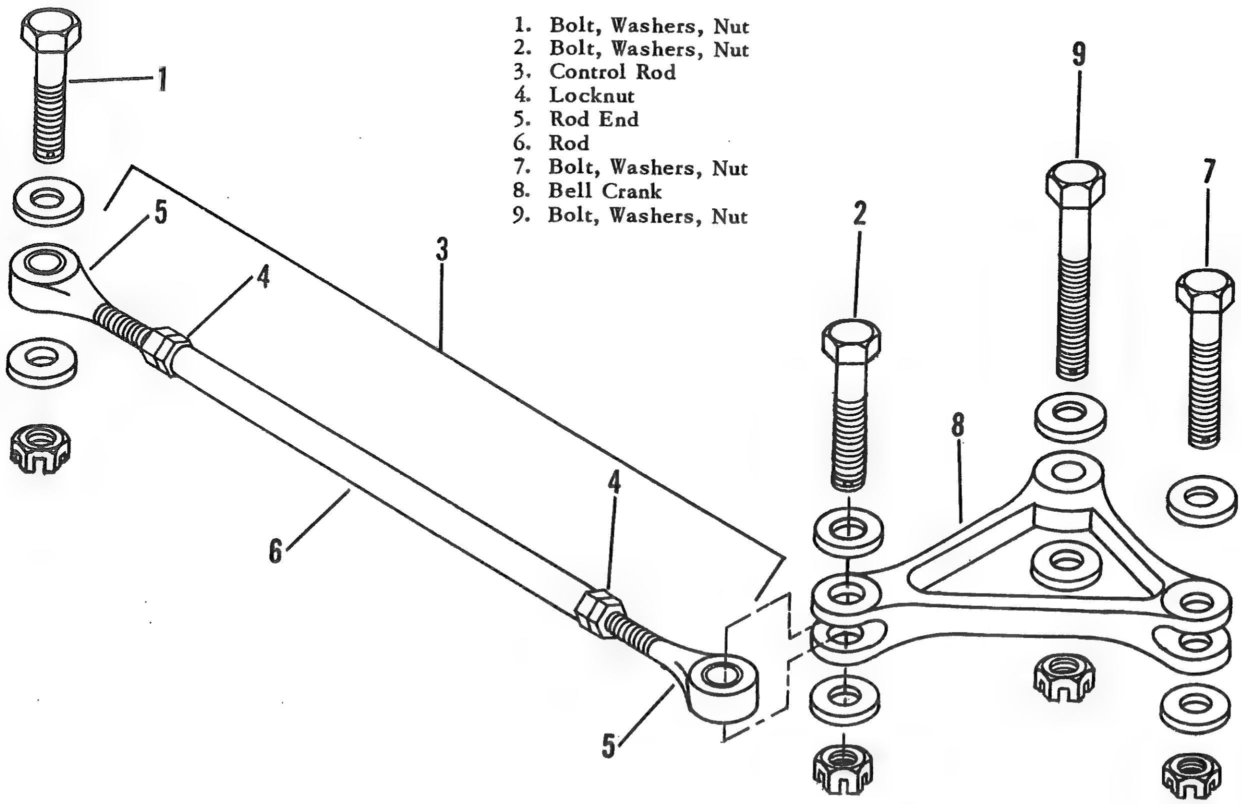


Figure 3–58. Control Rod and Bell Crank

bearings are adaptable to various angular requirements as well as having an adjustable dimension between rod-end axes. Some control rods incorporate non-rigid rod-end bearings which permit angular deflection required in their normal operation.

3–206. REMOVAL. (See figure 3–58.) Remove bolts, washers, and nuts (1 and 2) and remove control rod (3) from system.

3–207. DISASSEMBLY. Loosen locknuts (4, figure 3–58) and unscrew rod ends (5) from rod (6).

3–208. CLEANING. Clean all parts in dry-cleaning solvent, Federal Specification P-S-661, and allow to drip dry or dry with dehumidified air stream.

3–209. INSPECTION.

a. Inspect all parts for distortion caused by excessively applied forces.

b. Inspect rod (6, figure 3–58) for nicks, scratches, and dents.

c. Inspect bearings in rod ends for binding or rough spots when rotated.

3–210. REPAIR AND REPLACEMENT.

a. Replace all distorted parts.

b. Replace rods (6, figure 3–58) which have nicks, scratches, and/or dents that would damage or distort internal threads or cause loss of structural strength.

c. Replace bearings in rod ends (5) which have rough spots or show signs of overheating when rotated.

3–211. REASSEMBLY AND INSTALLATION.

a. Install locknuts (4, figure 3–58) on threaded portion of rod ends (5).

b. Screw rod ends (5) into rod (6).

c. Position control rod (3) at proper location in control system and install bolts, washers, and nuts (1 and 2).

Note

Angular positioning of rod-end bearings will be done at time of installation. Adjustment of control rod length will be done during rigging of control system.

3–212. BELL CRANKS.

3–213. DESCRIPTION. Bell cranks are units of the control system which receive and transmit push-pull mechanical motion and at the same time change the direction of the motion. Bell cranks normally consist of a single casting with three holes. One hole is the pivot point and the remaining two holes provide attachment facilities for other units of the control system. Motion ratios and leverage values may be achieved by varying the dimensions between the pivot hole and the attachment holes.

3–214. REMOVAL.

a. Remove bolts, washers, and nuts (2 and 7, figure 3–58) and remove connecting links from bell crank (8).

b. Remove bolt, washers, and nut (9) that secure bell crank (8) to helicopter structure and also serves as axle for bell crank rotation.

c. Remove bell crank (8).

3–215. DISASSEMBLY. Remove bearing from pivot hole if bell crank (8, figure 3–58) incorporates bearing.

3–216. CLEANING. Clean parts with dry-cleaning solvent, Federal Specification P-S-661.

3–217. INSPECTION.

a. Check bell crank (8, figure 3–58) for indication of distortion or impending failure.

b. Examine bearing for indication of binding or excessive play.

3–218. REPAIR AND REPLACEMENT. Replace any items found defective by inspection.

3–219. REASSEMBLY. Use arbor press or hydraulic press to install bearing if bell crank (8, figure 3–58) incorporates bearing in pivot hole.

3–220. INSTALLATION.

a. Position bell crank (8, figure 3–58) at its proper location in the control system and install bolt, washers, and nut (9).

b. Position control rod (3) to bell crank (8) and install bolts, washers, and nuts (2 and 7).

3–221. CONTROL CABLE PULLEYS.

3–222. DESCRIPTION. (See figure 3–59.) Control cable pulleys are used in the engine control system as a means of changing travel direction of control cables. Pulleys are manufactured from phenolic material and have a permanently lubricated bearing concentrically installed. Special brackets are normally fabricated to insure that pulleys are positioned in the locations and attitudes dictated by the system.

3–223. REMOVAL.

a. Relieve tension of cable (1, figure 3–59) used with pulley (2) at turnbuckle (3).

b. Remove bolt, washer, spacer, and nut (4).

c. Remove pulley (2) from bracket (5).

3–224. CLEANING. Clean pulley (2, figure 3–59) with dry-cleaning solvent, Federal Specification P-S-661.

CAUTION

Do not allow pulley to soak in dry-cleaning solvent, Federal Specification P-S-661, as permanent lubrication may be impaired.

3–225. INSPECTION.

a. Inspect phenolic material for excessive wear or damage.

b. Test bearing for binding or abnormal looseness.

3–226. REPAIR AND REPLACEMENT. Replace pulley if inspection reveals unserviceable condition.

3–227. INSTALLATION.

a. Position pulley (2, figure 3–59) in bracket (5) so that all holes are correctly aligned.

b. Install bolt, washers, spacer, and nut (4).

c. Adjust turnbuckle (3) to obtain cable tension specified in cable rigging procedure outlined in paragraph 3–285.

3–228. CONTROL CABLES.

3–229. DESCRIPTION. Control cables are the mechanical means employed to transmit physical movement from one point to another. Normally control cables are installed in a complete circuit manner in order that reciprocal action is possible. Control cables are manufactured from preformed high-carbon steel wire and are capable of operating under tremendous loads without hazard of failure.

3–230. REMOVAL.

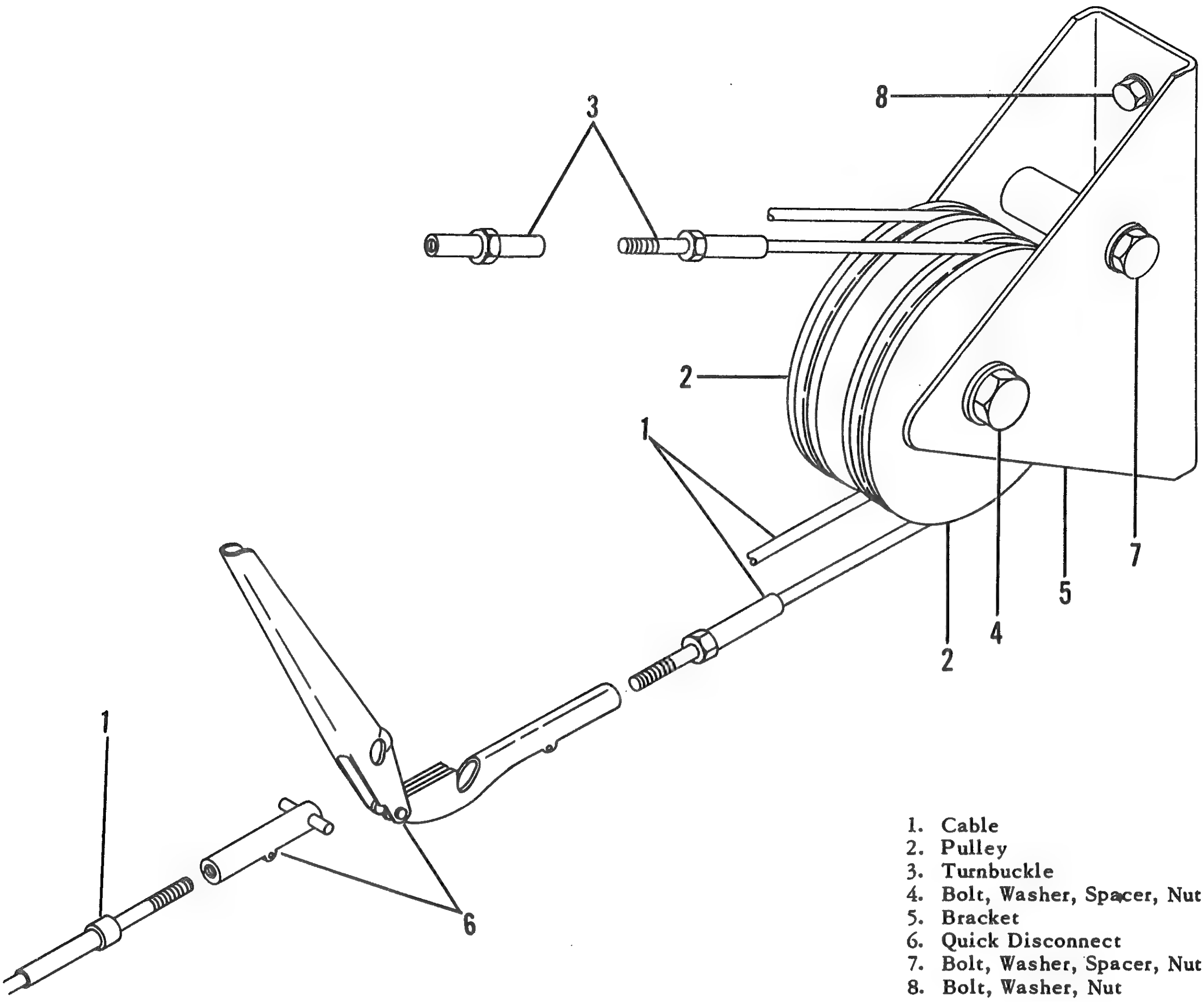
a. Relieve cable tension by loosening turnbuckle (3, figure 3–59).

Note

It may be necessary to loosen more than one turnbuckle in the system to relieve the cable tension.

WARNING

Cable connections should never be completely separated as long as any cable tension remains. Whip-lash resulting from freeing a taut cable has the power to inflict severe damage or injury.



1. Cable
2. Pulley
3. Turnbuckle
4. Bolt, Washer, Spacer, Nut
5. Bracket
6. Quick Disconnect
7. Bolt, Washer, Spacer, Nut
8. Bolt, Washer, Nut

Figure 3–59. Control Cables and Pulley Bracket

b. Disconnect cable at turnbuckle (3) and/or at quick disconnect (6).

c. Tie a string to end of cable (1) so string will be in cable position when cable is pulled from system.

d. Remove necessary pulleys as outlined in paragraph 3–223.

e. Pull cable (1) from system and untie string.

3–231. CLEANING. Clean cable with cloth dampened with dry-cleaning solvent, Federal Specification P-S-661.

CAUTION

Do not immerse cable in dry-cleaning solvent, Federal Specification P-S-661, as some cables incorporate a center wick which contains cable lubricant.

3–232. INSPECTION. Refer to applicable manual listed in Appendix I.

3–233. REPAIR AND REPLACEMENT. Replace all unserviceable control cables.

3–234. INSTALLATION.

a. Arrange serviceable cable (1, figure 3–59) in helicopter so cable is free to be pulled into system where replacement is required.

b. Tie string to end of cable (1).

c. Pull cable (1) into system and remove string.

d. Install pulleys (2) in bracket (5). (Refer to paragraph 3–227.)

e. Fasten turnbuckle (3) and/or quick-disconnect (6) and adjust for cable tension as outlined in paragraph 3–285.

3–235. CONTROL BRACKETS.

3–236. DESCRIPTION. Control brackets are items which facilitate the proper locating, positioning, and routing of control cable pulleys. Control brackets are either machined casting or heat-treated sheet aluminum. Bolts with spacers are incorporated in control brackets as a means of keeping cables in grooves of pulleys.

3–237. REMOVAL.

a. Remove pulleys as outlined in paragraph 3–223.

b. Remove control cables as outlined in paragraph 3–230.

c. Remove bolt, washer, spacer, and nut (7, figure 3–59).

d. Remove bolts, washers, and nuts (8), and remove control bracket (5) from system.

3–238. CLEANING. Clean control brackets with dry-cleaning solvent, Federal Specification P-S-661.

3–239. INSPECTION. Examine control bracket for distortion, dents, or cracks which may cause weakened condition.

3–240. REPAIR AND REPLACEMENT. Replace unserviceable control brackets.

3–241. INSTALLATION.

a. Position control bracket (5, figure 3–59) so mounting holes align with holes in structure.

b. Install bolts, washers, and nuts (8).

c. Install bolt, washer, spacer, and nut (7).

d. Install control cables (1) as outlined in paragraph 3–234.

e. Install control cable pulleys (2) as outlined in paragraph 3–227.

f. Adjust tension of control cables as outlined in paragraph 3–285.

3–242. THROTTLE CONTROL SYSTEM. (See figures 3–60 and 3–61.)

3–243. DESCRIPTION. The throttle control system consists of a series of control rods, cables, bell cranks, and brackets all so arranged and connected as to form the complete system. The system starts with the pilots' controls in the pilots' compartment and terminates at the canted bulkhead where it merges with the power plant engine controls.

Note

All items common to the engine control system are covered in paragraphs 3–203 through 3–241.

3–244. THROTTLE LIMIT SWITCH. (See figures 3–60 and 3–62.)

3–245. DESCRIPTION. On helicopters serial No. prior to 55-4462, the throttle limit switch 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. On helicopters serial No. 55-4462 and subsequent, the throttle limit switch is located on the forward cabin bulkhead and is actuated by a sheet metal cam on an adjacent pulley. The throttle limit switch prevents engine starter operation when the collective stick is not in the low pitch position and the throttle closed.

3–246. REMOVAL.

WARNING

Make sure that helicopter electrical system is not energized and external power supply is not connected.

a. Disconnect electrical wiring from throttle limit switch.

b. Remove screws, washers, and nuts (1, figure 3–60) and remove throttle limit switch (2).

3–247. CLEANING. Clean throttle limit switch with clean cloth.

3–248. TEST. Use any satisfactory continuity indicator to determine if the throttle limit switch functions electrically as required.

3–249. REPAIR AND REPLACEMENT. If throttle limit switch proves to be electrically defective, replace with serviceable item.

3–250. INSTALLATION.

WARNING

Make sure helicopter electrical system is not energized and external power supply is not connected.

a. Position throttle limit switch (2, figure 3–60) so holes in throttle limit switch align with holes in helicopter structure.

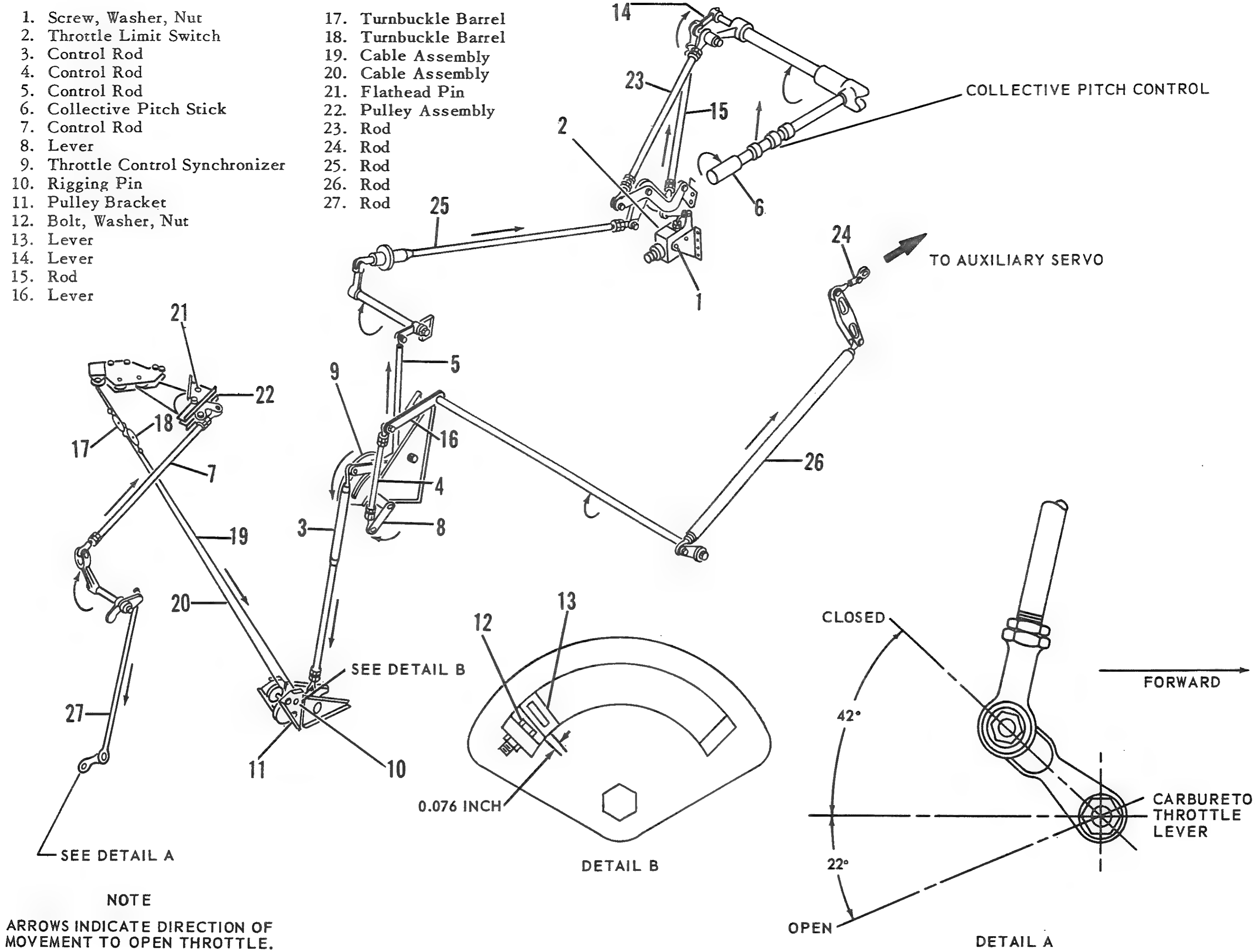
b. Install screws, washers, and nuts (1).

c. Connect electrical wiring to throttle limit switch.

3–251. THROTTLE CONTROL SYNCHRONIZER. (See figures 3–60 and 3–63.)

3–252. DESCRIPTION. The throttle control synchronizer receives throttle control movements from

1. Screw, Washer, Nut
2. Throttle Limit Switch
3. Control Rod
4. Control Rod
5. Control Rod
6. Collective Pitch Stick
7. Control Rod
8. Lever
9. Throttle Control Synchronizer
10. Rigging Pin
11. Pulley Bracket
12. Bolt, Washer, Nut
13. Lever
14. Lever
15. Rod
16. Lever
17. Turnbuckle Barrel
18. Turnbuckle Barrel
19. Cable Assembly
20. Cable Assembly
21. Flathead Pin
22. Pulley Assembly
23. Rod
24. Rod
25. Rod
26. Rod
27. Rod



NOTE

ARROWS INDICATE DIRECTION OF MOVEMENT TO OPEN THROTTLE.

Figure 3–60. Throttle Control System (Helicopters Serial No. Prior to 55-4462)

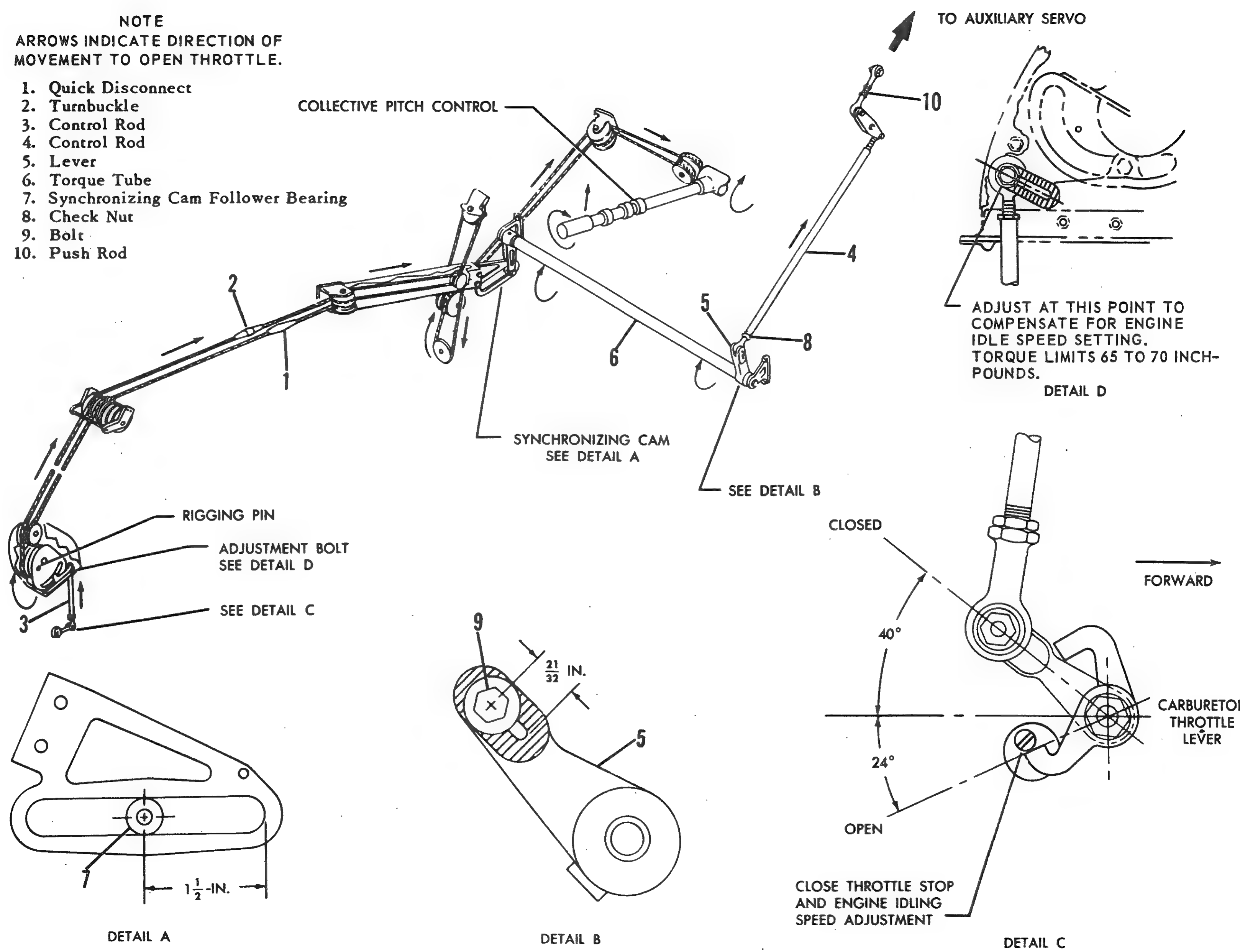


Figure 3–61. Throttle Control System (Helicopters Serial No. 55-4462 and Subsequent)

1. Screw, Washer, Nut
2. Throttle Limit Switch
3. Bolt, Washer, Nut
4. Lever
5. Bolt, Washer
6. Bolt, Washer, Nut
7. Torque Tube
8. Bolt, Washer, Nut
9. Pulley
10. Bolt, Washer, Nut
11. Pulley
12. Pin
13. Clip
14. Clip
15. Pulley Assembly
16. Bracket
17. Link

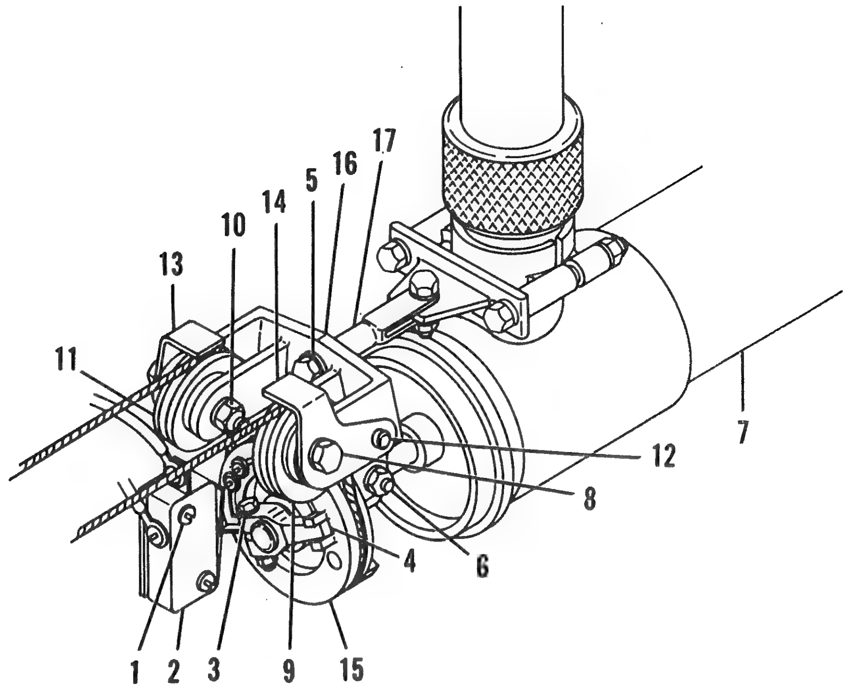


Figure 3–62. Throttle Control Pulley Bracket

the collective stick and auxiliary servo. The synchronizer mixes these two movements and produces a single movement which is transmitted through the mechanical linkage to the carburetor.

3–253. REMOVAL.

a. Disconnect and remove control rods (3, 4, and 5, figure 3–60) from throttle control system, as outlined in paragraph 3–206.

b. Remove mounting bolts, washers, and nuts (1, figure 3–63), and remove throttle control synchronizer.

3–254. DISASSEMBLY.

a. Remove taper pin, washer, and nut (2, figure 3–63) and remove lever (3).

b. Remove bolt, washers, spacers, and nut (4).

c. Remove bolt, washers, spacer, and nut (5).

d. Remove bolt, washers, and nut (6) and remove levers (7 and 8) and bell crank (9).

e. Remove bolts, washers, spacers, and nuts (10) and screws, washers, spacers, and nuts (11). Separate cams (12 and 13) so that shaft (14) is freed.

f. Frames (15 and 16) are automatically isolated by disassembly of other items.

3–255. CLEANING. Clean all parts in dry-cleaning solvent, Federal Specification P-S-661, and dry with dehumidified compressed air.

3–256. INSPECTION.

a. Inspect all castings and heat-treated parts for dents, cracks, corrosion, distortion, or impending failure from any cause.

b. Inspect bolts, screws, and nuts for evidence of cross threading.

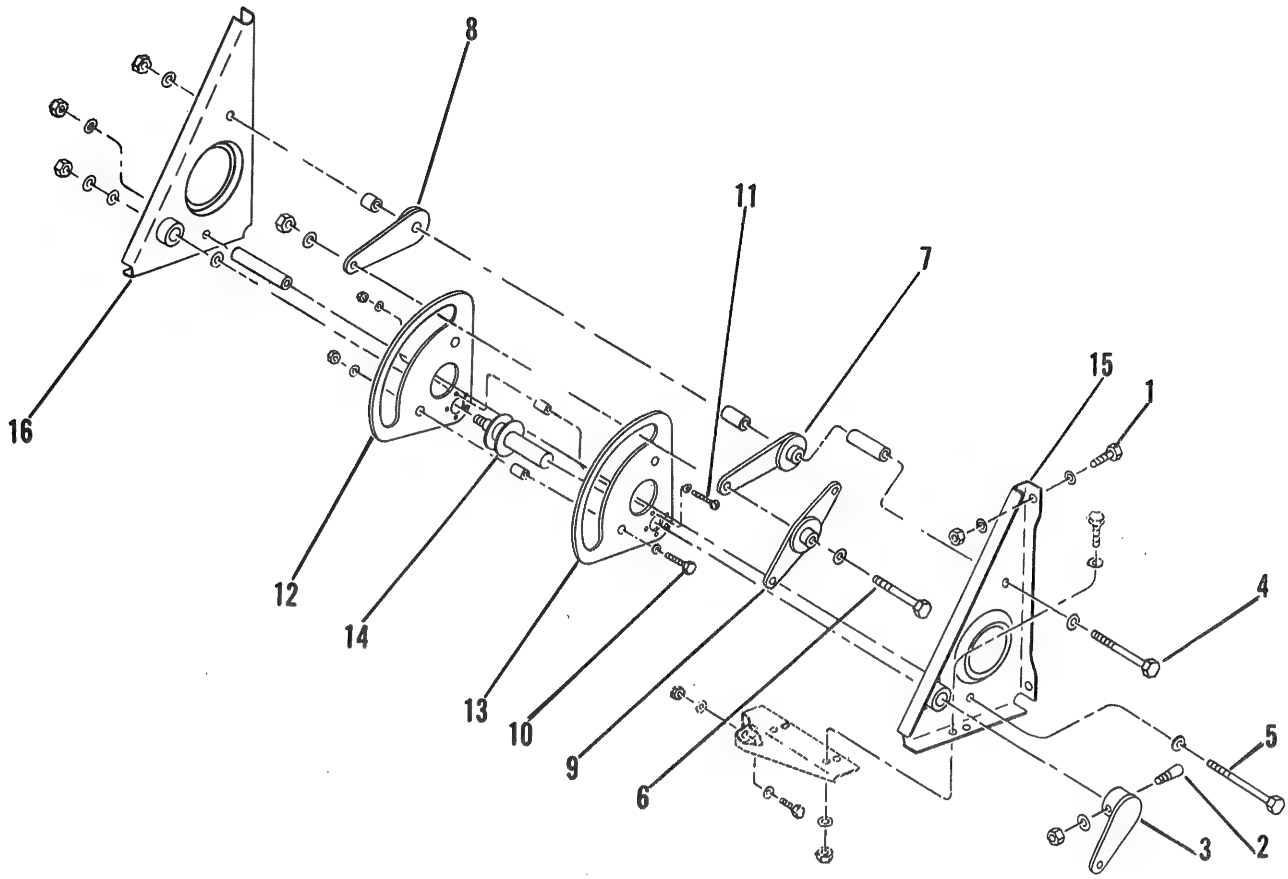
c. Inspect bearing surfaces for abnormal wear beyond acceptable tolerances.

3–257. REPAIR AND REPLACEMENT. Castings and heat-treated parts with minor nicks, cracks, and/or corrosion should be worked smooth with No. 00 sandpaper, polished with crocus cloth, Federal Specification P-C-458, and sprayed with two coats of zinc chromate primer, Military Specification MIL-P-8585.

3–258. REASSEMBLY.

a. Position shaft (14, figure 3–63) between cams (13 and 12). Install screws, washers, spacers, and nuts (11) and bolts, washers, spacers, and nuts (10).

b. Install bolt, washers, and nut (6) through bell crank (9), lever (7), cam (13), cam (12), and lever (8) in sequence stated.



1. Bolt, Washers, Nut
2. Taper Pin, Washer, Nut
3. Lever
4. Bolt, Washers, Spacers, Nut
5. Bolt, Washers, Spacer, Nut
6. Bolt, Washers, Nut
7. Lever
8. Lever
9. Bell Crank
10. Bolt, Washers, Spacer, Nut
11. Screw, Washers, Spacer, Nut
12. Cam
13. Cam
14. Shaft
15. Frame
16. Frame

Figure 3–63. Throttle Control Synchronizer (Helicopters Serial No. Prior to 55-4462)

c. Position assembly formed by steps *a* and *b* between frames (15 and 16) and install bolt, washers, spacer, and nut (5).

d. Install bolt, washers, spacers, and nut (4).

e. Place lever (3) on shaft (14) and install taper pin, washer, and nut (2).

3–259. INSTALLATION.

a. Place throttle synchronizer so that mounting holes in frames (15 and 16, figure 3–63) align with holes in helicopter structure and install bolts, washers, and nuts (1).

b. Connect control rods (3, 4, and 5, figure 3–60).

c. Adjust control rods (3, 4, and 5) according to instructions contained in paragraph 3–285.

3–260. THROTTLE CONTROL PULLEY BRACKET.

3–261. DESCRIPTION. The throttle control pulley bracket has special and unique features and is used only on helicopters serial No. 55-4462 and subsequent. This special item is a unit which mixes collective stick movement with stick grip twist to produce a single coordinated movement, yet retains independent throttle control if either movement is performed alone.

3–262. REMOVAL. (See figure 3–62.)

a. Remove control cables as outlined in paragraph 3–230.

b. Remove bolt, washers, and nut (3) and slip lever (4) from shaft.

c. Remove bolt and washer (5).

d. Remove bolt, washer, and nut (6) and remove unit from torque tube (7).

3–263. DISASSEMBLY.

a. Remove bolt, washer, and nut (8, figure 3–62) and remove pulley (9).

b. Remove bolt, washer, and nut (10) and remove pulley (11).

c. Remove pin (12) and clips (13 and 14).

d. Slide pulley assembly (15) from hub of bracket (16).

3–264. INSPECTION.

a. Examine pulleys (9 and 11, figure 3–62) and pulley assembly (15), for broken grooves, binding or worn bearings, and distortion.

b. Inspect clips (13 and 14) for indications of rubbing on cables, cracks, and dents.

c. Inspect all bolts and nuts for evidence of cross threading.

d. Examine castings for cracks, nicks, and evidence of distortion.

3–265. REPAIR AND REPLACEMENT.

a. Replace pulleys with broken grooves or unsatisfactory bearings.

b. Replace bolts and nuts with evidence of cross threading.

c. Use No. 00 sandpaper to smooth small nicks and cracks in heat-treated items and castings. After smoothing, use crocus cloth, Federal Specification P-C-458, to polish area. After polishing, spray with two coats of zinc chromate primer, Military Specification MIL-P-8585.

d. Replace castings and heat treated items having evidence of distortion or impending failure.

3–266. REASSEMBLY.

a. Position pulley assembly (15, figure 3–62) on hub of bracket (16).

b. Position pulley (11) between arms of bracket (16), position clip (13) outside of arms, and install bolt, washer, and nut (10). Tighten nut fingertight.

c. Position pulley (9) between arms of bracket (16), and position clip (14) outside of arms and install bolt, washer, and nut (8). Tighten nut fingertight.

d. Install pin (12) through four arms of bracket (16).

e. Tighten bolts, washers, and nuts (8 and 10).

3–267. INSTALLATION.

a. Position unit so that hole in pulley assembly (15, figure 3–62) is aligned with shaft in end of torque tube (7).

b. Install bolt and washer (5) through bracket (16) and into end of link (17).

c. Slide lever (4) on shaft in end of torque tube (7) and install bolt, washer, and nut (3).

d. Install bolt, washer, and nut (6).

e. Install cables as outlined in paragraph 3–234.

f. Adjust throttle control system as outlined in paragraph 3–268.

3–268. THROTTLE CONTROL SYSTEM ADJUSTMENT.

3–269. DESCRIPTION. Adjustment of the throttle control system is accomplished with all units connected and the entire system in the CLOSED THROTTLE position.

3–270. HELICOPTERS SERIAL NO. PRIOR TO 55-4462.

a. Position all units in system to CLOSED THROTTLE position.

b. Move collective pitch stick (6, figure 3–60) to BOTTOMED position.

c. Adjust all control rods to lengths specified in table 3–VII.

d. Disconnect control rod (7, figure 3–60) as outlined in paragraph 3–206.

Note

Install attaching hardware in end of control rod (7) after disconnecting.

e. Disconnect upper end of control rod (4) from lever (8) by reaching into clutch compartment and removing attaching hardware.

f. Disconnect control rod (3) from throttle control synchronizer (9).

g. Install 0.186-inch rigging pin (10) in pulley bracket (11).

Note

Procedure outlined in step *g* locks pulley bracket (11) in THROTTLE CLOSED position.

Note

There should be 0.076 inch between head of bolt (12) and lever (13) when in CLOSED THROTTLE position.

Table 3–VII. Basic Engine Control Rod Lengths (Model CH-34A Serial No. Prior To 55-4462)

ROD ASSEMBLY, INDEX AND FIGURE NO.		*LENGTH CENTER-TO-CENTER OF ROD-END BEARINGS IN INCHES
23	3–60	12
15	3–60	12
24	3–60	3-1/2
25	3–60	26-7/8
5	3–60	11-1/8
4	3–60	12-11/16
26	3–60	39-3/32
3	3–60	29-3/16
7	3–60	29-3/8
27	3–60	8-5/16
15	3–65	13-1/2
14	3–65	4-7/8
10	3–65	30-1/4

*Note: All rod lengths given are basic. If necessary, the rod assemblies with adjustable rod ends may be adjusted to obtain proper rigging.

h. Move cams (12 and 13, figure 3–63) to full forward position.

i. Secure control rod (3, figure 3–60) to right side of bell crank (9, figure 3–63).

Note

Do not depress or extend control rod (3, figure 3–60). Hold collective pitch control in low pitch position and rotate throttle grip, if necessary, to align hole in bell crank with hole in rod-end bearing.

j. Check to see that lever (14, figure 3–60) on torque tube installation in cabin does not strike intercostal. Adjust length of rod (15) attached to lever, if necessary, to provide clearance.

Note

Step *k* pertains to adjusting linkage leading from auxiliary servo unit.

k. After completing instructions in steps *a* through *j* of this paragraph, hold cams (12 and 13, figure 3–63) in full forward position and connect upper end of control rod (4, figure 3–60) and retainer to serrated surface of long lever (16) on torque tube installation located just above synchronizer assembly.

Note

Do not depress or extend control rod (3), but secure rod as near to forward end of lever as possible. Adjust length of rod as necessary. Steps *l* through *n* pertain to adjusting cables at canted bulkhead.

l. Loosen or remove turnbuckle barrels (17 and 18) from cable assemblies (19 and 20) at canted bulkhead.

m. Insert 0.186-inch diameter flathead pin (21) through hole in throttle pulley bracket installation at top of canted bulkhead to lock pulley in closed throttle position.

Note

Rigging pin used in step *g* of this paragraph should be left in pulley installation at bottom of canted bulkhead while adjusting cables.

n. Replace turnbuckle barrels (17 and 18) on the cable assemblies (19 and 20). Adjust turnbuckle barrels to produce an equal tension of 25 to 30 pounds on each cable.

Note

Steps *o* and *p* pertain to adjusting linkage from pulley installation at top of canted bulkhead to throttle arm on carburetor.

o. Move throttle arm on carburetor to CLOSED (up) position.

Note

In CLOSED position, center line of throttle arm should be 42 degrees above horizontal.

p. Secure control rod (7) to levers on pulley assembly (22) at top of canted bulkhead. Adjust length of rod as necessary.

Note

Secure upper end of rod to levers of pulley assembly (22) with same bolt, washers, and nut that are installed in rod end. Be certain that bolt, washers, and nut are properly secured.

Note

Length of control rod (7) should be approximately 29 inches.

q. Remove flathead pin (21) from throttle pulley bracket installation and pulley installation.

r. Position collective pitch stick (6) in mid position and throttle twist-grip in open position. Be certain carburetor is in open position and hitting open stop. Adjust open auxiliary stop, located in pulley bracket installation at bottom of canted bulkhead, to obtain clearance of 0.010 inch.

s. Position collective pitch stick (6) in mid position and throttle twist-grip in closed position. Be certain carburetor is in closed position and hitting closed stop. Adjust closed auxiliary stop, located in pulley bracket installation at bottom of canted bulkhead, to obtain clearance of 0.010 inch.

t. If any new rods were installed, rod-end bearing on one end only of each new rod will contain No. 40 (0.098-inch diameter) pilot hole located 90 degrees from inspection hole. Drill through this pilot hole with No. 51 (0.067-inch diameter) drill and install cotter pin in each new rod.

u. Adjust throttle limit switch (2, figure 3–60) on helicopters serial No. prior to 55-4462. The throttle limit switch must be adjusted to open when gap between carburetor throttle lever and throttle stop on carburetor is as near 0.000 inch as possible. This gap must not exceed 0.070 inch under any circumstances. To adjust throttle limit switch within this tolerance, proceed as follows:

CAUTION

Throttle limit switch must be adjusted after each power plant change, each carburetor change, or after replacement of any component of the throttle control system.

(1) Place collective pitch stick (6) in low pitch position and throttle twist-grip in closed position. Move throttle twist-grip out of closed position to establish gap not to exceed 0.070 inch between carburetor throttle lever and throttle stop on carburetor.

(2) Loosen bronze adjusting nut located between actuator and actuator support arm of throttle limit switch.

(3) Position roller on end of actuator against rod-end bearing of collective pitch rod. Tighten adjusting nut.

(4) Disconnect electrical wiring from terminal of throttle limit switch. Attach one wire of test light to this terminal and ground other wire of test light to structure of helicopter.

(5) Raise collective pitch control out of low pitch position. Move the control slowly back to the low pitch position; stop movement of collective pitch control immediately when test light comes on, indicating throttle limit switch has closed.

(6) Measure gap between throttle lever and throttle stop of carburetor.

Note

This gap must not exceed 0.070 inch and should be as near 0.000 inch as possible. Repeat steps (2) through (6) if gap is greater than 0.070 inch.

(7) Move throttle twist-grip from closed position. Move twist-grip slowly back to closed position; stop movement immediately when test light comes on, indicating throttle limit switch has closed. Repeat step (6).

Note

Gap must not exceed 0.070 inch and should be as near 0.000 inch as possible. Repeat steps (2) through (7) if gap is greater than 0.070 inch.

v. Test adjustment of throttle control system for following; with collective pitch stick (6) in low pitch position, throttle should close fully; with collective pitch stick in high pitch position, throttle should open fully; with collective pitch stick in mid position, throttle should open fully and close fully.

3–271. HELICOPTERS SERIAL NO. 55-4462 AND SUBSEQUENT.

a. Reach into clutch compartment, open quick disconnect (1, figure 3–61), and disengage lower throttle cables. Disconnect upper cables at turnbuckle (2).

Note

When idle speed stop at carburetor is adjusted, equal adjustment must be made at pulley cam in control assembly above carburetor. This adjustment is accomplished by rotating head of bolt (detail D) securing control rod to pulley cam levers. Shoulder of bolt is eccentric for this purpose. If desired setting is not achieved with bolt, slide bolt one serration at a time until desired results are obtained.

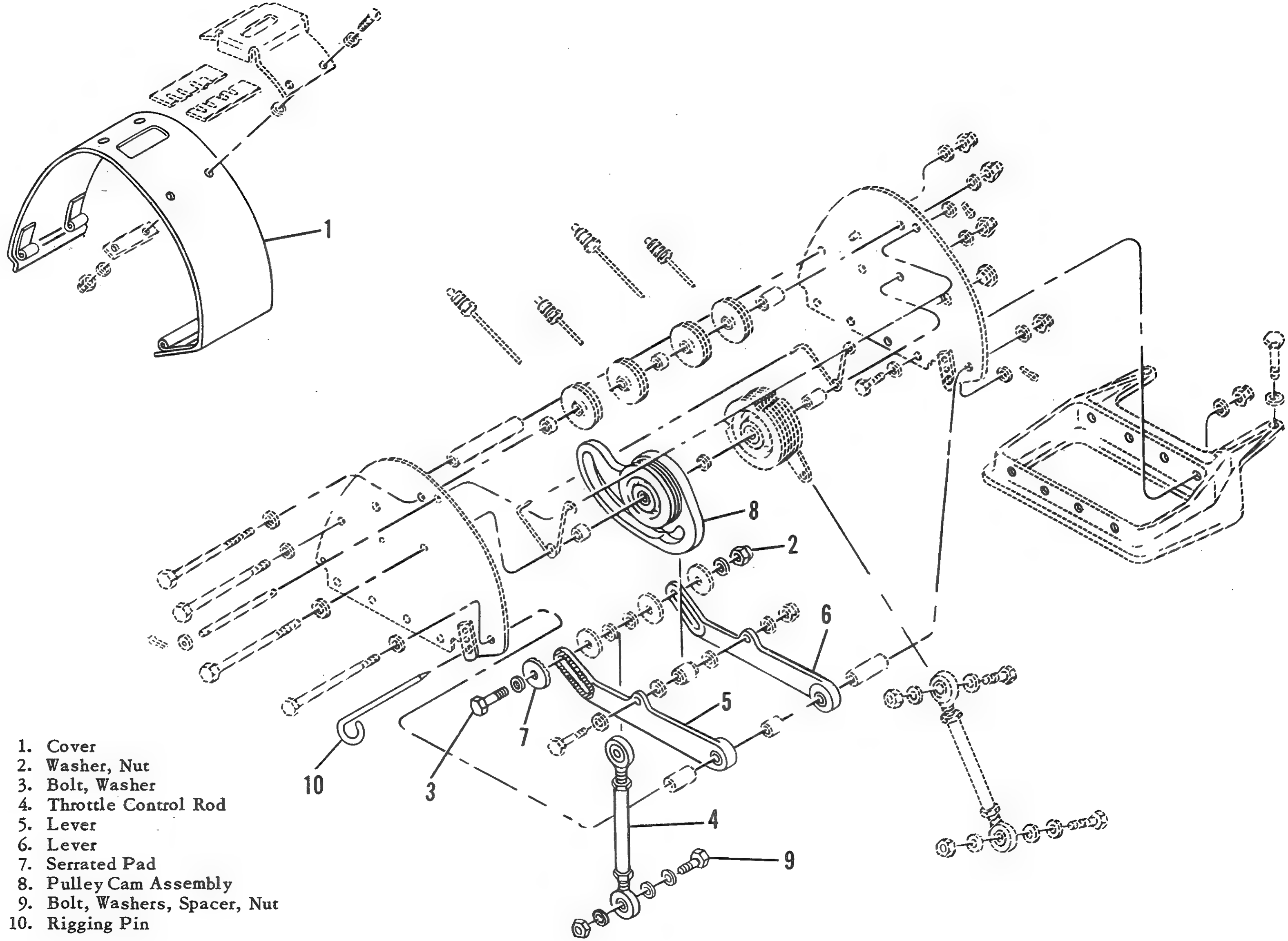
b. Disconnect control rod (3) from arm of carburetor. Move arm against its open stop. Arm should now be 24 degrees below line parallel with top deck of carburetor. (See detail C.)

Note

If this condition does not exist, loosen nut that secures arm to shaft and adjust as necessary. Retighten nut.

c. Remove cover (1, figure 3–64) from control assembly above carburetor.

d. Move linkage at control assembly to place throttle arm at carburetor in full open position



1. Cover
2. Washer, Nut
3. Bolt, Washer
4. Throttle Control Rod
5. Lever
6. Lever
7. Serrated Pad
8. Pulley Cam Assembly
9. Bolt, Washers, Spacer, Nut
10. Rigging Pin

Figure 3–64. Throttle Control Assembly – Typical View and against its stop. Continue moving linkage into override. Move linkage to place throttle arm in full closed position and against its stop. (See detail C, figure 3–61.) Continue moving linkage into override. If desired results were not obtained, proceed as follows:

Note

Pulley cam in control assembly will continue to move after throttle arm on carburetor has hit either closed or open stop. This movement of pulley cam is called override.

e. If throttle arm did not hit either closed or open stop in step *d,* loosen nut (2, figure 3–64) on bolt (3) that secures throttle control rod (4) to levers (5 and 6) enough to disengage serrated pad (7) from serrations on lever (5), and slide bolt (3) forward in slot. If arm hits both stops but pulley cam does not, continue to move into each override and slide bolt aft in slot.

Note

Shoulder of bolt (3) is eccentric to provide for adjustment between serrations. Rotate bolt head until desired setting is achieved.

f. Tighten nut (2) on bolt (3) fingertight to secure serrated pad (7). Repeat instructions outlined in step *d.* If throttle arm at carburetor hits only one stop or pulley cam assembly in control assembly goes into only one override and not others, disconnect throttle control rod (4) from throttle arm at carburetor. Loosen check nut and lengthen or shorten rod until proper results are obtained.

g. Tighten check nut and secure throttle control rod (4) to arm at carburetor with bolt, washers, and nut (9). Tighten nut (2) on bolt (3) securing serrated pad (7) to a torque of 65 to 70 inch-pounds.

h. Move linkage in throttle control assembly so arm on carburetor is against its closed stop. Insert rigging pin (10) through holes in bracket and pulley cam in control assembly.

Note

With rigging pin installed, carburetor throttle arm must be against its closed stop. If this condition does not exist, readjust system as necessary.

i. Place collective pitch stick in full low pitch position and lock in position with friction lock.

j. Set pilot's twist-grip one-quarter from closed position and lock in position with friction lock.

Note

To check that twist-grip is one-quarter from closed position, measure fixed stops on drive pulley located at base of pilot's collective pitch control in relation to bracket.

k. Disconnect lower end of control rod (4, figure 3–61) from lever (5) on torque tube (6). Set synchronizing cam follower bearing (7) to measure 1-1/2 inches from aft end of cam slot to center line of cam follower bearing bolt. (See detail A.) Clamp or hold follower and torque tube in position.

l. With torque tube (6) in position, loosen check nut (8) and adjust length of control rod (4) to position bolt (9) 21/32 inch from the bottom of slot in lever (5) to centerline of bolt (9). (See detail B.)

Note

If sufficient adjustment cannot be obtained with control rod (4) due to limits of rod, further adjustment may be accomplished by adjusting length of short push rod (10) connected to servo unit.

m. With bolt (9) in position, tighten nut while serrations on pad are engaged in serrations on lever (5).

Note

Bolt, washers, and nut must be installed with bolt head inboard, washer under the head, washer on each side of rod-end bearing, and washer between serrated pad and nut. (See figure 3–61, detail B.)

n. Connect upper throttle cables at turnbuckle (2, figure 3–61).

o. Reach into clutch compartment and engage lower throttle cables at quick disconnect (1).

p. Adjust quick disconnect (1) and turnbuckle (2) to produce equal tension of 25 to 30 pounds on each cable, using cable tensiometer, Pacific Scientific part No. T5-3001-104-00. Close quick disconnect, and secure quick disconnect (1) and turnbuckle (2) with lock wire.

q. Remove rigging pin (10, figure 3–64) from control assembly and check adjustment of throttle limit switch and adjust as necessary. (Refer to step *r.*)

r. The throttle limit switch must be adjusted to open when gap between carburetor throttle lever and throttle stop on the carburetor is as near to 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:

Note

Adjust throttle limit switch after each engine change, carburetor change, or replacement of any component of throttle control system.

(1) Place collective pitch stick (6, figure 3–60) in low pitch position and throttle in closed position. Move throttle twist-grip out of closed position to establish gap not to exceed 0.070 inch between carburetor throttle lever and throttle stop on carburetor.

(2) Disconnect K69A18 wire from terminal, marked N.O., on throttle limit switch. Attach one wire of test light to N.O. terminal on limit switch and ground other light wire to structure of helicopter.

(3) Shift throttle limit switch (2) on bulkhead until it makes contact with cam on end of pulley bracket assembly and test light comes on. Tighten screws securing switch to bulkhead. If switch does not make contact or light does not come on, loosen adjusting screws that secure sheet metal cam to pulley and shift cam until light comes on.

(4) Measure gap between throttle lever and throttle stop on carburetor. Gap must not exceed 0.070 inch and should be as near 0.000 inch as possible.

(5) Remove throttle twist-grip out of closed position. Move twist-grip slowly back to closed position, but stop movement of twist-grip immediately when test light comes on, indicating that throttle limit switch has closed.

(6) Measure gap between throttle lever and throttle stop on carburetor. Gap must not exceed 0.070 inch and should be as near 0.000 inch as possible.

s. Check throttle control system for following conditions:

(1) With twist-grip locked in one-quarter from closed position and collective pitch stick in full low position, throttle arm at carburetor should be against its closed stop. Pulley cam in control assembly should not be in override.

(2) With twist-grip locked in one-quarter from closed position and collective pitch stick in full high position, throttle arm at carburetor should be against its open stop. Pulley cam in control assembly should not be in override.

Note

If conditions outlined in steps (1) and (2) do not exist, readjust the system as necessary.

(3) Unlock twist-grip, place collective pitch stick in full low position, and turn twist-grip to closed and then into override. Place collective pitch control in full high position and turn twist-grip to open and then into override. Movement in each direction should be smooth with slight detent felt when going into override. From closed position into override, light spring action will be felt. When twist-grip is released, it will return to closed but not to override. If detent action is hard, further adjustment at control assembly is necessary.

3–272. CARBURETOR MIXTURE AND CARBURETOR AIR TEMPERATURE CONTROL SYSTEMS.

3–273. DESCRIPTION. The carburetor mixture and carburetor air temperature control systems extend from the quadrant in the pilots' compartment to their respective control areas in the power package. The systems are composed of control rods, bell cranks, cables, pulleys and pulley brackets, and a control quadrant.

3–274. COMMON ITEMS. Remove, repair, and install control rods, bell cranks, cables, pulleys, and pulley brackets in accordance with instructions in paragraphs 3–203 through 3–241.

3–275. CONTROL QUADRANT.

3–276. DESCRIPTION. The control quadrant is installed in the control pedestal and provides the pilot with control over the fuel air mixture in the carburetor and temperature of the input air to the carburetor.

3–277. REMOVAL. (See figures 3–65 and 3–66.)

a. On helicopters serial No. prior to 55-4462, disconnect cables (1 and 2, figure 3–65) at turnbuckles (3 and 4).

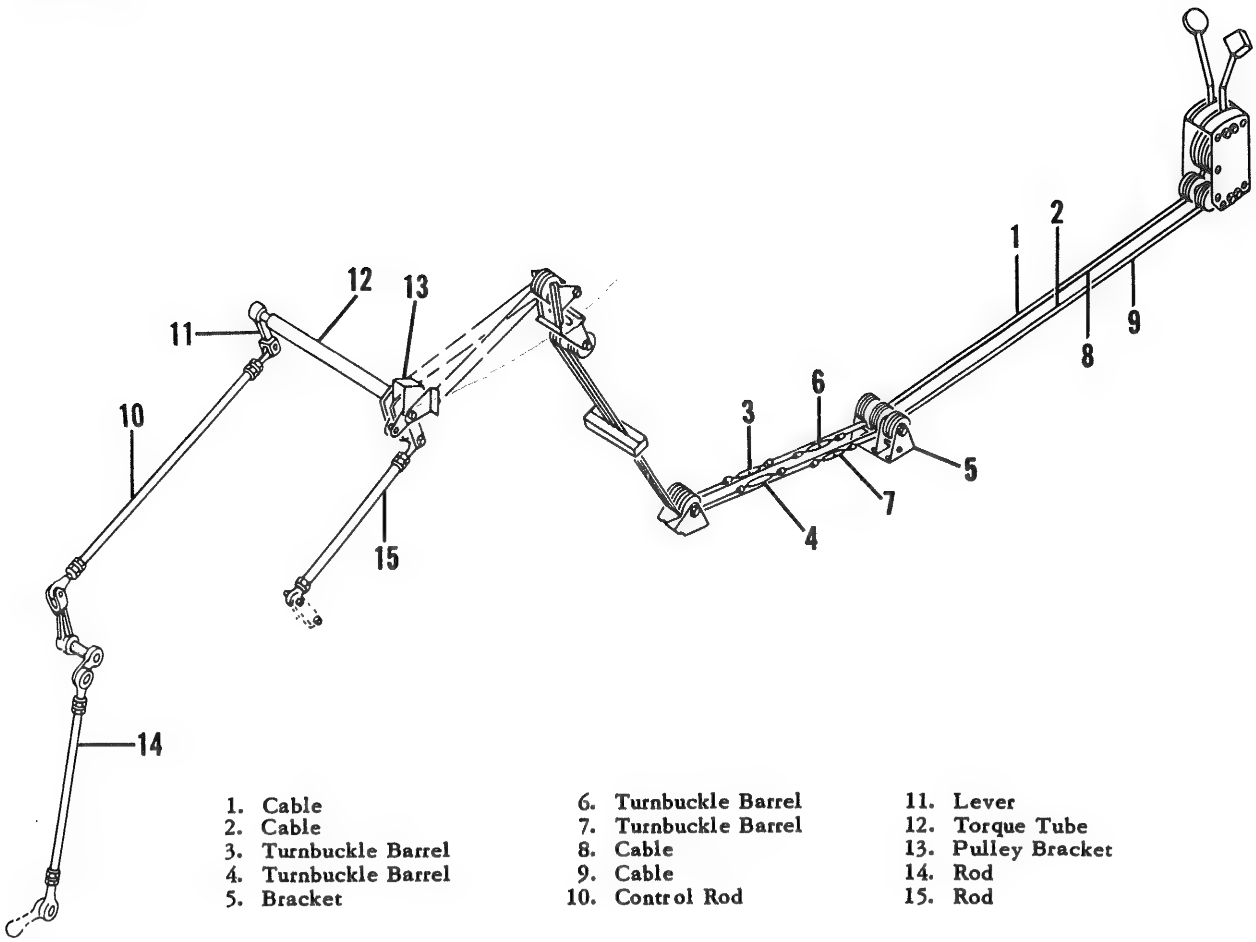
b. On helicopters serial No. 55-4462 and subsequent, disconnect cables (1, 2, 3, and 4, figure 3–66) at turnbuckles (5, 6, 7, and 8) and remove mixture and carburetor heat pulleys and cables from bracket (5, figure 3–65).

c. On helicopters serial No. prior to 55-4462, disconnect turnbuckles (6 and 7).

d. Push cables (1, 2, 8, and 9, figure 3–65 and 1, 2, 3, and 4, figure 3–66) toward rear of control pedestal.

e. Remove access panel at right side of control pedestal.

f. Render the helicopter electrical system safe and disconnect electrical circuit to primer switch on quadrant on helicopters serial No. 55-4462 and subsequent.



1. Cable
2. Cable
3. Turnbuckle Barrel
4. Turnbuckle Barrel
5. Bracket
6. Turnbuckle Barrel
7. Turnbuckle Barrel
8. Cable
9. Cable
10. Control Rod
11. Lever
12. Torque Tube
13. Pulley Bracket
14. Rod
15. Rod

Figure 3–65. Carburetor Mixture and Carburetor Air Temperature Control System (Helicopters Serial No. Prior to 55-4462)

1. Cable
2. Cable
3. Cable
4. Cable
5. Turnbuckle Barrel
6. Turnbuckle Barrel
7. Turnbuckle Barrel
8. Turnbuckle Barrel
9. Rod
10. Pulley Assembly
11. Pulley Bracket
12. Pulley Bracket
13. Pulley Bracket
14. Pulley Bracket
15. Control Assembly

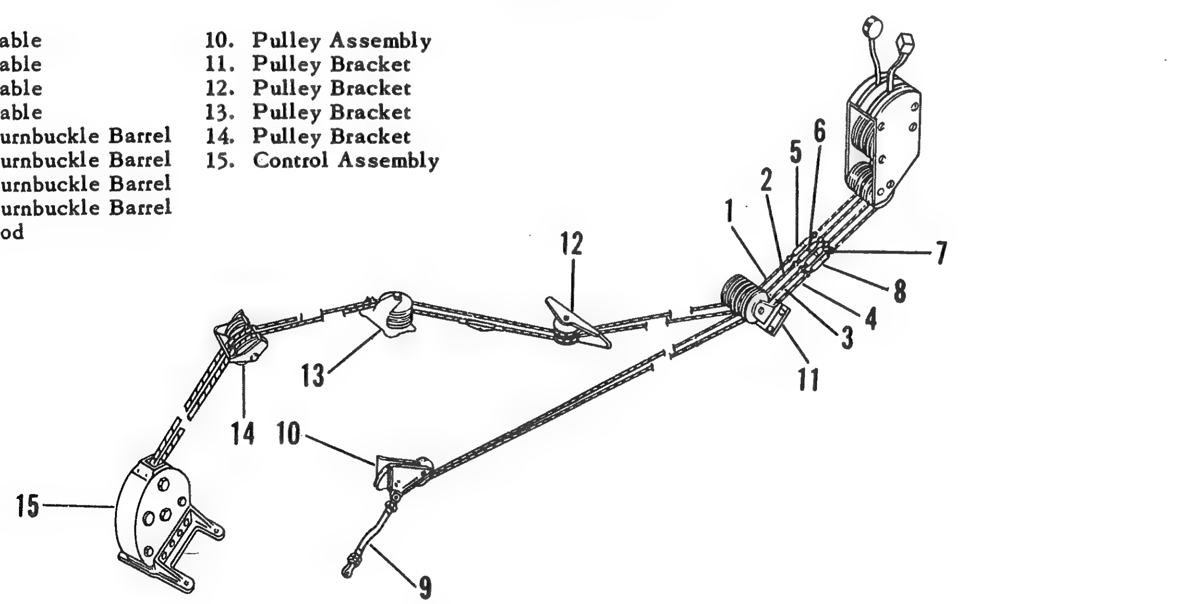


Figure 3–66. Carburetor Mixture and Carburetor Air Temperature Control System (Helicopters Serial No. 55-4462 and Subsequent)

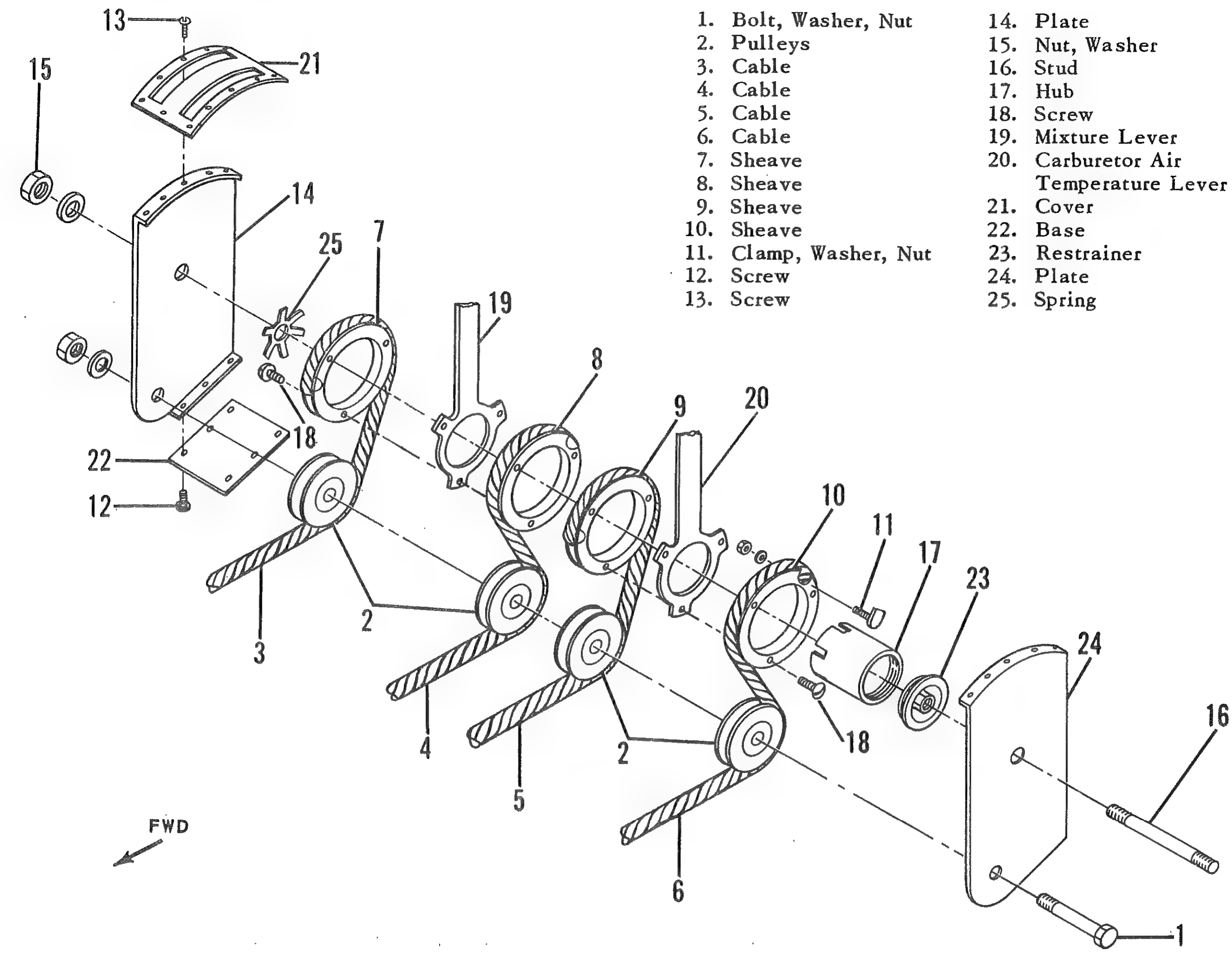


Figure 3–67. Control Quadrant

g. Remove bolts and washers securing bottom of quadrant to helicopter structure.

h. Remove access panel from left side of control pedestal.

i. Remove bolts, washers, and nuts (2 and 3, figure 3–3) attaching top of quadrant to control pedestal and lift quadrant from control pedestal.

3–278. DISASSEMBLY. (See figure 3–67.)

a. Remove bolt, washer, and nut (1) and lift pulleys (2) from quadrant.

b. Remove screws (12 and 13) securing cover (21) and base (22) to plates (14 and 24).

c. Remove nut and washer (15) from stud (16). Separate plates (14 and 24), hub (17), spring (25), and sheaves (7, 8, 9, and 10).

d. Remove screws (18) securing sheaves (7 and 8) to mixture lever (19) and sheaves (9 and 10) to carburetor air temperature lever (20).

e. Disconnect cables (3, 4, 5, and 6) from sheaves (7, 8, 9, and 10) by removing clamps, washers, and nuts (11).

f. Unscrew hub (17) from restrainer (23).

3–279. CLEANING. Clean all parts with dry-cleaning solvent, Federal Specification P-S-661, and dry with stream of dehumidified air.

3–280. INSPECTION.

a. Inspect all structural parts for nicks, dents, cracks, minor abrasions, and indications of distortion.

b. Examine all moving parts having bearing surfaces for excessive wear, pitting, galling, and corrosion

c. Inspect all phenolic parts for evidence of excessive wear, cracks, and general deterioration.

3–281. REPAIR AND REPLACEMENT.

a. Smooth metal structural parts having minor nicks, dents, abrasions, and corrosion with crocus cloth, Federal Specification P-C-458. Spray with two applications of zinc chromate primer, Military Specification MIL-P-8585.

b. Stop-drill cracks in metal heat-treated parts and refinish area in accordance with instructions in step *a.*

c. Replace any metal part having indications of distortion and severe cracks.

d. Moving metal parts having bearing surfaces with minor roughness may be lapped on a smooth surface so long as critical dimensional tolerances are not exceeded.

e. Replace metal parts having excessively worn bearing surfaces.

f. Replace phenolic parts having rough or worn bearings, and replace any phenolic material which is deteriorated.

3–282. REASSEMBLY. (See figure 3–67.)

a. Screw hub (17) on restrainer (23).

b. Connect cables (3, 4, 5, and 6) to sheaves (7, 8, 9, and 10) with clamps, washers, and nuts (11).

c. Secure sheaves (7 and 8) to mixture lever (19) and sheaves (9 and 10) to carburetor air temperature lever (20) with screws (18).

d. Slide carburetor air temperature and mixture lever assemblies on hub (17).

e. Install stud (16) through hub (17) and position plates (14 and 24) and spring (25) on stud. Install nut and washer (15).

f. Position base (22) to plates (14 and 24) and install screws (12).

g. Position cover (21) to top of plates (14 and 24) and install screws (13).

CAUTION

Cables (3 and 5) are routed up from the rear to attach to sheaves (7 and 9). Cables (4 and 6) are routed up from the front to attach to sheaves (8 and 10).

h. Position pulleys (2) over their respective cables and install bolt, washer, and nut (1).

3–283. INSTALLATION.

a. Remove access panels from right and left sides of control pedestal.

b. Position quadrant to control pedestal and install bolts, washers, and nuts (2 and 3, figure 3–3).

c. Install bolts and washers securing bottom of quadrant to helicopter structure.

d. Render helicopter electrical system safe and connect electrical circuit to engine primer switch on helicopters serial No. 55-4462 and subsequent.

e. On helicopters serial No. prior to 55-4462, pull cables (1, 2, 8, and 9, figure 3–65) forward and install pulleys in bracket (5).

f. Fasten cables into system by connecting turnbuckles (3, 4, 6, and 7).

g. On helicopters serial No. 55-4462 and subsequent, pull cables (1, 2, 3, and 4, figure 3–66) forward and fasten into systems at turnbuckles (5, 6, 7, and 8).

h. Adjust systems in accordance with paragraphs 3–84 and 3–85.

3–284. ADJUSTING CARBURETOR MIXTURE AND CARBURETOR AIR TEMPERATURE CONTROL SYSTEMS (HELICOPTERS SERIAL NO. PRIOR TO 55-4462).

a. Remove control rod (10, figure 3–65) from lever (11) on torque tube (12) at top of canted bulkhead.

b. Loosen or remove turnbuckles (3 and 6).

c. Insert 0.186-inch diameter flathead pin through hole in pulley assemblies in pulley bracket (13).

d. Set MIXTURE lever on control console in the NORMAL position.

e. Replace turnbuckles (3 and 6) on cables (1 and 8). Adjust turnbuckles to produce an equal tension of 35 ±5 pounds on each cable. Secure turnbuckles with lock wire.

Note

MIXTURE lever must remain in NORMAL position during this adjustment.

f. Move mixture lever on carburetor to mid position.

Note

Rod (14) must measure 4-7/8 inches between center of hole in each rod-end bearing.

g. Adjust control rod (10) and secure it to lever (11) on torque tube (12).

h. Remove flathead pin from pulley assemblies in pulley bracket (13).

i. Hold piece of thin paper over idle cut-off stop on carburetor. Have MIXTURE lever on control quadrant moved to full IDLE CUT-OFF position. Try to remove paper. If paper tears or is difficult to remove, adjustment is satisfactory.

j. Repeat paper test with paper on rich stop of carburetor and MIXTURE lever in full RICH position.

k. Remove rod (15) from pulley assembly in pulley bracket (13).

l. Loosen or remove carburetor air turnbuckles (4 and 7).

m. Insert 0.186-inch diameter flathead pin through hole in pulley assemblies in pulley bracket (13) at top of canted bulkhead to lock pulley in mid position.

n. Set CARB HEAT lever on control console in mid position.

o. Replace carburetor air turnbuckles (4 and 7) on cables (2 and 9). Adjust turnbuckles to produce equal tension of 35 ±5 pounds on each cable. Secure turnbuckles with lock wire.

Note

CARB HEAT lever must remain in mid position during adjustment.

p. Move lever on air intake duct to mid position. Adjust rod (15) and secure it to arms on pulley assembly in pulley bracket (13).

q. Remove flathead pin from pulley assemblies in pulley bracket (13).

r. Move CARB HEAT lever to full DIRECT position. Door in warm air duct of air intake duct should be fully closed. Move lever to full ALTERNATE position. Door should be fully open.

3–285. ADJUSTING CARBURETOR MIXTURE AND CARBURETOR AIR TEMPERATURE CONTROL SYSTEMS (HELICOPTERS SERIAL NO. 55-4462 AND SUBSEQUENT).

a. Loosen or remove turnbuckles (5 and 6, figure 3–66) located inside console in pilots' compartment.

b. Place MIXTURE lever on control quadrant in NORMAL position.

c. Move mixture arm on carburetor to normal detent.

Note

Center line of mixture arm should now be parallel with top deck of carburetor.

Note

Control rod (7, figure 3–13) attached to mixture lever should measure 7 inches between center of hole in each rod-end bearing.

d. Adjust turnbuckles (5 and 6, figure 3–66) to produce equal tension of 25 to 30 pounds on each cable, using cable tensiometer, Pacific Scientific part No. T5-3001-104-00. Secure turnbuckles with lockwire.

e. Hold piece of thin paper over idle cut-off stop on carburetor. Have MIXTURE lever on control quadrant moved to full IDLE CUT-OFF position. Try to remove paper. If paper tears or is difficult to remove, adjustment is satisfactory.

f. Repeat paper test with paper on rich stop of carburetor and MIXTURE lever in full RICH position.

g. Remove rod (9) from pulley assembly (10) at canted bulkhead.

h. Loosen or remove turnbuckles (7 and 8) located inside console in pilots' compartment.

i. Set CARB HEAT lever on control console in mid position.

j. Replace turnbuckles (7 and 8). Adjust turnbuckles to produce equal tension of 35 ±5 pounds on each cable. Secure turnbuckles with lock wire.

Note

CARB HEAT lever must remain in mid position during adjustment.

k. Move lever on air intake duct to mid position. Adjust rod (9) and secure it to arm of the pulley assembly (10).

l. Move CARB HEAT lever to full DIRECT position. Door in warm air duct of air intake duct should be fully closed. Move lever to full ALTERNATE position. Door should be fully open.

3–286. MAINTENANCE OF POWER PLANT COMPONENTS AND ACCESSORIES.

3–287. GENERAL. In the normal process of performing third and fourth echelon maintenance, it is often necessary to repair or replace one or more of the components and accessories which are a part of the power plant. Maintenance instructions for such items are incorporated in paragraphs 3–288 through 3–345. There are some components and accessories which are accessible for repair or replacement with the power plant in the installed position. There are some components and accessories which cannot be repaired or removed with the power plant in the installed position. To facilitate the removal of these items without complete removal of the power plant, top overhaul stands are provided.

3–288. ENGINE TOP OVERHAUL STANDS. Proceed in the following manner for installation and adjustment of top overhaul stands:

a. Open nose doors.

b. Remove upper accessory compartment shroud panel.

c. Position engine top overhaul stand support fitting on engine mount ring behind upper mounting bracket of each upper double bracket assembly. Secure fitting with bolt and washer.

d. With base of engine top overhaul stand secured to jackscrew at lower end of support tube and with jackscrew in retracted position, fit top end of support tube over each support fitting installed in step *c*.

CAUTION

Wheels of helicopter must be chocked before power plant is hinged down on top overhaul stand.

e. Install hoist sling assembly. (Refer to paragraph 3–13.)

f. Remove two bolts (34, figure 3–4) and lower power plant to horizontal position with hoist sling assembly, using eyebolts (33) and hinge points (36) as hinges. Lower power plant until weight is supported by top overhaul stands.

g. Extend tubes to support power plant in desired position by unscrewing jackscrews at bottom of support tube.

CAUTION

Do not attempt to support the power package in hinged down position with link support, part No. S14-50-4194, or any other link between the holes in engine mount arms and corresponding holes in brackets on bottom structure, as structure failure may result. Always support power package with hoist sling or top overhaul stands.

h. Remove hoist sling assembly.

i. Upon completion of repair or overhaul of power plant components, remove top overhaul stands and install power plant in helicopter as outlined in paragraph 3–193.

3–289. FAN ASSEMBLY (REPAIR OR OVERHAUL – FOURTH ECHELON). The fan assembly is a portion of hydromechanical clutch and fan assembly. Refer to paragraph 3–18 for removal instructions. Refer to applicable manual listed in Appendix I for instructions on repair or overhaul procedures. Refer to paragraph 3–190 for installation.

3–290. ENGINE MOUNT RING. Refer to paragraph 3–66 for removal instructions. Refer to paragraph 6–7 for repair instructions. Refer to paragraph 3–93 for installation.

3–291. DOUBLE BRACKET ASSEMBLIES (FOURTH ECHELON).

3–292. Maintenance requirements for double brackets are performed with procedures covering the engine mount ring.

3–293. REMOVAL.

a. Remove nut (8, figure 3–27) and washer (11) from each double bracket.

b. Remove each double bracket as a unit.

3–294. CLEANING.

a. Wipe excess oil and dirt from double bracket rubber cones with clean cloth.

b. Wash metal parts in dry-cleaning solvent, Federal Specification P-S-661.

CAUTION

Do not use cleaner on rubber parts of double brackets

Note

Steel parts are corrosion resistant and are plated or coated with lord compound, RP-8. Coating compound can be removed, if desired, by cleaning with ethyl alcohol, Military Specification MIL-A-6091.

3–295. INSPECTION.

a. Check all metal parts for dents, cracks, or other surface damage. Replace faulty parts.

b. Check mounting core for metal-to-rubber bond separation. Check for flex cracks in rubber. Separation or flex cracks found to have progressed inwardly to a depth of 0.25 inch warrants replacement of mounting core.

3–296. REPLACEMENT. Replace all parts found defective as outlined in paragraph 3–295.

3–297. INSTALLATION. (Refer to paragraph 3–92.) Installation of double brackets are accomplished during engine mount buildup.

3–298. THRUST BEARING NUT AND OIL SEALS.

3–299. DESCRIPTION. The oil seal ring complates the tappet oil annulus in the crankcase front section of the engine. The thrust bearing nut must be removed in order to remove and replace the oil seal.

3–300. INSPECTION. Inspect around the thrust bearing nut for signs of oil leakage.

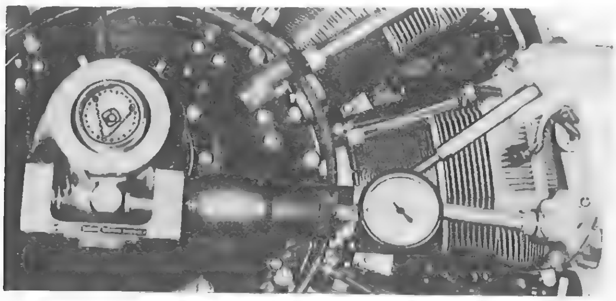


Figure 3–68. Breaking Loose Thrust Bearing Nut

3–301. REMOVAL. Refer to paragraph 3–18, step c, for removal of the hydromechanical clutch and fan assembly and paragraph 3–21 for removal of the contravane and fan shroud. Use torque wrench assembly, part No. 80731, to break loose the thrust bearing nut. (See figure 3–68.)

Note

Right and left are determined as viewed facing the front of the engine.

a. Assemble housing and thrust bearing nut adapter. Slide assembly over propeller shaft and engage it with thrust bearing nut.

b. Install splined adapter over propeller shaft splines. Insure that ball handle of adapter is at right as you face propeller shaft and pointer is at left limit of travel as indicated on scale at top of housing.

c. Screw jack and gage assembly into hole at right of housing. Insure that jack and gage relief valve is closed.

d. Build up pressure until force of ram acting against ball of handle of splined adapter turns housing and thrust bearing nut adapter in counterclockwise direction, causing thrust bearing nut to back off.

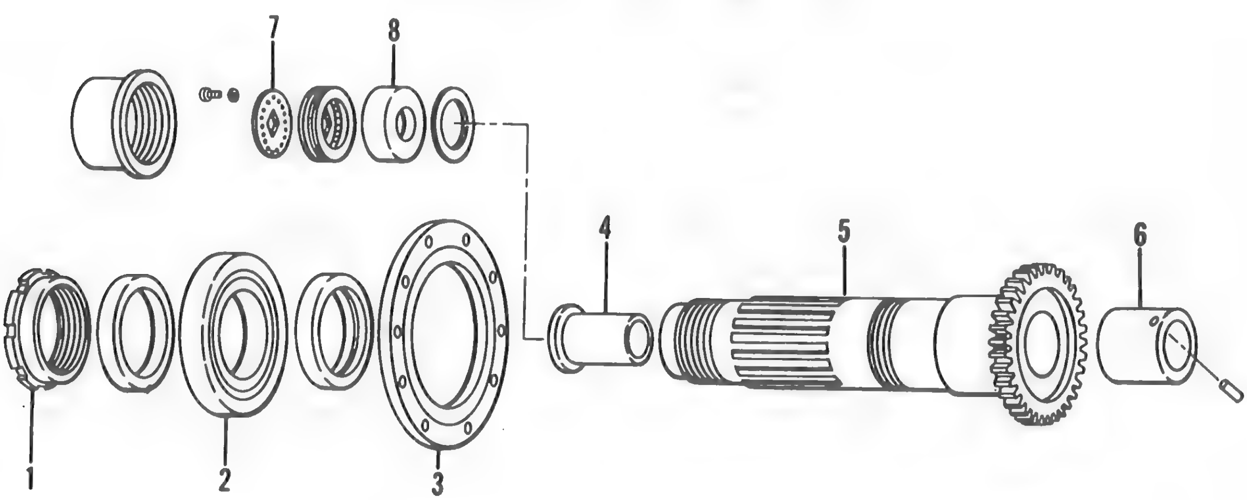
e. If pointer reaches its right limit of travel before nut is sufficiently loose to be readily turned by lug wrench, open jack and gage relief valve to retract ram. Remove splined adapter from propeller shaft and reinstall it in original position relative to the housing as described in step *b* above. Close jack and gage relief valve and repeat operation as described in step *d* above.

f. Remove thrust bearing nut (1, figure 3–69) and thrust nut sleeve.

g. Remove crankcase front section flange assembly (1, figure 3–70). Remove retaining ring (3) from flange. Position crankcase front section flange assembly on base of plug and base assembly, part No. 808081, or equivalent. Set this assembly with plug of plug and base on arbor press table and press out oil seal (2). Discard flange packing ring, retaining ring, and oil seal.

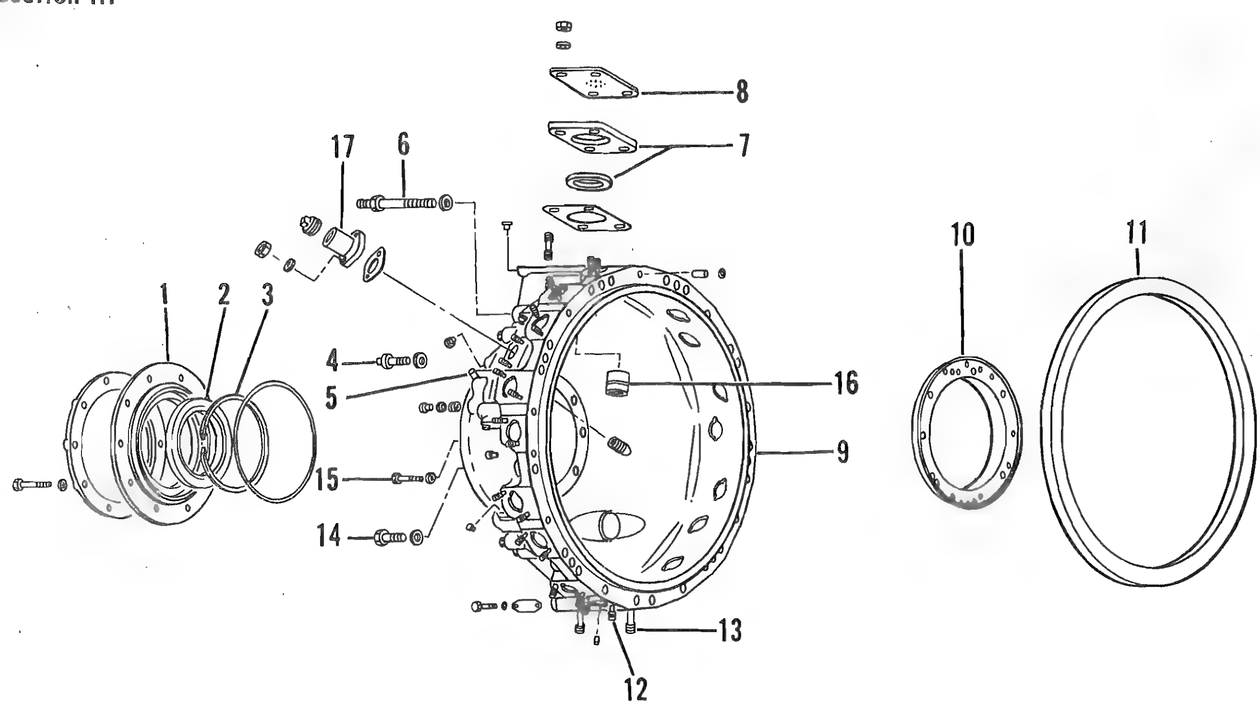
3–302. INSTALLATION.

a. Place crankcase front section flange (1, figure 3–70) on base of plug and base and rest assembly on arbor press table. Place seal (2) on crankcase front section flange. Place plug of plug and



1. Thrust Bearing Nut
2. Thrust Bearing
3. Thrust Bearing Retaining Ring
4. Propeller Shaft Front Bushing
5. Propeller Shaft and Bushing Assembly
6. Propeller Shaft Rear Bushing
7. Hydro Oil Substituting Cover Nut Lock
8. Hydro Oil Substituting Cover

Figure 3–69. Propeller Shaft



1. Crankcase Front Section Flange
2. Oil Seal
3. Retaining Ring
4. Crankcase Front to Main Section Bolt
5. Thrust Bearing Anti-corrosion Compound Fitting
6. Crankcase Front to Main Section Bolt
7. Oil Spinner Air Separator Drive Adapter and Oil Seal
8. Oil Spinner Air Separator Substituting Cover
9. Crankcase Front Section
10. Propeller Shaft Thrust Liner
11. Crankcase Front to Main Section Ring
12. Valve Tappet Guide Stud
13. Oil Sump Stud
14. Crankcase Front to Main Section Bolt
15. Crankcase Front to Propeller Shaft Thrust Liner Support Bolt
16. Oil Spinner Air Separator Drive Shaft Gear Bushing
17. Oil Tank Vent Flange

Figure 3–70. Crankcase Front Section

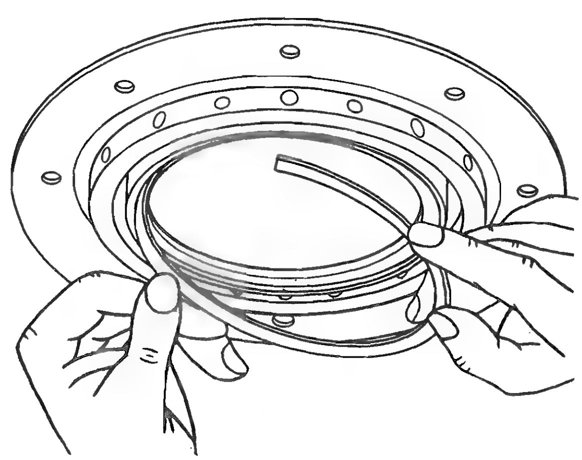
base on top of oil seal and press seal into crankcase front section flange. Lock in place with retaining ring (3). (See figure 3–71.)

b. Assemble thrust bearing nut and nut sleeve. Coat the threads of nut with antiseize compound, Military Standard MS35496, and swab nut sleeve with engine oil. Install nut and sleeve assembly on propeller shaft and run it down fingertight. (See figure 3–72.)

3–303. TIGHTENING.

a. Assemble the thrust nut adapter to the housing. Slide the assembly over propeller shaft, engaging it with thrust bearing nut. (See figure 3–73.)

b. Install splined adapter over propeller shaft splines. Ensure that ball arm of adapter is at left, as viewed facing front of engine, and pointer at top of adapter is at right of its limit of travel as indicated on scale.



3–71. Installing Oil Seal and Retaining Ring

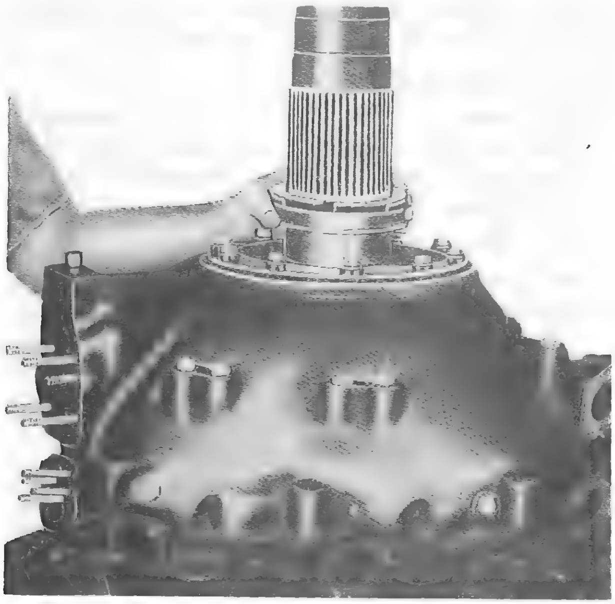


Figure 3–72. Installing Thrust Bearing Nut

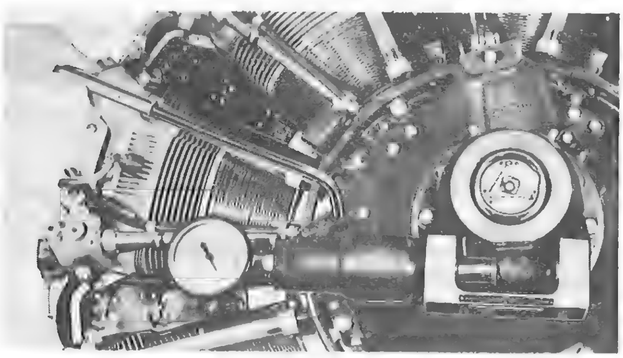


Figure 3–73. Tightening Thrust Bearing Nut

c. Screw the jack and gage assembly into hole at left of housing. If necessary, back off assembly sufficiently to bring gage into full view.

d. Ensure that jack and gage relief valve is closed.

e. Build up pressure until force of ram acting against ball handle of splined adapter turns housing and thrust nut adapter in clockwise direction, causing nut to run down on its thread. Tighten nut to a torque of 14,400 to 15,600 inch-pounds.

Note

The gage reading must be taken when the pointer position on the top of the housing is within the graduated limits.

f. If sufficient torque has not been obtained when pointer is at limit of travel, release the ram pressure, and remove splined adapter. Repeat procedure as outlined in steps *b* through *e* above.

g. When thrust bearing nut has been tightened within proper limits, release relief valve screw. Withdraw jack and gage assembly and withdraw complete wrench assembly.

3–304. CYLINDER AND PISTON ASSEMBLIES.

3–305. Refer to applicable manual listed in Appendix I for instructions of description, removal, replacement, and installation of the cylinder and piston assemblies.

3–306. PUSHRODS AND PUSHROD HOUSINGS.

3–307. Refer to TM 55-1520-202-20, Chapter 2, Section IV, for description, removal, and inspection of pushrods and pushrod housings.

3–308. REPLACEMENT. Replace all pushrods and pushrod housings found defective.

3–309. INSTALLATION. Refer to TM 55-1520-202-20, Chapter 2, Section IV, for installation of pushrods and pushrod housings.

3–310. INTAKE AND EXHAUST VALVES.

3–311. Refer to TM 55-1520-202-20, Chapter 2, Section IV, for description.

3–312. INSPECTION.

a. Refer to TM 55-1520-202-20, Chapter 2, Section IV, for compression test.

b. Refer to applicable manual listed in Appendix I for inspection of intake and exhaust valves.

3–313. ADJUSTMENT.

Note

All operations must be performed on a cold engine.

a. Turn engine, in direction of normal rotation, four revolutions until piston in cylinder No. 1 is at top center on compression stroke.

Note

Use piston position indicator or a calibrated timing disk to determine top center. If the piston is at top center of its compression stroke, both valve tappet rollers are between lobes on the cam and the rocker arm rollers can be lifted from valve stem tips by pressing against the adjusting screw end of the rocker arm. The spring tension under the valve tappet ball socket can also be felt.

b. Press hard against adjusting screw until tappet spring is fully compressed. Insert a 0.010-inch feeler gage between rocker arm rollers and valve tip, parallel to roller pin.

c. Using an adjusting screwdriver, maintain sufficient pressure on adjusting screw to take up all clearance in pushrod and valve tappet assembly and turn in screw until feeler gage binds. Back off adjusting screw only enough to permit removal of feeler gage. Tighten lockscrew sufficiently so adjusting screw will not turn when crankshaft is rotated. Adjust valve clearances on each successive cylinder in firing order (1-3-5-7-9-2-4-6-8-) with corresponding cylinder on top center of compression stroke. On initial adjustment, all valves shall be adjusted to specified clearance without regard to location of oil holes in adjusting screw.

d. Conduct a second valve clearance check as outlined in step *c.* If zero reference on top of adjusting screw is closer than 0.060 inch to nearest edge of slot in rocker arm, turn adjusting screw in direction to increase clearance until 0.060 inch limit is obtained. In no case will valve clearance violate allowable limits of 0.010 to 0.017 inch.

e. Conduct third valve clearance check to insure that all valves are within allowable limits. Readjust any clearance found to be out of tolerance.

f. Conduct a fourth and final valve clearance check. Reset any clearances found out of adjustment. This fourth check is performed in order that valve clearances may be checked between each of the four cam lobes.

Note

If maximum valve clearance of 0.017 inch is exceeded when reference marks are properly aligned, replace the adjusting screw and readjust valve clearance.

g. After valve clearance checks have been completed, tighten lockscrews to a torque of 250 to 300 inch-pounds. Lockscrews must be tightened sufficiently so as a torque of 350 inch-pounds will not turn the adjusting screw. If adjusting screw turns when above torque is applied, readjust clearance of effected valve. Tighten lockscrew, but do not tighten more than necessary to obtain required torque value on adjusting screw.

3–314. CYLINDER AIR DEFLECTOR AND BAFFLES.

3–315. Refer to TM 55-1520-202-20, Chapter 2, Section IV, for description, removal, and inspection.

3–316. REPAIR.

a. Blend out dents and bends of baffle or deflector surfaces.

b. Stop-drill cracks.

3–317. INSTALLATION. Refer to TM 55-1520-202-20, Chapter 2, Section IV for installation.

3–318. INTAKE PIPES.

3–319. Refer to TM 55-1520-202-20, Chapter 2, Section IV, for description, and inspection. Refer to applicable manual listed in Appendix I for removal of intake pipes.

3–320. REPLACEMENT. Refer to conditions found during inspection procedures. Replace defective intake pipes.

3–321. INSTALLATION.

a. Remove covers from intake ports of supercharger and cylinders.

b. Position new packing ring on cylinder end of each intake pipe. Slide triangular attaching flange over each intake pipe from supercharger end and seat against packing ring.

Note

Flanges of intake pipe for cylinders No. 4, 5, 6, and 7 are integral with intake pipes. These intake pipes incorporate drain tubes for lower cylinder drainage.

c. Position gasket on each cylinder intake port.

d. Position packing nut on supercharger end of each intake pipe.

e. Insert intake pipe into supercharger port. Adjust flange on cylinder end of intake pipe and slide up to cylinder port. Secure flange to cylinder with bolts and washers.

f. Tighten packing nut at supercharger end to a torque of 250 to 275 inch-pounds.

3–322. MAGNETO.

3–323. REMOVAL.

a. Disconnect electrical plugs from magneto.

b. Cut lock wire from mounting nuts and remove nuts and washers from mounting studs.

c. Support magneto and pull straight out from engine until magneto drive shaft and coupling are completely disengaged from accessory drive mechanism.

3–324. OVERHAUL. Refer to applicable manual listed in Appendix I for overhaul instructions.

3–325. INSTALLATION.

a. Position magneto on studs of accessory drive mechanism pad. Align magneto drive shaft and coupling with coupling of accessory drive mechanism. Mate couplings and move magneto into position on mounting studs.

b. Secure magneto on mounting studs with washers and nuts.

c. Secure nuts with lock wire.

d. Connect electrical plugs to magneto.

3–326. IGNITION HARNESS AND CONDUIT.

3–327. REMOVAL.

WARNING

Be sure ignition switch is in OFF position and all electrical power is disconnected.

a. Disconnect primary lead to magneto.

b. Disconnect leads to high tension coil.

c. Remove bolts securing ignition manifold to power plant.

d. Remove spark plug lead clamps.

e. Remove ignition manifold and harness.

3–328. REPAIR. Refer to applicable manual listed in Appendix I for repair and test procedures.

3–329. INSTALLATION.

WARNING

Be sure ignition switch is in OFF position and all electrical power is disconnected.

a. Position ignition manifold and harness to power plant and secure with bolts.

b. Install spark plug lead clamps.

c. Connect leads to high tension coil.

d. Connect primary lead to magneto.

3–330. FRONT OIL SUMP.

3–331. Refer to applicable manual listed in Appendix I for removal, repair, and replacement of front oil sump.

3–332. ACCESSORY OVERHAUL (FOURTH ECHELON).

3–333. STARTER. Refer to paragraph 3–39 for removal. Refer to applicable manual listed in Appendix I for overhaul procedures. Refer to paragraph 3–114 for installation.

3–334. FUEL PUMP. Refer to paragraph 3–48 for removal. Refer to applicable manual listed in Appendix I for repair or overhaul of engine-driven fuel pump. Refer to paragraph 3–120 for installation.

3–335. HYDRAULIC PUMP. Refer to paragraph 3–51 for removal. Refer to applicable manual listed in Appendix I for overhaul procedures. Refer to paragraph 3–125 for installation.

3–336. CARBURETOR. Refer to paragraph 3–36 for removal. Refer to applicable manual listed in Appendix I for repair or overhaul procedures. Refer to paragraph 3–134 for installation.

3–337. AUTOMATIC MIXTURE CONTROL. The automatic mixture control is a portion of the carburetor. Overhaul should be accomplished during overhaul of carburetor. Refer to applicable manual listed in Appendix I for overhaul procedures.

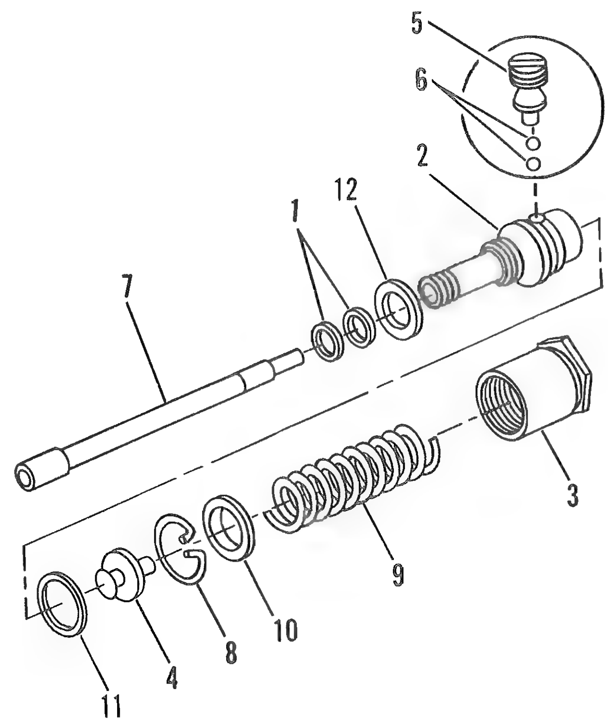
3–338. SUPERCHARGER DRAIN VALVE.

3–339. REMOVAL.

a. Disconnect drain line from supercharger drain valve connection on right side of supercharger housing.

b. Using an open end wrench, remove complete supercharger drain valve assembly from supercharger rear section. Discard two rings (1, figure 3–74) located in groove in small diameter end of valve body (2).

c. If valve housing (3) is removed from valve body, leaving body in supercharger section, remove



1. Rings
2. Valve Body
3. Valve Housing
4. Piston and Disc Assembly
5. Retaining Screw
6. Check Balls
7. Return Tube
8. Circlet
9. Valve Spring
10. Retainer
11. Packing Ring
12. Washer

Figure 3–74. Supercharger Drain Valve

valve body with wrench, part No. 800821, or equivalent.

d. To remove valve assembly as a unit, hold flats on body with holder, part No. 800523, or equivalent, and remove valve housing from body. Do not drop piston and disc assembly (4).

3–340. DISASSEMBLY. (See figure 3–74.)

a. Remove retaining screw (5) from side of body and shake out two small check balls (6). Do not drop balls.

b. Pull return tube (7) from valve body.

c. Using a pair of needle nose pliers, remove circlet (8) securing valve spring (9) and retainer (10) in valve housing. Remove retainer and spring from housing.

3–341. CLEANING. Clean supercharger drain valve with dry-cleaning solvent, Federal Specification P-S-661.

3–342. INSPECTION. Inspect for damaged threads, resiliency of spring, and cracked housing.

3–343. REPAIR. Replace any damaged or worn parts.

3–344. REASSEMBLY. Make sure there is no foreign material on valve body or ball check valves.

a. Assemble valve spring (9, figure 3–74) and retainer (10) in valve housing (3) insuring lugs on retainer face are away from spring. Install circlet (8) with needle nose pliers.

b. Insert one check ball (6) through valve body (2). Tip body to seat ball in bottom center of body. Insert other ball through screw hole at side of body. Install retaining screw (5), ensuring that balls are not jammed. Check by shaking assembly. If balls do not rattle, adjust retaining screw.

c. Lubricate a new packing ring (11) with antiseize compound, Military Standard MS35496, and install it on outer end of valve body.

d. Install piston and disc assembly (4) by inserting large diameter end of assembly into hole in valve body. Assemble valve housing to valve body and tighten.

e. Insert small end of return tube (7) into valve body, using a fiber mallet to seat tube.

3–345. INSTALLATION. (See figure 3–74.)

a. Coat two new rings (1) with antiseize compound, Military Standard MS35496. Install washer (12) and rings (1) on valve body (2).

b. Install supercharger drain valve to supercharger rear housing with washer on flange of valve body. Insert entire assembly into supercharger rear housing and tighten with open end wrench.

c. Connect drain line to supercharger drain valve connection at right side of supercharger rear housing.

d. Secure supercharger drain valve with lock wire.

3–346. FUEL SYSTEM.

3–347. DESCRIPTION. (See figure 3–75.) The fuel system is an open-vent system consisting of three main tanks, three fuel tank sumps, two electric transfer pumps, a level control valve, an overflow safety system, low pressure warning system, low level warning system, one electric booster pump, a fuel selector valve system, an engine-driven fuel pump, an electrically operated priming system, fuel pressure and fuel quantity indicating systems, and necessary tubes and hoses 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 pilots' 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 on 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.

3–348. FUEL TANKS.

3–349. FORWARD FUEL TANK. (See figure 3–76.)

3–350. 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

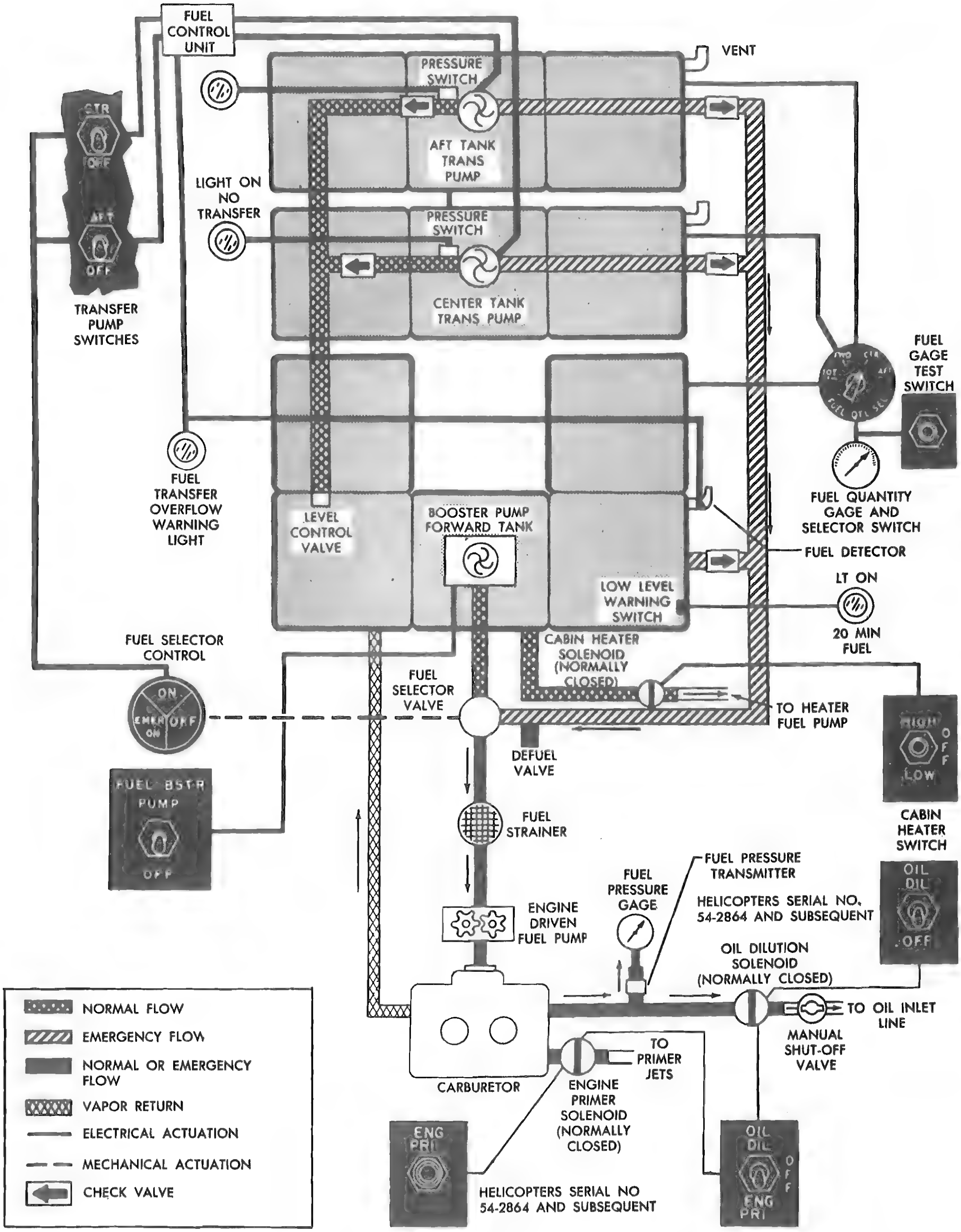


Figure 3–75. Fuel System Schematic

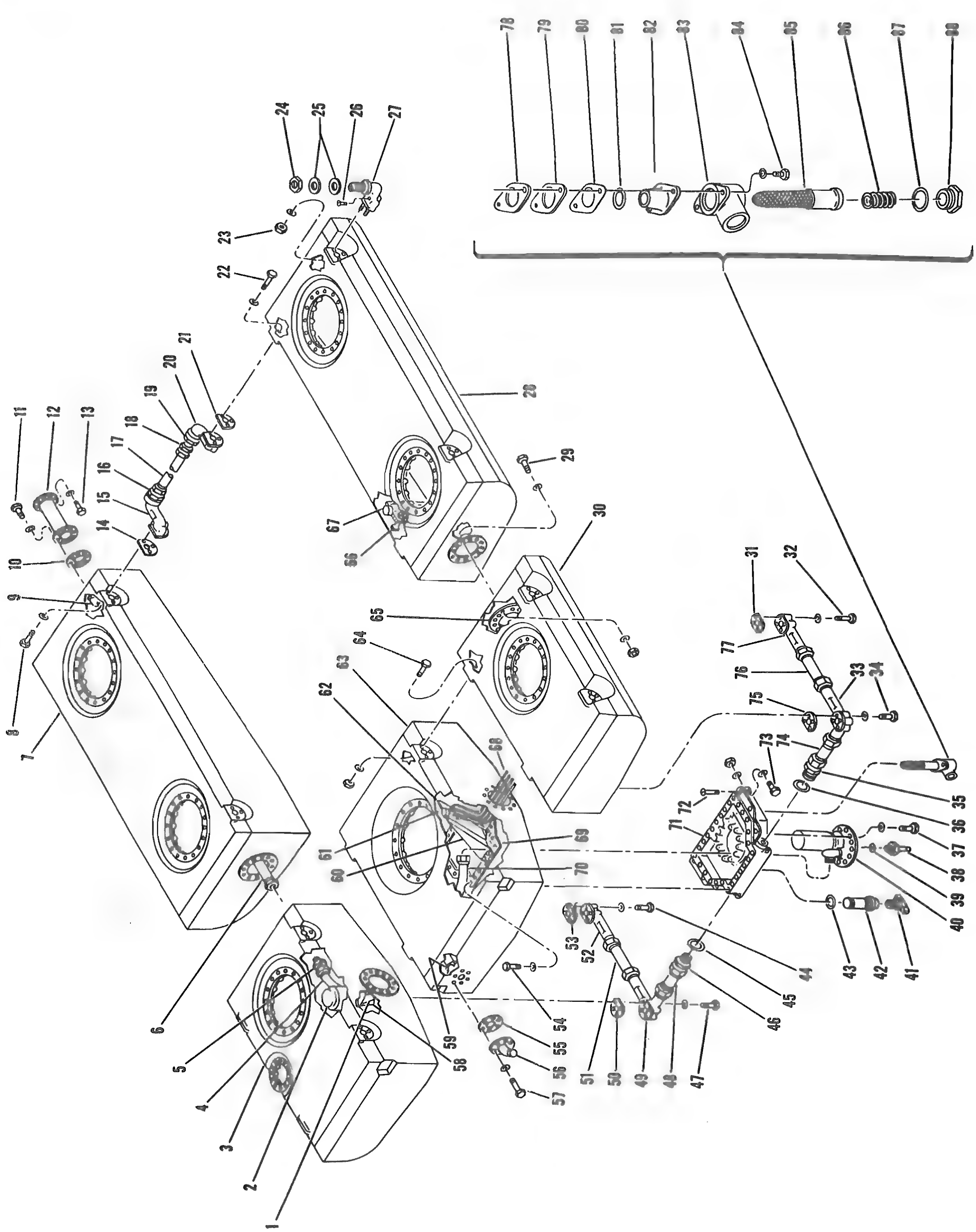


Figure 3-76. Forward Fuel Cells Installation (Sheet 1 of 2)

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
   **Washer, Nut
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
    **Washer, Nut
23. Washer, Nut
24. Nut
25. Washer
26. Screw
27. Vent Fitting
28. Aft Left Cell
29. Bolt, Washers, Nut
30. Forward Left Cell
31. Gasket
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, Swivel Flange
59. Booster Pump Outlet Tube Fitting
60. Bracket
61. Fuel Quantity Tank Probe
62. Bracket
63. Forward Center Cell
64. Bolt, Washer, Nut
65. Flange
66. Mounting Post, Washer, Nut
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. Plate
80. Gasket
81. Gasket
82. Standpipe
83. Strainer Housing
84. †Bolt, Washer
    ††Washer, Nut
85. Strainer
86. Spring
87. Gasket
88. Plug

*Helicopters Serial No. Prior to 57-1726.
**Helicopters Serial No. 57-1726 and Subsequent.
†Helicopters Serial No. Prior to 55-4497.
††Helicopters Serial No. 55-4497 and Subsequent.

Figure 3–76. Forward Fuel Cells Installation (Sheet 2 of 2)

left cell each contain 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.

3–351. REMOVAL. Before accomplishing any work on the fuel system, refer to paragraph 3–352. To remove individual cells, refer to table 3–VIII and accomplish as much of each indicated step as applies to a particular cell.

WARNING

A fire extinguisher that will extinguish a fuel fire should be on hand at all times.

Table 3–VIII. Removal of Individual Fuel Cells – Forward Tank

TO REMOVE	REFER TO PARAGRAPH 3–351, STEPS:
Forward left cell	*a* through *c*, *o*, through *v*, *ab*, *ac*
Forward center cell	*a* through *e*, *i*, *m*, *n*, *p*, *q*, *s* through *v*, *ab*, *ac*
Forward right cell	*a* through *c*, *e*, *j*, *k*, *o* through *v*, *ab*, *ac*
Aft left cell	*a* through *c*, *f* through *o*, *q* through *s*, *w* through *y*, *ab*, *ac*
Aft right cell	*a*, *f*, *g*, *j* through *l*, *q* through *s*, *w*, *s*, *aa* through *ac*

CAUTION

Exercise extreme care when handling 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 cells. Upper limit of temperature is 71°C (160°F).

a. Drain and purge all fuel cells.

b. Remove bolts and washers (2 and 3, figure 3–77) securing forward center and forward left access covers (1 and 4) to cabin floor. Remove covers and gaskets (5 and 56).

c. Remove bolts and washers (55) securing center cell cover (54) to support (51). Remove bolts and washers (6) securing forward left cell cover to support (14). Lift cell cover up and disconnect four connectors (7, 8, 9, and 10) to tank probe. Remove covers and gaskets.

Note

Remove acid-resistant lacquer from area around connectors at top of cell cover with thinner, Federal Specification TT-T-266.

d.* Remove tank sump. (Refer to paragraph 3–378.)

Note

If only forward left cell is being removed, remove clip and pull probe leads into center cell.

e. Remove level control valve. (Refer to paragraph 3–392.)

f. Remove bolts and washers (15 and 25) securing each of aft cell access covers (16 and 26) to cabin floor. Remove covers and gaskets (17 and 27).

g. Remove bolts and washers (18 and 28). Remove aft cell covers (21 and 29) and gaskets (22 and 30) from supports (24 and 32).

Note

At forward access hole of aft left cell only, disconnect probe leads from each end of connectors in cell cover while removing cover.

h. Remove washers and nuts from mounting post (66, figure 3–76) securing fuel quantity tank probe (67) to mounting posts in aft left cell (28). Remove probe.

i. Remove fuel quantity tank probe (61) from forward center cell (63). Disconnect booster pump outlet tube (70) from booster pump outlet tube fitting (59) at forward wall of cell. Remove tube.

j. Disconnect short transfer pump tube (4) from reducer (5) in forward right cell (3). Remove tube. Remove reducer from long transfer pump tube (6).

Note

If only aft right cell is being removed, remove access cover and cell cover from forward right cell before disconnecting short transfer pump tube.

k. Remove screw, washers, and nut from clip around transfer pump tube at front of aft right cell (7). Remove clip.

Note

If only forward right cell is being removed, remove forward access cover and cell cover from aft right cell before removing clip and bracket.

l. Disconnect long transfer pump tube (6) from fitting (9) at aft wall of aft right cell (7).

Note

Leave tube inside cells at this time.

m. Remove clutch access door from cabin forward bulkhead. Remove fuel tube located just forward of bulkhead. Loosen jamnut and remove elbow and gasket from fuel strainer fitting. Remove bolts and washers securing small access door to fitting. Remove screws securing access door to floor. Remove door and gaskets from strainer fitting flange.

n. Remove bolts and washers (57) securing booster pump outlet tube fitting (56) and gasket (55) to forward surface of bulkhead. Remove corresponding booster pump outlet tube fitting (59) from forward center cell (63).

o. Remove washers and nuts (23) from three overboard vent fittings (27) inside the forward right cell (3), forward left cell (30), and aft left cell (28).

Note

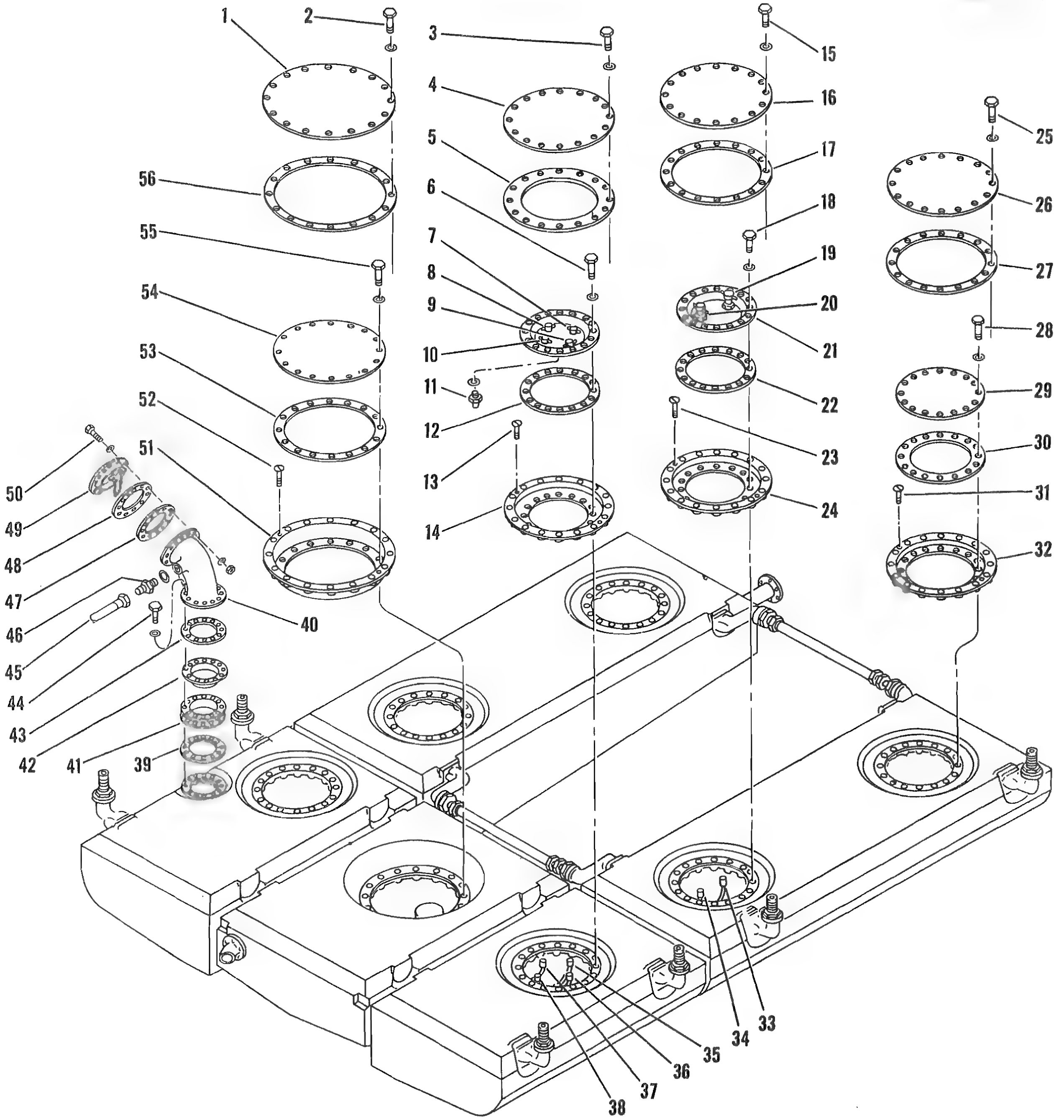
On helicopters serial No. 53-4475 through 53-4477, remove bolts and washers from overboard vent fittings.

p. Remove bolts, washers, and nuts (64) at two interconnecting vent fittings between each forward cell.

q. Remove bolts, washers, and nuts (29) securing cell at interconnecting hole in forward wall of each aft cell and each side wall of forward center cell (63). Remove bracket secured at flange in aft right cell (7) and bracket secured at flange in forward left cell (30).

Note

If only forward left cell or forward center cell is being removed, remove access cover and cell cover from adjacent cell or cells before removing bolts, washers, and nuts which interconnect cells. If only forward right cell is being removed, remove center cell access cover and cell cover before removing bolts, washers, and nuts which interconnect cells.



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. Spacer
40. Elbow
41. Gasket
42. Collar
43. Gasket
44. Bolt, Washer
45. Vapor Return Line
46. Union
47. Gasket
48. Gasket
49. Filler Cap
50. Bolt, Washers, Nut
51. Support
52. Screw
53. Gasket
54. Cell Cover
55. Bolt, Washer
56. Gasket

Figure 3–77. Forward Fuel Tank

r. Remove plates from beneath helicopter below external fuel tubes leading to sump (71). Remove interconnecting tubes (48, 51, 74, and 76). Remove bolts and washers (32, 34, 44, and 47) securing fittings (33, 49, 52, and 77) below each outside cell. Remove each fitting and gasket (31, 50, 53, and 75).

s. Remove screws (13, 23, 31, and 52, figure 3–77) securing cell cover supports (14, 24, 32, and 51) to lower surface of floor panel at each cell access hole. Lay supports on cells.

Note

Each cell cover support must be detached from floor panel regardless of number of forward cells that are being removed.

t. Remove bolts, washers, and nuts (50) securing filler cap flange (49) and elbow (40) to scupper in right cabin wall. Remove filler cap and flange and gasket (48). Disconnect vapor return line (45) from union (46) in elbow.

u. Remove bolts and washers (44) securing elbow (40) to floor panel. Remove elbow and gasket (47), gasket (43), and collar (42), leaving gasket (41) and spacer (39) in position in floor panel.

v. Remove bolts securing floor panel over forward cells. Remove floor panels.

w. Remove bolts securing floor panel over aft cells and hatch. Remove floor panels.

x. Remove bolts and washers or washers and nuts (8 and 22, figure 3–76) from two interconnecting vent tube fittings (15 and 20) inside each aft cell.

y. On helicopters serial No. 57-1726 and subsequent, remove tube (17). Support vent tube fittings (15 and 20). Remove washer and nuts from two interconnecting vent tube fittings (15 and 20) inside each aft cell. Remove fittings and gaskets (14 and 21).

z. Remove washers and nuts securing mounting posts (66) inside aft left cell (28). Remove posts.

aa. Remove bolts and washers (11) securing transfer pump tube fitting (9) to aft wall of aft right cell (7). Remove fitting. Remove long transfer pump tube (6) from cell through aft access hole.

ab. Remove cell cover support or supports (14, 24, 32, and 51, figure 3–77) from top of each cell.

ac. Deflate each cell as much as possible and remove it from bottom structure cavity.

CAUTION

Do not damage cells on projecting fittings or flanges within cavities while removing cells from bottom structure.

Note

Refer to applicable manual listed in Appendix I for disposition of cells.

3–352. CLEANING AND INSPECTION. The following precautionary measures should be taken while working on any component of fuel system:

WARNING

A fire extinguisher that will extinguish a fuel fire should be on hand at all times.

a. Exercise extreme care when handling fuel cells in temperatures below 4.4°C (40°F). In regions where temperatures of 4.4°C (40°F) and below exist, make provision to heat cabin section while working on cells. Upper limit of temperature is 71°C (160°F).

b. Insure that all fuel tanks are purged before working on any section of fuel system.

c. Inspect interior of each cell housing for cleanness. Remove all foreign objects and make certain cell housing is free of sharp metal edges, burrs, and filings before installing cell.

d. Inspect interior of each cell. Clean each cell thoroughly and remove all foreign matter.

e. Use a lint-free cloth only in cleaning fuel cells.

f. Clean any fuel cells preserved with glycerine with water and a lint-free cloth until all traces of glycerine have been removed.

g. Clean all plumbing lines and hoses with a high pressure air blast and then cap until time of installation. If cap is removed for any reason, reclean line prior to installation.

h. Remove and inspect fuel strainers after first engine run following any change of major component in fuel system. If foreign matter appears on any of strainers, reclean fuel system as necessary.

3–353. REPAIR (FOURTH ECHELON). Refer to applicable manual listed in Appendix I.

Table 3–IX. Installation of Individual Fuel Cells – Forward Tank

TO INSTALL	REFER TO PARAGRAPH 3–354, STEPS:
Forward left cell	*a* through *d*, *i* through *l*, *n*, *p*, *u*, *v*, *y* through *ac*
Forward center cell	*a* through *d*, *i* through *l*, *n*, *q*, *r*, *t* through *x*, *z* through *ac*
Forward right cell	*a* through *d*, *i* through *p*, *s*, *u* through *x*, *z*, *ab*, *ac*
Aft left cell	*a* through *d*, *f*, *h*, *l*, *n*, *u*, *v*, *y* through *ac*
Aft right cell	*a* through *e*, *g*, *h*, *l* through *n*, *s*, *v*, *y*, *aa* through *ac*

3–354. INSTALLATION. To install an individual cell, refer to table 3–IX and accomplish as much of each indicated step as applies to that particular cell.

CAUTION

Exercise extreme care 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 cells. Upper limit of temperature is 71°C (160°F).

Note

Apply antiseize compound, Federal Specification TT-A-580, to the threads of all fittings.

a. If new cell is being installed, remove it from its shipping container in accordance with applicable manual listed in Appendix I.

b. Inspect bottom structure cell cavities for cleanness and make certain cavities are free of sharp metal edges, burrs, and filings.

c. Deflate cells as much as possible and position them in bottom structure cavities. Align openings in each cell with corresponding openings in bottom structure.

CAUTION

Care must be taken while inserting cells into bottom structure to avoid damaging cells on projecting fittings or flanges within cavities.

d. Lay cell cover supports (14, 24, 32, and 51, figure 3–77) on top of each cell.

e. Insert long transfer pump tube (6, figure 3–76), into aft right cell (7) through aft access hole.

CAUTION

Do not damage cell while installing tube. Forward end of tube protrudes into forward right cell through interconnecting hole.

f. Install mounting posts (66) inside aft left cell (28) and secure them with washers and nuts. Position fuel quantity tank probe (67) against posts and secure with washers and nuts.

g. Secure transfer pump tube fitting (9) to aft wall of aft right cell (7) with bolts and washers (11). Secure bolts with lock wire. Connect long transfer pump tube (6) to fitting.

h. Install floor panel over aft cells and hatch. Secure panel with bolts and washers.

i. Install floor panel over forward cells and secure it with bolts and washers.

j. Check to see that gasket (41, figure 3–77) and spacer (39) are correctly positioned at filler hole in floor panel. Position collar (42) and gasket (43). Position elbow (40) over hole and secure it to floor panel with bolts and washers (44). Tighten bolts to a torque of 25 to 30 inch-pounds. Secure bolts with lock wire. Connect vapor return line (45) to union (46) in elbow.

Note

Be sure spacer is placed within rims of gasket. Thin section of spacer should be positioned under frame.

k. Position filler cap flange (49) against outer surface of scupper. Secure filler cap flange and elbow (40) to scupper with bolts, washers, and nuts (50).

l. Secure cell cover support (14, 24, 32, and 51) to lower surface of floor panel at each cell access hole with screws (13, 23, 31, and 52).

m. Secure cells at interconnecting hole in forward wall of aft right cell (7, figure 3–76) with bolts, washers, and nuts (29). Use two most inboard nuts to secure the bracket against aft cell. Install clip around transfer pump tube and secure to bracket with screw, washers, and nut.

Note

If only forward right cell is being installed, install forward cell cover and access cover on aft right cell.

n. Install bolts and washers or washers and nuts (8 and 22) at two interconnecting vent tube fittings (15 and 20) inside each cell. Secure bolts or nuts with lock wire.

o. On helicopters serial No. 57-1726 and subsequent, position gaskets (21 and 14) on vent tube fittings (20 and 15.) Insert fittings through interconnecting vent ports in aft cell. Secure fittings with washers and nuts. Install tube (17).

p. Install washers and nuts (23) at three overboard vent fittings (27) inside forward right cell (3), forward left cell (30), and aft left cell (28).

Note

On helicopters serial No. 53-4475 through 53-4477, secure overboard vent fittings with bolts and washers. Secure bolts with lock wire.

q. Position booster pump outlet tube fittings (59) at forward wall of forward center cell (63). Install corresponding booster pump outlet tube fitting (56) and gasket (55) on forward surface of bottom structure bulkhead. Secure two fittings with bolts and washers (57). Secure bolts with lock wire.

Note

Access to forward surface of bottom structure bulkhead is gained through small door in floor just forward of cabin forward bulkhead (Refer to paragraph 3–351, step *m*.)

r. Install gaskets and access door on fuel strainer fittings flange just forward of cabin forward bulkhead. Install as many gaskets on strainer fitting flange as are required to prevent bending of access door when bolts and washers are installed. Secure door to floor with screws. Secure door and gaskets to strainer fitting flange with bolts and washers. Install gasket, jamnut, and elbow in strainer fittings. Tighten jamnut. Install fuel tube and clutch access door.

s. Install reducer (5) in end of long transfer pump tube (6) in forward right cell (3). Connect short transfer pump tube (4) to reducer.

Note

If only aft right cell is being installed, connect short tube to level control valve (2) and install cell cover and access cover on forward right cell.

t. Insert booster pump outlet tube (70) into forward center cell (63) and connect it to booster pump outlet tube fitting (59) at forward wall of cell. Lay fuel quantity tank probe (61) inside cell.

u. Secure cells at interconnecting hole in forward wall of aft left cell and each side wall of forward cell with bolts, washers, and nuts (29). Install bracket on lower bolt in forward left cell (30).

Note

Tighten nuts only fingertight.

v. Inspect each cell for cleanliness. Wipe cells clean of all dirt and foreign material with clean, soft cloth dampened with water.

w. Install level control valve. (Refer to paragraph 3–393.)

Note

If only forward left cell is being installed, pull probe leads through interconnecting hole from forward center cell and install clip.

x. Install tank sump, but do not install access cover. (Refer to paragraph 3–380.)

Note

Do not fill fuel tanks at this time.

y. Install external fuel tube fitting (33, 49, 52, and 77, figure 3–76) and gasket (31, 50, 53, and 75) at bottom of helicopter below each outside cell. Secure each fitting with bolts and washers (32, 34, 44, and 47). Secure bolts with lock wire. Install each external fuel tube. Do not install plates at this time.

z. Tighten bolts, washers, and nuts (29) that secure flanges at interconnecting hole in forward wall of aft left cell (28) and each side wall of forward cell.

Note

If only individual cell is being installed, install cell cover and access cover on adjacent cell or cells. If only forward right cell is being installed, install cell cover and access cover on forward center cell.

aa. Install cell covers (21, 29, and 54, figure 3–77) and gaskets (12, 22, 30, and 53) and access covers (1, 4, 16, and 26) and gaskets (5, 17, 27, and 56) for all cells. Secure them with bolts and washers (2, 3, 6, 15, 18, 25, 28, and 55). Secure bolts (6, 18, 28, and 55) with lock wire, securing cell covers.

Note

Bolts that secure cell cover to support also secure nut ring, which is part of cell, to support. To assist in positioning nut ring, thread one end of piece of drill rod that is 8 to 10 inches long and same diameter as bolt. Insert end of drill rod through one of holes in support and screw it into corresponding hole in nut ring. Raise nut ring into position against support and use drill rod to hold nut ring in position while installing and securing cell cover.

Note

At forward left cell access hole and at forward access hole of aft left cell, connect probe leads to each end of connectors in cell cover while installing cover.

Note

When installing connectors, apply acid-resistant lacquer, Federal Specification TT-L-54, to area around the connectors at top of cell covers.

3–355. TESTING.

a. Disconnect transfer line at connector in aft end of forward tank aft right cell to pressure test fuel tank. Cap connector.

b. Disconnect overboard vent tubes at fittings in cabin walls and plug vent tubes.

c. Disconnect heater fuel line at forward tank sump and plug port.

d. Disconnect booster pump outlet tube at elbow on top of selector valve and plug line.

e. Disconnect emergency fuel line at elbow under selector valve and plug line.

f. Disconnect vapor return line from union on filler elbow of forward tank and cap union.

g. Connect water-filled manometer, graduated up to 34 inches in increments of 1/16 inch, to source of air pressure. Apply 1 psi pressure to one filler elbow. Drop in pressure must not exceed 1/16 inch of water within period of 15 minutes.

Note

Do not attempt to pressure test fuel cells in extreme temperatures.

h. Remove plugs and connect lines disconnected in steps *a* through *g* above.

i. Fill all cells with proper grade fuel. Check all external connections for leakage.

j. Install access plates and covers at bottom of helicopter.

3–356. CENTER FUEL TANK. (See figure 3–78.)

3–357. 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.

Table 3–X. Removal of Individual Fuel Cells – Center Tank

TO REMOVE	REFER TO PARAGRAPH 3–358 STEPS:
Left cell	*a* through *d*, *o* through *w*, *y*
Center cell	*a* through *b*, *p* through *s*, *u* through *w*, *y*
Right cell	*a* through *f*, *i* through *y*

3–358. REMOVAL. Before accomplishing any work on fuel system, refer to paragraph 3–352. To remove individual cell, refer to table 3–X and accomplish as much of each indicated step as applies to particular cell.

CAUTION

Exercise extreme care when handling 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 cabin section while working on cells. The upper limit of temperature is 71°C (160°F).

a. Drain and purge all fuel cells.

b. Remove low pressure warning switch from center cell forward cell cover. (Refer to paragraph 3–401, steps *b* through *h*.)

c. Remove bolts and washers (11, figure 3–78) securing each access cover (12) to cabin floor. Remove each cover and gasket (13).

d. Remove bolts and washers (14) securing each cell cover (15) to support (18). Remove each cover and gasket (16).

e. Remove screw, washers, and nut from bracket clamp (52) around short transfer pump tube (51) at interconnecting hole in right cell (64).

f. Disconnect short transfer pump tube (51) from check valve and gasket (55) at front of right cell (64) and from tee (50) in center cell (10). Remove tube.

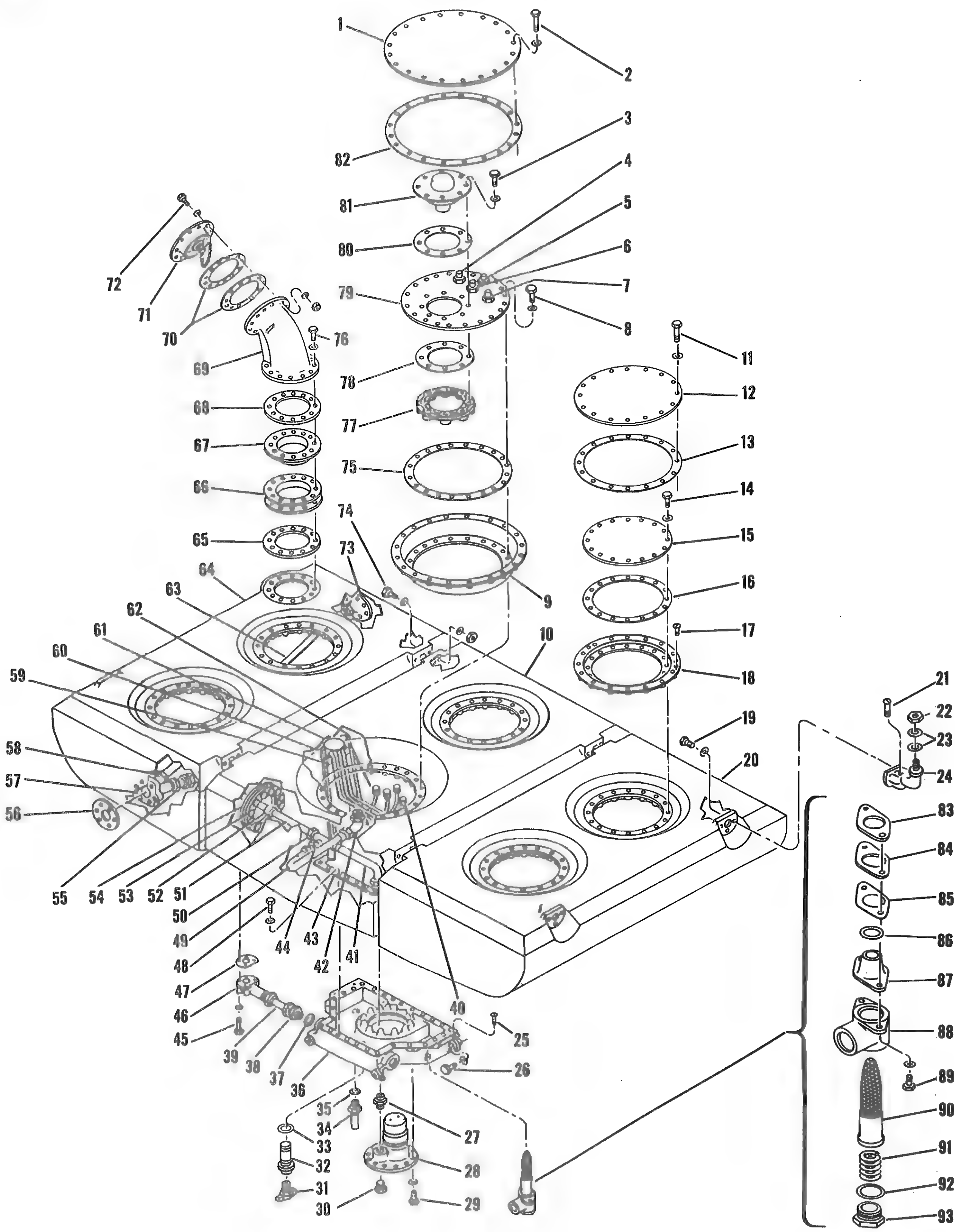


Figure 3–78. Center Fuel Tank (Sheet 1 of 2)

1. Access Cover	25. Screw	49. Flexible Hose	72. Bolt, Washers, Nut
2. Bolt, Washer	26. Bolt, Washer	50. Tee	73. Connector
3. Bolt, Washer	27. Nipple	51. Short Transfer Pump Tube	74. Bolt, Washers, Nut
4. Connector	28. Transfer Pump	52. Bracket Clamp	75. Gasket
5. Connector	29. Bolt, Washer	53. Bolt, Washer, Nut	76. Bolt, Washer
6. Connector	30. Plug	54. Flanges	77. Nut Ring
7. Connector	31. Drain Valve	55. Check Valve, Gasket	78. Gasket
8. Bolt, Washer	32. Corrosion Inhibitor Cartridge	56. Gasket	79. Cell Cover
9. Support	33. Gasket	57. Y-Connector	80. Gasket
10. Center Cell	34. Drain Fitting	58. Union, Gasket	81. Pressure Warning Switch
11. Bolt, Washer	35. Gasket	59. Screw, Spacer	82. Gasket
12. Access Cover	36. Sump	60. Bracket	83. Gasket
13. Gasket	37. Gasket	61. Fuel Quantity Tank Probe	84. Plate
14. Bolt, Washer	38. Union	62. Bracket	85. Gasket
15. Cell Cover	39. Interconnecting Tube	63. Long Transfer Pump Tube	86. Gasket
16. Gasket	40. Probe Leads	64. Right Cell	87. Stand Pipe
17. Screw	41. Transfer Pump Outlet Tube	65. Gasket	88. Strainer Housing
18. Support	42. Nut, Gasket, Elbow	66. Spacer	89. *Bolt, Washer **Washer, Nut
19. Bolt, Washer	43. Sealing Flange	67. Collar	90. Strainer
20. Left Cell	44. Bushing, Nut, Gasket	68. Gasket	91. Spring
21. Screw	45. Bolt, Washer	69. Elbow	92. Gasket
22. Nut	46. Fitting	70. Gasket	93. Plug
23. Washer	47. Gasket	71. Filler Cap and Flange	
24. Vent Fitting	48. Bolt, Washer		

*Helicopters Serial No. Prior to 55-4497.

**Helicopters Serial No. 55-4497 and Subsequent.

Figure 3–78. Center Fuel Tank (Sheet 2 of 2)

g. Disconnect flexible hose (49) from bushing in tee (50) in center cell (10). Remove hose. Disconnect transfer pump outlet tube (41) from transfer pump (28). Remove tube and tee.

h. Remove tank sump. (Refer to paragraph 3–378.)

i. Disconnect long transfer pump tube (63) from union and gasket (58) and connector (73) at each end of right cell (64).

Note

Leave tube inside cell at this time.

j. Remove access covers (26, figure 3–77) from aft cells of forward tank. Remove screws (31) which secure supports (32) to floor panel.

k. Remove bolts and washers securing floor panel over hatch and aft cells of forward tank. Remove floor panel.

l. Remove bolts and washers (13, figure 3–76) from aft end of transfer connector (12) in bottom structure cavity just forward of right cell (64, figure 3–78). Remove Y-connector (57) and check valve and gasket (55) from inside right cell. Remove union and gasket (58), and gaskets from connector.

m. Remove forward access cover and cell cover from right cell of aft tank. (Refer to paragraph 3–365, steps *c* and *d.*)

n. Remove bolts, washers, and nuts (61, figure 3–79) securing connector (73, figure 3–78) to aft wall of right cell (64). Remove connector.

o. Remove bolts and washers (19) from single overboard vent fitting (24) in right cell (64) and two overboard vent fittings in left cell (20).

Note

On helicopters serial No. 53-4537 through 53-4554, washers and nuts are used.

p. Remove bolts, washers, and nuts (53) securing flanges (54) at interconnecting hole in each cell. Remove flanges. Remove bracket clamp (52) secured at flange in right cell (64).

q. Remove bolts, washers, and nuts (74) at two interconnecting vent fittings between each cell.

r. Remove bolts, washers, and nuts (72) that secure filler cap and flange (71) and elbow (69) to scupper in right cabin wall. Remove filler cap and gaskets (70).

s. Remove bolts and washers (76) that secure elbow (69) to floor panel. Remove elbow and gasket (70), and remove gasket (68) and collar (67), but leave gasket (65) and spacer (66) in position in floor panel.

t. Remove plates from beneath helicopter below interconnecting tubes (39) leading to sump (36). Remove tubes. Remove bolts and washers (45) that secure fittings (46) below right cell (64), and left cell (20). Remove each fitting and gasket (47).

u. Remove screws (17), securing cell cover supports (9 and 18) to lower surface of floor panel at each cell access hole. Lay each support on cell.

Table 3–XI. Installation of Individual Fuel Cells – Center Tank

TO INSTALL	REFER TO PARAGRAPH 3–361, STEPS:
Left cell	*a* through *d*, *f* through *l*, *p*, *q*, *x*, *ab*
Center cell	*a* through *d*, *f* through *k*, *p*, *r* through *t*, x through *ab*
Right cell	*a* through *q*, *t* through *ab*

v. Remove bolts and washers that secure floor panel over center tank. Remove panel.

w. Remove cell cover supports (9 and 18).

x. Remove long transfer pump tube (63) from right cell (64).

y. Deflate each cell as much as possible and remove it from bottom structure cavity.

CAUTION

Do not damage cells on projecting fittings or flanges within cavities while removing the cells from bottom structure.

Note

Disposition of cells should be made in accordance with applicable manual listed in Appendix I.

3–359. CLEANING AND INSPECTION. Refer to paragraph 3–352.

3–360. REPAIR (FOURTH ECHELON). Refer to applicable manual listed in Appendix I for repair instructions.

3–361. INSTALLATION. To install individual cell, refer to table 3–XI and accomplish as much of each indicated step as applies to that particular cell.

CAUTION

Extreme care should be exercised when handling 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 cabin section while working on cells. Upper limit of temperature is 71°C (160°F).

Note

Apply antiseize compound, Federal Specification TT-A-580, to threads of all fittings.

a. If new cell is being installed, remove it from its shipping container in accordance with applicable manual listed in Appendix I.

b. Inspect bottom structure cell cavities for cleanness and make certain they are free of sharp metal edges, burrs, and fittings.

c. Deflate cells as much as possible and position them in bottom structure cavities. Align openings in each cell with corresponding openings in the bottom structure.

CAUTION

Care must be exercised while inserting cells into bottom structure to avoid damaging cells on projecting fittings or flanges within cavities.

d. Lay cell cover supports (9 and 18, figure 3–78) on top of each cell.

e. Insert long transfer pump tube (63) into right cell (64).

f. Install floor panel over center tank. Secure panel with bolts and washers.

g. Secure cell cover support (9 and 18) to lower surface of floor panel at each cell access hole with screws (17).

h. Insure gasket (65) and spacer (66) are correctly positioned at filler hole in floor panel. Position collar (67) and gasket (68). Position elbow (69) over hole and secure it to floor panel with bolts and washers (76). Tighten bolts to a torque of 25 to 30 inch-pounds, and secure with lock wire.

Note

Be sure spacer is placed within rims of gasket. Thin section of spacer should be positioned under frame.

i. Position filler cap and flange (71) against outer surface of scupper. Install gasket (65) against each surface of scupper. Secure filler cap and elbow (69) to scupper with bolts, washers, and nuts (72).

j. Install bolts, washers, and nuts (74) at two interconnecting vent fittings between each cell.

k. Install flanges (54) at interconnecting hole in each cell and secure them with bolts, washers, and nuts (53). Use first two nuts below centerline at forward edge of hole to secure bracket clamp (52) against flange in right cell (64).

l. Install bolts and washers (19) in single overboard vent fitting in right cell (64) and two overboard vent fittings (24) in left cell (20). Secure bolts with lock wire.

Note

On helicopters serial No. 53-4537 and subsequent, washers and nuts are used.

m. Position connector (73) at aft wall of right cell (64). Reach into right cell (62, figure 3–79) of aft tank and install bolts, washers, and nuts (61) that secure connector.

n. Install check valve and gasket (55, figure 3–78) and union and gaskets (58) in transfer pump tube Y connector (57). Position Y connector (57) at forward wall of right cell (64). Secure connector by installing bolts and washers (13, figure 3–76) in aft end of transfer connector (12) in bottom structure cavity just forward of right cell (64, figure 3–78). Secure bolts with lock wire.

CAUTION

Check to see that check valve is installed so direction of flow is forward.

o. Connect long transfer pump tube (63) to connector (73) at aft end of right cell (64) and union and gasket (58) in Y-connector (57) at forward end of cell.

p. Inspect each cell for cleanness. Wipe cells clean of all dirt and foreign material with clean, soft cloth dampened with water.

q. At bottom of helicopter, install external fuel tube fitting (46) and gasket (47) below right cell (64) and left cell (20). Secure each fitting with bolts and washers (45). Secure bolts with lock wire. Install each interconnecting tube.(39). Do not install plates at this time.

r. Install tank sump, but do not install access cover. (Refer to paragraph 3–380.)

Note

Do not fill fuel tanks at this time.

s. Install bushing, nut, and gasket (44, figure 3–78) in tee (50). Install tee in transfer pump outlet tube (41). Connect tube to transfer pump (28). Connect flexible hose (49) to bushing in tee.

t. Connect transfer pump outlet tube (41) to tee (50) in center cell (10) and to check valve and gasket (55) in right cell (64). Install bracket clamp (52) around tube and secure it to bracket at interconnecting hole with screws, washers, and nuts.

CAUTION

Check to see that check valve is installed so direction of flow is forward.

u. Install forward cell cover and access cover in right cell of aft tank. (Refer to paragraph 3–368, step *t.*)

v. Install floor panel over hatch and aft cells of forward tank and secure with bolts and washers.

w. Secure supports (9 and 18) to floor panel with screws (17). Install access covers (16 and 26, figure 3–77) over aft right cell (7, figure 3–76) and aft left cell (28) of forward tank.

x. Install low pressure warning switch in center cell cover. (Refer to paragraph 3–403, steps *c* through *g.*)

Note

Do not fill fuel tanks at this time.

y. Install cell covers (15, figure 3–78) and gaskets (16) and secure with bolts and washers (14). Secure bolts with lock wire. Install access covers (12) and gaskets (13) and secure with bolts and washers (11). As an aid in positioning nut ring (77) below cell cover, use drill rod as described in paragraph 3–335, step *aa.*

3–362. TESTING (FOURTH ECHELON).

a. Disconnect transfer line at connector in aft end of forward tank aft right cell to pressure test fuel tanks individually. Cap connector.

b. Disconnect overboard vent tubes at fittings in cabin walls.

c. Plug remaining vent tubes.

d. Connect water-filled manometer graduated up to 34 inches in increments of 1/16 inch to source of air pressure. Apply 1 psi pressure to one filler elbow. Drop in pressure must not exceed 1/16 inch of water within period of 15 minutes.

CAUTION

Do not fill fuel cells with fuel until fuel transfer lines have been pressure tested. (Refer to paragraph 3–388.)

Note

Do not attempt to pressure test fuel cells in extreme temperatures.

e. Remove plugs and connect transfer line and vent tubes disconnected in steps *a* and *b* above.

f. Fill all cells with proper grade fuel. Check external connections for leakage.

g. Install access plates and covers at bottom of helicopter.

b. Test low pressure warning system. (Refer to paragraph 3–404.)

3–363. AFT FUEL TANK. (See figure 3–79.)

3–364. 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.

3–365. REMOVAL. Before accomplishing any work on the fuel system, refer to paragraph 3–352.

Table 3–XII. Removal of Individual Fuel Cells – Aft Tank

TO REMOVE	REFER TO PARAGRAPH 3–365, STEPS:
Left cell	*a* through *d*, *k* through *t*
Center cell	*a* through *b*, *l* through *o*, *q* through *t*
Right cell	*a* through *f*, *i* through *t*

To remove individual cell, refer to table 3–XII and accomplish as much of each indicated step as applies to that particular cell.

CAUTION

Extreme care should be exercised when handling 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 cabin section while working on cells. Upper limit of temperature is 71°C (160°F).

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, Washers, Nut
62. Right Cell
63. Bracket
64. Screw, Spacer
65. Fuel Quantity Tank Probe
66. Bracket
67. Gasket
68. Spacer
69. Collar
70. Gasket
71. Screw
72. Bolt, Washer
73. Elbow
74. Gasket
75. Filler Cap and Flange
76. Bolt, Washers, Nut
77. Cell Cover
78. Gasket
79. Pressure Warning Switch
80. Bolt, Washer
81. Gasket
82. Plate
83. Gasket
84. Gasket
85. Stand Pipe
86. Strainer Housing
87. *Bolt, Washer
    **Washer, Nut
88. Strainer
89. Spring
90. Gasket
91. Plug

*Helicopters Serial No. Prior to 55-4497. **Helicopters Serial No. 55-4497 and Subsequent.

Figure 3–79. Aft Fuel Tank (Sheet 1 of 2)

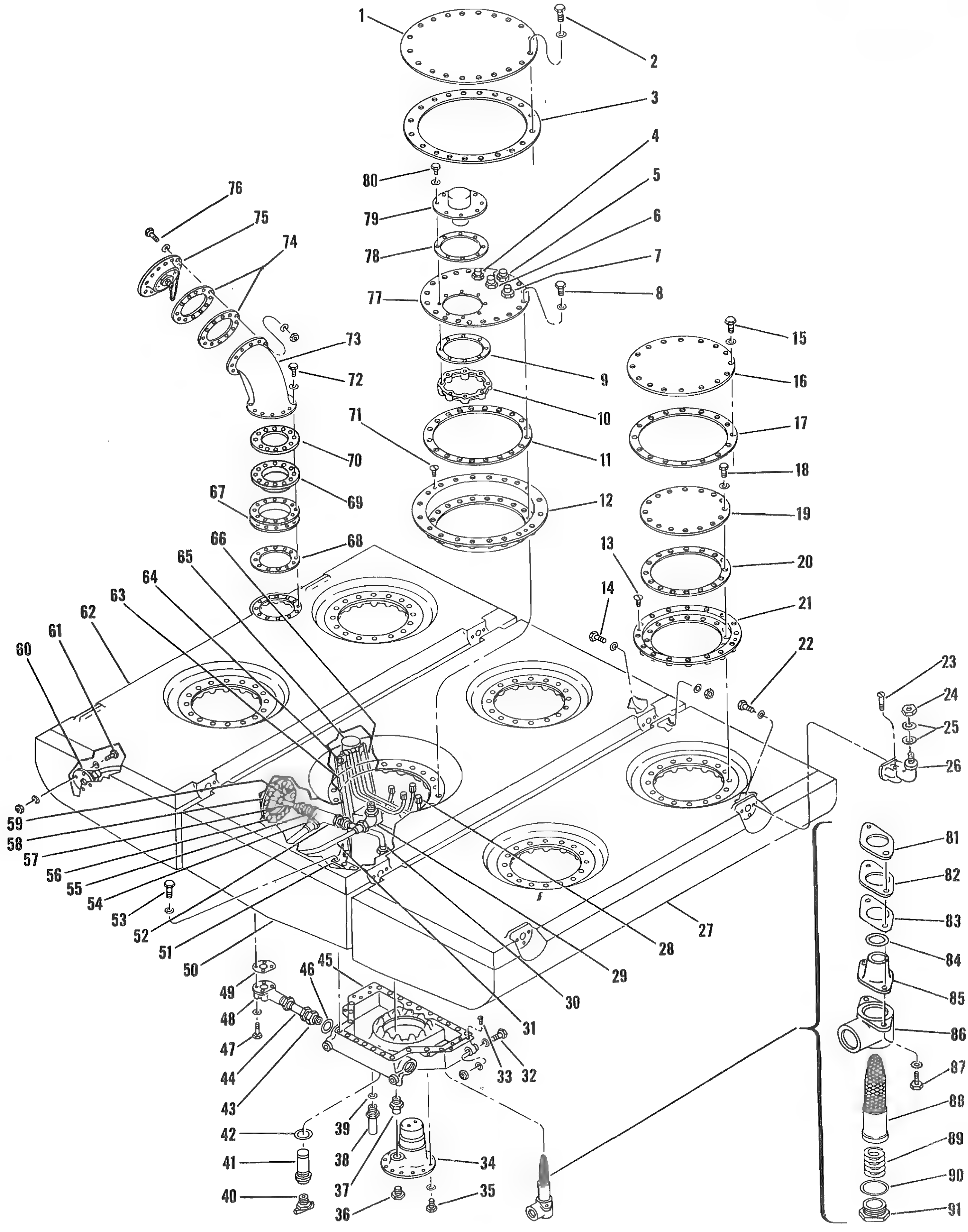


Figure 3–79. Aft Fuel Tank (Sheet 2 of 2)

a. Drain and purge all fuel cells.

b. Remove low pressure warning switch from center cell forward cell cover. (Refer to paragraph 3–401, steps *b* through *g.*)

c. Remove bolts and washers (15, figure 3–79) securing each access cover (16) to cabin floor. Remove each cover and gasket (17).

d. Remove bolts and washers (18) securing each cell cover (19) to support (21). Remove each cover and gasket (20).

e. Remove screw, washers, and nut from clamp and bracket (59) around transfer pump tube (57) at interconnecting hole in right cell (62). Remove clamp.

f. Disconnect transfer pump tube (57) from connector (60) at front of right cell (62) and from check valve (55) in tee (52) in center cell (50). Remove tube.

g. Disconnect flexible hose (31) from reducer (54) in tee (52) in center cell (50). Remove hose. Disconnect transfer pump outlet tube (30) from transfer pump (34). Remove tube and tee.

h. Remove tank sump. (Refer to paragraph 3–378.)

i. Remove aft access cover and cell cover from right cell of center tank. (Refer to paragraph 3–358, steps *c* and *d.*)

j. Remove bolts, washers, and nuts (61), securing connector (60) at forward wall of right cell (62). Remove connector.

k. Remove bolts and washers (22) from two overboard vent fittings (26) in right cell (62) and left cell (27).

Note

On helicopters serial No. 53-4537 through 53-4554, washers and nuts are used.

l. Remove bolts, washers, and nuts (56) securing flanges (58) at interconnecting hole in each cell. Remove flanges. Remove bracket and clamp (59) secured to flange (58) in right cell (62).

m. Remove bolts, washers, and nuts (14) at two interconnecting vent fittings between each cell.

n. Remove bolts, washers, and nuts (76) securing filler cap and flange (75) and elbow (73) to scupper in right cabin wall. Remove filler cap and gasket (74).

o. Remove bolts and washers (72) securing elbow (73) to floor panel. Remove elbow and gasket (74), remove gasket (70) and collar (69), but leave gasket (67) and spacer (68) in position in floor panel.

p. Remove plates from beneath helicopter below interconnecting tubes (44) leading to sump (45). Remove tubes. Remove bolts and washers (47) securing fitting (48) below left cell (27) and right cell (62). Remove each fitting and gasket (49).

q. Remove screws (13 and 71) securing cell cover support (12 and 21) to lower surface of floor panel at each cell access hole. Lay each support on cell.

r. Remove bolts and washers securing floor panel over aft tank. Remove panel.

s. Remove cell cover supports (12 and 21).

t. Deflate each cell as much as possible and remove it from bottom structure cavity.

CAUTION

Do not damage the cells on projecting fittings or flanges within cavities while removing cells from bottom structure.

Note

Disposition of cells should be made in accordance with applicable manual listed in Appendix I.

3–366. CLEANING AND INSPECTION. (Refer to paragraph 3–352.)

3–367. REPAIR (FOURTH ECHELON). Refer to applicable manual listed in Appendix I for repair instructions.

a. Test check valve for proper operation and possible leakage.

b. Test flexible hose lines for possible leakage.

3–368. INSTALLATION. To install an individual cell, refer to table 3–XIII and accomplish as much of each indicated step as applies to the particular cell.

CAUTION

Exercise extreme care when handling 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 cabin section while working on cells. Upper limit of temperature is 71°C (160°F).

Note

Apply antiseize compound, Federal Specification TT-A-580, to threads of all fittings.

Table 3–XIII. Installation of Individual Fuel Cells – Aft Tank

TO INSTALL	REFER TO PARAGRAPH 3–68, STEPS:
Left cell	*a* through *k*, *m*, *n*, *s* through *w*
Center cell	*a* through *j*, *m*, *o* through *q*, *s* through *w*
Right cell	*a* through *n*, *q* through *w*

a. If new cell is being installed, remove it from its shipping container in accordance with applicable manual listed in Appendix I.

b. Inspect bottom structure cell cavities for cleanness and make certain they are free of sharp metal edges, burrs, and filings.

c. Deflate cells as much as possible and position them in bottom structure cavities. Align openings in each cell with corresponding openings in bottom structure.

CAUTION

Exercise care while inserting cells into bottom structure to avoid damaging the cells on projecting fittings or flanges within cavities.

d. Lay cell cover supports (12 and 21, figure 3–79) on top of each cell.

e. Install floor panel over aft tank. Secure panel with bolts and washers.

f. Secure cell cover supports (12 and 21) to lower surface of floor panel at each cell access hole with screws (13 and 71).

g. Check that gasket (67) and spacer (68) are correctly positioned at filler hole in floor panel. Position collar (69) and gasket (70). Position elbow (73) over hole and secure it to floor panel with bolts and washers (72). Tighten bolts to a torque of 25 to 30 inch-pounds, and secure bolts with lock wire.

Note

Be sure spacer is placed within rims of gasket. Thin section of spacer should be positioned under frame.

h. Position filler cap and flange (75) against outer surface of scupper. Install gasket (74) against each surface of scupper. Secure filler cap and elbows (73) to scupper with bolts, washers, and nuts (76).

i. Install bolts, washers, and nuts (14) at two interconnecting vent fittings between each cell.

j. Install flanges (58) at interconnecting hole in each cell and secure them with bolts, washers, and nuts (56). Use first two nuts below centerline at forward edge of hole to secure bracket and clamp (59) against flange in right cell (62).

k. Install bolts and washers (22) in two overboard vent fittings (26) in left cell (27) and right cell (62). Secure bolts with lock wire.

Note

On helicopters serial No. 53-4537 and subsequent, washers and nuts are used.

l. Position connector (60) at forward wall of right cell (62) and secure it with bolts, washers, and nuts (1).

Note

Reach into aft access hole of center tank right cell to install the washers and nuts.

m. Inspect each cell for cleanness. Wipe cells clean of all dirt and foreign material with clean, soft cloth dampened with water.

n. At bottom of helicopter, install external fuel tube fitting (48) and gasket (49) below left cell (27) and right cell (62). Secure each fitting with bolts and washers (47). Secure bolts with lock wire. Install each interconnecting tube (44). Do not install plates at this time.

o. Install tank sump, but do not install access cover. (Refer to paragraph 3–380.)

Note

Do not fill fuel tanks at this time.

p. Install union, check valve (55), reducers and gaskets (54) in tee (52). Install tee in transfer pump tube (57). Connect tube to transfer pump (34). Connect flexible hose (31) to reducer (54) in tee.

q. Connect transfer pump tube (57) to connector (60) at front of right cell (62) and to check valve (55) in tee (52) in center cell (50). Install clamp around tube and secure it to bracket (59) at interconnecting hole with screw, washers, and nut.

CAUTION

Check to see that check valve is installed so direction of flow is forward.

r. Install low pressure warning switch in center cell forward cell cover. (Refer to paragraph 3–403, steps *c* through *g*.)

Note

Do not fill fuel tanks at this time.

s. Install cell covers (19, figure 3–79) and gaskets (20), and secure with bolts and washers (18). Secure bolts with lock wire. Install access covers (16) and gaskets (17) and secure with bolts and washers (15). As an aid in positioning nut ring (10) below cell cover, use drill rod as described in paragraph 3–354, step *aa.*

3–369. TESTING.

a. Disconnect transfer line at connector in aft end of forward tank aft right cell to pressure test fuel tank. Cap connector.

b. Disconnect overboard vent tubes at fittings in cabin walls.

c. Plug remaining vent tubes.

d. Connect water-filled manometer graduated up to 34 inches in increments of 1/16 inch to source of air pressure. Apply 1 psi pressure to one filler elbow. Drop in pressure must not exceed 1/16 inch of water within period of 15 minutes.

CAUTION

Do not fill fuel cells with fuel until fuel transfer lines have been pressure tested. (Refer to paragraph 3–388.)

Note

Do not attempt to pressure test fuel cells in extreme temperatures.

e. Remove plugs and connect transfer line and vent tubes disconnected in steps *a* and *b* above.

f. Fill all cells with proper grade fuel. Check external connections for leakage.

g. Install access plates and covers at bottom of helicopter.

Note

Do not attempt to pressure test fuel cells in extreme temperatures.

h. Test low pressure warning system. (Refer to paragraph 3–404.)

3–370. FUEL TANK VENT SYSTEM.

3–371. 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 pilots' compartment. 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 pilots' compartment 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.

3–372. REMOVAL.

a. Disconnect tube from each tank vent fitting (27, figure 3–76) at right and left sides of cabin floor.

b. Remove floor panels located over fuel tanks.

c. Remove bolts and washers (6, 18, and 28, figure 3–77) securing cell covers (21 and 29) and gaskets (12, 22, and 30) at right and left cells of all fuel tanks.

d. Disconnect probe leads (33 through 38) from connectors (7 through 10, 19, and 20) which are installed in cell cover of each left cell of forward tank.

e. In forward tank, remove washers and nuts (23, figure 3–76) from vent fittings (27). In center and aft tanks, remove bolts and washers (19, figure 3–78) from vent fittings (24) inside each outboard cell.

f. Remove screws (26, figure 3–76) securing vent fittings (27) to bottom structure longerons.

g. Support vent fittings (27). Remove washers (25) and nut (24) securing each vent fitting to bottom structure longerons. Remove fittings.

h. Support tube (17) between aft cells of forward tank. Disconnect tube from unions (16 and 18). Remove tube. Remove unions, nuts, and gaskets (19) from vent tube fittings (15 and 20).

i. Support vent tube fittings (15 and 20). Reach into cells and remove bolts and washers (8 and 22) from fittings. Remove fittings and gaskets (14 and 21).

j. On helicopters serial No. 57-1726 and subsequent, support vent tube fittings (15 and 20). Reach inside cells and remove washers and nuts that secure fittings to aft cells. Remove fittings and gaskets (21 and 14).

k. Remove fuel detector. (Refer to paragraph 3–397.)

l. Remove screws, washers, nuts, and clamps from all tubes.

m. Disconnect tubes from unions and elbows. Remove washers, nuts, unions, and elbows.

n. Disconnect tubes from fittings which are riveted to cabin wall at hoods. Remove tubes.

o. Disconnect outside vent tubes on right side of fuselage from vent fittings and remove screws, washers, and nuts securing clamps to fuselage. Remove tubes and clamps.

3–373. REPAIR.

a. Check tubes and fittings for dents or leakage.

b. Replace tubes or fittings that have damaged threads.

c. Inspect tubes and fittings for foreign matter which may cause stoppage.

3–374. INSTALLATION.

Note

Apply antiseize compound, Federal Specification TT-A-580, to threads of all fittings.

a. Position two tube assemblies and clamps on right side of helicopter and install screws, washers, and nuts. Connect tubes to forward vent fittings.

b. Secure tube to each of fittings which are riveted to cabin walls.

c. Install unions, elbows, washers, and nuts in frames. Connect tubes to unions and elbows.

d. Install fuel detector. (Refer to paragraph 3–398, steps *a* and *b.*)

e. Install all clamps and secure them with screws, washers, and nuts.

f. Secure gaskets (14 and 21, figure 3–76) and vent tube fittings (15 and 20) to aft cells of forward tank with bolts and washers (8 and 22). Secure bolts with lock wire.

g. On helicopters serial No. 57-1726 and subsequent, secure gaskets (14 and 21) and vent tube fittings (15 and 20) to aft cells of forward tank with washers and nuts.

h. Install unions (16 and 18), nut, and gasket (19) on vent tube fittings (15 and 20). Connect tube (17) to unions (16 and 18).

i. Position tank vent fittings (24, figure 3–78) in center and aft tanks at outboard side of each cell wall. Secure fittings with bolts and washers (19). Secure bolts with lock wire. In forward tank, secure vent fittings (27, figure 3–76) with washers and nuts (23).

j. Secure vent fittings (27) to bottom structure longerons with screws (26). Install washers (25) and nuts (24).

k. Connect probe leads (33 through 38, figure 3–77) to connectors (7 through 10, 19, and 20) which are installed in each cell cover of forward tank left cells.

l. Install cell covers (21 and 29) and gaskets (12, 22, and 30) on lip of support at right and left cells of all fuel tanks. Secure covers with bolts and washers (6, 18, and 28).

m. Install floor panels over fuel tanks.

n. Connect tube to each tank vent fitting (27, figure 3–76).

3–375. TESTING.

Note

Pressure test complete fuel tank installation as a unit.

a. Disconnect overboard vent tubes at fittings in cabin walls.

b. Install hose assembly between overboard vent tube in aft tank and vent tube in center tank and between vent tube in center and forward tanks.

c. Plug remaining vent tubes.

d. Disconnect heater fuel line at forward tank sump and plug port.

e. Disconnect booster pump outlet tube at elbow on top of selector valve and plug line.

f. Disconnect emergency fuel line at elbow under selector valve and plug line.

g. Disconnect vapor return line from union on filler elbow of forward tank and cap union.

h. Connect water-filled manometer graduated up to 34 inches in increments of 1/16-inch to source of air pressure. Apply 1 psi pressure to one filler elbow. Drop in pressure must not exceed 1/16-inch of water within period of 15 minutes.

Note

Do not attempt to pressure test fuel cells in extreme temperatures.

i. Remove hose assemblies and plugs installed in steps *b* and *c* above.

j. Connect overboard vent tubes at fittings in cabin walls.

k. Remove plugs and connect lines disconnected in steps *d* through *g* above.

l. Fill all cells with proper grade fuel. Check all external connections for leakage.

m. Install access covers and plates at bottom of helicopter.

3–376. FUEL TANK SUMPS.

3–377. 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.

3–378. REMOVAL.

a. Remove tank drain. (Refer to TM 55-1520-202-20, Chapter 2, Section IV.)

b. Remove tank strainer. (Refer to paragraph 3–436.)

c. Remove booster pump (paragraph 3–413) or transfer pump (paragraph 3–384).

d. From inside cabin reach into forward center cell (63, figure 3–76) and remove bolts, washers, and spacers securing fuel quantity tank probe (61) to brackets (62). Lay probe on bottom of cell.

Note

Step *d* applies to forward tank; step *e* applies only to center and aft tanks.

e. From inside cabin reach into center cell (10, figure 3–78) and remove screws and spacers securing fuel quantity tank probe (61) to brackets (62). Remove tank probe from cell.

f. Remove bolts and washers (54, figure 3–76) securing tank unit brackets (60) to sealing flange (69) on top of the sump (71). Remove both brackets from forward center cell (63).

Note

Index each bracket to sealing flange to insure proper installation.

g. Remove bolts and washers (48, figure 3–78) securing sealing flange (43) to the sump (36). Remove flange from center or aft cell.

Note

On helicopters serial No. 54-2864 and subsequent, remove washers and nuts from sump studs.

h. Remove screws (72, figure 3–76, 25, figure 3–78, or 33, figure 3–79) securing sump to skin, if screws are installed. Discard screws.

CAUTION

Lift bottom of self-sealing fuel cell to gain access to these screws. Lift bottom of the cell no more than is absolutely necessary and use caution to avoid damaging cell. Slide bottom of bladder-type cells first to right and then to left to gain access to screws.

i. Disconnect emergency fuel system tube from check valve in strainer housing (83, figure 3–76).

Note

All fuel tanks must be drained and purged before disconnecting tube.

j. On helicopters serial No. prior to 55-4496, remove bolts and washers (84). On helicopters serial No. prior to 54-2864, remove strainer housing (83) and gasket (78). On helicopters serial No. 54-2864 through 55-4496, remove strainer housing, gaskets (80 and 81), and plate (79).

k. On helicopters serial No. 55-4497 and subsequent, remove washers and nuts (84) securing strainer housing (83) to sump (71). Remove strainer housing and standpipe.

l. Disconnect both interconnecting tubes (48 and 74), from unions (35 and 46) in sump (71) and fittings (33 and 49) below forward right cells (3) and forward left cells (30).

m. Disconnect cabin heater fuel line at elbow in cabin heater strainer assembly installed in forward fuel tank. Remove elbow, with nut and gasket attached, from strainer assembly. Remove strainer assembly.

n. Remove bolts, washers, and nuts (73) that secure sump (71) to the bottom structure frame.

o. Remove union (35 and 46) and gasket (36 and 45) from each side of sump (71).

3–379. REPAIR.

a. Check inserts and rings or studs and rings for security.

b. Check nuts and rivets for security.

c. Wipe interior of sump body clean.

d. Check sump body for possible cracks or corrosion. Replace if necessary.

3–380. INSTALLATION.

Note

Apply antiseize compound, Federal Specification TT-A-580, to threads of all fittings.

a. Install gaskets (36 and 45, figure 3–76) and unions (35 and 46) for interconnecting tubes (48 and 74) in each side of sump (71).

b. Raise sump (71) into position against bottom of forward center cell (63). Secure sump to bottom structure frame with bolts, washers, and nuts (73).

Note

Sump is positioned with straight edge to the rear.

c. Connect each interconnecting tube (48 and 74) to unions (35 and 46) in sump (71) and fittings (33 and 49) below adjacent forward cells (3 and 30).

d. On helicopters serial No. prior to 54-2864, secure gasket (78) and strainer housing (83) to sump. On helicopters serial No. 54-2864 through 55-4496, secure plate (79), gaskets (80 and 81), and strainer housing (83) to sump (71) with bolts and washers (84). Secure bolts with lock wire.

e. On helicopters serial No. 55-4497 and subsequent, carefully insert rubber standpipe (82) into sump. Secure strainer housing (83) to sump (71) with washers and nuts (84). Tighten nuts to torque of 20 to 25 inch-pounds.

CAUTION

Standpipe must be seated evenly in sump.

Note

Check valve installed in strainer housing should face forward.

f. Install cabin heater strainer assembly in forward tank sump. Install elbow, with nut and gasket attached, in strainer assembly. Connect cabin heater fuel line to elbow.

g. Connect emergency fuel system tube to check valve in strainer housing (83).

Note

Check valve should be installed so direction of flow is forward.

h. Do not install screws (72, figure 3–76, 25, figure 3–78, or 33, figure 3–79). (Refer to paragraph 3–378, step *h.*)

i. Reach into center cell (10, figure 3–78) from inside cabin and position sealing flange (43) on sump (36). Position both tank probe brackets (62) on flange. Secure brackets and flange to sump with bolts and washers (48). Secure bolts with lock wire.

Note

On helicopters serial No. 54-2864 and subsequent, secure flange to sump studs with washers and nuts. Do not secure nuts with lock wire.

j. Secure fuel quantity tank probe (61, figure 3–76) to brackets (62).

k. Install booster pump (paragraph 3–415) or transfer pump (paragraph 3–387).

Note

Do not fill fuel tanks at this time.

l. Install tank strainer. (Refer to paragraph 3–435.)

Note

Do not fill fuel tanks at this time.

m. Install tank drain. (Refer to TM 55-1520-202-20, Chapter 2, Section IV.)

3–381. TESTING.

a. Check to see that all drain valves are closed.

b. Pressure test fuel tanks. (Refer to paragraph 3–375, steps *a* through *k.*)

c. Fill tanks with proper grade fuel and check for possible leakage around sump (71, figure 3–76), drain valve (41), strainer housing (83), and booster or transfer pump mounting flange.

d. Replace cover and grommet below sump. Replace fairing panel.

3–382. FUEL TRANSFER PUMPS.

3–383. 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 pilots' compartment. The switches, in turn, are energized only when the fuel selector valve control is in 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.

3–384. REMOVAL.

a. Drain and purge all tanks.

b. Remove low pressure warning switch (81, figure 3–78) from center cell cover (79) of tank from which transfer pump (28) is to be removed. (Refer to paragraph 3–401, steps *a* through *g.*)

c. Reach into center cell (10) and disconnect transfer pump outlet tube (41) from nipple (27) in outlet port of transfer pump (28).

WARNING

Make certain all electrical power is turned off.

d. Remove fairing panel fastened to bottom of helicopter below sump (36) of tank from which transfer pump (28) is being removed. Remove access cover and grommet around pump drain fitting (34). Disconnect electrical leads to pump.

e. Support transfer pump (28) and remove bolts (29) securing pump to sump (36). Lower pump and gasket from sump.

f. Remove drain fitting (34) and gasket (35) from bottom of transfer pump (28). Remove nipple (27) from outlet port of pump. Remove plug (30) from bottom of pump below outlet port.

3–385. REPAIR. Refer to applicable manual listed in Appendix I.

3–386. OVERHAUL (FOURTH ECHELON). Refer to applicable manual listed in Appendix I.

3–387. INSTALLATION.

Notes

Apply antiseize compound, Federal Specification TT-A-580, to threads of all fittings.

a. Remove plug from seal drain port of transfer pump (28, figure 3–78). Position gasket (35) on drain fitting (34). Install drain fitting in drain port.

b. Remove plug from outlet port of transfer pump (28) and install nipple (27).

c. Install plug (30) in bottom of transfer pump (28) below outlet port.

d. Raise transfer pump (28) into position through hole in sump (36). Position pump with outlet port forward.

Note

Be sure gasket that is furnished with pump is positioned on upper surface of pump mounting flange.

e. Secure pump mounting flange and gasket to sump (36) with bolts and washers (29). Secure bolts with lock wire.

WARNING

Make certain all electrical power is turned off.

f. Connect electrical leads to transfer pump (28).

g. Reach into center cell (10) from inside cabin and connect transfer pump outlet tube (41) to nipple (27) in outlet of transfer pump (28).

h. Install low pressure warning switch (81) in cell cover (79). (Refer to paragraph 3–403, steps *c* through *h*.)

3–388. TESTING.

3–389. PRESSURE TESTING FUEL TRANSFER LINES.

a. Disconnect outlet tube from aft tank transfer pump.

b. Install short line from open tube to source of air pressure.

c. Remove cover from top of level control valve in forward right cell of forward tank. Raise float up to level position and hold it while applying pressure.

Note

Make sure ball and pin assembly is as high as it will go. If necessary to free pin, vibrate float slightly while lifting.

d. Apply 6 to 8 psi air pressure to fuel transfer line. Pressure must not drop below 2 psi during period of 3 minutes.

e. Fill tanks with fuel and check for leakage around pump mounting flange.

f. Install access cover below sump. Install grommet around drain fitting (34, figure 3–78). Install fairing panel.

Note

If new drain fitting (34) is installed, cut bevel on lower end of fitting at angle of 30 degrees to horizontal. Bevel must face aft. Apply primer, Military Specification MIL-P-8585.

3–390. LEVEL CONTROL VALVE.

3–391. DESCRIPTION. A mechanical, float-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.

3–392. REMOVAL.

a. Drain and purge all fuel tanks.

b. Remove bolts and washers (2, figure 3–77) securing access cover (1) of forward right cell of forward fuel tank to cabin floor. Remove cover and gasket.

c. Remove bolts and washers (55) securing cell cover (54) to support (51). Remove cover and gasket (53).

d. Reach into forward right cell (3, figure 3–76) and disconnect short transfer pump tube (4) from elbow at bottom of level control valve (2).

e. Remove bolts and lift level control valve (2) and bracket from cell.

f. Remove bolts and washers securing level control valve (2), elbow, and swivel flange (58) to bracket (1). Separate valve bracket swivel fitting, swivel elbow, and gaskets.

3–393. INSTALLATION.

a. Secure bracket and fittings against bottom surface of control valve with bolts and washers in following order: level control valve (2, figure 3–76), gasket, bracket (1), gasket, elbow, swivel flange (58), and swivel elbow. Secure bolts with lock wire.

Note

Before tightening bolts, adjust elbow so it will point aft and 30 degrees to the right when valve is installed in fuel cell. This measurement can be made from surface of valve bracket vertical flange.

b. Position level control valve (2) and bracket (1) inside forward right cell (3) of forward fuel tank at interconnecting hole in left wall. Secure bracket against wall of cell with four bolts, washers, spacers, and nuts.

Note

Bracket should be positioned at four upper bolt holes.

c. Connect short transfer pump tube (4) to elbow and swivel flange (58) at bottom of valve.

Note

Apply antiseize compound, Federal Specification TT-A-580, to threads of the elbow.

d. Position cell cover (54, figure 3–77) and gasket (53) on lip of support (51) and secure with bolts and washers (55). Secure bolts with lock wire.

e. Secure access cover (1) and gasket (56) to cabin floor with bolts and washers (2).

3–394. TESTING.

a. Pressure test transfer lines. (Refer to paragraph 3–389.)

b. Fill all fuel tanks with fuel and check for leaks.

3–395. FUEL OVERFLOW SAFETY SYSTEM.

3–396. 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 on Model CH-34A serial No. prior to 56-4313, and is mounted on the battery box shelf on helicopters serial No. 56-4313 and subsequent and on Model CH-34C. A relay in the level control unit is deenergized which automatically turns the transfer pumps off and illuminates 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 pilots' compartment. Within a period of 80 seconds after the fuel level falls below the detector, the relay within the level control unit is reenergized and the transfer pumps turned on.

3–397. REMOVAL.

Note

Steps *a* and *b* apply to removal of fuel detector; steps *c* and *d* apply to removal of level control unit.

WARNING

Make certain all electrical power is turned off.

a. Disconnect fuel detector wiring from terminal strip and ground at left side of cabin forward bulkhead.

b. Disconnect short tubes at each end and remove fuel detector from vent tube.

c. Disconnect wiring from level control unit.

d. Remove screws, washers, and nuts and remove level control unit from electronics compartment shelf.

3–398. INSTALLATION.

Note

Steps *a* and *b* apply to installation of fuel detector; steps *c* and *d* apply to installation of level control unit.

a. Install fuel detector between two short tubes and connect tubes at each end.

WARNING

Make certain all electrical power is turned off.

b. Connect wiring to terminal strip and ground.

c. Position level control unit in place and install screws, washers, and nuts.

d. Connect wiring to level control unit.

3–399. FUEL LOW PRESSURE WARNING SYSTEM.

3–400. 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 pilots' compartment. 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.

3–401. REMOVAL.

a. Drain and purge all fuel tanks.

b. Remove bolts and washers (2, figure 3–78) securing forward access cover (1) of center cell to cabin floor. Remove cover and gasket (82).

WARNING

Make certain all electrical power is turned off.

c. Disconnect electrical leads at the pressure warning switch (81).

d. Remove bolts and washers (3) securing pressure warning switch (81) to cell cover (79).

CAUTION

These bolts hold nut ring beneath cell cover which must be supported before all bolts are removed. Thread one end of piece of drill rod that is same diameter as bolts and 8 to 10-inches long. Remove one bolt and washer and replace bolt with drill rod. Use rod to support nut ring while balance of bolts and washers are removed. Raise switch and replace two bolts and washers. Remove rod.

e. Raise pressure warning switch (81) enough to obtain access to flexible hose (49) secured to elbow in bottom of switch. Disconnect hose from elbow. Remove switch. Remove nut, gasket, and elbow (42) from bottom of switch.

f. Disconnect electrical leads at connectors (4, 5, 6, and 7) in the cell cover (79).

g. Remove bolts and washers (8) securing cell cover (79) to support (9). Raise cover enough to disconnect probe leads (40) at lower end of connectors (4, 5, 6, and 7). Remove cover and gasket (75). Remove nut ring (77) and gaskets (78 and 80) from cover.

Note

On helicopters serial No. 53-4475 through 53-4519, four connectors are installed in cell cover (79) with electrical leads attached to connectors. Two middle connectors (5 and 6) contain dummy leads and are taped with adhesive tape, Military Specification MIL-T-6841. On helicopters serial No. 53-4530 through 53-4554, two connectors are installed in cell cover (79).

Note

Before disconnecting probe leads from connectors, index each lead and connector.

h. Reach into center cell (10) and disconnect flexible hose (49) from bushing or reducer in tee (50) in transfer pump outlet tube (41). Remove hose from cell. Remove bushing, nut, and gasket (44) or reducer and gasket from tee. Install plug in tee.

Note

A bushing, nut, and gasket (44) are used in center fuel tank. A reducer and gasket (54, figure 3–79) are used in aft tank.

i. Remove LT ON NO TRANS light assembly from FUEL TRANS PUMP switch panel in pilots' compartment.

3–402. REPAIR. Refer to Appendix I for applicable directives of repair instructions.

3–403. INSTALLATION.

a. Install LT ON NO TRANS light assembly on FUEL TRANS PUMP switch panel in pilots' compartment.

b. Reach into center cell (10, figure 3–78) and remove plug from tee (50) in transfer pump outlet tube (41). Install bushing, nut, and gasket (44) or reducer and gasket in tee. Connect flexible hose (49) to bushing or reducer.

Note

A bushing, nut, and gasket (44) are used in center fuel tank. A reducer and gasket (54, figure 3–79) are used in aft fuel tank.

Note

Apply antiseize compound, Federal Specification TT-A-580, to threads of all fittings.

c. Position nut ring (77, figure 3–78) and gasket (78) against lower surface of cell cover (79) and gasket (80) against upper surface. Secure gaskets and nut ring loosely to cover with two bolts and washers (3). Position cell cover and gasket (75) on lip of support (9). Connect probe leads to lower end of connectors (4, 5, 6, and 7) in cell cover. Secure cell cover and gasket to support with bolts and washers (8). Secure bolts with lock wire.

Note

When installing cover, Apply acid-resistant lacquer, Federal Specification TT-L-54, to area around connectors on top of cell cover.

d. Install elbow, nut, and gasket (42) in bottom of pressure warning switch (81). Draw end of flexible hose (49) through hole in cell cover (79) and secure to elbow.

e. Install drill rod (paragraph 3–401, step *d)* through flange of pressure warning switch (81) and into nut ring (77). Remove two bolts and washers (3) and position switch on gasket (80). Secure switch with bolts and washers. Secure bolts with lock wire.

WARNING

Make certain all electrical power is turned off.

f. Connect electrical probe leads (40) to connectors (4, 5, 6, and 7) in cell cover (79) and to pressure warning switch (81).

Note

On helicopters serial No. 53-4475 through 53-4529, four connectors are installed in cell cover (79) with electrical leads attached to connectors. Two middle connectors (5 and 6) contain dummy leads and are taped with adhesive tape, Military Specification MIL-T-6841. On helicopters serial No. 53-4530 through 53-4554, two connectors are installed in cell cover (79).

g. Install access cover (1) and gasket (82) and secure them with bolts and washers (2).

3–404. TESTING.

a. Fill center and aft tanks with fuel.

b. Connect auxiliary source of power to external power receptacle.

Note

WARN LTS and FUEL PUMP – BSTR circuit breakers should be pushed in.

c. Press amber LT ON NO TRANS lights to determine that they function correctly.

d. Place fuel selector valve control in OFF position, and place FUEL TRANS PUMP switches for center and aft tanks in CTR and AFT positions, respectively.

e. Check to see that both amber LT ON NO TRANS lights come on and remain on.

f. Place fuel selector valve control in ON position. Each transfer pump should start.

Note

Allow time for transfer pumps to build up pressure.

g. Check to see that both amber LT ON NO TRANS lights go off indicating that each pressure switch is operating properly.

Note

After moving fuel selector valve control to ON, if either CTR or AFT amber LT ON NO TRANS light remains on, go to cabin section and listen for transfer pump indicated by illuminated LT ON NO TRANS light. If transfer pump is running, replace pressure switch.

3–405. FUEL LOW LEVEL WARNING SYSTEM.

3–406. DESCRIPTION. The fuel low level warning system consists of a Thervel-type level switch, a red LT ON 20 MIN FUEL warning light, and an electronic type control unit. 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; the control unit is mounted on the shelf in the battery compartment.

3–407. REMOVAL.

a. Remove Thervel-type level switch. (Refer to TM 55-1520-202-20, Chapter 2, Section X for removal instructions for fuel tank probes.)

b. Remove LT ON 20 MIN FUEL light and lamp from main switch panel on instrument panel.

3–408. REPAIR. Refer to applicable manual listed in Appendix I.

3–409. INSTALLATION.

a. Install LT ON 20 MIN FUEL light and lamp on main switch panel on instrument panel.

b. Install Thervel-type level switch. (Refer to TM 55-1520-202-20, Chapter 2, Section X for installation instructions for fuel tank probes.)

3–410. TESTING.

a. Pump minimum of 50 gallons of fuel into forward fuel tank.

b. Connect auxiliary source of power to external power receptacle.

c. Place battery switch in BATT position.

d. Press LT ON 20 MIN FUEL light to determine that it functions correctly.

e. Open forward tank sump drain and drain fuel from tank until LT ON 20 MIN FUEL light flashes on.

Note

Close drain as soon as light flashes on.

f. Drain remaining fuel from forward tank into separate container and measure it. If low level indicator is functioning properly, remaining fuel will not be less than 22 gallons.

3–411. FUEL BOOSTER PUMP.

3–412. 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 pilots' compartment. 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.

3–413. REMOVAL.

a. Drain and purge all tanks.

b. Remove bolts and washers (2, figure 3–77) securing the forward center cell access cover (1) to cabin floor. Remove cell cover (54) and gasket.

c. Remove bolts and washers (55) securing cell cover (54) to support (51). Remove cover and gasket (53).

d. Reach into forward center cell (63, figure 3–76) and disconnect booster pump outlet tube (70) from elbow on bottom pump (40).

WARNING

Make certain all electrical power is turned off.

e. Remove fairing panel fastened to bottom of helicopter below tank sump (71). Remove access cover and grommet around pump drain fitting (38). Disconnect electrical leads to booster pump (40).

f. Support booster pump (40) and remove bolts and washers (37) securing pump to forward tank sump (71). Lower pump and gasket from sump.

g. Remove drain fitting (38) and gasket (39) from booster pump (40).

3–414. OVERHAUL (FOURTH ECHELON). Refer to Appendix I for applicable directives of overhaul instructions.

3–415. INSTALLATION.

Note

Apply antiseize compound, Federal Specification TT-A-580, to threads of all fittings.

a. Remove plug from the seal drain port of booster pump (40, figure 3–76). Position gasket (39) on drain fitting (38). Install drain fitting in drain port.

b. Raise booster pump (40) into position through the hole in forward tank sump (71). Position pump with outlet elbow facing 45 degrees to right of forward.

Note

Be sure gasket furnished with pump is positioned on upper surface of pump mounting flange.

c. Secure pump mounting flange and gasket to forward tank sump (71) with bolts and washers (37). Secure bolts with lock wire.

WARNING

Make certain all electrical power is turned off.

d. Connect electrical leads to booster pump (40).

e. Reach into forward center cell (63) from inside cabin and connect booster pump outlet tube (70) to elbow on booster pump (40).

f. Position cell cover (54, figure 3–77) and gasket (53) on support (51) and secure them with bolts and washers (55). Secure bolts with lock wire.

g. Position forward center cell access cover (1) and gasket (56) and secure them to cabin floor with bolts and washers (2).

3–416. TESTING.

a. Pressure test forward tank. (Refer to paragraph 3–355.)

b. Fill tanks with fuel and check for leakage around pump mounting flange.

c. Install access cover below forward tank sump (71, figure 3–76). Install grommet around drain fitting (38). Install fairing panel.

Note

If new drain fitting (38) is installed, cut bevel on lower end of fitting at angle of 30 degrees to horizontal. Bevel must face aft. Apply primer, Military Specification MIL-P-8585.

3–417. FUEL SELECTOR VALVE CONTROL SYSTEM.

3–418. DESCRIPTION. (See figures 3–80 and 3–81.) The fuel selector valve control 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 pilots' compartment to the selector valve and provides the pilot with mechanical control of the valve.

3–419. FUEL SELECTOR VALVE.

3–420. 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 centerline 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 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.

3–421. REMOVAL.

Note

Fuel selector valve and fuel system strainer are mounted on same bracket and must be removed from fuselage bottom structure as a unit.

a. Drain and purge all fuel tanks. Place fuel selector valve control in ON position.

b. Remove forward section of fuel line fairing from bottom of helicopter.

c. Loosen fasteners in hinged panel below fuel selector valve and swing panel down.

d. Disconnect emergency fuel system outlet tube from elbow in Y-drain connector at bottom of selector valve and from tee below forward fuel tank. Loosen jamnut at bottom of Y-drain and remove elbow, nut, and gasket.

e. Remove clutch access door from cabin forward bulkhead. Remove fuel tube located just forward of bulkhead. On helicopters serial No. 56-4313, 57-1684, and 57-1697 and subsequent, remove fuel hose assembly located just forward of bulkhead. Loosen jamnut and remove elbow and gasket from fuel strainer fitting. Remove bolts and washers securing small access door to fitting. Remove screws that secure access door to floor. Remove door and gaskets from strainer fitting flange.

f. Disconnect fuel booster pump outlet tube from fitting at forward surface of bulkhead and from elbow at top of selector valve. Remove tube.

g. Remove bolts and washers securing upper edge of selector valve mounting bracket to bulkhead.

h. At bottom of helicopter, remove bolts and washers from lower end of Y-drain connector. Support selector valve and strainer and remove bolts and washers that secure lower edge of selector valve mounting bracket to bulkhead. Lower selector valve, strainer, and bracket from bottom structure as unit.

Note

Lower unit straight down until driver on the lower end of selector valve control shaft disengages from yoke on selector valve gear box.

i. Remove screws and washers securing Y-drain connector to bottom of selector valve. Remove connector and drain valve.

j. Remove screws and washers securing elbow to top of selector valve. Remove elbow.

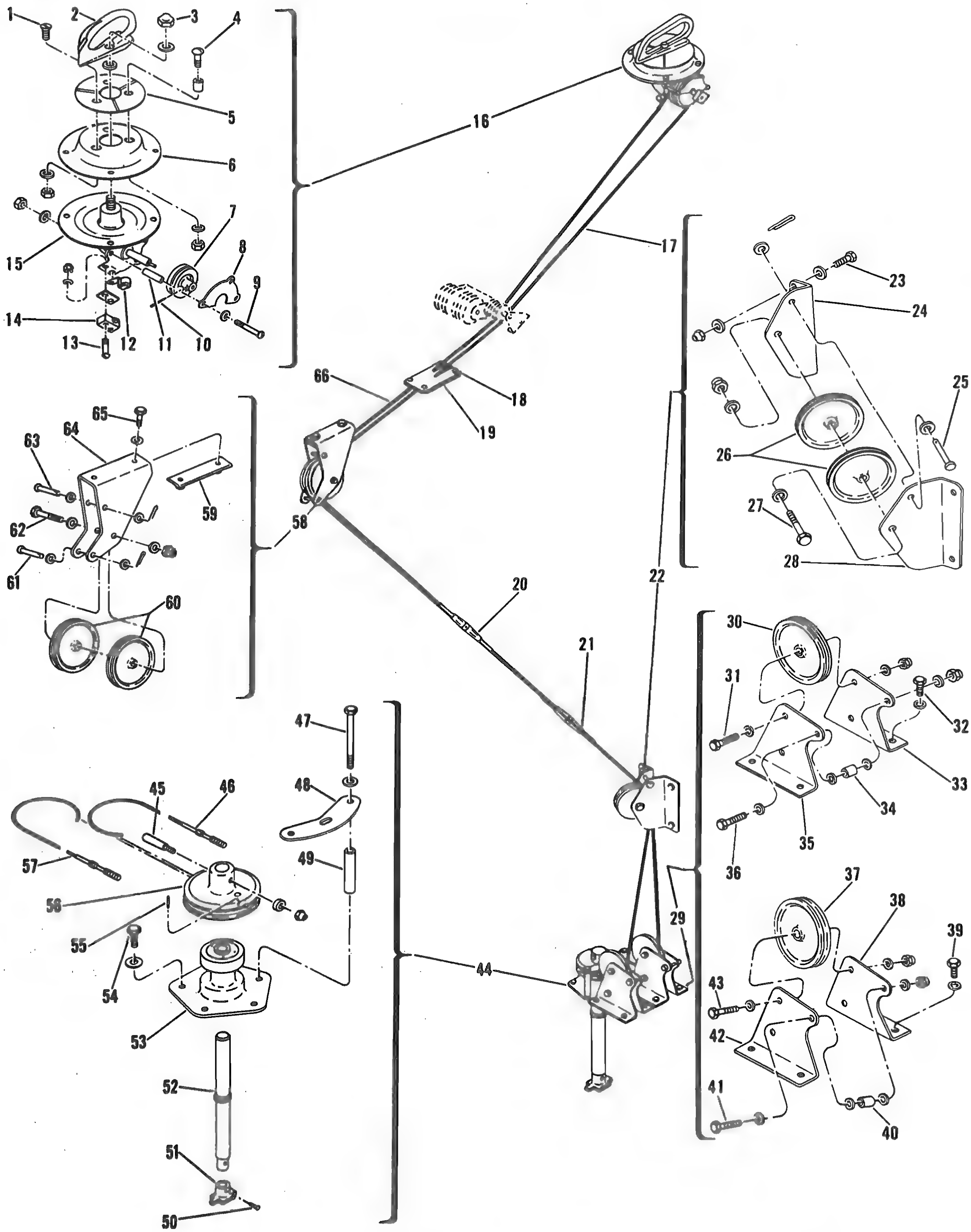


Figure 3–80. Fuel Control System (Helicopters Serial No. Prior to 56-4313) (Sheet 1 of 2)

1. Screw, Washer, Nut	18. Screws, Washers, Nuts	35. Bracket	51. Driver
2. Handle	19. Seal	36. Bolt, Washers, Nut	52. Shaft
3. Washers, Nut	20. Turnbuckle Barrel	37. Pulley	53. Housing Assembly
4. Screw, Washer, Nut, Spacer	21. Turnbuckle Barrel	38. Bracket	54. Bolt, Washer
5. Dial Plate	22. Pulley Installation	39. Bolt, Washer	55. Rollpin
6. Support Assembly	23. Bolt, Washers, Nut	40. Spacer	56. Pulley
7. Pulley	24. Bracket	41. Bolt, Washers, Nut	57. Cable
8. Plate	25. Pin, Washers, Cotter Pin	42. Bracket	58. Pulley Installation
9. Screw, Washers, Nut	26. Pulley	43. Bolt, Washers, Nut	59. Filler Assembly
10. Rollpin	27. Bolt, Washers, Nut	44. Pulley Installation	60. Pulley
11. Spacer	28. Bracket	45. Taper Pin, Washer, Nut	61. Pin, Washers, Cotter Pin
12. Spacer, Actuator	29. Bracket Installation	46. Cable	62. Bolt, Washers, Nut
13. Screw, Washer, Nut	30. Pulley	47. Bolt, Washer	63. Pin, Washers, Cotter Pin
14. Switch	31. Bolt, Washers, Nut	48. Plate	64. Bracket
15. Support	32. Bolt, Washer	49. Spacer	65. Bolt, Washer
16. Control Assembly	33. Bracket	50. Rivet	66. Cable
17. Cable	34. Spacer		

Figure 3–80. Fuel Control System (Helicopters Serial No. Prior to 56-4313) (Sheet 2 of 2)

k. Remove screws and washers securing flanged fitting to selector valve. Remove washers and nuts securing fitting to strainer. Remove fitting and gasket.

l. Remove bolts, washers, and nuts securing gear box and selector valve to small brackets. Pull gear box away from brackets to disengage gear box drive from yoke on selector valve.

m. Remove bolts and washers securing small bracket to large bracket. Support selector valve and remove small bracket. Remove selector valve.

3–422. OVERHAUL (FOURTH ECHELON).

a. Refer to Appendix I for applicable directives of overhaul instructions.

b. Replace selector valve gear box if it is damaged or if backlash between gears is not within 0.002 to 0.010 inch.

3–423. INSTALLATION.

Note

Fuel selector valve and fuel system strainer are mounted on same bracket and must be installed in fuselage bottom structure as unit.

a. Position fuel selector valve against small bracket that is riveted to selector valve mounting bracket. Position other small bracket on mounting bracket and secure it with bolts and washers. Secure bolts with lock wire.

Note

Yoke on selector valve should point toward wide end of mounting bracket.

b. Mesh driver on gear box with yoke on selector valve. Position gear box and support against small bracket. Secure gear box and selector valve to small brackets with bolts, washers, and nuts.

c. Position sealing ring at outlet port of selector valve and gasket at inlet port of strainer. Secure flanged fitting to strainer with washers and nuts and to selector valve with screws and washers. Secure bolts with lock wire.

Note

Three sealing rings, Parker Aircraft Co. part No. 10-1448-2-2, are furnished with selector valve by manufacturer.

d. Position elbow and sealing ring at top of selector valve. Secure elbow to valve with screws and washers. Secure screws with lock wire.

e. Position sealing ring and Y-drain connector, with drain valve attached, at bottom of selector valve. Secure connector to valve with screws and washers. Secure screws with lock wire.

f. Position mounting bracket with selector valve and strainer attached, in bottom structure by inserting it through the access hole in bottom of helicopter. Mesh driver on lower end of selector valve control shaft with yoke on selector valve gear box as bracket is raised into position.

Note

To insure ease of installation, selector valve and selector valve control should both be in ON position.

g. Install bolts and washers securing lower edge of mounting bracket to bulkhead. Install bolts and washers at lower end of Y-drain connector.

h. Reach through access door in clutch compartment floor and install bolts and washers securing upper edge of mounting bracket to bulkhead.

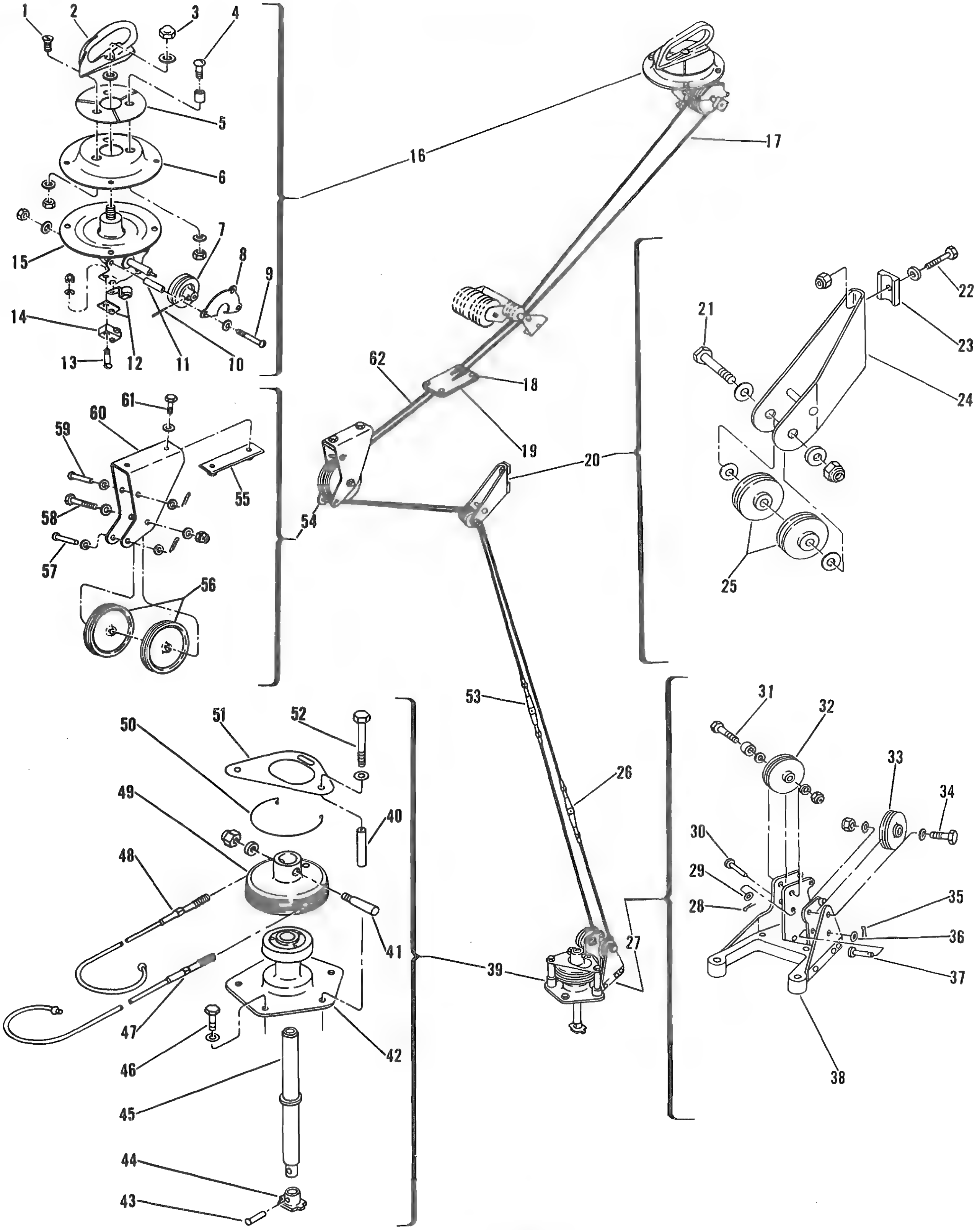


Figure 3–81. Fuel Selector Valve Control System (Helicopters Serial No. 56-4313 and Subsequent) (Sheet 1 of 2)

1. Screw, Washer, Nut
2. Handle
3. Washers, Nut
4. Screw, Washer, Nut, Spacer
5. Dial Plate
6. Support
7. Pulley
8. Plate
9. Screw, Washers, Nut
10. Rollpin
11. Spacer
12. Actuator
13. Screw, Washer, Nut
14. Switch
15. Support
16. Control Assembly
17. Cable Assembly
18. Screws, Washers, Nut
19. Seal
20. Pulley Bracket Installation
21. Bolt, Washers, Nut
22. Bolt, Washer, Barrel-Nut
23. Block
24. Bracket Assembly
25. Pulley
26. Turnbuckle Barrel
27. Pulley Assembly
28. Cotter Pin
29. Washer
30. Pin
31. Bolt, Washers, Spacer, Nut
32. Pulley
33. Pulley
34. Bolt, Washers, Nut
35. Cotter Pin
36. Washer
37. Pin
38. Bracket Assembly
39. Pulley Assembly
40. Spacer
41. Taper Pin, Washer, Nut
42. Housing Assembly
43. Rivet
44. Driver
45. Shaft
46. Bolt, Washer
47. Cable Assembly
48. Cable Assembly
49. Pulley
50. Retainer
51. Plate
52. Bolt, Washer
53. Turnbuckle Barrel
54. Pulley Installation
55. Filler Assembly
56. Pulley
57. Pin, Washers, Cotter Pin
58. Bolt, Washers, Nut
59. Pin, Washers, Cotter Pin
60. Bracket
61. Bolt, Washer
62. Cable Assembly

Figure 3–81. Fuel Selector Valve Control System (Helicopters Serial No. 56-4313 and Subsequent) (Sheet 2 of 2)

i. Connect fuel booster pump outlet tube to fitting at forward surface of bulkhead and to the elbow at top of the selector valve.

Note

Apply antiseize compound, Federal Specification TT-A-580, to threads of all fittings.

j. Install gaskets and access door on fuel strainer fitting flange. Secure door to floor with screws. Secure door and gaskets to strainer fitting flange with bolts and washers. Install gaskets, jamnut, and elbow in strainer fitting. Tighten jamnut. Install fuel tube. On helicopters serial No. 56-4313, 57-1684, and 57-1697 and subsequent, install fuel hose assembly.

Note

Install as many gaskets on strainer fitting flange as are required to prevent binding of access door when bolts and washers are installed.

k. Install gasket, jamnut, and elbow in bottom of Y-drain connector. Tighten jamnut. Connect emergency fuel system tube to elbow and to tee below forward fuel tank.

3–424. TESTING.

a. Fill all tanks with fuel. Check all connections for leakage with fuel booster pump running. Test selector valve for proper operation in all positions.

b. Secure hinged panel in place below selector valve. Replace fuel line fairing and clutch access door.

3–425. FUEL SELECTOR VALVE CONTROL.

3–426. DESCRIPTION. (See figure 3–3.) The fuel selector valve control consists of a control handle and gear box, which are mounted on the console in the pilots' compartment, 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 microswitch, 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

Fuel selector valve control must be rigged when a component has been removed or tension of either or both cables has been changed. For rigging instructions, refer to paragraph 3–433.

3–427. REMOVAL (HELICOPTERS SERIAL NO. PRIOR TO 56-4313). (See figure 3–80.)

a. Place fuel selector valve control handle (2, figure 3–80) in ON position.

b. Remove clutch access door from cabin forward bulkhead.

c. Remove turnbuckle barrels (20 and 21) from cables in clutch compartment. Pull upper cables (17 and 66) clear of self-aligning pulleys (60) located just below pilots' compartment floor. Pull lower cables (46 and 57) clear of pulleys (26) on cabin forward bulkhead and vertical bracket installation (29) on clutch compartment floor.

Note

Remove pin, washers, and cotter pin (25) from upper end of brackets (24 and 28) that support pulleys (26) on bulkhead before pulling cables off pulleys.

d. Remove bolts, washers (65), and nut plate that secure bracket (64) to pilots' compartment floor. Remove pulley installation (58).

Note

To remove pulleys (60) from bracket (64), remove washer and nut from bolt (62) on which pulleys turn and withdraw bolt and washer.

e. Remove bolts, washers, and nuts (23) that secure pulleys (26) and brackets (24 and 28) to cabin forward bulkhead.

Note

To remove pulleys from brackets, remove washer and nut from bolt (27) on which pulleys turn and withdraw bolt and washer.

f. Remove bolts and washers (32) that secure bracket installation (29) to clutch compartment floor.

Note

To remove either pulley (30 or 37) from its brackets, remove washer and nut from bolt on which pulley turns and withdraw bolt and washer. To separate brackets, remove remaining bolts, washers, nuts, and spacers.

g. Remove bolts, washers (47), and spacers (49) that secure plate (48) over horizontal pulley (56) on clutch compartment floor. Remove plate (48).

Note

Prior to removing the plate, check that selector valve is in ON position by inserting 3/16-diameter pin through elongated hole in plate (48) and corresponding hole in pulley (56). Do not rotate pulley following this check.

h. Remove bolts and washers (54) that secure pulley installation (44) to floor. Remove pulley installation and cables.

Note

Raise pulley assembly straight up until driver (51) on lower end of shaft (52) disengages from yoke on selector valve gear box.

i. Remove rollpins (55) from pulley. Remove cables (46 and 57) from pulley (56).

Note

Omit steps *j* and *k* unless it is necessary to disassemble pulley installation (44).

j. Remove taper pin, washer, and nut (45) that secure pulley (56) to shaft (52). Remove taper pin.

k. Remove shaft (52) from housing assembly (53).

l. Open hinged door on right side of console in pilots' compartment. Remove screws, washers, and nuts (18) that secure seals to bottom surface of pilots' compartment floor at point where upper cables pass through floor.

m. On helicopters serial No. prior to 55-4462, release tension on carburetor mixture control cables (1 and 8, figure 3–65) and carburetor air temperature control cables (2 and 9) at turnbuckles (3, 4, 6 and 7). Remove washer and nut from bolt on which pulleys in bracket (5) are suspended. Withdraw bolt through small hole in left side of console and remove pulleys and spacers. Pull cables up through floor and push them to rear of console.

n. On helicopters serial No. 55-4462 through 56-4312, remove bolt, washers, nut, and spacer securing two small pulleys in bracket of pulley installation. Remove pulleys. Remove bolts, washers, and nuts securing angle channel. Remove angle.

o. Remove screws and washers that secure dial plate support and gear box support to bracket on tunnel. Move control assembly (16, figure 3–80) to right to withdraw gear box output shaft from bearing on side of bracket. Raise control assembly (16) and disconnect electrical leads from transfer pump switch (14). Remove control assembly and cables from bracket.

p. Remove screws, washers, nuts (9), and spacer (11) that secure plate (8) to gear box at side of pulley. Remove plate (8).

q. Remove rollpins that secure cables to pulley. Remove cables.

Note

Omit steps *r* through *u* unless further disassembly of control assembly is necessary.

r. Remove rollpin (10) that secures pulley (7) to gear box output shaft. Remove pulley (7) from shaft.

s. Remove screws, washers, and nuts (13) that secure transfer pump switch (14) to bracket on gear box. Remove switch (14) and actuator (12).

t. Remove washer and nut (3) that secure control handle (2) to gear box input shaft. Remove handle and washer below handle.

u. Lift dial plate (5) and support from gear box support.

Note

Remove screws, washers, nuts, and spacers (4) to separate dial plate from support.

Note

Do not disassemble control assembly gear box beyond this point.

v. Remove screws, washers, and nuts that secure bearing to panel on left side of bracket on tunnel. Remove bearing.

3–428. REPAIR OR REPLACEMENT.

a. Replace control assembly gear box if it is damaged or if backlash between gears exceeds 0.002 to 0.010 inch.

b. Inspect all bearings for smoothness of operation.

c. Inspect all cables for possible damage or fraying and for security of fittings. Replace cables if necessary.

d. Inspect all pulleys, plates, and brackets for possible damage. Repair or replace damaged pulleys, plates, and brackets.

3–429. INSTALLATION (HELICOPTERS SERIAL NO. PRIOR TO 56-4313). (See figure 3–80.)

Note

When possible, install bolts with heads up.

Note

Omit steps *a* through *e* unless control assembly was disassembled.

a. Position dial plate (5, figure 3–80) on support assembly. Install screw, washer, and nut in hole below word ON. Install screw, washer, nut, and spacer (4) at each of remaining holes.

Note

Spacers are installed between dial plate and head of screw.

b. Position dial plate (5) and support assembly (6) on gear box support.

c. Position washer on gear box input shaft. Position control handle (2) on shaft. Secure handle on shaft with washer and nut (3).

d. Position actuator (12) and transfer pump switch (14) on bracket attached to gear box and secure them with screws, washers, and nuts (13).

e. Install pulley (7) on gear box output shaft. Align hole in pulley with hole in shaft. Install rollpin (10) to secure pulley to shaft.

Note

Check that pulley is properly positioned on shaft by turning control handle 90 degrees to left while facing end of gear box output shaft. Center of flat spot on pulley should now be down and 45 degrees left of center.

f. Position cables around pulley. Seat ball on end of each cable in recess in pulley. Install rollpin to hold cables on pulley.

Note

Install short cable in outboard groove of pulley.

Note

Drive rollpin flush with face of pulley.

g. Install plate (8, figure 3–80) at side of pulley (7) and secure it with screws, washers, nuts (9), and spacers (11).

h. Position bearing at small hole in panel on left side of bracket on tunnel. Secure bearing to panel with screws, washers, and nuts.

WARNING

Make certain all electrical power is turned off.

i. Route cables through hole in bracket on tunnel and into console. Connect electrical leads to switch (14) of transfer pumps. Position control assembly (16) on bracket with output shaft in bearing mounted on panel on left side of bracket. Secure dial plate support and gear box support to bracket with screws and washers.

Note

Dial plate and support will rotate on gear box shaft and should be positioned with word ON in forward position.

j. On helicopters serial No. prior to 55-4462, open hinged door on right side of console. Pull cables (17 and 66) forward into console. Install pulleys and spacers at bracket assembly in console. (Refer to paragraph 3–283.) Install turnbuckle barrels (3, 4, 6 and 7, figure 3–65) on carburetor mixture control cables (1 and 8) and carburetor air temperature control cables (2 and 9).

Note

Short cable rides in extreme left pulley.

k. On helicopters serial No. 55-4462 through 56-4312, open hinged door on right side of console. Pull cables forward into console. Install angle with bolts, washers, and nuts. Install two small pulleys with bolt, washers, nut, and spacer. Route cables under pulleys and install guide pin.

l. Route two cables through hole in console floor. Install seals (19, figure 3–80) around cables at floor with screws, washers, and nuts (18). Close hinged door.

Note

Omit steps *m* through *o* unless pulley assembly attached to bottom of pilots' compartment floor was disassembled.

m. Position pulleys (60) between legs of bracket (64). Bolt pulleys and bracket to clip.

Note

Pulleys must be aligned to obtain free movement of control shaft after cables are routed.

n. Position bracket against lower surface of pilots' compartment floor and secure it with bolts and washers (65) and filler assembly.

Note

Corner of plate with sharpest angle is secured against support lug.

o. Route upper cables over pulleys.

Note

Short cable rides in left pulley.

p. Insert guard pin through holes in bracket, position washers, and secure pins with cotter pins (63).

Note

Cables should be positioned under guard pins.

Note

Omit steps *q* and *r* unless pulley assembly attached to clutch compartment floor above selector valve was disassembled.

q. Insert shaft (52) through bottom of housing assembly (53).

r. Install pulley (56) on upper end of shaft (52) and secure it with taper pin, washer, and nut (45).

Note

Head of taper pin should line up with small lug on driver on lower end of shaft.

s. Position cables (46 and 57) around pulley. Seat ball on end of each cable in recess in pulley. Install rollpin (55) to hold cables on pulleys.

Note

Install long cable in upper groove of pulley.

t. Insert shaft (52) of pulley assembly through clutch compartment floor. Mesh driver (51) on shaft with yoke on selector valve gear box.

Note

Align pulley assembly to obtain free movement of shaft.

u. Secure pulley installation (44) to floor with short bolts and washers (54). Position plate over pulley and install spacers (49). Secure bracket with bolts and washers (47).

Note

Omit step *y* unless vertical pulley assemblies attached to clutch compartment floor were disassembled.

v. Position pulley (30) between each pair of brackets (33 and 35) and secure it with bolt, washers, and nut (36).

w. Position bracket installation (29) on clutch compartment floor and secure it with bolts and washers (32).

Note

Pulley assembly brackets should be positioned and secured to clutch compartment floor adjacent to cabin forward bulkhead with brackets slanting aft.

x. Position pulley brackets (24 and 28) against cabin forward bulkhead and secure them with bolts, washers, and nuts (23). Secure pulleys between brackets with bolt, washers, and nut (27).

y. Route lower cables through pulleys. Install turnbuckle barrels (20 and 21). Install bolt, washers, nut (36), and spacer (34) at upper end of pulley brackets. Cables should be routed between pulleys and pin, and pulleys and spacers.

z. Rig selector valve control. (Refer to paragraph 3–433.)

aa. Check adjustment on carburetor mixture control system and carburetor air temperature control system. (Refer to paragraphs 3–84 and 3–85.)

3–430. REMOVAL (HELICOPTERS SERIAL NO. 56-4313 AND SUBSEQUENT).

a. Place fuel selector valve control handle (2, figure 3–81) in ON position.

b. Remove clutch access door from cabin forward bulkhead.

Note

Omit steps *c* through *e* unless it is necessary to completely disassemble pulley assembly.

c. Remove turnbuckle barrels (26 and 53) from cables in clutch compartment.

d. Remove bolts and washers (52) and spacers (40) securing plate (51) to pulley assembly (39) on clutch compartment floor. Remove plate.

Note

Prior to removing plate, insure selector valve is in ON position by inserting a 3/16-inch diameter pin through elongated hole in plate and corresponding hole in pulley. Do not rotate pulley following this check.

e. Remove bolts and washers (46) securing pulley assembly to clutch compartment floor. Remove pulley assembly.

Note

Raise pulley assembly straight up until driver (44) on lower end of shaft disengages from yoke on selector valve gear box.

f. Remove retainer (50) from horizontal pulley assembly (39). Remove cotter pins (28), washers (29), and guard pins (30) from vertical pulley assembly (27). Detach collars of cables from shoulders of cable retaining grooves of horizontal pulley assembly. Remove vertical pulley assembly.

g. To disassemble vertical pulley assembly, remove nuts, washers, spacer, and bolts (31) that secure pulleys (32) in bracket assembly (38). Remove vertical pulley assembly.

h. To disassemble horizontal pulley assembly, remove nut, washer, and taper pin (41). Remove pulley (49) and shaft (45) from housing assembly (42).

i. Remove barrel-nuts, washers, and bolts (22) that secure blocks (23) and pulley bracket installation (20) to transverse beam. Remove blocks and pulley bracket installation. Remove nut, washers, and bolt (21) that secure pulleys to bracket. Remove pulleys and cables.

Note

Pulleys must be removed in order to remove cables without removing pulley bracket installation.

j. Remove cotter pins, washers, and guard pins, (57 and 59) from pulley installation attached to pilots' compartment floor. Pull cables up through pulleys.

k. Remove nut, washers, and bolt (58) that position pulleys and secure pulley installation to the clip. Remove pulleys.

l. Remove bolts, washers (61), and filler assembly (55) securing pulley installation (54) to pilots' compartment floor. Remove pulley installation.

m. Remove nuts, washers, and screws (18) securing seal (19) in console floor. Remove seal.

n. Remove guard pin in fuel selector valve control pulley assembly in tunnel. Pull cables free of pulleys.

o. Remove nuts, washers, bolt, and spacer that secure pulleys to pulley assembly. Remove pulleys. Remove nuts, washers, and bolts that secure angle to channel. Remove angle.

WARNING

Make certain all electrical power is turned off.

p. Remove screws and washers securing dial plate support and gear box support to bracket on tunnel. Move control assembly (16) to right to withdraw gear box output shaft from bearing on side of bracket. Raise control assembly and disconnect electrical leads from transfer pump switch (14). Remove control assembly and cables from bracket.

q. Remove nuts, washers, screws (9), and spacers (11) that secure plate (8) to gear box at side of pulley. Remove plate.

r. Remove rollpins that secure cables to pulley.

Note

Omit steps *s* through *v* unless further disassembly of control assembly is necessary.

s. Remove rollpin (10) securing pulley (7) to gear box output shaft. Remove pulley from shaft.

t. Remove nuts, washers, and screws (13) securing transfer pump switch (14) to bracket on gear box. Remove switch and actuator (12).

u. Remove nut and washers (3) securing control handle (2) to gear box shaft. Remove handle and washer below handle.

v. Lift dial plate (5) and support (6) from gear box support (15).

Note

Remove nuts, washers, spacers, and screws (4) to separate dial plate from support.

Note

Do not disassemble control assembly gear box beyond this point.

w. Remove nuts, washers, and screws securing bearing to panel on left side of bracket on tunnel. Remove bearing.

3–431. REPAIR. Refer to paragraph 3–428 for repair or replacement instructions.

3–432. INSTALLATION (HELICOPTERS SERIAL NO. 56-4313 AND SUBSEQUENT). (See figure 3–81.)

Note

When possible, install bolts with heads up.

Note

Omit steps *a* through *e* unless control assembly was disassembled.

a. Position dial plate (5) on support. Install screw, washer, and nut in hole below word ON. Install screw, washer, nut, and spacer at each of remaining holes.

Note

Spacers are installed between dial plate and head of screw.

b. Position dial plate (5) and support (6) on gear box support.

c. Position washer on gear box input shaft. Position handle (2) on shaft and secure with washers and nut (3).

d. Position actuator (12) and transfer pumps switch (14) on bracket attached to gear box and secure with screws, washers, and nuts.

e. Install pulley (7) on gear box output shaft. Align hole in the pulley with hole in shaft. Install rollpin (10) to secure pulley to shaft.

Note

Check that pulley is properly positioned on shaft by turning control handle 90 degrees to left while facing end of gear box output shaft. Center of flat spot on pulley should now be down and 45 degrees left of center.

f. Position cables around pulley. Seat collar on end of each cable in cable retaining groove in pulley. Install rollpin to hold cables on pulley.

Note

Install short cable in outboard groove of the pulley.

Note

Drive rollpin flush with face of pulley.

g. Install plate (8) at side of pulley and secure with screws, washers, nuts (9), and spacers (11).

h. Position bearing at small hole in panel on left side of bracket on tunnel. Secure bearing to panel with screws, washers, and nuts.

WARNING

Make certain all electrical power is turned off.

i. Route cables through hole in bracket assembly on tunnel. Connect electrical leads to switch (14) of transfer pumps. Position control assembly (16) on bracket with output shaft in bearing mounted on panel on left side of bracket. Secure dial plate support and gear box support to bracket with screws and washers.

Note

Dial plate (5) and support (6) will rotate on gear box shaft and should be positioned with word ON in forward position.

j. Open hinged door on right side of console. Pull cables forward into console and thread lower cable through hole in tunnel bracket.

k. Install angle of pulley assembly with bolts, washers, and nuts.

l. Install two selector valve control pulleys with bolt, washers, spacer, and nut.

m. Thread cables through pulleys and install guard pin.

Note

Short cable rides in extreme left pulley.

n. Route two cables through hole in console floor. Install seals (19) around cables to floor with screws, washers, and nuts (18). Close hinged door.

Note

Omit steps *o* and *p* unless pulley installation (54) attached to bottom of pilots' compartment floor was disassembled.

o. Position pulleys (56) between legs of bracket (60). Secure pulleys and bracket to clip with bolt, washers, and nut.

p. Secure bracket of pulley installation to pilots' compartment floor with bolts, washers (61), and filler assembly (55).

q. Route cables over pulleys. Install pins, washers, and cotter pins (57 and 59).

Note

Omit step *r* unless pulley bracket installation (20) attached to transverse beam was disassembled.

r. Secure bracket assembly (24) of pulley bracket installation to transverse beam with bolts, washers, and barrel-nuts (22).

Note

Be certain to install the blocks (23) between bracket assembly and transverse beam.

s. Position cables over pulleys (25) and secure pulleys between legs of bracket assembly with bolt, washers, and barrel-nut (21).

Note

Be certain cables are positioned under riveted guard pin.

Note

Omit steps *t* and *u* unless pulley installation was disassembled.

t. To assemble horizontal pulley assembly, insert shaft (45) up through housing assembly (42). Position pulley (49) on shaft. Install taper pin, washer, and nut (41).

CAUTION

Small end of tapered shank of taper pin must not extend more than 1/16-inch above surface of pulley.

Note

Head of tapered shank must be aligned with small lug of driver on shaft assembly.

u. To assemble vertical pulley assembly (27), thread cable over forward pulley (33), install pulleys with bolt, washers, and nut (34), and install guard pin, washer, and cotter pin. Install aft pulley (32) with bolt, washers, spacer, and nut (31), thread cable through pulley, and install guard pins, washers (29), and cotter pins (28).

v. Position horizontal pulley assembly over holes provided in clutch compartment floor and mesh driver (44) on shaft with yoke on selector valve gear box. Align holes in bracket assembly (38) with holes in housing assembly (42). Secure assemblies to floor with bolts and washers (46).

w. Position collar of cables in shoulder of cable retaining grooves in pulley (49). Insert cable retainer.

x. Position plate (51) over pulley. Align holes in plate with holes in bracket assembly. Secure plate with bolts, washers (52), and spacers (40).

y. Connect lower selector valve control cables with upper cables by installing turnbuckle barrels (26 and 53).

3–433. RIGGING.

CAUTION

Fuel selector valve control must be rigged whenever a component has been removed or tension of either or both cables has been changed.

Note

Fuel selector valve control may be checked quickly for proper rigging by placing control handle in ON position and inserting 3/16-inch diameter pin through elongated hole in plate over horizontal pulley on clutch compartment floor and on through corresponding hole in pulley.

a. Place fuel selector valve in ON position by rotating horizontal pulley located just above clutch compartment floor until 3/16-inch diameter pin can be inserted through elongated hole in plate cover pulley and on through corresponding hole in pulley. Leave pin in pulley.

b. Lock control handle in ON position or have it held in that position.

c. Adjust turnbuckle barrel on each cable so tension of 35 ± 5 pounds is applied to each cable.

d. Unlock control handle and remove pin from pulley and plate. Check control handle for freedom of movement throughout entire range.

e. Insure hole in pulley aligns with hole in plate as control handle is moved to ON position.

f. Secure each turnbuckle barrel with lock wire.

g. Replace clutch access door.

3–434. FUEL SYSTEM STRAINER.

3–435. 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.

3–436. REMOVAL.

Note

Fuel system strainer and fuel selector valve are mounted on same bracket and must be removed from fuselage bottom structure as unit.

a. Remove strainer, selector valve, and mounting bracket from bottom structure. (Refer to paragraph 3–421, steps *a* through *h*.)

b. Remove washers and nuts securing fitting to inlet port of strainer.

c. Remove washers and nuts securing fitting to top of strainer. Remove fitting and gasket.

d. Remove bolts, washers, and nuts securing strainer to mounting bracket. Remove strainer. Remove gasket from strainer inlet port.

e. Loosen jamnuts at elbow above drain cock. Remove drain cock, nut, and gasket from elbow. Remove elbow, nut, and gasket from union. Remove union and gasket from strainer housing.

f. Remove plug and gasket located at side of strainer housing.

3–437. REPAIR OR REPLACEMENT. Repair or replace any damaged parts in accordance with applicable manual listed in Appendix I.

3–438. INSTALLATION.

Note

Fuel system strainer and fuel selector valve are mounted on same bracket and must be installed in fuselage bottom structure as a unit.

Note

Apply antiseize compound, Federal Specification TT-A-580, to the threads of all fittings.

a. Install union and gasket in drain port at bottom of fuel strainer. Install elbow, jamnut, and gasket on union. Install drain cock, jamnut, and gasket in elbows. Tighten jamnuts.

b. Position gasket over plug and secure plug strainer housing. Secure plug with lock wire.

c. Position strainer on mounting bracket. Install gasket at strainer inlet port. Secure strainer to bracket with bolts, washers, and nuts.

d. Secure flanged fitting and gasket to strainer inlet port with washers and nuts.

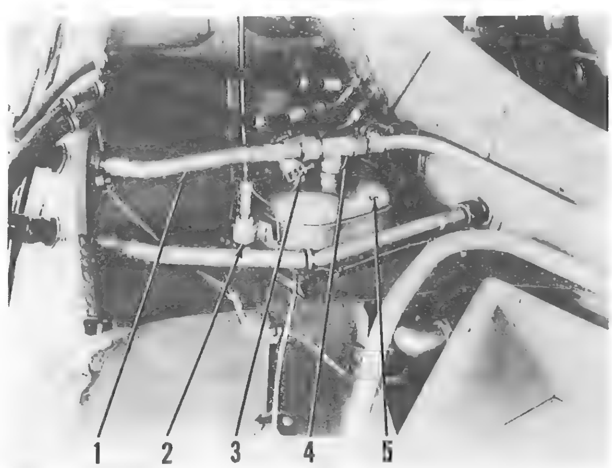
e. Position fitting and gasket at top of strainer. Secure fitting to strainer with washers and nuts.

f. Install strainer, selector valve, and mounting bracket in bottom structure. (Refer to paragraph 3–423, steps *f* through *k*.)

3–439. LUBRICATION SYSTEM.

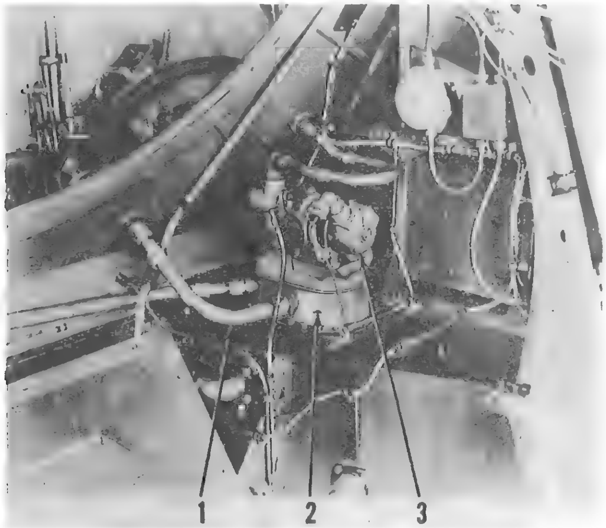
3–440. OIL CELLS.

3–441. DESCRIPTION. (See figures 3–82 and 3–83.) 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 tube is attached to a fitting in each of 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 dipstick 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. On helicopters serial No. prior to



1. Vent Tube
2. Oil Dilution Solenoid Valve
3. Coupling
4. Tee
5. Right Cell Cover

Figure 3–82. Right Oil Cell



1. Clutch Oil Return Tube
2. Left Cell Cover
3. Clutch Oil Pump

Figure 3–83. Left Oil Cell

56-4313, the clutch oil pump is mounted on the cover over the left cell. On helicopters serial No. 56-4313 and subsequent, the clutch diverter valve is located above the cover of the right cell.

3–442. 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 type gage as used in paragraph 3–362.

3–443. REMOVAL.

CAUTION

Extreme care should be exercised when handling oil cells in temperature below 4.4°C (40°F). In regions where temperature of 4.4°C (40°F) and below exist, provisions should be made to heat engine compartment while working on cells. Upper limit of temperature is 71°C (160°F).

a. Open nose doors.

b. Remove power plant. (Refer to paragraph 3–12.)

c. Hinge down power plant. (Refer to paragraph 3–288.)

Note

Preservation of engine should be accomplished, based on length of time engine will be inactive.

d. Drain each cell sump at drain valve.

WARNING

Make certain all electrical power is off.

e. On helicopters serial No. prior to 56-4313, remove clutch oil pump (3, figure 3–83) from left cell cover (2). (Refer to paragraph 3–459 for removal instructions.) On helicopters serial No. 56-4313 and subsequent, remove clutch diverter valve from right cell cover. (Refer to paragraph 3–464 for removal instructions.)

f. Remove screws that secure oil filler flange to scupper in right wall of helicopter. Loosen strap-type coupling (3, figure 3–82) located around filler at right cell cover (5). Pull filler out through scupper.

Note

Slide coupling (3), collar, and gasket off filler while removing filler from scupper.

g. Disconnect clutch oil return tube (1, figure 3–83) from elbow in left cell cover (2).

h. Remove screw, washers, nut, and clamp supporting long engine vent tube (3, figure 3–84) between two cell covers. Disconnect tube from fitting in each cell cover. Remove tube.

i. Disconnect short engine vent tube (1, figure 3–82) from tee (4) in right cell cover (5) and elbow at engine compartment forward bulkhead. Remove tube.

j. Disconnect both oil dilution tubes at oil dilution solenoid valve (2) near right oil cell cover.

k. Remove bolts and washers securing right cell cover (5, figure 3–82) and left cell cover (2, figure 3–83). Move oil dilution solenoid valve (2, figure 3–82) and bracket to one side and remove each cover and gasket.

l. Remove drain valve and gasket from each cell sump. Remove bolts and washers securing retainers to support adapters. Remove fitting retainer rings. Reach into each cell and remove drain fitting and gasket.

m. Support outlet fittings inside each cell and loosen bolts that secure oil outlet tube connectors (6 and 14, figure 3–84) to side of each cell. Remove fitting and gasket from each cell. Support outlet tube (7) and remove bolts and washers. Remove tube and gaskets.

Note

Do not bend oil dilution tube while removing oil outlet tube. If tube becomes bent, replace it.

n. Support return fitting inside each cell and loosen bolts securing oil return tube elbow and flange to side of each cell. Remove fitting and gasket from each cell. Remove bolts and washers from each flange. Remove gasket under each flange.

o. Release snap fasteners that secure top of each cell to bottom structure skin.

p. Collapse each cell as much as possible and remove it from bottom structure cavity.

CAUTION

Care must be observed while removing cells from bottom structure to avoid damaging cells.

Note

Disposition of cells should be made in accordance with applicable manual listed in Appendix I.

3–444. REPAIR. Refer to applicable manual listed in Appendix I.

3–445. INSTALLATION.

CAUTION

Extreme care should be observed when handling 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 engine compartment while working on cells. Upper limit of temperature is 71°C (160°F).

Note

Apply antiseize compound, Federal Specification TT-A-580, to threads of all fittings.

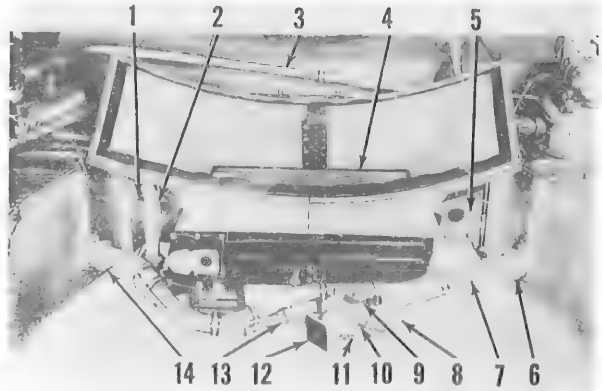
a. Remove new cell from its shipping container before installation.

b. Inspect bottom structure cell cavities for cleanness 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 bottom structure cavity. Align openings in each cell with corresponding openings in bottom structure.

d. Secure top of each cell to bottom structure skin with snap fasteners.

e. Install new gasket between each oil return line flange and bulkhead. Install bolts and washers. Position return fitting and new gasket inside each cell and secure it with bolts. Tighten each bolt to torque of 50 ± 5 inch-pounds, and secure with lock wire.



1. Bracket
2. 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. Pre-Oil Fitting
12. Housing
13. Valve
14. Outlet Tube Connector

Figure 3–84. Oil Cooler

Note

Opening on each return fitting should point forward.

f. Position oil outlet tube (7, figure 3–84) between cells. Install new gasket between each outlet tube connector (14) and bulkhead. Install bolts and washers. Position outlet fitting and new gasket inside each cell and secure with bolts. Tighten each bolt to a torque of 50 ± 5 inch-pounds, and secure with lock wire.

Note

Sloping surface of each outlet fitting should be up.

g. Position drain fitting and new gasket inside each cell. Position fitting retainer ring against support adapter below each cell. Secure each drain fitting, gasket, and retainer to support adapter with bolts and washers. Tighten each bolt to a torque of 50 ± 5 inch-pounds, and secure with lock wire.

h. Install a drain valve and gasket in each drain fitting.

i. Position gaskets with right cell cover (5, figure 3–82) and left cell cover (2, figure 3–83) over each cell access hole and secure them with bolts and washers. Tighten each bolt to a torque of 50 ± 5 inch-pounds.

Note

In order to line up nut ring when installing cell covers, thread one end of a piece of drill rod 8 to 10 inches long and same diameter as bolts. Insert drill rod through one of holes in reinforcing ring and gasket and pick up corresponding hole in nut ring. Raise nut ring into position reinforcing ring and slide cell cover and gasket over drill rod.

Note

Do not install forward center bolt or bolt just to left of it in right cell cover at this time.

j. Position oil dilution solenoid valve (2, figure 3–82) and bracket on flange of right cell cover (5) and secure with bolts and washers. Tighten each bolt to a torque of 50 ± 5 inch-pounds. Secure all bolts in both covers with lock wire.

Note

Position right hole in solenoid bracket over forward center hole in cell cover flange.

k. Connect both oil dilution tubes to oil dilution solenoid valve (2).

l. Connect short engine vent tube (1) to elbow at engine compartment forward bulkhead and to tee (4) in right cell cover.

Note

Wrap asbestos tape, Military Specification MIL-T-4117, helically around tube wherever necessary so that thick end of tape overlaps thin end on each spiral. Leave enough space on either end of tube so that tube fittings can slip over tube when they are being connected. Wrap all fittings separately. Be sure that there are no open spaces. Secure tape with lock wire.

m. Connect long engine vent tube (3, figure 3–84) to tee (4, figure 3–82) in right cell cover (5) and to aft union in left cell cover (2, figure 3–83). Install clamp near center of the tube and secure it with screw, washers, and nut.

n. Connect clutch oil return tube (1) to forward elbow in left cell cover (2).

o. Insert end of oil filler through scupper in right wall of helicopter. Slide coupling (3, figure 3–82), collar, and gasket onto end of filler. Insert filler into right cell cover.

Note

Replace collar if largest diameter exceeds 2-5/8 (2.625) ± 1/32 (0.03125) inches. Use only part No. AN6230B4 gasket.

p. Secure filler flange to scupper with screws. Slide gasket and collar down against lip on sleeve and secure them with coupling (3).

Note

Tighten coupling until gap between the ends is reduced to 1/8 (0.125) ± 1/16 (0.0625) inch.

q. On helicopters serial No. prior to 56-4313, install clutch oil pump (3, figure 3–83) on left cell cover. (Refer to paragraph 3–461.) On helicopters serial No. 56-4313 and subsequent, install clutch diverter valve on right cell cover. (Refer to paragraph 3–466.)

r. Install power plant. (Refer to paragraph 3–193.)

s. Pressure test oil cells. (Refer to paragraph 3–442.)

t. Check to see that all drain valves are closed. Fill cells with oil. (Refer to servicing instructions in TM 55-1520-202-20, Chapter 2, Section II.)

WARNING

Do not overfill. Overfilling reduces necessary foaming space.

u. Pre-oil engine. (Refer to TM 55-1520-202-20, Chapter 2, Section IV.)

CAUTION

The engine must be pre-oiled immediately prior to starting after engine change, after engine has been idle for more than 96 hours, or after air has been allowed to enter oil inlet line to engine in any manner.

3–446. OIL COOLER (OIL TEMPERATURE REGULATOR).

3–447. DESCRIPTION. (See figure 3–84.) 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.

3–448. REMOVAL.

a. Open nose doors.

b. Drain oil from both oil cells at drain valve (8, figure 3–84) just forward of oil cooler (4).

c. Remove large hex-head plug at forward right corner of oil cooler (4) and drain cooler.

d. Remove washers and nuts to disconnect engine oil outlet hose at oil cooler. Remove gasket.

Note

On helicopters serial No. 53-4475 through 53-4479, an adapter is installed on mounting pad of inlet port. Remove adapter and gasket.

e. Remove nuts and washers connecting oil cell return tube (2), fitting, flange, and gasket to outlet port on right side of cooler.

f. Disconnect and remove long bracket assembled to brackets (1 and 5) on each side of cooler.

g. Remove nuts and washers from bolts securing oil cooler (4) to brackets (1 and 5). Support cooler and remove bolts. Lower cooler and remove it from helicopter.

h. Remove nuts, washers, and bolts securing lower flange of oil cooler duct to brackets on bottom structure bulkheads. Remove nuts, washers, and bolts securing brackets to clips. Remove brackets.

Note

To remove oil cooler duct, remove or hinge down power package. (Refer to paragraphs 3–13 and 3–288.) Duct may then be disconnected from brackets on top surface of bottom structure and removed from helicopter. Remove brackets from forward keel beams.

3–449. REPAIR OR REPLACEMENT. Refer to applicable manual listed in Appendix I.

a. Inspect oil cooler duct and all brackets for possible cracks or damage. Replace if cracked or damaged.

b. Inspect oil duct for security of rivets. Replace loose rivets.

c. Check condition of seals on oil cooler duct. Replace damaged seals.

d. Inspect clips attached to bottom structure bulkheads for possible cracks. Replace cracked clips.

e. If necessary, clean oil cooler as follows: Wash cooler in dry-cleaning solvent, Federal Specification P-S-661, and dry thoroughly. Reverse flush cooler with dry-cleaning solvent at rate of 30 gallons per minute until no foreign particles appear in solvent after solvent passes through.

3–450. INSTALLATION.

a. Position bracket on each forward keel beam and secure it with bolts, washers, and nuts.

b. Position bracket (1 and 5, figure 3–84) against each clip on bottom structure bulkhead and secure it with bolts, washers, and nuts.

Note

If new brackets are being installed, drill through brackets with a No. 10 drill. Deburr holes.

c. Position oil cooler duct against keel beam brackets and secure it with bolts and washers.

d. Bolt lower flange of oil cooler duct to bulkhead brackets.

e. Position oil cooler (4) between bulkhead brackets (1 and 5).

Note

Inlet and outlet ports are at right front corner of cooler.

f. Insert bolts through bulkhead brackets (1 and 5) and cooler brackets.

Note

Eyebolts are installed in forward brackets. Head of each eyebolt should be aft.

g. Secure bolts with washers and nuts.

Note

Tighten nuts at right side of cooler first.

h. Position long bracket between bulkhead brackets (1 and 5) on each side of cooler and secure it to eyebolt and clip with bolts, washers, and nuts.

Note

If new brackets are being installed, drill through pilot hole in aft end of each bracket with No. 10 drill. Deburr hole in each bracket.

i. Secure oil cell return tube (2), fitting, flange, and gasket to outlet port on right side of oil cooler (4) with washers and nuts.

j. Bring power plant into position. (Refer to paragraph 3–193.)

k. Secure engine oil outlet hose and gasket to inlet port of cooler with washers and nuts. Secure nuts with lock wire.

Note

On helicopters serial No. 53-4475 through 53-4479, adapter and gasket should be secured to mounting pad and engine outlet hose and gasket secured to adapter.

l. Check to see that large, hex-head drain plug is installed at forward, right corner of oil cooler (4). Fill cells with oil. (Refer to servicing instructions in TM 55-1520-202-20, Chapter 2, Section II.)

WARNING

Do not overfill. Overfilling reduces necessary foaming space.

m. Pre-oil engine.

CAUTION

Engine must have been pre-oiled within 2 hours prior to starting after an engine change, after engine has been idle for more than 96 hours, or after air has been allowed to enter oil inlet line to engine in any manner. For instructions on pre-oiling engine, refer to TM 55-1520-202-20, Chapter 2, Section II.

3–451. ENGINE COOLING SYSTEM.

3–452. DESCRIPTION. 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 pilots' compartment windshield and is directed downward between the inclined fire wall (pilots' compartment 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.

3–453. ENGINE COWLING. Refer to paragraph 3–13 for removal instructions. Refer to Chapter 3, paragraph 6–25 for repair instructions. Refer to paragraph 3–195 for installation.

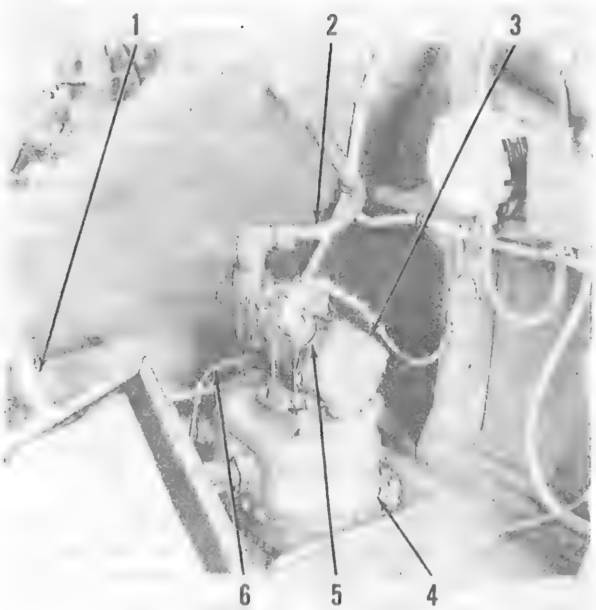
3–454. CONTRAVANE ASSEMBLY.

3–455. 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 cap screws 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. They 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.

3–456. REMOVAL, REPAIR, AND INSTALLATION. Refer to paragraph 3–21 for removal instructions. Refer to Chapter 3, paragraph 6–32 for repair instructions. Refer to paragraph 3–143 for installation instructions.

3–457. CLUTCH PUMP.

3–458. DESCRIPTION. (See figure 3–85.) On helicopters serial No. prior to 56-4313, 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 CLUTCH-OFF switch on the control console is placed in the CLUTCH position. A pressure switch in the rotor brake system of helicopters serial No. 55-4462 and subsequent opens the clutch pump circuit, preventing the pump from operating when the rotor brake is engaged. A warning light is lighted during opera-



1. Return Tube
2. Pressure Tube
3. Clutch Pump
4. Oil Cell Cover
5. Disconnect Plug
6. Drain Tube

Figure 3–85. Clutch Pump

tion only. A pressure line carries oil to the clutch, a return line connects to the left oil cell, and a tube assembly, through which the engine oil is drawn, runs from the pump directly to the oil cell below.

3–459. REMOVAL.

a. Open nose doors.

WARNING

Make certain all electrical power is turned off.

b. Disconnect wiring to pump at disconnect plug (5, figure 3–85).

c. Disconnect pressure tube (2) and drain tube (6) from elbow and nipple in pump housing and drain into receptacle.

d. Remove bolts which secure clutch pump (3) to cover assembly on left oil cell.

e. Remove tube assembly which fits down into oil cell from the pump inlet port. Remove pump from cover assembly.

f. Remove elbow from pump outlet port and nipple from drain opening on pump.

3–460. OVERHAUL. Refer to applicable manual listed in Appendix I.

3–461. INSTALLATION. (See figure 3–85.)

a. Install elbow in pump outlet port and nipple in drain opening on pump housing.

b. Position clutch pump (3) on top of oil cell cover assembly and secure it with attaching bolts.

c. Connect pressure tube (2) to elbow on pump outlet port and drain tube (6) to nipple on pump.

WARNING

Make certain all electrical power is turned off.

d. Connect electrical wires to pump at disconnect plug (5).

e. Tighten tube assembly from oil cell into pump inlet port.

f. Close nose doors.

3–462. CLUTCH DIVERTER VALVE.

3–463. DESCRIPTION. (See figures 3–86 and 3–87.) On helicopters serial No. 56-4213 and subsequent, an electrically actuated diverter valve is installed in the oil return line from the oil cooler to the oil cells. The valve is positioned above the cover assembly on top of the right oil cell forward of the canted bulkhead in the clutch compartment. When the CLUTCH-OFF switch on the control console is placed in the CLUTCH position, the valve diverts oil that is returning to the oil cells from the engine oil pump into the clutch oil pressure line. A red warning light, located next to the switch, lights when oil is flowing to the clutch. A pressure line carries oil from the diverter valve to the clutch, an oil return line connects the clutch to the left oil cell. A drain line between the valve and the right oil cell allows residual oil to drain from the pressure line after each clutch engagement. A manual override toggle switch on the valve indicates the position of the valve gate and allows manual operation of the valve in the event of electrical failure. A pressure switch in the rotor brake system prevents operation of the diverter valve while the rotor brake is engaged.

CAUTION

Release main rotor brake before operating diverter valve manually.

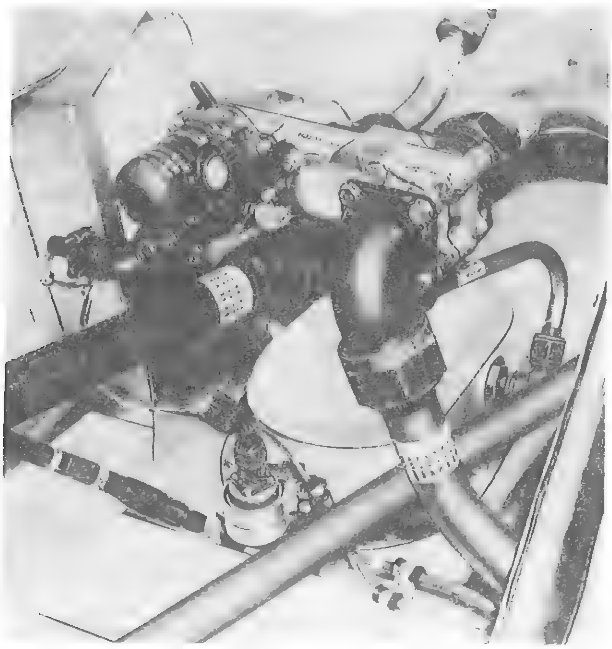


Figure 3–86. Clutch Diverter Valve

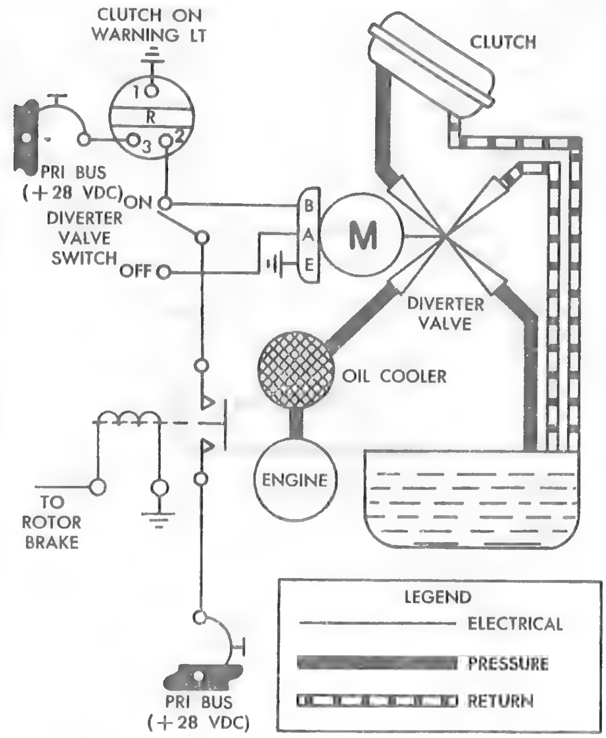


Figure 3–87. Clutch Diverter Valve System

3–464. REMOVAL.

a. Open nose doors.

WARNING

Make certain all electrical power is turned off.

b. Disconnect electrical wiring from diverter valve at disconnect plug.

c. Disconnect drain hose from elbow in bottom of valve.

d. Disconnect clutch pressure tube from connector at rear of valve.

e. Support valve. Disconnect oil cooler tube from elbow at front of valve and oil cell tube from connector at rear of valve. Remove valve.

f. Loosen nut and remove elbow, nut, and gasket from drain port of valve.

g. Remove bolts and washers securing flange to inlet port of valve. Remove elbow, flange, and gasket.

h. Remove bolts and washers securing connector to each outlet port of valve. Remove connectors and gaskets.

3–465. OVERHAUL. Refer to applicable manual listed in Appendix I.

3–466. INSTALLATION.

Note

If O-ring packing is furnished with diverter valve for inlet port and both outlet ports, gaskets mentioned in this paragraph may be omitted at these ports.

a. Position O-ring packing or gasket and connector at oil cell outlet port near left rear corner of diverter valve and secure them with bolts and washers. Secure bolts with lock wire.

b. Position O-ring packing or gasket and connector at clutch outlet port of valve and secure them with bolts and washers. Secure bolts with lock wire.

Note

Clutch outlet port is to right of oil cell outlet port.

c. Position O-ring packing or gasket, elbow, and flange at inlet port of valve. Install bolts and washers, but do not tighten bolts.

d. Install nut on drain port elbow. Install elbow and gasket in drain port at bottom of valve with elbow pointing to rear. Do not tighten nut.

e. Position valve above right oil cell cover with electrical receptacle at right. Connect oil cooler tube to elbow at inlet port of valve and oil cell tube to connector at oil cell outlet port of valve.

f. Connect clutch pressure tube to connector at clutch outlet port of valve.

g. Connect drain hose to elbow in bottom of valve. Tighten nut that secures the elbow.

h. Tighten bolts that secure flange at inlet port of valve. Secure bolts with lock wire.

WARNING

Make certain all electrical power is turned off.

i. Connect electrical wiring to receptacle on valve.

j. Move CLUTCH-OFF switch on control console to CLUTCH position. Check to see that manual toggle switch on valve has moved to right hand position. Move switch to OFF position. Manual toggle switch on valve should be moved to left-hand position.

k. Close nose doors.

SECTION IV

TRANSMISSIONS

4-1. DESCRIPTION.

4-2. The transmission system consists of a main drive shaft and three gear boxes with connecting shafting. The purpose of the transmission system is to transmit engine torque to the main and tail rotors. The main drive shaft transmits engine torque from the hydro-mechanical clutch to the main transmission gear box. The main gear box, in turn, transmits engine torque to the main rotor and, by means of the tail rotor drive shaft, to the pylon transmission installation. From there the pylon drive shaft extends upward to the tail rotor gear box which drives the tail rotor. All drive shafts are equipped with rubber couplings to reduce shock loads. Shims and spacers are provided to permit minute adjustments of the shafts. A main gear box oil cooler fan is pulley-driven off the tail rotor drive shaft. The rotor brake is located on the tail rotor drive shaft, just aft of the main gear box.

4-3. MAIN DRIVE SHAFT ASSEMBLY.

4-4. DESCRIPTION. The main drive shaft transmits engine torque from the hydro-mechanical clutch to the main gear box. The assembly is composed of an upper and lower rubber coupling, adjusting 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 door in the cabin forward bulkhead and through the drive shaft tunnel extension cover.

4-5. REMOVAL.

a. Remove clutch access door from cabin forward bulkhead.

b. Remove lower rubber coupling (4, figure 4-1).

c. Reach into clutch compartment and remove bolts, washers, and nuts (10) that secure flange (6) to main drive shaft (11). Remove bolts, washers, and nuts (9) and remove flange and spacers (5, 7, and 8) from lower rubber coupling (4).

d. Disconnect lower rubber coupling (4) from splined flange on hydro-mechanical clutch assembly (1). Remove rubber coupling and bonding jumper (3).

e. Hinge down power package (refer to paragraph 3-6), and remove lower rubber coupling (4) and flange (6) as outlined in steps *a* through *c*. Remove flight control rods from tunnel. (Refer to paragraph 3-6, steps *n* and *o*.) Do not change control rod lengths when removing control rods. Support drive shaft and remove bolts, washers, and nuts (12) that secure drive shaft to upper coupling (13); lower drive shaft from tunnel.

CAUTION

Use care when removing drive shaft from tunnel to avoid damaging hydraulic tubing in tunnel. Replace tubing if damaged.

Note

As alternate method of removing drive shaft, remove upper rubber coupling as outlined in step *f*, disconnect lower end of drive shaft from flange (6) as outlined in step *c*, and lift drive shaft out of tunnel.

f. Disconnect upper rubber coupling (13) from main gear box spline coupling (14). Remove main gear box and rotor quick change unit. (Refer to paragraph 4-17.) Support coupling and remove bolts, washers, and nuts (12) that secure coupling to main drive shaft (11), and remove coupling.

Note

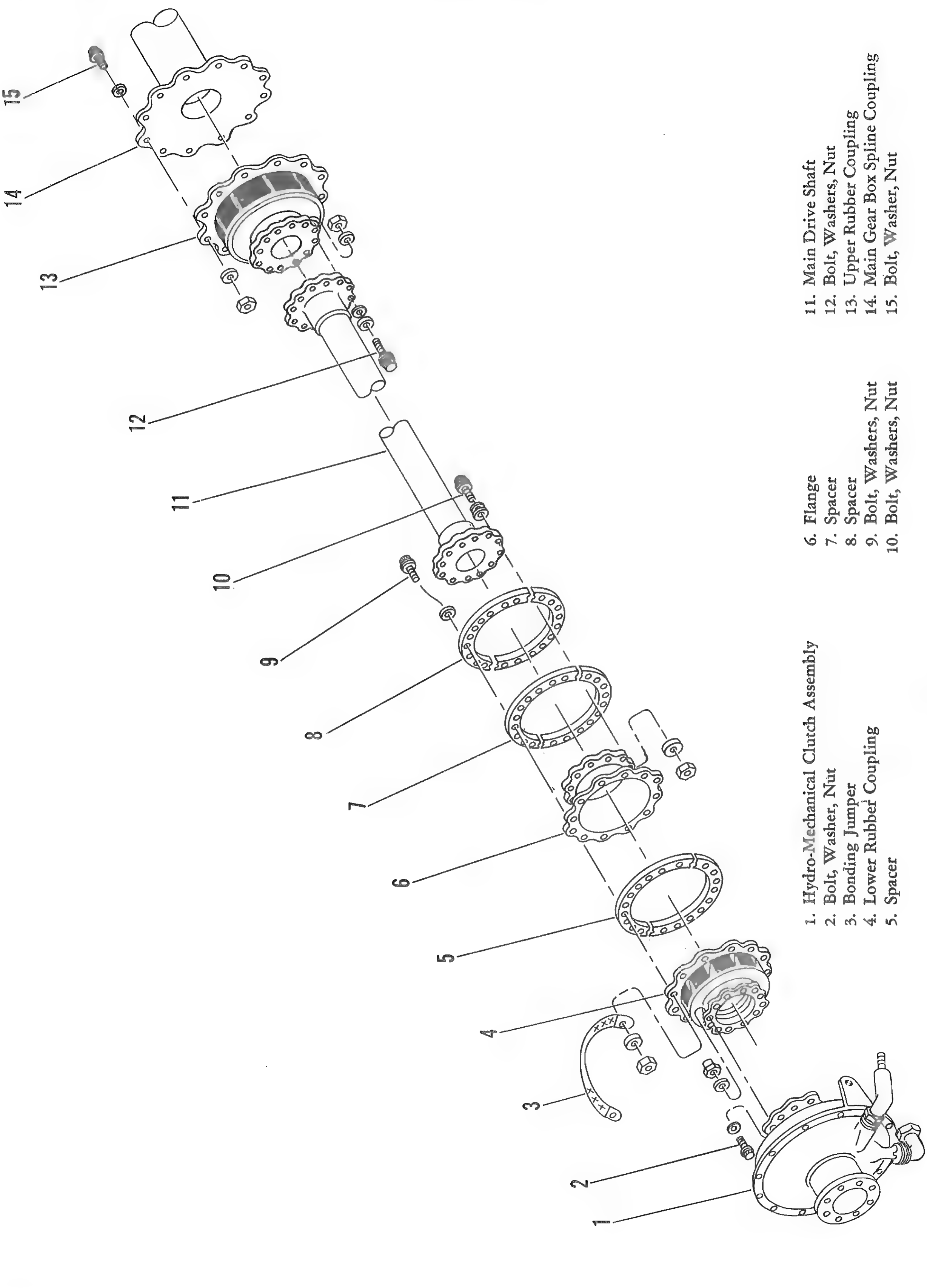
As alternate method of removing upper rubber coupling, remove auxiliary servo and mixer unit (paragraph 7-30), disconnect coupling from drive shaft as outlined in step *f*, disconnect coupling from main gear box spline coupling (14), and remove coupling through opening in cockpit canopy canted bulkhead.

4-6. MINOR REPAIRS.

a. Scratches, scores, nicks, gouges, or dents which are located on the main drive shaft either between the stepped-up areas or on the stepped-up areas, may be polished out if the maximum depth is 0.010 inch or less and the minimum outside diameter dimensions of the shaft remain the same.

CAUTION

No rework is allowable on 1/4-inch radius adjacent to the flange or on 1/4-inch radius 2-3/8 inches from the flange.



1. Hydro-Mechanical Clutch Assembly
2. Bolt, Washer, Nut
3. Bonding Jumper
4. Lower Rubber Coupling
5. Spacer
6. Flange
7. Spacer
8. Spacer
9. Bolt, Washers, Nut
10. Bolt, Washers, Nut
11. Main Drive Shaft
12. Bolt, Washers, Nut
13. Upper Rubber Coupling
14. Main Gear Box Spline Coupling
15. Bolt, Washer, Nut

Figure 4–1. Main Drive Shaft Disassembled *b.* The minimum allowable outside diameter of the main drive shaft between the stepped-up areas after rework is 2.970 inches at any cross section.

Note

The main drive shaft, between stepped-up areas, may be reworked any number of times, provided the outside diameter is never less than 2.970 inches at any cross section.

c. The minimum allowable outside diameter of the main drive shaft on the stepped-up areas after rework is 3.240 inches at any cross-section.

Note

The main drive shaft, on stepped-up areas, may be reworked any number of times; provided the outside diameter is never less than 3.240 inches at any cross-section.

d. Remove scratches, scores, nicks, gouges, or dents which fall within the above limitations as follows:

(1) Remove paint from area to be repaired with thinner, Military Specification MIL-T-6095.

CAUTION

Do not use a scraper, knife, or other metallic object to remove paint in order to prevent scratching surface of shaft.

(2) Examine area to determine whether it is within allowable repair limitations.

(3) Use abrasive cloth, Federal Specification P-C-451, to remove scratches or scores.

CAUTION

When removing scratches or scores from shaft, follow direction of scratch, maintaining a minimum blend radius of not less than 1/2 inch.

(4) Examine repaired area with a strong magnifying glass to determine whether scratch or score is completely removed.

(5) Polish repaired area with crocus cloth, Federal Specification P-C-458.

(6) Determine whether minimum shaft diameter has been maintained throughout repaired area.

(7) Clean repaired area with thinner, Military Specification MIL-T-6095.

(8) Touch up repaired area with Alodine, Military Specification MIL-C-5541, and allow to dry.

(9) Apply one coat of primer, Military Specification MIL-P-8585, to repaired area, allowing 20 minutes to dry.

CAUTION

Do not apply primer to mating faces of main drive shaft.

(10) Apply a second coat of primer, Military Specification MIL-P-8585, to repaired area.

(11) Shafting removed for rework should be checked for runout upon reassembly. The maximum permissible runout of the installed main drive shaft is 0.025-inch total indicator reading.

4–7. DAMAGE NECESSITATING REPLACEMENT. Any damage greater than that specified in paragraph 4–6 requires replacement of the section.

4–8. INSTALLATION.

a. Install upper rubber coupling (13, figure 4–1) on upper end of main drive shaft (11). Tighten nuts to a torque of 275 to 325 inch-pounds. Install main gear box and rotor quick change unit. (Refer to paragraph 4–22.) Install upper rubber coupling (13) to main gear box spline coupling (14). Tighten nuts to a torque of 275 to 325 inch-pounds.

Note

If auxiliary servo and mixer unit was removed instead of main gear box, install upper rubber coupling through opening in cockpit canopy canted bulkhead. Install auxiliary servo and mixer unit. (Refer to paragraph 7–35.)

b. Raise main drive shaft (11) into tunnel and install upper end of shaft to upper rubber coupling (13). Tighten nuts to a torque of 275 to 325 inch-pounds. Hinge up power package (paragraph 3–168, steps *e* through *ad.*) and install lower rubber coupling (4) and flange (6) as outlined in step *c*. Install flight control rods in tunnel. (Refer to paragraph 3–168, steps *n* and *o.*) Do not change control rod length when installing control rods.

c. Position lower rubber coupling (4) and bonding jumper (3) on splined flange of hydro-mechanical clutch assembly (1), and install bolts, washers, and nuts (2). Tighten nuts to a torque of 275 to 325 inch-pounds.

d. Install flange (6) on end of drive shaft. Tighten nuts to a torque of 275 to 325 inch-pounds.

e. Check alignment of main drive shaft. (Refer to paragraph 3–9.)

f. If measurements of gap between lower rubber coupling (4) and flange (6) that were taken while checking alignment are equal, select spacer or spacers (5, 7, and 8) required to fill gap within ± 1/16 inch. If measurements of gap are unequal, select spacer or spacers (5, 7, and 8) required to fill gap at minimum dimension (figure 4–2) within ± 1/16 inch.

Note

Three spacers (5, 7, and 8, figure 4–1) are 0.064, 0.125, and 0.250 inch in thickness.

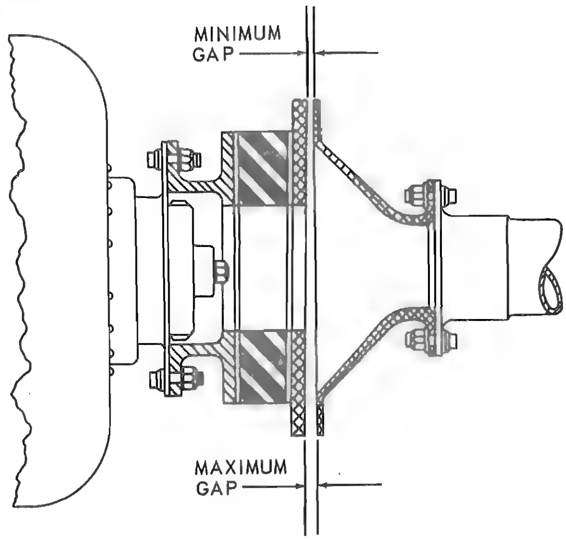


Figure 4–2. Main Drive Shaft Alignment

g. Install selected spacer or spacers between coupling and flange, position remaining spacer or spacers on aft side of flange, and install bolts, washers, and nuts (9). Secure bonding jumper by placing loose end under one of nuts. Tighten nuts to a torque of 275 to 325 inch-pounds.

h. Check main drive shaft for runout. (Refer to paragraph 4–6c(11).

i. Install clutch access door in cabin forward bulkhead by locking fasteners.

4–9. CHECKING ALIGNMENT. (See figure 4–2.) Any possible misalignment between the power package and the main gear box will show up as an out-of-parallel condition between the mating surfaces of the lower rubber coupling and the large flange which is secured to the lower end of the main drive shaft. This paragraph contains instructions for checking this condition and determining whether it is within acceptable limits.

a. Remove spacers (5, 7, and 8, figure 4–1) as outlined in paragraph 4–5, *a* through *c*.

b. Measure gap between mating surfaces of lower rubber coupling (4) and flange (6) at four equally spaced points on circumference. Record measurements for future use in selecting spacers.

c. If all measurements are equal, alignment is acceptable and no further check need be made. Proceed with installation of main drive shaft.

d. If measurements are unequal, check again at several points to find minimum gap, and maximum gap. (See figure 4–2.) These points should be opposite each other. Maximum allowable difference between minimum and maximum is 1/8 inch. If alignment is within this limit, proceed with installation of main drive shaft.

e. If alignment is not within this limit, correct misalignment. (Refer to paragraph 4–10.)

4–10. CORRECTING MISALIGNMENT. If the difference in gap between the lower rubber coupling and the spacer flange exceeds the maximum allowable limits stated in paragraph 4–9 the following steps are required:

a. Remove power package. (Refer to paragraph 3–6.)

b. Remove engine mount. (Refer to paragraph 3–8.)

c. Support each double bracket assembly and remove mounting bolts, washers, and nuts that secure each end plate to lug on engine mount ring.

d. Install three washers between mounting ring and lower mounting ring and lower mounts. Install one washer between mounting ring and lower half of upper right and upper left mounts. No washers are required for upper half of upper right-hand and upper left-hand mounts.

e. Replace double bracket assembly. (Refer to paragraph 3–25, steps *b* through *f*.

f. Install engine mount on engine. (Refer to paragraph 3–26.)

g. Install power package. (Refer to paragraphs 3–27 and 3–28.)

Note

If corrections in steps *a* through *g* do not reduce alignment error to within maximum allowable limits, install all new double bracket assemblies.

4–11. MAIN DRIVE SHAFT RUBBER COUPLINGS.

4–12. DESCRIPTION. The main drive shaft rubber couplings transmit engine torque, absorb transmission shock and vibration, and adjust for permissible minor misalignment of the components. One upper and one lower rubber coupling is installed. Each rubber coupling is composed of two metal jaws with interlocking vanes that are joined by molded rubber segments between their mating surfaces. The brick-shaped rubber segments are each bonded to two vanes, one from each jaw. Spaces occur alternately between the tapered sides of the vanes.

4–13. REMOVAL. Removal of the main drive shaft rubber couplings is part of the removal procedure of the main drive shaft assembly. (Refer to paragraph 4–5.)

4–14. INSTALLATION. Installation of the main drive shaft rubber couplings is part of the installation procedure of the main drive shaft assembly. (Refer to paragraph 4–8.)

4–15. MAIN GEAR BOX AND ROTOR QUICK CHANGE UNIT.

4–16. DESCRIPTION. The main gear box and the main rotor may be installed in the helicopter as a quick change unit. The main gear box and rotor quick change unit (figure 4–3) 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.

4–17. REMOVAL.

a. Drain service oil from main gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

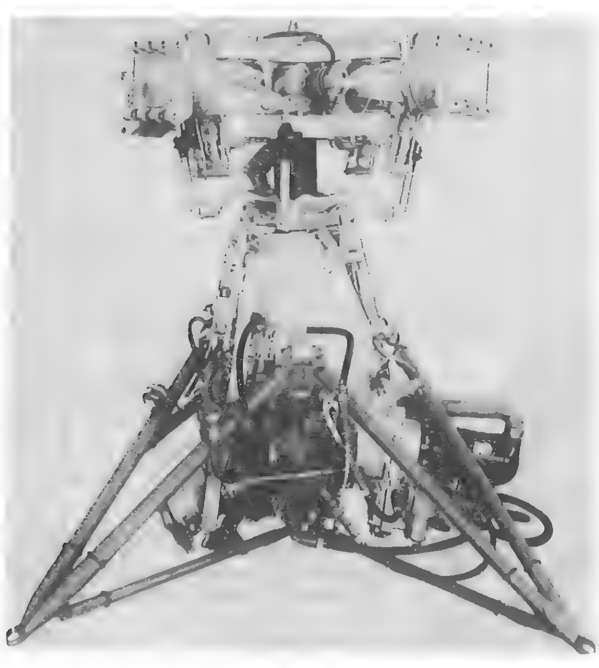


Figure 4–3. Main Gear Box and Rotor Quick Change Unit

b. Hinge down service platforms and remove main rotor blades. (Refer to TM 55-1620-202-20, Chapter 2, Section I.)

c. Connect two canted bulkhead support cables (1, figure 4–4) for canted bulkhead to attachment fittings on fuselage and adjust turnbuckles.

d. Remove screens (2) and fairing (3) which cover gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

e. Remove terminal block covers and disconnect electrical wiring to quick change unit at terminal blocks (4) and oil inspection light switch (5) on aft left-hand side of canted bulkhead.

f. Disconnect primary system hydraulic pressure line (6) at transmitter, mounted in support on transmission deck to left of gear box, by backing off attaching nut. Plug line and disconnect hydraulic pressure wiring (7) at disconnect on transmitter.

g. Remove soundproofing from ceiling inside cabin and remove screws, nuts, and washers that secure transmitter support (8) to transmission deck. Remove support with transmitter attached.

h. Disconnect flight control rod (9) from bell crank (10) which is secured to support at forward left side of gear box lower housing.

i. Disconnect hydraulic reservoir vent tubing and hydraulic pump drain line at hydraulic quick disconnects (11) on transmission deck.

j. Disconnect auxiliary system hydraulic pressure lines leading from top of tunnel to manifold below restrictor and snubber on right side of transmission deck. Plug lines.

k. Disconnect electrical wiring from generator (12) and tachometer-generator (13) on accessory drive housing.

l. Disconnect oil pressure line (14) from elbow (15) at oil pump (16) and remove elbow, gasket, (17) nut (18), and ring (19) from oil pump housing (20). Discard gasket (17) and ring (19).

m. Disconnect and remove oil hoses (22) from tee (21) at main gear box inlet.

n. Disconnect auxiliary hydraulic system line (23) which lies across forward right support rod assembly at pressure transmitter on transmission deck to right of gear box. Plug line.

o. Disconnect electrical wiring from transmitter (24). Remove screws, nuts, and washers that secure transmitter support (25) to transmission deck. Remove support with transmitter attached.

p. Remove flight control actuating cylinder (26) from support mounted on right side of input housing.

1. Canted Bulkhead Support Cable
2. Screens
3. Fairing
4. Terminal Block
5. Oil Inspection Light Switch
6. Primary System Hydraulic Pressure Line
7. Hydraulic Pressure Wiring
8. Transmitter Support
9. Flight Control Rod
10. Bell Crank
11. Hydraulic Quick Disconnects
12. Generator
13. Tachometer-Generator
14. Oil Pressure Line
15. Elbow
16. Oil Pump
17. Gasket
18. Nut

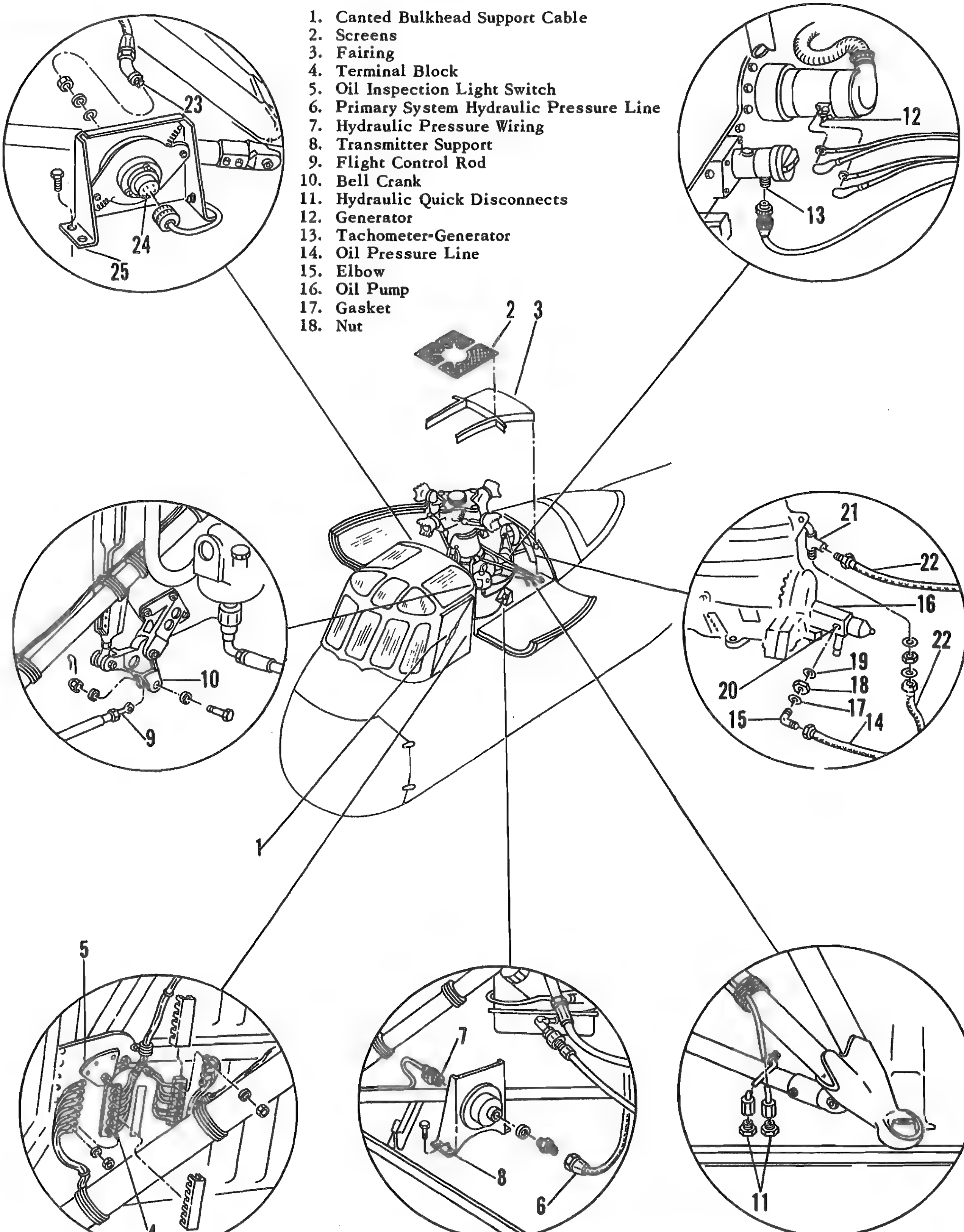
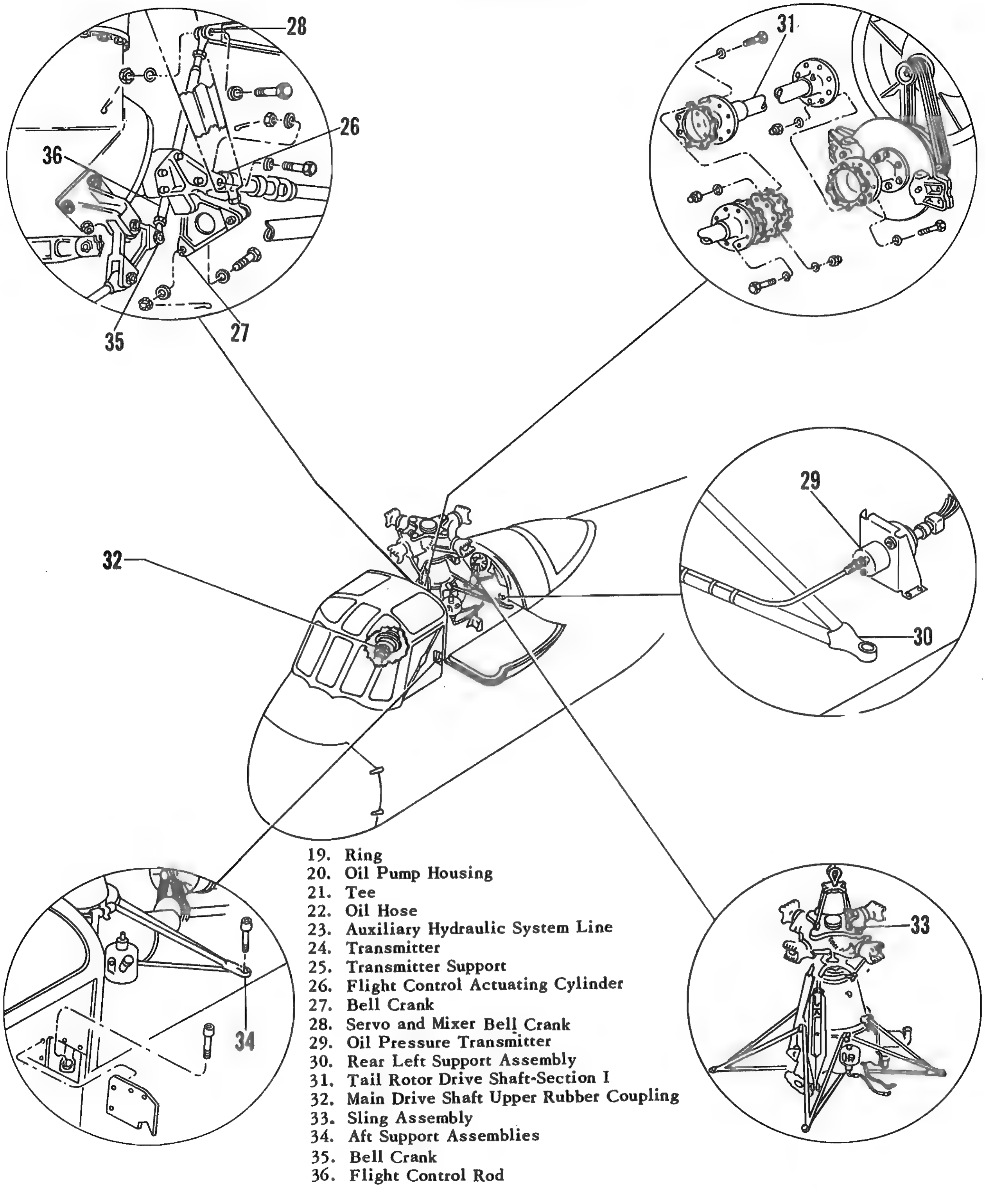


Figure 4–4. Main Gear Box and Rotor Quick Change Unit Removal (Sheet 1 of 2)



19. Ring
20. Oil Pump Housing
21. Tee
22. Oil Hose
23. Auxiliary Hydraulic System Line
24. Transmitter
25. Transmitter Support
26. Flight Control Actuating Cylinder
27. Bell Crank
28. Servo and Mixer Bell Crank
29. Oil Pressure Transmitter
30. Rear Left Support Assembly
31. Tail Rotor Drive Shaft-Section I
32. Main Drive Shaft Upper Rubber Coupling
33. Sling Assembly
34. Aft Support Assemblies
35. Bell Crank
36. Flight Control Rod

Figure 4–4. Main Gear Box and Rotor Quick Change Unit Removal (Sheet 2 of 2)

Remove flight control rod from bell crank (27) mounted on same support. Remove flight control rod from bell crank at servo and mixer assembly.

q. Disconnect hose and electrical wiring from oil pressure transmitter (29) mounted on transmission deck adjacent to rear left support assembly (30).

r. Remove section I of tail rotor drive shaft (31). (Refer to paragraph 4–89.)

s. Remove cover assembly from main drive shaft tunnel extension inside cabin and disconnect gear box spline coupling from main drive shaft upper rubber coupling (32).

t. Position and attach sling assembly (33), part No. S1670-10151, to upper plate eyebolts of main rotor hub. Attach hoist to sling to support quick change unit.

u. Unscrew and remove cover plates on forward side of canted bulkhead to expose gear box support fittings. Using hex wrench, Snap-On Tool Co. part No. LAW-118, remove forward support assemblies from fittings. Remove bolts from two aft support assemblies (34) on transmission deck.

Note

Barrel nuts will stay in place in helicopter. They may be pushed out if necessary.

v. Hoist quick change unit out of helicopter and place it on transportation dolly, part No. S1670-10570-1, and attach towing bar, part No. S1570-10616, to dolly.

CAUTION

Care must be exercised while removing quick change unit to prevent damage to flight control rods.

Note

All components removed in steps *w* through *y* must be retained for installation on new quick change unit.

w. Disconnect hydraulic pump drain line from pump and release clamps that secure pump drain tubing to rear left support rod assembly. Remove tubing.

x. Remove attaching bolt and remove flight control rod (36) from bell crank (35) at main gear box.

y. Disconnect oil pressure transmitter hose (22) from tee (21) at main gear box oil inlet. Remove hose clamp from rear left support assembly and remove hose.

4–18. CLEANING AND PREPARATION FOR STORAGE.

a. Clean exterior surfaces of main gear box with dry-cleaning solvent, Federal Specification P-S-661, or a low grade of kerosene, Federal Specification VV-K-211.

b. Prepare main rotor head for shipment. (Refer to paragraph 5–11.)

c. Prepare main gear box for shipment. (Refer to paragraph 4–43, steps *b* through *e.*)

d. Prepare servo units for shipment. (Refer to paragraph 7–70.)

e. Drain hydraulic reservoir and fill with preservative hydraulic fluid, Military Specification MIL-H-6083, and plug all ports. Coat all metallic surfaces of reservoir with petrolatum, Military Specification MIL-C-11796.

f. Secure all loose electrical wiring and hoses to support assemblies with string or twine.

g. Remove cover from shipping container, part No. S1670-11250 or Ludwig Honold Mfg. Co. part No. E-1-10673.

h. Hoist and lower quick change unit onto frame with short tube support, marked FRONT, on its side.

i. Engage alignment pins in adapter plate.

j. Attach transmission tube supports to frame using special bolts that are chained to frame.

k. Secure bottom portion of gear box to adjustable pedestal fitting.

l. Secure sway brace members to frame with clips.

m. Mount hub tie assembly below sleeve and spindle assemblies.

n. Secure each spindle with base and clamp assembly.

o. Install bolts in spacer ring assembly to shaft below stationary star.

p. Place 192 units of desiccant, Military Specification MIL-D-3464, inside container.

CAUTION

Place a spark plug type humidity indicator in provided receptacle so that it can be easily viewed from outside. Desiccant should be replaced if indicator turns pink.

q. Clean O-ring gasket and groove in lower sealing flange. Inspect metal surface contacting gasket for dents and grooves. File smooth, if necessary.

r. Align all T-bolt heads with slots in cover flange. Place container cover in position observing match lines pointed on container and press cover with O-ring gasket.

s. Engage T-bolts by rotating one-fourth turn counterclockwise.

Note

If T-bolt does not clear cover flange, increase clearance by rotating T-bolt counterclockwise.

t. Tighten T-bolts to a torque of 140 to 150 inch-pounds.

u. Remove 1/4-inch pipe plug and install an air filling valve. Pressurize shipping container to 5 psi air pressure. Apply soap and water solution and check for leaks.

v. Remove air filling valve and insert 1/4-inch pipe plug.

w. Insert history card in receptacle provided for it.

4–19. PLACING IN SERVICE AFTER SHIPMENT.

a. Disconnect quick change unit and remove it from shipping container.

b. Cut strings that secure electrical wiring and hoses to support assemblies.

c. Clean petrolatum, Military Specification MIL-C-11796, from hydraulic reservoir with drycleaning solvent, Federal Specification P-S-661.

d. Remove the plugs and drain preservative hydraulic fluid, Military Specification MIL-H-6083, from hydraulic reservoir.

e. Prepare servo units for service. (Refer to paragraph 7–71.)

f. Prepare main gear box for service. (Refer to paragraph 4–44, steps *b* through *e.*)

g. Prepare main rotor head for service. (Refer to paragraph 5–12.)

4–20. DISASSEMBLY. If it is necessary to replace only the main gear box, the following procedure should be followed for removal of the main gear box and rotor quick change unit components.

a. Remove main rotor head assembly, (1, figure 4–5) from top of main gear box (2). (Refer to paragraph 5–10.)

b. Remove three servo control arm assemblies (3). (Refer to paragraph 7–67.)

c. Unscrew and remove light assembly (4) for oil level sight gage from bracket on left side of lower housing and remove clamps that secure electrical wiring on forward left support rod assembly. Remove electrical wiring. Unplug light assembly wiring at disconnect plug (5) on hydraulic reservoir. Remove screw, nut, and washer that secures ground connection (6) to reservoir mounting bracket. Disconnect plugs (7, 8, and 9) from temperature bulb on gear box above generator, hydraulic panel, and oil pressure switch on forward left support assembly. Release clamps that secure electrical wiring to support assemblies and remove wiring.

Note

On helicopters serial No. 54-2882 and subsequent, oil temperature bulb is installed in strainer in lower housing.

d. Disconnect vent line from fitting at top of hydraulic reservoir (10). Disconnect hydraulic pump supply line (11) to pump from fitting at bottom of reservoir and drain reservoir into receptacle. Disconnect servo return line (12) and servo pressure line (13) and remove lines. Disconnect bypass line (14) from pump. Remove transmitter line (15) from fitting at reservoir. Remove hydraulic panel and reservoir support bracket (16) from left side of gear box; remove nut and washer from bolt which attaches left support rod assemblies (17) to bracket on gear box and release strut assembly. Remove hydraulic panel from gear box.

Note

To avoid losing attaching parts, replace bolts, washers, and nuts that secure hydraulic panel to main gear box.

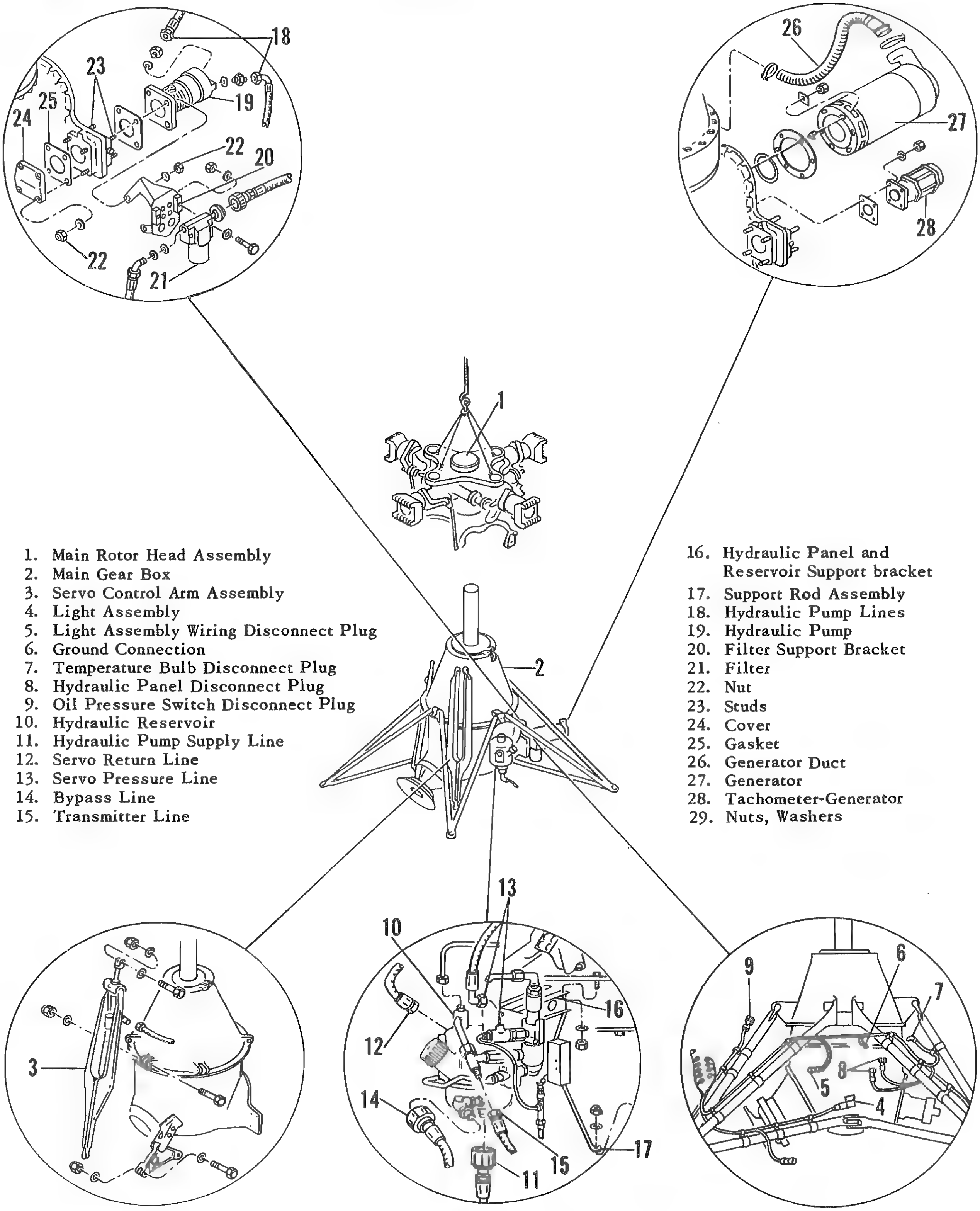
e. Disconnect hydraulic pump lines (18) from hydraulic pump (19) and filter (21). Remove bolts which secure filter (21) to support bracket (20). Remove lines and filter. Remove nuts and washers (22) and remove hydraulic pump, gasket, and filter support bracket from studs (23) on gear box. Remove nuts and washers (22) that secure cover (24) and gasket (25), to studs forward of pump attaching studs.

Note

If overhaul of pump is required, refer to TM 55-1650-223-50.

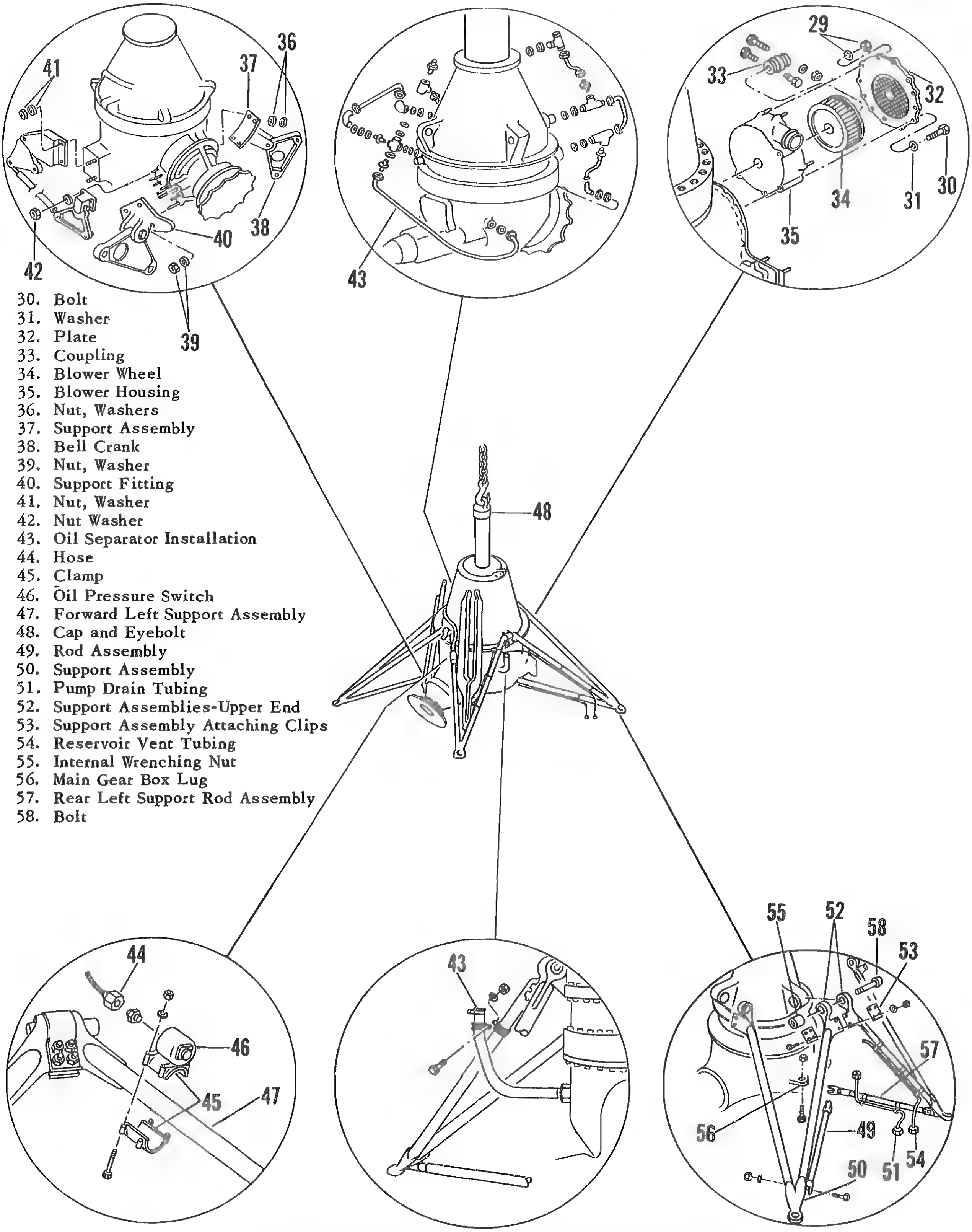
f. Disconnect flexible generator duct (26) from generator blower and remove generator (27). (Refer to TM 55-1520-202-20, Chapter 2, Section XII.) Remove nuts and washers that secure tachometer-generator (28) to gear box and remove tachometer-generator and gasket from studs.

g. Remove nuts and washers (29) and bolts (30) and washers (31). Remove plate (32). Remove bolts



1. Main Rotor Head Assembly
2. Main Gear Box
3. Servo Control Arm Assembly
4. Light Assembly
5. Light Assembly Wiring Disconnect Plug
6. Ground Connection
7. Temperature Bulb Disconnect Plug
8. Hydraulic Panel Disconnect Plug
9. Oil Pressure Switch Disconnect Plug
10. Hydraulic Reservoir
11. Hydraulic Pump Supply Line
12. Servo Return Line
13. Servo Pressure Line
14. Bypass Line
15. Transmitter Line
16. Hydraulic Panel and Reservoir Support bracket
17. Support Rod Assembly
18. Hydraulic Pump Lines
19. Hydraulic Pump
20. Filter Support Bracket
21. Filter
22. Nut
23. Studs
24. Cover
25. Gasket
26. Generator Duct
27. Generator
28. Tachometer-Generator
29. Nuts, Washers

Figure 4–5. Main Gear Box and Rotor Quick Change Unit Disassembly (Sheet 1 of 2)



30. Bolt
31. Washer
32. Plate
33. Coupling
34. Blower Wheel
35. Blower Housing
36. Nut, Washers
37. Support Assembly
38. Bell Crank
39. Nut, Washer
40. Support Fitting
41. Nut, Washer
42. Nut Washer
43. Oil Separator Installation
44. Hose
45. Clamp
46. Oil Pressure Switch
47. Forward Left Support Assembly
48. Cap and Eyebolt
49. Rod Assembly
50. Support Assembly
51. Pump Drain Tubing
52. Support Assemblies-Upper End
53. Support Assembly Attaching Clips
54. Reservoir Vent Tubing
55. Internal Wrenching Nut
56. Main Gear Box Lug
57. Rear Left Support Rod Assembly
58. Bolt

Figure 4–5. Main Gear Box and Rotor Quick Change Unit Disassembly (Sheet 2 of 2) from coupling (33) on end of blower drive shaft. Work pins free from generator blower drive shaft and slide blower wheel (34) and blower housing (35) off shaft.

h. Remove nuts and washers (36) and remove support assembly (37) and bell crank (38) from studs at forward left side of lower housing. Remove nuts and washers (39) from actuating cylinder support fitting (40) at right side of input housing and remove support assembly and bell crank from studs of gear box. Remove nuts and washers (41 and 42) and remove two bell cranks, support fittings, and rod assembly from right side of lower housing as a unit.

i. Remove oil separator installation (43) from gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

j. Disconnect hose (44), and release clamp (45) that secures oil pressure switch (46) to forward left support assembly (47).

k. In preparation for removal of transmission supports, install shaft cap, part No. S1670-10364, and eyebolt (48), part No. S1670-10388, on shaft at top of gear box and support gear box with hoist.

l. Remove bolts which secure rod assemblies (49) to lower end of support assemblies and from lugs on gear box. Release clamps that secure pump drain tubing (51) to rear left support rod assembly (57) and remove tubing. Remove upper end of support assemblies from gear box, using bolt and bearing remover, part No. S10-50-4147-10, and a 1-1/16 inch by 3/4-inch drive socket wrench, Snap-On Tool Co., part No. GL DH-342. Unbolt upper end of each support assembly from each other. Remove clips which support attachments. Release clamps that secure reservoir vent tubing (54) to rear left support assembly and remove tubing.

4–21. ASSEMBLY.

a. Install shaft cap, part No. S1670-10364, and eyebolt (48, figure 4–5), part No. S1670-10388, on main gear box shaft and support main gear box with hoist.

b. Secure support assemblies on main gear box lugs with bolts (58), washers, and internal wrenching nuts, (55) using bolt and bearing remover, part No. S10-50-4147-10, and a 1-1/16 x 3/4-inch drive socket wrench, Snap-On Tool Co., part No. GL DH-342. Position and bolt clips at support assemblies. Do not apply torque to nuts at this time.

Note

Install clip with chamferred edge on aft attaching support. To prevent interference between upper clip bolts and main gear box lugs in this location, it is necessary to install bolts with heads toward lugs. Two washers are installed on nut ends of bolts.

c. Position and install rod assemblies on support assemblies (50) and main gear box lugs (56). Clamp hydraulic reservoir vent tubing to rear left support assembly and pump drain tubing (51) to rear left support rod assembly (57).

Note

On helicopter serial No. prior to 57-1733, when a new or overhauled gear box is installed, it may be necessary to use new or redrilled support rods. Rod length must be determined at installation and drilled at that time. (Refer to paragraph 4–22, step *g.*) On helicopter serial No. 57-1733 and subsequent, support rods are adjustable. (Refer to paragraph 4–22, step *h.*)

d. Install oil separator installation (43) on gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

e. Position and clamp oil pressure switch (46) on forward left support assembly. Connect hose to oil pressure switch and to tee at front of gear box near top of upper housing. Clamp line to forward left support assembly.

f. Position actuating cylinder support fitting (40), bell cranks with support fittings and rod assembly with washers and nuts (41 and 42), and bell crank (38) and support assembly (37) on main gear box studs. Secure flight control fittings with washers and nuts.

g. Work blower pins into position on generator blower shaft and slide blower housing (35) and blower wheel (34) onto shaft. Install coupling (33) at blower shaft and secure bolts with lock wire. Secure plate (32) with bolts and washers, (30 and 31) and washers and nuts (29).

h. Install generator (27) on gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section XII.) Connect generator duct (26) to generator blower. Install gasket and tachometer-generator (28) on gear box studs and secure them with washers and nuts.

i. Install gasket (25) and cover (24) on studs forward of hydraulic pump mounting boss and secure with nuts and washers (22). Position and secure gasket, hydraulic pump, and filter support bracket (20) on studs (23) with nuts and washers (22). Install bolts which secure filter (21) to filter support bracket

(20). Connect hydraulic pump lines (18) to hydraulic pump (19) and filter (21).

j. Position hydraulic panel, including support bracket (16) and strut assembly, and install bolts which secure bracket to flange on left side of gear box. Tighten nuts that secure hydraulic panel to gear box to a torque of 180 to 225 inch-pounds. Position lower end of strut assembly on left support rod assembly (17). Attach bolt and tighten nut. Connect following lines or tubing to reservoir: reservoir vent tubing (54) to fitting at top of hydraulic reservoir (10), hydraulic pump supply line (11), servo return line (12), inlet line from filter, bypass line (14) to pump and transmitter line (15).

k. Connect temperature bulb disconnect plug (7), hydraulic panel disconnect plug (8), and light assembly wiring disconnect plug (5) to hydraulic reservoir (10). Connect ground wire (6) to reservoir mounting bracket (16) and secure light assembly (4) for the oil level sight gage to its bracket with mounting screws. Clamp wiring to support assemblies and forward left rod assembly.

Note

On helicopters serial No. 54-2882 and subsequent, oil temperature bulb is installed in strainer in lower housing.

l. Install three servo control arm assemblies (3), (Refer to paragraph 7–73.)

m. Install main rotor head assembly (1) on main gear box shaft. (Refer to paragraph 5–13.)

4–22. INSTALLATION.

a. Clamp oil pressure transmitter line to rear left support assembly and connect line to tee (21, figure 4–4) at main gear box oil inlet.

b. Install bolt which secures flight control rod (36) to bell crank (35) at main gear box.

c. Clamp hydraulic pump drain line to rear left support rod assembly. Connect line to pump.

d. Remove lower rubber coupling from main drive shaft (paragraph 4–5, steps *a.* through *d*).

CAUTION

Support shaft in tunnel to avoid dropping main drive shaft assembly onto clutch assembly.

e. Position and attach sling assembly (33) part No. S1670-10151, to upper plate eyebolts of main rotor hub. Position quick change unit into helicopter, using suitable hoist.

CAUTION

Care must be exercised while installing quick change unit to prevent damage to flight control rods.

Note

Support quick change unit with hoist and sling until it has been secured to transmission deck.

f. Line up lower holes in aft support assemblies (34) with holes in fittings on transmission deck and install lower support bolts, washers, and nuts. Tighten lower bolts to a torque of 3000 to 3200 inch-pounds, using hex wrench, Snap-On Tool Co., part No. LAW-118. Tighten upper support bolts to a torque of 4500 to 5000 inch-pounds. Tighten bolts as follows: With nuts loose, tighten each bolt to determine bolt turning torque value, add this value to specified torque, and apply total to bolt head. Install cover plates on canted bulkhead.

CAUTION

Check nuts at upper support assembly bolts for deterioration or damage before reusing.

Note

In order to assure true torque reading at lower support assembly bolt threads, lubricate bolts with anti-seize compound, Federal Specification TT-A-580.

Note

At installation, replace all lower support assembly bolts with new bolts. If replacement is not possible, examine used bolts to insure against cracks. Using magnetic particle inspection method, inspect bolts or study them under highest power magnifying glass available.

g. On helicopters prior to serial No. 57-1733, install bolts which secure outboard end of each support rod to transmission support and inboard lug fitting to main gear box. If new or overhauled gear box is being installed, it may be necessary to install new or redrilled support rods. To change length of support rods, unbolt rod-end fittings. Ream holes to 0.250 $+\frac{0.0015}{0.0000}$ inch. Deburr the holes and touch up with zinc chromate primer, Military Specification MIL-P-6889. Apply one coat of zinc chromate primer to 1-1/2 inches of both tube ends. Install tube to fitting while wet. Install bolts, washers, and nuts.

Note

Maintain minimum of 1.25 inches tube diameter edge distance from center of bolt hole to edge of tube.

h. On helicopter serial No. 57-1733 and subsequent, attach outboard end of each support rod to transmission support and inboard lug fitting to the main gear box. If new or overhauled gear box is being installed, it may be necessary to adjust length of support rods. This may be done by removing bolts which secure inboard lug fitting to inboard rod-end fitting, installing bolts which secure lug fitting to main gear box, and rotating eccentric bushing in rod-end fitting until alignment between lug fitting and rod-end fitting is made.

i. Tighten nuts at clips that secure one support assembly to other to a torque of 480 to 690 inch-pounds. Tighten bolts as follows: With nuts loose, tighten each bolt to determine bolt turning torque value add this value to the specified torque, and apply total to bolt head.

j. Release hoist and remove sling assembly, part No. S1670-10151, from upper plate of main rotor hub.

k. Install section I of tail rotor drive shaft (31, figure 4–4). (Refer to paragraph 4–95.)

l. Install main drive shaft and rubber couplings and check alignment of drive shaft. (Refer to paragraph 4–8.)

m. Connect flight control rod (9) to bell crank (10) located in support on forward left side of main gear box lower housing.

n. Connect flight control rod (36) extending from bell crank (35) located at forward right side of lower housing to servo and mixer bell crank (28). Connect flight control actuating cylinder (26) to support, and control rod to bell crank (27).

o. Install elbow, gasket, nut, and ring on oil pump housing and connect oil pressure line (14) to elbow (15).

p. Connect oil pressure line to tee (21) at main gear box oil inlet (36).

q. Connect electrical wiring to generator (12) and tachometer-generator (13).

r. Connect auxiliary system hydraulic pressure lines leading from top of tunnel to manifold below restrictor and snubber on right side of transmission deck.

s. Connect hydraulic reservoir vent and pump drain tubing to fittings on transmission deck.

t. Secure auxiliary hydraulic pressure transmitter support (25) to transmission deck with screws, washers, and nuts. Remove plug and connect auxiliary hydraulic system line (23) to transmitter (24).

u. Secure primary hydraulic pressure transmitter support (8) to transmission deck with screws, washers, and nuts. Remove plug and connect primary system hydraulic pressure line (6) to transmitter (24). Connect hydraulic pressure wiring (7) to transmitter.

v. Connect electrical wiring to terminal blocks (4) and to oil inspection light switch (5) on aft side of canted bulkhead. Replace terminal block covers.

w. Connect electrical wiring and pressure hose to oil pressure transmitter (29) at transmission deck.

x. Install screens (2) and fairings (3) over gear box.

y. Disconnect canted bulkhead support cables (1) from fuselage.

z. Service main gear box. (Refer to servicing instructions in TM 55-1520-202-20, Chapter 2, Section II.)

aa. Install main rotor blades. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

ab. Check flight control rigging. (Refer to paragraph 7–143.)

ac. Close service platforms. Replace tunnel extension cover in cabin and snap soundproofing in place at cabin ceiling.

ad. Perform run-in of main gear box. (Refer to paragraph 4–46.)

WARNING

Complete run-in of main gear box is mandatory and must be performed for safety of flight.

4–23. MAIN GEAR BOX ASSEMBLY.

4–24. REMOVAL.

a. Remove main gear box and rotor quick change unit. (Refer to paragraph 4–17.)

b. Disassembly main gear box and rotor quick change unit. (Refer to paragraph 4–20.)

4–25. 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 paragraphs 4–20 and 4–21. Disassembly for repair of main gear box components is covered in paragraphs 4–27 through 4–33 and 4–35 through 4–42.

4–26. MAIN ROTOR SHAFT SIDE PLAY. Excessive vibration in the helicopter, which is not attributed to other causes, may be related to excessive side play of the main rotor shaft. Check the maximum allowable side play tolerance as outlined in the following steps.

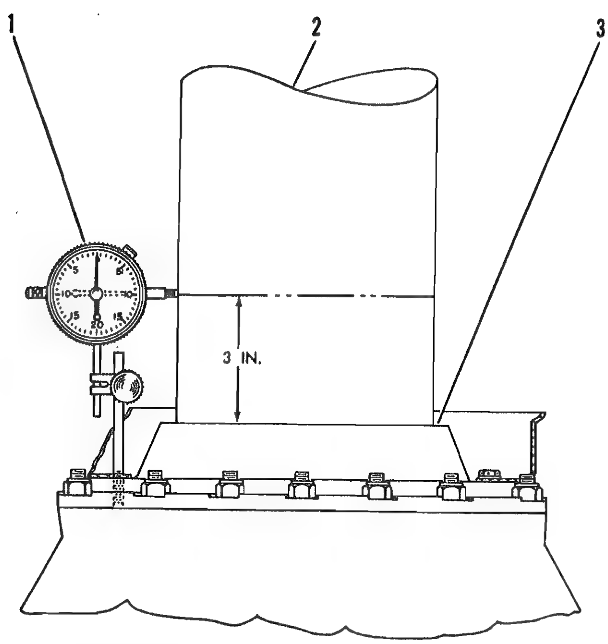
a. Remove main rotor head assembly. (Refer to paragraph 5–10.)

b. Place pointer of dial indicator (1, figure 4–6) against main rotor shaft (2) 3-inches above retainer assembly (3).

c. Push main rotor shaft (2) away from dial indicator (1) as far as it will go and take reading; pull main rotor shaft towards dial indicator as far as it will go and record total indicator reading.

Note

If total indicator reading recorded is 0.010 inch or less, radial play of bearings is within allowable tolerance. If total indicator reading recorded is in excess of 0.010 inch, main gear box should be replaced.



1. Dial Indicator
2. Main Rotor Shaft
3. Retainer Assembly

Figure 4–6. Checking Main Rotor Shaft Side Play

d. Position dial indicator (1) laterally 90-degrees away from position used for first reading. Place pointer of dial indicator against main rotor shaft (2) 3-inches above retainer assembly.

e. Push main rotor shaft away from dial indicator as far as it will go and take reading; pull main rotor shaft towards dial indicator as far as it will go and record total indicator reading.

Note

If total indicator reading recorded is 0.010 inch or less, radial play of bearings is within allowable tolerance. If total indicator reading recorded is in excess of 0.010 inch, main gear box should be replaced.

4–27. REPLACEMENT OF UPPER HOUSING RETAINER, BREATHER TUBE, AND OIL LEVEL WINDOW. (See figure 4–7.)

a. Remove bolts which secure retainer (2) to top of gear box.

b. Remove breather tube (37) from elbow on side of gear box.

c. Drain gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.) Remove nuts (23) and washers (24) that secure oil level window on lower gear box housing. Slide off window frame (25), oil window (26), and window gasket (27).

d. To reassemble, replace window gasket (27), oil window (26), and window frame (25) on studs and secure with washers (24) and nuts (23). Service gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

e. Install breather tube (37), on elbow on side of gear box.

f. Position retainer (2) and secure with bolts and washers (1). Lockwire bolts.

4–28. DISASSEMBLY OF OIL PUMP COVER ASSEMBLY AND OIL PUMP GEARS.

a. Remove washers and nuts (21, figure 4–7) securing cover assembly (18) to oil pump housing. Slide cover assembly (18) and gaskets (19, 19A, 19B, and 19C) off studs.

b. Remove two nuts (8 and 9), ring (7), and gasket (10) securing oil filter (6) to cover and liner assembly (11). Slide oil filter from cover and liner assembly. Remove gasket (5) from oil filter.

c. Back off cap (17) and remove gasket (16) from bottom of cover and liner assembly (11).

d. Remove nut (15), screw (14), spring (13), and plunger (12).

1. Bolt, Washers
2. Retainer
3. Lock Ring
4. Stud
5. Gasket
6. Oil Filter
7. Ring
8. Nut
9. Nut
10. Gasket
11. Cover and Liner Assembly
12. Plunger
13. Spring
14. Screw
15. Nut
16. Gasket
17. Cap
18. Cover Assembly
19. Gasket
19A. Gasket
19B. Gasket
19C. Gasket
20. Oil Pump Driven Gear
21. Washer, Nut
22. Oil Pump Driver Gear
23. Nut
24. Washer
25. Window Frame
26. Oil Window
27. Window Gasket
28. Spacer
29. Shim
30. Klosure Seal
31. Gasket
32. Cap
33. Spline Coupling
34. Nut
35. Cotter Pin
36. Washer, Nut
37. Breather Tube

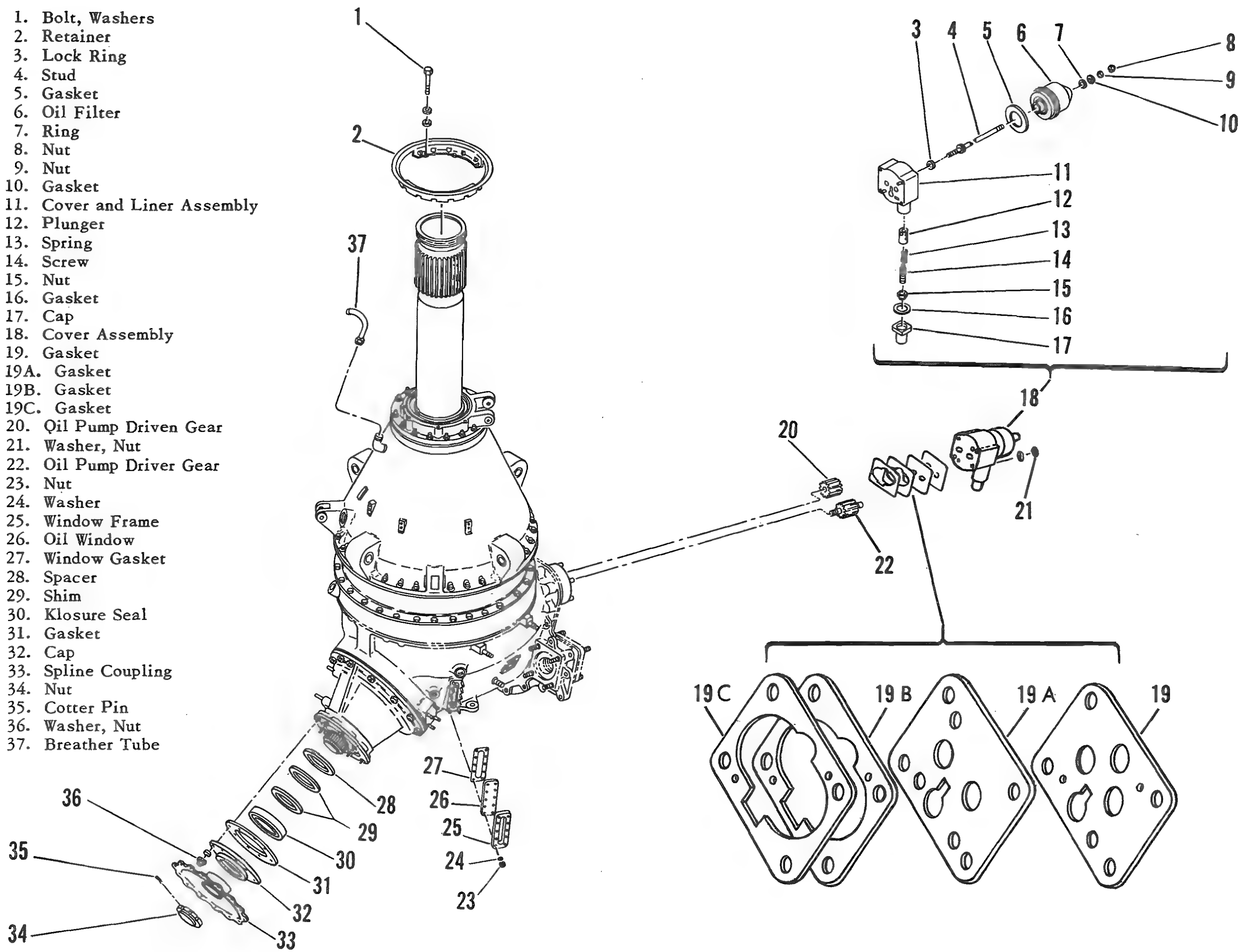


Figure 4–7. Main Gear Box Assembly – Replacement of Parts

e. Remove stud (4), using remover tool, Rosan part No. SM 121-22, to mill out lock ring (3). Unscrew stud (4) from cover assembly. Use prick punch and mallet to remove any existing pieces of lock ring (3).

CAUTION

Mill no deeper than depth of lock ring.

f. Remove oil pump driven gear (20) and oil pump driver gear (22) from gear housing.

4–29. CLEANING. Clean cover assembly with dry-cleaning solvent, Federal Specification P-S-661.

4–30. INSPECTION. (See figure 4–7.)

a. Inspect cover for scores, nicks, and cracks.

b. Inspect gears and splines for signs of galling and wear.

c. Inspect cap (17), spring (13), and plunger (12).

d. Inspect oil filter (6). (Refer to paragraph 4–42.)

4–31. OVERHAUL (FOURTH ECHELON). Replace any damaged or worn parts. (Refer to paragraph 4–32.)

4–32. REASSEMBLY. (See figure 4–7.)

a. Insert oil pump driver gear (22) into gear housing with splined end first and insert oil pump driven gear (20) on post.

Note

Replace oil pump driven gear, part No. S1635-20148-2, with gear, part No. S1535-20214-1, if old gear is installed.

b. Insert stud (4), using driver tool, Rosan part No. S121D-12. Use inserting tool, Rosan part No. R1107XW, to install lock ring (3).

c. Replace plunger (12) and spring (13) in cover and liner assembly (11). Install screw (14) and nut (15).

d. Replace gasket (16) and screw on cap (17). Secure cap (17) with lock wire.

e. Replace gasket (5) on oil filter (6) and install oil filter cover on stud (4). Replace gasket (10) and ring (7) and secure with two nuts (8 and 9).

f. Slide gaskets (19, 19A, 19B, and 19C) and cover assembly (18) with plunger housing pointing downward on studs attached to gear housing. Secure with washers and nuts (21).

Note

Assemble unit with new gaskets throughout. (See figure 4–7 for proper gaskets and stack-up).

4–33. TEST AND ADJUSTMENT. Test and adjustments will be made on initial run-up. (Refer to TM 55-1520-202-20, Chapter 2, Section IV, paragraph 4–9).

4–34. OIL LEAKAGE. Leakage of the main gear box assembly caused by a faulty seal, gasket, packing, shim, or parting flange must not exceed the maximum listed in table 4–I. Total leakage from all sources listed in table 4–I must not exceed 5 cubic centimeters per hour. During a flight of 10 hours duration, total leakage from all sources including loss from breather or vent openings, must not exceed one-third of the distance from the FULL to the REFILL lines on the oil level sight gage.

Table 4–I. Main Gear Box Oil Leakage

COMPONENT	MAXIMUM LEAKAGE PER COMPONENT
Seal	Two cubic centimeters per hour
Gasket	One cubic centimeter per hour
Packing	One cubic centimeter per hour
Shim	One cubic centimeter per hour
Parting flange	One cubic centimeter per hour

4–35. REPLACEMENT OF REAR COVER GASKET.

a. Drain main gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section IV.) Remove generator (TM 55-1520-202-20, Chapter 2, Section IV), generator blower (paragraph 4–20, step *g*), tachometer-generator (paragraph 4–20, step *f*.), and hydraulic pump and filter (paragraph 4–20, step *e*) from rear cover. Disconnect oil line at oil pump. Remove section I of tail rotor drive shaft. (Refer to paragraph 4–89.)

b. Remove cotter pin from tail rotor takeoff flange lock nut. Prevent flange from turning by using anti-torque plate, part No. S1670-10401-4, on flange. Remove lock nut and pull off flange with wrench assembly, part No. S1670-10308.

c. Remove washers and nuts which secure rear cover to lower housing. Take off rear cover and gasket, tapping as necessary with rawhide mallet.

CAUTION

When removing rear cover from studs, make certain that gears do not fall out.

Note

It is recommended that all accessory drive seals in rear cover be replaced whenever the rear cover gasket is replaced. (Refer to paragraph 4–38.)

d. Clean mating surface of lower housing and rear cover. Lightly coat new rear cover gasket with plug valve grease, Military Specification MIL-G-6032, and place gasket on lower housing studs. Install rear cover. Using rawhide mallet, drive rear cover into place. Install securing washers and nuts and tighten evenly to a torque of 180 to 225 inch-pounds.

e. Install tail rotor takeoff flange on splined shaft. Coat threads of shaft and threads of lock nut with anti-seize compound, Federal Specification TT-A-580. Install nut on shaft, prevent flange from turning by using anti-torque plate, part No. S1670-10401-4, and using wrench assembly, part No. S1670-10308, tighten lock nut to a torque of 125 to 175 foot-pounds. Install cotter pin and secure plug with lock wire.

f. Replace section I of tail rotor drive shaft (paragraph 4–95), hydraulic pump and filter (paragraph 4–21, step *i*), tachometer-generator (paragraph 4–21, step *b*), generator blower (paragraph 4–21, step *g*), and generator (TM 55-1520-202-20, Chapter 2, Section IV). Connect oil line at oil pump. Service main gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

4–36. HANDLING OF SEALS. The following procedure must be followed to reduce oil seal leakage to a minimum:

a. All seals should be used in the as-received condition. Seals should not be washed in solvent.

b. Under no circumstances should seal lips be touched.

4–37. INSTALLATION OF SEALS.

a. When installing seals, apply light coat of Garlock sealing compound, No. 101, manufactured by Garlock Packing Co., to housing bore only. Do not coat seal outside diameter.

b. Seals should be pressed into their respective housings, using proper ram and an arbor press. Use of makeshift tools and a hammer should be avoided.

c. Lightly coat any thimble, flange, or metal object that is to be inserted into inside diameter of seal with petrolatum, Federal Specification VV-P-236.

4–38. REPLACEMENT OF ACCESSORY DRIVE SEALS. The following procedure is to be used when replacing any accessory drive seal in the rear cover.

Table 4–II. Replacement of Main Gear Box Accessory Drive Seals

TO INSTALL	USE SEAL INSTALLER	WITH MOUNTING THIMBLE
Tachometer gear seal	S1670-10604	S-1450-4161-3
Oil pump gear seal	S1670-10602	S1670-10339
Generator gear seal	S1670-10603	S1670-10340
Blower gear seal	S1670-10605	S1670-10341

a. Drain main gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

Note

For removal of individual components necessary for replacement of seals, refer to paragraph 4–35, step *a.*

b. Remove desired accessory drive seal by inserting two screws into threaded holes in seal. Grip screws and pull out seal.

c. Install proper mounting thimble and seal installer on accessory drive shaft from which seal was removed. For appropriate mounting thimble and seal installer, refer to table 4–II.

d. Coat thimble and inside surface of seal with petrolatum, Federal Specification VV-P-236, and the outside surface of the seal with Garlock sealing compound No. 101, manufactured by Garlock Packing Co. Press seal in place, using seal press cylinder, part No. S1670-10485, and remove thimble.

Note

For installation of individual components or seals, refer to paragraph 4–35, step *f.*

e. Service main gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

4–39. REPLACEMENT OF TAKEOFF PINION SEAL.

a. Drain main gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

b. Remove takeoff flange. (Refer to paragraph 4–35, step *b.*)

c. Remove takeoff pinion seal by inserting two screws of seal puller, part No. S1670-10479-14, into threaded holes in seal. Pull out seal by turning jackscrew on seal puller.

d. Coat outside surface of seal with Garlock sealing compound, No. 101, manufactured by Garlock Packing Co, and inside surface with petrolatum, Federal Specification VV-P-236. Using seal press cylinder, part No. S1670-10495, press seal in place.

e. Install takeoff flange. (Refer to paragraph 4–35, step *e.*)

f. Service main gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

4–40. REPLACEMENT OF MAIN SHAFT SEAL.

a. Remove main rotor head assembly. (Refer to Section V.) Disconnect oil line to seal retainer at fitting. Remove bolts and washers which secure seal retainer. Lift seal retainer off main shaft. Remove O-ring. Using seal pusher, part No. S1670-10468, and reaction ring, part No. S1670-10469, press out seal.

b. Coat outside diameter of replacement seal with Garlock sealing compound, No. 101, manufactured by Garlock Packing Co. Press seal into retainer and insert seal and retainer into seal pusher, part No. S1670-10468. Install new O-ring

in groove. Coat seal and O-ring with petrolatum, Federal Specification VV-P-236. Slide seal retainer carefully into its proper position and secure with bolts and washers. Secure bolts with lock wire. Connect oil line at the fitting. Install main rotor head assembly. (Refer to paragraph 5–13.)

4–41. REPLACEMENT OF INPUT SEAL.

a. Remove main drive shaft. (Refer to paragraph 4–5.)

b. Drain main gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

c. Remove cotter pin from input bevel gear lock nut. Remove lock nut, using wrench part No. S1670-10347, and spanner wrench, part No. S1670-10626-4.

d. Remove washers and nuts that secure cap to input housing. Slide flange and cap from bevel gear. Support cap and press out klosure seal (30, figure 4–7), using seal pusher, part No. S1670-10487. Remove shims (29) and spacer (28).

e. To reassemble, install spacer (28) and shims (29). Coat outside surface of new seal with Garlock sealing compound, No. 101, manufactured by Garlock Packing Co, and inside surface with petrolatum, Federal Specification VV-P-236. Coat liner of cap with Garlock sealing compound, No. 101, manufactured by Garlock Packing Co. Using seal pusher, part No. S1670-10487, press seal in place.

f. Slide flange and cap onto bevel gear. Secure cap to input housing with washers and nuts and tighten nuts to a torque of 80 to 100 inch-pounds.

g. Using wrench, part No. S1670-10347, and spanner wrench, part No. S1670-10626-4, install and tighten lock nut to a torque of 500 to 600 foot-pounds. Install cotter pin, and secure it to plug in bevel gear with lock wire.

h. Service main gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

i. Replace main drive shaft. (Refer to paragraph 4–8.)

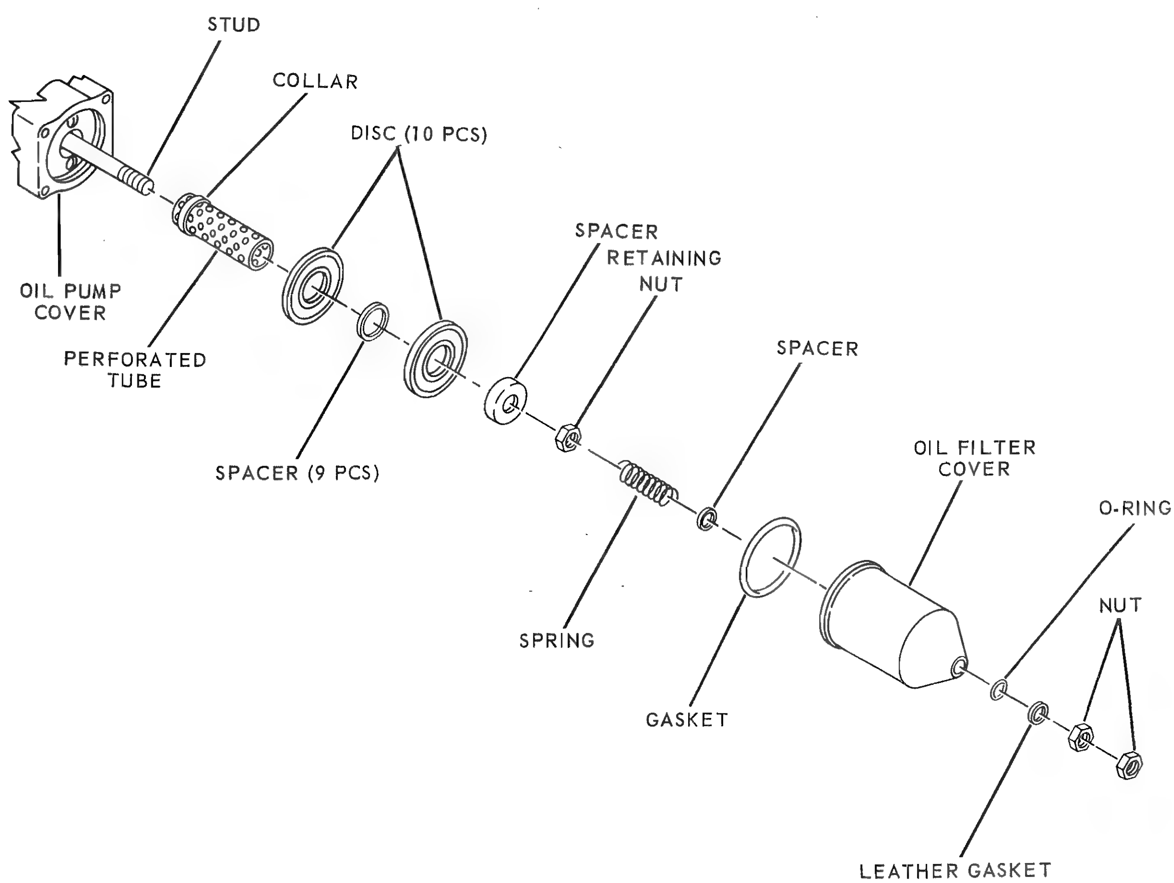


Figure 4–8. Disassembly of Oil Filter

4–42. CLEANING OIL FILTER ASSEMBLY. (See figure 4–8.)

a. Remove nuts, leather gasket, and O-ring and remove oil filter cover. Remove spring and spacer. Remove retaining nut and disc stack, consisting of perforated tube discs and spacers, from oil pump cover. Remove discs and spacers from perforated tube.

b. Clean discs by washing in dry-cleaning solvent, Federal Specification P-S-661. Remove lint or large dirt particles with a small soft-bristle brush.

CAUTION

If metal particles are found in filter, investigate to determine source and cause. Refer to metal particle contamination of main gear box in TM 55-1520-202-20, Chapter 2, Section VII.

c. Position discs and spacers on collar of perforated tube, alternating discs and spacers. Install retaining nut and tighten until discs cannot be turned by hand. Secure retaining nut with lock wire. Position perforated tube and disc stack in oil pump cover.

d. Install washer and spring. Place O-ring on oil filter cover and install oil filter cover, ring, gasket, and nuts.

Note

Apply pressure to filter cover when tightening nuts to prevent damage to O-ring.

Note

Check filter for possible leaks after first flight.

4–43. PREPARATION FOR STORAGE OR SHIPMENT. (See figure 4–9). Prior to storage or shipment of the main gear box, prepare each unit as follows:

a. Install upper and lower gear box housing bolts which were removed to release hydraulic support brackets.

b. Drain all service oil out of gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

c. Flush gear box with lubricating oil, Military Specification MIL-L-21260, Grade 2.

d. Drain any excess lubricating oil from gear box.

e. Coat unprotected surfaces, such as shafts, with petrolatum, Military Specification MIL-C-11796. Cover with greaseproof barrier material, Military Specification MIL-B-121. Secure barrier material with tape, Federal Specification PPP-T-60.

Figure 4–9. Main Gear Box Storage and Shipping Container

f. Hoist gear box into shipping container, part No. S1670-11050, Price Fireplace Co. part No. 339A, or Buffalo Metal Container Corp. part No. 516A, and bolt support assemblies to mounting brackets inside container. Coat bolts with corrosion-preventive solvent, Military Specification MIL-C-16173.

g. Install 80 units of desiccant, Military Specification MIL-D-3464, in wire basket, located inside container.

CAUTION

Place humidity indicator in window of container so that it can be easily viewed from outside. Desiccant should be replaced if indicator turns pink.

h. Place gasket and cover on shipping container and bolt down cover.

i. Apply 5 psi air pressure to shipping container. Apply a soap and water solution and check for leaks.

j. Insert history card in receptacle provided for it.

4–44. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove main gear box from container.

b. Remove greaseproof barrier material and adhesive tape.

c. Strip corrosion-preventative compound from external machined surfaces with dry-cleaning solvent, Federal Specification P-S-661.

d. Flush gear box with lubricating oil. (Refer to TM 55-1520-202-20, Chapter 2, Section II.) Drain gear box.

e. Install gear box and refill with lubricating oil.

4–45. INSTALLATION.

a. Assemble main gear box and rotor quick change unit. (Refer to paragraph 4–21.)

b. Install main gear box and rotor quick change unit. (Refer to paragraph 4–22.)

4–46. RUN-IN OF MAIN GEAR BOX.

4–47. DESCRIPTION. Certain run-in tests must be performed on every main gear box before the box is placed in service. To determine the run-in status of a gear box, examine the gear box historical record. For run-in of main gear box, part No. S1635-20000, -1, -2, -3, -6, -7, and -8, refer to paragraph 4–50. For run-in of main gear box, part No. S1635-20000-5, -9, and subsequent, refer to paragraph 4–55.

4–48. IDENTIFICATION – GEAR BOX RUN-IN.

4–49. DESCRIPTION. Main, intermediate, and tail rotor gear boxes are identified by annotation of the applicable gear box record to designate the type of test run-in that the gear box has received, weather new or overhauled, as follows:

a. Full load run-in test performed, (date).

b. No load (Green Run) run-in test performed, (date).

4–50. RUN-IN OF MAIN GEAR BOX, PART NO. S1635-20000, -1, -2, -3, -6, -7, and -8.

4–51. DESCRIPTION. Four run-in tests must be performed on every new or overhauled main gear box, part No. S1635-20000, -1, -2, -3, -6, -7, and -8, before being 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 the manufacturer on a new gear box and by an overhaul facility on an overhauled gear box, using a test stand, and consists 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 was used to run the gear box for a specified time while the oil pressure was 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 4–52. If only the no load bench test has been accomplished, perform the ground-run and hovering-run tests outlined in paragraph 4–53.

WARNING

All tests are mandatory and must be conducted for safety of flight.

4–52. RUN-IN OF MAIN GEAR BOX PART NO. S1635-20000, -1, -2, -3, -6, -7, AND -8, WHICH HAS RECEIVED ONE-QUARTER LOAD AND FULL LOAD TESTS. The ground-run and hovering-run tests outlined in this paragraph must be performed on every part No. S1635-20000, -1, -2, -3, -6, -7, and -8 main gear box that has received the one-quarter load and full load tests. To determine the run-in status of the gear box, refer to paragraph 4–51.

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 main gear box for final run-in. (Refer to paragraph 4–54.)

b. Start engine and engage clutch. Make a 30-minute ground-run at 1500, 2000, and 2400 rpm, allowing 10 minutes for each, and using minimum collective pitch and power. Observe transmission oil pressure and transmission oil temperature during 30-minute ground-run for signs of abnormality.

c. At end of the 30-minute ground-run, check gear box for signs of excessive leakage. (For maximum allowable leakage, refer to paragraph 4–34.)

Figure 4–10. Deleted

d. Check transmission oil temperature and preheat transmission oil, if necessary, to obtain a temperature of 50°C (122°F).

e. Start engine, engage clutch, and make a hovering-run for 1 hour at 2500 rpm with 47.5 inches manifold pressure.

Note

It will be necessary to hover several feet off ground during this run.

f. From readings on potentiometer, record temperature in area of sleeve bearing every minute from time of takeoff until end of flight. Temperature should normally stabilize within range of 85 to 97°C (185 to 206°F) within period of 15 to 25 minutes. Once temperature has stabilized within this range, it should remain within ± 1°C (1.8°F) of stabilized temperature for remainder of hovering-run.

CAUTION

Temperature of gear box in area of sleeve bearing should normally not exceed 100°C (212°F). Should the temperature exceed 100°C (212°F) at any time and continue to rise without stabilizing within prescribed period, land helicopter immediately, remove main gear box, and return it to an overhaul facility for teardown inspection. Under no conditions should temperature be allowed to exceed maximum of 110°C (230°F).

CAUTION

If thermocouple and potentiometer are not available or if gear box has not been reworked to provide hole in area of sleeve bearing for thermocouple, constant check must be maintained during the hovering-run for a strong odor of overheated transmission oil which should indicate excessively high gear box temperature. If such an odor is detected, land helicopter immediately and follow instructions outlined in steps *i* through *k*.

g. Observe and record transmission oil pressure and transmission oil temperature readings from indicators on instrument panel in pilots' compartment at 5-minute intervals during this run.

CAUTION

If transmission oil temperature exceeds 85°C (185°F) at any time during flight, land helicopter and check transmission oil cooler thermostat for proper operation. Faulty thermostat could cause high sleeve bearing temperature readings and result in unnecessary removal of gear box.

h. At end of 1-hour hovering-run, check main gear box for oil leaks. (For maximum allowable leakage, refer to paragraph 4–34.)

i. Check zinc chromate primer strip for discoloration. Discoloration of strip indicates excessive temperature rise.

j. Inspect inside of splined shaft for any signs of burning of lacquer.

Note

Splined shaft may be inspected while main gear box is installed on helicopter by using mirror and flashlight and looking up from deck through opening located in lowest point of lower housing.

k. Inspect magnetic plug in oil pump for metal particles. Drain and filter oil.

CAUTION

If metal particles are found, investigate to determine source and cause. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

CAUTION

If zinc chromate primer strip shows discoloration, if lacquer is burned on inside of spindle shaft, or if bronze, lead, or steel chips are found on magnetic plug or finger strainer, main gear box should be removed and returned to an overhaul depot for teardown inspection.

l. If all checks appear normal during run-in procedure, main gear box is ready for flight service.

Note

Indicate completion of run-in test on main gear box historical record.

4–53. RUN-IN OF MAIN GEAR BOX, PART NO. S1635-20000, -1, -2, -3, -6, -7, AND -8, WHICH HAS RECEIVED NO LOAD BENCH TEST. The ground-run and hovering-run tests outlined in this paragraph must be performed on every part No. S1635-20000, -1, -2, -3, -6, -7, and -8 main gear box that has received a no load bench test. To determine the run-in status of the gear box, refer to paragraph 4–51.

Note

Tests outlined in this paragraph are not to be performed on main gear box that has received one-quarter load and full load tests.

a. Prepare main gear box for final run-in. (Refer to paragraph 4–54.)

b. Start engine and engage clutch. Make a 45-minute ground-run at 1500, 2000, and 2400 rpm, allowing 15 minutes for each, and using minimum collective pitch and power. Observe transmission oil pressure and transmission oil temperature during 45-minute ground-run for signs of abnormality.

c. At end of 45-minute ground-run, check gear box for signs of excessive leakage. (For maximum allowable leakage, refer to paragraph 4–34.)

d. Check transmission oil temperature and preheat transmission oil, if necessary, to obtain temperature of 50°C, (122°F).

e. Start engine, engage clutch, and make hovering-run for 90 minutes at 2500 rpm with 47.5 inches manifold pressure.

Note

It will be necessary to hover several feet off ground during this run.

f. Observe and record oil pressure and temperatures as outlined in paragraph 4–52, items *f* and *g*.

g. At the end of 90 minute hovering-run check main gear box as outlined in paragraph 4–52, items *b* through *l*.

4–54. PREPARATION OF MAIN GEAR BOX, PART NO. S1635-20000, -1, -2, -3, -6, -7, AND -8, FOR FINAL RUN-IN. The following procedure is mandatory and must be complied with.

a. Service main gear box with lubricating oil. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

b. Load helicopter to its maximum gross weight of 13,300 pounds.

c. Remove vertical strip of heat-resistant paint, 1 inch wide and 5 inches long, on right side of lower housing adjacent to sleeve bearing, using paint remover, Military Specification MIL-R-25134.

d. Apply a coat of zinc chromate primer, Military Specification MIL-P-8585, to strip where paint was removed.

e. Remove plug and install AN4075 fitting and bayonet-type thermocouple, part No. AN5541-1, in hole in lower housing casting adjacent to sleeve bearing. Mount a 0 to 200°C (32 to 392°F) potentiometer in pilots' compartment and connect wiring from thermocouple to potentiometer.

Note

If thermocouple and potentiometer are not available or if gear box has not been reworked to provide a hole in area of sleeve bearing for installing thermocouple, excessive heat in main gear box is indicated by zinc chromate primer strip turning brown and/or prevalent strong odor of overheated transmission oil around gear box.

4–55. RUN-IN OF MAIN GEAR BOX, PART NO. S1635-20000-5, -9, AND SUBSEQUENT.

4–56. DESCRIPTION. Two run-in tests must be performed on every main gear box, part No. S1635-20000-5, -9, and subsequent, before the gear box is placed in service: a one-quarter load and a full load test. The one-quarter load and full load tests are normally performed by the manufacturer on a new gear box and by an overhaul depot on an overhauled gear box, using a test stand, and consist of two separate runs at specified loads and speeds. However, if the overhaul depot had no test stand, a substitute no load bench test should have been performed, during which an electric motor was used to run the gear box for a specified time while the oil pressure was 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 preflight check outlined in paragraph 4–57. If only the no load bench test has been accomplished, perform the ground-run and hovering-run tests outlined in paragraph 4–58.

WARNING

All tests are mandatory and must be conducted for safety of flight.

4–57. PREFLIGHT CHECK OF MAIN GEAR BOX, PART NO. S1635-20000-5, -9 AND SUBSEQUENT, WHICH HAS RECEIVED ONE-QUARTER LOAD AND FULL LOAD TESTS. The preflight check outlined in this paragraph must be performed on every main gear box, part No. S1635-20000-5, -9, and subsequent, that has received the one-quarter load and full load tests. To determine the run-in status of the gear box, refer to paragraph 4–56.

CAUTION

Test outlined in this paragraph is not to be performed on main gear box that has received no load bench test.

a. Prepare main gear box for final run-in by servicing with lubricating oil. (Refer to TM 55-1520-202-20, Chapter 2, Section II.

b. Conduct normal preflight warm-up at 1800 engine rpm and check that transmission oil pressure and transmission oil temperature are within normal operating limits.

c. If all checks appear normal during preflight warm-up procedure, main gear box is ready for flight service.

Note

Indicate completion of run-in test on main gear box historical record.

4–58. RUN-IN OF MAIN GEAR BOX, PART NO. S1635-20000-5, -9, AND SUBSEQUENT, WHICH HAS RECEIVED NO LOAD BENCH TEST. The ground-run and hovering-run tests outlined in this paragraph must be performed on every main gear box, part No. S1635-20000-5, -9, and subsequent, that has received a no load bench test. To determine the run-in status of the gear box, refer to paragraph 4–56.

Note

Tests outlined in this paragraph are not to be performed on main gear box that has received one-quarter load and full load tests.

a. Prepare main gear box for final run-in by servicing with lubricating oil. (Refer to TM 55-1520-202-20, Chapter 2, Section II.) Load helicopter to its maximum gross weight of 13,300 pounds. Apply a coat of zinc chromate primer, Military Specification MIL-P-8585, on the right side of the gear box lower housing as outlined in paragraph 4–54, steps *c* and *d.*

b. Start engine and engage clutch. Make a 30-minute ground-run at 1500, 2000, and 2500 rpm, allowing 10 minutes for each, and using minimum collective pitch and power. Observe transmission oil pressure and transmission oil temperature indicator readings for signs of abnormality.

c. At end of the 30-minute ground-run, check gear box for signs of excessive leakage. (For maximum allowable leakage, refer to paragraph 4–34.)

d. Start engine, engage clutch, and make hovering-run for 1 hour at 2500 rpm with 47.5 inches manifold pressure.

Note

It will be necessary to hover several feet off ground during this run.

e. Observe transmission oil pressure and transmission oil temperature indicator readings during this run for signs of abnormality.

CAUTION

If any abnormal readings are indicated, land helicopter immediately and follow instructions in steps *g* and *h*.

f. At end of 1-hour hovering-run, check main gear box for oil leaks.

g. Check zinc chromate primer strip for discoloration. Discoloration of strip indicates excessive temperature rise.

h. Inspect magnetic plug in rear cover and in lower housing for metal particles. Drain and filter oil. Inspect filter in oil pump cover for metal particles.

CAUTION

If metal particles are found investigate to determine source and cause. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

CAUTION

If zinc chromate primer strip shows discoloration, if lacquer is burned on inside of spindle shaft, or if bronze, lead, or steel chips are found on magnetic plug, main gear box should be removed and returned to an overhaul depot for teardown inspection.

i. If all checks appear normal during run-in procedure, main gear box is ready for flight service.

j. Indicate completion of run-in test on main gear box historical record. Metal stamp gear box with an encircled T. (Refer to paragraph 4–48.)

4–59. 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 main gear box and oil cooler.

b. Flush main gear box, oil cooler, and lines thoroughly with lubricating oil, Military Specification MIL-L-21260.

c. Clean and reinstall oil filter, oil strainer screen, and magnetic sump plug.

d. Service main gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section I.)

e. Run up gear box for 1 hour and inspect oil strainer screen and magnetic sump plug. If amount of particles has increased, gear box should be changed; if amount of particles has decreased, continue gear box in service, but continue inspections of gear box as outlined in steps *f* through *i*.

f. After 5 hours of normal operation or during daily inspection, whichever comes first, drain gear box and filter 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 lubricating oil. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

h. Repeat steps *f* and *g* at 5-hour intervals or daily, whichever comes first, to determine whether amount of particles has increased or decreased.

i. If amount of particles has increased, gear box should be changed. If amount of particles has decreased, gear box may be continued in service.

4–60. MAIN GEAR BOX OIL COOLER AND BLOWER.

4–61. DESCRIPTION. The main gear box oil cooler and blower assembly (figure 4–11) 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 matched vee belts. Outside air for cooling enters the canopy where it is drawn into the blower and rammed through the cooler. Two hoses 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 71.1°C (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 71.1°C (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.

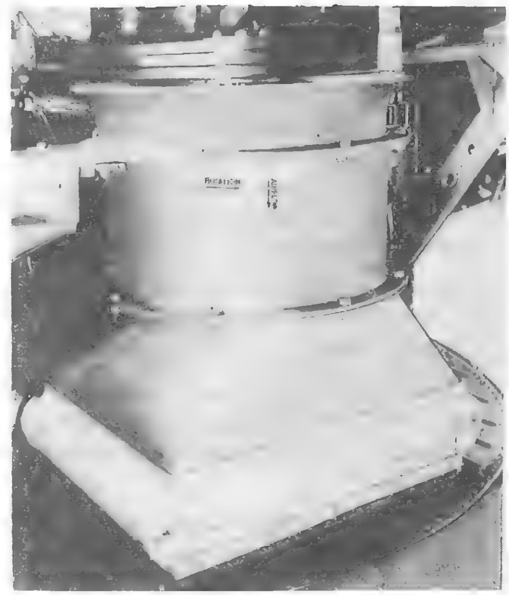


Figure 4–11. Main Gear Box Oil Cooler and Blower Installed

4–62. BLOWER.

4–63. REMOVAL. (See figure 4–12.)

a. Hinge down service platforms and remove skin assemblies over oil cooler and blower by unlocking Camloc fasteners.

b. Loosen bolts, (21) to release tension on pulley belts (31). Take belts off driven pulley (3).

Note

Do not remove belts from driving pulley. If belts must be replaced, refer to TM 55-1520-202-20, Chapter 2, Section VII.

c. Remove bolts, washers, and nuts (30), that secure duct (6), to fan (28).

d. Remove bolts, washers, and nuts (14), that attach fan to mounting plate (18).

e. Lift off fan.

1. Lock Nut
2. Cover Plate
3. Driven Pulley
4. Flange
5. Bolt, Nut
6. Duct
7. Bolt, Washer
8. Oil Cooler
9. Aft Support
10. Bolt, Washer
11. Elbow
12. Hose
13. Front Support
14. Bolt, Washer, Nut
15. Nipple
16. Hose
17. Bolt, Washers, Nut
18. Plate
19. Quick Disconnect
20. Bolt, Washer, Nut
21. Bolt, Washers, Nut
22. Quick Disconnect
23. Hose
24. Bolt, Washer, Nut
25. Elbow
26. Hose
27. Elbow
28. Fan
29. Key
30. Bolt, Washer, Nut
31. Pulley Belt
32. Small Washer
33. Large Washer

Figure 4–12. Main Gear Box Oil Cooler and Blower Disassembled (Sheet 1 of 2)

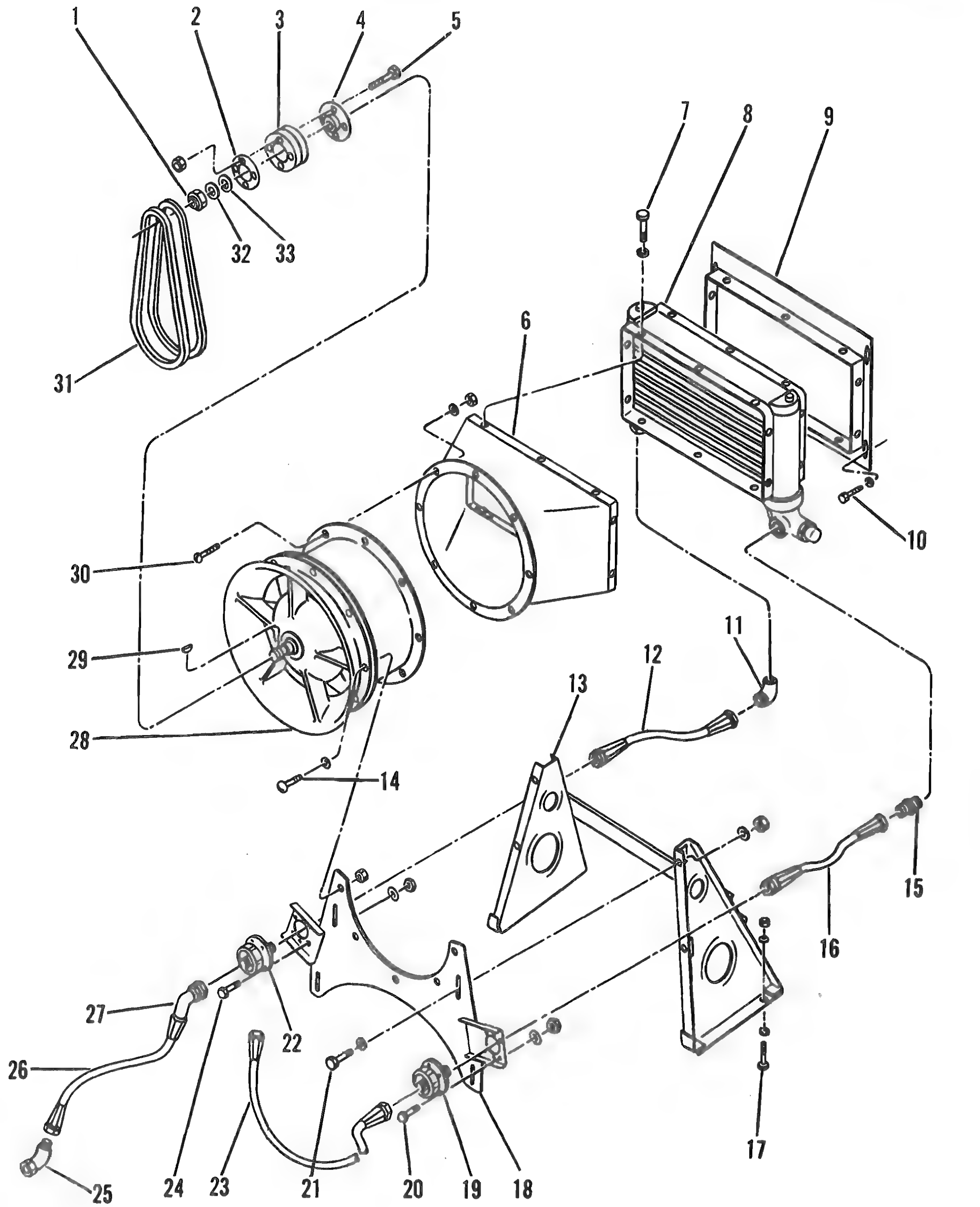


Figure 4–12. Main Gear Box Oil Cooler and Blower Disassembled (Sheet 2 of 2)

4–64. DISASSEMBLY. (See figure 4–12.)

a. Remove driven pulley (3) from blower shaft by removing lock nut (1), small washer (32), large washer (33), and key (29).

b. Remove intake flange (1, figure 4–13) from casing (2) by removing remaining bolts (3) and pull off flange.

c. Remove nut (4) and washer from rear end of rotor shaft (5) and pull out rotor (6) and shaft.

d. Remove rotor retaining nut (7) and washer. Remove rotor from shaft.

e. Remove rear shaft bearing (10) by removing screws (8) and bearing retaining plate (9) and press out bearing.

f. Remove screws (11) that secure flanged bushing (12) to rotor, and remove bushing.

4–65. CLEANING.

a. This fan is self cleaning. Any dirt or grease contracted during removal or disassembly may be removed by washing with dry-cleaning solvent, Federal Specification P-S-661.

b. Dry parts thorough with compressed air.

4–66. INSPECTION.

a. Inspect pulley for condition of vee-belt grooves and hub bore and keyway.

b. Inspect shaft bearing journal for wear or out of round and keyway for wear.

c. Inspect rotor for condition and bore; keyway bearing journal for wear and out of round.

d. Inspect shaft, using magnetic particle inspection, for cracks and defects.

e. Inspect bearings for freedom of rotation and wear.

f. Inspect casing assembly for wear of bearing bores.

g. Inspect all threads for condition and cleanliness.

h. Inspect all parts for physical damage.

4–67. REPAIR. Replace all parts found defective.

4–68. REASSEMBLY. (See figure 4–13.)

a. Replace flanged bushing (12) in rotor (6) and secure with screws (11).

b. Replace bearings (10) and bearing retainer plates (9). Secure with screws (8).

c. Place rotor (6) on rotor shaft (5) and secure with rotor retaining nut (7).

d. Install rotor and shaft in casing (2) and secure with washer and nut (4) at rear of fan.

e. Position intake flange (1) on shaft and secure to casing (2) with top bolts (3).

f. Install driven pulley (3, figure 4–12) to shaft with key (29), washers (33 and 32), and lock nut (1). Tighten nut to a torque of 165 to 195 inch-pounds.

4–69. LUBRICATION. Lubrication is not required since all bearings are prelubricated.

4–70. INSTALLATION. (See figure 4–12.)

a. Place fan on support assembly and install bolts, washers, and nuts (14).

b. Install bolts, washers, and nuts (30), that secure duct (6) to fan (28).

c. Install bolts, washers, and nuts (21). Do not tighten until pulley belts are adjusted.

d. Install and adjust pulley belts (31). (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

e. Install skin assemblies over oil cooler and blower. Secure with Camloc fasteners.

4–71. OIL COOLER.

4–72. REMOVAL. (See figure 4–12.)

a. Refer to paragraph 4–63 for fan removal.

b. Drain service oil from main gear box as necessary. (Refer to TM 55-1520-202-20, Chapter 2, Section VII.)

c. Disconnect hoses (12 and 16) from oil cooler (8) and plug lines.

d. Remove duct (6) from oil cooler (8) by removing bolts and washers (7).

e. Remove bolts and washers (10) and lift out cooler and aft support (9). Remove aft support from oil cooler.

4–73. REPAIR AND REPLACEMENT OF PARTS (FOURTH ECHELON). (Refer to TM 1-7R1-4-8-3.)

4–74. INSTALLATION. (See figure 4–12.)

a. Assemble oil cooler (8), aft support (9), and duct (6).

b. Support oil cooler and install with bolts and washers (10).

Note

Apply sealing compound, Minnesota Mining and Mfg. Co, Part No. EC-612, to mating surfaces of aft support and oil cooler; cooler and duct; and to fan and duct.

c. Connect hoses (12 and 16) to oil cooler.

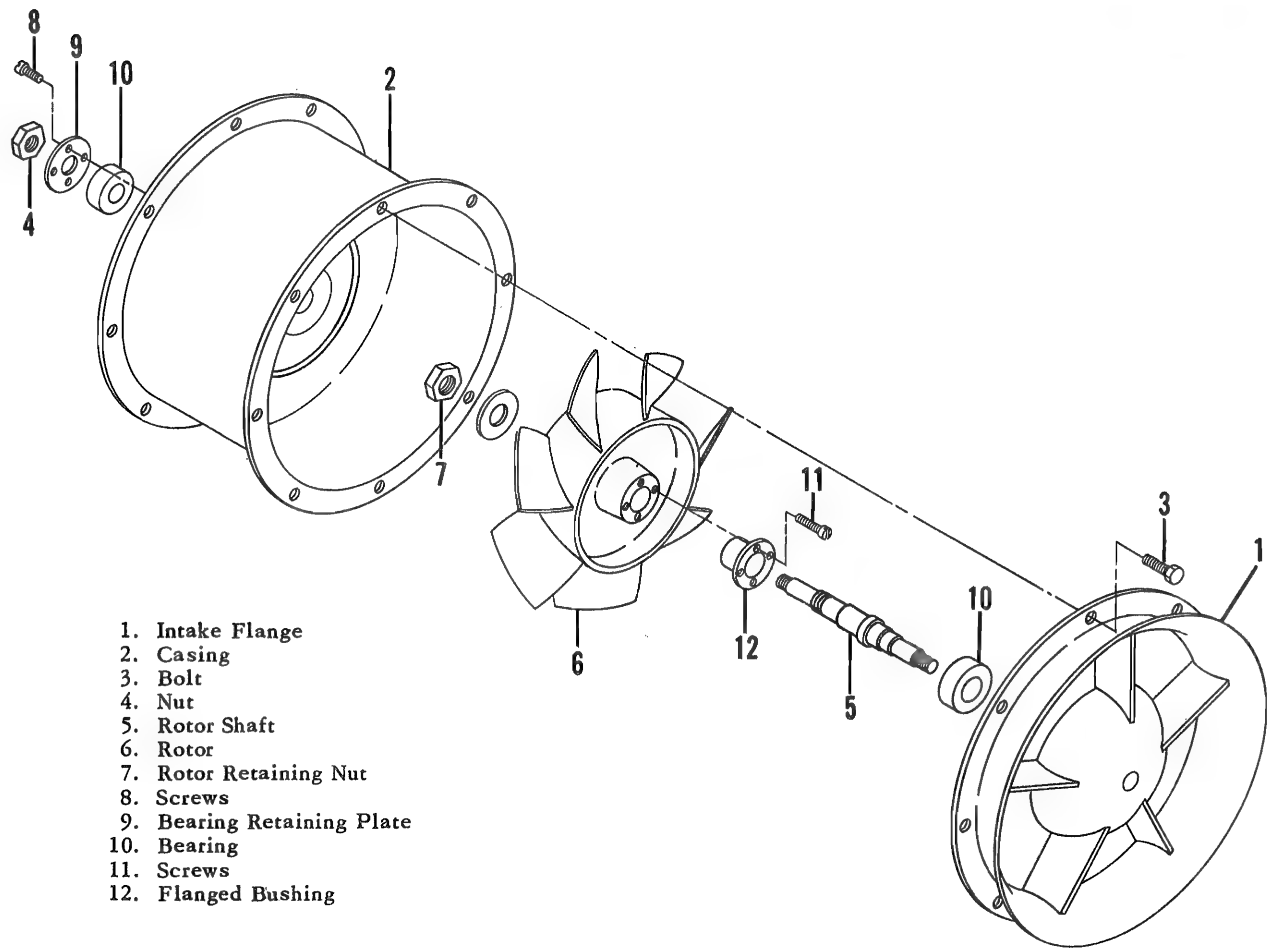


Figure 4–13. Fan Assembly

d. Install fan (28). (Refer to paragraph 4–70.)

e. Fill main gear box with oil. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

4–75. ROTOR BRAKE SYSTEM.

4–76. DESCRIPTION. The rotor brake system is a nonpressurized hydraulic system for stopping the main and tail rotors from windmilling. The system incorporates a rotor brake assembly and a master brake cylinder with necessary tubing, relief valve, pressure switch, and accumulator. On helicopters serial No. 54-2890 and subsequent, a relief valve has been incorporated into the rotor brake system. On helicopters serial No. 55-4462 and subsequent, a pressure switch has been incorporated in the rotor brake system.

4–77. REMOVAL, HELICOPTERS SERIAL NO. PRIOR TO 54-2890.

a. Remove master brake cylinder. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

b. Remove accumulator. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

c. Remove rotor brake. (Refer to paragraph 4–81.)

d. Remove tubing which extends from master cylinder to canted bulkhead by releasing clamp and disconnecting tubing from bulkhead elbow.

e. Disconnect tubing from aft end of bulkhead elbow and remove tubing and elbow.

f. Remove line from accumulator to rotor brake by removing clamps, union, tee fitting, and elbows.

4–78. REMOVAL, HELICOPTERS SERIAL NO. 54-2890 AND SUBSEQUENT.

a. Remove master brake cylinder. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

b. On helicopters serial No. 55-4462 and subsequent, remove pressure switch.

c. Remove accumulator. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

d. Remove relief valve. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

e. Remove rotor brake. (Refer to paragraph 4–81).

f. Remove tubing which extends from master cylinder to canted bulkhead by releasing clamps and disconnecting tubing from bulkhead tee.

g. On helicopters serial No. 55-4462 and subsequent, disconnect pressure switch hose from elbow on aft end of bulkhead tee.

h. Remove accumulator tubing from bulkhead tee and accumulator tee.

i. Disconnect tees from lines and remove lines which extend from accumulator to relief valve by removing clamps and union.

j. Remove tube assembly which extends from relief valve to rotor brake from relief valve tee.

4–79. ROTOR BRAKE.

4–80. DESCRIPTION. The rotor brake, Goodyear part No. PD1105, consists of a disc that is mounted on section II of the tail rotor drive shaft and four hydraulic brake halves that are 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 enough to restore the normal gap.

4–81. REMOVAL.

a. Hinge down left main gear box service platform.

b. Remove tubing joining each set of brake halves. Disconnect tubing outboard of tees in line to left brake.

Note

Drain any hydraulic fluid into receptacle.

c. Unbolt brake halves from supporting brackets and remove brake halves and shims.

d. Unscrew tee fittings and elbows from brake housings.

e. Remove disc, if necessary. (Refer to paragraph 4–98, step *b.*)

Note

Brake disc (56, figure 4–14) is removed only in conjunction with components of tail rotor drive shaft.

4–82. OVERHAUL (FOURTH ECHELON).(Refer to TM 1-1H-34-1009.)

4–83. INSTALLATION.

a. Install rotor brake disc, if it was removed. (Refer to paragraph 4–102, step *a.*)

b. Check runout of rotor brake disc. (Refer to paragraph 4–84.)

c. Position pair of brake halves at supporting bracket on each side of brake halves at supporting bracket on each side of brake disc. Install bolts, washers, and nuts. Tighten nuts to a torque of 50 foot-pounds.

Note

Install each bolt with head forward.

Note

Install shims between brake halves and support as necessary to equalize space between disc and each of four brake halves are in plane with disc.

d. Screw tee fittings and elbows into brake housings.

e. Connect tubing between fittings on halves and tighten nuts. Connect tubing from accumulators at tee below the left brake.

f. Fill and bleed rotor brake system. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

g. Check clearance of rotor brake disc and linings. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

h. Close main gear box service platform.

4–84. CHECKING RUNOUT OF ROTOR BRAKE DISC.

a. Using dial indicator, check braking surface of brake disc at its periphery for runout. Maximum permissible runout is 0.010-inch TIR, (Total Indicator Reading).

b. If runout exceeds 0.010-inch TIR, replace disc. (Refer to paragraphs 4–98, steps *a* and *b* and 4–102, step *a.*)

c. Use dial indicator to check OD of brake disc for runout. Maximum permissible runout is 0.003-inch TIR.

d. If runout exceeds 0.003-inch TIR, loosen nuts securing disc to brake hub and adjust disc. Retighten nuts to a torque of 100 to 140 inch-pounds.

4–85. ROTOR BRAKE MASTER CYLINDER. Removal and installation procedures are covered in TM 55-1520-202-20, Chapter 2, Section V. Repair and overhaul procedures are covered in TM 1-4BA1-22-3.

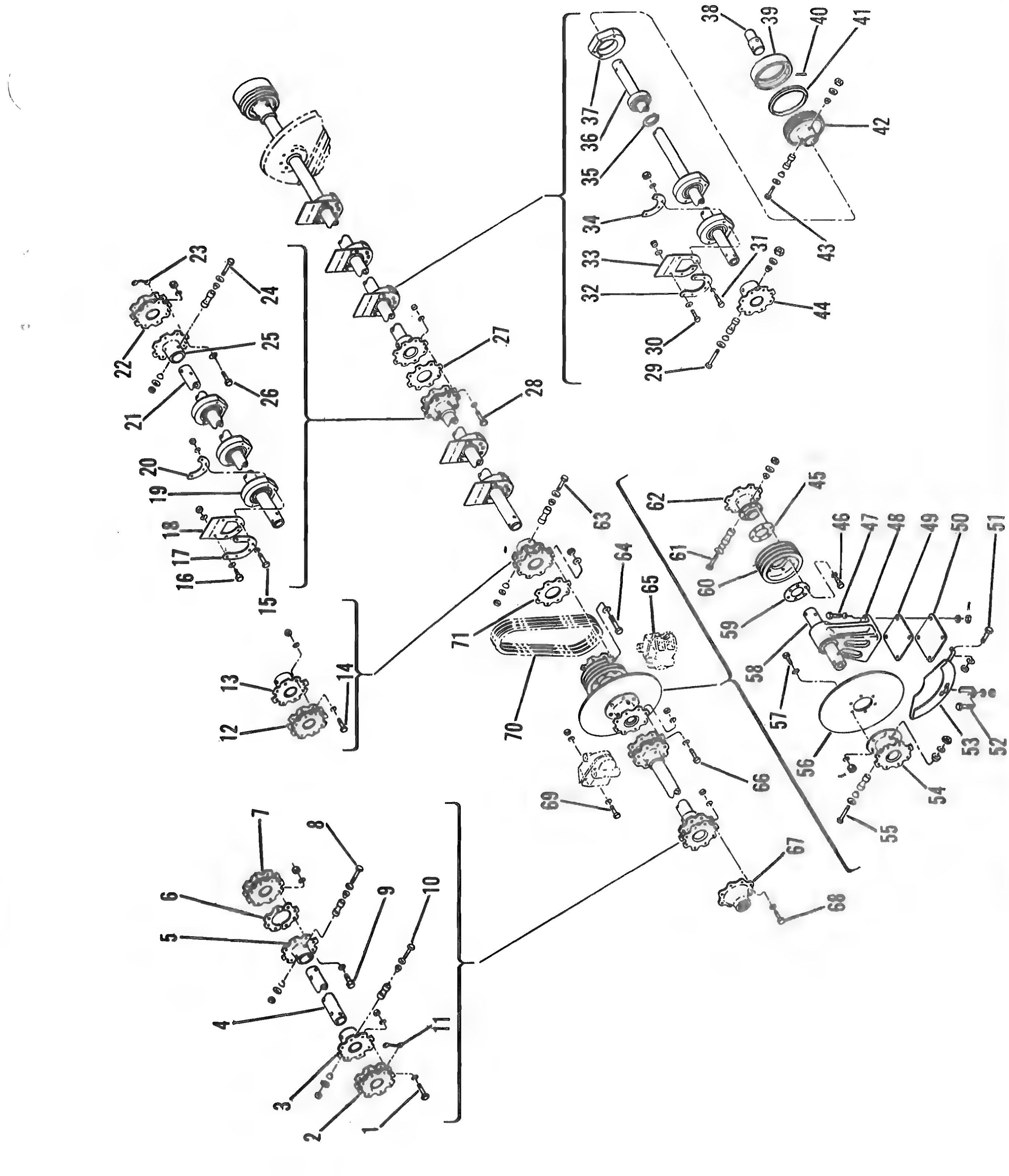


Figure 4-14. Tail Rotor Drive Shaft Removal and Disassembly (Sheet 1 of 2)

1. Bolt, Washers, Nut
2. Rubber Coupling
3. Flange
4. Drive Shaft (Section I)
5. Flange
6. Shim
7. Rubber Coupling
8. Bolt, Washers, Nut, Wedges, Bushing
9. Bolt, Washers, Nut
10. Bolt, Washers, Nut, Wedges, Bushing
11. Bonding Jumper
12. Rubber Coupling
13. Flange
14. Bolt, Washers, Nut
15. Bolt, Washers, Nut
16. Bolt, Washers, Nut
17. Plate
18. Bearing Support
19. Bearing
20. Bearing Ring
21. Drive Shaft (Section III)
22. Rubber Coupling
23. Bonding Jumper
24. Bolt, Washers, Nut, Wedges, Bushing
25. Flange
26. Bolt, Washers, Nut
27. Shim
28. Bolt, Washer, Nut
29. Bolt, Washers, Nut, Wedges, Bushing
30. Bolt, Washers, Nut
31. Bolt, Washers, Nut
32. Plate
33. Bearing Support
34. Bearing Ring
35. Snap Ring
36. Drive Shaft (Section IV)
37. Bearing Housing
38. Guide Shaft
39. Cover
40. Cotter Pin
41. Gasket
42. Input Coupling
43. Bolt, Washers, Nut, Wedges, Bushing
44. Flange
45. Pulley Spacer
46. Bolt, Washers, Nut
47. Bolt, Washers, Nut, Cotter Pin
48. Bearing Housing
49. Shim
50. Plate
51. Bolt, Washer, Nut
52. Bolt, Washer, Nut
53. Shield and Clip Assembly
54. Brake Hub
55. Bolt, Washers, Nut, Wedges, Bushing
56. Brake Disc
57. Bolt, Washers, Nut, Cotter Pin
58. Drive Shaft (Section II)
59. Pulley Spacer
60. Pulley
61. Bolt, Washers, Nut, Wedges, Bushing
62. Pulley Hub
63. Bolt, Washers, Nut, Wedges, Bushing
64. Bolt, Washers, Nut
65. Brake Half
66. Bolt, Washers, Nut
67. Main Gear Box Takeoff Flange
68. Bolt, Washers, Nut
69. Bolt, Washers, Nut
70. Pulley Belts
71. Shim

Figure 4–14. Tail Rotor Drive Shaft Removal and Disassembly (Sheet 2 of 2)

4–86. INSTALLATION ROTOR BRAKE SYSTEM.

Note

Apply anti-seize compound, Epon Resin, No. 828, manufactured by Shell Chemical Co., to threads of all fittings.

a. Position lines which connect relief valve with accumulator and install unions and clamps.

b. Connect forward end of line to leg of accumulator tee fitting and connect aft end of line to forward end of relief valve tee.

c. Connect tubing, which extends from relief valve to rotor brake, to leg of relief valve tee.

d. Install tee on pilots' compartment canted bulkhead and connect accumulator tubing to leg of bulkhead tee and to upper end of accumulator tee.

e. Install tubing from aft end of bulkhead tee; on helicopters serial No. 55-4462 and subsequent, connect pressure switch hose to elbow.

f. Position tubing which extends from master cylinder to pilots' compartment canted bulkhead. Connect aft end of tubing to forward end to bulkhead tee and install clamp.

g. Install rotor brake. (Refer to paragraph 4–83.)

h. Install relief valve. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

i. Install accumulator. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

j. On helicopters serial No. 55-4462 and subsequent, install pressure switch.

k. Install master brake cylinder. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

4–87. TAIL ROTOR DRIVE SHAFT.

4–88. DESCRIPTION. The tail rotor drive shaft (figure 4–14) 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 coupling, hubs, rubber mounted support bearings, and attachment flanges. Section I, which is above the transmission deck, consists of a shaft with a rubber coupling at the forward end and two flanges. There is a rubber coupling between sections I and II of the shaft. Section II, also located above the transmission deck, is composed of a brake hub, brake disc, oil cooler and blower pulley hub, attached pulley, a rubber coupling, and a shaft and support bearing. Section III, 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. Section IV extends through the tail cone and is made up of a flange, a shaft with three support bearings, and an input coupling at the rear of the tail cone section. Sections II and III 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 shaft of section III. Access to section I is gained by hinging down the gear box service platforms. Access to section II of the tail rotor drive shaft is gained by removing the skin assemblies aft of the service platforms. Access to section III is made by removing the louvered Fiberglas fairing at the rear of the skin assemblies and removing the tail rotor drive shaft covers located in the cabin and electronics compartment. Section IV is exposed in the tail cone section.

4–89. REMOVAL (SECTION I). (See figure 4–14.)

a. Hinge down service platforms.

b. Support section I of drive shaft (4) and unbolt rubber coupling (2), from main gear box takeoff flange (67).

c. Unbolt flange (5) at aft end of section I of drive shaft from rubber coupling (7). Remove shims (6) and shaft assembly.

Note

If shims (6) are between rubber coupling (7) and brake hub (54), remove bolts, washers, and nuts (66) and remove shims. Secure rubber coupling to brake hub.

4–90. DISASSEMBLY (SECTION I) (See figure 4–14.)

a. Unbolt rubber couplings (2 and 7) from flange (3) on forward end of section I of drive shaft (4). Remove couplings and bonding jumper (11).

b. Remove bolts, washers, nuts, wedges, and bushings (8 and 10) that secure flanges (3 and 5) to each end of drive shaft (4), and slide flange off shaft.

4–91. CLEANING. Clean with dry-cleaning solvent, Federal Specification P-S-661.

4–92. INSPECTION OF FLANGES AND SHAFTS.

a. Using fluorescent penetrant inspection methods in accordance with Military Specification MIL-I-6866, inspect all flanges and ends of each tail rotor drive shaft section in area of wedge and collet holes.

b. Inspect for excessive elongation of wedge and collet holes, using telescoping gage tool or fabricated plug gage.

Note

Hold plug gage perpendicular to wedge and collet holes. Apply gage to holes in at least six different positions. Do not force plug gage into wedge and collet holes.

c. Using plug gage, inspect 0.626/0.625-inch diameter wedge and collet holes in tail rotor drive shaft to determine whether they are out of round beyond 0.6300/0.6305-inch diameter.

d. Replace that section of tail drive shaft if plug gage enters either tail drive shaft wedge or collet holes.

e. Using plug gage, inspect 0.625/0.624-inch diameter wedge and collet holes in tail drive shaft flange to determine whether they are out of round beyond 0.6300/0.6305-inch diameter.

f. Replace tail drive shaft flange if plug gage enter any of tail drive shaft flange wedge and collet holes.

g. Measure 0.251/0.250-inch diameter holes in tail drive shaft flange and rubber couplings. If holes are out of round more than 0.002 inch, replace tail drive shaft flange and rubber coupling.

h. Measure 0.345/0.343-inch diameter brake disc mounting holes in hub. If holes are out of round more than 0.005-inch TIR, replace hub.

4–93. REPAIR. Limited scratches, dents, or scoring in a section of the tail rotor drive shaft may be repaired within the following limits:

CAUTION

No rework is permissible within 4 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 or axial scratches or scoring not exceeding 0.005 inch may be polished out, providing there are no more than two such dents or scratches within an area of 3 inches as measured along the section of the tail rotor drive shaft.

c. Tail rotor drive shaft may be reworked to a minimum outside diameter of 1.734 inches in an imaginary band at each end of the shaft in which the holes are located, and all other areas may be reworked to 1.728 inches.

d. Refer to paragraph 4–6 for repair techniques and procedures.

4–94. ASSEMBLY (SECTION I). (See figure 4–14.)

a. Slide flanges (3 and 5) on each end of section I of drive shaft (4). Line up holes and install bolts, washers, nuts, wedges, and bushings (8 and 10). Tighten nuts to a torque of 165 to 185 inch-pounds.

Note

Slot in each bushing should face nearest drive shaft end.

b. Position rubber coupling (2) on forward end of drive shaft section. Install bolts, washers, and nuts (1) and bonding jumper (11) that secures coupling to flange (3). Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

Install bolts with heads forward.

4–95. INSTALLATION (SECTION I). (See figure 4–14.)

a. Position and support section I of tail rotor drive shaft on transmission deck and determine amount of shims (6), necessary to fill gap at aft end of installation.

b. Line up holes and install bolts, washers, and nuts (68) that secure forward rubber coupling (2) to main gear box takeoff flange (67). Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

Removal of shaft, flanges, or rubber couplings from each other will not affect shimming requirements when original parts are reinstalled. Install bolts with heads forward.

c. Line up holes and install bolts, washers, and nuts (9) that secure flange (5) and shims (6) to rubber coupling (7) which is secured to brake hub. Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

On helicopters serial No. 56-4313 and subsequent, a full set of four shims must be installed at aft connection. After shimming as required, place unused shims inside of coupling under washers and nuts.

d. Close service platforms.

4–96. ALIGNMENT. Alignment of the tail rotor drive shaft can be accomplished only after all sections are installed. (Refer to paragraph 4–128).

4–97. REMOVAL (SECTION II). (See figure 4–14.)

a. Unfasten skin assemblies secured to frame and bulkhead assemblies aft of service platforms. Remove screws that secure skin assemblies to cabin and lift skin off transmission deck.

b. Release main rotor brake at master brake cylinder located on ceiling of pilots' compartment.

c. Loosen adjustment bolts at forward oil cooler and blower support and bolts that secure radiator support to bulkhead and lower oil cooler and blower in slotted holes. Release pulley belts (70) from driven pulley on blower fan shaft.

d. If section I of drive shaft is installed, unbolt rubber coupling (7) and shims (6) from aft flange (5). Remove shims.

e. Unbolt and remove rubber coupling (7) from brake hub (54) at forward end of section II of drive shaft.

f. Remove pulley hub (62) and shims (71) from rubber coupling (12) at aft end of second section of drive shaft. Remove shims.

g. On helicopters serial No. 55-4497 and subsequent, unbolt and remove shield and clip assembly (53) from underside of brake halves (65).

h. Loosen bolts, (69) that secure brake halves (65) to their supports and spread them apart to provide clearance for brake disc (56) when removing second section of drive shaft.

i. Unbutton soundproofing from cabin ceiling and remove cotter pins, nuts, washers and bolts (47) that secure base of bearing housing (48) to transmission deck. Work section of drive shaft out of helicopter as a unit. Remove shims (49) from transmission deck and plate from cabin ceiling.

4–98. DISASSEMBLY (SECTION II). (See figure 4–14.)

a. Remove bolts, washers, and nuts, wedges, and bushings (55) that secure brake hub (54) to forward end of section II of drive shaft (58) and slide brake hub off shaft.

b. Remove bolts, washers, nut and cotter pin (57) that secures brake disc (56) to brake hub (54). Separate disc and hub.

c. Remove bolts, washers, nuts, wedges, and bushings (61) that secure pulley hub (62) to aft end of section II of drive shaft (58) and slide pulley hub off shaft.

d. Remove bolts, washers, and nuts (46) that secure pulley (60) and pulley spacers (59 and 45) to flange of pulley hub (62) and separate pulley and pulley spacers from hub.

4–99. CLEANING. (Refer to paragraph 4–91.)

4–100. INSPECTION. (Refer to paragraph 4–92.)

4–101. REPAIR. (Refer to paragraph 4–93.)

4–102. ASSEMBLY (SECTION II). (See figure 4–14.)

a. Install brake disc (56) on brake hub (54) with bolts, washers, nut, and cotter pin, (57). Tighten nuts to a torque of 100 to 140 inch-pounds.

b. Slide brake hub on forward end of section II of drive shaft (58), line up holes, and install bolt, washers, nut, wedges, and bushing (55). Tighten nut to a torque of 165 to 185 inch-pounds.

Note

Slot in bushing should face forward end of shaft.

c. Position pulley (60) and pulley spacers (59 and 45) on pulley hub (62) and install bolts, washers, and nuts (46). Tighten nuts to a torque of 20 to 25 inch-pounds.

d. Slide pulley hub (62) on aft end of drive shaft (58), line up holes, and install bolt, washers, nut, wedges, and bushing (61). Tighten nut to a torque of 165 to 185 inch-pounds.

Note

Slot in bushing should face aft end of shaft.

4–103. INSTALLATION (SECTION II). (See figure 4–14.)

a. Loop pulley belts (70), around drive shaft (58) aft of bearing housing, before section II of drive shaft is replaced. Position section II of shaft on transmission deck.

b. Bolt flange of brake hub (54) to rubber coupling (7). Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

Install bolts with heads forward.

CAUTION

Install shims (49) required between base of support bearing housing (48) and transmission deck to line up flange of pulley hub (62) with rubber coupling (12) on section III of drive shaft and line up forward rubber coupling (7) with flange (5) on section I of drive shaft.

c. Position plate (50) on underside of transmission deck and install bolts, washers, nuts, and cotter pins (47) that secure bearing housing to deck. Tighten nuts to a torque of 85 to 95 inch-pounds.

Note

Install bolts with heads up. Do not overtighten bolts.

d. Install shims (6) required between flange (5) on section I of drive shaft and rubber coupling (7). Bolt shims and rubber coupling to flange. Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

On helicopters serial No. 56-4313 and subsequent, a full set of four shims must be installed at connections at each end of section II of drive shaft. After shimming as required, place unused shims inside of coupling under washers and nuts.

e. Insert shims (71) required at aft end of drive shaft section and install bolts, washers, and nuts (64) that connect rubber coupling (12) to flange of pulley hub (62). Tighten nuts to a torque of 50 to 55 inch-pounds.

f. Loop pulley belts (70) over driven pulley on oil cooler and blower fan shaft and driving pulley (60) on section II of drive shaft. For adjustment of belts refer to TM 55-1520-202-20, Chapter 2, Section VII.

g. Check runout of rotor brake disc. (Refer to paragraph 4–84.)

h. Install bolts, washers, and nuts (69) that secure brake halves (65) to their supports. Tighten nuts to a torque of 50 foot-pounds.

Note

On helicopters serial No. 55-4497 and subsequent, position and bolt shield and clip assembly (53) to underside of brake halves.

i. Check clearance between brake disc and linings. (Refer to TM 55-1520-202-20, Chapter 2, Section V.)

j. Replace soundproofing in cabin ceiling. Install skin assemblies aft of service platforms and secure them with fasteners and screws.

4–104. ALIGNMENT. Alignment of this section can be accomplished only after all sections are installed. (Refer to paragraph 4–128.)

4–105. REMOVAL (SECTION III). (See figure 4–14.)

a. Remove screws that secure louvered fairing to fuselage.

b. Unbolt rubber coupling (12), and shims (71) from pulley hub (62) at aft end of section II of drive shaft. Remove shims.

c. Unbolt rubber coupling (12) from flange (13). Remove rubber coupling.

d. Remove nut, bolt, washers, wedges, and bushing (63) that secure flange (13) to forward end of section III of drive shaft. Remove flange (13).

e. Release personnel barrier and remove two tail rotor drive shaft access covers from cabin and electronics compartment ceiling to gain access to electronics compartment. (Refer to TM 55-1520-202-20, Chapter II, Section XIV. Unbutton seal in tail cone opening at electronics compartment rear bulkhead.

f. Remove nuts, washers, and bolts that secure rubber coupling (22) on aft end of section III to flange (44) at forward end of section IV of drive shaft. Remove shims (27).

g. Remove nuts, washers, and washer head screw and remove reinforcement plates below tail rotor drive shaft opening in aft cabin bulkhead and electronics compartment bulkhead.

h. Support section III of drive shaft and remove bolts, washers, and nuts (15) that secure three support bearings to bearing supports (18) and bolts, washers, and nuts (16) that secure plates (17) to bearing supports (18); remove bearing rings (20) and plate (17).

i. Lower aft end of section down into openings in bulkhead until support bearings clear bulkheads. Guide drive shaft section, aft flange (25), and rubber coupling (22) back until forward end of shaft clears opening in frame at rear of transmission deck. Remove drive shaft section through cabin.

4–106. DISASSEMBLY (SECTION III). (See figure 4–14.)

a. Remove bolts, washers, and nuts (26) that secure rubber coupling (22) to flange (25) on aft end of section III. Remove coupling and bonding jumper (23).

b. Remove bolt, washers, nut, wedges, and bushing (24) that secure flange (25) to aft end of section III and slide flange off drive shaft (21).

4–107. CLEANING. (Refer to paragraph 4–91.)

4–108. INSPECTION. (Refer to paragraph 4–92.)

4–109. REPAIR. (Refer to paragraph 4–93.)

4–110. ASSEMBLY (SECTION III). (See figure 4–14.)

a. Slide flange (25) on aft end of section III of drive shaft (21), line up holes, and install bolt, washers, nut, wedges, and bushing (24). Tighten nut to a torque of 165 to 185 inch-pounds.

Note

Slots in bushing should face aft end of shaft. Install bolts with heads forward.

b. Position rubber coupling (22) and bonding jumper (23) on flange (25) and install bolts, washers and nuts (26). Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

Install bolts with heads forward.

4–111. INSTALLATION (SECTION III). (See figure 4–14.)

a. Support section III of tail rotor drive shaft inside cabin and electronics compartment and guide forward end of section III drive shaft (21), up through opening in frame at rear of transmission deck.

b. Position bearing rings (20) and plates (17) and bolt bearings (19) to bearing supports (18) at transmission deck frame, aft cabin bulkhead, and electronics compartment bulkhead. Bolt plates to bearing supports (18). Tighten nuts to a torque of 50 to 55 inch-pounds.

c. Install flange (13) on forward end of section III. Line up holes of flange with holes in forward end of drive shaft and install bolt, washers, nut, wedges, and bushing, (63). Tighten nuts to a torque of 165 to 185 inch-pounds.

Note

Slots in bushing should each face forward end of drive shaft.

d. Install rubber coupling (12) to flange (13) on forward end of section III of drive shaft.

Note

Install bolts with heads forward.

e. Insert shims (71) required between rubber coupling (12) and pulley hub flange and bolt rubber coupling to flange of pulley hub. Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

On helicopters serial No. 56-4313 and subsequent, a full set of four shims must be installed at each end of section III of drive shaft. After shimming as required, place unused shims under washers and nuts.

f. Insert shims (27) required between rubber coupling on aft end of section III and forward flange of section IV and install bolts, washers, and nuts (28). Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

Place unused shims under washers and nuts.

g. Position reinforcement plates on cabin and electronics compartment bulkheads and install screws, washers and nuts.

h. Replace seal in electronics compartment rear bulkhead to tail cone opening. Replace tail rotor drive shaft covers in cabin and electronics compartment ceilings. Replace the personnel barrier at aft cabin bulkhead. (Refer to TM 55-1520-202-20, Chapter 2, Section II.) Install louvered fairing with attaching screw.

4–112. ALIGNMENT. Alignment of this section can be accomplished only after all sections are installed. (Refer to paragraph 4–128.)

4–113. REMOVAL (SECTION IV). (See figure 4–14.)

a. Unbutton seal installed in tail cone opening at electronics compartment rear bulkhead.

b. Fold pylon. (Refer to TM 55-1520-202-20, Chapter 2, Section I.)

c. Remove bolt, washers, nut, wedges, and bushing (43), that secure input coupling (42) to aft end of section IV of drive shaft. Slide input coupling and guide shaft (38) off drive shaft (36).

d. Remove bolts, washers, and nuts (28) that secure rubber coupling (22) and shims (27) to flange on aft end of section III of drive shaft. Remove shims.

e. Support drive shaft (36) in tail cone and unbolt three support bearings forward of tail cone hinged bulkhead from bearing supports (33). Remove bolts, washers, and nuts (30) that secure plates (32) to bearing support (33). Remove bearing rings (34) and plates.

f. Lower section IV of drive shaft (36) in tail cone and remove it through electronics compartment and cabin.

g. Replace input coupling (42) on aft end of section IV of tail rotor drive shaft (36).

4–114. DISASSEMBLY (SECTION IV). (See figure 4–14.)

a. Remove bolts, washers, nut, wedges, and bushings (29) that secure flange (44) on forward end of section IV of drive shaft and slide flange off drive shaft (36).

b. Remove bolt, washers, nut, wedges, and bushings (43) that secure input coupling (42) to aft end of drive shaft and slide input coupling and guide shaft (38) off drive shaft (36).

c. Disassemble input coupling assembly. Remove cotter pins (40) and guide shaft (38), slide cover (39) off input coupling (42), and lift gasket (41) out of groove in coupling.

4–115. CLEANING. (Refer to paragraph 4–91.)

4–116. INSPECTION. (Refer to paragraph 4–92.)

4–117. REPAIR. (Refer to paragraph 4–93.)

4–118. ASSEMBLY (SECTION IV). (See figure 4–14.)

a. Slide flange (44) on section IV of drive shaft (36), line up holes, and install bolt, washers, nut, wedges, and bushing (29). Tighten nut to a torque of 165 to 185 inch-pounds.

Note

Slots in bushing should face forward end of shaft.

b. Assemble input coupling (42). Place gasket (41) in groove of input coupling (42), install guide shaft (38), and position cover (39) on coupling. Install three cotter pins attaching cover to coupling.

Note

Do not replace input coupling on aft end of section IV of drive shaft until shaft section is located in tail cone.

4–119. INSTALLATION (SECTION IV). (See figure 4–14.)

a. If input coupling is installed, remove bolt, washers, nut, wedges, and bushing, (43) and slide input coupling (42) off section IV of drive shaft.

b. Support section IV of drive shaft in position inside tail cone. Work shaft aft through opening in hinged bulkhead.

c. Position bearing rings (34) and plates (32) at three bearing supports (33) in tail cone. Install bolts, washers, and nuts (30 and 31) and tighten nuts to a torque of 50 to 55 inch-pounds.

d. Install input coupling (42) on aft end of section IV of drive shaft and secure it with bolt, washers, nut, wedges, and bushings (43). Tighten nuts to a torque of 165 to 185 inch-pounds.

Note

Slot in each bushing should face aft end of drive shaft.

e. Insert shims (27) required between flange (44) on forward end of section IV of drive shaft and rubber coupling (22) on aft end of section III and install bolts, washers and nuts (28). Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

Install bolts with heads forward.

Note

On helicopters serial No. 56-4313 and subsequent, full set of four shims must be installed at forward connection. After shimming as required, place unused shims under washers and nuts.

f. Unfold and lock pylon in flight position. (Refer to TM 55-1520-202-20, Chapter II, Section I.)

g. Replace seal in tail cone opening at electronics compartment rear bulkhead.

4–120. ALIGNMENT. Alignment will be accomplished only after all sections are installed. (Refer to paragraph 4–128.)

4–121. REPLACEMENT OF DRIVE SHAFT SUPPORT BEARINGS. Replace a damaged or rough support bearing as follows:

a. Tap support bearing assembly off bushing on drive shaft.

CAUTION

Do not exert pressure on bearing retaining plates.

b. Remove snap rings which hold bearing in position and press bearing out of liner in housing.

c. Coat outside surface of replacement bearing with primer, Military Specification MIL-P-8585, and press it into position in liner of housing. Install two snap rings.

d. Tap support bearing assembly into position on bushing bonded to drive shaft.

Note

If any undue stress is put on drive shaft in removing or replacing bearings, check shaft for runout before installation (Refer to paragraph 4–123).

4–122. BONDING LOOSE BUSHING TO DRIVE SHAFT.

a. Clean area on shaft to which bushing is to be bonded with dry-cleaning solvent, Federal Specification P-S-661. Also clean inside surfaces of bushing.

b. Apply moderately heavy 3-inch wide coat of adhesive, Military Specification MIL-A-5090, to area where bushing is to be located.

c. Slide bushing into place.

d. Wipe off excess adhesive with lacquer thinner, Federal Specification TT-T-266.

e. Allow adhesive to set for 24 hours.

f. Repaint exposed shaft surfaces with primer, Military Specification MIL-P-8585.

4–123. RUNOUT OF TAIL ROTOR DRIVE SHAFT. Prior to installation of a new or repaired tail rotor drive shaft, check drive shaft sections I, III, and IV for runout as follows:

a. Mount V-blocks on surface plate and place drive shaft section on V-blocks. Position V-blocks adjacent to each bearing location on sections III and IV of shaft.

b. Position dial indicator against shaft.

c. Rotate shaft and check runout.

d. Permissible runout is 0.012-inch TIR.

4–124. TAIL ROTOR DRIVE SHAFT RUBBER COUPLINGS.

4–125. DESCRIPTION. The tail rotor drive shaft rubber couplings transmit torque,. absorb transmission shock and vibration, and adjust for permissible minor misalignment of the tail drive shaft components. Each rubber coupling is composed of two metal jaws with interlocking vanes joined and separated by molded rubber segments located between the vanes. The rubber segments located between the straight sides of the vanes are brick-shaped and bonded to both vanes, one from each jaw. The rubber segments, located between the tapered sides of the vanes, are separators and are bonded to only one of the adjacent vanes. The two types of rubber segments occur alternately around the rubber coupling.

4–126. REMOVAL. Remove bolts, washers, and nuts connecting coupling to flange on each side. Drive shaft sections on each side of coupling must be adequately supported before disconnecting coupling.

4–127. 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 that secure the rubber couplings to the flanges of the section I, and to the aft flange of section III of the tail rotor drive shaft to a torque of 100 inch-pounds.

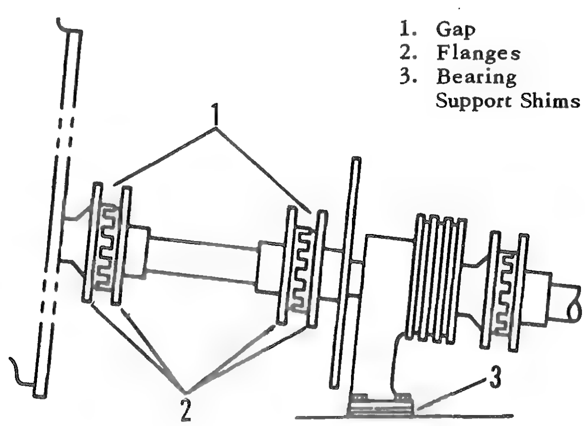


Figure 4–15. Alignment of Sections I and II of Tail Rotor Drive Shaft

Tighten other rubber coupling securing nuts to a torque of 50 to 55 inch-pounds.

Note

If a rubber coupling is removed in conjunction with a drive shaft section, divide amount of shimming required by disconnecting opposite shaft end and inserting a shim or shims equally between coupling and flange at each end. Install bolts with the heads forward.

4–128. ALIGNMENT OF TAIL ROTOR DRIVE SHAFT.

Note

If section I, III, or IV or any combination of sections I, III, or IV of tail rotor drive shaft is replaced, perform steps *i* and *j* of the following procedure. If section II of drive shaft is replaced or a main gear box is replaced, perform steps *a* through *h*. If all tail rotor drive shafting or a bearing support bracket is replaced, all steps of alignment procedure must be performed.

a. Position section II of drive shaft in helicopter. (Refer to paragraph 4–103, steps *a* through *c*.)

b. Place section I of drive shaft in helicopter. Attach forward flange only. (Refer to paragraph 4–95.)

c. Obtain temporary alignment of brake hub (54, figure 4–14) of section II of drive shaft with aft flange (5) of section I of drive shaft by shimming under bearing support of section II.

d. Attach rubber coupling (7) to flange of brake hub with four bolts located at 3, 6, 9, and 12 o'clock positions. Tighten nuts to maximum torque of 5 inch-pounds.

CAUTION

Nuts must be tightened enough to prevent flange from shifting against rubber coupling, due to variations in diameter of the bolts, but torque must not exceed 5 inch-pounds.

e. Measure gap (1, figure 4–15) across flanges (2) at four places 90-degrees apart with micrometer. Record these measurements.

f. Rotate shaft 90 degrees and measure gap at same four points. Record these measurements.

g. Maximum difference between any of the eight measurements must not exceed 0.032 inch. Necessary vertical adjustment may be made by shimming at (3) under bearing support for section II of drive shaft. Necessary lateral adjustment may be made by shifting position of support slightly.

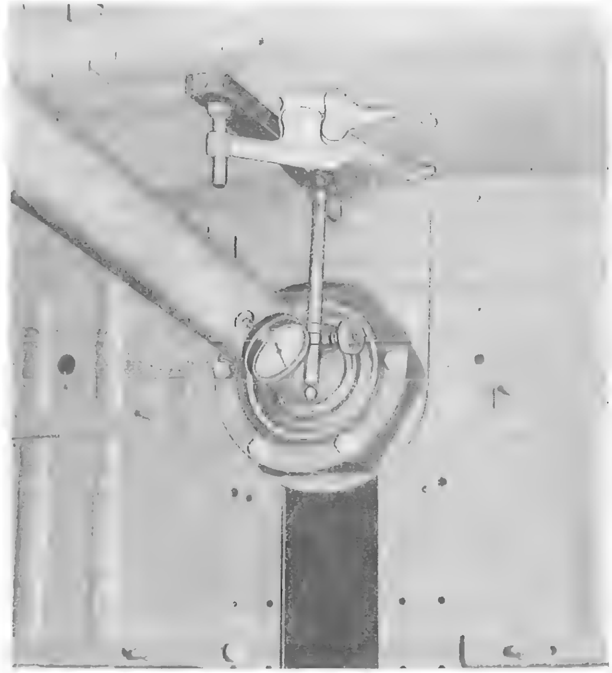


Figure 4–16. Checking Drive Shaft Runout

h. Tighten nuts securing section II of drive shaft bearing support to deck to a torque of 85 to 95 inch-pounds.

CAUTION

Do not overtighten these bolts or deck will be crushed by pressure.

i. Use dial indicator attached to main gear box, or some other rigid attaching point, to check runout of installed section I of drive shaft. (See figure 4–16.) Maximum runout is 0.012-inch TIR.

j. Adjust to correct runout by loosening bolts attaching flange and rubber coupling and shifting shaft position as required. If this adjustment is not sufficient to correct runout, remove bolts and rotate shaft 90 degrees and position to attain required tolerance.

Note

Adjust one end of shaft at a time.

k. If pylon has been folded back, close and secure secure it to tail cone.

l. Disconnect and remove top left-hand pylon hinge bolt.

m. Insert hinge pin assembly from input coupling alignment fixture, part No. S1670-10608, in top left-hand pylon hinge.

n. Fold pylon back and secure it to side of tail cone.

Note

Alignment may be accomplished with pylon detached by placing spacer, part No. S1670-10623 or equivalent, between upper pylon hinge points and inserting hinge pin assembly. Necessary adjustments must be made with setscrew located on left arm of alignment fixture.

o. Install input coupling alignment fixture, part No. S1670-10608, between upper pylon hinge points. (See figure 4–17.)

p. Lock right-hand side of fixture in place with tail pylon lockpin assembly. Slot on left-hand side of fixture must engage the hinge pin assembly.

q. Secure 0.035 inch x 24 foot music wire, or 60 pound test fishing line, to forward plate assembly and bolt plate assembly on rotor brake aft flange.

r. Remove locator from input coupling alignment fixture and install in its place locator assembly from alignment fixture assembly, part No. S1670-10471-22. (See figure 4–18.)

s. Pass wire or line through hole in plate and bolt on locator assembly. Pull wire or line taut and turn bolt for final tightening.

WARNING

During tightening procedure all personnel should remain clear as wire or line may snap and cause injury to personnel.

t. If support brackets are attached to helicopter, use template to check brackets for proper alignment. Position dowel pins on template with upper two holes on each support bracket. Flat of template should be on topside, and wire or line must fall within, but not contact, radius at bottom of each V. (See figure 4–18.)

u. If support brackets are not attached to helicopter, use disc assembly for locating support brackets. Clamp disc assembly to support brackets with flat of disc on topside.

Note

Lateral adjustment is made by shifting support bracket. Vertical adjustment is accomplished by shimming between support bracket and fuselage prior to drilling and riveting.

v. All tail rotor drive shaft support brackets must align within 1/32 inch of true center of tail rotor drive shaft. Relocate any support bracket which is not aligned within the permissible tolerance.

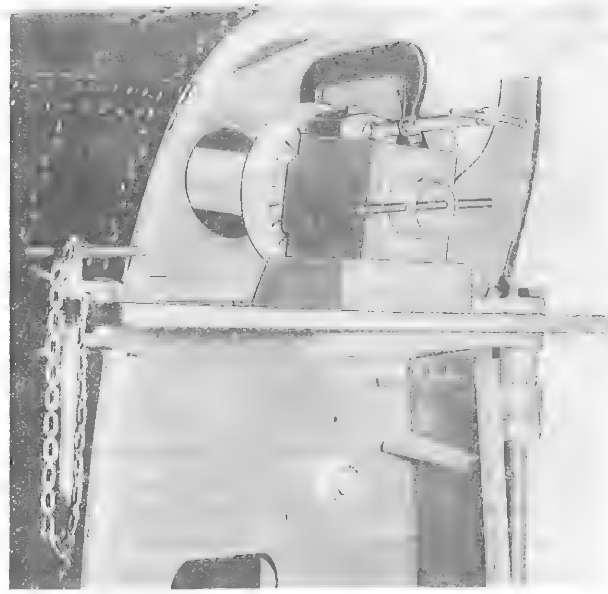


Figure 4–17. Using Alignment Fixture on Input Coupling

w. After check or recheck of support brackets, if relocated, release tension on wire or line and remove forward plate assembly, locator assembly, and disc assembly or template.

x. Install locator of input coupling alignment fixture, part No. S1670-10608, within fixture itself.

y. Install section IV of tail drive shaft. (Refer to paragraph 4–119, steps *a* through *f*.)

z. Clamp face of input coupling against input coupling alignment fixture.

aa. Install section III of drive shaft. (Refer to paragraph 4–111, steps *a* through *d*.)

ab. Check installed shafting for runout. Use dial indicator attached to rigid point. (See figure 4–16.)

Note

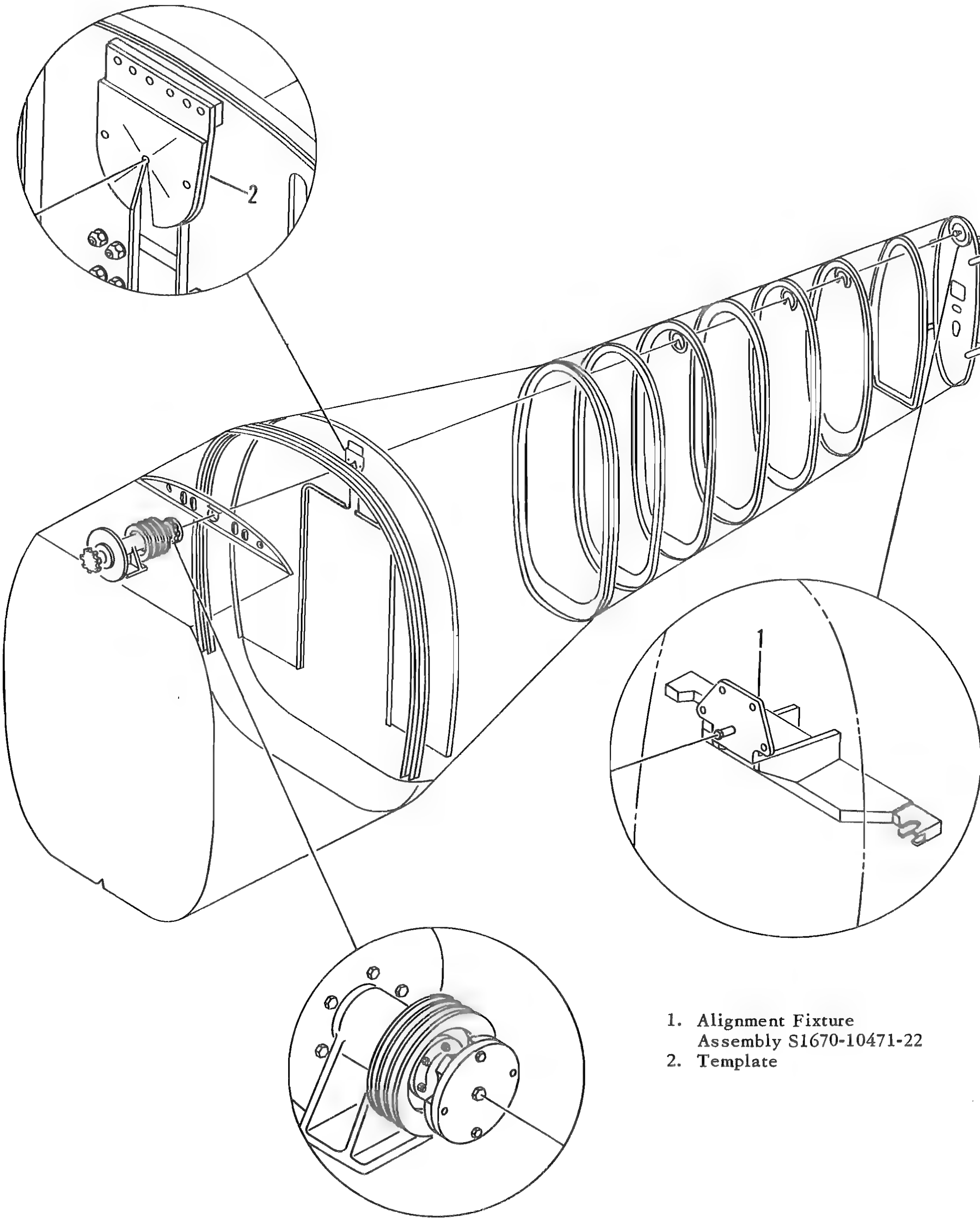
Maximum permissible runout between bearings, for the tail rotor drive shaft, is 0.012-inch TIR.

ac. Adjust runout, if TIR cannot be brought within permissible tolerances.

ad. With feeler gage, check for possible angular misalignment between input coupling face and face of input coupling alignment fixture.

Note

This procedure is required to prevent overloading spring in disconnect assembly when pylon is in closed position.



1. Alignment Fixture Assembly S1670-10471-22
2. Template

Figure 4-18. Checking Drive Shaft Alignment *ae.* Remove input coupling alignment fixture.

af. Close tail pylon and lock it securely.

ag. Remove hinge pin assembly and insert hinge bolt in its place.

ah. If tail pylon was detached, remove hinge pin assembly and spacer. Position pylon and secure it in place.

Note

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. For maximum allowable misalignment, see figure 4–19. To allow for shimming requirements, install the four drive shaft section in the following order: section II, I, IV, and III.

4–129. PYLON TRANSMISSION INSTALLATION.

4–130. DESCRIPTION. (figure 4–20.) 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.

4–131. TAIL ROTOR DRIVE SHAFT DISCONNECT COUPLING.

4–132. DESCRIPTION. The tail rotor drive shaft disconnect coupling 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 windmilling 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.

4–133. REMOVAL. (See figure 4–20.)

a. Fold pylon (TM 55-1520-202-20, Chapter 2, Section I) and remove air intake screened fairing (1) by removing attaching screws.

b. Disconnect the disconnect coupling from rubber coupling on disconnect drive shaft by removing nuts (2), washers (3), bolts (4), and shims (8). Release bonding jumper.

c. Unbolt disconnect coupling (5) from pylon forward bulkhead (6), and remove disconnect coupling and shims from pylon.

4–134. INSTALLATION. (See figure 4–20.)

a. Position and bolt disconnect coupling (5) and shims (7) on pylon forward bulkhead (6).

b. Install shims (8) required for a line-to-line fit and bolt disconnect coupling to rubber coupling (9). Refer to table 4–III for shim thickness. Connect bonding jumper and tighten nuts to a torque of 50 to 55 inch-pounds.

Note

Whenever possible, use shims so that there is same number of shims between forward rubber coupling and disconnect coupling as between aft rubber coupling and intermediate gear box assembly. Install bolts with heads forward.

c. Install air intake screened fairing (1) and unfold pylon. (Refer to TM 55-1520-202-20, Chapter 2, Section I.)

d. Lubricate disconnect coupling (Refer to lubrication chart in TM 55-1520-202-20, Chapter 2, Section II.)

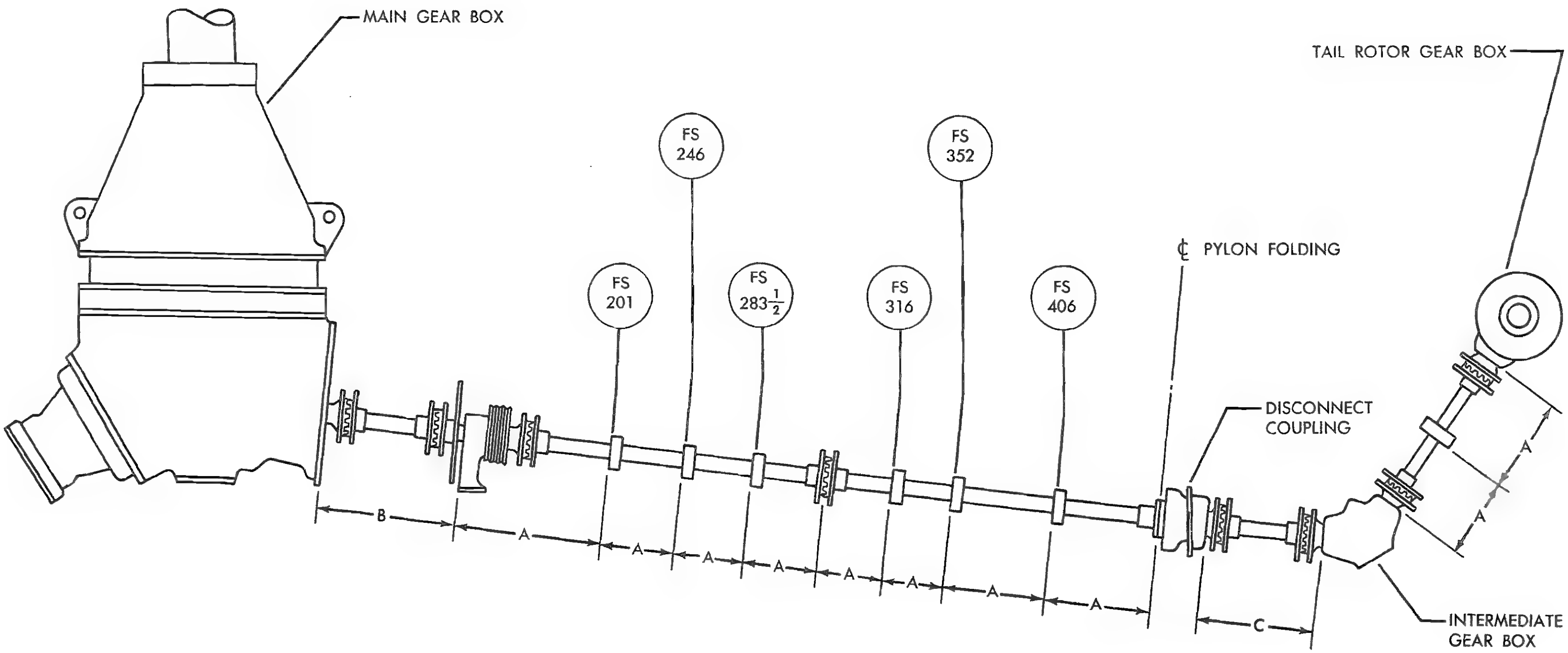
4–135. ALIGNMENT OF DISCONNECT COUPLING. (See figure 4–20.)

a. Unfold tail pylon and secure it to tail cone.

b. Disconnect and remove top left hand pylon hinge bolt.

Table 4–III. Tail Rotor Drive Shaft Disconnect Coupling Shims

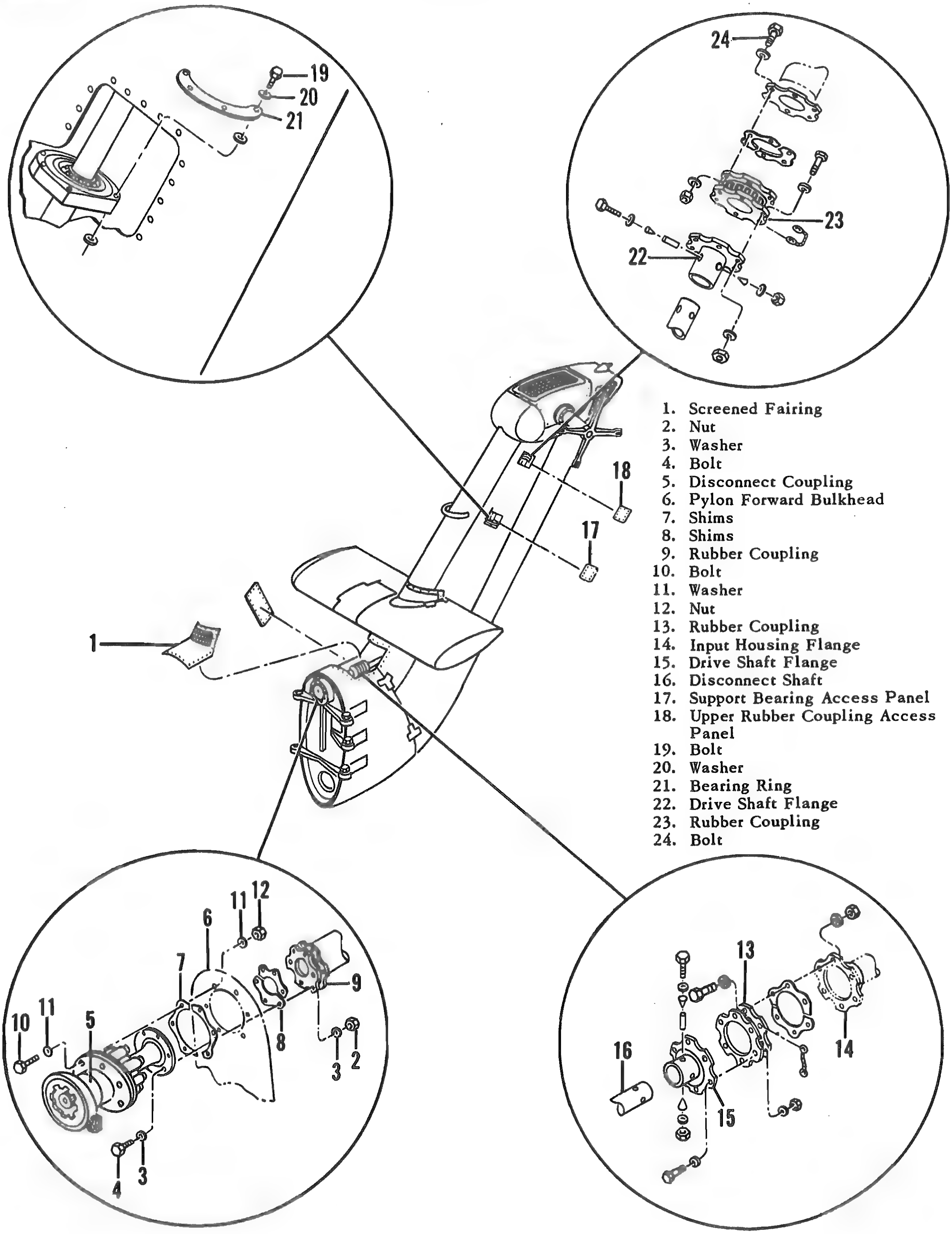
PART NUMBER	THICKNESS
S1635-64312-1	0.064
S-1635-64312-2	0.091
S1635-64312-3	0.032
S1635-64312-5	0.125



NOTES

1. MAXIMUM MISALIGNMENT (OUT OF PLANE) OF BEARINGS FOR EACH SECTION A IS 1/32 INCH.
2. MAXIMUM ANGULAR MISALIGNMENT ACROSS COUPLINGS (FACE TO FACE AT FOUR POINTS) NOT TO EXCEED 0.032-INCH DIFFERENCE BETWEEN MAXIMUM AND MINIMUM MEASUREMENT FOR EACH COUPLING.
3. MAXIMUM RUNOUT PERMITTED BETWEEN BEARINGS IS 0.012-INCH TOTAL INDICATOR READING.

Figure 4–19. Alignment of Tail Rotor Drive Shaft



1. Screened Fairing
2. Nut
3. Washer
4. Bolt
5. Disconnect Coupling
6. Pylon Forward Bulkhead
7. Shims
8. Shims
9. Rubber Coupling
10. Bolt
11. Washer
12. Nut
13. Rubber Coupling
14. Input Housing Flange
15. Drive Shaft Flange
16. Disconnect Shaft
17. Support Bearing Access Panel
18. Upper Rubber Coupling Access Panel
19. Bolt
20. Washer
21. Bearing Ring
22. Drive Shaft Flange
23. Rubber Coupling
24. Bolt

Figure 4–20. Pylon Transmission Installation *c.* Insert hinge pin assembly from input coupling alignment fixture, part No. S1670-10608, in top left-hand pylon hinge.

d. Fold pylon back and secure it to side of tail cone.

e. Position disconnect coupling assembly (5) in helicopter.

f. Install disconnect coupling alignment fixture. part No. S1670-10609, on upper hinges of pylon. Lock left side with Ball-Lok pin, part No. 8L-8-1.500.

g. Check clearance, if any, between face of disconnect coupling fixture and disconnect coupling jaw. Lowest measurement between two faces is amount of shim required between disconnect housing flange and mounting bulkhead.

Note

If, after installing proper shims for fore-and-aft alignment, angular misalignment exceeds 0.016 inch with one point in contact between two faces, it can be corrected by adding half shims in addition to full shim between disconnect housing flange and mounting bulkhead. Locating half shim correctly will position disconnect assembly so as to eliminate any angular misalignment.

h. Install bolts (10), washer (11), and nuts (12).

i. Install disconnect coupling alignment fixture to see if any pressure is required between faces for installation of fixture.

Note

If pressure is required, shims should be removed to eliminate this condition. Incorrect forward position may overload spring in disconnect assembly. Incorrect aft position may cause coupling to disengage.

j. Remove disconnect coupling alignment fixture.

k. Install disconnect shaft in pylon. (Refer to paragraph 4–139 step *c*.)

l. Attach dial indicator to rigid point and check runout. (See figure 4–16.)

Note

Maximum allowable runout of disconnect shaft is 0.012-inch TIR.

m. Adjust runout by method described in alignment of tail rotor drive shaft. (Refer to paragraph 4–128.)

4–136. DISCONNECT SHAFT ASSEMBLY.

4–137. 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.

4–138. REMOVAL. (See figure 4–20.)

a. Remove air intake screened fairing (1) by removing attaching screws.

b. Support disconnect shaft. Remove nuts (2), washers (3), bolts (4), and shims (8) that secure forward rubber coupling to disconnect coupling. Release bonding jumper and remove nuts, washers, bolts, and shims that secure aft rubber coupling (13) to input housing flange (14) of intermediate gear box. Remove disconnect shaft.

Note

If disassembly of shaft is desired, remove rubber couplings and flanges by following steps *c* and *d*.

c. Unbolt rubber couplings from drive shaft flanges (15).

d. Remove nuts, washers, bolts, wedges, and bushings that secure flanges to disconnect shaft (16) and remove flanges.

4–139. INSTALLATION. (See figure 4–20.)

Note

If rubber coupling and flanges were removed from shaft, install them on shaft by following steps *a* and *b*.

a. Place flanges on shaft, line up holes in shaft and flanges, insert bushings and wedges, and bolt flanges (15) to disconnect shaft (16). Tighten nuts to a torque of 165 to 185 inch-pounds.

Note

Install bolts with heads forward.

c. Position disconnect shaft in pylon. Shim evenly at each end of shaft to obtain line-to-line fit. Install bolts, washers, and nuts that secure rubber couplings (9) to disconnect coupling (5) and to input housing flange (14). Connect bonding jumper and tighten nuts to a torque of 85 to 95 inch-pounds.

Note

Install bolts with heads forward.

d. Install air intake screened fairing (1).

Note

Maximum allowable runout of disconnect shaft assembly is 0.012 inch TIR.

4–140. ALIGNMENT OF DISCONNECT SHAFT. The maximum misalignment (out of plane) permitted in the disconnect shaft is shown in figure 4–19.

4–141. INTERMEDIATE GEAR BOX.

4–142. DESCRIPTION. (See figure 4–21.) 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 filter 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.

4–143. DRAINING. Drain lubricating oil from intermediate gear box as follows:

a. Open access door in intermediate gear box access panel.

Figure 4–21. Intermediate Gear Box Installed

b. Unscrew magnetic plug from bottom plate of center housing.

Note

Magnetic plug may now be inspected without necessity of draining gear box.

c. Screw drain attachment, Tedeco, part No. D-730, into fitting and drain oil into receptacle.

d. Unscrew drain attachment, install magnetic plug, and secure with lock wire. Close access door.

4–144. REMOVAL. (See figure 4–22.)

Note

Replacement of seal, gasket, or packing, or of intermediate gear box because of leaking seal, gasket, packing, or shim is unnecessary unless leakage exceeds maximum established in table 4–IV.

a. Remove intermediate gear box access panel (1) from right side of pylon. Remove disconnect shaft and air intake screened fairing (2).

Note

On helicopters serial No. 53-4475 through 53-4478, unscrew and remove oil filler assembly from input housing of intermediate gear box and remove it from pylon.

b. Drain lubricating oil from gear box. (Refer to paragraph 4–143.)

c. Remove nuts, washers, bolts, and shims that secure rubber coupling to output housing flange (4).

d. Remove bolts, washers, nuts, and shims that secure rubber coupling to output housing flange (3). Release bonding jumper.

e. Support gear box (5). Remove washers and nuts that secure gear box to frame and lift out gear box (5) and shim.

4–145. CLEANING. Wash the external surfaces of the intermediate gear box with dry-cleaning solvent, Federal Specification P-S-661, or a low grade of kerosene, Federal Specification VV-K-211.

4–146. INSPECTION. Oil Leakage of the intermediate gear box assembly caused by a faulty seal, gasket, packing, or shim must not exceed the component maximum listed in table 4–IV. Total leakage from all sources listed in table 4–IV must not exceed 3 cubic centimeters per hour. During a flight of 10 hours duration, total leakage, including loss from breather or vent openings, must not exceed the amount which will cause the oil level of the gear box to drop one third from the FULL to the REFILL line on the oil sight level gage.

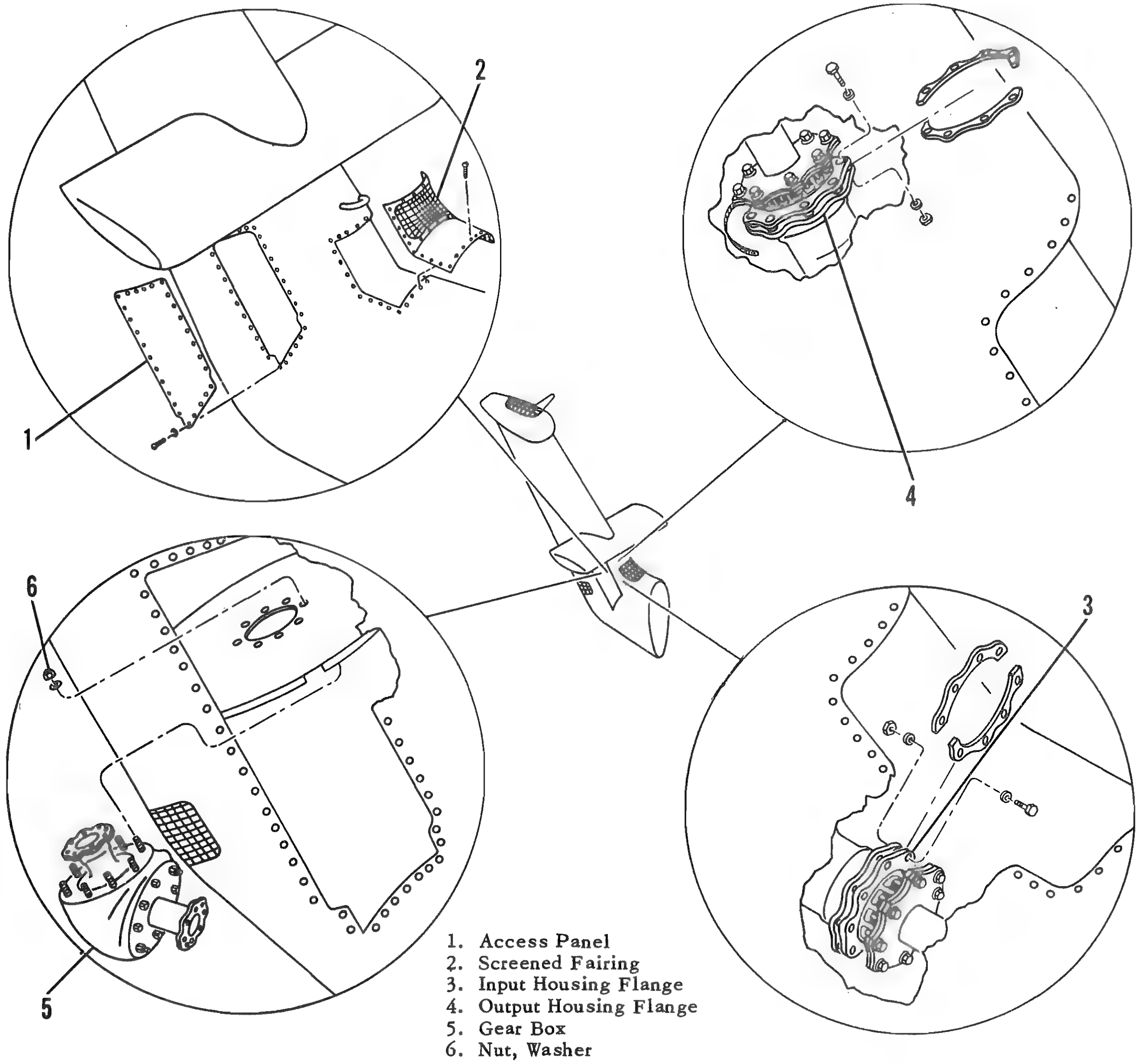


Figure 4–22. Intermediate Gear Box Removal

Table 4–IV. Intermediate Gear Box Oil Leakage

COMPONENT	MAXIMUM LEAKAGE PER COMPONENT
Seal	Two cubic centimeters per hour
Gasket	One cubic centimeter per hour
Packing	One cubic centimeter per hour
Shim	One cubic centimeter per hour

4–147. DISASSEMBLY.

Note

Replacement of seal, or replacement of intermediate gear box because of leaking gasket, packing, or shim is unnecessary unless leakage exceeds maximum established in table 4–IV.

a. Remove intermediate gear box. (Refer to paragraph 4–144.)

b. Remove oil level window from center housing by removing the eight washers and nuts. Remove frame, gasket, window, and gasket from center housing.

c. Support gear box on suitable stand or padded vise. Remove cotter pin from retainer nut.

d. Secure flange with anti-torque plate, part No. S1670-10401-4, and remove retainer nut with spanner wrench, part No. S1570-10117. Remove flange.

e. Remove seal by inserting two screws of seal puller assembly, part No. S1670-10479-14, into threaded holes in seal. Pull out seal by turning jackscrew on seal puller.

4–148. REPAIR AND REPLACEMENT OF PARTS. Replace all seals and gaskets. (Refer to paragraph 4–149.)

4–149. REASSEMBLY.

a. Coat outside surface of new seal with sealing compound No. 101, manufactured by Garlock Packing Co. Install seal, using seal press cylinder, part No. S1670-10485.

b. Slide flange onto pinion. Apply anti-seize compound, Federal Specification TT-A-580, to threads of retainer nut. Secure flange with anti-torque plate, part No. S1670-10401-4. Using spanner wrench, part No. S1570-10117, install and tighten retainer nut to a torque of 100 to 150 foot-pounds. Install cotter pin and secure plug with lock wire.

c. Install gasket, window, gasket, and frame. Secure with washers and nuts. Tighten nuts 50 to 55 inch-pounds.

d. Install intermediate gear box. (Refer to paragraph 4–150.)

e. Service gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

4–150. INSTALLATION. (See figure 4–22.)

a. Position intermediate gear box in pylon and secure gear box in place on frame with nuts and washers (6).

CAUTION

If aluminum washers have been used, replace them with two steel washers, part No. AN-122583, under each nut. Apply zinc chromate primer, Military Specification MIL-P-8585, to pylon area under washers, install steel washers, and partially tighten nuts. To insure proper seating of washers and to provide an equal torque, nuts should be tightened in diametric sequence. Tighten nuts to a torque of 165 to 185 inch-pounds.

Note

Recheck torque on each of nuts after 5 hours of flight time have been completed.

b. Install shims for line-to-line fit, connect bonding jumper, and fasten rubber coupling to output housing flange with bolts, washers, and nuts. Tighten nuts to a torque of 85 to 95 inch-pounds.

c. Install shims for line-to-line fit and bolt rubber coupling to input housing flange. Tighten nuts to a torque of 85 to 95 inch-pounds.

d. Replace disconnect shaft and air intake screened fairing (2) and install access panel (1).

Note

On helicopters serial No. 53-4475 through 53-4478, install oil filler assembly by inserting it through hole in pylon skin and securing it to input housing of intermediate gear box.

e. Fill gear box with lubricating oil. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

4–151. PREPARATION FOR STORAGE OR SHIPMENT. (See figure 4–23.)

a. Drain all lubricating oil from gear box at bottom of center housing assembly.

b. Flush with lubricating oil, Military Specifi- MIL-L-21260, Grade 2.

c. Drain excess lubricating oil from gear box.

d. Coat unprotected machined surfaces with petrolatum, Military Specification MIL-C-11796. Cover with barrier material, Military specification MIL-B-121, and secure with tape, Federal Specification PPP-T-60.

e. Remove cover from shipping container, part No. AN8027, or Buffalo Metal Container Corp, part No. SRX 428-5, and fiber cushioning material.

f. Place gear box in shipping container and repack fiber cushioning material, Military Specification MIL-C-7769, to avoid damage during shipment.

g. Insert 24 units of desiccant, Military Specification MIL-D-3464, in shipping container.

h. Place humidity indicator in shipping container.

Note

Place humidity indicator close to window so that it can be easily viewed from outside. Desiccant should be replaced if indicator turns pink.

i. Insert history card inside container.

Figure 4–23. Intermediate Gear Box Storage and Shipping Container

j. Place gasket and cover on shipping container and secure with fastener.

4–152. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove greaseproof barrier material and adhesive tape.

b. Remove corrosion-preventive compound from external machined surfaces with dry-cleaning solvent, Federal Specification P-S-661.

c. Flush with lubricating oil. Drain the gear box. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

d. Install gear box and refill with lubricating oil.

4–153. PYLON DRIVE SHAFT.

4–154. DESCRIPTION. The pylon drive shaft, 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. The support bearing is fastened to a bracket at the center of the pylon. 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.

4–155. REMOVAL.

a. Remove intermediate gear box access panel (1, figure 4–22), support bearing access panel (17, figure 4–20), and upper rubber coupling access panel (18), from left side of pylon.

b. Remove bolts, washers, nuts, and shims that secure lower rubber coupling to output housing flange (4, figure 4–22) of intermediate gear box (5).

c. Remove tail rotor gear box. (Refer to paragraph 4–163.)

d. Support drive shaft. Disconnect support bearing from frame by removing bolt (19, figure 4–20), washers (20), and bearing ring (21).

e. Remove bearing support from pylon frame.

f. Lift out pylon drive shaft assembly.

4–156. REPLACEMENT OF DRIVE SHAFT SUPPORT BEARINGS. (Refer to paragraph 4–121.)

4–157. BONDING LOOSE BUSHING TO SHAFT. (Refer to paragraph 4–122.)

4–158. ALIGNMENT OF PYLON DRIVE SHAFT. The maximum misalignment (out of plane) permitted in the pylon drive shaft is shown in figure 4–19.

4–159. INSTALLATION. (See figure 4–20.)

Note

If rubber couplings and flanges were removed from shaft, install them on shaft by following steps *a* and *b*.

a. Slide flanges on ends of drive shaft, line up holes, and install bolts, washers, nuts, bushings, and wedges that secure them to drive shaft. Tighten nuts to a torque of 165 to 185 inch-pounds.

b. Position rubber coupling (23) and install bolts, washers, nuts, and bonding jumper to drive shaft flanges (22). Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

Install bolts with heads up.

c. Position drive shaft assembly in pylon.

CAUTION

Drive shaft must be supported until two or more attaching points are connected.

d. Bolt bearing support to pylon frame.

e. Install tail rotor gear box (paragraph 4–169), but do not bolt shaft to flange.

f. Install one bolt and nut on each side of upper rubber coupling (23) and tighten so that drive shaft assembly is tight against input housing flange of tail rotor gear box. At support bearing, measure distance between lower surface of bearing and center cell frame. Unbolt upper end of drive shaft from tail rotor gear box. Install necessary shims, as measured, between upper rubber coupling and tail rotor gear box and install bolts, washers, and nuts. Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

Install bolts with heads up.

g. Install bearing ring (21), bolts (19), and washers (20) that secure support bearing to pylon frame.

Note

Place washers next to rubber coupling on each side of bearing and under the head of the bolts.

h. Insert required shims for a line-to-line fit between lower rubber coupling and output housing flange (4, figure 4–22) of intermediate gear box and install bolts, washers, and nuts. Tighten nuts to a torque of 50 to 55 inch pounds.

Note

Install bolts with heads up.

Note

If possible, same amount of shims should be used at each end of shaft. Install bolts with heads between flanges of coupling.

i. Replace intermediate gear box access panel (1), support bearing access panel (17, figure 4–20), and upper rubber coupling access panel (18) on pylon.

4–160. TAIL ROTOR GEAR BOX.

4–161. DESCRIPTION. (See figure 4–24.) 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

Figure 4–24. Tail Rotor Gear Box Assembly

rod assembly, operates a pitch beam bolted to the shaft assembly. A protective boot is installed on the pitch beam shaft. The pitch beams connect 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. Access to the tail rotor gear box is gained by removing the screen and fairing at the top of the pylon.

4–162. DRAINING. Drain the lubricating oil from the tail rotor gear box, using the following procedure:

a. Remove access panel on upper left side of pylon.

b. Unscrew magnetic drain plug from tail rotor gear box.

Note

Magnetic plug may now be inspected without necessity of draining gear box.

c. Screw drain attachment, Tedeco part No. D-730 into fitting and drain oil into receptacle.

d. Unscrew drain attachment, replace magnetic drain plug and secure with lock wire, and install access panel.

4–163. REMOVAL. (See figure 4–25.)

Note

Replacement of seal, gasket, or packing or replacement of tail rotor gear box because of a leaking shim is unnecessary unless leakage exceeds maximums established in table 4–V.

Note

Use maintenance platform, part No. 4R16420, for removal.

a. Disconnect outboard end of each pitch change link (1, figure 4–25) from each fork of pitch change

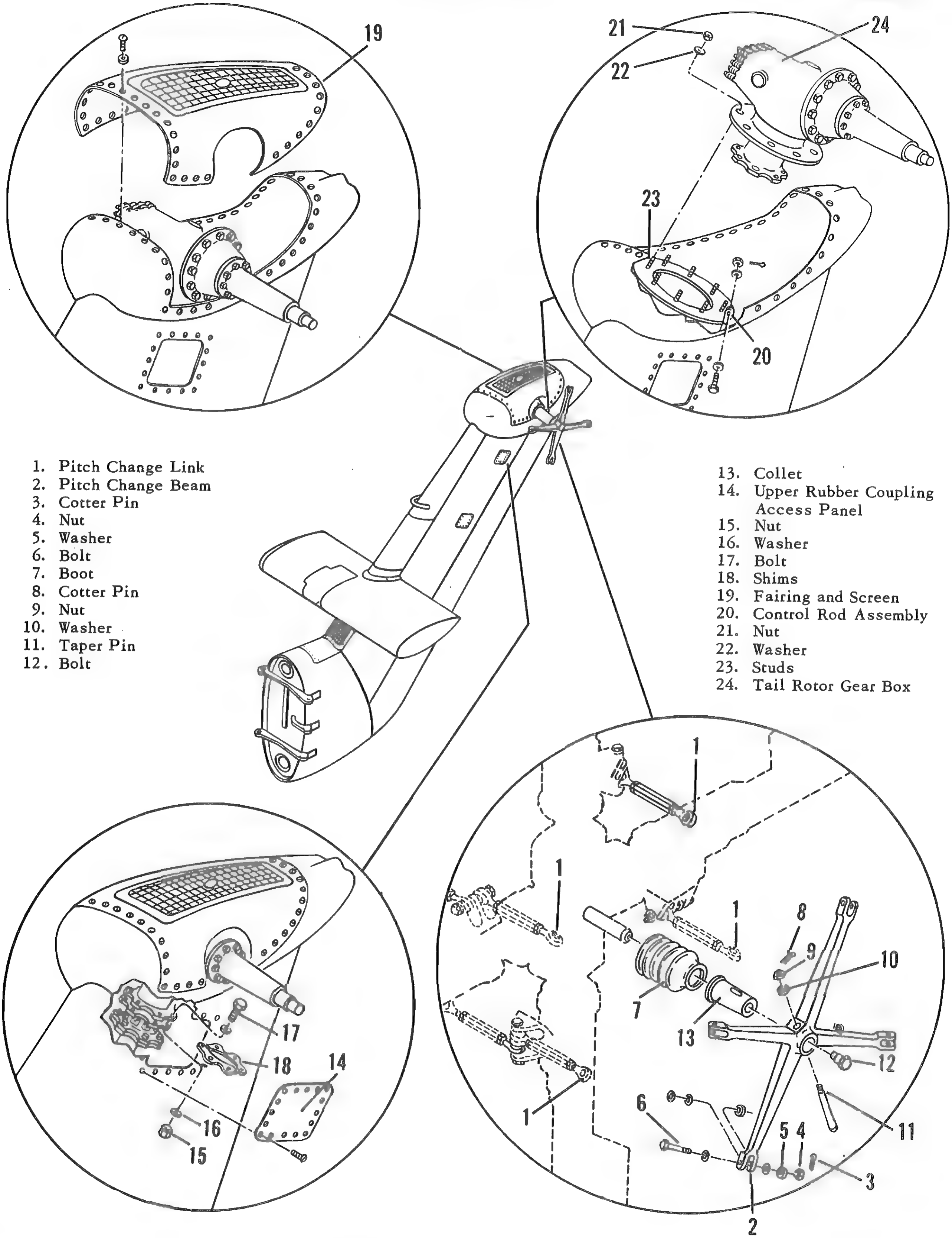


Figure 4–25. Tail Rotor Gear Box Removal

beam (2) by removing cotter pin (3), nut (4), washers (5), bolt (6), and shims.

b. On helicopters serial No. 54-2864 and subsequent, work outboard end of boot (7) off hub of pitch change beam or off collet (13).

c. On helicopters prior to serial No. 56-4284, remove cotter pin (8), nut (9), washer (10), and taper pin (11) that secures pitch change beam to actuator shaft, using socket wrench head and C-clamp, Bonney Tool Co. part No. CC404. Slide pitch change beam off actuator shaft.

d. On helicopters serial No. 56-4284 and subsequent, remove taper pin, washer, and nut that secures pitch change beam to actuator shaft, and remove bolt (12) from collet (13).

e. On helicopters serial No. 56-4284 and subsequent, position Grip-O-Matic puller, Owatonna part No. 1002-L, on pitch change beam so jaws of puller are against hub of pitch change beam. Place block of wood between collet and jackscrew of puller. Tighten puller to separate pitch change beam from collet. Remove puller. Remove pitch change beam from collet. Remove collet from actuator shaft.

CAUTION

Jaws of puller must not touch collet. Arms of puller must not rest against arms of pitch change beam.

f. Remove tail rotor assembly. (Refer to paragraph 6–9.)

g. Remove upper rubber coupling access panel (14). Disconnect rubber coupling from input housing by removing nuts, (15), washers (16), bolts (17), and shims (18).

h. Remove tail rotor gear box fairing and screen (19).

i. Disconnect control rod assembly (20) from arm assembly on tail rotor gear box by removing cotter pin, nut, washers, and bolt. Remove nuts (21) and washers (22) from studs (23) that secure tail rotor gear box (24) to bulkhead at top of pylon and lift tail rotor gear box off pylon.

4–164. CLEANING. Wash the external surfaces of the tail rotor gear box with dry-cleaning solvent, Federal Specification P-S-661, or a low grade of kerosene, Federal Specification VV-K-211.

4–165. INSPECTION.

a. Inspect the input housing seal, the horn seal, the pivot shaft seal and gaskets, the sight gage gaskets, and the drain plug packing for leakage.

Table 4–V. Tail Rotor Gear Box Oil Leakage

COMPONENT	MAXIMUM LEAKAGE PER COMPONENT
Seal	Two cubic centimeters per hour
Gasket	One cubic centimeter per hour
Packing	One cubic centimeter per hour
Shim	One cubic centimeter per hour

b. Replacement of a faulty seal, gasket, packing, or shim in the tail rotor gear box is unnecessary unless the leakage exceeds the component maximum listed in table 4–V. Total leakage from all sources listed in table 4–V must not exceed 3 cubic centimeters per hour. During a flight of 10 hours duration, total leakage, including loss from breather or vent openings, must not exceed the amount which causes the oil level of the gear box to drop one-third from the FULL to the REFILL line on the oil sight level gage.

c. The pitch change beam may be inspected for side play without removing the tail rotor gear box or the pitch change beam as follows:

(1) Clamp dial indicator (1, figure 4–26) to actuator shaft (4) and extend it to point on forked end of pitch change beam (2) 6 inches from surface of actuator shaft. On helicopters serial No. 54-2864 and subsequent, loosen and slide boot on actuator shaft to provide space for clamping dial indicator.

Note

Crocus cloth, Federal Specification P-C-458, (3) wrapped around shaft with abrasive side out, will insure tight grip on actuator shaft.

(2) Grasp hub and attempt to rock pitch change beam on actuator shaft. If side play reading is 0.020 inch or more, replace pitch change beam.

CAUTION

Use care to avoid bending arms of pitch change beam and thereby obtaining false reading.

d. The following inspection for checking the side play between the actuator shaft and the control shaft bearing may be accomplished without removing the tail rotor gear box or the pitch change beam.

(1) Work outboard end of boot off shoulder of collet or hub of pitch change beam in order to expose actuator shaft.

(2) Position and attach dial indicator to shaft as close as possible to control shaft bearing.

(3) Grasp actuator shaft and move it from side to side. Maximum side play should not be in excess of 0.010 inch.

4–166. DISASSEMBLY. Disassembly of the tail rotor gear box consists of removing the input housing seal, the horn seal, and the pivot shaft seal. Remove these seals as follows: (See figure 4–27).

a. Input housing seal.

(1) Place gear box on suitable stand.

(2) Remove cotter pin (1) and retaining nut (2) using spanner wrench, part No. S1570-10117, and anti-torque plate, part No. S1670-10401-4.

(3) Remove input flange (3) from input pinion (4).

(4) Remove seal, (5) using seal puller, part No. S1670-10479-10 or -14.

b. Horn seal.

(1) Remove retaining nut, (6) washer, and spacer from horn (7).

(2) Remove horn seal, (8) using seal puller assembly, part No. S1670-10479-10 or -14.

c. Pivot shaft seal.

(1) Disconnect pitch control rod assembly (9) from lever assembly (10) by removing cotter pin, nut, washer and bolt (11).

(2) Remove lever from pivot shaft (12) by removing cotter pin, nut, washer, and taper pin (13), using threaded taper pin knockout, part No. AN8510-4.

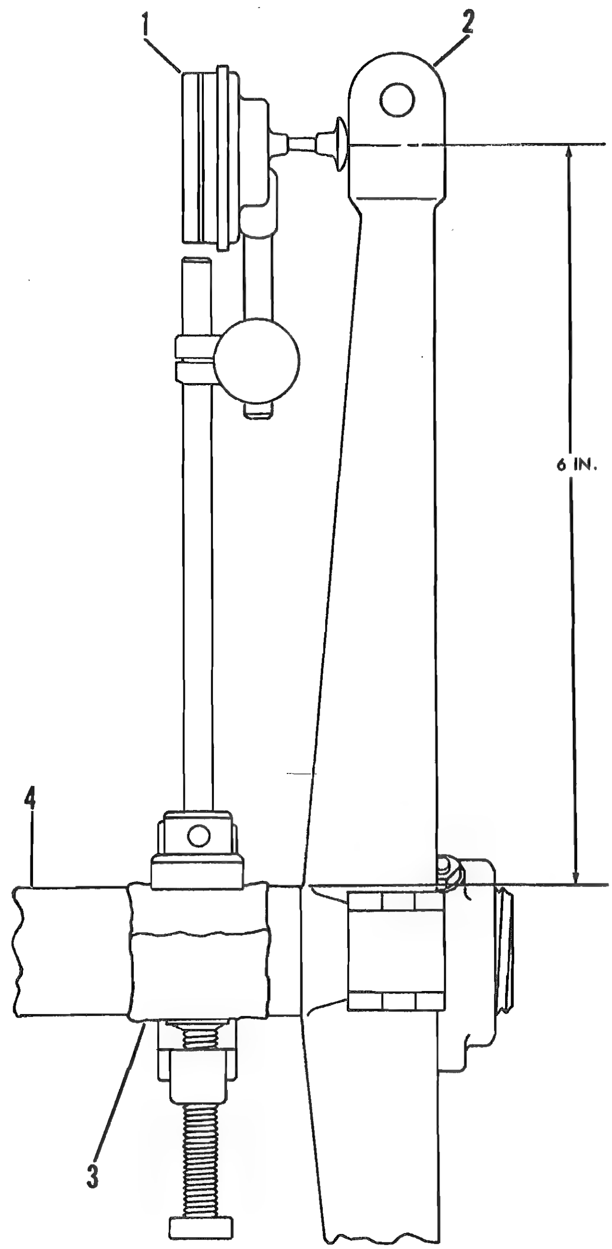
(3) Remove nuts and washers, seal retainer, seal, and gasket from intermediate housing assembly (14).

(4) Remove seal from seal retainer, using seal puller assembly, part No. S1670-10479-10 or -14.

4–167. REPAIR AND REPLACEMENT OF PARTS. The only components of the tail rotor gear box which may be replaced are the input housing seal, the horn seal, the pivot shaft seal, and gaskets.

Note

Replacement of a seal, gasket, or packing because of leakage, or replacement of the tail rotor gear box because of a leaking shim is unnecessary unless the leakage exceeds the maximum limits established in table 4–V.



1. Dial Indicator
2. Pitch Change Beam
3. Crocus Cloth
4. Actuator Shaft

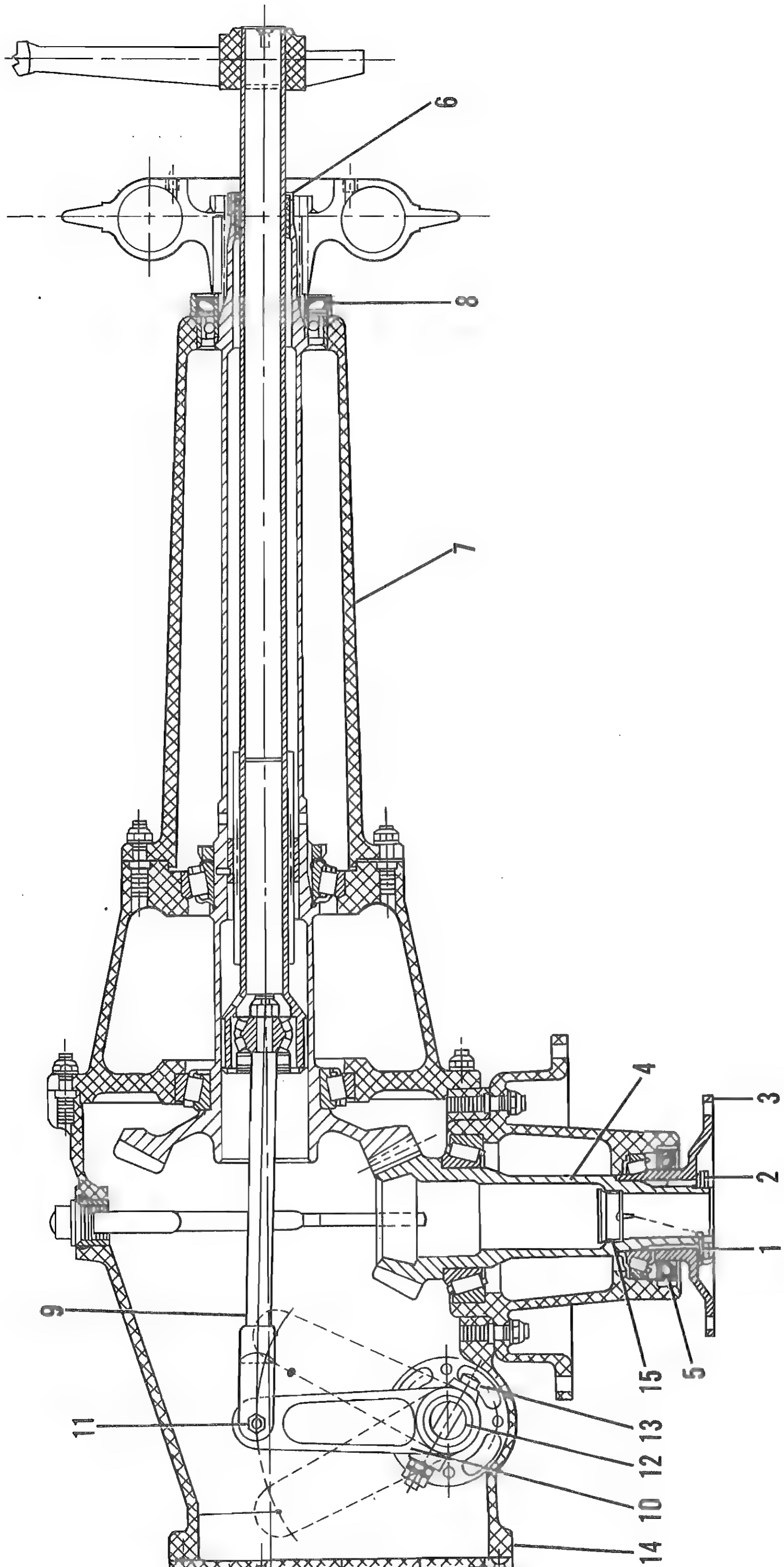
Figure 4–26. Measuring Side Play of Pitch Beam

a. Input housing seal.

(1) Coat outside surface of new seal with Garlock sealing compound, No. 101, manufactured by Garlock Packing Co.

(2) Install seal (5), using seal press cylinder, part No. S1670-10485.

(3) Install input flange (3) on input pinion (4).



1. Cotter Pin
2. Retaining Nut
3. Input Flange
4. Input Pinion
5. Seal
6. Retaining Nut
7. Horn
8. Horn Seal
9. Pitch Control Rod Assembly
10. Lever Assembly
11. Bolt
12. Pivot Shaft
13. Taper Pin
14. Intermediate housing assembly
15. Pinion Plug

Figure 4–27. Tail Rotor Gear Box

b. Horn seal.

(1) Coat outside surface of new seal (8) with Garlock sealing compound, No. 101, manufactured by Garlock Packing Co.

(2) Using seal press cylinder, part No. S1670-10485, tap seal (8) into place.

c. Pivot shaft seal.

(1) Apply sealing compound, Military Specification MIL-S-7916, on both sides of gasket and on mating surface of intermediate housing assembly (14) and install gasket on side of intermediate housing assembly.

(2) Apply Garlock sealing compound, No. 101, manufactured by Garlock Packing Co., to metal side of seal and seat seal in seal retainer.

(3) Position seal retainer with seal on left side of housing and, using a suitable socket, tap seal in place.

CAUTION

When pressing in seal, make certain that it is not cut on edges of taper pin holes in end of pivot shaft.

4–168. REASSEMBLY. Reassemble the tail rotor gear box after replacing the input housing seal, the horn seal, and the pivot shaft seal as follows:

a. Coat threads of retaining nut (2) with anti-sieze compound, Federal Specification TT-A-580. Install nut on input pinion (4). Prevent flange (3) from turning by using anti-torque plate, part No. S1670-10401-4 and using spanner wrench, part No. S1570-10117, tighten nut to a torque of 100 to 150 foot-pounds.

b. Install cotter pin and secure pinion plug (15) to cotter pin (1) with lock wire.

c. Install spacer, lock washer, and nut (6) on horn (7).

d. Using torquemeter, Snap-On part No. TQ-602AL, or equivalent. Tighten nut (6) to a torque of 180 to 220 foot-pounds.

e. Line up index marks on lever assembly (10) and on pivot shaft (12) and install lever on pivot shaft with taper pin (13) washer and nut.

Note

Small end of the tapered shank must not extend more than 1/16 inch above the surface of the control lever.

f. Install cotter pin in taper pin.

g. Install lever (10) to pitch control rod (9) and secure with bolt (11), washer, nut and cotter pin.

Note

Lever will have a permissible travel of approximately 4 inches.

4–169. INSTALLATION. (See figure 4–25.)

a. Install tail rotor gear box (24, figure 4–25) at bulkhead on top of pylon and secure it to studs (23) with washers (22) and nuts (21).

CAUTION

If aluminum washers have been used, replace them with two steel washers, part No. AN122583, under each nut. Apply zinc chromate primer, Military Specification MIL-P-8585, to mounting flange where it is necessary. Exercise care in tightening nuts. Nuts must be tightened alternately to provide an equal torque and to insure proper seating of washers. Tighten nuts to a torque of 165 to 185 inch-pounds.

b. Secure control rod assembly (20) to arm assembly on tail rotor gear box with bolts, washers, nuts, and cotter pin.

c. Replace shims (18) and bolt rubber coupling on drive shaft to input housing flange. Tighten nuts to a torque of 50 to 55 inch-pounds.

Note

To keep length of bolts uniform and to keep matched set of shims together, place extra shims on outside of flange under bolt heads. Install bolts with heads up.

d. Fasten upper rubber coupling access panel (14) in place.

e. Fill tail rotor gear box with lubricating oil. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

f. Fasten tail rotor gear box fairing and screw in place.

g. Install tail rotor assembly. (Refer to paragraph 6–48.)

h. On helicopters prior to serial No. 56-4284, coat area of actuator shaft on which pitch change beam (2) is installed, and taper pin, (11) with corrosion-preventive compound, Military Specification MIL-C-16173. While compound is wet, secure pitch change beam on actuator shaft with taper pin, washer, and nut. Tighten nut to a torque of 40 to 60 inch-pounds. Install cotter pin. If new pitch change beam is being installed, align pilot hole in the pitch change beam with tapered hole in actuator shaft and taper ream pitch change beam, using Brown and Sharpe No. 3 taper reamer or equivalent.

CAUTION

Care should be exercised not to enlarge diameter of tapered hole in actuator shaft.

Note

Small end of tapered shank of taper pin must not extend more than 1/16-inch above surface of pitch change beam.

i. On helicopters serial No. 56-4284 and subsequent, coat outer surface of collet (13), area of the actuator shaft on which the collet is installed, and taper pin with corrosion-preventive compound, Military Specification MIL-C-16173. While compound is wet, install collet in hub of pitch change beam. Align holes in collet with hole in pitch change beam. Position collet and pitch change beam on actuator shaft and secure them with taper pin, washer, and nut. Tighten nut to a torque of 40 to 60 inch-pounds. If new pitch change beam is being installed, install collet and pitch change beam without corrosion-preventive compound, drill and ream through pilot hole, using Brown and Sharpe No. 3 taper reamer or equivalent, picking up holes in collet and reamed hole in shaft. Remove collet and pitch change beam, apply corrosion-preventive compound, and reinstall them.

Note

Small end of tapered shank of taper pin must not extend more than 1/16-inch above surface of pitch beam.

j. On helicopters serial No. 56-4284 and subsequent, install bolt (12) in end of collet (13). Tighten bolt to a torque of 140 to 160 inch-pounds. Secure bolt to taper pin with lock wire.

k. Apply sealing compound, Military Specification MIL-S-7502, to joint between pitch change beam and collet at each side of pitch change beam hub.

l. On helicopters serial No. 54-2864 and subsequent, work outboard end of boot (7) onto groove on hub of pitch change beam or over collet mounted on actuator shaft.

m. Install pitch change links (1). (Refer to paragraph 6–48, step *e.*)

n. Check tail rotor rigging. (Refer to paragraph 7–167.)

o. Fasten tail rotor gear box fairing and screen (19) in place.

4–170. PREPARATION FOR STORAGE OR SHIPMENT. (See figure 4–28).

a. Replace pitch change beam on drive shaft and install taper pin, washer, nut, and cotter pin. Drain all lubricating oil out of tail rotor gear box.

b. Prepare a corrosion-preventive mixture of one part corrosion-preventive compound concentrate 51, Military Specification MIL-C-006529, and three parts lubricating oil, Military Specification MIL-L-21260, Grade 2.

c. Flush corrosion-preventive mixture through gear box.

d. Drain excess mixture from gear box.

e. Coat unprotected machined surfaces, such as shafts, with petrolatum, Military Specification MIL-C-11796. Cover unprotected machined surfaces with barrier material, Military Specification MIL-B-121, and secure with tape, Federal Specification PPP-T-60.

f. Remove cover from shipping container, part No. S1670-11350, or No. E-1-6567 Ludwig Honold Mfg. Co.

g. Remove nuts, washers, and bolts securing mounting plate inside container.

h. Bolt mounting plate to input housing flange.

i. Place gear box in container.

j. Position forked end of pitch change beam arm over corked tube located inside container.

k. Secure mounting plate with bolts, washers, and nuts.

l. Bolt arm of gear box to locking angle.

m. Secure output end of gear box with clamp assembly.

n. Place 64 units of desiccant, Military Specification MIL-D-3464, inside container.

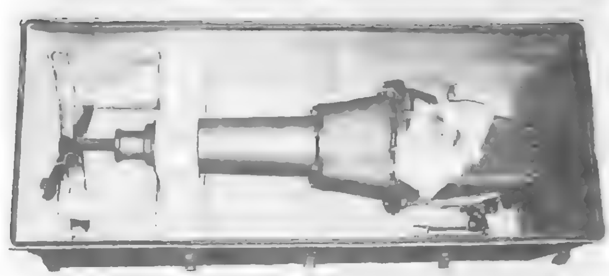


Figure 4–28. Tail Rotor Gear Box Storage and Shipping Container

CAUTION

Place humidity indicator close to window inside container so that it can be easily viewed from outside. Desiccant should be replaced if indicator turns pink.

4–171. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove greaseproof barrier materials.

b. Remove corrosion-preventive compound from unprotected machined surfaces with dry-cleaning solvent, Federal Specification P-S-661.

c. Flush tail rotor gear box with lubricating oil.

d. Drain lubricating oil, install gear box, and refill with lubricating oil. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

e. Install tail rotor gear box. (Refer to paragraph 4–169.)

SECTION V

MAIN ROTOR SYSTEM

5–1. DESCRIPTION.

5–2. The main rotor system consists of the main rotor blades, the main rotor head assembly, and the linkage necessary to transmit main rotor flight control movement to the blades. The main rotor head assembly, consisting of a main rotor hub assembly and a star assembly, is mounted directly above the main transmission and is splined to the main rotor drive shaft. The four all-metal main rotor blades are hinged at the main rotor hub assembly in such a way that each blade is free to flap vertically, hunt horizontally, and rotate about its spanwise axis to change the angle of incidence. Droop restrainers, attached to the hub, limit the downward movement, and antiflapping restrainers limit the upward movement of the blades about the flapping hinges when the blades are stopped or are turning at low speed.

5–3. MAIN ROTOR BLADES.

5–4. 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, 23 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 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 within its own group. On helicopters serial No. 54–3050 and subsequent, the blade cuffs and the main rotor sleeve assemblies are heavier than those on earlier helicopters. The blades with heavier cuffs can be used only on main rotor head assemblies having heavier sleeve assemblies. Plates are installed on the heavier blade cuffs and main rotor sleeve assemblies to prevent installation of these blades on the wrong rotor head assembly. (Refer to paragraph 5–6.)

5–5. REMOVAL. (See figure 5–1.)

a. Support blade at both ends, using crutch assembly, part No. S1670-10013.

b. Remove nut (2) and washer (1) from each taper pin (3).

c. Remove each taper pin (3) by threading puller, part No. S1570-10338-11, onto threads on large end of taper pin and tightening puller until pin is pulled free. Remove pin.

d. Remove blade from sleeve of main rotor head assembly. Transport blade from helicopter to blade storage rack, using suitable method of transportation. Store blade in a suitable padded rack with leading edge down.

5–6. INTERCHANGEABILITY OF BLADES. Any main rotor blade having a plate on its cuff may be installed on any main rotor head assembly which has mating plates on its sleeve assemblies. Any main rotor blade not having a plate on its cuff may be installed on any main rotor head assembly which does not have plates on its sleeve assemblies. The two design groups are not interchangeable.

CAUTION

Main rotor blades are painted and balanced after fabrication. Any attempt to paint blades in field will change their balance and set up undersirable flight characteristics.

5–7. REPAIR. (Refer to Chapter 3, Section II.)

5–8. INSTALLATION. (See figure 5-1.)

CAUTION

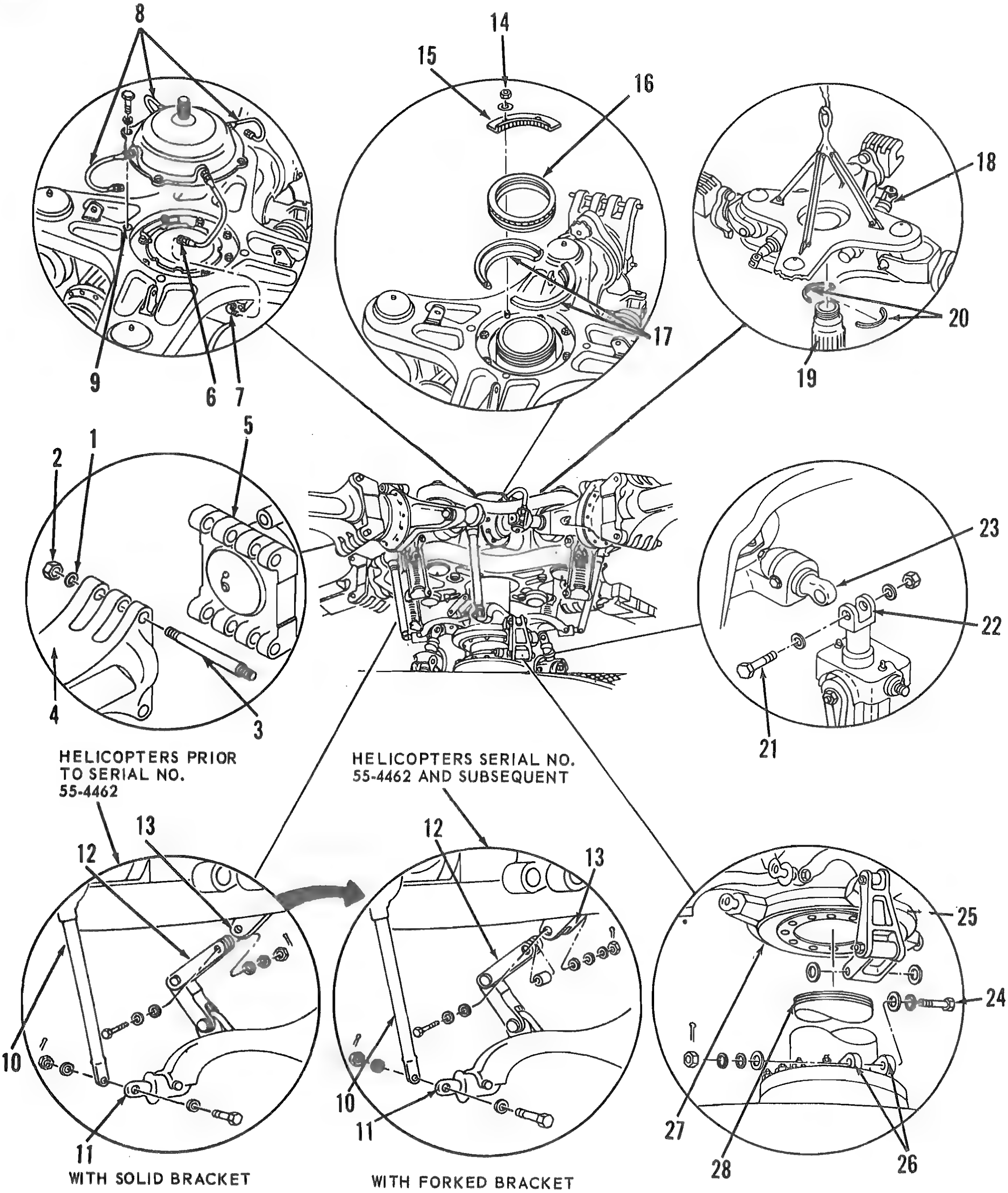
Before installing a main rotor blade, insure that blade is proper type for main rotor head assembly on which it is to be installed. (Refer to paragraph 5–6.)

a. Support blade at both ends, using crutch assembly, part No. S1670-10013. Line up cuff of blade with sleeve of main rotor head assembly.

Note

Leading edge of blade must face direction of rotation.

b. Coat taper pins (3) lightly with graphite grease, Military Specification MIL-G-7187, and insert pins into sleeve and cuff from leading edge side. Lightly tap pins into position with a soft-headed mallet.



1. Washer
2. Nut
3. Taper Pin
4. Blade Cuff
5. Sleeve
6. Hose Assembly
7. Damper
8. Hose Assemblies
9. Main Rotor Head
10. Rod Assembly
11. Bearing Assembly
12. Rotating Scissors
13. Bracket
14. Nut, Washer
15. Lock
16. Lock Nut
17. Upper Split Cone
18. Hub Assembly
19. Transmission Shaft
20. Lower Split Cone
21. Bolt
22. Servo Unit
23. Bearing Assembly
24. Bolt
25. Stationary Scissors
26. Lugs
27. Star Assembly
28. Main Transmission Shaft

Figure 5–1. Removal of Main Rotor Head Assembly

CAUTION

Do not hammer pins after they are once seated.

c. Install washer and nut on each taper pin. Tighten nut to a torque of 60 to 65 inch-pounds regardless of torque stenciled on the blades.

d. Track blades. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

5-9. MAIN ROTOR HEAD ASSEMBLY.

5-10. DESCRIPTION. The main rotor head assembly accomplishes the following functions: Supports the helicopter in flight, and converts cockpit control movement to rotor blade movement by use of the star assembly consisting of a stationary star and scissors assembly and a rotating star and scissors assembly. The rotor head allows rotor blade lead, lag, feathering, and flapping. Sleeve spindles allow each blade to be rotated on its spanwise axis to change blade pitch. Dampers restrict the (hunting) movements of the blades. Antiflapping restrainers and droop restrainers restrict flapping movements at low rotor speeds.

5-11. REMOVAL.

CAUTION

Use extreme care when stepping on transmission deck. Careless stepping on hose connections and other components can result in serious damage.

a. Remove main rotor blades. (Refer to paragraph 5-5.)

Note

Before proceeding with removal of main rotor head assembly, adjust air pressure in main shock struts or jack helicopter until main shaft of main gear box is in a true vertical position. Elimination of 3-degree foward angle of main transmission shaft will facilitate removal of rotor head.

b. Disconnect hose assembly (6, figure 5-1) from damper (7) and drain fluid tank.

Note

Any of the four hose assemblies may be disconnected to drain the fluid tank.

c. Disconnect other three hose assemblies (8) from dampers (7). Remove attaching hardware and lift fluid tank assembly from main rotor head.

d. Remove four rod assemblies (10) from bearing assemblies (11) on rotating star. Remove rotating scissors (12) from bracket on the lower plate of hub assembly.

Note

Helicopters serial No. 55-4462 and subsequent incorporate a bushing in the rotating scissors.

e. Remove nuts and washers (14) and remove lock (15) by inserting two 10-32 NF 3B screws in threaded holes provided and backing off lock from two bolts.

CAUTION

Do not remove two bolts that hold lock.

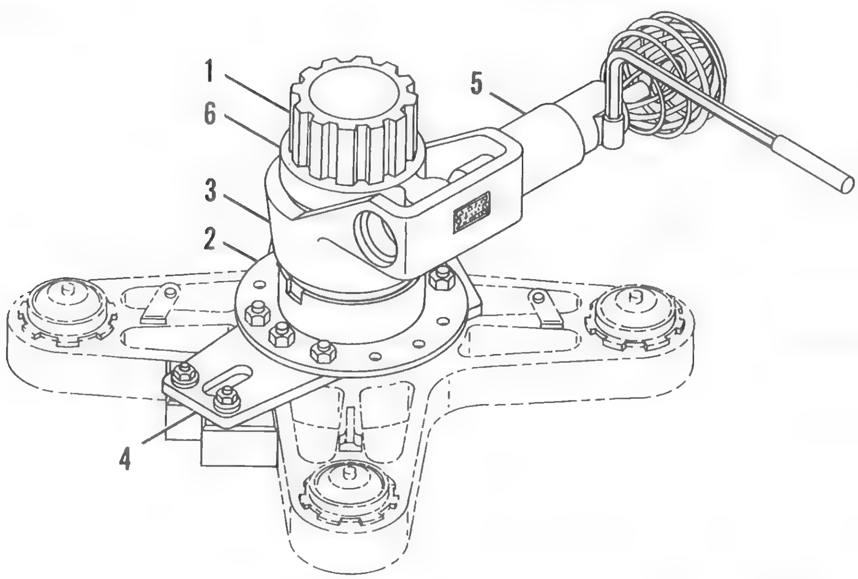
f. Set wrench, part No. S1670-10399, on lock nut. Mate splines of the drive cylinders (1, figure 5-2), part No. S1570-10190-1 and S1570-10190-2, together and mate splines of a drive cylinder into wrench. Bolt flange adapter (2), part No. S1570-10377-4, to housing (3), Kell Strom part No. KS-2172 or HSP-ST5003; and bolt arm assembly (4), part No. S1570-10189 or S1670-10447-7, to flange adapter (2). Set assembled unit over drive cylinders (1). Screw Hydra-Pak ram and gage assembly (5), Kell-Strom part No. HSP-ST50006, into housing (3), Kell-Strom part No. KS-2172. Slide forged ball arm sleeve (6), Kell-Strom part No. KS-2187 or KS-2069, revision C or later, over splines of drive cylinder (1) and use Hydra-Pak ram and gage assembly (5) to loosen lock nut.

Note

Wrench, part No. S1670-10399, cannot be identified in figure 5-2 as it is completely hidden when parts are assembled. Refer to list of special tools in Section I for identification of individual items.

WARNING

Do not, under any circumstances, use welded ball arm sleeve, Kell-Strom part No. KS-2069, revision A or B. Use only forged ball arm sleeve, Kell-Strom part No. KS-2069, revision C or later, or KS-2187. Failure of any part under high stress condition can cause immediate death or injury to operating personnel.



1. Drive Cylinders
2. Flange Adapter
3. Housing
4. Arm Assembly
5. Ram and Gage Assembly
6. Ball Arm Sleeve

Figure 5–2. Using Special Tools on Main Rotor Nut

Note

Sweeney part No. SWE-8100 Powerench, SWE-8103 Powerench, and SWE-81048 adapter may be used as an alternate set.

g. Unscrew and lift out lock nut (16, figure 5–1) and upper split cone (17).

Note

Split cones, both upper and lower, must be maintained in matched sets.

h. Bolt sling, part No. S1670-10151, to hoisting lugs on hub upper plate. Hoist hub assembly (18) off the main transmission shaft (19).

Note

Lift out halves of lower split cone (20) when hub assembly clears shaft.

i. Place hub assembly on shaft of transportation dolly, part No. S1670-10108. Position split cone between shaft and hub assembly. Position cap on top of hub assembly covering shaft and secure it with nut. Attach towing bar, part No. S1570-10616, to transportation dolly.

j. Remove bolts from three servo units (22) and remove servo units from bearing assemblies (23) on stationary star assembly.

k. On helicopters serial No. 54-911 and subsequent, remove clamp that secures upper boot assembly to main transmission drive shaft. Unfasten zipper, and remove boot. Remove lower boot assembly from boot retainers on stationary star and main transmission by unfastening zipper.

l. Remove bolts from stationary scissors (25) and remove stationary scissor from lugs (26) on main transmission. Lift off star assembly (27).

5–12. PREPARATION FOR STORAGE OR SHIPMENT. (See figure 5–3.)

a. Clean main rotor head. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

b. Lubricate main rotor head assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

c. Coat taper pin holes, splines inside hub, and ends of control rods with petrolatum, Military Specification MIL-C-11796.

Figure 5–3. Main Rotor Head Shipping Container

d. Prepare dampers for shipment. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

e. Cover taper pin holes and caps of sleeves with barrier material, Military Specification MIL-B-121, and secure with tape, Federal Specification PPP-T-60. Pack main rotor head assembly securely in a shipping container, part No. S1670-11150, or Buffalo Metal Container part No. 524A.

Note

> When returning main rotor head assembly for overhaul, include dampers, fluid tank, antiflapping restrainers, droop restrainers, stationary scissors, rotating scissors, control rods, taper pins, and star assembly.

5–13. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove barrier material and tape.

b. Clean petrolatum from inside taper pin holes in sleeves and from splines inside hub with dry-cleaning solvent, Federal Specification P-S-661.

c. Install main rotor head assembly. (Refer to paragraph 5–14.)

d. Lubricate main rotor head assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

e. Prepare damper for service. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

5–14. INSTALLATION. (See figure 5–1.)

Note

> Before installation, determine that precautions to prevent corrosion, as outlined in TM 55-1520-202-20, Chapter 2, Section VIII, have been taken. If not, perform those steps before installation.

a. Install star assembly (27) on main transmission shaft (28). Bolt stationary scissors (25) to lugs (26) on main transmission with two thrust washers, bolt, washer, and nut. Shim evenly with other washers to obtain a fit with no end play or binding. Do not install nut tight enough to cause deflection of lugs and binding. Install cotter pin.

Note

> On helicopters serial No. 54-911 and subsequent, position lower boot assembly on stationary star and main transmission boot retainers; fasten zipper; and secure with lock wire, as necessary. Position and secure upper boot assembly on the main transmission drive shaft with clamp, fasten zipper, and secure with lock wire, as necessary.

b. Connect three servo units (22) to bearing assemblies (23) on stationary star assembly.

c. Apply engine oil, Military Specification MIL-L-6082, Grade 1100, to split cones and apply oscillating bearing grease, Military Specification MIL-G-25537, to splines. Apply anti-seize compound, Federal Specification TT-A-580, to threads of hub.

d. Lift hub assembly from transportation dolly, part No. S1670-10108, by removing nut, cap, and split cones and lower the hub assembly onto main transmission shaft with sling, part No. S1670-10151. Set halves of lower split cones (20) inside hub, and hold halves in place until hub is set on shaft (19).

Note

> Before proceeding with removal of main rotor head assembly, adjust air pressure in main shock struts, or jack helicopter until main shaft of main transmission is in a true vertical position. Elimination of 3–degree forward angle of main transmission shaft will facilitate installation of rotor head.

e. Position halves of upper split cones (17) on lock nut (16) and set both in place on hub. Screw on lock nut. Set wrench, part No. S1670-10399, on lock nut. Mate the splines of drive cylinders (1, figure 5–2), part No. S1570-10190-1 and S1570-10190-2, together and mate splines of drive cylinders into wrench. Bolt flange adapter (2), part No. S1570-10377-4, housing (3), Kell–Strom part No. KS-2172 or HSP-ST5003, and bolt arm assembly (4), part No. S1570-10189 or S1670-10447-7, to flange adapter (2). Set assembled unit over drive cylinders. Screw Hydra-Pak ram and gage assembly (5), Kell-Strom part No. HSP-ST5006, into housing (3). Slide forged ball arm sleeve (6), Kell-Strom part No. KS-2069, revision C or later, or Kell-Strom part No. KS-2187, over splines of drive cylinder (1).

WARNING

> Do not, under any circumstances, use welded ball arm sleeve, Kell–Strom part No. KS-2069, revision A or B. Use only the forged ball arm sleeve, part No. KS-2069, revision C or later. Failure of any part under high stress conditions can cause immediate death or severe injury to operating personnel.

f. Use Hydra-Pak ram and gage assembly to tighten lock nut to a torque of 2000 to 2500 foot-pounds. (See figure 5–2.)

Note

Sweeney part No. SWE-8100 Powerench, SWE-9103 Powerench, and SWE-81048 adapter may be used as an alternate set.

WARNING

After 1 flying hour has accumulated on main rotor head assembly, retighten lock nut to a torque of 2000 to 2500 foot-pounds. (See figure 5–2.)

g. Install lock on any two bolts, except bolt with index zero, and tighten nuts (14, figure 5–1) to a torque of 560 to 690 inch-pounds.

h. On main rotor head assemblies with a forked bracket, connect rotating scissors (12) to bracket (13) on the lower plate with bolt, thrust washers, washer, and nut. Do not overtighten nut. Install cotter pin.

i. On main rotor head assemblies with a solid bracket, connect rotating scissors (12) to solid bracket (13) on lower plate with bolt, washers, nut, cotter pin, spacer, and shim. Do not overtighten nut.

j. Connect each rod assembly (10) to bearing assembly (11) on rotating star. Do not overtighten nut. Install cotter pin.

k. Bolt fluid tank to main rotor head (9).

l. Connect hose assemblies (6 and 8) to dampers (7).

m. Install main rotor blades. (Refer to paragraph 5–8.)

n. If main rotor head assembly was leveled by means of struts, service landing gear with air as outlined in TM 55-1520-202-20, Chapter 2, Section II.

o. Lubricate main rotor head assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

CAUTION

Rotor head must be thoroughly purged using a grease gun and grease, Military Specification MIL-G-3278, after ground run and before first flight is made on a new rotor head. (Refer to lubrication chart, TM 55-1520-202-20, Chapter 2, Section II.)

p. Check flight control rigging. (Refer to paragraph 7-134.)

q. Track main rotor blades. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

5–15. DAMPER ASSEMBLY.

5–16. REPLACEMENT OF PARTS. (See figure 5–4.)

Note

The following instructions are to be performed only at fourth echelon level of maintenance except steps *a* through *d* which may be performed at third echelon.

a. Remove damper. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

b. Remove plug and washer (10, figure 5–4), plug and gasket (14), and plug, gasket, and packing (25).

c. Remove setbolt and washer (15) and cover (26).

d. Drive out rollpin (2). Unscrew shock absorber assembly (1) while holding opposite end of piston rod (18) in padded vise. Remove boot (3).

e. In opening where plug (14) was removed, insert a drive pin and press out differential check valve assembly (24). Remove packing (23) and drain damper.

f. Secure shock absorber (28) in a padded vise and remove nut (27) and shock absorber from end of piston rod (18).

g. Support damper assembly in protectors, part No. S1570-10179-5, which are clamped in a vise,

1. Shock Absorber Assembly
2. Rollpin
3. Boot
4. Retainer Nut
5. Packing
6. Felt Washer
7. Backup Ring
8. Packing
9. Backup Ring
10. Plug, Washer
11. Gasket
12. Head
13. Cylinder
14. Plug, Gasket
15. Setbolt, Washer
16. Bolt, Washers, Nut
17. Packing
18. Piston Rod
19. Packing
20. Relief Valve Assembly
21. Screw, Washer
22. Washer
23. Packing
24. Differential Check Valve Assembly
25. Plug, Gasket, Packing
26. Cover
27. Nut
28. Shock Absorber
29. Retainer Nut
30. Packing
31. Felt Washer
32. Backup Ring
33. Packing
34. Backup Ring

Figure 5–4. Damper Assembly – Disassembled (Sheet 1 of 2)

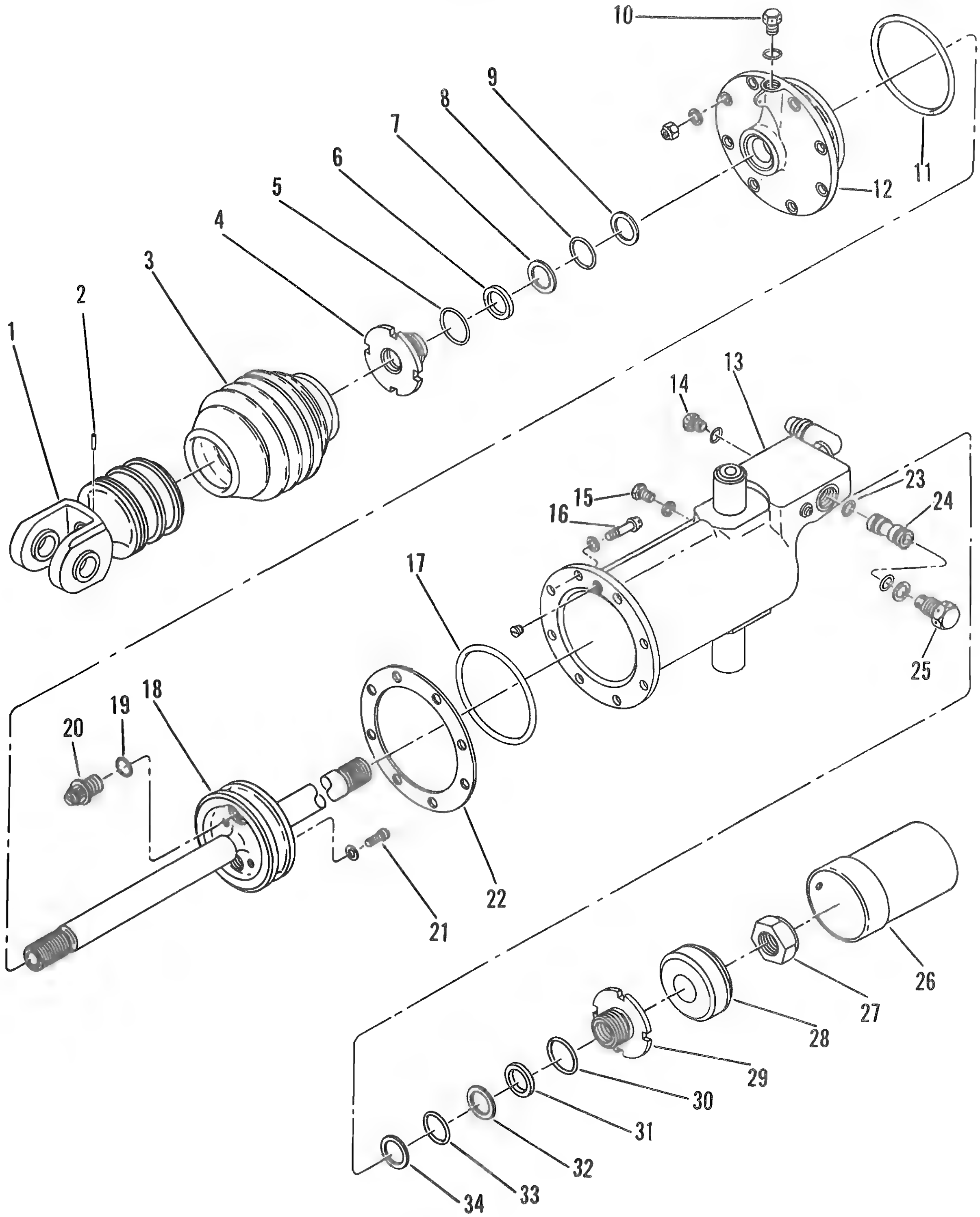


Figure 5–4. Damper Assembly – Disassembled (Sheet 2 of 2)

and remove retainer nut (4) from head (12), using wrench adapter, part No. S1570-10179-7.

h. Remove packing (5) from outside of retainer nut and remove felt washer (6), packing (8), and backup rings (7 and 9) from inside retainer nut (4).

i. Remove bolts, washers, and nuts (16) that secure head (12) to cylinder (13). Remove head (12).

j. Remove gasket (11) and washer (22).

k. Slide piston rod (18) from open end of cylinder (13). Remove packing (17).

l. Remove screws and washers (21) and remove relief valve assemblies (20). Remove packings (19).

m. Remove retainer nut (29) from cylinder (13), using wrench adapter, part No. S1570-10179-7. Remove packing (30) from outside of retainer nut, and remove felt washer (31), packing (33), and backup rings (32 and 34) from inside of retainer nut.

n. Install relief valve assemblies (20), packings (19), and screws and washers (21) in piston rod (18) with relief valve assemblies facing in opposite directions. Tighten relief valve assemblies to a torque of 50 to 70 inch-pounds. Secure relief valve assemblies to screws with lock wire. Install packing (17) on piston.

Note

Make certain that each damper assembly has two relief valves of same part number and orifice size as each of the other dampers.

o. Install felt washer (31), backup ring (32), packing (33), and backup ring (34) in retainer nut (29) with smooth surface of backup rings against packing. Install packing (30) and retainer nut in cylinder (13), using wrench adapter, part No. S1570-10179-7, and protector, part No. S1570-10179-5, while supporting damper in padded vise.

p. Place a protector, part No. S1570-10178 or equivalent, on slotted end of piston rod (18) with tapered end facing outward. Lubricate cylinder walls, piston rod, and protector with hydraulic fluid, Military Specification MIL-H-5606. Insert piston rod into cylinder and carefully push piston rod through bearing and retainer nut. Use care to avoid damage to packings and washers. Remove the protector. Install shock absorber (28) and nut (27) at slotted end of piston rod while holding opposite end of rod in a padded vise.

q. Place a protector, part No. S1570-10178 or equivalent, on free end of piston rod (18) with tapered part of protector facing outward. Lubricate protector with hydraulic fluid, Military Specification MIL-H-5606. Install gasket (11) on head (12) and carefully slide head (12) and washer (22) over piston rod (18) and up against cylinder (13). Install bolts, washers, and nuts (16) that secure head to cylinder with nuts outboard, and tighten them to a torque of 80 to 100 inch-pounds.

r. Install felt washer (6) on retainer nut (4), place packing (8) between two backup rings (7 and 9), and install on retainer nut. Put packing (5) on outside channel of retainer nut (4) against shoulder. Carefully install retainer nut (4) over piston rod (18) and tighten it into head (12), using wrench adapter, part No. S1570-10179-7, while supporting damper in protectors, part No. S1570-10179-5, which are clamped in a vise. Remove protector.

s. Install packings (23) on differential check valve assembly (24) and press valve assembly, with a clockwise motion, into cylinder (13), using a drive pin. Install plug and gasket (14).

t. Install boot (3) on retainer nut (4). Screw shock absorber assembly (1) on piston rod hand-tight while holding nut (27) with a wrench. Tighten shock absorber assembly to next pin hole and install rollpin. (2). Secure rollpin with lock wire. Fit foot onto shock absorber assembly.

u. Install cover (26) and setbolt and washer (15). A maximum loose fit of 0.008 inch between cover and cylinder (13) is allowed.

v. Install plug and washer (10), plug and gasket (14), and plug, gasket, and packing (25).

w. Install damper. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

5–17. DAMPER TIMING TEST. Perform the static timing test at a room temperature of 21.1° to 32.2° C (70° to 90° F), using hydraulic fluid, Military Specification MIL-H-5606, between 21.1° and 43.3°C (70° and 110° F). (See figure 5–5.)

a. Place damper in a bench vise after two wooden cleats have been fitted around damper to prevent any movement or distortion of cylinder.

b. Connect an external reservoir to elbow and fill with hydraulic fluid.

c. Install a ring of small diameter wire cable to a ring at piston rod fork and through a 3- to 6-inch diameter pulley. Suspend pulley so that cable from the damper yoke to the pulley is in line with centerline of the damper piston rod.

d. Suspend proper weight to provide 360 pounds of force at unattached end of cable. Support weight at proper height with damper fully retracted.

e. Place a sawhorse or similar stand beneath cable and midway between damper yoke and pulley. On top surface of stand, scribe two lines at right angles to cable and 2 inches apart. Wind a piece of tape around cable a little before first of two lines.

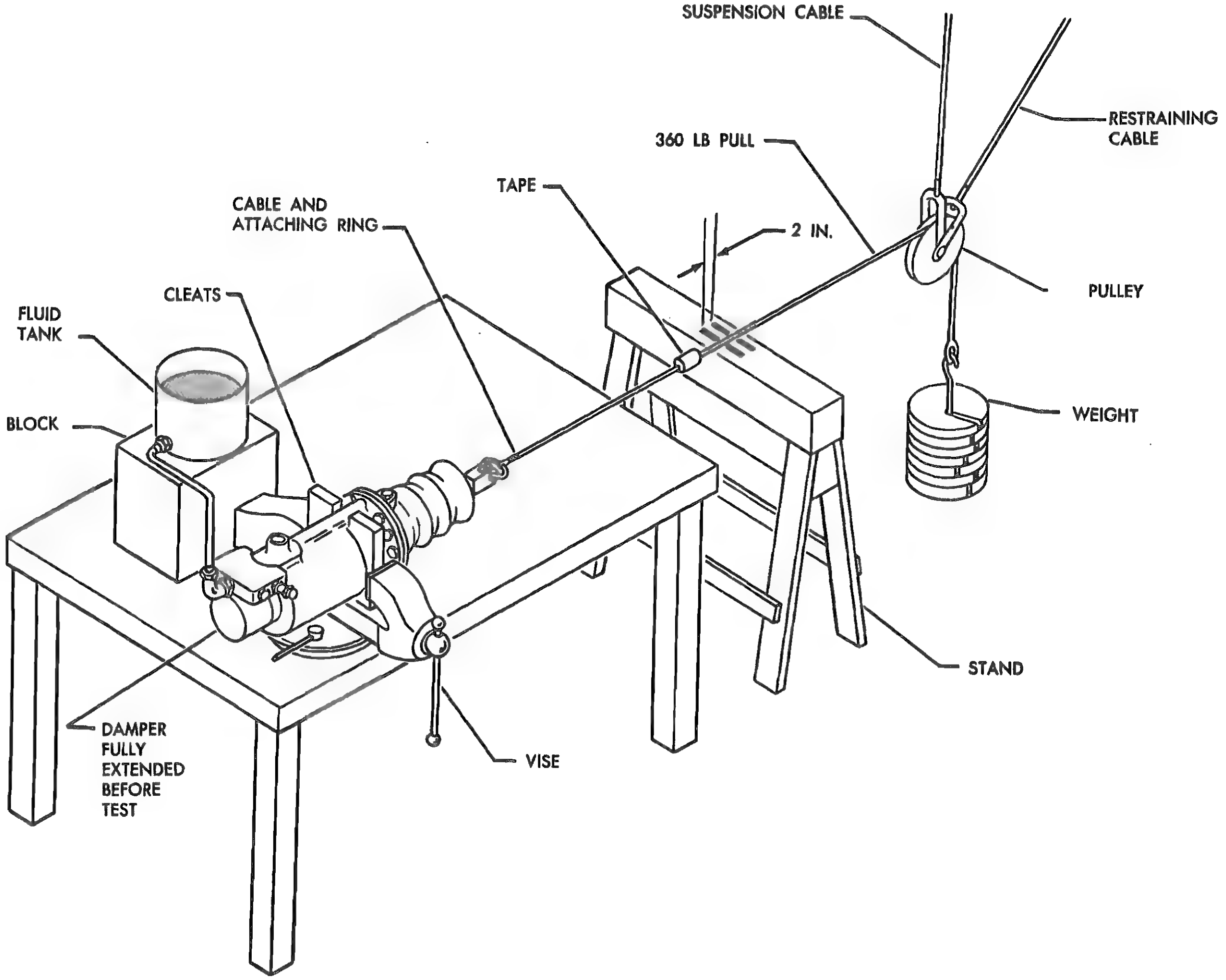


Figure 5–5. Damper Timing Test

f. Release weight and at same time be prepared to time forward edge of tape's travel, with a stopwatch, at the instant the edge passes first scribed line. Check that time required by taped portion of cable to pass between two scribed lines is between 28 and 33 seconds. Repeat this test five times.

g. Reverse damper and repeat test five times on other stroke of damper.

Note

The cable connection can be made by removing cover (26, figure 5–4) and passing cable through center of piston rod (18).

h. If damper fails to meet timing limitations, disassemble damper, replace relief valves, and test damper.

5–18. STATIONARY SCISSORS.

5–19. DESCRIPTION. The stationary scissors consists of two links, upper and lower. These links are attached to each other by a common bolt which acts as a pivot point for the scissors action. The lower link is secured to lugs on the seal retainer of the main gear box. The upper link is secured to an eyebolt on the stationary star. The stationary scissors prevents the stationary star from rotating, simultaneously permitting the tilting action of the stationary star.

Note

Rotational play of stationary star of 1/8-inch is acceptable when measured at a trunnion to star.

5–20. REMOVAL. (See figure 5–6.)

a. Disconnect lower link of the stationary scissors (1) from lugs on seal retainer of main transmission.

b. Disconnect upper link of stationary scissors (3) from bearing assembly (4) on stationary star.

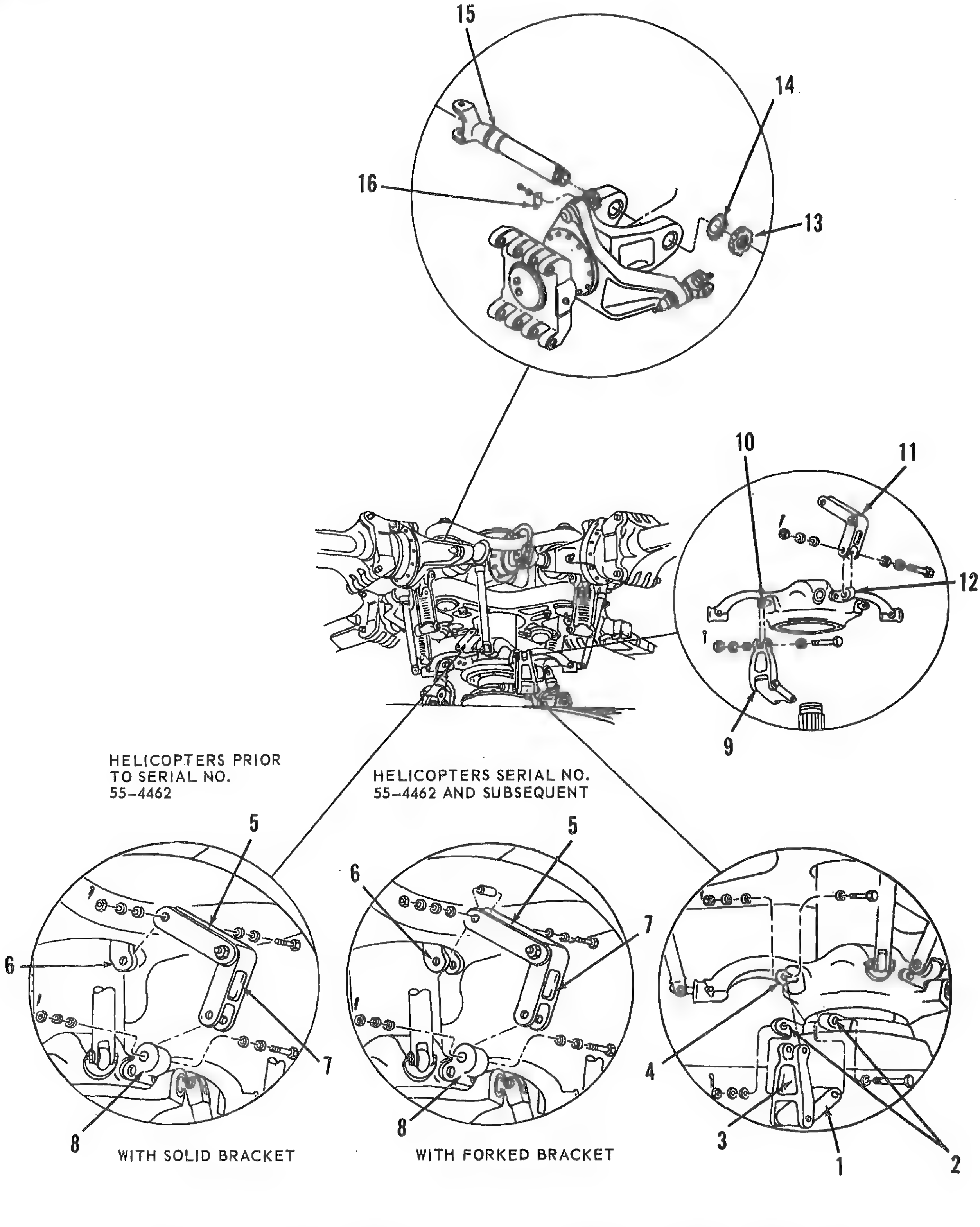


Figure 5-6. Removal of Main Rotor Head Assembly Components (Sheet 1 of 2)

1. Stationary Scissors Lower Link
2. Lugs
3. Stationary Scissors Upper Link
4. Bearing Assembly
5. Rotating Scissors Upper Link
6. Bracket
7. Rotating Scissors Lower Link
8. Bracket
9. Stationary Scissors
10. Bearing Assembly
11. Rotating Scissors
12. Bracket
13. Lock Nut
14. Lockwasher
15. Horizontal Pin
16. Lock

Figure 5-6. Removal of Main Rotor Head Assembly Components (Sheet 2 of 2)

5-21. INSTALLATION. (See figure 5-6).

CAUTION

Install stationary scissors with straight surface of lower link facing down. Dished out area of lower link, which provides necessary clearance for scissors in extreme closed position, should be facing up.

a. Connect lower link of stationary scissors (1) to lugs on seal retainer of main transmission 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 nut. Install cotter pin.

b. Connect scissors (3) to bearing assembly (4) on stationary star. Shim with washers as required. Do not overtighten nut. Install cotter pin.

5-22. ROTATING SCISSORS.

5-23. DESCRIPTION. The rotating scissors consists of two links, upper and lower. These links are attached to each other by a common bolt which acts as a pivot point for the scissors action. The lower link is secured to a bracket on the rotating star assembly. The upper link is secured to a bracket on the main rotor hub assembly. The rotating scissors cause the rotating star to rotate with the main rotor hub assembly, simultaneously permitting the tilting action of the rotating star.

5-24. REMOVAL. (See figure 5-6.)

a. On main rotor head assemblies with a forked bracket, disconnect upper link of rotating scissors from forked bracket (6) on lower plate of the hub assembly.

b. On main rotor head assemblies with a solid bracket on lower plate of hub assembly, disconnect upper link of rotating scissors (5) from bracket (6) on lower plate of hub assembly.

c. Disconnect lower link of rotating scissors (7) from bracket (8) on rotating star.

5-25. INSTALLATION. (See figure 5-6.)

CAUTION

Install rotating scissors with straight surface of lower link facing outboard. Dished out area of lower link which provides necessary clearance for scissors in extreme closed position should be facing inboard.

a. On main rotor head assemblies with a forked bracket, connect lower link of rotating scissors (7) to bracket (8) on rotating star.

b. Connect scissors to forked bracket on lower plate of hub assembly by installing the bolt, thrust washers, other washers as required, and nut. Do not overtighten nut. Install cotter pin.

Note

On main rotor head assemblies with a solid bracket on lower plate of hub assembly, connect lower link of scissors to bracket on lower plate of hub assembly by installing bolt, washers, nut, cotter pin, spacer, and shim.

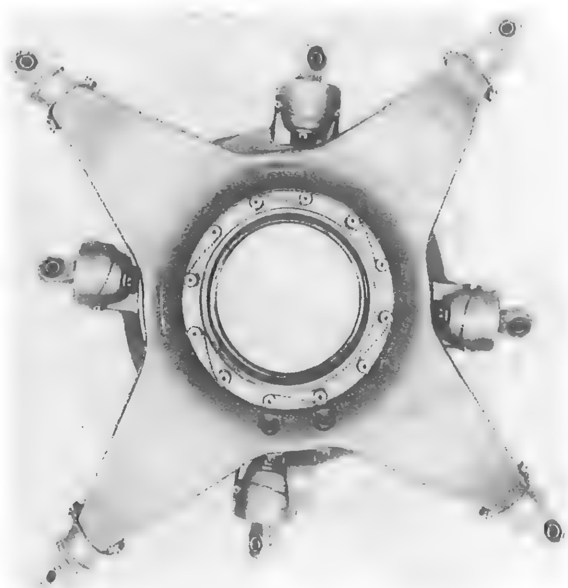


Figure 5-7. Main Rotor Star Assembly

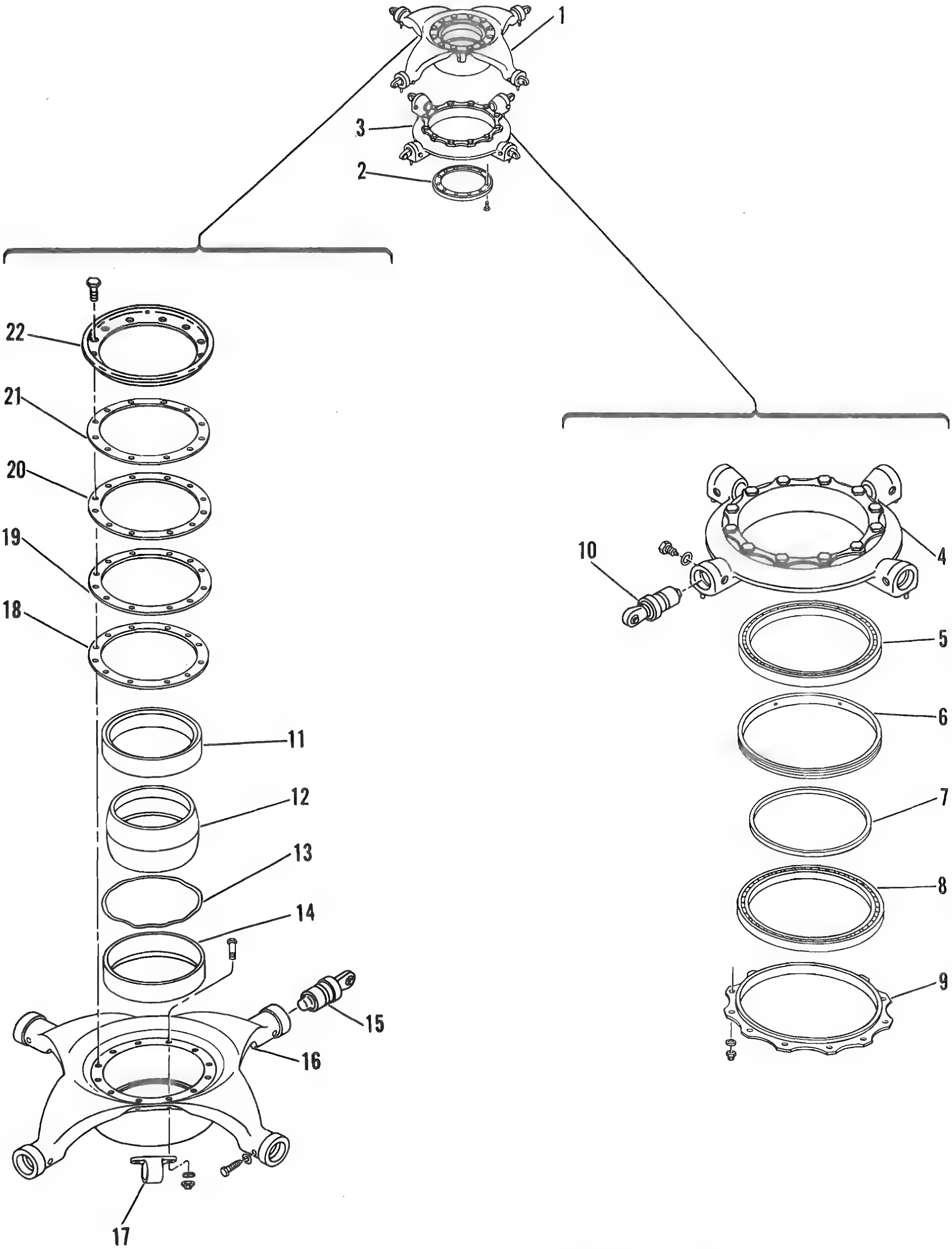


Figure 5–8. Star Assembly – Disassembly (Sheet 1 of 2)

1. Rotating Star Assembly
2. Retainer
3. Stationary Star Assembly
4. Stationary Star
5. Bearing
6. Outer Race Spacer
7. Inner Race Spacer
8. Bearing
9. Ring Washer
10. Bearing Assembly
11. Socket
12. Ball-Ring
13. Spring
14. Socket
15. Bearing Assembly
16. Rotating Star
17. Bracket Assembly
18. Solid Shim
19. Laminated Shim
20. Retainer
21. Shim
22. Retainer

Figure 5–8. Star Assembly – Disassembly (Sheet 2 of 2)

5–26. STAR ASSEMBLY.

5–27. DESCRIPTION. (See figure 5–7.) 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 rotating scissors and a stationary star which is prevented from rotating by the stationary scissors which are connected to the main transmission. 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.

Note

Rotational play of the stationary star of 1/8 inch is acceptable when measured at a trunnion to the star.

5–28. REMOVAL. (See figure 5–6.)

a. Remove main rotor head assembly and star assembly from main shaft of main transmission. (Refer to paragraph 5–11.)

b. Disconnect stationary scissors (9) from bearing assembly (10) on stationary star.

c. Remove rotating scissors (11) from bracket (12) on rotating star.

5–29. REPLACEMENT OF PARTS (FOURTH ECHELON). (See figure 5–8.)

Note

Bearing assemblies may be replaced on stationary star and rotating star without removing main rotor head. (Refer to steps *a* through *g* and *w* through *ad*.) For replacement of remaining parts (steps *h* through *v*), main rotor head must be removed.

a. Rotate main rotor head to position horn of rotating star between horns of stationary star. (See figure 5–7.)

b. Disconnect servo units (22, figure 5–1) from bearing assemblies (23).

c. Remove stationary scissors. (Refer to paragraph 5–20). Remove rotating scissors. (Refer to paragraph 5–24.)

d. Remove control rod assemblies. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

e. Cut lock wire and remove setscrews and washers that secure bearing assemblies (10 and 15, figure 5–8) to horns on star assemblies.

f. Position bolt and bearing remover, part No. S10-50-4147-10, over bearing assembly which is to be removed from star assembly. (See figure 5–9.)

g. Remove bearing assembly.

h. Remove main rotor head. (Refer to paragraph 5–11.) Separate rotating star assembly (1, figure 5–8) from stationary star assembly (3).

i. Remove ring washer (9). Place plate, part No. S1670-10331-3, on top of bearings (5 and 8) and press bearings, inner race spacer (7), and outer race spacer (6) from stationary star (4). The inner race spacer and outer race spacer are a matched set and must be wired together when disassembled.

j. Remove retainer (22). Remove shim (21), retainer (20), solid shim (18), and laminated shim (19). Record thickness of solid and laminated shims (18 and 19) as an aid to reassembly.

k. Lightly tap bottom of ball-ring (12) with a rawhide mallet and lift socket (11), ball-ring (12), spring (13), and socket (14) from top of rotating star. Sockets and ball-ring are a matched set and must be wired together.

Note

Ball-ring, sockets, and spring are removed for test procedure on reassembly.

l. Remove bracket assembly (17).

m. To reassemble star assembly, install bracket assembly (17).

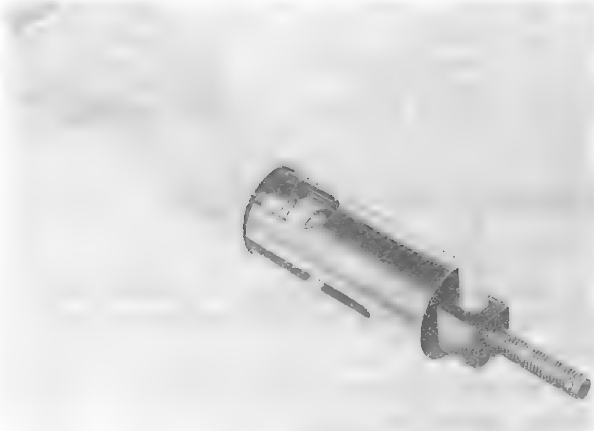


Figure 5–9. Removing Bearing Assembly from Rotating Star

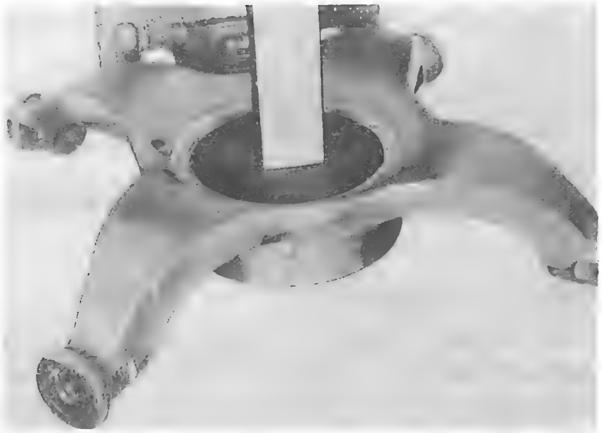


Figure 5–10. Installing Lower Socket in Rotating Star

n. Install socket (14) in rotating star (16) and seat socket, using plate, part No. S1670-10333, and an arbor press. (See figure 5–10.) With a feeler gage, check that socket is evenly seated. Remove special tool and place ball-ring (12, figure 5–8) into lower socket. Install socket (11) and tap into position with a phenolic drift.

CAUTION

Ball-ring and sockets are a matched set and must be maintained and installed as a set.

Note

Soak upper and lower sockets in lubricating oil, Military Specification MIL-L-7808, at 104.44° C (220° F) for at least 20 minutes prior to installation. Assembly must be at room temperature of 18.3° C (65° F) to 23.89° C (75° F).

o. Install laminated shim (19, figure 5–8) and retainer (20). Install bolts and tighten to a torque of 60 to 75 inch-pounds.

p. If no end play exists between ball-ring (12) and sockets (11 and 14), slide rotating star (16) on a suitable shaft and, using a fish scale, check that star begins to move when a downward pull of 3 to 7 pounds is applied. (See figure 5–11.) Adjust for this test by using different thicknesses of the shim.

Note

Shim ring is 0.036 inch thick and made up of laminations which may be peeled off for a selective fit.

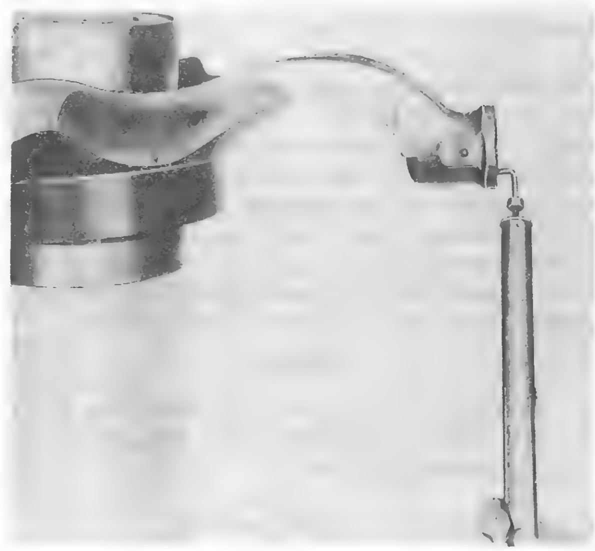


Figure 5–11. Checking Drag of Bearings in Star Assembly

q. After proper thickness of laminated shim (19, figure 5–8) has been ascertained, remove retainer (20), laminated shim (19), and socket (11). (Refer to step *k.*) Insert spring (13, figure 5–8) on top of socket (14). Install ball-ring (12) and tap socket (14) into position, using a phenolic drift. Position laminated shim (19), solid shim (18), retainer (20), shim (21), and retainer (22). Tighten to a torque of 60 to 70 inch-pounds. Secure bolts in pairs with lock wire.

r. Apply graphite grease, Military Specification MIL-G-7187, to liner and press one bearing (5) into stationary star (4) with a plate, part No. S1670-10331-3, until evenly seated. (See figure 5–12.) Remove plate and install outer and inner race spacers (6 and 7, figure 5–8). Press the bearing

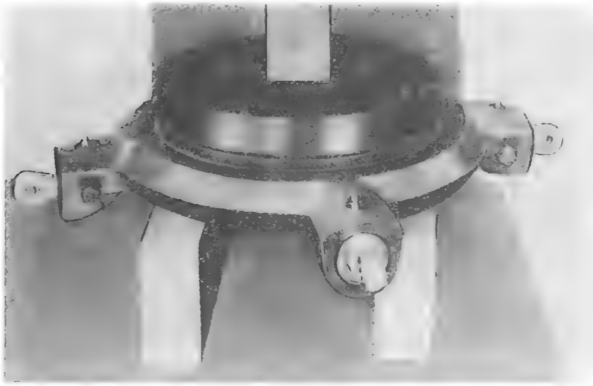


Figure 5–12. Pressing Bearing into Stationary Star

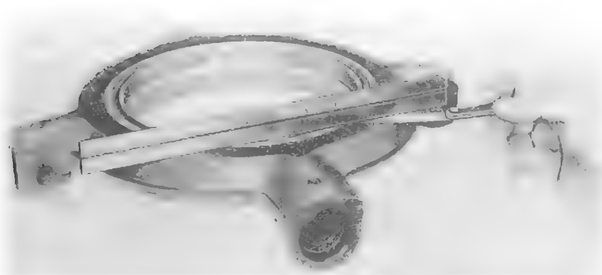


Figure 5–13. Checking Pitch Fit of Stationary Star Bearings

(8) into stationary star, using special tool in above manner. Remove special tools.

Note

Inner race spacer (7) and outer race spacer (6) are matched sets and must be replaced as a unit. When installing bearings, make certain that seals are on outside of bearings. Handpack the bearings one-third full with oscillating bearing grease, Military Specification MIL-G-25537, before installation.

s. Check that outer races of bearings (5 and 8) are clamped with 0.003 to 0.005-inch fit to prevent turning in liner. Place a straightedge across upper surface of stationary star (4) and measure gap with a feeler gage. (See figure 5–13.)

t. Invert stationary star (4, figure 5–8) and install ring washer (9).

Note

Dip bolts in primer, Military Specification MIL-P-8585, and install while still wet.

u. Apply oscillating bearing grease, Military Specification MIL-G-25537, to liner and insert

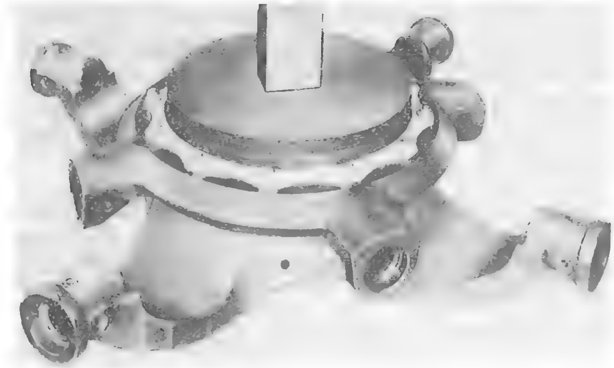


Figure 5–14. Pressing Stationary Star onto Rotating Star

rotating star assembly (1) into stationary star assembly (3). Place a plate, part No. S1670-10331-3, over rotating star assembly and press stars together until rotating star seats stationary star. (See figure 5–14.) Remove plate.

CAUTION

Before applying pressure with an arbor press, make certain that the inner race spacer (7, figure 5–8) is in perfect alignment with the bearings (5 and 8).

v. Install retainer (2) on bottom of rotating star assembly (1). Tighten bolts to a torque of 60 to 75 inch-pounds. Secure bolts together with lock wire.

w. Insert bearing assemblies (10 and 15) into horn of star assembly.

x. Position bearing pusher, part No. S1670-10484, over bearing assembly and screw bearing assembly into place.

y. Install setscrews and washers and secure setscrews with lock wire.

z. Install control rod assemblies. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

aa. Install stationary scissors. (Refer to paragraph 5–21.) Install rotating scissors. (Refer to paragraph 5–25.)

ab. Connect servo units (22, figure 5–1) to the bearing assemblies (23).

ac. Check flight control rigging. (Refer to paragraph 7–144.)

ad. Track main rotor blades. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

5–30. PREPARATION FOR STORAGE OR SHIPMENT. Lubricate the star assembly. (Refer to lubrication chart, TM 55-1520-202-20, Chapter 2, Section I.) Cover machined surfaces with corrosion preventive compound, Military Specification MIL-C-15074.

5–31. PLACING IN SERVICE AFTER SHIPMENT. Remove corrosion preventive compound from star assembly with dry-cleaning solvent, Federal Specification P-S-661.

5–32. INSTALLATION. (See figure 5–6.)

a. Connect rotating scissors (11) to bracket (12) on rotating star by installing bolt, washers, nut, and cotter pin.

b. Connect stationary scissors (9) to bearing assembly (10) on star by installing bolt, washers, other washers as required, and nut. Do not over-tighten nut. Install cotter pin.

c. Install star assembly and main rotor head assembly on main shaft of main transmission. (Refer to paragraph 5–14, steps *a* through *b.*)

5–33. SLEEVE-SPINDLE ASSEMBLY.

5–34. DESCRIPTION. The sleeve-spindle assembly, which transmits pitch to the main rotor blade from the control rods, is located between the upper and lower plate of the main rotor hub assembly. A main rotor blade is connected directly to each sleeve-spindle assembly.

5–35. REMOVAL. (See figure 5–6.)

a. Remove control rod assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

b. Remove damper assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

c. Remove lock nut (13, figure 5–6) from horizontal pin (15) using wrench, part No. S1670-10324-3. (See figure 5–15.) Remove lockwasher (14, figure 5–6).

d. Remove lock (16).

e. Insert long screw of screw and adapter, part No. S1570-10170, through horizontal pin from forked end. Install plate on screw at threaded end of horizontal pin and secure the plate. Install push puller, Owatonna part No. 927, at forked end of horizontal pin. Place a phenolic block between legs of puller and spindle. Attach power twin ram, Owatonna part No. Y-32, to screw, and pull horizontal pin from sleeve-spindle assembly. Apply an O impression stamp to flat on horizontal pin where it contacts with lock.

Figure 5–15. Removing Lock Nut from Horizontal Pin

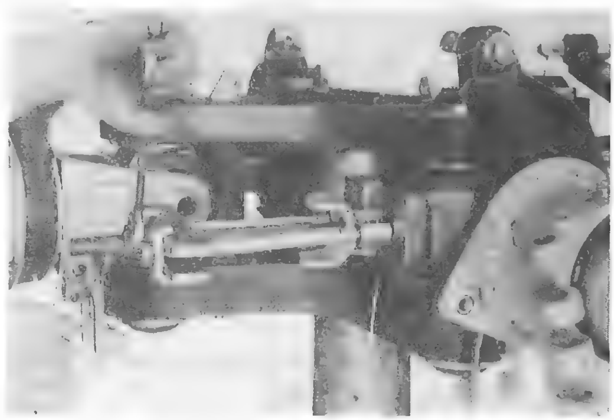


Figure 5–16. Removing Horizontal Pin

Note

Use puller without power twin ram as an alternate method. (See figure 5–16.)

Note

Two persons are required to remove sleeve-spindle assembly, due to the weight of the assembly.

Note

Mark the flats, using Lo-Stress dies, manufactured by James H. Mathews and Co, 3942 Forbes St. Pittsburgh 13, Pennsylvania, or equivalent.

5–36. REPLACEMENT OF PARTS (THIRD ECHELON).

Note

Blade lock assembly and horn assembly may be removed without removing sleeve-spindle assembly from main rotor head.

1. Screw, Washer
2. Cap
3. Seal
4. Lock Nut
5. Lockwasher
6. Washer
7. Lock Assembly
8. Lockwasher
9. Lock Nut
10. Thrust Washer
11. Knob
12. Washer
13. Nut
14. Screw, Washer
15. Washer
16. Lockwasher
17. Lock Nut
18. Spindle
19. Trunnion Yoke
20. Housing
21. Washer
22. Nut, Cotter Pin
23. Lockwasher
24. Cap Nut
25. Lubrication Fitting
26. Sleeve

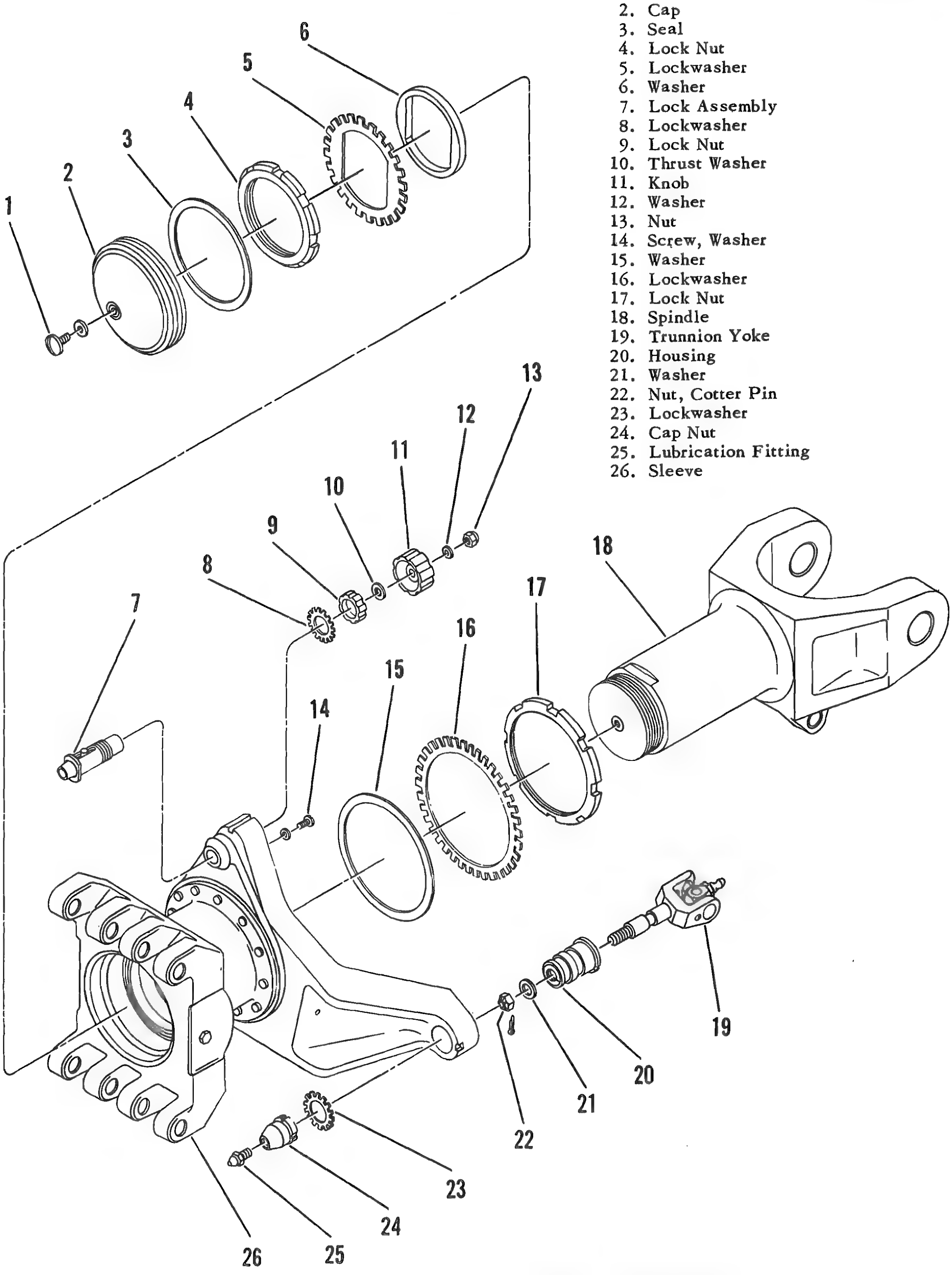


Figure 5–17. Sleeve-Spindle Assembly – Disassembled

a. Remove damper assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

b. Remove control rod assembly. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

c. Remove washer (12, figure 5–17), nut (13), knob (11), and thrust washer (10) from lock on horn. Remove lock nut (9), using wrench adapter, part No. S14-50-4102. Remove lockwasher (8) and remove lock assembly (7) from horn.

d. Remove cap nut (24) from the trunnion yoke (19), using adapter and wrench, part No. S1570-10217-1 and -5. Prevent housing (20) from turning with wrench, and use adapter on cap nut. (See figure 5–18.) Remove lubrication fitting (25, figure 5–17) from cap nut. Remove lockwasher (23). Remove washer (21) and cotter pin and nut (22).

e. Pull trunnion yoke (19) from housing (20), using bearing puller, part No. S1570-10429 or part No. S1570-10429-8, or equivalent.

f. Press trunnion yoke into housing (20). Install washer (21) and nut (22).

Note

Shim as required to permit no preload on bearing. There should be very little end play and trunnion should rotate freely.

g. Install cotter pin so that there is at least 1/4-inch clearance with the cap nut (24). Tighten cap nut with 120 to 150 inch-pounds torque, using adapter and wrench, part No. S1570-10217-1 and -5. Use adapter to tighten nut while restraining yoke with wrench. Bend a tang of lockwasher (23) up into cap nut (24) and one down into horn. Install lubrication fitting (25) in cap nut.

h. Apply primer, Military Specification MIL-P-8585, to housing of lock assembly (7) and insert lock assembly into horn. Install lockwasher (8) and lock nut (9). Bend a tang of lockwasher into groove in horn. Tighten lock nut to a torque of 120 to 150 inch-pounds, using wrench adapter, part No. S14-50-4102. Bend a tang of lockwasher up into nut. (See figure 5–19.)

i. Install thrust washer (10, figure 5–17) and knob (11). Install washer (12) and nut (13). When nut is tightened, knob should move freely. Install screw and washer (14).

5–37. REPLACEMENT OF PARTS (FOURTH ECHELON).

a. Set sleeve-spindle assembly, with sleeve end up, in torque and assembly fixture, part No. S1670-10370, by running pin of fixture through ears of spindle (18, figure 5–17) and securing sleeve-

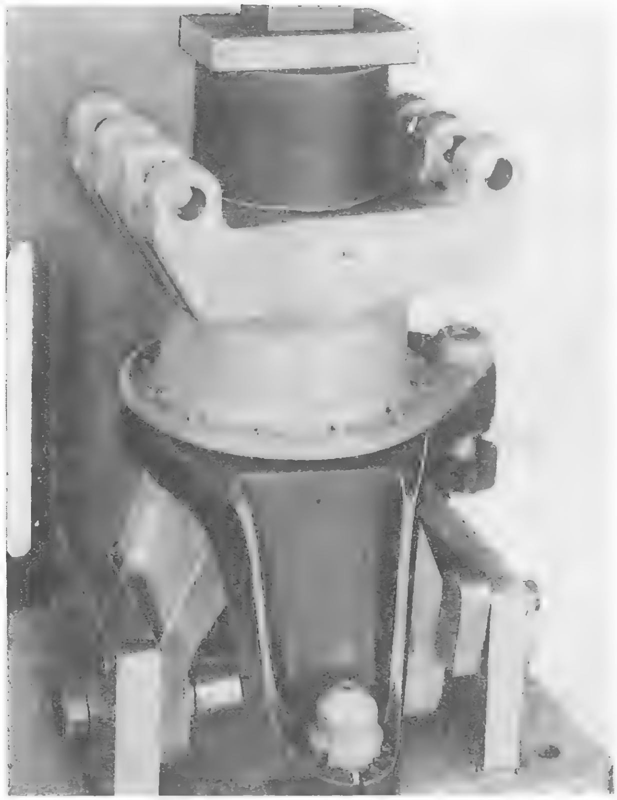


Figure 5–18. Removing Cap Nut from Trunnion Assembly on Horn

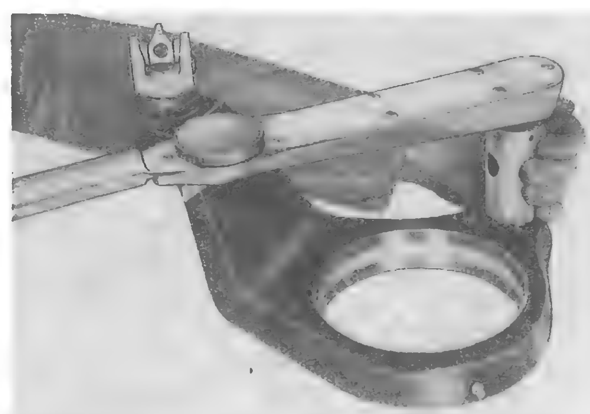


Figure 5–19. Tightening Lock Nut on Lock Assembly of Horn

spindle assembly with stops. Remove screw and washer (1). Insert an AN3DD23 bolt through a cross bar into cap (2). Pull cap from sleeve (26) and remove seal (3).

b. Secure guide of wrench assembly and adapter, part No. S1670-10317-8, to ears of sleeve (26) with taper pins. Remove lock nut (4) with wrench. (See figure 5–20.) Remove lockwasher (5, figure 5–17) and washer (6). Remove wrench and adapter.

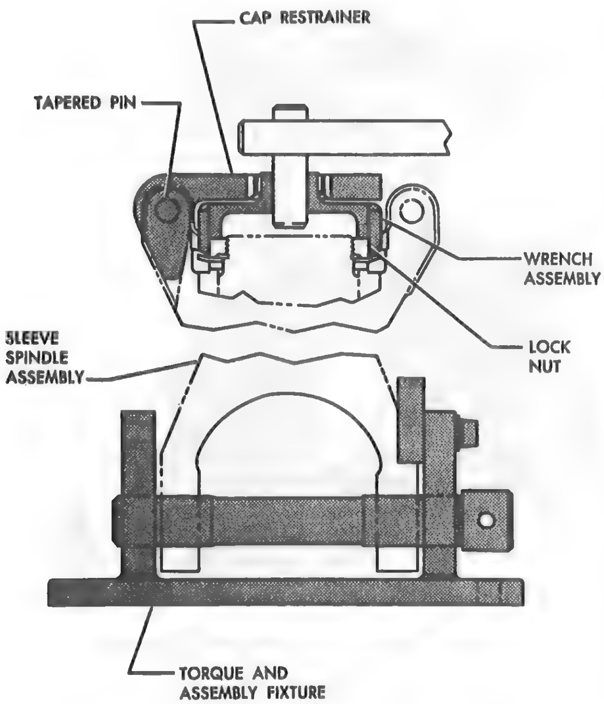


Figure 5–20. Removing Lock from Sleeve-Spindle Assembly

c. Pull sleeve (26) from spindle (18), using arm puller set, part No. S1670-10319-1 and part No. S1670-10319-2, and push puller, Owatonna part No. 927, as follows: Install arm puller between center ears of sleeve assembly and secure with taper pins. Place cap of push puller over plug in spindle. Set up forcing screw, forcing nut, and thrust washer of push puller and cross block. Hold forcing nut and tighten forcing screw to press sleeve assembly from spindle. (See figure 5–21.)

d. Remove screw and washer (14, figure 5–17). Turn knob (11) on lock assembly at top of horn to revolve horn on sleeve (26).

e. Free lock nut (17) from tangs of lockwasher (16). Remove lock nut, using wrench, part No. S1670-10394, and breaking bar. Remove lockwasher (16) and washer (15).

f. Install washers (15), lockwasher (16), and lock nut (17). Tighten lock nut, using wrench, part No. S1670-10394, to produce no end play and to allow horn to turn freely. Bend up two tangs of lockwasher. Turn horn and engage lock. Secure knob to the screw (14) with lock wire.

Note

Make certain horn turns freely before lock-wiring lock nut (9).

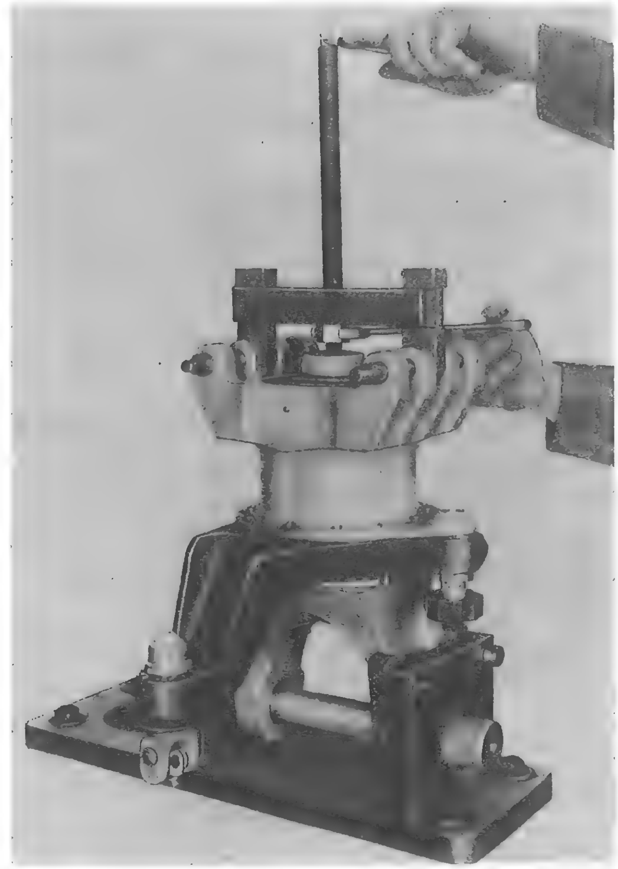


Figure 5–21. Pulling Sleeve and Bearing from Spindle

g. Position spindle (18) in torque and assembly fixture, part No. S1670-10370, by running pin of assembly through ears of spindle and supporting sleeve between stops. Lightly coat shaft of spindle with graphite grease, Military Specification MIL-G-7187, and press sleeve assembly onto spindle, using bearing and seal pusher, part No. S1670-10457.

h. Install washer (6), lockwasher (5), and lock nut (4). Secure guide of wrench assembly and adapter, part No. S1670-10317-8, over wrench secured with taper pins through ears of sleeve (26). Tighten lock nut to produce 140 to 160 inch-pounds rotational drag. (See figure 5–22.) Check drag by attaching a spring scale to trunnion on horn for a reading of 18 to 20 pounds. (See figure 5–23.) When correct drag has been obtained, bend up tang of lockwasher (5, figure 5–17.)

Note

Install washer (6) and lockwasher (5) when absolutely dry. Apply anti-seize compound, Federal Specification TT-A-580, to threads and bearing surface of lock nut (4) only.

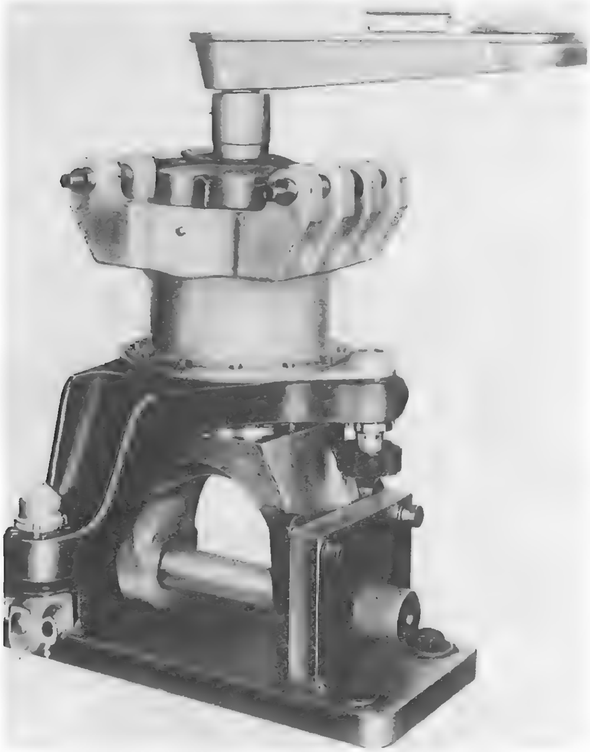


Figure 5–22. Tightening Lock Nut on Sleeve Spindle Assembly

i. Install seal (3) on cap (2). Lightly tap cap into sleeve (26). Install screws and washers (1) in cap and secure screws with lock wire.

5–38. PREPARATION FOR STORAGE OR SHIPMENT.

a. Apply dry-cleaning solvent, Federal Specification P-S-661, to taper pin holes and wipe clean with a lintless cloth.

b. Apply petrolatum No. 6060 to taper pin holes.

c. Cover taper pin holes and caps with barrier material, Military Specification MIL-B-121. Secure with tape, Federal Specification PPP-T-60.

5–39. PLACING IN SERVICE AFTER SHIPMENT. Remove barrier material.

5–40. INSTALLATION.

a. Remove grease or oil from horizontal pin. Coat portion of pin that extends into spindle ears

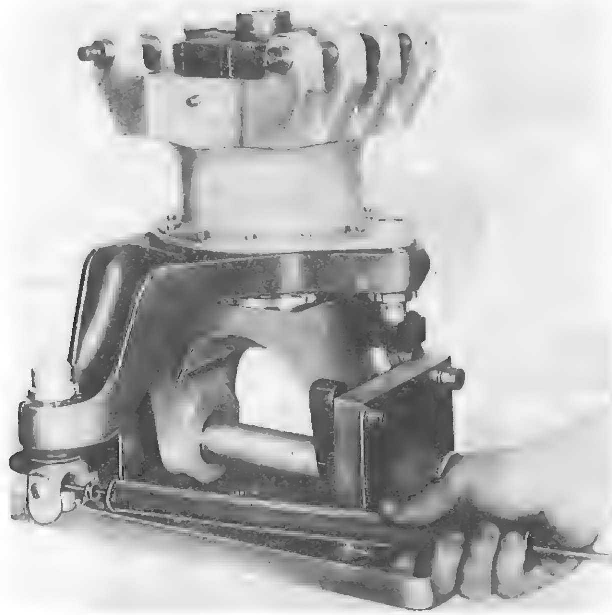


Figure 5–23. Checking Rotational Drag on Sleeve-Spindle Bearings

and inner face of vertical hinge assembly with Paralketone, Military Specification MIL-C-16173. Freeze coated pin by placing it in a container of chipped dry ice for a minimum of 1-1/2 hours (do not use dry ice solvent baths as this will dissolve Paralketone). Remove coated pin from dry ice and install immediately. Position pin so that flat, marked O, is next to lock.

b. Apply lubricating oil, Military Specification MIL-L-7808, inside holes of ears in sleeve-spindle assembly. Install lock with washers and screws. Line up ears of the sleeve-spindle assembly with hinge assembly. Line up flat surface on horizontal pin with guide, and insert horizontal pin through ears of sleeve-spindle and through hinge until pin is seated. Check that a 0.001-inch feeler gage cannot be inserted between shoulder of horizontal pin and ears of spindle to insure a proper seating.

c. Install lockwasher (14, figure 5–6) and lock nut (13) on each horizontal pin. Tighten nut to a torque of 125 to 150 foot-pounds, using wrench assembly, part No. S1670-10324-3.

d. Check flight control rigging. (Refer to paragraph 7–144.)

e. Track main rotor blades. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

SECTION VI

TAIL ROTOR SYSTEM

6–1. DESCRIPTION.

6–2. The tail rotor system (figure 6–1) consists of the pitch change mechanism, tail rotor assembly and counterweight assembly, supported and driven by the tail rotor gear box. The tail rotor produces anti-torque forces which may be varied by the pilot. 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 arms on the spindle sleeves by pitch change links; the counterweight assembly is linked to the same arms by counterweight links. The counterweight assembly reduces the load on tail rotor pedals. Four flapping hinges to which the spindles are connected permit coning (flapping) of the blades to a maximum of 10 degrees in each direction.

6–3. PITCH CHANGE MECHANISM.

6–4. DESCRIPTION. The pitch change mechanism consists of the pitch change link assemblies which connect the pitch change beam and the arm on the spindle sleeves.

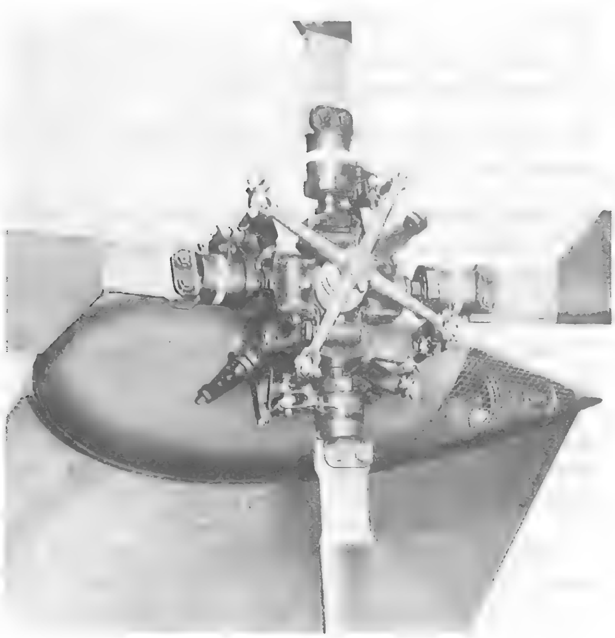


Figure 6–1. Tail Rotor System

6–5. REMOVAL. (See figure 6–2.)

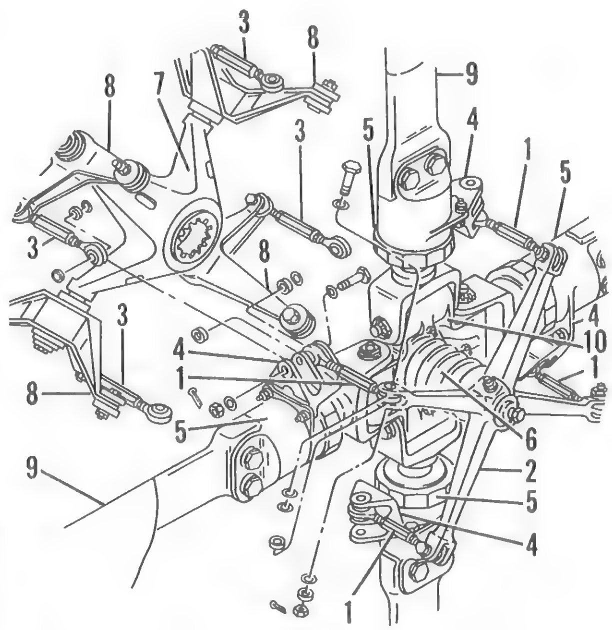
Note

Maintenance platform, part No. 47R16420, should be used for removal of tail rotor.

a. Disconnect outboard end of each pitch change link (1) from each fork of pitch change beam (2).

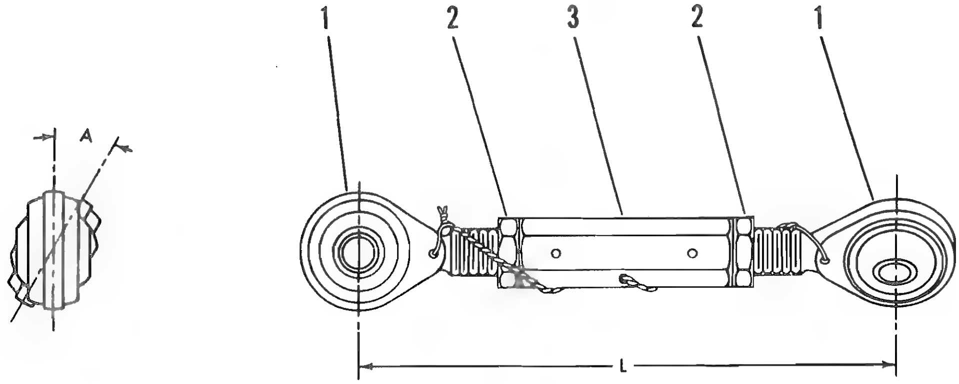
b. Remove pitch change beam (2). (Refer to paragraph 4–163.)

c. Disconnect inboard end of each pitch change link (1) and outboard end of each counterweight link (3) from arm (4) on sleeve (5).



1. Pitch Change Link
2. Pitch Change Beam
3. Counterweight Link
4. Arm
5. Sleeve
6. Boot
7. Counterweight Assembly
8. Counterweight Bracket
9. Tail Rotor Blades
10. Hub Assembly

Figure 6–2. Tail Rotor Assembly Removal And Disassembly



	PITCH CHANGE LINK ASSEMBLY	COUNTERWEIGHT LINK ASSEMBLY
A	60°	53°
L	$4\frac{9}{16}$ INCHES	$4\frac{3}{8}$ INCHES

NOTE

THE $4\frac{9}{16}$ INCH APPROXIMATE LENGTH OF THE PITCH CHANGE LINK ASSY IS SUBJECT TO ADJUSTMENT OF ROTOR RIGGING. THE $4\frac{3}{8}$ INCH LENGTH OF THE COUNTERWEIGHT LINK ASSY IS PREDETERMINED AND FIXED.

1. Rod End 2. Check Nut 3. Link

Figure 6–3. Pitch Change Link and Counterweight Link Assemblies

6–6. INSPECTION OF LINK ASSEMBLY BEARINGS. (See figure 6–3.)

a. With link assembly installed on tail rotor, try to move each rod-end bearing of link assembly at a right angle to attaching bolt. If there is little or no movement, the rod-end bearings may be considered serviceable.

Note

This check is to be performed prior to removal of pitch change links from helicopter.

b. If there is considerable movement (which may indicate excessive wear), remove link assembly to measure exact amount of end play in rod-end bearing.

CAUTION

Remove and reinstall link assemblies one at a time to avoid incorrect stackup on reassembly. Existing stackup must be maintained. Do not reinstall an attaching bolt that was used for testing.

c. Install an attaching bolt, washers (as required), and a nut on rod-end bearing of link assembly and tighten nut to a torque of 40 to 60 inch-pounds.

d. Mount link assembly in a vise so that jaws of vise grip head and shank of bolt.

e. Place a dial indicator against outer race of rod-end bearing in same axis as bore.

f. Push outer race of rod-end bearing toward dial indicator so that any slack will be taken up.

Note

Direction of play being measured is along axis of bore through which attaching bolt passes.

g. Seat dial indicator at zero and pull link assembly in an axial direction away from dial indicator.

h. Maximum reading on dial indicator will be amount of end play. If end play is greater than 0.025 inch, replace rod end. If end play is 0.025 inch or less, continue rod end in service.

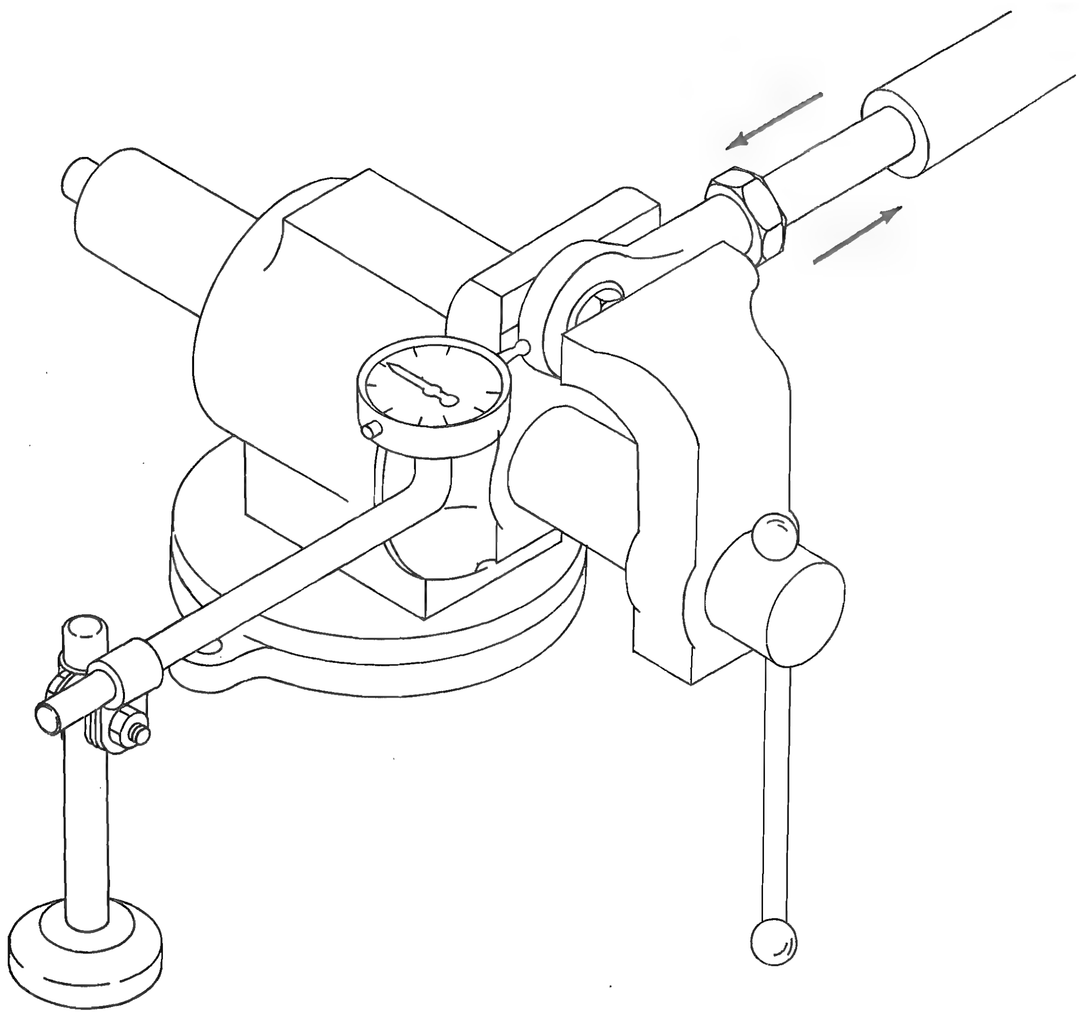


Figure 6–4. Checking Rod-End Bearing End Play

i. Measure length of link and angle setting of rod-end bearings in accordance with figure 6–4.

6–7. TAIL ROTOR ASSEMBLY.

6–8. DESCRIPTION. (See figure 6–2.) Helicopter heading and anti-torque control are provided by the tail rotor assembly which consists of four rotor blades (9) attached to the sleeves (5) of the four spindle assemblies which connect to a single central hub assembly (10). The ears of the sleeve attach, with shims, to the cuff end of the blade. The spindle, which attaches to the hub, also runs through a set of ringed stack bearings within the sleeve. A lubrication fitting is located on the surface of the sleeve. An arm on the sleeve serves as an attaching point for one rod end of both the pitch change link and the counterweight link assemblies.

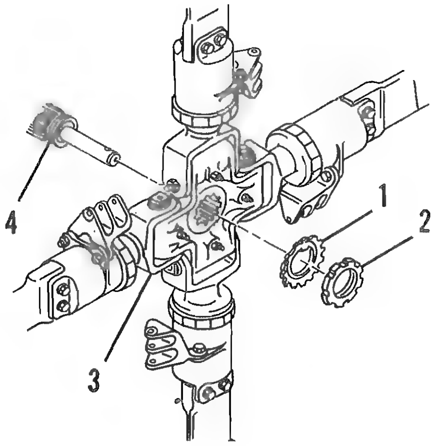
6–9. REMOVAL. (See figure 6–5.)

a. On helicopters serial No. 54-2864 and subsequent, work inboard end of boot (6, figure 6–2) off lock nut. Remove boot.

b. Bend back tang of lockwasher (1, figure 6–5) located under nut (2) that secures tail rotor assembly to tail rotor gear box output shaft. Remove washer and nut using wrench, part No. S1670-10433-3. Slide tail rotor assembly (3) off output shaft (4).

6–10. TAIL ROTOR BLADES.

6–11. DESCRIPTION. Each tail rotor blade is constructed of a sheet aluminum skin bonded to a solid aluminum leading edge spar, a honeycomb core, a trailing edge cap, and a tip cap. The skin is wrapped completely around the spar. The trailing



1. Lockwasher
2. Nut
3. Tail Rotor Assembly
4. Shaft

Figure 6–5. Removing Tail Rotor Retaining Nut

edge cap is installed over the top edge of the skin at the trailing edge of the blade. The tip cap is riveted to the outer edge of the blade. Each blade is bolted through the root end of the spar to the sleeves of the spindle.

WARNING

Part No. S1615-30000 series tail rotor blades and part No. S1615-30100 series tail rotor blades are not interchangeable with each other and one must never be substituted for the other. Tail rotor blades, part No. S1615-30100-2, -8, and -8X, are interchangeable and any combination of these tail rotor blades may be used. Tail rotor blades, part No. S1615-30100-4, must never be used in combination with tail rotor blades, part No. S1615-30100-2, -8, or -8X. Any part No. S1615-30000 series tail rotor blade is interchangeable with any other part No. S1615-30000 series tail rotor blade, and any combination of this series tail rotor blade is permissible.

Note

Tail rotor blades bearing part No. S1615-30100-8X have been inspected and X-rayed by the manufacturer for possible shifting of the honeycomb filler from the trailing edge of the spar. These blades have been found suitable for continued service.

6–12. REMOVAL OF BLADES. (See figure 6–6.)

Note

This paragraph contains instructions for removing the tail rotor blades from spindles on the hub assembly. Instructions in this paragraph apply only when replacing one or more of the blades. To remove blades with spindles attached, refer to paragraph 6–13.

a. Remove each blade by removing bolts (1), washers, nuts, and balancing shims. Tap out bolts with a fiber mallet. Remove assembly fitting shims (2). Reinstall bolts, washers, nuts, and shims as each blade is removed.

CAUTION

If tail rotor hub assembly is to be shipped without blades, blade attaching bolts must be included with hub assembly. These bolts must be magnetic-particle inspected at each overhaul of hub assembly.

b. Store blades in a padded rack with leading edge down.

6–13. REMOVAL OF BLADES WITH SPINDLES ATTACHED. (See figure 6–7.)

Note

This paragraph contains instructions for removing tail rotor blades, with spindles attached, from hub assembly. Instructions in this paragraph apply only when preparing complete tail rotor assembly for shipment. To remove blades from spindles on hub assembly, refer to paragraph 6–12.

a. Support each tail rotor blade and spindle. Remove pin (1), washers, nut, and cotter pin which secure spindle (2) to arm of the hub (3).

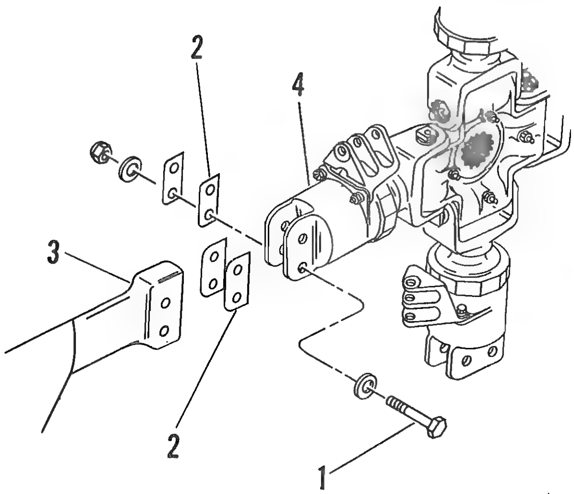
b. Remove thrust washers (4) located between ears of spindle and hub. Remove blade, with spindle attached, from hub.

6–14. INSPECTION OF TAIL ROTOR BLADE ATTACHING BOLTS.

a. Degrease bolts with dry-cleaning solvent, Federal Specification P-S-661.

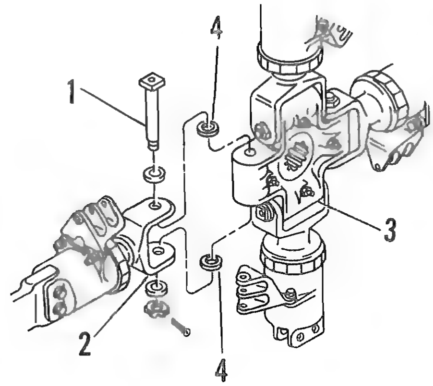
b. Remove paint with paint remover, Military Specification MIL-R-25134.

c. Visually inspect each bolt for corrosion, fretting, wear, scoring, or damage.



1. Bolt, Washers, Nut
2. Fitting Shims
3. Rotor Blade
4. Sleeve

Figure 6–6. Removal of Blades



1. Pin, Washers, Nut, Cotter Pin
2. Spindle
3. Hub
4. Thrust Washer

Figure 6–7. Removal of Blades with Spindles Attached

d. If any defects are found, replace defective bolt.

6–15. DISASSEMBLY OF TAIL ROTOR ASSEMBLY. Remove blades. (Refer to paragraph 6–12.)

6–16. REMOVAL OF SPINDLE ASSEMBLY. (See figure 6–8.) Remove pin (4), washers (3 and 7), thrust washers (2), nut (6), and cotter pin (5) that secure each spindle assembly (8) to hub assembly (1). Remove spindle assemblies (8).

6–17. DISASSEMBLY OF SPINDLE ASSEMBLY.

a. Remove lubrication fitting (10) from sleeve (11).

b. Cut lock wire and remove bolts, washers, and nuts (9) that secure arm (13) to sleeve (11). Remove arm (13).

Note

Steps *d* through *h* may be performed at fourth echelon level of field maintenance only.

c. Loosen outer nut (18) with wrench, part No. S1670-10451, or crowfoot attachment, part No. S1670-10334. (See figure 6–9.)

d. Pull sleeve (11, figure 6–8) from spindle (19) with puller, part No. S1670-10438. (See figure 6–10.)

Note

Back outer nut (18, figure 6–8) off sleeve as sleeve is being pulled from spindle.

e. Bend back tang of lockwasher (14). Remove inner nut (12) from spindle (19) with wrench, part No. S1670-10452. Remove lockwasher and plug (15) from spindle.

f. Support outer nut (18) on two blocks and press stack bearing assembly (16) and outer nut from spindle. (See figure 6–11.)

g. Press seal (17, figure 6–8) from outer nut (18) with drift plate, part No. S1670-10304.

h. Remove stop (20) from spindle (19) by shrinking with dry ice.

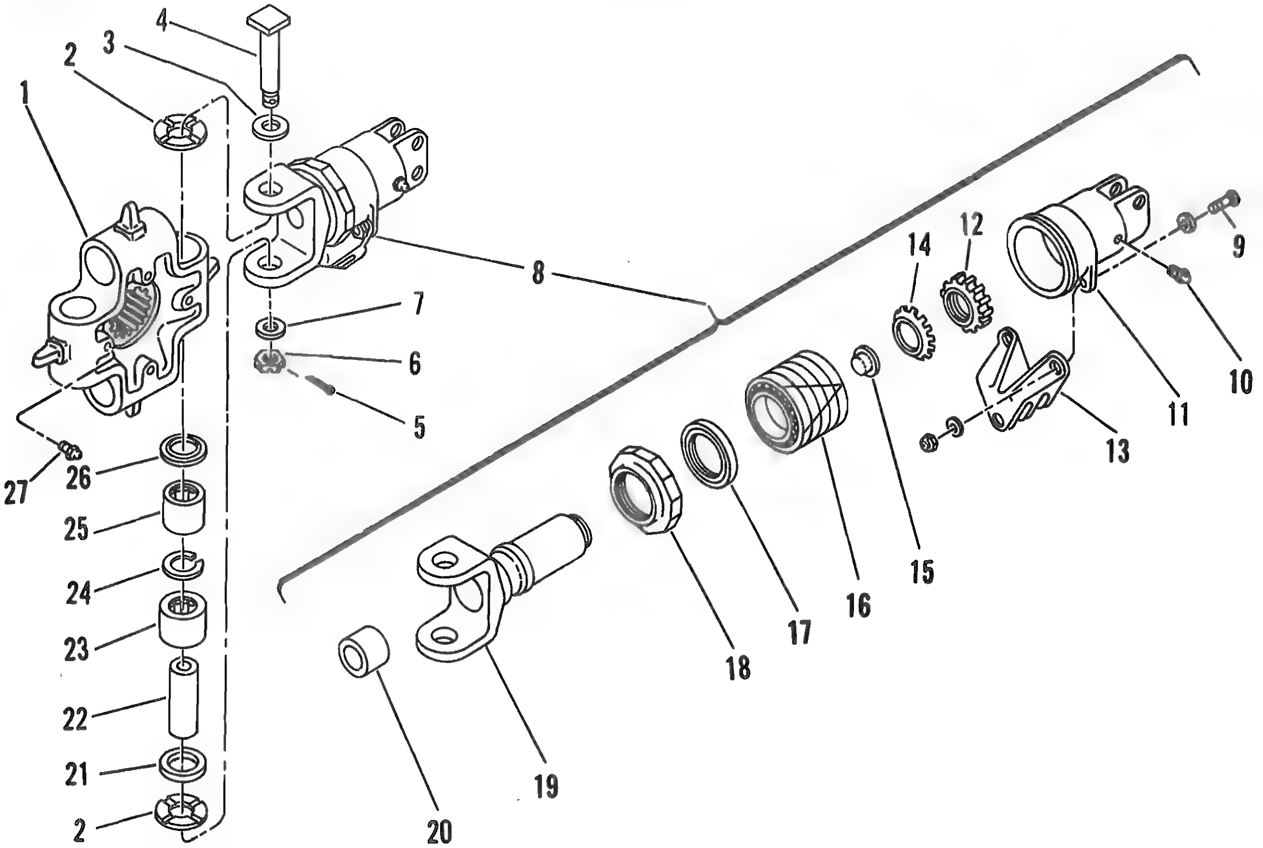
6–18. DISASSEMBLY OF HUB ASSEMBLY (FOURTH ECHELON). (See figure 6–8.)

a. Remove lubrication fittings (27) from hub assembly (1).

b. Support hub assembly (1) on a hollow cylinder, position drift cylinder, part No. S1670-10305, on seal (26) and inner race (22), and press out seals (21 and 26), bearings (23 and 25), spacer (24), and inner race from hub assembly (1). (See figure 6–12.)

CAUTION

All functions requiring use of drift cylinder must be performed with use of arbor press. Do not use hammer on drift cylinder.



1. Hub
2. Thrust Washer
3. Washer
4. Pin
5. Cotter Pin
6. Nut
7. Washer
8. Spindle Assembly
9. Bolt, Washers, Nut
10. Lubrication Fitting
11. Sleeve
12. Inner Nut
13. Arm
14. Lock washer
15. Plug
16. Stack Bearing Assembly
17. Seal
18. Outer Nut
19. Spindle
20. Stop
21. Seal
22. Inner Race
23. Bearing
24. Spacer
25. Bearing
26. Seal
27. Lubrication Fitting

Figure 6–8. Tail Rotor Assembly with Blades Removed

Note

The thick-wall end of drift cylinder is placed against seal and inner race in removal.

c. Remove seals (21 and 26, figure 6–8), bearings (23 and 25), and spacer (24) from inner race (22).

d. Remove seals (21 and 26), bearings (23 and 25), spacers (24), and inner races (22) from other three sections of hub assembly (1) as in step *b.* Remove seals, bearings, and spacers from inner races.

6–19. INSPECTION.

a. Magnaflux the hub assembly (1, figure 6–8), spindle (19), inner nut (12), outer nut (18), sleeve (11), pin (4), and inner race (22).

b. Zyglo the arm (13).

c. Inspect the bearings (16, 23, and 25) for possible excessive wear, fretting, corrosion, brinelling, chipping, and evidence of failure.

d. Inspect all parts for possible damage, corrosion, and excessive wear.

Figure 6–9. Removing Outer Nut from Sleeve

Figure 6–10. Removing Sleeve from Spindle Assembly

e. Inspect all components which exhibit excessive wear for the dimensions given in the table of fits and clearance. (Refer to table 6–I.)

f. Replace any damaged or worn parts that do not conform to the service tolerance given in the table of fits and clearances.

g. Replace all seals.

6–20. FITS AND CLEARANCES. The table of fits and clearances gives the service tolerance of mating parts of the tail rotor assembly. The table is used to determine whether the various mating parts of the tail rotor assembly may be continued in use or must be replaced. (Refer to table 6–I.)

6–21. CLEANING.

a. Clean the tail rotor (except blades) with dry-cleaning solvent, Federal Specification P-S-661.

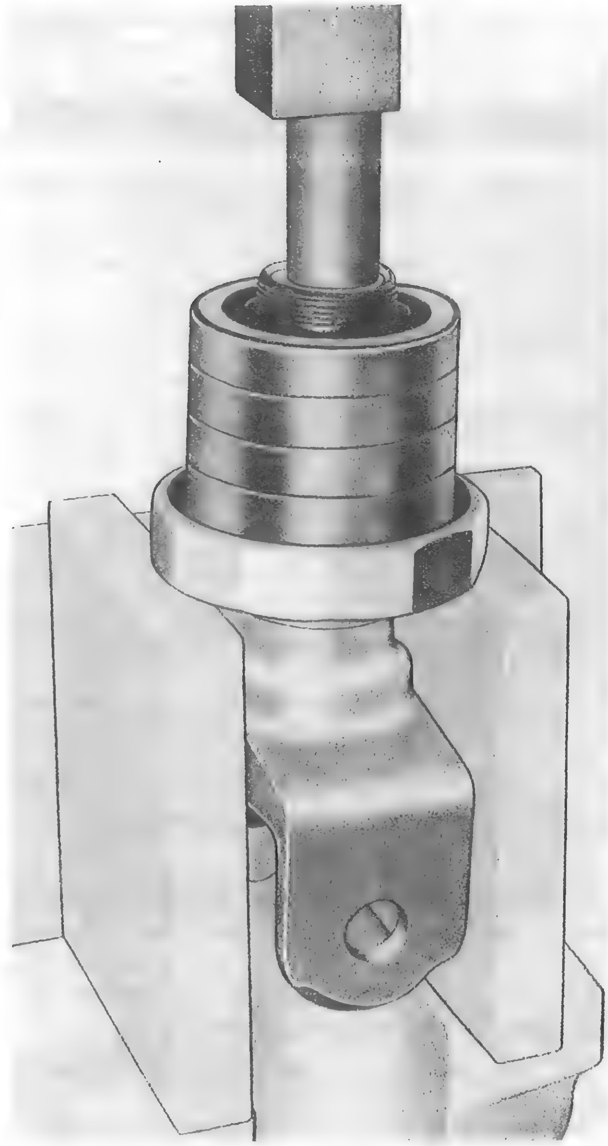


Figure 6–11. Pressing Stack Bearing Assembly from Spindle

b. Wash tail 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.

Table 6–I. Table of Fits and Clearances

PART NO.	NOMENCLATURE	MFG DIM. (IN.)	MATING PART NO.	NOMENCLATURE	MFG DIM. (IN.)	SERVICE TOLERANCE (IN.)
S1610-33107	Sleeve	2.6774 ID	S1610-33116	Stack Bearing Assembly	2.6672 OD	0.0002 L
		2.6784			2.6667	0.0117 L
S1610-33205	Spindle	1.5746 OD	S1610-33116	Stack Bearing Assembly	1.5743 ID	0.0003 T
		1.5741			1.5748	0.0007 L
S1610-33003-2	Hub	1.5615 ID	SB-2500-1	Bearing	1.5625 OD	0.0010 T
		1.5620			1.5620	0.0000 L to L
S1610-33205	Spindle	1.124 ID	S1610-33114	Plug	1.128 OD	0.004 T
		1.125			1.126	0.001 T

NOTE

ID ---Inside Diameter
L ---Loose
L to L---Line to Line
OD ---Outside Diameter
RBC ---Roller Bearing Company of America
T ---Tight

6–22. REASSEMBLY OF TAIL ROTOR SYSTEM.

6–23. REASSEMBLY OF HUB ASSEMBLY. (See figure 6–8.)

a. Support hub (1) and coat mating surfaces of hub (1) and bearings (23) with anti-seize compound, Federal Specification TT-A-580. Position drift cylinder, part No. S1670-10305, on bearing (23), and press bearing (23) into position in hub.

b. Turn hub (1) over and place spacer (24) in position.

c. Coat mating surfaces of hub (1) and bearing (25) with anti-seize compound, Federal Specification TT-A-580. Press bearing into position.

d. Apply a light coat of sealing compound, No. 101, manufactured by Garlock Packing Co. Palmyra, N.Y., to mating surface of hub and seals (21 and 26) and press seals into position.

e. Repeat procedure in steps *a* through *d* for installing bearings (23 and 25), spacer (24), and seals (21 and 26) in other three sections of hub (1).

f. Coat threads of lubrication fittings (27) with anti-seize thread compound, Federal Specification MIL-T-5544. Install lubrication fittings (27) in hub assembly (1).

g. Coat threads of lubrication fittings (27) with anti-seize thread compound, Federal Specification MIL-T-5544. Install lubrication fittings (27) in hub assembly (1).

6–24. REASSEMBLY OF SPINDLE ASSEMBLIES. (See figure 6–8.)

a. Press stop (20) into spindle (19) with a suitable tool. Seal around edge of stop with sealing compound, EC-1239, manufactured by Minnesota Mining and Mfg. Co., St. Paul, Minn.

b. Apply a light coat of sealing compound, No. 101, manufactured by Garlock Packing Co., Palmyra, N. Y., to bore of outer nut (18) and press seal (17) into outer nut (18) with drift plate, part No. S1670-10304.

c. Position thimble, part No. S1670-10435, on spindle (19) and lightly coat it with corrosion-preventive petrolatum, Military Specification MIL-C-11796. Press outer nut (18) and seal (17) into place. Remove thimble.

d. Paint plug (15) with zinc-chromate primer, Military Specification MIL-P-8585, and press into position while wet.

e. Coat mating surface of spindle with anti-seize compound, Federal Specification TT-A-580. Press stack bearing assembly (16, figure 6–8) on spindle with bearing pusher, part No. S1670-10362 or S1570-10264. (See figure 6–13.)

Figure 6–12. Pressing Out Seats, Bearings, Spacer, and Inner Race

CAUTION

Check that numbers etched on outside of stack bearing assembly (16, figure 6–8) are in consecutive order and etched converging lines form a V shape.

f. Install lockwasher (14, figure 6–8) and inner nut (12) and tighten inner nut to a torque of 125 foot-pounds using wrench, part No. S1670-10452, and a suitable torque indicating wrench, and obtain a 4 to 10 inch-pound rotational drag on stack bearing assembly (16). Bend down tang of lockwasher (14), maintaining a torque on inner nut of 115 to 135 foot-pounds.

g. Press sleeve (11) onto spindle (19). (See figure 6–14.) Handtighten outer nut (18, figure 6–8) on sleeve as the sleeve is being pressed onto spindle.

h. Tighten outer nut (18) to a torque of 140 to 180 foot-pounds, using the wrench assembly, part No. S1670-10451, or crowfoot attachment, part No. S1670-10334, and a suitable torque indicating wrench.

Note

Place torque indicating wrench at a 90-degree angle from long axis of wrench assembly or crowfoot attachment to obtain a correct torque reading.

i. Paint mating surface of arm (13, figure 6–8) with zinc-chromate primer, Military Specification MIL-P-8585.

j. Position arm (13) on flange of sleeve (11) and secure arm with bolts, washers, and nuts (9). Secure outer nut (18) and arm (13) together with lock wire.

k. Coat threads of lubrication fitting (10) with anti-seize compound, Federal Specification TT-A-580. Install lubrication fitting in sleeve.

l. Install pin (4), washers (3 and 7), thrust washers (2), and nut (6) that secure each spindle assembly (81) to hub assembly. Tighten nuts to a torque of 36 to 40 foot-pounds. Install cotter pins (5).

Note

Install thrust washers so that grooves face inboard.

6–25. INSTALLATION OF BLADES. (See figure 6–6.)

WARNING

Part No. S2615-30000 series tail rotor blades and part No. S1615-30100 series tail rotor blades are not interchangeable with each other and one must never be substituted for the other. Tail rotor blades, part No. S1615-30100-2, -8, and -8X, are interchangeable and any combination of these tail rotor blades may be used. Tail rotor blades, part No. S1610-30100-4, must never be used in combination with tail rotor blades, part No. S1615-30100-2, -8, or -8X. Any part No. S1615-30000 series tail rotor blade is interchangeable with any other part No. S1615-30000 series tail rotor blade, and any combination of this series tail rotor blade is permissible.

Note

This paragraph contains instructions for installing tail rotor blades on spindles of hub assembly. Instructions in this paragraph apply when replacing one or more blades.

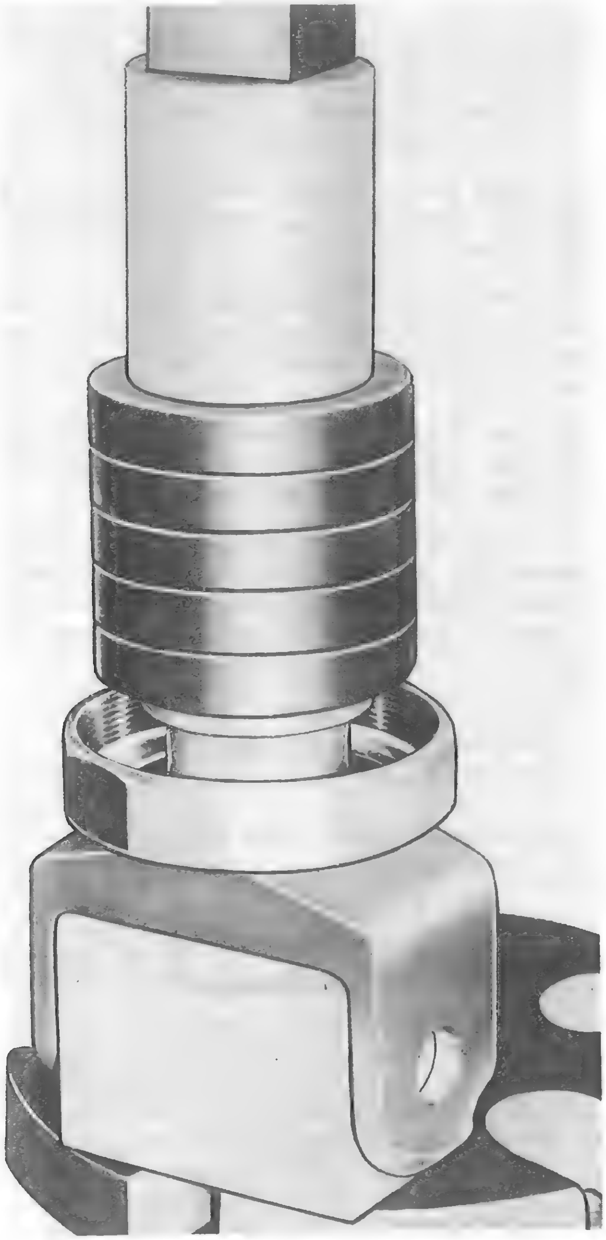


Figure 6–13. Pressing Stack Bearing Assembly on Spindle

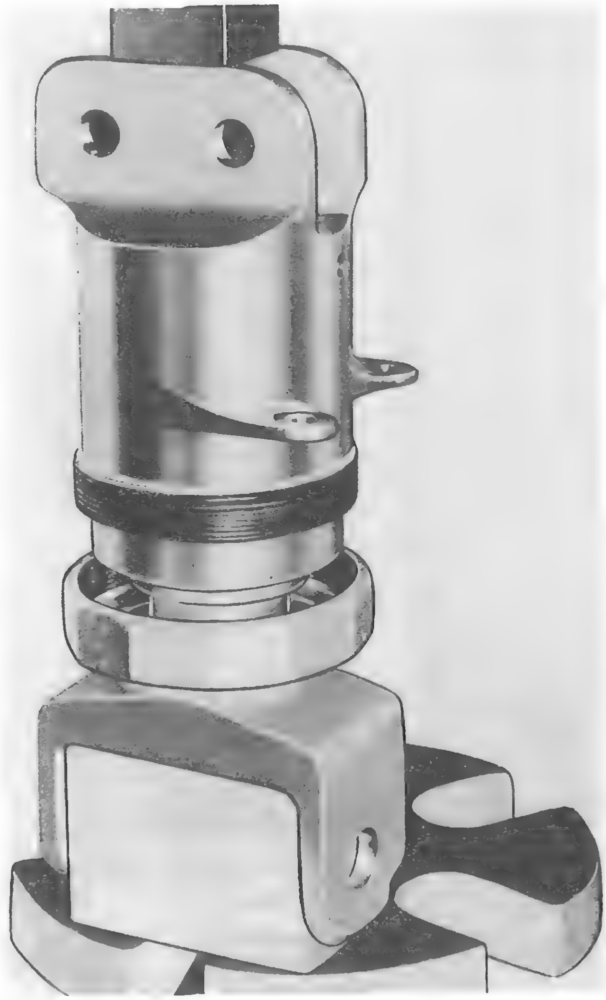


Figure 6–14. Pressing Sleeve on Spindle Assembly

Note

To install blades with spindles attached, refer to paragraph 6–26.

a. Position end of the tail rotor blade (3, figure 6–6) between ears of sleeve (4).

b. Measure gap between end of blade and ears of spindle assembly. Select a thickness of shims for existing gap. Amount of allowable gap shall not exceed 0.008 inch after shims have been installed. Refer to table 6–II for the proper combination of shims.

c. Secure tail rotor blade and shims to spindle assembly with bolts (1), washers, and nuts. Tighten nuts fingertight only.

Note

Shrink bolts for 30 minutes to 1 hour in a mixture of dry ice and primer, zinc-chromate primer, Military Specification MIL-P-8585, prior to installation. Install bolts while wet with primer.

d. Balance tail rotor assembly. (Refer to paragraph 6–43 or 6–44.)

Note

Tighten blade attachment nuts to a torque of 36 to 40 foot-pounds after balancing.

Table 6–11. Acceptable Tail Rotor Combinations

TAIL ROTOR INSTALLATION	COUNTERWEIGHT ASSEMBLY	TAIL ROTOR ASSEMBLY	BLADE	ASSEMBLY FITTING SHIMS		STEEL BALANCING SHIMS	HUB ASSEMBLY	SPLINE ASSEMBLY
				PHENOLIC	SYNTHANE			
S1610-30100-11	S1610-342000	S1610-31100-13	S1615-30100-2 (Light Spar)	S1615-30113 and/or S1615-30113-1 (Selective)	S1615-30113-4 and/or S1615-30113-5 (Selective)	S1614-30014-1 and/or S1615-30014-2 (Selective)	S1610-33000-1 (Light)	S1610-33112-1
S1610-30100-11	S1610-34200	S1610-31100-13	S1615-30100-8 (Light Spar)	S1615-30113 and/or S1615-30113-1 (Selective)	S1615-30113-4 and/or S1615-30113-5 (Selective)	S1615-30014-1 and/or S1615-30014-2 (Selective)	S1610-33000-1 (Light)	S1610-33112-1
S1610-30100-11	S1610-34200	S1610-31100-13	S1615-30100-8X (Light Spar)	S1615-30113 and/or S1615-30113-1 (Selective)	S1615-30113-4 and/or S1615-30113-5 (Selective)	S1615-30014-1 and/or S1615-30014-2 (Selective)	S1610-33000-1 (Light)	S1610-33112-1
S1610-30100-14	S1610-34200	S1610-31100-16	S1615-30100-2 (Light Spar)	S1615-30113 and/or S1615-30113-1 (Selective)	S1615-30113-4 and/or S1615-30113-5 (Selective)	S1615-30014-1 and/or S1615-30014-2 (Selective)	S1610-33000-2 (Heavy)	S1610-33112-1
S1610-30100-14	S1610-34200	S1610-31100-16	S1615-30100-8 (Light Spar)	S1615-30113 and/or S1615-30113-1 (Selective)	S1615-30113-4 and/or S1615-30113-5 (Selective)	S1615-30014-1 and/or S1615-30014-2 (Selective)	S1610-33000-2 (Heavy)	S1610-33112-1
S1610-30100-14	S1610-34200	S1610-31100-16	S1615-30100-8X (Light Spar)	S1615-30113 and/or S1615-30113-1 (Selective)	S1615-30113-4 and/or S1615-30113-5 (Selective)	S1615-30014-1 and/or S1615-30014-2 (Selective)	S1610-33000-2 (Heavy)	S1610-33112-1
S1610-30100-17	S1610-34200	S1610-31100-19	S1615-30100-4 (Heavy Spar)	NONE	S1615-30113-4 and/or S1615-30113-5 (Selective)	S1615-30014-1 and/or S1615-30014-2 (Selective)	S1610-33000-2 (Heavy)	S1610-33112-1

Notes:

1. Special spare, part No. S1610-31100-20, consists of hub assembly, part No. S1610-33000-2 (Heavy), and four spindle assemblies, part No. S1610-33112-1, less blades.
2. Special spare, part No. S1610-31100-21, consists of hub assembly, part No. S1610-33000-1 (Light), and four spindle assemblies, part No. S1610-33112-1, less blades.

6–26. INSTALLATION OF BLADES WITH SPINDLES ATTACHED. (See figure 6–7.)

WARNING

Part No. S1615-30000 series tail rotor blades and part No. S1615-30100 series tail rotor blades are not interchangeable with each other and one must never be substituted for the other. Tail rotor blades, part No. S1615-30100-2, -8, and -8X, are interchangeable and any combination of these tail rotor blades may be used. Tail rotor blades, part No. S1615-30100-4, must never be used in combination with tail rotor blades part No. S1615-30100-2, -8, and -8X. Any part No. S1615-30000 series tail rotor blade is interchangeable with any other part No. S1615-30000 series tail rotor blade, and any combination of this series tail rotor blade is permissible.

Note

This paragraph contains instructions for installing tail rotor blades, with spindles attached, on hub assembly. Instructions in this paragraph apply only when placing previously balanced tail rotor assemblies in service.

Note

To install only the blades on spindles of hub assembly, refer to paragraph 6–25.

a. Position blade, with spindle attached (2, figure 6–7), on arm of tail rotor hub assembly (3).

CAUTION

Each blade and spindle must be installed on proper arm of hub assembly to maintain balance of tail rotor assembly. Position of each blade and spindle on hub assembly is indicated by color coding on hub assembly and on spindle.

b. Position one thrust washer (4) between arm of hub assembly and each ear of spindle.

Note

Install each thrust washer with grooves on hub assembly sides.

c. Secure spindle to hub assembly with pin (1), washers, and nut. Tighten nut to a torque of 25 to 38 foot-pounds. Install cotter pin.

Note

Pin must be installed with head toward leading edge of blade.

6–27. LUBRICATION.

a. Hand pack all bearings with grease, Military Specification MIL-G-7711.

b. After reassembly, pressure lubricate tail rotor assembly with grease, Military Specification MIL-G-7711, at grease fittings.

6–28. REPLACEMENT OF BLADES. After 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.

WARNING

Part No. S1615-30000 series tail rotor blades and part No. S1615-30100 series tail rotor blades are not interchangeable with each other and one must never be substituted for the other. Tail rotor blades, part No. S1615-30100-2, -8, and -8X, are interchangeable and any combination of these tail rotor blades may be used. Tail rotor blades, part No. S1615-30100-4, must never be used in combination with tail rotor blades, part No. S1615-30100-2, -8, or -8X. Any part No. S1615-30000 series tail rotor blade is interchangeable with any other part No. S1615-30000 series tail rotor blade, and any combination of this series tail rotor blade is permissible.

CAUTION

Tail rotor blades are painted and balanced after fabrication. Any attempt to paint blades in field will change their balance and set up undesirable flight characteristics.

Table 6–III. Painting Requirements Tail Rotor Assembly and Parts

PART	INDEX AND FIGURE NO.	PAINT AND SPECIFICATION	NO. OF COATS	NOTES
*Arm	13, 6–4	Primer – MIL-P-8585A	1	Do not paint holes.
Sleeve	11, 6–4	Primer – MIL-P-8585A	1	Paint outside only. Do not paint holes and threads.
Outer nut	18, 6–4	Primer – MIL-P-8585A	1	Paint all exposed surfaces.
Inner nut	12, 6–4	Primer – MIL-P-8585A	1	Do not paint threads.
Spindle	19, 6–4	Primer – MIL-P-8585A	1	Paint outside surfaces of fork only.
Hub	1, 6–4	Primer – MIL-P-8585A	1	Do not paint holes.
Plug	15, 6–4	Primer – MIL-P-8585A	1	Do not paint threads.
Tail rotor assembly	----------	No. 604 Black Lacquer–MIL-L-6805	1	Paint all surfaces which have primer. Rubber stamp serial numbers on spindle, sleeve and hub. **Paint or apply tape identification stripes.

*Apply primer within 24 hours after paint removal.

**Paint identification strips in each sleeve and on adjacent part of hub with No. 502 Insignia Blue Lacquer, No. 506 Orange Yellow Lacquer, No. 509 Insignia Red Lacquer, and No. 514 Instrument Black Lacquer, Military Specification MIL-L-7178. One-half inch wide No. 600 (blue, yellow, red, and black) Scotch Brand pressure sensitive tapes, Federal Specification L-T-101(1), may be used on the sleeves. Paint Sikorsky tail rotor assembly No. on hub with white paint, Military Specification MIL-L-7178, or white ink, Federal Specification TT-1-558.

6–29. PAINTING. The painting requirements for the tail rotor assembly and its parts are listed in table 6–III.

6–30. COUNTERWEIGHT ASSEMBLY.

6–31. DESCRIPTION. A counterweight assembly is installed on the tail rotor gear output shaft between the gear box and the tail rotor assembly. The counterweight assembly is connected by four counterweight link assemblies to the arms of the spindle assembly. The counterweight assembly reduces the load on the tail rotor controls, thereby making the pedals easier to manipulate. The action of the counterweight assembly is completely automatic and no adjustment is necessary other than adjusting the length of the pitch change links while rigging the tail rotor flight controls.

6–32. REMOVAL.

a. Remove tail rotor assembly. (Refer to paragraph 6–9.)

b. Slide counterweight assembly (7, figure 6–2) off tail rotor gear box output shaft.

6–33. DISASSEMBLY OF COUNTERWEIGHT ASSEMBLY.

a. Remove bolts, washers, and nuts (18, figure 6–15) that secure counterweight link assemblies to counterweight brackets (19).

b. Loose check nuts (14 and 16) and remove rod-end bearings (13 and 17) from links (15). Remove check nuts from rod ends.

c. Remove bolts, washers, and nuts (6) that secure counterweights (7) to counterweight brackets (19).

d. Unscrew lubrication fittings (1) from nuts (2). Unscrew nuts (2) from counterweight brackets (19).

e. Remove bolts (3), washers (4 and 11), nuts (10), spacers (12), and cotter pins, that secure counterweight brackets (19) to support beam (9).

f. Press bearings (5) from counterweight brackets (19).

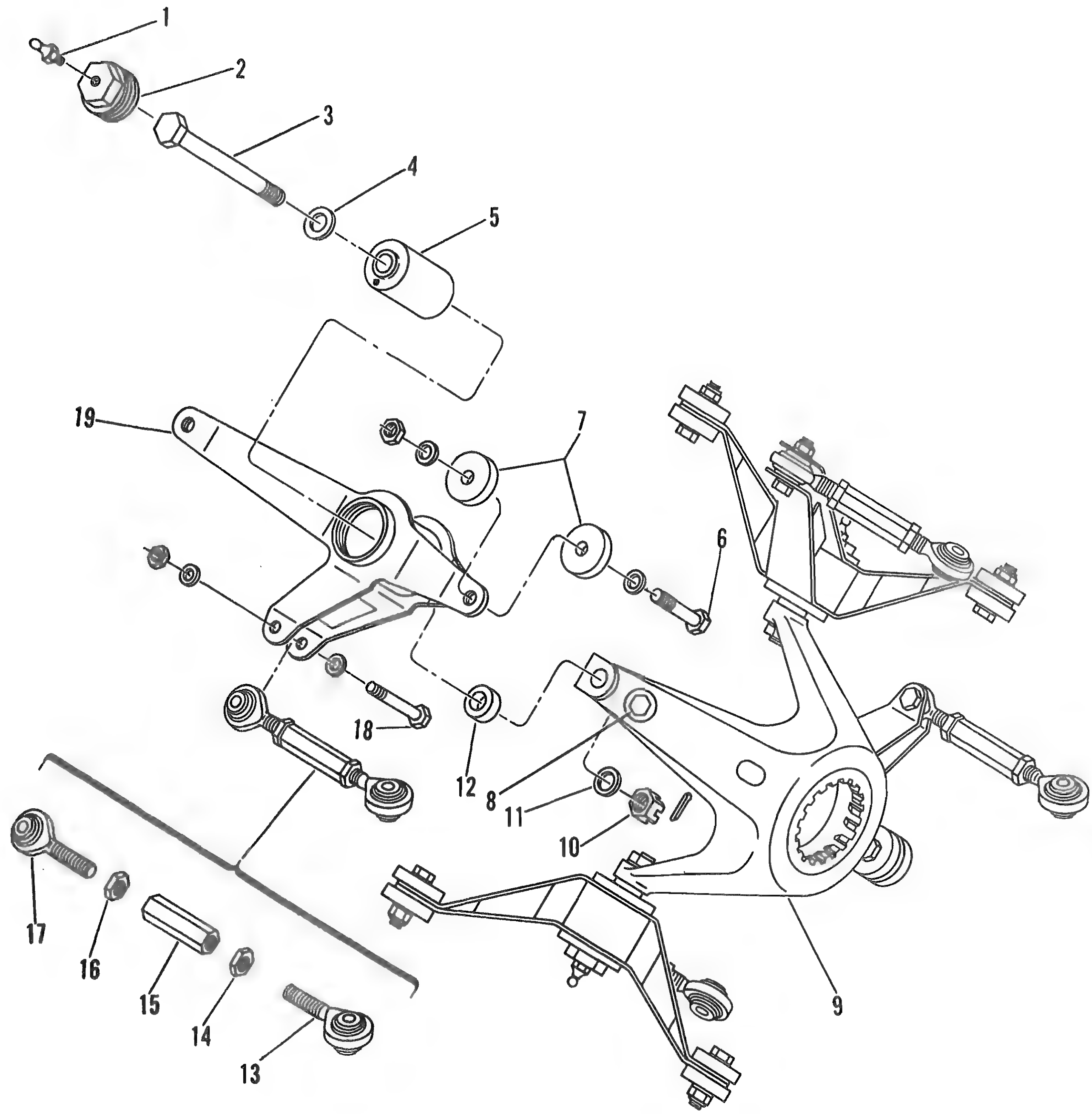
g. Remove balancing bolts, washers, and nuts (8) from support beam (9).

6–34. CLEANING. Clean all metal parts in drycleaning solvent, Federal Specification P-S-661.

6–35. INSPECTION.

a. Inspect all parts for damage, corrosion, and excessive wear.

b. Inspect the counterweight link assemblies. (Refer to paragraph 6–6.)



1. Lubrication Fitting
2. Nut
3. Bolt
4. Washer
5. Bearing
6. Bolt, Washers, Nut
7. Counterweight
8. *Bolt, Washers, Nut
9. Support Beam
10. Nut
11. Washer
12. Spacer
13. Rod-End Bearing
14. Check Nut
15. Link
16. Check Nut
17. Rod-End Bearing
18. Bolt, Washers, Nut
19. Counterweight Bracket

*Used for balancing only.

Figure 6–15. Counterweight Assembly – Disassembled

6–36. REASSEMBLY OF COUNTERWEIGHT ASSEMBLY. (See figure 6–15.)

a. Install balancing bolts, washers, and nuts (8) on support beam (9).

b. Press bearings (5) into counterweight brackets (19).

c. Position counterweight brackets (19) on support beam (9) with bolts (3), washers (4 and 11), nuts (10), spacers (12), and cotter pins.

CAUTION

Tighten bolts (3) and nuts (10) to a torque of 100 to 130 inch-pounds.

d. Screw nuts (2) into counterweight brackets (19). Tighten nuts to a torque of 50 to 100 inch-pounds. Screw lubrication fittings (1) into nuts (2).

e. Install counterweights (7) on counterweight brackets (19) with bolts, washers, and nuts (6).

f. Screw check nuts (14 and 16) on rod-end bearings (13 and 17). Screw rod ends into links (15). (Refer to CAUTION in paragraph 6–48 at end of step *e.*)

g. Adjust length of counterweight link assemblies and angle of rod ends in accordance with figure 6–3. Tighten check nuts. Secure rod ends to links with lock wire.

h. Install counterweight links (3, figure 6–2) at fork of counterweight bracket (8) with lubricator fittings on rod ends facing outboard. Select a thickness of shims that will eliminate any side play between rod ends and forks of counterweight brackets.

i. Fasten link assemblies to counterweight bracket with bolts, washers, and nuts. Tighten nut to a torque of 40 to 60 inch-pounds.

CAUTION

A pitch change link may be used in place of a counterweight assembly link if necessary, but the link must be readjusted as follows: Distance from center to center of hole (figure 6–4) in each rod-end bearing must be 4-3/8 ± 1/32 inches; angle between centerline of each rod-end bearing must be 53 degrees.

6–37. BALANCING COUNTERWEIGHT ASSEMBLY WITH SIKORSKY ARBOR ASSEMBLY. (See figure 6–16.)

Note

Balance counterweight assembly free of service lubricant except for lubricant in prepacked bearings. If counterweight assembly has been lubricated previously, assure an even distribution of grease by lubricating assembly with grease, Military Specification MIL-G-3278, at all lubrication fittings. Wipe off excess grease from external surfaces.

a. Level balancing stand, Kell-Strom part No. HSP-46, and balancing ways, part No. HSP-841.

b. Check arbor assembly, part No. S1670-10565, for balance by placing it on leveled balancing ways of balancing stand. If arbor assembly is out of balance, it will rotate on balancing ways. The heavy arm or arms will come to rest in a downward position.

CAUTION

Arbor assembly must be balanced as a unit to 0.2 inch-ounce.

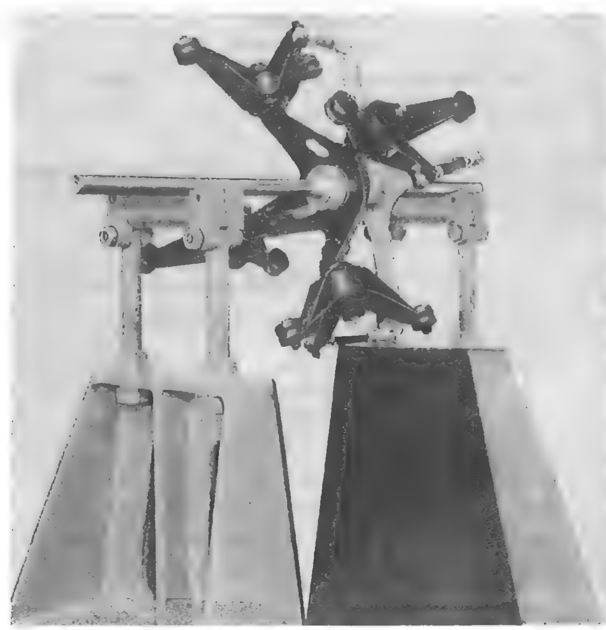


Figure 6–16. Balancing Counterweight Assembly with Sikorsky Arbor Assembly and Kell-Strom Balancing Stand And Cylindrical Balancing Ways

c. Slide counterweight assembly on balanced arbor assembly shaft, with flat surface of support beam against spacer on arbor assembly shaft.

d. Secure link assembly to four eyebolts.

Note

Make sure same number and type of bolts, washers, and nuts are used to secure link assemblies.

e. Slide cone on arbor assembly shaft and secure it with knurled nut. The knurled nut and cone secures and centers counterweight assembly on arbor assembly during balancing procedure.

f. Place arbor assembly, with attached counterweight assembly, on balancing ways. If counterweight assembly is out of balance, arbor assembly and counterweight assembly will rotate on balancing ways. Heavy arm or arms of support beam will come to rest in a downward position.

g. Balance counterweight assembly by installing part No. AN970-4 and AN960-416 washers under part No. AN365-428 balancing nut on light arm or arms of support beam.

h. Lift arbor assembly and counterweight assembly off balancing ways. Rotate it 90 degrees and place it on balancing ways.

CAUTION

Counterweight assembly must be balanced within 0.7 inch-ounce.

i. If there is an unbalanced condition, repeat steps *g* and *h*.

6–38. BALANCING COUNTERWEIGHT ASSEMBLY WITH MARVEL BALANCING KIT. (See figure 6–17.)

CAUTION

Balance counterweight assembly free of service lubricant except for lubricant in prepacked bearings. If counterweight assembly has been lubricated previously, assure an even distribution of grease by lubricating assembly with grease, Military Specification MIL-G-3278, at all lubrication fittings. Wipe off excess grease from external surfaces.

Note

All parts used in this balancing procedure are manufactured by Marvel Manufacturing Co.

a. Assemble balancing kits, part No. 7A050 and 7HEL051, following instructions enclosed in carrying case.

Note

Kit components provide for close tolerance slip fits. It is essential that all mating surfaces are thoroughly cleaned and freshly oiled before assembly.

b. Center adapter plate assembly, part No. 2238 (7HEL051 kit), on work stand. Place spacer, part

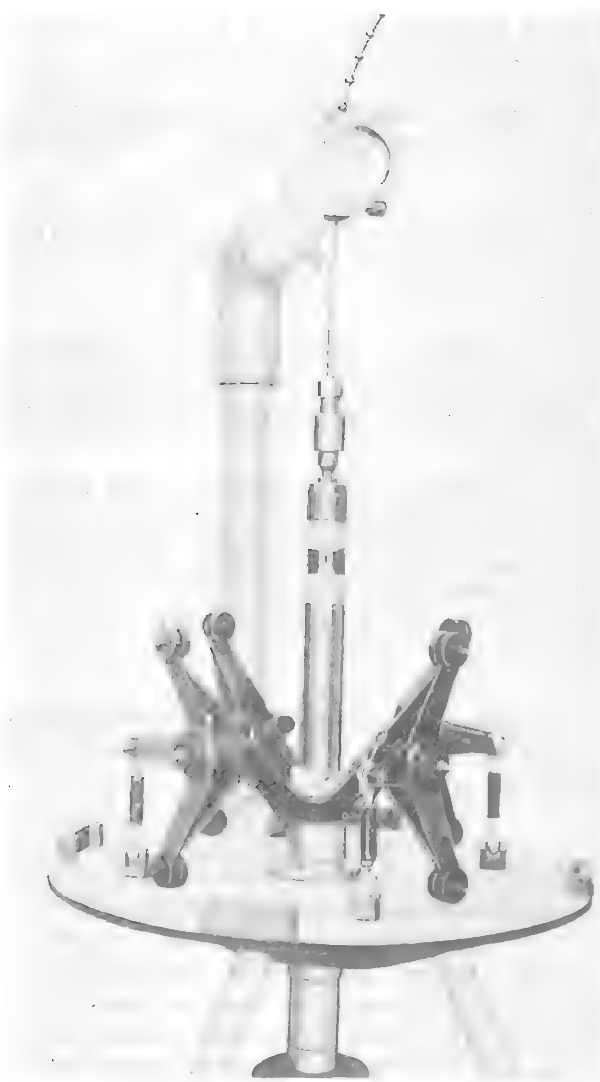


Figure 6–17. Balancing Counterweight Assembly with Marvel Balancing Kit

No. 2226, on hub of plate assembly with inside chamber upward.

c. Position counterweight assembly on part No. 2246 spacer with splines of support beam downward, so counterweight link assemblies fall within cut-outs of phenolic clevis blocks. Secure link assemblies to clevis blocks with four part No. AN4-13A bolts.

Note

Installation of nuts on four part No. AN4-13A bolts is not essential; frequent checks should be made to insure that bolts do not shift during balancing.

d. Install bushing, part No. 2242 (7HEL051 kit), on balancing arbor with pilot end down. Align top surface of bushing with 12-inch mark on balancing arbor scale. Lock bushing in position with setscrew.

e. Insert lower end of balancing arbor downward through support beam of counterweight assembly, spacer, and plate assembly. Push balancing arbor down until pilot end of bushing is firmly seated in support beam. Install spacers, part No. 2201, 2203, and 2204, over lower end of balancing arbor and install handwheel. Turn handwheel to clamp assemblies firmly together.

f. Install quick disconnect coupling, with 3/16-inch cable (7A050 kit), on suspension rod end that protrudes from arbor assembly. Install cable end of quick disconnect coupling in lifting plate of hydraulic pump located in forward section of upper arm of balancing stand.

g. Place hydraulic pump valve in closed position. Jack entire plate assembly and counterweight assembly approximately 1/2 inch off work stand.

h. Stop plate assembly and counterweight assembly from oscillating by using thumb and forefinger of each hand with palms braced against work stand.

i. Balance or out of balance is indicated by concentric (balanced) or eccentric (unbalanced) position of indicator bushing. Counterweight assembly is in balance when disc in top of arbor becomes continuously visible all around edge of indicator bushing. Unbalance is indicated when black disc appears wider on heavy side of assembly. Unbalance beyond permissible limits is apparent when black indicator disc appears as a crescent with one side missing entirely. (See figure 6–18.)

j. Bring counterweight assembly into balance by adding part No. AN970-4 and AN960-416 washers under part No. AN365-428 balancing nut or nuts on light arm or arms of support beam.

CAUTION

Counterweight assembly must be balanced within 0.7 inch-ounce.

k. Lower plate assembly and remove balanced counterweight assembly.

6–39. BALANCING COUNTERWEIGHT ASSEMBLY WITH MICRO-POISE BALANCING MACHINE. (See figure 6–19.)

CAUTION

Balance counterweight assembly free of service lubricant except for lubricant in prepacked bearings. If counterweight assembly has been lubricated previously, assure an even distribution of grease by lubricating the assembly with grease, Military Specification MIL-G-3278, at all lubrication fittings. Wipe off excess grease from external surfaces.

a. Place operating handle of balancing machine, part No. 9710, Micro-Poise Engineering and Sales Co., in locked position. Bring bubble to center of indicator dial (12, figure 6–19) by adjusting leveling bolt at base of machine.

Note

The bubble diameter on indicating dial must be 3/8 inch, the same diameter as inner circle on indicator dial (12).

b. Slide adapter (9), part No. 3437, Micro-Poise Engineering and Sales Co., on spindle (10). Position counterweight assembly (1) on adapter (9). Fasten counterweight link assemblies (8) to adapter (9).

c. Place cone (4) on spindle (10) so counterweight assembly (1) is centered on adapter (9). Install spindle nut (5) on center cone (4).

d. Move sliding weights (2 and 6) on upper and lower compensator arms (3 and 7) to zero (inboard) position. Release operating handle. Observe direction and magnitude of unbalance on indicator dial (12).

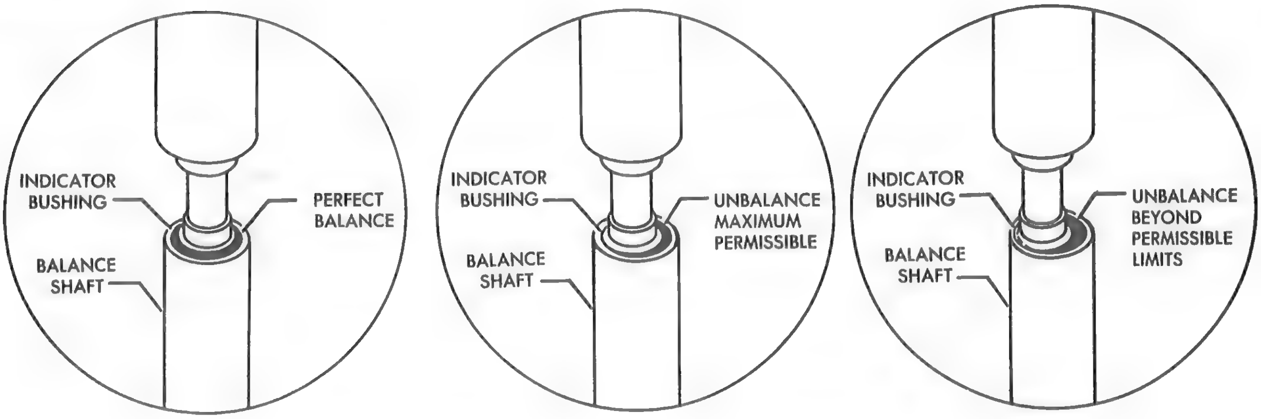
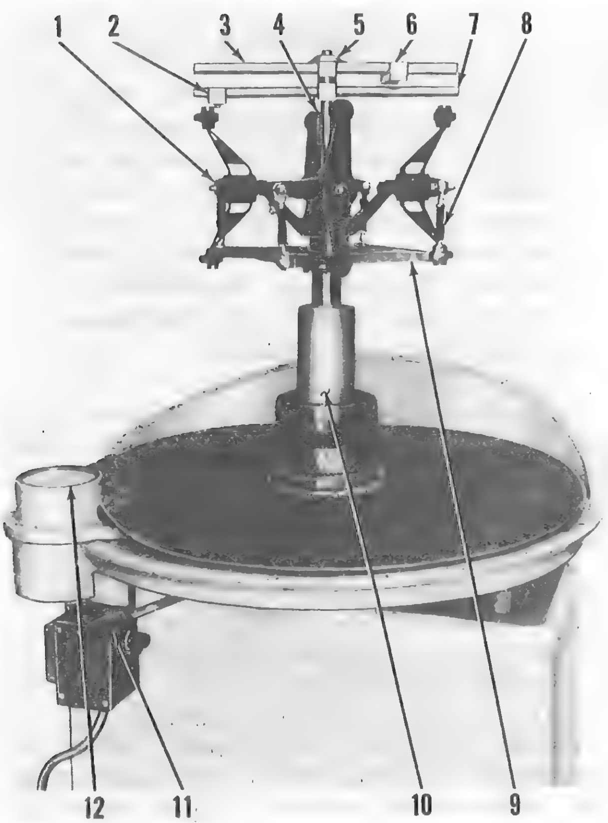


Figure 6–18. Balance Conditions On Marvel Arbor Assembly



1. Counterweight Assembly
2. Sliding Weight
3. Upper Compensator Arm
4. Cone
5. Spindle Nut
6. Sliding Weight
7. Lower Compensator Arm
8. Link Assembly
9. Adapter
10. Spindle
11. Operating Handle
12. Indicator Dial

Figure 6–19. Balancing Counterweight Assembly with Micro-Poise Balancing Machine

e. Rotate lower compensator arm (7) to corresponding angle of bubble. Move sliding weight (2) outboard until bubble zeros.

f. Place operating handle (11) in locked position. Loosen spindle nut (5) and rotate counterweight assembly (1) exactly 180 degrees. Tighten spindle nut.

g. Release operating handle (11) and, observing position of bubble, rotate upper compensator arm (3) to corresponding angle of bubble. Move sliding weight (6) outboard until bubble zeros.

h. Place operating handle (11) in locked position; note position of sliding weight (6) on large scale of upper compensator arm (3). Move sliding weight (6) inboard until it corresponds to same reading on small scale of upper compensator arm (3).

Note

Machine is now in balance. All unbalance is now in the counterweight assembly.

i. Release operating handle (11) and bring bubble to center of indicator dial (12) by installing or removing part No. AN970-4 and AN960-416 washers under part No. AN365-428 nut on support beam (9, figure 6–15).

CAUTION

Counterweight assembly must be balanced within 0.7 inch-ounce.

6–40. PREPARATION FOR STORAGE OR SHIPMENT. Prior to storage or shipment of counterweight assembly, prepare units as follows:

a. Using dry-cleaning solvent, Federal Specification P-S-661, clean all unprotected machined surfaces. Wipe clean with a lintless cloth.

b. Coat machined surfaces with a hot application of petrolatum, Military Specification MIL-C-11796.

c. Pack bearings with oscillating bearing grease, Military Specification MIL-G-25537.

d. Wrap coated surfaces in barrier material, Military Specification MIL-B-121, and secure with tape, Federal Specification PPP-T-60.

e. Place unit in cushioning material, Federal Specification PPP-C-843, and pack unit in a suitable box.

6–41. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove tape and barrier material.

b. Remove petrolatum from all surfaces with dry-cleaning solvent, Federal Specification P-S-661.

6–42. INSTALLATION OF COUNTERWEIGHT ASSEMBLY.

a. Slide counterweight assembly (7, figure 6–2) on tail rotor gear box output shaft.

CAUTION

Align index mark on support beam with index mark on tail rotor gear box output shaft.

b. Install tail rotor assembly. (Refer to paragraph 6–48.)

6–43. BALANCING TAIL ROTOR ASSEMBLY WITH SIKORSKY ARBOR ASSEMBLY. (See figure 6–20.)

Note

Balance tail rotor assembly less the counterweight assembly and links, and without pitch change beams and links. If possible, balance tail rotor assembly with hub and spindle assembly free of service lubricant except for lubricant in prepacked bearings. If tail rotor assembly has been lubricated previously, assure an even distribution of the grease by lubricating assembly with grease, Military Specification MIL-G-3278, at all lubrication fittings. Wipe off excess grease from external surfaces.

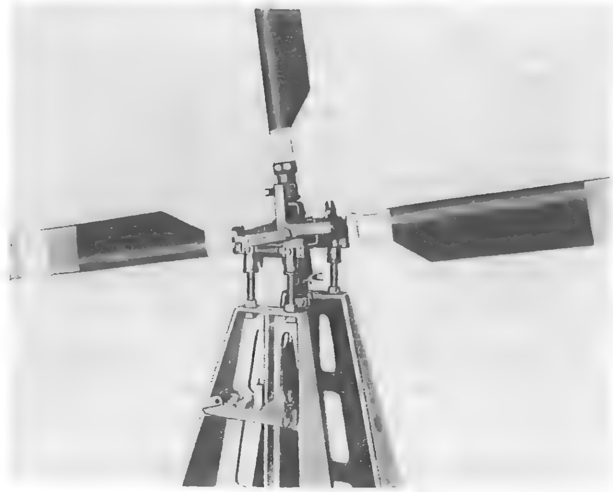


Figure 6–20. Use Of Tail Rotor Balancing Arbor

a. Install tail rotor assembly on balancing arbor assembly, part No. S1670-10301-12.

CAUTION

Do not attempt to use whole number balancing arbor, part No. S1670-10301, to balance tail rotor assembly.

b. Secure cylindrical balancing ways, Kell-Strom part No. HSP-841, to balancing stand, Kell-Strom part No. HSP-46. Place arbor on balancing ways.

c. Set two blades in a horizontal position and note which blade falls. Compensate lighter blade by placing steel shims and pairs of part No. AN960-816 or AN960-816L washers, if necessary, on nuts of blade attaching bolts. Do not remove nuts from blade attaching bolts.

Note

Rough adjustment balance weight is added by the steel shims. Fine adjustment balance weight is added by pairs of part No. AN960-816 or AN960-816L washers. Washers must be added in pairs with one washer of each pair on each blade attaching bolt to preserve balance.

d. When blades are close to balance, determine if they are within allowable tolerance by using two part No. AN960-916L washers as a tolerance weight gage. Place one washer on each blade attaching bolt of lighter blade. Observe whether or not blade comes into horizontal position or falls below horizontal.

Note

Tail rotor assembly must be balanced within 0.7 inch-ounce. Two tolerance weight washers, part No. AN960-816L, which furnish tolerance weight gage, are the equivalent of 0.7 inch-ounce when they are placed on blade attaching bolts. If lighter blade comes into horizontal position or falls below horizontal position, blades are satisfactorily balanced.

e. Remove two tolerance washers, part No. AN960-816L, and install remaining washers and shims under nuts of blade attaching bolts.

f. Set other pair of blades in a horizontal position and repeat steps *b* through *d.*

g. Recheck balance of blades which were balanced first.

h. Tighten blade attachment nuts on all blades to a torque of 36 to 40 foot-pounds.

6–44. BALANCING TAIL ROTOR ASSEMBLY WITH MARVEL BALANCING KIT. (See figure 6–21.)

Note

Balance tail rotor assembly less pitch change beams links and counterweight assembly. If possible, balance tail rotor assembly with hub and spindle assembly free of service lubricant except for lubricant in prepacked bearings. If tail rotor assembly has been lubricated previously, assure an even distribution of grease by lubricating assembly with grease, Military Specification MIL-G-3278, at all lubrication fittings. Wipe off excess grease from external surfaces.

a. Assemble Marvel balancing Kits, Marvel part No. 7A050 and 7HEL051, following instructions which are secured to inside of carrying case.

Note

Kit components provide for close tolerance slip fits. It is essential that all mating surfaces are thoroughly cleaned and freshly oiled before assembly.

b. Position tail rotor assembly (lubrication fittings downward) on plate assembly of balancing unit, so that heads of blade attaching bolts fall within cut-outs of support blocks.

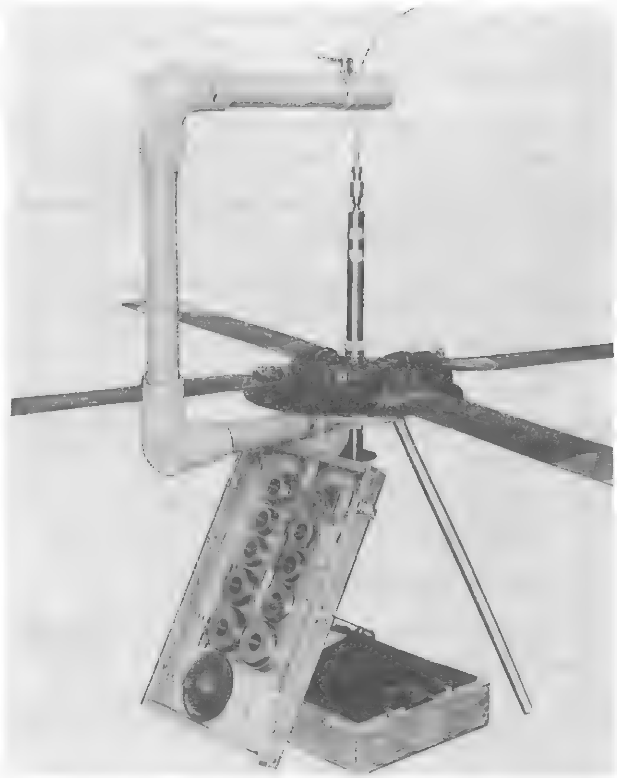


Figure 6–21. Balancing Tail Rotor Assembly with Marvel Balancing Kit

c. Install bushing, Marvel part No. 2242 (7HEL051 kit), on arbor with small diameter down. Align top surface of bushing with 11-inch mark on arbor scale and lock bushing in position with setscrew.

d. Insert lower end of arbor downward through part No. 2242 bushing, tail rotor hub, and adapter plate hub. Push arbor down until all components are seated firmly together. Install spacers, Marvel part No. 2203 and 2204, over lower end of balancing arbor and install handwheel. Turn handwheel to clamp assembly firmly together.

e. Tap shoulder of each blade hinge, adjacent to square-head bolts, lightly with a mallet. Insert two wedges Marvel part No. 2247, into each hinge between shoulder and spindle assembly. This wedging procedure simulates flight positioning of blades and eliminates variations in balance indications caused by slight shifting of blades on hinges.

CAUTION

Do not apply more than thumb pressure to wedges.

f. Install quick disconnect coupling, with 3/16-inch cable, on arbor suspension rod end and jack entire assembly approximately 1/2 inch off work stand.

g. Stop assembly oscillating by using thumb and forefinger of each hand with palms braced against work stand.

h. Balance or out of balance is indicated by the concentric (balanced) or eccentric (unbalanced) position of indicator bushing. Tail rotor assembly is in balance when disc in top of arbor becomes continuously visible all around edge of indicator bushing. Unbalance is indicated when black disc appears wider on heavy side of assembly. Unbalance beyond permissible limits is apparent when black indicator disc appears as a crescent with one side missing entirely. (See figure 6–18.)

i. Bring tail rotor assembly into balance by adding a maximum of three steel shims and a maximum of three pairs of part No. AN960-816 or AN960-816L washers to blade attaching bolts or as close to bolts as possible, where necessary. Do not remove nuts from blade attaching bolts at this time.

Note

Rough adjustment balance weight is added by steel shims. Fine adjustment balance weight is added by pairs of part No. AN960-816 or AN960-816L washers. To preserve balance, washers must be added in pairs with one washer of each pair on each attaching bolt of a given blade.

CAUTION

Tail rotor assembly must be balanced within 0.7 inch-ounce.

j. Install balancing washers and shims under nuts of blade attaching bolts.

k. Lower assembly to table, and tighten all blade attaching nuts to a torque of 36 to 40 foot-pounds. Raise assembly and recheck for proper balance as outlined in step *h.*

6–45. ACCEPTABLE TAIL ROTOR COMBINATIONS. Table 6–II outlines acceptable combinations of tail rotor assembly components. No combination of components should be used other than those shown in the table.

6–46. PREPARATION FOR STORAGE OR SHIPMENT. (See figure 6–22.)

a. Remove blades, with spindles attached, from tail rotor hub assembly. (Refer to paragraph 6–13.)

b. Pack blades, with spindles attached, in a shipping container in accordance with general specification for boxes, wood, cleated plywood, Federal Specification PPP-B-601, with leading edge of blade down.

c. Lubricate tail rotor hub and each spindle assembly. (Refer to lubrication chart in TM 55-1520-202-20.)

d. Coat all exposed machined surfaces and bushings with petrolatum, corrosion preventive, Military Specification MIL-C-11796.

e. Coat bearings of counterweight assembly with grease, Military Specification MIL-G-3278.

f. Wrap tail rotor hub assembly in barrier material, Military Specification MIL-B-121, and secure it with tape, Federal Specification PPP-T-60. Pack assembly in a suitable box.

CAUTION

If tail rotor hub assembly is to be shipped without blades, blade attaching bolts must be included with hub assembly. These bolts must be magnetic-particle inspected at each overhaul of hub assembly.

6–47. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove petrolatum from all surfaces with dry-cleaning solvent, Federal Specification P-S-661.

b. Lubricate tail rotor hub assembly. (Refer to lubrication chart in TM 55-1520-202-20.)

c. Install tail rotor blades, with spindles attached, on hub. (Refer to paragraph 6–26.)

6–48. INSTALLATION OF TAIL ROTOR ASSEMBLY AND PITCH CHANGE MECHANISM. (See figure 6–5.)

Note

For installation, use maintenance platform, part No. 47R16420.

a. Install balanced tail rotor assembly (3) on tail rotor gear box output shaft (4).

CAUTION

Align index mark on tail rotor assembly hub with index mark on tail rotor gear box output shaft.

b. Install lockwasher (1) and nut (2). Use anti-seize compound, Federal Specification TT-A-580, on nut. Tighten nut to a torque of 180 to 220 foot-pounds, using wrench, part No. S1670-10433-3. Bend down a tang of lockwasher to lock the nut.

c. On helicopters serial No. 54-2864 and subsequent, position boot (6, figure 6–2) on actuator shaft, with larger opening facing inboard. Work inboard end of boot over nut (2, figure 6–5.)

d. Install pitch change beam. (Refer to paragraph 4–169.)

e. Secure a pitch change link (1, figure 6–2) to each fork of pitch beam (2). Install bolt with head in direction of rotation. Lubrication fitting on rod-end bearing should be outboard. Install a thin washer under head of bolt, a thick and a thin washer under the nut, a thick washer between one side of rod-end bearing and fork, and a thin washer and fork. Place thin washer between rod-end bearing and shim. Peel shim as necessary to obtain best possible fit and eliminate any side play. Tighten nut to a torque of 40 to 60 inch-pounds. Install cotter pin.

CAUTION

Before installing a new link assembly (figure 6–3), a new link, or a new rod-end bearing, the following check should be performed: Measure overall length of link and distance from center of bolt hole to end of shank of each rod-end bearing. Rod-end bearings that measure 1-3/4 (1.750) ± 1/32 inches must be used only with a link that measures 1-31/32 (1.9687) inches. Rod-end bearings that measure 1-7/8 (1.875) ± 1/32 inches may be used with a link that measures either 1-3/4 (1.750) inches or 1-31/32 (1.9687) inches.

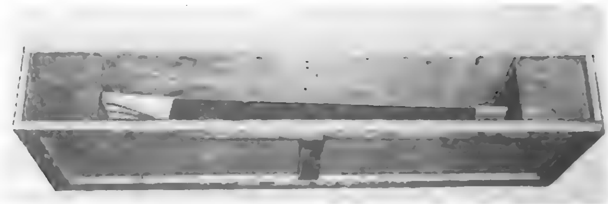


Figure 6–22. Tail Rotor Blade Shipping Container

CAUTION

A counterweight assembly link may be used in place of a pitch change link if necessary, but link must be readjusted as follows: Distance from center to center of hole in each rod-end bearing must be 4-9/16 (4.563) ± 1/32 inches; angle between centerline of each rod-end bearing must be 60 degrees.

f. Position rod-end bearing on each counterweight link (3, figure 6–2) in outboard fork of arm (4) on corresponding tail rotor sleeve. Check to see that rod-end bearing on each pitch change link (1) is in inboard fork of each arm (4). Secure links to each arm with bolt, washers, and nut. Install bolt with head toward tail rotor gear box output shaft. Install a thin washer under head of bolt and under nut, a thick washer between one side of each rod-end bearing and fork, and a thick washer and a shim between other side of each rod-end bearing and fork. Do not place shim against rod-end bearing. Peel shim as necessary to obtain best possible fit and eliminate any side play. Tighten nut to a torque of 40 to 60 inch-pounds.

Note

Rod-end bearing on end of each link must be positioned in forks of arm as outlined. With tail rotor blades in neutral, centerline of four weights on each counterweight bracket (8) should be approximately parallel with tail rotor gear box output shaft.

Note

For instructions on securing counterweight links to counterweight brackets, refer to paragraph 6–36, steps *b* and *i*.

g. Lubricate tail rotor hub and spindle assemblies, counterweight assembly bearings, and link bearings. (Refer to lubrication chart in TM 55-1520-202-20.)

b. Work tail rotor controls with auxiliary servo system off to ascertain that there is no binding or interference. Check tail rotor rigging. (Refer to paragraph 7–167.)

SECTION VII

FLIGHT CONTROLS

7–1. DESCRIPTION.

7–2. Flight controls consist of the cyclic control system, cyclic control stick trim system, collective pitch control system, flight controls hydraulic system, and tail rotor control system. (See figures 7–1 and 7–2.) Each of these systems have such common items in their mechanical linkage as push-pull rods and bell cranks, which provide mechanical linkage between components within the systems. The tail rotor system provides a means of compensating for main rotor torque and changing the heading of the helicopter. Hydraulic servos relieve control forces in the flight control systems.

7–3. COMMON MECHANICAL LINKAGE.

7–4. DESCRIPTION. Common mechanical linkage will be found as part of all systems covered in this section and consists of push-pull rods and bell cranks. (See figure 7–3.) The function of mechanical linkage within a system is to transmit a motion in one part of the vehicle to another part of the vehicle without necessarily following a straight line course.

7–5. PUSH-PULL ROD.

7–6. REMOVAL.

a. Remove cotter pin or lock wire from bolts (4, figure 7–3) in ends of push-pull rod assembly (1).

b. Remove nut (2), washer (3), and bolt (4) from both ends of push-pull rod assembly (1).

c. Lift push-pull rod assembly (1) from system.

d. For replacement of rods, refer to TM 55-405-3.

7–7. ADJUSTMENT. If center-to-center dimension is known, (table 7–I) proceed in the following manner for obtaining correct adjustment.

a. Back off on jam nuts (10, figure 7–3).

b. Screw rod-end bearings (9) in or out of push-pull rod (11) to obtain proper center-to-center dimension.

Note

Both rod-end bearings must be altered in the same direction and to the same amount.

c. Align rod-end bearings (9) for proper attachment to related units in the system.

d. Tighten jam nuts (10) and recheck center-to-center dimension.

e. Install lock wire if provisions for securing have been incorporated.

7–8. INSTALLATION.

a. Position push-pull rod assembly (1, figure 7–3) for proper alignment with related components of the system.

b. Install bolt (4), washer (3), and nut (2) in both ends of push-pull rod (1).

c. Install cotter pin or lock wire as appropriate.

7–9. BELL CRANK.

7–10. REMOVAL.

a. Remove any safetying devices at points of attachment to other linkage units.

b. Remove nut (2, figure 7–3), washer (3), and bolt (4) at all points where other linkage items attach to bell crank (8).

c. Remove nut (5), washer (6), and bolt (7) which fasten bell crank (8) to structure.

d. Remove bell crank (8) from system.

e. For replacement of bell cranks, refer to TM 55-405-3.

7–11. INSTALLATION. (See figure 7–3.)

a. Position bell crank (8) for proper alignment with related components of system.

b. Install bolt (4), washer (6), and nut (5).

c. Tighten nut to proper torque.

d. Position other linkage items, as required, to bell crank and secure.

e. Safety all points of attachment as required.

7–12. CYCLIC CONTROL SYSTEMS.

7–13. DESCRIPTION. (See figure 7–1.) The cyclic control system provides directional control of the helicopter by changing angle of incidence of the main rotor. Moving the cyclic control stick

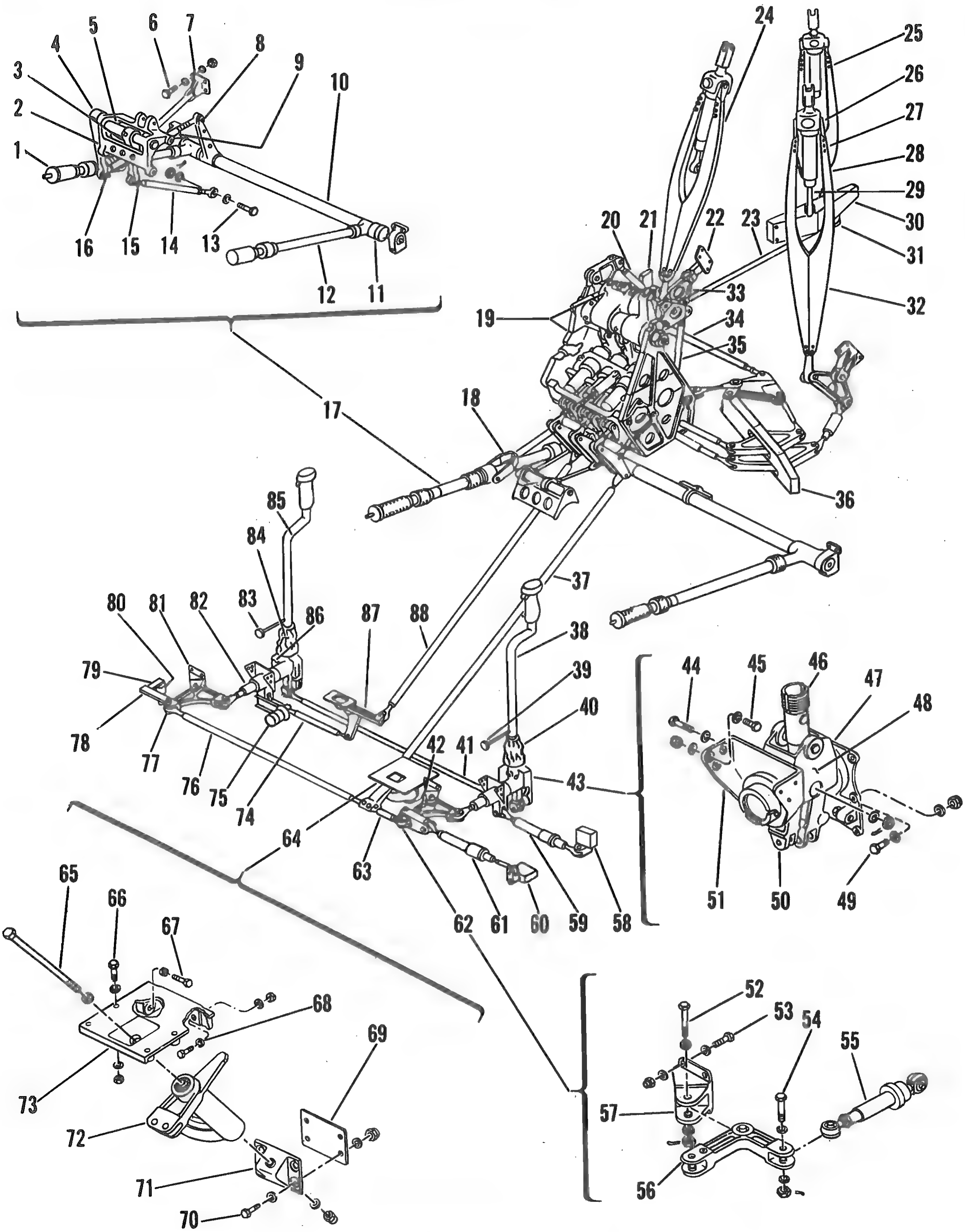


Figure 7–1. Main Rotor Flight Control System (Sheet 1 of 2)

1. Pilot's Collective Pitch Control Stick
2. Bracket
3. Arm Assembly
4. Arm Assembly
5. Tube Assembly
6. Bolt, Washers, Nut
7. Bracket
8. Bolt
9. Rod
10. Shaft
11. Shaft Assembly
12. Copilot's Collective Pitch Control Stick
13. Bolt, Washers, Nut, Cotter Pin
14. Rod
15. Bolt, Washer, Nut, Cotter Pin
16. Bolt, Washer, Nut, Cotter Pin
17. Collective Pitch Controls Installation
18. Drag
19. Auxiliary Servo and Mixer Unit
20. Rod
21. Support
22. Support
23. Rod
24. Control Arm and Primary Servo Unit Assembly
25. Control Arm and Primary Servo Unit Assembly
26. Fitting
27. Bolts, Washers, Nuts
28. Control Arm and Primary Servo Unit Assembly
29. Servo Unit
30. Support
31. Bell Crank
32. Control Arm
33. Bell Crank
34. Rod
35. Rod
36. Support
37. Rod
38. Copilot's Cyclic Control Stick
39. Disconnect Plug
40. Boot
41. Rod
42. Universal
43. Socket and Yoke Assembly Universal
44. Bolt, Washers, Nut, Cotter Pin
45. Bolt, Washers, Nut
46. Copilot's Socket Assembly
47. Support
48. Copilot's Yoke Assembly
49. Bolt, Washers, Nut
50. Yoke
51. Support
52. Bolt, Washers, Nut, Cotter Pin
53. Bolt, Washers, Nut
54. Bolt, Washers, Nut, Cotter Pin
55. Rod
56. Bell Crank
57. Support
58. Lateral Magnetic Brake Unit
59. Lateral Stick Trim Cylinder
60. Fore-and-Aft Magnetic Brake Unit
61. Fore-and-Aft Stick Trim Cylinder
62. Bell Crank and Support Assembly
63. Rod
64. Bell Crank and Support Assembly
65. Bolt, Washers, Nut
66. Bolt, Washers, Nut
67. Bolt, Check Nut
68. Bolt, Washers, Nut
69. Shim
70. Bolt, Washers, Nut
71. Copilot's Support
72. Copilot's Bell Crank Assembly
73. Copilot's Support
74. Rod
75. *Canceller
76. Rod
77. Bell Crank
78. *Link
79. *Arm
80. *Canceller
81. Support
82. Rod
83. Disconnect Plug
84. Boot
85. Cyclic Control Stick and Socket
86. Pilot's Support and Yoke Assembly
87. Bell Crank
88. Rod

*Model CH-34C

Figure 7–1. Main Rotor Flight Control System (Sheet 2 of 2)

in any direction causes the aircraft to move in that direction by tilting the main rotor. The cyclic control system consists of the following components: A pilot's and copilot's cyclic control stick, a socket and yoke assembly located at the base of each control stick, control rods extending from each socket and yoke assembly to bell cranks and the mixer assembly, and control rods extending aft to the bell cranks and the main rotor servo units. The grip of each control stick contains control switches.

7–14. CYCLIC CONTROL STICK.
(See figure 7–4.)

7–15. REMOVAL.

a. Disconnect pilot's and copilot's cyclic control stick electrical wiring (1) at disconnect plug (2) located a few inches forward of control sticks. Remove bolts (3) which secure boot (4) and remove boot.

b. Back off knurled nut (5) securing copilot's cyclic control stick (6) to copilot's socket

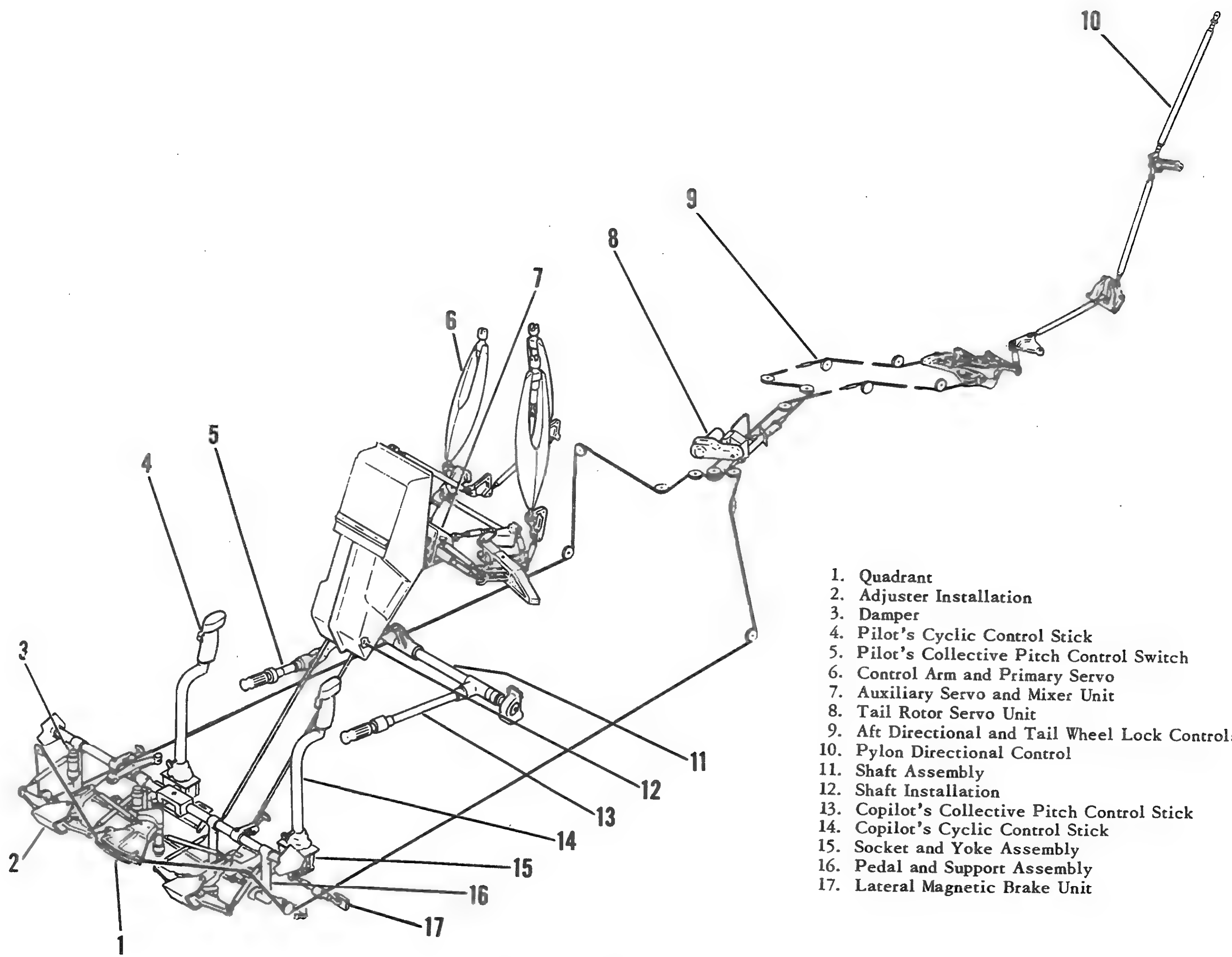


Figure 7–2. Flight Control System

Table 7–1. Basic Flight Control Rod Lengths

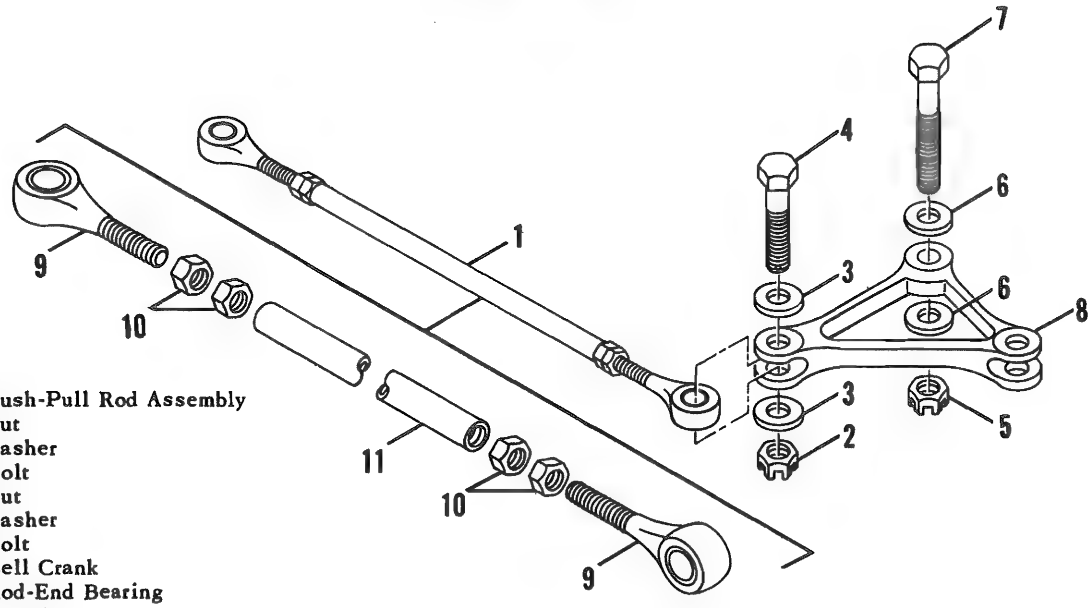
ROD ASSEMBLY INDEX AND FIGURE NO. (INSTALLATION AND REMOVAL)	ROD ASSEMBLY INDEX AND FIGURE NO. (FOR RIGGING PROCEDURE)	*LENGTH (CENTER-TO-CENTER OF MOUNTING BOLT HOLES IN INCHES)
82, figure 7–1	9, figure 7–28	Adjustable
88, figure 7–1	41, figure 7–28	Adjustable
40, figure 7–5	20, figure 7–28	4-1/16
20, figure 7–1	25, figure 7–28	19-7/16
23, figure 7–1	22, figure 7–28	23-3/32
11, figure 7–5	39, figure 7–28	8-9/32
9, figure 7–5	38, figure 7–28	6-17/32
34, figure 7–1	26, figure 7–28	13-11/16
–	30, figure 7–28	8-27/32
–	28, figure 7–28	11
–	34, figure 7–28	Adjustable
–	35, figure 7–28	Adjustable
9, figure 7–1	–	6-1/8
14, figure 7–1	42, figure 7–28	Adjustable
37, figure 7–1	43, figure 7–28	Adjustable
55, figure 7–1	48, figure 7–28	Adjustable
63, figure 7–1	1, figure 7–28	4-5/8
41, figure 7–1	45, figure 7–28	Adjustable
74, figure 7–1	6, figure 7–28	11
76, figure 7–1	4, figure 7–28	Adjustable
153, figure 7–20	8, figure 7–36	Adjustable
127, figure 7–20	2, figure 7–36	Adjustable
45, figure 7–20	13, figure 7–36	10-7/8 (S1640-64009-3)
45, figure 7–20	13, figure 7–36	10-23/32 (S1640-61157-6)
71, figure 7–20	22, figure 7–36	Adjustable
69, figure 7–20	20, figure 7–36	44-5/32 (S1640-64007-1)
69, figure 7–20	20, figure 7–36	44-5/16 (S1640-61157-5)
73, figure 7–20	17, figure 7–36	26-7/16 (S1640-64009-2)
73, figure 7–20	17, figure 7–36	26-3/8 (S1640-61157-4)
75, figure 7–20	15, figure 7–36	Adjustable
119, figure 7–20	1, figure 7–36	Adjustable
123, figure 7–20	3, figure 7–36	16-5/8
151, figure 7–20	6, figure 7–36	Adjustable
150, figure 7–20	7, figure 7–36	15-5/8

*Note: All rod lengths given are basic. If necessary, the rod assemblies with adjustable rod ends may be adjusted to obtain proper rigging.

assembly (7) of copilot's socket and yoke assembly. Remove control stick by sliding it up and out of copilot's socket.

e. Remove bolt (8) which secures cyclic control stick and socket assembly (9) to yoke of pilot's support and yoke assembly (10). Remove control stick by sliding it up and out of yoke.

7–16. DISASSEMBLY (MODEL CH-34C). (See figure 7–4.) Disassembly of the cyclic control stick grip consists primarily of removing the electrical



1. Push-Pull Rod Assembly
2. Nut
3. Washer
4. Bolt
5. Nut
6. Washer
7. Bolt
8. Bell Crank
9. Rod-End Bearing
10. Jam Nut
11. Push-Pull Rod

Figure 7–3. Typical Control Linkage Installation

switches from the grip. All switches are removable. The method of removal of each switch depends on type and location of switch involved. The instructions in this paragraph cover all switches used in grip assemblies on CH-34 series helicopters. A small amount of slack exists in the electrical wiring (1) inside stick. However, additional slack may be necessary to disconnect wiring at a switch. This additional slack may be obtained as outlined below.

Note

The grip on the cyclic control stick may be disassembled without removing the cyclic control stick from the helicopter, even though the logical sequence is after removal from the helicopter.

a. To obtain additional slack in electrical wiring inside cyclic control stick, disconnect wiring (1) at the plug (2) located near the base of the stick. Remove bolt (11) that secures grip to stick. Remove grommet at hole where wiring enters stick. Push wiring into stick. With bolt removed grip can be removed from stick if desired.

b. To remove hoist switch (12), locate spot of putty just below switch. The putty appears as a dull round spot. Remove putty to expose screw head (13) recessed in grip. Remove screw and washer. Slowly work switch out of grip.

c. Removal of CARGO SWITCH (14), CARGO TRIM RELEASE (15), or AUTO STAB. RELEASE (16) switches may be accomplished by firmly grasping switch housing with a pair of flat nose pliers. While exerting an alternating left-hand then right-hand twisting motion, maintain a steady firm pull in the outward direction of the longitudinal axis of the switch.

CAUTION

Gradually decrease the outward force as the switch begins to clear the grip to prevent unnecessary damage to the wiring.

1. Electrical Wiring
2. Plug
3. Bolt
4. Boot
5. Nut
6. Cyclic Control Stick
7. Socket Assembly (Co-pilot)
8. Bolt
9. Socket Assembly (Pilot)
10. Yoke Assembly
11. Bolt
12. Hoist Switch
13. Screw
14. Cargo Switch
15. Trim Release Switch
16. Auto. Stab. Release Switch
17. Mike Switch
18. Pin
19. Screws

Figure 7–4. Cyclic Control Stick (Sheet 1 of 2)

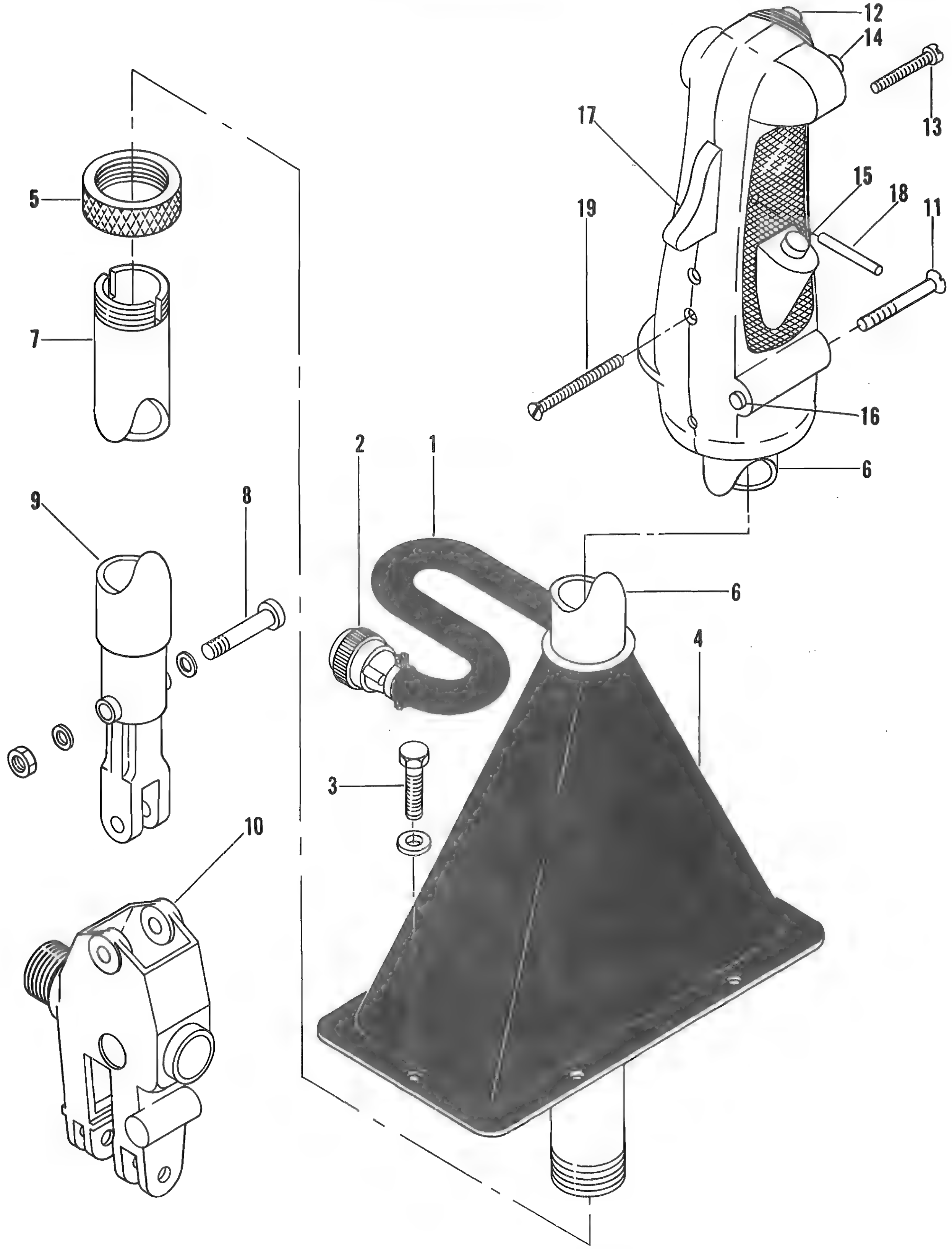


Figure 7–4. Cyclic Control Stick (Sheet 2 of 2)

Note

Switches removed in this manner should not be reinstalled. Removal should be accomplished as outlined above only on switches determined to be definitely defective.

d. To remove red trigger for MIKE (17) switch from front of grip, remove black putty from small hole in outboard end of boss located at each side of trigger to expose ends of pin (18) on which trigger pivots. Place a small-diameter drift against right end of pin and gently tap pin completely out of grip. Remove trigger.

CAUTION

Pin must be removed from right to left, as viewed when sitting in pilot's or copilot's seat, because it is serrated. Pressure applied in the opposite direction will break the grip.

e. To remove MIKE switch, remove grip from stick as outlined in step *a.* It is recommended that red trigger also be removed as outlined in step *d.* Locate the two spots of putty on front of grip slightly below the trigger hole. The putty appears as dull, round spots. Remove putty to expose screws (19) recessed in grip. Remove screws. Pull switch out of bottom of grip.

f. To remove trigger detent mechanism, remove screw and nut located on right side near top of grip. Remove spring. Do not attempt to remove bushing. Tip grip and shake out ball. If ball sticks, remove tension mechanism as outlined in step *g*, install detent spring and screw, and tighten screw to push ball into tension mechanism cavity.

g. To remove tension mechanism, remove cap nut from top of grip; this nut contains a screwdriver slot. Remove spring and piston. Do not attempt to remove bushing.

7–17. REPAIR OR REPLACEMENT. Replace only those switches known to be defective.

7–18. REASSEMBLY. (See figure 7–4.)

a. To install MIKE switch, check switch for proper operation of contacts in both positions and for security of all bonded joints. Pay particular attention to small brass plate containing two tapped holes. Push switch up into position through bottom of grip with small brass plate to rear. Align holes in switch with holes in front of grip and install screws (19). Tighten screws snugly but do not overtighten.

b. To install red trigger for MIKE switch (17), position trigger between bosses at front of grip. Insert pin (18) on which trigger pivots in hole in right boss. Tap pin through trigger and into left boss. Use a small-diameter drift to seat pin.

CAUTION

Pin (18) must be installed from right, as viewed when sitting in pilot's or copilot's seat, because it is serrated. These serrations will cause grip to break if pin is installed from left.

c. After installing MIKE switch (17) or red trigger, depress trigger slowly to be sure it actuates both positions of switch. If necessary, position of switch, relative to trigger, can be adjusted slightly be tightening one of the screws (19) that secure switch in grip. Adjust, as necessary, to obtain proper operation of switch.

d. To install trigger tension mechanism, place a small amount of graphite grease on long part of piston at shoulder between large and small diameters. Drop piston into bushing in top of stick with flange end up. Insert spring into bushing and onto end of piston. Install cap nut and turn it down as far as it will go.

e. To install trigger detent mechanism, drop ball into bushing in right side near top of grip. Insert spring. Install nut on screw and install screw in bushing. Turn screw in to provide enough detent tension to prevent accidental actuation of MIKE switch. Hold screw stationary and tighten nut.

f. To install red button CARGO (14), TRIM REL (15) or AUTO STAB REL switch (16), align switch with hole in grip and slowly push switch into grip until it is seated.

g. To install HOIST switch (12), hold switch with key at bottom. Push switch into grip with key aligned with screw hole just below switch.

h. Replace any putty that was removed at MIKE switch mounting screws (19), trigger pin (18), and HOIST switch screw.

i. If grip was removed from stick, check entire visible length of wiring to see that no wires are kinked. Separate wires opposite bolt hole in base of grip into two even bundles to allow bolt (11) to pass between them. Position grip on stick and secure it.

j. If grommet was removed, pull enough wiring out of stick to allow plug (2) to be connected to receptacle located at base of stick. Move stick through all extreme positions and check for sufficient slack in wiring outside stick. Install grommet.

k. Check for proper operation of system controlled by each button in grip.

7–19. INSTALLATION. (See figure 7–4.)

a. Position pilot's cyclic control stick and socket assembly (9) in yoke of pilot's support and yoke assembly (10); secure with bolt, washer, and nut.

b. Position copilot's cyclic control stick (6) into copilot's socket assembly (7) of copilot's yoke assembly.

c. Secure by tightening knurled nut (5).

d. Replace boot (4) and secure with bolts (3).

WARNING

Inspect boot for possible signs of deterioration. Replace boot if it is deteriorating. A defective boot allows water to collect in pilot valve area, causing corrosion or freezing of controls.

e. Connect cyclic control stick wiring.

f. Check adjustment of stick trim system. (Refer to paragraph 7–59.)

7–20. SOCKET AND YOKE ASSEMBLY.

7–21. REMOVAL. (See figure 7–1.)

a. Remove pilot's cyclic control stick as outlined in paragraph 7–15.

b. Remove clutch compartment access door to gain access to control rods, bell cranks, and socket and yoke assembly.

c. Remove rods as outlined in paragraph 7–6.

d. Remove bell cranks as outlined in paragraph 7–10.

e. Remove support (51, figure 7–1), copilot's yoke assembly (48), and copilot's socket assembly (46) as a unit.

f. Remove socket assembly from yoke assembly.

g. Remove and disassemble pilot's support and yoke assembly (86) in same manner as copilot's socket and yoke assembly.

7–22. INSTALLATION.

a. Install pilot's support and yoke assembly (86, figure 7–1).

b. Install copilot's socket assembly (46) and yoke assembly (48).

c. Place support (47) in position on cabin forward bulkhead; secure with bolts and lock wire.

d. Install copilot's socket assembly (46) in yoke (50). Install nut on yoke and turn fingertight.

e. Place yoke in position in support (47). Secure support (51), tighten nut, and install cotter pin.

Note

Avoid tightening nut so as to cause binding of bearings in supports (47 and 51) on helicopters incorporating sockets which allow bearings to move shim as required to eliminate end play in yoke in excess of 0.005 inch.

f. Install pilot's cyclic control stick.

7–23. MIXER ASSEMBLY.

7–24. DESCRIPTION. (See figure 7–5.) The mixer assembly is located next to the auxiliary servo unit and is functionally tied into the auxiliary servo. The purpose of the mixing unit is to receive the mechanical movement of both the cyclic and collective control sticks in the pilots' compartment and mix these movements into a single mechanical movement which is transmitted through mechanical linkage to the main rotor blades. The mixing unit is composed of levers, push-pull rods, and bell cranks so arranged as to achieve the function as outlined.

7–25. REMOVAL. (See figure 7–5.)

a. Remove rods as outlined in paragraph 7–6.

b. Remove bell cranks as outlined in paragraph 7–10.

c. Remove mixer and auxiliary servo assembly as a unit by disconnecting hydraulic lines and removing it from transmission deck between stations 112 and 121. On Model CH-34C, disconnect plugs that connect servo motors to motor box assembly.

d. Disconnect and remove links (23) linking mixer to servo.

e. Remove caps (4 and 13) from supports (16 and 31), and remove mixer assembly.

7–26. REPAIR.

7–27. INSTALLATION.

a. Place mixer assembly in position on supports (16 and 31, figure 7–5) and install caps (4 and 13).

b. Tighten bolts, securing cap (4) to support (31), to a torque of 320 to 390 inch-pounds.

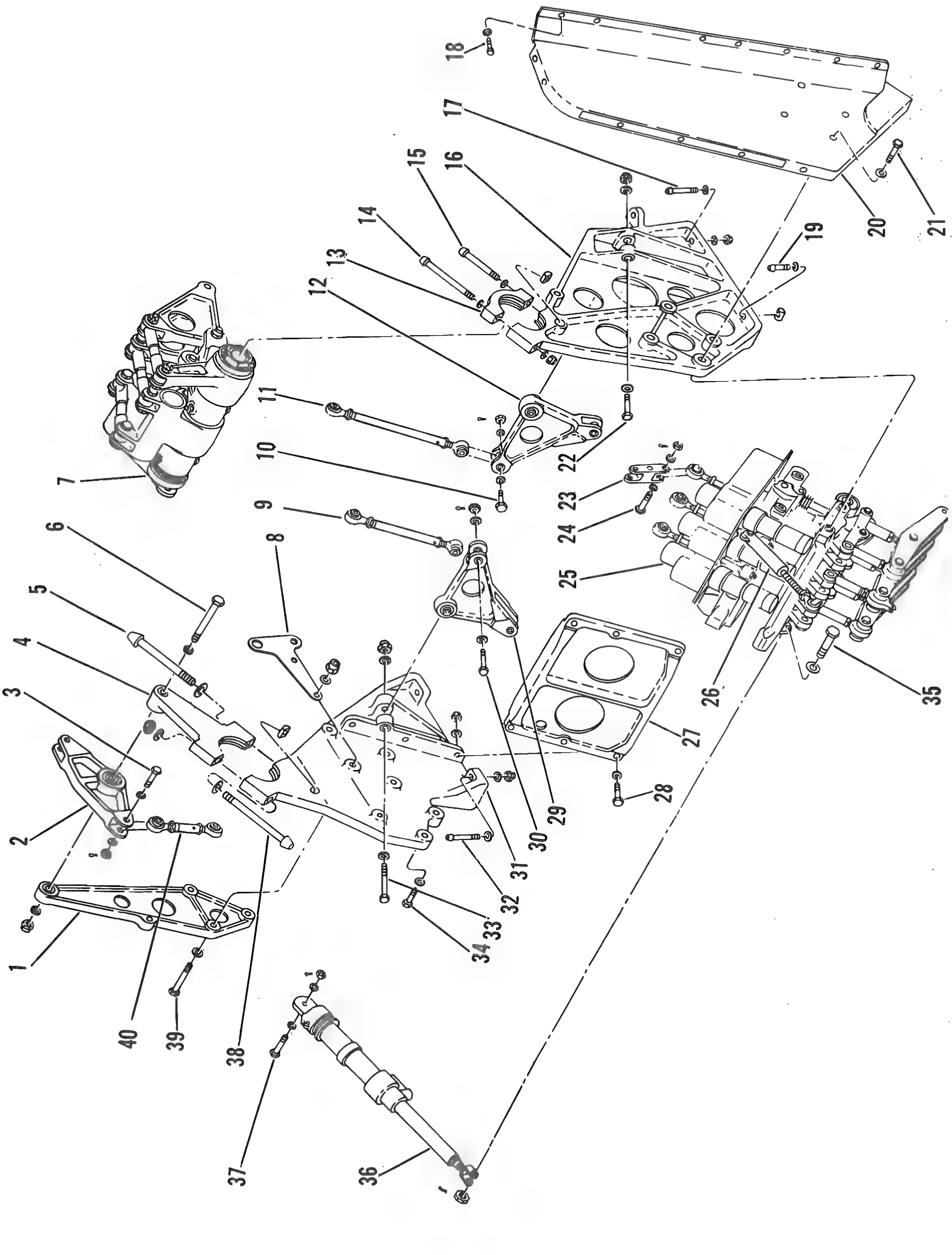


Figure 7-5. Auxiliary Servo and Mixing Unit (Sheet 1 of 2)

1. Bracket
2. Bell Crank Assembly
3. Bolt,Washers,Nut, Cotter Pin
4. Cap
5. Bolt, Washer, Nut
6. Bolt, Washers, Nut
7. Mixer Assembly
8. Bracket
9. Rod Assembly
10. Bolt, Washers, Nut, Cotter Pin
11. Rod Assembly
12. Bell Crank Assembly
13. Cap
14. Bolt, Washers, Nut
15. Bolt, Washer, Barrel Nut
16. Support
17. Bolt, Washers, Nut
18. Bolt, Washer
19. Bolt, Washer, Barrel Nut
20. Support
21. Bolt, Washer
22. Bolt, Washers, Nut
23. Link
24. Bolt, Washers, Nut, Cotter Pin
25. Servo Unit Assembly
26. Collective Open-Loop Spring Cylinder
27. Beam
28. Bolt, Washers, Nut
29. Bell Crank Assembly
30. Bolt, Washers, Nut, Cotter Pin
31. Support
32. Bolt, Washers, Nut
33. Bolt, Washers, Nut
34. Bolt, Washer
35. Bolt, Washer, Nut, Cotter Pin
36. Actuating Cylinder
37. Bolt, Washer, Nut, Cotter Pin
38. Bolt, Washers, Nut
39. Bolt, Washers, Nut
40. Rod Assembly

Figure 7–5. Auxiliary Servo and Mixing Unit (Sheet 2 of 2)

c. Tighten bolts, securing cap (13) to support (16), to a torque of 100 inch-pounds.

d. Place servo and mixer assembly in position on transmission deck and secure.

e. Tighten bolts, securing left-hand side of servo and mixer assembly, to a torque of 80 to 100 inch-pounds.

f. Tighten bolts, securing right-hand side of servo and mixer assembly, to a torque of 180 to 225 inch-pounds.

g. Replace bell cranks as outlined in paragraph 7–11.

h. Replace rods as outlined in paragraphs 7–6 and 7–8.

i. Connect hydraulic lines.

7–28. MAIN ROTOR AUXILIARY SERVO UNIT.

7–29. DESCRIPTION. (See figures 7–6 and 7–7.) 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 torque shaft which rotates to bypass the hydraulic oil when the auxiliary hydraulic system is shut off, and on Model CH-34C, the three servo motor assemblies for control of the pilot valve and power pistons by the automatic stabilization equipment. 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 movement of the controls. Movement of the pilot valves is accomplished manually through the flight control or electronically and mechanically by the automatic stabilization equipment and servo motor assemblies. 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 motor box cover between the pilot and the copilot.

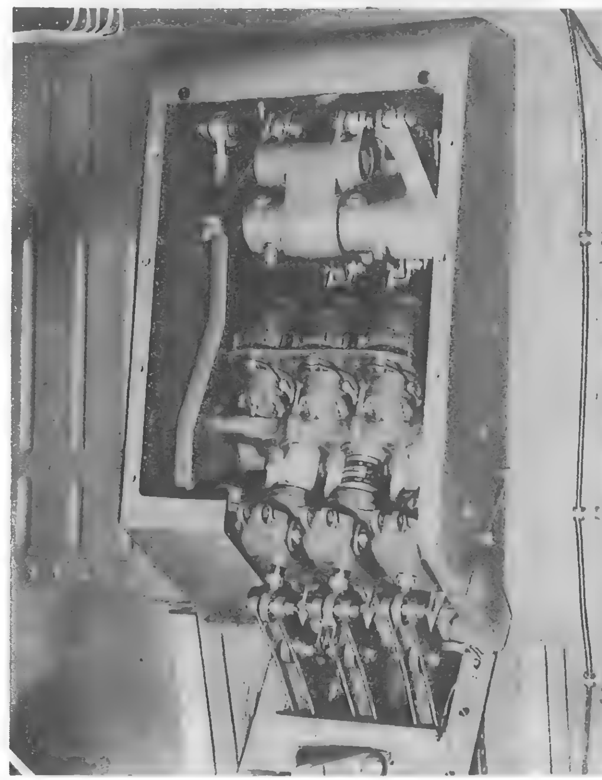
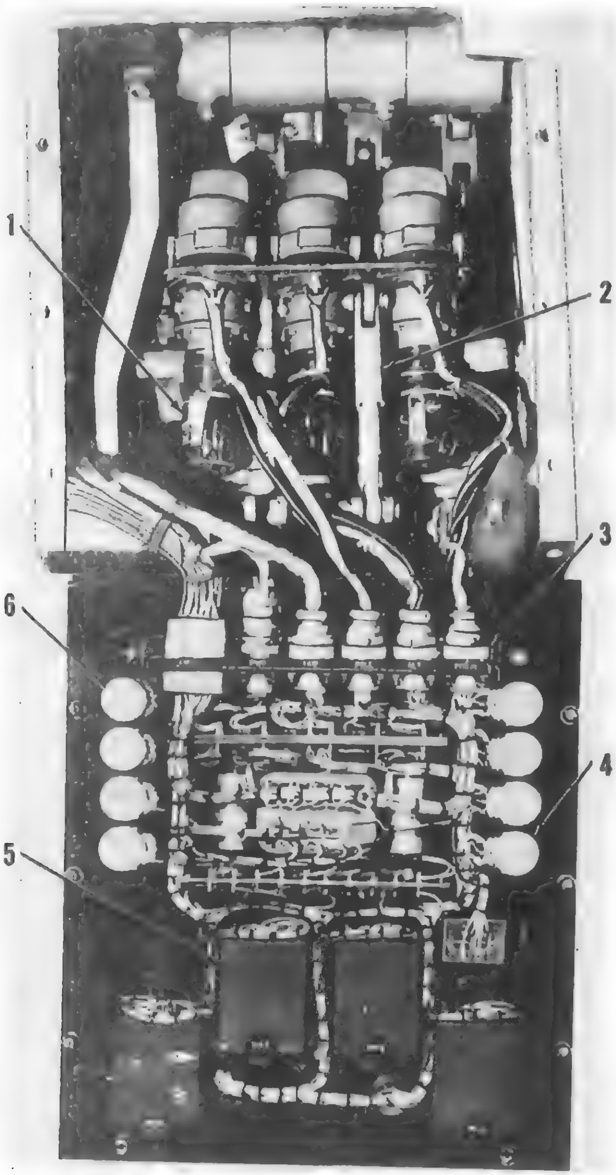


Figure 7–6. Main Rotor Auxiliary Servo and Mixer Installed (CH-34A)



1. Servo Motor
2. Collective Open-Loop Spring Cylinder
3. Motor Box Disconnect Plug
4. F.U. Null Adjustment Potentiometers
5. Magnetic Amplifier
6. TECH GEN Adjustment Potentiometers

Figure 7–7. Main Rotor Auxiliary Servo Unit and Motor Box Assembly Installed (CH-34C)

7–30. REMOVAL.

a. Remove pilot's seat. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

b. On Model CH-34A, hinge down and remove panel (1, figure 7–8) from upper servo and mixer cover. Unfasten and remove lower cover (2) from main drive shaft tunnel. Remove bolts from right-hand panel supporting covers (3). Remove panel (4).

c. On Model CH-34C, hinge down motor box top panel in pilots' compartment and disconnect wiring from motor box. Remove motor box assembly (5). Unfasten and remove lower cover assembly (6) from main drive shaft tunnel. Remove bolts from right-hand panel (7).

d. Remove bolts, washers, nuts, and cotter pins (8) securing links (9) on mixer assembly to aft end of piston. Disconnect links from aft end of piston.

e. Remove bolts, washers, nuts, and cotter pins (10 and 11) securing control rods (12) to input arms on servo unit. Disconnect control rods from input arms.

f. Hinge down right service platform. Disconnect hydraulic lines (13) to servo unit at servo unit bracket inboard of right transmission support assembly and at forward end of servo unit.

g. Remove bolt, washer, and nut (14) securing fork on actuating cylinder assembly (15) to lever (16) on servo unit (18).

h. Remove bolts and washers (17) securing servo unit (18) to panel supporting covers. Remove servo unit; then remove hydraulic tubing (19).

7–31. CLEANING. Clean exposed surfaces of power pistons with a soft, clean cloth dampened in hydraulic fluid, Military Specification MIL-H-5606.

7–32. PREPARATION FOR STORAGE OR SHIPMENT.

a. Fill servo unit with preservative hydraulic fluid, Military Specification MIL-H-6083. Clean the servo unit with dry-cleaning solvent, Federal Specification P-S-661. Coat external machined surfaces, except power pistons with petrolatum, Military Specification MIL-C-11796.

b. Wrap unit in barrier material, Military Specification MIL-B-121, and secure with tape, Federal Specification PPP-T-60.

c. Pack unit securely in a suitable box.

7–33. PLACING IN SERVICE AFTER SHIPMENT. Unpack unit, drain preservative hydraulic fluid, and strip petrolatum from exterior surfaces with dry-cleaning solvent, Federal Specification P-S-661.

7–34. REPAIR. (Refer to TM 1-1HA1-5-3-53.)

7–35. INSTALLATION.

a. Install sections of hydraulic tubing (19, figure 7–8.) Position servo unit (18) and secure to panel supporting cover with bolts and washers (17). Secure bolts with lock wire.

b. Connect fork of actuating cylinder assembly (15) to lever on servo unit.

WARNING

Bolt must be installed with bolt head on auxiliary servo side. Install washer under bolt head.

c. Connect servo unit hydraulic lines (13) at bracket on transmission deck and at forward end of servo unit.

d. Connect control rods (12) to input arms on servo unit and install cotter pins.

e. Position washers and bolt (8) thru links (9) on mixer assembly to aft ends of power pistons. Install cotter pins.

f. Apply a source of 1000 to 1500 psi pressure to auxiliary servo hydraulic system and check for a clearance of 0.002 to 0.007 inch between cam and roller. (See detail A, figure 7–9.) Adjust, if necessary, at fork of actuating cylinder.

Note

Hydraulic pressure may be obtained by running the engine or by connecting an external pressure source at disconnect panel on right side of engine.

g. On Model CH-34A, secure right-hand panel (4, figure 7–8) to canted bulkhead. Fasten lower cover (2) to main drive shaft tunnel. Install and hinge panel (1) into position.

h. On Model CH-34C, position automatic stabilization equipment motor box covers at canted bulkhead and secure right-hand panel (7) of cover assemblies in place. Fasten lower cover assembly (6) to main drive shaft tunnel. Install motor box cover assembly and connect wiring to motor box. Hinge and install top panel in position.

WARNING

Motor box covers must be securely fastened to prevent seepage of exhaust fumes into cockpit.

i. Install pilot's seat. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

7–36. TESTING.

a. Apply 1500 psi hydraulic pressure to auxiliary servo system.

b. Back off collective pitch friction adjustment so that stick motion is not restrained.

c. Loosen rod-end jam nut (6, figure 7–10) at lower end of collective open-loop spring cylinder. Slide washer along shaft (5) so rod end is free to turn.

d. If collective pitch stick drops when released after being placed in mid position, screw shaft (5) out of rod end until stick remains stationary.

e. If stick rises when released, screw shaft (5) into rod end until it remains stationary. Secure rod-end jam nut.

f. Check main rotor flight control rigging. (Refer to paragraph 7–143.)

g. Check automatic stabilization equipment. (Refer to TM 55-1520-202-20, Chapter 2, Section X.)

h. Check helicopter's flight control system to insure that it is properly rigged. (Refer to paragraph 7–141.)

i. On Model CH-34C, place automatic stabilization equipment in standby. (Refer to turn-on procedures for testing equipment, TM 55-1520-202-20, Chapter 2, Section X.)

j. Null servo motors electrically and mechanically. (Refer to servo motor bind check, TM 55-1520-202-20, Chapter 2, Section X.) Check null indicator for proper operation. (Refer to null indicator check in TM 55-1520-202-20, Chapter 2, Section X.)

k. Center cyclic control sticks and pull up collective control sticks approximately 3 inches.

l. Switch auxiliary hydraulic pressure on and off while holding control sticks fixed. At same time, observe cyclic and collective control sticks for signs of movement.

Note

A sudden displacement of control sticks, called stick jump, may occur even though sticks are held.

m. If one or more of control sticks jump more than 1/8 inch while being held, stick jump is present and steps *n* through *p* are to be followed. If there is no jump, or jump is 1/8 inch or less, omit steps *n* through *p*.

Note

Amount of stick displacement is measured at top of control sticks.

n. Determine in which channel stick jump occurs by switching auxiliary hydraulic pressure

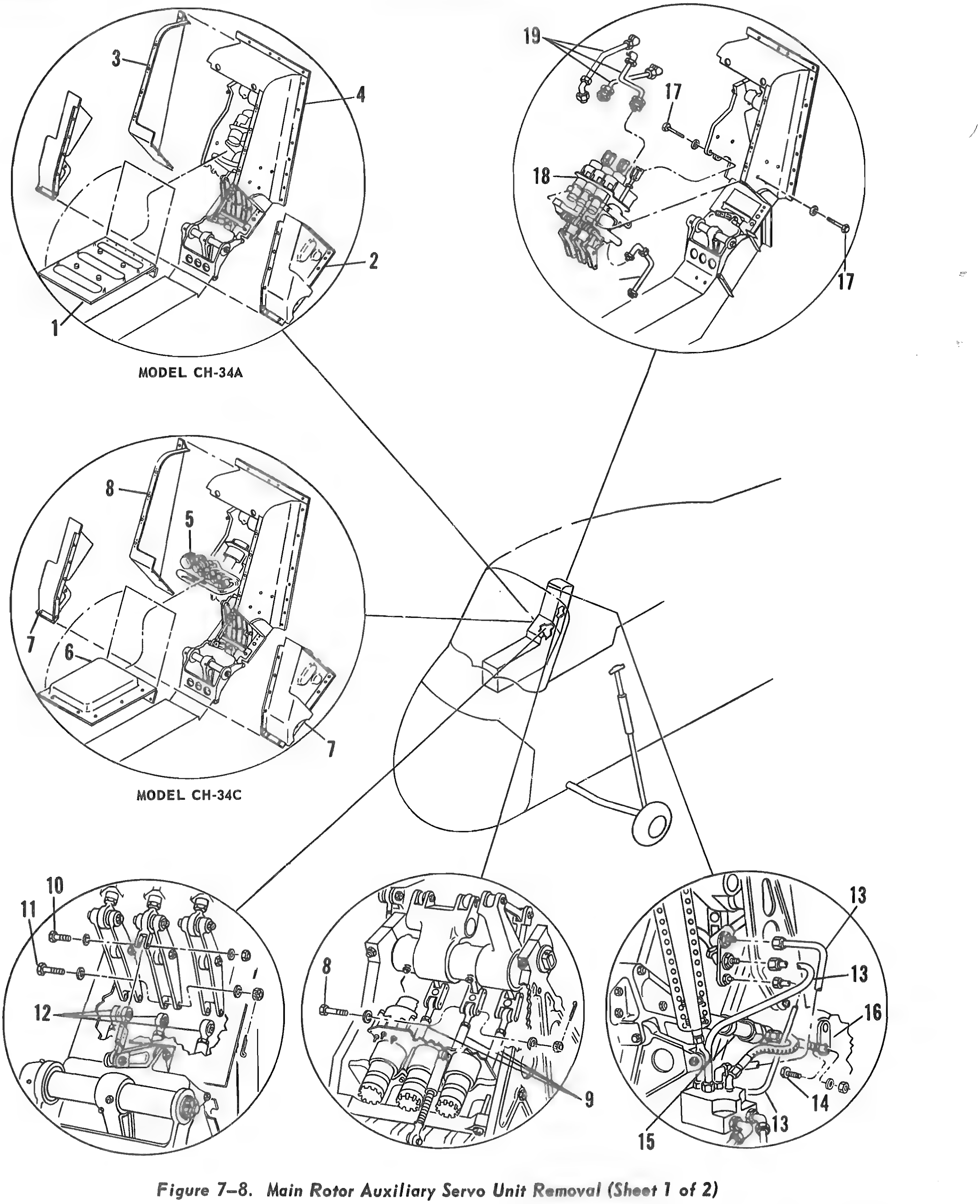


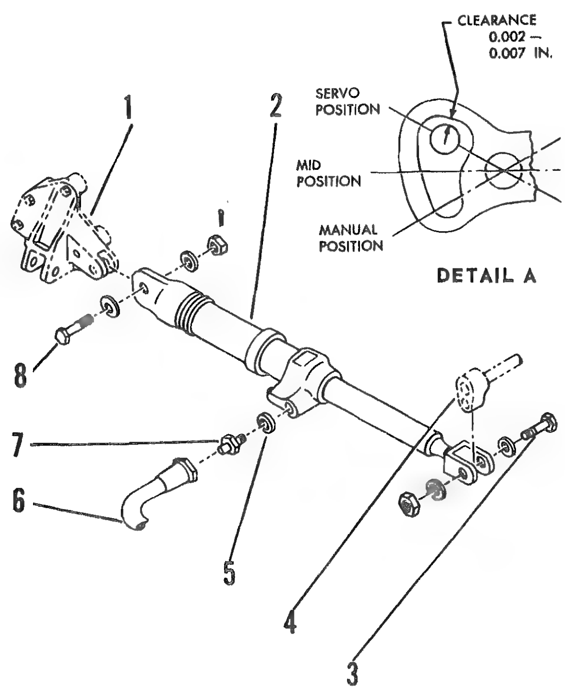
Figure 7–8. Main Rotor Auxiliary Servo Unit Removal (Sheet 1 of 2)

1. Panel
2. Lower Cover
3. Right-Hand Panel Support Cover
4. Panel
5. Motor Box Assembly
6. Lower Cover Assembly
7. Right-Hand Panel
8. Bolt, Washers, Nut, Cotter Pin
9. Links
10. Bolt, Washers, Nut
11. Bolt, Washers, Nut, Cotter Pin
12. Control Rods
13. Hydraulic Lines
14. Bolt, Washer, Nut
15. Cylinder Assembly
16. Lever
17. Bolts, Washers
18. Servo Unit
19. Hydraulic Tubing

Figure 7–8. Main Rotor Auxiliary Servo Unit Removal (Sheet 2 of 2)

on and off and at same time observe stick that moves and direction of movement. If cyclic stick moves left or right, jump is in roll channel. If cyclic stick moves fore and aft, jump is in pitch channel. If cyclic stick moves diagonally, jump is in roll and pitch channels. If collective stick jumps, jump is in altitude channel.

o. Loosen dust cover on servo motor whose channel is causing stick jump. Loosen and tighten screw and nut that secure servo motor to mounting plate on servo unit. Tighten this nut only



1. Support
2. Actuating Cylinder Assembly
3. Bolt, Washers, Nut
4. Lever Arm
5. Gasket
6. Hydraulic Hose
7. Union
8. Bolt, Washers, Nut, Cottor Pin

Figure 7–9. Actuating Cylinder Assembly Removal

within its standard torque and do not exceed values for it. Repeat steps *l* and *m*.

p. If procedures outlined in step *o* fails to eliminate stick jump, refer to paragraph 7–37.

7–37. ADJUSTMENT OF PILOT VALVE.

a. Remove auxiliary servo unit from helicopter. (Refer to paragraph 7–30.)

b. Mount auxiliary servo unit in a suitable fixture that will hold it rigid.

c. Disconnect open-loop spring cylinder.

d. Connect servo motors to receptacles on lower right side of test panel assembly of the automatic stabilization equipment bench test kit, part No. S1670-10085-1.

Note

Servo motor that is on same side as lever attached to cam rollers is connected to receptacle marked ROLL. Servo motor in center is connected to receptacle marked ALTITUDE. Remaining servo motor is connected to receptacle marked PITCH.

e. Connect an external source of hydraulic pressure to auxiliary servo unit. This source of hydraulic pressure must be capable of producing 1500 psi at 5 to 5-1/2 gallons per minute.

Note

Pressure hose is connected to upper port on same side as lever. Return line is connected to port on opposite side.

f. Start hydraulic pressure equipment and apply 1500 psi to servo. Cycle all three banks by hand several times to insure that system has no air trapped within it. Stop pistons in approximately their center position and turn off hydraulic power.

g. Place a 5/16 x 12-inch piece of drill rod through lower holes in input arms so that they are held together.

h. Remove hydraulic return line and in its place install a pipe that is approximately 2 feet long.

i. Cut lock wire on three rod end assemblies at bottom of servo unit.

j. Start test panel assembly of automatic stabilization equipment bench test kit and place it in STANDBY.

k. Null each servo motor separately by turning NULL IND CONTROL switch to that position for servo motor that is to be nulled, and using a screwdriver, adjust F. U. NULL until null indicator shows that servo motor is electrically nulled.

l. Lock bypass arm in manual position. (See detail A, figure 7–9.)

m. Apply hydraulic pressure.

Note

Use a clean container to catch hydraulic fluid that will escape from pipe that was installed in step *b.*

n. Adjust pilot valves by backing off lock nuts on rod-end assemblies at bottom of servo unit and thread adjusting bushings in or out until a minimum amount of leakage is observed at return pipe.

Note

A small adjustment of adjusting bushing is all that is necessary to adjust flow.

o. Place bypass arm in servo position.(See detail A, figure 7–9.)

Note

Power pistons should not drift nor should leakage increase.

p. Allow leakage to stabilize for 2 minutes. Should power pistons drift, recheck pilot valve adjustment.

q. Using a stopwatch and a 50 cc graduate, measure leakage from return pipe for 1 minute. Total leakage should not exceed 36 cc.

r. Remove 5/16 x 12-inch drill rod.

s. Move bypass arm from servo position to manual position. (See detail A, figure 7–9.) At same time, observe power pistons. If one or more pistons move 1/64 inch or more, repeat instructions outlined in steps *g* through *q*.

t. Tighten lock nut, and secure lock nut and adjusting bushing with lock wire.

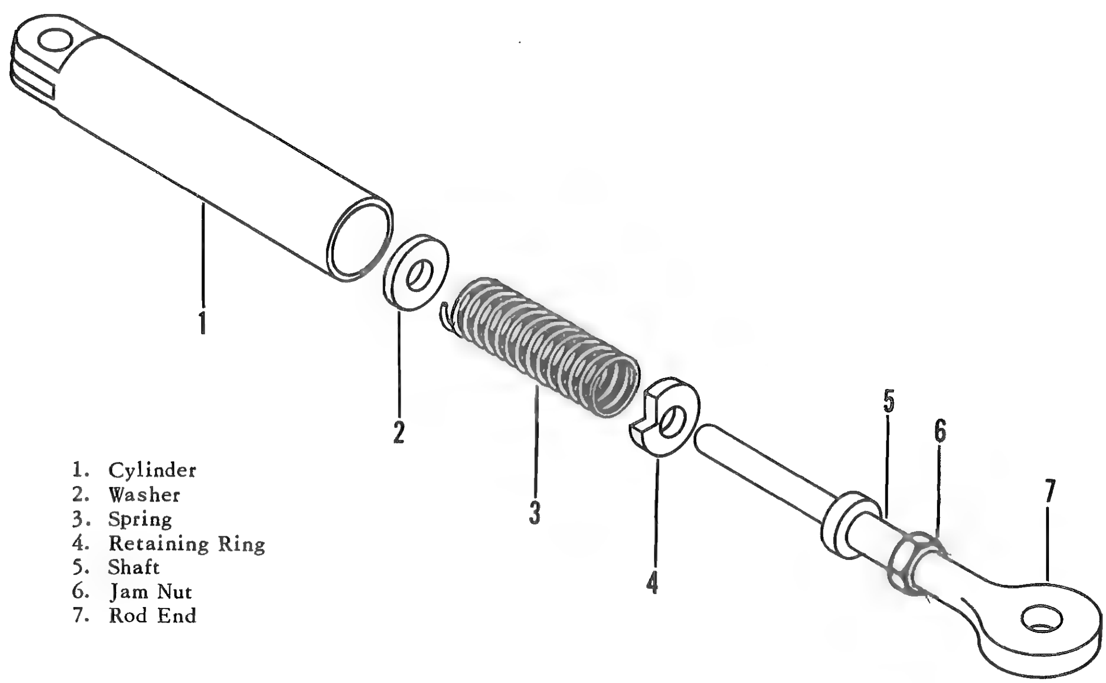
u. Turn off automatic stabilization equipment bench test kit and hydraulic power.

v. Disconnect servo motors from bench test kit.

w. Connect open-loop spring cylinder.

x. Disconnect hydraulic pressure line and return pipe.

y. Remove auxiliary servo unit from fixture that held it during adjustment.



1. Cylinder
2. Washer
3. Spring
4. Retaining Ring
5. Shaft
6. Jam Nut
7. Rod End

Figure 7–10. Collective Open-Loop Spring Cylinder *z.* Install servo unit in helicopter. (Refer to paragraph 7–35.)

7–38. ACTUATING CYLINDER ASSEMBLY.

7–39. DESCRIPTION. (See figure 7–9.) 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 the servo cylinders and to 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.

7–40. REMOVAL.

a. Disconnect hydraulic hose (6, figure 7–9.) from actuating cylinder assembly (2). Remove union (7) and gasket (5).

b. At support (1) for actuating cylinder, located on main gear box input housing, remove bolt, washers, nut, and cotter pin (8).

c. Remove bolt, washers, and nut (3) securing cylinder fork end to lever arm (4) of servo unit. Remove actuating cylinder assembly (2) from servo unit.

7–41. DISASSEMBLY.

a. Bend up tabs of washer (9, figure 7–11). Loosen check nut (8) and unscrew fork end (7). Remove washer (9) and check nut (8) from fork end (7).

b. Cut lock wire and remove screw (20) and washer (19) in upper end cap (18).

c. Remove upper end cap and piston from cylinder (3) by unscrewing upper end cap (18) from cylinder.

d. Pull piston (17) out of upper end cap (18).

e. Remove felt (10), packing ring (12), and backup rings (11 and 13) from small bore of upper end cap.

f. Remove packing (15), and backup rings (14 and 16) from threaded bore of upper end cap (18).

g. Remove compression spring (5) and washer (6) from cylinder (3).

h. Remove lock wire between lower end cap (2) and cylinder (3) and remove lower end cap (2) from cylinder (3).

i. Remove packing (22) and backup rings (21 and 23) from piston (17).

j. Remove bearing (1) from lower end cap (2).

k. Remove nameplate (4) from cylinder (3).

7–42. CLEANING. Thoroughly clean all parts with dry-cleaning solvent, Federal Specification P-S-661. After removing paint, rinse parts thoroughly in water. Dry with air pressure from a moisture-free nozzle.

7–43. INSPECTION

a. Zyglo all aluminum or magnesium parts.

b. Magnaflux all steel parts.

c. Inspect all parts which exhibit excessive wear for dimensions given in the table of fits and clearances, table 7–II.

d. Inspect all parts for corrosion, damage, cracks, and excessive wear.

e. Inspect bearing in lower end cap (2, figure 7–11) for roughness, corrosion, damage, and evidence of failure.

f. Inspect working surfaces of cylinder (3), piston (17), and upper end cap (18) for scoring.

g. Inspect compression spring (5) for a free length of 6-3/4 ± 1/64 inches and a load of 200 pounds at the compressed length of 4-1/4 inches.

h. If any of the parts exhibit any of the conditions mentioned in steps *a* through *f* above, condemn those parts.

7–44. FITS AND CLEARANCES.

a. The table of fits and clearances gives service tolerances of mating parts of actuating cylinder assembly. The table is used to determine whether various mating parts may be continued in use. (Refer to table 7–II.)

b. The following code is used in table 7–II in order to conserve space in the table:

FAF	–	Fafnir Bearing Company
ID	–	Inside Diameter
L	–	Loose
OD	–	Outside Diameter
T	–	Tight

7–45. REPLACEMENT. Replace all backup rings, felts, and packings.

Table 7–II. Table of Fits and Clearances

PART NO.	NOMENCLATURE	MANUFACTURING DIMENSIONS (IN.)	MATING PART NO.	NOMENCLATURE	MANUFACTURING DIMENSIONS (IN.)	SERVICE TOLERANCE (IN.)
S1665-61518	Piston	0.809 0.808 OD	S1565-61578	Upper End Cap	0.812 0.814 ID	0.003L 0.006L
S1565-61575	Cylinder	1.062 1.064 ID	S1665-61518	Piston	1.059 1.058 OD	0.003L 0.006L
S1665-61517	Lower End Cap	0.9002 0.9007 ID	KS4	Bearing (FAF)	0.9014 0.9009 OD	0.0012T 0.0002T

Table 7–III. Actuating Cylinder Painting Requirements

PART	INDEX AND FIGURE NO.	PAINT AND SPECIFICATION	NO. OF COATS	NOTES
Fork end	7, 7–11	Interior Green MIL-P-8585A	1	Do not paint in holes and threads.
Upper end cap	18, 7–11	Interior Green MIL-P-8585A	1	Paint outside only.
Lower end cap	2, 7–11	Interior Green MIL-P-8585A	1	Paint outside only.
Cylinder	3, 7–11	Interior Green MIL-P-8585A	1	Do not paint inside and upper unthreaded end.

7–46. PAINTING REQUIREMENTS. The painting requirements for actuating cylinder are listed in table 7–III.

7–47. LUBRICATION.

a. Soak all felts, backup rings, and packings in hydraulic fluid, Military Specification MIL-H-5606, prior to assembly. Thoroughly lubricate all mating parts with hydraulic fluid, Military Specification MIL-H-5606, at assembly.

b. Remove snapring and composition seal from one side of bearing in lower end cap assembly and handpack bearing with low-temperature grease, Military Specification MIL-G-3278. Replace seal snapring.

7–48. REASSEMBLY.

a. Bond nameplate (4, figure 7–11) to cylinder (3) with bonding cement, EC-711, Minnesota Mining and Mfg. Co.

b. Press bearing (1) into lower end cap (2) and stake three places on both sides using an arbor press.

c. Screw lower end cap assembly (2) on cylinder (3) and bottom; back off enough to line up lock wire holes and secure with lock wire.

d. Insert compression spring (5) into position in cylinder (3). Set washer (6) on top of spring.

e. Install backup ring (21), packing (22), and backup ring (23) on piston (17).

f. Insert backup ring (14), packing (15), and backup ring (16) into upper end cap (18). Insert backup ring (13), packing (12), and backup ring (11) into upper end cap (18). Insert felt (10) into upper end cap (18).

g. Carefully insert piston into upper end cap (18).

h. Insert piston into cylinder, being careful not to damage packing and backup rings on piston. Screw upper end cap (18) onto cylinder (3) and bottom. Install screw (20) and washer (19) in upper end cap to lock end cap. Secure screw (20) to upper end cap (18) with lock wire.

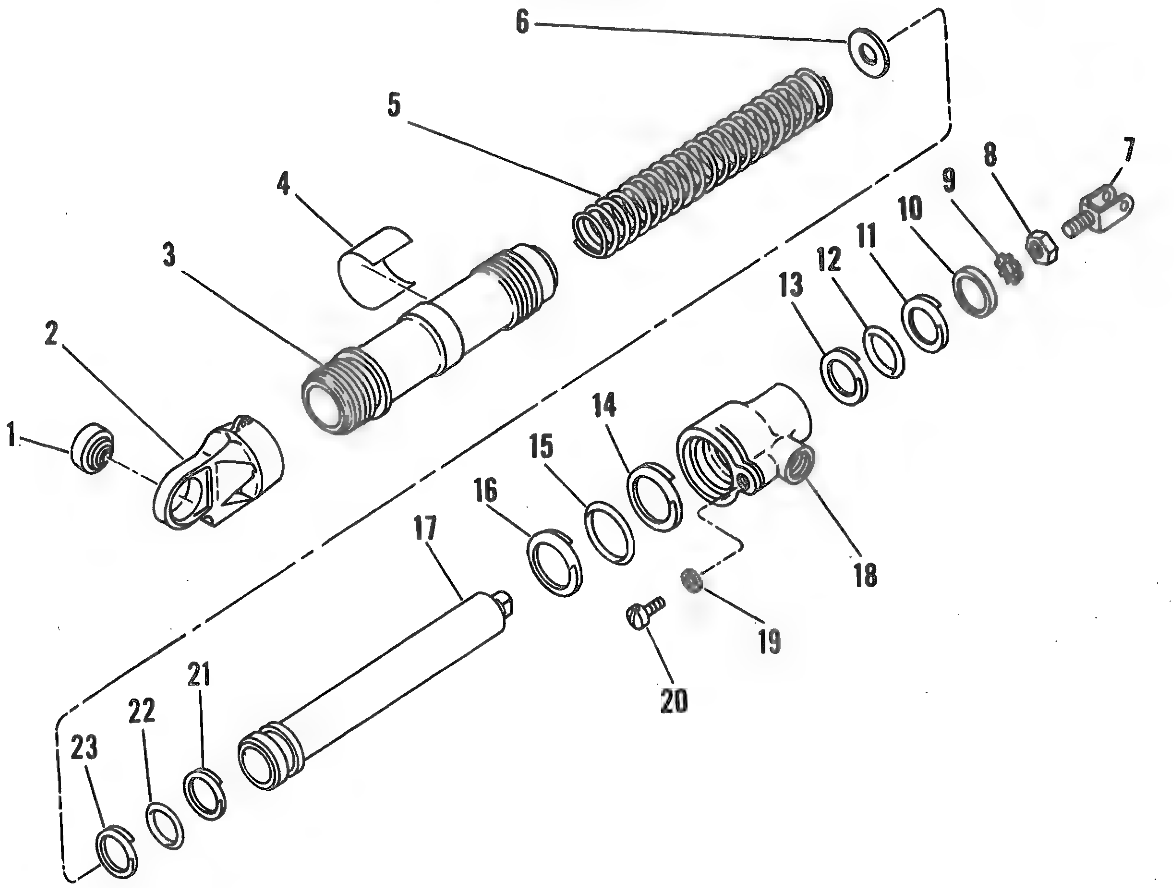
i. Install check nut (8) and washer (9) on fork end (7). Screw fork end into end of piston (17).

7–49. PREPARATION FOR STORAGE AND SHIPMENT.

a. Clean all unprotected machined surfaces with dry-cleaning solvent, Federal Specification P-S-661.

b. Dry unit with a clean, lint-free cloth.

c. Fill unit with hydraulic fluid, Military Specification MIL-H-6083. Coat exposed part of piston with hydraulic fluid and wrap in barrier



1. Bearing	7. Fork End	13. Backup Ring	19. Washer
2. Lower End Cap	8. Check Nut	14. Backup Ring	20. Screw
3. Cylinder	9. Washer	15. Packing	21. Backup Ring
4. Nameplate	10. Felt	16. Backup Ring	22. Packing
5. Compression Spring	11. Backup Ring	17. Piston	23. Backup Ring
6. Washer	12. Packing Ring	18. Upper End Cap	

Figure 7–11. Servo Actuating Cylinder Assembly

material, Military Specification MIL-B-121. Secure with tape, Federal Specification PPP-T-60.

d. Install temporary port caps in both end caps.

e. Coat unprotected machined surfaces with grease, Military Specification MIL-G-3278. Wrap unit in barrier material, Military Specification MIL-B-121, and secure with tape, Federal Specification PPP-T-60.

f. Place unit in barrier material, Military Specification MIL-B-131, and heat-seal.

g. Pack sealed unit in a suitably padded shipping box in such a manner as to prevent damage during shipment.

7–50. TESTING.

a. Proof Pressure Test. Apply 2250 psi, using hydraulic fluid, Military Specification MIL-H-5606, to pressure port in upper end cap (18) for a 2-minute period. Visually inspect for external leakage at joints or bosses.

b. Operating Pressure Test. Pressure actuate piston 25 cycles with 1500 psi, noting the operation of unit and length of stroke. Observe the following conditions:

(1) Piston rod must extend and retract instantly without evidence of binding.

(2) Leakage past shaft packing must not exceed one drop for 25 cycles.

(3) Piston stroke must be between 2-3/32 and 2-7/32 inches.

7–51. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove tape and wrapping material.

b. Drain preservative hydraulic fluid and refill actuating cylinder with hydraulic fluid, Military Specification MIL-H-5606.

7–52. INSTALLATION.

a. Fully extend actuating cylinder assembly (2, figure 7–9) and check center-to-center distance between end cap and fork end attachment points of the cylinder. Adjust to obtain a length of 16-39/64 inches by threading fork end in or out of cylinder. Tighten lock nut, but avoid bending lockwasher tangs until final adjustment is made.

b. Install fully extended actuating cylinder assembly (2) at support (1).

c. Install gasket (5) and union (7) at actuating cylinder assembly (2). Connect hydraulic hose (6) to union (7). Apply pressure of 1000 to 1500 psi to auxiliary hydraulic system until 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 engine or by connecting external pressure to disconnect panel on right side of engine.

d. Place lever arm (4) in full aft position. Check to be sure that all three rollers are in uppermost position (sloppy link position) in cams of auxiliary servo unit. (See detail A.)

e. Secure fork end of actuating cylinder assembly (2) to lever arm (4).

Note

It may be necessary to turn piston in order to align servo lever arm with fork end of cylinder.

f. Check for a clearance of 0.002 to 0.007 inch between cam and roller. (See detail A.) If necessary, adjust for proper clearance by disconnecting fork end from lever arm (4), threading fork end in or out of power piston to obtain desired clearance and securing fork end to servo unit lever arm.

g. Tighten fork end nut. Bend lockwasher tangs only after proper clearance has been obtained. Recheck for 0.002 to 0.007-inch clearance between cam and roller. Relieve pressure in actuating cylinder.

7–53. CYCLIC CONTROL STICK TRIM SYSTEM (FORCE GRADIENT INSTALLATION).

7–54. DESCRIPTION. 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, located on the overhead switch panel provides master control of the system. When the master switch is placed in the ON position, the brake solenoids are deenergized and the stick trim system is in operation. When the master switch is placed in the STICK TRIM position, the brake solenoids are energized and the magnetic brakes are inoperative and do not hold the arms, thus leaving the stick trim system inoperative. The cyclic stick may be moved from the fixed position, but the resistance created by the spring cylinders increases progressively. When pressure on the stick is released, the action of the spring cylinders brings the stick 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 brakes. 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.

CAUTION

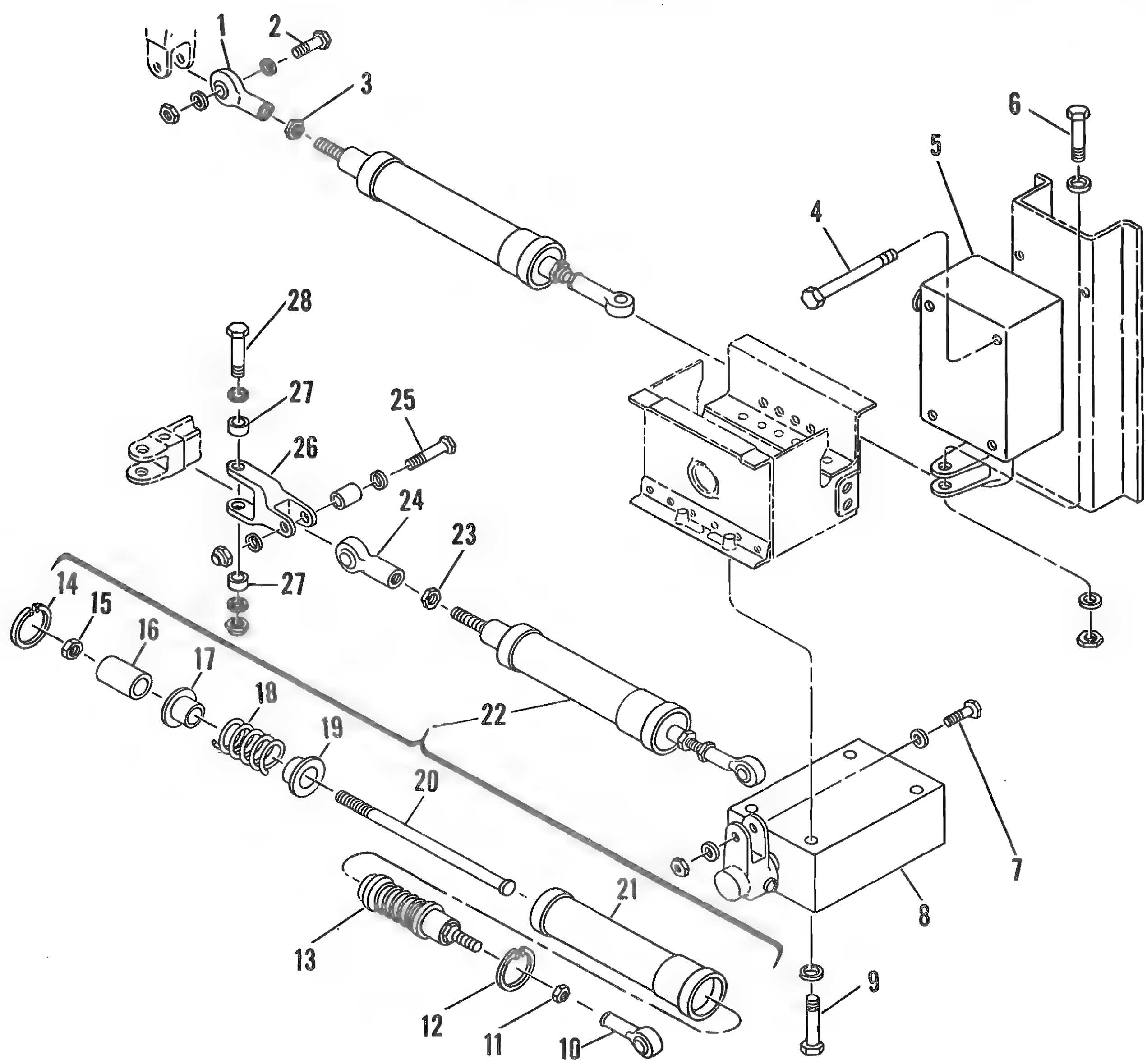
It is permissible to move the cyclic control stick from one extreme position to another extreme position with the stick trim system operating, but the STICK TRIM switch must not be pressed under these conditions.

7–55. REMOVAL. (See figure 7–1.)

a. For disassembly of magnetic brake refer to paragraph 9–50.

b. Disconnect rod ends at lateral stick trim cylinder (59, figure 7–1) and at lateral magnetic brake unit (58).

c. Disconnect universal (42) at bell crank (56) forward of yoke (50) of copilot's cyclic control stick. Disconnect outboard rod end from fore-and-aft magnetic brake unit. Disconnect universal (42) from fore-and-aft stick trim cylinder (61).



1. Rod End
2. Bolt, Washers, Nut
3. Check Nut
4. Bolt
5. Lateral Magnetic Brake Unit
6. Bolt, Washers, Nut
7. Bolt, Washers, Nut
8. Fore-and-Aft Magnetic Brake Unit
9. Bolt, Washer
10. Rod End
11. Check Nut
12. Retaining Ring
13. Piston Assembly
14. Retaining Ring
15. Adjustment Nut
16. Spacer
17. Flange
18. Spring
19. Flange
20. Rod
21. Cylinder
22. Cylinder Assembly
23. Check Nut
24. Rod End
25. Bolt, Washers, Spacer, Nut
26. Universal
27. Spacer
28. Bolt, Washers, Nut

7–12. Spring Cylinder and Magnetic Brake

CAUTION

Measure exact length of both cylinders from hole center-to-hole center of rod end before disassembly.

7–56. DISASSEMBLY. (See figure 7–12.)

a. Loosen check nuts (3, 11, and 23) and remove rod ends (1, 10, and 24) from rod (20) and piston assembly (13). Remove check nuts (3, 11, and 23).

b. At each end of cylinder (21), remove retaining rings (12 and 14) which position rod assembly and piston assembly within cylinder (21). Remove piston assembly and rod assembly.

c. Unscrew adjustment nut (15) from rod assembly and slide spacer (16), flange (17), spring (18), and flange (19) off rod (20).

7–57. REASSEMBLY. (See figure 7–12.)

a. Position and install flanges (17 and 19), spring (18), and spacer (16) on rod (20) with adjustment nut (15).

b. Fit piston and rod assemblies within cylinder (21) and secure them in place with retaining rings (12) and (14) at cylinder ends. Adjust nuts to eliminate all end play on rod (20) and piston assembly (13) within cylinder (21).

c. Install check nuts (3, 11, and 23) and rod ends (1, 10, and 24).

Note

On helicopters serial No. 53-4498 and subsequent, adjust each spring cylinder per instructions in steps *i* through *m*.

d. Tighten adjustment nuts on each end of cylinder assembly (22) until 1/16-inch to 1/8-inch clearance is obtained between the retaining rings (12 and 14) and flanges. Back off each nut, in turn, only enough to eliminate end play between retaining ring and flange.

Note

Do not loosen adjustment nut enough to cause end play between spacer and flange.

e. With rod end (24) held securely, apply an 8-pound force, as measured by a scale, to rod end (10). Apply this force first in one direction and then in reverse direction. Total motion of shaft to which the force is applied should not exceed 0.004 inch.

f. With a 10.5 ± 1.5-pound pull, cylinder springs should start to deflect.

Table 7–IV. Cylinder Deflection Under Load

DEFLECTION (INCHES)	LOAD APPLIED (POUNDS) +20% −10%
1/8	19.25
1/4	23.8
1/2	29.6
1	45.5

g. The ratio between cylinder deflection and load should fall within values in table 7–IV.

7–58. INSTALLATION. (See figure 7–12.)

a. Tighten or loosen rod ends (10 and 24) and check nuts (11 and 23) as required to adjust cylinder to exact length determined in caution following step *c*, paragraph 7–55.

Note

Apply graphite grease, Military Specification MIL-G-7187, sparingly to all rubbing surfaces on the installation.

b. Install universal (42, figure 7–1) to fore-and-aft stick trim cylinder (61). Install universal (42) to bell crank (56) forward of yoke (50). Connect cylinder to arm on fore-and-aft magnetic brake unit.

c. Connect lateral stick trim cylinder (59) to brake arm and connect inboard rod end to yoke (50).

7–59. ADJUSTMENT.

a. Remove clutch access door. Center cyclic control sticks fore and aft and laterally by installing a 1/4 x 10-inch rigging pin through both yokes (50, figure 7–1) and a 3/16 x 6-inch rigging pin through bell cranks (77 and 56).

b. Disconnect lateral stick trim cylinder (59) from arm on lateral magnetic brake unit (58). Disconnect fore-and-aft stick trim cylinder (61) from arm on fore-and-aft magnetic brake unit (60).

c. Connect a source of external power and place battery generator switch in BATT. ONLY position. Check that STICK TRIM switch on overhead switch panel is in STICK TRIM position. Center arms of magnetic brake units in midpoint of travel by pressing STICK TRIM switch on either cyclic control stick.

Note

When STICK TRIM switch on either cyclic control stick is pressed, arm on fore-and-aft brake unit must rotate 45 degrees in either direction from vertical. Lateral brake unit arm must rotate 45 degrees in either direction from neutral forward position. If necessary, position arm on shaft of magnetic brake unit to obtain this movement.

d. Connect fore-and-aft stick trim cylinder (61) to fore-and-aft magnetic brake unit (60) and connect lateral stick trim cylinder (59) to lateral magnetic brake unit (58). Remove rigging pins which were installed.

Note

Check cylinders for end play and spring resistance by following instructions in steps *e* through *h*.

e. Hold cyclic stick in neutral position to center magnetic brake arm, place master control switch on overhead control panel in STICK TRIM position, and press STICK TRIM button on circuit breaker panel.

f. Apply external hydraulic pressure to auxiliary servo system at disconnects.

g. Check pilot's cyclic stick free play in a fore-and-aft or lateral direction does not exceed 1/8 inch when stick is subject to a 1/4-pound load.

h. Connect a scale to grip. The pull required to move stick from its set position should be between 0 and 3/4 pound in any direction.

Note

Check stick trim system for operation by following instructions in steps *i* and *j*.

i. Move either cyclic control stick to full forward, full aft, full left lateral, and full right lateral positions. Check stick for a force of from 2 to 4-1/2 pounds at each extreme of travel.

j. Press STICK TRIM switch on either cyclic control stick and move stick to full forward, full aft, full left lateral, and full right lateral positions until it hits stops with no resistance from cylinders. Release switch when stick is in each extreme of travel and check that stick stays in each position. While stick is in each extreme of travel, move stick to opposite extreme of travel without pressing STICK TRIM switch and check for a force of 2 to 7 pounds in this position. Check that stick returns to each position for which it was set.

CAUTION

Do not press STICK TRIM switch on either cyclic control stick until stick returns to its preset or neutral position.

k. Replace clutch access door.

7-60. COLLECTIVE PITCH CONTROL SYSTEM.

7-61. DESCRIPTION. The collective pitch control system is designed to increase or decrease the total lift generated by the main rotor blades. This function is accomplished through the mixing unit in order that the collective and cyclic systems may operate concurrently. In order for the collective pitch system to accomplish its purpose, the following units are incorporated as integral parts of the system: Pilot's and copilot's collective pitch control stick connected to a torque shaft, three main rotor primary servo units, and two control arms.

7-62. COLLECTIVE PITCH CONTROL STICK AND TORQUE SHAFT.

7-63. REMOVAL. (See figure 7-1.)

a. Remove copilot's seat from pilots' compartment. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

b. Remove control box installation from pilot's collective pitch control stick (1).

c. Place collective stick in low pitch position. Disconnect and remove drag (18) extending from bracket on aft bulkhead of pilots' compartment to pilot's collective pitch control stick (1).

d. Remove lock ring, and back off knurled nuts securing pitch sticks to torque shaft. Remove collective sticks.

e. Disconnect and remove rod (9) extending from shaft (10) to arm assembly (4) of torque shaft installation.

f. Remove screws from each end of throttle control outer tube that is connected to right end of collective pitch stick shaft. Slide throttle control tube to right to gain access to coupling which connects throttle tube shaft and stick shaft. Remove screw from coupling.

g. Slide coupling to right until it clears end of shaft (10).

h. Remove screw which secures adapter to stick shaft. Remove adapter.

i. Disconnect support fittings and remove stick shaft and fittings as a unit from helicopter.

j. Disconnect and remove rod (14) extending from arm assembly (3) to servo unit assembly (25, figure 7-5).

k. Remove taper pins, washers, nuts, and cotter pins securing the arm assembly (3, figure 7-1) in position on tube assembly (5). Remove arm assembly (4), tubes, and arm assembly (3) from bracket (2).

Note

Retain any shims found on tube assembly (5). These shims have been installed to reduce end play of tube assembly (5) in bracket (2) and should be installed upon reassembly of torque shaft.

l. Remove taper pins, washers, nuts, and cotter pins securing arm assembly (4) to tube assembly (5) and remove arm from tube.

m. Remove bracket (2) and shims, as necessary, from tunnel.

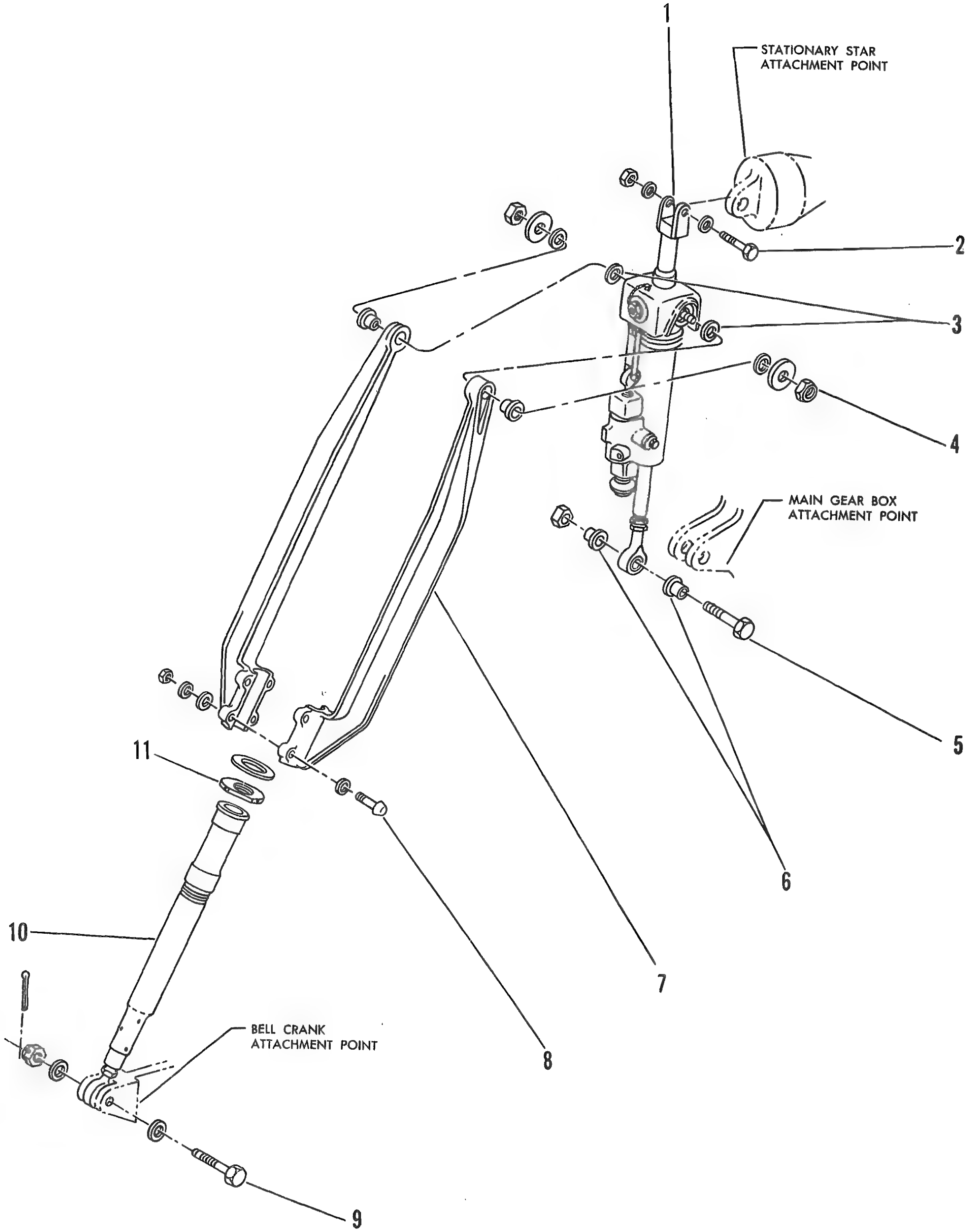


Figure 7–13 . Main Rotor Servo and Forged Control Arm Removal and Disassembly (Sheet 1 of 2)

1. Primary Servo System Main Rotor Servo Unit
2. Bolt, Washers, Nut
3. Chamfered Washers
4. Washers, Nuts
5. Bolt, Nut
6. Bushings
7. Fork Arms
8. Bolt, Washers, Nut
9. Bolt, Washers, Nut, Cotter Pin
10. Tube Assembly
11. Washer, Nut

Figure 7–13. Main Rotor Servo and Forged Control Arm Removal and Disassembly (Sheet 2 of 2)

7–64. INSTALLATION.

Note

Refer to table 7-I for basic rod lengths of component rod assemblies of collective pitch system.

a. Place shaft (10, figure 7–1) and support fittings in position in pilots' compartment. Secure fittings.

b. Place bracket (2) in position on tunnel. Shim with thin washers, as required, and secure.

c. Place arm assembly (4) in position on tube assembly (5) and secure with taper pins, washers, nuts, and cotter pins.

d. Slide tube assembly (5) into right-hand mounting hole of bracket (2). Slide arm assembly (3) onto tube assembly (5) and complete installation of tube in bracket.

Note

Inboard of bracket left mounting hole, shim as required to reduce end play of tube assembly (5) in bracket (2) without preloading bearings.

e. Install taper pins, washers, nuts, and cotter pins securing arm assembly (3) in position on tube assembly (5).

f. Install rod (9) which extends from shaft (10) to arm assembly (4). Install rod (14) which extends from arm assembly (3) to servo unit assembly (25, figure 7–5).

g. Place pilot's and copilot's collective pitch control sticks (1 and 12, figure 7–1) into their respective fittings on shaft (10). Tighten knurled nut at base of each pitch stick, and install lock ring and secure with lock wire.

Note

Collective sticks should be in low pitch position. Install shims as required at base of each inert stick tube to eliminate end play of more than 0.006 inch at throttle grip

h. Position and secure drag (18) to pilot's collective pitch control stick (1) and bracket located on aft bulkhead of cockpit.

i. Secure throttle control torque tube to right end of collective pitch stick shaft.

Note

Check backlash by holding throttle control output arm firmly and applying a minimum of 10 ounce-inches of torque to pilot's throttle grip and the copilot's throttle grip. Pilot's grip should not exceed 2 degrees 30 minutes in either direction and copilot's grip should not exceed 4 degrees in either direction.

j. With one throttle grip locked and a 50 inch-pound load applied on other grip, check that deflection obtained is less than 10 percent and that linkage does not take a permanent set. One or both of universals on shaft (10) must be replaced if this limit is exceeded.

k. Check throttle control system for proper operation.

7–65. MAIN ROTOR PRIMARY SERVO UNITS.

7–66. DESCRIPTION. (See figure 7–13.) Three main rotor primary servo units are installed in the helicopter adjacent to the main gear box. The primary servo units, which operate from the primary hydraulic system, provide a hydraulic assist to the pilot in the operation of the cyclic control and collective pitch control systems. The forward right servo unit, operating in conjunction with the stationary scissors, controls fore-and-aft flight and is called the fore-and-aft servo unit. The aft right servo unit and the left servo unit operate together to control lateral flight and are called right lateral servo unit and laft lateral servo unit, respectively. Each servo unit consists primarily of a housing, yoke, power piston, and pilot valve. A fork at the top of the housing is secured to an arm of the stationary star; the lower end of the power piston, which extends from the bottom of the housing, is secured to a lug on the main gear box. The pilot valve is connected by a link and a ring to the yoke which encircles the fork at the top of the housing. Play in the yoke allows the yoke to be moved off center which opens the pilot valve. The pilot valve routes hydraulic pressure to the proper side of the piston to achieve the desired movement of the servo unit. Since the power piston is secured to a lug on the main gear box, the housing of the servo unit is the moving part and slides up or down the power piston. Movement of the yoke is controlled by a riveted sheet metal control arm which forms a part of the main rotor flight controls. The lower end of the control arm is secured to a flight control bell crank; the upper end is secured to the yoke on the servo unit. Movement of the flight controls by the pilot is transmitted through the control arm to the yoke, the yoke is moved off center, and the servo unit is set in motion. The servo unit continues to move until movement of the flight controls ceases and the yoke is allowed to center. In the event the primary hydraulic system is turned off or malfunctions, the control arm transmits movements of the main rotor flight controls directly to the stationary star, and a relief valve within the servo unit allows trapped hydraulic oil to bypass the power piston. A hydraulic pressure hose and a return hose are connected to each servo unit. Access to the servo units is gained by hinging down the service platforms.

WARNING

If pilot valve boot on main rotor servo unit is damaged or shows possible signs of deterioration, replace boot. A damaged or deteriorated boot may result in ice or corrosion forming within unit.

7-67. REMOVAL OF FORGED CONTROL ARM AND MAIN ROTOR PRIMARY SERVO. (See figure 7-13.)

a. Disconnect hydraulic hoses at fittings that are attached to pressure and return ports of primary servo. Plug hoses and servo unit fittings.

b. Remove rings, gaskets, nuts, unions, elbows, brushings, and tees from servo.

c. Remove control arm from bell crank at transmission deck.

CAUTION

Use great care to avoid spreading fork.

d. Back off washer and nut (11) on tube assembly (10). Unbolt fork arms (7) from assembly.

e. Remove washers and nuts (4) attaching fork arms (7) to each primary servo system main rotor servo unit (1). Slide fork arms (7) and chamfered washers (3) outboard from servo yoke studs.

f. Remove bolt and nut (5) securing each servo unit to a main gear box lug. Remove brushings (6) from each lug.

g. Unbolt each servo unit from stationary star.

7-67A. REMOVAL OF SHEET METAL CONTROL ARM AND MAIN ROTOR PRIMARY SERVO. (See figure 7-13A.)

a. Disconnect hydraulic hoses at fittings that are attached to pressure and return ports of primary servo. Plug hoses and servo unit fittings.

b. Remove rings, gaskets, nuts, unions, elbows, bushings, and tees from servo.

c. Remove control arm (8) from bell crank on lower housing of main gear box.

CAUTION

Use great care to avoid spreading control arms. Upon removal of each control arm (8) and attaching primary servo system main rotor servo unit (1), separate two components only as outlined below.

d. Remove fittings (7) from control arm (8).

e. Remove washers and nuts (4), attaching fittings (7) to each servo unit. Slide fittings (7) and chamfered washers (3) outboard off servo yoke studs.

f. Remove bolt and nut (5) securing each servo unit to main gear box lugs. Remove bushings (6) from each lug.

g. Remove each servo unit from stationary star.

7-68. DISASSEMBLY.

a. Unbolt link (23, figure 7-14) from ring (27).

b. Slip inner end of boot (20) from groove on sleeve and slide boot back with grommet (21) on rod end (22). Back off jam nut (17) and unscrew rod end from servo valve unit (16). Remove boot and grommet from rod end. Remove safety clip (19), lockwasher (18), and jam nut (17).

c. Remove plate (12).

d. Loosen jam nut (9) and remove rod end (7).

Note

Steps *e* through *n* should be performed at fourth echelon level of maintenance.

e. Remove lockwasher (8) and jam nut (9) from piston.

f. Remove studs (3 and 25) and packings (2 and 26). Slide cover (1) off yoke (5).

g. Remove yoke (5) from end cap (6). Remove bushing (4).

h. Unbolt end cap (6) from housing (13) and slide out piston rod (24). Remove lock ring (10) and retaining ring (11) from housing (13).

1. Primary Servo System Main Rotor Servo Unit
2. Bolt, Washers, 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

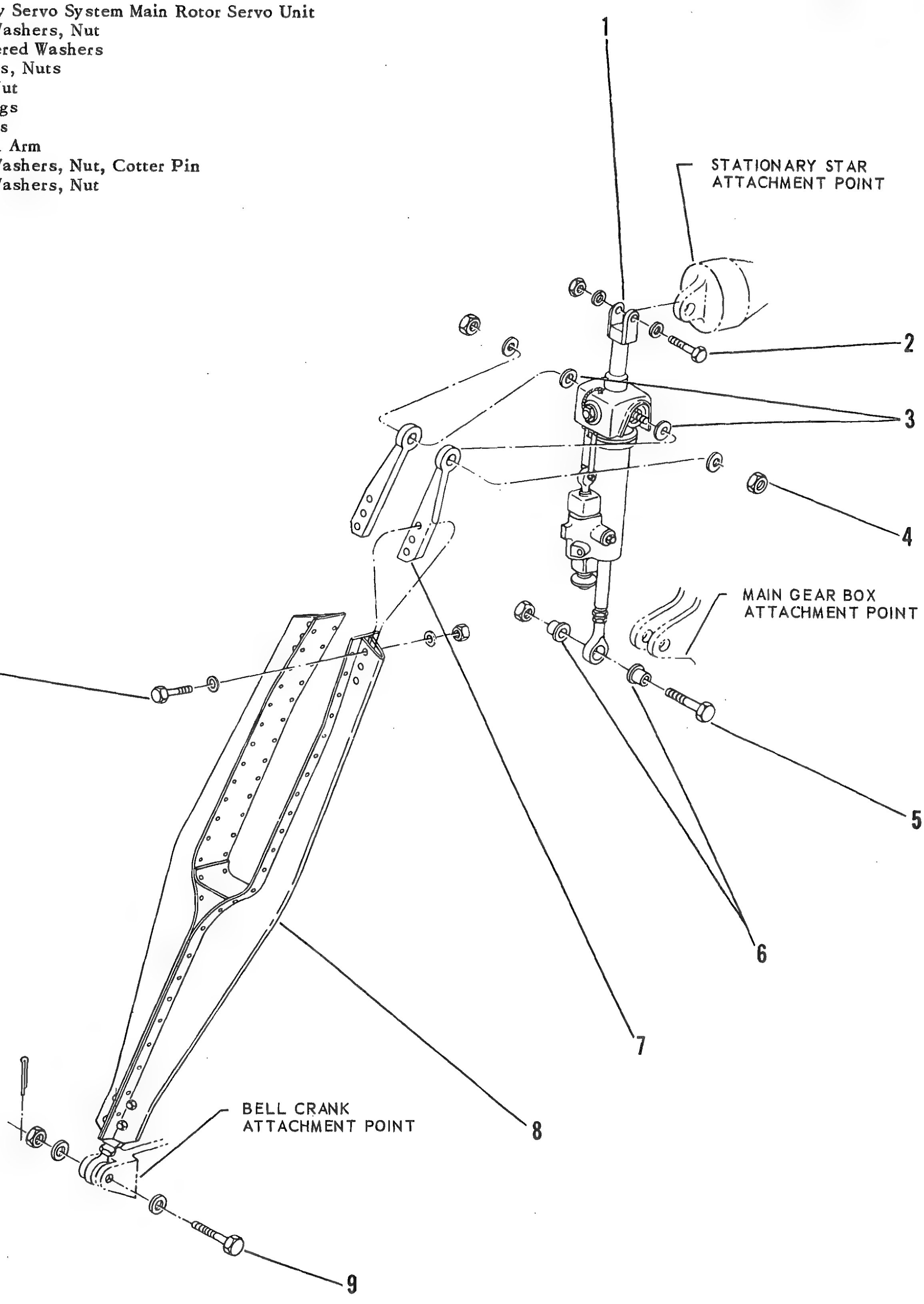


Figure 7–13A. Main Rotor Primary Servo and Sheet Metal Control Arm Removal and Disassembly

i. Remove boot (14) from end cap (15). Remove end cap.

7–69. REASSEMBLY. (See figure 7–14.)

a. Screw end cap (15) on fingertight and secure with lock wire. Install boot (14) on end cap (15).

b. Press bushing (4) into yoke (5) while wet with primer, Military Specification MIL-P-8585.

c. Install lock ring (10) and retaining ring (11) in housing (13). Slide piston rod (24) carefully into housing and bolt end cap (6) on housing (13). Position yoke (5) over end cap.

d. Slide cover (1) over yoke (5). Install packings (2 and 26) on studs (3 and 25) and coat studs lightly with graphite grease, Military Specification MIL-G-7187. Insert studs through cover (1) and secure to end cap (6). Secure studs to cover (1) with lock wire.

e. Install jam nut (9) and lockwasher (8) on piston rod (24).

f. Screw rod end (7) on piston.

g. Bond plate (12) to housing (13) with cement, EC-1357, Minnesota Mining and Mfg. Co.

h. Install jam nut (17), lockwasher (18), and safety clip (19) on servo valve assembly. Slide grommet (21) and boot (20) on rod end (22) and screw rod in place.

i. Connect link (23) to ring (27). Tighten to a torque of 35 to 40 inch-pounds.

j. Check adjustment of servo valve. (Refer to paragraph 7–72.)

7–70. PREPARATION FOR STORAGE OR SHIPMENT.

a. Fill main rotor servo unit with preservative hydraulic fluid, Military Specification MIL-H-6083.

CAUTION

During storage of servo unit and control arm assembly, avoid spreading control arm. On helicopters using sheet metal control arm, reinstall fittings (7, figure 7–13A) at each control arm and servo unit. On helicopters using forged control arms, reinstall fork arms (7, figure 7–13) at tube assembly and servo unit. Push servo unit piston into housing, pass lock wire through piston rod end, and fasten each end of lock wire to control arm. Complete storage preparation according to steps c through e.

b. Push piston rod up into housing.

c. Coat rod-end bearings with grease, Military Specification MIL-G-3278. Lubricate rod end of primary servo system main rotor servo unit (1, figure 7–13) with grease, Military Specification MIL-G-3278, by applying nozzle, Shafer Bearing Corporation part No. N2, or Lincoln Engineering Company part No. 5803, to each rod-end flush-type fitting.

d. Wrap entire unit in barrier material, Military Specification MIL-B-121.

e. Secure with tape, Federal Specification PPP-T-60.

7–71. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove tape and barrier material.

b. Drain preservative oil and flush servo units with hydraulic fluid, Military Specification MIL-H-5606.

CAUTION

At control arm and servo unit assembly, unfasten lock wire securing control arm at servo unit piston rod.

7–72. SERVO VALVE ADJUSTMENT TESTS. The following test and possible adjustment must be performed on the main rotor servo unit assembly after the pilot valve boot has been replaced. A hydraulic test stand capable of producing 1500 psi, a standpipe, and a suitable fixture on which the servo unit can be mounted in a vertical position are required to perform the test. The test should be performed at a room temperature of 21.1° to 32.2°C (70° to 90°F) with hydraulic fluid, Military Specification MIL-H-5606, at a temperature of 21.1° to 43.3°C (70° to 110°F).

a. Secure main rotor servo unit assembly to a suitable fixture. Servo unit assembly must be in a vertical position with pilot valve rod end pointing downward.

b. Connect a pressure line to HI port of servo unit.

c. Connect a return line from LO port of servo unit to standpipe.

Note

Standpipe must be at least 6 inches above surface of table and in a horizontal plane.

d. Start hydraulic test stand and adjust rate of flow for 5 to 5–1/2 gallons per minute.

e. Adjust output pressure of hydraulic test stand to 1500 psi.

f. Cycle servo unit in one direction by moving yoke assembly and at same time mark that point on table where trajectory of return flow from standpipe hits table.

g. Cycle servo unit in opposite direction by moving yoke assembly and at same time mark that point on table where trajectory of return flow from standpipe hits table.

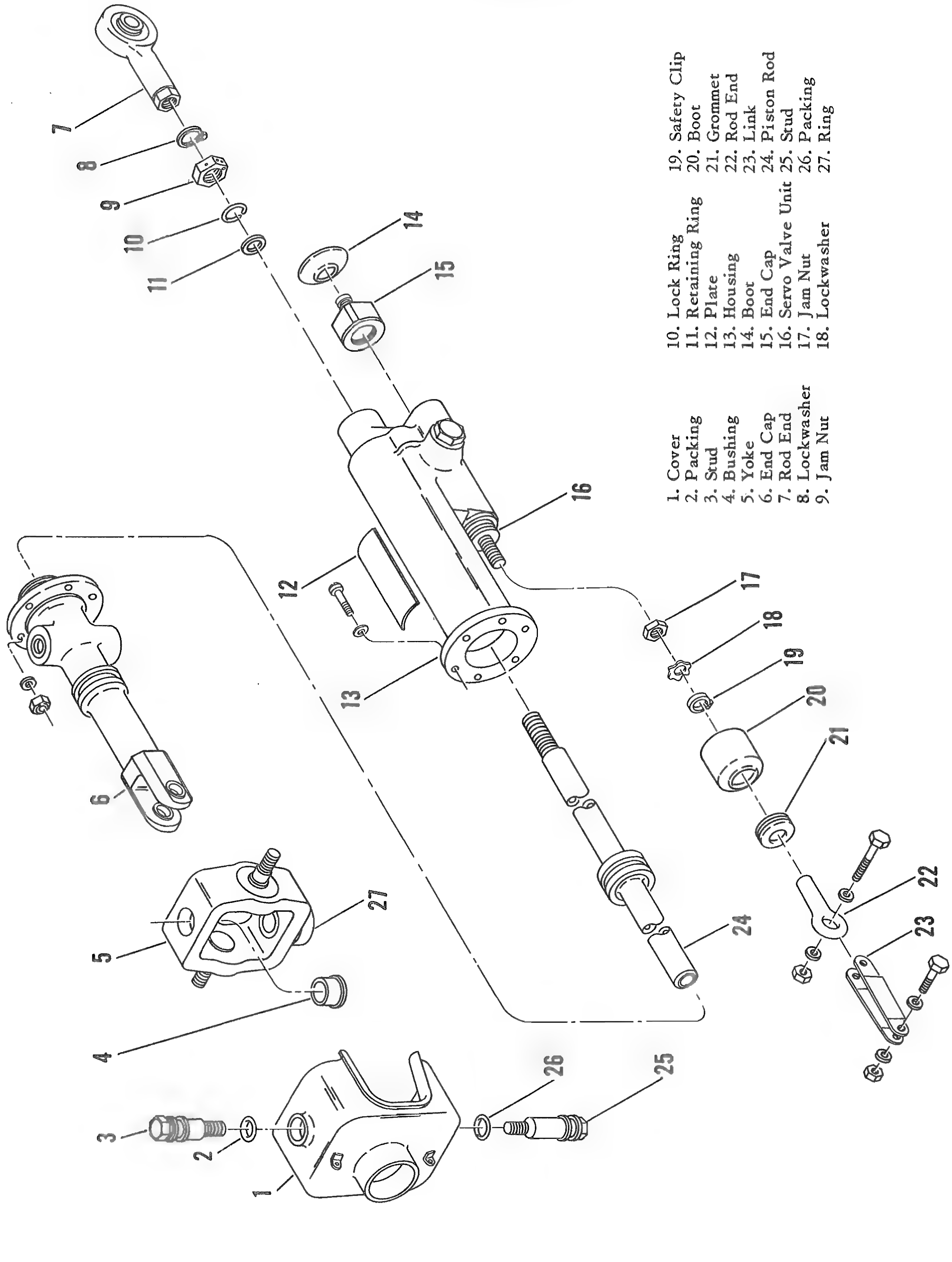
h. Measure distance between two trajectories. If this distance does not exceed 2 inches, servo valve is adjusted correctly and steps *i* through *m* may be omitted. If distance between two trajectories exceeds 2 inches, servo valve is not adjusted correctly and must be adjusted as outlined in steps *i* through *m*.

i. Slip pilot valve boot down to expose jam nut (17, figure 7–14), lockwasher (18), and safety clip (19). Loosen jam nut.

j. Adjust trajectories so they will not exceed 2-inch limit by threading servo valve unit (16) in or out of rod end (22).

k. When trajectories are within prescribed tolerance, tighten jam nut and secure jam nut to safety clip and lockwasher with lock wire.

l. Slide boot back over jam nut, safety clip, and lockwasher. Position lip of boot in groove on servo valve sleeve.



1. Cover
2. Packing
3. Stud
4. Bushing
5. Yoke
6. End Cap
7. Rod End
8. Lockwasher
9. Jam Nut
10. Lock Ring
11. Retaining Ring
12. Plate
13. Housing
14. Boot
15. End Cap
16. Servo Valve Unit
17. Jam Nut
18. Lockwasher
19. Safety Clip
20. Boot
21. Grommet
22. Rod End
23. Link
24. Piston Rod
25. Stud
26. Packing
27. Ring

Figure 7-14. Main Rotor Servo Unit Assembly Disassembled.

m. Repeat steps *f* through *h* to insure that trajectories are within prescribed tolerance.

n. Remove servo unit from test fixture.

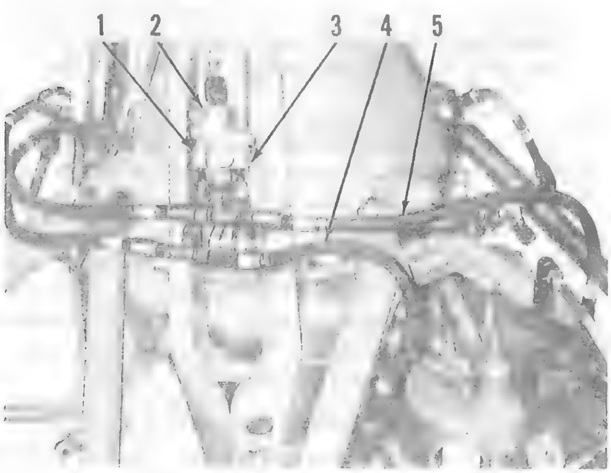
7–73. INSTALLATION OF FORGED CONTROL ARM AND MAIN ROTOR PRIMARY SERVO UNIT.

Note

Prior to installation, coat rings and gaskets and threads of elbows, unions, bushings, tee, and nuts with petrolatum, Military Specification MIL-C-11796.

a. On left lateral primary servo unit (2, figure 7–15), or fore-and-aft servo, install gasket on short end of union. Screw short end of union into HI port (3) of servo. Install nut, backup ring, and gasket on long end of union. Install 90-degree elbow on union and position elbow to point outboard. Tighten jam nut. Place gasket on male end of bushing and screw bushing into elbow. Install nut, backup ring, and gasket on leg of tee and screw tee into elbow. Tighten jam nut.

b. On left lateral primary servo unit (2), or fore-and-aft servo, install gasket on short end of union. Screw short end of union into LO port (1) of servo. Install nut, back up ring, and gasket on long end of union. Install 45-degree elbow on union and position elbow to point outboard. Tighten jam nut. Place a gasket on male end of bushing and screw bushing into elbow. Install nut, backup ring, and gasket on leg of tee and screw tee into elbow. Tighten jam nut.



1. LO Port
2. Left Lateral Primary Servo Unit
3. HI Port
4. Return Line
5. Pressure Line

Figure 7–15. Hydraulic Connections at Left Lateral Servo Unit

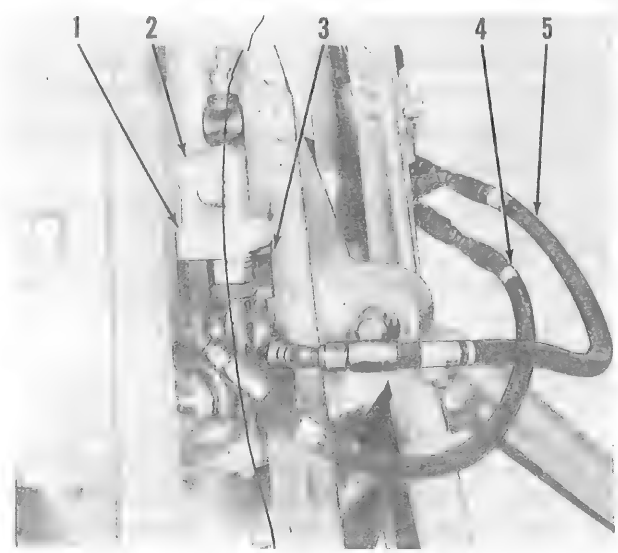
c. On right lateral primary servo unit (2, figure 7–16), install a gasket on male end of bushing and screw bushing into HI port (3) of servo. Install gasket on short end of union and screw short end of union into bushing. Install nut, backup ring, and gasket on long end of union. Screw 90-degree elbow into union and position elbow to point outboard and forward. Tighten jam nut. Install backup ring, gasket, and nut on long end of 45-degree elbow and screw long end of 45-degree elbow into 90-degree elbow. Position 45-degree elbow to point forward. Tighten jam nut.

d. On right lateral primary servo unit (2), install gasket on male end of bushing and screw bushing into LO port (1) of servo. Install backup ring, gasket, and nut on long end of 45-degree elbow. Screw long end of 45-degree elbow into bushing. Position elbow to point forward. Tighten jam nut.

e. If not assembled, temporarily install fork arms (7, figure 7–13) at primary servo system main rotor servo unit (1) and tube assembly (10).

f. Check length of servo unit and control arm for dimensions given in figure 7–17 and table 7-V.

g. To avoid spreading fork arms during installation, remove fork arms (7, figure 7–13) from tube assembly (10) and primary servo system main rotor unit (1).



1. LO Port
2. Right Lateral Primary Servo Unit
3. HI Port
4. Return Line
5. Pressure Line

Figure 7–16. Hydraulic Connections at Right Lateral Servo Unit

Table 7–V. Main Rotor Primary Servo Unit Dimensions

SERVO UNIT	FIGURE 7–17 DIMENSION A	FIGURE 7–17 DIMENSION B	FIGURE 7–17 DIMENSION C
Left-Hand Lateral	18.65 inches	32.87 inches (32-7/8 inches)	3-7/64 inches
Right-Hand Lateral	18.81 inches	35.04 inches (35-1/32 inches)	3-17/64 inches
Fore-and-Aft	18.65 inches	32.94 inches (32-15/16 inches)	3-7/64 inches

CAUTION

These dimensions are critical and extreme accuracy must be used when establishing them.

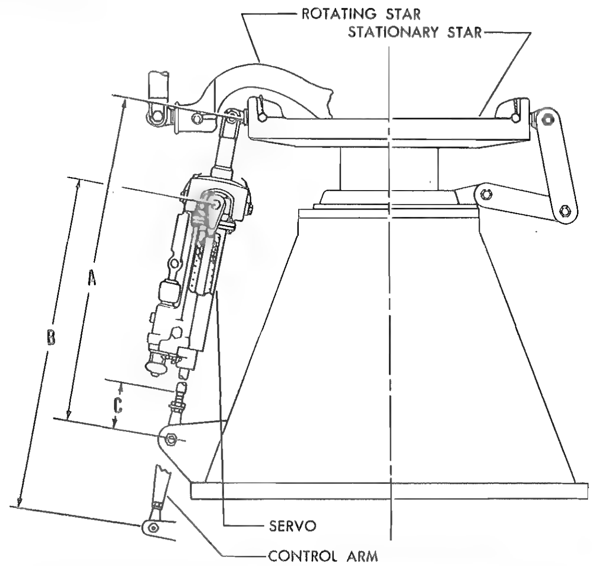


Figure 7–17. Rigging Dimensions Main Rotor Primary Servo Units

CAUTION

Adjustment of servo pilot valve should be made only by qualified personnel.

h. Install each servo unit at stationary star.

i. Install bushings (6) in main gear box lug. At piston rod end, secure each servo unit to main gear box lug.

j. Slide chamfered washers (3) and fork arms (7) on servo yoke studs. Install washers and nuts (4).

Note

Chamfered washers (3) must be installed with the inner chamfer facing towards the servo unit.

k. Secure fork arms (7) to tube assembly (10). Tighten washer and nut (11) on tube assembly.

l. Tighten nut on tube assembly to a torque of 250 to 300 inch-pounds.

m. Install control arm at bell crank on transmission deck.

n. Connect pressure and return lines to each servo unit.

CAUTION

Pressure line (5, figure 7–15), which runs from tee attached to solenoid valve on aft side of main hydraulic reservoir, is attached to ports marked HI. Return line (4), which runs to forward side of main hydraulic reservoir, is attached to ports marked LO.

o. Check main flight control rigging. (Refer to paragraph 7–141.)

7–73A. INSTALLATION OF SHEET METAL CONTROL ARM AND MAIN ROTOR PRIMARY SERVO UNIT.

Note

Prior to installation, coat rings and gaskets and threads of elbows, unions, bushings, tee, and nuts with petrolatum, Military Specification MIL-C-11796.

a. On left lateral primary servo unit (2, figure 7–15), or fore-and-aft servo, install gasket on short end of union. Screw short end of union into HI port (3) of servo. Install nut, backup ring, and gasket on long end of union. Install 90-degree elbow on union and position elbow to point outboard. Tighten jam nut. Place gasket on male end of bushing and screw bushing into elbow. Install nut, backup ring, and gasket on leg of tee and screw tee into elbow. Tighten jam nut.

b. On left lateral primary servo unit (2), or fore and aft servo, install gasket on short end of union. Screw short end of union into LO port (1) of servo. Install nut, backup ring, and gasket on long end of union. Install 45-degree elbow on union and position elbow to point outboard. Tighten jam nut. Place gasket on male end of bushing and screw bushing into elbow. Install nut, backup ring, and gasket on leg of tee and screw tee into elbow. Tighten jam nut.

c. On right lateral primary servo unit (2, figure 7–16), install gasket on male end of bushing and screw bushing into HI port (3) of servo. Install gasket on short end of union and screw short end of union into bushing. Install nut, backup ring, and gasket on long end of union. Screw 90-degree elbow into union and position elbow to point outboard and forward. Tighten jam nut. Install nut, backup ring, and gasket on long end of 45-degree elbow and screw long end of 45-degree elbow into 90-degree elbow. Position 45-degree elbow to point forward. Tighten jam nut.

d. On right lateral primary servo unit (2), install gasket on male end of bushing and screw bushing into LO port (1) of servo. Install nut, backup ring, and gasket on long end of 45-degree elbow. Screw long end of 45-degree elbow into bushing. Position elbow to point forward. Tighten jam nut.

e. If not assembled, temporarily install fittings (7, figure 7–13A) at primary servo system main rotor servo unit (1) and control arm (8).

f. Check lengths of servo unit and control arm for dimensions given in figure 7–17 and table 7–V.

g. To avoid spreading control arm during installation, remove fittings (7, figure 7–13A) from control arm (8) and primary servo system main rotor servo unit (1).

h. Install each servo unit at stationary star with bolt, washers, and nut (2).

i. Install bushing (6) in each main gear box lug. At piston rod end, install each servo unit to main gear box lugs with bolt and nut (5).

j. Install chamfered washers (3) on servo yoke studs.

Note

Chamfered washers (3) must be installed with the inner chamfer facing towards the servo unit.

k. Slide fittings (7) onto servo yoke studs.

l. Install washers and nuts (4). Tighten nuts to a torque of 165 to 185 inch-pounds.

m. Install control arm (8) to fittings (7) using bolts, washers, and nuts (10).

n. Install control at bell crank at transmission deck with bolt, washers, nut, and cotter pin (9).

o. Connect pressure and return lines to each servo unit.

Note

Pressure line (5, figure 7–15), which runs from tee attached to solenoid valve on aft side of main hydraulic reservoir, is attached to ports marked HI. Return line (4), which runs to forward side of main hydraulic reservoir, is attached to ports marked LO.

p. Check main rotor flight control rigging. (Refer to paragraph 7–141).

CAUTION

Adjustment of servo pilot valve should be made only by qualified personnel.

7–74. LEAKAGE LIMITATIONS. A small accumulation of hydraulic oil around the servo valve end cap may occur during the time the helicopter is not operating. This condition is considered normal and in no way does it affect the performance of the servo unit. If any hydraulic fluid is evidenced in this area, during the normal periodic inspection of the servo units, wipe it off with a clean, dry cloth. Dynamic leakage may occur in this area during operation of the servo units. This leakage should not exceed 1 drop in 25 cycles of the servo unit. In the event leakage exceeds 1 drop in 25 cycles, replace the servo unit.

7–75. FLIGHT CONTROLS HYDRAULIC SYSTEM.

7–76. PRIMARY HYDRAULIC SYSTEM.

7–77. DESCRIPTION. 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 when 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. 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 the necessary tubing, and a hose with quick disconnects. Several of the units are grouped into a hydraulic panel at the left side of the main gear box. Access to the primary hydraulic system components may be gained by hinging down the service platforms.

7–78. PRESSURE RELIEF VALVE.

7–79. DESCRIPTION. The system is protected from excessive pressure by a pressure relief valve mounted at the hydraulic panel on the left side of of the main gear box. (Refer to primary servo system schematic diagram in TM 55-1520-202-20, Chapter 2, Section V.) The relief valve has a cracking pressure of 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.

7–80. REMOVAL. (See figure 7–18.)

a. Disconnect tubing from fittings of pressure relief valve (12).

b. Remove nut, washers, spacer, and screws (13) securing relief valve to panel bracket (11) and remove relief valve (12).

c. Remove fittings from relief valve.

7–81. INSTALLATION. (See figure 7–18.)

a. Install fittings on relief valve (12).

b. Position pressure relief valve at panel bracket and secure with screws, washers, spacer, and nut (13).

c. Connect tubing to valve fittings.

7–82. THREE-WAY SOLENOID VALVE

7–83. DESCRIPTION. An electrically operated three-way solenoid valve furnishes a means of shutting off the primary hydraulic system. (Refer to primary servo system schematic diagram in TM 55-1520-202-20, Chapter 2, Section V.) The solenoid circuit is energized by placing the SERVO switch on the pilot's collective pitch stick in the PRI OFF position. 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 to the solenoid valve by hinging down the service platform on the left side of the helicopter.

7–84. REMOVAL.

a. Disconnect wiring at solenoid valve (2, figure 7–18) receptacle.

b. Disconnect inlet, outlet, and return lines at solenoid valve.

c. Remove nut, washers, and bolts (1) and lift solenoid valve off hydraulic panel bracket.

d. Remove fittings from valve.

7–85. INSTALLATION. (See figure 7–18.)

a. Install fittings on solenoid valve (2).

b. Position and secure solenoid valve to hydraulic panel bracket (11).

c. Connect inlet, outlet, and return lines at solenoid valve.

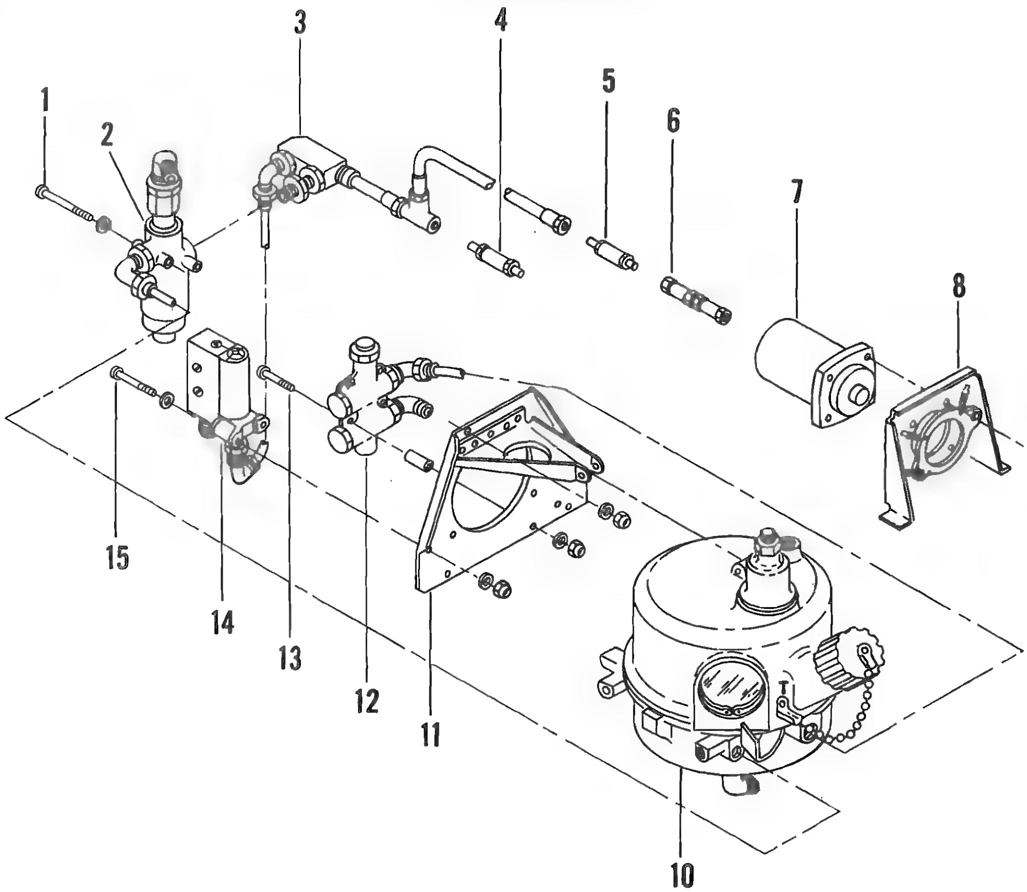
d. Plug wiring into solenoid valve receptacle.

Note

Plug and receptacle for solenoid valve are indentified by a yellow stripe.

7–86. RESTRICTOR AND SNUBBER.

7–87. DESCRIPTION. A restrictor (5, figure 7–18) and a snubber (6) are installed in the pressure hydraulic line to the pressure transmitter. (Refer to primary servo system schematic diagram in TM 55-1520-202-20, Chapter 2, Section V.) The restrictor and snubber prevent surges of pressure



1. Nut, Washer, Bolt
2. Solenoid Valve
3. Manifold
4. Hydraulic Fuse
5. Restrictor
6. Snubber
7. Pressure Transmitter
8. Bracket
9. Screws
10. Hydraulic Reservoir
11. Bracket
12. Pressure Relief Valve
13. Screw, Washers, Spacer, Nut
14. Pressure Switch
15. Bolt, Washers, Nut

Figure 7–18. Flight Control Hydraulic Systems Parts Identification.

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 by removing the restrictor and snubber from the tee on the pressure switch.

7–88. PRESSURE TRANSMITTER.

7–89. DESCRIPTION. The pressure transmitter electrically transmits the hydraulic pressure indication in the primary hydraulic system to the primary hydraulic pressure indicator on the instrument panel. (Refer to primary servo system schematic diagram in TM 55-1520-202-20, Chapter 2, Section V.) 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.

7–90. REMOVAL. (See figure 7–18.)

a. Disconnect wiring from pressure transmitter (7).

b. Disconnect pressure hose from elbow at pressure transmitter.

c. Remove screws (9) and lift pressure transmitter out of transmitter bracket (8).

d. Remove elbow from pressure transmitter.

7–91. INSTALLATION. (See figure 7–18.)

a. Install elbow in pressure transmitter (7).

b. Secure pressure transmitter in transmitter bracket (8).

c. Connect pressure hose line to elbow in transmitter.

d. Connect pressure indicator wiring into pressure transmitter.

7–92. RESERVOIR.

7–93. REMOVAL.

a. Drain reservoir.

b. Disconnect oil level inspection light.

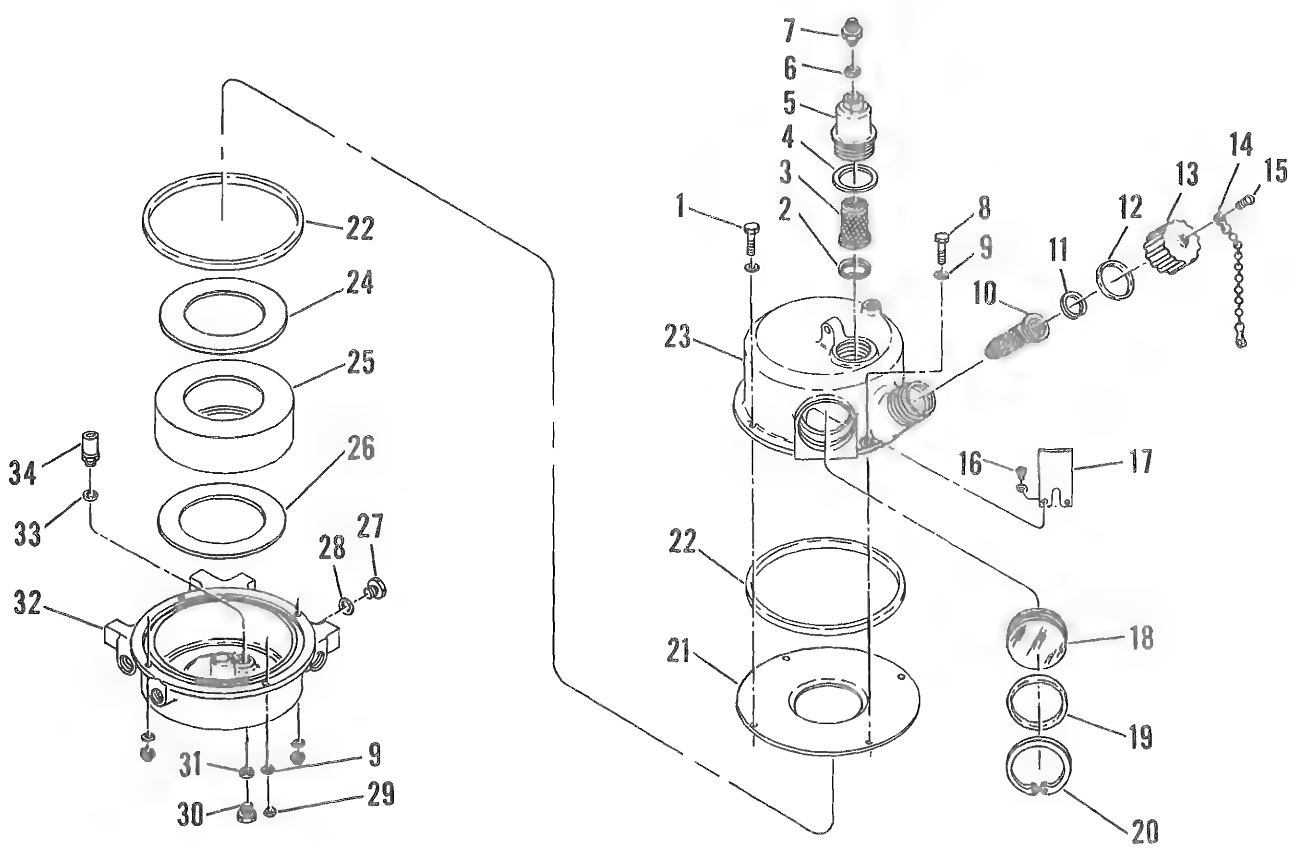
c. Disconnect servo supply, pump bypass, relief valve, servo return, reservoir vent, and, on helicopters serial No. 56-4284 and subsequent, rescue hoist supply and return lines at reservoir.

d. Disconnect and remove reservoir from hydraulic panel and reservoir support brackets.

e. Remove fittings from reservoir.

7–94. DISASSEMBLY.

a. Unscrew and remove adapter (5, figure 7–19) and gasket (4).



1. Bolt, Washers, Nut	10. Strainer	19. Packing	27. Plug
2. Retainer Ring	11. Retainer Ring	20. Retainer Ring	28. Gasket
3. Filter Element	12. Packing	21. Plate	29. Nut
4. Gasket	13. Filler Cap Assembly	22. Packing	30. Bleeder Plug
5. Adapter	14. Chain	23. Upper Reservoir	31. Gasket
6. Gasket	15. Screw	24. Gasket	32. Lower Reservoir
7. Reducer	16. Screw, Washer	25. Filter Element	33. Packing
8. Bolt	17. Reflector	26. Gasket	34. Relief Valve
9. Washers	18. Window		

Figure 7–19. Hydraulic Reservoir Disassembled

b. Remove retainer ring (2) and filter element (3) from adapter (5). Remove reducer (7) and gasket (6) from adapter.

c. Remove bolts from upper reservoir (23) and lower reservoir (32).

d. Remove light bracket and chain (14) of filler cap assembly from upper and lower reservoirs (23 and 32).

e. Separate upper and lower reservoirs (23 and 32) and remove packing (22) and plate (21).

f. Remove gasket (24 and 26) and filter element (25) from lower reservoir (32).

g. Unscrew and remove relief valve (34) and packing (33).

h. Unscrew and remove bleeder plug (30) and gasket (31).

i. Unscrew and remove plug (27) and gasket (28).

j. Remove retainer ring (20), window (18), and packing (19) from upper reservoir (23).

k. Unscrew and remove filler cap assembly (13).

l. Remove strainer (10) from filler tube.

m. Remove screws and washers (16) that secure the reflector (17) to inside of upper reservoir (23).

7–95. CLEANING. Clean all parts with dry-cleaning solvent, Federal Specification P-S-661.

7–96. REPLACEMENT.

a. Replace all gaskets and crushed washers.

b. Replace filter element if bad.

c. Replace all packings.

7–97. REASSEMBLY. (See figure 7–19.)

a. Position reflector (17) in upper reservoir (23) and secure in place.

b. Install strainer (10) in filler tube. Screw on filler cap assembly (13).

c. Position window (18) and packing (19). Install retainer ring (20).

d. Install plug (27) and gasket (28) on lower reservoir (32).

e. Install bleeder plug (30) and gasket (31). Secure bleeder plug (30) to plug (27) with lock wire.

f. Position packing (33). Screw relief valve (34) into lower reservoir (32).

g. Position gasket (26), filter element (25), and other gasket (24) in lower reservoir (32).

h. Position packing (22) on lower reservoir (32) and upper reservoir (23). Position plate (21).

i. Place upper reservoir (23) on lower reservoir (32) and secure with bolts.

j. Slide end of filler cap assembly chain (14) and one washer (9) on bolt (8). Position bolt (8) and slide on light bracket and other washer (9). Secure with nut (29).

k. Install filter element (3) in adapter (5). Install retainer ring (2).

l. Position gasket (4) and screw adapter (5) into reservoir.

m. Position gasket (6) and screw reducer (7) into adapter.

7–98. INSTALLATION.

Note

Before installing reservoir on helicopter, test for leakage following procedure outlined in TM 55-1520-202-20, Chapter 2, Section V.

a. Install fittings in reservoir.

b. Position reservoir on hydraulic panel and reservoir brackets and secure in place with washers and bolts. Secure bolts with lock wire.

Note

To insure proper support of reservoir at reservoir support bracket, adjust length of strut assembly.

c. Connect oil level inspection light.

d. Connect reservoir vent, relief valve, pump bypass, servo return, servo supply, and, on helicopters serial No. 56–4284 and subsequent, rescue hoist supply and return lines at reservoir.

e. Fill reservoir with hydraulic fluid, Military Specification MIL-H-5606, in accordance with servicing instructions. (Refer to TM 55-1520-202-20, Chapter 2, Section II.)

CAUTION

Use extreme care to prevent foreign matter from contaminating hydraulic fluid. If hydraulic fluid from a previously opened container is used, pass the fluid through a filter before it is added to helicopter's system.

7–99. AUXILIARY HYDRAULIC SYSTEM.

7–100. DESCRIPTION. 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 only in the auxiliary hydraulic system. On the other hand, if the primary hydraulic system is shut off, 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 a pressure switch in each system. If the pressure in one hydraulic system falls below 1000 psi, the pressure switch in that system opens and prevents the other hydraulic system from being turned off. Components of the auxiliary hydraulic system include a hydraulic pump, filter, three-way solenoid valve, pressure relief valve, pressure switch, hydraulic fuse, tail rotor pedal damper, pressure transmitter, restrictor, snubber, pressure indicator actuating cylinder, main rotor auxiliary servo unit, tail rotor servo unit, servo switch reservoir, and necessary interconnecting tubing and quick disconnects. Several of the components are grouped into a hydraulic panel. On helicopters serial No prior to 56-4313, this hydraulic panel is located in the clutch compartment. On helicopters serial No 56-4313 and subsequent, this hydraulic panel is located on the right side of the transmission deck.

Note

The primary and auxiliary servo hydraulic systems serve the same functional purpose; therefore, the systems and their components are essentially the same. The only difference between systems is the location of components which is pointed out in figure 7–18.

7–101. BLEEDING. The primary and auxiliary hydraulic systems are vented systems and will automatically expel any air that enters either system through normal functioning of the system. However, to insure smooth operation of either system after a line has been disconnected, after a component has been replaced, or after air has been allowed to enter the system in any other manner, the system should be operated through at least one complete cycle of the hydraulic fluid. This should be done with normal hydraulic pressure in the system and the SERVO switch set so only the system that is being bled is operating. To bleed the auxiliary hydraulic system, move both the main rotor and tail rotor flight controls through all extreme and intermediate positions enough times to insure that the hydraulic fluid has traveled through the system at least once. Bleed the primary hydraulic system in the same manner, but move only the main rotor flight controls.

7–102. TAIL ROTOR CONTROL SYSTEM.

7–103. DESCRIPTION. The functions of the tail rotor control system are to compensate for main rotor torque and to provide a means for changing the heading of the helicopter. The tail rotor control system consists of the following components: Two sets of tail rotor control pedals, a pilot's and copilot's pedal 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. 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 the copilot'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.

7–104. COMMON CONTROL CABLES. Common control cables will be found as part of the tail rotor control system connecting to a quadrant in the pilot's compartment running aft over pullys through fairleads at bulkheads to the tail rotor system.

7–105. REMOVAL.

a. Remove turnbuckles to relieve tension on cable.

b. Disconnect cable at quadrant.

c. Disconnect cable at tail rotor gear box.

d. Remove pulleys and fairleads if required.

e. Secure a piece of string or lock wire to one end of cable. Pull cable from opposite end until string or wire appears.

f. Secure string or wire to new cable to facilitate threading or replacement cable.

7–106. INSPECTING CABLES FOR DETERIORATION.

a. Inspect visually all control cables for broken wires, corrosion, or excessive wear.

Note

A shiny surface as compared to rest of cable indicates possible excessive wear. Cable should be carefully inspected.

b. Inspect for breakage occuring in that length of a cable normally passing over a pulley or through a fairlead.

c. Pass a clean, dry lint-free cloth along length of each cable.

Note

Broken wires will indicate where cloth is snagged.

d. Any 7 x 7 cable that shows more than three wires broken in any 1-inch length of cable is defective.

e. Any 7 x 19 cable that shows more than six wires broken in any 1-inch length of cable is defective.

f. Replace corroded or excessively worn cable even through number of broken wires is less than specified for replacement.

7–107. INSTALLATION.

a. Attach protuding string or wire to replacement cable.

b. Pull opposite end of string until cable appears.

c. Replace pulleys and fairleads as required.

d. Connect cable at tail rotor gear box.

e. Connect cable at quadrant.

f. Connect and adjust cable tension with turnbuckles.

7–108. TAIL ROTOR CONTROL PEDALS.

7–109. REMOVAL. (See figure 7–20).

a. Disconnect brake cylinders (152) from their upper and lower attachment points on pilot's pedals.

b. Disconnect tube fitting (156) and tube (154) from fuselage. Supporting instrument panel by an auxiliary means, disconnect support (122) of pedal and support installation from instrument panel shock mounts.

c. Remove pilot's pedal and support assembly from helicopter. Remove tube fitting (156) and support (122) from pedal and support assembly.

d. Remove retaining rings and washers securing pedal and control assembly (130) to tube (154) and remove pedal and control assembly.

e. Remove and disassemble copilot's pedal and support assembly (125) in same manner as pilot's pedal and support assembly, as outlined in steps *b* through *d*.

7–110. INSTALLATION. (See figure 7–20.).

a. Assemble pilot's pedal and support prior to installation as follows: Slide pedal and control assembly (130) onto tube (154) and secure with retaining rings and washers.

Note

Prior to installation of pedal and control assemblies (19 and 130) on tube (154), lubricate bearings of the pedal and control assemblies liberally with oscillating bearing grease, Military Specification MIL-G-25537.

b. Position support (21), fitting, and bracket (20) on tube (154) and secure. Slide pedal and control assembly (19) onto tube (154) and secure with retaining rings and washers. Position tube fitting (156) on end of tube (154) and secure. Install support (122). Secure tail wheel lock control handle and bell crank to support (21).

c. Inserting rod (119) into fitting, place pedal and support assembly in position in pilot's compartment. Secure pedal and support assembly at either end with bolt, washers, and nut and at support (21) to instrument panel shock mounts.

7–111. PEDAL ADJUSTER ASSEMBLY.

7–112. REMOVAL. (See figure 7–20.)

a. Disconnect rods (123 and 151) which extend from pilot's adjustor assembly (148) to quadrant (142).

b. Disconnect rods (119, 127, 150, and 153) which extend from pilot's adjustor assembly (148) to control pedals.

c. Remove retaining rings which secure handles (10 and 121) in position and remove handles.

d. Disconnect rod assembly (11) from adjustor bell crank (8). Remove rod assembly (11) by unscrewing it from yoke (14).

e. Disconnect and remove two links (15) which extend from yoke (14) to adjustor arms (17). Remove yoke.

f. Disconnect and remove adjustor arms (17) from adjustor bell crank (8).

g. Disconnect and remove adjustor bell crank (8) from fitting assembly (3) by removing bolt, washers, nut, and cotter pin (6), and shims. Disconnect and remove fitting assembly (3).

h. Remove and disassemble copilot's adjustor assembly in same manner as pilot's adjustor assembly.

7–113. INSTALLATION.

a. Connect rods (119, 127, 150, and 153) extending from adjustor assemblies to pedal and support assemblies.

Note

With one pedal held firmly, adjust to eliminate play of more than ± 1/16 inch maximum in other pedal.

b. Secure handles (10 and 121) to rod assembly (11) with retaining rings.

c. Install fitting assembly (3). Position adjustor bell crank (8) on fitting assembly and secure in place.

Note

Shim as required between upper end of adjustor bell crank (8) and fitting assembly (3) to reduce end play on bell crank.

d. Connect adjustor arms (17) to adjustor bell crank (8).

e. Connect links (15) to adjustor arms (17). Place yoke (14) in position in adjustor bell crank (8). Connect links (15) to yoke (14) and secure in place.

f. Thread rod assembly (11) into yoke (14) and secure rod to the adjustor bell crank (8). Secure screws with lock wire.

g. Repeat steps *c* through *f* for assembly and installation of copilot's adjustor assembly.

h. Connect rods (123 and 150).

7–114. TAIL ROTOR PEDAL DAMPER.

7–115. DESCRIPTION. (See figure 7–21.) A pedal damper assembly is located in the pilot's compartment 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.

7–116. REMOVAL.

a. Disconnect hydraulic hose (1, figure 7–21) from elbow on pedal damper assembly (8) by unscrewing nut.

b. Disconnect piston yoke from arm on quadrant arm (3).

c. Cut lock wire on trunnions and washers (4) which secure damper housing to trunnion assembly (5) and remove trunnions and pedal damper.

d. Remove elbow, nut, ring, and gasket (7) from pedal damper assembly (8). Plug damper port.

7–117. DISASSEMBLY (FOURTH ECHELON).

a. Remove yoke (68, figure 7–22) from power piston (51).

b. Press each bushing (63 and 67) from yoke (68) only if necessary.

c. Remove end plug (60) from housing (33), using an adjustable face spanner wrench, Armstrong part No. 482, and slide end plug off power piston (51).

d. Remove packing (55) and backup ring (56) from outside of end plug (60).

e. Remove packing (57), backup ring (58), and felt (59) from inside of end plug (60).

f. Slide power piston (51) from housing (33).

g. Remove relief plug (45) and compression spring (46) from power piston (51). Remove nylon insert (44) from relief plug.

WARNING

Power piston (51) contains a compression spring (46) of approximately 21 pounds load, which will be released upon separation of relief plug (45) from power piston.

h. Thread an AN510B4–28 screw into tapped hole in face of actuator (50) and remove actuator from power piston (51).

i. Remove packing (48) and each backup ring (47 and 49) from actuator (50).

j. Remove packing (53) and backup rings (52 and 54) from power piston (51).

Note

Retain power piston (51) and actuator (50) together as a matched lapped set.

k. Loosen locknut (8) on elbow filter fitting (11).

l. Remove elbow filter fitting (11) from housing (33).

m. Remove filter (9) from inside elbow filter fitting (11).

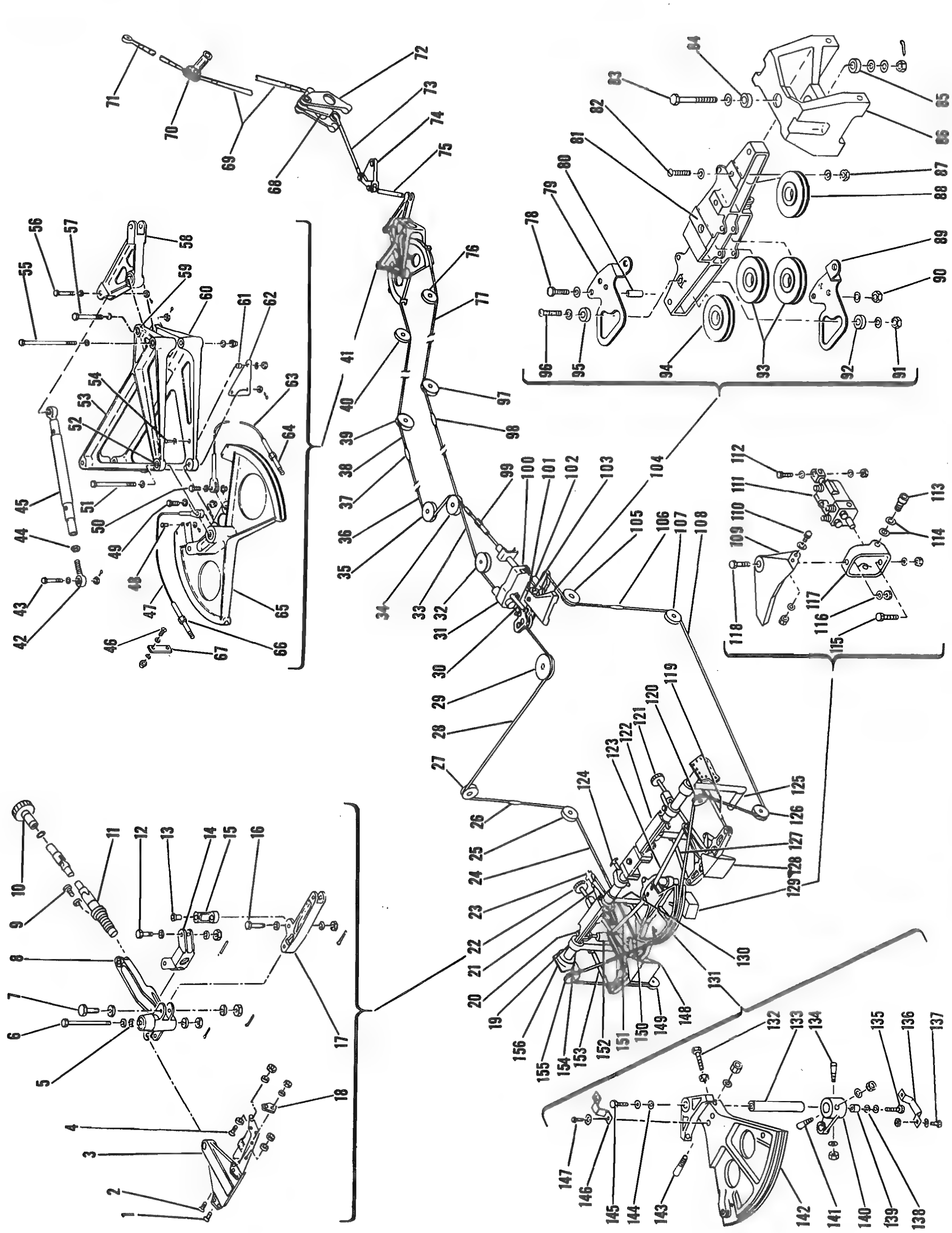


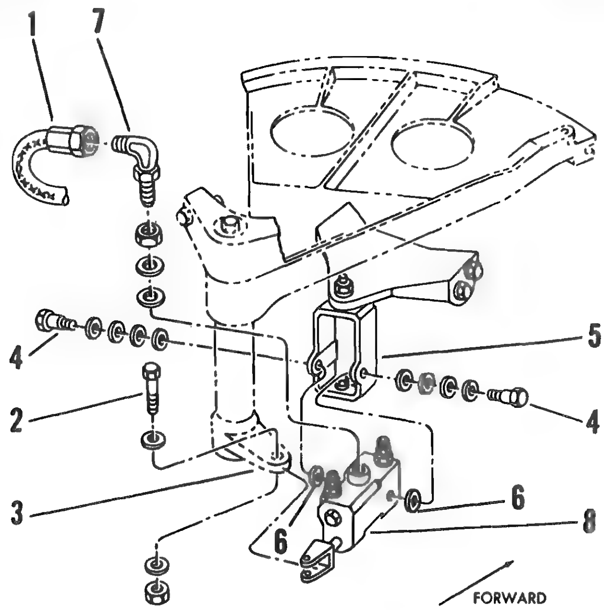
Figure 7–20. Tail Rotor Flight Controls System (Sheet 1 of 2)

1. Screw, Washer, Nut
2. Bolt, Washer, Nut
3. Fitting Assembly
4. Bolt, Washers, Nut
5. Shim
6. Bolt, Washers, Nut, Cotter Pin
7. Bolt, Washers, Nut, Cotter Pin
8. Adjustor Bell Crank
9. Screw, Washer
10. Handle
11. Rod Assembly
12. Bolt, Washers, Nut, Cotter Pin
13. Bushing
14. Yoke
15. Link
16. Bolt, Washers, Nut, Cotter Pin
17. Adjustor Arm
18. Guard
19. Pedal and Control Assembly
20. Bracket
21. Support
22. Adjustment Installation
23. Handle Adapter
24. Cable
25. Pulley
26. Turnbuckle
27. Pulley
28. Cable
29. Pulley
30. Arm
31. Servo Unit Assembly
32. Pulley
33. Cable
34. Pulley
35. Pulley
36. Cable
37. Turnbuckle
38. Cable
39. Pulley
40. Pulley
41. Aft Directional Control Installation
42. Rod-End Bearing
43. Bolt, Washer, Nut, Cotter Pin
44. Check Nut
45. Rod
46. Screw, Washers, Nut
47. Cable Assembly
48. Pin, Washer, Cotter Pin
49. Bolt, Washer, Nut
50. Bolt, Washer, Nut
51. Bolt, Washer, Nut, Cotter Pin
52. Bushing
53. Support
54. Screw, Washers, Nut
55. Bolt, Washers, Nut
56. Bolt, Washer, Nut, Cotter Pin
57. Bolt, Washer, Nut, Cotter Pin
58. Bell Crank Assembly
59. Bushing
60. Support
61. Spacer
62. Tab
63. Cable Assembly
64. Turnbuckle
65. Quadrant Assembly
66. Turnbuckle
67. Guard
68. Bell Crank
69. Rod
70. Idler
71. Rod
72. Bracket
73. Rod
74. Idler
75. Rod
76. Pulley
77. Cable
78. Bolt, Washer
79. Cam
80. Spacer
81. (Pulley) Support
82. Bolt, Washer
83. Bolt, Washers, Nut, Cotter Pin
84. Bearing
85. Bearing
86. Pedestal
87. Washer, Nut
88. Pulley
89. Cam
90. Washer, Nut
91. Washer, Nut
92. Bearing
93. Pulleys
94. Pulley
95. Bearing
96. Bolt, Washer
97. Pulley
98. Turnbuckle
99. Terminal
100. Lug
101. Cable
102. Spring Cylinder Assembly
103. Bolt, Washer, Clip
104. Pedestal Assembly
105. Pulley
106. Turnbuckle
107. Pulley
108. Cable
109. Fitting Assembly
110. Bolt, Washers, Nut
111. (Pedal) Damper
112. Bolt, Washers, Nut
113. Trunnion
114. Washers
115. Bolt, Washer, Nut
116. Washer, Nut
117. Trunnion Assembly
118. Bolt
119. Rod
120. Pulley
121. Handle
122. Support
123. Rod
124. Parking Brake Valve and Handle
125. Copilot's Pedal and Support Assembly
126. Pulley
127. Rod
128. Fitting
129. Damper Assembly
130. Pedal and Control Assembly
131. Quadrant Installation
132. Bolt, Check Nut
133. Shaft
134. Taper Pin, Washer, Nut
135. Bolt, Washer
136. Stop
137. Screw, Washer, Nut
138. Key Ring
139. Insert
140. Arm Assembly
141. Taper Pin, Washer, Nut
142. Quadrant
143. Taper Pin, Washer, Nut
144. Key Ring
145. Bolt, Washer
146. Stop
147. Screw, Washer
148. Pilot's Adjustor Assembly
149. Pulley
150. Rod
151. Rod
152. Brake Cylinder
153. Rod
154. Tube
155. Pulley
156. Tube Fitting

Figure 7–20. Tail Rotor Flight Controls System (Sheet 2 of 2)

n. Remove lock nut (8) and gasket (10) from elbow filter fitting (11).

o. Viewing pedal damper from end, with hole of elbow filter fitting (11) upright, remove end plug (43) located to left of power piston hole, releasing tension on compression spring (40). Remove gasket (42) from end plug. Remove stop (41) and compression spring from housing (33). Thread an AN510B5–28 screw into tapped hole in face of piston (39) and pull it from housing. Remove packing (37) and back-up ring (38) from piston.



1. Hydraulic Hose
2. Bolt, Washers, Nut
3. Quadrant Arm
4. Trunnions and Washers
5. Trunnion Assembly
6. Shims
7. Elbow, Nut, Ring, Gasket
8. Pedal Damper Assembly

Figure 7–21. Pedal Damper Removal

p. Remove end plug (20) located to right of hole of power piston (51), releasing tension on compression spring (14). Remove gasket (19) from end plug. Thread an AN510B5–28 screw into tapped hole in face of piston (17) and pull it from housing (33). Remove packing (16) and backup ring (15) from piston. Remove stop (13) and compression spring.

q. Remove brushing (18) from end plug (20) only if necessary.

r. Remove end plate (21) and plug (25) from housing (33). Remove packing (23) and backup rings (22 and 24) from plug. Slide out filter and orifice assembly and remove tube (26), packing (28), and backup rings (27 and 29) from filter and orifice (30).

s. Remove end plug (74) which gives access to check valve plug (72). Remove gasket (73) from end plug. Unscrew check valve plug and remove it from housing (33). Remove nylon insert (1) from check valve plug. Remove differential check valve assembly from housing. Remove packings (6 and 71) body (69) of differential check valve assembly.

Note

Do not disassemble metal parts of differential check valve assembly.

t. Remove felt (36), packing (34), and backup ring (35) from housing (33).

Note

Remove tapered plugs (7, 12, and 32) from housing only if necessary.

u. Remove nameplate (31) from housing (33).

7–118. CLEANING.

a. Clean all metal parts with dry-cleaning solvent, Federal Specification P-S-661.

b. Remove paint from parts with paint remover, Military Specification MIL-R-25134. Mix thoroughly prior to use. Rinse parts with water after removing paint.

WARNING

Work should be done outdoors in shaded areas, sheltered from excessive wind. If work is done indoors, provide adequate ventilation since paint remover is toxic.

c. If not reused immediately, dip, spray, or coat all steel parts subject to corrosion with a mixture of 75 percent lubricating oil, Military Specification MIL-L-6082, and 25 percent corrosion preventive (type 1), Military Specification MIL-C-6529.

7–119. INSPECTION.

a. Use magnetic particle inspection methods in accordance with Military Specification MIL-I-6868 on parts designated in table 7–VI.

b. Use fluorescent penetrant inspection methods in accordance with Military Specification MIL-I-6866 on parts designated in table 7–VI.

c. Inspect all components for damage, corrosion, and excessive wear.

d. Inspect mating surfaces of power piston (51, figure 7–22), pistons (17 and 39), and housing (33) for scoring and scratches.

e. Examine all threads for condition and cleanliness.

f. Inspect springs for breakage and set.

7–120. TESTING DIFFERENTIAL CHECK VALVE. Place the differential check valve assembly in a suitable holding fixture and proof pressure the check valve at 500 psi hydraulic

Table 7–VI. Inspection Requirements – Pedal Damper Assembly

NOMENCLATURE	FIGURE 7–22 INDEX NO.	RECOMMENDED METHOD OF INSPECTION	ITEMS FOR SPECIAL ATTENTION
Compression Spring	14, 40	MAGNETIC PARTICLE	Bent, or burrs on ends.
Housing	33	FLUORESCENT PENETRANT	Damaged threads, chipped hole edges, foreign particles lodged in interior, corrosion.
Compression Spring	46	MAGNETIC PARTICLE	Bent, or burrs on ends.
Actuator	50	MAGNETIC PARTICLE	Nicks, scored, sharp edges, scratched OD.
Power Piston	51	MAGNETIC PARTICLE	Distortion, damaged threads, nicked edges.
Yoke	68	FLUORESCENT PENETRANT	Cracked corners, distortion, elongated bushing holes, scored or scratched bushings, corrosion.

pressure, using hydraulic fluid, Military Specification MIL-H-5606, at a temperature of 21.1° to 43.3°C (70° to 110°F) in a room with an ambient temperature of 21.1° to 32.2°C (70° to 90°F). Test each side alternately. Leakage through each bleed hole, after a momentary spurt, shall not exceed 0.5 cc per minute (10 drops per minute). Apply 500 psi simultaneously to both parts of the check valve. A steady stream of fluid should flow through both bleed holes.

7–121. REPLACEMENT OF PARTS.

a. Replace all gaskets, backup rings, felts, and packings.

b. Replace all nylon inserts that do not lock part containing insert into its mating part.

Note

New nylon inserts may be filed to facilitate installation but must still retain full locking qualities

c. Replace differential check valve assembly as a unit if it does not pass testing requirements.

7–122. LUBRICATION (BEFORE REASSEMBLY). Soak all packings and felts in hydraulic fluid, Military Specification MIL-H-6083.

7–123. REASSEMBLY.

Note

If plugs (7, 12, and 32, figure 7–22) were removed, apply a light coat of petrolatum, Military Specification MIL-C-11796, or hydraulic fluid, Military Specification MIL-H-5606, to threads of plugs and screw into place in the housing (33). Tighten plugs to a torque of 30 to 40 inch-pounds.

a. Bond nameplate (31) to the housing (33) using cement, EC-711, Minnesota Mining and Mfg. Co.

b. Install packing (34) and backup ring (35), with packing on inboard side, in inboard channel of housing (33). Install felt (36) in outboard channel of housing.

c. Install each packing (6 and 71) on body (69) of differential check valve assembly and slide it into place in housing (33). Apply a light coat of petrolatum, Military Specification MIL-C-11796, or hydraulic fluid, Military Specification MIL-H-5606, to threads of check valve plug (72) and screw it into place against differential check valve assembly in housing (33). Install gasket (73) and nylon insert (1) on end plug (74). Apply a light coat of petrolatum, Military Specification MIL-H-11796, or hydraulic fluid, Military Specification MIL-H-5606, on threads end of plug and screw it into housing.

Note

Make certain that nylon insert (1) in check valve plug binds it tightly.

d. Install packing (28) and backup rings (27 and 29) on spool of filter and orifice (30). Install tube (26) on filter and orifice and slide complete assembly into housing (33). Install packing (23) and backup rings (22 and 24) on plug (25). Thread plug into end plate (21) and insert plug into housing.

e. Viewing pedal damper from end, with orifice of elbow filter fitting (11) upright, install stop (13) and compression spring (14) into hole at right of power piston hole. Install packing (16) and backup ring (15) on the piston (17) with ring toward narrow end of piston. Seat piston, narrow end first, over compression spring.

f. If removed, apply a light coat of graphite grease, Military Specification MIL-G-7187, to the mating surfaces of the bushing (18) and press into end plug (20) Install gasket (19) on end plug.

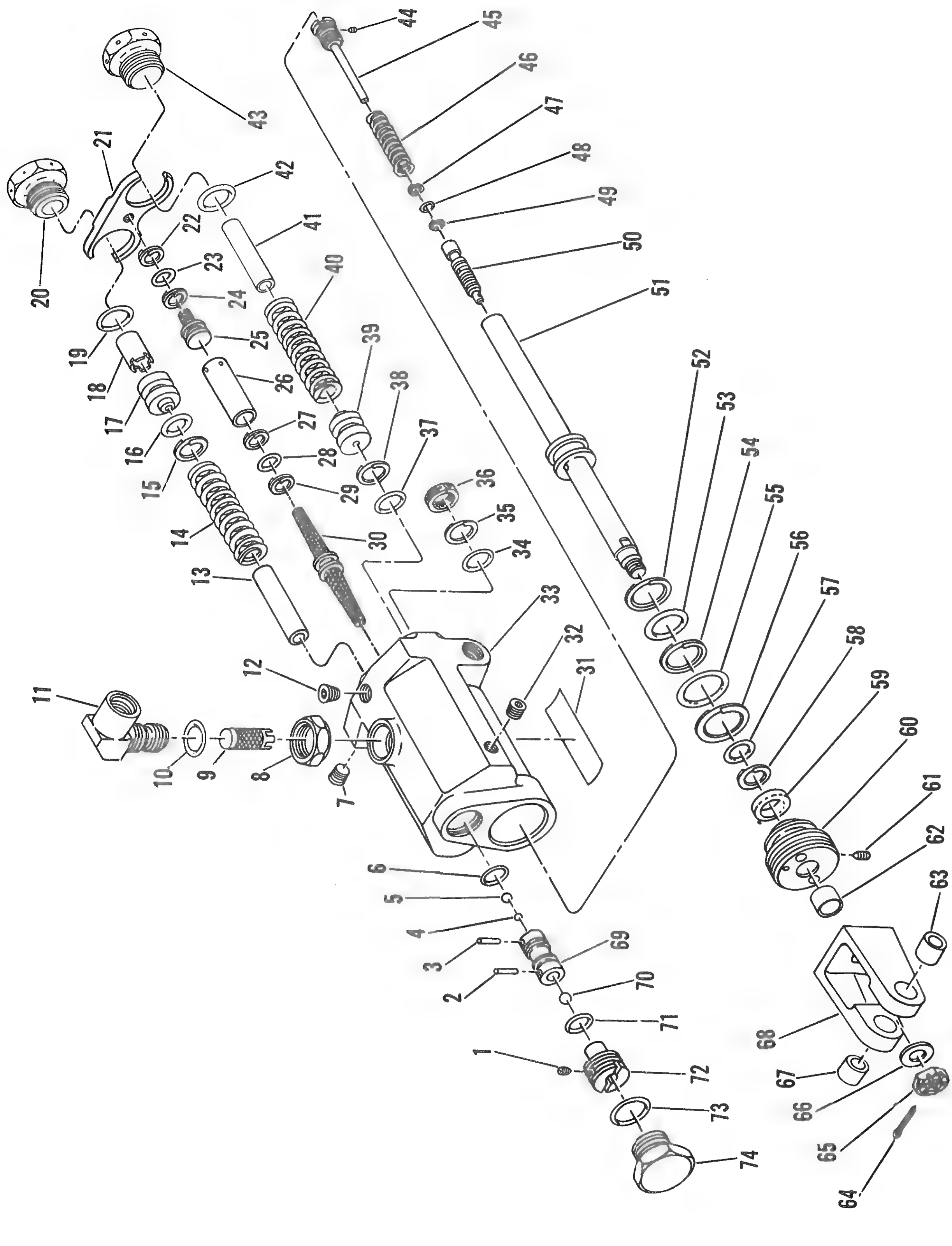


Figure 7–22. Pedal Damper Assembly–Disassembled (Sheet 1 of 2)

1. Nylon Insert
2. Pin (Staked)
3. Pin (Staked)
4. Ball
5. Ball
6. Packing
7. Plug
8. Locknut
9. Filter
10. Gasket
11. Elbow Filter Fitting
12. Plug
13. Stop
14. Compression Spring
15. Backup Ring
16. Packing
17. Piston
18. Bushing
19. Gasket
20. End Plug
21. End Plate
22. Backup Ring
23. Packing
24. Backup Ring
25. Plug
26. Tube
27. Backup Ring
28. Packing
29. Backup Ring
30. Filter and Orifice
31. Nameplate
32. Plug
33. Housing
34. Packing
35. Backup Ring
36. Felt
37. Packing
38. Backup Ring
39. Piston
40. Compression Spring
41. Stop
42. Gasket
43. End Plug
44. Nylon Insert
45. Relief Plug
46. Compression Spring
47. Backup Ring
48. Packing
49. Backup Ring
50. Actuator
51. Power Piston
52. Backup Ring
53. Packing
54. Backup Ring
55. Packing
56. Backup Ring
57. Packing
58. Backup Ring
59. Felt
60. End Plug
61. Nylon Insert
62. Bushing
63. Bushing
64. Cotter Pin
65. Nut
66. Washer
67. Bushing
68. Yoke
69. Body
70. Ball
71. Packing
72. Check Valve Plug
73. Gasket
74. End Plug

Figure 7–22. Pedal Damper Assembly–Disassembled (Sheet 2 of 2)

Apply a light coat of petrolatum, Military Specification MIL-C-11796, or hydraulic fluid, Military Specification MIL-H-5606, to threads of end plug and install into housing.

g. Position packing (37) and backup ring (38) on piston (39) with ring toward narrow end of piston. Viewing pedal damper from end, with elbow filter fitting (11) upright, install piston, wide end first, into hole at left of power piston hole. Seat compression spring (40) over piston. Insert stop (41) into compression spring. Install gasket (42) on end plug (43). Apply a light coat of petrolatum, Military Specification MIL-C-11796, or hydraulic fluid, Military Specification MIL-H-5606, on threads of end plug and install into housing. Secure end plugs (20 and 43) and plug (25) together with lock wire.

h. Apply a light coat of hydraulic fluid, Military Specification MIL-H-5606, or petrolatum, Military Specification MIL-C-11796, on threads of elbow filter fitting (11) and install lock nut (8) above groove on elbow filter fitting. Place gasket (10) on groove on elbow filter fitting. Place filter (9) into elbow filter fitting and install into housing (33). Position elbow filter fitting in place in housing and tighten lock nut. Secure lock nut and end plug (74) together with lock wire.

i. Install packing (48) and backup rings (47 and 49) in groove at large end of actuator (50).

j. Slide small end of actuator (50) into large end of power piston (51).

k. Slide compression spring (46) into place in power piston (51). Thread nylon insert (44) into relief plug (45) and apply a light coat of hydraulic fluid, Military Specification MIL-H-5606, or petrolatum, Military Specification MIL-C-11796, on threads of relief plug and then install into power piston. Place packing (53) and backup rings (52 and 54) on power piston head.

Note

If bushing (62) was removed from end plug (60), apply a light coating of graphite grease, Military Specification MIL-G-7187, to outside surface of bushing and inside diameter of end plug and press bushing into end plug.

l. Install backup ring (56) and packing (55) on outside of end plug (60) with packing on inboard side.

m. Place packing (57) and backup ring (58) in inside groove of end plug (60) with packing inboard. Install felt (59) in outboard groove at end plug. Thread nylon insert (61) into end plug.

n. Slide end plug assembly over power piston (51) and slide power piston into housing (33).

o. Apply a light coat of hydraulic fluid, Military Specification MIL-H-5606, or petrolatum, Military Specification MIL-C-11796, to threads of end plug (60) and install it into housing (33), using an adjustable face spanner wrench, Armstrong part No. 482.

p. If new bushings (63 and 67) are to be installed in yoke (68), it may be necessary to expand yoke up to a maximum of 121.11°C (250°F) in hot lubricating oil, Military Specification MIL-L-7870, or in a thermostatically controlled oven. Freeze bushing to −73.3°C (−100°F) in dry ice and thinner, Federal Specification TT-T-291, and insert bushings in yoke bushing boss so that outside bushing faces are flush with outer sides of yoke.

q. After yoke (68) and bushings (63 and 67) have been assembled and returned to room temperature, machine inner bushing faces equally square and true to a width measurement of 0.487 to 0.485 inch between bushing faces.

r. Slide yoke (68) onto power piston (51) and secure.

7–124. LUBRICATION (AFTER REASSEMBLY). After reassembly of the pedal damper, lubricate the felts (36 and 59, figure 7–22) with hydraulic fluid, Military Specification MIL-H-5606, using a squirt can around the power piston (51), through the appropriate fittings in the housing (33), and the end plug (60).

7–125. TESTING (AFTER REASSEMBLY). Use a hydraulic test bench, Greer part No. Z767, and hydraulic fluid, Military Specification MIL-H-5606 or MIL-H-6083, from 21.1° to 55°C (70° to 130°F), at room temperature of 10° to 43°C (50° to 110°F):

a. Build up 1500 psi on test bench at 5 gallons per minute at this pressure.

b. Place pedal damper assembly in a suitable fixture to move damper positioner through to its entire stroke.

c. Attach a suitable Plexiglas tubing to inlet port of pedal damper. Fill Plexiglas tube with hydraulic fluid. Pump pedal damper piston back and forth until all the air is bled from damper and no more air bubbles come up in the Plexiglas tube.

d. After damper is bled, remove Plexiglas tube and using a suitable hand pump, apply 6000 psi to inlet port of damper and allow pressure to remain for 5 minutes. There should be no external leakage or deformation of unit.

e. Connect a line from test stand to damper inlet port.

f. Actuate damper piston back and forth while slowly increasing pressure. Bypass valve should be fully closed on or before 600 psi. A closed bypass is evidenced by restricted motion of piston.

g. Increase pressure to 1500 psi. Slowly decrease pressure until bypass valve opens. Bypass valve should be fully opened at 200 psi. An open bypass is evidenced by free motion of piston.

h. Increase pressure of 1500 psi and time damper stroke.

i. With 150 pounds applied to piston, the damper should move full travel in 15 to 21 seconds. Both strokes should have approximately same timing.

j. Cycle damper 100 times at 1500 psi. Damper piston should not be retracted or stopped within its 100 cycles. This cycling will be conducted with a 75-pound load on piston.

k. Test damper springs in both directions by applying an instantaneous load of 100 pounds intermittently to damper piston. Piston should move 9/32 ±1/32 inch as soon as load is applied.

l. When leakage is evident as a result of test, replace backup ring and packings, and retest. When other faults are evident, or if leakage continues, damper should be replaced.

7–126. PREPARATION FOR STORAGE OR SHIPMENT.

a. Fill damper with preservative hydraulic fluid, Military Specification MIL-H-6083. Clean with dry-cleaning solvent, Federal Specification P-S-661. Coat external machined surfaces, except the piston, with petrolatum, Military Specification MIL-C-11796.

b. Wrap unit in barrier material, Military Specification MIL-B-121, and secure with tape, Federal Specification PPP-T-60.

c. Pack unit securely in a suitable box.

7–127. PLACING IN SERVICE AFTER SHIPMENT. Unpack unit, drain preservative hydraulic fluid, and strip petrolatum from exterior surfaces with dry-cleaning solvent, Federal Specification P-S-661. Fill damper with hydraulic fluid, Military Specification MIL-H-5606.

7–128. INSTALLATION.

a. Install gasket and ring on elbow, and screw nut and elbow into pedal damper assembly (8, figure 7–21).

b. Position damper in trunnion assembly (5). Install trunnions and washers (4) that attach damper to trunnion assembly (5).

c. Install 2 shims (6), part No. S1640-61773, to obtain between 0.005 and 0.010-inch end play at both sides when installing pedal damper assembly to trunnion assembly.

d. Tighten trunnions (4) to a torque of 20 to 30 inch-pounds, and secure with lock wire.

Note

Install bolt, part No. AN 174-15A, in place of bolt, part No. AN 174-16A, when attaching pedal damper piston yoke to quadrant arm.

e. Connect hydraulic hose (1) to elbow.

7–129. TESTING (AFTER INSTALLATION).

a. With 1500 psi applied at auxiliary hydraulic system and with 50-pound loads applied at control pedals, check for an elapsed time of 18 seconds ±3 seconds for full travel of pedal damper piston from one extreme to other.

b. Check damper springs by rapidly applying force to pedals. The pedals should deflect approximately 1 inch at load application and spring back to their original position at release.

Note

If damper rate is high, check tail rotor control rigging for excessive binding in cables.

c. Test rate of pedal damper which has been removed from helicopter by applying a 150-pound load at piston and checking the piston for an elapsed time of 18 ±3 seconds for full travel from one extreme to other with 1500 psi hydraulic pressure.

7–130. TAIL ROTOR SERVO UNIT.

7–131. DESCRIPTION. (See figure 7–23.) 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. On model CH-34C the automatic stabilization equipment operates the tail rotor servo unit by actuating the pilot valve by means of a servo motor assembly on the tail rotor servo unit. The servo motor is controlled electrically by the automatic stabilization equipment. An open-loop system in the tail rotor servo unit comprised of a spring cylinder assembly permits major tail rotor adjustment by the automatic stabilization equipment by keeping the pilot valve displaced after the servo motor has reached its limit of travel without manual movement of the pilot's tail rotor control pedals. 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.

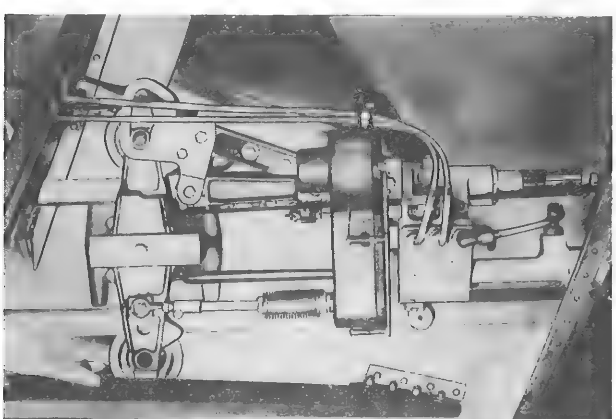


Figure 7–23. Tail Rotor Servo Unit Installed

7–132. REMOVAL.

a. In cabin at frame aft of tail rotor servo unit, unfasten soundproofing and disconnect terminal from control cable. Remove cotter pin, back off check nuts, and remove terminal and check nuts from cable (1, figure 7–24). Remove clamp (2) around servo unit cylinder at frame.

b. In tail cone, disconnect tail rotor control cable at turnbuckle (3) on left side and work cable through pulleys. Remove pulleys as necessary.

c. Hinge down service platforms. Remove aft skin panel (4).

d. Pull control cable out through power piston. Take out screws (5) remove guides, and pull other control cable out through housing. Reinstall screw (5).

e. Disconnect hydraulic lines from servo unit housing at couplings (6).

f. On model CH-34C disconnect wiring to servo motor assembly at quick disconnect (7).

g. On model CH-34C, remove nuts, washers, and bolts (8) from spring cylinder assembly (9). Remove spring cylinder assembly.

h. On model CH-34C, remove screws (10) from lug (11) and remove lug.

i. Remove bolt and washers (12) and clip (13) from pedestal assembly.

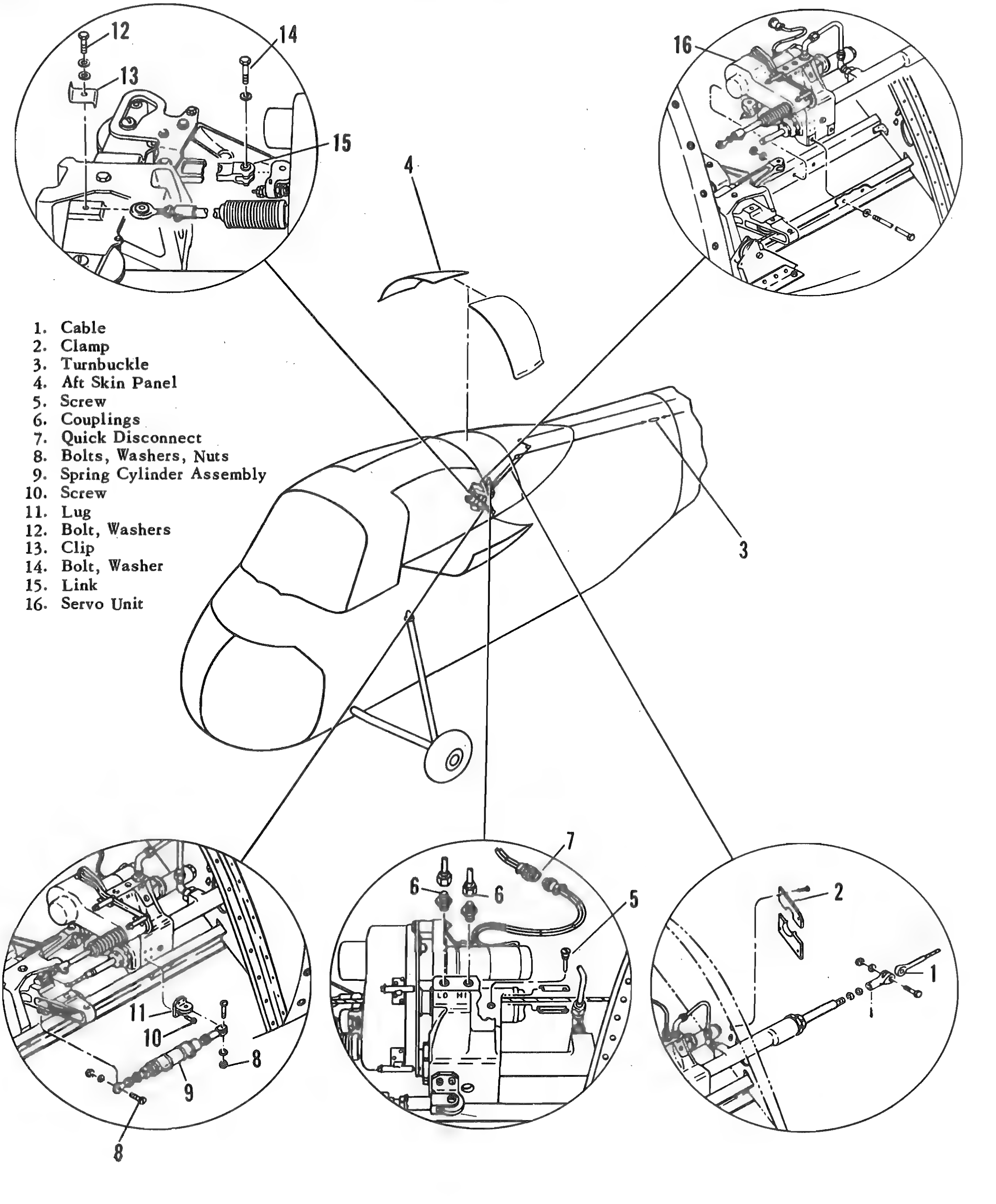
j. Remove bolt and washer (14) from link (15).

k. Disconnect servo unit (16) from supporting channels and remove from helicopter.

7–133. DISASSEMBLY.

a. Loosen check nut (30, figure 7–25) and remove rod end (29). Remove adjusting bushing (31) from end fitting (33).

b. Press taper pins (34) from end fitting (33) and remove end fitting.



1. Cable
2. Clamp
3. Turnbuckle
4. Aft Skin Panel
5. Screw
6. Couplings
7. Quick Disconnect
8. Bolts, Washers, Nuts
9. Spring Cylinder Assembly
10. Screw
11. Lug
12. Bolt, Washers
13. Clip
14. Bolt, Washer
15. Link
16. Servo Unit

Figure 7–24. Tail Rotor Servo Unit Removal *c.* Slide bellows assembly (36) slightly forward and remove packings (35 and 37) from internal grooves at each end of bellows. Do not break soldered connections of bellows.

d. Remove bellows assembly (36) from rod (27).

e. Remove cover (28) from mounting plate (18).

f. Disconnect rod end (25) from fork (22). Press bearing (26) from rod end (25).

g. Disconnect servo motor assembly (19) and slide free from servo unit.

h. Disconnect fork (21) from fork (22).

i. Press out bearings (20) from fork (21). Press out bearings (23 and 24) from fork (22).

j. Loosen lock nut (11) and remove end cap (14) from cylinder (10), using spanner wrench, Williams Co. part No. 471 or equivalent. Remove felt (17), packings (12 and 15), and backup rings (13 and 16) from end cap (14).

k. Loosen lock nut (7) and remove end cap (4) from housing (8), using spanner wrench, Williams Co. part No. 471 or equivalent. Remove packings (3 and 6), backup rings (2 and 5),and felt (1).

l. Remove spring retainer (9) from housing (8).

7–134. REASSEMBLY. (See figure 7–25.)

a. Install spring retainer (9) on housing (8) to a torque of 65 to 70 inch-pounds. Secure spring retainer to housing with lock wire.

b. Install packing (6) in inboard slot in end cap (4) and install backup ring (5) outboard of packing. Soak felt (1) in hydraulic fluid, Military Specification MIL-H-6083, and install in end cap. Install packing (3) and backup ring (2) outboard of packing.

c. Apply anti-seize compound, Military Specification TT-A-580, to threads of end cap (4), and install lock nut (7). Thread end cap into housing (8) and tighten end cap and lock nut using spanner wrench, Williams Co. part No. 971 or equivalent. Secure end cap and lock nut to housing with lock wire.

d. Install packing (12) in inboard slot of end cap (14) and backup ring (13) outboard of packing. Soak felt (17) in hydraulic fluid, Military Specification MIL-H-6083, and install it in outboard slot of end cap. Install packing (15) on end cap and backup ring (16) outboard of packing.

e. Apply anti-seize compound, Military Specification TT-A-580, to threads of end cap (14), and install lock nut (11) on end cap. Thread end cap into cylinder (10). Tighten end cap and lock nut using spanner wrench, Williams Co. part No. 471, or equivalent. Secure end cap and lock nut to cylinder with lock wire.

f. Apply a small amount of graphite grease, Military Specification MIL-G-7187, to bearing seats in fork (22) and press bearings (20) into fork with bearing flanges on outside surface. After new bearings are installed, line ream bores to 0.2495/0.2498 inch after press-fit.

g. Apply a small amount of graphite grease, Military Specification MIL-G-7187, to bearing seats in fork (22) and press bearings (23 and 24) in place. After new bearings (24) are installed, line ream to 0.3123/0.3125 inch after press-fit. After new bearings (23) are installed, line ream to 0.2495/0.2498 inch after press-fit.

h. Position fork (21) and secure in place.

i. Secure fork (22) to fork (21).

j. Install servo motor assembly (19).

k. Apply a light coating of graphite grease, Military Specification MIL-G-7187, to bore of rod end (25), press bearings (26) into rod end, and stake in three places. Slide cover (28), bellows assembly, and packings (35 and 37) on rod (27) and install end fitting (33) and taper pin (34). Secure taper pin with lock wire.

l. Thread adjusting bushing (31) into end fitting (33) and thread check nut (30) on rod end (29). Thread rod end into adjusting bushing. Install screw, washers, and nut (32) in end fitting.

m. Install rod assembly and cover (28) as a unit.

n. Position cover (28) against mounting plate (18) and secure. Slide packing (37), bellows assembly (36), and packing (35) in place. Press packings in internal grooves of bellows assembly.

Note

Do not secure screw, washers, and nut (32), check nut (30), or adjusting bushing (31) with lock wire until installation.

7–135. CLEANING.

a. Clean exterior surfaces of tail rotor servo unit with a cloth dipped in dry-cleaning solvent, Federal Specification P-S-661.

b. Clean exposed portion of power piston with a clean cloth dipped in hydraulic fluid, Military Specification MIL-H-5606.

7–136. PREPARATION FOR STORAGE OR SHIPMENT.

a. Fill servo unit with preservative hydraulic fluid, Military Specification MIL-H-6083, and plug ports.

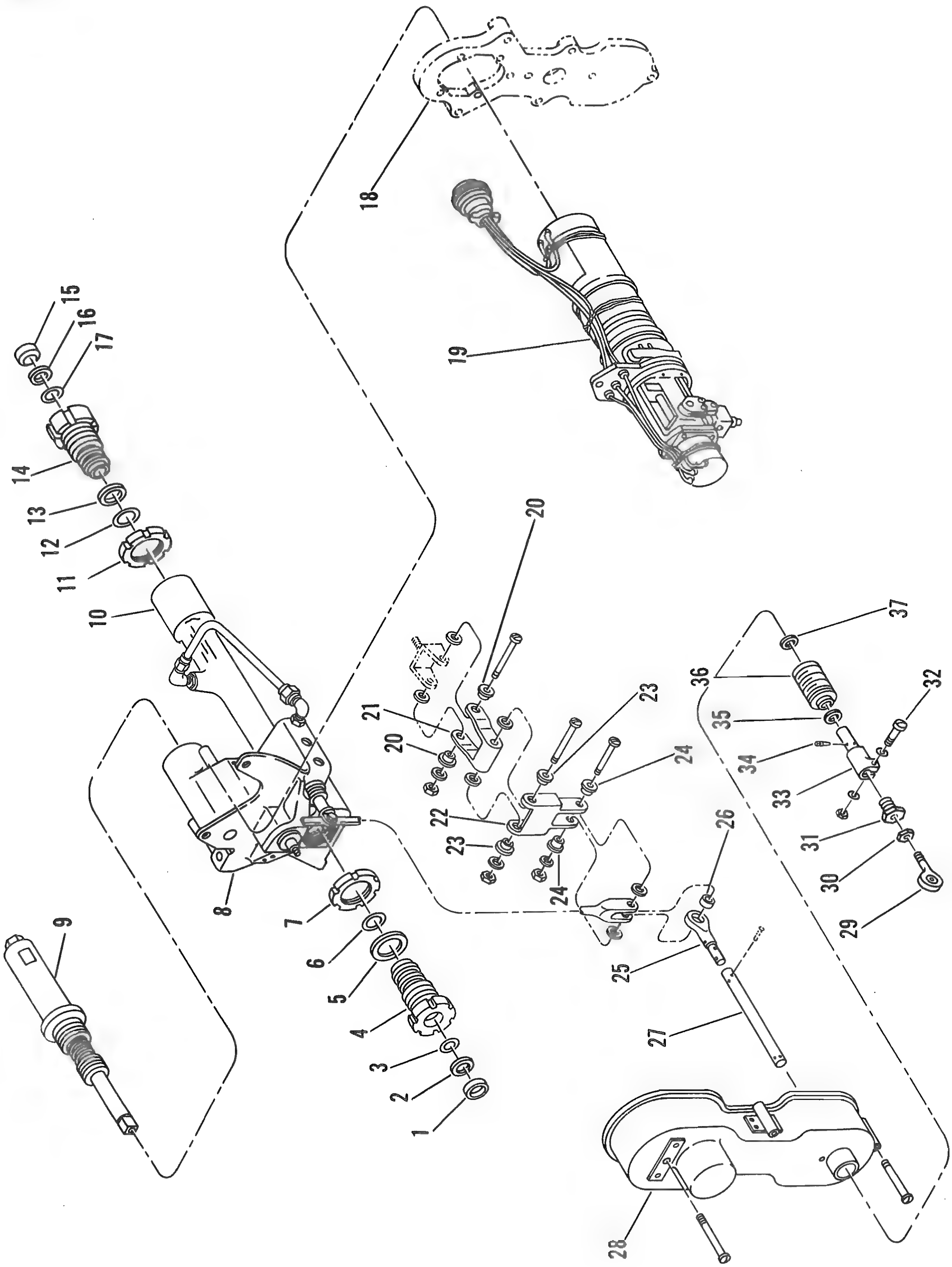


Figure 7–25. Tail Rotor Servo Unit Assembly Disassembled (Sheet 1 of 2)

1. Felt
2. Backup Ring
3. Packing
4. End Cup
5. Backup Ring
6. Packing
7. Lock Nut
8. Housing
9. Spring Retainer
10. Cylinder
11. Lock Nut
12. Packing
13. Backup Ring
14. End Cap
15. Packing
16. Backup Ring
17. Felt
18. Mounting Plate
19. Servo Motor Assembly
20. Bearing
21. Fork
22. Fork
23. Bearings
24. Bearings
25. Rod End
26. Bearing
27. Rod
28. Cover
29. Rod End
30. Check Nut
31. Adjusting Bushing
32. Screw,Washers, Nut
33. End Fitting
34. Taper Pin
35. Packing
36. Bellows Assembly
37. Packing

Figure 7–25. Tail Rotor Servo Unit Assembly Disassembled (Sheet 2 of 2)

b. Coat rod-end bearings with grease, Military Specification MIL-G-3278.

c. Wrap unit in barrier material, Military Specification MIL-B-121, secure with tape, Federal Specification PPP-T-60, and pack unit securely in a suitable box.

7–137. PLACING IN SERVICE AFTER SHIPMENT. Unpack unit, remove tape and barrier material, drain preservative hydraulic fluid, and refill the servo unit with hydraulic fluid, Military Specification MIL-H-5606.

7–138. INSTALLATION. (See figure 7–24.)

a. Secure tail rotor servo unit (16) to supporting channel.

Note

Bolts should be dipped in primer, Military Specification MIL-P-8585, and inserted while wet.

b. Secure link (15) which connects cam to actuating rod at rod end with bolt and washer (14). Secure bolt with lock wire.

c. Secure rod from servo unit pilot valve and clip (13) to pedestal assembly with bolt and washers (12). Secure bolt (12) to clip with lock wire.

d. Install lug (11) at servo unit housing, and secure with screws (10). Secure screws with lock wire.

e. On Model CH-34C secure rod end of spring cylinder assembly (9) to pedestal assembly and forked end to lug (11) on servo unit body with bolts, washers, and nuts (8). Do not secure with lock wire until adjustment has been made.

f. On Model CH-34C connect wiring to servo motor assembly.

g. Connect hydraulic lines to servo unit housing.

h. Insert control cable which has ball stop swaged to it through power piston. In cabin, install clamps (2) around servo unit cylinder opening in frame. Install a check nut on aft terminal of cable. Position cable in servo by tightening check nut until ball terminal of cable seats itself snugly against forward end of piston assembly. Lock in position with a second check nut. Tighten check nut to a torque of 15 to 18 inch-pounds. Install terminal at cable terminal and secure with cotter pin. Connect terminal to aft control cable (1).

i. Insert other control cable through housing into cabin. Remove screw (5) from servo unit housing and install guides with screw (5). Work control cable through pulleys and into tail cone. Install any pulleys which were removed. Connect cable at turnbuckle (3) on left side of tail cone. Fasten cabin soundproofing in place.

j. Check rigging of tail rotor controls. (Refer to paragraph 7–144.)

k. Adjust tail rotor servo unit. (Refer to paragraph 7–139 or 7–140.)

l. Replace canopy skin assemblies and close service platforms.

7–139. ADJUSTMENT (MODEL CH-34A).

a. Connect an auxiliary source of hydraulic pressure at 1500 psi to auxiliary hydraulic system at quick disconnect panel on right side of engine.

b. Check that cam roller is in servo position and that it clears cam by 0.002 to 0.007 inch. Adjust for position at rod end on bypass piston rod, secure lock nut, bend down tang of lockwasher, and secure lock nut and washer with lock wire.

c. Attach a hand pump to pressure inlet port and lower hydraulic pressure in servo unit until cam roller moves down to bypass index position. Hold hydraulic pressure and adjust actuator bolt until it just contacts flange of valve extension. Advance or back off actuator bolt minimum amount necessary to allow cotter pin installation. Tighten actuator bolt lock nut and install cotter pin. Shut off hydraulic pressure completely. Check that cam roller is in manual position and bypass actuator is extended. Adjust nut on bottom of valve extension to obtain 0.010-inch clearance with contact bolt. Back off nut minimum amount necessary to install cotter pin. Tighten small lock nut and install cotter pin.

Note

Spanner wrench, Willians Co. part No. 471, may be used for adjustment of tail rotor servo.

d. Bring hydraulic pressure back up to 1500 psi. Center cam roller in cam slot by adjusting rod end of servo unit rod assembly. Cut off hydraulic pressure and observe roller and cam as actuator returns cam to manual position. There is to be no lateral movement of cam throughout this transition period. Check operation of tail rotor control pedals from one extreme to other.

e. Disconnect pedal damper from arm of quadrant assembly. (See figure 7–21.) Apply 1500 psi hydraulic pressure to the auxiliary servo system using servo rigging test stand, part No. S1670-10280, and check force required to move tail rotor control pedal. If force required exceeds 10 pounds, check tail rotor control rigging for excessive binding or interference.

f. Connect pedal damper to arm of quadrant.

g. Disconnect auxiliary source of hydraulic pressure.

7–140. ADJUSTMENT (MODEL CH-34C).

a. Disconnect pedal damper from system by detaching damper from arm of quadrant assembly.

b. Connect an auxiliary source of hydraulic pressure to auxiliary servo system at quick disconnect panel on right side of engine.

c. Adjust bypass valve and actuator according to procedure outlined in steps *d* through *o.*

d. Apply 1500 psi hydraulic pressure.

e. Check that cam roller is in servo position and bypass actuator is fully retracted, that is [illegible], in housing.

f. Back off jam nut (2, figure 7–26), and slide back lockwasher (3) on bypass actuator piston rod end (1). Rotate piston rod on its rod end (1) clockwise or counterclockwise in increments of 1/4 turn, using wrench, part No. S1670-10673, until cam roller clears cam by 0.002 to 0.007 inch. (See detail A, figure 7–27.)

Note

Lockwasher (3, figure 7–26) must be positioned to clear housing. Rotate piston rod (4), 1/4 turn, using wrench, part No. S1670-10673, if necessary, staying within 0.002 to 0.007-inch clearance. (See figure 7–27.)

Note

If lower cam roller does not clear cam, increase clearance on the upper roller until lower roller has necessary 0.002 to 0.007-inch clearance.

g. Tighten jam nut (2, figure 7–26) and secure jam nut to lockwasher (3) with lock wire.

h. Decrease hydraulic pressure until two lines scribed on cam line up with center line of cam roller. (See figure 7–27.) Hold hydraulic pressure at this point.

i. Remove cotter pin (8, figure 7–26) from flange at bypass actuator piston and rod end (1).

j. Adjust bolt (10) on bypass valve extension (11) to barely contact valve extension shoulder.

k. Advance or back off bolt (10) minimum amount necessary to install cotter pin (8) in flange at rod end (1) of bypass actuator piston. Install cotter pin.

l. Relieve hydraulic pressure.

m. Extend piston rod (4) of bypass actuator piston. Cam roller should be bottomed in manual position. (See figure 7–27.)

n. Back off jam nut (5, figure 7–26) on forward end of bypass valve extension (11). Remove cotter pin (6) and adjust nut (7) to obtain a 0.010-inch minimum clearance between nut (7) and tip of bolt (10).

o. Back off nut (7) minimum amount necessary to install cotter pin (6). Tighten jam nut (5).

p. Disconnect open-loop spring cylinder (13) from lug (12) on servo unit housing.

Note

Make certain free end of open-loop spring cylinder does not interfere with motion of pulley support arm (14).

q. Connect an external source of electrical power to helicopter.

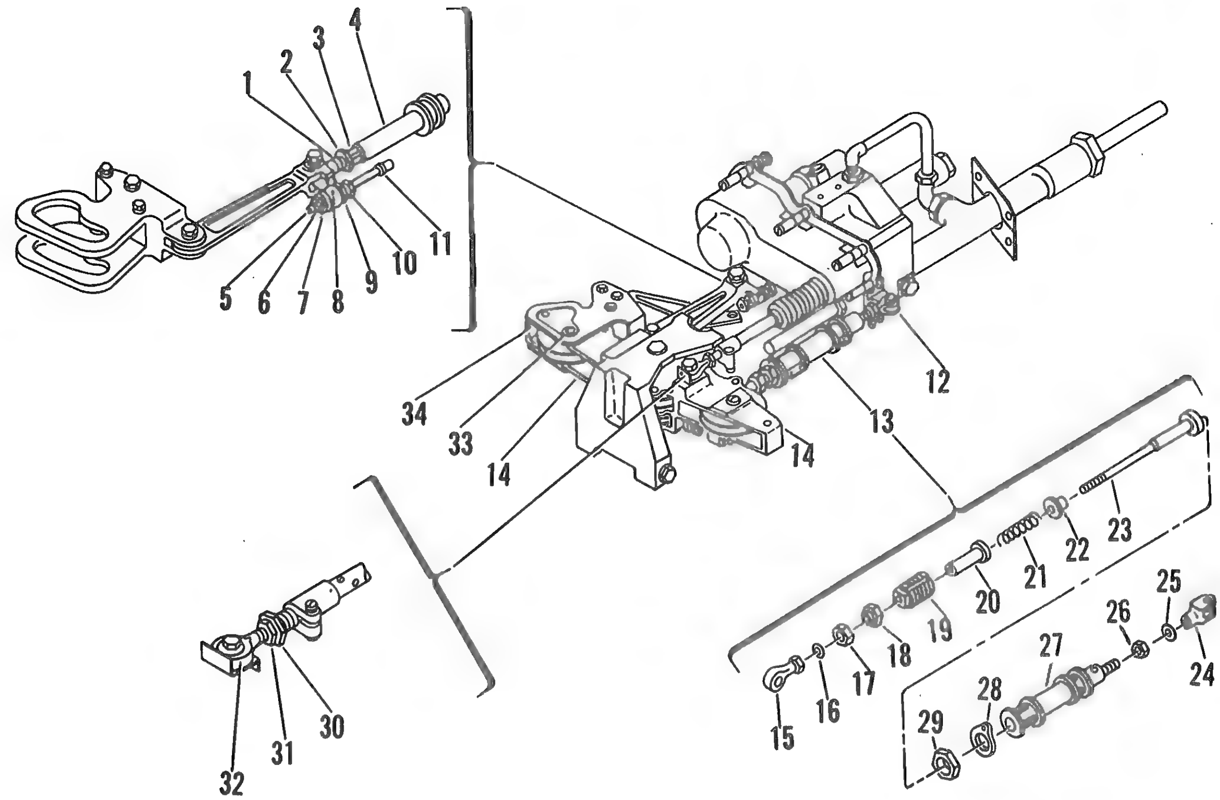
r. Apply 1500 psi hydraulic pressure.

s. Place electrical power switch in BATT position.

Note

Make certain No. 2 inverter circuit beaker and automatic stabilization equipment and compass circuit breaker are pushed in.

t. Wait 2-1/2 minutes and engage automatic stabilization equipment by pushing on ENG button on automatic stabilization equipment control panel until green light stays on.



1. Rod End
2. Jam Nut
3. Lockwasher
4. Piston Rod
5. Jam Nut
6. Cotter Pin
7. Nut
8. Cotter Pin
9. Nut
10. Bolt
11. Bypass Valve Extension
12. Lug
13. Open-Loop Spring Cylinder
14. Pulley Support Arm
15. Rod End
16. Lockwasher
17. Jam Nut
18. Sleeve Nut
19. Plug
20. Sleeve
21. Spring
22. Sleeve
23. Rod
24. Rod End
25. Lockwasher
26. Jam Nut
27. Rod
28. Lockwasher
29. Plug Nut
30. Adjusting Bushing
31. Jam Nut
32. Rod End
33. Cam Roller
34. Cam

Figure 7–26. Tail Rotor Servo Unit Adjustment

u. Push STANDBY button to place automatic stabilization equipment in standby mode.

v. Place channel selector switch in YAW so that servo motor position may be observed on null indicator, NULL INDIC.

w. Servo motor may now be driven to its limit of travel by actuating OVERRIDE CHECK switch to left or right.

Note

It is possible to tell when servo motor reaches one end of its travel by observing NULL INDIC needle position, listening for clicks as motor hits a stop, and by observing cam roller (33) moving back and forth on cam with motion of servo motor.

x. Check pilot valve for proper adjustment according to procedures outlined in steps *y* and *z.*

Note

Make certain OVERRIDE CHECK switch is in center and off position.

y. Relieve hydraulic pressure.

z. As cam returns to manual position, cam roller should move into closed end of cam without striking either side of cam surface. Rotation of cam roller will indicate that roller is striking cam.

Note

If cam roller does not strike cam surface, apply 1500 psi hydraulic pressure and proceed to step *aj.* If cam roller does strike cam surface, proceed to step *aa.*

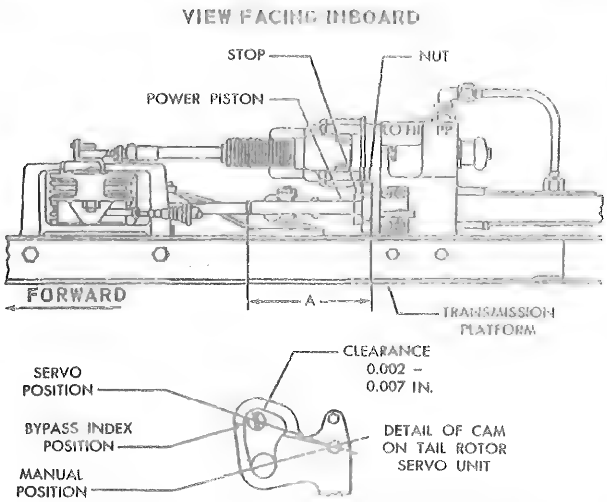


Figure 7–27. Tail Rotor Servo Unit Neutral Position

aa. Adjust pilot valve rod according to procedure outlined in steps *ab* through *ai.*

ab. Apply 1500 psi hydraulic pressure.

ac. Place OVERRIDE CHECK switch in RIGHT AFT UP position.

ad. Cut lock wire on adjusting bushing (30) and jam nut (31). Back off jam nut (31).

ae. Rotate adjusting bushing (30) clockwise or counterclockwise, as necessary, to position cam roller (33) 1/16 inch from end of cam (34).

af. Place OVERRIDE CHECK switch in LEFT FWD DOWN position.

ag. Distance between cam roller and cam should equal 1/16-inch gap obtained in step *ae.* If not, reset adjusting bushing (30) till gaps are equal. Tighten jam nut (31).

ah. Check pilot valve for proper adjustment. (Refer to step *x.*)

ai. Secure jam nut (31) and adjusting bushing (30) with lock wire.

aj. Run servo motor from one end of its travel to other with OVERRIDE CHECK switch. Rate in both directions should be equal. Return OVERRIDE CHECK switch to center and off position.

ak. With tail rotor control pedals in approximately neutral position, repeat step *aj*; pedals should not move.

al. Check force necessary to move tail rotor control pedals with tail rotor servo unit on. Follow procedure in step *am.*

am. Using a spring scale on pedals, force required to move pedals throughout range of pedal travel is not to exceed 20 pounds in either direction.

Note

Permissible force in last inch of travel may be a maximum of 25 pounds.

an. Relieve hydraulic pressure.

ao. Connect pedal damper to system by attaching pedal damper to quadrant assembly arm.

ap. Make applicable tests for proper operation of pedal damper in helicopter by following procedure outlined in paragraph 7–129.

aq. Connect open-loop spring cylinder (13, figure 7–26) to lug (12) on servo unit housing.

ar. Run servo motor from one end of its travel to other in both directions with OVERRIDE CHECK switch. Full travel of pedals in either direction should be 26 to 31 seconds.

Note

If time is between 26 to 31 seconds, proceed to step *bi.* If full travel does not occur in 26 to 31 seconds, proceed to step *as.*

as. Adjust open-loop spring cylinder following procedures outlined in steps *at* through *bb.*

Note

Steps *at* through *ba* are preliminary adjustments.

at. Back off jam nut (17), and slide back lockwasher (16) at forward end of open-loop spring cylinder (13).

au. Disconnect rod end (24) of open-loop spring cylinder from lug on servo unit housing.

av. Rotate rod (23) in rod end (15) to two threads past safety hole by rotating body of open-loop spring.

aw. Position lockwasher (16), tighten jam nut, and secure with lock wire.

ax. Rotate sleeve nut (18) against sleeve (20) until spring (21) is held firmly, but under no preload. Then tighten sleeve nut (18) until external sleeve (20) can barely be turned with fingers.

ay. Back off jam nut (26), and slide back lockwasher (25) at rod end (24).

az. Thread rod end (24) onto rod (27) as far as possible.

ba. Back off plug nut (29) and thread out plug (19) so that 3/8 inch of thread is showing beyond plug nut (29) in tightened position. Tighten plug nut (29). Connect forked end of open-loop spring cylinder to lug (12) on servo unit housing.

bb. Place OVERRIDE CHECK switch in LEFT FWD DOWN position.

bc. When servo motor is at its stop, place OVERRIDE CHECK switch in RIGHT AFT UP position. Pedal travel from stop to stop should between 26 to 31 seconds.

Note

If time is between 26 to 31 seconds, proceed to step *be*. If time is not between 26 to 31 seconds, proceed to step *bd*.

bd. Thread out rod (27) from rod end (24) in 1/4-turn increments and repeat procedure from step *bb*.

be. Place OVERRIDE CHECK switch in RIGHT AFT UP position.

bf. When servo motor is at its stop, place OVERRIDE CHECK switch in LEFT FWD DOWN position. Time pedal travel from stop to stop. Time should be between 26 to 31 seconds.

Note

If time is between 26 and 31 seconds, proceed to step *bh*. If time is not between 26 and 31 seconds, proceed to step *bg*.

bg. Loosen plug nut (29), thread in plug (19), tighten plug nut, and repeat procedure from step *be*.

bh. Secure all adjustments with lock wire.

bi. Hook a spring scale to pedal.

bj. Operate OVERRIDE CHECK switch to move pedal away from operator. Force required to stop pedal movement should not exceed 40 pounds.

bk. Operate OVERRIDE CHECK switch to send servo motor to either extreme of its travel.

bl. With a spring scale, apply 105-pound pull to pedals in opposite direction. Rate for full travel of pedals should not exceed 31 seconds.

Note

If, in an isolated case, override of hold forces are exceeded due to an accumulation of tolerances, make one or more of following changes as required: Reduce friction in cable system below specified maximum; select pedal damper that is on low time limit (14 to 15 seconds); set pedal rates to maximum 31 seconds travel (steps *bb* through *bh*).

bm. Move OVERRIDE CHECK switch to one side and back to center rapidly. Pedal jump should be 1 inch. Return OVERRIDE CHECK switch to center and off position.

bn. Check proportional band for proper operation by following procedures outlined in steps *bo* through *bq*.

bo. Press ENG engage button on automatic stabilization equipment control panel.

bp. Center servo motor with YAW TRIM knob, observing NULL INDIC needle.

bq. Move YAW TRIM knob slowly 1/2 of half travel of NULL INDIC needle.

br. Observe pedals. They may jiggle or jump a bit as YAW TRIM knob is being rotated, but they should not go into open-loop operation (pedals moving with servo motor).

Note

If pedals do not go into open-loop operation, proceed to step *bx*. If pedals do go into open-loop operation, proceed to step *bs*.

bs. Adjust proportional band as outlined in steps *bs* through *bw*.

bt. Thread sleeve nut (18) two full turns against sleeve (20).

bu. Back off jam nut.

bv. With fingers, thread rod (27) into rod end (24) one full turn. Tighten jam nut (26) and secure with lock wire.

bw. Repeat procedure from step *bn*.

bx. Press STANDBY button on automatic stabilization equipment control panel.

by. Place channel selector switch in PITCH position.

bz. Press automatic stabilization equipment RELEASE button on pilot's or copilot's cyclic control stick grip.

ca. Disconnect auxiliary source of hydraulic pressure quick disconnect panel on right side of engine.

cb. Place electrical power switch in OFF position.

cc. Disconnect auxiliary source of electrical power.

7–141. RIGGING OF FLIGHT CONTROLS.

7–142. 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 cylic 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 placing a main rotor head assembly, a main gear box, or any other main rotor flight control component, make a careful check of main rotor control rigging. Immediately after replacing a tail rotor assembly, a tail rotor gear box, or any other component of the tail rotor flight control system, 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 7–VII.

Table 7–VII. Rigging Pins (Fabricate from Drill Rod)

NO. REQUIRED	DIAMETER	LENGTH (INCHES)
1	3/16	4
2	3/16	5
2	3/16	6
2	1/4	10
1	1/4	11
1	5/16	13

7–143. RIGGING MAIN ROTOR FLIGHT CONTROLS. (See figure 7–28.) All main rotor rigging is to be done with only the primary servo system operating hydraulically. The auxiliary servo must be in manual. All angular dimensions at the rotor head are taken with the rotor head level and the damper positioned against the inboard stops. Rods having a specified dimension are measured from hole center to hole center of the rod ends. (See table 7–I.) Once the helicopter has been properly rigged, there should be no necessity for readjusting any of the rods carrying fixed dimensions as there are adjustable rods in the system to make up for any tolerances on new components. Tolerances on all angular dimensions are ± 1/2 degree unless otherwise specified. Tolerances, when using the main rotor rigging tool, part No. S1670-10564-3, will be ± 1/16 inch unless otherwise specified.

Note

Before proceeding with rigging, check to see that slop in cams on main rotor auxiliary servo is entirely eliminated.

1. Rod
2. Bell Crank
3. Bell Crank
4. Lateral Rod
5. Bell Crank
6. Rod
7. Bell Crank
8. Rigging Pin
9. Fore-and-Aft Rod
10. Pilot's Support and Yoke Assembly
11. Rigging Pin
12. Collective Pitch Arm and Bracket
13. Input Arm
14. Rod-End Assembly
15. Collective Pitch Input Arm
16. Rod-End Assembly
17. Input Arm
18. Rod-End Assembly
19. Auxiliary Servo Unit
20. Rod
21. Bell Crank
22. Rod
23. Bell Crank
24. Bell Crank
25. Rod
26. Rod
27. Bell Crank
28. Rod
29. Bell Crank
30. Rod
31. Rigging Pin
32. Bell Crank
33. Bell Crank
34. Control Rod
35. Control Rod
36. Bell Crank
37. Bell Crank
38. Rod
39. Rod
40. Rigging Pin
41. Control Rod
42. Flight Control Rod
43. Control Rod
44. Rigging Pin
45. Lateral Rod
46. Rigging Pin
47. Copilot's Support and Yoke Assembly
48. Fore-and-Aft Rod
49. Rigging Pin
50. Bell Crank

Figure 7–28. Main Rotor Flight Controls Rigging Schematic (Sheet 1 of 2)

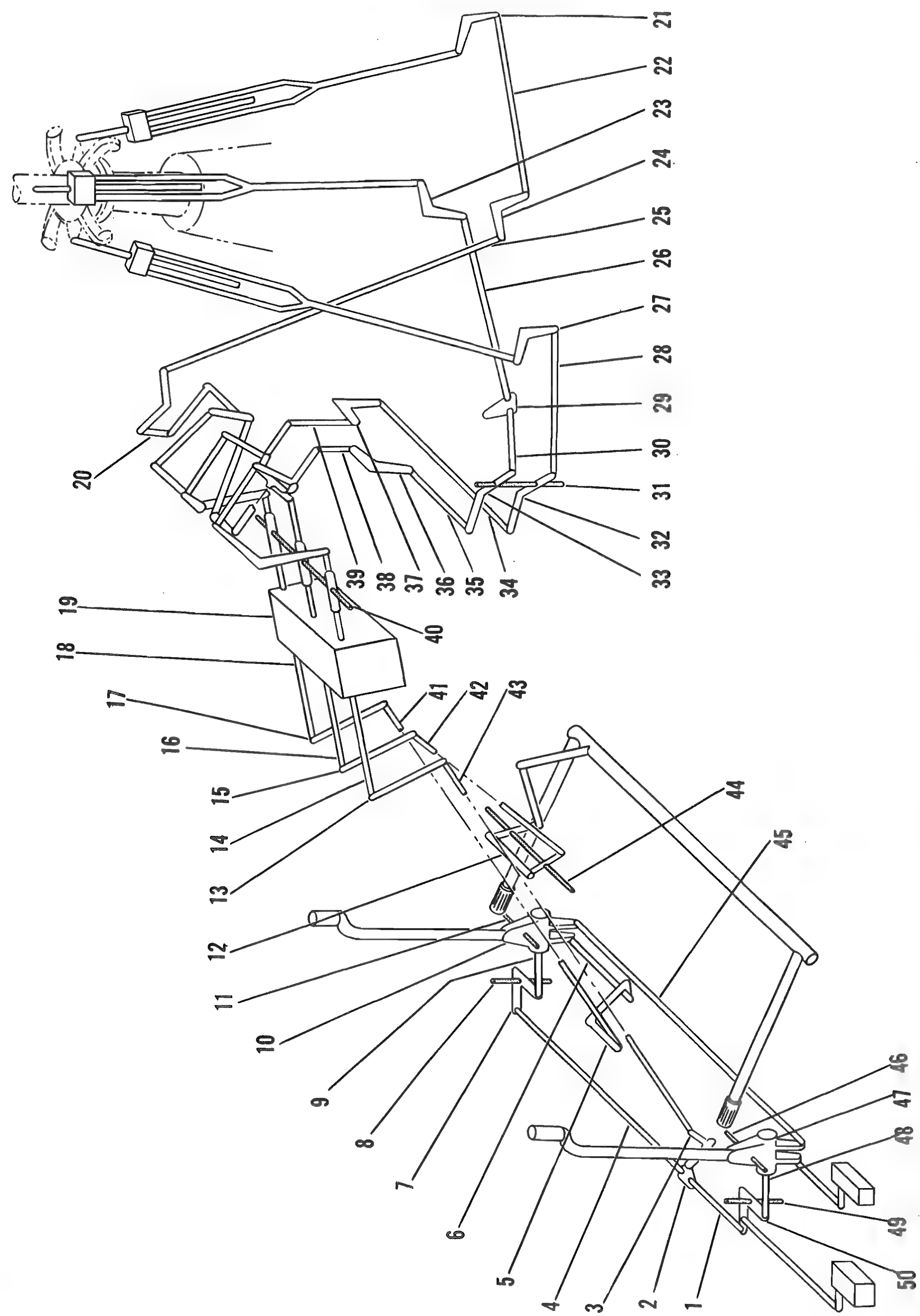


Figure 7–28. Main Rotor Flight Controls Rigging Schematic (Sheet 2 of 2)

a. Using a propeller protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, level main rotor head assembly fore and aft and laterally on upper plate by jacking helicopter, as necessary, at three fuselage jack points with hydraulic jacks.

Note

If jacks are not available, level main rotor head by inflating or deflating main or tail landing gear shock struts.

Note

If rigging tool, part No. S1670-10564-3, is used in place of a propeller protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, it is not necessary to level helicopter as blade angles may be set and checked with helicopter in any attitude. Personnel proficient in full use of propellor protractor can check blade angles without jacking helicopter and leveling rotor head.

b. Pull all blades in a counterclockwise direction so that they are in their full autorotative position and, using shackle jack, Rinck McIlwaine Inc. part No. 955 or equivalent, position dampers against their inboard stops. (See figure 7-29.) Shackle jack is mounted on damper assembly in such a way that one phenolic face of shackle jack is against fork on damper assembly and other phenolic face of shackle jack is against head of cylinder on damper assembly. Screw on the shackle jack is turned until each damper is positioned at its inboard stop. This is evidenced by no further movement of damper assembly piston rod.

CAUTION

Avoid puncturing or tearing boot on damper assembly.

c. Hinge down service platforms and connect an auxiliary source (servo rigging test stand, part No. S1670-10280) of 1500 psi hydraulic pressure to primary servo hydraulic system at three quick disconnect couplings located on primary hydraulic panel on left side of main gear box.

CAUTION

All main rotor rigging is performed with only primary servo system operative.

d. Screw all secondary stops all way in to give full travel to control sticks. (See figures 7-30, 7-31, and 7-32.)

Note

Control sticks are now limited in their travel only by the stops on power pistons in auxiliary servo.

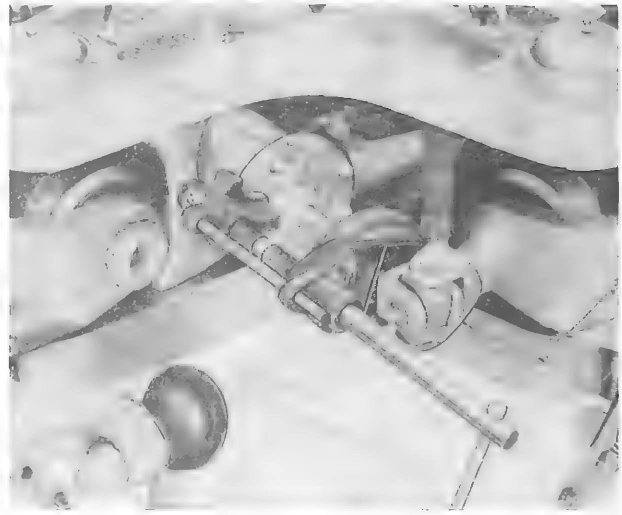


Figure 7–29. Positioning Damper Against its Inboard Stop Using Shackle Jack

Note

On helicopters with passenger accommodations installed, remove door in forward bulkhead. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

e. Remove clutch access door. Install a 1/4 x 10-inch rigging pin (11, figure 7–28) in pilot's support and yoke assembly (10) and a 1/4 x 10-inch rigging pin (46) in copilot's support and yoke assembly (47). Install a 3/16 x 5-inch rigging pin (8 and 49) in each bell crank (7 and 50).

Note

If rigging pins can be installed in each support and yoke assembly and in each bell crank, install pins and omit step *f*. If all four pins cannot be installed, proceed with step *f* and then insert pins.

f. Disconnect one end of long lateral rods (4 and 45) from support and yoke assembly. Unbolt short fore-and-aft rods (9 and 48) from bell cranks (7 and 50). Install rigging pins as outlined in step *e*, with length of rod (1) fixed as specified in table 7–1. Adjust length of fore-and-aft rods (9 and 48) to fit and secure them to bell cranks. Adjust length of long lateral rods (4 and 45) to fit and secure them to support and yoke and bell cranks.

Note

When rigging pins are installed in yoke assemblies and bell cranks, cylic control sticks are centered in neutral position, 90 degrees to the pilots' compartment floor.

g. Hinge down servo and mixer cover between pilots' compartment seats. Check that actuating

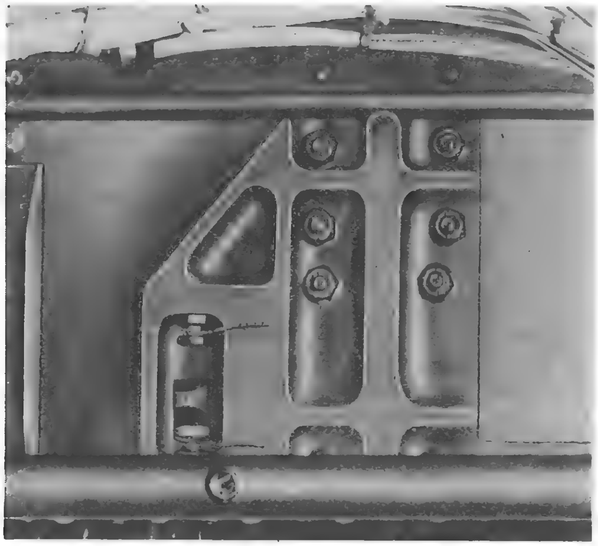


Figure 7–30. Collective Pitch Control Stops

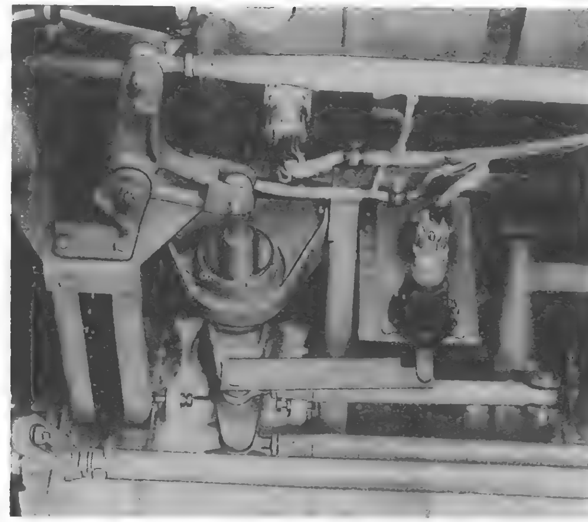


Figure 7–31. Cyclic Control Stick Lateral Stops

cylinder assembly has returned auxiliary servo cams to servo off (manual) position. Disconnect flight control rod (42) in tunnel from collective pitch input arm (15) of auxiliary servo unit (19). Disconnect control rods (41 and 43) from bell cranks (3 and 5).

Note

If rigging pins described in step *b* can be installed in collective pitch arm and bracket and in mixing unit without disconnecting rods, and if dimensions A and B mentioned in step *i* agree with dimensions given in table 7-VIII, install two rigging pins and disregard instructions in steps *g* through *j*. If one or both rigging pins cannot be installed, or if dimensions A or B do not agree with those given in table 7-VIII, perform all instructions in steps *g* through *j*.

b. Install 1/4 x 11-inch rigging pin (44) in collective pitch arm and bracket (12) below auxiliary servo unit (19). After 1/4 x 11-inch rigging pin (44) is installed, tighten collective pitch control friction lock to ease strain on rigging pin. Install 5/16 x 13-inch rigging pin (40) through right auxiliary servo support, through three small links which attach to aft rod ends of power piston shafts, and through left support.

Note

The 1/4 x 11-inch rigging pin (44) centers collective pitch control in neutral position and 5/16 x 13-inch rigging pin (40) centers mixing unit in neutral position.

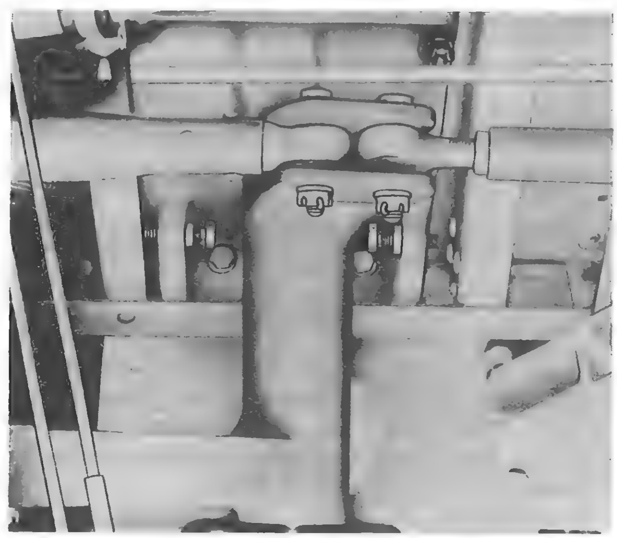


Figure 7–32. Cyclic Control Stick Fore-and-Aft Stops

Table 7–VIII. Main Rotor Auxiliary Servo Unit Dimensions

INDEX, FIGURE 7–32	DIMENSIONS
A	2.59375 inches (2-19/32 inches)
B	1.058 inches
C	13.375 inches (13-3/8 inches)

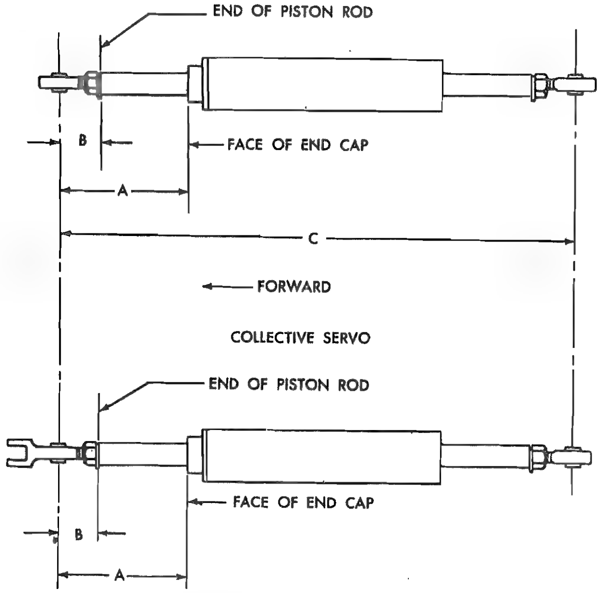


Figure 7–33. Rigging Dimensions–Main Rotor Auxiliary Servo Units

i. Using vernier calipers, carefully measure dimensions A and B (figure 7–33) on power pistons of the auxiliary servo units for lengths given in table 7-VIII. Disconnect auxiliary servo unit rod ends and adjust, if necessary, to obtain dimensions.

Note

The closer dimensions A and B are set, the more accurate will be angular results.

j. Adjust length of flight control rod (42, figure 7–28) below auxiliary servo unit and connect it to collective pitch input arm (15) of auxiliary servo unit (19). Adjust length of control rods (41 and 43) and connect to bell cranks (3 and 5).

k. Disconnect outboard ends of control rods (34 and 35) behind mixing unit from two outboard bell cranks (32 and 33) on transmission deck. Install a 3/16 x 6-inch rigging pin (31) through both bell cranks, adjust two disconnected control rods (34 and 35) for length, and connect to bell cranks (32 and 33).

Note

If rigging pin described in step *k* can be installed in both bell cranks without disconnecting rods, install rigging pins, disregard instructions in step *k*, and proceed with remaining steps in this paragraph. If rigging pin cannot be ininstalled in both bell cranks, perform all of instructions in step *k* before proceeding with remaining steps in this paragraph.

l. Place rigging block, part No. S1670-10201-1 (figure 7–34), against exposed portion of left lateral servo power piston shaft. Check that top of block touches bottom of servo housing and that bottom of block seats on piston shaft rod-end check nut which should be snug against rod end. Adjust main control arm rod end, if necessary, to obtain a snug block fit.

Note

If rigging blocks are not available, vernier calipers or trammel points may be used. Using vernier calipers or trammel points, carefully measure dimension C (figure 7–17), distance from centerline of bolt smooth shoulder just above threads of piston rod, on primary main rotor servo units for the length in table 7-V. Adjust rod end to obtain dimension C. Carefully measure dimension A (figure 7–17) for length given in table 7-V. Adjust dimension B at rod end of bottom of arm assembly to obtain dimension A.

Note

Dimension B (figure 7–17) is reference dimension only.

m. Place rigging block, part No. S1670-10201-1 (figure 7–34), against exposed portion of fore-and-aft servo power piston shaft. Check that top of of block touches bottom of servo housing and that bottom of block seats on piston shaft rod-end check nut. Adjust main control arm rod end if necessary to obtain a snug block fit.

n. Place rigging block, part No. S1670-10201-3, against exposed portion of right lateral servo power piston shaft and follow same procedure as outlined in step *m*.

o. Place rigging block, part No. S1670-10201-2, against exposed portion of each of three power piston shafts with top of block touching servo housing. Bottom of block should be even with smooth shoulder on power piston shafts at point just above where threads begin. Adjust for this dimension, if necessary, by turning power piston shafts in or out of their rod-end bearing. When all three servos meet required dimension, repeat steps *l* through *n* to check that first dimensions have been maintained.

CAUTION

Failure to center power piston properly, using rigging block, part No. S1670-10201-2, could result in primary servo piston bottoming while there is still range left in auxiliary servo.

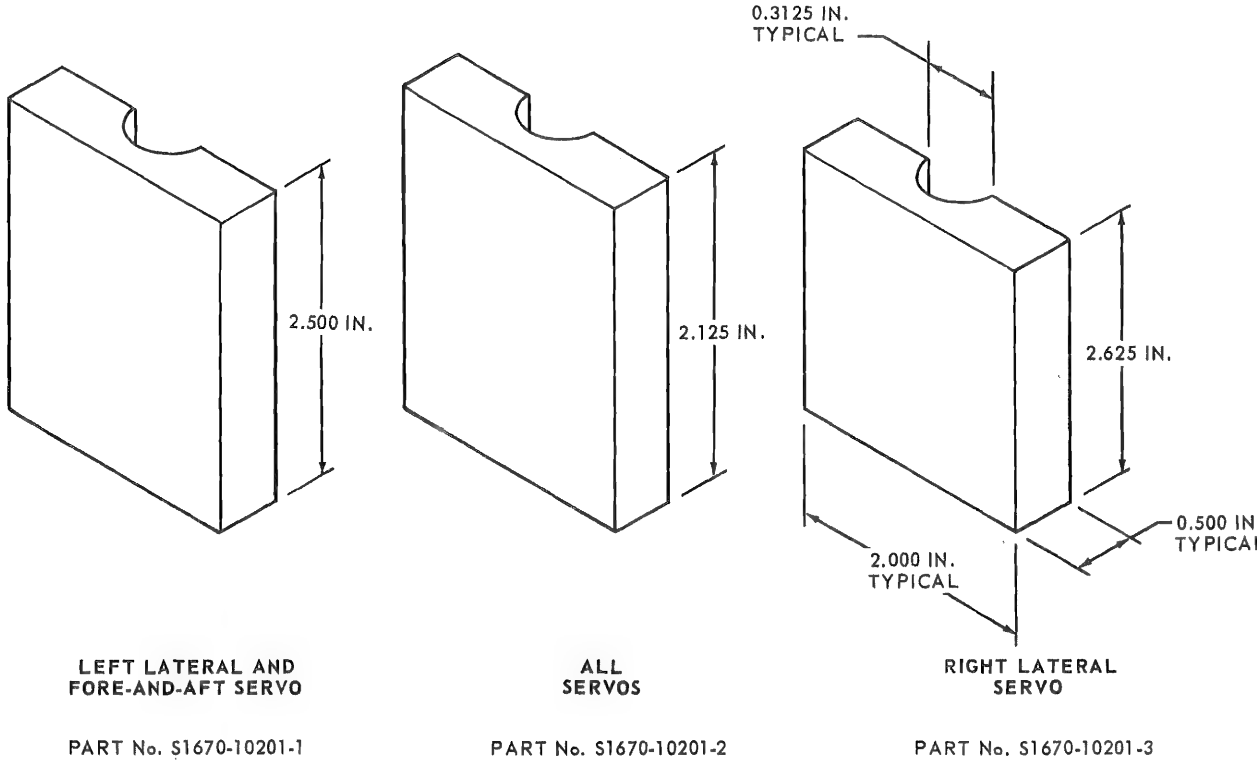


Figure 7–34. Rigging Block Dimensions

p. Remove 3/16 x 6-inch rigging pin (31, figure 7–28) from bell cranks (32 and 33) on transmission deck, 5/16 x 13-inch rigging pin (40) from mixing unit, and 1/4 x 11-inch rigging pin (44) from collective pitch arm and bracket (12). Release collective pitch control friction lock.

CAUTION

Be sure that these rigging pins have been removed before proceeding, as damage to system may occur if pins have not been removed and collective pitch control is moved.

q. Move collective pitch control to low pitch position until power piston in collective pitch auxiliary servo unit bottoms. Lock collective pitch control in this position.

Note

If auxiliary servo is equipped with an external stop at forward end of collective piston shaft, remove it as it is no longer required. Removal may be accomplished by removing forward rod end on collective power piston shaft. Count number of turns when removing rod end so that dimension B, table 7-VIII, will be maintained upon installation of rod end.

r. With collective pitch control in full low pitch position and cyclic sticks still pinned, check that star assembly is level fore and aft and laterally. If conditions have not permitted helicopter to be leveled, check distance between star assembly and underside of lower plate at four points around star. If dimensions are equal, the star is parallel. Adjust, if necessary, at rod ends at bottom of primary servo control arms to level star.

Note

If it is necessary to adjust rod ends of primary servo control arms to level star, recheck power piston position in servos. (Refer to step *o* or first note following step *l*.)

Note

Low pitch position is only place where star is parallel with rotor head due to lateral head in control system. Once this position has been established, no further leveling checks of star need be made.

s. At main rotor head, check again to see that each blade is in its forward autorotative position (damper shaft against its inboard stop). Place a protractor or rigging tool, part No. S1670-10564-3, on top of main rotor blade attachment lugs on each sleeve assembly and check for a low collective pitch control pitch reading of + 8 degrees + 12

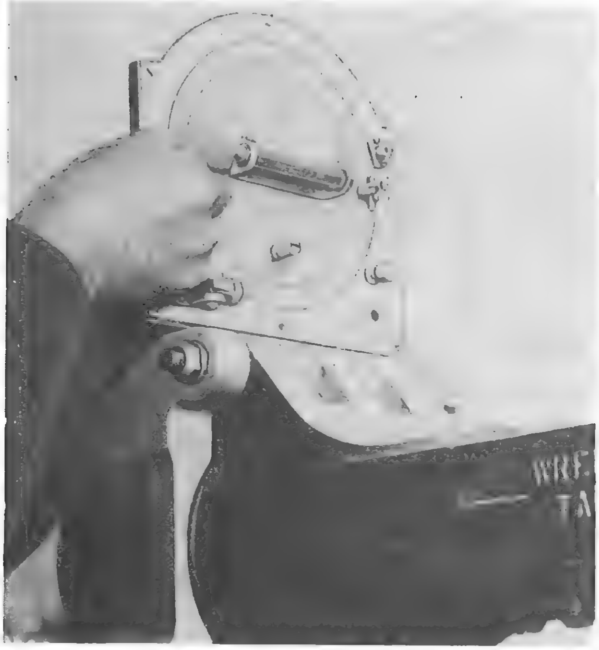


Figure 7–35. Measuring Pitch on Main Rotor Blade

minutes with blade control rod assembly directly over left lateral main rotor servo unit. (See figure 7–35.) Make adjustments at top of each control rod assembly that extends from rotating star to horn assembly.

CAUTION

Care must be taken to make adjustments on hex flats of rod-end fitting underneath trunnion or spider. After shortening or lengthening control rod assembly, tighten lock nut and secure lock to lock nut with lock wire.

Note

Be sure to check and adjust all blades in same position.

t. Unlock collective pitch control, move it to high pitch position until power piston in collective pitch auxiliary servo unit bottoms, and lock collective pitch control in place. Check at main rotor blade attachment lugs with a protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, or rigging tool, part No. S1670-10564-3, for a high collective pitch control reading of +20±1/2 degrees with blade control rod assembly directly over left lateral main rotor servo unit. Set both high pitch stops (figure 7–30) in cabin for reading with a 0.010-inch clearance and secure with lock wire.

Note

When using main rotor rigging tool, part No. S1670-10564-3, in place of protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, upper edge of slot in horn should line up with high pitch index line on rigging tool.

Note

It is necessary to check only one blade in high pitch position.

u. Return collective pitch control to low pitch position and lock in place. Remove 1/4 x 10-inch rigging pins (11 and 46, figure 7–28) from pilot's and copilot's support and yoke assemblies (10 and 47) and 3/16 x 5-inch rigging pins (8 and 49) from both bell cranks (7 and 50) in clutch compartment.

CAUTION

Be sure that these rigging pins have been removed before proceeding, as damage to system may occur if pins have not been removed and cyclic control sticks are moved.

v. Move cyclic control stick to extreme left position until power piston in lateral control auxiliary servo unit bottoms. Check for a left lateral cyclic control stick reading of -1±1/2 degrees with a protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, or rigging tool, part No. S1670-10564-3, at main rotor blade attachment lugs with blade control rod assembly placed directly over left lateral main rotor servo unit. Adjust both left lateral cyclic control stick stops in clutch compartment for a 0.010-inch clearance. Secure stops with lock wire. Move cyclic control stick to extreme right position until power piston in lateral control auxiliary servo unit bottoms. Check for a right lateral cyclic control stick reading of +17±1/2 degrees with a protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, or rigging tool, part No. S1670-10564-3, at main rotor blade attachment lugs with blade pitch control rod assembly directly over left lateral main servo unit. Adjust both right-hand lateral control stick stops in clutch compartment for a 0.010-inch clearance. Secure with lock wire.

w. With collective pitch controls still locked in low pitch position, move cyclic control sticks to extreme forward position until power piston in fore-and-aft control auxiliary servo unit bottoms. Check with a protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, or rigging tool, part No. S1670-10564-3 for a forward cyclic control stick reading of -4±1/2 degrees at main rotor blade attachment lugs with blade pitch control rod assembly positioned directly over fore-and-aft main rotor servo unit. Adjust forward control stop in clutch compartment for 0.010-inch clearance. Secure with lock wire. Move cyclic control stick to extreme aft position until power piston in fore-and-aft control auxiliary servo unit bottoms. Check with a protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, or rigging tool, S1670-10564-3, for an aft cyclic control stick reading of +20±1/2 degrees at main rotor blade attachment lug with blade control rod assembly directly over fore-and-aft main rotor servo unit. Adjust aft control stop in clutch compartment for a 0.010-inch clearance. Secure with lock wire.

x. If angular reading in steps *v* and *w* are not obtained because a power piston bottoms in auxiliary servo unit before correct angle is obtained, perform following: Disconnect power piston rod ends from links (23, figure 7–5) that are attached to mixing unit. Disconnect power piston rod ends from input arms (13 and 17, figure 7–28) and collective pitch input arm (15) on auxiliary servo unit. To increase forward stick or left stick blade angles or to decrease aft stick or right stick blade angles, increase length of dimension B (figure 7–33) on that end of power piston that connects to mixing unit and decrease dimension B exactly the same amount on that end of power piston that connects to input arm. To decrease forward stick or left stick blade angles or to increase aft stick or right stick blade angles, decrease length of dimension B on that end of power piston that connects to mixing unit and increase dimension B exactly the same amount on that end of power piston that connects to input arm. Dimension C must be held constant. Connect power piston rod ends to input arms and to links at mixing unit. To insure that rest of flight controls have not been disturbed, install a 5/16 x 13-inch rigging pin (40, figure 7–28) through pilot's and the copilot's support and yoke assembly, and 3/16 x 5-inch rigging pins (8 and 49) through bell cranks (7 and 50). Remove rigging pins and repeat steps *v* and *w*.

Note

One full turn on power piston rod end equals 1/2 degree on main rotor head blade angles.

y. With collective pitch stick in full low pitch position, auxiliary servo in manual, and collective power piston bottomed against its internal stop in auxiliary servo, set low pitch mechanical stops (figure 7–30) to have a 0.090 to 0.100-inch clearance.

Note

Steps *z* through *ad* pertain only to Model CH-34C. These helicopters are equipped with automatic stabilization equipment.

z. Open engine nose doors and connect an auxiliary source (servo rigging test stand, part No. S1670-10280) of 1500 psi hydraulic pressure to auxiliary servo hydraulic system at three quick disconnect couplings located on right-hand side of engine shroud.

aa. Place automatic stabilization equipment (ASE) in STANDBY.

ab. Holding collective pitch sticks in full low position, bottomed against stick stops, move ASE OVERRIDE CHECK switch in both directions.

Note

There should be no motion of collective power piston shaft when switch is thrown. If any motion is detected, back off mechanical stick stops an additional amount, as required, until no motion of collective power piston shaft can be observed when OVERRIDE CHECK switch is moved in both directions.

ac. Return ASE OVERRIDE CHECK switch to center position and turn off automatic stabilization equipment.

ad. Disconnect auxiliary source of hydraulic pressure at three quick disconnect couplings located on right-hand side of engine shroud. Close nose doors and secure mechanical stick stops with lock wire.

ae. Adjust collective open-loop spring cylinder. (Refer to paragraph 7–35.)

Note

If main rotor was leveled by inflating or deflating main and tail landing gear shock struts, service struts with air as outlined in TM-1520-202-20, Chapter 2, Section III.

af. Adjust cyclic control stick trim system. (Refer to paragraph 7–12.)

ag. Check cyclic control stick for clearance fore-and-aft. If stick hits seat with seat in full high position, install 3/16 x 5-inch rigging pins (8 and 49, figure 7–28) at bell cranks (7 and 50) and adjust fore-and-aft rods (9 and 48) to reposition sticks.

ah. Replace clutch access door and servo and mixer cover.

ai. Track main rotor blades as outlined in Section V and flight check the control rigging. (Refer to paragraph 7–142.)

7–144. RIGGING TAIL ROTOR FLIGHT CONTROLS.

Note

Tail rotor controls are rigged with servo systems inoperative.

a. Insert a 3/16 x 4-inch rigging pin (5, figure 7–36) into hole in damper arm on quadrant (4) and hole in sheet metal bracket just below damper arm to lock quadrant in mid position.

b. Screw pedal adjustment handles for pilot's and copilot's tail rotor control pedals in or out to position pedals in middle of their fore-and-aft adjustment. Check that both sets of pedals line up vertically and horizontally. Adjust position of pedals, if necessary, by lengthening or shortening rod ends of rods (6 and 8 or 1 and 2) which attach to pedals.

c. Loosen tail rotor control cables at turnbuckles in cabin, one turnbuckle just aft of cargo door, other turnbuckle just forward of front left cabin window, and two turnbuckles in tail cone. Lock quadrant (12) at aft end of tail cone with a 3/16 x 6-inch rigging pin (11).

d. Hinge down left service platform and remove left rear skin panel.

e. Check that cam on tail rotor servo unit is in manual position. (See cam detail, figure 7–27.) Using vernier calipers, carefully measure dimension A, distance from face of servo unit housing to forward end of power piston, for a dimension of 4.78125 (4-25/32) inches. Set power piston to this dimension and hold it in position with blocks and C clamps.

Note

To hold power piston in this position, use two sets of split phenolic blocks machined to fit power piston shaft. Clamp a set of blocks on power piston shaft in contact with end cap at each end of servo unit.

f. Adjust length of cable at four turnbuckles for set position of power piston. Tighten turnbuckles to tension given in table 7–IX according to ambient temperature.

CAUTION

Cables must be tightened evenly to avoid bending rigging pins or damaging quadrants. Check rigging pins continually while tightening cables to see that pins remain movable and are movable after cables reach proper tension.

g. Position adjustable stops at ends of tail rotor servo power piston housing to middle of their adjustment, using wrench, part No. S1670-10673. Remove blocks and C clamps from tail rotor unit power piston. Recheck dimension A (See figure 7–27.) If dimension has varied from 4.78125 (4-25/32) inches, adjust turnbuckles as necessary to obtain correct dimension, at same time maintaining proper cable tension and quadrant position. (See CAUTION after step *f.*) Secure turnbuckles with lock wire.

h. Open access panel below intermediate gear box on right side of pylon. Reach down and install a 3/16 x 6-inch rigging pin (18, figure 7–36) in bell crank (19), if possible. If rigging pin will not fit, adjust as follows: Fold pylon. (Refer to TM 55-1520-202-20, Chapter 2, Section II.) Back off lock nut at forward end of rod (15, figure 7–36) and disconnect forward end of rod from bell crank (14). Insert 3/16 x 6-inch rigging pin (18) in bell crank (19). Unfold and lock pylon. Adjust rod (15) and secure to bell crank (14).

1. Rod
2. Rod
3. Rod
4. Quadrant
5. Rigging Pin
6. Rod
7. Rod
8. Rod
9. Servo Unit Installation
10. Tail Rotor Spring Cylinder Assembly
11. Rigging Pin
12. Quadrant
13. Rod
14. Bell Crank
15. Rod
16. Idler
17. Rod
18. Rigging Pin
19. Bell Crank
20. Rod
21. Idler
22. Control Rod

Figure 7–36. Tail Rotor Rigging (Sheet 1 of 2)

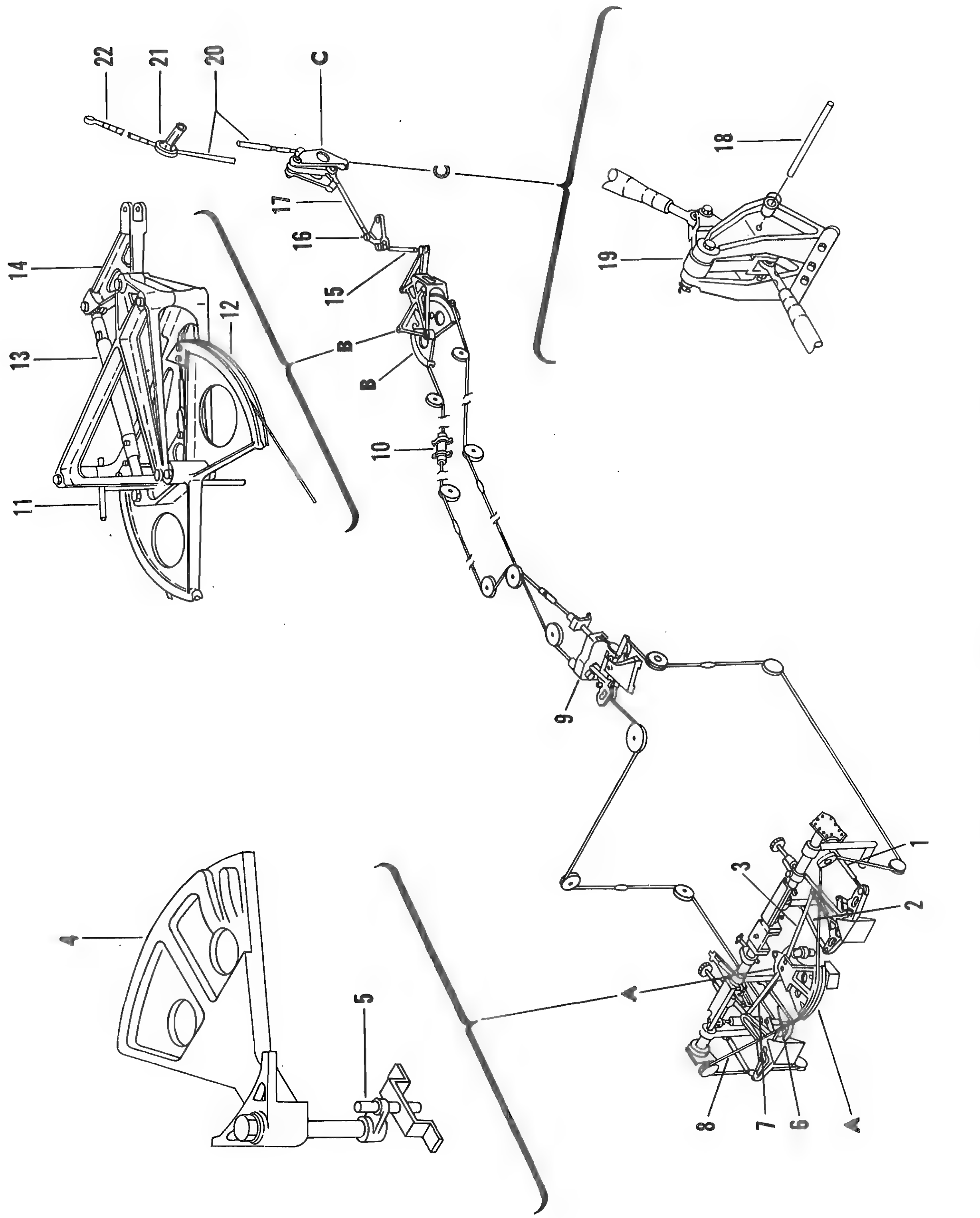


Figure 7–36. Tail Rotor Rigging (Sheet 2 of 2)

Table 7–IX. Temperature Corrected Tail Rotor Cable Tension Chart

TEMPERATURE RANGE (DEGREES F)	TEMPERATURE RANGE (DEGREES C)	CABLE TENSION IN POUNDS FOR PART NO. S1640-63521-1 CYLINDER ASSEMBLY
−65 to −56	−53.9 to −48.9	38 to 44
−55 to −36	−48.3 to −37.8	45 to 54
−35 to −16	−37.2 to −26.7	55 to 64
−15 to +4	−26.1 to −15.6	65 to 72
+ 5 to +24	−15.0 to −4.5	73 to 81
+25 to +44	− 3.9 to +6.6	82 to 89
+45 to +64	+ 7.2 to +17.7	90 to 97
+65 to +84	+18.3 to +28.8	98 to 106
+85 to +104	+29.4 to +40.0	107 to 116
+105 to +124	+40.6 to +51.1	117 to 126
+125 to +144	+51.7 to +62.2	127 to 136
+145 to +160	+62.8 to +71.1	137 to 144

Note

This table is for ambient air temperatures with cables at same temperature as outside skin of helicopter. Park helicopter out of sun for a minimum of 1/2 hour before setting initial cable tension. Do not check cable tension until 1/2 hour has elapsed after helicopter has been removed to area of different temperature.

CAUTION

If it is necessary to check cable tension with helicopter parked in sun, a 25-percent deviation from this table is allowable, but cable tension must never exceed 240 pounds. If 25-percent deviation is exceeded, allow helicopter to stand at constant temperature for a minimum of 1/2 hour before resetting cable tension.

CAUTION

Do not fold or unfold pylon with quadrant (12) and bell crank (19) pinned and rod (15) connected at both ends.

i. Remove screen and cover from top of pylon. Check that input arm on tail rotor gear box is parallel with frame to which gear box is attached. This will position center of hole in input arm 2.875 (2-7/8) inches from frame surface. Adjust, if necessary, at rod end of control rod (22). Replace screen and cover on top of pylon.

j. Secure blades in center of their flapping range (0-degree flapping) by installing a blade restrainer, part No. S1670-10650-13, to tail rotor assembly.

Note

If a blade restrainer is not available, phenolic or wood wedges may be inserted between spindle and hub to keep blades in center of their flapping range.

k. Screw tail rotor pedal stops at quadrant (4) behind instrument panel all the way in so that they do not prohibit pedal travel.

Note

If a rigging protractor assembly, part No. S1670-10566, is available, follow procedure outlined in steps *m* through *v* and omit steps *l* through *ag*. If a rigging protractor assembly, part No. S1670-10566, is not available, omit steps *m* through *v* and follow procedure outlined in steps *l* through *ag*.

l. Remove 3/16 x 6-inch rigging pins (11 and 18) from quadrant (12) at aft end of tail cone and bell crank (19) in pylon. Remove 3/16 x 4-inch rigging pin from quadrant (4) behind instrument panel. Replace intermediate gear box access panel.

m. Move left rudder pedal full forward until power piston bottoms internally in tail rotor servo. Check to see that mechanical stops are not hitting at this time.

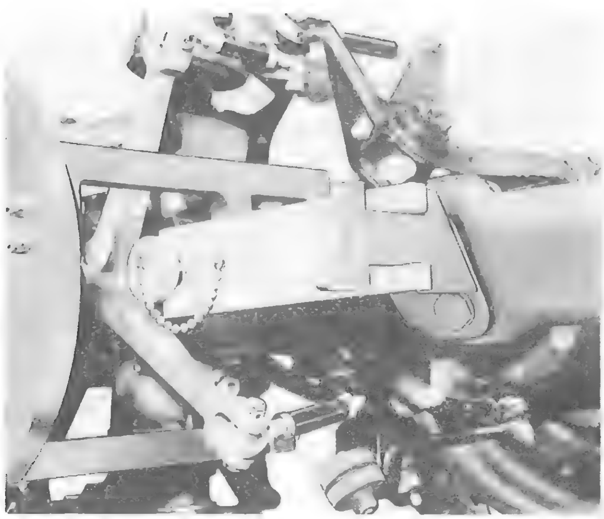


Figure 7–37. Setting Blade Pitch

n. Mount rigging protractor assembly, part No. S1670-10566, on blade restrainer, part No. S1670-10650-13, at aft blade with that blade in a horizontal position. Install slide in slot of rigging protractor with slide marked 30° LEFT facing blade hub and engraved side of slide facing outboard. Move slide against blade hub and tighten thumbscrew. (See figure 7–37.)

Note

Rigging protractor assembly, part No. S1670-10566, can be use only in conjunction with blade restrainer, part No. S1670-10650-13.

Note

When checking tail rotor blade angles, remove any free play that exists in bearings on short links at blades and in gear box by manually pushing leading edge of blade in direction of fuselage.

o. Adjust short link from pitch change beam as required to bring blade hub flush with angled surface of slide. Tighten attaching nut to a torque of 40 to 60 inch-pounds.

Note

If sufficient adjustment is not available on pitch change links, adjust piston stops on tail rotor servo.

p. Repeat steps *n* and *o* on each remaining blade.

q. Loosen thumbscrew. Remove slide from slot in rigging protractor.

r. Set left rudder mechanical stop at pedals to have a 0.010-inch clearance. Secure stop with lock wire.

s. Move right rudder pedal full forward until power piston bottoms internally in tail rotor servo. Check to see that mechanical stops are not hitting at this time.

t. Install slide with side marked 20° RIGHT facing blade hub and engraved side facing outboard. Tighten thumbscrew.

u. Adjust tail rotor servo adjustable stop to bring blade hub flush with angled surface of slide.

Note

For right rudder, it is necessary to check only one blade.

v. Remove rigging protractor from blade restrainer.

w. Place a protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, on tail rotor pitch change shaft and establish a 0 reference on protractor if the helicopter is not level laterally.

Note

If a protractor is not available, or protractor is not capable of being set, pitch change shaft must be leveled. This may be accomplished by leveling helicopter. (Refer to TM 55-1520-202-20, Chapter 2, Section III.)

x. Move left rudder pedal full forward until power piston bottoms internally in tail rotor servo. Check to see that mechanical stops are not hitting at this time.

y. Rotate tail rotor until one blade is pointing forward. Place a level on leading edge and insure that leading edge is level.

z. Place protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, on flat of blade sleeve just outboard of two blade attaching bolts. Measure blade angle for a reading of +30 plus 1/2 minus 1 degrees. (See figures 7–38 and 7–39.)

Note

When leading edge of forward blade points inboard toward fuselage, angle of blade with respect to vertical is known as a PLUS angle and blade is in left rudder position. When leading edge points outboard away from fuselage, angle from vertical is a MINUS angle and blade is in right rudder position.

Note

When checking tail rotor blade angles, remove any free play that exists in bearings on short links at blades and in gear box by manually pushing leading edge of blade in direction of fuselage.

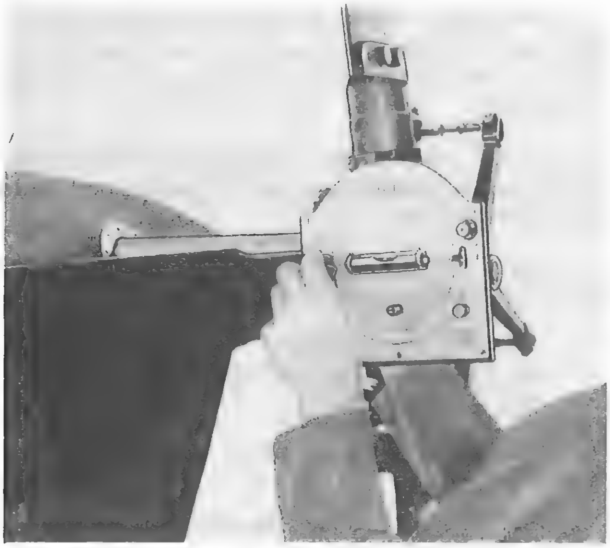


Figure 7–38. Measuring Pitch on Tail Rotor Blade

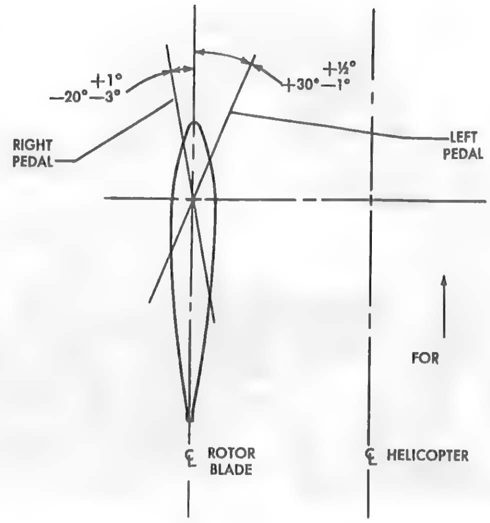


Figure 7–39. Tail Rotor Rigging Angles

aa. Adjust short link from pitch change beam, if necessary, to obtain blade angle. Tighten attaching nut to a torque of 40 to 60 inch-pounds.

Note

If sufficient adjustment is not available on pitch change links, adjust piston stops on tail rotor servo.

ab. Repeat procedure outlined in steps *z* and *aa* for other three blades.

ac. Set left rudder mechanical stop at pedals to have a 0.010-inch clearance. Secure stop with lock wire.

ad. Move right rudder pedal full forward until power piston bottoms internally in tail rotor servo. Check to see that mechanical stops are not hitting at this time.

ae. Rotate tail rotor until one blade is pointing forward. Place a level on leading edge and insure that leading edge is level.

af. Place protractor, Guardian Electric Mfg. Co. part No. 36-D-2844, on flat of blade sleeve just outboard of two blade attaching bolts. Measure blade angle for a reading of -20 plus 1 minus 3 degrees. (See figures 7–38 and 7–39.)

ag. Adjust tail rotor servo adjustable stop to obtain proper blade angle. Tighten lock nut and secure stop and nut with lock wire.

Note

For right rudder, it is necessary to check only one blade.

Note

Rigging counterweights is accomplished by setting blade at 0-degree coning (flapping) angle and 0-degree blade pitch, and setting length of short link from blade to counterweight at 4-3/8 inches. This positions counterweights at 0-degree angle.

ah. Check adjustment of servo unit pilot valve, but do not disconnect auxiliary source of pressure. (Refer to paragraph 7–139.)

ai. Check pedal damper rate. (Refer to paragraph 7–129.)

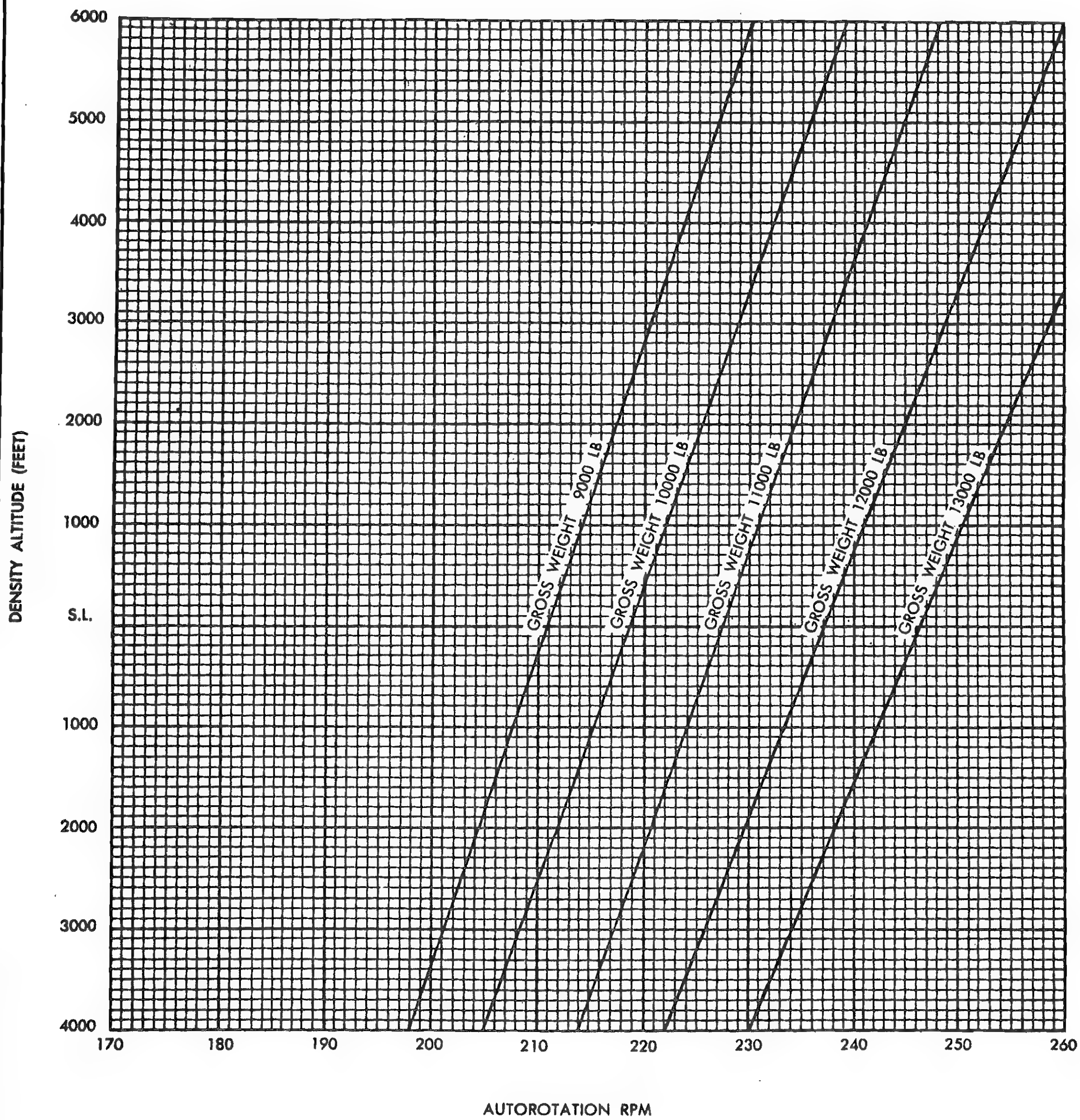
aj. Remove blade restrainer assembly or wedges from tail rotor blade, replace left rear skin panel at transmission, and close service platform.

ak. Flight check control rigging.

al. Check automatic stabilization equipment. (Refer to minimum performance standards – operational checks in TM 55-1520-202-20, Chapter 2, Section X.)

7–145. FLIGHT CHECK OF CONTROL RIGGING.

7–146. 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 movements is available. If the flight checks meet the standards of REQUIRED PERFORMANCE listed in table 7–X, the rigging is correct and the proper range of the flight controls is available. The flight test must be made with a



NOTES

THIS CHART HAS BEEN SET UP WITH THE HELICOPTER IN THE FOLLOWING CONDITIONS: NEUTRAL CENTER OF GRAVITY (CG 137.7) LOW PITCH (8.0 ±2 DEGREES) AND 60 KNOTS INDICATED AIRSPEED (IAS).

Figure 7–40. Autorotation RPM Chart

Table 7–X. Flight Check Chart (Sheet 1 of 2)

FLIGHT CHECK	CONDITIONS OF CHECK	REQUIRED PERFORMANCE	ADJUSTMENT FOR CORRECTION
Autorotation (low pitch check)	1. Gross weight (See figure 7–40.) 2. 137.7 inches cg (neutral) 3. 60 knots IAS 4. Full low pitch	See figure 7–40	Lengthen all flight control rods equally at main rotor head to decrease rpm or shorten all flight control rods equally on main rotor head to increase rpm. One turn on pitch change rod equals approximately 8 rpm. Recheck blade track.
Forward cg controllability check **WARNING** Be sure that area is clear prior to takeoff; take off with helicopter heading into wind; exercise care when turning downwind until aft control has been proven adequate.	1. 10,500 to 13,000 lb gross weight 2. 130.7 inches cg (most forward) 3. 2500 rpm 4. Sea level to 1000 feet	Adequate aft control should be available in all conditions	Recheck rigging if control is not available.
Aft cg controllability check	1. 10,500 to 13,000 lb gross weight 2. 146.7 inches cg (most aft) 3. 2500 engine rpm and 47.5 inches Hg 4. Sea level to 1000 feet	A minimum of 1-1/2 inches of forward control should remain at high speed forward flight of 128 knots	Recheck rigging if control is not available.
Tail rotor control (sideward flight)	1. 10,500 to 13,000 lb gross weight 2. 2500 engine rpm 3. Any cg within range 4. Sea level to 1000 feet	35 knots left and right Approximately 10 degrees of yaw should be available Adequate tail rotor control should be available during all conditions of flight and autorotation	Recheck tail rotor rigging if control is not available.
Operation of servos	1. Any weight or cg within range 2. 80 knots IAS 3. Primary servo off	A 1-inch stick displacement to right to maintain level flight	Recheck blade track. Check for blade damage. Recheck rigging if control is not available.
Throttle synchronizer	1. Helicopter on ground 2. 2500 ±50 rpm	25 inches Hg friction on throttle Raise collective pitch until take-off is accomplished Rpm should remain at 2500 ±50 rpm, 100 to 200 rpm increase with throttle governor	Lengthen throttle control adjustment rod in clutch compartment to decrease rpm. Shorten rod to increase rpm.

Table 7–X. Flight Check Chart (Sheet 2 of 2)

FLIGHT CHECK	CONDITIONS OF CHECK	REQUIRED PERFORMANCE	ADJUSTMENT FOR CORRECTION
Throttle rigging	1. 110 knots IAS 2. 2300 rpm 3. 38 inches Hg	Slight margin of collective pitch remaining	Recheck throttle rigging. **WARNING** Do not reset collective pitch stops.
Note After required rpm has been established in autorotation, following check is to be made on all helicopters equipped with ASE to determine collective pitch ASE equipment override. Autorotation (low pitch check)	1. Gross weight (See figure 7–37) 2. 137.7 inches cg (neutral) 3. 60 knots forward speed 4. ASE engaged 5. BAR ALT engaged 6. Full low pitch	See figure 7–37 **CAUTION** As soon as autorotative rpm has been achieved, disengage BAR ALT as unnecessary wear to BAR ALT clutch could result.	Check low pitch stick stops.

gross weight and the center of gravity as specified in the autorotation rpm chart. (See figure 7–40.) (Refer to TM 55-1520-202-10, Chapter 8, Sections XIV and XV for correct information on the location of the center of gravity and 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. (See figure 7–40.) Refer to table 7–X for the flight check chart.

WARNING

In addition to usual before takeoff check, make certain control surfaces respond in proper direction to movement of collective pitch control, cyclic control stick, and tail rotor control pedals. Immediately after helicopter is airborne, a general check should be made of flight controls for overall operating safety. With helicopter in a hovering position, cyclic control stick should be approximately in its neutral position. Check tail rotor control pedals while hovering by pressing one pedal and then other pedal to see if there is control in each direction. Fly short distances forward, backward, and sideways, turning helicopter to right and to left.

SECTION VIII

INSTRUMENTS

8-1. PITOT-STATIC SYSTEM.

8-2. DESCRIPTION. (See figures 8-1 and 8-2.) The pitot-static system consists of a pitot pressure system and a static pressure system.

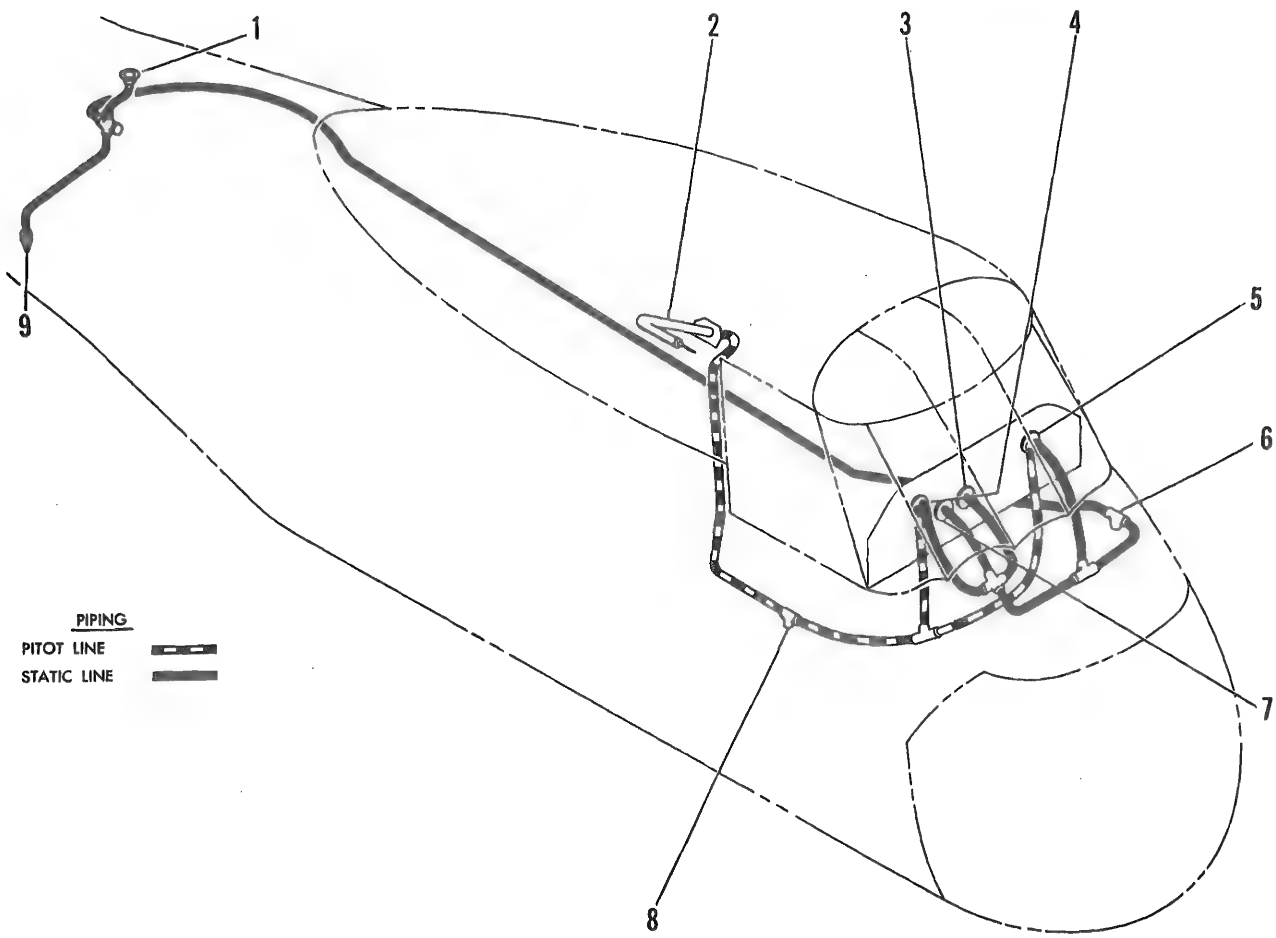
8-3. PITOT PRESSURE SYSTEM.

8-4. DESCRIPTION. (See figures 8-1 and 8-2.) The pitot pressure system consists of a pitot tube, tubing, and hoses extending to the airspeed indicators. The pitot tube is mounted on the end of a support that extends from a base assembly mounted on the pilots' compartment 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, located on the overhead switch panel, operates the heater.

8-5. REMOVAL.

WARNING

Make certain all electrical power is turned off.



1. Static Connection
2. Pitot Tube
3. Altimeter
4. Airspeed Indicator
5. Airspeed Indicator (Helicopters, Serial No. 54-3000 and Subsequent)
6. Static Line Drain
7. Rate-of-Climb Indicator
8. Pitot Line Drain
9. Static Connection Drain

Figure 8-1. Pitot-Static System Diagram – Aircraft Serial No. Prior to 57-1742 *a.* Disconnect wiring and tubing at base assembly inside pilots' compartment canopy.

b. Remove both screws which secure support to base assembly on outside of canopy.

c. Pull support with pitot tube out of base assembly.

d. Remove tubing connections from airspeed indicators.

Note

On aircraft, serial No. prior to 54-3000, there is only one airspeed indicator.

e. Disconnect tubing from drain, located on right side of helicopter at forward cabin bulkhead, by removing drain fitting.

f. Remove bulkhead fittings, connections, and clamps which secure tubing to bulkheads and pilots' compartment canopy. Remove tubing.

8–6. INSTALLATION.

a. Install connections, clamps, and bulkhead fittings which mount pitot tubing to bulkheads and pilots' compartment canopy, and install tubing.

b. Install drain fitting and connect tubing to both ends.

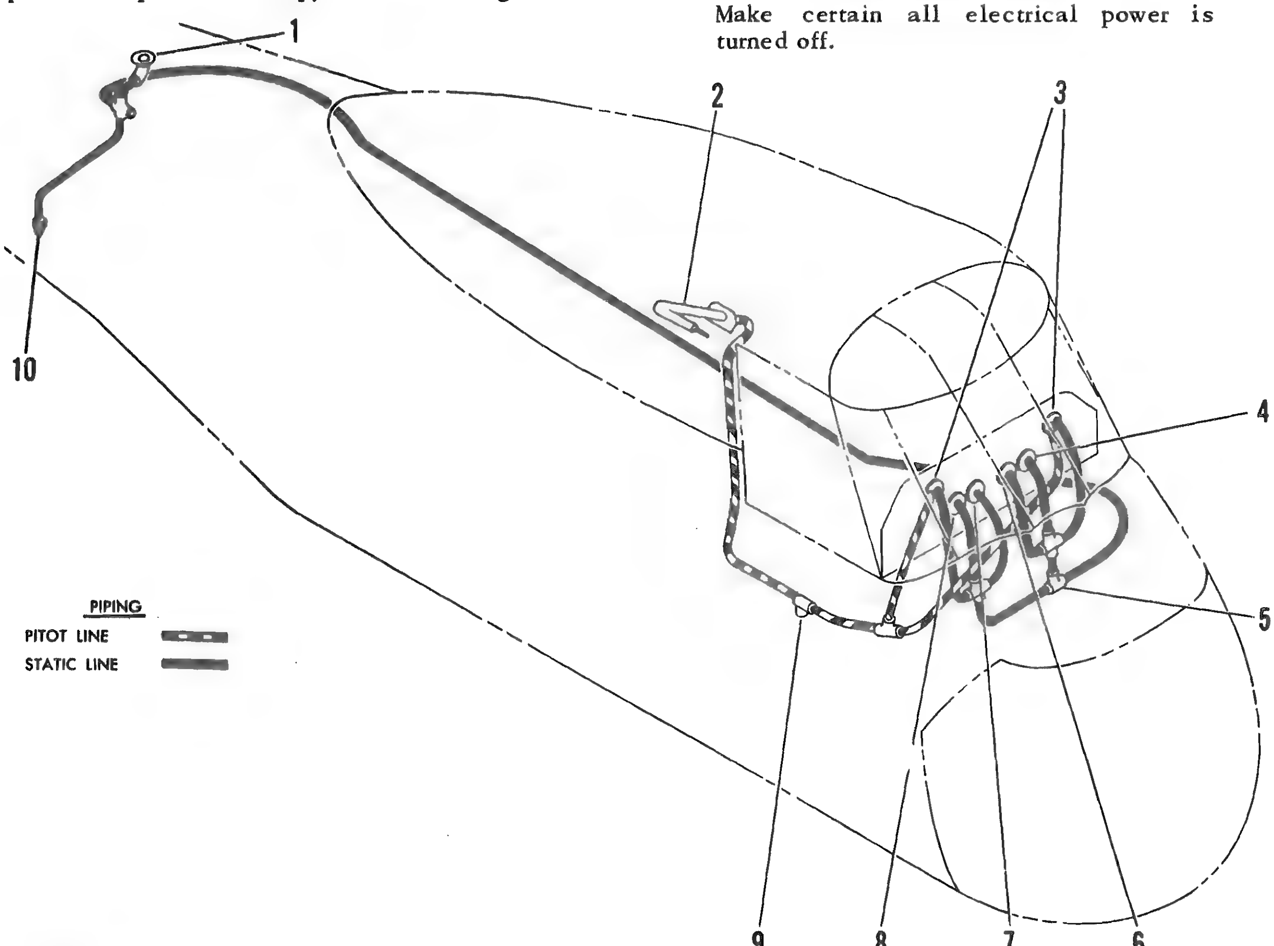
c. Connect tubing to rear of airspeed indicators. (See note following step *d* of paragraph 8–5.)

d. Position support, with pitot tube, in base assembly on right side of forward pilots' compartment canopy.

e. Secure support to base assembly with both locking screws. Secure screws with lock wire.

WARNING

Make certain all electrical power is turned off.



1. Static Connection
2. Pitot Tube
3. Airspeed Indicators
4. Altimeter
5. Static Line Drain
6. Rate-of-Climb Indicator
7. Altimeter
8. Rate-of-Climb Indicator
9. Pitot Line Drain
10. Static Connection Drain

Figure 8–2. Pitot-Static System Diagram – Model CH-34C Serial No. 57-1742 and Subsequent *f.* Connect wiring and tubing to pitot tube at base assembly inside pilots' compartment canopy.

8–7. MAINTENANCE. Drain off moisture daily which collects in pitot system at drain on right side of forward cabin bulkhead. Access to drain is at front of cabin. Check that drain holes in pitot tube are free of dirt.

CAUTION

Do not blow or suck on any pitot line unless it is disconnected from instrument.

8–8. TESTING PITOT SYSTEM (FOURTH ECHELON).

a. To prevent error in airspeed indicator readings, check pitot pressure system to see that it is leakproof.

b. Seal pitot tube pressure chamber drain, located on underside outboard end of pitot tube, with plastic tape or other clean, easily removed material.

c. With airspeed indicators properly connected to pitot pressure lines, connect an air pressure source to outboard opening of pitot tube.

CAUTION

Use care with pressure source since more than approximately 0.4 psi of air pressure will damage airspeed indicator.

d. Slowly apply pressure in sufficient quantity to cause airspeed indicator pointers to indicate 130 knots (approximately 0.82 inch Hg, or 11.18 inches of water).

e. At this point pinch off sources of pressure.

f. During 1-minute period, airspeed indicator pointers must not drop more than 5 knots. (Minimum indication must be 125 knots.)

Note

Tap instrument panel during test period to simulate engine vibration and remove friction error from indicators.

g. Remove sealing material from pitot tube drain at completion of test.

CAUTION

Following this test, allow pressure to escape from pitot pressure system slowly to avoid damaging indicators. To release pressure, slowly open pitot bleeder and pitot pressure port.

8–9. STATIC PRESSURE SYSTEM.

8–10. DESCRIPTION. (See figures 8–1 and 8–2.) The static pressure system consists of a static pressure connection, tubing and hoses extending from the connection to the barometric altimeter, airspeed 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.

8–11. REMOVAL.

a. Disconnect tubing from airspeed indicator, altimeter, and rate-of-climb indicator at rear of instrument panel.

b. Disconnect tubing from static line drain (6, figure 8–1, or 5, figure 8–2) at left side of cabin forward bulkhead and remove drain.

c. Remove fittings, connections, and clamps which secure tubing to left side of fuselage.

Note

On helicopters, serial No. 54-2861 and subsequent, remove fittings, connections, and clamps and slide tubing out of holes in frames along left side of fuselage.

d. Disconnect tubing from tee below static connection (1, figure 8–1, or 1, figure 8–2) at upper right side of electronics compartment.

Note

Static connection is riveted to skin of helicopter and therefore is not readily removable.

e. Disconnect drain tube from tee, remove clamps, and remove drain tube. Remove union and cap assembly from tube.

f. Remove tee and tube from static connection (1, figure 8–1,or 1, figure 8–2).

8–12. INSTALLATION.

a. Connect tube and tee to static connection at upper right side of electronics compartment.

b. Install cap assembly and union on drain tube. Connect drain tube at tee and secure with clamps.

c. Connect tubing to tee below static connection in electronics compartment.

d. Install fittings, connections, and clamps and secure tubing to left side of fuselage.

Note

On helicopters serial No. 54-2861 and subsequent, slide tubing through holes in frames along left side of fuselage and install fittings, connections, and clamps,

e. Install drain at tee fitting on left side of forward cabin bulkhead.

f. Connect tubing to rear of airspeed indicator, altimeter, and rate-of-climb indicator on instrument panel.

8–13. MAINTENANCE. Drain off moisture daily which collects in static system at static connection drain (9, figure 8–1, or 10, figure 8–2) mounted on right side of electronics compartment aft bulkhead, and static line drain (6, figure 8–1, or 5, figure 8–2) on left side of cabin forward bulkhead. Check that openings at static connection are free of dirt.

CAUTION

Do not blow or suck on any static line unless it is disconnected from instruments.

8–14. TESTING STATIC SYSTEM (FOURTH ECHELON)

a. To prevent errors in altimeters, barometric altitude control, airspeed indicators, and rate-of-climb indicators, check entire system to see that it is leakproof.

b. With instruments properly connected to static pressure system lines, seal static pressure holes in fuselage skin with static tape or with other clean, easily removed material.

c. Disconnect drain tube at cross and attach a source of vacuum at available connection on bottom of cross.

d. Set altimeter pointers to indicate zero.

e. Slowly apply vacuum (at a rate not to exceed 5000 fpm on rate-of-climb indicators) until altimeter pointer indicates 10,000 feet altitude (manometer value of 9.10 inches Hg differential pressure). At this point, close off vacuum source.

f. During a 1-minute period, indicated altitude on altimeters must not have fallen more than 3000 feet. (The altimeters must not read less than 7000 feet.)

Note

Tap instrument panel during test period to simulate engine vibration and remove friction error from indicators.

g. Remove vacuum source from bottom of cross at completion of test and reconnect drain line.

h. Remove seal from static pressure holes in fuselage skin. Be certain the holes are clean.

i. Set altimeters to indicate proper elevation.

CAUTION

Break vacuum static pressure system at a rate not to exceed 5000 fpm on rate-of-climb indicator.

8–15. INSTRUMENTS MAINTENANCE INSTRUCTIONS.

8–16. Maintenance instructions for all flight instruments, navigation instruments, and engine and miscellaneous instruments are provided in component technical manuals listed in Appendix I.

SECTION IX

ELECTRICAL

9–1. DESCRIPTION.

9–2. The Model CH-34A and CH-34C helicopters have two electrical supply systems: A 24-volt dc system and a 115-volt ac system. The helicopter is equipped with a 24-volt battery and a generator which is mounted at the left rear of the main gear box assembly. In addition, an external power receptacle is provided as a means for connecting 28-volt dc external power. Distribution for this system is through the overhead control panel.

9–3. DC POWER SUPPLY SYSTEM.

9–4. DESCRIPTION. The dc power supply distribution system is so designed that it provides electrical energy to the units on the system when the main rotor speed is 124 rpm or more, regardless of engine speed. The direct current system is used for all power functions, such as relays, motors, actuators, and electro magnets, plus some ignition units and all lighting within the aircraft. By employing a converting process, dc power also becomes the source of all ac electrical energy on the aircraft.

9–5. BATTERY.

9–6. DESCRIPTION. The 24-volt, 24-ampere-hour battery on Model CH-34A helicopter serial No. prior to 56-4313 is located in the forward right corner of the electronics compartment. On helicopters serial No. 56-4313 and subsequent and on Model CH-34C the battery is located in the battery box in the left side of the clutch compartment. For access to and removal of battery refer to TM 55-1520-202-20, Chapter 2, Section XII.

9–7. BATTERY CAPACITY TEST.

a. Charge battery fully. (Refer to paragraph 9–8.)

b. Overcharge 2 hours at normal rate.

c. Check specific gravity of all cells.

d. Adjust specific gravity if above 1.310 or below 1.260. (Refer to paragraph 9–11.)

e. Allow to stand 12 hours.

f. Test capacity with battery capacity tester.

g. Recharge fully if battery passes test. This will require about 5 hours at normal charging rate.

CAUTION

Battery maintenance personnel should exercise extreme care when attaching or detaching battery charging leads to prevent short circuit flashes as this may ignite hydrogen gas generated in the battery cells during charging, thus causing battery to explode. Be sure that power switch is in off position at rectifier prior to disconnecting or connecting.

9–8. CHARGING.

9–9. STARTING CHARGE. (Series charging.) Adjust controls to give charging rate listed below for type battery being charged. It is desirable to use same size batteries in series in one string; otherwise smallest size battery in string determines maximum charging current for the entire string. The following charging currents are for recharging batteries in service and should not be used for initial charge on new batteries after filling with electrolyte. Refer to paragraph 9–13 for details on initial charging.

9–10. ATTENTION DURING CHARGE.

a. Batteries undergoing charge should be inspected at intervals of 2 hours (after initial 4 hours) and a specific gravity reading taken of positive end cell of each battery. Maintain suitable records of specific gravity readings for reference in subsequent gravity checks. All specific gravity readings should be corrected for temperature in accordance with temperature correction data shown on hydrometer.

b. The temperature rise of the battery, obtained by a thermometer reading of the electrolyte, should never exceed 15°F above surrounding air temperature. In the absence of a thermometer, note temperature of the battery with fingers. If it feels uncomfortably warm to the hand, it is too hot. It should be kept below that point by reducing charging rate, if necessary, since higher temperatures are detrimental to the life of the battery.

c. Remove battery from charging line when after 4 hours of charging two successive readings taken 2 hours apart show no increase in specific gravity of electrolyte.

d. As a battery reaches a charged condition, gas bubbles rise to the surface of the electrolyte. This is a normal condition. However, if charge is continued for too long a period or at too high a rate, excessive gassing will occur. In this case, electrolyte appears to be boiling violently and charging rate should be reduced or battery removed if fully charged.

9–11. ADJUSTING SPECIFIC GRAVITY.

9–12. GENERAL. Unless electrolyte is actually lost through spilling or leaking, or acid has been added, the full charge specific gravity of electrolyte will not require adjusting during the life of the battery, since it decreases very little with age. It should be adjusted only if continued charging results in readings above 1.310 or below 1.260.

a. Charge at normal rate until specific gravity shows no further rise with all cells gassing; then charge for 2 hours longer. (Never adjust specific gravity of a cell that does not gas on charge.)

b. Check specific gravity of all cells.

c. Check terminal voltage while charging at normal rate if specific gravity of any cell is above 1.310 or below 1.260.

d. If voltage is above that given in table 9–I, adjust specific gravity as outlined in steps *f* and *g*. If only 1 or 2 cells require adjustment, voltage of these cells should be above value shown for single cells.

e. If voltage is below that given in table 9–I, reject battery.

f. To increase specific gravity, withdraw some electrolyte from battery. Replace it at once with electrolyte of higher specific gravity. DO NOT ALLOW A CELL TO STAND PARTIALLY EMPTY. The right amount electrolyte to withdraw is determined by trial, as the lower the specific gravity reading of the battery, the more electrolyte must be replaced with a stronger solution. Continue charge until all cells have been gassing for 1 hour and again check specific gravity of cells. If specific gravity is not 1.275 to 1.300, repeat adjustment.

g. To decrease specific gravity, withdraw electrolyte and replace it with water. Charge at normal rate until all cells have been gassing for 1 hour. Then, if specific gravity is not between 1.275 and 1.300, repeat the adjustment.

9–13. INITIAL CHARGING.

a. The battery can be placed in service 1 hour after filling, if necessary. If time permits, an 18-hour charge at rate indicated in figure 9–1 is preferable before placing battery in service.

b. Make certain that positive terminal of battery (marked POS + or painted red) is connected to positive terminal of charging circuit and negative terminal of battery (marked NEG- or painted black) is connected to negative terminal of charging circuit.

c. Reduce charging rate and lengthen time proportionately if electrolyte temperature exceeds 15°F above room temperature.

d. After completion of charge, specific gravity should be between 1.275 and 1.300. If specific gravity is low, increase by removing some electrolyte and replacing with electrolyte of higher specific gravity. If specific gravity is high, remove some electrolyte and replace with water. Always wash off any electrolyte that may be spilled, charge 1 hour longer, and recheck specific gravity.

e. A record to indicate that battery has been capacity tested and date of test will be stamped on

Table 9–I. Specific Gravity Table

TEMPERATURE DEGREES FAHRENHEIT	1 CELL VOLTS	6 CELLS VOLTS	12 CELLS VOLTS
35° – 44°	2.57	15.5	30.9
45° – 54°	2.55	15.3	30.6
55° – 64°	2.52	15.1	30.2
65° – 74°	2.49	14.9	29.9
75° – 84°	2.46	14.7	29.5
85° – 94°	2.43	14.6	29.1
95° – 104°	2.40	14.4	28.8
105° – 114°	2.36	14.2	28.4
115° – 124°	2.34	14.0	28.1
125° – 135°	2.31	13.8	27.7

STOCK NUMBER	VOLTS	TAP HR	AMP HOUR CAPACITY AT 5 HOUR RATE	DISCHARGE TIME FOR CAPACITY TEST (MINUTES)	DISCHARGE RATE FOR CAPACITY TEST (AMPERES)	END VOLTAGE FOR CAPACITY TEST (MINIMUM)	AF SPEC	AF TYPE	CHARGING RATE FOR SERVICE BATTERIES (AMPERES)	INITIAL CHARGING RATE FOR NEW BATTERIES (AMPERES)	LENGTH	HEIGHT	WIDTH	WEIGHT FILLED (POUNDS)	WEIGHT EMPTY (POUNDS)	SHIELDED	AEROBATIC
4904-AAF043550	12	5	68	2.0	540	8.0	MIL-B-9225	K-1	5.5	5.5	11	12-1/4	8-9/16	70.0	64.5	NO	YES
4904-AN3150	24	2	34	3.5	144	14.4	MIL-B-6148	G1A	3.0	2.5	11-3/4	10-1/8	11-3/4	77.0	62.5	YES	YES
4904-AN3151	24	1	17	3.5	72	14.4	MIL-B-6147	F1A	1.5	1.0	9-15/16	8-3/4	13-5/16	50.0	41.5	YES	YES
4904-AN3152	12	3	34	3.5	144	7.2	MIL-B-6740	C5A	3.0	2.5	9-7/8	10-5/32	5-5/32	40.0	32.75	YES	YES
4904-AN3154	24	1	11	2.0	42	14.2	MIL-B-6741	NONE	2.0	1.0	10-29/32	7-3/4	9-25/32	34.0	28.0	YES	YES
4906-6FH13	12	4	88	5.0	372	7.2	NONE	NONE	6.0	5.0	13-5/16	10-13/16	7-1/4	78.0	62.0	NO	NO
4906-6TA59B	12	3	34	3.5	144	7.2	NONE	NONE	3.0	2.5	10-5/8	9-3/16	5-13/32	33.5	28.5	NO	YES
4913-08	12	4	88	5.0	372	7.2	NONE	NONE	6.0	5.0	13-5/16	10-13/16	7-1/4	78.0	62.0	NO	NO
4916-324LD	6	3	24	2.5	102	3.6	NONE	NONE	2.0	1.5	5-1/8	7-7/8	5-5/16	11.75	9.5	NO	YES
4916-333LD	6	3	33	3.5	140	3.6	NONE	NONE	3.0	2.5	5-1/8	7-7/8	5-5/16	14.0	11.75	NO	YES
4916-S12	12	1	12	3.0	52	7.2	NONE	NONE	4.0	6.0	7-3/4	7-7/8	5-1/4	15.0	12.5	NO	YES
4916-S24	12	3	24	1.0	102	7.2	NONE	NONE	4.0	4.0	7-5/8	7-3/16	5-3/16	21.5	17.56	NO	YES
4916-T88	12	4	88	5.0	372	7.2	NONE	NONE	6.0	5.0	13-5/16	10-13/16	7-1/4	78.0	62.0	NO	NO
4922-AAF054020	12	4	68	3.5	288	7.2	MIL-B-6429	D6A	6.0	5.0	16-3/4	10-1/4	6-1/4	71.0	57.5	YES	YES

Maximum charging current on AN3151 battery may be 3 amps if the battery is removed from the charging circuit within 1 hour after no further rise in specific gravity is noted. This will facilitate charging of the AN3151 battery in series with several larger batteries without reducing their rate. Discharge times are based on 80° F electrolyte temperature. No new battery will be condemned for low capacity unless the battery fails to give rated capacity after five complete cycles.

Figure 9–1. Battery Test and General Information Table

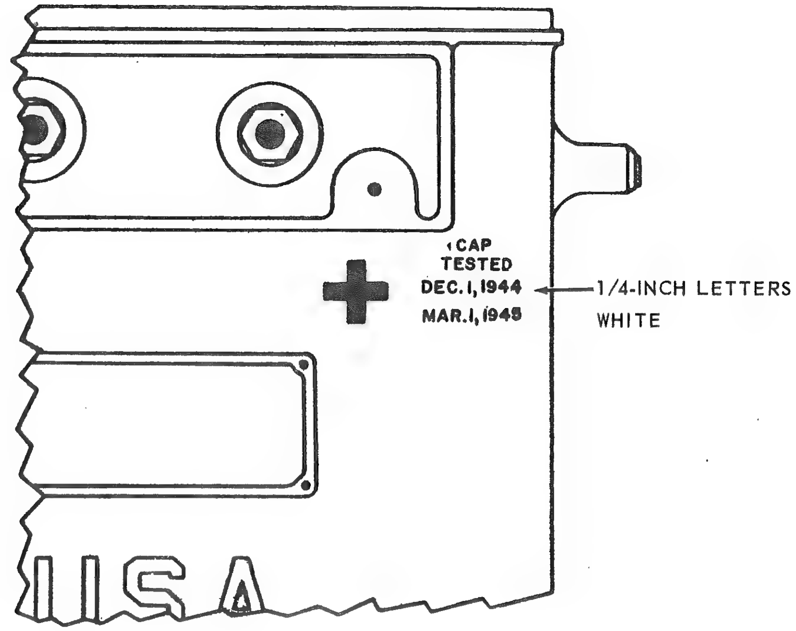


Figure 9–2. Capacity Test Record on Battery Case

terminal side of battery as shown in figure 9–2. Subsequent tests need only to be recorded with date stamped directly under previous date.

9–14. STORING BATTERIES.

9–15. DRY. New batteries without electrolyte in them and as received from the manufacturer should be stored in a cool, dry location and removed for service in the order in which they are received. All batteries will be given a capacity test prior to installation by using organization.

9–16. WET.

9–17. New batteries that have electrolyte in them and have been given their first charge, or batteries that have been in service and are not worn out, should be stored in as cool a location as possible.

9–18. Overhaul will not be accomplished because batteries are so designed that positive and negative plates and separators all wear out together. If one cell fails, the others are in about the same condition and are likely to fail at nearly the same time.

9–19. DISPOSAL OF BATTERIES WHEN WORN OUT.

9–20. Batteries which are no longer fit for service in aircraft may be painted bright yellow and stenciled on two sides with black letters DO NOT INSTALL IN ANY AIRCRAFT – FOR GROUND USE ONLY. These batteries may then be used on testing devices, battery carts, or other equipment. Batteries known to be completely worn out shall be emptied of solution and returned to Depots or Base Maintenance Activities for salvage.

9–21. GENERATOR.

9–22. DESCRIPTION. (See figure 9–3.) The generator, mounted at the left rear of the main gear box assembly, is rated at 30 volts, 200 amperes, at 3000 to 8000 rpm, cooled by a centrifugal blower. Both generator and blower are driven by accessory drive gears on the main gear box assembly. The generator and blower operate only when main rotor is turning.

9–23. REMOVAL. (Refer to TM 55-1520-202-20, Chapter 2, Section XII.)

9–24. MINOR REPAIR.

a. Replace any brushes that are less than 1/2 inch in length, chipped, or badly pitted.

b. Check spring tension of brush spring. Tension should be between 100 and 108 ounces at an extended length of 1-9/32 inch.

c. Install a new spring if tension is not within limits.

d. Inspect brush board assembly and jumper assembly for cracked insulation and broken or corroded terminals.

e. Make certain that brush boxes are firmly riveted to brush board assembly.

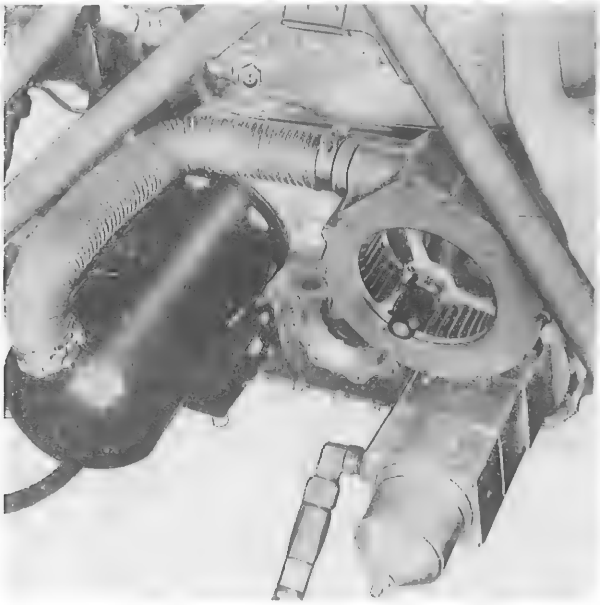


Figure 9–3. Generator Installed

f. Inspect brush boxes for cracks around flange where brush leads mount to brush box.

g. If flange is broken, perform the following steps:

(1) Fabricate a steel strip 7/16 inch wide by 1-1/16 inches long, the thickness and hardness of steel strip to be equal to that of brush box.

(2) Weld or braze flat side of steel strip onto outside of brush box and to under side of jumper assembly flange, so as to give additional support to flange.

(3) Screw holes of flange should be retapped if necessary.

(4) Smooth out and clean inside of brush box of any foreign matter to insure that brushes fit smoothly in brush box.

9–25. TESTING.

a. Mount generator on test stand mounting bracket. Attach air spout to generator if it has not been done previously.

b. Make connections for air blast cooling, and be sure all duct connections are securely clamped.

CAUTION

Do not operate generator under load without proper air blast cooling, or excessive heating will result.

c. Start blower and adjust air intake to blower until manometer measures 6 inches of water pressure (static plus velocity) head.

d. Maximum permissible temperature of cooling air is 30°C (86°F). When manometer pressure is properly adjusted, shut down blower until performing tests.

CAUTION

Maintain correct blast cooling pressure during all tests which require loading of generator.

e. Connect generator load leads from terminals B and E of terminal block assembly to input binding posts located on right side of test panel as described in the following steps:

f. Connect lead from B to top binding post marked INPUT +.

g. Connect lead from E to binding post marked INPUT-300 AMPS.

h. Set ammeter selector switch to 300A on ammeter scale.

i. Move all load switches to OFF position.

j. Connect carbon pile regulator or rheostat and meters.

k. Attach a slotted, felt pad to generator and insert a laboratory-type thermometer through slot. Tape thermometer securely against pole shoe screw.

9–26. BRUSH SEATING.

CAUTION

Turn on blower.

a. Move TACHOMETER ROTATION switch to proper position, depending on whether motor control switch must be set on FORWARD or REVERSE to make generator rotate in a counterclockwise direction (viewing the generator drive end).

b. Start test stand by pushing proper motor control button, and increase generator speed to approximately 5000 rpm.

c. Apply a load of 100 amperes, as indicated on dc ammeter on test panel.

d. Operate generator for a minimum of 10 hours.

e. Shut off driving and air blast cooling motor and examine brush seating.

f. The face of each brush should contact commutator surface 100 percent in direction of rotation

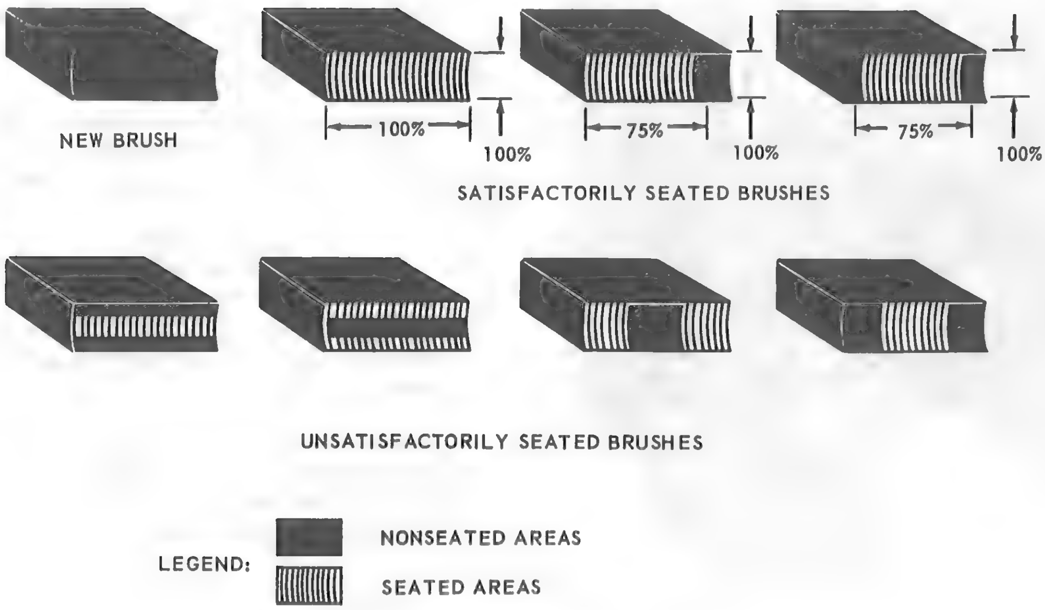


Figure 9–4. Typical Brush Seating

and at least 75 percent of dimension parallel to shaft. (See figure 9–4.)

g. There should be no excessive grooving or other damage to face of brush.

h. If brush seating does not meet these requirements (steps *f* and *g*) after operating for 10 hours, continue operation until proper seating is obtained.

i. If seating is close to required specification, increase dc load to between 150 and 200 amperes for short periods until proper seating is obtained.

j. After brushes are properly seated, open all load switches and shut off driving and air blast cooling motors. Let unit cool to room temperature.

9–27. INSTALLATION. (Refer to TM 55-1520-202-20, Chapter 2, Section XII.)

9–28. EXTERNAL POWER RECEPTACLE.

9–29. DESCRIPTION. (See figure 9–5 or 9–6.) On Model CH-34A serial No. prior to 56-4313, the external power receptacle is attached to right side of power relay junction box. The external receptacle extends through right side of helicopter. On helicopters serial No. 56-4313 and subsequent and on Model CH-34C, external receptacle is located on right side just aft of air intake screens. The receptacle provides means for connecting an external source of 28-volt dc power to helicopter's dc power distribution system. The receptacle is energized when an external power plug is placed in the receptacle and external power is applied. The receptacle has three contact pins, two positive and one negative. The negative pin is grounded to helicopter structure. One positive pin connects to solenoids of both external power relay and ground check relay. The other positive pin connects to primary bus through contacts of external power relay.

Figure 9–5. External Power Receptacle (Serial No. Prior to 56-4313)

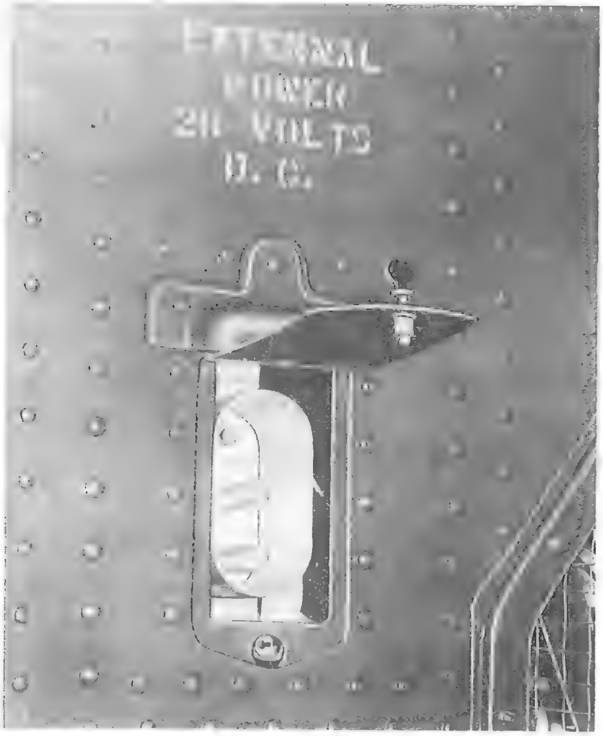


Figure 9–6. External Power Receptacle (Serial No. 56-4313 and Subsequent)

9–30. REMOVAL. (See figure 9–7.)

CAUTION

Accidental short circuits in power relay junction box may cause serious fires. Before removing cover of power relay junction box, be sure BATT and GEN switches are in OFF and GEN OFF positions, respectively, and that external power is disconnected.

a. Disconnect battery.

b. Working inside of helicopter, remove cover of power relay junction box.

c. Remove nuts from external power bus bar (8, figure 9–7) and remove bus bar.

d. Remove nut from battery cable to receptacle.

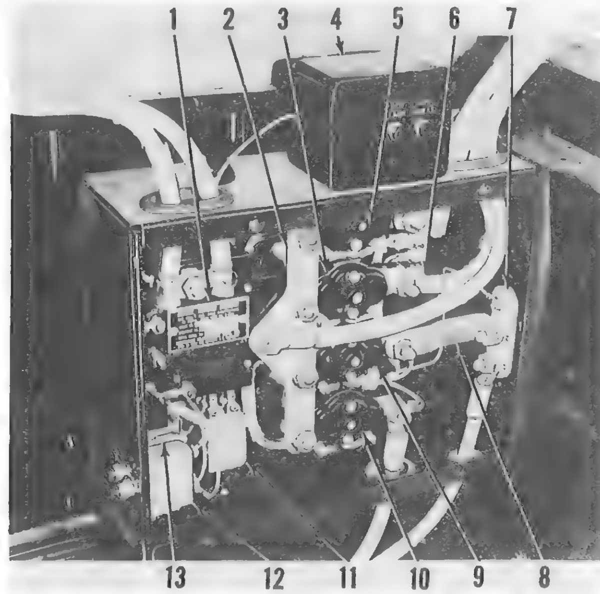
e. Remove nut from negative pin.

f. Remove bolts and pull receptacle out.

9–31. INSTALLATION.

a. Disconnect battery.

b. Place BATT and GEN switches in OFF and GEN OFF positions, respectively.



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 9–7. Power Relay Junction Box (Cover Removed)

c. Position receptacle in helicopter with small terminal at top. Secure receptacle with bolts, nuts, and washers.

d. Replace external power bus bar and secure with nuts and washers.

e. Place battery cable on bottom terminal and secure with washer and nut.

f. Replace cover on power relay junction box.

CAUTION

Before replacing cover, be sure all electrical connections are properly made and secure and that no foreign objects are left in the box. Short circuits in power relay junction box may cause serious fires.

9–32. DC POWER DISTRIBUTION SYSTEM.

9–33. DESCRIPTION. DC power is distributed through three supply circuits: battery, primary, and

Table 9–II. 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

*Assuming generator at operating speed (engine speed at least 1400 rpm and clutch engaged).
**Energized by generator power and battery is charging.
***Energized by external power and battery is charging.

secondary. Except for battery supply circuit, the distribution system is controlled by BATT switch, GEN switch, and five relays: battery relay, reverse current cut-out relay, ground check relay, bus-tie relay, and external power relay. Within the distribution system are such common items as junction boxes, electrical disconnects, panels, and terminal strips which facilitate testing and repair of circuitry. A generator failure warning light, marked GEN OFF, is included in the distribution system. Switches are located on main switch panel on instrument panel and switch panel of overhead control panel. Protective circuit breakers are located on the fuse and circuit breaker panel at overhead control panel. The battery supply circuit connects directly in the battery and is always energized. Table 9–II presents a summary of operating conditions for the dc power distribution system.

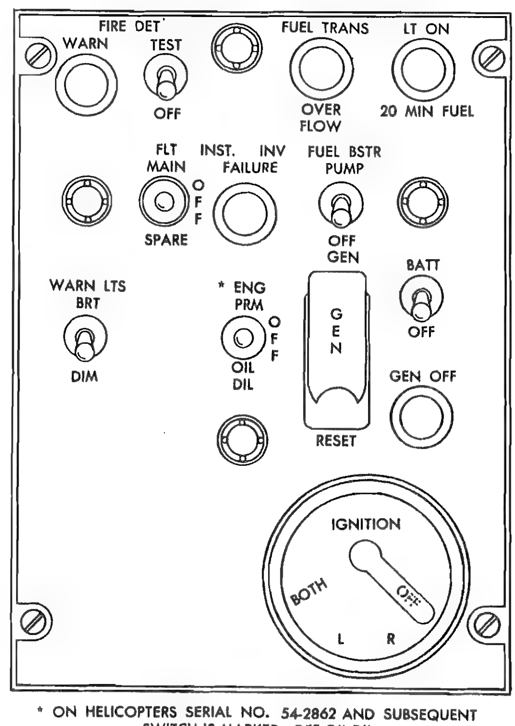
9–34. MAIN SWITCH PANEL.

9–35. DESCRIPTION. (See figure 9–8 or 9–9.) The main switch panel is located on the instrument panel. The following are among the electrical system components mounted on the switch panel: Battery switch, generator switch, generator failure warning light, inverter switch, and inverter failure warning light.

9–36. REMOVAL.

CAUTION

Accidental short circuits in main switch panel may cause serious fires. Before removing main switch panel, disconnect battery and external power source.



* ON HELICOPTERS SERIAL NO. 54-2862 AND SUBSEQUENT SWITCH IS MARKED OFF-OIL DIL

Figure 9–8. Main Switch Panel (Serial No. Prior to 55-4462)

a. Place BATT and GEN switches in OFF and GEN OFF positions, respectively.

b. Loosen fasteners securing switch panel to instrument panel.

c. Pull switch panel out from instrument panel.

d. Carefully disconnect wiring from each unit.

e. Remove panel.

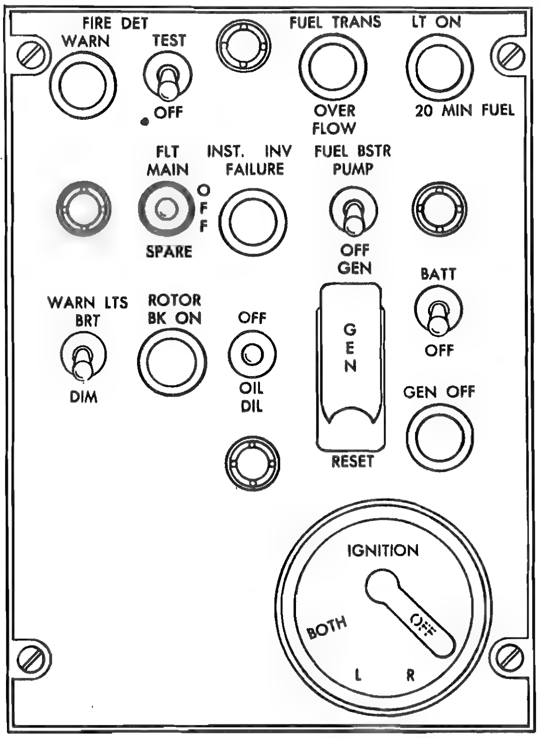


Figure 9–9. Main Switch Panel (Serial No. 55-462 and Subsequent)

9–37. INSTALLATION.

CAUTION

Accidental short circuits in main switch panel may cause serious fires. Before installing main switch panel, disconnect battery and external power source.

a. Place BATT and GEN switches in OFF and GEN OFF positions, respectively.

b. Carefully connect wiring to each unit on switch panel, using appropriate wiring diagram.

c. Position switch panel on instrument panel and secure with fasteners.

9–38. OVERHEAD CONTROL PANEL.

9–39. DESCRIPTION. (See figure 9–10, 9–11, or 9–12.) The overhead control panel is installed in the center of the cockpit ceiling. The control panel consists of three sections. The forward section contains the overhead switch panel. The center section contains the fuse and circuit breaker panel. The aft section contains the cockpit dome light panel. Figures 9–10, 9–11, and 9–12 show components that are installed on each of these panels. Each panel is hinged along one edge and can be lowered to allow access to the rear of panel and interior of control panel box.

9–40. REMOVAL.

CAUTION

Accidental short circuits in overhead control panel may cause serious fires. Before removing overhead control panel, disconnect battery and external power source.

a. Place BATT and GEN switches in OFF and GEN OFF positions, respectively.

b. Lower right service platform and disconnect plugs on canted bulkhead which carry electrical wiring to overhead control panel in cockpit.

c. Remove screws, washers, and nuts that secure receptacles for plugs which were removed in step *b* to forward side of canted bulkhead in cockpit. Remove receptacles from bulkhead.

d. Disconnect wiring that leads to control panel from terminal strip at upper right of canted bulkhead in cockpit.

e. Loosen fasteners and hinge down fuse and circuit breaker panel.

f. Remove washers and nuts that secure power supply cable to primary bus bar and secondary bus bar on back of fuse and circuit breaker panel.

g. Disconnect wiring above fuse and circuit breaker panel from top forward fuselage light.

h. Pull two loose power supply cables, that were disconnected in step *f*, out through gommet in right side of control panel box.

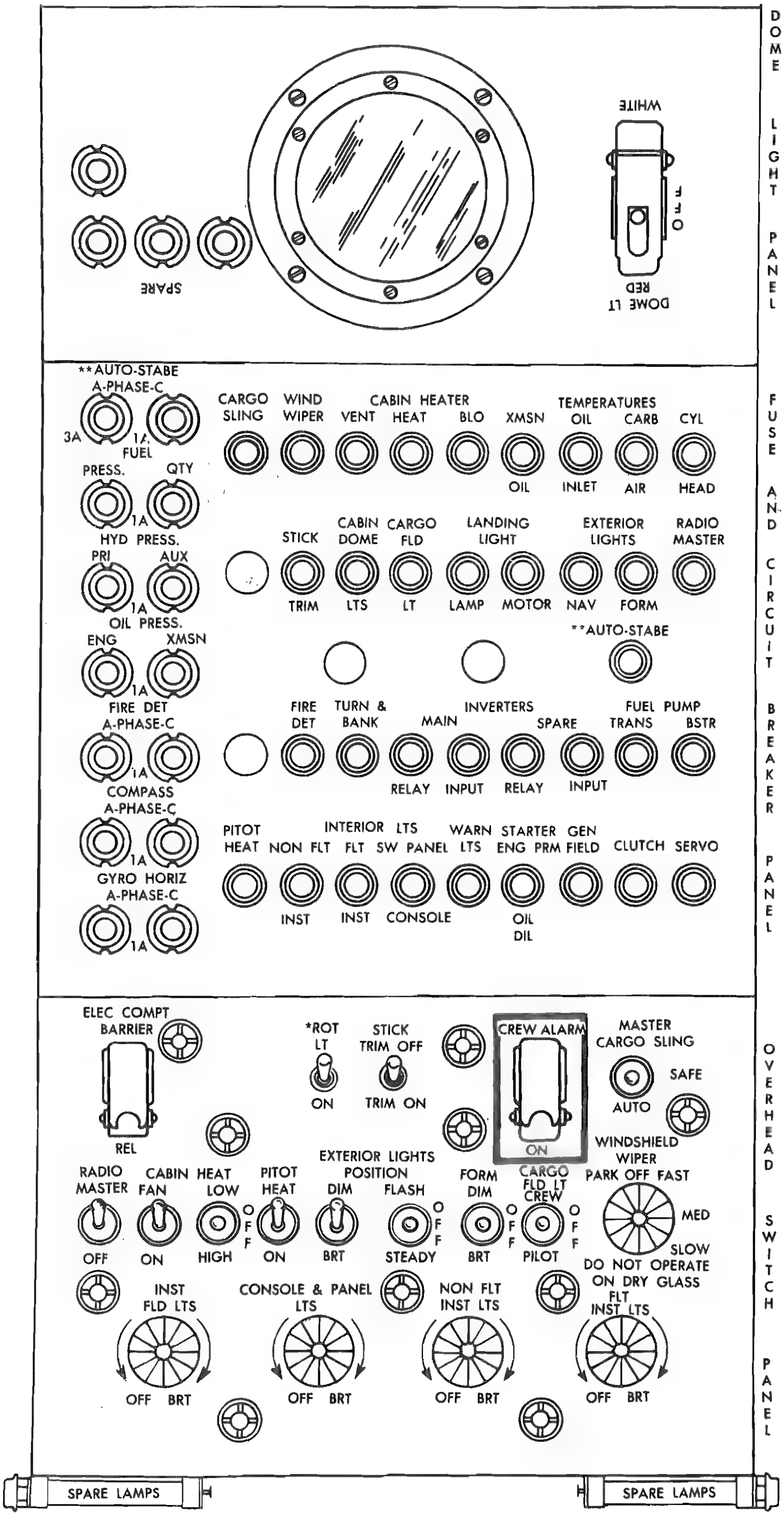
i. Hinge up fuse and circuit breaker panel and secure with fasteners.

j. Provide support for control panel to prevent its dropping down. Remove screws and washers that secure control panel to cockpit canopy intercostals and remove box, with panels attached, from helicopter.

9–41. INSTALLATION.

CAUTION

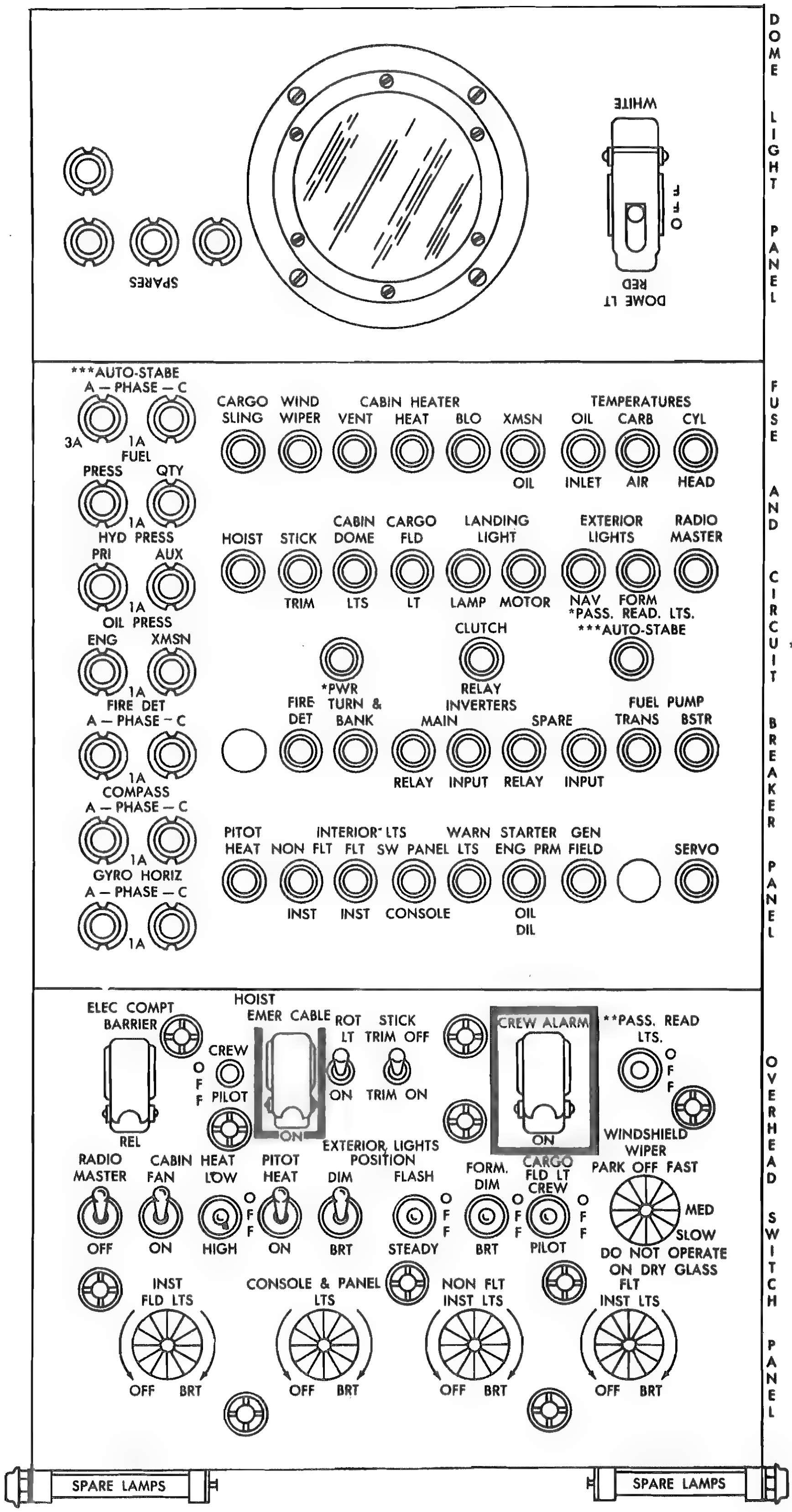
Accidental short circuits in overhead control panel may cause serious fires. Before removing overhead control panel, disconnect battery and external power source.



*HELICOPTERS SERIAL NO. 54-3007 AND SUBSEQUENT

**MODEL CH-34C

Figure 9–10. Overhead Control Panel (Serial No. Prior to 56-4284)



*HELICOPTERS SERIAL NO. 56-4284 THROUGH 56-4312

**HELICOPTERS SERIAL NO. 56-4315 56-4316, 56-4320 AND 57-1684

***MODEL CH-34C

Figure 9–11. Overhead Control Panel (Serial No. 56-4284 through 57-1741)

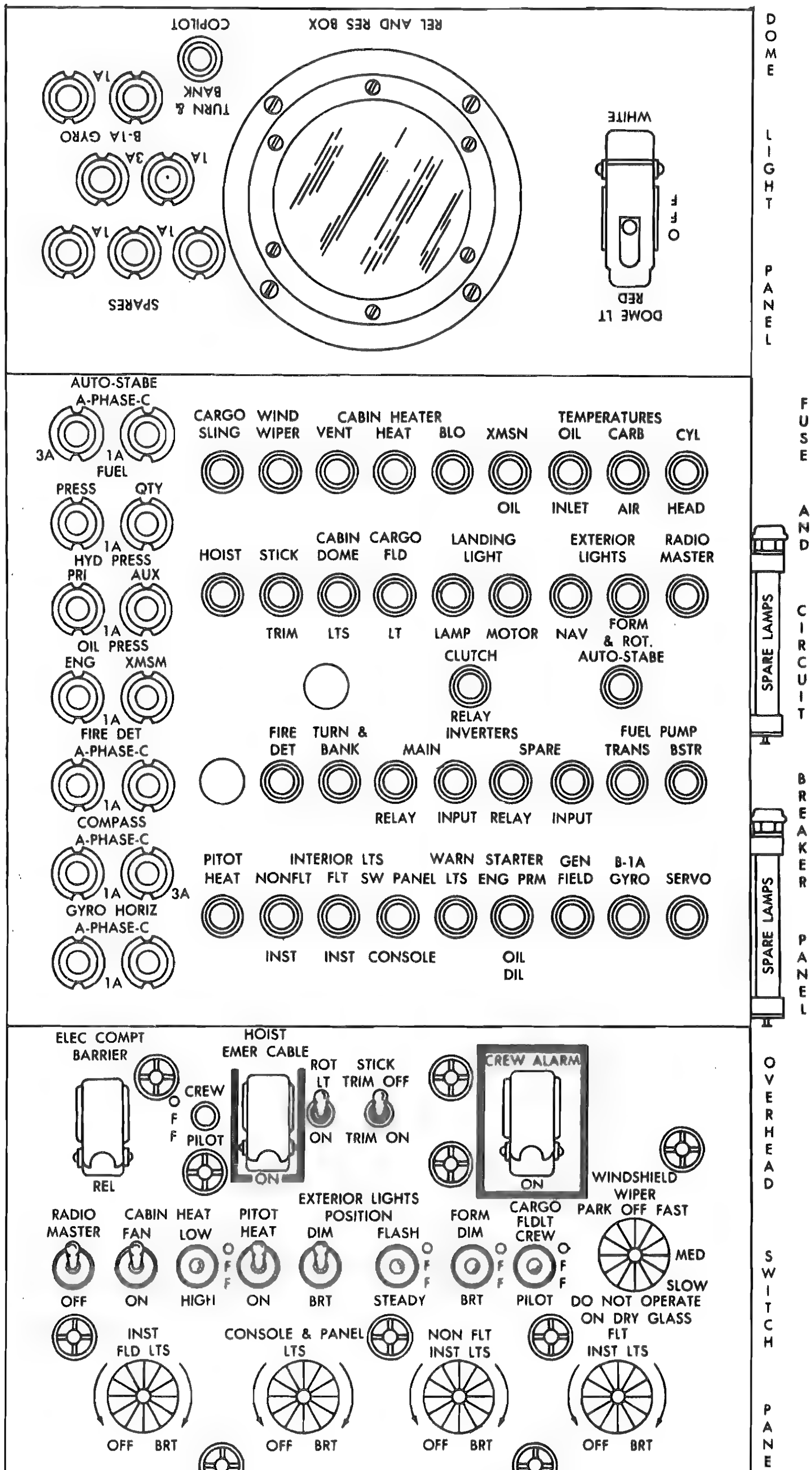


Figure 9–12. Overhead Control Panel (Serial No. 57-1742 and Subsequent)

a. Place BATT and GEN switches in OFF and GEN OFF positions, respectively.

b. Position control panel box, with panels attached, in position on inside of cockpit canopy and secure it to intercostals with screws and washers.

c. Loosen fasteners and hinge down fuse and circuit breaker panel.

d. Connect wiring above fuse and circuit breaker panel to top forward fuselage light. Refer to appropriate wiring diagrams in TM 55-1520-202-20, Chapter 2, Section XIII.

e. Insert two power supply cables through grommet on right side of control panel box. Connect each appropriate bus bar with washers and nut. Place thick washer against each side of each terminal and thin washer under each nut. (Refer to appropriate wiring diagrams in TM 55-1520-202-20, Chapter 2, Section XIII.)

f. Hinge up fuse and circuit breaker panel and secure it with fasteners.

g. Connect wires hanging from right side of control panel box to terminal strip at upper right of canted bulkhead. Refer to appropriate post terminal chart in TM 55-1520-202-20, Chapter 2, Section XIII for correct wiring connections.

h. Secure receptacles on wiring that hangs from right side of control panel box to canted bulkhead at mounting holes.

i. Lower right service platform and connect plugs to receptacles that were installed in step *h*. Close service platform.

9–42. JUNCTION BOXES.

9–43. REMOVAL.

CAUTION

Short circuits in junction boxes may cause serious fires. Before removing junction box covers, make sure that BATT and GEN switches are in OFF and GEN OFF positions, respectively, and external power is disconnected.

a. Remove cover from junction box.

b. If wiring diagram is not available, identify all wiring and connections which must be pulled from junction box, to facilitate reinstallation.

c. Remove nuts from terminal post and remove all wires which extend from openings in junction box and pull wires from openings.

NOTE

Temporarily replace nuts removed in step *c*.

d. Remove nuts, washers, and screws which secure box to structure of helicopter.

e. Remove junction box.

9–44. INSTALLATION.

CAUTION

Short circuits in junction boxes may cause serious fires. Before installing junction box or junction box covers, make sure that BATT and GEN switches are in OFF and GEN OFF positions, respectively, and external power is disconnected.

a. Position junction box and install attaching hardware.

b. Use appropriate wiring diagram for reference to connect all electrical wiring and connections. If wiring diagram is not furnished, follow method identification instructions in paragraph 9–43, step *b*.

c. Install junction box cover.

9–45. INTERIOR LIGHTS.

9–46. DESCRIPTION. Interior lights are provided for both general and specific illumination, troubleshooting, inspection, signaling, warning of circuit failure, trouble in systems or other than electrical, and indication of system conditions. Interior lights include dome and trouble lights, console and panel lights, instrument lights, and inspection lights and their particular components, such as relays. All interior lights operate from the 28-volt dc power distribution system.

9–47. REPAIR INTERIOR LIGHTS.

9–48. REMOVAL.

a. Remove all attaching hardware, lift light from mounting, disconnect wiring, remove lens cover hardware, and remove lamp.

b. Visually inspect light for damaged components or broken wiring. Repair or replace damaged components.

c. Wipe light components clean with lint-free wiring cloth.

9–49. INSTALLATION.

a. Connect wiring to light connection, place light in position, and install attaching hardware.

b. Install lamp, position lens cover, and secure with attaching hardware.

c. Place BATT switch in ON position or connect external power.

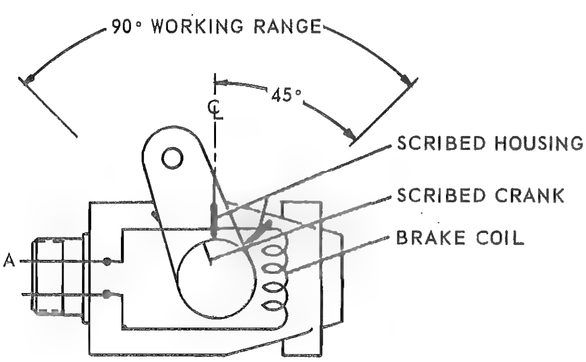
d. Operate light switches, if light or lights fail to function, and follow disassembly procedure, paragraph 9–48, step *a*.

e. Check for voltage at light receptacle. If no voltage reading is obtained, check continuity of wiring between light and power source.

f. Correct discrepancies and follow installation procedure outlined in steps *a* and *b*.

9–50. MAGNETIC BRAKE (MODEL 4460M3-21).

9–51. DESCRIPTION. Two electrically operated magnetic brakes are incorporated in the cyclic stick trim system. One magnetic brake is installed for lateral control and one for fore and aft control. They are mounted in the left side of the clutch compartment where they are connected to the cyclic control system by the spring cylinders. They are controlled by the stick trim switch. When the master switch is ON, the brake solenoids are deenergized and the stick trim system is in operation. When the switch is placed in the STICK TRIM position, the brake solenoids are energized and the magnetic brakes are inoperative. 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 and fuse panel. (See figure 9–13.)



CURRENT ON=	FREE ROTATION
CURRENT OFF=	BRAKE ON

Figure 9–13. Magnetic Brake (Wiring Diagram)

9–52. REMOVAL. (Refer to paragraph 7–55.)

9–53. DISASSEMBLY. (See figure 9–14.)

a. Remove nut (1, figure 9–14), bolt (2), and washer (3) and pull off arm (4).

b. Remove screws (5) that attach receptacle (6) to housing.

c. Remove screws (7 and 8) that attach adapter (9) to housing, and remove adapter and shim (10).

d. Remove nuts (11) and screws (12, 13, 14, and 15) that hold housing (16 and 17) halves together and separate housing.

e. Lift out gear and motor assembly.

f. Disassemble gear and motor assembly using following procedure:

(1) Remove retaining ring (18) and pull off ball bearing (19).

(2) Remove shims (20 and 21) from gear (22).

(3) Pull gear (22) from shaft assembly.

(4) Remove washer (23), bushing (24), flanged bushing (25), and shim (26) from shaft assembly (27).

(5) Remove ball bearing (28) from shaft.

(6) Pull out shaft assembly (27), and remove brake disc assembly (29) and spring (30) from coil and core assembly (31).

g. Remove helical and pinion gear assemblies from housing halves.

h. Disassemble helical and pinion gear assembly as follows:

(1) Remove retaining ring (32).

(2) Remove shims (33 and 34).

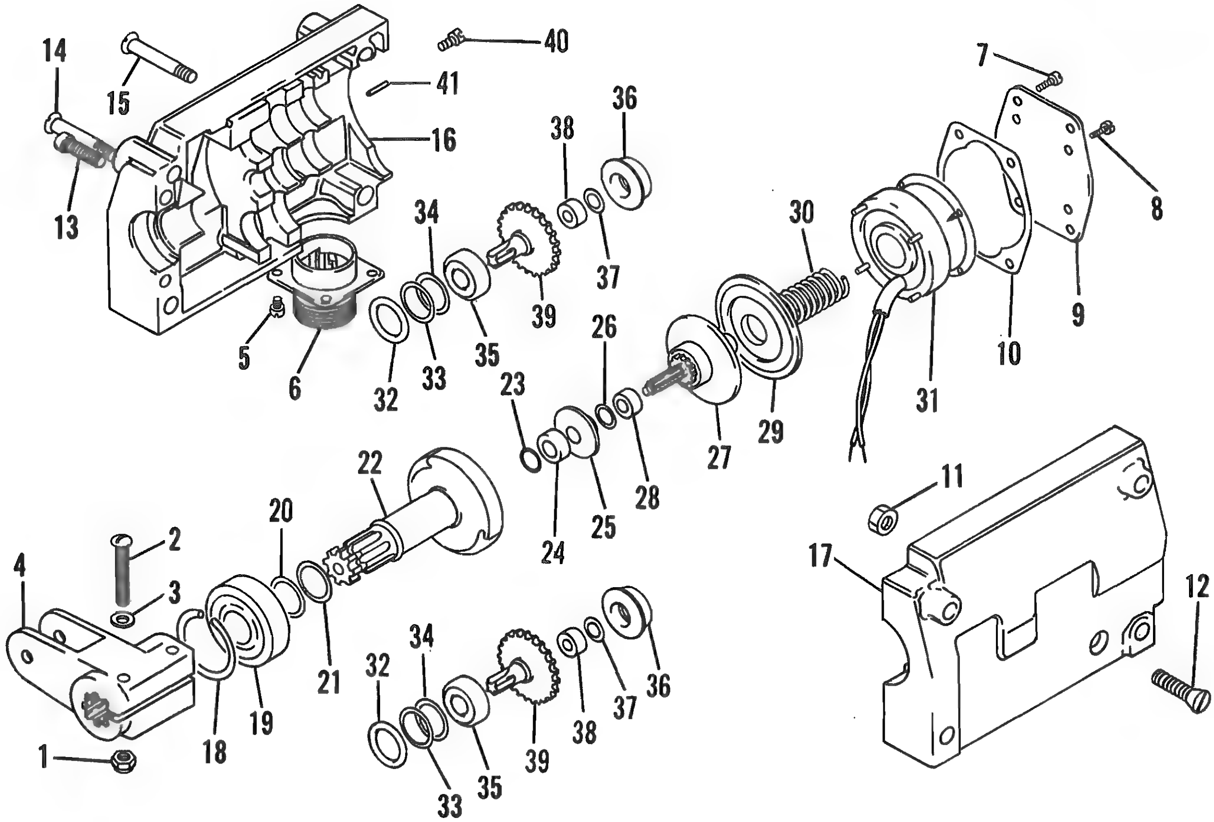
(3) Remove ball bearings (35) and linear bearing (36).

(4) Remove shim (37) and ball bearing (38) from helical and pinion gear (39).

9–54. CLEANING.

a. Loosen hand accumulations of dirt with a soft-bristle brush.

b. Blow dirt from coil and core assembly and receptacle with dry, filtered air at 20 psi. Wipe assembly clean with a soft, dry, lintless cloth.



1. Nut
2. Bolt
3. Washer
4. Arm
5. Screw
6. Receptacle
7. Screw
8. Screw
9. Adapter
10. Shim
11. Nut
12. Screw
13. Screw
14. Screw
15. Screw
16. Housing
17. Housing
18. Ring, Retaining
19. Bearing
20. Shim
21. Shim
22. Gear
23. Washer
24. Bushing
25. Bushing
26. Shim
27. Shaft Assembly
28. Bearing
29. Disc Assembly
30. Spring
31. Coil and Cone Assembly
32. Ring, Retaining
33. Shim
34. Shim
35. Bearing
36. Bearing, Linear
37. Shim
38. Bearing
39. Gear
40. Screw
41. Pin

Figure 9–14. Magnetic Brake (Model R460M3-21)

CAUTION

Never immerse the coil and core assembly in dry-cleaning solvent.

c. Clean all other parts in dry-cleaning solvent, Federal Specification P-S-661, and dry thoroughly.

Note

Traces of sealing compound which remain in screw holes can be loosened while parts are immersed in solvent, using a soft-bristle brush. Be careful not to damage threads.

9–55. INSPECTION.

a. Visually inspect all parts for damage or corrosion.

b. Check threads for crossed, nicked, or stripped conditions.

c. Inspect coil and core assembly (31, figure 9–14) for evidence of breakdown or shorted, open, or high resistance windings.

d. Inspect brake disc assembly (29) for worn lining. Lining must be 0.03-inch minimum above surface of the brake disc.

9–56. REPAIR OR REPLACEMENT.

a. Replace all parts which are worn, defective, or damaged beyond simple repair.

b. Clean up minor surface damage from steel parts, using crocus cloth, Federal Specification P-S-458.

c. Clean up minor surface damage from aluminum parts, using aluminum oxide abrasive cloth, Federal Specification P-S-451.

9–57. LUBRICATION.

a. Apply anti-sieze compound, Military Specification MIL-T-5544, to all aluminum screw parts and to steel screw parts that anchor into aluminum parts, except screws (13 and 40).

b. Coat gears and bearings lightly with grease, Military Specification MIL-G-3278.

9–58. REASSEMBLY. (See figure 9–14.)

a. Assemble gear and motor assembly as follows:

(1) Assemble brake disc assembly (29), spring (30), and coil and core assembly (31) on shaft assembly (27).

(2) Press ball bearing (28) on shaft.

(3) Place shim (26), flanged bushing (25), bushing (24), and washer (23) on shaft.

(4) Install gear (22) on shaft and use shims (20 and 21) as required to eliminate end play.

(5) Use shims (33, 34, and 37) as required to obtain 0.002-inch maximum backlash.

(6) Press ball bearing (19) on gear (22) and install retaining ring (18).

b. Place gears and motor assembly into housing and coat surfaces of housing with compound 3M-EC-776, manufactured by Minnesota Mining and Mfg. Co.

c. Install screws (12, 13, 14, and 15) and install nuts (11). Tighten screws (13, 14, and 15) to a torque of 18 to 22 inch-pounds.

d. Install shim (10), as required to set brake air gap to allow brake operation at 17 vdc and adapter (9) to housing with screws (7 and 8).

e. Install receptacle (6) to housing with screws (5).

f. Place arm (4) on gear (22), and install washer (3), bolt (2), and nut (1).

g. Secure all drilled head screws with 0.020-inch stainless steel wire. Seal other screws with adhesive, Airborne Accessories part No. 9163001.

h. Paint 90 degree scribe marks using red paint, Military Specification MIL-E-7729. (See figure 9–13.)

9–59. TEST PROCEDURE. (See figures 9–13 and 9–14.)

a. To obtain a 90-degree arc of rotation (working range), set scribe line on crank arm (4) in line with scribe line on gear and motor housing (16).

b. Apply 26 volts dc across receptacle pins. Current should not exceed 0.5 amperes. Crank arm (4) should rotate freely with 3 inch-pounds torque applied.

c. Switch off power. Brake disc assembly (29) should snap against plate of shaft assembly (27) with an audible click. Check brake holding torque by loading to 200 inch-pounds. Brake should hold against this load without slipping.

9–60. INSTALLATION. (Refer to paragraph 7–58.)

9–61. INDUCTION VIBRATOR.

9–62. DESCRIPTION. The induction vibrator is mounted just aft of the left engine nose door frame. The vibrator supplies 27-volt, 2.7-ampere pulsating current when starting the engine. Power to operate the vibrator is supplied by the power supply through the starter switch.

9–63. REMOVAL.

a. Open engine access doors.

b. Disconnect conduits from vibrator.

c. Remove cover from unit and disconnect electrical leads.

d. Remove mounting screws and remove vibrator.

9–64. REPAIR. Repair of the induction vibrator should be accomplished in accordance with TM 1-8E2-8-3-3.

9–65. INSTALLATION.

a. Position induction vibrator behind left engine nose door frame just aft of junction box and secure it with 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 electrical leads inside vibrator. Replace cover on front of vibrator.

c. Connect ignition conduits to top and bottom of vibrator.

d. Close left engine nose door.

9–66. IGNITION SWITCH.

9–67. 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.

9–68. REMOVAL.

a. Loosen fasteners and lift main switch panel away from instrument panel.

b. Disconnect ignition conduit from back of ignition switch.

c. Remove cover from back of switch and disconnect electrical leads.

d. Remove screws that hold switch to panel and remove switch.

9–69. INSTALLATION.

a. Position ignition switch on main switch panel and secure with screws.

b. Connect electrical leads inside switch. Replace cover on back of switch.

c. Connect ignition conduit to back of switch.

d. Position switch panel on instrument panel and secure with fasteners.

9–70. TESTING. With engine idling smoothly at 1100 rpm, turn ignition switch off momentarily, then on again to ascertain that switch turns ignition off and on.

9–71. AC POWER SUPPLY SYSTEM.

9–72. Complete maintenance coverage of the ac electrical system and its components is included in TM 55-1520-202-20.

SECTION X

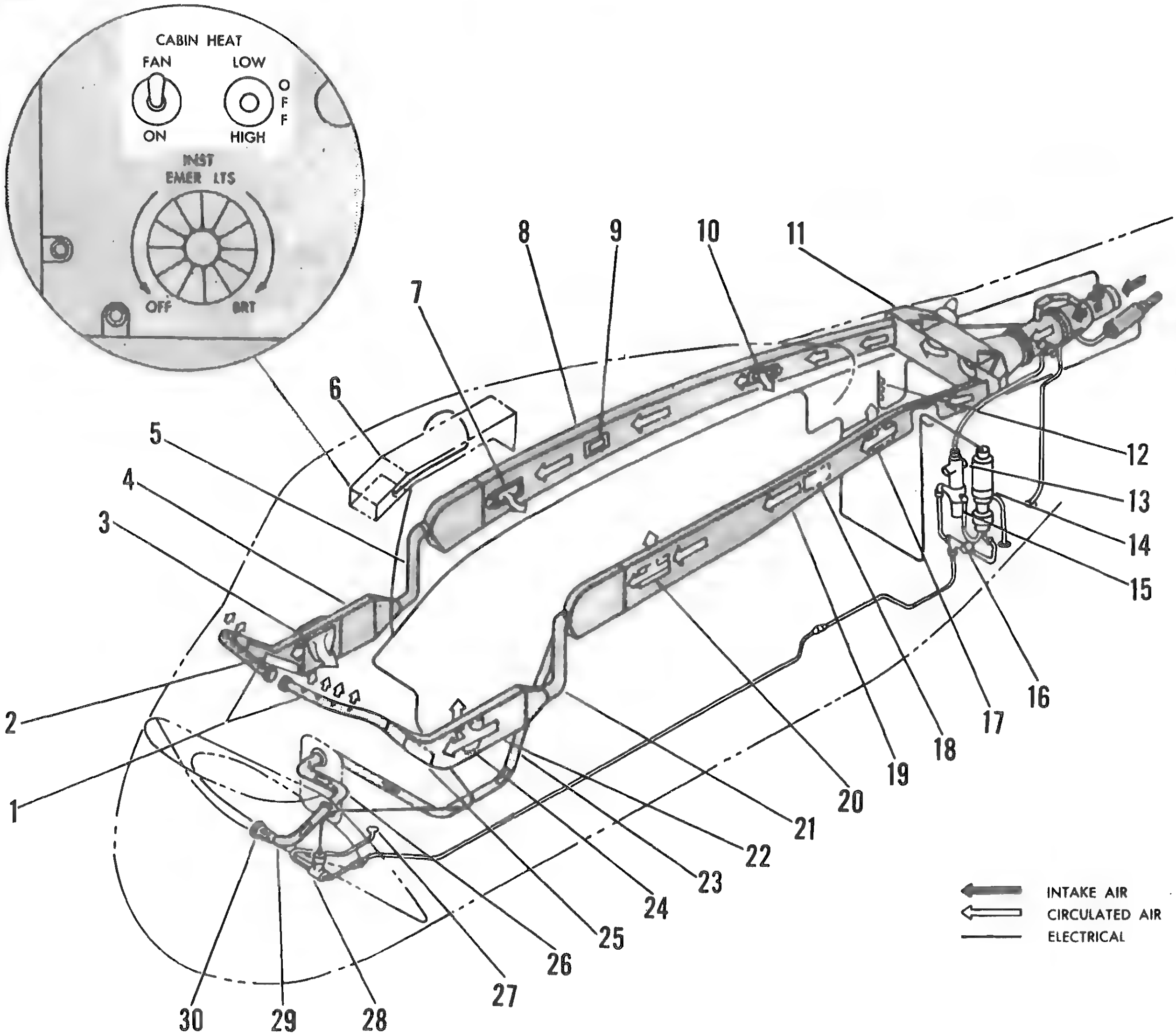
UTILITY SYSTEMS

10–1. HEATING AND VENTILATING SYSTEM.

10–2. DESCRIPTION. (See figure 10–1.) The heating and ventilating system consists primarily of the following: 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 or two nozzles and two flexible 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 preheat 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, air passes through an adapter into the heating chamber of the heater and on into the plenum duct. From the plenum duct, air is distributed to the cabin, cockpit, and defroster ducts. A flexible duct and a damper assembly or elbow, mounted on top of the heater and adapter, supply 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 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 cockpit. The CABIN HEAT – LOW – OFF – HIGH switch controls the heater and fan for heating operations. When the switch is placed in either 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. The CABIN HEAT – FAN – ON switch, located on the overhead control panel, 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).

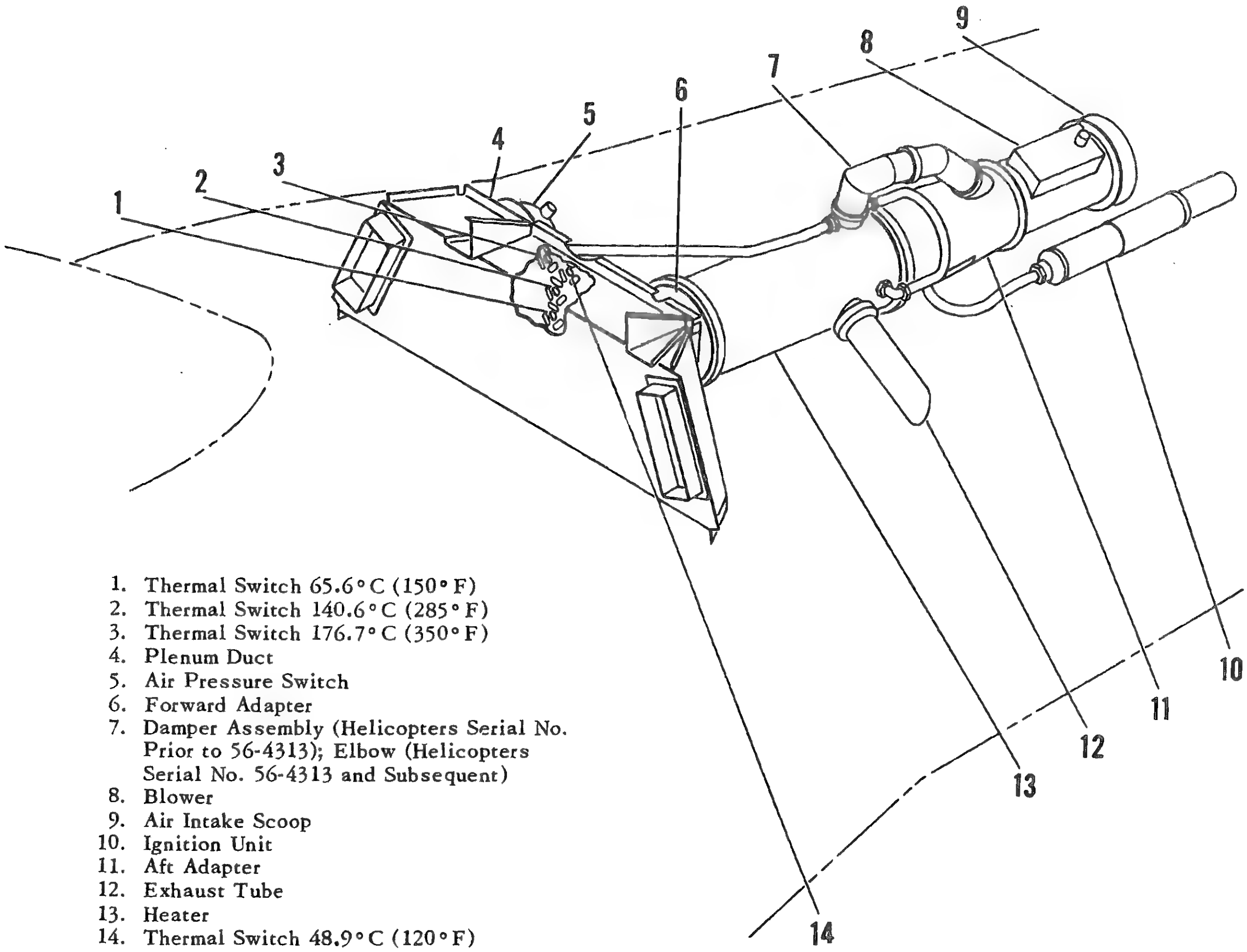
10–3. HEATER.

10–4. DESCRIPTION. (See figure 10–2.) The 50,000 BTU heater (13) 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 crossover 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 (10) operating from the helicopter dc power supply. A shielded lead connects the ignition coil to the spark plug. A small amount of 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. Fresh air thus introduced around the nozzle inhibits carbon formation. Air for combustion enters the combustion chamber at right angles to its length on a tangent to its inner surface. This causes the air to have a whirling or spinning



1. Flexible Defroster Duct (Helicopters Serial No. Prior to 56-4323); Nozzle and Flexible Duct (Helicopters Serial No. 56-4323 and Subsequent)
2. Diffuser Assembly (Helicopters Serial No. 56-4313 and Subsequent)
3. Cockpit Anemostat (Register) (Helicopters Serial No. Prior to 56-4313)
4. Cockpit Duct
5. Adapter
6. Overhead Control Panel
7. Cabin Anemostat (Register)
8. Main Heating Duct
9. Cabin Anemostat (Register)
10. Cabin Anemostat (Register)
11. Heater Installation
12. Relays
13. Aft Fuel Shutoff Valve
14. Heater Fuel Pump
15. Pressure Relief Valve
16. Fuel Filter
17. Cabin Anemostat (Register)
18. Cabin Anemostat (Register)
19. Main Heating Duct
20. Cabin Anemostat (Register)
21. Adapter
22. Cockpit Duct
23. Preheat Duct (Aft Section)
24. Cockpit Anemostat (Register) (Helicopters Serial No. Prior to 56-4313)
25. Diffuser Assembly (Helicopters Serial No. 56-4313 and Subsequent)
26. Preheat Duct (Center Section)
27. Strainer
28. Forward Fuel Shutoff Valve
29. Preheat Duct (Forward Section)
30. Connector Assembly

Figure 10-1. Heating and Ventilating System



1. Thermal Switch 65.6°C (150°F)
2. Thermal Switch 140.6°C (285°F)
3. Thermal Switch 176.7°C (350°F)
4. Plenum Duct
5. Air Pressure Switch
6. Forward Adapter
7. Damper Assembly (Helicopters Serial No. Prior to 56-4313); Elbow (Helicopters Serial No. 56-4313 and Subsequent)
8. Blower
9. Air Intake Scoop
10. Ignition Unit
11. Aft Adapter
12. Exhaust Tube
13. Heater
14. Thermal Switch 48.9°C (120°F)

Figure 10–2. Heater Installation

action. 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 crossover passages into the radiator and return through the radiator to the inlet end where gases pass through the outlet flue to the exhaust tube (12). 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, air emerges from the outlet end of the heater.

10–5. REMOVAL.

a. Remove screws that secure cover plate to bottom of aft adapter (11, figure 10–2) and slide cover plate back along ignition lead. Reach into access opening and disconnect ignition lead from spark plug. Withdraw lead from adapter.

b. Disconnect tube leading to air pressure switch (5) at combustion air inlet of heater (13). Remove nipple from inlet.

c. Unclamp and remove damper assembly or elbow (7) from combustion air inlet on top of heater (13).

d. Disconnect fuel inlet tube at fuel inlet connection on heater.

e. Disconnect fuel drain tube from heater.

f. Unclamp and remove exhaust tube (12) from heater.

g. Support heater and remove jacket clamp at each end of heater. Remove heater. (See figure 10–3.)

10–6. DISASSEMBLY (FOURTH ECHELON). (See figure 10–4.)

a. Remove spark plug (1).

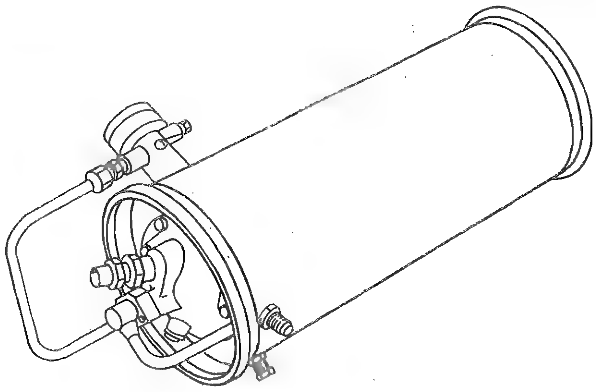


Figure 10–3. Aircraft Heater

b. Disconnect tube (2) from nipple (3) and elbow (4).

c. Remove attaching screw (5) from combustion adapter (6); remove adapter.

d. Disconnect air tube (7) from nozzle holder and tube assembly (8); remove elbow (4), nut (9), and washer (10). Remove air tube.

e. Remove nut (11), washer (12), and screws (13). Remove fuel nozzle holder and tube assembly (8).

f. Withdraw spray nozzle (14).

g. Using a torch, unsolder flanges (16) from the ends of jacket assembly (17) and slide them off jacket assembly.

CAUTION

Exercise care to avoid burning jacket assembly or flanges.

Note

Beginning with serial No. 12555205, unsolder jacket assembly (17) at three points along jacket seam. On heaters earlier serial numbers jacket is held together by a screw (18) and nut (19) which secure the jacket clips along the seam.

h. Slide jacket assembly (17) off combustion chamber and radiator assembly (20).

i. Remove ground electrode (22) and washer (23) from head (24).

j. Remove screws (25) from head (24).

10–7. CLEANING.

a. Clean all parts except spray nozzle, spark plug, and combustion chamber and radiator assembly by immersing them in dry-cleaning solvent, Federal Specification P-S-661. Use a small-bristle brush to assist cleaning if necessary.

b. The combustion chamber and radiator assembly may be cleaned by either of two methods. One method is to soak combustion chamber and radiator assembly overnight in an Oakite M-3 stripper solution which is made by mixing 1 pound of Oakite with each gallon of water used. The solution should be kept at a temperature of 88°C to 99°C (190°F to 210°F). After soaking, rinse the heater thoroughly in water to remove Oakite solution. (Oakite is manufactured by Oakite Products, Inc. New York, New York.) An alternate method is to use a stainless steel brush or sandblast cleaner to remove any accumulation of carbon or other foreign material from inside the combustion chamber and radiator assembly. If sandblast is used, be sure to remove all traces of sand. It is advisable not to brush the outside of the combustion chamber and radiator assembly until after inspection as it would tend to make inspection more difficult.

CAUTION

Be sure to use a stainless steel brush. An ordinary steel bristle brush may cause corrosion.

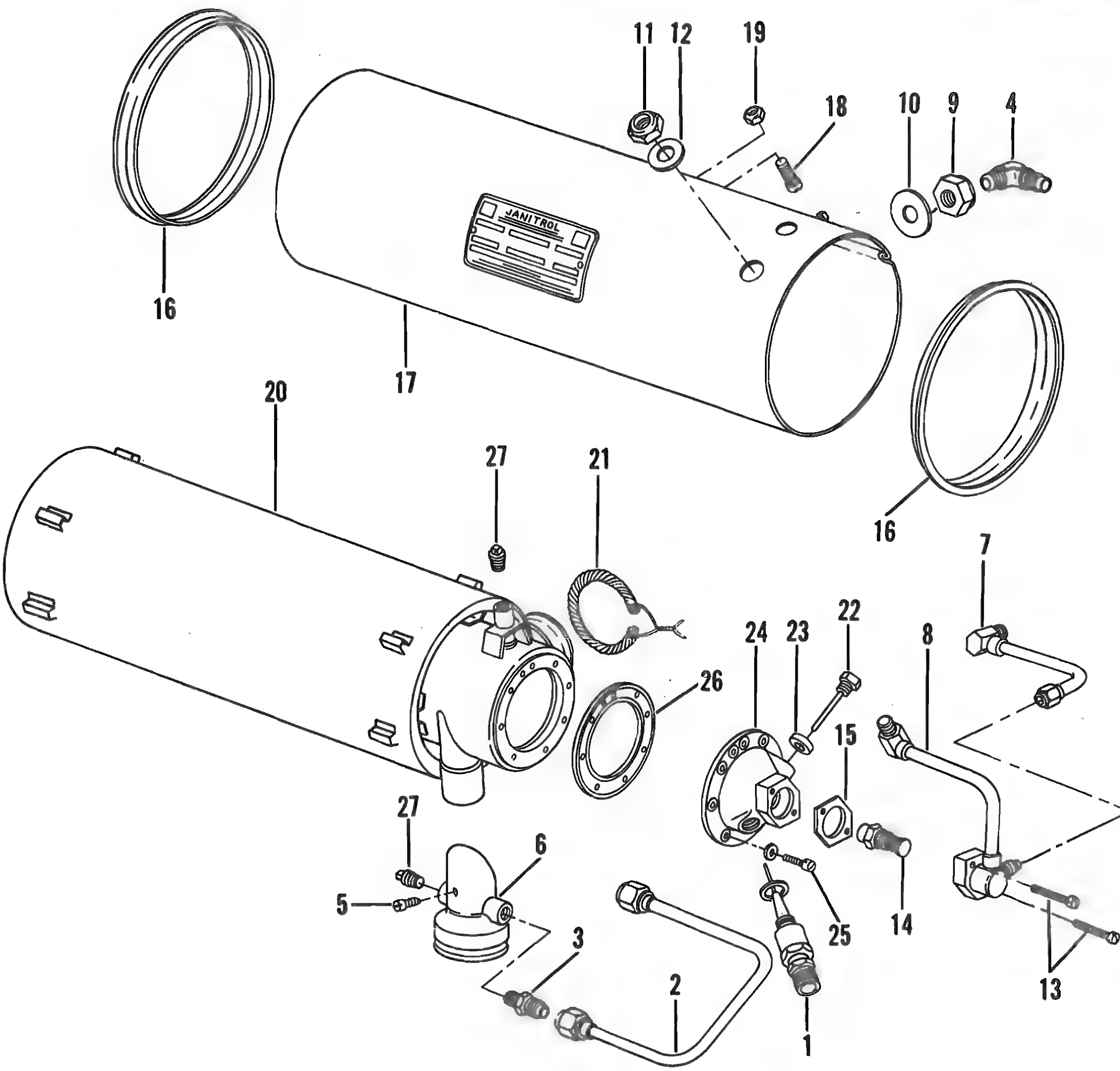
c. Clean spark plug on an ordinary automotive spark plug cleaner. It may be necessary to use two adapters to hold the plug high enough to accommodate the long porcelain and electrode. Be sure to remove all foreign material with compressed air after cleaning.

d. Disassemble the spray nozzle and immerse parts in dry-cleaning solvent, Federal Specification P-S-661. (See figure 10–5.) If solvent fails to remove foreign material, use a soft nonmetallic brush to remove stubborn particles from the groove in the core and orifice in the body. Cleaning can also be facilitated by sharpening a piece of soft wood, such as a matchstick. Do not use metal tools for cleaning. Reassemble the spray nozzle and place parts in a cellophane bag until ready for use.

e. Wipe jacket assembly with a clean cloth moistened with dry-cleaning solvent.

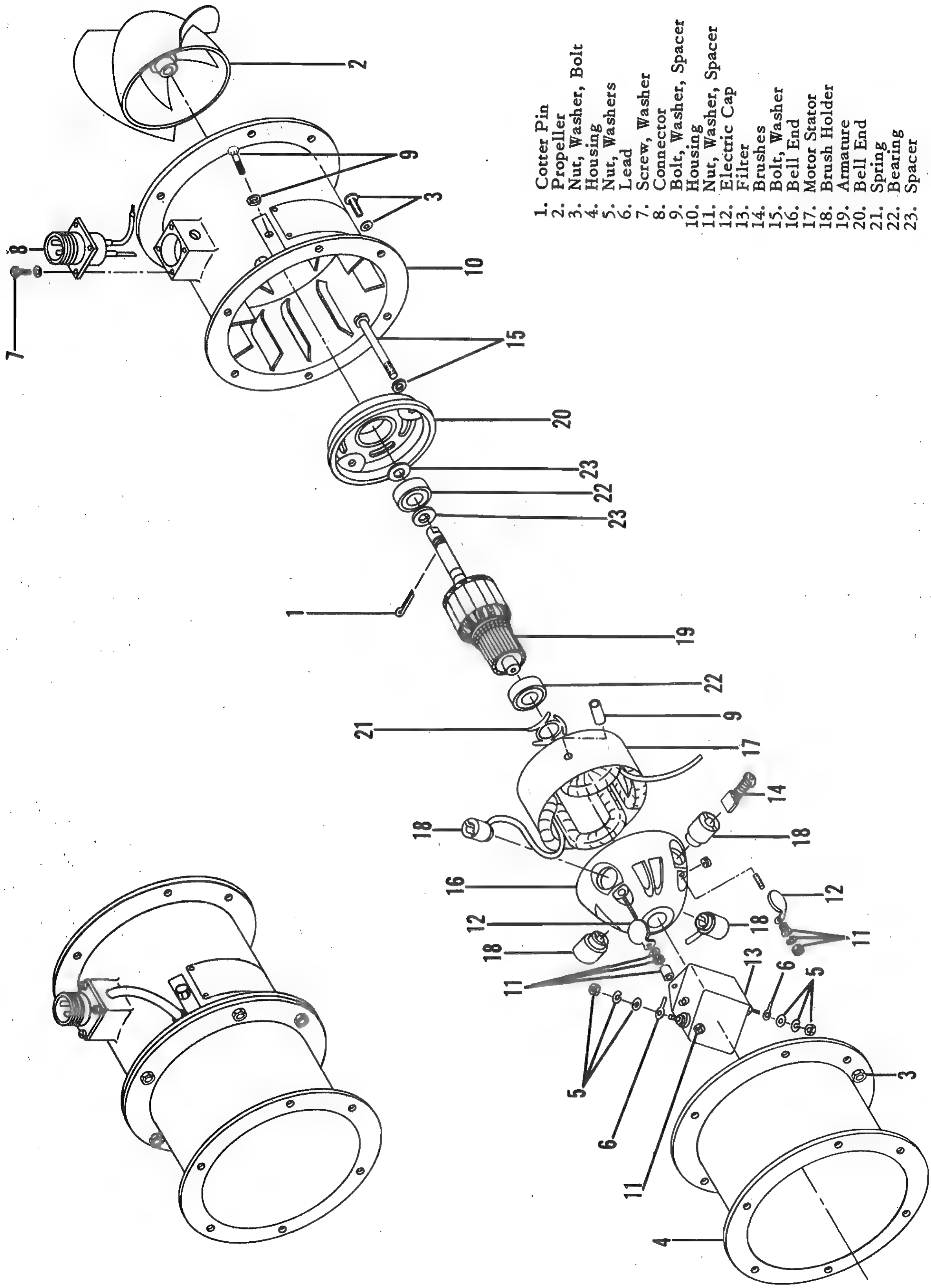
10–8. INSPECTION.

a. Slight scaling and discoloration of combustion chamber and radiator assembly are normal for heaters that have been in service. The scale will be mottled and a blue powder sometimes present. This condition does not constitute grounds for rejection of the heater unless severe overheating has produced soft spots in the metal.



1. Spark Plug
2. Tube
3. Nipple
4. Elbow
5. Screw
6. Combustion Adapter
7. Air Tube
8. Nozzle Holder and Tube Assembly
9. Nut
10. Washer
11. Nut
12. Washer
13. Screws
14. Spray Nozzle
15. Gasket
16. Flange
17. Jacket Assembly
18. Screw
19. Nut
20. Combustion Chamber and Radiator Assembly
21. Gasket
22. Ground Electrode
23. Washer
24. Head
25. Screw
26. Gasket
27. Plug

Figure 10–4. Heater Assembly



1. Cotter Pin
2. Propeller
3. Nut, Washer, Bolt
4. Housing
5. Nut, Washers
6. Lead
7. Screw, Washer
8. Connector
9. Bolt, Washer, Spacer
10. Housing
11. Nut, Washer, Spacer
12. Electric Cap
13. Filter
14. Brushes
15. Bolt, Washer
16. Bell End
17. Motor Stator
18. Brush Holder
19. Armature
20. Bell End
21. Spring
22. Bearing
23. Spacer

Figure 10–5. Heater Blower

b. Damage to combustion chamber and radiator assembly can be classified as soft and spongy metal as a result of overheating, deformation as a result of overheating or backfiring, fatigue cracks, and pin holes.

Note

A heater showing damage due to overheating has been operating in a system where some control is not functioning correctly. Be sure to check all parts of the heating system before placing repaired heater back into service.

c. Soft and spongy metal can be detected by tapping assembly lightly with a ball peen hammer. Soft spots will produce a dull sound in contrast to the solid ringing response obtained when tapping on live metal. Soft spots will usually occur opposite crossover passages. If soft spots are noted, combustion chamber and radiator assembly should be replaced.

d. Deformation as a result of overheating will usually distort wall of radiator near crossover passages. These spots will be accompanied by evidence of extreme oxidation and is sufficient reason for replacement of assembly.

e. Deformation as a result of backfiring usually pushes inner wall of the radiator in toward the combustion chamber. This sometimes occurs in a relatively new heater and does not constitute sufficient reason for replacement unless it causes an increase of more than 10 percent in the ventilating air pressure drop across the heater.

f. Fatigue cracks can sometimes be detected visually; but slight cracks and pin holes will usually require a pressure test for detection.

g. Cap fuel inlet opening and connect air supply to drain opening. Close combustion air inlet opening with an expansion plug assembly, part No. J24C14, and exhaust opening with an expansion plug assembly, part No. B24C14. Install test head assembly, part No. 25C01, on combustion chamber and radiator assembly.

h. Submerge combustion chamber and radiator assembly in a tank of water and apply an air pressure of 6.0 psi to assembly. Air bubbles will reveal leaks. Be sure to recheck assembly after repairs have been made.

10–9. REPAIR OR REPLACEMENT. Except for sheet metal parts which can be welded successfully provided proper precautions are taken, repairs will consist of replacement of damaged parts.

a. Pin holes and cracks can be welded if they are located in accessible areas. Access holes to damaged areas should never be made as this would destroy serviceability of the combustion chamber and radiator assembly. Also, no attempts should be made to weld a part containing soft and spongy metal. If metal is in good condition, clean area to be welded either by brushing with a stainless steel brush or by sandblasting. Be sure to remove all sand before welding.

b. Wipe areas to be welded with a 30 percent solution of nitric acid, and weld using stainless steel rods SAE Type 309 and Solar No. 16GH flux if a torch is used. Type I or Type B flux can also be used if desired. When welding holes or cracks, be sure to use the same material as in the construction of the original part. It is advisable to save scrap heater parts as a source of repair material.

10–10. REASSEMBLY. (See figure 10–4.)

a. Reassembly is essentially the reverse of disassembly with addition of the following information.

b. Temporarily install spark plug (1) (with gasket) and ground electrode (22) with washer (23) in combustion head (24). Measure the spark gap which should be 0.312 to 0.250 inch. Make necessary corrections and remove spark plug and gasket and leave ground electrode in place.

c. Install jacket (17) over combustion chamber and radiator assembly (20). On heaters preceding serial No. 12555205 jacket is held in position by clips fastened together by a nut (19) and screw (18). On all later production heaters, starting with serial No. 12555205, no jacket clips are used and jacket is to be silver soldered in three places. Silver solder should be applied to an area about 3/8 inch in length at each location. One solder spot should be 5 inches from downstream end of heater and the other two spots 1/2 inch away from exhaust outlet at each side of outlet.

d. After jacket has been installed, slide two flanges (16) on ends of jacket assembly (17) and silver solder them to jacket.

CAUTION

These flanges must be set to provide correct jacket length and must be in alignment with each other within 0.030 inch.

e. Install spark plug; tighten to 28 foot-pounds.

10–11. TEST PROCEDURE (AFTER OVERHAUL).

10–12. TEST EQUIPMENT REQUIRED.

a. A blower rated at 1260 pounds per hour at a static pressure of 8.0 inches of water.

b. A 28-volt direct current power supply.

c. A filtered, controlled fuel supply of 3.5 pounds per hour delivered at 12.0 psi.

d. A ventilating air orifice plate, located at the outlet end of heater, having a 3-inch diameter orifice.

e. An ignition unit, part No. 11C30, and shielded lead assembly, part No. E02C96, for connecting to the spark plug.

f. Two 15-inch water manometers.

10–13. OPERATIONAL TEST.

a. Connect heater for testing. (See figure 10–6.)

b. Install 3-inch diameter orifice plate.

c. Close both blast gates and start blower.

d. Adjust combustion air pressure to 3.3 inches of water and ventilating air pressure differential to 1.5 inches of water. These adjustments are made by positioning blast gates.

e. Turn on ignition to heater.

f. Turn on fuel supply and adjust pressure to 12.0 psi. Heater should ignite within 10 seconds. If not, turn off ignition and fuel supply. First replace spark plug. If it still fails to start, replace spray nozzle.

g. After heater begins operating, readjust blast gates to produce above values.

h. Operate heater for several minutes; then turn it off and on several times to check ignition dependability. A minimum of 1 minute should elapse between trials.

10–14. LEAKAGE TEST. This test should be performed after operational test to make certain that no leakage has occurred as a result of expansion and contraction.

10–15. EQUIPMENT REQUIRED.

a. Expansion plug assemblies, part No. B24C14 and J24C14.

b. A source of air pressure capable of exceeding 10.0 inches of mercury.

c. A mercury gage for measuring air pressure.

d. A cap for closing fuel inlet opening.

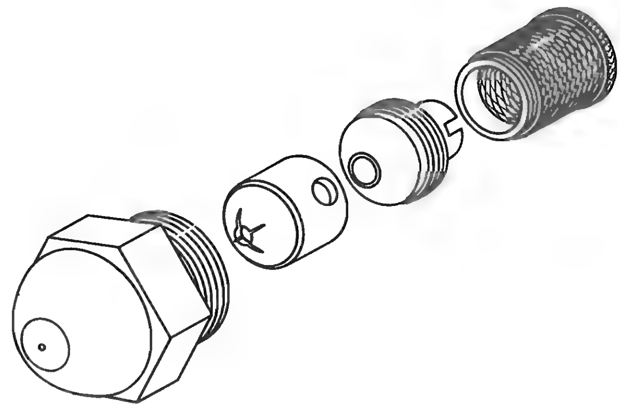


Figure 10–6. Spray Nozzle

10–16. TEST PROCEDURE.

a. Connect heater to air supply at drain plug connection. Two shutoff valves, in series, should be used in air line to insure positive shut off.

b. Apply a pressure of 10.0 inches of mercury to heater and shut off air supply between gage and source. Maximum allowable pressure drop in 35 seconds is 1.0 inch of mercury.

10–17. INSTALLATION.

a. Position heater (13, figure 10–2) between forward and aft adapters (6 and 11) and secure to adapters with jacket clamps.

b. Install exhaust tube (12) in left side of heater (13) and secure with clamp.

c. Connect fuel drain tube to heater.

d. Connect fuel inlet tube to fuel inlet connection on heater.

e. Secure damper assembly or elbow (7) to combustion air inlet on top of heater (13) with clamp.

f. Install nipple in combustion air inlet. Connect tube from air pressure switch (5) to nipple.

g. Insert ignition lead into access opening at bottom of aft adapter (11) and connect lead to spark plug in heater (13). Slide cover plate up against adapter and secure with screws.

10–18. BLOWER.

10–19. DESCRIPTION. (See figure 10–2.) The blower (8) is installed at the rear of the heater (13), and is separated from the heater by the aft adapter (11). The fan in the blower circulates heated air in the helicopter when the CABIN HEAT switch on the overhead control panel (6, figure 10–1) is placed in either the HIGH or LOW position. The CABIN HEAT – FAN – ON switch, located adjacent to the CABIN HEAT – LOW – OFF – HIGH 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 when the temperature in the plenum duct (4, figure 10–2) is above 48.9°C (120°F) and the secondary bus of the electrical system is energized.

10–20. REMOVAL.

a. Disconnect electrical wiring from top of blower (8, figure 10–2).

b. Unbolt blower from aft adapter (11).

c. Support blower, and unbolt and remove it from support and angles.

d. Unbolt and remove air intake scoop (9) from blower.

10–21. DISASSEMBLY. (See figure 10–7.)

a. Remove cotter pin (1).

b. Unscrew propeller (2) from armature shaft.

c. Remove nuts, washers and bolts (3) that secure housing (4). Remove housing.

d. Remove nuts and washers (5) and leads (6) from filter (13).

e. Remove screws and washers (7) that secure connector (8); remove connector with leads attached.

f. Remove bolts, washers, and spacer (9).

g. Withdraw motor from housing (10).

h. Remove nuts, washers, spacers (11) and electric cap (12).

i. Remove filter (13).

j. Remove brushes (14) from brush holders (18).

k. Remove bolts and washers (15).

l. Remove bell end (16).

m. Remove motor stator (17) with brush holders (18) attached.

n. Remove armature (19) from bell end (20).

o. Remove spring (21), bearings (22), and spacers (23) from armature shaft.

10–22. CLEANING.

a. This fan is a self-cleaning unit. However, any dirt or grease contracted during removal or disassembly may be removed by using dry-cleaning solvent, Federal Specification P-S-661.

CAUTION

Do not allow any assembly, containing insulation or plastics, to soak in the solvent. Do not permit solvent to come in contact with rubber or with parts which are sealed with wax.

WARNING

Dry-cleaning solvent, Federal Specification P-S-661, shall not be used near an open flame or in areas where very high temperatures prevail.

b. Dry with compressed air.

10–23. REPAIR OR REPLACEMENT.

a. Replace defective wiring as required and resolder loose connections.

b. Replace all screws that have damaged or worn threads.

c. Remove burrs from fan rotor blades with crocus cloth, Federal Specification P-C-458.

d. Replace brushes if length is 7/16 inch or less.

e. Replace bearing seat inserts if physical damage or evidence of rotating bearings is present. Inside diameter must not be more than 1.1814 inch nor less than 1.1811 inch.

f. Replace armature if it fails to pass dielective test of 500 RMS volts at 60 cycles ac for 1 minute. Insulation resistance must measure 200 megohms or more.

CAUTION

Before making dielective test be sure all carbon dust has been removed with compressed air.

g. If commutator on armature is worn it should be rotated on its own ball bearings to maintain concentricity and turned down enough to eliminate evidence of wear. A special fixture to fit lathe should be made to receive and hold armature with bearings installed. After turning, undercut mica between bars approximately 0.031 deep and 0.030 wide. Cutting edge of tool should cut down rather than up to prevent a burr. Remove all particles of mica. Polish with 3/0 sandpaper and remove all particles of copper between bars. While armature is rotating, clean, polish and coat commutator with Long Life manufactured by Magnus

Chemical Co., Inc., Garwood, N.J. Repeat step *f*, and check for shorts. Wrap in lint-free cloth or paper until reassembled.

h. Replace stator if it fails the hi-potential test as outlined in step *f*.

i. Replace bearings if unit has seen 500 hours service, or at any time brushes are replaced. Bearings used in this unit are critical parts. Great care should be taken to protect bearings in handling and assembly to prevent damage to fit.

j. If holder and electrical lead or holders have to be replaced, extreme care must be exercised to get them positioned to clear commutator by 1/32 inch and to align the rectangular portion exactly parallel with the centerline of the shaft.

10–24. REASSEMBLY. (See figure 10–7.)

a. Assemble bearings (22), spacers (23), and spring (21) on armature (19).

b. Place bearing (22) into bearing insert of bell end (20).

c. Replace motor stator (17).

d. Replace bell end (16) and brush holders (18). (Refer to paragraph 10–23, step *j*.)

CAUTION

Spring fingers of loading spring must be against outer race of bearing to prevent wear of bearing seat in end bell.

Upset center of bearing shield must fit against inner race of bearing to prevent bearing failure.

e. Insert and tighten bolts and washers (15).

f. Replace filter (13) and electric cap (12) using nuts, washers, and spacers (11).

g. Place assembled motor into housing (10) and secure with bolts, washers and spacers (9).

h. Feed leads from connector (8) through housing to filter. Secure leads to filter with nuts and washer (5).

i. Secure connector to housing with screws and washers (7).

j. Replace housing (4) and secure with bolts, nuts, and washers (3).

k. Replace propeller (2) on armature shaft and secure with cotter pin (1).

10–25. TEST PROCEDURE.

a. Operate blower motor on low voltage of 8 to 14 volts until brushes are 75 to 90 percent seated before full voltage is used.

b. After brushes are seated, operate blower motor for 20 minutes and check performance with 27 volts (measured at motor terminals). Current input should not exceed 16.5 amperes and rpm should not be less than 12,750.

c. Operate blower motor at 27 vdc using a 5-inch I. D. duct restricted to 2.796-inch I. D. outlet. (See figure 10–8.)

d. After 10 minutes the input current shall not exceed 18.7 amperes. Static pressure shall not be less than 5.5 inches H_2O at 0.0765 density. (See figure 10–9.)

e. Check unit for excessive vibration. Vibration must not exceed 2 mils.

10–26. INSTALLATION.

a. Position air intake scoop (9, figure 10–2) on blower (8) and bolt together.

b. Position blower behind aft adapter (11) and bolt it to support and angles.

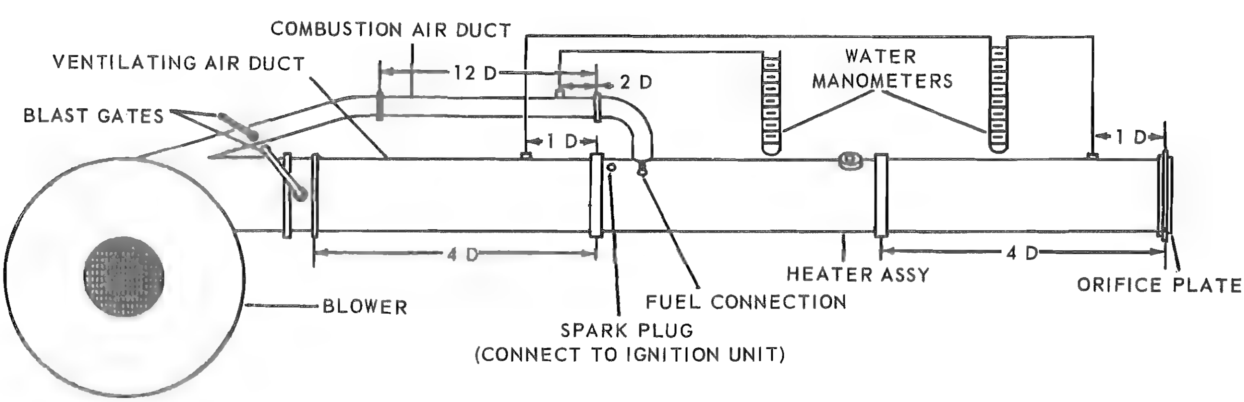


Figure 10–7. Test Diagram for Heater

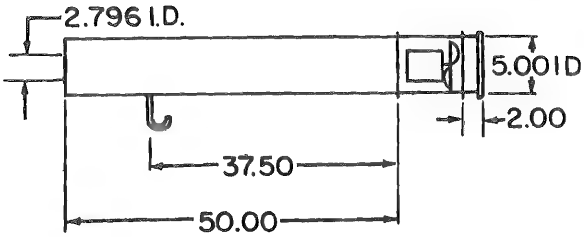


Figure 10–8. Test Diagram

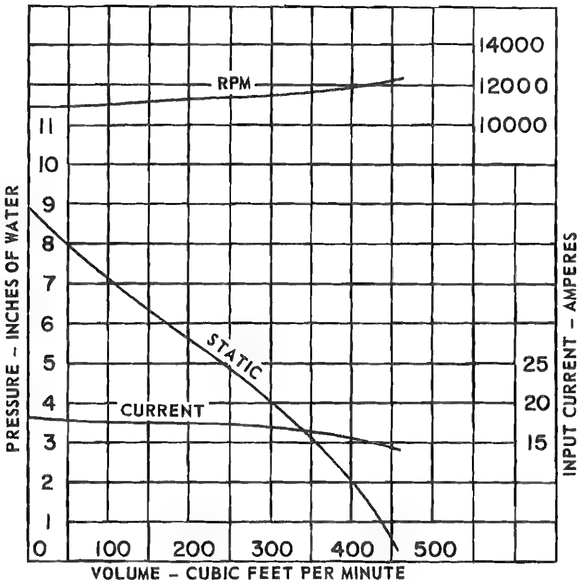


Figure 10–9. Performance Chart

c. Bolt blower to aft adapter.

d. Connect electrical wiring to receptacle on top of blower.

10–27. IGNITION UNIT.

10–28. DESCRIPTION. The ignition unit (10, figure 10–2) is secured with clamps to the left side of the tail cone beside the blower (8). The ignition unit converts 28-volt direct current to high voltage and produces a continuous spark between the spark plug and the ground electrode with the heater (13). The principal component parts are two radio noise filters, a capacitor, and a relay mounted internally, and a vibrator and an ignition coil mounted externally. Due to the nature of this equipment, complete disassembly as a routine procedure is not recommended. All component parts, except the relay, are sealed assemblies and require removal only when mechanical or electrical breakdown occurs. All components of the unit which require service can be removed for replacement.

10–29. REMOVAL.

a. Disconnect electrical plug from receptacle on ignition unit (10, figure 10–2).

b. Disconnect ignition lead from ignition unit.

c. Loosen clamps securing ignition unit to side of tail cone and slide ignition unit out of clamps.

CAUTION

Do not disassemble ignition unit unless it is inoperative after the test outlined in paragraph 10–31 has been performed or visual inspection shows reason for disassembly. If unit satisfactorily passes visual inspection and operational test, it should be returned to service without overhaul.

10–30. INSPECTION OF UNIT EXTERIOR. (See figure 10–10.)

a. Check vibrator (3) for solder cracks around the base, also check for punctures or fractures in the vibrator case.

b. Check the jacket assembly (44) for oil leaks, dents, or punctures in the jacket or coil.

c. Check the coil output connection for carbon traces or breakage of bakelite insulator. If any of the above are found, replace damaged part.

d. Check all screw connections and vibrator for lock wire installation.

10–31. TEST OF IGNITION UNIT. The ignition unit should be tested for operation and amperage draw on a test bench as a complete unit with which it has been operating.

10–32. TEST EQUIPMENT REQUIRED.

a. A battery that will supply power at approximately 28 volts.

b. A voltmeter with a range of 0–30 volts.

c. A lead from the battery to ignition unit in which is included an ammeter with a 0- to 3-ampere range; a normally open, momentary closed switch; and a double-pole, double-throw (dpdt), three-position switch. Total resistance of the lead including ammeter and switches must not exceed 0.3 ohm. (See figure 10–11.)

d. A spark gap of 5/16 inch (plug 0, minus 1/32). A convenient means of arranging the proper gap is to install a spark plug, part No. D02C12, a ground electrode, part No. 51A05, and a ground electrode washer, part No. 56A14, in a spray-type head, part No. 51A33. Ground electrode must be grounded to the case of ignition unit.

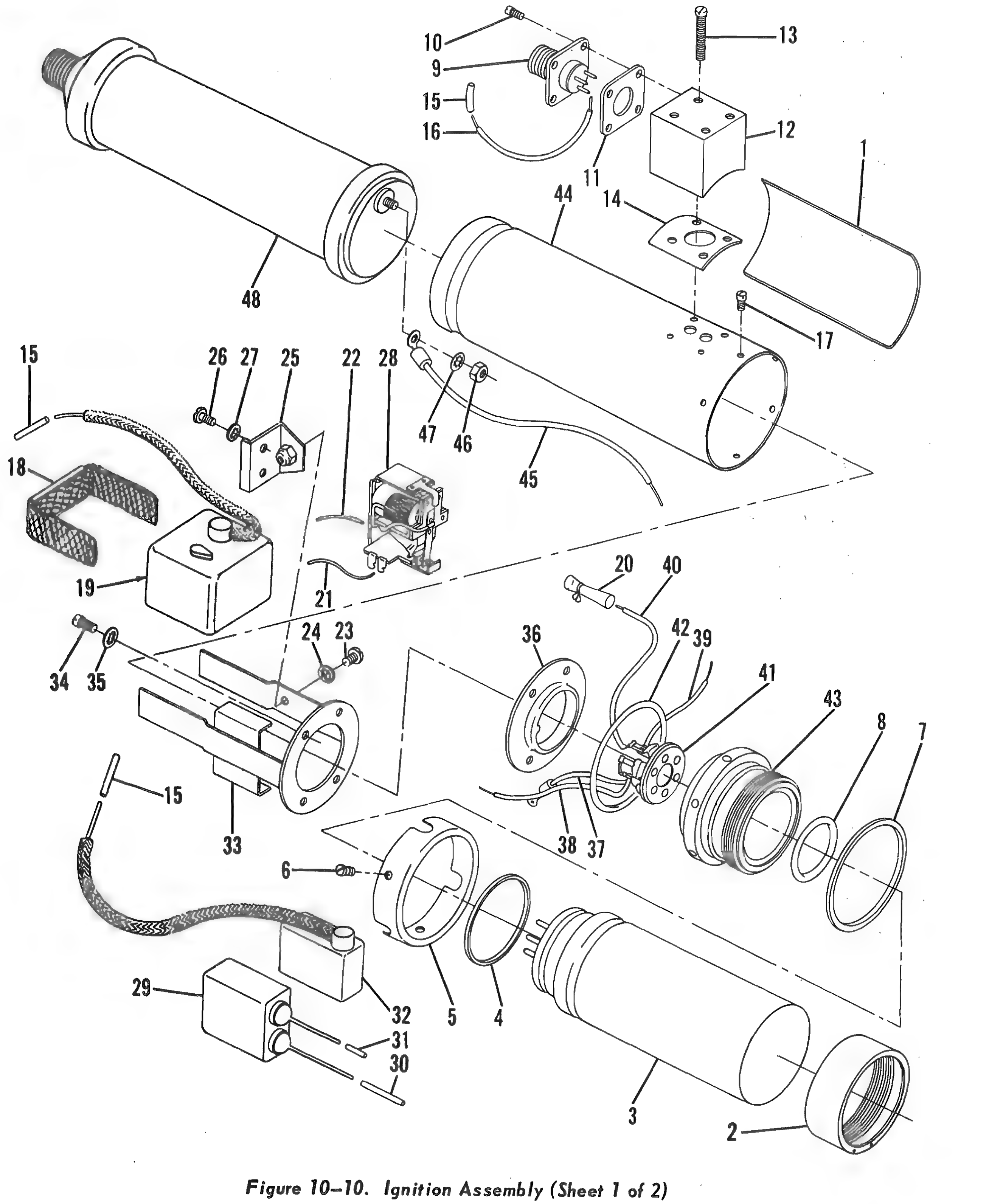


Figure 10–10. Ignition Assembly (Sheet 1 of 2)

1 Identification Plate
2 Vibrator Retaining Ring
3 Vibrator
4 Radio Noise Shield
5 Vibrator Support Collar
6 Screw
7 Radio Noise Shield
8 O-Ring
9 Receptacle
10 Screw
11 Gasket
12 Receptacle Adapter
13 Screw
14 Gasket
15 Insulating Sleeve
16 Ground Wire
17 Screw
18 Channel Assembly
19 Radio Noise Filter
20 Insulating Sleeve
21 Wire
22 Wire
23 Screw
24 Lockwasher
25. Bracket Assembly
26 Screw
27 Lockwasher
28 Relay
29 Capacitor
30 Insulating Sleeve
31 Insulating Sleeve
32 Radio Noise Filter
33 Bracket Assembly
34 Screw
35 Lockwasher
36 Socket Holder
37 Ground Wire
38 Wire
39 Wire
40 Wire
41 Socket
42 O-Ring
43 Vibrator Support
44 Jacket Assembly
45 Wire Assembly
46 Nut
47 Lockwasher
48 Ignition Coil

Figure 10–10. Ignition Assembly (Sheet 2 of 2)

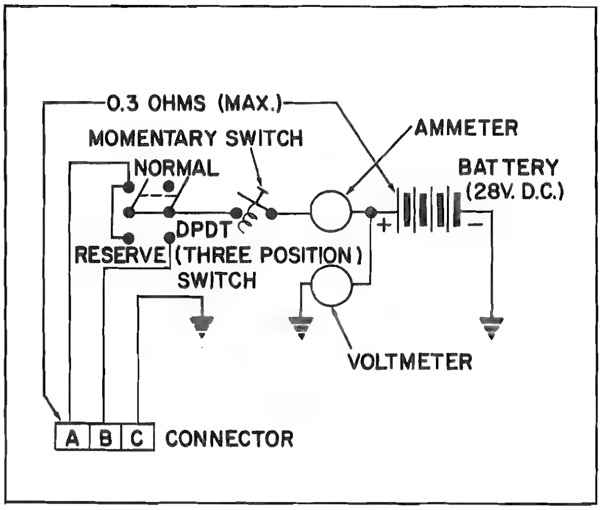


Figure 10–11. Test Circuit Diagram

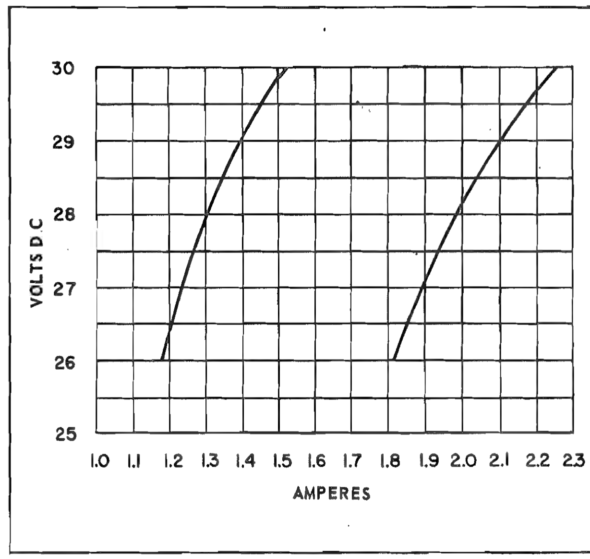


Figure 10–12. Vibrator Performance Chart

e. A shielded lead assembly, part No. 02C96 series or an equivalent, between ignition unit and spark plug.

10–33. TEST PROCEDURE.

a. Place the dpdt three-position switch in NORMAL position. Close momentary switch and read voltmeter and ammeter. Release momentary switch immediately.

b. Place the dpdt three-position switch in the RESERVE position. Close momentary switch and read voltmeter and ammeter. Release momentary switch immediately.

c. Amperage reading in relation to the voltage reading must fall within limits on vibrator performance chart. (See figure 10–12.)

d. If amperage draw does not fall within limits set up in performance chart on either NORMAL or RESERVE sides, the vibrator should be rejected and test repeated with a new vibrator. If satisfactory readings cannot be obtained on new vibrator, ignition unit must be disassembled to locate cause of failure.

10–34. DISASSEMBLY (FOURTH ECHELON). (See figure 10–10.)

10–35. REMOVAL OF IGNITION BODY ASSEMBLY.

a. Cut lock wire and remove vibrator retaining ring (2).

b. Pull vibrator (3) out of socket and remove radio noise shield (4).

c. Remove screws (6) that hold vibrator support collar (5) to jacket assembly (44).

d. Remove vibrator support collar (5) and radio noise shield (7).

e. Replace vibrator retaining ring (2) temporarily, and remove remaining screws (17) to free vibrator support (43) from jacket assembly (44).

f. Grasp vibrator retaining ring (2) and carefully pull vibrator support (43) out of jacket assembly (44) far enough to expose primary coil wire assembly (45).

g. Unsolder primary coil wire assembly (45) from terminal on relay (28) and withdraw body assembly. (See figure 10–13.) Do not turn or twist body assembly when pulling it from jacket.

CAUTION

Turning or twisting body assembly during removal from jacket will damage internal wiring. Filter leads are long enough to permit body assembly to clear jacket without unsoldering filter leads.

10–36. INSPECTION OF INTERIOR OF UNIT. Before removing or replacing any part of ignition body assembly, the following procedure must be followed.

a. Examine ignition body assembly for broken wires and loose solder connections. If broken wires are found, resolder, using rosin core solder only.

b. Examine relay (28, figure 10–10) for pitted or burned relay contacts and broken bakelite. If any of these conditions exist, replace relay.

c. Check socket holder (36) and socket (41) for security to vibrator support (43).

d. Examine capacitor (29) for broken wires and evidence of oil leaks around soldered portion of unit. If either or both conditions are found, replace capacitor.

e. Examine radio noise filters (19 and 32) for broken wire connections (input leads) and wax leakage. If either or both conditions exist, replace radio noise filter.

f. Check channel assembly (18) for security to radio noise filter (19). If loose, resolder using rosin core solder only.

10–37. DISASSEMBLY OF IGNITION BODY ASSEMBLY.

10–38. REMOVAL OF SOCKET ASSEMBLY. (See figures 10–10 and 10–13.)

a. Unsolder wires from terminals of relay (28, figure 10–10) at locations A and B (figure 10–13).

b. Cut waxed cord and slide insulating sleeve (20, figure 10–10) back on wire (40). Unsolder wire from terminal of large radio noise filter (19) at location C, figure 10–13.

c. Unsolder wire leading to capacitor (29, figure 10–10) at location D, figure 10–13.

d. Remove screws (34, figure 10–10) and lockwashers (35) from vibrator support (43). This will free vibrator support, vibrator socket holder (36), and release O-ring (42).

e. To remove vibrator socket (41) from socket holder (36), remove vibrator socket retaining ring (a part of the vibrator socket) and slide vibrator socket out of holder (36).

10–39. REMOVAL OF RELAY ASSEMBLY. (See figures 10–10 and 10–13.)

a. Unsolder relay wires at locations E and F, figure 10–13.

b. Remove screw (23, figure 10–10) and lockwasher (24), and slide relay (28), with bracket assembly (25) attached, out from under arm of bracket assembly (33). If removal of bracket assembly is required, remove screw (26) and lockwasher (27).

10–40. REMOVAL OF RECEPTACLE AND RECEPTACLE ADAPTER. (See figure 10–10.)

Note

Wires need not be unsoldered from receptacle pins unless replacement of radio noise filters (19 and 32) is required. If it is necessary to replace radio noise filters on ground wire, proceed as follows:

a. Cut lock wire and remove screws (10) from receptacle (9), and slide receptacle away from receptacle adapter (12).

b. Unsolder wires from receptacle pins and remove receptacle (9) and gasket (11).

c. Cut lock wire and remove four screws (13) from receptacle adapter (12). This will free receptacle adapter. Remove receptacle adapter (12) and gasket (14).

10–41. REMOVAL OF LARGE RADIO NOISE FILTER. (See figure 10–10.)

Note

The large radio noise filter (19) is soldered to bracket assembly and should not be removed except for replacement.

a. Unsolder bracket which holds channel assembly (18) to radio noise filter (19) and separate parts.

b. Remove receptacle (9) and receptacle adapter (12) in accordance with paragraph 10–40.

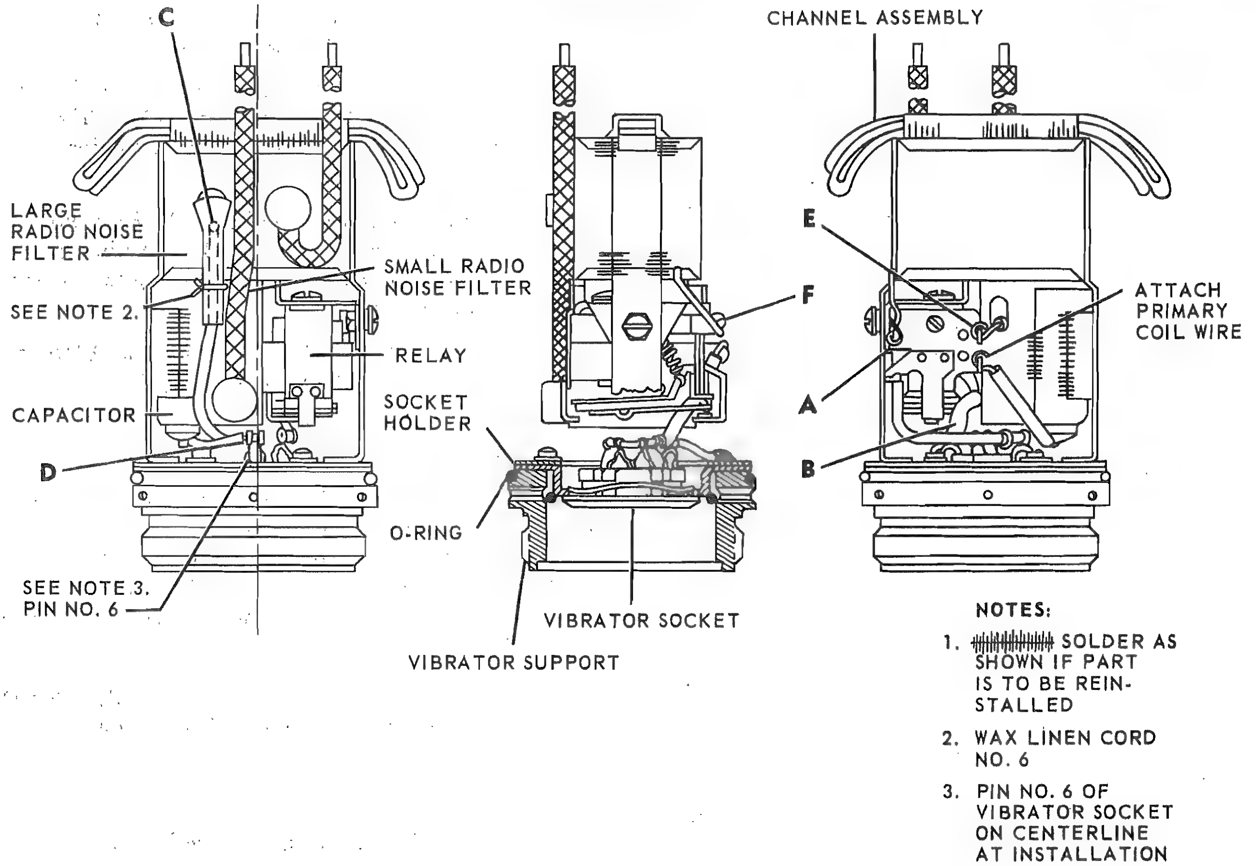


Figure 10–13. Location of Parts in Ignition Body

c. Unsolder braided shield on filter wire from jacket assembly. (See figure 10–14.)

d. Using a large soldering iron, melt solder holding radio noise filter (19, figure 10–10) to bracket assembly (33) and slide radio noise filter out of bracket.

10–42. REMOVAL OF SMALL RADIO NOISE FILTER AND CAPACITOR. (See figure 10–10.)

Note

The small radio noise filter and capacitor are attached to each other with solder at assembly. The capacitor is soldered into the bracket assembly. These parts should not be removed except for replacement. The filter can be replaced by itself; but if capacitor is to be removed, capacitor and filter must both be removed.

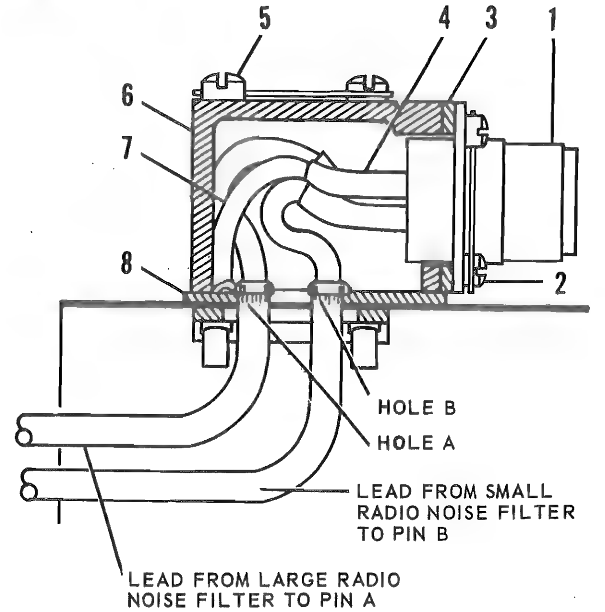
a. Remove receptacle (9) and receptacle adapter (12) in accordance with paragraph 10–40.

b. Unsolder braided shield on filter wire from jacket assembly. (See figure 10–14.)

c. Unsolder radio noise filter (32, figure 10–10) from capacitor (29).

d. Unsolder capacitor (29) from bracket assembly (33) and lift out capacitor.

10–43. REMOVAL OF IGNITION COIL. (See figure 10–10.) No attempt should be made to remove jacket assembly (44) from ignition coil (48). The ignition jacket is spun on coil at assembly. If removal of coil and jacket assembly is required, remove ignition body assembly, receptacle (9), and receptacle adapter (12) in accordance with preceding paragraphs. The wire assembly (45) can be disconnected from primary terminal of coil by removing nut (46) and lockwasher (47) with a long handled socket wrench.



1. Receptacle
2. Screw
3. Gasket
4. Insulating Sleeve
5. Screw
6. Receptacle Adapter
7. Ground Wire
8. Gasket

Figure 10–14. Sectional View of Receptacle Adapter

Note

Many repair parts for this equipment are provided in the form of kits. Presence of a new part in the applicable kit eliminates necessity of cleaning, inspecting, or reworking equivalent used part removed from assembly being repaired; therefore such instructions have been omitted. Activities shall replace all parts (regardless of condition) which are removed in the process of disassembly with all like parts furnished in kit. If an installed part is not defective, it need not be removed solely for the purpose of replacement by a corresponding kitted part. Residue from kits and removed parts in this category shall be administratively condemned. Instructions which follow cover removed parts not supplied in kits and kitted parts (if any) which require cleaning, inspecting, or testing prior to installation.

10–44. CLEANING.

a. Before disassembly, remove foreign material from external surfaces with a clean, dry cloth. All parts are encased in a sealed container and, normally, no internal cleaning will be required.

b. A leaking capacitor case or radio noise filter case will sometimes allow oil or wax to run out on certain parts in which case it may be necessary to remove the contaminated parts and wipe them clean with a dry cloth.

10–45. INSPECTION.

a. Check relay (28, figure 10–10) for pitted or burned relay contacts, broken insulator plates, and an open circuit in coil winding. The relay coil winding can be checked for continuity by connecting leads of an ohmmeter across two relay coil terminals, points E and F. (See figure 10–13.) Coil resistance should be approximately 500 ohms. Replace for any of these conditions.

b. Check resistance of coil. Primary of the coil should be approximately 3.0 ohms. The secondary winding of coil should measure approximately 6000 ohms.

10–46. REPAIR OR REPLACEMENT. Repairs will consist of replacing damaged or defective parts.

10–47. REASSEMBLY.

10–48. REASSEMBLY OF IGNITION BODY ASSEMBLY.

10–49. INSTALLATION OF VIBRATOR SOCKET. (See figure 10–10.)

a. Place vibrator socket (41) in socket holder (36) and secure it by installing retaining ring which is a part of vibrator socket. Be sure to align slot in socket with spline on socket holder.

b. Locate bracket assembly (33) and vibrator support (43) against socket holder (36). Align pin No. 6 of vibrator socket (41) with one of the screw holes in vibrator support as shown in figure 10–13. Locate O-ring (42, figure 10–10) between socket holder (36) and vibrator support (43). Then install four screws (34) and lockwashers (35). Be sure to connect ground wire (37) from pin No. 3 of vibrator socket under head of one of these screws.

10–50. INSTALLATION OF SMALL RADIO NOISE FILTER AND CAPACITOR. (See figure 10–10.)

a. Place capacitor (29) in position in bracket assembly (33), and solder capacitor to bracket assembly with rosin core solder.

b. Position radio noise filter (32) against capacitor (29) as shown in figure 10–13, and solder in place using rosin core solder.

c. Slip insulating sleeve (31) onto capacitor lead closest to pin No. 6 of vibrator socket (41). Solder lead to pin No. 6 and position insulating sleeve.

10–51. INSTALLATION OF RELAY. (See figure 10–10.)

a. If removed during disassembly, attach relay bracket assembly (25) to relay (28) with screw (26) and lockwasher (27).

b. Place relay (28) in position on the leg of bracket assembly (33) and install screw (23) and lockwasher (24).

c. Connect all relay wires possible at this time in accordance with wiring diagram. (See figure 10–15.)

10–52. INSTALLATION OF LARGE RADIO NOISE FILTER. (See figure 10–10.)

a. Slide large radio noise filter (19) into end of bracket assembly (33). (Refer to figure 10–13 for correct position.)

b. Solder legs of bracket assembly (33, figure 10–10) to radio noise filter (19) with rosin core solder.

c. Position channel assembly (18) on radio noise filter (19) as shown in figure 10–13. Solder channel assembly bracket to body of radio noise filter.

d. Install insulating sleeve (20, figure 10–10) on wire (40) and solder wire to terminal of radio noise filter (19). Slide sleeve up against terminal and tie sleeve in place with waxed cord. Trim ends of cord close to knot. Fold back end of insulating sleeve from soldered connection and brush one coat of unichrome air-dry rack coating No. 203, Mfg. by United Chromium, Inc. over soldered connection completely covering terminal. Roll insulating sleeve back into position and brush a second coat over sleeve and around terminal.

Note

No drying time is required between first and second coats, but second coat should be air-dried at room temperature for 24 hours before reinstalling body assembly. For thinning of this material, use unichrome thinner No. 203-T. Ordinary lacquer thinner must not be used.

e. Connect and solder remaining wires in ignition body assembly, making certain that connections coincide with figure 10–15.

10–53. INSTALLATION OF IGNITION BODY ASSEMBLY. (See figure 10–10.)

a. If wire assembly (45) was removed during disassembly, attach it to primary coil terminal with nut (46) and lockwasher (47).

b. Slide ignition body assembly into jacket assembly (44) far enough to permit soldering primary coil wire assembly (45) to relay terminal. (See figure 10–13.)

c. Position ignition body in jacket assembly (44, figure 10–10) with shielded leads, which are attached to radio noise filters, next to openings under receptacle adapter (12).

d. Shielded leads from radio noise filters (19 and 32) must be inserted through the holes A and B in jacket assembly (44) before ignition body assembly is inserted all the way. The lead from the large radio noise filter (19) must pass through hole A and the lead from small radio noise filter (32) must pass through hole B. (See figure 10–14.)

e. Pull leads through holes A and B so that only enough slack is left inside the jacket assembly (44, figure 10–10) to permit ignition body assembly to be removed without unsoldering leads from jacket assembly.

f. Solder shields to jacket assembly (44) by flowing solder in such a manner that holes A and B will be completely sealed. (See figure 10–14.)

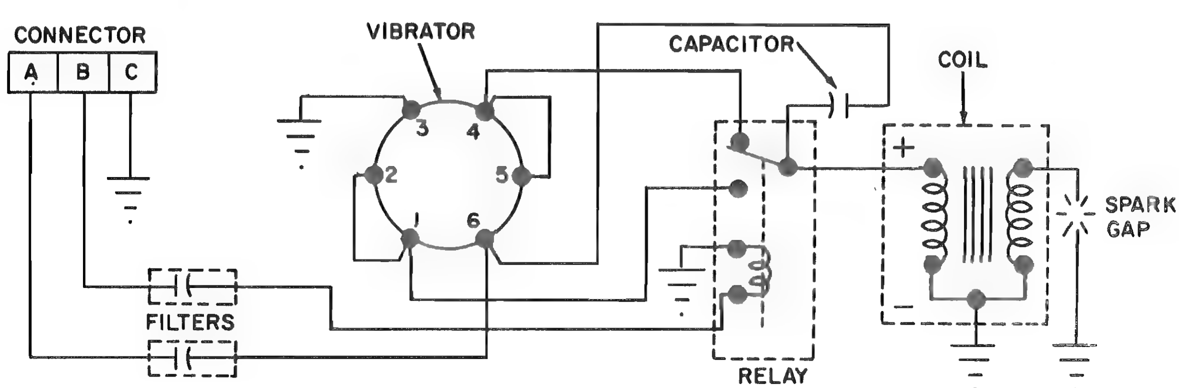


Figure 10–15. Wiring Diagram

CAUTION

Exercise care to prevent solder from piling up or spreading out so far that it would interfere with seating of receptacle adapter on jacket assembly.

g. Trim off double shielding on both leads 1/4 inch from outside surface of jacket assembly (44, figure 10–10). Then roll back ends of shielding braid so that there will be no tendency for sharp ends to become frayed and to pierce wire insulation.

h. If new filter leads are installed, cut them 1-3/4 inches from outside surface of jacket assembly (44), strip 1/4-inch insulation, and tin ends with solder.

i. Solder end of ground wire (16) to shielding braid of either lead where previous solder joint to jacket assembly was made.

j. With parts in this approximate position, align screw holes in the jacket assembly (44) with tapped holes in the vibrator support (43), and install screws (17).

k. Place radio noise shield (7) on outside of vibrator support (43), and install vibrator support collar (5) with screws (6) inserted in the remaining tapped holes of vibrator support.

10–54. INSTALLATION OF RECEPTACLE AND RECEPTACLE ADAPTER. (See figure 10–10.)

a. Place gasket (14) in position on jacket assembly (44), feed filter wires through side opening in receptacle adapter (12), and install receptacle adapter with screws (13) coated with glyptal.

Note

Coat 1/4 inch of threaded end of screws with clean glyptal solution, No. 1202, diluted with three parts glyptal thinner, No. 1500, or an equivalent. (Glyptal is manufactured by General Electric Corporation.)

b. Pull ground wire (16) and filter wires through side opening in the receptacle adapter (12); slide gasket (11) over wires. Solder large radio noise filter wire to receptacle pin A, small radio noise filter wire to receptacle pin B, and ground wire to receptacle pin C. Move receptacle (9) into position, and secure it by installing screws (10) treated with glyptal.

10–55. INSTALLATION OF VIBRATOR. (See figure 10–10.)

a. Insert O-ring (8) into vibrator support (43).

b. Slide radio noise shield (4) over small end of vibrator socket.

c. Insert vibrator (3) into its socket. Proper position of vibrator can be determined by two large pins on vibrator and corresponding larger holes (separated by a raised dot) in vibrator socket.

d. Slide vibrator retaining ring (2) over end of vibrator (3) and tighten it handtight to hold vibrator in place.

e. Install lock wire in all screw heads and vibrator retaining ring (2).

10–56. APPLICATION OF INSULATING AND SEALING COMPOUND.

a. The high voltage coil outlet connection must be coated with insulating and sealing compound, Military Specification MIL-I-8660, to prevent corona discharge and to provide sufficient insulation.

Note

This compound must not be used elsewhere in the ignition unit.

b. Because of the nature of this compound, foreign materials adhere easily to it which could act as an electrical conductor and cause considerable trouble. For this reason, the compound should be kept as free from dirt as possible. If there is evidence of dirt in compound, wipe off old compound with a clean cloth and apply new compound. The receptacle should be approximately one-half full of compound.

CAUTION

Do not use carbon tetrachloride, trichloroethylene, or other chlorinated solvents to remove insulating and sealing compound.

c. Install a shipping cap on receptacle (9, figure 10–10) on high voltage outlet connection.

10–57. OPERATIONAL TEST.

a. Connect test equipment as shown in figure 10–11.

b. Conduct test as outlined in paragraph 10–31.

10–58. INSTALLATION.

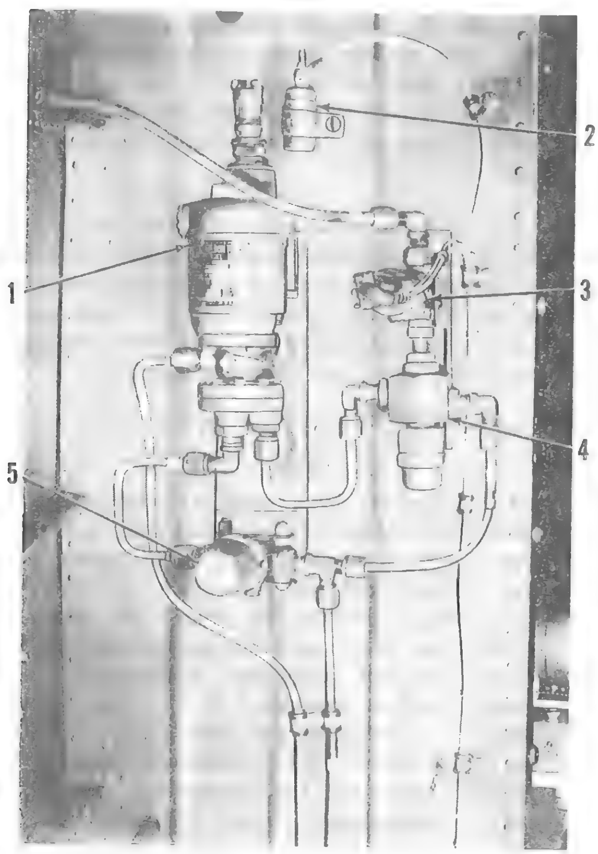
a. Slide ignition unit (10, figure 10–2) into clamps on side of tail cone and tighten two clamps.

b. Connect ignition lead to ignition unit.

c. Connect electrical plug to receptacle of ignition unit.

10–59. HEATER CONTROL SYSTEM.

10–60. DESCRIPTION. (See figures 10–1, 10–2, and 10–16.) The heater control system controls fuel flow from forward fuel tank to the inlet port of heater (13, figure 10–2). The system consists of a forward fuel shutoff valve (28, figure 10–1), fuel filter (5, figure 10–16), heater fuel pump (1), pressure relief valve (4), aft fuel shutoff valve (13, figure 10–1), and necessary fuel lines. Fuel shutoff valves are electric solenoid types, controlled by cabin heat switches located on overhead panel (6, figure 10–1) in the pilots' compartment. Fuel is carried from forward tank sump to forward fuel shutoff valve, which is located in the fuselage bottom structure. From this valve, fuel is carried to fuel filter located in heater compartment on the side aft of the electronics compartment rear bulkhead. From the filter, 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 shutoff valve. From the pressure relief valve, fuel passes through the aft fuel shutoff valve and then to the inlet port of heater.



1. Heater Fuel Pump
2. Noise Filter
3. Aft Fuel Shutoff Valve
4. Pressure Relief Valve
5. Fuel Filter

Figure 10–16. Heater Control System

CAUTION

When removing any component of heater fuel system, be sure CABIN HEAT switch located on overhead control panel, is in OFF position. Drain fuel in lines into a suitable container.

10–61. FUEL SHUTOFF VALVES.

10–62. FORWARD FUEL SHUTOFF VALVE.

10–63. DESCRIPTION. (See figure 10–1.) The forward fuel shutoff valve (28), 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 centerline of the helicopter. Access to the valve is provided by means of a hinged panel at bottom of helicopter This valve is controlled by the CABIN HEAT switch on overhead control panel (6).

10–64. REMOVAL.

a. Drain forward fuel tank.

b. Open hinged access panel at bottom of helicopter at forward end of fuel line fairing.

c. Disconnect electrical wiring and inlet and outlet tubes from forward shutoff valve (28, figure 10–1).

d. Remove screws, washers, nuts, and spacers that hold valve to bracket. Remove valve.

e. Remove elbow, gasket, and nut from each port of valve.

10–65. AFT FUEL SHUTOFF VALVE.

10–66. DESCRIPTION. (See figure 10–1.) The aft fuel shutoff valve (13) is mounted on forward bulkhead in heater compartment just to the right of heater fuel pump (14). The valve controls flow of fuel from fuel pump to cabin heater. The valve is controlled by CABIN HEAT switches on overhead control panel (6), during operation of heater.

10–67. REMOVAL.

a. Disconnect inlet and outlet tubes from elbows in pressure relief valve (4, figure 10–16).

b. Disconnect electrical wiring and outlet tube from aft shutoff valve (3).

c. Remove screws, washers, nuts, and spacers that hold shutoff valve to bracket. Remove pressure relief valve (4) and aft shutoff valve (3) as a unit.

d. Loosen jam nut and unscrew aft shutoff valve (3) from union in the outlet port of pressure relief valve (4).

10–68. DISASSEMBLY (FOURTH ECHELON).

a. Clamp valve body and screen assembly (8) in a soft-jawed vise, and unscrew and remove solenoid assembly (2) from valve body and screen assembly.

b. Slide plunger assembly out of solenoid assembly.

Note

Due to the construction of valve assembly, it should not be disassembled further unless disc requires replacement. If disc is worn or damaged, continue disassembly procedure.

c. Open crimped edge of disc retainer (3) and remove it from lower end of plunger shell. This will allow disc (5) and plunger shim (4) to drop out.

d. Remove plunger spring (6) and plunger stem assembly (7) by dropping them out of plunger shell.

10–69. CLEANING.

a. Direct a stream of filtered, compressed air or dry-cleaning solvent, Federal Specification P-S-661, through valve body in a reverse direction to dislodge any foreign particles that might be found on strainer which is pressed into inlet side of valve body and screen assembly.

b. Wash plunger shell, plunger shim, disc, plunger spring, and plunger stem assembly in dry-cleaning solvent to remove foreign material. Dry parts thoroughly with compressed air and place them in cellophane bag until ready for reassembly.

CAUTION

Do not immerse solenoid assembly in dry-cleaning solvent. It may be cleaned by wiping with a clean cloth moistened with dry-cleaning solvent, Federal Specification P-S-661,

10–70. REPAIR OR REPLACEMENT.

Note

Repairs consist of replacing damaged parts to the extent specified in the following instructions.

a. Connect terminals of solenoid assembly to a 28-volt dc power source with an ammeter and single-throw switch (spst) connected in series. Close switch, and if ammeter needle fails to deflect, magnet coil is open circuited and solenoid assembly (with plunger shell) must be replaced.

b. Amperage draw should be between 0.3 and 0.4 amperes. If it fails to fall within this range, replace solenoid assembly (with plunger shell).

c. Inspect disc (5, figure 10–17) for grooves, nicks, scratches, or wear. Replace for any of these conditions.

Note

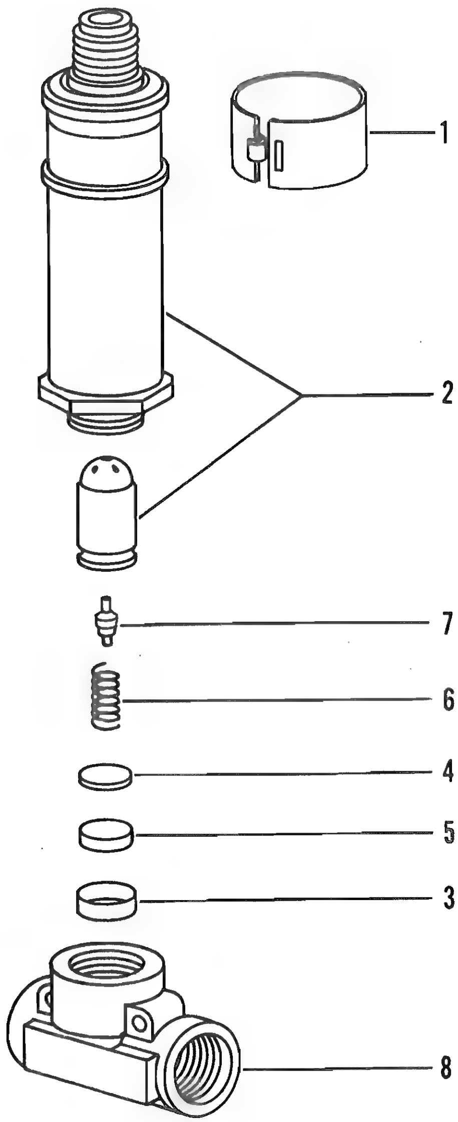
Be sure to retain all shims located above the disc so that same number of shims can be installed as a trail setting. It is also advisable to use a new disc retainer after it has once been uncrimped and removed.

d. Check screen in the valve body and screen assembly (8) for damage. Replace valve body and screen assembly if screen is corroded or has been punctured. Also check valve body for condition of screw threads; and if threads have been damaged, replace valve body and screen assembly.

10–71. REASSEMBLY. (See figure 10–17.)

Note

Two different style plunger assemblies have been used in production fuel solenoid valve assemblies. In first production valves, the top end of the plunger shell was cone-shaped, while in later production they were hemispherical in shape. Valves with the hemispherical plunger can be identified by the letter C which is a suffix of the serial number on the nameplate. Parts contained in the plunger shell are interchangeable. However, a cone-shaped plunger must be used with a solenoid valve assembly designed for it. Likewise, a hemispherical plunger must be used with a solenoid valve assembly for which it was designed. Cone-shaped plungers and solenoid valves are no longer available as spare parts, although component parts of plunger assembly are usable in either design.



1. Plate
2. Solenoid Assembly
3. Retainer
4. Shim
5. Disc
6. Spring
7. Stem Assembly
8. Valve Body and Screen Assembly

Figure 10–17. Fuel Shutoff Valve

a. Place plunger stem assembly (7) in plunger shell and make sure there is no binding between the two parts.

b. Install plunger spring (6), plunger shims (4), and disc (5) with disc retainer (3).

c. Before crimping disc retainer (3), check dimension shown in figure 10–18, which should be between 0.396 and 0.400 inch, with plunger fully inserted. If this dimension is not within these limits, remove or add shims between disc and lower end of plunger shell until the correct dimension has been established. When the dimension shown in figure 10–18 has been established, crimp disc retainer (3) carefully into groove at lower end of plunger shell to hold all plunger parts in place.

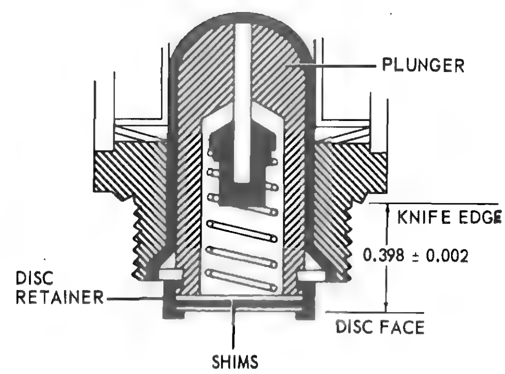


Figure 10–18. Distance of Stem Above Plunger

d. Slide plunger assembly into solenoid assembly.

e. Clamp valve body and screen assembly (8) in a soft-jawed vise and screw solenoid assembly (2), with plunger in place, into valve body and screen assembly. Tighten securely with an open-end wrench.

10–72. TEST PROCEDURE.

a. Plug outlet port of the fuel shutoff valve assembly.

b. Connect receptacle at top of valve to a 28-volt dc power source through a single-pole, single-throw (spst) switch.

c. Energize fuel shutoff valve by closing spst switch.

d. Apply dry-cleaning solvent, Federal Specification P-S-661, at 75 psi to inlet port for a period of 5 minutes. No external leakage should be detected during this time.

e. Reduce fuel pressure to 50 psi (rated pressure), deenergize the valve, and remove plug from the outlet port to check for leakage around valve seat. After solvent from previous test has drained, there shall be no visible leakage through valve. If leakage can be detected, the valve and seat must either be cleaned or replaced.

f. With a pressure of 50 psi applied to the inlet port, energize fuel valve with 18 volts dc. Increase to 24 volts, opening and closing valve several times. When closed, recheck for leaks as in steps *a* through *d*.

10–73. INSTALLATION OF FORWARD FUEL SHUTOFF VALVE.

a. Install an elbow, gasket, and nut in each port of forward shutoff valve (28, figure 10–1).

b. Position valve on the bracket in the fuselage bottom structure and secure with the screws, washers, nuts, and spacers.

c. Connect inlet and outlet tubes and electrical wiring to valve. Connect valve inlet tube to elbow at forward fuel tank sump. Clamp tube to emergency fuel system tube.

d. Remove gaskets (2 and 17) from receptacle (16) and hub cap (28).

e. Check all fittings at valve for possible leakage.

f. Close hinged access panel at bottom of helicopter and install fairing panel beneath forward fuel tank sump.

10–74. INSTALLATION OF AFT FUEL SHUTOFF VALVE.

a. Check to see that a jam nut and gasket are installed on union in outlet port of pressure relief valve (4, figure 10–16). Screw inlet port of aft shutoff valve (3) onto union. Tighten jam nut.

Note

The inlet and outlet ports of the shutoff 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 bracket in heater compartment and secure unit with screws, washers, nuts, and spacers.

c. Connect electrical wiring and outlet tube to aft shutoff valve (3).

d. Connect inlet and outlet tubes to elbows in pressure relief valve (4).

e. Check all connections for possible leakage while heater is operating.

10–75. FUEL FILTER. (For instructions covering fuel filter, refer to TM 55-1520-202-20, Section XI.)

10–76. FUEL PUMP.

10–77. DESCRIPTION. (See figure 10–16.) The heater fuel pump (1) is secured to a bracket on the forward bulkhead in heater compartment. The pump delivers fuel through pressure relief valve (4) and aft fuel shutoff valve (3) to heater (13, figure 10–2). A drain line attached to the pump extends down and through the bottom of the helicopter.

10–78. REMOVAL.

a. Disconnect electrical wiring from top of heater fuel pump (1, figure 10–16).

b. Disconnect drain, inlet, and outlet tubes from pump.

c. Unscrew and remove pump from bracket.

d. Disconnect wiring from top of noise filter (2). Unscrew clamp and remove clamp and noise filter from bulkhead.

e. Remove nipple from drain port of pump. Remove union and gasket from outlet port of pump. Remove elbow, gasket, and nut from inlet port of pump.

10–79. DISASSEMBLY.

10–80. PUMP. (See figure 10–19.)

a. After removing fittings and tubing, clip lock wire from three pipe plugs (10) in pump neck and remove plugs.

b. Clip lock wire from screws (12) which join pump and assembly to motor assembly. Remove screws, thereby separating pump end assembly from motor.

c. Remove seal spring (7) and seal washer (8) from pump rotor shaft (2).

d. Remove seal cage (5) from rotor shaft (2) by using long nose thin pliers or tweezers and pulling outwards, using care to avoid injury to bronze seat below cage.

e. Clip safety wire from screws (11) holding pump cover to pump body and remove screws. Remove cover assembly (9) from body (1).

f. Remove rotor by exerting pressure on end of rotor shaft.

g. Collapse blades (3) toward center and remove blades and retaining ring (4) with tweezers or small pliers. Identify each blade so that upon reassembly each blade may be restored to its original slot and original position.

10–81. MOTOR. (See figure 10–20.)

a. If motor is mounted on adapter plate, leave plate on helicopter when motor is disassembled for overhaul.

b. Clip lock wire on receptacle (16), hub cap (28), and brush holder lock screws (12) and remove.

1. Body
2. Rotor Shaft
3. Blade
4. Retaining Ring
5. Seal Cage
6. Seal Insert
7. Seal Spring
8. Seal Washer
9. Cover
10. Pipe Plug
11. Screw
12. Screw

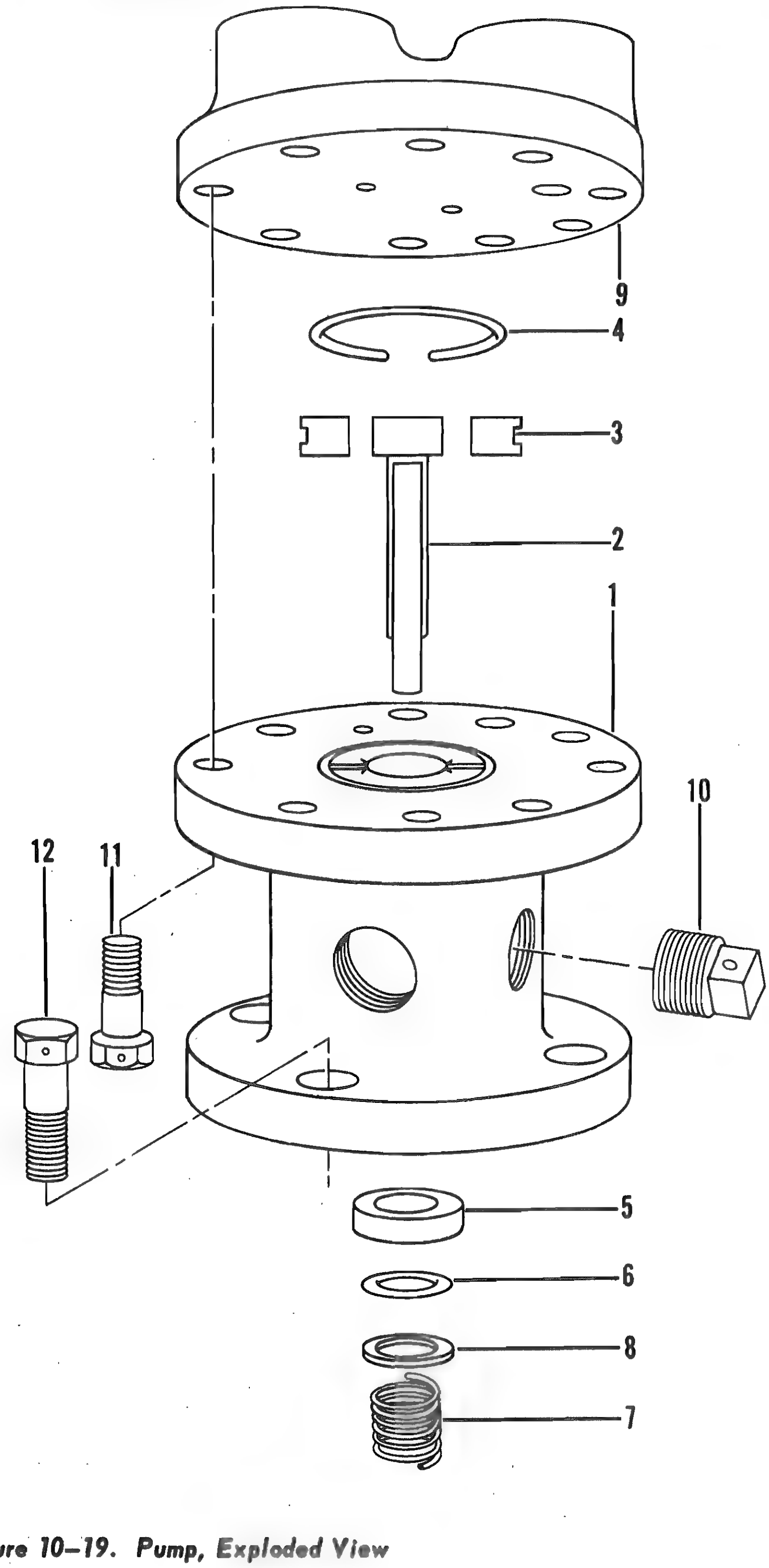
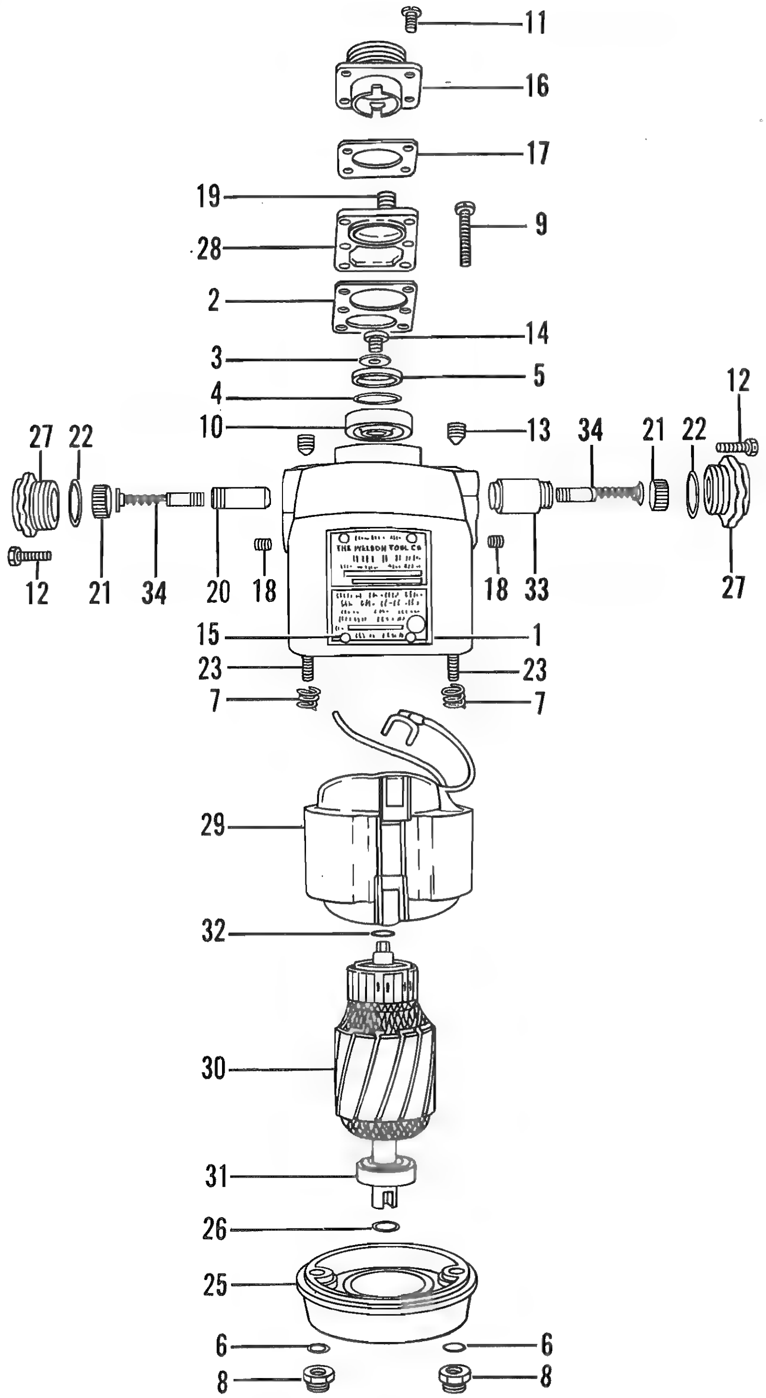


Figure 10–19. Pump, Exploded View



1. Motor Assembly
2. Gasket
3. Armature Washer
4. Bearing Spacer Washer
5. Bearing Seal Washer
6. Stud Washer
7. Spring
8. Nut
9. Screw
10. Bearing
11. Screw
12. Brush Holder Lock Screw
13. Brush Holder Setscrew
14. Armature Screw
15. Screw
16. Receptacle
17. Gasket
18. Screw
19. Sleeve
20. Brush Holder
21. Screw
22. Washer
23. Stud
24. Commutator End Bracket
25. Shaft End Bracket
26. Seal ring
27. Screw
28. Hubcap
29. Field Assembly
30. Armature
31. Bearing
32. Washer
33. Brush Holder
34. Brush

Figure 10–20. Motor Assembly, Exploded View

c. Loosen screws (9 and 11) holding receptacle (16) and hub cap (28) and remove.

Note

The inlet and outlet ports of valve may be identified by the flow direction arrow on valve.

d. Fill forward fuel tank with fuel.

e. Remove spacer washer (4) and seal washer (5) from commutator end bearing (10).

f. Unscrew screws (12) which hold the brush holder assembly screws (27) in position.

g. Unscrew brush holder assembly screws (27).

h. Remove brush holder screws (21) from brush holders (20 and 33) in commutator end bracket (24).

i. Remove brush (34) from motor and mark so they will be reassembled in same position.

j. Mark cross-line on shaft end bracket (25) and commutator end bracket (24) to facilitate reassembling in same relative position.

10–82. CLEANING.

a. Wash pump parts with dry-cleaning solvent, Federal Specification P-S-661.

b. Wash motor components with dry-cleaning solvent, Federal Specification P-S-661.

CAUTION

Do not immerse field assembly or other insulated electrical items in solvent.

10–83. REPAIR OR REPLACEMENT.

10–84. PUMP. (See figure 10–19.)

a. Seal Cage – Inspect seal face for scratches and nicks. Regrind and lap if nicked, or replace if too badly damaged.

b. Seal Insert – Inspect for wear and deterioration. If worn or broken, remove and replace with new seal insert.

c. Pump End Assembly – Inspect the bronze seal face on bottom of insert in body (1) for scratches or nicks. If marred, smooth with piloted spotfacer, or replace with necessary new parts if not repairable. Examine blade retaining ring (4). Replace if worn at blade contact point. Before installing new ring, check its outer diameter, which must measure between 0.812 and 0.817 inches. If necessary, manually adjust to dimension with care. Be sure to eliminate all dirt from blade slots, port holes, and passages.

d. Rotor – Inspect for wear, nicks, and scratches. If worn, nicked, or scratched, replace with new rotor.

e. Cover Assembly – Inspect for scratches, nicks, and general condition of mating surface. Repair or replace as necessary.

f. Blades – Inspect for wear, chipping, and breaking. If worn, chipped or cracked, replace with new blades.

10–85. MOTOR. (See figure 10–20.)

a. Inspect brushes (34) visually and if length is shorter than 1/8 inch, replace with new set.

b. Inspect bearings for signs of looseness or wear. Replace commutator end bearing (10) or armature (3) and bearing (31) if necessary. Spare bearings are prepacked with grease and are ready to install. If dirt is found present in used bearings, wash clean with gasoline. Then apply grease, Military Specification MIL-G-3278, as follows: Force grease into the ball races until grease overflows. Then spin the outer race of the bearing at approximately 2500 rpm for 2 minutes to eliminate surplus grease.

c. Inspect general condition of armature and wiring. Replace armature (30) and bearing (31) if necessary.

d. Inspect commutator condition. If dirty, clean with fine sandpaper. If pitted or scored, turn down in lathe.

e. Inspect mounting face on shaft end bracket (25) for dents and nicks. Smooth with file if necessary.

10–86. REASSEMBLY.

Note

It is imperative that all parts be thoroughly cleaned of foreign matter before assembly.

10–87. PUMP. (See figure 10–19.)

a. Replace blades (3) in slots and retaining ring (4) in groove. Push blades to extreme outside and tilt the tops outward to form a cone; this position allows for easy entrance of rotor shaft (2).

b. Push rotor shaft (2) into place. The blades (3) will then assume their normal position. Check tops of blades and rotor to make sure they are 0.0004 to 0.0006 inch below the surface of the body assembly (1).

c. Place cover assembly (9) on body assembly (1) with inlet port hole directly over drilled hole in body and screw in place with screws (11).

d. Apply several drops of light grade, clean oil to inlet port to serve as lubricant for initial start.

e. Turn rotor shaft (2) to make sure it turns freely.

f. Rewire screws (11) for safety.

g. Apply drop of light grade, clean oil to seal face of bronze insert to serve as lubricant for initial start.

h. Push seal assembly (seal insert (6) inside seal cage (5)) onto rotor shaft (2).

i. Place seal washer (8) and then seal spring (7) on rotor shaft (2).

10–88. MOTOR. (See figure 10–20.)

a. Slide armature (30) and bearing (31) into commutator end bracket (24).

b. Replace commutator end bearing (10) and washers (32 and 3) and screw (14) in commutator end of armature shaft.

c. Replace two springs (7) on studs (23) and replace shaft end bracket (25) on commutator end bracket (24), utilizing cross-line to restore original position.

d. Replace washers (6) and nuts (8) holding shaft end bracket (25) on commutator end bracket (24) and tighten nuts (8).

e. Replace brush (34), utilizing markings made during disassembly, making sure the brushes are placed in their original positions.

f. Replace brush holder screws (21).

g. Replace brush holder washers (22) and brush holder assembly screws (27).

h. Replace lock screws (12) which prevent brush holder assembly screws (27) from turning.

i. Replace washers (4 and 5) and gaskets (2 and 17), hub cap (28) and receptacle (16), and screws (9 and 11).

j. Rewire screws (9 and 11) in rear and brush holder lock screws (12) for safety.

10–89. REASSEMBLY OF PUMP TO MOTOR. (See figure 10–19.) Join pump end assembly to motor assembly with inlet port of pump on top in relation to motor mounting base, and lock in place with screws (12), first making sure that seal washer (8) and seal spring (7) are in place on rotor shaft (2) of pump. Rewire screws (12). Overboard emergency tubing is to be reconnected to drain hole which then is on downward side of pump neck. The other three drain holes shall be plugged with metal plugs. Then rewire plugs (10) and proceed to install fittings and tubing.

10–90. TEST PROCEDURE.

a. See figure 10–21 for diagram of test equipment.

b. Pumping gasoline, operate pump at 20 volts for 1 hour and at 27 volts for another hour, with no pressure applied to inlet or outlet. At the end of this 2-hour period the temperature of neither pump end assembly nor motor shall exceed 80°C (176°F). If motor exceeds this temperature, replace with new motor. If pump end assembly exceeds this temperature, disassemble and recheck freedom of rotor shaft.

c. Pumping gasoline, operate pump at 27 volts for 7 minutes with 15 psi pressure applied to inlet and 35 psi pressure applied to outlet. No seal leakage is allowable. In event of seal leakage, remove pump end assembly from motor and recheck condition of seal assembly and seal face of bronze insert.

d. With gasoline in inlet line but with pump inoperative, apply 25 psi pressure to inlet for 7 minutes with outlet port plugged. No seal leakage is

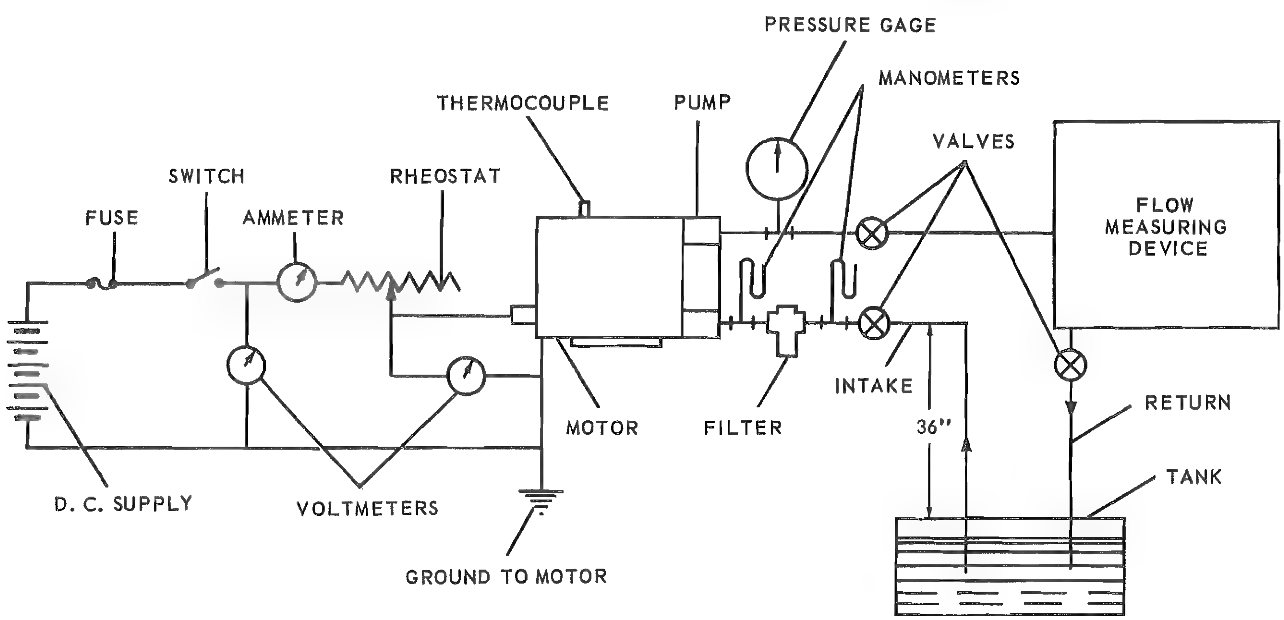


Figure 10–21. Test Setup

allowable. In event of seal leakage take remedial action recommended in step *c*.

e. Pumping gasoline, operate pump at 27 volts with 25 psi pressure applied to outlet. Flow from outlet shall be at the rate of from 4 to 5 gallons per hour (3.33 to 4.16 imperial gallons). Amperage input shall not exceed 1.8 amperes. Wet suction at inboard manometer shall be a minimum of 5 inches Hg. If drop across the fluid filter exceeds 3 inches Hg, clean filter element or replace with new filter and repeat tests. If any specification set forth in this paragraph is not then met, replace complete assembly.

10–91. INSTALLATION OF FUEL PUMP.

a. Install elbow, gasket, and nut in the inlet port of the heater fuel pump (1, figure 10–16). Install union and gasket in the outlet port of pump. Install a nipple in the drain port of pump.

b. Position pump on bracket and secure with screws and washers. Secure screws with lock wire.

c. Connect drain, inlet, and outlet tubes to pump.

d. Install noise filter (2) on bulkhead and clamp in place. Connect wiring to top of filter.

e. Connect electrical wiring to receptacle at top of pump.

f. Check all connections for possible leakage while heater is operating.

10–92. PRESSURE RELIEF VALVE.

10–93. DESCRIPTION. (See figure 10–1.) The pressure relief valve (15) is attached to the bottom of the aft fuel shutoff valve (13) 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 (14).

10–94. REMOVAL.

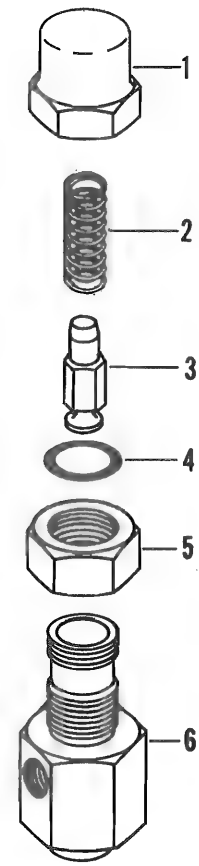
a. Disconnect inlet and outlet tubes from elbows in pressure relief valve (4, figure 10–16).

b. Disconnect electrical wiring and outlet tube from aft fuel shutoff valve (3).

c. Remove screws, washers, nuts, and spacers that hold shutoff valve to brackets. Remove pressure relief valve (4) and aft fuel shutoff valve (3) as a unit.

d. Loosen jam nut and unscrew pressure relief valve (4) from union in inlet port of aft fuel shutoff valve (3).

e. Remove elbow, gasket, and nut from each port of pressure relief valve (4).



1. Adjusting Cap
2. Spring
3. Plunger
4. O-Ring
5. Lock Nut
6. Valve Body

Figure 10–22. Relief Valve, Exploded View

10–95. DISASSEMBLY. (See figure 10–22.)

a. Unscrew adjusting cap (1).

b. Remove spring (2).

c. Remove plunger (3).

d. Lift out O-ring (4).

e. Unscrew lock nut (5) from body (6).

10–96. CLEANING.

a. Wash all metallic parts with dry-cleaning solvent, Federal Specification P-S-661.

b. Dry thoroughly with compressed air.

10–97. REPAIR OR REPLACEMENT.

a. Inspect O-ring (4). If deteriorated or worn, replace.

b. Inspect spring (2), plunger (3),and valve body (6). Replace all damaged or worn parts.

10–98. REASSEMBLY. (See figure 10–22.)

a. Install lock nut (5) on valve body (6).

b. Place O-ring (4) around threaded portion of valve body (6) above nut (5).

c. Replace plunger (3).

d. Replace spring (2).

e. Screw adjusting cap (1) into position.

10–99. TEST PROCEDURE.

a. Loosen lock nut (5) and adjust spring (2) tension by turning adjusting cap (1) until the desired pressure is obtained.

b. Retighten lock nut against the adjusting cap. The O-ring between the cap and lock nut should remain in the body groove to prevent damage to the O-ring seal.

c. Stop and start flow through the valve a few times to check pressure setting and consistency of operation.

10–100. INSTALLATION.

a. Install elbow, gasket, and nut in each port of pressure relief valve (4, figure 10–16).

Note

These ports are directly opposite each other.

b. Check to see that a jam nut and gasket are installed on union in inlet port of aft fuel shutoff valve (3). Screw pressure relief valve (4) onto union. Tighten jam nut.

Note

The inlet port of pressure relief valve must be to the left.

c. Position both valves as a unit on bracket in heater compartment and secure unit with screws, washers, nuts, and spacers.

d. Connect electrical wiring and outlet tube to aft fuel shutoff valve (3).

e. Connect inlet and outlet tubes to elbows in pressure relief valve (4).

f. Check all connections for possible leakage while the heater is operating.

10–101. CABIN HEAT SWITCHES. (See figure 10–1.) (For information concerning switches, refer to TM 55-1520-202-20, Chapter 2, Section XI.)

SECTION XI
WIRING DATA

Complete instructions on wiring data are contained in TM 55-1520-202-20, Chapter 2, Section XIII.

CHAPTER 3
FIELD MAINTENANCE STRUCTURAL REPAIR

SECTION I
GENERAL INFORMATION

1–1. DESCRIPTION.

1–2. The models CH-34A and CH-34C helicopters consist of three main fuselage sections with each section detachable from the other. The sections are identified as the forward fuselage section, the tail cone (aft fuselage) section, and the folding pylon section. The forward fuselage section is comprised of the engine compartment in the nose which is accessible through two large clam-shell type doors, the cockpit located aft and partially above the engine compartment, the cabin located aft of the engine compartment and below the cockpit, and the electrical and electronics compartment aft of the cabin. The landing gear consists of two main landing gear assemblies and a tail wheel assembly. (For major assemblies see figure 1–1).

1–3. TYPE OF CONSTRUCTION.

1–4. MAIN ROTOR BLADES. (Refer to Section II.) The main rotor blades are of all-metal construction and consist of a leading edge spar, pockets bonded to the spar, a tip cap, and a cuff at the root end of the blade. The rotor blades are interchangeable individually.

1–5. TAIL ROTOR GROUP. (Refer to Section III.) The tail rotor group of the helicopter consists of the tail rotor pylon, the stabilizer, and the tail rotor blades. The basic sectional contour of the pylon, aft of fuselage station 448, is that of an NACA0025 airfoil with a transition section between fuselage station 448 and pylon station 50.438. The pylon is semimonocoque in construction consisting of spars, stringers, ribs, and skin covering. The entire pylon is designed to pivot about two forged aluminum hinges at fuselage station 448. The intermediate gear box is mounted on a forging which is an integral part of the bulkhead at pylon station 50.4. The tail rotor gear box is mounted on a forging which forms an integral part of the bulkhead at pylon station 128.5. The stabilizer is mounted on the pylon between pylon stations 57 and 81.6 by means of hinged fittings attached to the two front spar caps. The front stabilizer support is adjustable vertically, to vary the angle of incidence of the stabilizer, by means of a turnbuckle arrangement attached to the front spar. The tail rotor blade is all-metal construction and consists of a solid spar and trailing edge skin. The skin is wrapped around the spar and bonded together at the extreme trailing edge. The tail rotor blade is designed with a constant chord of 7.178 inches. The blades are interchangeable individually.

1–6. BODY GROUP. (Refer to Section IV.) The fuselage is assembled in two main sections, the forward section from stations 5 to 316 and the tail cone section from stations 316 to 448. Both sections are semimonocoque in construction, reinforced in cross section by stiffened bulkheads and frames and longitudinally by longerons, stringers, and intercostals. Construction of the fuselage combines the use of aluminum alloy, magnesium, and stainless steel.

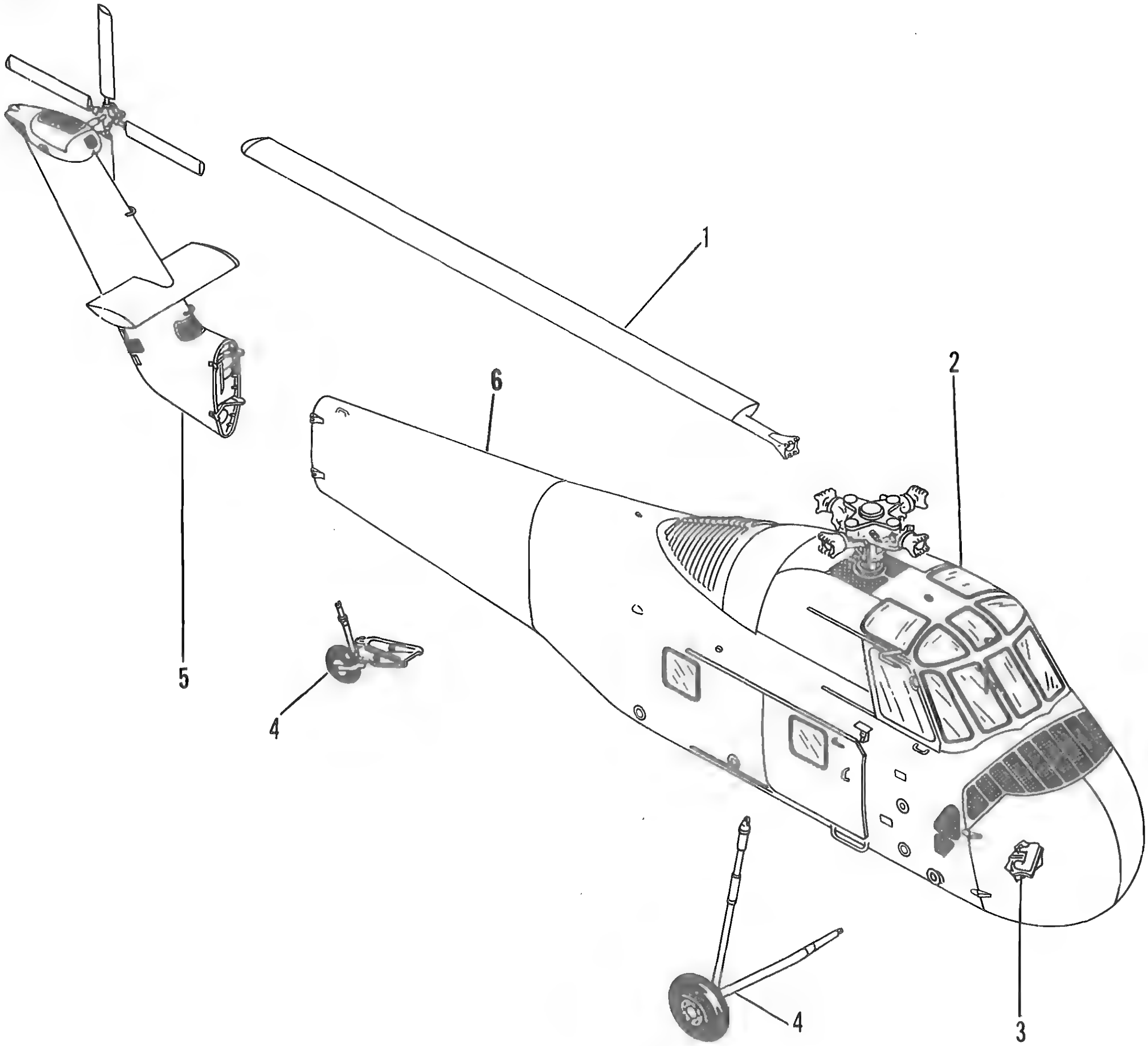
1–7. LANDING GEAR GROUP. (Refer to Section V.) The conventional, fixed-type landing gear group consists of a main landing gear assembly and a tail wheel. The main wheels are attached to the leg and axle assembly and oleo shock struts at fuselage station 101. The tail wheel is supported below the tail cone by means of a yoke casting and oleo shock strut at fuselage station 440. The tail wheel is full-swiveling and self-centering and may be locked in the center position to prevent the aft end of the fuselage from swinging around.

1–8. POWER PLANT GROUP. (Refer to Section VI.) The engine section between stations 5 and 75.5 includes the engine, engine cowling, contravane assembly, air ducts, engine supports, and the engine accessory shroud panel.

1–9. INVESTIGATING DAMAGE.

1–10. LOCAL DAMAGE. Thoroughly inspect area in which the damage occurs. Check all rivets, bolts, and spot welds for distortion or failure. Examine the skin and supporting members for distortion or cracks which may spread if allowed to remain unrepaired.

1–11. TRANSMITTED DAMAGE DUE TO SHOCK LOADS. While examining local damage, carefully examine all surrounding structure to determine the damage caused by impact and the transmission of shock loads which create failure at points removed from primary damage. Examination for transmitted damage should include a thorough inspection of all



1. Main Rotor Blades
2. Body Group
3. Engine Section
4. Landing Gear
5. Tail Rotor Group
6. Tail Cone

Figure 1-1. Major Assemblies

adjacent members, rivets, bolts, and rivet holes which might be drawn in the affected members. Use a feeler gage to insure that rivets have not stretched or failed.

1-12. SUPPORT OF STRUCTURE DURING REPAIR.

1-13. DESCRIPTION. When any member, or part of a member, is removed for repair or replacement, it is essential that the structure be adequately supported to prevent distortion or misalignment. This is particularly necessary when repairing the fuselage where damage may necessitate removal of the plating. The assembled helicopter may be supported by means of a sling, part No. S1670-10151, threaded through hoisting eyes provided on the upper plate of the main rotor hub assembly, or by the forward and aft jacking pads, located under the fuselage. Two of the jacking pads are located under the right and left main landing gear leg assemblies at fuselage stations 79.0 and 94.6 of the forward section, and two under the tail cone or aft portion of the fuselage. The aft jacking pads are at station 406.6 forward of the tail wheel yoke, and at station 425.3 directly under the yoke. (For detailed jacking instructions, refer to TM 55-1520-202-20, Chapter 2, Section II.) When the forward section and the tail cone and pylon sections are to be supported as individual units, use padded cradles placed directly under the bulkheads. (See figure 1–2.) The pylon may be supported as a separate unit by means of a pylon hoisting sling, part No. S1670-19449 or S1670-10449-4. The design weight of the component sections of the helicopter is as follows:

Basic Operational Weight	7545 lb
Forward Section	6000 lb
Aft Section	400 lb
Pylon Section	290 lb

CAUTION

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

CAUTION

To avoid crushing fuselage skin, do not place supporting cradles between bulkheads or frames. Use sponge-type rubber between structure and supporting cradle to prevent damaging surface of skin.

1–14. LOCATION OF LEVELING POINTS.

1–15. DESCRIPTION. Special leveling points are installed on the cabin door frames at fuselage station 139.5 for leveling the helicopter. Suspend a plumb bob from the leveling clip on top of the cabin door frame and check that the plumb bob is in direct alignment with the marked plate on the door sill. If the helicopter is not level laterally or longitudinally, make leveling adjustments by adding or releasing air in the landing shock struts or adjusting the jacks if the helicopter is on jacks. (For detailed leveling instructions, refer to TM 55-4520-202-20, Chapter 2, Section II.)

1–16. CLASSIFICATION OF DAMAGE AND TYPES OF REPAIR.

1–17. DESCRIPTION. After the damage has been evaluated, it should be classified in one of four classifications: Negligible damage, damage repairable by patching, damage repairable by insertion, or damage necessitating replacement.

1–18. NEGLIGIBLE DAMAGE. Damage which may be permitted to remain, or which can be repaired by a simple procedure (removing shallow nicks and scratches, stop-drilling cracks, etc), may be classified as negligible. In general, smooth dents which are free from cracks, abrasions, or sharp corners need not be repaired if the dents do not affect adjacent rivets or supporting structure; however, dents should be removed when possible, thus restoring the surface to its original shape. Limitations on negligible damage will be found in

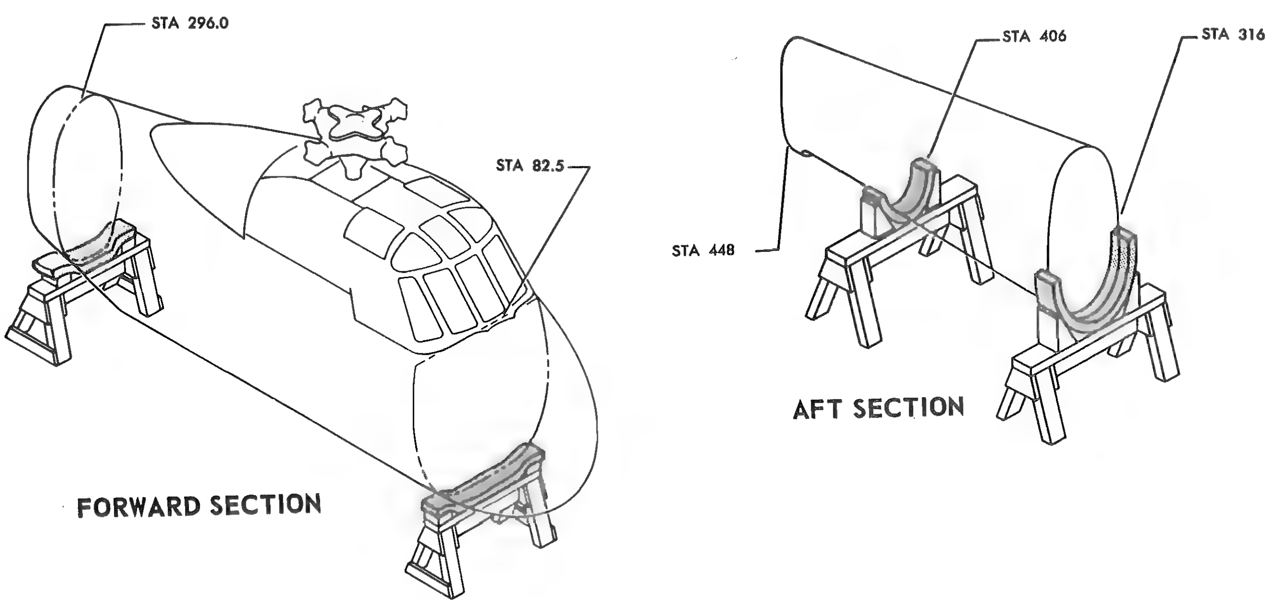


Figure 1–2. Supporting Fuselage

the text for the various components of the helicopter.

1–19. DAMAGE REPAIRABLE BY PATCHING. Damage exceeding negligible classification, such as holes or distortion, which require repair by addition of a reinforcement, is classified as damage repairable by patching.

1–20. DAMAGE REPAIRABLE BY INSERTION. Extensive damage requiring removal of a major portion of the damaged component must be repaired by the insertion of strengthening members and splicing in of a new section.

1–21. DAMAGE NECESSITATING REPLACEMENT. Extensive damage involving severe distortion or complete destruction of a member, making repair by patching or insertion impractical, nessitates replacement of the part. Damage to forgings or fittings (non-repairable part) exceeding negligible classification necessitates replacement. Bulkhead and structural fittings which do not require alignment will be replaced at Fourth Echelon. Bulkhead and structural fittings which do require jig alignment will be replaced at Fifth Echelon.

1–22. GENERAL INFORMATION FOR REPAIR OF MATERIALS.

1–23. ALUMINUM AND ALUMINUM ALLOYS. (Refer to table 1–I.) Repair material specifications for aluminum and aluminum alloys are designated by a four-digit index system. The first digit indicates the alloy groups and the last two digits the aluminum alloy. The second digit indicates modification of the original alloy. The temper designation system, in effect since December 31, 1947, is being continued without change. The temper designation follows the alloy designation and is separated from it by a dash; for example, Alclad 75S-T6 will now read 7075-T6.

Table 1–I. Aluminum Alloy Designations

CONVERSION TABLE	
OLD DESIGNATION	NEW DESIGNATION
2S	1100
3S	3000
14S	2014
17S	2017
A17S	2117
24S	2024
52S	5052
56S	5056
61S	6061
62S	6062
75S	7075

1–24. REPAIR OF MAGNESIUM ALLOY. The material used for repairing magnesium alloy by patching or insertion should be of similar type and gage as specified in the repair table for the applicable illustrations in the text. If magnesium alloy is not available, then Alclad 2024-T3 sheet may be substituted without increasing the gage of the material. When aluminum alloy is used for repair, it is necessary that the mating surfaces of the metals be insulated to prevent electrolytic corrosion between the metals. For corrosion-preventive measures and insulation methods, refer to TM 55-1520-202-20, Chapter 2, Section III. In addition to the insulation procedures, magnesium alloy assemblies shall be riveted with 5056, type B, aluminum anodized rivets.

1–25. REPAIR OF ALUMINUM ALLOY. For corrosion-preventive measures, refer to TM 55-1520-202-20, Chapter 2, Section III. Material used for repairing aluminum alloys, by patching or insertion, should be of the type specified in the repair table for the applicable illustrations in the text. In most cases, the repair material will be the same as the original material. If Alclad 7075-T6 sheet is not available for making the repair in the field, then Alclad 2024-T3 sheet may be substituted, as indicated in Maintenance Engineering Manual for Structural Repair, TM 55-405-4.

ALUMINUM SHEET	MINIMUM TENSILE STRENGTH
2024–T4, Alclad (0.012-0.050 in.)	56,000 psi
2024–T4, Alclad (0.063–0.249 in.)	59,000 psi
2024–T3, Bare (0.025 in. max)	64,000 psi
6061–T6, Bare (0.025 in. max)	42,000 psi
7075–T6, Alclad (0.016–0.039 in.)	70,000 psi
7075–T6, Alclad (0.040–0.249 in.)	72,000 psi
7075–T6, Bare (0.016–0.039 in.)	76,000 psi
7075–T6, Bare (0.040–0.249 in.)	77,000 psi

1–26. MINIMUM BEND RADII FOR ALUMINUM ALLOY. Heat-treated aluminum alloy (T) repair parts that necessitate forming, but will stand only limited bend radii, may be formed in their annealed (0) condition and heat-treated to develop their tensile strength and required physical properties before assembling. In some cases, where annealed metal is not available, the metal should be heated and quenched, then formed before age hardening sets in. Refer to Maintenance Engineering Manual for Structural Repair, TM 55-405-4, for bend radii tables and Section V for heat-treatment information.

1–27. MINIMUM BEND RADII FOR MAGNESIUM ALLOY. Bending magnesium alloys is done by the

Table 1–11. Typical Minimum Bend Radii for Magnesium

GAGE	INCH AT 70°F	INCH AT 300°F	INCH AT 400°F
0.016	0.190	0.090	0.062
0.020	0.190	0.090	0.062
0.025	0.250	0.160	0.093
0.032	0.320	0.160	0.093
0.040	0.380	0.190	0.125
0.050	0.500	0.250	0.156
0.063	0.620	0.320	0.203
0.071	0.820	0.320	0.220
0.080	0.820	0.440	0.250
0.090	1.000	0.440	0.281

same method that is used for other metals, except that magnesium is usually worked at higher temperatures. Small pieces of sheet may be heated with a blow torch, provided extreme care is exercised in heating the magnesium as the metal is likely to catch fire above 426.7°C (800°F). Good results may be obtained by clamping heated steel bars on both sides of the section to be bent. The steel bar will warm the sheet enough to permit bending. Cold bending has a very limited application, but can be used where the radius of the bend is many times the thickness of the material. Minimum bend radii, expressed in multiples of sheet thickness of 90-degree bends in magnesium alloy at room and elevated temperatures, are given in table 1–11.

CAUTION

Bend lines should not be prick-punched or scribed with a metal tool, as such marring of the surface will result in fatigue cracks starting from these points. An ordinary carbon lead pencil may be used for satisfactory layout work.

Note

The advantage of hot working magnesium is that springback will be eliminated and more severe working can be done.

1–28. GENERAL PROCEDURE FOR CLEANING OUT DAMAGED AREA. In most circumstances, the damaged area will contain a very jagged edge with numerous small cracks radiating from the hole into the skin, frames, or extrusion. All damaged areas must be cleaned out properly by cutting away the jagged edges and the severely distorted material. The following procedure for cleaning out a damaged area applies to all types of damage:

a. Restore all dented skin and supporting structure to original shape where possible. Exercise care to insure that no further damage develops as a result of this operation.

b. Smooth out all shallow abrasions or nicks. Trim all deep abrasions or nicks, eliminating sharp corners and edges.

c. Round up all holes in flat or curved sheets to form a smooth outline. When cleaning out larger damaged areas, leave as large a radius as possible in all corners of cutout.

d. Clean out all minute cracks in surrounding area when trimming jagged holes or tears.

e. Do not leave isolated cracks unattended even if area is considered nonstressed. Drill a 3/32-inch diameter hole at ends of crack.

1–29. CORROSION PREVENTION.

1–30. DESCRIPTION. The airframe is composed of magnesium and aluminum alloys and should be examined regularly for signs of corrosion, especially in area of dissimilar metal contacts. Corrosion of metals is the result of several conditions: deterioration of insulation between dissimilar metal contacts; tears or punctures in the metal; and worn, scratched, and scuffed areas on the metal. For treatment of corroded surfaces, refer to TM 55-1520-202-20, Chapter 2, Section III.

1–31. INSULATION OF DISSIMILAR METALS AGAINST ELECTROLYTIC CORROSION.

1–32. DESCRIPTION. Dissimilar metal contacts should be avoided when possible. For instructions on insulation procedures, including use of primer, vinyl tape, and sealing compound, refer to TM 55-1520-202-20, Chapter 2, Section III.

Table 1–III. Aluminum Alloy Rivet Size and Spacing

RIVET DIAMETER	DRILL SIZE NO.	DRILL DIAMETER	MINIMUM SPACING	MINIMUM EDGE DISTANCE
3/32	40	0.0980	3/8	3/16
1/8	30	0.1285	1/2	1/4
5/32	21	0.1590	5/8	5/16
3/16	11	0.1910	3/4	3/8
1/4	F	0.2570	1	1/2
5/16	O	0.3160	1-1/4	5/8

1–33. SELECTION OF NEW REPAIR RIVETS.

1–34. INSERTION OF NEW REPAIR RIVETS. Before drilling the correct size hole for the repair rivets, it is preferable to start the new holes with a No. 41 (0.096-inch diameter) pilot drill. This will insure more accurate locations for the rivets. All rivets must fit their holes snugly for proper security of the rivets. If the rivet has been found to be loose after driving, it should be drilled out and replaced with a new rivet. For removal of rivets, refer to Maintenance Engineering Manual for Structural Repair, TM 55-405-4. Table 1–III lists the recommended drill sizes and rivet spacings for various size rivets.

1–35. RIVET LENGTH-UNIVERSAL AND COUNTERSUNK HEAD. The length of universal head or countersunk head rivet is governed by total thickness of the material to be riveted together. A close approximation of the length can be made by adding one and one-half times the diameter of the rivet to the total material thickness. The next nearest standard size rivet length should be used. The length of a universal head rivet is the length from the underside of the manufactured head to the end. The length of a countersunk head rivet is the length from the top of the manufactured head to the end. For information concerning rivets, refer to Maintenance Engineering Manual for Structural Repair, TM 55-405-4.

1–36. BLIND BOLT FASTENERS. The blind bolt fixkit, Hi-Shear Rivet part No. FK-101, is used where authorized for modification or repair where accessibility problems are encountered. The kit includes stainless steel blind bolts and blind nuts in diameters from 5/32 inch through 3/8 inch and a variety of grip lengths from 1/8 inch to 1 inch. Also included in the kit are the required hand tools with replacement mandrels and crowfoot wrenches.

1–37. HUCK BLIND RIVET FASTENERS. Huck blind riveting is accomplished where access is available to only one side of the work to be riveted, and where the use of a bucking bar or squeezer yoke is impossible. Huck blind rivets are furnished in various sleeve lengths to accommodate different thicknesses of material. Any given rivet can be used for material of a certain range of thickness, and this range of material thickness is referred to as the grip range.

1–38. DETERMINING HUCK BLIND RIVET GRIP RANGE. To determine the rivet grip range required, the total thickness of the material should be measured with a hook scale through the rivet hole. This measurement should be made with the parts clamped, and will include variations due to tolerances in sheet thickness, primer, possible slight burrs resulting from drilling operation, and any spaces existing between sheets due to irregularities in contour.

1–39. DETERMINING HUCK BLIND RIVET TYPE. (Refer to table 1–IV.) In determining the rivet type to be used, the following procedures are applied:

a. The first letter of a part number indicates head type, thus P represents a brazier head, 100V represents a 100-degree countersunk head, and 78V represents a 78-degree modified countersunk head.

b. The figure following first letter represents nominal rivet shank diameter in thirty-seconds of an inch.

c. The last letter is the grip code letter which indicates the grip range as listed in the grip range table. For example, P5C indicates a brazier head rivet (P), 5/32 inch in diameter (5), having a grip range from 0.077 to 0.107 inch inclusive (C). Likewise, 100V6E indicates a 100-degree countersunk head (100V), 6/32 or 3/16 inch in diameter (6), for grips ranging from 0.236 to 0.272 inch inclusive (E).

Table 1–IV. Huck Rivets

BRAZIER HEAD HUCK RIVETS										
Rivet Diameter	Grip Range	Grip Code Letter A	B	C	D	E	F	G	H	J
1/8	Min	0.020	0.037	0.062	0.087	0.112	0.137	0.162		
	Max	0.036	0.061	0.086	0.111	0.136	0.161	0.186		
5/32	Min	0.025	0.046	0.077	0.108	0.139	0.170	0.201	0.232	
	Max	0.045	0.076	0.107	0.138	0.169	0.200	0.231	0.262	
3/16	Min	0.030	0.055	0.092	0.129	0.166	0.203	0.240	0.277	0.314
	Max	0.054	0.091	0.128	0.165	0.202	0.239	0.276	0.313	0.350
COUNTERSUNK HEAD HUCK RIVETS										
Rivet Diameter	Grip Range	Grip Code Letter A	B	C	D	E	F	G	H	J
1/8	Min	0.062	0.079	0.104	0.129	0.154	0.179	0.204		
	Max	0.078	0.103	0.128	0.153	0.178	0.203	0.228		
5/32	Min	0.080	0.101	0.130	0.163	0.194	0.225	0.256	0.287	
	Max	0.100	0.131	0.162	0.193	0.224	0.255	0.286	0.317	
3/16	Min	0.100	0.125	0.162	0.199	0.236	0.273	0.310	0.347	0.384
	Max	0.124	0.161	0.198	0.235	0.272	0.309	0.346	0.383	0.420

1–40. USE OF HUCK LOCK BOLTS AND HI-SHEAR RIVETS. (See figure 1–3.) Huck lock bolts are used extensively throughout the helicopter structure where high tension strength and very high fatigue resistance of the fastener is required. The Huck lock bolt secures the structural components tightly together with sufficient force to prestress the pin in tension comparable to a highly torqued bolt with the required uniformity. All areas of the helicopter structure requiring repair, where Huck lock bolts and Hi-Shear rivets have been used in fabrication, must be secured with Huck lock bolts or Hi-Shear rivets of the same type and strength as the original. Where removal of Huck fasteners is necessary, another Huck fasteners of the same diameter may be used as a replacement. It is possible to make several replacements in the same hole and still maintain an interference fit for structural tightness, provided the hole is not distorted. Huck lock bolts are available in diameters of 3/16 inch, 1/4 inch, 5/16 inch, and 3/8 inch. For use of Hi-Shear rivets, refer to Maintenance Engineering Manual for Structural Repair, TM 55-405-4.

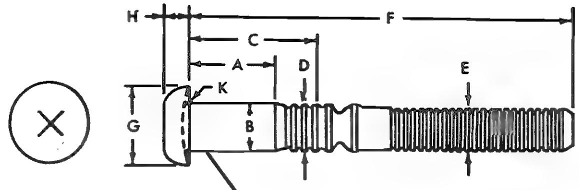
CAUTION

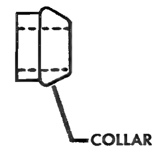
Do not substitute steel alloy Huck lock bolts for aluminum-type lock bolts.

1–41. REMOVAL OF HUCK LOCK BOLTS. Huck lock bolts may be removed by splitting the collar axially in two parts with a sharp chisel. File a small flat on the broken-off end of the bolt to remove the burred edge, and drive bolt out of the hole with a drift pin. Back up the sheets to prevent dishing.

1–42. TREATMENT OF ENLARGED RIVET HOLES. If a rivet hole is found to be elongated or enlarged after the rivet has been removed during repair operations, the next larger diameter rivet should be used on reassembly of the parts. Damaged hole should be drilled to the correct size for larger diameter rivet. (For drill sizes refer to table 1–III.) Take care to keep the center of the hole as nearly as possible in its original location.

1–43. TREATMENT OF ENLARGED BOLT HOLES. Before replacing fittings originally attached by bolts, bolt holes in the fitting and attachment structure should be carefully examined for enlargement or elongation. Fitting must be replaced unless oversize bolts can be provided. Oversize bolts, 1/16-inch larger in diameter than the original bolts, may be used provided a reasonable edge distance can be maintained after oversize holes are drilled. In cases where a 1/16-inch larger diameter bolt would seriously impair the strength of the fitting or attachment structure due to reduced





(RECOMMENDED COLLAR PART NUMBERS)

HUCKBOLT	COLLAR
ALPP(H)(N)-T6	LC-C6
ALPP(H)(N)-T8	LC-C8
ALPP(H)(N)-T6	LC-R6 } High Temp
ALPP(H)(N)-T8	LC-R8 } Applications
ALPP(H)(N)-E6	LC-F6
ALPP(H)(N)-E8	LC-F8
ALPP(H)(N)-E10	LC-F10
ALPP(H)(N)-E12	LC-F12

DIA (INCHES)	B	D	E	G	H	J	K	L
3/16	0.187	0.1845/0.177	0.171/0.180	0.297/0.327	0.009/0.111	0.193	0.010/0.025	3/64
1/4	0.246	0.2415/0.235	0.227/0.235	0.390/0.430	0.128/0.147	0.252	0.010/0.025	1/16
5/16	0.309	0:3045/0.294	0.281/0.291	0.485/0.535	0.158/0.184	0.316	0.101/0.025	5/64
3/8	0.371	0.3675/0.361	0.341/0.351	0.595/0.655	0.194/0.224	0.378	0.010/0.030	3/32

SUGGESTED HOLE PREPARATION			
DIA (INCHES)	INTERFERENCE KIT		
	PRE DRILL	SIZE DRILL	LIMITS
3/16	No. 18 (0.1695)	No. 13 (0.185)	0.185/0.188
1/4	No. 1 (0.228)	6.2mm (0.2441)	0.244/0.247
5/16	Ltr L (0.290)	7.8mm (0.3071)	0.307/0.310
3/8	11/32 (0.343)	Ltr U (0.368)	0.369/0.372

LOCK BOLT

3/16 IN. DIA					
PART NO. *	Grip Range MIN	Grip Range MAX	A	C	F
ALPPH-T6-1	0.031	0.094	0.062	0.222	1.431
ALPPH-T6-2	0.094	0.156	0.125	0.284	1.556
ALPPH-T6-3	0.156	0.219	0.187	0.347	1.681
ALPPH-T6-4	0.219	0.281	0.250	0.409	1.806
ALPPH-T6-5	0.281	0.344	0.312	0.472	1.931
ALPPH-T6-6	0.344	0.406	0.375	0.534	2.056
ALPPH-T6-7	0.406	0.469	0.437	0.597	2.181
ALPPH-T6-8	0.469	0.531	0.500	0.659	2.306
ALPPH-T6-9	0.531	0.594	0.562	0.722	2.431
ALPPH-T6-10	0.594	0.656	0.625	0.784	2.556
ALPPH-T6-11	0.656	0.718	0.687	0.847	2.681
ALPPH-T6-12	0.718	0.781	0.750	0.909	2.806
ALPPH-T6-13	0.781	0.843	0.812	0.972	2.931
ALPPH-T6-14	0.843	0.906	0.875	1.034	3.056
ALPPH-T6-15	0.906	0.968	0.937	1.097	3.181
ALPPH-T6-16	0.968	1.031	1.000	1.159	3.306
ALPPN-T6-17	1.031	1.094	1.052	1.222	2.365
ALPPN-T6-18	1.094	1.156	1.125	1.284	2.427
ALPPN-T6-19	1.156	1.219	1.187	1.347	2.490

1/4 IN. DIA					
PART NO. *	Grip Range MIN	Grip Range MAX	A	C	F
ALPPH-T8-2	0.094	0.156	0.125	0.341	1.917
ALPPH-T8-3	0.156	0.219	0.187	0.403	2.042
ALPPH-T8-4	0.219	0.281	0.250	0.466	2.167
ALPPH-T8-5	0.281	0.344	0.312	0.528	2.292
ALPPH-T8-6	0.344	0.406	0.375	0.591	2.417
ALPPH-T8-7	0.406	0.469	0.437	0.653	2.542
ALPPH-T8-8	0.469	0.531	0.500	0.716	2.667
ALPPH-T8-9	0.531	0.594	0.562	0.778	2.792
ALPPH-T8-10	0.594	0.656	0.625	0.841	2.917
ALPPH-T8-11	0.656	0.718	0.687	0.903	3.042
ALPPH-T8-12	0.718	0.781	0.750	0.966	3.167
ALPPH-T8-13	0.781	0.843	0.812	1.028	3.292
ALPPN-T8-14	0.843	0.906	0.875	1.091	2.543
ALPPN-T8-15	0.906	0.968	0.937	1.153	2.605
ALPPN-T8-16	0.968	1.031	1.000	1.216	2.668
ALPPN-T8-17	1.031	1.094	1.062	1.278	2.730
ALPPN-T8-18	1.094	1.156	1.125	1.341	2.793
ALPPN-T8-19	1.156	1.219	1.187	1.403	2.855

5/16 IN. DIA					
PART NO.	Grip Range MIN	Grip Range MAX	A	C	F
ALPPH-E10-2	0.094	0.156	0.125	0.386	2.045
ALPPH-E10-3	0.156	0.219	0.187	0.448	2.170
ALPPH-E10-4	0.219	0.281	0.250	0.510	2.295
ALPPH-E10-5	0.281	0.344	0.312	0.583	2.420
ALPPH-E10-6	0.344	0.406	0.375	0.636	2.545
ALPPH-E10-7	0.406	0.469	0.437	0.698	2.670
ALPPH-E10-8	0.469	0.531	0.500	0.761	2.795
ALPPH-E10-9	0.531	0.594	0.562	0.823	2.920
ALPPH-E10-10	0.594	0.656	0.625	0.886	3.045
ALPPH-E10-11	0.656	0.718	0.687	0.948	3.170
ALPPH-E10-12	0.718	0.781	0.750	1.011	3.295
ALPPN-E10-13	0.781	0.843	0.812	1.073	2.608
ALPPN-E10-14	0.843	0.906	0.875	1.136	2.670
ALPPN-E10-15	0.906	0.968	0.937	1.198	2.733
ALPPN-E10-16	0.968	1.031	1.000	1.261	2.795
ALPPN-E10-17	1.031	1.094	1.062	1.323	2.858
ALPPN-E10-18	1.094	1.156	1.125	1.386	2.920
ALPPN-E10-19	1.156	1.219	1.187	1.448	2.983

3/8 IN. DIA					
PART NO.	Grip Range MIN	Grip Range MAX	A	C	F
ALPPH-E12-2	0.094	0.156	0.125	0.449	2.080
ALPPH-E12-3	0.156	0.219	0.187	0.511	2.205
ALPPH-E12-4	0.219	0.281	0.250	0.574	2.330
ALPPH-E12-5	0.281	0.344	0.312	0.636	2.455
ALPPH-E12-6	0.344	0.406	0.375	0.699	2.580
ALPPH-E12-7	0.406	0.469	0.437	0.761	2.705
ALPPH-E12-8	0.469	0.531	0.500	0.824	2.830
ALPPH-E12-9	0.531	0.594	0.562	0.886	2.955
ALPPH-E12-10	0.594	0.656	0.625	0.949	3.080
ALPPH-E12-11	0.656	0.718	0.687	1.011	3.205
ALPPH-E12-12	0.718	0.781	0.750	1.074	3.330
ALPPN-E12-13	0.781	0.843	0.812	1.136	2.591
ALPPN-E12-14	0.843	0.906	0.875	1.199	2.653
ALPPN-E12-15	0.906	0.968	0.937	1.261	2.716
ALPPN-E12-16	0.968	1.031	1.000	1.324	2.778
ALPPN-E12-17	1.031	1.094	1.062	1.386	2.841
ALPPN-E12-18	1.094	1.156	1.125	1.449	2.903
ALPPN-E12-19	1.156	1.219	1.187	1.511	2.966

*T = Alloy Steel (Substitute "E" for 7075-T Al Alloy)

ALPPH-T6-1 – (T) – Designates Heat-Treated alloy steel

ALPPH-E6-1 — (E) — Designates 7075-T6 Al Alloy

Figure 1–3. Huck Lock Bolts

edge distance, special bolts, slightly oversize but otherwise identical, should be made up.

1-44. REBALANCE OF FLIGHT AND CONTROL SURFACES.

1-45. DESCRIPTION. All main rotor blade repair instructions in Section II are for repairs which do not require rebalancing of the main rotor blades. When repairs to the tail rotor blades in Section III are made, the tail rotor assembly must be checked for balance. For balancing of the tail rotor assembly, refer to Chapter 2, Section VI.

1-46. SPECIAL TOOLS.

1-47. DESCRIPTION. Special tools and equipment used in field maintenance are called out where applicable in the instructions in the remaining sections of this chapter. A complete listing of field maintenance tools and equipment is provided in Chapter II, Section I.

SECTION II

MAIN ROTOR GROUP

2–1. MAIN ROTOR GROUP.

2–2. DESCRIPTION. (See figure 2–1.) The main rotor group is comprised of the four main rotor blades. The main rotor blades are fabricated of aluminum alloy with the exception of the forged steel cuff. The main supporting member of the blades is a hollow, aluminum alloy extruded spar which forms the leading edge. A steel cuff is bolted to the root end of the spar and serves as the point of attachment of the blade to the main rotor hub assembly. Twenty-three individual pockets, each constructed of inboard and outboard aluminum ribs, aluminum foil honeycomb core, and aluminum skin covering, are bonded to the trailing edge of the spar. The tip end of the blade contains a readily removable tip cap fastened to the spar and tip pocket rib by means of screws and nut plates. The root pocket of the blade is sealed at its inboard end by an aluminum alloy root cap cemented and riveted to the pocket. The tip cap, root cap, and the root pocket rubber seal are the only components of the main rotor blades that may be replaced.

2–3. CLASSIFICATION OF DAMAGE.

2–4. REPAIR LIMITATIONS TO MAIN ROTOR BLADES.

a. Cleaning main rotor blades is restricted to the use of mild soap and fresh water followed by a clean fresh water rinse.

WARNING

Never use solvents or cleaners such as lacquer thinner, naphtha, carbon tetrachloride, etc. They will weaken the bonding adhesive used in assembly of the blade.

b. Repair of holes greater than 1 inch in diameter in the main rotor blade pockets may be made by patching with bonded aluminum or fabric, or by filling with resin filler. These repair materials to be used are restricted to specific additional weight limitations allowed to be applied to particular sections and zones of the blade as shown in figure 2–2. Small symmetrical holes in the blade pockets, 1 inch or less in diameter, may be repaired by patching with Scotch Brand aluminum tape No. 425 as outlined in paragraph 2–11.

c. A bonded aluminum or fabric patch should be used to repair punctured pockets where the hole is nearly symmetrical in shape and the patch size does not exceed 3 x 3 inches. Resin filler should be used to repair irregularly shaped holes (figures 2–3 and 2–4), or where the patch size required after trimming the hole will exceed 3 x 3 inches. Replacement of the blade is required if the weight of the resin required to fill a hole exceeds the weight limitations in figure 2–2.

d. Damage which requires the replacement of any of the pockets, or a hole in a pocket which damages a rib, necessitates replacement of the blade.

e. See figure 2–2 for specific additional weight limitations allowed as a result of patches applied to damaged pockets.

Note

The pockets must be inspected for repairs which may have been made at an earlier date. If previous repairs have been made in the field, the blades must be returned to overhaul for repair and rebalancing. Scotch Brand aluminum tape patches which appear to be insecure, may be replaced as often as necessary provided the pocket skin does not become cracked as a result of initial damage.

f. A crack in a pocket in the area of the pocket-to-spar bonded joint must not be stop-drilled since resultant damage to the section of the spar covered by the pocket will require replacement of the blade.

g. A hole in the root pocket (twenty-third from the tip) closer than 1/2 inch from the edge of the root cap may be repaired with a resin filler, provided the weight limitations shown in figure 2–2 are complied with. Replacement of the blade is required if resin required to fill the hole exceeds weight limitations.

h. Any damage to the steel cuff (figure 2–1), greater than the limitations given in paragraph 2–10, necessitates replacement of the blade.

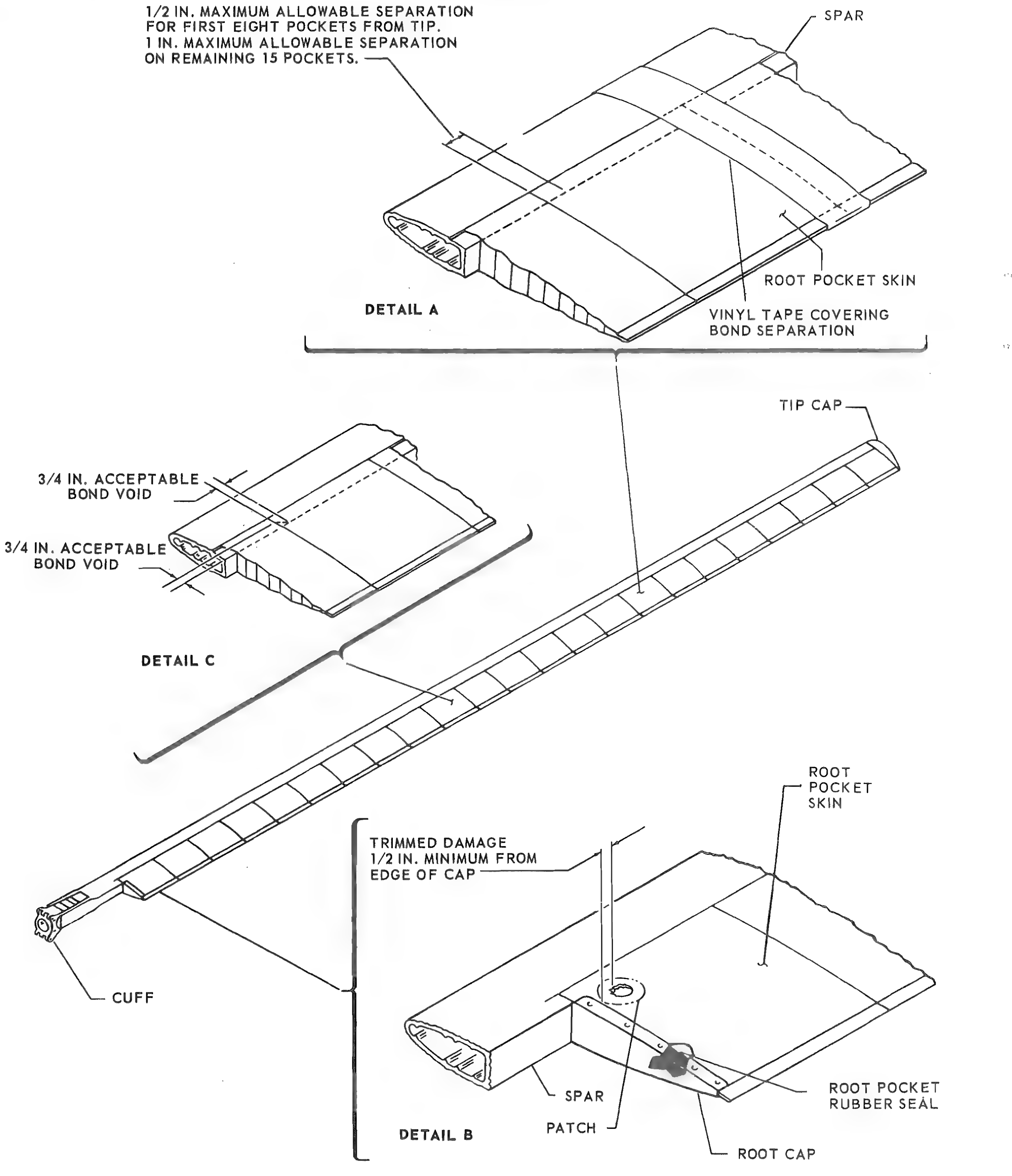
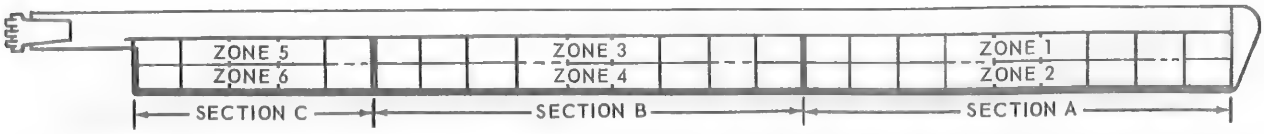


Figure 2–1. Main Rotor Blade Repair Limitations



SECTION C (FIVE POCKETS) MAX ADDED WEIGHT ALLOWED	SECTION B (NINE POCKETS) MAX ADDED WEIGHT ALLOWED	SECTION A (NINE POCKETS) MAX ADDED WEIGHT ALLOWED
ZONE 5 – 0.30 POUNDS	ZONE 3 – 0.20 POUNDS	ZONE 1 – 0.10 POUNDS
ZONE 6 – 0.15 POUNDS	ZONE 4 – 0.10 POUNDS	ZONE 2 – 0.05 POUNDS

CAUTION

REPAIRS TO ONE OR MORE POCKETS IN A ZONE MAY BE ACCOMPLISHED PROVIDED THE TOTAL WEIGHT LIMITATIONS FOR THE PARTICULAR ZONE IN A SECTION ARE NOT EXCEEDED. WITHIN THESE WEIGHT LIMITATIONS ONLY THE POCKETS IN ONE ZONE MAY BE REPAIRED. IF POCKETS IN TWO ZONES IN ONE OR TWO SECTIONS NEED REPAIRING, THE APPLICABLE WEIGHT LIMITATION IS ONE-HALF. IN THIS CASE NO MORE THAN TWO ZONES MAY BE REPAIRED.

Figure 2–2. Limitations of Resin Filler Repairs to Main Rotor Blade Pockets

Figure 2–3. Resin Filler in Damaged Pocket

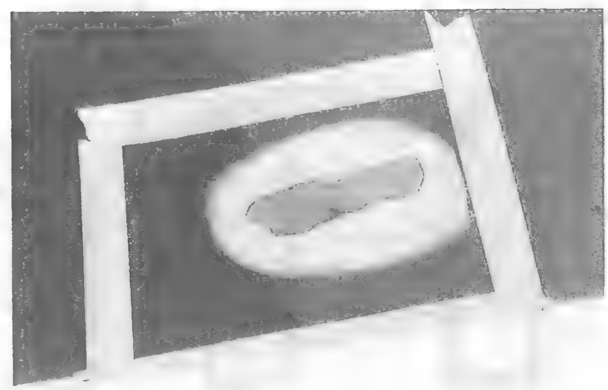


Figure 2–4. Resin Filler Sanded to Blade Contour

i. Separation of the bonded joints greater than the repairable limitations in detail A, figure 2–1, necessitates replacement of the blade.

j. Any damage to the spar exceeding the limits described in figure 2–5 necessitates replacement of the blade.

k. Corrosion pits on the span that cannot be removed by rubbing with crocus cloth, Federal Specification P-C-458, necessitates replacement of the blade.

2–5. NEGLIGIBLE DAMAGE.

2–6. CONDITIONS NOT REQUIRING REPAIR. Negligible damage that does not require repair consists of the following:

a. Very smooth dents in the spar not exceeding 0.010 inch in depth with the exception of area C, figure 2–5.

b. Dents in the pockets, tip cap, or root cap (figure 2–1) which do not puncture the skin. The dents may be quite pronounced without causing skin fracture and are not considered serious unless they cause unusual distortion at the trailing edge or tip.

c. Deepening of the gap between the pockets which is caused by the shrinking of the sponge rubber seal.

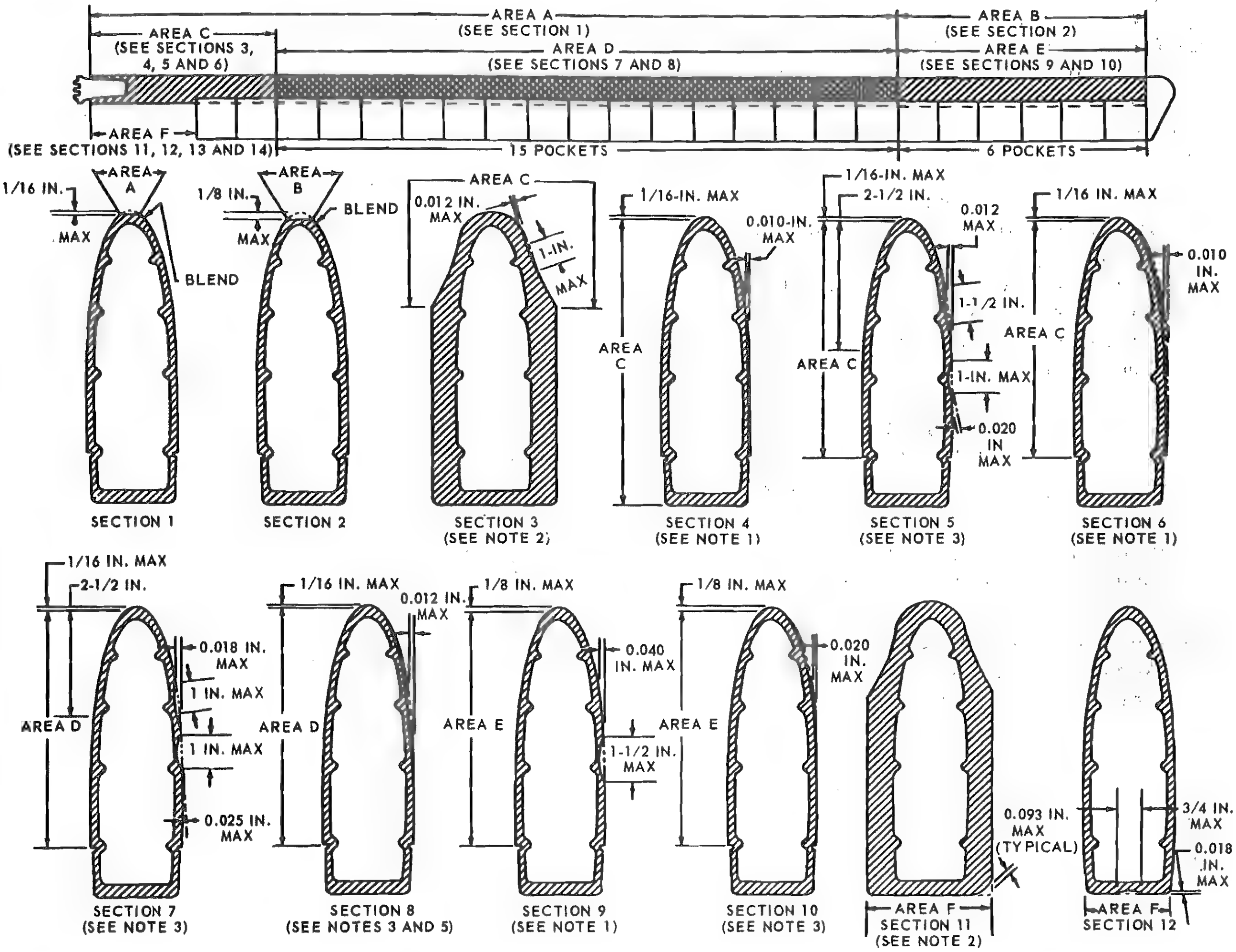
d. Voids that do not exceed the limitation given in detail C, figure 2–1.

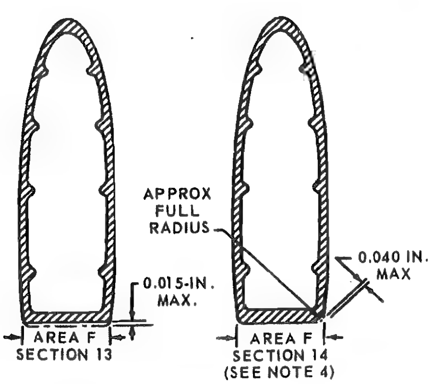
2–7. CONDITIONS REQUIRING REPAIR. Negligible damage which requires repair consists of the following:

a. Indentations in the spar exceeding 0.010 inch in depth, but not greater than the limitations shown in figure 2–5.

b. Small cracks in the pockets or tip and root caps may be stop-drilled to prevent spreading. Refer to paragraph 2–4, step *f*, for limitations.

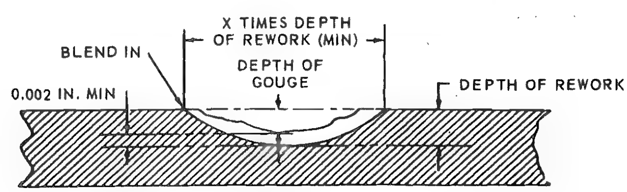
c. A temporary repair is permitted for the separation of the bonded joint between the pocket and the spar. The separation must not exceed 1/2 inch from either edge of the first eight pockets from the tip of blade and 1 inch from either edge of the remaining 15 pockets. (See detail A, figure 2–1.) The tem-





WARNING

REWORK MAY BE PERFORMED WITHIN LIMITATIONS SHOWN PROVIDED A COMBINATION OF NO MORE THAN TWO REPAIRS OCCUR WITHIN A 1-INCH SPANWISE DISTANCE. REPLACE THE BLADE ASSEMBLY IF THE DAMAGE TO THE SPAR EXCEEDS LIMITATIONS SHOWN. DO NOT DRILL HOLES IN, OR MODIFY, THE SPAR IN ANY MANNER EXCEPT FOR CLEANING OUT LIMITED SCRATCHES, NICKS, OR DENTS.



SPANWISE WIDTH OF BLEND AREA

AREA	X
A, B	10
C, D, E AND F	30

NOTES

1. REPAIR LIMITATION SHOWN IS ALLOWABLE ON EITHER OR BOTH SIDES OF SPAR AND MAY BE CONSIDERED AS A SINGLE REWORK.
2. REPAIR LIMITATION SHOWN IS ALLOWABLE ON EITHER OR BOTH SIDES.
3. REPAIR LIMITATION SHOWN IS ALLOWABLE ONLY ON ONE SIDE OF THE SPAR.
4. REPAIR LIMITATION SHOWN IS ALLOWABLE ON EITHER OR BOTH CORNERS.
5. NO MORE THAN ONE REPAIR OF THIS TYPE IS ALLOWED IN A 2-INCH SPANWISE DISTANCE.

Figure 2–5. Repair Limitations to Main Rotor Blade Spar porary repair is made by wrapping vinyl plastic tape No. 471, manufactured by Minnesota Mining and Mfg Co, around the blade to cover the area of the separated bond. Permanent repair of the separated pockets must be made as soon as practicable by overhaul procedures not within the scope of this manual.

Note

Separations that are not readily visible can usually be detected by tapping lightly along the pocket-to-spar bond area with a metal object such as a coin. Areas of separation will produce a sound different from the areas where no separation exists.

CAUTION

Do not use a feeler gage or other metallic objects to determine or measure separations. Metallic objects may damage other metallic objects of softer material.

d. Inspect the finish on the surface of the blade for excessive abrasions. On blades requiring refinishing, refer to paragraph 2–17.

e. Separation of the pocket skin from the rib just aft of the spar may be repaired by riveting as shown in figure 2–6. The separation may occur from quick starts or high edgewise loading.

2–8. REPAIR OF NICKS OR SCRATCHES IN MAIN ROTOR BLADE SPAR.

2–9. GENERAL. Limited nicks, dents, or scratches in the main rotor blade spar may be repaired within certain limits given in figure 2–5.

a. Determine maximum depth of damage permitted in damaged area.

CAUTION

Damage may continue across the area boundary so that it is actually contained in two or three areas. In such cases, the limits for each area will apply to that portion of the damage contained in the area.

Note

The spanwise or chordwise location of damage within an area does not affect the depth limitations.

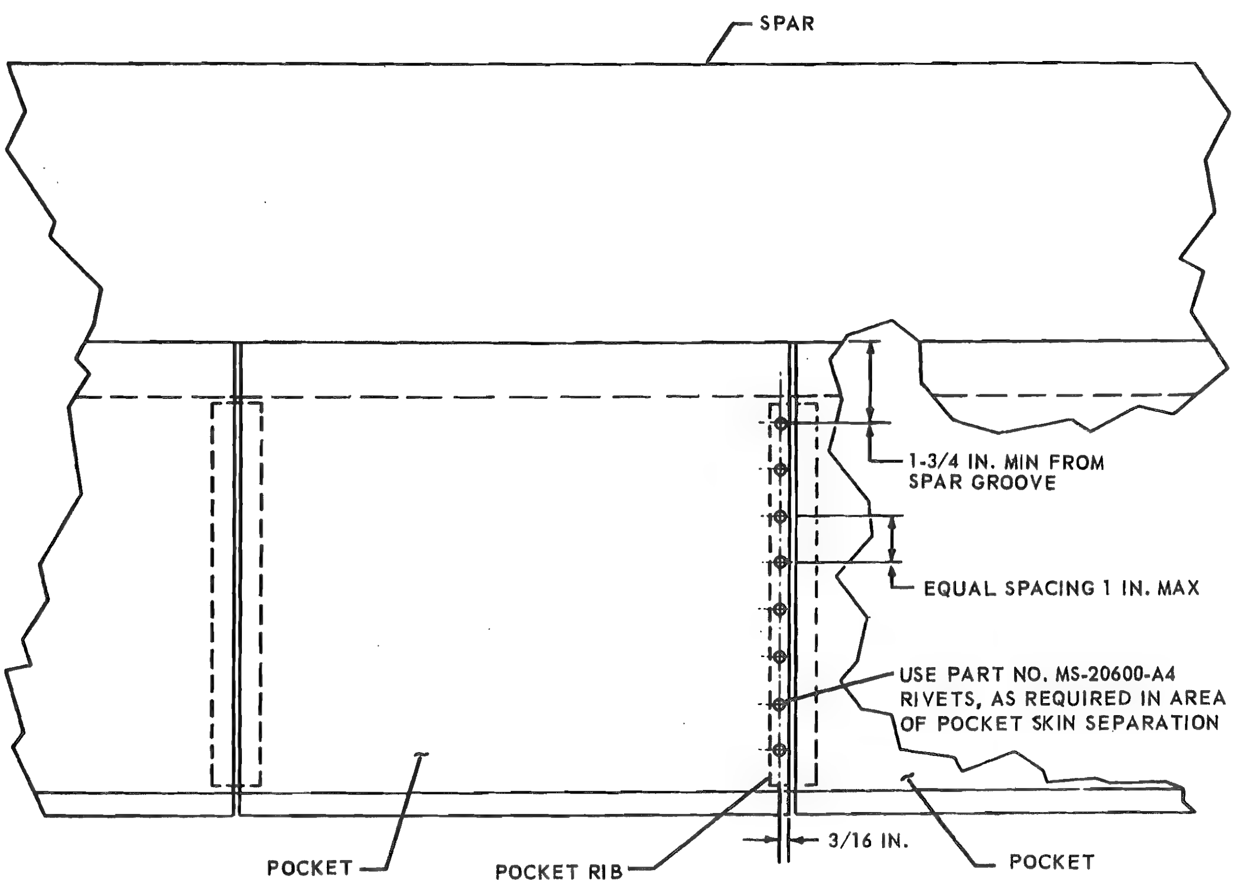


Figure 2–6. Repair of Pocket Skin Separation from Pocket Rib

b. If damage appears to be repairable, use single cut mill file or No. 80 Carborundum Aloxite Metal Cloth to remove damage.

CAUTION

Do not go deeper than the bottom of the damage, or remove a larger area of material than necessary, as this will unnecessarily weaken the structure.

c. When the damage has been removed completely, carefully measure depth of repair. This must be no deeper than the limits established for the area. (See figure 2–5.)

d. Using No. 240 Carborundum Aloxite Metal Cloth, or fine sandpaper, remove all file marks and blend the area so that depth is at least 0.002 inch deeper than depth of damage. The width of the blend area must be at least 10 times the depth of the final rework in areas A and B, and at least 30 times the depth of the final rework in areas C through F. (See figure 2–5.)

CAUTION

Do not use emery cloth for any sanding since fine particles of emery abrasive will remain embedded in the aluminum which is conducive to accelerated corrosion, thereby necessitating repairs which could otherwise be avoided.

e. Apply protective Alodine finish as outlined in steps *f* through *j* to areas of spar from which anodic film has been removed during repair.

f. Clean repaired area thoroughly with lacquer thinner, Federal Specification TT-T-266, and allow thinner to evaporate.

CAUTION

Do not allow lacquer thinner to seep into the joints where the pockets are bonded to the spar. Thinner is a solvent and will weaken the bond.

g. Rinse area with clean, fresh water applied with a clean lintless cloth.

h. Apply Alodine solution, Military Specification MIL-C-5541, liberally with swab.

i. Allow solution to remain on surface for not less than 1 minute, and not more than 5 minutes.

Note

Avoid letting the Alodine solution dry on the surface. If it has dried, rewet the surface.

j. Rinse Alodine-treated surface with clean, fresh water. After rinsing, wipe off excess moisture with clean lintless cloth. Air-blow any moisture from joints or crevices and allow to dry completely in clean, dry air.

Note

If Alodine solution, Military Specification MIL-C-5541, cannot be obtained, the procedures in steps *k* and *l* will serve as a temporary finish.

k. When area is completely dry, spray refinished area with light coat of zinc-chromate primer, Military Specification MIL-P-8585, and allow primer to dry approximately 30 minutes.

l. When zinc-chromate primer has dried, spray on one coat of proper color lacquer. Refer to paragraph 2–17, steps *c* and *d*, for painting instructions.

2–10. REPAIR OF NICKS OR SCRATCHES IN MAIN ROTOR BLADE CUFF. Blend out nicks, dents, or scratches in the main rotor blade cuff which do not exceed 0.010 inch in depth to the surrounding surface with No. 00 fine sandpaper. After removing damage, protect surface from rust or corrosion by applying brush coat of zinc-chromate primer, Military Specification MIL-P-8585. Allow at least 30 minutes for primer to dry, then spray repaired area with single coat of proper color lacquer. Refer to paragraph 2–17, steps *c* and *d* for painting instructions.

CAUTION

Do not make repairs to the taper pin holes. Such repairs are beyond the scope of this manual.

2–11. DAMAGE REPAIRABLE BY PATCHING. Holes in the blade pockets may be patched with either a bonded aluminum or bonded fabric patch provided the holes and the patch are within the limitations described in paragraph 2–4, steps *b*, *c*, and *e*. Small symmetrical holes in the pockets, 1 inch or less in diameter after trimming, may be repaired with Scotch Brand aluminum tape No. 425 as follows:

Note

The temperature of the patch area of the pocket skin should be at least 10° C (50° F) before the aluminum tape patch is applied in order to obtain proper adhesion of the patch. Warm the area of the pocket skin if the temperature is less than required.

a. Trim hole in pocket skin with snips to remove jagged edge.

b. Use fine file to remove sharp or burred edge of trimmed hole. Bend edge of trimmed skin slightly toward honeycomb core to provide smooth, flat surface when the patch is applied.

c. Use masking tape and mask off rounded area on the skin 1-1/8 inches from and around the edge of the trimmed hole. This will provide a 1-inch overlap area for the patch.

d. Use clean, lintless cloth moistened with lacquer thinner, Federal Specification TT-T-266, to remove paint inside masked area and to clean bare metal. Wipe area dry with clean, lintless cloth.

CAUTION

Do not allow the lacquer thinner to come in contact with the bonding adhesive in the areas where the pocket is bonded to the spar or where the honeycomb core is bonded to the pocket skin. Thinner is a solvent and will weaken the bond.

e. Make either paper or cardboard patch template approximately same size as cleaned patch area inside masking tape. Trim template 1/8 inch short of the masking tape edges.

f. Use scissors and cut piece of Scotch Brand aluminum tape No. 425 to the shape and size of template.

CAUTION

Do not place the adhesive side of the aluminum tape patch against the paper template, since contamination of the adhesive will restrict the security of the patch.

g. Carefully place aluminum tape patch in place over damaged area on skin and approximately 1/8 inch away from edges of masking tape. Use clean lintless cloth and rub aluminum tape patch to pocket skin, making sure edge of patch adheres firmly to pocket.

CAUTION

Do not rub or depress the foil patch over the area of the trimmed hole.

h. Remove masking tape from blade and spot-spray patch area as described in paragraph 2–17.

Note

The Scotch Brand aluminum tape patch on the blade pocket should be inspected frequently for security to the pocket. A new aluminum tape patch may be applied in place of an insecure patch as often as required, provided the pocket skin does not become cracked as a result of the initial damage.

2–12. DAMAGE REPAIRABLE BY INSERTION. Holes in the rotor blade pockets which cannot be patched with bonded aluminum or bonded fabric, according to the limitations in paragraph 2–4, steps *b* and *c*, may be repaired by filling with Scotch Coat resin, manufactured by Minnesota Mining and Manufacturing Co. Refer to paragraph 2–13 for alternate resin filler. Scotch Coat resin is available in 2-1/2 ounce Unipak containers or 12-1/2 ounce Unipak containers. The 2-1/2 ounce container is sufficient to fill a 3 cubic-inch area and weighs approximately 0.21 pound when mixed without vermiculite or a grated cork expander, Federal Specification HH-C-571. This amount of resin will increase the weight of the blade by approximately two-thirds of the resin weight, or 0.15 pound after the excess has been removed and the remainder sanded smooth with the contour of the pocket surfaces. If 50 percent by weight of grated cork or vermiculite is added to the 0.21 pound of liquid resin, the weight added to the blade will then be reduced to approximately 0.075 pound.

a. See figure 2–2 for sections, zones, and additional weight limitations applied to repair of blade pockets. Replace blade if weight of resin required to fill hole exceeds weight limitations in figure 2–2.

b. Trim hole in pocket skin with snips to remove jagged edges and round off all sharp corners.

Note

Do not trim the foil honeycomb core out of the pocket.

c. Use fine file to remove sharp or burred edges of trimmed skin. Bend trimmed edge of skin inward toward honeycomb core.

d. Use masking tape and mask trimmed area approximately 4 to 6 inches from trimmed edge on all sides in preparation for cleaning and filling damaged area. (See figure 2–3.)

Note

Repeat steps *b* through *d* on the opposite side of the blade if the damage runs completely through the pocket.

e. Use clean, lintless cloth dampened with lacquer thinner, Federal Specification TT-T-266, and remove paint to bare metal around the damage within masked area. Use clean cloth and wipe area dry.

CAUTION

Do not allow any lacquer thinner to seep into the hole and between the pocket skin and the honeycomb core, or into the areas where the pocket is bonded to the spar. Thinner is a solvent and will weaken the bond.

Note

Steps *f* through *h* are procedures which involve repair of a damage that runs completely through both sides of the pocket. Step *i* gives the repair for damage to one side of the pocket skin only.

f. Mix resin filler according to instructions on Unipak container in quantity not to exceed weight limitations for particular section and zone of the blade shown in figure 2–2. Pour liquid resin into clean, preweighed glass container and add up to 50 percent by weight of grated cork or vermiculite and stir well.

CAUTION

Weigh the expanded resin, allowing for the weight of the glass container, to make sure the weight of the resin does not exceed the limitations for the area shown in figure 2–2.

g. Use clean putty knife and compress expanded resin halfway into the hole in pocket. Mask over entire area of resin with wide masking tape to keep resin from dropping loose when blade is turned over to fill damage through opposite side.

h. Turn blade over and compress expanded resin into hole with putty knife until resin has humped approximately 3/16 inch above blade surface. Make sure resin has also humped against masking tape on opposite side of blade. Allow resin filler to set or harden for approximately 24 hours. (See figure 2–3.)

i. If damage affects skin on one side of pocket only, lightly compress honeycomb core in trimmed area to prevent resin from seeping through. Use putty knife and fill damage area with resin filler allowing approximately 3/16-inch hump above blade surface. (See figure 2–3.)

j. Use sharp, three-cornered scraper and evenly scrape excess resin leaving approximately 1/16-inch hump for sanding.

CAUTION

When scraping the excess resin, stay within the masked area and do not scrape into the pocket skin since the skin is only 0.016-inch thick.

k. Use No. 00 fine sandpaper in flat, nonrotating vibrator sanding machine and sand resin smooth to blend with airfoil contour of blade. (See figure 2–4.)

CAUTION

Do not sand any more of the bare metal skin than is absolutely necessary.

l. After repair area has been sanded smooth and air holes in surface of hardened resin have developed, use putty knife and squeeze sufficient quantity of lacquer putty into air holes. Allow putty to harden for approximately 2 hours and sand smooth.

m. Wipe all resin and paint dust from repair area with clean, lintless cloth dampened with lacquer thinner, Federal Specification TT-T-266, and wipe dry.

n. Areas of pocket skin from which anodic film (anodize) has been removed during sanding must be given protective Alodine finish as outlined in paragraph 2–9, steps *f* through *j*.

o. After application of Alodine solution, remove masking tape and spot-spray repaired area of pocket as outlined in paragraph 2–17, steps c and *d*.

2–13. ALTERNATE RESIN MIXTURE. Refer to paragraph 4–57, step a for mixing Epon resin filler, No. 828, manufactured by Shell Chemical Co., New York, N. Y. if the Scotch Coat resin is not available.

2–14. DAMAGE NECESSITATING REPLACEMENT OF PARTS. A damaged tip cap, root cap, and root pocket inboard rubber seal (figure 2–1) are the only parts of the main rotor blade that can be replaced.

2–15. REPLACING TIP CAP.

a. Remove 10 screws, part No. AN507-832R8, securing leading edge portion of tip cap to spar. Remove eight screws, part No. AN507-832R6, securing trailing edge portion of tip cap to pocket rib. Remove tip cap from blade.

CAUTION

The weights bolted to the blade spar under the tip cap must not be altered or disturbed in any way. If there is lead wool cemented inside the tip cap, it should not be disturbed unless necessary when repairing the tip cap. When the repairs are completed, the lead wool must be recemented in the same location. The lead wool should be located in the V inside the tip cap within the area which starts 1 inch from, and ends 3-1/2 inches from, the leading edge of the blade. A new tip cap should weigh 0.780 pound.

b. Use clean lintless cloth moistened with lacquer thinner, Federal Specification TT-T-266, to remove all dirt and other foreign matter from mating area on spar, pocket rib, and tip cap.

CAUTION

Do not allow any lacquer thinner to seep into the joints where the pocket is bonded to the spar. Thinner is a solvent and will weaken the bond.

c. When cementing lead wool inside tip cap, clean area of oil, grease, soapstone, or dirt using clean, lintless cloth moistened with lacquer thinner, Federal Specification TT-T-266.

d. Apply two brush coats of cement, Military Specification MIL-C-4003, over cleaned surface allowing first coat to dry at least 30 minutes before applying second coat. The second coat should be allowed to dry until most of the solvent has evaporated and the cement exhibits an aggressive tack. This will require approximately 10 minutes.

e. Press lead wool firmly to cement and allow to dry at room temperature at least 24 hours.

f. Before installing tip cap on main rotor blade, coat contacting surfaces of spar, pocket rib, and tip cap with sealing compound, Military Specification MIL-S-7916.

g. Install new or repaired tip cap on tip of blade using screws, part No. AN507-832R8, in the first five top and bottom holes from leading edge, and screws, part No. AN507-832R6, in remaining four top and bottom holes aft of leading edge spar. Refer to paragraph 2–17, steps *c* and *d* for refinishing blade tip surface.

2–16. REPLACING ROOT CAP. (See figure 2–7.)

a. Remove five top and bottom blind rivets that attach root cap to blade pocket. Use 1/8-inch diameter drill to remove the rivet heads.

Note

Do not drill through the rivets unless a drill smaller than 1/8-inch diameter is used.

b. Since root cap is also cemented to pocket, soften cement with a clean lintless cloth moistened with lacquer thinner, Federal Specification TT-T-266, while simultaneously separating cap from pocket with thin phenolic or wood wedge starting at the trailing edge. Remove cap and root pocket rubber seal. Discard rubber seal.

CAUTION

Do not allow any lacquer thinner to seep into the areas where the pocket skin is bonded to the honeycomb core or the spar. Thinner is a solvent and will weaken the bond.

CAUTION

Do not dent, distort, scratch the surface, or cause any rough spots on the blade pocket as a result of using a tool to remove the root cap.

c. In order to transfer rivet holes in root pocket to new and undrilled root cap, it will be necessary to make hole locations layout on pocket and root cap as outlined in steps *d* through *g*. (See figure 2–7.)

d. Draw pencil line from center of each rivet hole in pocket approximately 2 inches long on both sides of pocket and toward tip end of blade. Keep pencil lines parallel to leading edge of blade.

e. Draw chordwise pencil line on both sides of root cap 1/4 inch from inboard or closed side of the cap.

f. Place root cap in position on root pocket and extend pencil lines on root pocket across chordwise pencil line on root cap. The points where the pencil lines on the root cap bisect each other indicate the location of rivet holes to be drilled.

g. Remove root cap from blade and, at each bisector point on cap, center-punch and drill No. 30 (0.128) hole. Remove all burrs from the root cap.

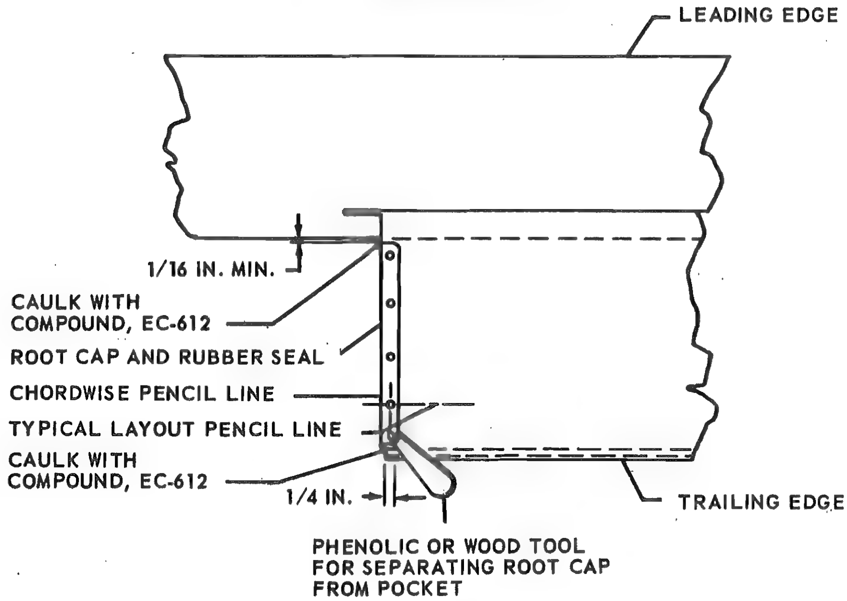


Figure 2–7. Root Cap Removal and Layout Diagram

h. Prepare mating surfaces of root cap, pocket skin, and rubber seal area in rib for cementing by thoroughly cleaning with lacquer thinner, Federal Specification TT-T-266.

CAUTION

Do not allow any lacquer thinner to seep into the joints where the pocket skin is bonded to the rib or the spar. Thinner is a solvent and will weaken the bond.

i. Apply brush coat of cement, Military Specification MIL-C-4003, over mating areas on pocket skin and all areas inside root cap. Also brush cement on all sides of the new root pocket rubber seal, part No. S10-10-2039-4, and areas inside pocket rib where rubber seal mates.

j. Insert the rubber seal into pocket rib.

k. Rivet root cap to root pocket using rivets, part No. MS20600AD4-1.

Note

The cement used on the root cap is only an air seal. It does not serve in any way as a bonding agent. The retention of the root cap is entirely dependent upon the rivets.

l. Caulk open area between root cap and pocket at trailing edge and area between root cap and spar with sealer compound EC-612, manufactured by Minnesota Mining and Manufacturing Co, St. Paul, Minnesota.

2–17. REFINISHING MAIN ROTOR BLADE SURFACES.

Note

In view of the nature of the adhesives, blade balancing, etc, repainting entire blade should not be attempted. Spot-spray repair areas only.

a. To remove old paint, use clean, lintless cloth moistened with lacquer thinner, Federal Specification TT-T-266.

CAUTION

Do not allow lacquer thinner to seep into joints where pockets are bonded to the spar. Thinner is a solvent and will weaken the bond. Cloths wet with thinner must never be left on the blade at any time.

b. Unless absolutely necessary, avoid stripping and reapplication of paint to trailing edge section (pockets) of blade. On refinishing of leading edge spar, mask off pocket sections at edge of area of attachment.

CAUTION

Do not use sandpaper or any other type of abrasive to remove old paint, since this will scratch through the protective anodize coating on the blades.

c. Before applying paint to area being refinished, clean bare metal with metal conditioner, Military Specification MIL-M-10578. Apply conditioner to area and rub in thoroughly. Allow it to remain for few minutes, then reapply conditioner and while it is wet, wipe blade completely dry. Use only clean white cloth for wiping to avoid any contamination of metal surface which will prevent proper adhesion of paint.

CAUTION

Do not allow any metal conditioner to seep into the joints where the pocket is bonded to the spar or into the gap between pockets.

d. Spray main rotor blades with light coat of zinc-chromate primer, Military Specification MIL-P-8585, then even coat of gull gray lacquer, Military Specification MIL-L-6805, on top surface of blade and even coat of camouflage black lacquer, Military Specification MIL-L-6805, on bottom surface. Finish tip cap with even coat of orange yellow lacquer, Military Specification MIL-L-7178, color No. 13538.

SECTION III

TAIL ROTOR GROUP

3–1. DESCRIPTION.

3–2. The tail rotor group of the helicopter (figure 3–1) is the section aft of fuselage station 448 and consists of the tail rotor blades, stabilizer, and pylon.

3–3. TAIL ROTOR BLADES.

3–4. DESCRIPTION. The tail rotor blades are of aluminum alloy construction. The structural supporting member of the blade assembly consists of a solid spar around which the skin is wrapped and bonded. The skin is bonded together at the trailing edge and forms an integral part of the blade structure. An aluminum foil honeycomb core is sandwiched and bonded between top and bottom skin and the trailing edge side of the spar to form structural support for the skin aft of the spar. The tip of the blade is sealed by means of a riveted tip cap, and the root end is sealed with a cemented balsa filler. The root end of the blade assembly is reinforced by a strap which is wrapped and bonded on both sides, and around the leading edge of the blade. Repair of the tail rotor blade is limited due to the construction of the all-metal blade.

3–5. CLASSIFICATION OF DAMAGE.

3–6. REPAIR LIMITATIONS TO TAIL ROTOR BLADES.

a. Cleaning tail rotor blades is restricted to use of mild soap and fresh water followed by a clean, fresh water rinse.

WARNING

Never use solvents or cleaners such as lacquer thinner, carbon tetrachloride, naphtha, etc. They will weaken bonding adhesive used in assembly of blade.

b. Any additional paint applied to blade surfaces, with the exception of minor touch-up, will tend to throw blade out of balance and should not be attempted.

3–7. NEGLIGIBLE DAMAGE.

3–8. CONDITIONS NOT REQUIRING REPAIR. Negligible damage not requiring repair consists of smooth, nonpuncturing dents in the skin, tip cap, or strap, unless they are suspected of causing tail rotor vibration. For replacement of the tip cap, refer to TM 55-1520-202-20, Chapter 2, Section VIII.

3–9. CONDITIONS REQUIRING REPAIR. Small cracks in the tip cap should be stop-drilled to prevent further spreading.

a. Nicks or scratches to that area of the spar shown as Section A-A (figure 3–2) must be filed smooth to blend with the surrounding area, and the rework must be kept to the dimensions shown in figure 3–2. The diameter of the blend area must be no less than 10 times the depth of the repair.

Note

Do not use metal abrasives or emery cloth for any sanding, since fine particles of metal abrasive will remain embedded in the aluminum, thus forming potential corrosion cells.

b. For application of protective finish to repaired areas, refer to paragraph 3–13.

3–10. DAMAGE REPAIRABLE BY PATCHING. (See figure 3–2.)

a. A small, symmetrical hole in the blade skin with a maximum diameter no greater than 1 inch and within certain restricted areas on the blade surface may be repaired with aluminum tape No. 425, manufactured by Minnesota Mining and Mfg Co. For patching instructions using aluminum tape, refer to paragraph 2–11.

Note

The aluminum tape patch on blade skin should be frequently inspected for security. A new aluminum tape patch may be applied in place of an insecure patch as often as required provided the skin has not become cracked as a result of the damage, in which case blade must then be replaced.

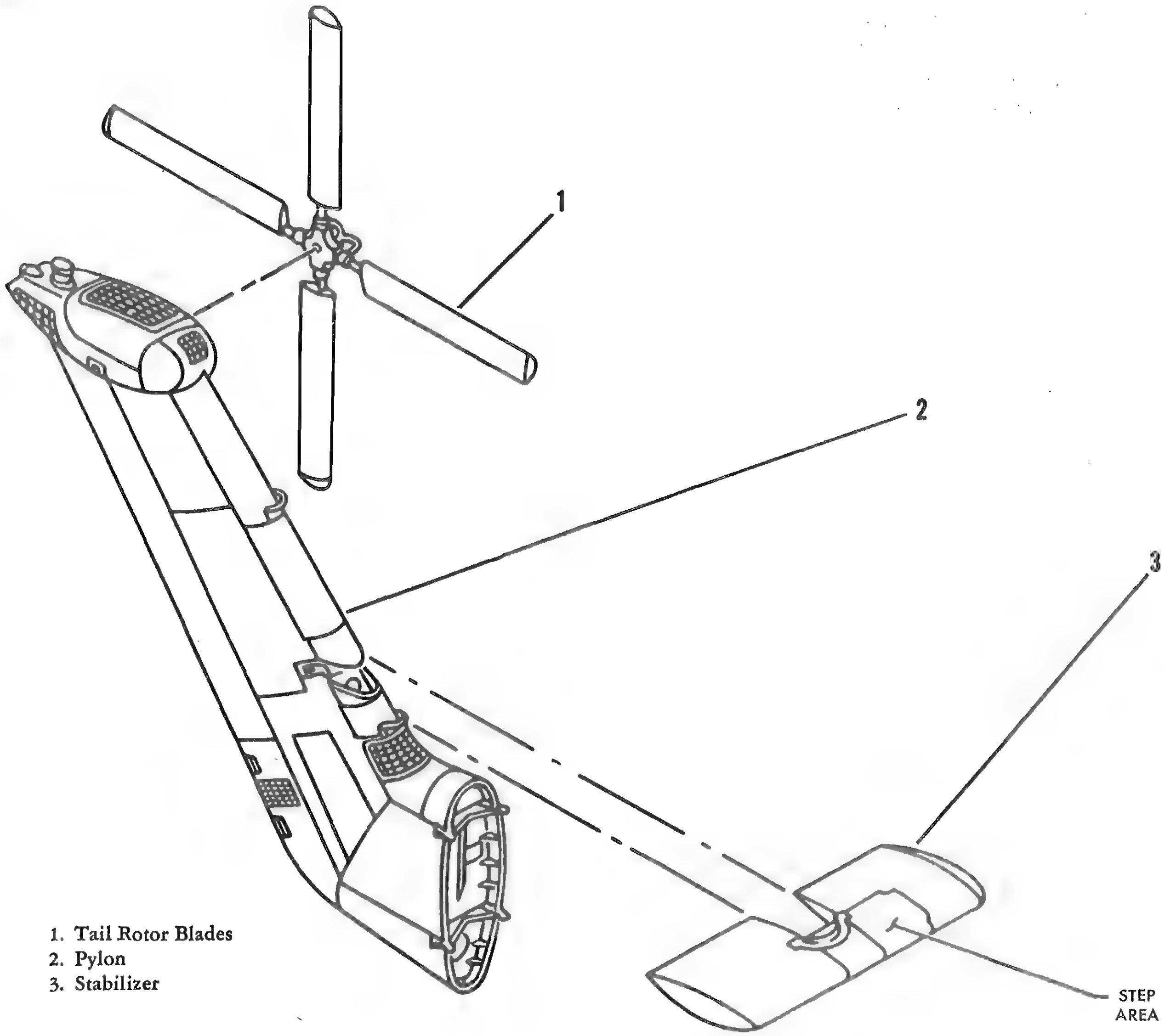


Figure 3–1. Exploded View – Tail Rotor Group

b. Spot-spray patch area with one coat of primer, Military Specification MIL-P-8585, and allow primer to dry approximately 30 minutes. Spot-spray primed area with an even coat of the proper lacquer. For paint requirements, refer to paragraph 3–13.

3–11. DAMAGE REPAIRABLE BY INSERTION. Tail rotor blades cannot be successfully repaired by insertion.

3–12. DAMAGE NECESSITATING REPLACEMENT.

Note

Tail rotor blades replaced due to damage in excess of the repair limitations specified below are to be condemned and disposed of locally.

a. Any separation of bonded skin from spar or honeycomb core may be determined by lightly pressing the skin for visible indications of oil canning. Movement of skin indicates bond separation necessitating replacement of tail rotor blade.

Note

Separations that are not readily visible can usually be detected by tapping lightly along the skin-to-spar bond area with a metal object such as a coin. Areas of separation will produce a sound different from areas where no separation exists.

CAUTION

Do not use a feeler gage or other metallic objects to determine or measure separation.

b. A hole, larger than 1 inch in diameter after trimming, makes repair by patching impractical and necessitates replacement of blade.

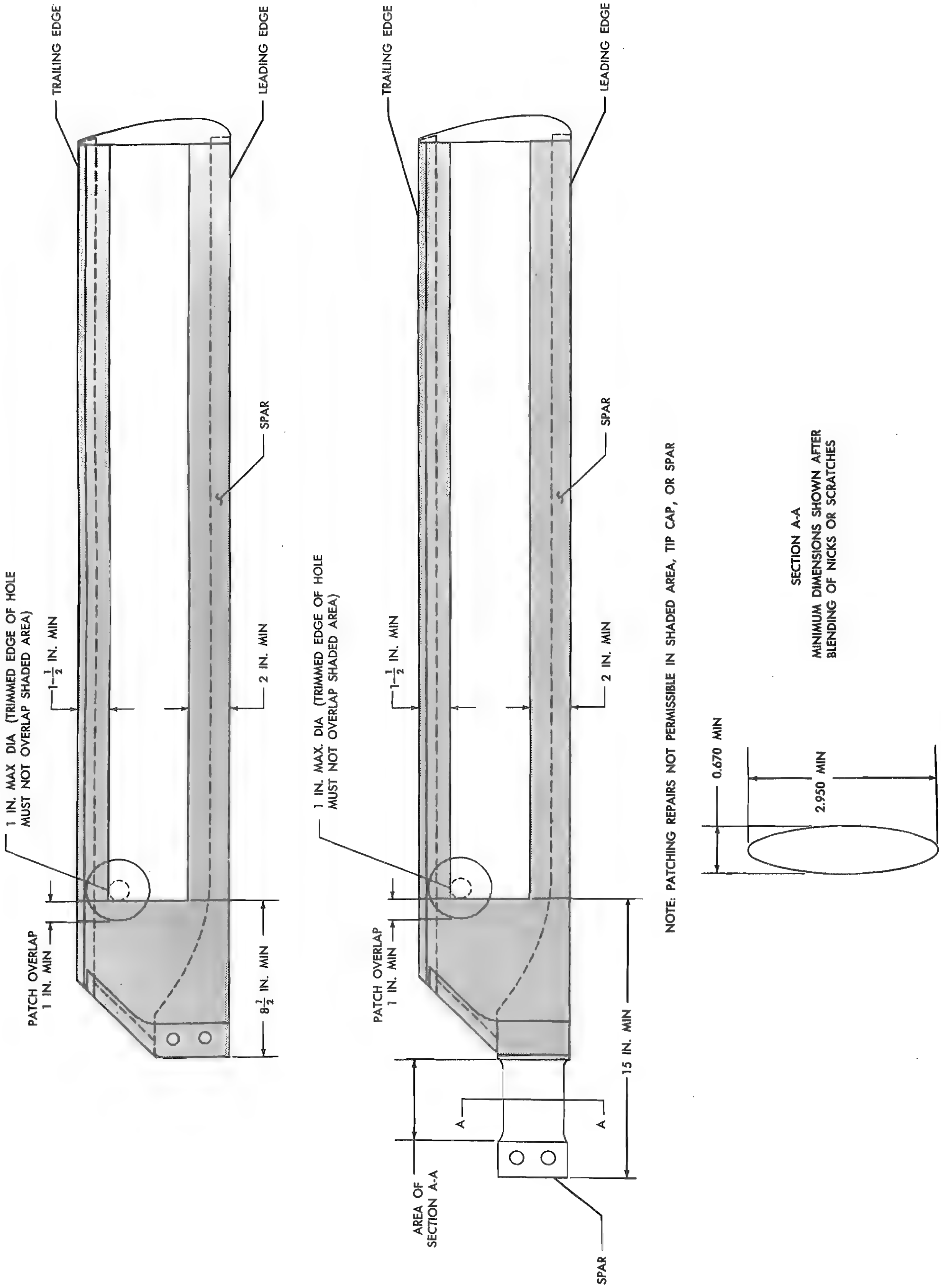


Figure 3-2. Patching Limitations to Tail Rotor Blade

c. A damaged tip cap is the only part of tail rotor blade that may be replaced. (Refer to TM 55-1520-202-20, Chapter 2, Section VIII.)

d. A small crack, or a dent in skin, which shows signs of cracking and cannot be trimmed to within the 1 inch diameter limitation for patching, necessitates replacement of blade.

e. Damage involving more than one hole in blade skin necessitates replacement of blade.

f. A hole, crack, or sharp dent in the shaded area of either blade assembly (figure 3–2), which shows signs of cracking, necessitates replacement of blade.

g. Any damage to that area of the spar at root end not contained within Section A-A will necessitate replacement of blade.

h. Any separation of bonded spanwise cap which is formed around both sides of trailing edge of pocket skin, or the strap at root end of blade, necessitates replacement of blade. Use paper to determine separation.

CAUTION

Do not use a feeler gage or other metallic objects to determine or measure separation.

3–13. REFINISHING TAIL ROTOR BLADE SURFACES. Beginning at the end of the tip cap, there are three 6-inch wide bands, two of bright red lacquer, No. 31136, Military Specification MIL-L-6805, separated by one of white lacquer, No. 37875, Military Specification MIL-L-6805. The remainder of the blade is black lacquer, No. 37038, Military Specification MIL-L-6805, except for the root, which is painted with bright red lacquer.

Note

Touch up only those areas of blade which require refinishing.

a. Clean affected area thoroughly with thinner, Military Specification MIL-T-6095, to remove grease and old paint. Allow the thinner to evaporate.

b. Wash cleaned area with a mild soap and clean, fresh water followed by a clean water rinse. Wipe dry with a clean, lintless cloth.

c. Apply Alodine, Military Specification MIL-C-5541, liberally with a swab.

d. Allow solution to remain on surface for not less than 1 minute and not more than 5 minutes.

Note

Do not allow Alodine to dry on surface. If it does dry, retreat with more Alodine.

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

f. When area is completely dry, spray on one light coat of pretreatment coating, Military Specification MIL-C-8514, over Alodized area. Allow coating to dry approximately 30 minutes.

g. Spray one coat of lacquer, Military Specification MIL-L-6805, over the primed area to match original finish.

3–14. STABILIZER.

3–15. DESCRIPTION. (See figures 3–3 and 3–4.) The stabilizer, of semimonocoque construction, is mounted on the pylon by three 2014 aluminum alloy fittings. Three chordwise sections of ribs, forward, center, and aft sections, are riveted to two spars and provide the structural support for the magnesium alloy skin panels. A step area (figure 3–1) of 0.032-inch magnesium alloy sheet, reinforced with plastic foam manufactured by Armour & Co., under the skin, is provided on the stabilizer in the four-bay area beginning chordwise from the leading edge to the aft spar, and spanwise from the third left rib to the fifth left rib. The step area is covered with nonslip walkway coating, Military Specification MIL-W-5044. The tip ends of the stabilizer are sealed with a 0.025-inch magnesium alloy cap riveted to the outboard ribs. One aluminum fitting is riveted to the center of the forward 0.051-inch aluminum alloy spar to provide an attachment point for the turnbuckle used to adjust the angle of incidence of the stabilizer. Two aluminum fittings are riveted to the aft 0.072-inch aluminum alloy spar to provide a hinge or pivot point.

3–16. CLASSIFICATION OF DAMAGE TO STABILIZER RIBS. (See figure 3–4.)

3–17. NEGLIGIBLE DAMAGE. Small, smooth, isolated dents which are free from cracks, abrasions, or sharp corners, may be considered negligible if rivets and adjacent structure are not affected. Refer to table 3–I for limitations on negligible damage.

3–18. DAMAGE REPAIRABLE BY PATCHING AND INSERTION. (See figure 10–4.) Damage to any rib would invariably affect the skin plating

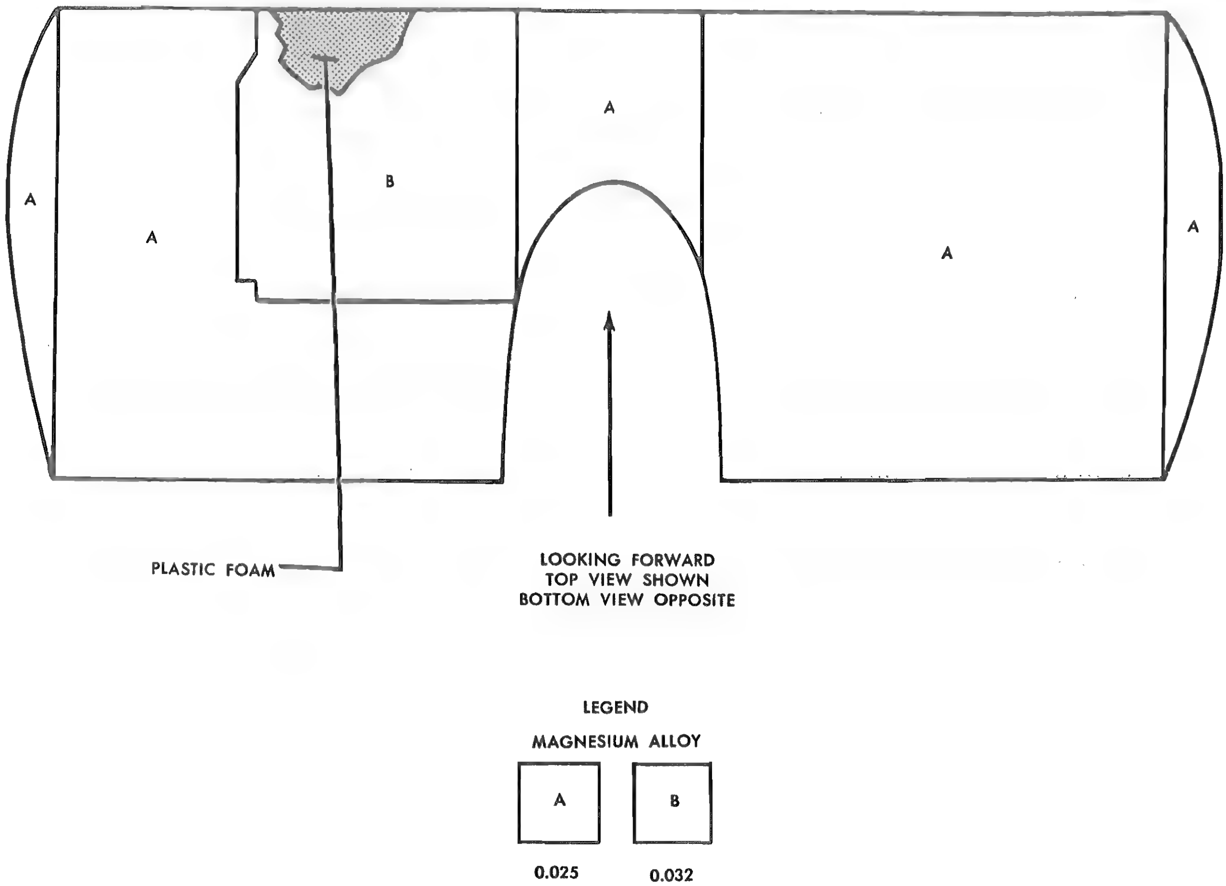


Figure 3–3. Stabilizer Skin Plating Diagram

and necessitate repairs by additional strengthening members and patching. Repair methods for the aluminum and magnesium alloy ribs are identical except for the material used. On aluminum alloy ribs, the patch angle should be 0.050 inch, 7075-T6 Alclad fastened with AN470-AD6-5 rivets in the web area. On magnesium alloy ribs, the patch angle should be 0.032-inch magnesium fastened with AN470B5-4 rivets in the web. For rivet pattern, see figure 10–2.

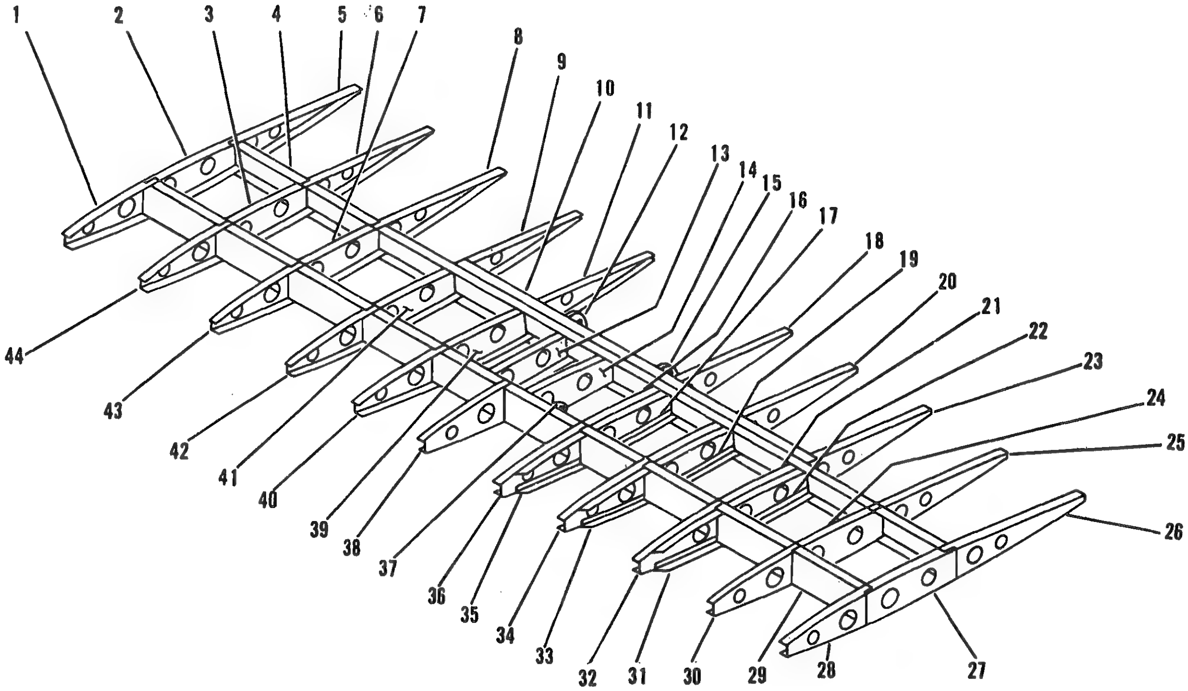
3–19. DAMAGE NECESSITATING REPLACEMENT. Damage to the attachment portion of any rib (figure 3–4), or where damage to the forward or aft sections of a rib allows less than 3 inches remaining from the forward or aft spar after the damaged area is trimmed, requires replacement of the entire rib. A new section replacing a damaged portion of a forward or aft section of a rib may be riveted to the trimmed rib provided the distance is not less than 3 inches to the trim line from the spar. For typical rib section replacement, see figure 3–5. Damage to an aluminum rib and support angle which support the step area skin requires replacement of the rib and angle.

3–20. CLASSIFICATION OF DAMAGE TO SPAR. (See figure 3–4.)

3–21. NEGLIGIBLE DAMAGE. Limitations and treatment of negligible damage to the spars may be found in table 3–I.

3–22. DAMAGE REPAIRABLE BY PATCHING. Nicks, holes, sharp dents, or deep scratches in the forward spar web which are beyond negligible classification should be patched as shown in figures 10–3 and 10–4. Use 5/32-inch diameter, type B rivets when fastening the skin.

3–23. DAMAGE REPAIRABLE BY INSERTION. Damage to the aft spar web and extruded angle cap support on the top and bottom portion of the spar should be repaired as shown in figure 10–5. The overlap of the patch angle should be sufficient to employ the use of seven 5/32-inch diameter, type B rivets through the skin and web on each side of



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Paragraph Reference	Figure Reference
1	Rib — Fwd	Mag	0.032	Mag	0.040	Para 3–15	10–4
2	Rib — Center	Mag	0.032	Mag	0.040		10–8
3	Rib — Center	Mag	0.032	Mag	0.040		10–8
4	Spar — Aft	Alclad	0.071	Alclad	0.080		10–8
5	Rib — Aft	Mag	0.025	Mag	0.032		10–4
6	Rib — Aft	Mag	0.025	Mag	0.032		10–4
7	Rib — Center	Mag	0.032	Mag	0.040		10–8
8	Rib — Aft	Mag	0.025	Mag	0.032		10–4
9	Rib — Aft	Mag	0.025	Mag	0.032		10–4
10	Angle	Al Alloy Alcoa	—— 65690	Replace	——		
11	Rib — Aft	Mag	0.025	Mag	0.032		10–4
12	Fitting — Aft	Al Alloy	——	Replace	——		
13	Rib — Center	Alclad	0.050	Alclad	0.063		10–8
14	Rib — Center	Alclad	0.050	Alclad	0.063		10–8
15	Fitting — Aft	Al Alloy	——	Replace	——		
16	Rib — Center	Alclad	0.050	Alclad	0.063		10–8
17	Angle — Center	Alclad	0.050	Replace	——		
18	Rib — Aft	Mag	0.025	Mag	0.032		10–4
19	Angle — Center	Alclad	0.050	Replace	——		
20	Rib — Aft	Mag	0.025	Mag	0.032		10–4
21	Rib — Center	Alclad	0.050	Alclad	0.063		10–8
22	Angle — Center	Alclad	0.050	Replace	——		
23	Rib — Aft	Mag	0.025	Mag	0.032		10–4
24	Rib — Center	Mag	0.032	Mag	0.040		10–8
25	Rib — Aft	Mag	0.025	Mag	0.032		10–4
26	Rib — Aft	Mag	0.025	Mag	0.032		10–4
27	Rib — Center	Mag	0.032	Mag	0.040		10–8
28	Rib — Fwd	Mag	0.032	Mag	0.040	Para 3–15	10–4
29	Spar — Fwd	Alclad	0.051	Alclad	0.063		10–8
30	Rib — Fwd	Mag	0.032	Mag	0.040	Para 3–15	10–4
31	Angle — Fwd	Alclad	0.050	Replace	——		
32	Rib — Fwd	Alclad	0.050	Alclad	0.063	Para 3–15	10–4
33	Angle — Fwd	Alclad	0.050	Replace	——		
34	Rib — Fwd	Alclad	0.050	Alclad	0.063	Para 3–15	10–4
35	Angle — Fwd	Alclad	0.050	Replace	——		
36	Rib — Fwd	Alclad	0.050	Alclad	0.063	Para 3–15	10–4
37	Fitting — Fwd	Al Alloy	——	Replace	——		
38	Rib — Fwd	Mag	0.032	Mag	0.040	Para 3–15	10–8
39	Rib — Center	Alclad	0.050	Alclad	0.063		10–8
40	Rib — Fwd	Alclad	0.051	Alclad	0.063	Para 3–15	10–4
41	Rib — Center	Mag	0.032	Mag	0.040		10–8
42	Rib — Fwd	Mag	0.032	Mag	0.040	Para 3–15	10–4
43	Rib — Fwd	Mag	0.032	Mag	0.040	Para 3–15	10–4
44	Rib — Fwd	Mag	0.032	Mag	0.040	Para 3–15	10–4

Figure 3–4. Stabilizer Skeleton Diagram

Table 3–1. Negligible Damage (Sheet 1 of 3)

NOMENCLATURE	DENTS Depth (Inches)	DENTS Treatment	SCRATCHES Depth (Inches)	SCRATCHES Treatment	CRACKS Depth (Inches)	CRACKS Treatment	NICKS Depth (Inches)	NICKS Treatment
Ribs	1/8	No Repair	0.005	Blend		Stop-Drill and Patch (figure 10–4)	0.005	Blend
	1/8+	Patch (figure 10–8)	0.005+	Stop-Drill and Patch (figure 10–4)		Stop-Drill and Patch (figure 10–2)	0.005+	Drill and Patch (figure 10–4)
Fittings	None		0.015	Blend	None		0.015	Blend
			0.005+	Replace			0.015+	Replace
Spar	1/16	No Repair	0.005	Blend		Stop-Drill and Patch (figure 10–4)	0.005	Blend
	1/16+	Patch (figure 10–4)	0.005+	Stop-Drill and Patch (figure 10–8)			0.005+	Drill and Patch (figure 10–8)
Spar Angle (Rear Spar)	None		0.005	Blend		Replace	0.005	Blend
Tip Caps	1/4	No Repair	0.004	Blend	1	Stop-Drill and Patch (figure 10–1)	0.005	Blend
	1/4+	Straighten	0.004+	Stop-Drill and Patch (figure 10–1)	1+	Stop-Drill and Patch (figure 10–1)	0.005+	Drill and Patch (figure 10–1)
Fairings	Same as Tip Caps		0.004	Blend		Stop-Drill	0.005	Blend
			0.004+	Stop-Drill			0.005+	Drill out
PYLON								
Skin – Center Cell Area	1/8	No Repair	0.004	Blend		Stop-Drill and Patch (figure 10–3)	0.004	Blend
	1/8+	Patch (figure 10–3)	0.004+	Stop-Drill and Patch (figure 10–3)		Stop-Drill and Patch (figure 10–3)	0.004+	Drill and Patch (figure 10–3)
Outer Cell Area	1/8	No Repair	0.004	Blend		Stop-Drill and Patch (figure 10–2)	0.004	Blend
	1/8+	Patch (figure 10–2)	0.004+	Stop-Drill and Patch (figure 10–3)			0.004+	Drill and Patch

Table 3–1. Negligible Damage (Sheet 2 of 3)

	DENTS		SCRATCHES		CRACKS		NICKS	
NOMENCLATURE	Depth (Inches)	Treatment	Depth (Inches)	Treatment	Depth (Inches)	Treatment	Depth (Inches)	Treatment
SKELETON								
Beam Webs	3/16	No Repair	0.004	Blend	1	Stop-Drill and Patch	0.004	Blend
	3/16+	Para 3–39	0.004+	Para 3–39	1+	Para 3–39	0.004+	Para 3–39
Stringers	None		0.004	Blend	None	Para 3–54	0.004	Blend
			0.004+	Para 3–54			0.004+	Para 3–54
Formers	3/16	No Repair	0.004	Blend			0.004	Blend
	3/16+	Patch	0.004+	Stop-Drill and Patch		Stop-Drill and Patch (figure 10–4)	0.004+	Drill and Patch (figure 10–3 and 10–4)
Frames	1/8	No Repair	0.004	Blend			0.004	Blend
	1/8+	Patch (figure 10–3)	0.004+	Stop-Drill and Patch (figure 10–3)		Stop-Drill and Patch (figure 10–3)	0.004+	Drill and Patch (figure 10–3)
Tubular Truss	None	Replace	None	Replace	None	Replace	None	Replace
Canted Bulkhead	None	Para 3–44	0.004	Blend	None	Para 3–44	0.004	Blend
			0.004+	Stop-Drill and Patch (figure 10–3)			0.004+	Drill and Patch (figure 10–3)
Hinge Fitting – Stabilizer	None	Para 3–49	0.015	Blend	None	Para 3–49	0.015	Blend
			0.015+	Para 3–49			0.015+	Para 3–49
Adjustment Fitting – Stabilizer	None	Replace	0.015	Blend	None		0.015	Blend
			0.015+	Replace			0.015+	Replace
Hinge Fitting – Pylon	None	Para 3–49	0.015	Blend	None		0.015	Blend
			0.015+	Para 3–49			0.015+	Para 3–49
Fitting – Int Gear Box	None	Replace	0.015	Blend	None		0.015	Blend
			0.015+	Replace			0.015+	Replace
Fitting – Tail Gear Box	None	Para 3–49	0.032	Para 3–49	None	Para 3–49	0.032	Para 3–49
Bulkhead Webs	1/8	No Repair	0.004	Blend		Para 3–44	0.004	Blend
	1/8+	Patch (figure 10–2)	0.004+	Stop-Drill and Patch (figure 10–3)			0.004+	Drill and Patch (figure 10–3)
Cap Strips	None	Para 3–54	0.004	Blend	None	Para 3–54	0.004	Blend
			0.004+	Para 3–54			0.004+	Para 3–54
STABILIZER								
Skin (Fwd of rear spar)	1/8	No Repair	0.004	Blend	1	Stop-Drill and Patch (figure 10–1)	0.004	Blend
	1/8+	Patch (figure 10–2)	0.004+	Stop-Drill and Patch (figure 10–2)	1+	Stop-Drill and Patch (figure 10–2)	0.004+	Drill and Patch (figure 10–1)

Table 3–I. Negligible Damage (Sheet 3 of 3)

NOMENCLATURE	DENTS Depth (Inches)	DENTS Treatment	SCRATCHES Depth (Inches)	SCRATCHES Treatment	CRACKS Depth (Inches)	CRACKS Treatment	NICKS Depth (Inches)	NICKS Treatment
Skin (Aft of rear spar)	3/16	No Repair	0.004	Blend	1	Stop-Drill and Patch (figure 10–1)	0.004	Blend
	3/16	Patch (figure 10–2)	0.004+	Stop-Drill and Patch (figure 10–2)	1+	Stop-Drill and Patch (figure 10–2)	0.004+	Drill and Patch (figure 10–1)

the splice angle from the trimmed damage. For single-row pattern and spacing, see figure 10–2.

3–24. DAMAGE NECESSITATING REPLACEMENT. Damage to either the forward or aft spar causing distortion not repairable by patching or insertion requires replacement of the stabilizer.

3–25. CLASSIFICATION OF DAMAGE TO SKIN. (See figure 3–3.)

3–26. NEGLIGIBLE DAMAGE. Nonpuncturing dents, not exceeding 1/8 inch in the skin forward of the aft spar, and not exceeding 3/16 inch in the skin aft of the aft spar, need not be repaired if the skin is free from cracks, abrasions, and stress wrinkles, the rivets are not affected, and the structure is not distorted. Nicks and scratches in the skin, not exceeding 0.004 inch in depth, should be sanded smooth to blend with the surrounding area. Use No. 00 fine sandpaper. Scratches deeper than 0.004 inch, and all cracks, should be stop-drilled and the damaged area reinforced with a doubler, attached with Huck rivets. For proper Huck rivet selection, refer to paragraph 1–33. Refinish the surface area as described in TM 55-1520-202-20, Chapter 2, Section III, except, in the step area, apply one coat of nonslip walkway coating, Military Specification MIL-W-5044, before application of pigmented lacquer. For limitations on negligible damage, refer to table 3–I.

3–27. DAMAGE REPAIRABLE BY PATCHING. Isolated holes or damage to the skin, greater than negligible classification but 1 inch or less in diameter, should be repaired using a fabric patch as described in Section X. Damage to the skin exceeding the 1-inch limitation, or damage to the step area, should be repaired with a riveted magnesium patch as shown in figure 10–2. Use Huck rivets as described in paragraph 1–33.

3–28. DAMAGE REPAIRABLE BY INSERTION. This type repair will not be performed on stabilizer skin.

3–29. DAMAGE NECESSITATING REPLACEMENT. If damage to the skin affects four or more bay areas within a skin panel on either the top or bottom side, the affected skin panel should be replaced and fastened with Huck rivets. For proper Huck rivet selection, refer to paragraph 1–33.

3–30. CLASSIFICATION OF DAMAGE TO TIP CAPS, CENTER CAPS, AND FAIRINGS.

3–31. NEGLIGIBLE DAMAGE. Limitations and treatment of negligible damage to the tip caps may be found in table 3–I.

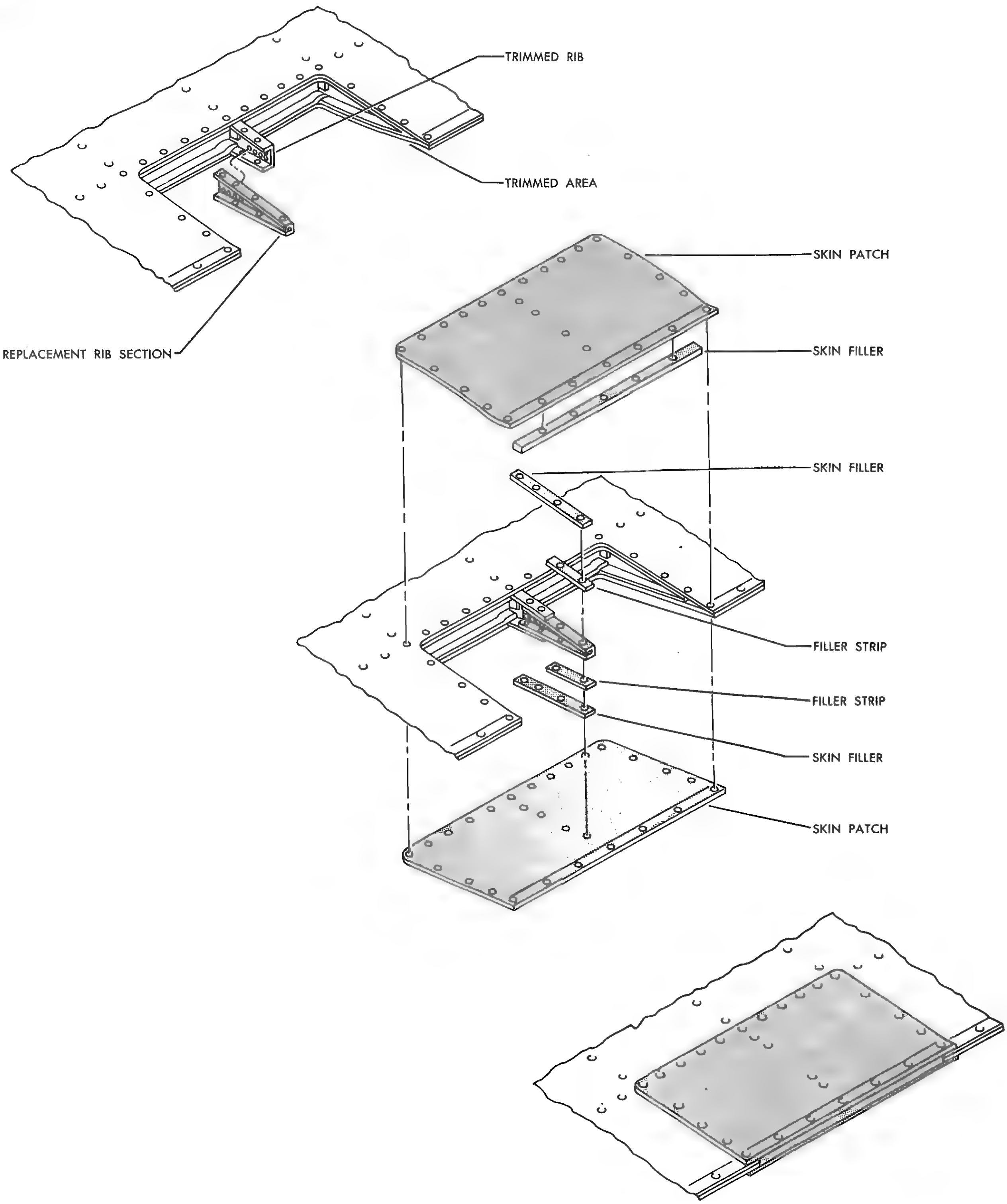
3–32. DAMAGE REPAIRABLE BY PATCHING. Scratches, nicks, cracks, or dents in the nonstructural tip cap or center fairing may be repaired by stop-drilling and patching. A bonded fabric patch may be used over the damaged areas in accordance with the instructions in paragraph 10–4.

3–33. DAMAGE REPAIRABLE BY INSERTION. Caps and fairings cannot be repaired by insertion.

3–34. DAMAGE NECESSITATING REPLACEMENT. Severe damage to either the tip caps, center caps, or center fairing, not repairable by patching, requires replacement of the part.

3–35. PYLON.

3–36. DESCRIPTION. (See figures 3–6 and 3–7.) The pylon is of semimonocoque construction and is composed of pylon skeleton and skin covering. In



NOTE

FOR RIVET TABLE
SEE FIG. 10-2 AND 10-3.

Figure 3–5. Stabilizer Rib Section Replacement

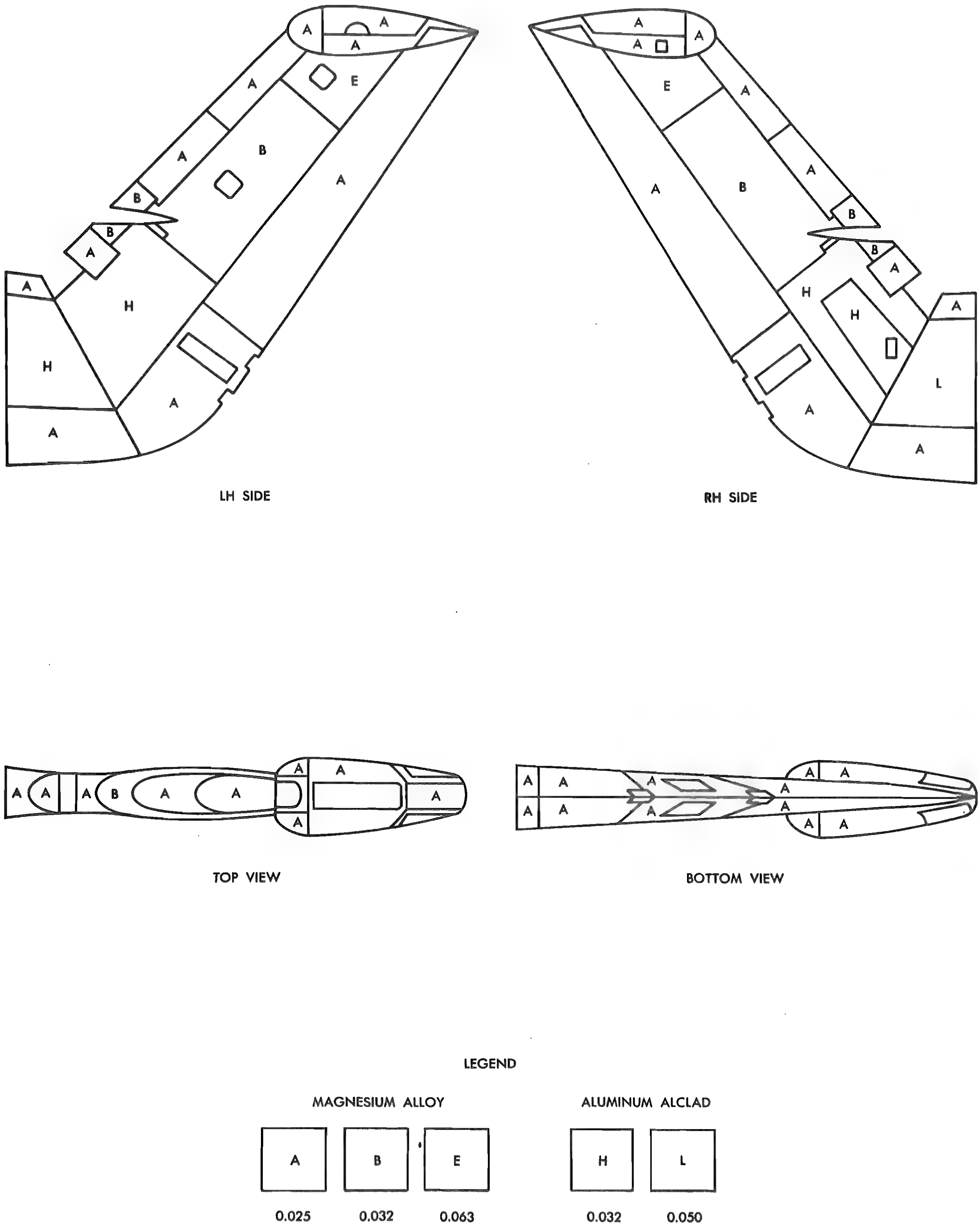


Figure 3–6. Pylon Skin Plating Diagram

detail, the structure consists of a three-cell box beam with only the center cell structurally effective. The structurally effective skin from fuselage station 448 to pylon station 65.9 is made of 7070-T6 aluminum alloy; while from pylon station 65.9 to pylon station 128.5 the skin consists of magnesium alloy. The leading edge cell of the pylon (from upper beam forward) and the trailing edge cell of the pylon (from lower beam aft) are considered nonstructural. The pylon ribs and formers are, for the most part, made of magnesium alloy with the exception of the redistribution bulkheads which are made of 7075-T6 aluminum alloy. The intermediate gear box is mounted on a magnesium forging which is an integral part of the bulkhead at pylon station 50.4. The tail rotor gear box is mounted on a magnesium alloy forging which is an integral part of the bulkhead at pylon station 128.5. The nonstructural fairing which encloses the tail rotor gear box is an airfoil consisting of two magnesium frames and magnesium skin.

3–37. PYLON SKELETON. (See figure 3–7.)

3–38. DESCRIPTION. The pylon skeleton consists of four main beams (forward, rear, upper, and lower), bulkheads, fittings, stringers, frames, formers, and supporting angles. The front and rear beams are located aft of the canted bulkhead and are secured to the upper and lower beams respectively by means of a splice fitting riveted to the canted bulkhead. The upper and lower beams are located forward of the canted bulkhead. The canted bulkhead and beams in the transition area are reinforced by cap strip angles on the right and left sides of the pylon. The area between the spanwise beams (center cell area) is the structurally effective area of the pylon and is reinforced by stringers, frames, and formed angles. The leading and trailing edge areas, outboard of the forward and rear beam (outer cell areas), are considered nonstructural and consist of formers and frames to support the skin plating. The treatment of the various types of damage, especially to the center cell area, is greatly limited because of the critical alignment factor and the highly stressed nature of the pylon assembly.

3–39. CLASSIFICATION OF DAMAGE TO BEAMS. (See figure 3–7.)

3–40. NEGLIGIBLE DAMAGE. (Refer to table 3–I.) Dents in any beam web which do not damage the flange of the lightening holes or cap strips may be allowed to remain provided the dent does not exceed 3/16 inch maximum in depth. Nicks and scratches not deeper than 0.004 inch in depth must be sanded smooth with No. 00 fine sandpaper to blend with the surrounding area.

3–41. DAMAGE REPAIRABLE BY PATCHING.

a. Scratches over 0.004 inch in depth and cracks in the beam webs which are not less than 1 inch from the edge of a lightening hole or framing member must be patched as shown in figure 10–3. All scratches must be stop-drilled with a 1/8-(0.125) inch diameter drill before patching.

b. Nicks over 0.004 inch in depth in the beam web and at least 3/4 inch from any framing member must be drilled clean and patched as shown in figure 10–3.

c. Dents in the beam web exceeding 2 inches in diameter or 3/16 inch deep must be patched as shown in figure 10–2, provided the patch overlap is not less than 3/4 inch in all directions.

3–42. DAMAGE REPAIRABLE BY INSERTION. Beams are not repairable by insertion.

3–43. DAMAGE NECESSITATING REPLACEMENT.

a. Large scratches, cracks, or dents in the beam web which would provide less than 3/4-inch patch overlap after stop-drilling, require replacement of the pylon.

b. If three or more adjacent angles between beams in the center cell are cracked or extensively damaged, replace the pylon. Damage greater than negligible scratches or nicks requires replacement of the angle provided not more than two angles are affected.

3–44. CLASSIFICATION OF DAMAGE TO BULKHEADS. (See figure 3–7.)

3–45. NEGLIGIBLE DAMAGE. Scratches and nicks not deeper than 0.004 inch must be sanded smooth to blend with the surrounding area.

3–46. DAMAGE REPAIRABLE BY PATCHING.

a. Cracks in any bulkhead web, except in the canted bulkhead, must be repaired by stop-drilling and patching as shown in figure 10–3. The damage must be at least 1 inch away from the framing members.

b. Isolated scratches in the canted bulkhead web exceeding 0.004 inch in depth must be stop-drilled with a 1/8-(0.125) inch diameter drill and patched as shown in figure 10–3.

3–47. DAMAGE REPAIRABLE BY INSERTION. This method will not be employed in repairing bulkheads.

3–48. DAMAGE NECESSITATING REPLACEMENT.

a. Any damage to the canted bulkhead beyond repair, as described in paragraphs 3–45 and 3–46, requires replacement of the pylon.

b. Dents, nicks, or scratches greater than 0.004 inch in depth in any stiffening angle on a bulkhead, require replacement of the angle.

c. Damage to hinge bulkhead allowing less than 3/4-inch patch overlap or included in an area less than 3/4 inch from a framing member, requires replacement of the pylon.

3–49. CLASSIFICATION OF DAMAGE TO FITTINGS. (See figure 3–7.)

3–50. NEGLIGIBLE DAMAGE.

a. Scratches and nicks 0.015 inch deep maximum must be sanded smooth to blend with the surrounding area. This damage, to be repairable, must be outside the critical area which is measured from the fold point centerline aft on pylon fitting 3 inches. The area beyond this point is repairable. Replace pylon hinge fitting if damage is not repairable.

b. Nicks and scratches on the stabilizer adjustment fittings 0.015 inch deep must be sanded smooth to blend with surrounding area.

c. Nicks or scratches of intermediate gear box fitting not exceeding 0.015 inch in depth must be sanded smooth to blend with the surrounding area.

d. Scratches and nicks of stabilizer fitting 0.015 inch deep maximum must be sanded smooth to blend with the surrounding area. The damage, to be repairable, must be away from the lug area.

e. Nicks, scratches, or gouges on the top surface of tail gear box fitting and on the inside diameter edge, including the cutout for the tail rotor gear box drain plug, may be blended into the surrounding surfaces of the fitting to a maximum depth of 0.032 inch.

3–51. DAMAGE REPAIRABLE BY PATCHING. Fittings cannot be satisfactorily patched.

3–52. DAMAGE REPAIRABLE BY INSERTION. Insertion will not be employed as a repair method.

3–53. DAMAGE NECESSITATING REPLACEMENT.

a. Damage greater than negligible requires replacement of pylon hinge fitting and hinge.

b. Damage beyond negligible classification of both stabilizer adjustment fitting and stabilizer fitting is not repairable. Replacement is necessary.

c. Damage greater than 0.015 inch deep in the intermediate gear box fitting requires replacement. Damage affecting both the fitting and the bulkhead which supports the fitting, requires replacement of the pylon.

d. Any cracks, dents, damage to the bottom surface of the tail gear box fitting, or negligible damage which cannot be blended within the maximum depth of 0.032 inch requires replacement of the pylon.

3–54. CLASSIFICATION OF DAMAGE TO CAP STRIPS AND STRINGERS. (See figure 3–7.)

3–55. NEGLIGIBLE DAMAGE. Scratches and nicks not deeper than 0.004 inch must be sanded smooth to blend with the surrounding area. Scratches between 0.004 and 0.020 inch in depth must be stop-drilled, using a 1/8-(0.125) inch diameter drill.

CAUTION

Dents or nicks in a stringer causing any amount of bowing or bending necessitates replacement of the pylon assembly.

3–56. DAMAGE REPAIRABLE BY PATCHING. Scratches in a cap strip or stringer exceeding 0.020 inch in depth must be stop-drilled with a 3/16-(0.187) inch diameter drill and spliced with 0.081 inch, 7075 Alclad splice angle as shown in figure 10–7. Pick up at least three rivet locations on each side of the stop-drill hole.

3–57. DAMAGE REPAIRABLE BY INSERTION. This method is not utilized.

3–58. DAMAGE NECESSITATING REPLACEMENT.

a. Cracked stringers, or any nicks or dents causing any amount of bowing in a stringer, require replacement of the pylon.

b. Damage to any cap strip greater than negligible classification or beyond patching limitations, requires replacement of the pylon.

3–59. CLASSIFICATION OF DAMAGE TO FRAMES AND FORMERS. (See figure 3–7.)

3–60. NEGLIGIBLE DAMAGE.

a. Dents up to 1/8 inch in depth are considered negligible and require no repair.

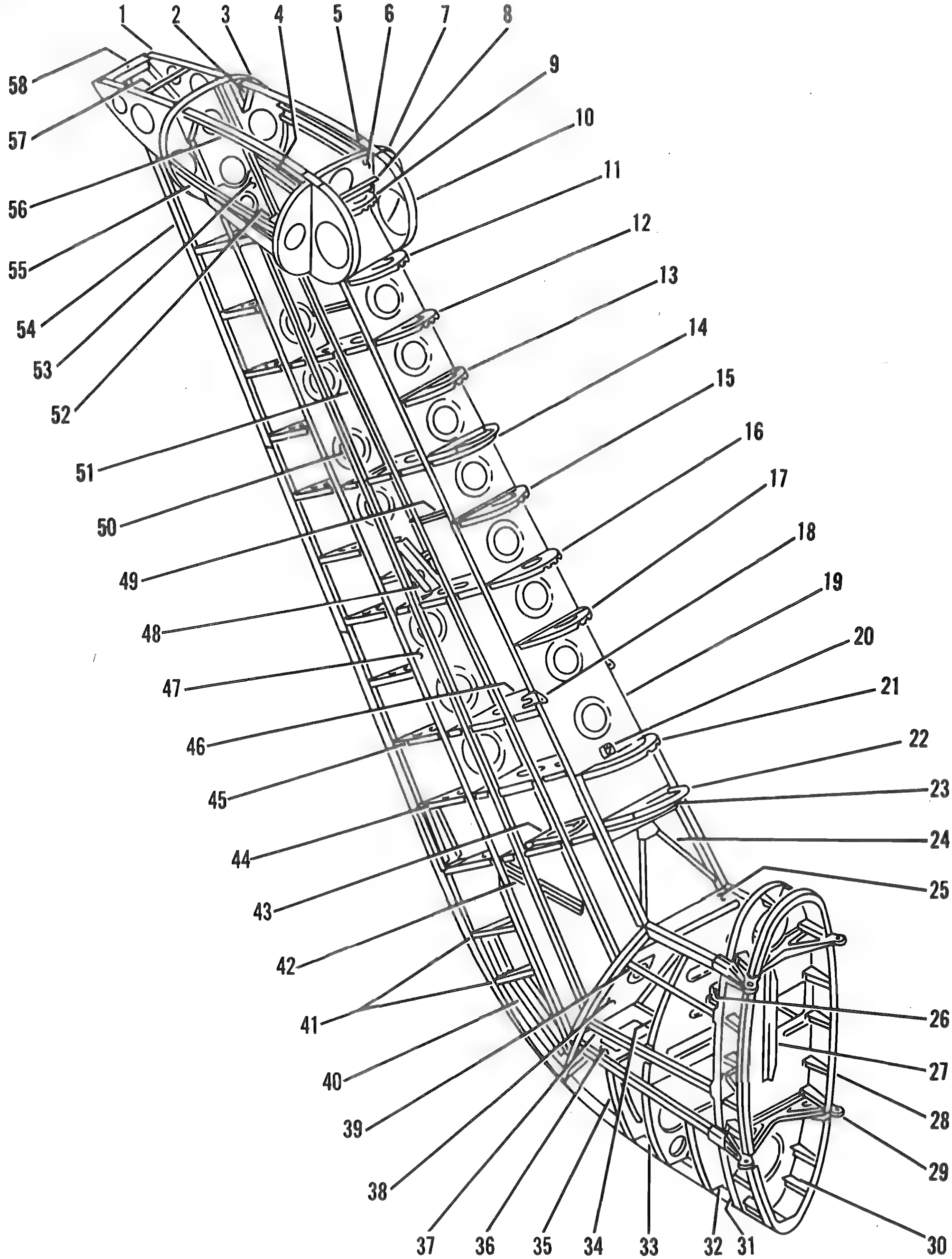


Figure 3–7. Pylon Skeleton Diagram (Sheet 1 of 2)

Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure or Paragraph Reference, Chapter 3	Figure Reference, Chapter 5
1	Former — LH	Mag	0.032	Mag	0.032		10—2, 10—4
2	Bracket — LH	Mag	0.032	Mag	0.032		10—8, 10—4
3	Frame — LH	Mag	0.032	Mag	0.032		10—3, 10—4
4	Channel — LH	Mag	0.040	Mag	0.040		10—8
5	Angle — LH	Mag	0.040	Mag	0.040		10—7
6	Frame	Mag	0.032	Mag	0.032		10—3, 10—4
7	Former — LH	Mag	0.032	Mag	0.032		10—3, 10—4
8	Angle	Mag	0.032	Mag	0.032		10—7
9	Frame — LE	Mag	0.032	Mag	0.040		10—3, 10—4
	Fitting — Tail	Mag	——	Replace	——		
	Gear Box	Mag	0.050	Mag	0.063		10—3, 10—4
	Trailing Edge						10—3, 10—4
10	Former — LH	Mag	0.032	Mag	0.040		10—3, 10—4
11	Former — LE & TE	Mag	0.032	Mag	0.040		10—3, 10—4
12	Frame — LE & TE	Mag	0.025	Mag	0.032		10—3
	Center Section	Mag	0.032	Mag	0.040		10—3, 10—4
13	Former — LE & TE	Mag	0.032	Mag	0.032		10—4
14.	Frame — LE & TE	Mag	0.025	Mag	0.032		10—3
	Center Section	Mag	0.032	Mag	0.040		10—3, 10—4
15	Former — LE & TE	Mag	0.032	Mag	0.032		10—3, 10—4
16	Frame — LE & TE	Mag	0.025	Mag	0.032		10—3
	Center Section	Mag	0.032	Mag	0.040		10—3, 10—4
17	Former — LE & TE	Mag	0.032	Mag	0.032	Para 3—51	
18	Hinge Fitting	Mag	——	——	——	Para 3—44	
19	Fwd Beam	Alclad	0.032	Alclad	0.040	Para 3—36	
20	Fitting — Stabilizer	Al Alloy	AND	——	——		
	Adjustment		10136-2409				10—3, 10—4
21	Former	Mag	0.032	Mag	0.040		
22	Handle — Lower	Al Tube	0.050	Replace	——		10—4
23	Frame — LE & TE	Mag	0.040	Mag	0.050		10—3
	Center Section	Alclad	0.050	Alclad	0.063		
24	Tubular Truss	Steel Tube	0.036	Replace	——	Para 3—59	
25	Upper Beam	Alclad	0.040	Alclad	0.040		
26	Bracket — Upper	Al Alloy	0.050	Replace			10—7
27	Angle	Al Alloy	AND	——	——		
			10133-0701				10—7
28	Fairing Angle	Mag	0.040	Mag	0.040	Para 3—36	
29	Hinge — Lower	Al Alloy	——	——	——		10—8, 10—9
30	Bracket	Mag	0.040	Mag	0.040		10—3
31	Bulkhead Web	Al Alloy	0.032	Al Alloy	0.040		10—3, 10—4
32	Frame	Mag	0.025	Mag	0.032		10—3, 10—4
33	Bulkhead	Mag	0.025	Mag	0.032		10—3, 10—4
34	Bulkhead	Al Alloy	0.040	Al Alloy	0.050		10—3, 10—4
35	Frame	Mag	0.025	Mag	0.032	Para 3—51	
36	Lower Beam	Alclad	0.032	Alclad	0.040	Para 3—36	
37	Stringer — RH	Alclad	0.032	Alclad	0.040	Para 3—47	
38	Bulkhead	Alclad	0.032	Alclad	0.040	Para 3—40	
39	Stringer — RH	Alclad	0.063	Alclad	0.071		10—8
40	Intercostal	Mag	0.063	Mag	0.071		10—3, 10—4
41	Frame	Mag	0.040	Mag	0.050		10—8
42	Channel	Alclad	0.050	Alclad	0.056		
43	Fitting — Intermediate	Mag	——	——	——		
	Gear Box	Mag	0.032	Mag	0.040		10—3, 10—4
44	Frame — Center & TE	Alclad	0.032	Alclad	0.040		10—3, 10—4
45	Frame—Center Section	Mag	0.032	Mag	0.040		10—4, 10—8
	Section TE Section	Alclad	0.050	Alclad	0.056		10—8
46	Channel	Alclad	0.032	Alclad	0.040		
47	Rear Beam	Al Alloy	0.040	Al Alloy	0.050		10—8
48	Bracket	Alclad	0.040	Replace	——		
49	Angle	Alclad	0.063	Alclad	0.071	Para 3—36	
50	Stringer — RH	Alclad	0.063	Alclad	0.071	Para 3—47	
51	Stringer — RH						
52	Fittings — Tail	Mag	——	——	——	Para 3—44	
	Gear Box						
53	Web	Mag	0.032	Mag	0.040		10—3
54	Trailing Edge Vee	Mag	0.032	Replace	——		
55	Channel	Mag	0.032	Mag	0.032		10—8, 10—9
56	Channel	Mag	0.040	Mag	0.040		10—8, 10—9
57	Angle	Mag	0.032	Mag	0.032		10—7
58	Vee	Mag	0.032	Replace	0.32		

Figure 3—7. Pylon Skeleton Diagram (Sheet 2 of 2)

b. Scratches and nicks not deeper than 0.004 inch must be sanded smooth to blend with the surrounding area.

3–61. DAMAGE REPAIRABLE BY PATCHING.

a. All holes and stop-drilled cracks in the leading edge or trailing edge formers or frames must be patched as shown in figure 10–4.

b. Isolated scratches over 0.004 inch in depth and small cracks in the center cell frames must be stop-drilled with a 1/8-(0.125) inch diameter drill and patched as shown in figure 10–3.

3–62. DAMAGE REPAIRABLE BY INSERTION. The only members of the pylon to which repairs by insertion may be made are those contained in the nonstructural areas (the leading and trailing edge sections of the pylon up to their respective support beams), and also the framing members of the fairing which houses the tail rotor gear box. For repair of formers and frames, see figure 10–3.

3–63. DAMAGE NECESSITATING REPLACEMENT.

a. Any damage to the frames at pylon stations 50.4 and 128.5 requires replacement of the pylon.

b. Damage beyond repair by patching or insertion, to any former in the leading or trailing edge cell of the pylon, requires replacement of the former. Damage to any center cell frame, beyond patching limitations described in paragraph 3–62, requires replacement of the pylon.

3–64. DAMAGE TO TUBULAR TRUSS. (See figure 3–7.) Any damage to the tubular truss requires replacement.

3–65. CLASSIFICATION OF DAMAGE TO PYLON SKIN. (See figure 3–6.)

CAUTION

Because the pylon structure consists of a three-cell box beam, the skin plating over the center cell area is considered to be structurally effective. The repair limitations and treatment of damage to the skins in each of the three-cell areas differ in accordance with the structural effectiveness of the particular area.

3–66. NEGLIGIBLE DAMAGE. Limited dents, free from cracks and abrasions, and nicks and scratches not greater than 0.004 inch in depth in any skin panel, may be regarded as negligible damage and must be sanded smooth to blend with the surrounding area. Scratches greater than 0.004 inch in depth in only the nonstructural skin panels outboard of the center cell should be stop-drilled with a 3/32-(0.0937) inch diameter drill to prevent spreading. For treatment of negligible damage to the pylon skins, refer to table 3–I.

3–67. DAMAGE REPAIRABLE BY PATCHING. Stop-drilled cracks and nicks greater than 0.004 inch in depth in the nonstructural skin panels outboard of the center cell must be repaired by patching. (See figure 10–2.) Nicks in these nonstructural skins must first be drilled to completely clean out the nick and then patched with a fabric patch as described in Section X. Nicks in the skins between pylon stations 112.8 and 123.6 that can be completely cleaned by using a 1/4-(0.250) inch diameter drill maximum must be drilled and covered with a fabric patch as described in Section X. Cracks and scratches deeper than 0.004 inch in depth in the skins in the area between the pylon canted bulkhead and pylon station 112.8 must be stop-drilled and patched with the rivet pattern depending upon the direction in which the crack runs. If the crack or scratch runs chordwise across the pylon skin, use a double rivet row pattern as shown in figure 10–3. If the direction is spanwise, use the single rivet row pattern as shown in figure 10–2. Nicks in these skins that can be completely cleaned by using a 1/2-(0.500) inch diameter drill should be drilled and covered with a fabric patch as described in Section X. If a drill larger than 1/2 inch is required, then a metal patch must be used as shown in figure 10–2.

3–68. DAMAGE REPAIRABLE BY INSERTION. Pylon skin will not be repaired by insertion.

3–69. DAMAGE NECESSITATING REPLACEMENT. Damage to the skin panels between pylon stations 112.8 and 123.6, which requires replacement of the panel, consists of the following:

a. Cracks in any area of the panel.

b. Scratches greater than 0.004 inch in depth.

c. Nicks greater than 0.004 inch in depth in any area of the skin panel above pylon station 123.6.

d. Nicks in any area of the skin panel below pylon station 123.6 requiring a drilled hole larger than 1/4 inch in diameter for cleaning out.

SECTION IV

BODY GROUP

4–1. DESCRIPTION.

4–2. The body group of the helicopter (figure 4–1) consists of the forward section and the tail cone section. The forward section extends from fuselage stations 5 to 316 and contains the engine access doors, cockpit canopy, cabin and bottom structure, main gear box support assembly and rescue hoist support assembly. The tail cone section, which is that section of the body group between fuselage stations 316 and 448, is detachable from the forward section at station 316 and serves as a redistribution area for the pylon hinge loads, tail wheel loads, and the jacking and tail tiedown loads. A large sliding door on the right side of the helicopter provides access to the cabin, the pilot's cockpit, and the tail cone interior.

4–3. CLASSIFICATION OF DAMAGE.

4–4. NEGLIGIBLE DAMAGE. (Refer to table 4–I.) Damage which may be permitted to remain, or which can be repaired by a single procedure (stop-drilling cracks and deep scratches, removing shallow nicks and scratches, etc), is considered to be negligible damage. All nicks and scratches up to 10 percent of the material thickness must be sanded smooth with No. 00 fine sandpaper to blend with the surrounding area, and the surface area must be refinished as described in TM 55-1520-202-20, Chapter 2, Section II. In general, smooth dents which are free of cracks, abrasions, or sharp corners need not be repaired if the dent does not affect adjacent rivets or supporting structure. However, dents should be removed, when possible, thus restoring the surface to its original shape.

4–5. DAMAGE REPAIRABLE BY PATCHING. All holes, cracks, nicks, or dents greater than negligible classification must be repaired by patching. The repair patch should be of the same material as the damaged member. When patching areas with metal dissimilar to the type damaged, the patch and structure must be protected by insulation to prevent any corrosion between the dissimilar metals. For anticorrosion measures, refer to TM 55-1520-202-20, Chapter 2, Section II. Repair materials to be used and figure references to be followed are given in repair tables accompanying reference illustrations for the particular member.

4–6. DAMAGE REPAIRABLE BY INSERTION. In areas where damage is extensive and cannot be repaired by patching, an insertion repair may be accomplished. The damaged section should be cut away and strengthening members fastened in place. Repair materials to be used and figure references to be followed are given in repair tables accompanying reference illustrations for the particular member.

4–7. DAMAGE NECESSITATING REPLACEMENT. Severe damage not repairable by patching or insertion requires replacement of the member or a section of the member. Small angles, gussets, or stiffeners attached to bulkheads, skin panels, or frames should be replaced rather than repaired because of their small size. Any damage to a nonrepairable member, such as fittings, hinges, etc, unless within negligible damage limits, requires replacement of the member.

4–8. FUSELAGE FORWARD SECTION.

4–9. DESCRIPTION. (See figure 4–1.) The fuselage forward section is of semimonocoque construction and is comprised primarily of magnesium alloy, aluminum alloy, and stainless steel. The structure consists of the cabin section to which the following structural subassemblies are attached: nose doors, cockpit canopy, left and right service platforms, fiberglas fairing, transmission support tubes, bottom structure, rescue hoist, and cabin door. The structure is reinforced transversely by bulkheads and frames and longitudinally by longerons, stringers, and intercostals. Magnesium and aluminum alloy skin plating is riveted to the forward section skeleton with the exception of the reinforced plastic fairing located behind the main rotor assembly. The top cabin structure supports the transmission deck and main gear box support tubes located between stations 112 and 167.

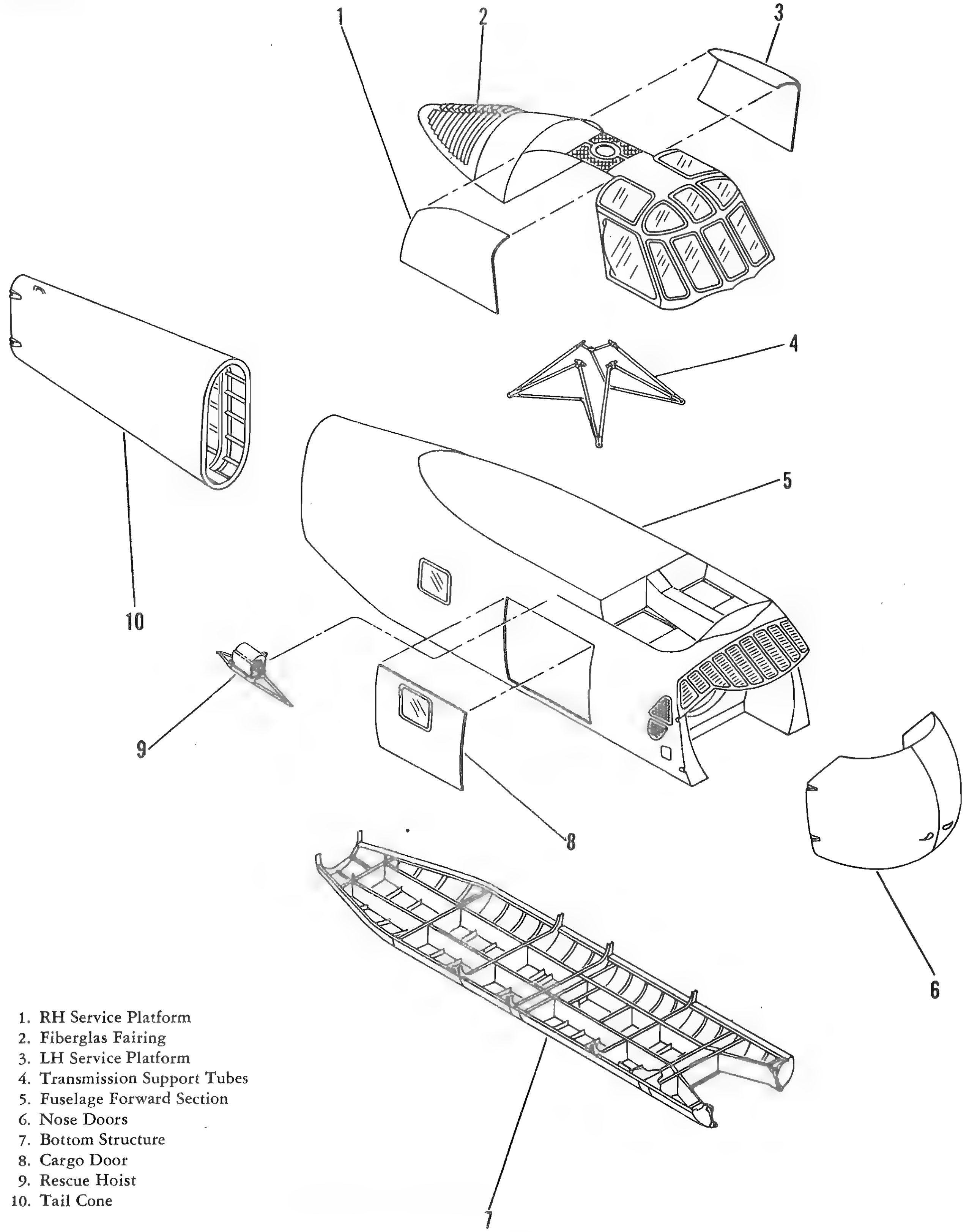
4–10. CABIN SECTION.

4–11. CABIN SKIN PLATING. (See figure 4–2.)

4–12. DESCRIPTION. The cabin section skin plating consists of magnesium alloy and aluminum alloy skins of varied gage.

4–13. CLASSIFICATION OF DAMAGE.

4–14. NEGLIGIBLE DAMAGE. Smooth, isolated dents free of cracks, abrasions, or sharp corners



1. RH Service Platform
2. Fiberglas Fairing
3. LH Service Platform
4. Transmission Support Tubes
5. Fuselage Forward Section
6. Nose Doors
7. Bottom Structure
8. Cargo Door
9. Rescue Hoist
10. Tail Cone

Figure 4–1. Body Group – Exploded View

Table 4–I. Negligible Damage (Sheet 1 of 2)

NOMENCLATURE	DENTS		SCRATCHES		CRACKS		NICKS	
	DEPTH (INCHES)	TREATMENT	DEPTH (INCHES)	TREATMENT	DEPTH (INCHES)	TREATMENT	DEPTH (INCHES)	TREATMENT
CABIN STRUCTURE SKIN PLATING		Para 4–14		Para 4–14		Para 4–15		Para 4–14
SKELETON BULKHEADS								
Webs		Para 4–23	0.004	Blend		Para 4–24		Para 4–24
			0.004+	Stop-Drill & Patch (figure 10–3)				
Angle & Channel Stiffeners		Para 4–23	0.004	Blend		Para 4–24	0.004	Blend
			0.004+	Stop-Drill & Patch (figures 10–7 and 10–8)			0.004+	Drill & Patch (figures 10–7 and 10–8)
Splice Plates		Para 4–23	0.004	Blend	None	Replace	0.004	Blend
			0.004+	Replace			0.004+	Replace
Fittings		None	0.015	Blend	None	Para 4–23	0.015	Blend
			0.015+	Para 4–23			0.015+	Para 4–23
Longerons		Para 4–30		Para 4–30	None	Para 4–31		Para 4–30
Frames		Para 4–37		Para 4–37	None	Para 4–38		Para 4–37
Stringers		Para 4–37		Para 4–37	None	Para 4–38		Para 4–37
Intercostals		Para 4–37		Para 4–37	None	Para 4–38		Para 4–37
Pilots' Floor Panel	3/16	No Repair		Para 4–43	None	Para 4–45		Para 4–45
	3/16+	Patch (figure 10–2)						
SERVICE PLATFORM								
Skin	3/16	No Repair		Para 4–50	None	Stop-Drill & Patch (figure 10–3)		Drill & Patch (figure 10–3)
	3/16+	Patch (figure 10–2)						
Fitting	None		0.015	Blend	None	Replace	0.015	Blend
			0.015+	Replace			0.015+	Replace
TRANSMISSION DECK		Para 4–56		Para 4–56	None	Para 4–57		Para 4–56
CARGO DOOR SKIN	3/16	No Repair	0.005	Blend		Stop-Drill & Patch (figure 10–2)	0.005	Blend
	3/16+	Patch (figure 10–2)	0.005+	Stop-Drill & Patch (figure 10–2)			0.005+	Stop-Drill & Patch (figure 10–2)
Tubular Frames	1/8	No Repair	0.005	Blend		Stop-Drill	0.005	Blend
	1/8+	Para 4–61	0.005+	Stop-Drill			0.005+	Drill out
NOSE DOORS								
Skin	3/16	No Repair		Para 4–65		Stop-Drill & Patch (figure 10–2)		Para 4–65
	3/16+	Patch (figure 10–2)						
Frames	3/16	No Repair		Para 4–65		Stop-Drill & Patch (figure 10–8)		Para 4–65
	3/16+	Patch (figure 10–8)						
Hinges	None	Replace	0.015	Blend	None	Replace	0.015	Blend
			0.015+	Replace			0.015+	Replace
CANOPY		Para 4–71		Para 4–71		Para 4–71		Para 4–71
TRANSMISSION SUPPORT TUBES		Para 4–82	None	Replace	None	Replace	None	Replace

Table 4–1. Negligible Damage (Sheet 2 of 2)

NOMENCLATURE	DENTS		SCRATCHES		CRACKS		NICKS	
	DEPTH (INCHES)	TREATMENT	DEPTH (INCHES)	TREATMENT	DEPTH (INCHES)	TREATMENT	DEPTH (INCHES)	TREATMENT
BOTTOM STRUCTURE								
Skin		Para 4–95		Para 4–95		Para 4–95		Para 4–95
Bulkheads & Frames		Para 4–100		Para 4–100		Para 4–100		Para 4–100
Longerons		Para 4–100		Para 4–100		Para 4–100		Para 4–100
Floor Panels		Para 4–116		Para 4–116		Para 4–116		Para 4–116
TAIL CONE STRUCTURE								
Skin Plating		Para 4–115		Para 4–115		Stop-Drill & Patch (figure 10–3)		Para 4–115
SKELETON								
Frames, Stringers, & Intercostals		Para 4–119		Para 4–119		Para 4–119		Para 4–119
Catwalk		Para 4–122		Para 4–122		Para 4–122		Para 4–122

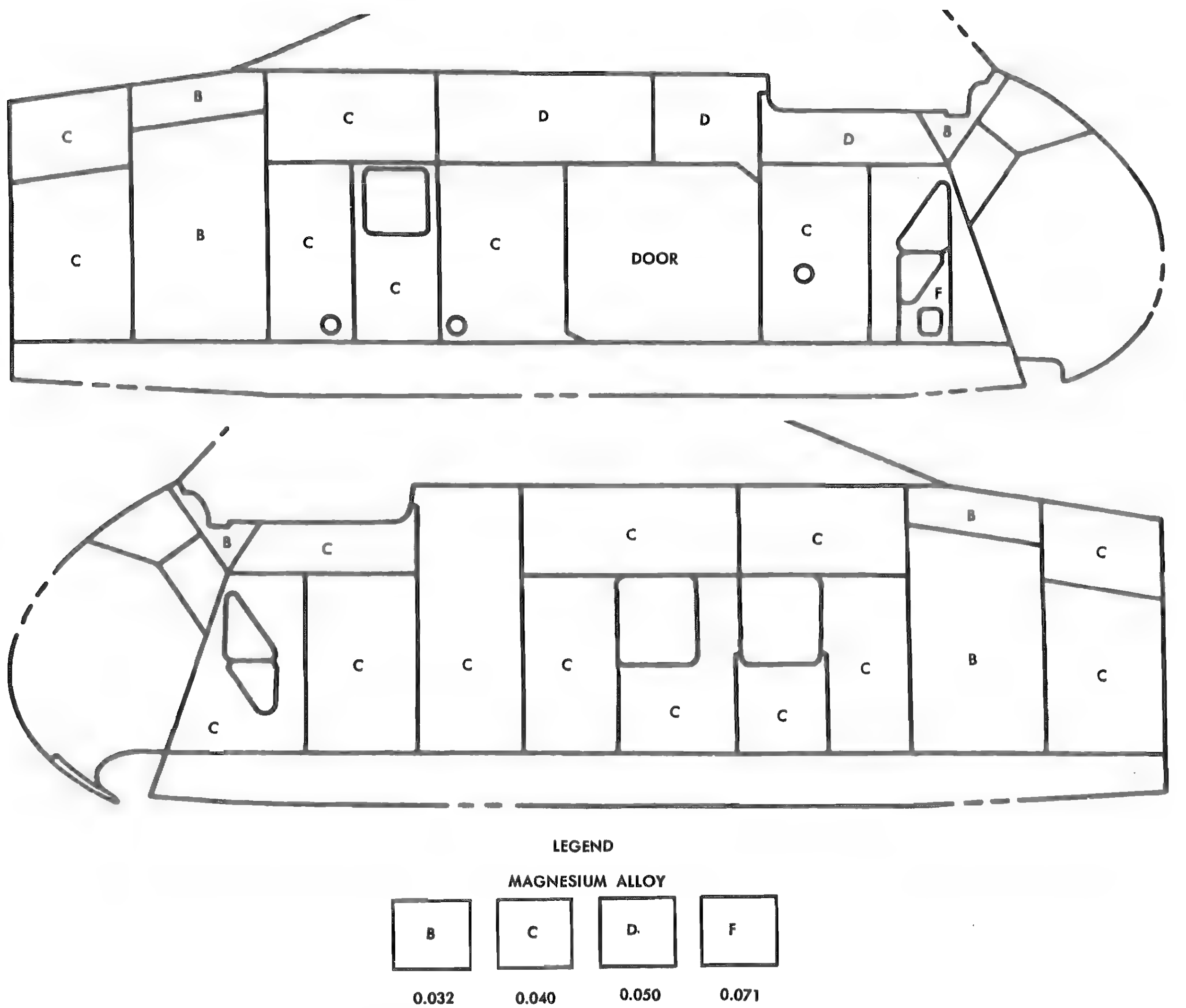


Figure 4–2. Cabin Skin Plating Diagram

need not be repaired if the damage is not deeper than the thickness of the material in which it occurs and adjacent riveting has not been disturbed. Scratches in the skin not exceeding 10 percent maximum thickness of the skin should be sanded smooth with No. 00 fine sandpaper to blend with surrounding area and surface areas refinished as described in TM 55-1520-202-20, Chapter 2, Section II. For treatment of nicks or scratches deeper than negligible limitations, refer to paragraph 4–15.

4–15. DAMAGE REPAIRABLE BY PATCHING. (See figures 10–2, 10–3, and 10–6.) Damage to the cabin skin, as defined in the following, must be repaired by patching. Refer to TM 55-1520-202-20, Chapter 2, Section II for treatment of dissimilar metals.

a. Patch all holes in skin.

b. Stop-drill cracks or scratches greater than 10 percent of skin thickness with 1/8-(0.125) inch diameter drill, and patch area. (See figure 10–3.)

c. Reinforce areas where smooth dents protrude beyond thickness of material with a doubler patch along undimpled surface of skin. Use a single rivet pattern as shown in figure 10–2.

d. Drill, clean, and patch nicks producing sharp corners in the skin. (See figure 10–3.)

4–16. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion is not permitted on cabin skin plating.

4–17. DAMAGE NECESSITATING REPLACEMENT. Holes or distortion in the skin that exceed 30 percent of the area between framing members necessitate trimming skin to each framing member and replacing skin section. The replacement skin section must be large enough that skin edges will extend at least 3/4 inch beyond each framing member. Pick up existing rivet holes through framing members and install an additional row of rivets providing a 5/16-inch rivet edge distance around replacement skin.

4–18. CABIN SKELETON.

4–19. DESCRIPTION. (See figure 4–3.) The cabin skeleton consists of bulkheads, longerons, frames, stringers, and intercostals.

4–20. BULKHEADS.

4–21. DESCRIPTION. (See figures 4–4 through 4–12.) There are six bulkheads located in the fuselage cabin section. Figure 4–3 shows the location of these. They are reinforced with stiffeners, clips, and angles riveted to the web and frames. The bulkhead at station 112 contains several vital fittings and forms the structural supporting member for the main landing gear and transmission loads.

4–22. CLASSIFICATION OF DAMAGE.

4–23. NEGLIGIBLE DAMAGE. (Refer to paragraph 4–6.) Nicks or scratches up to 0.015 inch in depth in any fitting attached to the bulkhead at station 112 must be sanded smooth to blend with surrounding area. For treatment of fittings with damage greater than negligible classification, refer to paragraph 4–26. Dents in any bulkhead web, which do not protrude beyond the thickness of the material, may be allowed to remain provided they are free from cracks, abrasions, or sharp corners.

4–24. DAMAGE REPAIRABLE BY PATCHING. Isolated scratches greater than 10 percent in depth of web thickness, and cracks in bulkhead webs must be stop-drilled with a 1/8-inch diameter drill and patched as shown in figure 10–3. All nicks in web must be repaired by drilling out nick and patching drilled hole as shown in figure 10–3. Smooth dents in web which protrude beyond material thickness, but are free from cracks or abrasions, should be reinforced with a doubler patch along undimpled surface and riveted as shown in figure 10–2. Cracked angles or channels attached to a bulkhead should be patched as shown in figure 10–7 or 10–8.

4–25. DAMAGE REPAIRABLE BY INSERTION. Damage to a bulkhead web affecting a stiffening member such as channels, angles, tees or a hat section may be repaired as shown in figure references in figures 4–5 through 4–12.

4–26. DAMAGE NECESSITATING REPLACEMENT. (Refer to paragraph 4–7.) Nicks or scratches greater than 0.015 inch in depth in transmission support fittings or landing gear strut support fittings on bulkhead at station 112 constitute a major repair by replacement of fittings which requires special alignment procedures and fixtures and does not come within the scope of this manual.

4–27. LONGERONS.

4–28. DESCRIPTION. Longeron assemblies extend along the right and left side of the fuselage forward section. The various areas where the longerons are located are shown in figure 4–3. The primary tensional loads are absorbed by the distribution of the longeron assemblies of varied gage of alclad and magnesium alloy.

4–29. CLASSIFICATION OF DAMAGE.

4–30. NEGLIGIBLE DAMAGE. Smooth dents, which do not protrude beyond the thickness of the material and are free from cracks, abrasions, or sharp corners, are considered negligible and need not be repaired. Scratches or nicks up to 10 percent of the material thickness must be sanded smooth to blend with surrounding area. For treatment of dents, nicks, or scratches greater than negligible classification, refer to paragraph 4–31.

4–31. DAMAGE REPAIRABLE BY PATCHING. Dents which protrude beyond the thickness of the material should be reinforced with a doubler as shown in figures 10–7 and 10–8. Scratches greater than 10 percent of the material thickness and all cracks must be stop-drilled with a 1/8-inch diameter drill and patched as shown in figures 10–7 and 10–8.

4–32. DAMAGE REPAIRABLE BY INSERTION. Damage to a longeron which affects a fuselage frame should be repaired as shown in figure 10–12.

4–33. DAMAGE NECESSITATING REPLACEMENT. Clips or doublers, which attach the longeron assemblies to the fuselage framing members, should be replaced if they are cracked or if nicks or scratches exceed 10 percent of the material thickness.

4–34. FRAMES, STRINGERS, AND INTERCOSTALS.

4–35. DESCRIPTION. In addition to bulkhead and longerons, the fuselage structure is reinforced transversely by frames and longitudinally by stringers and intercostals which are riveted to the frames. Their construction combines the use of alclad and magnesium alloy of varied gage. (See figure 4–3, sheet 2.)

4–36. CLASSIFICATION OF DAMAGE.

4–37. NEGLIGIBLE DAMAGE. Damage to frames, stringers, or intercostal channels that may be classified as negligible is the same as described in paragraph 4–30.

4–38. DAMAGE REPAIRABLE BY PATCHING. (Refer to paragraph 4–5.) Isolated dents, nicks, scratches, or cracks in the frames, stringers, or intercostals greater than negligible classification should be repaired as described in paragraph 4–31.

4–39. DAMAGE REPAIRABLE BY INSERTION. Extensive damage to cabin frames or intercostal channels which affect skin plating should be repaired as shown in figure 10–10. Damage affecting a frame and stringer or longeron joint should be repaired as shown in figure 10–12.

4–40. DAMAGE NECESSITATING REPLACEMENT. Small angles, channels, gussets, and stiffeners should be replaced rather than repaired due to their small size.

4–41. PILOTS' FLOOR.

4–42. DESCRIPTION. (See figure 4–13.) The pilots' cockpit floor extends from stations 61.7 to 82.5. The floor is made of 0.016-inch titanium and is reinforced by transverse beams and longitudinal beams and angles.

4–43. CLASSIFICATION OF DAMAGE.

4–44. NEGLIGIBLE DAMAGE. Refer to paragraph 4–4 for limitation and treatment of nicks and scratches. Smooth, isolated dents in the floor panel, approximately 3/16 inch deep, that are free from cracks, sharp corners, or abrasions may be permitted to remain.

4–45. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. Scratches and nicks greater than negligible classification and all cracks in the pilot's floor panel must be stop-drilled and patched as shown in figure 10–3. For types of material and their repair for pilot's floor panel, see figure 4–13.

4–46. DAMAGE NECESSITATING REPLACEMENT. (Refer to paragraph 4–7.) Stiffening angles or beams riveted to pilot's floor panel should be replaced if damage affects approximately 30 percent of the stiffening member.

4–47. SERVICE PLATFORM.

4–48. DESCRIPTION. (See figure 4–14.) The service platforms, on the right and left sides of the helicopter, are hinged to the top longeron between stations 112 and 178.5. Platforms serve as protective panels for the main gear box when locked in the closed position and when in the down position, and they provide support for personnel servicing the transmission compartment area of the helicopter. A door in the right-hand service platform on helicopter, serial No. 53-4503 and subsequent, provides for winch installation. (See figure 4–15.)

4–49. CLASSIFICATION OF DAMAGE.

4–50. NEGLIGIBLE DAMAGE. Refer to paragraph 4–4 for limitations and treatment of nicks or scratches in service platform skin. Treatment of negligible dents in service platform skin is the same as described in paragraph 4–42.

4–51. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. For types of material and repair procedure for service platform, see figures 4–14 and 4–15.

4–52. DAMAGE NECESSITATING REPLACEMENT. Extensive damage to any framing member that cannot be repaired by patching requires replacement of the member.

4–53. TRANSMISSION DECK.

4–54. DESCRIPTION. (See figure 4–16.) The transmission deck is fabricated of aluminum foil honeycomb core and mahogany strips sandwiched between a top layer of 0.012-inch aluminum plating

NOTE
ALL INTERCOSTALS ARE 0.040 MAG.
EXCEPT AS NOTED

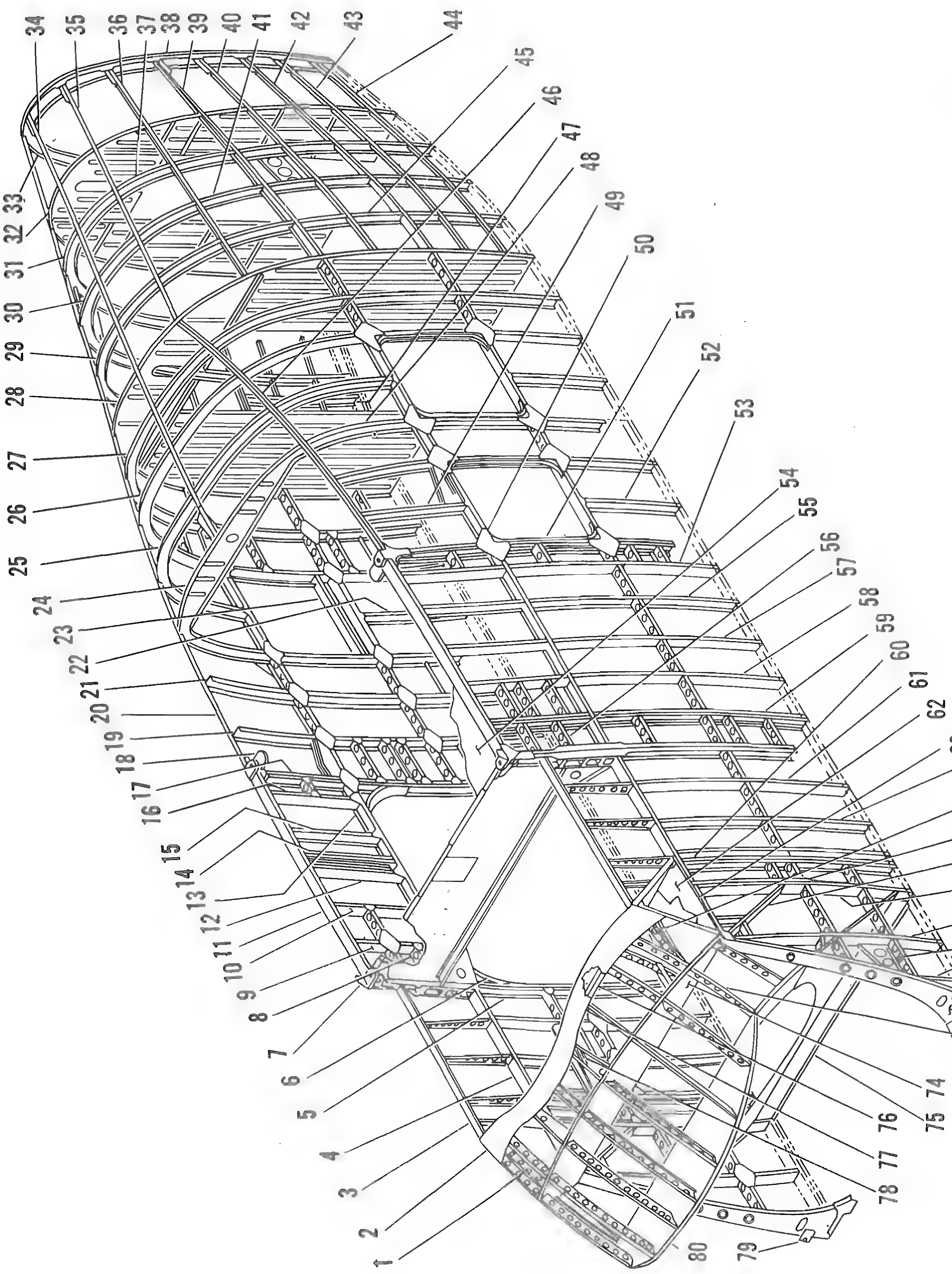
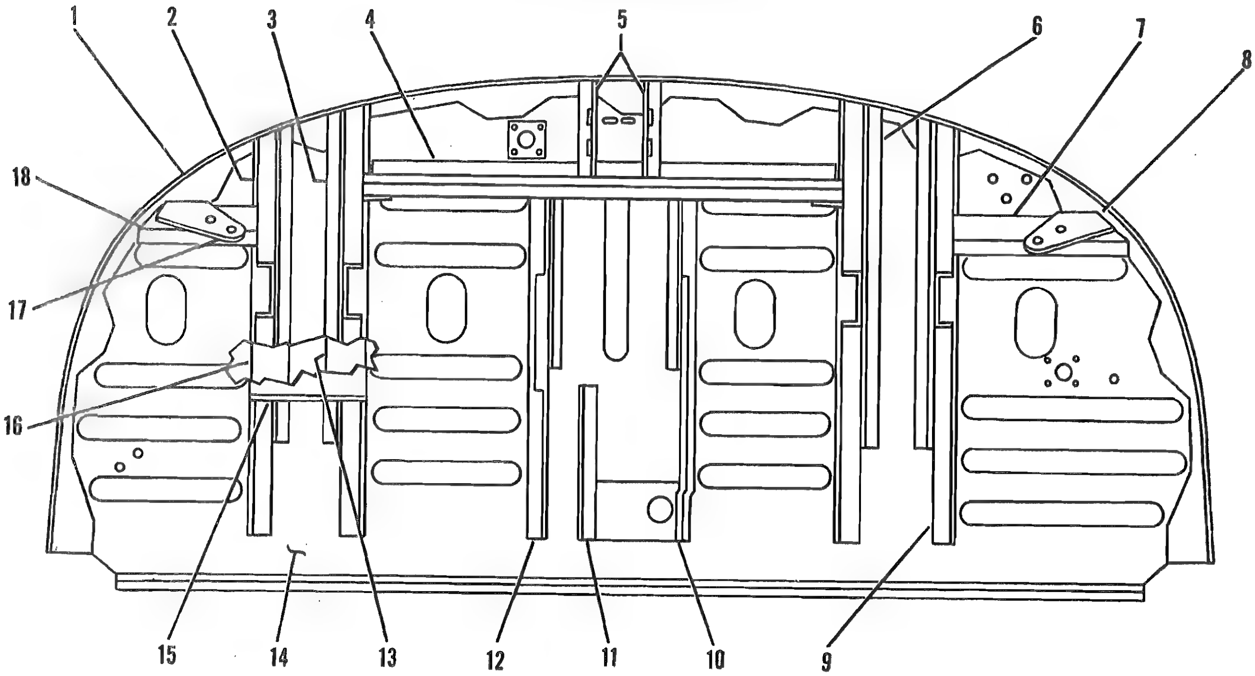


Figure 4-3. Cabin Skeleton Diagram (Sheet 1 of 2)

Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference	Figure or Paragraph Reference
1	Intercostal	Alclad	0.050	Alclad	0.063	10—8, 10—10	
2	Beam — RH	Alclad	0.032	Alclad	0.040	10—8	
3	Longeron	Mag	0.040	Mag	0.050	10—8	
4	Longeron	Mag	0.040	Mag	0.050	10—8	
5	Bulkhead	—	—	—	—		4—7
6	Reinforcement	Mag	0.040	Mag	0.050	10—8	
7	Fitting	—	—	—	—		Para 4—23, 4—26
8	Intercostal	Alclad	0.064	Alclad	0.071	10—8, 10—9	
9	Frame	Mag	0.050	Mag	0.063	10—10	
10	Frame	Mag	0.050	Mag	0.063	10—10	
11	Longeron	Alclad	0.050	Alclad	0.063	10—7	
12	Frame	Mag	0.050	Mag	0.063	10—10	
13	Longeron	Alclad	0.063	Alclad	0.071	10—8	
14	Frame	Mag	0.050	Mag	0.063	10—10	
15	Frame	Mag	0.050	Mag	0.063	10—10	
16	Frame	Mag	0.050	Mag	0.063	10—10	
17	Frame Angle	Alclad	0.078	Alclad	0.090	10—7	
18	Fitting	—	—	—	—		Para 4—23, 4—26
19	Frame	Mag	0.040	Mag	0.050	10—10	
20	Longeron	Mag	0.071	Mag	0.080	10—7	
21	Frame	Mag	0.040	Mag	0.050	10—10	
22	Frame	Mag	0.040	Mag	0.050	10—10	
23	Intercostal	Mag	0.032	Mag	0.040	10—8, 10—9	
24	Frame — RH	Mag	0.063	Mag	0.071	10—10	
25	Frame	Mag	0.040	Mag	0.050	10—10	
26	Frame	Mag	0.040	Mag	0.050	10—10, 10—12	
27	Frame Angle	Alclad	0.078	Alclad	0.090	10—7	
28	Bulkhead	—	—	—	—		4—8
29	Frame — RH	Mag	0.040	Mag	0.050	10—10, 10—12	
30	Frame — RH	Mag	0.040	Mag	0.050	10—10, 10—12	
31	Frame — RH	Mag	0.040	Mag	0.050	10—10, 10—12	
32	Bulkhead	—	—	—	—		4—9
33	Frame — RH	Alclad	0.063	Alclad	0.071	10—10	
34	Stringer	Alclad	0.032	Alclad	0.040	10—7, 10—12	
35	Stringer	Alclad	0.032	Alclad	0.040	10—7, 10—12	
36	Stringer	Alclad	0.032	Alclad	0.040	10—7, 10—12	
37	Frame — LH	Mag	0.040	Mag	0.050	10—7, 10—12	
38	Frame — LH	Alclad	0.063	Alclad	0.071	10—10	
39	Longeron	Alclad	0.032	Alclad	0.040	10—8, 10—12	
40	Stringer	Alclad	0.032	Alclad	0.040	10—7, 10—12	
41	Frame — LH	Mag	0.040	Mag	0.050	10—10, 10—12	
42	Longeron	Alclad	0.032	Alclad	0.040	10—8, 10—12	
43	Stringer	Alclad	0.032	Alclad	0.040	10—7, 10—12	
44	Stringer	Alclad	0.032	Alclad	0.040	10—7, 10—12	
45	Frame — LH	Mag	0.040	Mag	0.050	10—10, 10—12	
46	Longeron	Mag	0.071	Mag	0.080	10—8, 10—12	
47	Frame	Mag	0.040	Mag	0.050	10—10, 10—12	
48	Frame — LH	Mag	0.063	Mag	0.071	10—10	
49	Frame	Mag	0.040	Mag	0.050	10—10	
50	Gusset	Mag	0.040	Replace	—		
51	Frame Angle	Alclad	0.078	Alclad	0.091	10—7	
52	Frame	Mag	0.040	Mag	0.050	10—10	
53	Frame	Mag	0.050	Mag	0.063	10—10	
54	Transmission Deck	—	—	—	—		4—16
55	Frame	Mag	0.050	Mag	0.063	10—10	
56	Intercostal	Alclad	0.063	Alclad	0.071	10—8, 10—9	
57	Frame	Mag	0.050	Mag	0.063	10—10	
58	Frame	Mag	0.050	Mag	0.063	10—10	
59	Frame	Mag	0.050	Mag	0.063	10—10	
60	Frame	Mag	0.050	Mag	0.063	10—10	
61	Frame	Mag	0.040	Mag	0.050	10—10	
62	Pilot's Floor	—	—	—	—		4—13
63	Angle	Alclad	0.078	Alclad	0.090	10—7	
64	Frame	Mag	0.040	Mag	0.050	10—10	
65	Intercostal	Alclad	0.040	Alclad	0.050	10—8, 10—9	
66	Frame Angle	Alclad	0.094	Alclad	0.125	10—7	
67	Canted Frame	Mag	0.040	Mag	0.050	10—10	
68	Frame	Alclad	0.050	Alclad	0.063	10—8	
69	Frame	Mag	0.040	Mag	0.050	10—10	
70	Support	Mag	0.040	Mag	0.040	10—8	
71	Frame	Mag	0.040	Mag	0.050	10—10	
72	Frame	Alclad	0.050	Alclad	0.063	10—11	
73	Intercostal	Alclad	0.040	Alclad	0.050	10—8, 10—10	
74	Bulkhead	—	—	—	—		4—4
75	Bulkhead	—	—	—	—		4—5
76	Nose Ring	Alclad	0.050	Alclad	0.063	10—8	
77	Beam — LH	Alclad	0.032	Alclad	0.040	10—8	
78	Channel	Mag	0.040	Mag	0.050	10—8	
79	Hinge	Al Alloy	—	Replace	—		
80	Bulkhead	—	—	—	—		4—5

Figure 4—3. Cabin Skeleton Diagram (Sheet 2 of 2)



VIEW LOOKING FORWARD

Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Frame	Mag	0.040	Mag	0.040	10–7
2	Vertical Beam	Al Alloy	AND10133-1003	—	—	10–7
3	Vertical Beam	Al Alloy	AND10133-1003	—	—	10–7
4	Channel	Alclad	0.063	Alclad	0.063	10–8
5	Bracket	Mag	0.040	Replace	—	
6	Vertical Beam	Al Alloy	AND10133-1003	—	—	10–7
7	Support	Alclad	0.050	Alclad	0.050	10–8
8	Fitting	Mag	0.125	Replace	—	
9	Vertical Beam	Al Alloy	AND10133-1003	—	—	10–7
10	Angle	Alclad	0.063	Alclad	0.063	10–7
11	Angle	Alclad	0.040	Replace	—	
12	Angle	Alclad	0.063	Alclad	0.063	10–7
13	Tee LH	Al Alloy	AND10136-2405	—	—	10–5
14	Web	Titanium	0.016	St Steel	0.016	10–3
15	Support	Alclad	0.040	Replace	—	
16	Tee LH	Al Alloy	AND10136-2405	—	—	10–5
17	Fitting	Mag	0.125	Replace	—	
18	Support	Alclad	0.050	Alclad	0.050	10–8

Figure 4–4. Canted Firewall – Sta 61.7

and a bottom layer of 0.008-inch aluminum plating. The deck, which is reinforced by channels and a transverse brace assembly, forms the ceiling of the cabin section directly under the main transmission between stations 112 and 201.

4–55. CLASSIFICATION OF DAMAGE.

4–56. NEGLIGIBLE DAMAGE. Smooth contoured dents up to 1/16 inch in depth need not be repaired. Scratches that are less than 25 percent of skin thickness should be blended with the surrounding area, using No. 00 fine sandpaper.

4–57. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. Repairs to honeycomb panels described in this paragraph are typical repairs.

a. Prepare resin compound prior to patching. Add aluminum dust, No. MD101, manufactured by Metals Disintegrating Co., Chicago 166, Ill. in a quantity of 15 percent by weight to Epon resin No. 828, manufactured by Shell Chemical Co., New York, N.Y. Add activator, Diethylenetriamine, manufactured by Union Carbide and Carbon Co., New York, N.Y., in quantity of 1 part to 10 parts to resin mixture and mix thoroughly.

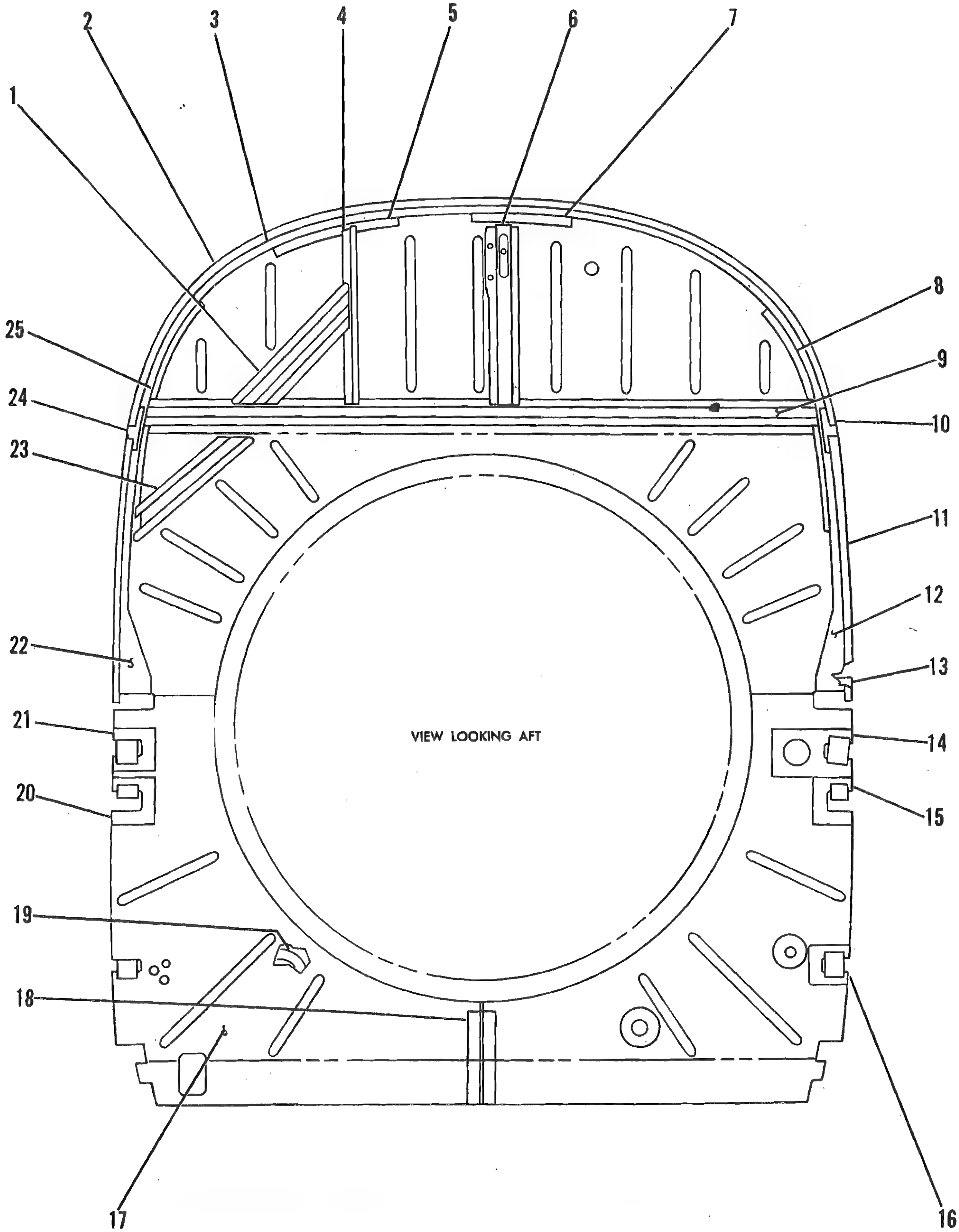


Figure 4–5. Canted Bulkhead – Sta 61.7 (Model CH-34A Serial No. Prior to 55-4462) (Sheet 1 of 2)

Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Channel	Mag	0.040	Mag	0.050	10—9
2	Channel	Mag	0.040	Mag	0.050	10—8
3	Angle	Mag	0.040	Mag	0.050	10—7
4	Angle	Mag	0.063	Mag	0.063	10—7
5	Angle	Mag	0.040	Mag	0.050	10—7
6	Channel	Mag	0.040	Mag	0.050	10—9
7	Angle	Mag	0.040	Mag	0.040	10—7
8	Angle	Mag	0.040	Mag	0.040	10—7
9	Channel	Mag	0.040	Mag	0.050	10—9
10	Splice	Mag	0.050	Replace	—	
11	Angle	Mag	0.040	Mag	0.040	10—7
12	Channel	Mag	0.040	Mag	0.050	10—8
13	Splice	Mag	0.040	Replace	—	
14	Doubler	Mag	0.040	Replace	—	
15	Doubler Plate	Mag	0.040	Replace	—	
16	Doubler Plate	Mag	0.040	Replace	—	
17	Cover	Mag	0.040	Replace	—	
18	Web	Mag	0.032	Mag	0.040	10—2
19	Splice Plate	Mag	0.040	Replace	—	
20	Doubler Plate	Mag	0.040	Replace	—	
21	Doubler	Mag	0.040	Replace	—	
22	Channel	Mag	0.040	Mag	0.050	10—8
23	Channel	Mag	0.040	Mag	0.050	10—9
24	Splice	Mag	0.050	Replace	—	
25	Angle	Mag	0.040	Mag	0.040	10—7

Figure 4–5. Canted Bulkhead – Sta 61.7 (Model CH-34A Serial No. Prior to 55-4462) (Sheet 2 of 2)

b. For a damaged area that does not exceed 1/2 inch in diameter, follow instructions in steps *c* and *d.*

c. Drill out damaged area and fill with resin compound. When inserting resin, allow a slightly humped surface.

d. After resin compound hardens, sand it flush with surrounding area.

e. Follow instructions in steps *f* through *m* for a damaged area greater than 1/2 inch, but not exceeding 2 inches in diameter.

f. Stop-drill each end of crack. If honeycomb core is not damaged, clean area and follow steps *g* through *l.* If honeycomb panel is damaged, slot area between stop-drilled holes.

g. Trim honeycomb core down to lower skin and 1/8 inch back from edge of slot.

h. Fill prepared area with resin compound. Allow slightly humped surface.

i. After resin compound hardens, sand it flush with the surrounding area.

Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Channel	Mag	0.050	Mag	0.063	10—9
2	Channel	Mag	0.040	Mag	0.050	10—8
3	Angle	Mag	0.050	Mag	0.063	10—7
4	Web	Mag	0.032	Mag	0.040	10—3
5	Angle	Mag	0.040	Mag	0.050	10—7
6	Channel	Mag	0.040	Mag	0.050	10—9
7	Angle	Mag	0.040	Mag	0.050	10—7
8	Angle	Mag	0.040	Mag	0.050	10—7
9	Channel	Mag	0.040	Mag	0.050	10—9
10	Splice	Mag	0.050	Replace	—	
11	Angle	Mag	0.040	Mag	0.050	10—7
12	Channel	Mag	0.040	Mag	0.050	10—8
13	Splice	Mag	0.040	Replace	—	
14	Doubler	Mag	0.040	Replace	—	
15	Doubler	Mag	0.040	Replace	—	
16	Doubler	Mag	0.040	Replace	—	
17	Web	Mag	0.032	Mag	0.040	10—3
18	Splice Plate	Mag	0.040	Replace	—	
19	Doubler	Mag	0.040	Replace	—	
20	Doubler	Mag	0.040	Replace	—	
21	Channel	Mag	0.040	Mag	0.050	10—8
22	Channel	Mag	0.040	Mag	0.050	10—9
23	Splice	Mag	0.050	Replace	—	
24	Angle	Mag	0.040	Mag	0.040	10—7

Figure 4–6. Canted Bulkhead – Sta 75.5 (Model CH-34C Serial No. 55-4462 and Subsequent) (Sheet 1 of 2)

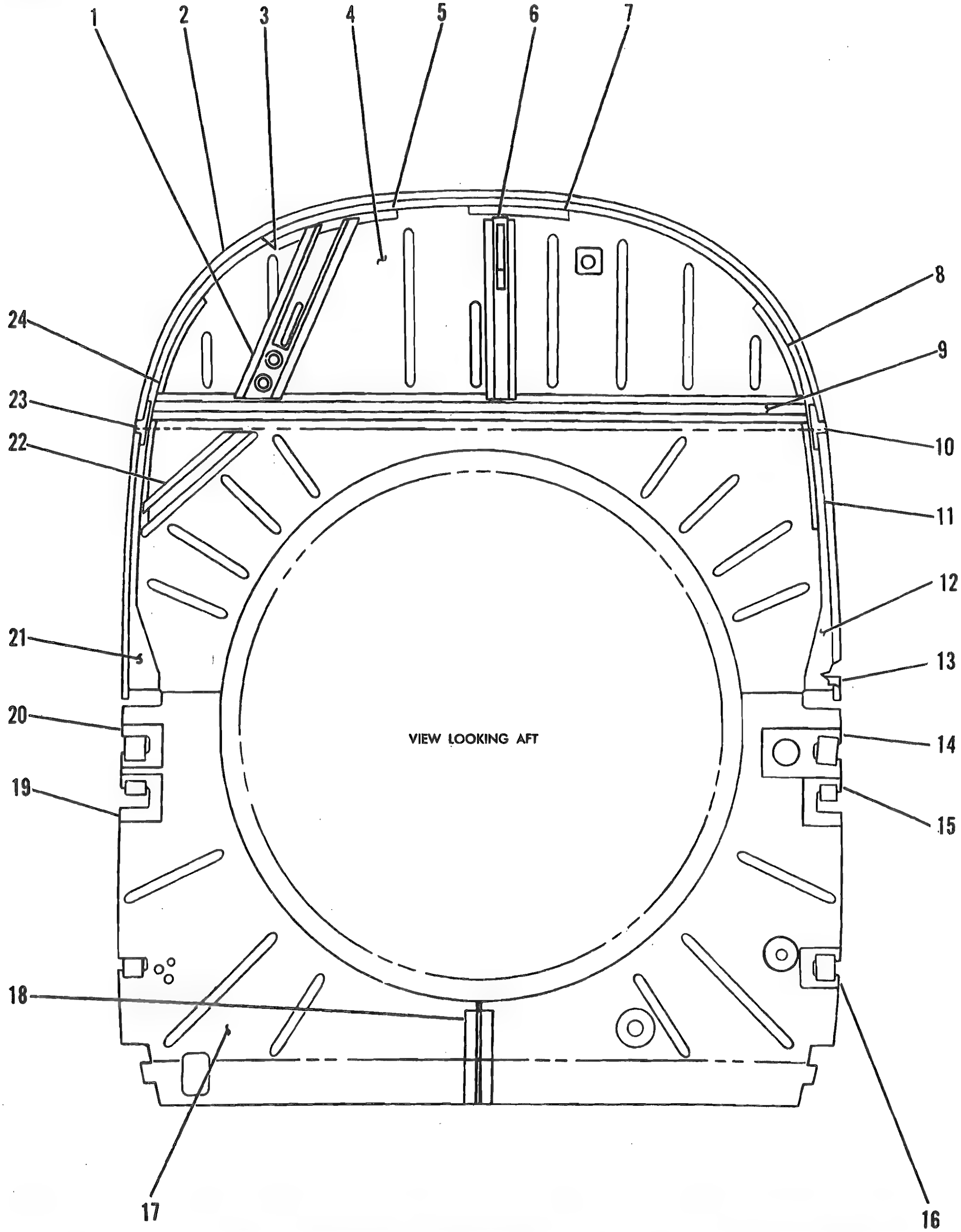
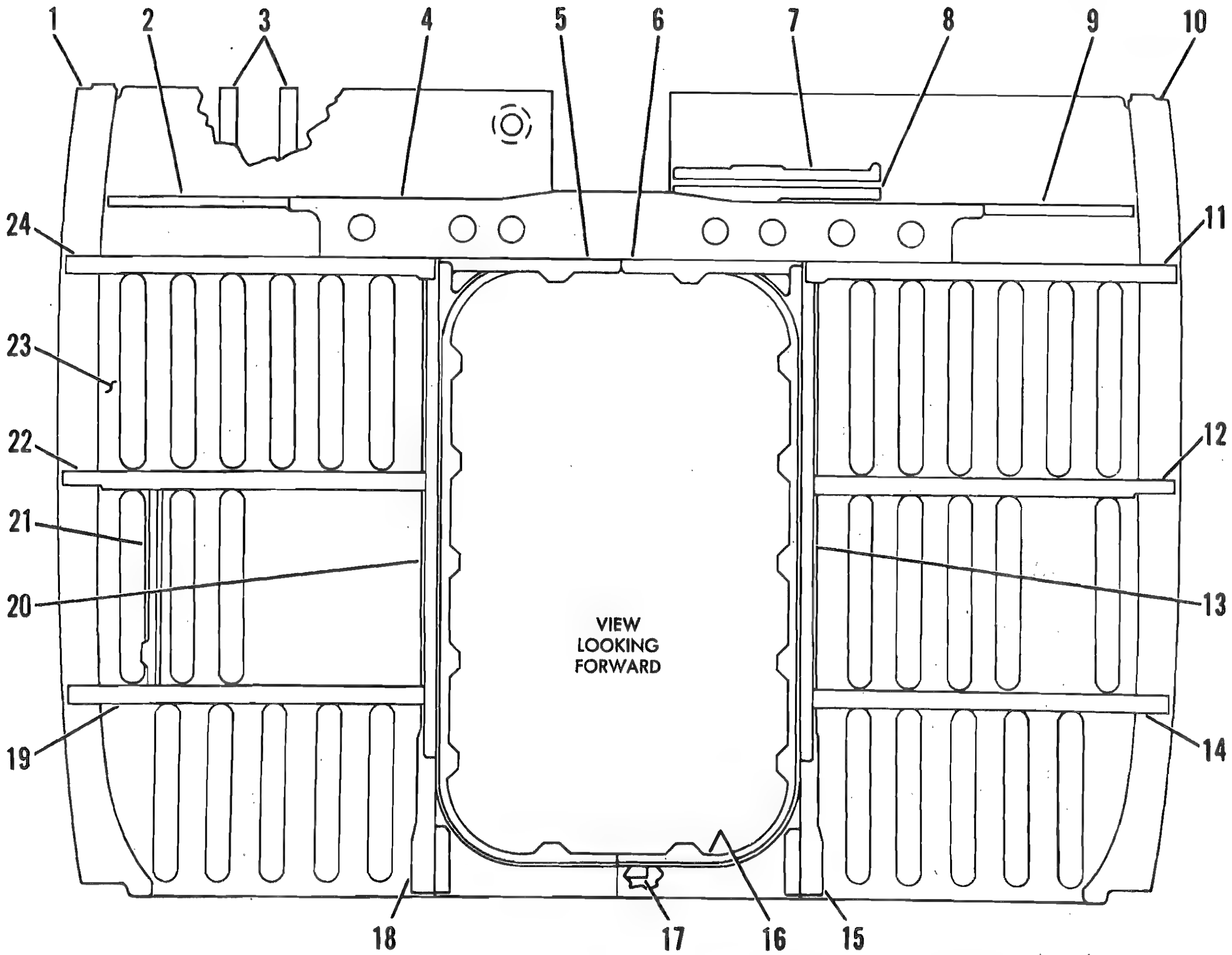
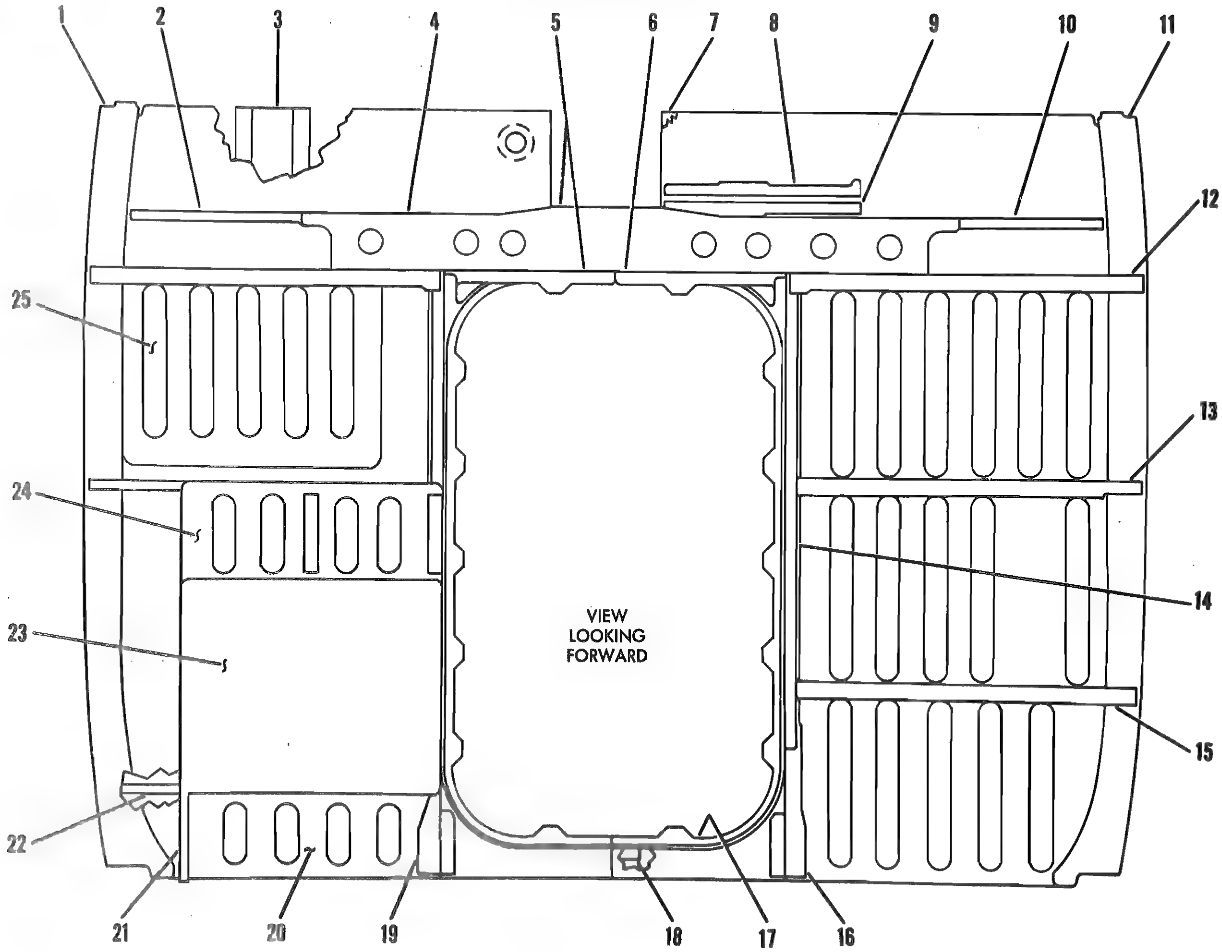


Figure 4–6. Canted Bulkhead – Sta 75.5 (Model CH-34C Serial No. 55-4462 and Subsequent) (Sheet 2 of 2)



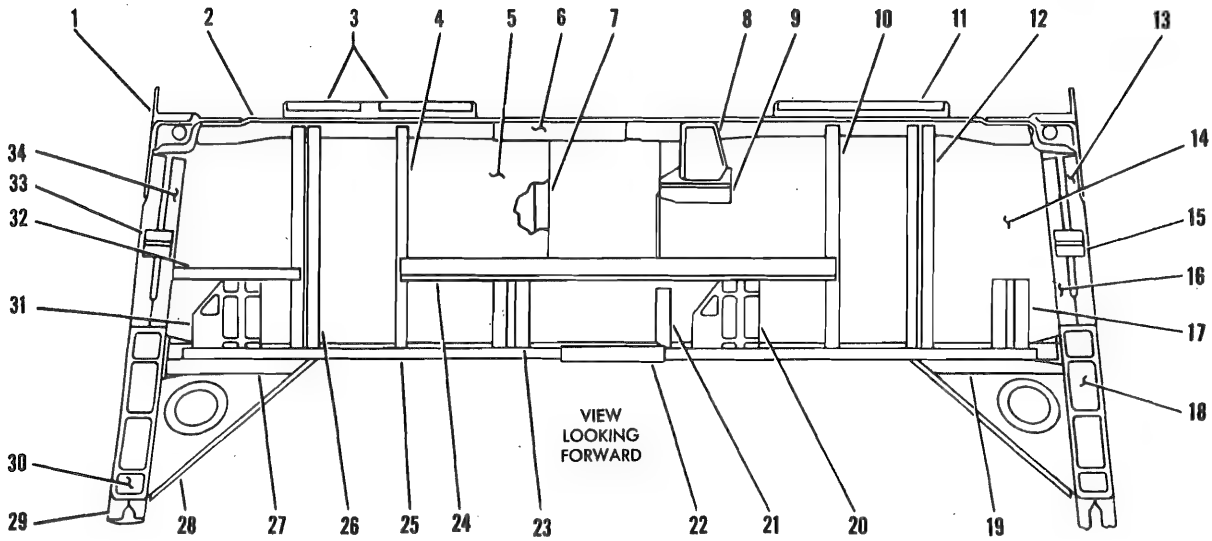
Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Frame — LH	Al Alloy	0.050	Al Alloy	0.063	10—8
2	Stiffener — LH	Alclad	0.050	Alclad	0.050	10—7
3	Stiffener — LH	Al Alloy	Alcoa 78F	Replace	—	
4	Splice Angle	Al Alloy	0.063	Al Alloy	0.071	10—8
5	Angle — LH	Mag	0.040	Mag	0.040	10—7
6	Angle — RH	Mag	0.040	Mag	0.040	10—7
7	Stiffener	Alclad	0.063	Alclad	0.063	10—7
8	Stiffener	Alclad	0.063	Alclad	0.063	10—7
9	Stiffener	Alclad	0.050	Alclad	0.050	10—7
10	Frame — RH	Al Alloy	0.050	Al Alloy	0.063	10—8
11	Rung — RH	Alclad	0.050	Alclad	0.063	10—8
	Channel — RH	Mag	0.040	Mag	0.050	10—8
12	Rung — RH	Alclad	0.050	Alclad	0.063	10—8
	Channel — RH	Mag	0.040	Mag	0.063	10—8
13	Angle — RH	Mag	0.040	Mag	0.050	10—7, 10—8
14	Rung — RH	Alclad	0.050	Alclad	0.063	10—8
	Channel — RH	Mag	0.040	Mag	0.050	10—8
15	Tee — RH	Al Alloy	AND10136-2401	—	—	10—7
16	Doubler — RH	Mag	0.040	Mag	0.040	10—7
17	Splice Angle	Mag	0.050	Replace	—	
18	Tee — LH	Al Alloy	AND10136-2401	—	—	10—7
19	Rung — LH	Alclad	0.050	Alclad	0.063	10—8
	Channel — LH	Mag	0.040	Mag	0.050	10—9
20	Angle — LH	Mag	0.040	Mag	0.050	10—7, 10—8
21	Angle	Alclad	0.040	Alclad	0.040	10—7
22	Rung — LH	Alclad	0.050	Alclad	0.063	10—8
	Channel — LH	Mag	0.040	Mag	0.050	10—8
23	Web	Titanium	0.016	St Steel	0.016	10—8
24	Rung — LH	Alclad	0.050	Alclad	0.063	10—8
	Channel — LH	Mag	0.040	Mag	0.050	10—8

Figure 4–7. Bulkhead – Sta 82.5 (Model CH-34A Serial No. Prior to 56-4313)



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Frame — LH	Al Alloy	0.050	Al Alloy	0.063	10–8
2	Stiffener — LH	Alclad	0.050	Alclad	0.050	10–7
3	Hat Section	Alclad	0.090	Alclad	0.090	10–9
4	Splice Channel	Al Alloy	0.063	Al Alloy	0.071	10–8
5	Angle — LH	Mag	0.040	Mag	0.040	10–7
6	Angle — RH	Mag	0.040	Mag	0.040	10–7
7	Angle	Alcoa 78F	—	Replace	—	
8	Stiffener	Alclad	0.063	Alclad	0.063	10–7
9	Stiffener	Alclad	0.063	Alclad	0.063	10–7
10	Stiffener	Alclad	0.050	Alclad	0.050	10–7
11	Frame — RH	Al Alloy	0.050	Al Alloy	0.063	10–8
12	Rung — RH	Alclad	0.050	Alclad	0.063	10–7
	Channel — RH	Mag	0.040	Mag	0.050	10–8
13	Rung — RH	Alclad	0.050	Alclad	0.050	10–8
	Channel	Mag	0.040	Mag	0.050	10–8
14	Angle	Mag	0.040	Mag	0.050	10–7
15	Rung — RH	Alclad	0.050	Alclad	0.050	10–8
	Channel	Mag	0.040	Mag	0.050	10–8
16	Tee Splice	Al Alloy	AND10136-2401	—	—	10–5
17	Doubler — RH	Mag	0.040	Mag	0.040	10–7
18	Splice Angle	Mag	0.050	Replace	—	
19	Tee Splice	Al Alloy	AND10136-2401	—	—	10–5
20	Web	Titanium	0.016	Titanium	0.020	10–8
21	Channel	Al Alloy	0.050	Al Alloy	0.063	10–8
22	Channel	Al Alloy	0.050	Al Alloy	0.063	10–3
23	Cover	Plastic	—	Replace	—	
24	Cover	Titanium	0.016	Titanium	0.020	10–3
25	Panel	Titanium	0.028	Titanium	0.028	10–3

Figure 4–8. Bulkhead – 82.5 (Model CH-34C Serial No. 56-4313 and Subsequent)



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference	Paragraph Reference
1	Fitting — LH	—	—	—	—		4–26
2	Cap Strip	Al Alloy	AND10134-1604	—	—	10–5	
3	Gang Channels	—	—	Replace	—		
4	Stiffener	Alclad	0.050	Alclad	0.063	10–7	
5	Web	Alclad	0.040	Alclad	0.050	10–3	
6	Splice	Al Alloy	AND10134-1604	Replace	—		
7	Angle — LH	Al Alloy	AND10133-1002	—	—	10–7	
8	Fitting	Al Alloy	—	Replace	—		
9	Tee	Al Alloy	AND10136-2401	Replace	—		
10	Stiffener	Alclad	0.050	Alclad	0.063	10–7	
11	Gang Channel	—	—	—	—	10–7	
12	Tee — RH	Al Alloy	AND10136-1601	—	—	10–5	
13	Cap Strip — RH	Al Alloy	Alcoa 54837	—	—	10–5	
14	Web	Alclad	0.050	Replace			
15	Tee — RH	Al Alloy	AND10136-3005	—	—	10–5	
16	Cap Strip — RH	Al Alloy	Alcoa 54837	Replace	—		
17	Seat Support — RH	Al Alloy	Alcoa 65709	Replace	—		
18	Fitting — RH	—	—	—	—		4–26
19	Stiffener — RH	Al Alloy	Alcoa 54837	Replace	—		
20	Fitting	Al Alloy	—	Replace	—		
21	Angle	Al Alloy	AND10133-1002	Replace	—		
22	Splice	Alclad	0.072	Replace	—		
23	Seat Support — LH	Al Alloy	Alcoa 65709	Replace	—		
24	Splice	Alclad	0.063	Alclad	0.071	10–11	
25	C — Sect. Channel	Alclad	0.071	Alclad	0.080	10–8	
26	Tee — LH	Al Alloy	AND10136-2401	—	—	10–7	
27	Stiffener	Al Alloy	Alcoa 54837	Replace	—		
28	Bolting Tee — LH	Al Alloy	AND10136-3005	—	—	10–7	
29	Cap Strip — LH	Al Alloy	Alcoa 54837	—	—	10–5	
30	Fitting — LH	—	—	—	—		4–26
31	Fitting	Al Alloy	—	Replace	—		
32	Angle	Al Alloy	AND10136-0701	—	—	10–7	
33	Tee — LH	Al Alloy	AND10136-3005	Replace	—		
34	Cap Strip — LH	Al Alloy	Alcoa 54837	—	—	10–5	

Figure 4–9. Bulkhead – Sta 112 (Model CH-34A Serial No. Prior to 56-4313)

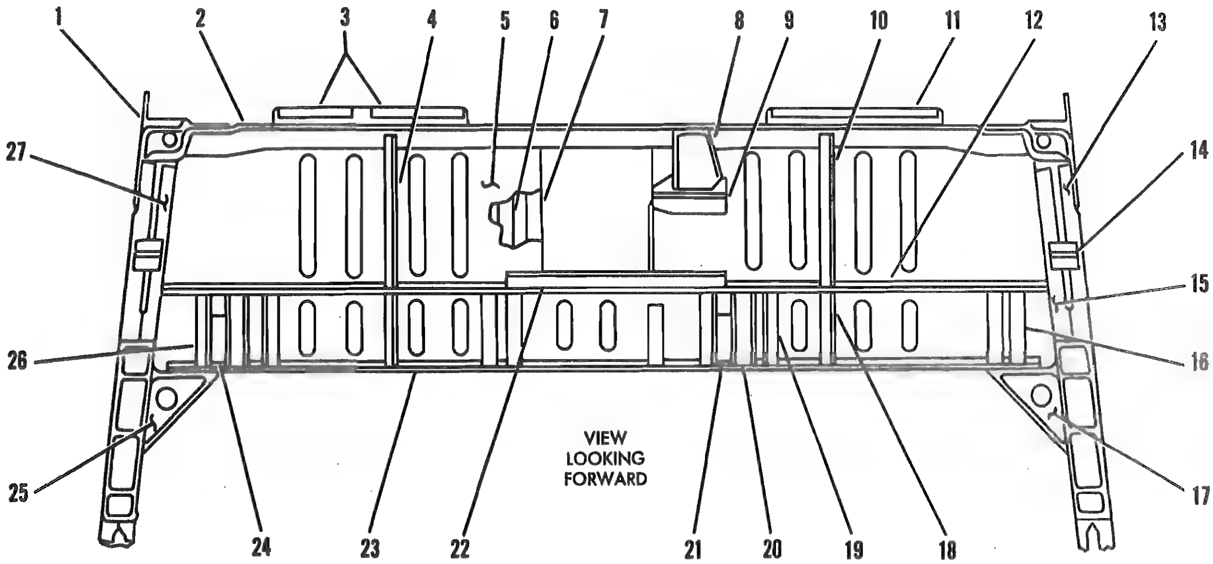
j. Apply thinner, Federal Specification TT-T-266, with clean, lintless cloth. Clean an area at least 2-1/2 inches beyond prepared area.

k. Cut a doubler of 2024-T4 aluminum alloy at least one gage heavier than damaged skin. Cut doubler to extend at least 2 inches on each side of damaged area.

l. Bond doubler to panel with adhesive, Military Specification MIL-A-1154.

m. For a damaged area greater than 2 inches but not exceeding 6 inches in diameter where damage is to upper skin and honeycomb core only, follow instructions in steps *n* through *r*.

n. Stop-drill each end of crack.



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference	Paragraph Reference
1	Fitting — LH	—	—	—	—		4–26
2	Cap Strip	Al Alloy	AND10134-1604	—	—	10–5	
3	Gang Channels	—	—	Replace	—		
4	Angle	Alclad	0.040	Alclad	0.050	10–7	
5	Web	Alclad	0.032	Alclad	0.040	10–3	
6	Support Fitting	Al Alloy	S1605-2137	Replace	—		
7	Angle	Al Alloy	AND10133-1002	—	—	10–7	
8	Fitting	Al Alloy	S1620-61256-2	Replace	—		
9	Tee	Al Alloy	AND10136-2401	Replace	—		
10	Angle	Alclad	0.040	Alclad	0.050	10–7	
11	Gang Channel	—	AND10135-1601	Replace	—		
12	Angle	Alclad	—	Replace	—		
13	Cap Strip	Al Alloy	Alcoa 29802	—	—	10–5	
14	Tee — RH	Al Alloy	AND10136-3005	Replace	—		
15	Cap Strip	Al Alloy	Alcoa 29802	—	—	10–5	
16	Hat	Alclad	0.040	Alclad	0.050	10–9	
17	Fitting — RH	—	—	—	—		4–26
18	Angle	Alclad	0.040	Alclad	0.050	10–7	
19	Angle	Alclad	AND10134-1806	Replace	—		
20	Channel	Alclad	AND10137-1603	Replace	—		
21	Spacer	Al Alloy	S1605-2015	Replace	—		
22	Angle	Al Alloy	0.063	Al Alloy	0.071	10–7	
23	Angle	Alclad	AND10135-1602	Replace	—		
24	Spacer	Al Alloy	S1605-2015	Replace	—		
25	Fitting — LH	—	—	—	—		4–26
26	Angle	Alclad	0.063	Alclad	0.071	10–7	
27	Cap Strip	Al Alloy	Alcoa 29802	—	—	10–5	

Figure 4–10. Bulkhead – Sta 112 (Model CH-34C Serial No. 56-4313 and Subsequent)

o. Remove jagged edges and clean up damaged area.

p. Cut a doubler of 0.050 inch, 2024-T4 aluminum alloy, providing a sufficient edge distance for a single row of rivets or bolts.

q. Prepare resin compound plugs in honeycomb core for rivet or bolt holes.

r. Attach doubler with rivets or bolts. For rivet pattern, see figure 10–2.

Note

Do not buck rivets. Use either Huck blind rivets or lock bolts.

s. For a damaged area greater than 2 inches but not exceeding 6 inches in diameter where damage is through both upper and lower skins, follow instructions in steps *t* through *w*.

t. Prepare damaged area as described in steps *o* and *p*.

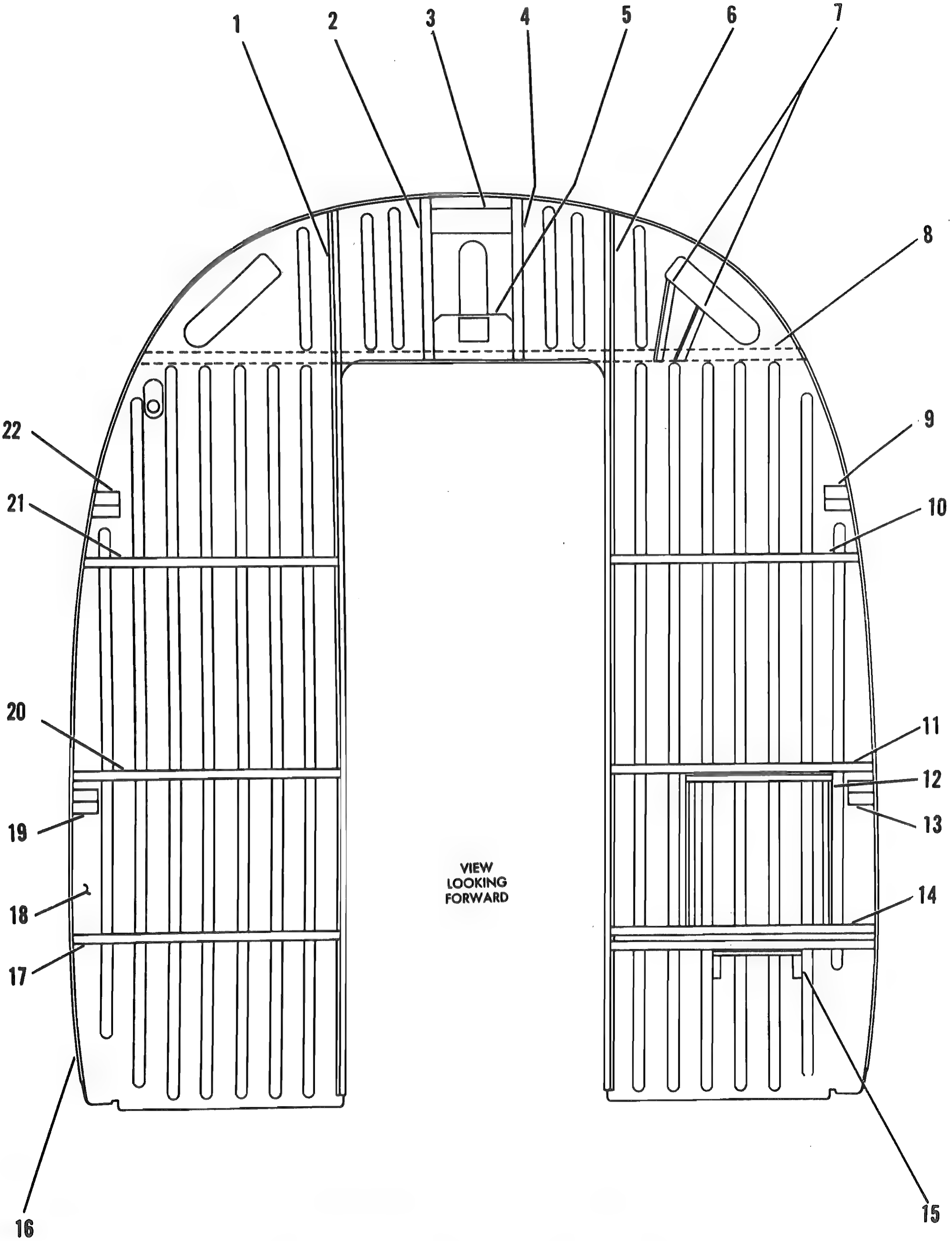


Figure 4–11. Bulkhead – Sta 246 (Sheet 1 of 2)

Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Channel — LH	Mag	0.040	Mag	0.040	10–8
2	Angle — LH	Mag	0.040	Mag	0.040	10–7
3	Splice	Mag	0.040	Mag	0.040	10–8
4	Angle — RH	Mag	0.040	Mag	0.040	10–7
5	Splice	Mag	0.040	Replace	—	
6	Channel — RH	Mag	0.040	—	—	10–8
7	Angle — RH	Mag	0.032	Replace	—	
8	Channel	Mag	0.040	Mag	0.040	10–8
9	Tee — RH	Al Alloy	AND10136-1706	Replace	—	
10	Angle — RH	Mag	0.040	Mag	0.040	10–7
11	Angle — RH	Mag	0.040	Mag	0.040	10–7
12	Support	Mag	0.032	Replace	—	
13	Tee — RH	Al Alloy	AND10136-1706	Replace	—	
14	Stiffener	Mag	0.040	Mag	0.040	10–7, 10–8
15	Bracket	Mag	0.032	Replace	—	
16	Angle — LH	Mag	0.040	Mag	0.050	10–7
17	Angle — LH	Mag	0.040	Mag	0.040	10–7
18	Web	Mag	0.025	Mag	0.032	10–2
19	Tee — LH	Al Alloy	AND10136-1706	Replace	—	
20	Angle — LH	Mag	0.040	Mag	0.040	10–7
21	Angle — LH	Mag	0.040	Mag	0.040	10–7
22	Tee — LH	Al Alloy	AND10136-1706	Replace	—	

Figure 4–11. Bulkhead – Sta 246 (Sheet 2 of 2)

u. Cut doublers of 0.050 inch, 2024-T4 aluminum alloy for both skins.

v. Prepare resin compound plugs in honeycomb core for rivet or bolt holes.

w. Attach a doubler on both sides of damaged area with rivets or bolts. For rivet pattern, see figure 10–2.

Note

Do not buck rivets. Use Huck blind rivets or lock bolts.

4–58. DAMAGE NECESSITATING REPLACEMENT. Damage exceeding an area greater than 6 inches necessitates replacement.

4–59. CABIN DOOR.

4–60. DESCRIPTION. (See figure 4–17.) The cabin door, on the right side of the cabin, is constructed of a welded magnesium tubular frame assembly to which magnesium skin panels are riveted.

4–61. CLASSIFICATION AND REPAIR OF DAMAGE. For general information on classification of damage and their repairs, refer to paragraphs 4–4 through 4–7. Specific repair references are given in figure 4–17.

4–62. NOSE DOORS.

4–63. DESCRIPTION. (See figure 4–18.) The nose or engine access doors provide access to the

Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Angle	Mag	0.040	Mag	0.040	10–7
2	Splice	Mag	0.040	Replace	—	
3	Splice	Mag	0.040	Replace	—	
4	Angle	Mag	0.040	Mag	0.040	10–7
5	Stiffener	Mag	0.040	—	—	10–7
6	Stiffener	Mag	0.040	Mag	0.040	10–7
7	Angle	Mag	0.040	Mag	0.040	10–7
8	Stiffener	Mag	0.040	Mag	0.040	10–7
9	Stiffener	Mag	0.040	Mag	0.040	10–7
10	Stiffener	Mag	0.040	Mag	0.040	10–7
11	Stiffener	Mag	0.040	Mag	0.040	10–7
12	Angle	Mag	0.032	Mag	0.032	10–7
13	Web	Mag	0.025	Mag	0.025	10–2
14	Angle	Mag	0.040	Mag	0.040	10–7
15	Stiffener	Mag	0.040	Mag	0.040	10–7
16	Angle	Mag	0.040	Mag	0.040	10–7
17	Stiffener	Mag	0.040	Mag	0.040	10–7
18	Angle	Mag	0.040	Mag	0.040	10–7
19	Stiffener	Mag	0.040	Mag	0.040	10–7

Figure 4–12. Bulkhead – Sta 296 (Sheet 1 of 2)

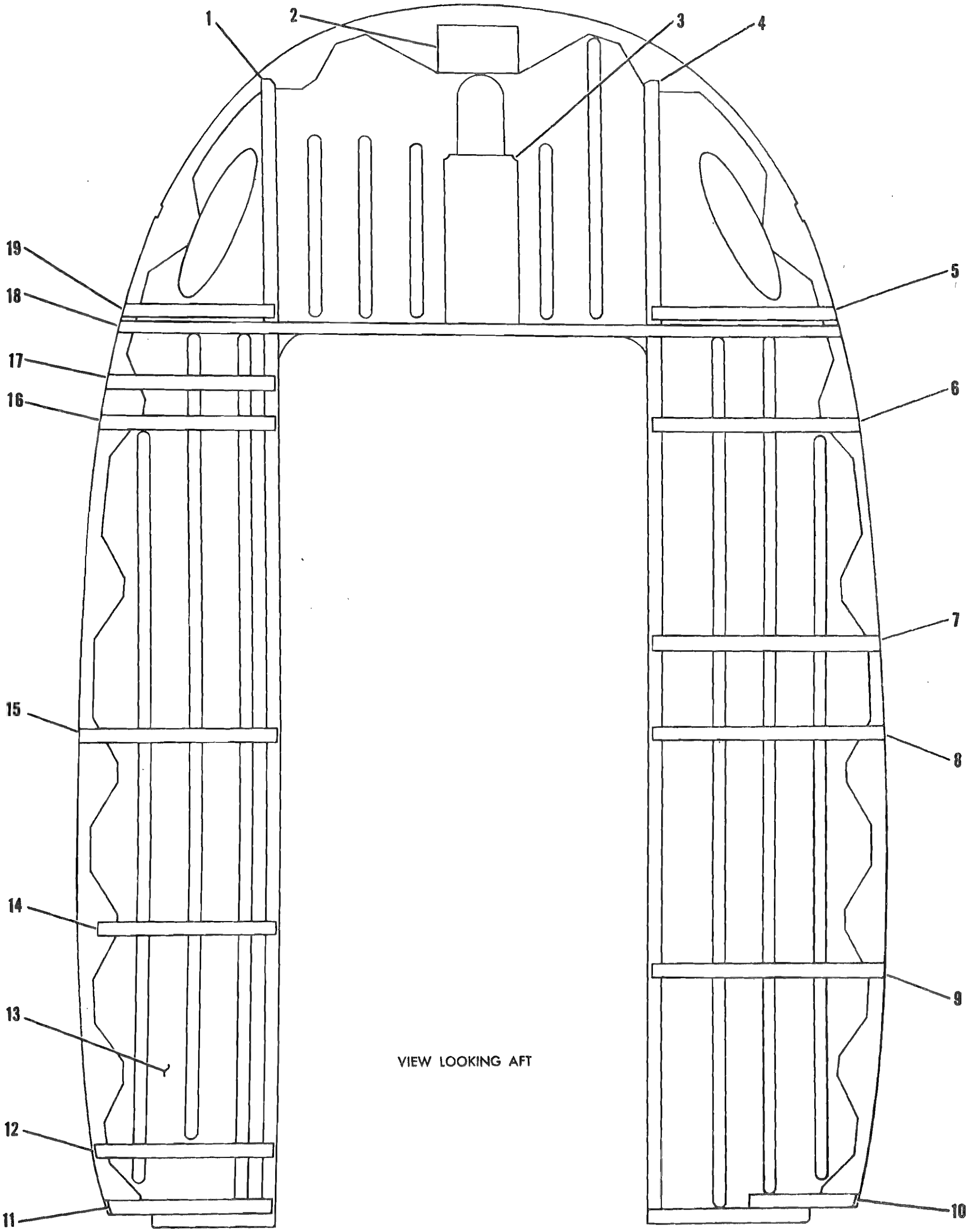
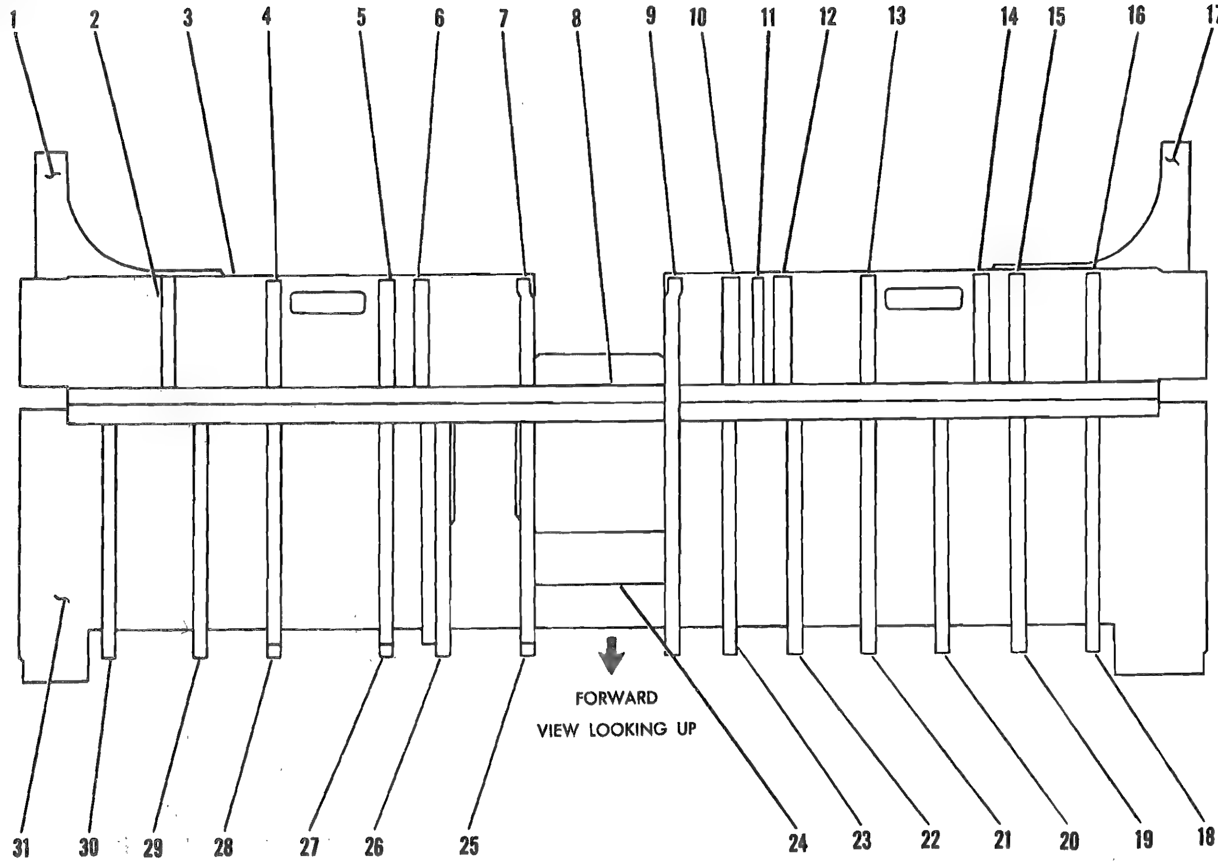
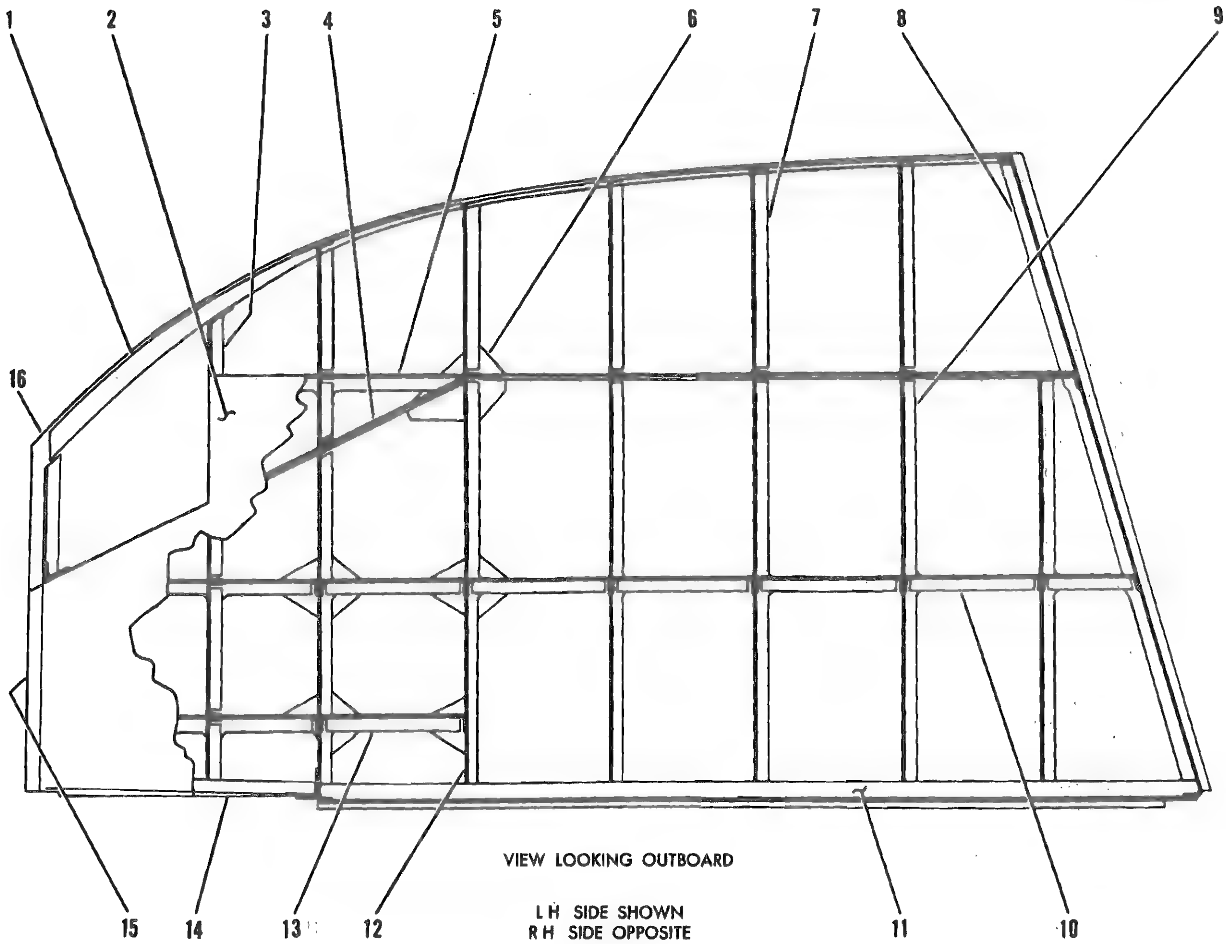


Figure 4–12. Bulkhead – Sta 296 (Sheet 2 of 2)



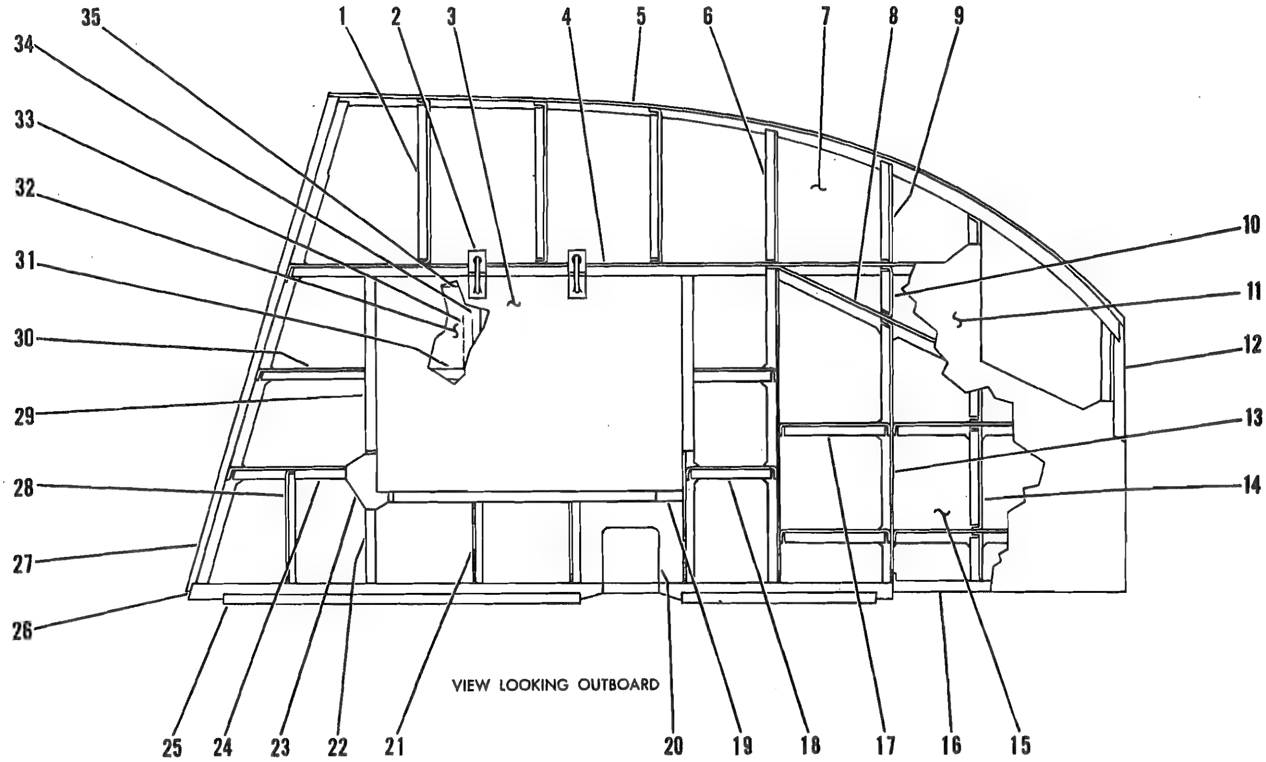
Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Gusset	Alclad	0.050	Replace	—	
2	Angle	Alclad	0.040	Alclad	0.050	10–7
3	Angle	Alclad	0.050	Alclad	0.063	10–7
4	Gusset	Alclad	0.090	Alclad	0.125	10–7, 10–8
5	Gusset	Alclad	0.090	Alclad	0.125	10–7, 10–8
6	Gusset	Alclad	0.090	Alclad	0.125	10–7, 10–8
7	Gusset	Alclad	0.090	Alclad	0.125	10–7, 10–8
8	Transverse Beam	Alclad	0.090	Alclad	0.125	10–7
9	Beam	Alclad	0.063	Alclad	0.071	10–7, 10–8
10	Angle	Al Alloy	AND10133-1002	—	—	10–7
11	Angle	Al Alloy	AND10133-1002	—	—	10–7
12	Angle	Al Alloy	AND10133-1002	—	—	10–7
13	Gusset	Alclad	0.090	Alclad	0.125	10–7, 10–8
14	Gusset	Alclad	0.090	Alclad	0.125	10–7, 10–8
15	Gusset	Alclad	0.090	Alclad	0.125	10–7, 10–8
16	Angle	Alclad	0.040	Alclad	0.050	10–7
17	Gusset	Alclad	0.050	Replace	—	
18	Angle	Alclad	0.040	Alclad	0.050	10–7
19	Beam	Alclad	0.063	Alclad	0.071	10–7
20	Angle	Alclad	0.040	Alclad	0.050	10–7
21	Beam	Alclad	0.063	Alclad	0.071	10–7
22	Angle	Alclad	0.040	Alclad	0.050	10–7
23	Angle	Alclad	0.040	Alclad	0.050	10–7
24	Hat	Alclad	0.050	Alclad	0.063	10–9
25	Beam	Alclad	0.063	Alclad	0.071	10–8
26	Beam	Alclad	0.063	Alclad	0.071	10–7
27	Beam	Alclad	0.063	Alclad	0.071	10–8
28	Beam	Alclad	0.063	Alclad	0.071	10–8
29	Angle	Al Alloy	AND10133-0701	—	—	10–7
30	Angle	Alclad	0.040	Alclad	0.050	10–7
31	Panel	Titanium	0.016	St. Steel	0.025	10–3

Figure 4–13. Pilots' Floor



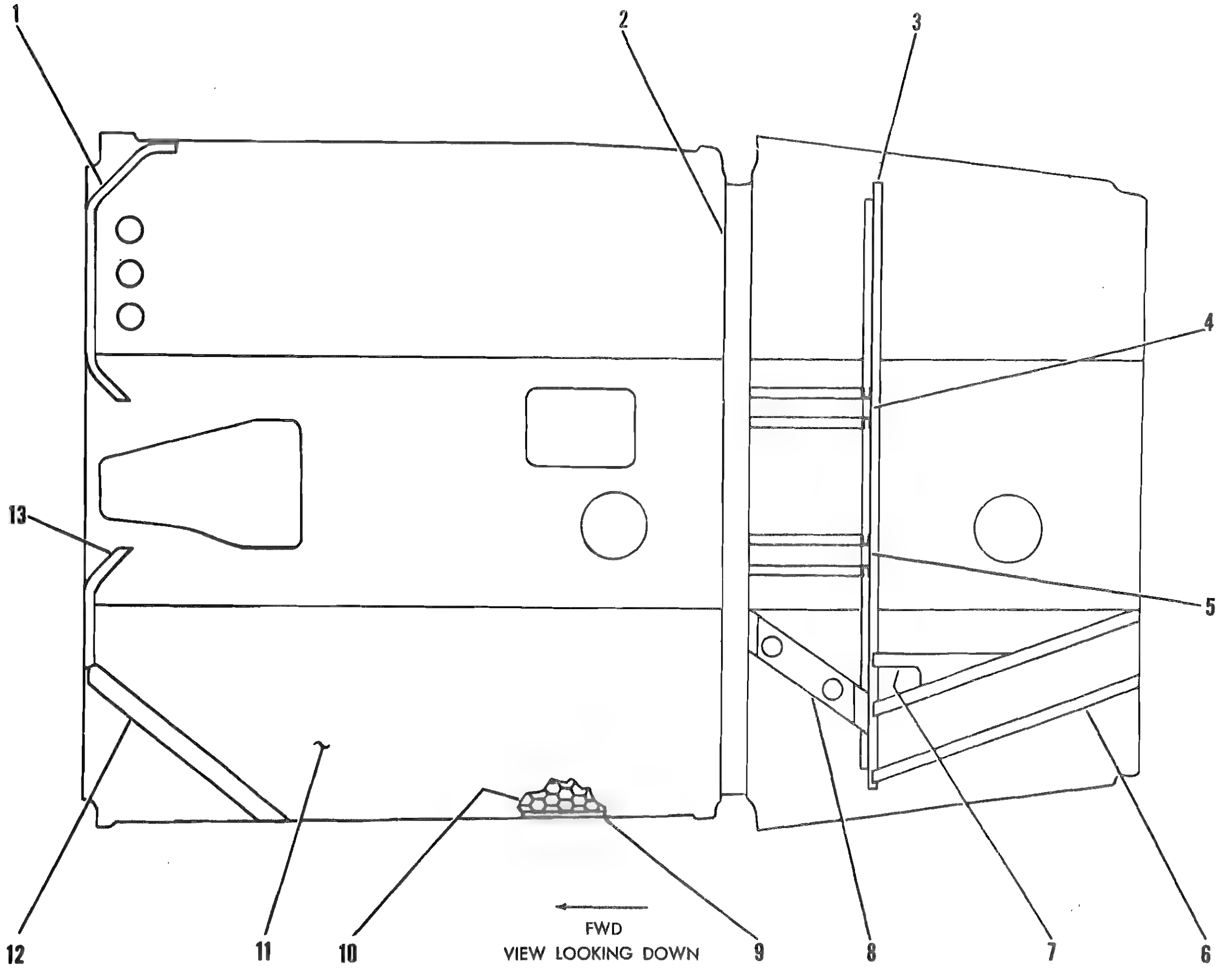
Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Channel	Alclad	0.050	Alclad	0.063	10-3, 10-8
2	Inner Skin	Mag	0.040	Mag	0.040	10-3
3	Frame	Alclad	0.050	Alclad	0.063	10-8, 10-10
4	Intercostal	Alclad	0.071	Alclad	0.080	10-8, 10-9
5	Intercostal	Alclad	0.071	Alclad	0.080	10-8, 10-9
6	Gusset	Alclad	0.040	Replace	—	
7	Frame	Alclad	0.040	Alclad	0.050	10-8, 10-10
8	Frame	Alclad	0.050	Alclad	0.063	10-8, 10-10
9	Frame	Alclad	0.040	Alclad	0.050	10-8, 10-10
10	Intercostal	Alclad	0.040	Alclad	0.050	10-8, 10-9
11	Channel	Alclad	0.050	Alclad	0.063	10-8
12	Frame	Alclad	0.063	Alclad	0.071	10-8, 10-10
13	Intercostal	Alclad	0.063	Alclad	0.071	10-8, 10-10
14	Intercostal	Alclad	0.050	Alclad	0.063	10-8, 10-9
15	Outer Skin	Mag	0.025	Mag	0.025	10-3
16	Outer Skin	Mag	0.025	Mag	0.025	10-3

Figure 4-14. Service Platform Skin Plating and Skeleton Diagram (Helicopters Serial No. Prior to 53-4503)



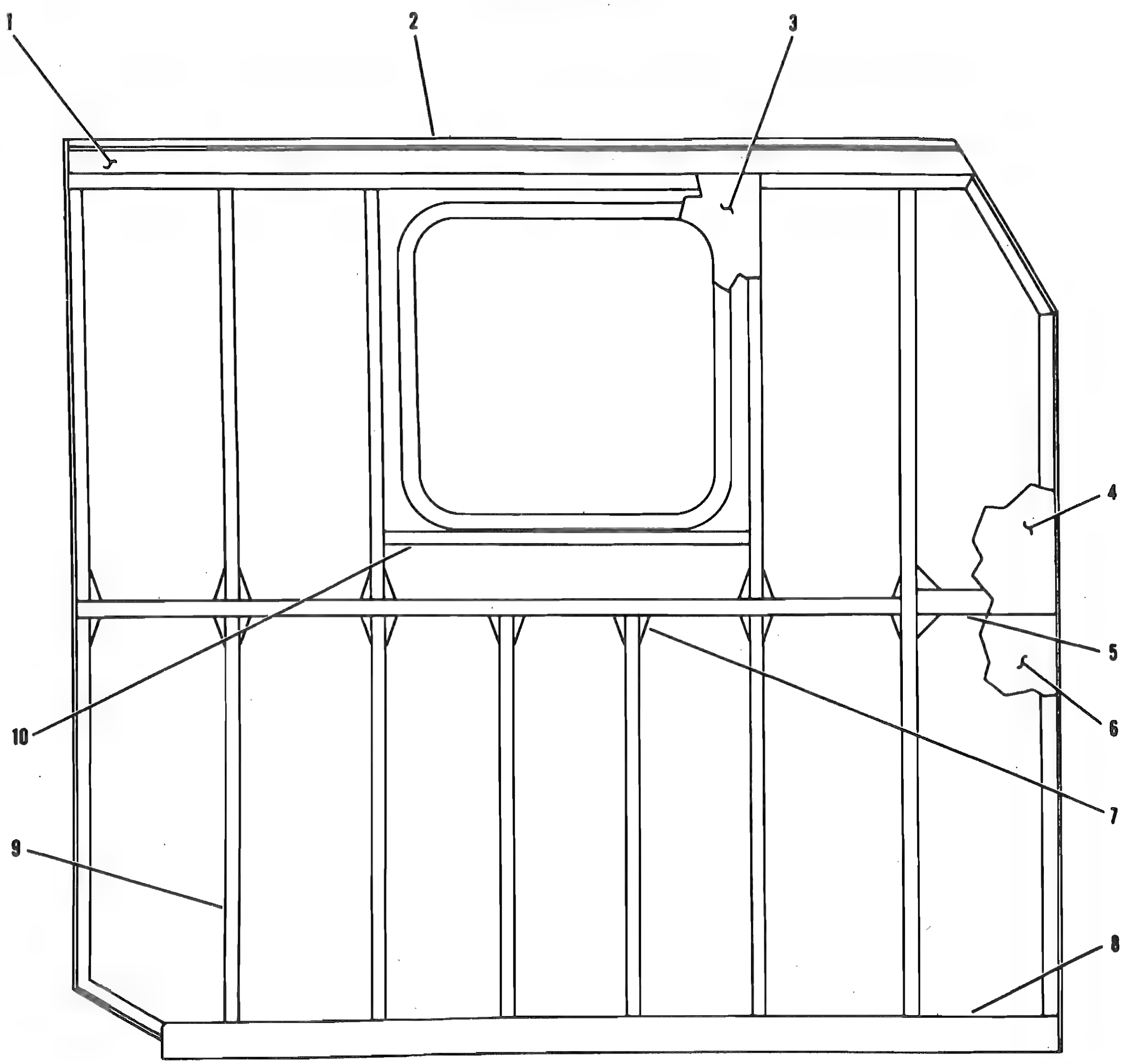
Index	*Nomenclature*	*Material*	*Gage*	*Repair Material*	*Repair Gage*	*Figure Reference*
1	Frame	Alclad	0.040	Alclad	0.050	10–8, 10–10
2	Hinge	Al Alloy	—	Replace	—	
3	Inner Skin	Mag	0.040	Mag	0.040	10–3
4	Intercostal	Alclad	0.071	Alclad	0.080	10–8, 10–9
5	Channel	Alclad	0.050	Alclad	0.063	10–3, 10–8
6	Frame	Alclad	0.063	Alclad	0.071	10–8, 10–10
7	Outer Skin	Mag	0.025	Mag	0.025	10–3
8	Intercostal	Alclad	0.071	Alclad	0.080	10–8, 10–9
9	Frame	Alclad	0.040	Alclad	0.050	10–8, 10–10
10	Frame	Alclad	0.050	Alclad	0.063	10–8, 10–10
11	Inner Skin	Mag	0.040	Alclad	0.025	10–3
12	Frame	Alclad	0.063	Alclad	0.071	10–8, 10–10
13	Frame	Alclad	0.050	Alclad	0.063	10–8, 10–10
14	Frame	Alclad	0.063	Alclad	0.071	10–8, 10–10
15	Outer Skin	Mag	0.025	Mag	0.040	10–3
16	Intercostal	Alclad	0.050	Alclad	0.063	10–8, 10–9
17	Intercostal	Alclad	0.063	Alclad	0.071	10–8, 10–9
18	Intercostal	Alclad	0.050	Alclad	0.063	10–8, 10–9
19	Intercostal	Alclad	0.050	Alclad	0.063	10–8, 10–9
20	Cover	Mag	0.032	Mag	0.032	10–2
21	Frame	Alclad	0.040	Alclad	0.050	10–8, 10–10
22	Frame	Alclad	0.050	Alclad	0.063	10–8, 10–10
23	Gusset	Alclad	—	Replace	—	
24	Intercostal	Alclad	0.050	Alclad	0.063	10–8, 10–9
25	Hinge	Al Alloy	—	Replace	—	
26	Intercostal	Alclad	0.050	Alclad	0.063	10–8, 10–9
27	Frame	Alclad	0.050	Alclad	0.063	10–8, 10–10
28	Frame	Alclad	0.040	Alclad	0.050	10–8, 10–10
29	Angle	Al Alloy	Alcoa K-1288	—	—	
30	Intercostal	Alclad	0.040	Alclad	0.050	10–8, 10–9
31	Intercostal	Alclad	0.040	Alclad	0.050	10–8, 10–9
32	Outer Skin	Mag	0.025	Mag	0.025	10–2, 10–3
33	Chafing Strips	Nylon Sheet	0.063	—	—	
34	Frame	Alclad	0.040	Alclad	0.050	10–8, 10–10
35	Intercostal	Alclad	0.050	Alclad	0.063	10–8, 10–9

Figure 4–15. Service Platform Skin Plating and Skeleton Diagram (Helicopters Serial No. 53-4503 and Subsequent)



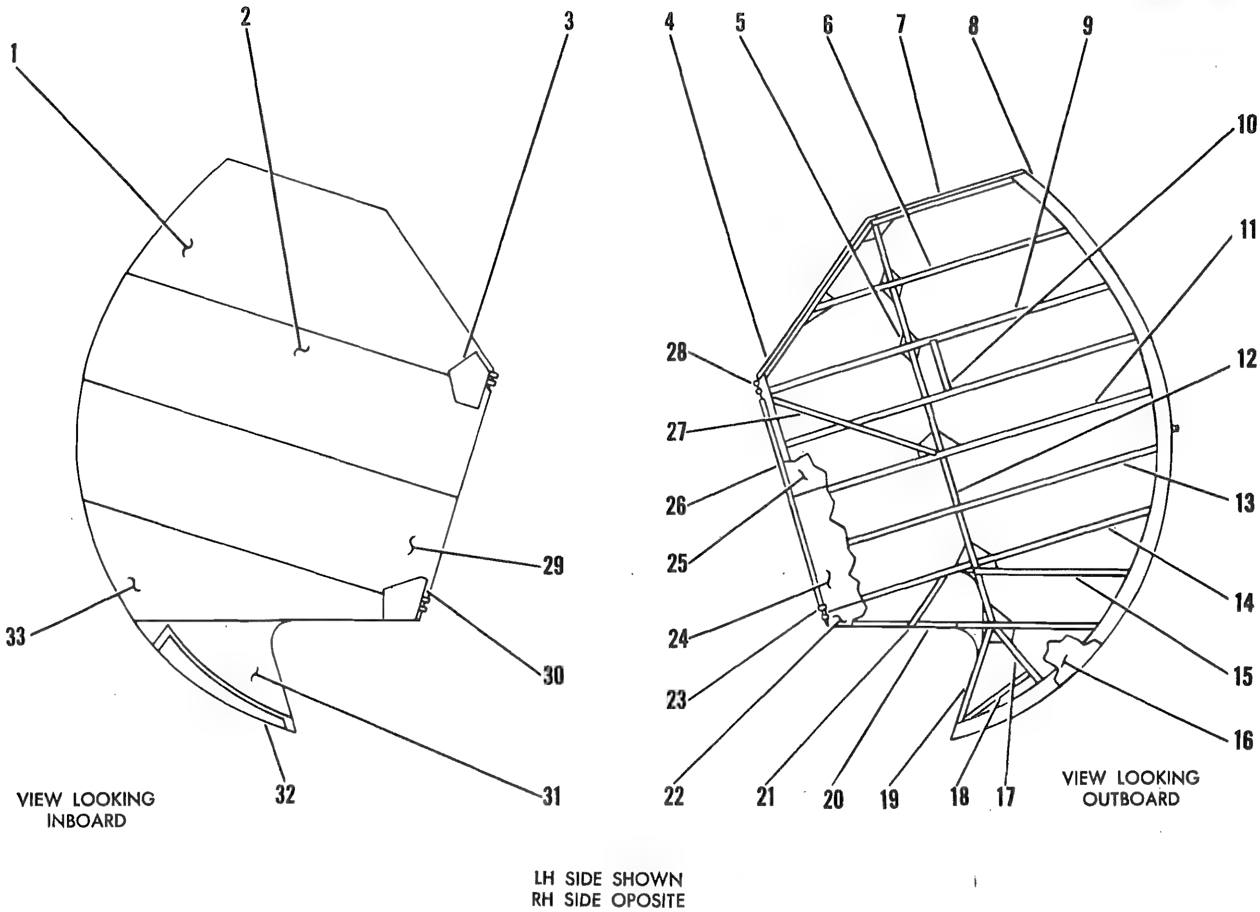
Index	Nomenclature	Material	Gage	Material Repair	Gage Repair	Figure Reference	Paragraph Reference
1	Angle	Mag	0.025	Mag	0.025	10–7	
2	Transverse Brace	Alclad	0.071	Alclad	0.080	10–9	
3	Brace	Alclad	0.080	Alclad	0.090	10–7	
4	Stiffener	Alclad	0.050	Alclad	0.050	10–9	
5	Stiffener	Alclad	0.050	Alclad	0.050	10–9	
6	Channel	Alclad	0.080	Alclad	0.080	10–8	
7	Bracket	Mag	—	Replace	—		
8	Bracket	Mag	0.040	Mag	0.040	10–8	
9	Strip	Mahogany	—	—	—		4–54
10	Core	Honeycomb	—	—	—		4–57
11	Deck Plate, Top	Alclad	0.012	—	—		4–56, 4–57
	Deck Plate, Bottom	Alclad	0.008	—	—		4–56, 4–57
12	Channel	Alclad	0.090	Alclad	0.090	10–8	
13	Angle	Mag	0.025	Mag	0.025	10–7	

Figure 4–16. Transmission Deck



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Plate	Mag	0.050	Replace	—	
2	Strip	Phenolic	0.062	Replace	—	
3	Skin	Mag	0.050	Mag	0.050	10–2
4	Skin	Mag	0.025	Mag	0.025	10–2
5	Tubular Frame	Mag	0.063 x 5/8	Mag	0.063 x 5/8	10–9
6	Skin	Mag	0.025	Mag	0.025	10–2
7	Gusset	Mag	0.040	Replace	—	
8	Channel	Mag	0.050	Mag	0.050	10–8
9	Tube	Mag	0.063 x 3/4	Mag	0.063 x 3/4	10–9
10	Angle	Mag	0.050	Mag	0.050	10–7

Figure 4–17. Cabin Door Skin Plating and Skeleton Diagram



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Outer Skin	Mag	0.025	Mag	0.025	10–2, 10–6
2	Outer Skin	Mag	0.025	Mag	0.025	10–2, 10–6
3	Gusset	Mag	0.032	Replace	—	
4	Channel	Mag	0.032	Mag	0.032	10–8, 10–9
5	Gusset	Mag	0.032	Replace	—	
6	Frame	Mag	0.025	Mag	0.032	10–8, 10–9
7	Channel	Mag	0.032	Mag	0.032	10–8, 10–9
8	Channel	Mag	0.032	Mag	0.032	10–8, 10–9
9	Frame	Mag	0.025	Mag	0.032	10–8, 10–9
10	Intercostal	Mag	0.040	Mag	0.050	10–8, 10–9
11	Frame	Mag	0.025	Mag	0.032	10–8, 10–9
12	Intercostal	Mag	0.025	Mag	0.032	10–8, 10–9
13	Frame	Mag	0.025	Mag	0.032	10–8, 10–9
14	Frame	Mag	0.025	Mag	0.032	10–8, 10–9
15	Frame	Mag	0.025	Mag	0.032	10–8, 10–9
16	Inner Skin	Mag	0.020	Mag	0.020	10–2, 10–6
17	Intercostal	Mag	0.025	Mag	0.032	10–8, 10–9
18	Frame	Mag	0.032	Mag	0.040	10–8, 10–9
19	Frame	Mag	0.032	Mag	0.040	10–8, 10–9
20	Frame	Mag	0.032	Mag	0.040	10–8, 10–9
21	Intercostal	Mag	0.032	Mag	0.040	10–8, 10–9
22	Inner Skin	Mag	0.020	Mag	0.020	10–2, 10–6
23	Hinge	Al Alloy	—	Replace	—	
24	Inner Skin	Mag	0.020	Mag	0.020	10–2, 10–6
25	Inner Skin	Mag	0.020	Mag	0.020	10–1, 10–6
26	Channel	Mag	0.040	Mag	0.050	10–8, 10–9
27	Intercostal	Mag	0.025	Mag	0.032	10–8, 10–9
28	Hinge	Al Alloy	—	Replace	—	
29	Outer Skin	Mag	0.025	Mag	0.025	10–2, 10–6
30	Doubler	Mag	0.032	Replace	—	
31	Outer Skin	Mag	0.025	Mag	0.025	10–2, 10–6
32	Light Panel	Al Alloy	0.050	Al Alloy	0.050	10–2
33	Outer Skin	Mag	0.025	Mag	0.025	10–2, 10–6

Figure 4–18. Nose Door Skin Plating and Skeleton Diagram

engine compartment in the fuselage forward section and are hinged to the fuselage frames at station 46.5. The skeleton structure of the doors consists of frames, channels, and intercostal reinforcements to which the inner and outer skin plating is riveted.

4–64. CLASSIFICATION OF DAMAGE.

4–65. NEGLIGIBLE DAMAGE. For treatment of nicks or scratches, refer to paragraph 4–4.

4–66. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. (Refer to paragraphs 4–5 and 4–6.) Specific repair references are given in figure 4–18.

4–67. DAMAGE NECESSITATING REPLACEMENT. Damage to the nose door hinge exceeding negligible classification requires replacement of the hinge.

4–68. COCKPIT CANOPY.

4–69. DESCRIPTION. (See figures 4–19 and 4–20.) The cockpit canopy is a removable structure that encloses the pilots' and transmission compartments from fuselage stations 70.2 and 258.5. The structure is of semimonocoque construction and is composed of aluminum and magnesium alloy framing members to which skin and transparent panels are fastened. The transparent panels are made of acrylic plastic with the exception of the pilots' windshield which is laminated glass. The fairing skin which encloses the transmission oil cooler is made of Fiberglas cloth. The canopy canted bulkhead (figure 4–21) is located at fuselage station 112 and forms the transverse supporting member of the canopy.

4–70. CLASSIFICATION OF DAMAGE.

4–71. NEGLIGIBLE DAMAGE. Negligible damage to the canopy skin plating and framing members is the same as for the nose doors in paragraph 4–4.

4–72. DAMAGE REPAIRABLE BY PATCHING. (Refer to paragraph 4–7.)

4–73. REPAIR OF REINFORCED PLASTIC FAIRING. (Refer to Section VII.)

4–74. DAMAGE REPAIRABLE BY INSERTION. (Refer to paragraph 4–6.)

4–75. DAMAGE NECESSITATING REPLACEMENT. Damage to a framing member beyond repair by patching or insertion requires replacement of the member.

4–76. TRANSPARENT PANELS.

4–77. DESCRIPTION. For general information on classification of damage and their repairs, refer to TM 55-405-4.

4–78. PILOTS' WINDSHIELD. Any damage whatsoever to the pilots' windshield necessitates replacement of the windshield.

Note

Replacement for plate glass should be safety plate glass, Military Specification MIL-G-8602.

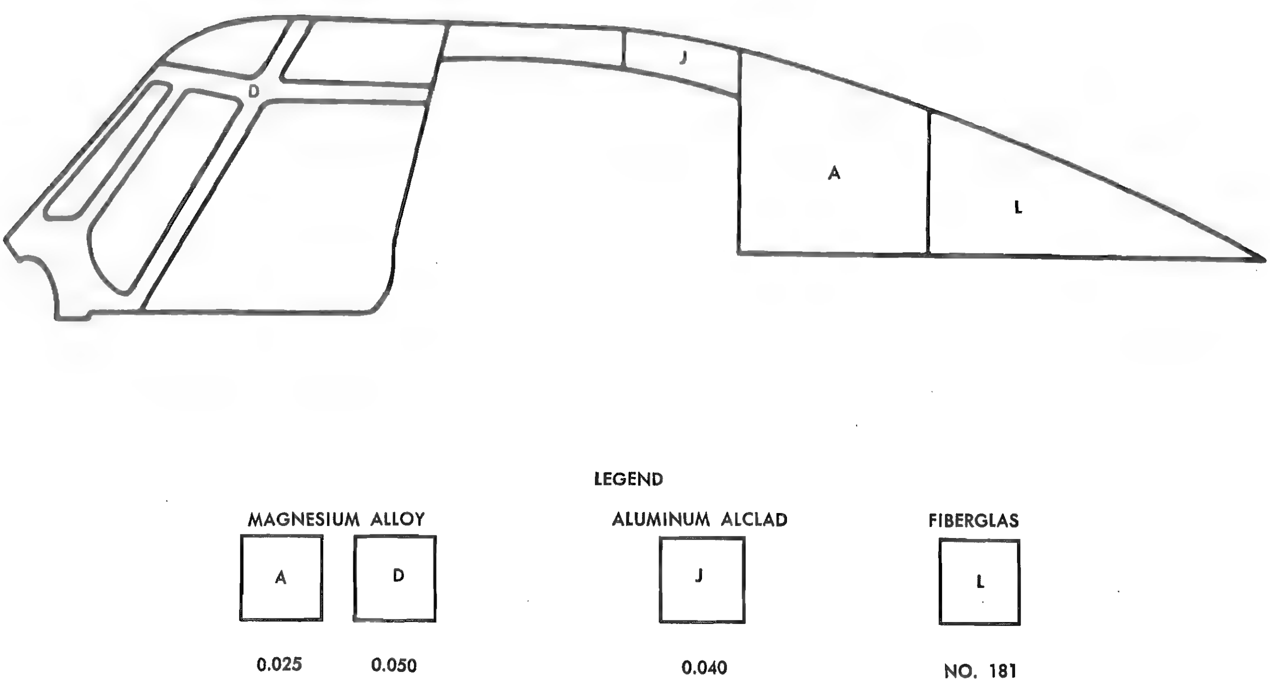
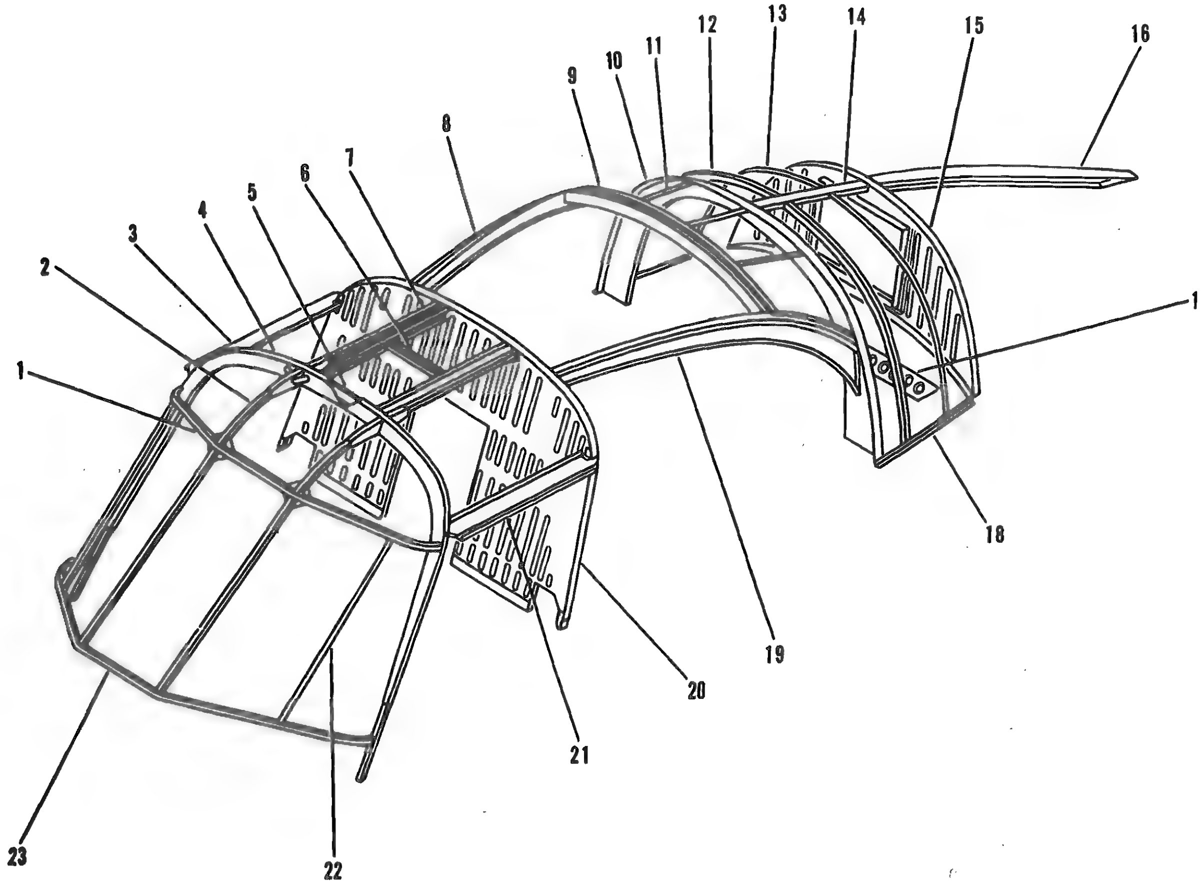
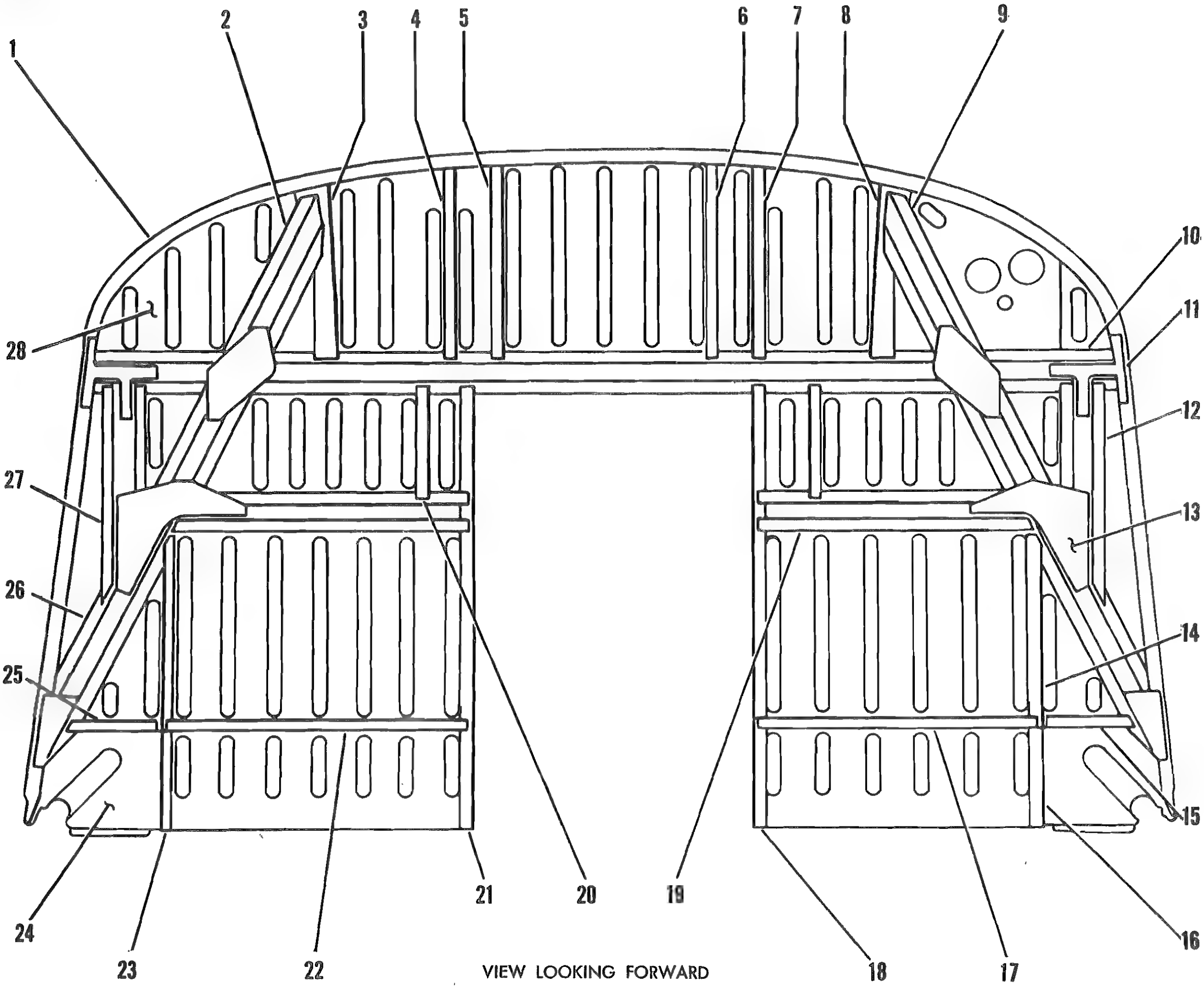


Figure 4–19. Canopy Skin Plating Diagram



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference	Paragraph Reference
1	Post Support	Mag	Dow Co 656	—	—	10–9	
2	Post	Mag	Dow Co 656	—	—	10–9	
3	Longeron	Alclad	0.050	Alclad	0.063	10–8	
4	Frame	Mag	0.090	Mag	0.125	10–3	
5	Support Angle	Mag	0.040	Mag	0.040	10–7	
6	Stiffener	Alclad	0.040	Alclad	0.040	10–8, 10–9	
7	Post	Mag	Dow Co 656	—	—	10–9	
8	Beam	Alclad	0.040	Alclad	0.050	10–8	
9	Frame	Alclad	0.040	Alclad	0.050	10–10	
10	Frame	Alclad	0.040	Alclad	0.050	10–10	
11	Angle	Alclad	0.040	Alclad	0.040	10–7	
12	Angle	Mag	0.032	Mag	0.040	10–7	
13	Angle	Mag	0.032	Mag	0.040	10–7	
14	Channel	Mag	0.050	Mag	0.063	10–8	
15	Bulkhead Web	Mag	0.025	Mag	0.025	10–2	
16	Beam	Mag	0.032	Mag	0.040	10–8	
17	Brace	Alclad	0.040	Alclad	0.040	10–8	
18	Doubler	Mag	0.050	Mag	0.050	10–7	
19	Beam	Alclad	0.040	Alclad	0.050	10–8	
20	Bulkhead	—	—	—	—		4–23
21	Longeron	Alclad	0.050	Alclad	0.063	10–8	
22	Post	Mag	Dow Co 656	—	—	10–9	
23	Post Support	Mag	Dow Co 656	—	—	10–9	

Figure 4–20. Canopy Skeleton Diagram



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Frame	Alclad	0.050	Alclad	0.063	10–8
2	Hat	Alclad	0.050	Alclad	0.063	10–9
3	Angle	Mag	0.040	Mag	0.040	10–7
4	Angle	Mag	0.040	Mag	0.040	10–7
5	Angle	Mag	0.040	Mag	0.040	10–7
6	Angle	Mag	0.040	Mag	0.040	10–7
7	Angle	Mag	0.040	Mag	0.040	10–7
8	Angle	Mag	0.040	Mag	0.040	10–7
9	Hat	Alclad	0.050	Alclad	0.063	10–9
10	Hat	Alclad	0.040	Alclad	0.050	10–9
11	Gusset	Alclad	0.063	Replace	—	
12	Hat	Alclad	0.040	Alclad	0.050	10–9
13	Gusset	Alclad	0.050	Replace	—	
14	Angle	Mag	0.032	Mag	0.032	10–7
15	Angle	Mag	0.032	Replace	—	
16	Angle	Mag	0.032	Mag	0.032	10–7
17	Angle	Mag	0.032	Mag	0.032	10–7
18	Angle	Mag	0.032	Mag	0.032	10–7
19	Hat	Mag	0.032	Mag	0.040	10–9
20	Angle	Mag	0.032	Replace	—	
21	Angle	Mag	0.032	Mag	0.032	10–7
22	Angle	Mag	0.032	Mag	0.032	10–7
23	Angle	Mag	0.032	Mag	0.032	10–7
24	Cover	Mag	0.032	Replace	—	
25	Angle	Mag	0.032	Replace	—	
26	Hat	Alclad	0.050	Alclad	0.063	10–9
27	Hat	Alclad	0.040	Alclad	0.050	10–9
28	Web	Mag	0.025	Mag	0.032	10–2

Figure 4–21. Canopy Canted Bulkhead – Sta 112

4–79. TRANSMISSION SUPPORT TUBES.

4–80. DESCRIPTION. (See figure 4–1.) The transmission support is a tubular structure of 4130 heat-treated steel located on top of the cabin just aft of the cockpit. The tubular supports are bolted to support fittings at stations 112 and 167 on the right and left side of the transmission deck, and they converge to support the main transmission.

4–81. CLASSIFICATION OF DAMAGE.

4–82. NEGLIGIBLE DAMAGE. Smooth dents not exceeding 1/20 of tube diameter in depth may be allowed to remain if dents are free from cracks, abrasions, or sharp corners and do not occur in middle third of length of tube. Bowed tubes are considered negligible damage if maximum bow does not exceed 1/600 of length of tube.

CAUTION

Do not attempt to straighten tubes bowed in excess of 1/600 length of tubes, or add a new weld over a previous weld to strengthen a welded seam.

4–83. DAMAGE REPAIRABLE BY PATCHING. Repair by patching not permitted on support tubes.

4–84. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion not permitted on support tubes.

4–85. DAMAGE NECESSITATING REPLACEMENT. Any damage to transmission support tubes greater than negligible classification requires replacement of tubes.

4–86. 600-POUND RESCUE HOIST SUPPORT ASSEMBLY.

4–87. DESCRIPTION. (See figure 4–1.) The 600-pound rescue hoist support assembly is mounted outside the helicopter above the cabin door. Three fittings installed at specially reinforced points attach the support assembly to the fuselage.

4–88. CLASSIFICATION OF DAMAGE.

4–89. NEGLIGIBLE DAMAGE. Smooth dents, not exceeding 1/20 of tube diameter in depth, need not be repaired if dents are free from cracks, abrasions, or sharp corners. Bowed tubes are considered negligible damage if maximum bow does not exceed 1/240 of length of tube. Smooth out nicks and scratches, not exceeding 0.010 inch in depth, in aluminum tubular supports or in steel tubes at brace assembly. Smooth out nicks and scratches, not exceeding 0.005 inch in depth in fittings of support assembly.

CAUTION

Do not attempt to straighten tubes bent in excess of 1/240 of length of tubes.

CAUTION

Do not use any welding procedures to repair any damage to steel brace assembly or to aluminum supports.

4–90. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. Repair by patching or insertion not permitted on hoist support assembly.

4–91. DAMAGE NECESSITATING REPLACEMENT. Damage described in the following steps necessitates replacement of parts or of entire 600-pound rescue hoist support assembly.

a. Replace steel brace assembly if damage is greater than negligible.

b. Replace aluminum tubes of support assembly if damage is greater than negligible.

c. Replace fittings of support assembly if damage is greater than negligible.

4–92. BOTTOM STRUCTURE.

4–93. DESCRIPTION. The bottom structure is of semimonocoque construction and is composed of magnesium and aluminum alloy. The structure is reinforced transversely by bulkheads and frames and longitudinally by longerons. The bottom structure, which supports the cabin floor and forms the outside contour of the helicopter, is divided into compartments for fuel cells.

4–94. BOTTOM STRUCTURE SKIN PLATING. (See figures 4–22 and 4–23.)

4–95. CLASSIFICATION OF DAMAGE. For information on negligible damage, repairable damage, and damage necessitating replacement of bottom structure skins, refer to paragraphs 4–14 through 4–17.

4–96. BOTTOM STRUCTURE SKELETON. (See figures 4–24, 4–25, and 4–26.)

4–97. BULKHEADS, FRAMES, AND LONGERONS. (See figure 4–27.)

4–98. DESCRIPTION. The bulkheads form the compartments for the fuel cells and, along with the frames, provide reinforcement for the bottom structure. Angles and tee cap strips are riveted to the bulkhead webs for structural support of both the

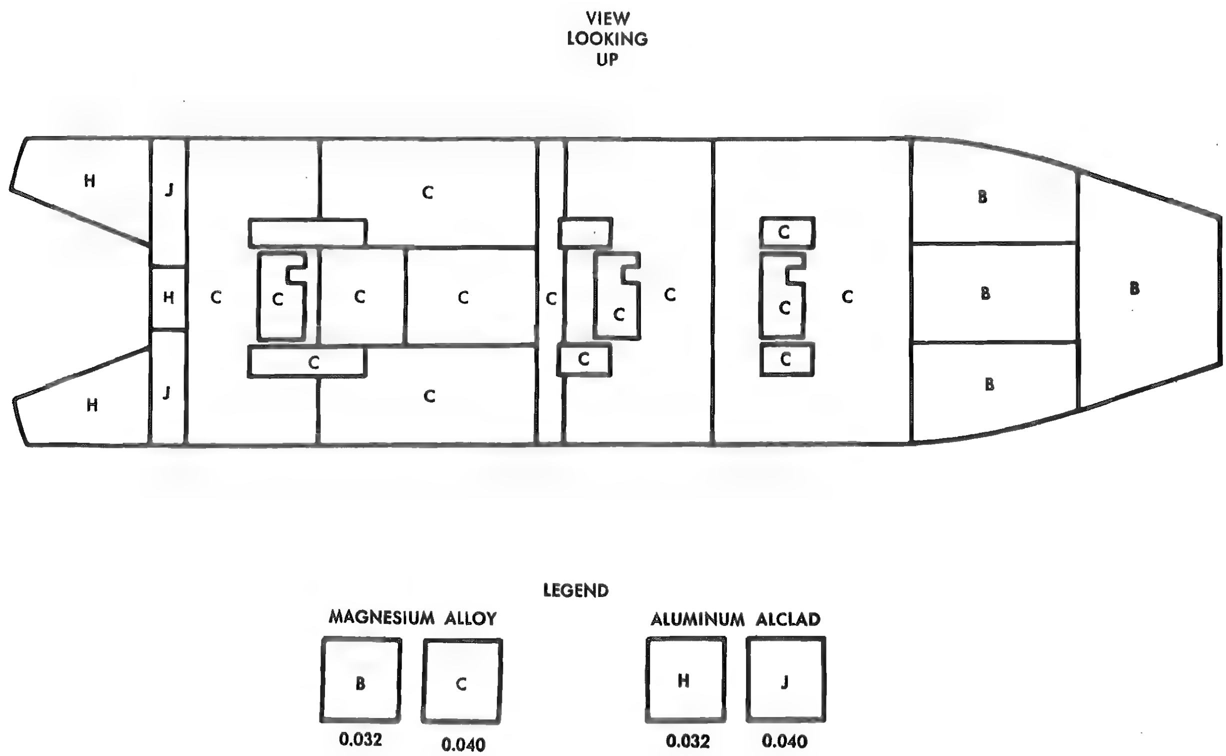


Figure 4–22. Bottom Structure Skin Plating Diagram (Helicopters Serial No. Prior to 56-4284)

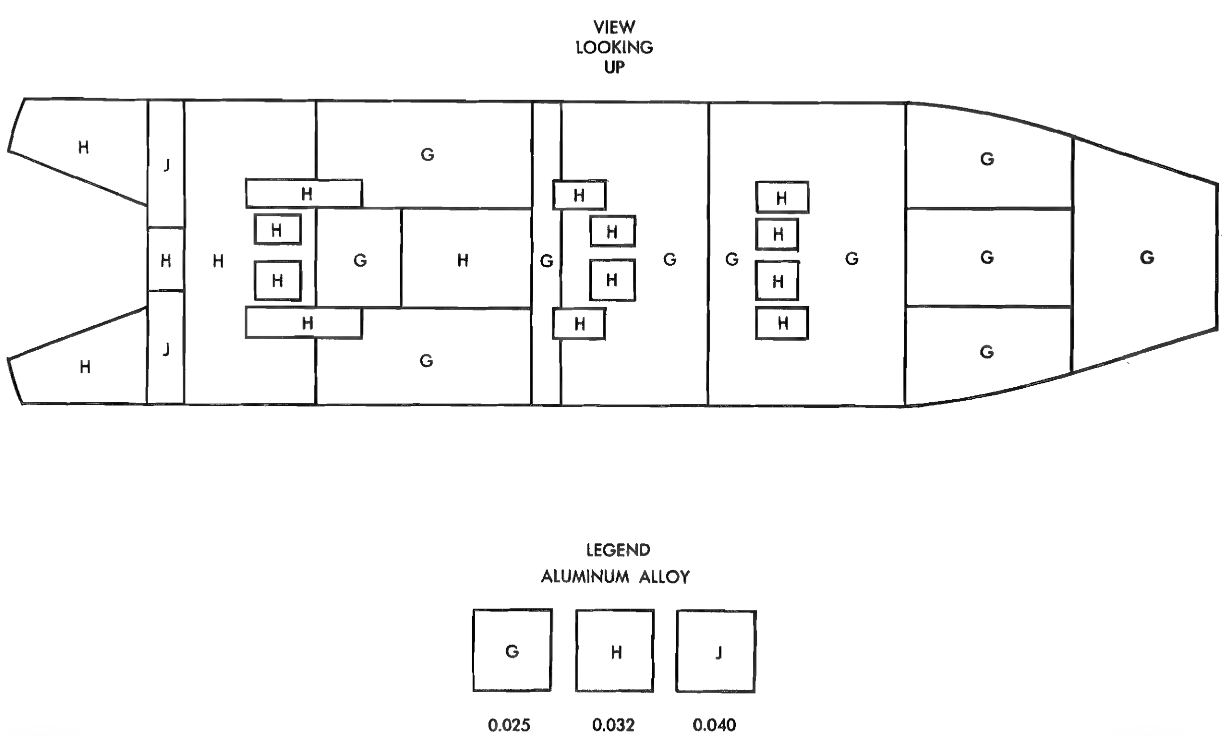
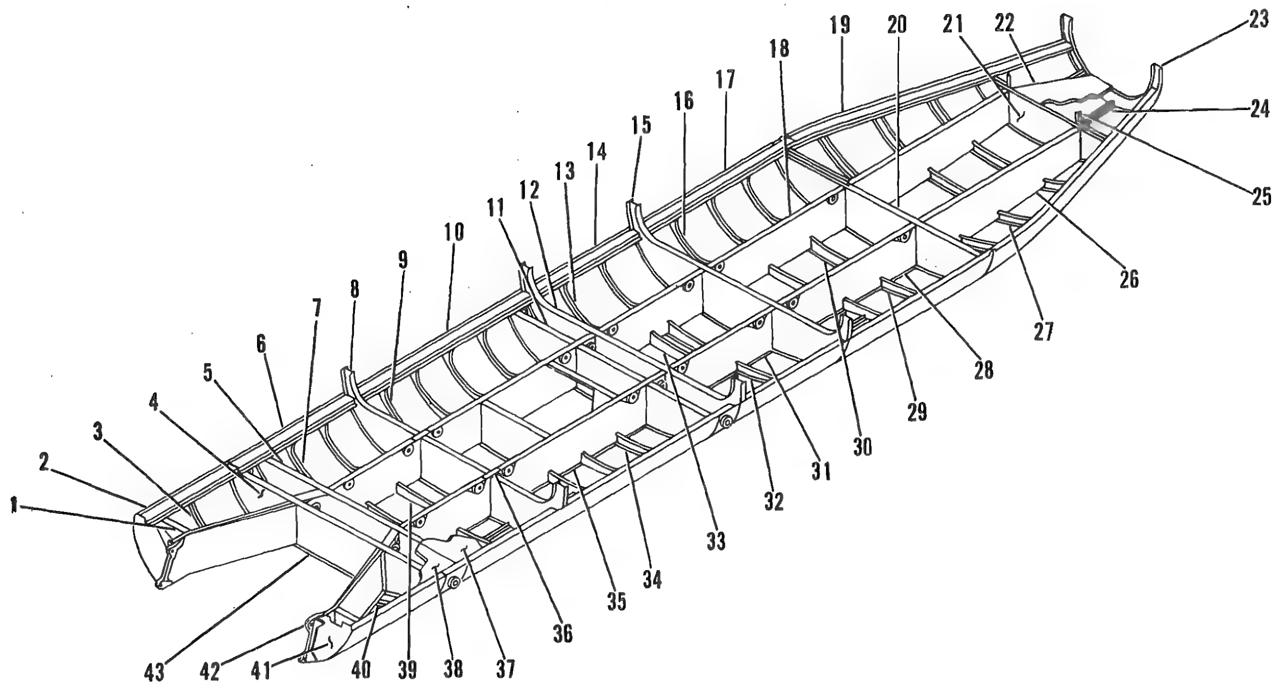
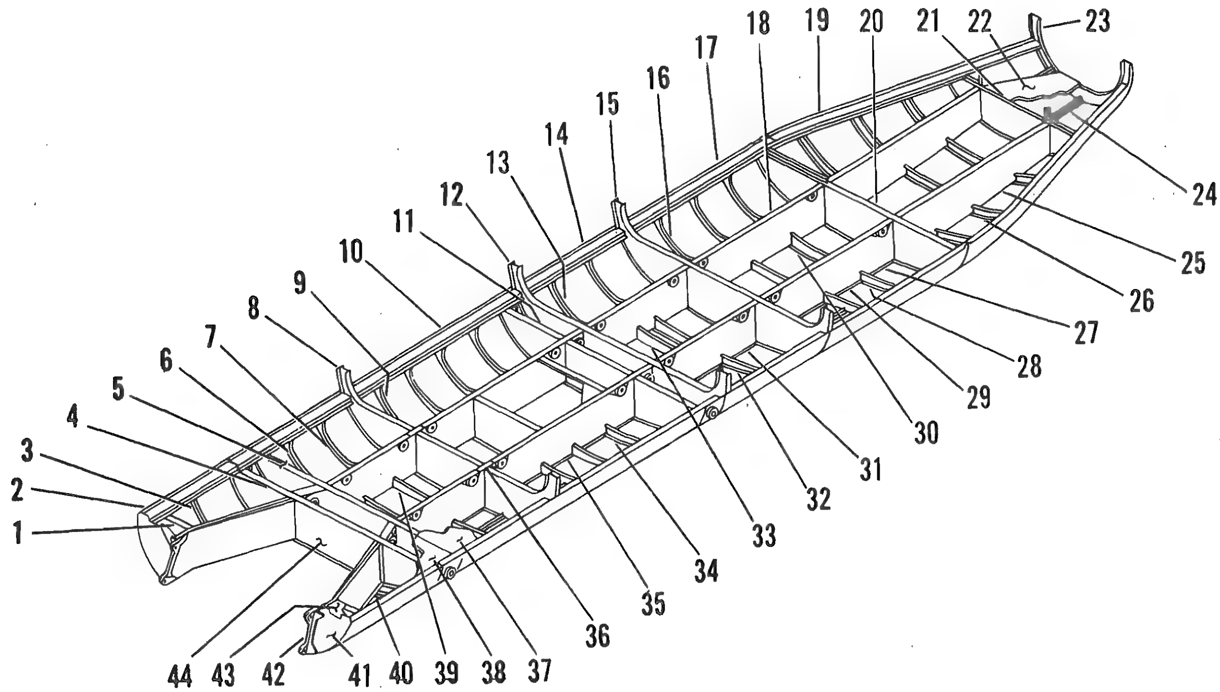


Figure 4–23. Bottom Structure Skin Plating Diagram (Helicopters Serial No. 56-4284 and Subsequent)



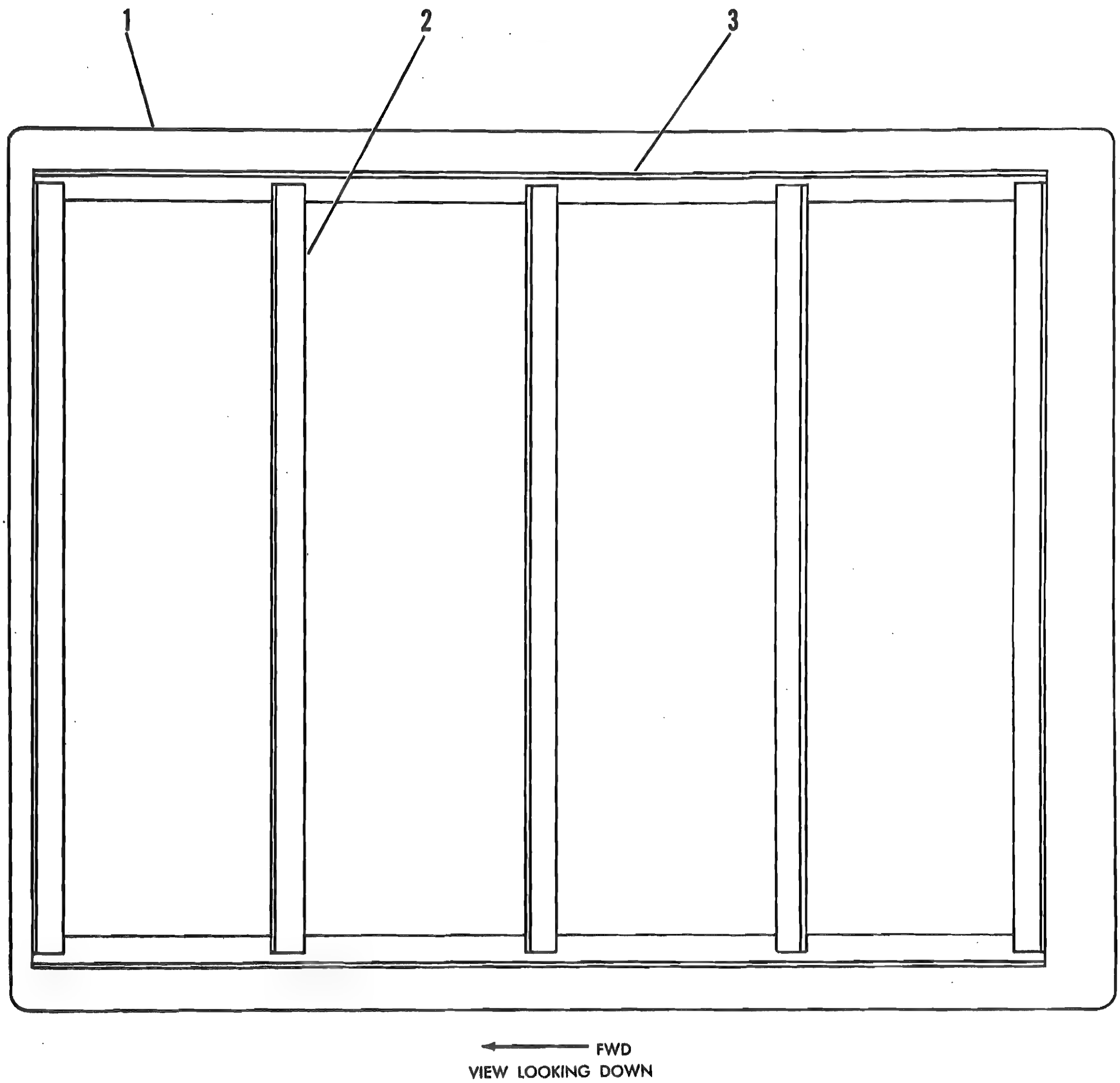
Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference	Figure or Paragraph Reference
1	Frame	Alclad	0.032	Alclad	0.040	10–8	
2	Longeron	Titanium	0.025	—	—		4–28, Para 4–100
3	Frame	Alclad	0.032	Alclad	0.040	10–8, 10–13	
4	Bulkhead Web	Al Alloy	0.050	Al Alloy	0.063	10–3, 10–5, 10–13	
5	Bulkhead Web	Al Alloy	0.050	Al Alloy	0.063	10–3, 10–5, 10–13	
6	Skin	—	—	—	—	10–8, 10–13	
7	Frame	Mag	0.050	Mag	0.063	10–3	
8	Bulkhead Web	Al Alloy	0.050	Al Alloy	0.063	10–3, 10–6	
9	Frame	Mag	0.050	Mag	0.063	10–8, 10–13	
10	Longeron	Al Alloy	0.050	—	—		4–28, Para 4–100
11	Bulkhead Web	Al Alloy	0.040	Al Alloy	0.050	10–3, 10–5, 10–13	
12	Bulkhead Web	Mag	0.040	Mag	0.050	10–3, 10–5, 10–13	
13	Frame	Mag	0.050	Mag	0.063	10–8, 10–13	
14	Longeron	Al Alloy	0.040	—	—		4–28, Para 4–100
15	Bulkhead Web	Al Alloy	0.050	Al Alloy	0.063	10–3, 10–5, 10–13	
16	Frame	Mag	0.050	Mag	0.063	10–8, 10–13	
17	Longeron	Al Alloy	0.040	—	—		4–28, Para 4–100
18	Tee Cap	Al Alloy	S1605-2058	—	—	10–5	
19	Longeron	Alclad	0.040	—	—		4–28, Para 4–100
20	Bulkhead Web	Mag	0.040	Mag	0.050	10–3, 10–5, 10–13	
21	Bulkhead Web	Mag	0.025	Mag	0.032	10–3, 10–5, 10–13	
22	Catwalk	Honeycomb	—	—	—		
23	Frame	Alclad	0.063	Alclad	0.071	10–8, 10–13	
24	Stringer	Alclad	0.032	Alclad	0.032	10–7	
25	Angle	Mag	0.040	Replace	—		
26	Beam Web	Mag	0.040	Mag	0.050	10–3, 10–5, 10–13	
27	Frame	Mag	0.040	Mag	0.050	10–8, 10–13	
28	Beam Web	Mag	0.050	Mag	0.063	10–3, 10–5, 10–13	
29	Frame	Mag	0.040	Mag	0.050	10–8, 10–13	
30	Frame	Mag	0.040	Mag	0.050	10–8, 10–14	
31	Beam Web	Mag	0.050	Mag	0.063	10–3, 10–5, 10–13	
32	Frame	Mag	0.050	Mag	0.063	10–8, 10–13	
33	Frame	Mag	0.040	Mag	0.050	10–8, 10–13	
34	Frame	Mag	0.040	Mag	0.050	10–8, 10–13	
35	Beam Web	Mag	0.050	Mag	0.063	10–3, 10–5, 10–13	
36	Plate	Mag	0.050	Replace	—		
37	Floor Panels	Honeycomb	—	—	—		Para 4–103
38	Floor — Fwd	Titanium	0.025	Titanium	0.025	10–3	
	Aft	Titanium	0.016	Titanium	0.016	10–3	
39	Frame	Mag	0.040	Mag	0.050	10–8, 10–13	
40	Frame	Alclad	0.040	Alclad	0.050	10–8, 10–13	
41	Bulkhead Web	Titanium	0.016	Titanium	0.025	10–3	
42	Engine Mount Fit.	Al Alloy	—	Replace	—		
43	Bulkhead Web	Titanium	0.016	Titanium	0.025	10–3, 10–5	

Figure 4–24. Bottom Structure Skeleton Diagram (Helicopters Serial No. Prior to 56-4284)



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference	Figure or Paragraph Reference
1	Frame	Alclad	0.032	—	—	10–8	
2	Longeron	Titanium	0.025	Al Alloy	0.050		4–28, Par 4–100
3	Frame	Alclad	0.032	Al Alloy	0.025	10–8, 10–13	
4	Bulkhead Web	Al Alloy	0.040	—	—	10–3, 10–5, 10–13	
5	Bulkhead Web	Al Alloy	0.040	Alclad	0.071	10–3, 10–5, 10–13	
6	Frame	Alclad	0.032	Alclad	0.040	10–8, 10–13	
7	Frame	Alclad	0.040	Alclad	0.040	10–8, 10–13	
8	Bulkhead Web	Al Alloy	0.050	Alclad	0.032	10–3, 10–8, 10–13	
9	Frame	Alclad	0.040	Alclad	0.040	10–8, 10–13	
10	Longeron	Al Alloy	0.050	Alclad	0.040		4–28, Par 4–100
11	Bulkhead Web	Alclad	0.025	—	—	10–3, 10–5, 10–13	
12	Bulkhead Web	Al Alloy	0.040	Alclad	0.040	10–3, 10–5, 10–13	
13	Frame	Alclad	0.040	Alclad	0.040	10–8, 10–13	
14	Longeron	Al Alloy	0.040	Alclad	0.050		4–28, Par 4–100
15	Bulkhead Web	Al Alloy	0.040	Alclad	0.040	10–3, 10–5, 10–13	
16	Frame	Alclad	0.040	Alclad	0.040	10–8, 10–13	
17	Longeron	Al Alloy	0.040	Alclad	0.040		4–28, Par 4–100
18	Tee Cap	Al Alloy	S1605-2113	—	—	10–5	
19	Longeron	Alclad	0.040	—	—		4–28, Par 4–100
20	Bulkhead Web	Al Alloy	0.040	Titanium	0.016	10–3, 10–5, 10–13	
21	Bulkhead Web	Al Alloy	0.020	Al Alloy	0.040	10–3, 10–5, 10–13	
22	Catwalk	Honeycomb	—	Alclad	0.040		Par 4–7
23	Frame	Alclad	0.063	Titanium	0.020	10–8, 10–13	
24	Stringer	Alclad	0.040	—	—	10–7	
25	Beam Web	Alclad	0.032	Titanium	0.025	10–3, 10–5, 10–13	
26	Frame	Alclad	0.025	Titanium	0.025	10–8, 10–13	
27	Beam Web	Alclad	0.032	Alclad	0.040	10–3, 10–5, 10–13	
28	Frame	Alclad	0.032	—	—	10–8, 10–13	
29	Angle	Alclad	0.040	Alclad	0.040	10–8, 10–13	
30	Frame	Alclad	0.032	Al Alloy	0.050	10–8, 10–13	
31	Beam Web	Alclad	0.032	Al Alloy	0.050	10–3, 10–5, 10–13	
32	Frame	Alclad	0.040	Alclad	0.040	10–8, 10–13	
33	Frame	Alclad	0.032	Alclad	0.050	10–8, 10–13	
34	Frame	Alclad	0.032	Al Alloy	0.063	10–8, 10–13	
35	Beam Web	Alclad	0.032	Alclad	0.050	10–3, 10–8, 10–13	
36	Plate	Alclad	—	Replace	—		
37	Floor Panels	Honeycomb	—	Alclad	0.032		Par 4–104
38	Floor Aft	Titanium	0.016	Al Alloy	0.050	10–3	
39	Frame	Al Alloy	0.032	Alclad	0.050	10–8, 10–13	
40	Frame	Alclad	0.032	—	—	10–8, 10–13	
41	Bulkhead Web	Titanium	0.016	Al Alloy	0.050	10–3, 10–5, 10–13	
42	Engine Mount Ftg	Al Alloy	—	Replace	—		
43	Floor Fwd	Titanium	0.025	Al Alloy	0.040	10–3	
44	Bulkhead Web	Titanium	0.016	—	—	10–3, 10–5, 10–13	

Figure 4–25. Bottom Structure Skeleton Diagram (Helicopters Serial No. 56-4284 and Subsequent)



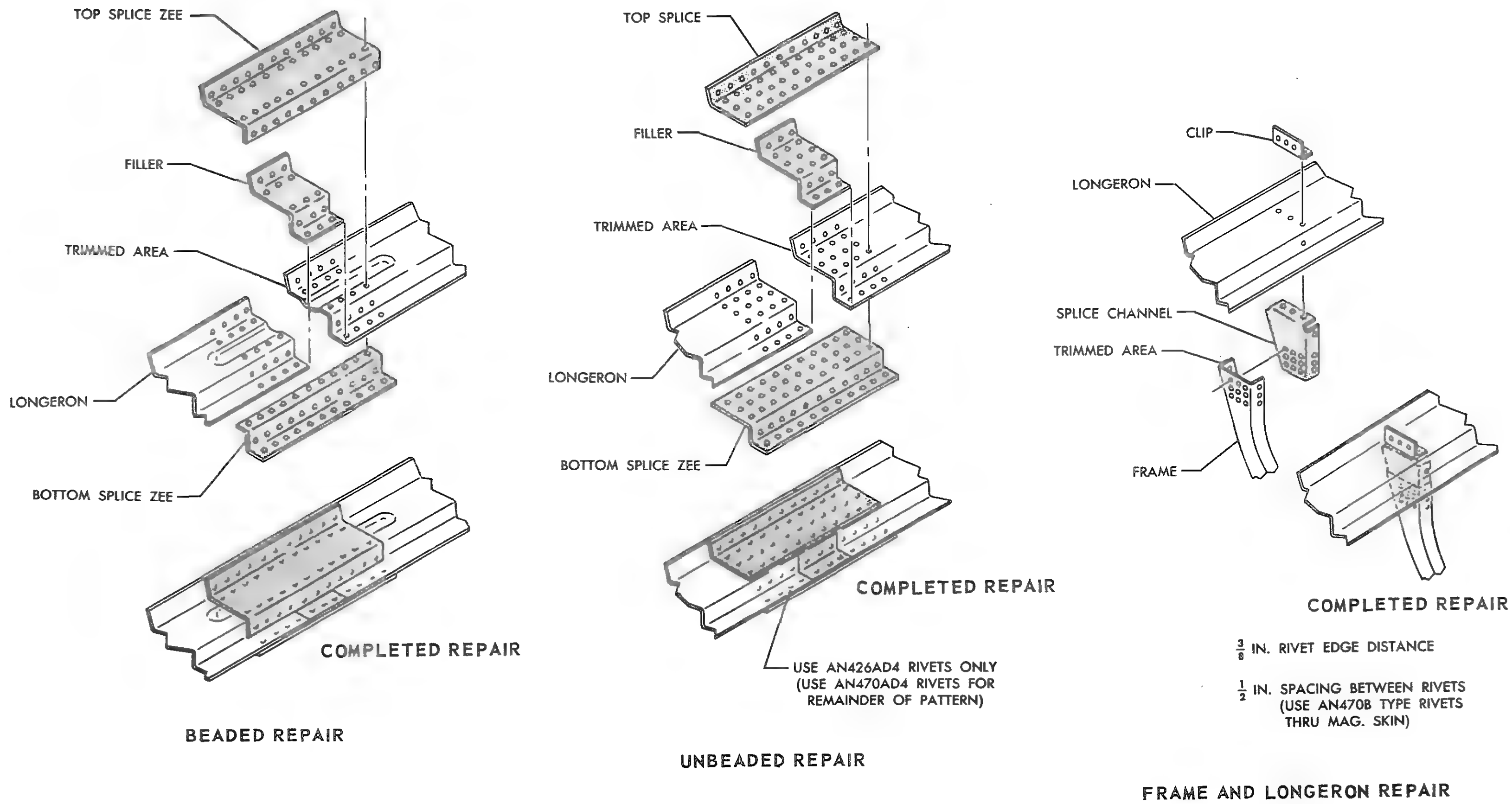
Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference
1	Panel	Mag	0.040	Mag	0.040	10–3
2	Angle	Mag	0.040	Mag	0.040	10–7
3	Angle — RH	Mag	0.040	Mag	0.040	10–7

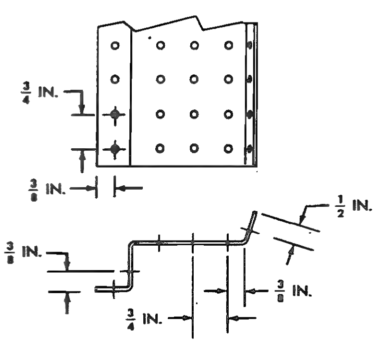
Figure 4–26. Bottom Structure Hatch Diagram

webs and the honeycomb cabin floor panels. The longerons extend longitudinally along the top right and left sides of the bottom structure and serve as the attachment members to the fuselage cabin section.

4–99. CLASSIFICATION OF DAMAGE.

4–100. NEGLIGIBLE DAMAGE. (Refer to paragraphs 4–23 and 4–37.) Damage to the longerons, which extends along the top edge on right and left





SPLICE PLATE RIVET PATTERN

FILLER GAGE . . . . SAME AS ORIGINAL MATERIAL
FILLER MATERIAL . . . . SAME AS ORIGINAL MATERIAL
SPLICE ANGLE MATERIAL . . . . SAME AS ORIGINAL MATERIAL
SPLICE ANGLE GAGE . . . . . . ONE GAGE HEAVIER THAN ORIGINAL MATERIAL
RIVET TYPES FOR ALUMINUM . . (AN470AD, AN426AD) STAINLESS STEEL (AN435M)

REPAIR MATERIAL

Figure 4–27. Longeron Repair – Bottom Structure side of bottom structure, not greater than that defined in the following, need not be repaired.

a. Smooth isolated dents not over 1/16 inch deep which are free from cracks, abrasions, or sharp corners need not be repaired.

b. Nicks in edges of flanges not deeper than 1/8 inch after cleaning out may be allowed to remain.

c. Holes not larger than 5/16 inch in diameter after cleaning may be allowed to remain if they are free from cracks and do not occur at edge of flange.

d. Holes not closer than 1 inch to any existing hole in longeron, and not adjacent to a fitting or frame where concentrated loads are applied, may be allowed to remain.

e. Cracks or scratches deeper than 10 percent of material thickness should be stop-drilled with a 1/8- (0.125) inch diameter drill. The stop-drill holes should be within limitations specified in step *d.*

4–101. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. The repair materials and illustration references to be followed are given in repair tables accompanying reference illustrations. (See figures 4–24 and 4–25.)

4–102. DAMAGE NECESSITATING REPLACEMENT. Refer to paragraph 4–7.)

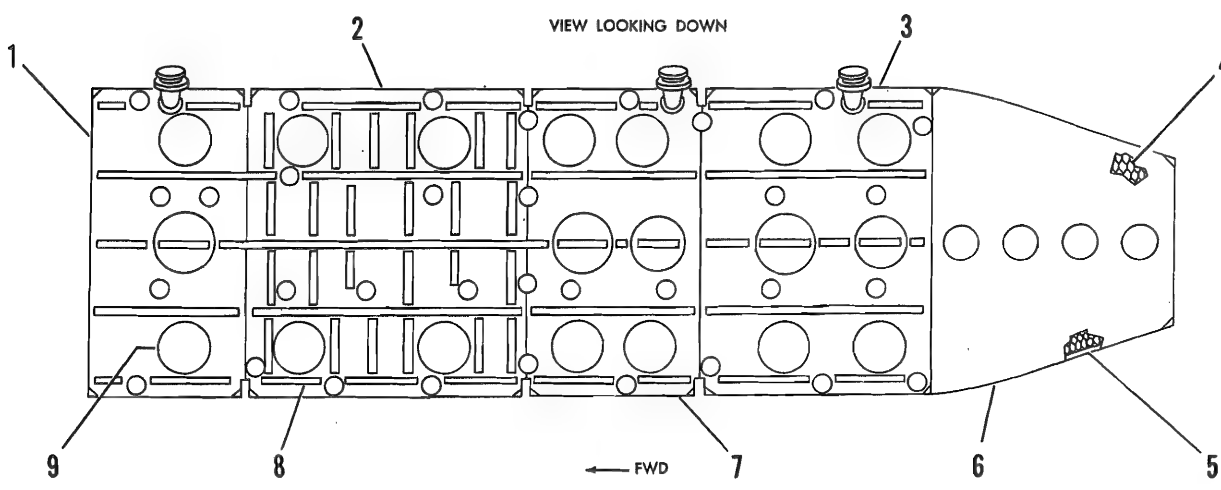
4–103. CABIN FLOOR PANELS. (See figure 4–28.)

4–104. DESCRIPTION. (See figure 4–28.) The cabin floor panels are fabricated of aluminum foil honeycomb core and mahogany strips sandwiched between a top layer of 0.012-inch aluminum alloy plating and a bottom layer of 0.008-inch aluminum plating.

4–105. CLASSIFICATION OF DAMAGE. For information on negligible damage, repairable damage, and damage necessitating replacement of damaged floor panels, refer to paragraphs 4–56 through 4–58.

CAUTION

The floor panel must be removed from the helicopter when repairing a damaged area with Epon resin to prevent damaging the fuel cells.



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Figure Reference	Paragraph Reference
1	Panel Skin — Top	Alclad	0.012	—	—		Para 4–103
2	Panel Skin — Top	Alclad	0.012	—	—		Para 4–103
3	Panel Skin — Top	Alclad	0.012	—	—		Para 4–103
4	Core	Honeycomb	—	—	—		Para 4–103
5	Edge	Mahogany	—	—	—		Para 4–103
6	Panel Skin — Top	Alclad	0.012	—	—		Para 4–103
7	Panel Skin — Top	Alclad	0.012	—	—		Para 4–103
8	Skid	Mag	—	Replace	—		
9	Cover	Alclad	0.050	Alclad	0.050	10 — 2	

Figure 4–28. Cabin Floor Panels

4–106. ENGINE MOUNT FITTINGS.

4–107. DESCRIPTION. (See figure 4–25.) The engine mount fittings are made of aluminum alloy. Mount fittings are located on forward section of fuselage bottom structure, attached to right and left keel beam with rivets and bolts. Engine mount fittings provide support for the engine mount ring.

4–108. CLASSIFICATION OF DAMAGE.

4–109. NEGLIGIBLE DAMAGE. Smooth scratches or nicks which do not exceed 0.015 inch in depth and are free from cracks are considered negligible damage.

4–110. DAMAGE NECESSITATING REPLACEMENT. Scratches or nicks which exceed 0.015 inch in depth and all dents or cracks necessitate replacement of engine mount fittings.

4–111. TAIL CONE SECTION.

4–112. DESCRIPTION. The fuselage tail cone section is of semimonocoque construction and is composed of magnesium and aluminum alloy. The structure is reinforced transversely by frames and longitudinally by stringers and intercostals to which magnesium skins are riveted. The frames support the aluminum foil honeycomb core catwalk in the bottom of the tail cone from stations 316 to 406.

4–113. CLASSIFICATION OF DAMAGE. (Refer to paragraphs 4–4 through 4–7.)

4–114. TAIL CONE SKIN PLATING. (See figure 4–29.)

4–115. CLASSIFICATION OF DAMAGE. For information on negligible damage, repairable damage, and damage necessitating replacement of the tail cone skin, refer to paragraphs 4–14 through 4–17.

4–116. TAIL CONE SKELETON. (See figure 4–30.)

4–117. FRAMES, STRINGERS, AND INTERCOSTALS.

4–118. DESCRIPTION. The transverse frames and longitudinal stringers and intercostals form the

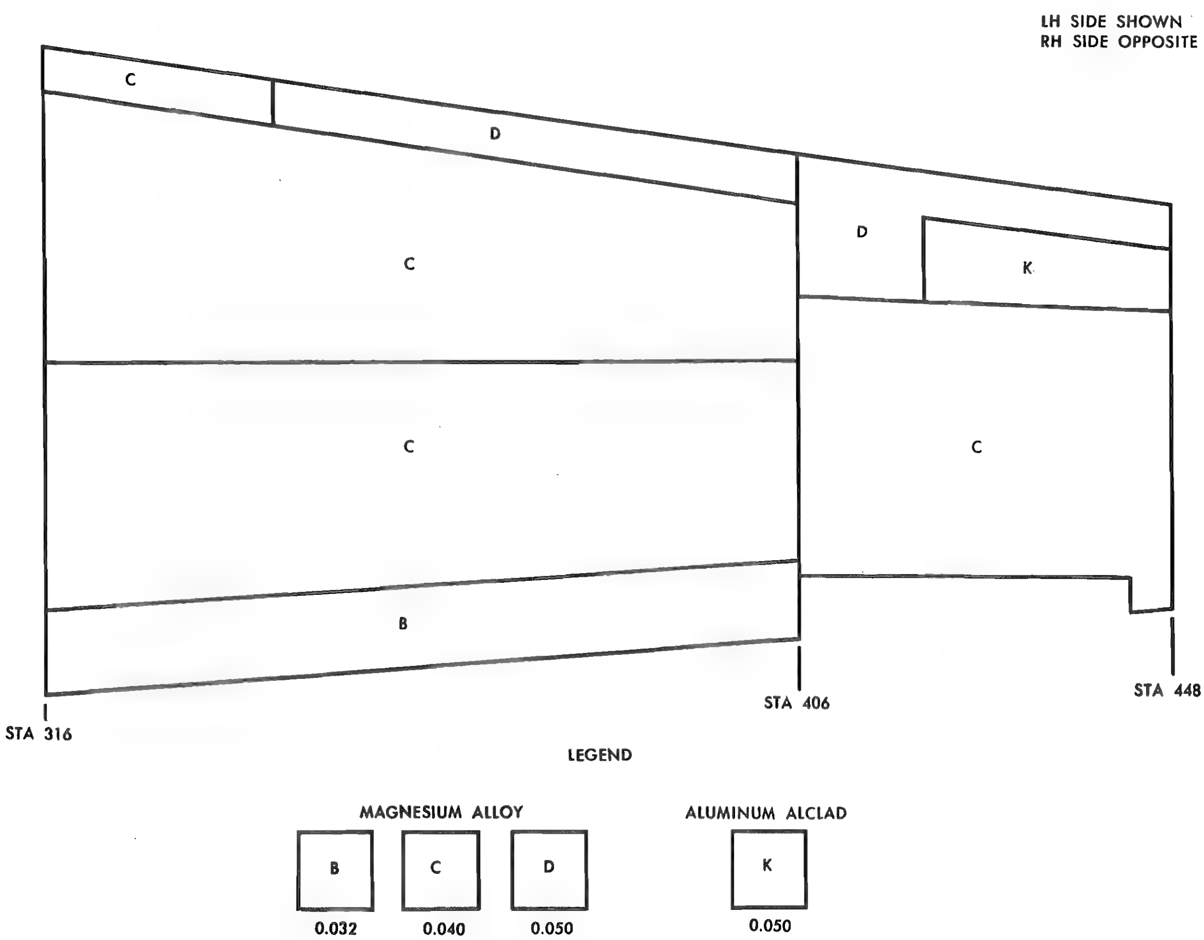
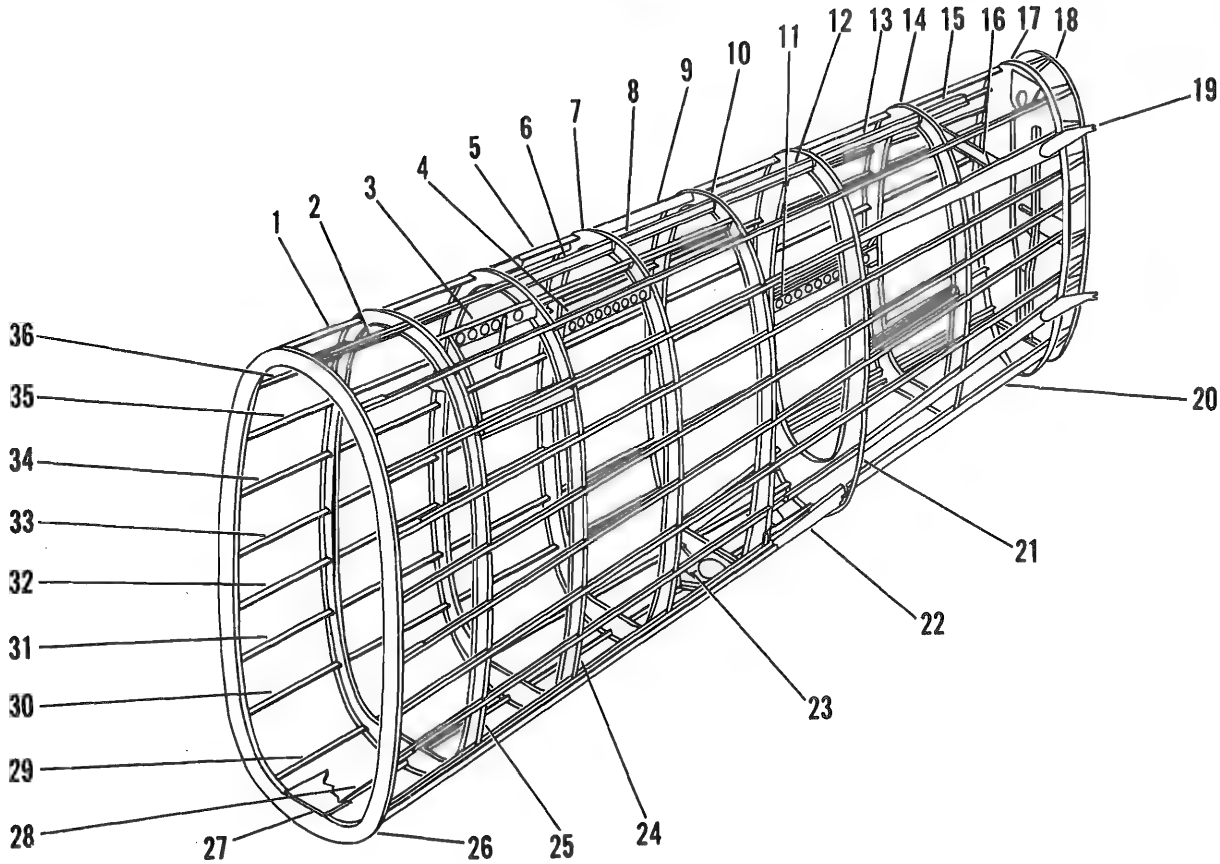


Figure 4–29. Tail Cone Plating Diagram



Index	Nomenclature	Material	Gage	Repair Material	Repair Gage	Paragraph Reference	Figure Reference
1	Stringer	Alclad	0.032	Alclad	0.040		10–7, 10–12
2	Stringer	Alclad	0.032	Alclad	0.040		10–7, 10–12
3	Blower Support	Mag	0.032	Mag	0.032		10–8
4	Bracket	Mag	0.040	Mag	0.040		10–8
5	Intercostal	Mag	0.040	Mag	0.050		10–8, 10–9
6	Intercostal	Mag	0.040	Mag	0.050		10–8, 10–9
7	Frame	Mag	0.040	Mag	0.050		10–10, 10–12
8	Intercostal	Mag	0.040	Mag	0.050		10–8, 10–9
9	Intercostal	Mag	0.040	Mag	0.050		10–8, 10–9
10	Frame	Mag	0.040	Mag	0.050		10–10, 10–12
11	Bracket	Alclad	0.032	Alclad	0.032		10–8
12	Intercostal	Mag	0.040	Alclad	0.050		10–8, 10–9
13	Intercostal	Mag	0.040	Mag	0.050		10–8, 10–9
14	Frame	Mag	0.040	Mag	0.050		10–10, 10–12
15	Intercostal	Mag	0.040	Mag	0.050		10–8, 10–9
16	Channel	Alclad	0.040	Alclad	0.050		10–8
17	Bulkhead Web	Alclad	0.063	Alclad	0.063		10–3
18	Frame Angle	Mag	0.040	Mag	0.050		10–7
19	Hinge	Al Alloy	—	Replace	—		
20	Horizontal Web	Mag	0.040	Mag	0.050		10–3, 10–7
21	Bulkhead Web	Alclad	0.050	Alclad	0.050		10–3
22	Intercostal	Alclad	0.063	Alclad	0.071		10–8, 10–9
23	Bracket	Alclad	0.040	Alclad	0.040		10–7
24	Frame	Mag	0.040	Mag	0.050		10–10, 10–12
25	Frame	Mag	0.032	Alclad	0.040		10–10, 10–12
26	Frame	Alclad	0.063	Alclad	0.071		10–8, 10–10
27	Catwalk	Honeycomb	—	—	—	Para 4–57	
28	Stringer	Mag	0.050	Mag	0.063		10–7, 10–12
29	Stringer	Alclad	0.032	Alclad	0.040		10–7, 10–12
30	Stringer	Alclad	0.032	Alclad	0.040		10–7, 10–12
31	Stringer	Alclad	0.032	Alclad	0.040		10–7, 10–12
32	Stringer	Alclad	0.032	Alclad	0.040		10–7, 10–12
33	Stringer	Alclad	0.032	Alclad	0.040		10–7, 10–12
34	Stringer	Alclad	0.032	Alclad	0.040		10–7, 10–12
35	Stringer	Alclad	0.032	Alclad	0.040		10–7, 10–12
36	Stringer	Alclad	0.032	Alclad	0.040		10–7, 10–12

Figure 4–30. Tail Cone Plating Diagram

structural support of the tail cone section from stations 316 to 448. Their construction combines the use of alclad and magnesium alloy of varied gage.

4–119. CLASSIFICATION OF DAMAGE. For information on negligible damage and repairable damage to tail cone frames, stringers, or intercostals, refer to paragraphs 4–37 through 4–39. Members damaged beyond repair by patching or insertion should be replaced.

4–120. CATWALK.

4–121. DESCRIPTION. The catwalk is fastened by screws to the frames in the tail cone and extends from stations 316 to 406. Its construction consists of a 1/8-inch thick aluminum foil honeycomb core and mahogany strips sandwiched between 0.016-inch top aluminum alloy plating and 0.012-inch bottom aluminum alloy plating.

4–122. CLASSIFICATION OF DAMAGE. For information on negligible damage, repairable damage, and damage necessitating replacement of the honeycomb core catwalk in the tail cone, refer to paragraphs 4–56 through 4–58.

SECTION V
LANDING GEAR GROUP

5–1. DESCRIPTION.

5–2. The landing gear group (figure 5–1) consists of a nonretractable land-type main landing gear and tail landing gear. The main landing gear is located at each side of the helicopter between stations 79 and 110. The tail landing gear is located between stations 407 and 442. On helicopters serial No. 56-4316, 56-4320, 57-1684, and 57-1697, emergency flotation gears are provided, consisting of two donut-type, emergency flotation bags installed on the main landing gear wheels and one on the tail gear wheel.

5–3. MAIN LANDING GEAR.

5–4. DESCRIPTION. The main landing gear consists of a strut assembly and a leg and axle assembly to which the wheel is attached.

5–5. STRUT ASSEMBLY.

5–6. DESCRIPTION. The strut assembly is constructed of an aluminum tube, 3-1/2 inches in diameter, with a wall thickness of 3/32 inch, and an oleo strut. The oleo strut consists of a tubular steel rod assembly 2-5/8 inches in diameter, with a wall thickness of 1/8 inch, and an aluminum cylinder. The tube assembly is bolted to the cylinder and serves as an extension for the oleo strut.

5–7. CLASSIFICATION OF DAMAGE.

5–8. NEGLIGIBLE DAMAGE. Negligible damage on the strut assembly is limited to smooth dents in the tube assembly wall of not over 1/32 inch in depth, and scratches, nicks, and gouges in the tube assembly or cylinder of the oleo strut no deeper than 15 percent of the material thickness in which they occur. All dents, scratches, nicks, and gouges must be filed smooth to blend in with the surrounding area. For treatment of the repaired aluminum surface, refer to TM 55-1520-202-20, Chapter 2, Section II.

5–9. DAMAGE REPAIRABLE BY PATCHING. Repair by patching is not permitted on the strut assembly.

5–10. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion is not permitted on the strut assembly.

5–11. DAMAGE NECESSITATING REPLACEMENT. Damage other than negligible necessitates replacement of the strut assembly.

5–12. LEG AND AXLE ASSEMBLY.

5–13. DESCRIPTION. The leg and axle assembly is constructed of a tubular steel leg 4 inches in diameter with a wall thickness of 1/4 inch, welded steel fittings, a universal assembly, and a bolted-on steel axle.

5–14. CLASSIFICATION OF DAMAGE.

5–15. NEGLIGIBLE DAMAGE. Negligible damage to the leg assembly may consist of smooth dents of not over 1/32 inch in depth, and scratches, nicks, and gouges no deeper than 15 percent of the material thickness in which they occur. Nicks, gouges, and tool marks on the axle assembly may be blended out to 0.010 inch. All dents, scratches, nicks, and gouges must be filed smooth to blend with the surrounding area.

5–16. DAMAGE REPAIRABLE BY PATCHING. Repair by patching is not permitted on the leg and axle assembly.

5–17. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion is not permitted on the leg and axle assembly.

5–18. DAMAGE NECESSITATING REPLACEMENT. Damage other than negligible necessitates replacement of the leg and axle assembly.

5–19. TAIL LANDING GEAR.

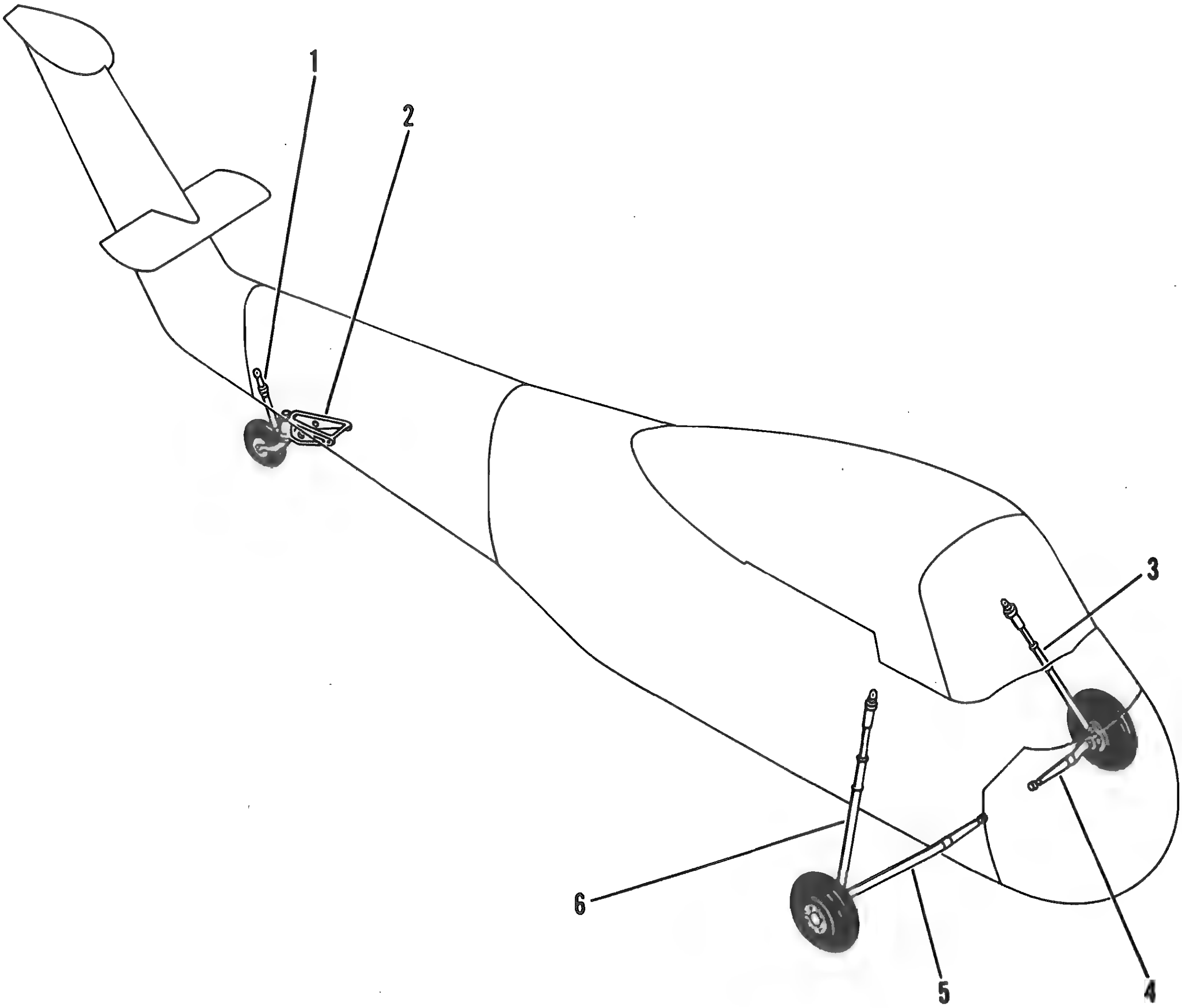
5–20. DESCRIPTION. The tail landing gear consists of a strut assembly and a yoke and fork assembly to which the wheel is attached.

5–21. STRUT ASSEMBLY.

5–22. DESCRIPTION. The strut assembly is made up of two universal assemblies and an oleo assembly. The oleo assembly is constructed of an aluminum alloy cylinder and a 2-1/8 x 1/8-inch tubular steel rod assembly.

5–23. CLASSIFICATION OF DAMAGE.

5–24. NEGLIGIBLE DAMAGE. Negligible damage on the strut assembly is limited to the cylinder of the oleo assembly and may consist of scratches,



1. Tail Wheel Strut
2. Tail Wheel Yoke
3. Main Strut (LH)
4. Leg and Axle (LH)
5. Leg and Axle (RH)
6. Main Strut (RH)

Figure 5–1. Landing Gear Diagram

nicks, and gouges no deeper than 15 percent of the material thickness in which they occur. All scratches, nicks, and gouges must be filed smooth to blend with the surrounding area. For treatment of the repaired aluminum surface, refer to TM 55-1520-202-20, Chapter 2, Section II.

5–25. DAMAGE REPAIRABLE BY PATCHING. Repair by patching is not permitted on the strut assembly.

5–26. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion is not permitted on the strut assembly.

5–27. DAMAGE NECESSITATING REPLACEMENT. Damage other than negligible necessitates replacement of the strut assembly.

5–28. YOKE AND FORK ASSEMBLY.

5–29. DESCRIPTION. The yoke and fork assembly consists of a yoke made from a magnesium casting to which the forged aluminum fork is attached.

5–30. CLASSIFICATION OF DAMAGE.

5–31. NEGLIGIBLE DAMAGE. Negligible damage on the yoke and fork assembly is limited to the fork and to the main body of the yoke. There is no allowable damage on the strut or pulley attachment lugs on the yoke, or within 1 inch from the holes by which the yoke is attached to the fuselage. Negligible damage may consist of smooth dents, scratches, nicks, and gouges no deeper than 25 percent of the thickness of the material in which they occur. All dents, scratches, nicks, and gouges must be filed smooth to blend in with surrounding area. For treatment of the repaired aluminum and magnesium surfaces, refer to TM 55-1520-202-20, Chapter 2, Section II.

5–32. DAMAGE REPAIRABLE BY PATCHING. Repair by patching is not permitted on the yoke and fork assembly.

5–33. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion is not permitted on the yoke and fork assembly.

5–34. DAMAGE NECESSITATING REPLACEMENT. Damage other than negligible necessitates replacement of the yoke and fork assembly.

5–35. EMERGENCY FLOTATION GEAR.

5–36. DESCRIPTION. (See figure 2–6, Chapter 2.) The emergency flotation gear consists of flotation bags of rubberized construction. Each bag is divided into four airtight compartments.

5–37. CLASSIFICATION OF DAMAGE.

5–38. NEGLIGIBLE DAMAGE. Negligible damage does not apply to the emergency flotation gear.

5–39. DAMAGE REPAIRABLE BY PATCHING. On helicopters equipped with emergency flotation gear, cuts, punctures and tears up to 1/2-inch maximum dimensions may be repaired in the emergency flotation gear as described in steps *a* through *q*. Those over 1/2 inch and up to 3 inches maximum dimensions may be repaired as described in steps *r* through *at*.

a. Check that cuts, punctures, and tears are not over 1/2 inch. They may be patched if damage is located in panel areas and is no closer than 2 inches from a seam or bulkhead. All patches must lap damaged area a minimum of 2 inches.

b. Check the contents of the repair kit, part No. PE-C-3056, manufactured by the U. S. Rubber Company, as listed in steps *c* through *h*.

c. Four bottles of carbon tetrachloride, Federal Specification O-C-141 (4 ounces in each bottle).

d. Eight tubes of cement, Loxite No. 6060, manufactured by Firestone Tire Company (2 ounces in each tube).

e. Six sheets of emery cloth of 120 grit, Metalite (commercial) (4 x 6 inches each).

f. Four envelopes of talc No. 76 Italian or No. 40 Vermont (2 ounces in each envelope).

g. One yard of cheese cloth.

h. Coated repair fabric E212, manufactured by U. S. Rubber (24 x 50 inches).

i. Wash damaged area with carbon tetrachloride, Federal Specification O-C-141, at least 2 inches beyond all damaged portions.

j. Allow solvent used in step *i* to dry before cementing.

k. Cut a patch of coated repair fabric E212, manufactured by U. S. Rubber, large enough to extend 2 inches in all directions beyond damaged area.

l. Hand buff (light surface scratching) patching material with emery cloth of 120 grit, Metalite (commercial).

CAUTION

Do not buff damaged area on float.

m. Apply three coats of cement, Loxite No. 6060, manufactured by Firestone Tire Company, to damaged area and buffed side of patch. Allow 10 to 20 minutes between each coat for drying.

n. Center patch over damaged area so center of patch contacts damaged surface first. Press patch down, slowly working to outer edges to avoid trapping air between surfaces.

o. Using one of the bottles listed in step *c* as a roller, rotate bottle several times over all portions of patch.

p. Powder entire surface lightly with talc No. 76 Italian or No. 40 Vermont (commercial) to remove surface tack.

q. Allow the patch to remain undisturbed for 4 hours before inflating or packing.

r. Be sure cuts, punctures, and tears are over 1/2 inch and not greater than 3 inches. Damage no greater than 3 inches, consisting of a straight cut in one direction only, may be repaired provided it is located in a panel area and no closer than 2 inches to a lapped seam or bulkhead. Frayed edges of cut, puncture, or tear are not to extend 1/4 inch in length away from main axis of the cut. All cuts, punctures, and tears falling under this category must be patched both inside and outside. Damage of less than 2 inches must be enlarged by a clean slit in the direction of the original puncture, no less than 2 inches nor more than 3 inches, to permit proper cleaning, cementing of the area, and proper insertion and application of inside patch.

s. Check availability of the materials listed in steps *t* through *ac.*

t. Cement SV-1940, manufactured by U.S. Rubber Company, part A and B.

u. Toluol, Federal Specification TT-T-548.

v. Coated repair fabric E212 manufactured by U.S. Rubber Company.

w. 1-inch standard stencil brush.

x. Emery cloth of 120, Metalite (commercial).

y. Steel ball bearing roller (1-1/2 x 1-1/2 inches).

z. Talc (No. 76 Italian or No. 40 Vermont) (commercial).

aa. Flat bristle toothbrush.

ab. Holland cloth.

ac. Cheese cloth.

ad. Prepare only enough cement to complete repair at hand. Use 15 parts of part A and 1 part of part B of cement SV-1940 manufactured by U.S. Rubber Company. Paddle stir thoroughly for about 5 minutes in a suitable glass jar. Keep cement covered when not in use. Dispose of unused cement after completion of repair.

ae. Enlarge opening if necessary by using scissors following grain of fabric. (Refer to step *r.*)

af. Clean inside and outside surfaces thoroughly to an area larger than what is to be covered by patches, using a clean cloth dampened with Toluol, Federal Specification TT-T-548.

ag. Cut two patches of coated repair fabric E212, manufactured by U.S. Rubber Company, large enough to extend 1-1/2 inches in all directions beyond the damaged area. Round off all corners of the patch approximately 1/2 inch in radius.

ah. Hand buff (light surface scratching) the patching material with emery cloth. (Refer to step *x.*)

CAUTION

Do not buff damaged area on inside or outside of float.

ai. Trace a pencil line, as long as the cut, down center of patch to prepare for application of inside patch.

Note

Considerable dexterity is required for application of inside patch.

aj. Insert patch through opening. Let patch rest on the opposite side of float keeping cemented side upward.

CAUTION

Prevent cemented surfaces from contacting each other until patch is properly aligned with cut.

ak. Shift patch around until it is generally in line with the opening. Bring the opening down onto patch, one side at a time.

al. Cement inside surface of damaged area beyond the limits of patch, using a toothbrush. Use a liberal amount of cement and brush in well over the entire cleaned surface. Allow 10 minutes for first coat to dry and apply a second coat of cement.

Note

The cemented area must not contact other inside surfaces. If necessary, insert Holland cloth cut larger than cemented area. Remove Holland cloth just prior to patch application.

am. Cement entire buffed side of patch working cement into buffed surface. Use a brisk circular motion with stencil brush. Allow 10 minutes and apply a second coat.

an. Remove Holland cloth if used.

ao. Curl patch between fingers, keeping cemented surface outward. Insert patch through slit. Align patch so that it is properly centered in all directions. Press float body cemented surface to the patch, working with the fingers from the center outward in all directions.

Note

Work one side down at a time, butting second side well against the first side.

ap. Cement outside of damaged area to prepare for application of outside patch. Use a stencil brush, working well into the surface. Use a brisk circular motion. Apply two coats of cement. Allow the coats to dry for 10 minutes each.

aq. Treat buffed side of patch as described in step *am.*

ar. Center patch over damaged area and, using a roller described in step *y*, roll from center outward holding opposite end of patch from contact. Roll down other side from center outward.

Note

Roll entire area well against a hard, even surface.

as. Dust surface of the float lightly with talc No. 76 Italian or No. 40 Vermont (commercial) immediately after application of patch.

at. Allow repair described in steps *r* through *as* to remain undisturbed for 24 hours before inflating or packing.

5–40. DAMAGE REPAIRABLE BY INSERTION. Damage repairable by insertion is not permitted on emergency flotation gear.

5–41. DAMAGE NECESSITATING REPLACEMENT. Damage other than that repairable by patching necessitates replacement of emergency flotation gear.

SECTION VI

POWER PLANT GROUP

6–1. DESCRIPTION.

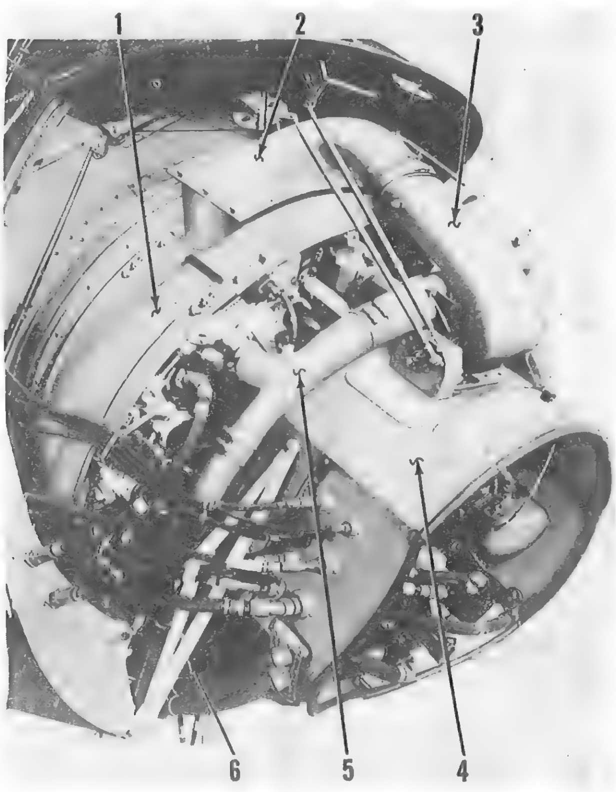
6–2. The power plant group (figure 6–1) is located in the nose of the helicopter and is accessible through the two large clamshell-type doors. Instructions for the repair of the engine mount ring, engine support arms, tubular sway brace, engine cowling, contravane assembly, exhaust collector, accessory shroud panel, and carburetor air ducts are given in this section.

6–3. CLASSIFICATION OF DAMAGE.

6–4. NEGLIGIBLE DAMAGE. Damage which may be allowed to remain or may be removed by a simple procedure (removing scratches, nicks, and dents that are free from cracks) is classified as negligible. Additional limitations are given in table 6–I and in text under each component of the power plant group.

6–5. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. Damage greater than negligible classification should be analyzed to determine possibility of using a patch or an insert or of welding. For welding information, refer to TM 55-405-4.

6–6. DAMAGE NECESSITATING REPLACEMENT. Damage not repairable by patching, insertion, or welding requires replacement.



1. Engine Cowling
2. Elbow Duct
3. Mixing Section Duct
4. Shroud Panel
5. Exhaust Collector
6. Engine Support Arms

Figure 6–1. Power Plant Group

6–7. ENGINE MOUNT RING.

6–8. DESCRIPTION. (See figure 6–2.) The engine mount ring is a 1-3/4 x 0.095-inch diameter steel tubular ring, to which are bolted right-and left-hand tubular support arm assemblies.

6–9. CLASSIFICATION OF DAMAGE.

6–10. NEGLIGIBLE DAMAGE. (Refer to table 6–I.) Smooth, isolated dents, free from cracks or abrasions and not exceeding one-fifth of the steel tubular ring wall in depth, are considered negligible and need not be repaired.

6–11. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. Repairs by patching or insertion are not permitted on engine mount ring.

CAUTION

The tubular engine mount ring is a highly stressed, heat-treated tubular structure; consequently, welding is not permitted.

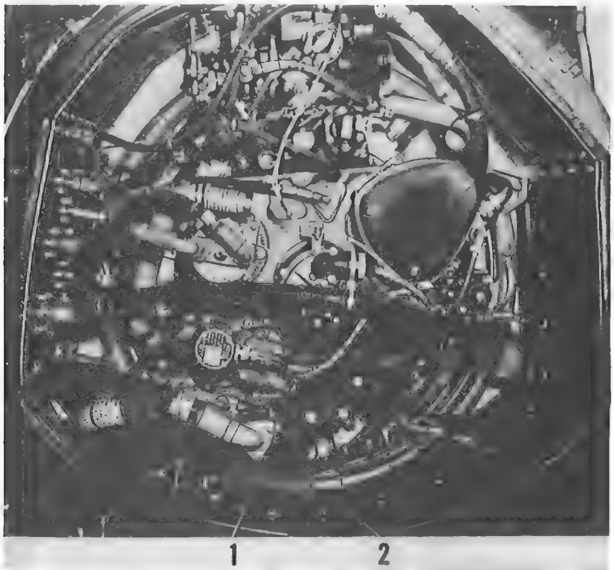
6–12. DAMAGE NECESSITATING REPLACEMENT. Damage to the tubular engine mount ring greater than negligible classification requires replacement of the ring assembly.

6–13. ENGINE SUPPORT ARMS.

6–14. DESCRIPTION. (See figure 6–1.) The engine support arms are welded structures of 1-1/4 x 0.049-inch steel tubing bolted at the lower end to

Table 6–1. Negligible Damage

	DENTS		SCRATCHES		CRACKS		NICKS	
NOMENCLATURE	DEPTH (INCHES)	TREATMENT	DEPTH (INCHES)	TREATMENT	LENGTH (INCHES)	TREATMENT	DEPTH (INCHES)	TREATMENT
ENGINE SECTION								
Engine Mount Ring	1/5 of wall	No Repair	None	Replace	None	Replace	None	Replace
	1/5+	Replace						
Engine Support Arms	1/5 of wall	No Repair	None	Para 6–17	None	Para 6–17	None	Para 6–17
	1/5+	Para 6–17						
Tubular Sway Brace	1/5 of wall	No Repair	None	Para 6–23	None	Para 6–23	None	Para 6–23
	1/5+	Para 6–23						
Engine Cowling		Para 6–28		Para 6–28	None	Stop-Drill & Patch, Figure 10–2	None	Drill & Patch Figure 10–2
Contravane Assembly	1/16	No Repair	0.003	Blend		Para 6–37	0.003	Blend
	1/16+	Para 6–41	0.003+	Para 6–41			0.003+	Para 6–41
Exhaust Collector		Para 6–47		Para 6–47		Para 6–47		Para 6–47
Accessory Shroud Panel		Para 6–54		Para 6–54	None	Stop-Drill & Patch, Figure 10–2		Para 6–54
Carburetor Air Induction Ducts		Para 6–61		Para 6–61	None	Para 6–62		Para 6–61



1. Engine Mount Ring
2. Shroud Panel

Figure 6–2. Engine Mount Ring

brackets on the forward bulkhead at station 46.5 of the bottom structure.

6–15. CLASSIFICATION OF DAMAGE.

6–16. NEGLIGIBLE DAMAGE. (Refer to table 6–I.) Smooth, isolated dents, free from cracks or abrasions and not exceeding one-fifth of the tube wall in depth, are considered negligible and need not be repaired.

6–17. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. Dents in the tubular support arm, exceeding one-fifth of the tube wall in depth, must be repaired by a welded split-sleeve patch. For split-sleeve welding, refer to TM 55-405-4. Tube damage consisting of punctures must also be patched by means of the welded split-sleeve, provided that:

a. Damaged area, after cleaning out, does not extend over more than one-third of circumference of tube.

b. Damaged area does not lie at either of the ends near welds, or within middle third of length of tube. Care must be exercised in cleaning out damaged material and in rounding up damaged areas. All jagged, protruding material should be carefully removed and tube rounded up before a split-sleeve patch is applied. If a small crack is present and is not removed when cleaning out damaged area, a small hole should be drilled with a No. 41 (0.096-inch diameter) drill at ends of crack to prevent spreading.

CAUTION

Since support arms are normalized steel tubing, all welded repairs must be torch normalized after welding to relieve stress set up during welding process. The weld and adjacent area should be uniformly heated with a torch to a full cherry-red color, then allowed to cool slowly in air.

6–18. DAMAGE NECESSITATING REPLACEMENT. Damage to the tubular support arms beyond repair by patching or insertion requires replacement of the support arm assembly.

6–19. TUBULAR SWAY BRACE.

6–20. DESCRIPTION. A 3/4 x 0.058-inch tubular sway brace extends from each support arm lower attachment point to a plate on the engine mount ring.

6–21. CLASSIFICATION OF DAMAGE.

6–22. NEGLIGIBLE DAMAGE. (Refer to paragraph 6–16.) Bows in the tubular sway brace are negligible if the maximum bow does not exceed 1/300 of the tube length. For limitations on negligible damage, refer to table 6–I.

6–23. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. (Refer to paragraph 6–17.)

6–24. DAMAGE NECESSITATING REPLACEMENT. Damage to the tubular sway brace beyond repair or insertion requires replacement of the sway brace assembly. Bows exceeding negligible classification require replacement of the brace assembly.

6–25. ENGINE COWLING.

6–26. DESCRIPTION. (See figure 6–1.) The engine cowling encircles the engine and serves to direct the cooling air around the engine. The cowling is fabricated from 0.040-inch aluminum alloy.

6–27. CLASSIFICATION OF DAMAGE.

6–28. NEGLIGIBLE DAMAGE. (Refer to table 6–I.) Smooth, isolated dents, scratches, or nicks, free from cracks or abrasions, need not be repaired except to satisfy appearance.

6–29. DAMAGE REPAIRABLE BY PATCHING. (See figure 10–2.) Holes or cracks in the engine cowling must be patched.

6–30. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion is not permitted on engine cowling.

6–31. DAMAGE NECESSITATING REPLACEMENT. Damage exceeding 25 percent of the cowling section requires replacement of the section.

6–32. CONTRAVANE ASSEMBLY.

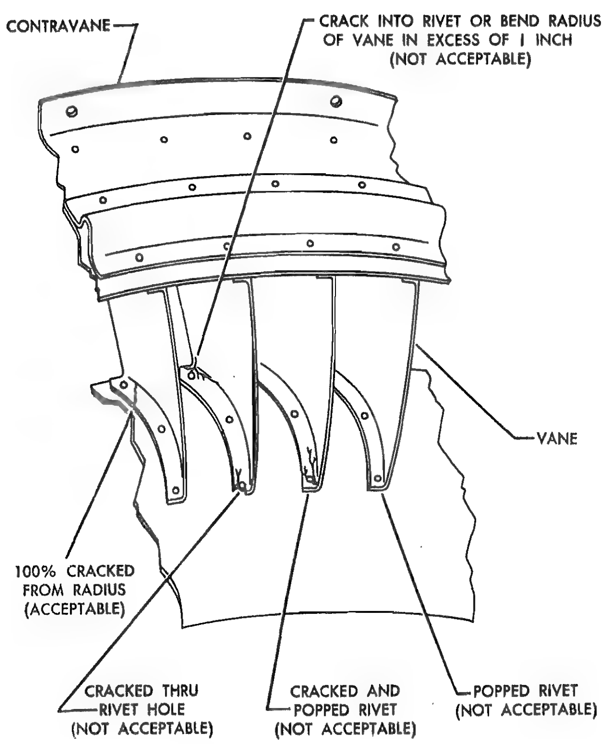
6–33. DESCRIPTION. The contravane assembly is located forward of the transmission clutch fan blades and directs cooling air to the engines. The contravane assembly is constructed of aluminum on helicopters serial No. prior to 57-1755. On helicopters serial No. 57-1755 and subsequent, the contravane assembly is constructed of reinforced plastic.

6–34. ALUMINUM CONTRAVANE ASSEMBLY.

6–35. INSPECTION. (See figure 6–3.)

a. Remove engine cowl panels.

b. Inspect contravane assembly for cracks on inner ring radius of each vane.



NOTE
ANY COMBINATION OF TWO OF THESE CONDITIONS ON ONE VANE MAKES THE VANE NOT ACCEPTABLE.

Figure 6–3. Inspection of Contravane Assembly Vanes

Note

Use an extension-type inspection mirror and a flashlight.

Note

If necessary, a more detailed inspection of lower vanes may be performed by lowering engines.

c. Inspect each vane at both tabs for loose or sheared rivets on inner ring radius of each vane.

d. Follow instructions of paragraphs 6–36 through 6–40 to determine disposition of contravane assembly.

6–36. CLASSIFICATION OF DAMAGE

6–37. NEGLIGIBLE DAMAGE. Smooth, non-puncturing dents, free from cracks or abrasions and not exceeding 1/16 inch in depth, need not be repaired if the damage does not affect adjacent riveting and supporting members. Retain the contravane assembly in service if there are no more than 18 cracked vanes around the circumference of the contravane assembly, or no more than 10 consecutively cracked vanes. (See figure 6–3.) If these limits are exceeded, follow the procedure described in paragraph 6–41. (See figure 6–4.) All scratches or nicks, not exceeding 0.003 inch in depth, should be removed with No. 00 fine sandpaper to blend with the surrounding area. Refinish the damaged area as described in TM 55-1520-202-20, Chapter 2, Section II to protect against corrosion.

CAUTION

Do not use metal abrasives or emery cloth for any sanding since fine particles of metal may become embedded in aluminum, forming potential corrosion cells.

Note

A 100 percent cracking is allowed on each vane at tab between first and second rivets on leading edge of inner vane flange.

Note

Vanes having cracks less than 1 inch long in random locations may be retained in service as long as there are two rivets supporting vane on inner ring.

6–38. DAMAGE REPAIRABLE BY PATCHING. Damage to the contravane assembly, beyond the limits set in paragraph 6–37, may be repaired by patching if the repair is not extensive and if the contravane is not severely distorted as a result of the damage. All nicks exceeding 0.003 inch in depth should be removed with a drill large enough

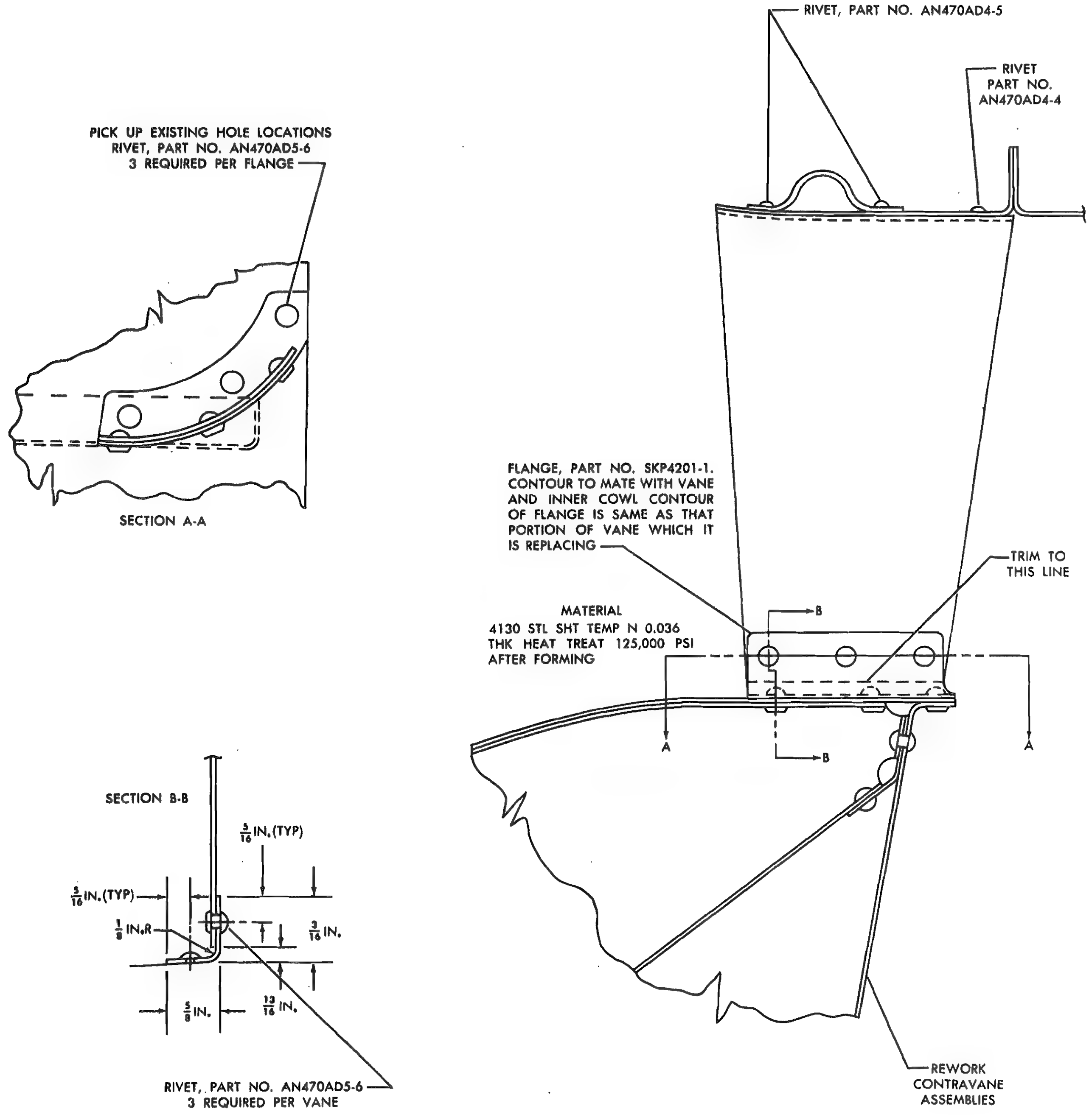


Figure 6–4. Rework of Contravane Assembly Vanes

to remove the entire nick and all radiating cracks. Stop-drill all cracks and scratches exceeding 0.003 inch in depth. For repairs necessitating patching, see figure 10–2. For rework on the vanes, refer to paragraph 6–41.

6–39. DAMAGE REPAIRABLE BY INSERTION. None except for the special rework described in paragraph 6–41.

6–40. DAMAGE NECESSITATING REPLACEMENT. An extensively damaged or severely distorted contravane assembly will necessitate replacement of the contravane assembly. Damage to the vanes exceeding the limitations set in paragraph 6–36 will necessitate replacement of the vane. A special rework is given in paragraph 6–41.

6–41. SPECIAL REWORK OF CONTRAVANE ASSEMBLY. (See figure 6–4.) When damage to the vanes is greater than that set in paragraph 6–37 (figure 6–3), the procedure is as follows:

a. Remove contravane assembly from engine.

b. Drill out rivets securing vane to outer ring.

c. Drill out rivets securing vane to inner ring.

d. Using snips, trim vane approximately 3/16 of an inch from radius.

e. File away any peaks or sharp edges. Round reworked edges to approximately 0.02-inch radius.

f. Using abrasive cloth, Federal Specification P-C-451, remove all traces of tool marks or other stress raisers.

g. Touch up reworked edges with Alodine, Military Specification MIL-C-5541, and allow to dry.

h. Apply a coat of primer, Military Specification MIL-P-8585, to reworked edges.

i. Position the flange, part No. SKP201-1, to inner ring, using two Cleco fasteners.

j. Scribe middle hole location of inner cowl to flange, part No. SKP4201-1.

k. Remove flange and drill a 1/8-(0.125) inch diameter hole in location shown by scribing.

l. Enlarge 1/8-(0.125) inch diameter hole by drilling with a No. 21 (0.159-inch diameter) drill.

m. Cleco flange on inner ring.

n. Rivet flange to inner ring of contravane assembly using rivets, part No. AN470AD5-6.

o. Clamp vane to flange, part No. SKP4201-1.

Note

Reworked edge of vane should not ride on inner radius of flange. If reworked edge rides on radius of flange, provide for a proper clearance and rework according to steps *e* through *j*.

p. Drill 1/8-(0.125) inch diameter holes in side of vane, using pilot holes on flange.

q. Enlarge 1/8-(0.125) inch diameter holes in side of vane and flange by drilling with a No. 21 (0.159-inch diameter) drill.

r. Rivet vane to flange using rivets, part No. AN470AD5-6.

Note

Dip rivets in primer, Military Specification MIL-P-8585; install while wet.

s. Rivet vane to outer ring with two part No. AN470AD4-5 rivets and one part No. AN470AD4-4 rivet.

6–42. REINFORCED PLASTIC CONTRAVANE ASSEMBLY.

6–43. CLASSIFICATION OF DAMAGE. For repair of the reinforced plastic contravane assembly, refer to Section VII.

6–44. EXHAUST COLLECTOR.

6–45. DESCRIPTION. (See figure 6–1.) The exhaust collector encircles the engine and is made from 0.049-inch stainless steel. The exhaust collector assembly consists of seven removable sections and a tailpipe which extends under and away from the left engine nose door.

6–46. CLASSIFICATION OF DAMAGE.

6–47. NEGLIGIBLE DAMAGE. Small dents, nicks, or scratches which do not puncture the stainless steel exhaust collector are considered negligible and need not be repaired. Small holes must be closed together by welding since the exhaust collector must remain leakproof. For welding information, refer to TM 55-405-4.

6–48. DAMAGE REPAIRABLE BY PATCHING. Large holes and cracks in the exhaust collector must be repaired by a welded-on stainless steel patch. For welding information, refer to TM 55-405-4.

6–49. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion is not permitted on exhaust collector.

6–50. DAMAGE NECESSITATING REPLACEMENT. Replace that section of the stainless steel exhaust collector if damage exceeds 50 percent of the section.

6–51. ACCESSORY SHROUD PANEL.

6–52. DESCRIPTION. (See figure 6–1.) The accessory shroud panel is made of 0.016-inch titanium and forms a fireproof enclosure which isolates the accessory section of the engine.

6–53. CLASSIFICATION OF DAMAGE.

6–54. NEGLIGIBLE DAMAGE. (Refer to table 6–I.) Smooth dents, scratches, or nicks free from cracks or abrasions and which do not puncture the titanium shroud panel need not be repaired.

6–55. DAMAGE REPAIRABLE BY PATCHING. All holes and stop-drilled cracks in the shroud panel must be repaired with a riveted 0.016-inch stainless steel patch as shown in figure 10–2.

Note

Stop-drilling of cracks is permitted to serve as temporary repair. Permanent repair by patching should be accomplished at the first opportunity permitting access to the damaged area, such as at time of engine change.

6–56. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion is not permitted on accessory shroud panel.

6–57. DAMAGE NECESSITATING REPLACEMENT. Damage exceeding 50 percent of the section of the shroud panel requires replacement of the section.

6–58. CARBURETOR AIR INDUCTION DUCTS.

6–59. DESCRIPTION. (See figure 6–1.) The carburetor air induction ducts consist of an 0.040-inch aluminum alloy elbow and mixing duct. The elbow is connected to the top engine cowling and the mixing duct is connected to the top of the carburetor. A rubber boot is clamped to connect each unit.

6–60. CLASSIFICATION OF DAMAGE.

6–61. NEGLIGIBLE DAMAGE. (Refer to table 6–I.) Smooth dents, scratches, or nicks free from cracks or abrasions and which do not puncture the ducts are considered negligible and need not be repaired.

6–62. DAMAGE REPAIRABLE BY PATCHING. All holes and stop-drilled cracks must be repaired with a 0.040-inch welded aluminum patch since the ducts must remain leakproof. For welding information, refer to TM 55-405-4.

6–63. DAMAGE REPAIRABLE BY INSERTION. Repair by insertion is not permitted on carburetor air induction ducts.

6–64. DAMAGE NECESSITATING REPLACEMENT. Damage exceeding 50 percent of the duct section requires replacement of the section.

SECTION VII

FABRIC REPAIR AND ATTACHMENT

7–1. DESCRIPTION.

7–2. Reinforced plastic is the only fabric-type attachment to the helicopter fuselage. It is used primarily for fairings which are found on the outside of the helicopter as secondary structures. Reinforced plastic is also used in the fabrication of the engine contravane. Many fibrous materials may be used as a reinforcement for reinforced plastic: cotton, nylon, asbestos, glass, and various synthetic fibers. No. 181 fabric cloth is the reinforcement most commonly used because of its high strength, light weight, insulating, and non-sparking properties. The reinforced plastic is used in laminated ply applications of varying thicknesses, depending on the contour and material strength desired.

7–3. REPAIR OF REINFORCED PLASTIC.

7–4. DESCRIPTION. (See figure 7–1.) The principal kinds of damage to reinforced plastic are cracks or fractures, delaminations, small holes, misdrilled, oversize, elongated or double holes, and demolished sections requiring replacement.

7–5. CLASSIFICATION OF DAMAGE.

7–6. NEGLIGIBLE DAMAGE. Surface scratches in the resin of the reinforced plastic need not be repaired if they do not penetrate the fabric.

7–7. DAMAGE REPAIRABLE BY PATCHING.

7–8. Repair damage greater than negligible to outer plies of components more than 0.050 inch thick as follows:

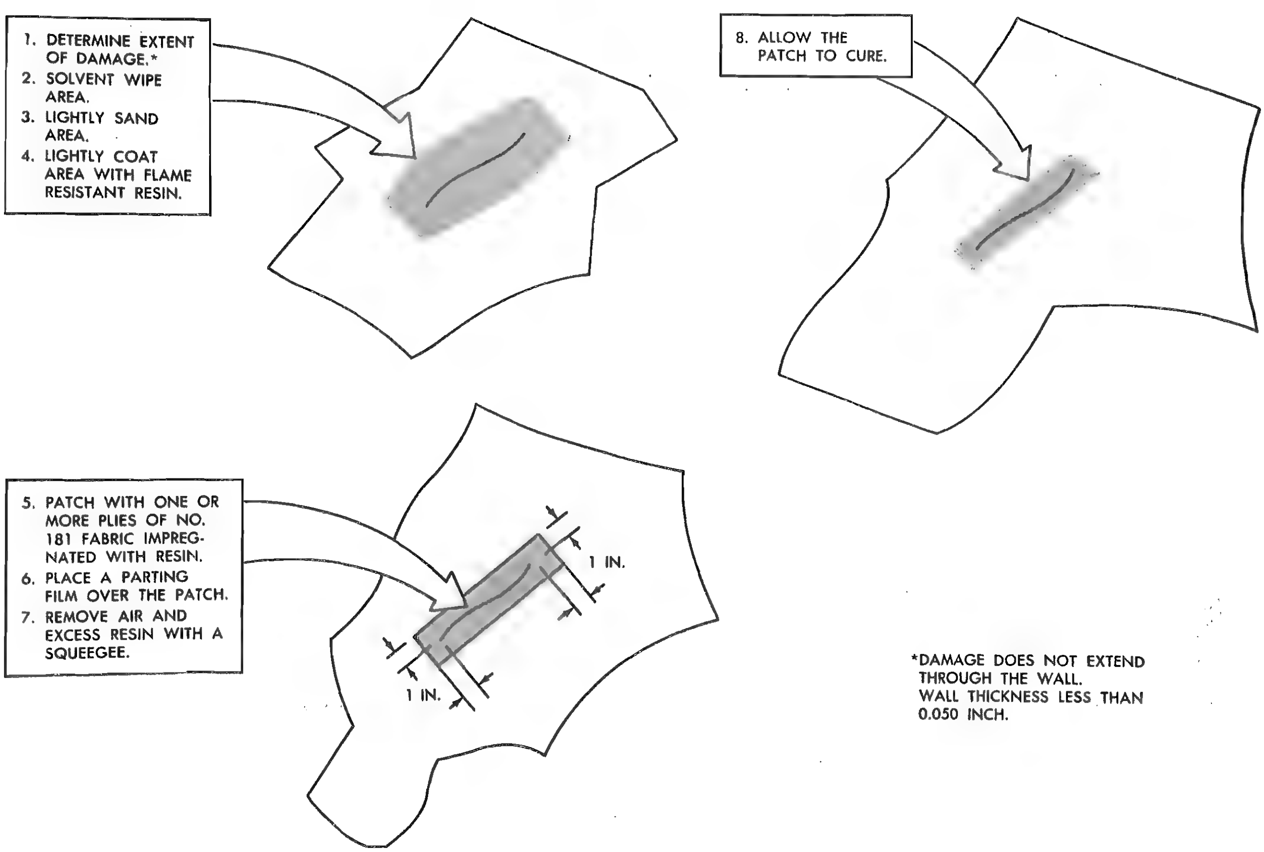


Figure 7–1. Fabric Repair

a. Wipe area of damage with a solvent such as acetone, Federal Specification O-A-51, or Methyl Ethyl Ketone, Federal Specification TT-M-261.

b. Sand area lightly to remove glossy surface. Repeat step *a.*

c. Apply light coat of flame-resistant Hetron resin No. 92 to damaged area. The Hetron resin should be accelerated and catalyzed according to instructions of the polyester resin supplier.

d. Prepare patch or patches of No. 181 fabric cloth large enough to overlap a minimum of 1 inch beyond damaged area. Impregnate patch or patches with Hetron resin. Apply patch or patches. Resin content of fabric cloth shall be approximately 50 percent (by weight) when thoroughly impregnated prior to laminating.

e. Place a film of polyvinyl alcohol over patch.

f. Carefully remove air and excess resin with a squeegee.

g. Allow patch to cold cure for a minimum of 24 hours at room temperature, or for a minimum of 15 minutes under temperature of 121.1° to 148.9°C (250° to 300°F), using infrared lamps or heat guns. Pressure should be applied in curing when possible.

7–9. Repair damage greater than negligible to components less than 0.050 inch thick by repairing both sides when damage extends through components. Leave sufficient portion of damaged area to retain original contour. Repair both sides using procedure outlined in paragraph 7–8.

7–10. Repair damage penetrating more than the outside plies of components more than 0.050 inch thick as follows. Repair both sides when damage extends through the component. Leave a sufficient portion of damaged area to retain original contour.

a. Determine size of area to be cut in outer ply by adding 1 inch all around damaged area and 1 additional inch all around for each ply to be removed.

b. Scribe square or rectangle equal to dimensions required on outer layer of damaged area. These dimensions, determined in step *a,* make it possible to remove additional layers 1 inch smaller all around, down to the final ply. This results in final ply being trimmed back a minimum of 1 inch on all sides of damage.

c. Cut along this outline with sharp knife, being careful to cut only outer ply which is then peeled from the part.

d. Remove additional plies, 1 inch smaller all around in the same manner, and repeat until required plies are removed.

e. Perform procedure outlined in paragraph 7–8, steps *a* through *c.*

f. Prepare required number of patches of No. 181 fabric cloth large enough to have 1-inch overlaps to replace plies removed. Impregnate fabric cloth with Hetron resin. Apply patches. Resin content of fabric cloth shall be approximately 50 percent (by weight) when thoroughly impregnated prior to laminating.

g. Perform procedure outlined in paragraph 7–8, steps *e* through *g.*

7–11. Repair damage consisting of misdrilled, oversize, elongated, or double holes as follows:

a. If part is six plies or less, fill holes with a mixture of chopped No. 181 fabric cloth and Hetron resin.

b. Patch each side with one ply of No. 181 fabric cloth impregnated with Hetron resin, extending at least 1/2 inch in all directions from discrepant holes.

c. If part consists of from seven to 12 plies, remove one ply from each side and apply two plies of No. 181 glass fabric or fabric cloth, impregnated with Hetron resin, to each side.

d. Perform procedure outlined in paragraph 7–8, step *e* through *g.*

7–12. Repair a broken corner or tab as follows:

a. Clean up jagged edges.

b. Sand area lightly to remove glossy surface. Clean the area with acetone, Federal Specification O-A-51, or Methyl Ethyl Ketone, Federal Specification TT-M-261.

c. If part consists of less than four plies, build up a new section with the required number of plies of No. 181 fabric cloth, impregnated with Hetron resin, attaching them to parent part with overlaps extending a minimum of 1 inch onto undamaged part.

d. If part consists of four or more plies, remove in staggered steps an equal number of plies from each side and follow procedure of step *c.*

e. Perform procedure in paragraph 7–8, steps *e* through *g.*

7–13. DAMAGE NECESSITATING REPLACEMENT. Major repairs shall not be permitted. Cracks, delaminations, holes, etc, shall be considered repairable on all reinforced plastic components if the following conditions are met:

a. Nature of repair shall be such that it shall not adversely alter critical dimensions, fit, contour, general appearance, maximum weight allowance, and ultimate usage and strength of component.

b. Estimated cost of repair must be commensurate with cost of original component.

SECTION VIII

EXTRUSION CHART

8-1. DESCRIPTION.

8-2. The extensive use of extrusions in the fabrication of Model CH-34A and CH-34C type helicopters provides greater efficiency, with relation to stresses the extrusion must withstand, than is possible in standard rolled structural shapes. Since some of the extrusions are impossible or difficult to duplicate with a formed sheet, the structural member should be repaired or replaced with a similar section if the extrusion is available. Where the original extruded section is unavailable, a bent sheet equivalent or a machined bar equivalent is required for replacement. Complete identification, substitutions, and dimensions of extruded shapes are provided with the exception of extruded main and tail rotor blade spars which cannot be substituted due to their special design.

8-3. For a sample illustration of rivet spacing and edge distances required when rivets must be used to make substitutions, see figure 8-1. Use staggered rivet pattern when rivets are necessary. When substitute extrusions are to be attached to a structural member containing rivet holes, the existing rivet pattern must be picked up.

8-4. On many of the formed substitute extrusions (figure 8-2), a special staggered rivet pattern must be utilized to maintain required structural loads applied to the extrusion, in which case the following notes apply as called out on the specific substitute:

Note 1:

At outboard end corners only, drill No. 30 (0.128-inch diameter) hole.

Use AN470AD4-5 rivets.

For all other rivets, use No. 21 (0.159-inch diameter) drill.

Use AN470AD5-5 rivets staggered.

Note 2:

At outboard end corners only, drill No. 30 (0.128-inch diameter) hole.

Use AN470AD406 rivets.

For all other rivets, use No. 21 (0.159-inch diameter) drill.

Use AN470AD5-6 rivets staggered.

Note 3:

At outboard end corners only, drill No. 30 (0.128-inch diameter) hole.

Use AN470AD4-7 rivets.

For all other rivets, use No. 21 (0.159-inch diameter) drill.

Use AN470AD5-7 rivets staggered.

Note 4:

At outboard end corners only, drill No. 30 (0.128-inch diameter) hole.

Use AN470AD4-8 rivets.

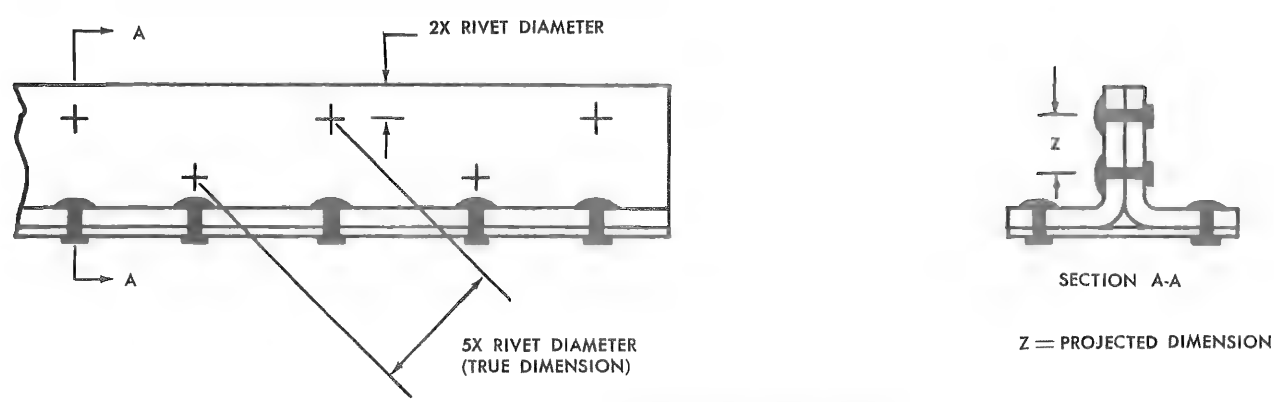


Figure 8-1. Typical Staggered Rivet Pattern

For all other rivets, use No 21. (0.159-inch diameter) drill.

Use AN470AD5-8 rivets staggered.

Note 5:

At outboard end corners only drill No. 30 (0.128-inch diameter) hole.

Use AN470AD4-9 rivets.

For all other rivets, use No. 21 (0.159-inch diameter) drill.

Use AN470AD5-9 rivets staggered.

Note 6:

At outboard end corners only, drill No. 30 (0.128-inch diameter) hole.

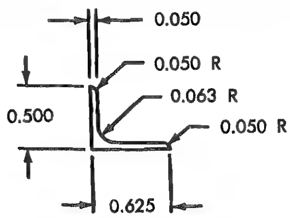
Use AN470AD4-10 rivets.

For all other rivets, use No. 21 (0.159-inch diameter) drill.

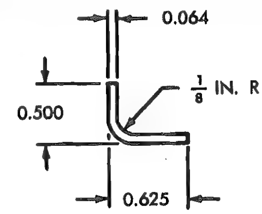
Use AN470AD5-10 rivets staggered.

EXTRUSION	SUBSTITUTION

S1620–61203–8

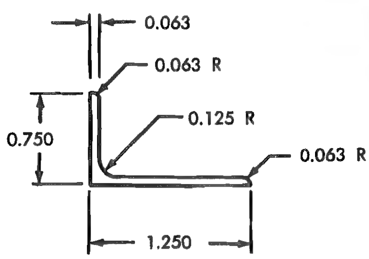


AND10134–0501
SPECIFICATION QQ–A–267
MATERIAL 2024–T

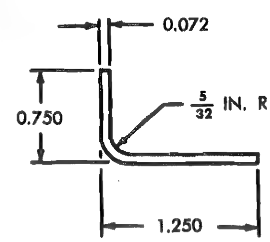


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING

S1620–61066

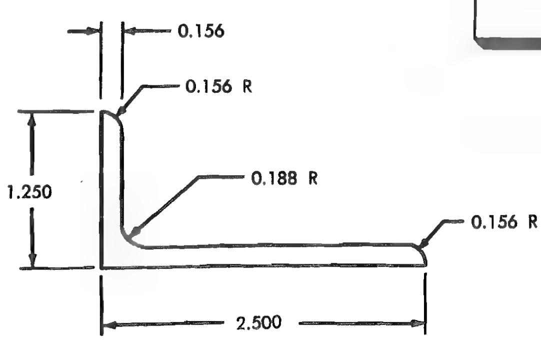


AND10133–1201
SPECIFICATION QQ–A–267
MATERIAL 2024–T

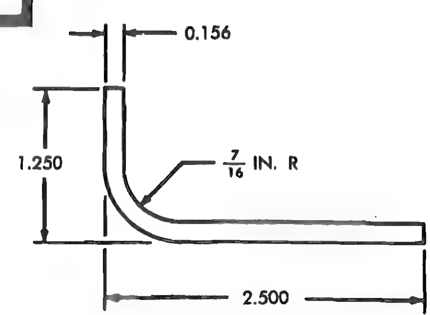


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING

S1615–20016–1



AND10134–2401
SPECIFICATION QQ–A–267
MATERIAL 2024–T

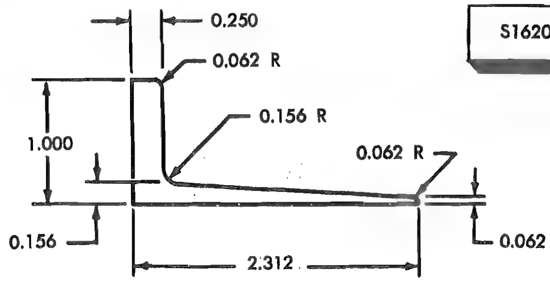


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING

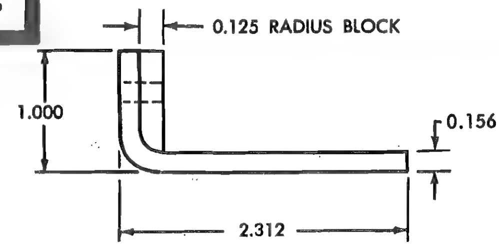
Figure 8–2. Extrusion Chart (Sheet 1 of 40)

EXTRUSION	SUBSTITUTION

S1620–61444–1 thru –6

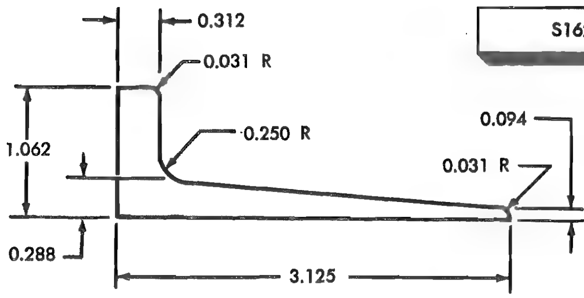


ALCOA DIE NO. K–13662
SPECIFICATION QQ–A–267
MATERIAL 2024–T



MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING
RADIUS BLOCK – MAKE FROM 2024–T

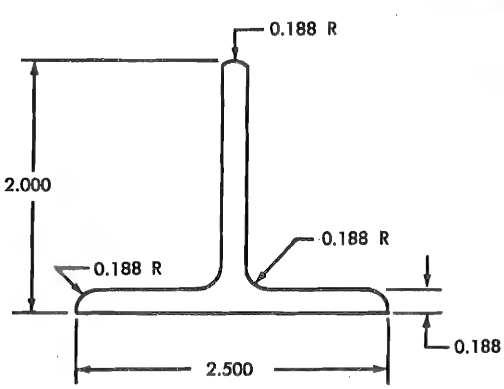
S1620–61645–6



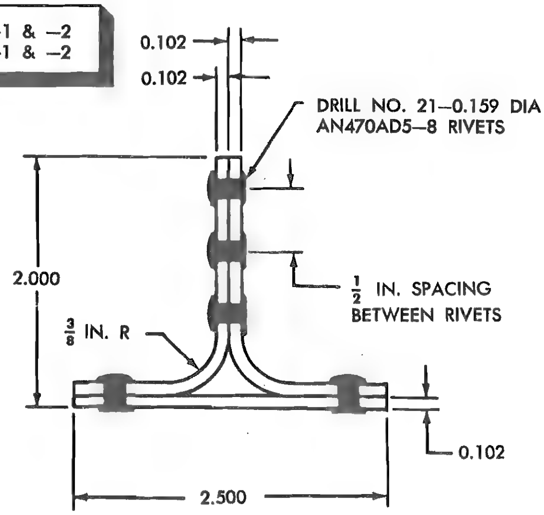
ALCOA DIA NO. K–24698
SPECIFICATION QQ–A–267
MATERIAL 2024–T

DUPLICATE FROM 2024–T BAR STOCK

S1620–61289–1 & –2
S1620–61234–1 & –2



AND10136–2409
SPECIFICATION QQ–A–267
MATERIAL 2024–T

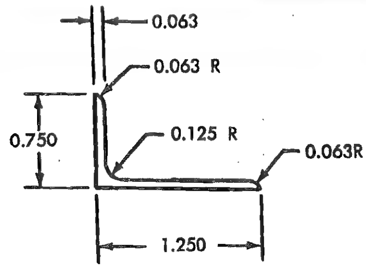


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING

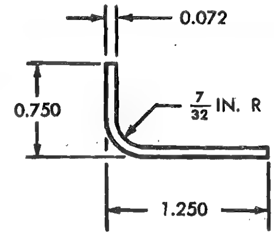
Figure 8–2. Extrusion Chart (Sheet 2 of 40)

EXTRUSION	SUBSTITUTION

S1620-61066-27

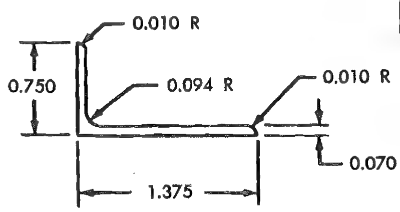


AND10134-1201
SPECIFICATION QQ-A-277
MATERIAL 7075-T

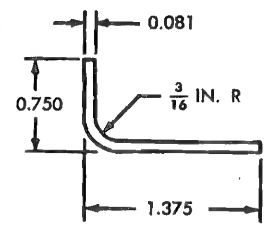


MAKE FROM 7075-T AL ALLOY
HEAT TREAT TO 7075-0 AFTER FORMING

S1620-61205-2

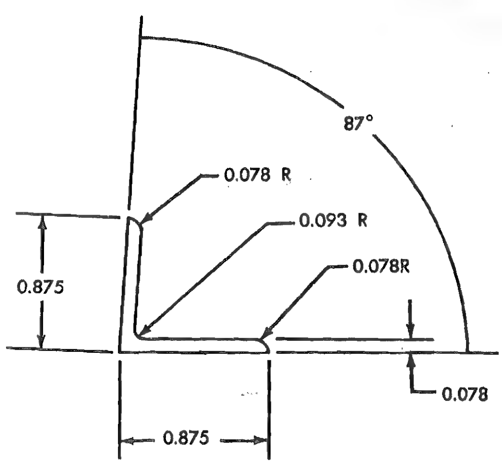


ALCOA DIE NO. K15045
SPECIFICATION QQ-A-267
MATERIAL 2024-T

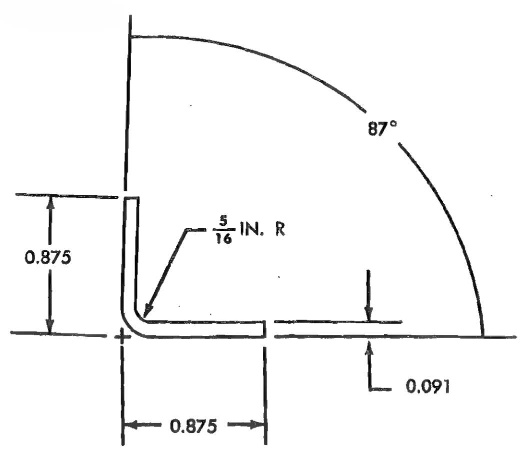


MAKE FROM 2024-0 AL ALLOY
HEAT TREAT TO 2024-T AFTER FORMING

S1605-2061



SPECIFICATION QQ-A-277
MATERIAL 7075-T

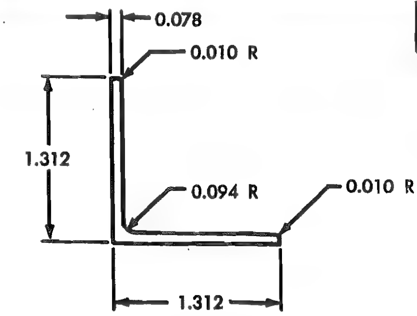


MAKE FROM 7075-0 AL ALLOY
HEAT TREAT TO 7075-T AFTER FORMING

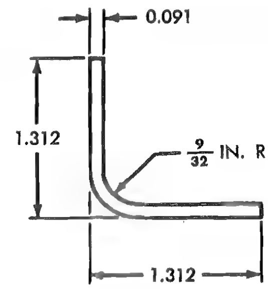
Figure 8-2. Extrusion Chart (Sheet 3 of 40)

EXTRUSION	SUBSTITUTION

S1620-65126–11 & –12

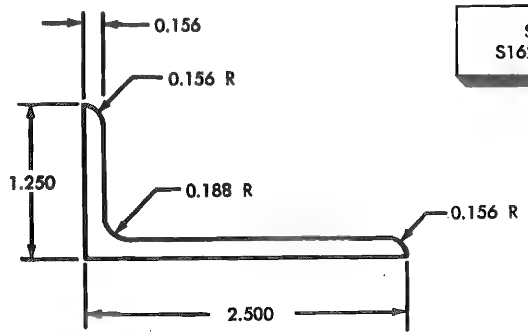


ALCOA DIE NO. K–54837
SPECIFICATION QQ–A–277
MATERIAL 7075–T



MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

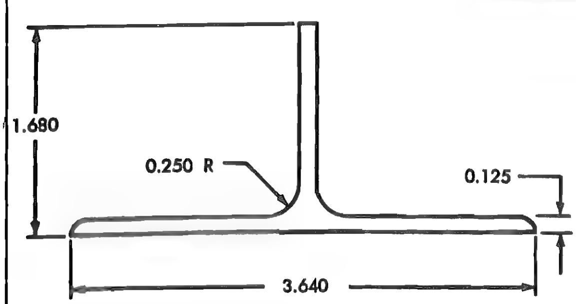
S1620–61531–7
S1620–61531–1 & –8



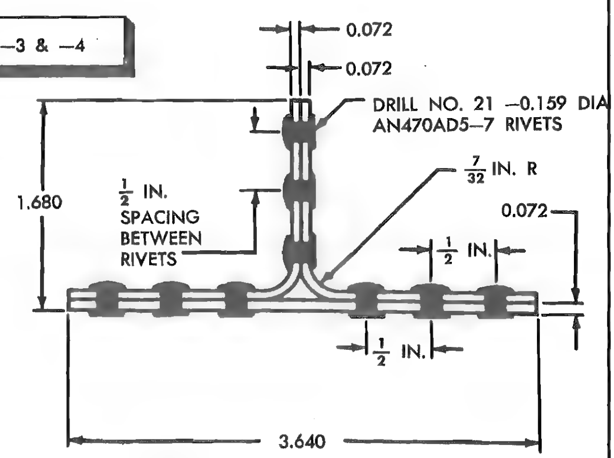
AND10134–2401
SPECIFICATION QQ–A–277
MATERIAL 7075–T

DUPLICATE FROM 7075–T BAR STOCK

S1620–65176–3 & –4



ALCOA DIE NO. K–30420
SPECIFICATION QQ–A–277
MATERIAL 7075–T



MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

Figure 8–2. Extrusion Chart (Sheet 4 of 40)

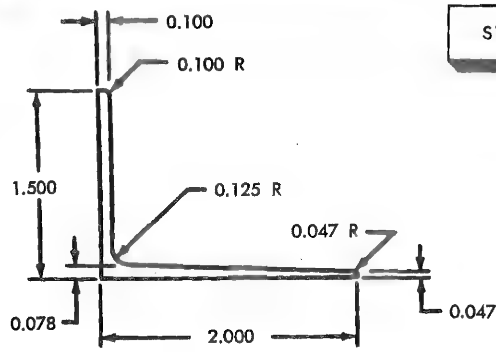
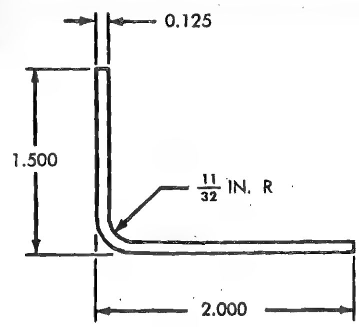
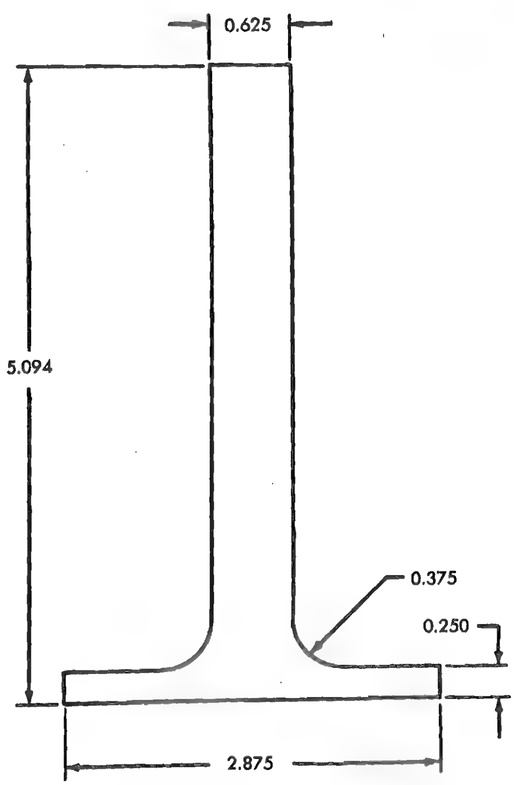
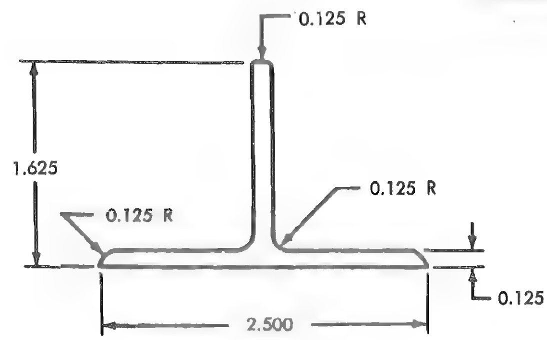
EXTRUSION	SUBSTITUTION
S1620–61553–2 & –3	
 ALCOA DIE NO. K–14030 SPECIFICATION QQ–A–277 MATERIAL 7075–T	 MAKE FROM 7075–0 AL ALLOY HEAT TREAT TO 7075–T AFTER FORMING
S1620–61603–3	
 ALCOA DIE NO. K–40039 SPECIFICATION QQ–A–277 MATERIAL 7075–T	DUPLICATE FROM 7075–T BAR STOCK

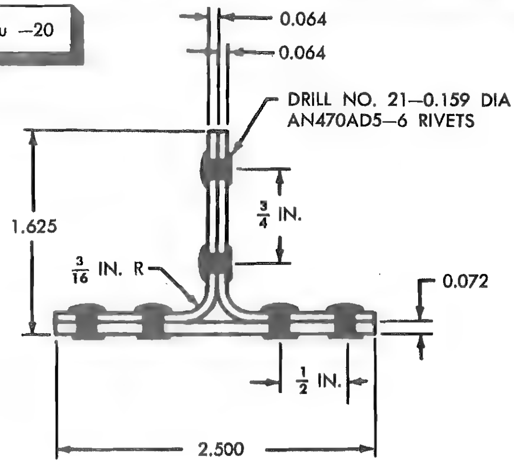
Figure 8–2. Extrusion Chart (Sheet 5 of 40)

EXTRUSION	SUBSTITUTION

S1620–61033–17 thru –20

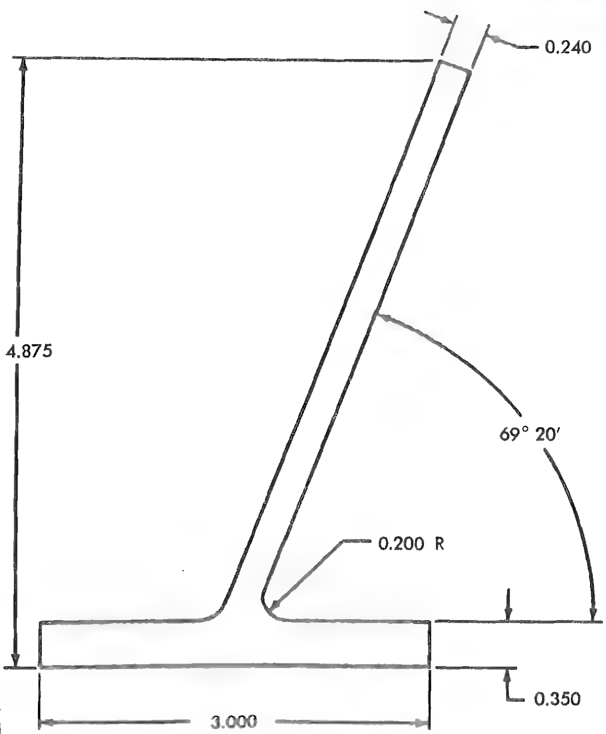


AND10136–2405
SPECIFICATION QQ–A–277
MATERIAL 7075–T



MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61473–1 thru –4



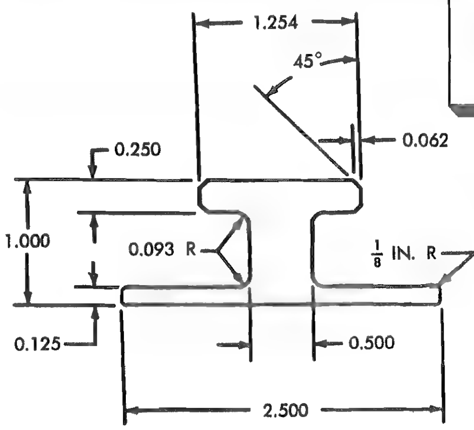
ALCOA DIE NO. K–52428
SPECIFICATION QQ–A–277
MATERIAL 7075–T

DUPLICATE FROM 7075–T BAR STOCK

Figure 8–2. Extrusion Chart (Sheet 6 of 40)

EXTRUSION	SUBSTITUTION

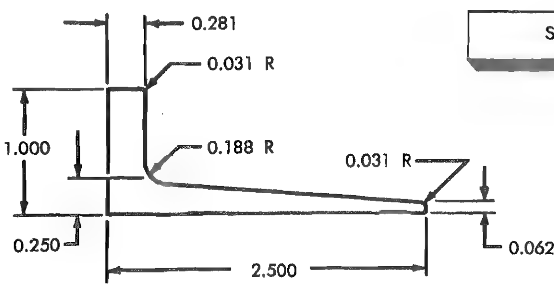
S1650–61102
S1650–61103
S1650–61104
S1650–61108



ALCOA DIE NO. K–65712
SPECIFICATION QQ–A–277
MATERIAL 7075–T

DUPLICATE FROM 7075–T BAR STOCK

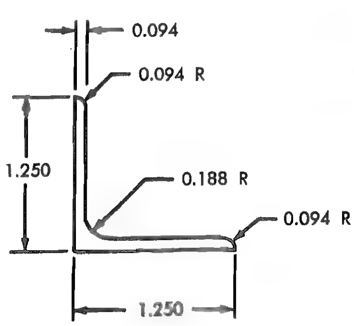
S1620–61603–19



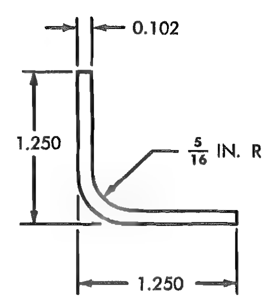
ALCOA DIE NO. K–16074
SPECIFICATION QQ–A–277
MATERIAL 7075–0

DUPLICATE FROM 7075–T BAR STOCK

S1620–61168–3 thru –6



AND10133–1202
SPECIFICATION QQ–A–277
MATERIAL 7075–T

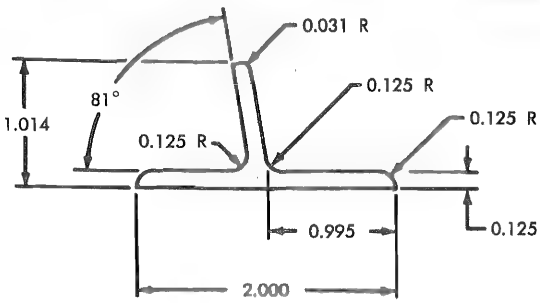


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

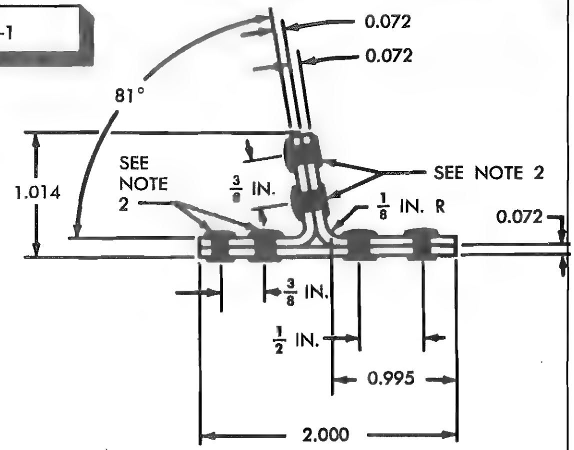
Figure 8–2. Extrusion Chart (Sheet 7 of 40)

EXTRUSION	SUBSTITUTION

S1620—61553—1

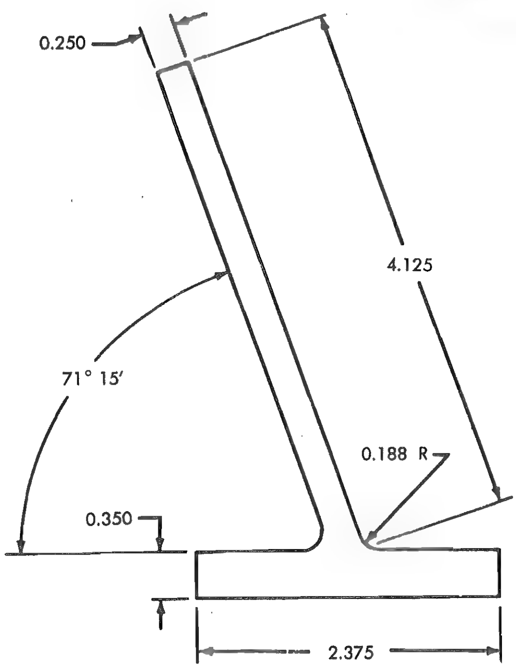


ALCOA DIE NO. K—44542
SPECIFICATION QQ—A—267
MATERIAL 2024—T



MAKE FROM 2024—0 AL ALLOY
HEAT TREAT TO 2024—T AFTER FORMING

S1620—61473—1 thru —4



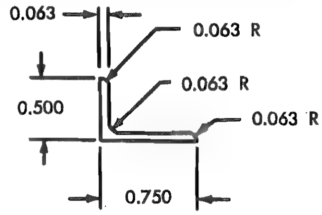
ALCOA DIE NO. K—65708
SPECIFICATION QQ—A—277
MATERIAL 7075—T

DUPLICATE FROM 7075—T BAR STOCK

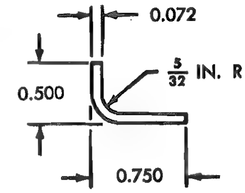
Figure 8—2. Extrusion Chart (Sheet 8 of 40)

EXTRUSION	SUBSTITUTION

S1620–61508–7 & –8

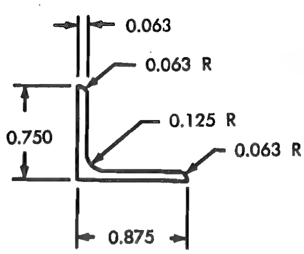


AND10134–0601
SPECIFICATION QQ–A–267
MATERIAL 2024–T

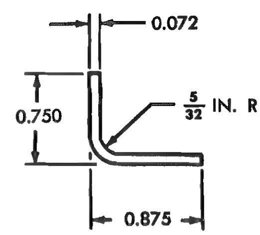


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING

S1630–61080–7 & –8

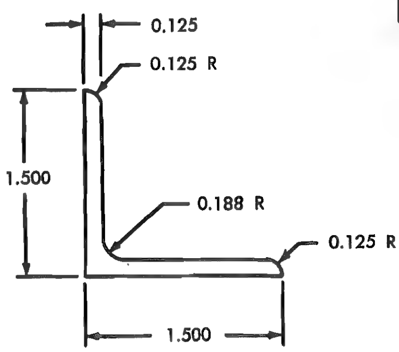


AND10134–0702
SPECIFICATION QQ–A–267
MATERIAL 2024–T

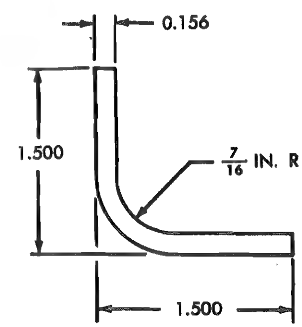


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING

S6120–61260–4



AND10133–1403
SPECIFICATION QQ–A–277
MATERIAL 7075–T



MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

Figure 8–2. Extrusion Chart (Sheet 9 of 40)

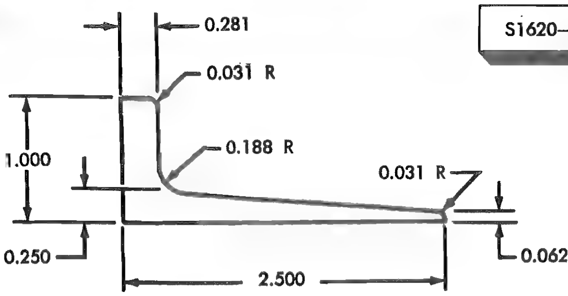
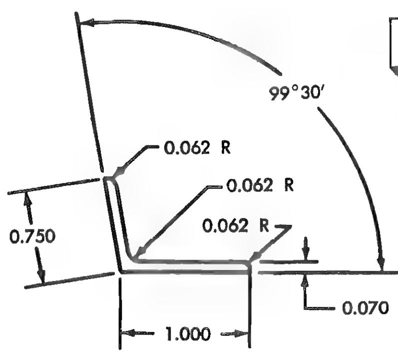
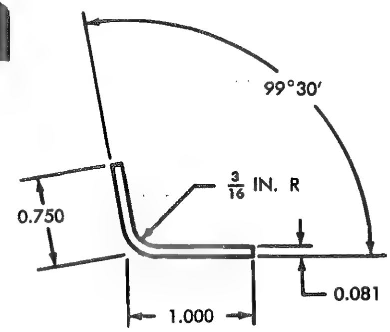
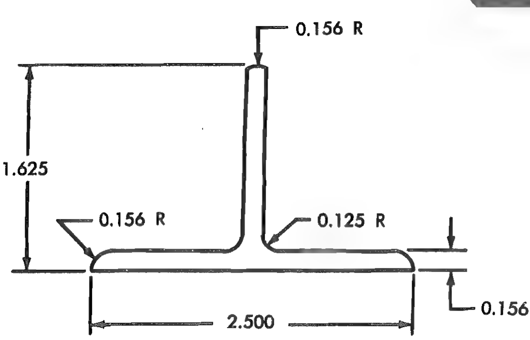
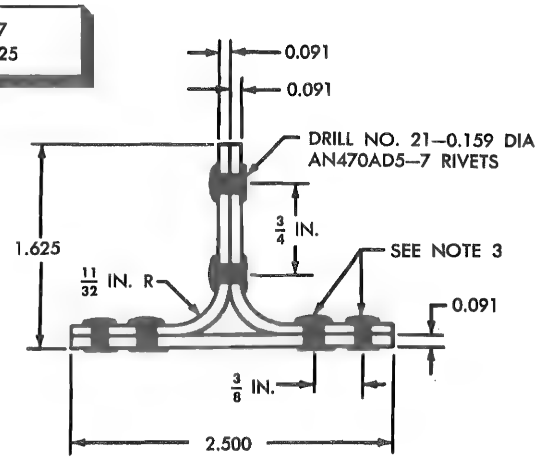
EXTRUSION	SUBSTITUTION
S1620–63147–1 thru –4	
 ALCOA DIE NO. 16074 SPECIFICATION QQ–A–267 MATERIAL 2024–T	DUPLICATE FROM 7075–T BAR STOCK
S1640–61682	
 ALCOA DIE NO. K–23992 SPECIFICATION QQ–A–267 MATERIAL 2024–T	 MAKE FROM 2024–0 AL ALLOY HEAT TREAT TO 2024–T AFTER FORMING
S1620–61415–7 S1620–61416–25	
 AND10136–2406 SPECIFICATION QQ–A–277 MATERIAL 7075–T	 MAKE FROM 7075–0 AL ALLOY HEAT TREAT TO 7075–T AFTER FORMING

Figure 8–2. Extrusion Chart (Sheet 10 of 40)

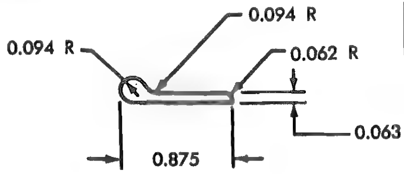
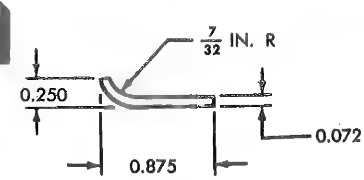
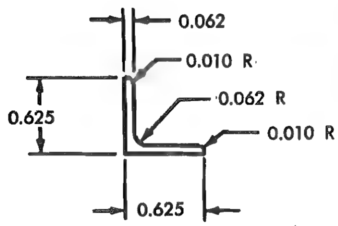
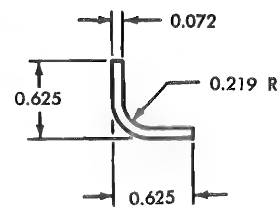
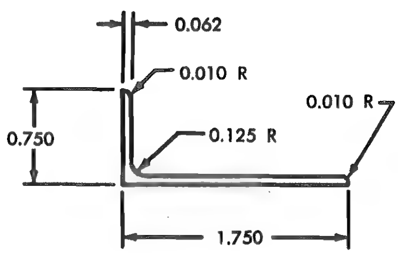
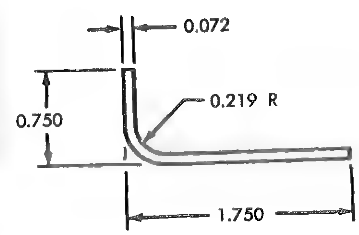
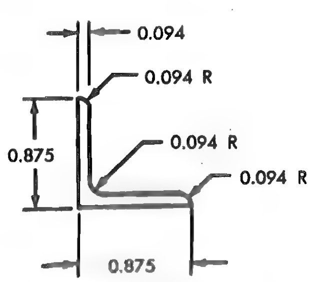
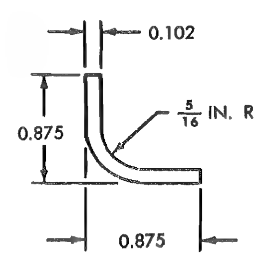
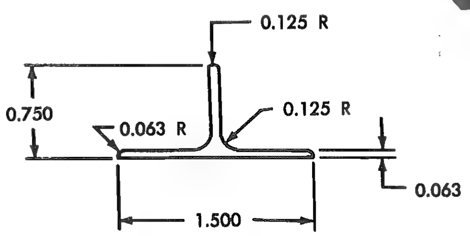
EXTRUSION		SUBSTITUTION
 ALCOA DIE NO. K-14064 SPECIFICATION QQ-A-267 MATERIAL 2024-T	S1645-65160-2	 MAKE FROM 2024-0 AL ALLOY HEAT TREAT TO 2024-T AFTER FORMING
 ALCOA DIE NO. K-22220 SPECIFICATION QQ-A-267 MATERIAL 2024-T	S1665-61544-1 & -2	 MAKE FROM 2024-0 AL ALLOY HEAT TREAT TO 2024-T AFTER FORMING
 ALCOA DIE NO. K-22991 SPECIFICATION QQ-A-267 MATERIAL 2024-T	S1620-61737 S1620-61736 S1620-61742 S1620-61747 S1620-61146-1 thru -4	 MAKE FROM 2024-0 AL ALLOY HEAT TREAT TO 2024-T AFTER FORMING
 AND10133-0702 SPECIFICATION QQ-A-277 MATERIAL 7075-T	S1620-61141-4	 MAKE FROM 7075-0 AL ALLOY HEAT TREAT TO 7075-T AFTER FORMING

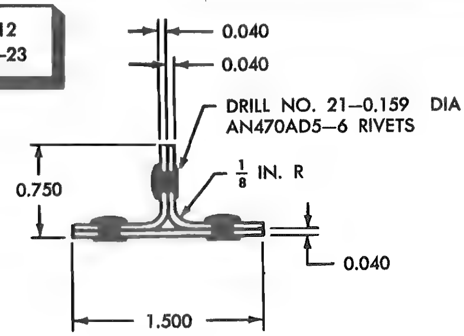
Figure 8-2. Extrusion Chart (Sheet 11 of 40)

EXTRUSION	SUBSTITUTION

S1620–61415–9 thru –12
S1620–61416–20 thru –23

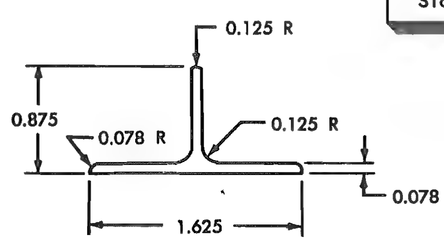


AND10136–1401
SPECIFICATION QQ–A–277
MATERIAL 7075–T

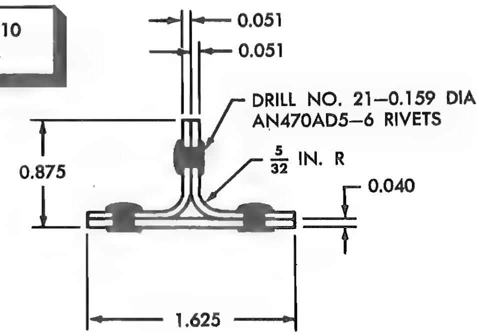


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620-61425–7 thru –10
S1620–61408–3 & –4

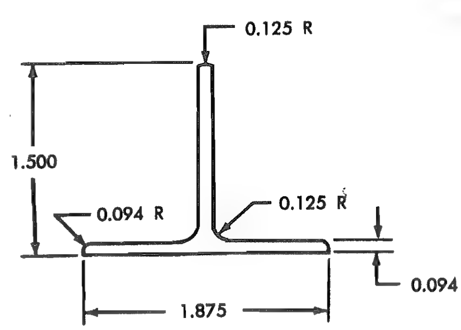


AND10136–1501
SPECIFICATION QQ–A–277
MATERIAL 7075–T

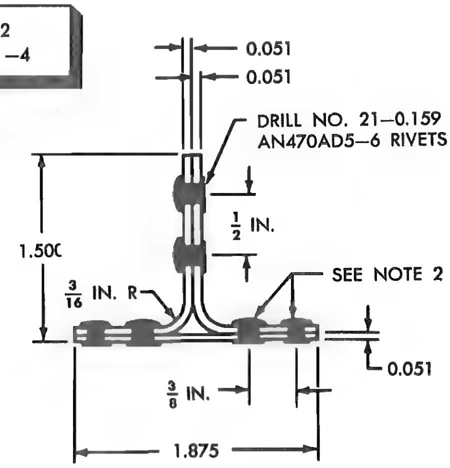


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61278–1 & –2
S1620–61224–1 thru –4



AND10136–1706
SPECIFICATION QQ–A–277
MATERIAL 7075–T

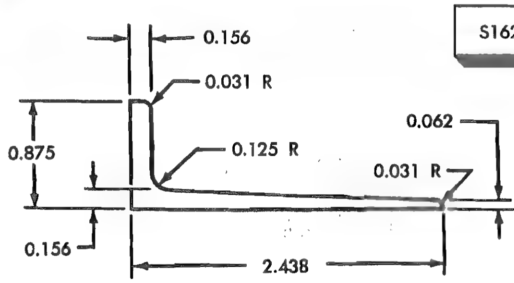


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

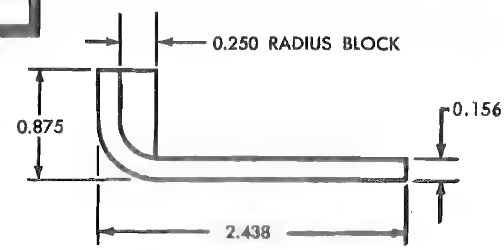
Figure 8–2. Extrusion Chart (Sheet 12 of 40)

EXTRUSION	SUBSTITUTION

S1620–61053–3 thru –6

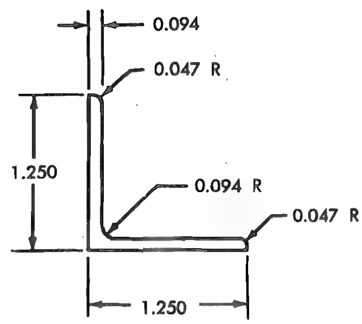


ALCOA DIE NO. 12447
SPECIFICATION QQ–A–267
MATERIAL 2024–T

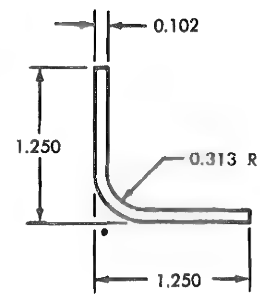


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING
RADIUS BLOCK – MAKE FROM 2024–T

S1620–61645–13 & –14

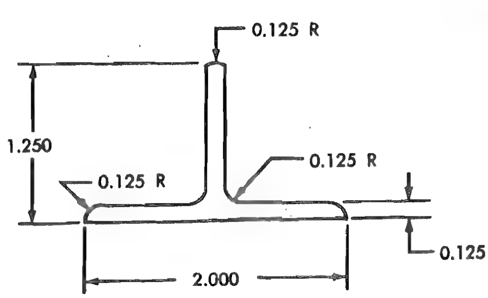


ALCOA DIA NO. 78Y
SPECIFICATION QQ–A–267
MATERIAL 2024–T

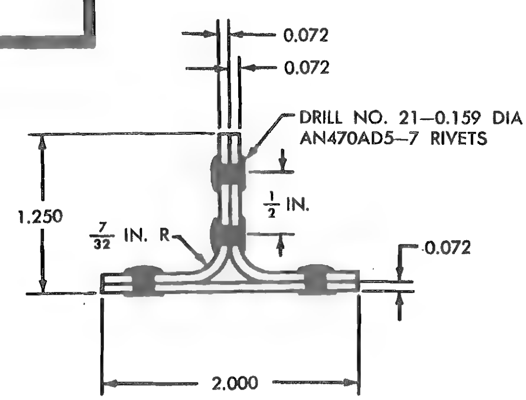


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING

S1620–61645



AND10136–2006
SPECIFICATION QQ–A–277
MATERIAL 7075–T

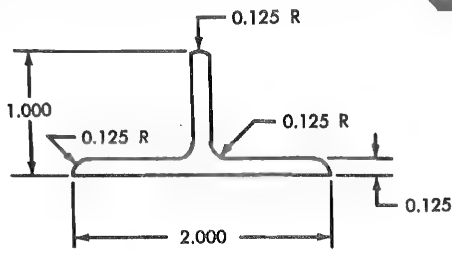


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

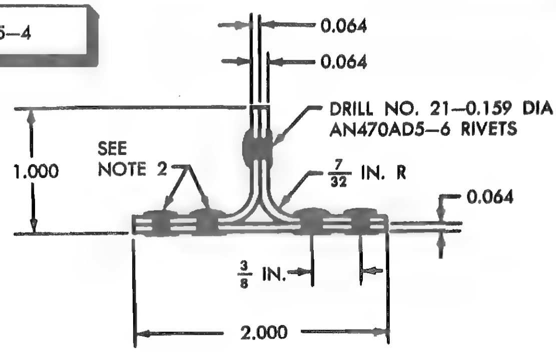
Figure 8–2. Extrusion Chart (Sheet 13 of 40)

EXTRUSION	SUBSTITUTION

S1620–61205–4

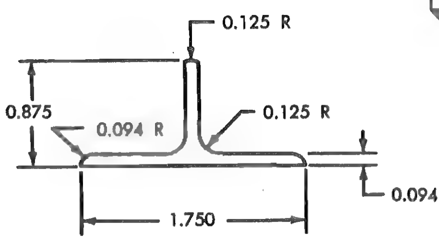


AND10136–2003
SPECIFICATION QQ–A–267
MATERIAL 2024–T

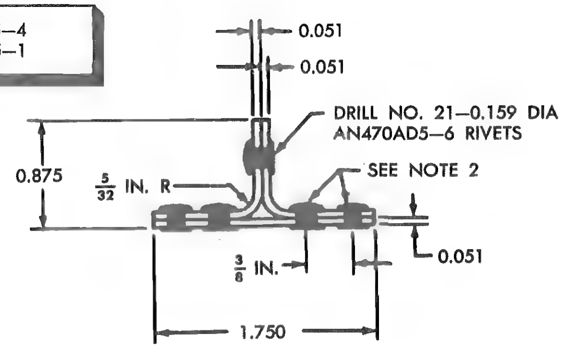


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61255–4
S1620–61255–1

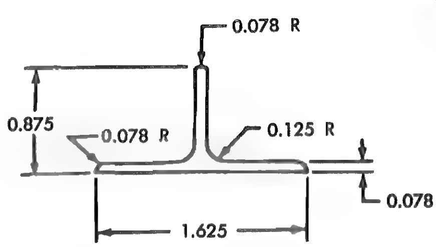


AND10136–1601
SPECIFICATION QQ–A–277
MATERIAL 7075–T

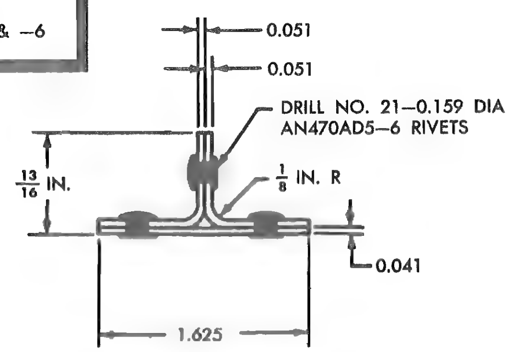


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61407–3 & –4
S1620–61428–22
S1620–61419–4 & –5
S1620–64114–17
S1620–61425–5 & –6



AND10136–1501
SPECIFICATION QQ–A–277
MATERIAL 7075–T



MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

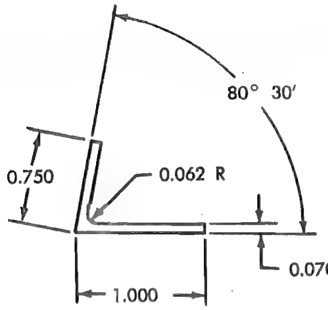
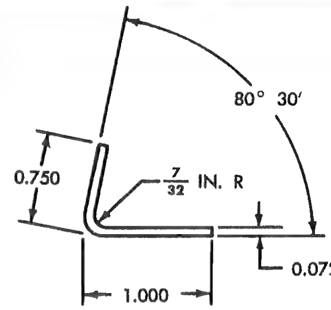
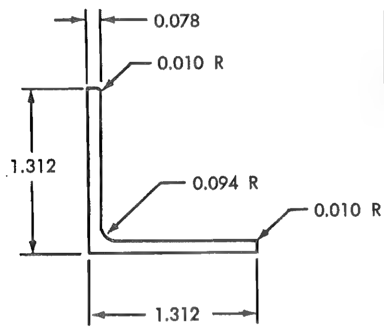
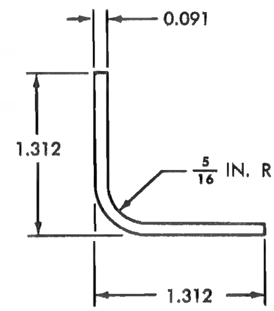
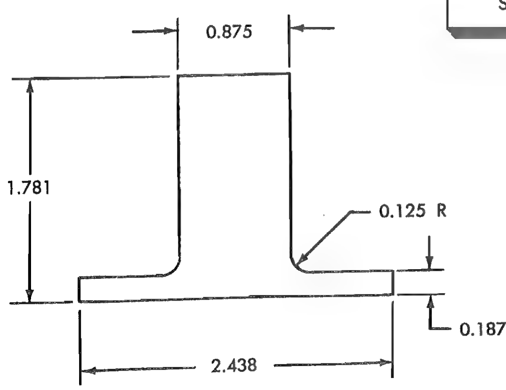
EXTRUSION		SUBSTITUTION
 ALCOA DIE NO. K–23993 SPECIFICATION QQ–A–267 MATERIAL 2024–T	S1640–61681	 MAKE FROM 7075–0 AL ALLOY HEAT TREAT TO 7075–T AFTER FORMING
 ALCOA DIE NO. K–54837 SPECIFICATION QQ–A–277 MATERIAL 7075–T	S1620–61272–1 thru –4 S1620–61253–1 thru –8	 MAKE FROM 7075–0 AL ALLOY HEAT TREAT TO 7075–T AFTER FORMING
 ALCOA DIE NO. K–11096 SPECIFICATION QQ–A–277 MATERIAL 7075–T	S1640–61453 S1620–61258–1 & 2	DUPLICATE FROM 7075–T BAR STOCK

Figure 8–2. Extrusion Chart (Sheet 15 of 40)

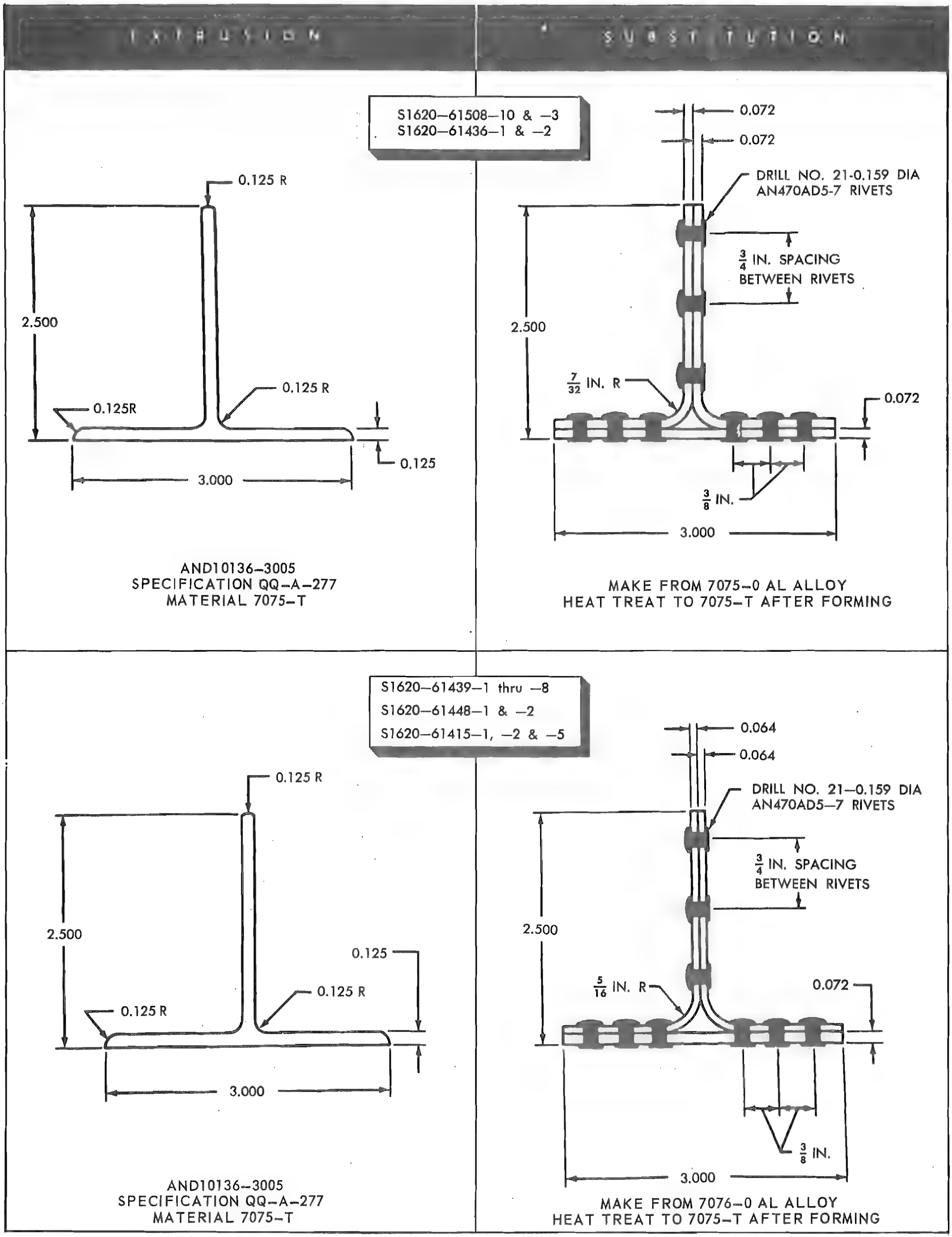


Figure 8–2. Extrusion Chart (Sheet 16 of 40)

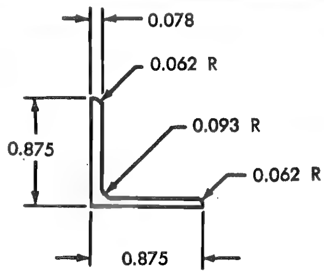
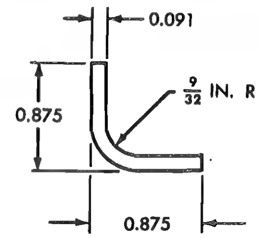
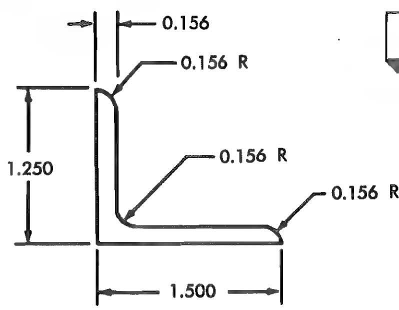
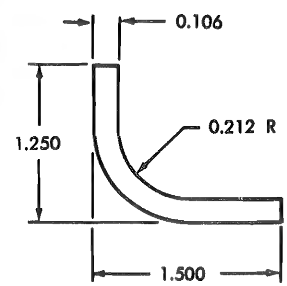
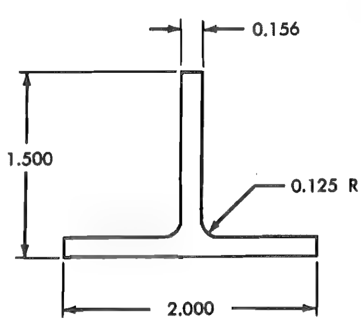
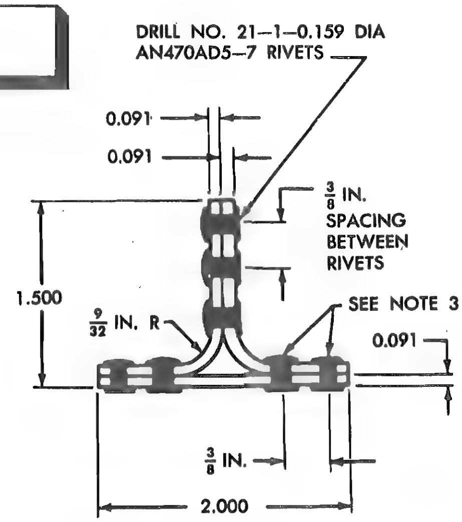
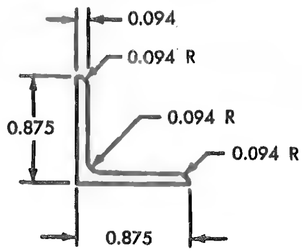
EXTRUSION		SUBSTITUTION
 ALCOA DIE NO. K-62564 SPECIFICATION QQ-A-277 MATERIAL 7075-T	S1620-61577-9	 MAKE FROM 7075-0 AL ALLOY HEAT TREAT TO 7075-T AFTER FORMING
 AND10134-1408 SPECIFICATION QQ-A-277 MATERIAL 7075-T	S1620-61603-4	 MAKE FROM 41300 STEEL
 ALCOA DIE NO. K-44027 SPECIFICATION QQ-A-227 MATERIAL 7075-T	S1620-61415-7 S1620-61416-25	 MAKE FROM 7075-0 AL ALLOY HEAT TREAT TO 7075-T AFTER FORMING

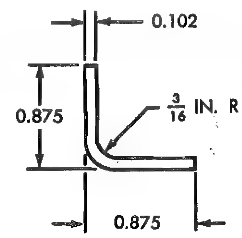
Figure 8-2. Extrusion Chart (Sheet 17 of 40)

EXTRUSION	SUBSTITUTION

S1620—61610—1 & —2

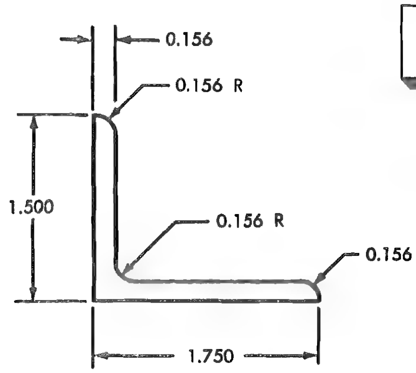


AND10133—0702
SPECIFICATION QQ—A—267
MATERIAL 2024—T

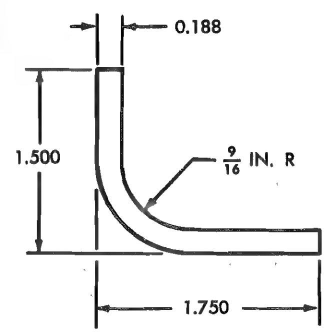


MAKE FROM 2024—0 AL ALLOY
HEAT TREAT TO 2024—T AFTER FORMING

S1620—61269—1 & —4
S1620—61276—3

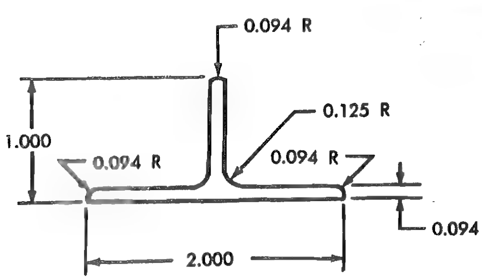


AND10134—1604
SPECIFICATION QQ—A—277
MATERIAL 7075—T

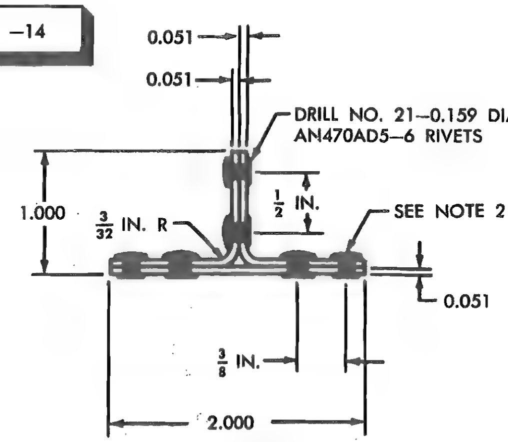


MAKE FROM 7075—0 AL ALLOY
HEAT TREAT TO 7075—T AFTER FORMING

S1620—61392—13 & —14



AND10136—2002
SPECIFICATION QQ—A—267
MATERIAL 2024—T



MAKE FROM 2024—0 AL ALLOY
HEAT TREAT TO 2024—T AFTER FORMING

Figure 8—2. Extrusion Chart (Sheet 18 of 40)

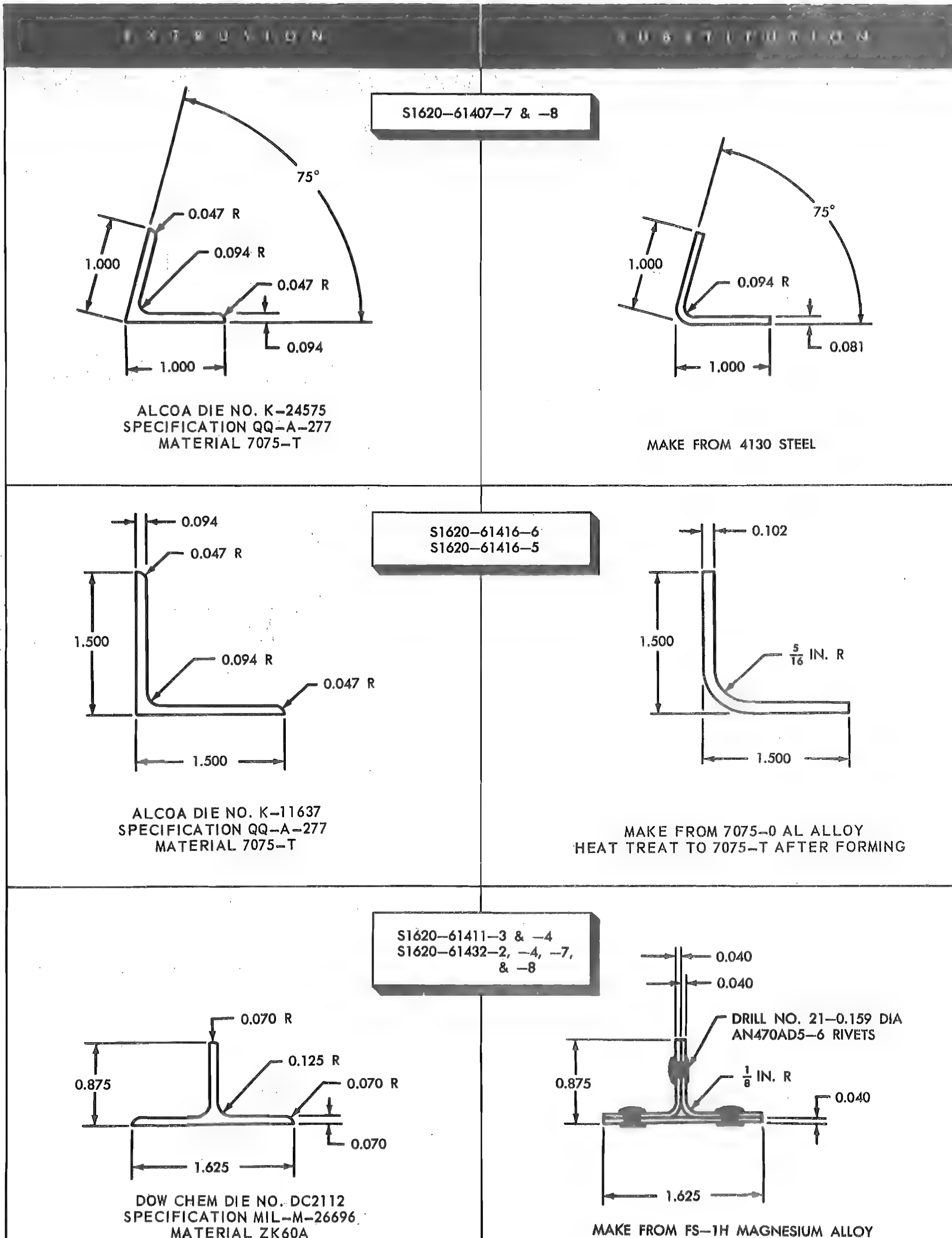
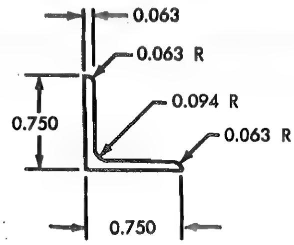


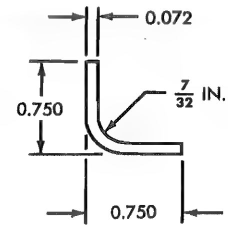
Figure 8–2. Extrusion Chart (Sheet 19 of 40)

EXTRUSION	SUBSTITUTION

S1620–61508–7 & –8

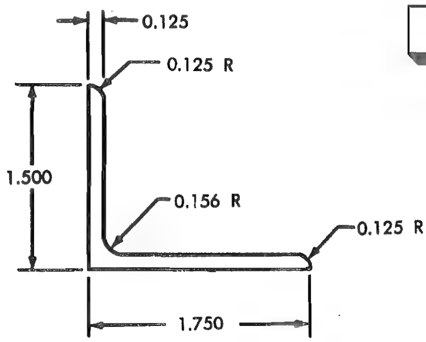


AND10133–0601
SPECIFICATION QQ–A–277
MATERIAL 7075–T

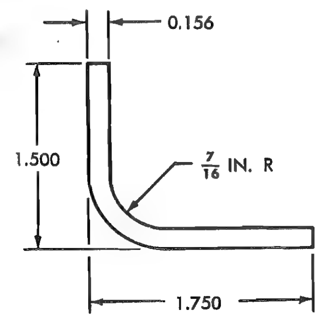


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61276–1 & –2

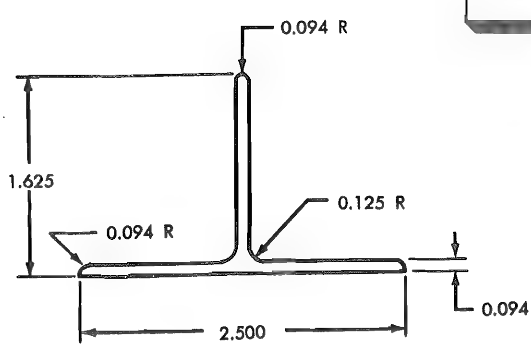


AND10134–1604
SPECIFICATION QQ–A–277
MATERIAL 7075–T

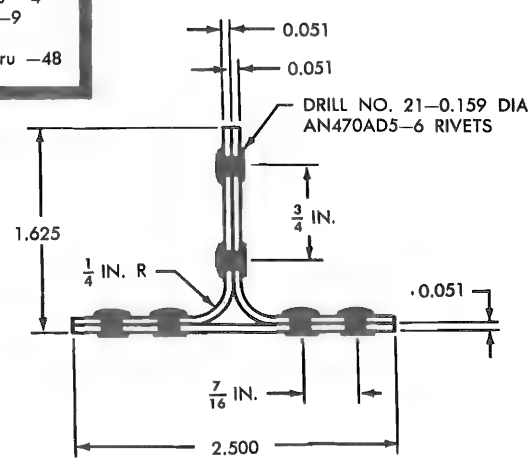


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61053–13 & –14
S1620–61721–1 thru –4
S1620–61095–7 & –9
S1620–61645–5
S1620–61771–46 thru –48



AND10136–2404
SPECIFICATION QQ–A–267
MATERIAL 7075–T

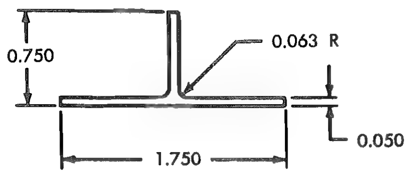


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

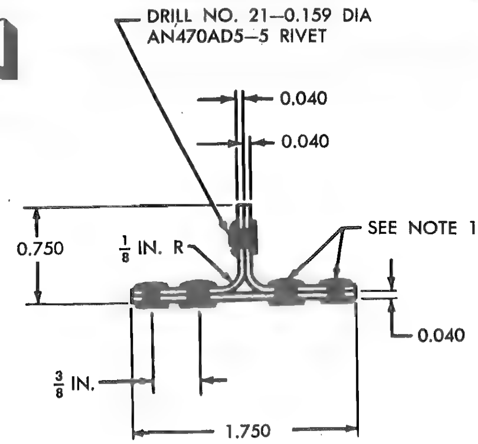
Figure 8–2. Extrusion Chart (Sheet 20 of 40)

EXTRUSION	SUBSTITUTION

S1620–64166–5

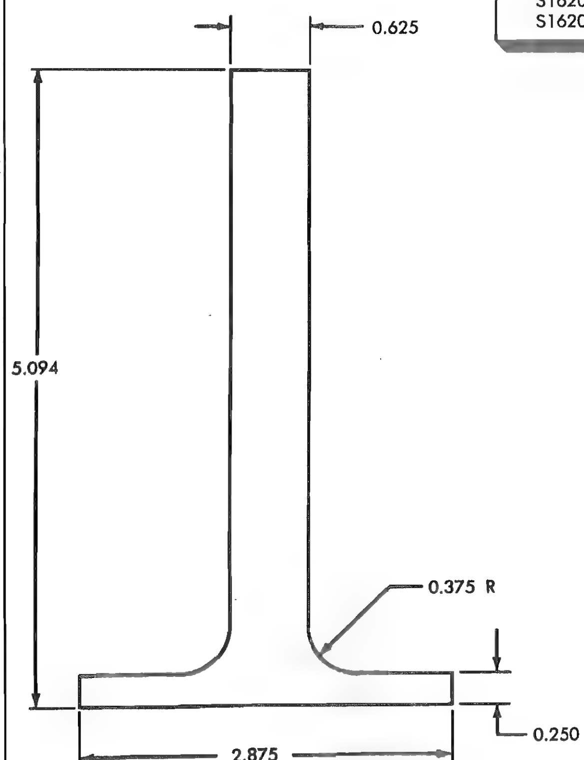


ALCOA DIE NO. K–16440
SPECIFICATION QQ–A–277
MATERIAL 7075–T



MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61645–3
S1620–61471–1 thru –4



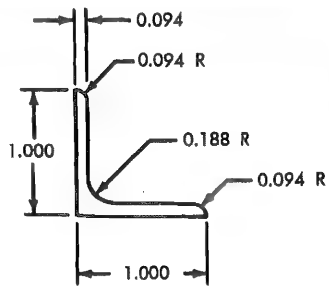
ALCOA DIE NO. K–40039
SPECIFICATION QQ–A–277
MATERIAL 7075–T

DUPLICATE FROM 7075–T BAR STOCK

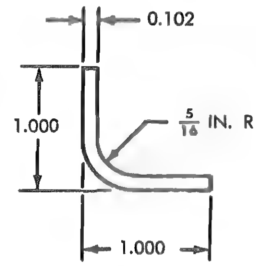
Figure 8–2. Extrusion Chart (Sheet 21 of 40)

EXTRUSION	SUBSTITUTION

S1620–61612–8 & –9
S1620–61260–3

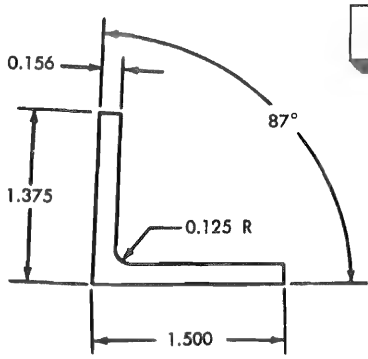


AND10133–1002
SPECIFICATION QQ–A–277
MATERIAL 7075–T

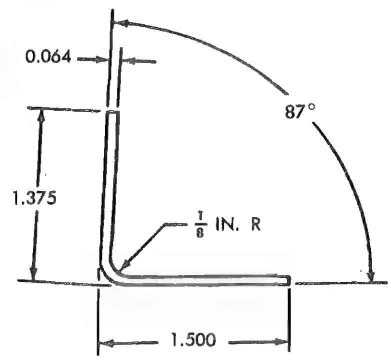


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61408–7 & –8

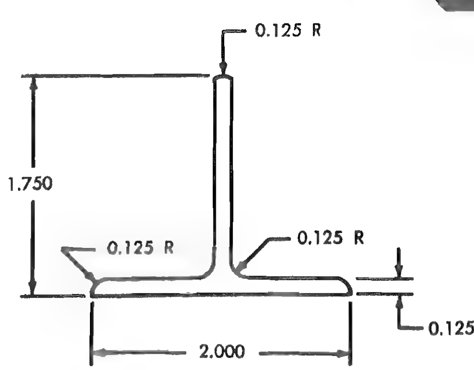


DOW CHEM DIE NO. DC624
SPECIFICATION QQ–M–31
MATERIAL AZ31

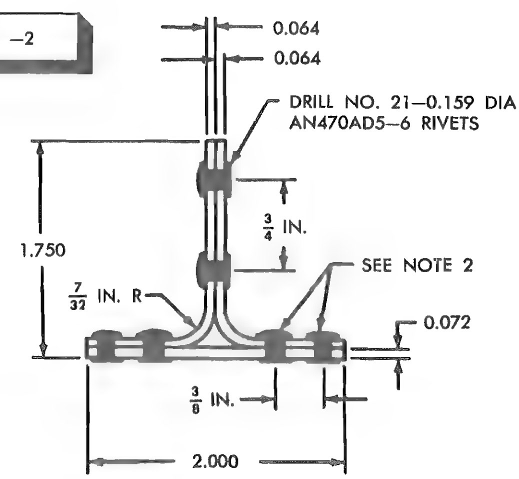


MAKE FROM 4130 STEEL

S1620–61492–1 & –2



AND10136–2008
SPECIFICATION QQ–A–277
MATERIAL 7075–T

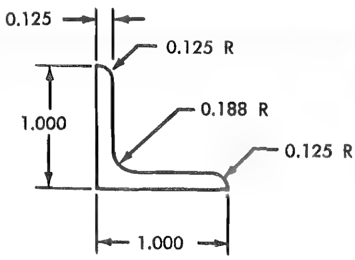


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

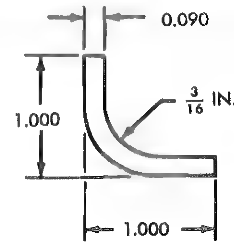
Figure 8–2. Extrusion Chart (Sheet 22 of 40)

EXTRUSION	SUBSTITUTION

S1620–61033–13 thru –16
S1620–61603–5

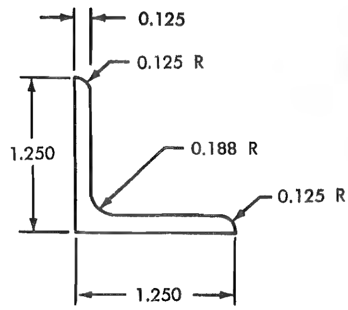


AND10133–1003
SPECIFICATION QQ–A–277
MATERIAL 7075–T

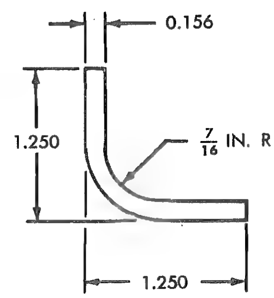


MAKE FROM 4130 STEEL

S1620–61603–1

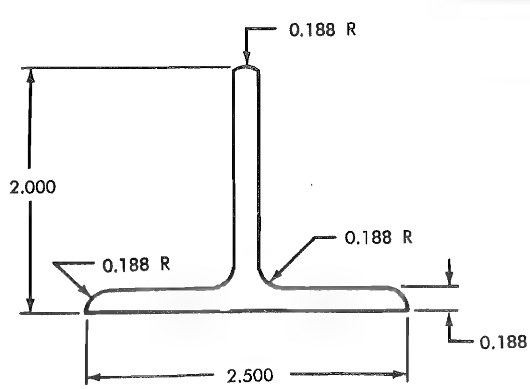


AND 10133–1203
SPECIFICATION QQ–A–277
MATERIAL 7075–T

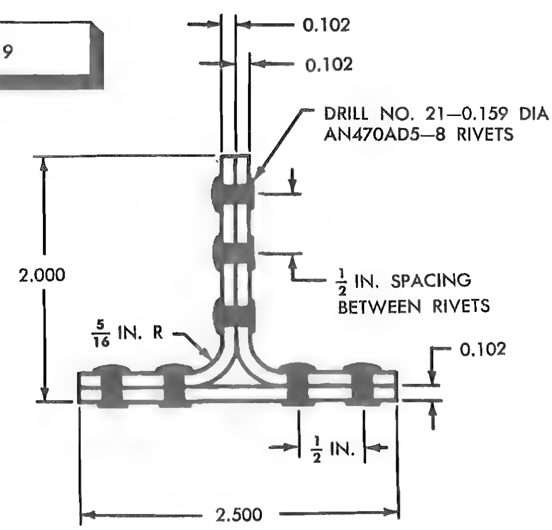


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–64119



AND10136–2409
SPECIFICATION QQ–A–277
MATERIAL 7075–T

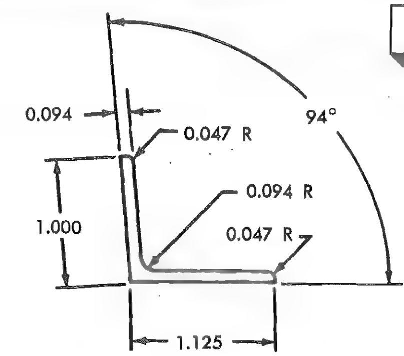


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

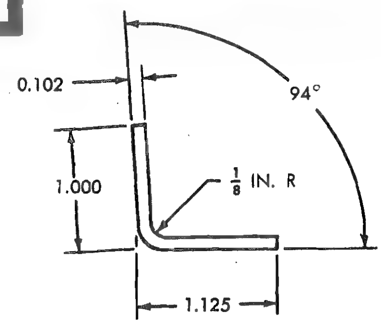
Figure 8–2. Extrusion Chart (Sheet 23 of 40)

EXTRUSION	SUBSTITUTION

S1620–61168–5 & –6

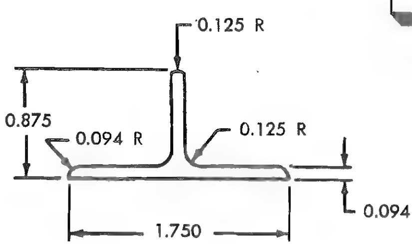


ALCOA DIE NO. K–51251
SPECIFICATION QQ–A–277
MATERIAL 7075–T

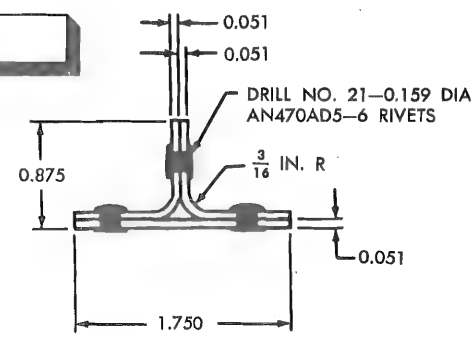


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61099–4

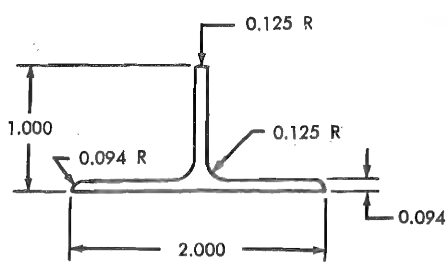


ALCOA DIE NO. K–51251
SPECIFICATION QQ–A–277
MATERIAL 7075–T

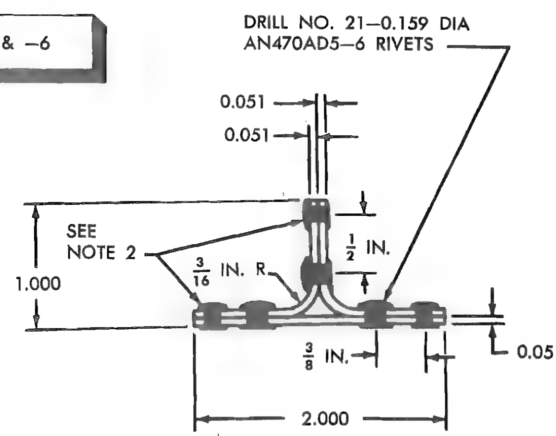


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–65176–5 & –6



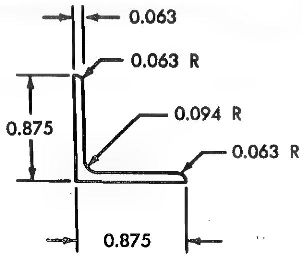
AND10136–1601
SPECIFICATION QQ–A–277
MATERIAL 7075–T



MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

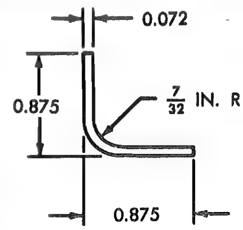
Figure 8–2. Extrusion Chart (Sheet 24 of 40)

EXTRUSION	SUBSTITUTION



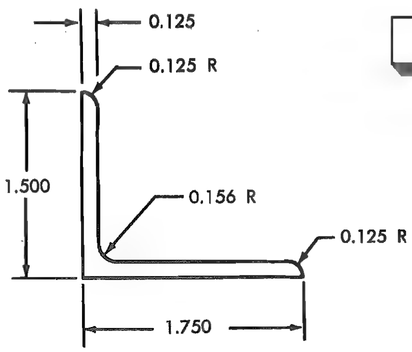
S1620–63215–3
S1620–61611
S1620–64103–6
S1620–61644–16 & –17
S1655–61209–1 & –2
S1620–64105–7 & –8
S1620–61641–17, –18, &–19

AND10133–0701
SPECIFICATION QQ–A–277
MATERIAL 7075–T

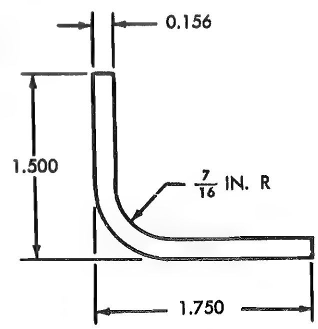


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61254–1 thru –4

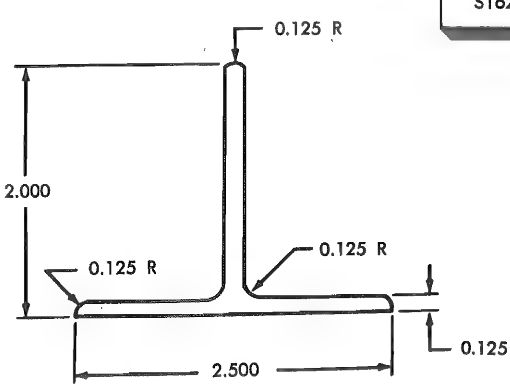


AND10134–1603
SPECIFICATION QQ–A–277
MATERIAL 7075–T

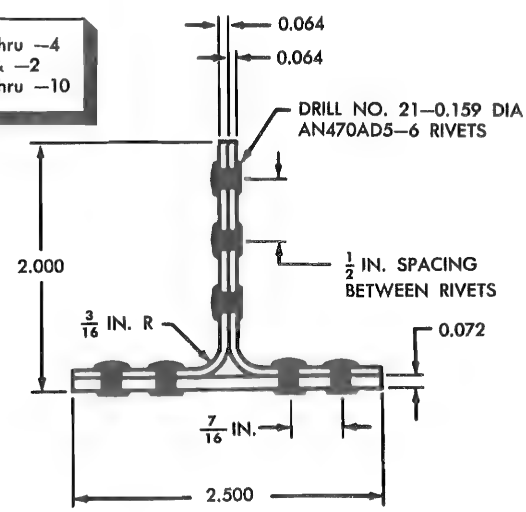


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61526–1 thru –4
S1620–61352–1 & –2
S1620–61353–1 thru –10



AND10136–2407
SPECIFICATION QQ–A–277
MATERIAL 7075–T

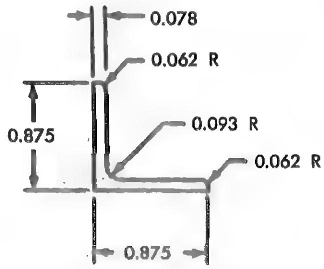


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

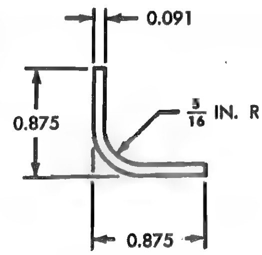
Figure 8–2. Extrusion Chart (Sheet 25 of 40)

EXTRUSION	SUBSTITUTION

S1620–61249–5 thru –10
S1620–61425–11 & –12
S1620–61112–2 thru –5
S1620–61137–2 thru –5

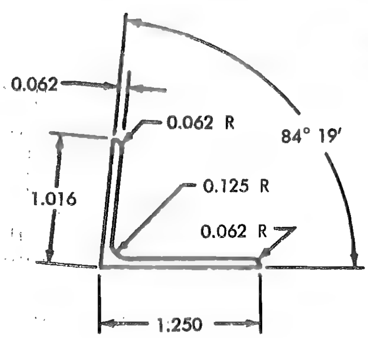


ALCOA DIE NO. K–62564
SPECIFICATION QQ–A–277
MATERIAL 7075–T

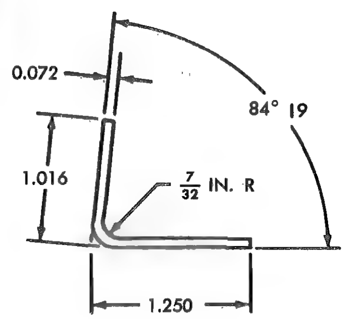


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61168–3 & –4

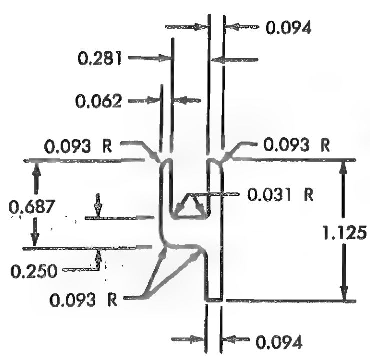


ALCOA DIE NO. K–51243
SPECIFICATION QQ–A–277
MATERIAL 7075–T

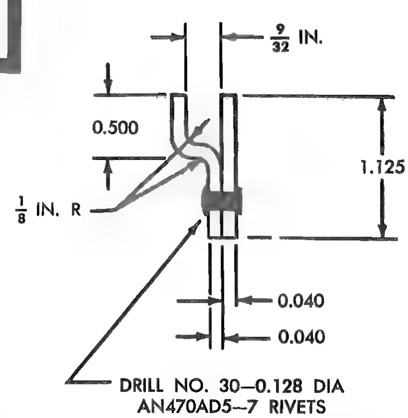


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61245–1
S1620–65106–11
S1620–61207–1



DOW CHEM DIE NO. DC2108
SPECIFICATION MIL–M–26696
MATERIAL ZK60A

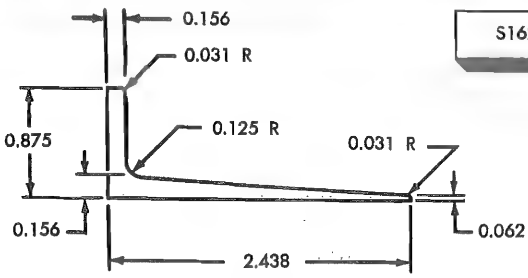


MAKE FROM FS–1H MAGNESIUM ALLOY

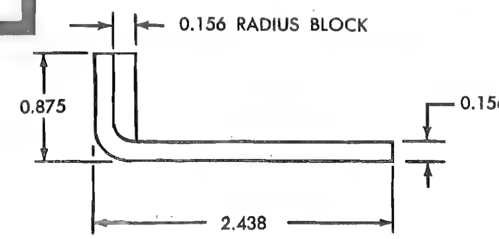
Figure 8–2. Extrusion Chart (Sheet 26 of 40)

EXTRUSION	SUBSTITUTION

S1620–61475–1 & –2

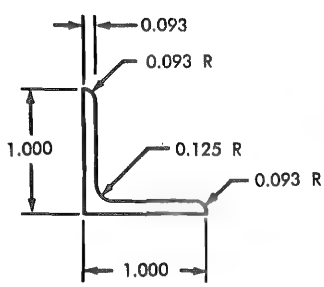


ALCOA DIE NO. K–12447
SPECIFICATION QQ–A–277
MATERIAL 7075–T

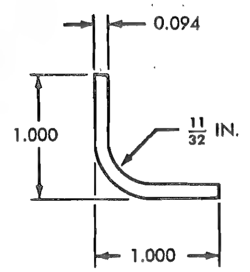


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING
RADIUS BLOCK – MAKE FROM 7075–T

S1620–61066–2, –3, –4, –8, –9, & –12

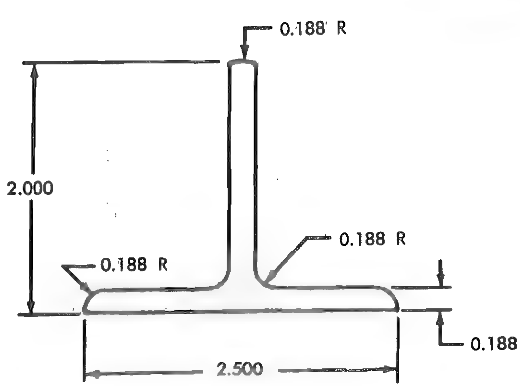


ALCOA DIE NO. 78F
SPECIFICATION QQ–A–277
MATERIAL 7075–T

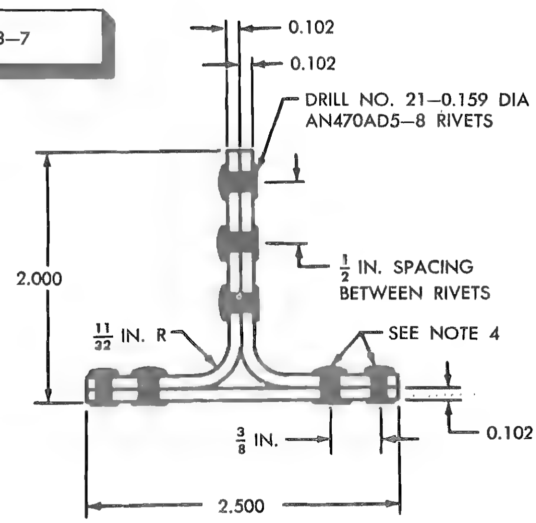


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–64133–7



AND10136–2409
SPECIFICATION QQ–A–277
MATERIAL 7075–T

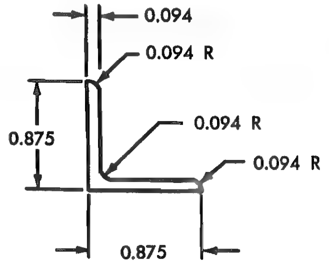


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

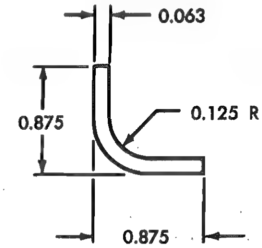
Figure 8–2. Extrusion Chart (Sheet 27 of 40)

EXTRUSION	SUBSTITUTION

S1620–61049–5 thru –8

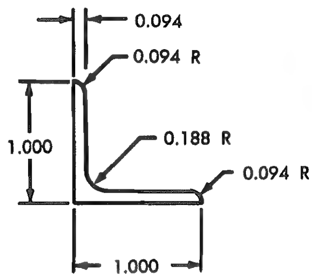


AND10133–0702
SPECIFICATION QQ–A–277
MATERIAL 7075–T

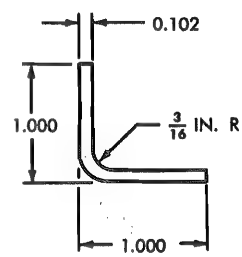


MAKE FROM 4130 STEEL

S1620–61685–1 & –2
S1620–61406–25

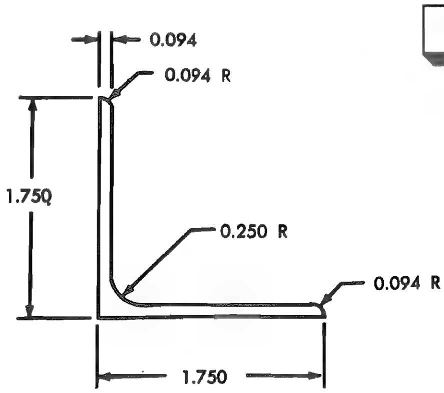


AND10133–1002
SPECIFICATION QQ–A–267
MATERIAL 2024–T

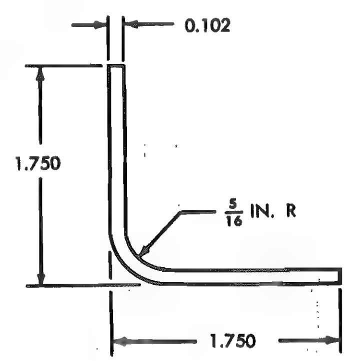


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING

S1620–61644–18 & –19



AND10133–1601
SPECIFICATION QQ–A–277
MATERIAL 7075–T

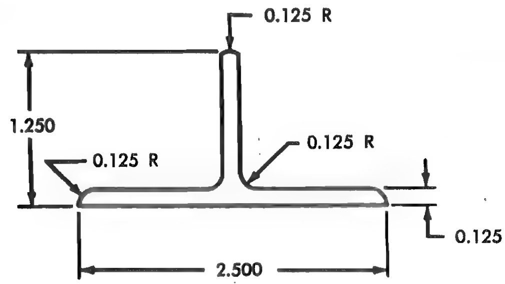


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

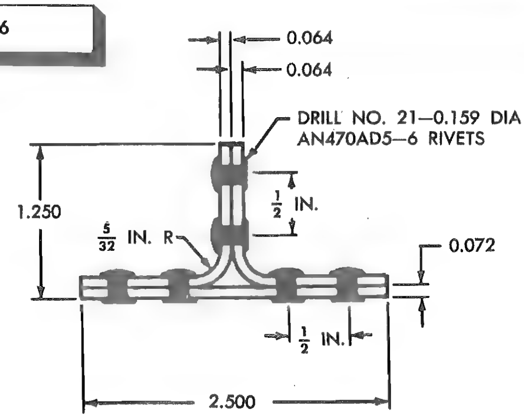
Figure 8–2. Extrusion Chart (Sheet 28 of 40)

EXTRUSION	SUBSTITUTION

S1620—63226

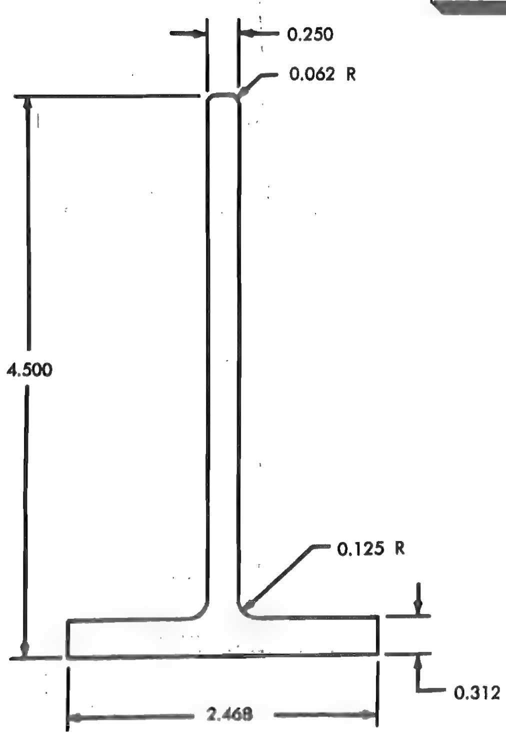


AND10136—2402
SPECIFICATION QQ—A—267
MATERIAL 2024—T

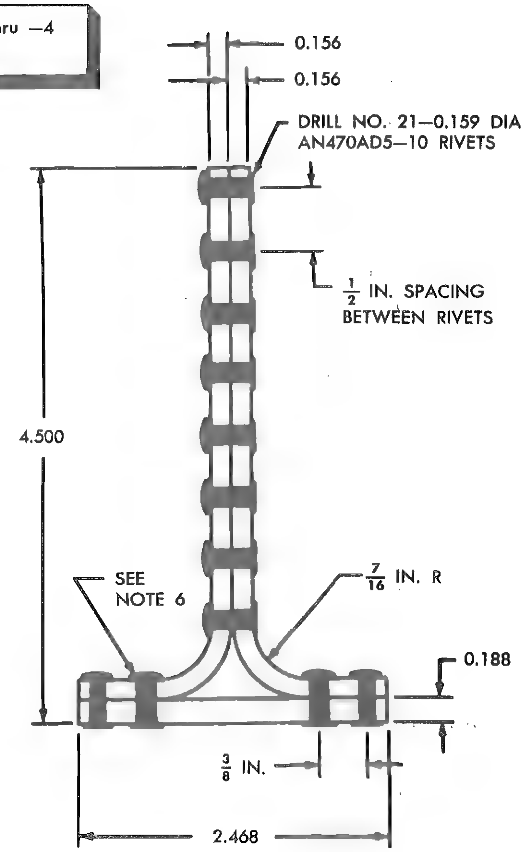


MAKE FROM 2024—0 AL ALLOY
HEAT TREAT TO 2024—T AFTER FORMING

S1620—61471—1 thru —4
S1620—61645—3



ALCOA DIE NO. K—65710
SPECIFICATION QQ—A—277
MATERIAL 7075—T



MAKE FROM 7075—0 AL ALLOY
HEAT TREAT TO 7075—T AFTER FORMING

Figure 8—2. Extrusion Chart (Sheet 29 of 40)

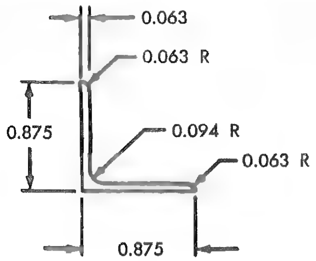
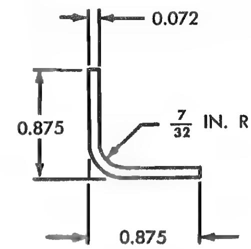
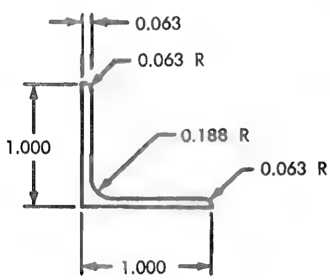
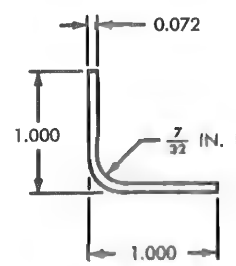
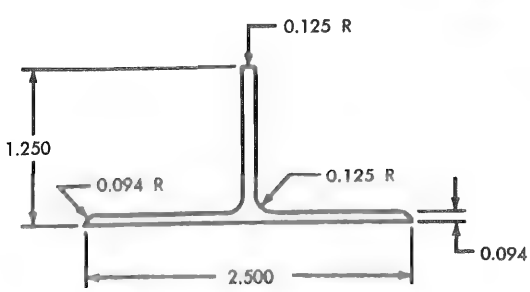
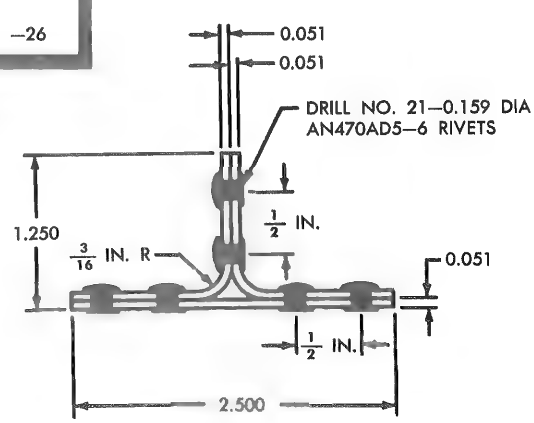
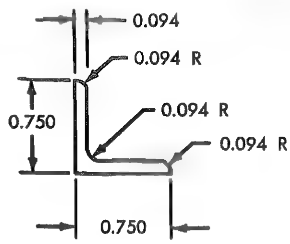
EXTRUSION	SUBSTITUTION
S1620—61392—15 & —16 S1620—64103—3 S1602—64113—18 S1620—64137 S1620—61428—21 S1620—61044—1	
 AND10133—0701 SPECIFICATION QQ—A—277 MATERIAL 7075—T	 MAKE FROM 7075—0 AL ALLOY HEAT TREAT TO 7075—T AFTER FORMING
S1620—61203—16	
 AND10133—1001 SPECIFICATION QQ—A—267 MATERIAL 2024—T	 MAKE FROM 2024—0 AL ALLOY HEAT TREAT TO 2024—T AFTER FORMING
S1620—61555—2 S1620—61066—25 & —26	
 AND10136—2401 SPECIFICATION QQ—A—277 MATERIAL 7075—T	 MAKE FROM 7075—0 AL ALLOY HEAT TREAT TO 7075—T AFTER FORMING

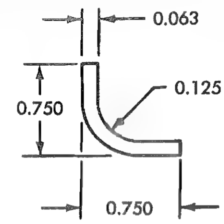
Figure 8—2. Extrusion Chart (Sheet 30 of 40)

EXTRUSION	SUBSTITUTION

S1620–61066–11, –10, –5, –21, & –22

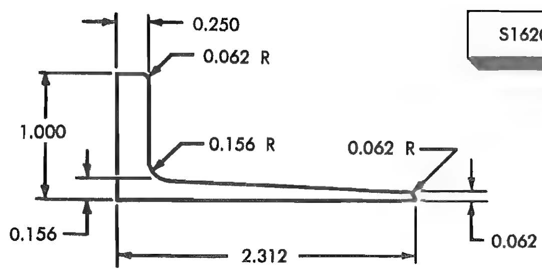


AND10133–0602
SPECIFICATION QQ–A–277
MATERIAL 7075–T

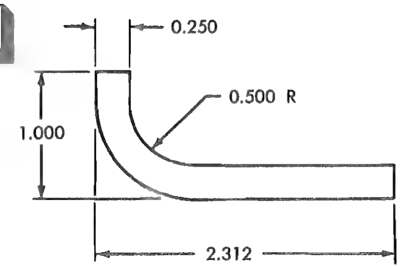


MAKE FROM 4130 STEEL

S1620–61035–1 thru –4

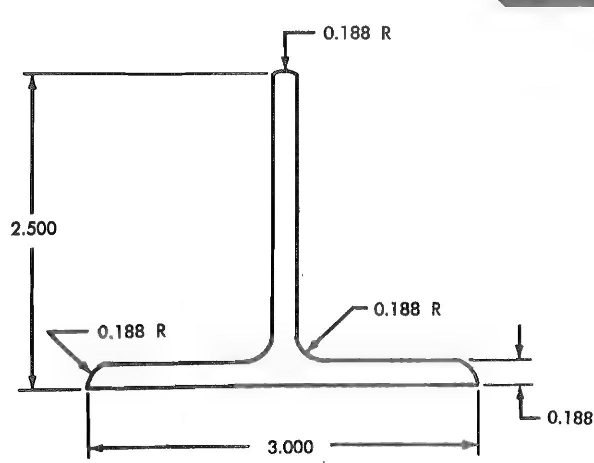


ALCOA DIE NO. K–13662
SPECIFICATION QQ–A–277
MATERIAL 7075–T

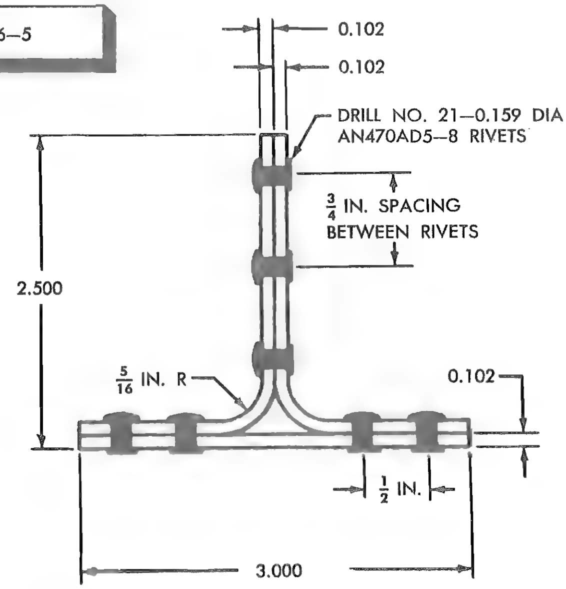


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61226–5



AND10136–3006
SPECIFICATION QQ–A–277
MATERIAL 7075–T



MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

Figure 8–2. Extrusion Chart (Sheet 31 of 40)

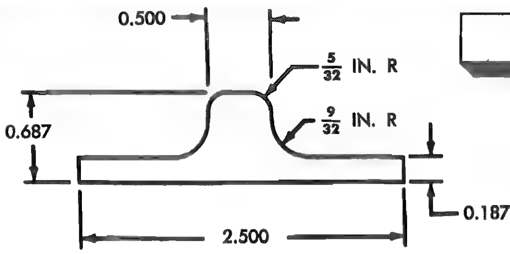
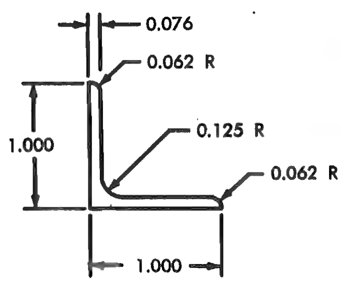
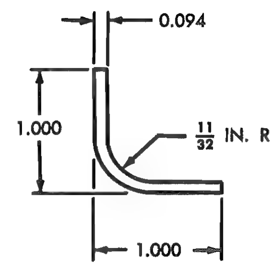
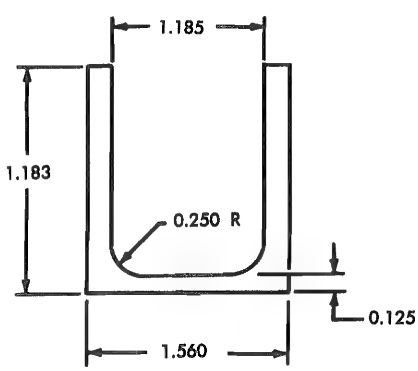
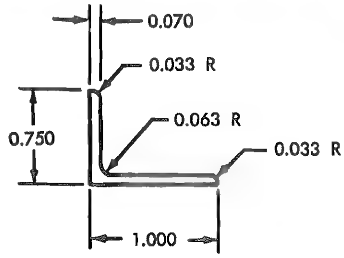
EXTRUSION	SUBSTITUTION
S1620–61258–1	
 ALCOA DIE NO. K–65709 SPECIFICATION QQ–A–277 MATERIAL 7075–T	DUPLICATE FROM 7075–T BAR STOCK
S1620–64133–3 thru –6 S1620–61645–7 & –8	
 ALCOA DIE NO.30845 SPECIFICATION QQ–A–277 MATERIAL 7075–T	 MAKE FROM 7075–0 AL ALLOY HEAT TREAT TO 7075–T AFTER FORMING
S1620–63131	
 ALCOA DIE NO. 65535 SPECIFICATION QQ–A–277 MATERIAL 7075–T	DUPLICATE FROM 7075–T BAR STOCK

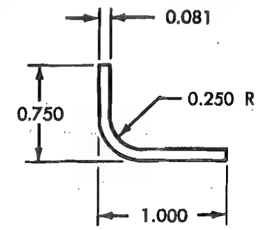
Figure 8–2. Extrusion Chart (Sheet 32 of 40)

EXTRUSION	SUBSTITUTION

S1620–61769

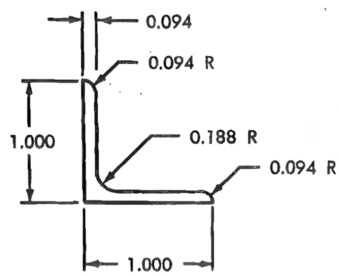


ALCOA DIE NO. K–1288
SPECIFICATION QQ–A–267
MATERIAL 2024–T

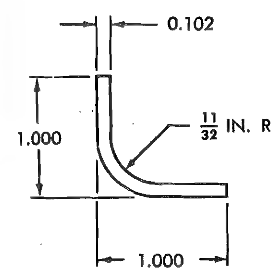


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING

S1620–61255–3
S1620–61435–3 thru –6
S1620–61603–6
S1620–61645–1

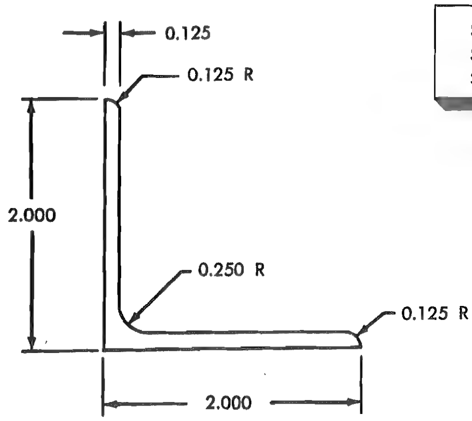


AND10133–1002
SPECIFICATION QQ–A–277
MATERIAL 7075–T

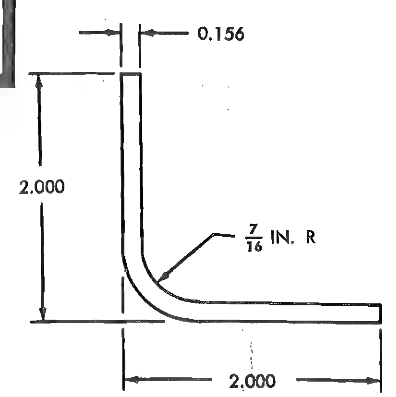


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61475–3 thru –6
S1620–61254–1 thru –4
S1620–61584



AND10133–2002
SPECIFICATION QQ–A–277
MATERIAL 7075–T

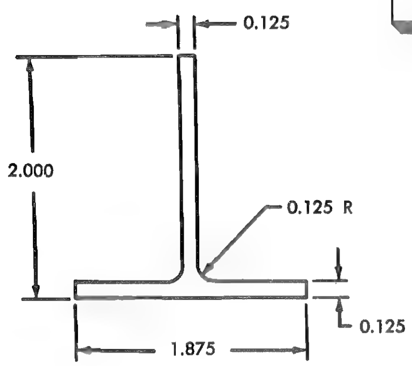


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

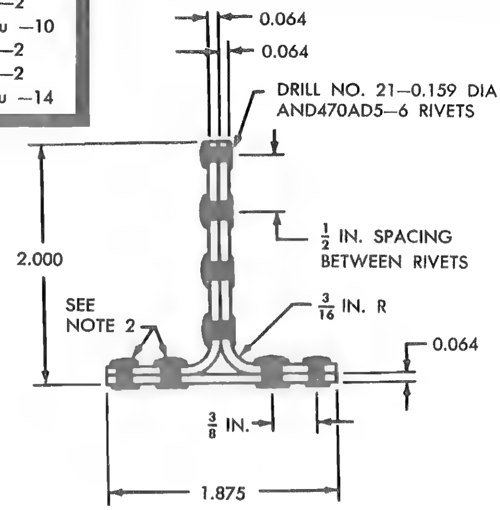
Figure 8–2. Extrusion Chart (Sheet 33 of 40)

EXTRUSION	SUBSTITUTION

S1650–61102
S1650–61103
S1650–61104
S1650–61108
S1620–61352–1 & –2
S1620–61353–1 thru –10
S1620–61354–1 & –2
S1620–61355–1 & –2
S1620–61525–1 thru –14

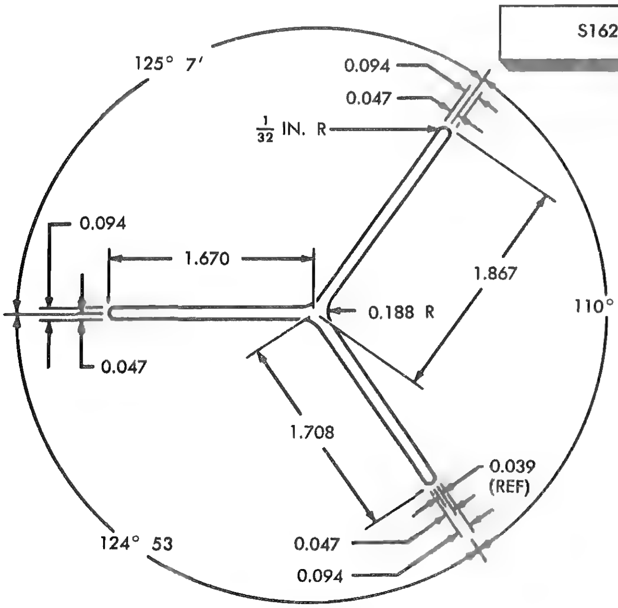


ALCOA DIE NO. K–65711
SPECIFICATION QQ–A–277
MATERIAL 7075–T

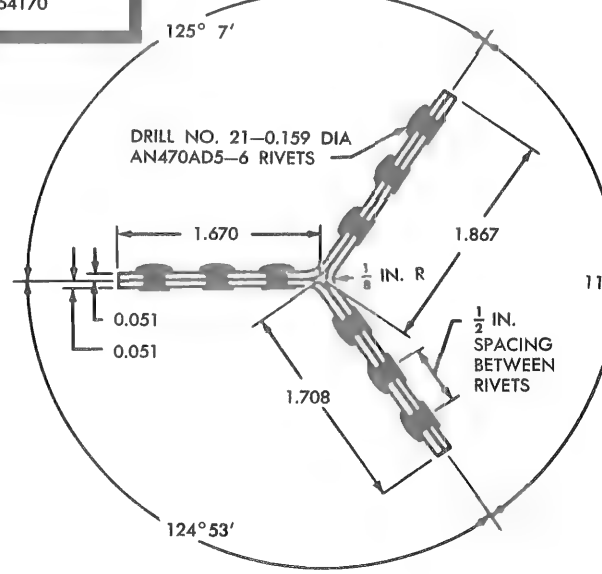


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–64170



S1605–2060
SPECIFICATION QQ–A–277
MATERIAL 7075–T

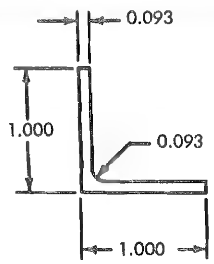


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

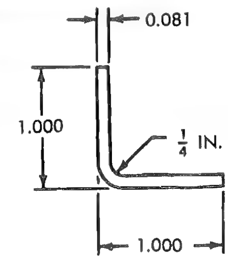
Figure 8–2. Extrusion Chart (Sheet 34 of 40)

EXTRUSION	SUBSTITUTION

S1620–61550–2, –3, & –4

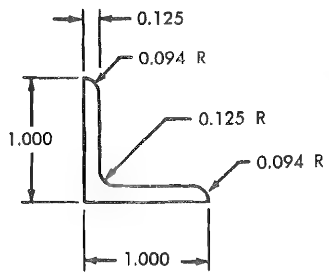


DOW CHEM. DIE NO. DC2113
SPECIFICATION MIL–M–26696
MATERIAL ZK60A

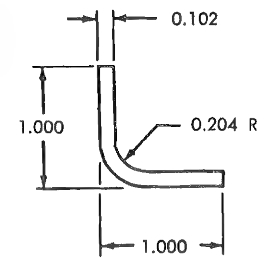


MAKE FROM 2024–0 AL ALLOY
HEAT TREAT TO 2024–T AFTER FORMING

S1620–61612–6 & –7

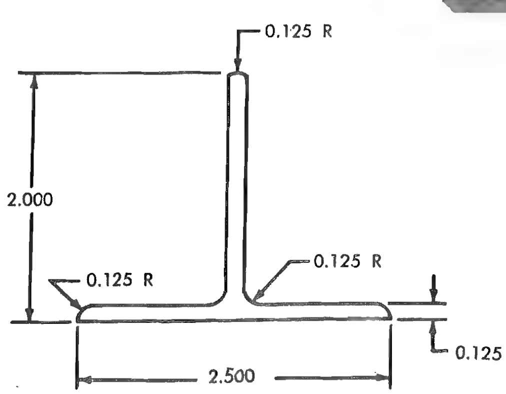


ALCOA DIE NO. 77B
SPECIFICATION QQ–A–277
MATERIAL 7075–T

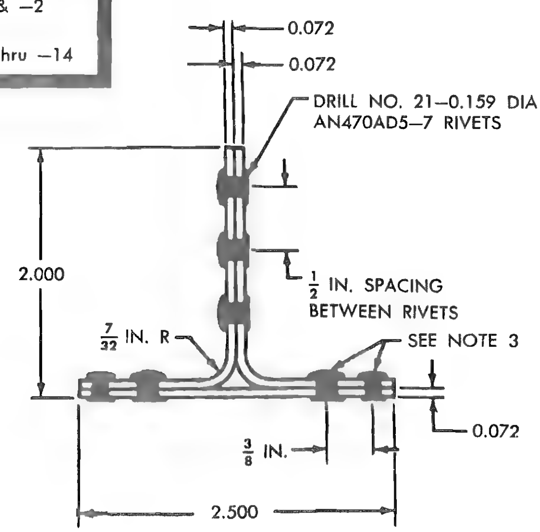


MAKE FROM 4130 STEEL

S1620–61354–1 & –2
S1620–61355–1
S1620–61525–1 thru –14



AND10136–2407
SPECIFICATION QQ–A–277
MATERIAL 7075–0

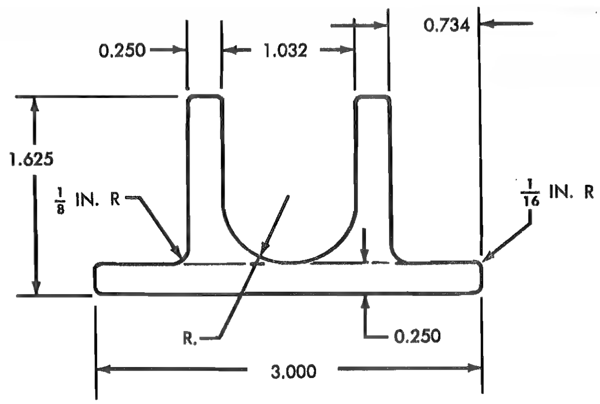


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

Figure 8–2. Extrusion Chart (Sheet 35 of 40)

EXTRUSION	SUBSTITUTION

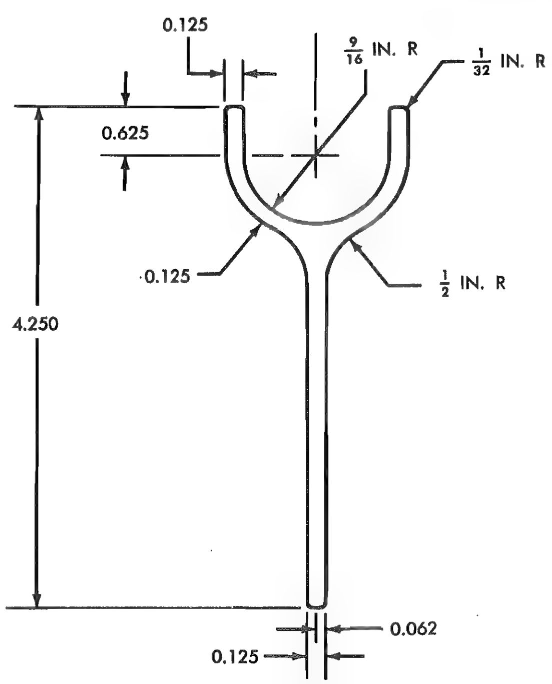
S1650–61302
S1650–61304



S1605–5056
SPECIFICATION MIL–M–26696
MATERIAL ZK60

DUPLICATE FROM AL ALLOY BAR STOCK

S1650–61305



S1605–5057
SPECIFICATION MIL–M–26696
MATERIAL ZK60

DUPLICATE FROM AL ALLOY BAR STOCK

Figure 8–2. Extrusion Chart (Sheet 36 of 40)

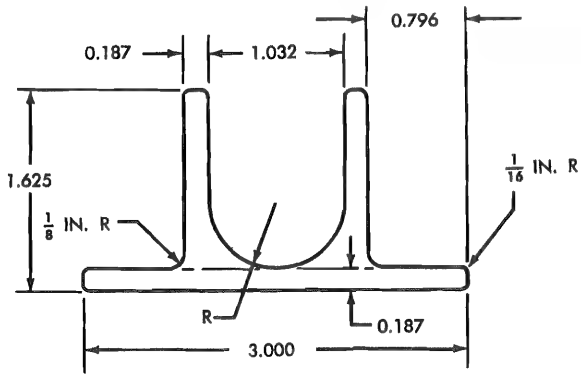
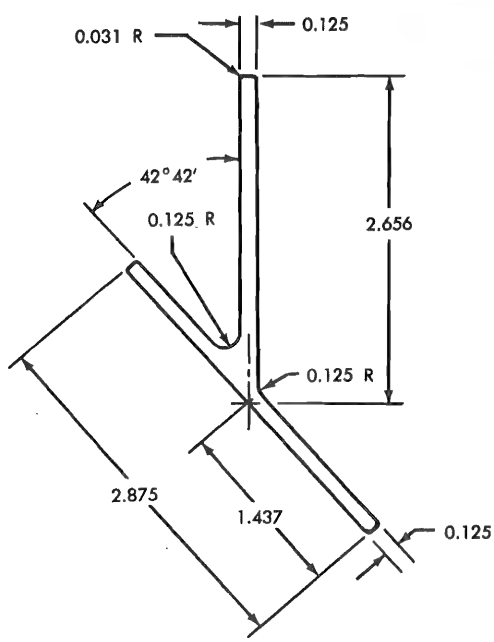
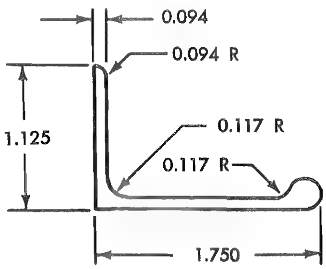
EXTRUSION	SUBSTITUTION
S1650—61301 S1650—61303	
 S1605—5055 SPECIFICATION MIL—M—26696 MATERIAL ZK60	DUPLICATE FROM AL ALLOY BAR STOCK
S6120—61053—7 thru —10	
 S1605—2115 SPECIFICATION MIL—M—26696 MATERIAL ZK60	DUPLICATE FROM AL ALLOY BAR STOCK

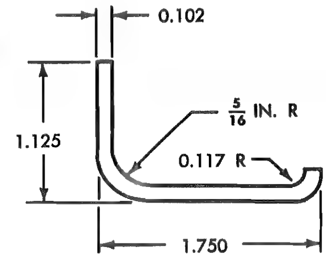
Figure 8—2. Extrusion Chart (Sheet 37 or 40)

EXTRUSION	SUBSTITUTION

S1620–61990–3

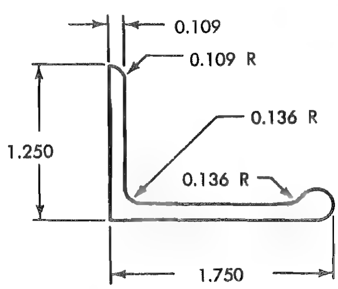


AND10135–1601
SPECIFICATION QQ–A–277
MATERIAL 7075–T

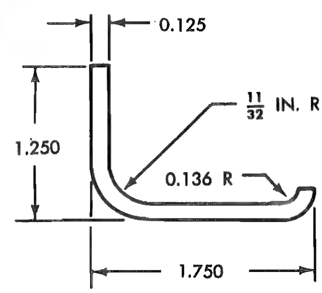


MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61990–2

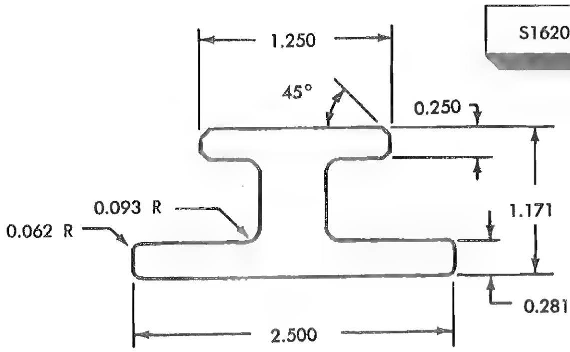


AND10135–1602
SPECIFICATION QQ–A–277
MATERIAL 7075–T



MAKE FROM 7075–0 AL ALLOY
HEAT TREAT TO 7075–T AFTER FORMING

S1620–61934–4 thru –7



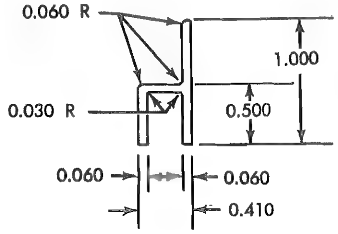
S1605–2137
SPECIFICATION QQ–A–277
MATERIAL 7075–T

DUPLICATE FROM
7075–T BAR STOCK

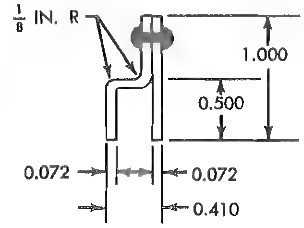
Figure 8–2. Extrusion Chart (Sheet 38 of 40)

EXTRUSION	SUBSTITUTION

S1620—66960—1

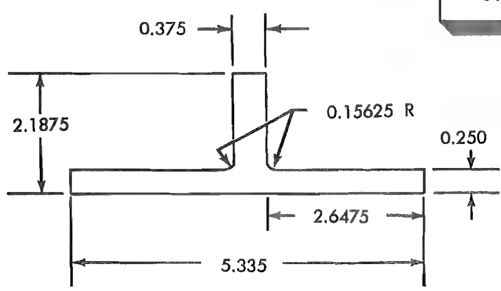


S1605—2129
SPECIFICATION QQ—A—267
MATERIAL 2024—T



MAKE FROM 2024—0 AL ALLOY
HEAT TREAT TO 2024—T AFTER FORMING

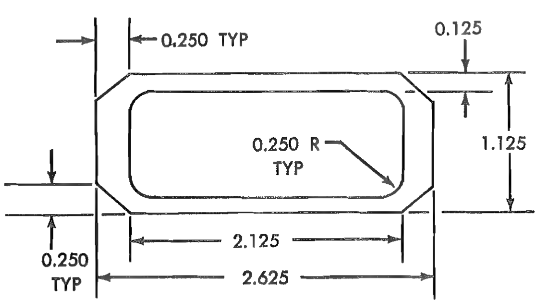
S1650—61384—3 & —4



S1605—5059
SPECIFICATION QQ—A—267
MATERIAL 2024—T

DUPLICATE FROM 2024—T BAR STOCK

S1620—61989—2



S1605—2015
SPECIFICATION QQ—A—277
MATERIAL 7075—T

DUPLICATE FROM 7075—T BAR STOCK

Figure 8—2. Extrusion Chart (Sheet 39 of 40)

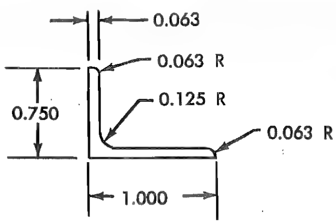
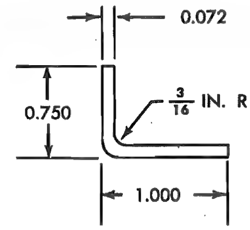
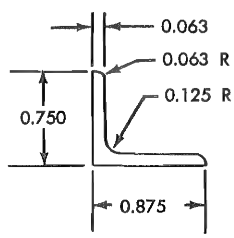
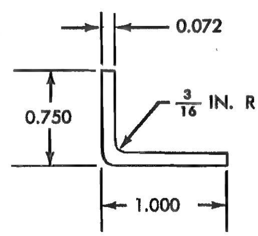
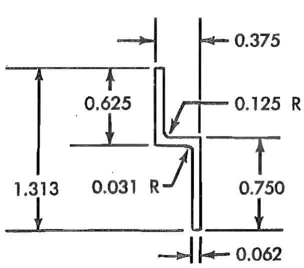
EXTRUSION	SUBSTITUTION
S1650–61231 S1650–61238 S1620–61990–32 & –33	
 AND10134–1003 SPECIFICATION QQ–A–277 MATERIAL 7075–T	 MAKE FROM 7075–0 AL ALLOY HEAT TREAT TO 7075–T AFTER FORMING
S1620–61989–10	
 AND10134–0702 SPECIFICATION QQ–A–267 MATERIAL 7075–0	 MAKE FROM 7075–0 AL ALLOY
S1620–66493–8	
 ALCOA DIE NO. K–28883 SPECIFICATION QQ–A–267 MATERIAL 2024–T	DUPLICATE FROM 2024–T BAR STOCK

Figure 8–2. Extrusion Chart (Sheet 40 of 40)

SECTION IX

TABLE OF HEAT-TREATED FITTINGS

PART NO.	NAME	H.T. 1000/SQ IN	COMM DESIGN	SPEC	MATERIAL
S10-10-5360-1	Arm	124-150	4340	MIL-S-5000 Cond C	Steel Bar
S14-25-3225	Spacer		2024	QQ-A-355 Cond T	Aluminum Rod
S14-35-2227-1	Blocker Plate		4130	MIL-S-18729 Cond A	Steel Sheet
S14-30-3122	Retainer		2024	QQ-A-355 Cond T	Aluminum Sheet
S14-30-3150	Piston		FM 10001		Nylon
S1510-23039	Flange		2024	QQ-A-268 Cond T4	Aluminum Bar
S1510-23085	Spider	315-Case 142-186 Core	9310	AMS-6260	Steel Bar
S1565-61377	Trunnion	159-176	4130	MIL-S-6758 Cond C	Steel Bar
S1565-61580	Fork End		4130	MIL-S-6758 Cond D	Steel Bar
S1565-61580-2	Fork End		4130	MIL-S-6758 Cond D	Steel Bar
S1565-61770	Arm		A280A	QQ-M-40 Cond F	Mag Forging
S1610-21001-1	Tapered Pin	315 Case 159-186 Core	9310	AMS-6260	Steel Bar
S1610-21016	Thrust Washer		4130	MIL-T-6736	Steel Tube
S1610-21021	Washer		4130	MIL-S-18729	Steel Sheet
S1610-21056	Lock	159-176	4130	MIL-S-18729 Cond A	Steel Plate
S1610-21058	Split Cone	154-176	4340	MIL-S-5000 Cond C	Steel Bar
S1610-21059	Split Cone		GR 18-22	MIL-B-6947	Aluminum Bronze Tube
S1610-23057	Lock Nut	127-154	4130	MIL-S-6758 Cond C	Steel Bar
S1610-23058	Lock Washer		302	MIL-S-5059 Cond A	Corrosion-Resistant Steel
S1610-23059-1	Washer		4130	MIL-T-6736 Cond N	Steel Tube
S1610-23067	Knob		AZ91	MIL-M-4204	Mag Casting
S1610-23081-1	Eye Bolt	168-191	4340	MIL-S-5000 Cond C	Steel Forging
S1610-24036-2	Thrust Washer		4130	MIL-S-6758 Cond F	Steel Bar
S1610-24043	Bushing		4130	MIL-S-6758 Cond C	Steel Bar
S1610-24044	Bushing		4130	MIL-S-6758 Cond C	Steel Bar

PART NO.	NAME	H.T. 1000/SQ IN	COMM DESIGN	SPEC	MATERIAL
S1610-25081	Arm	127-154	4340	MIL-S-5000 Cond F	Steel Forging
S1610-25087	Shaft	181-201	4130	MIL-S-6758 Cond C	Steel Rod
S1610-33003	Hub	159-176	4340	MIL-S-5000	Steel Forging
S1610-33107	Sleeve		4340	MIL-S-5000 Cond F	Steel Forging
S1610-33109	Nut	159-176	4130	MIL-T-6736 Cond A	Steel Bar
S1610-33110	Nut	159-176	4130	MIL-S-6758 Cond C	Steel Bar
S1610-33111	Stop		FM 10001		Nylon
S1610-33114	Plug		2024	QQ-A-268 Cond T4	Aluminum Rod
S1610-34103	Arm		2014	QQ-A-367 Cond T6	Aluminum Forging
S1610-34106	Nut	124-150	4340	MIL-S-5000 Cond C	Steel Bar
S1610-34200-1	Weight		4130	MIL-S-6758 Cond C	Steel Bar
S1615-20008-1	Plate		2024	QQ-A-267 Cond T4	Aluminum Bar
S1620-61189-8	Bearing Support		7075	QQ-A-287 Cond T6	Aluminum Sheet
S1620-61204-5	Bushing		10001 Dupont		Nylon
S1620-61204-6	Bushing		10001 Dupont		Nylon
S1620-61704-1	Hinge		2024	QQ-A-267 Cond T4	Aluminum Ext
S1620-61704-2	Hinge		2024	QQ-A-267 Cond T4	Aluminum Ext
S1620-61705-1	Hinge		2024	QQ-A-267 Cond T4	Aluminum Ext
S1620-61705-2	Hinge		2024	QQ-A-267 Cond T4	Aluminum Ext
S1620-61707-2	Hinge		2024	QQ-A-267 Cond T4	Aluminum Ext
S1620-61708-2	Hinge		2024	QQ-A-267 Cond	Aluminum Ext
S1620-61884	Step Fitting		AZ80A	QQ-M-40 Cond FA	Mag Casting
S1620-63129-1	Bushing	159-179	4130	MIL-S-6758 Cond C	Steel Rod
S1620-63134-2	Jack Pin Nut	127-154	4130	MIL-S-6758 Cond C	Steel Bar
S1620-63134-4	Jack Pin Nut	127-154	4130	MIL-S-6758 Cond C	Steel Bar
S1620-63134-5	Jack Pin Nut		Type 416	QQ-S-763 Cond C	Stainless Steel Rod
S1620-63134-6	Jack Pin Nut		Type 416	QQ-S-763 Cond C	Stainless Steel Rod
S1620-63136	Sleeve		2024	MIL-T-5063 Cond T3	Aluminum Tube

PART NO.	NAME	H.T. 1000/SQ IN	COMM DESIGN	SPEC	MATERIAL
S1620-63174	Ring	201-219	4340	MIL-S-5000	Steel Forging
S1620-63231	Collar		2024	QQ-A-268 Cond T4	Aluminum Bar
S1620-64120	Fitting		2014	QQ-A-367 CL 5	Aluminum Forging
S1620-64119	Fitting		7075	QQ-A-277 Cond T6	Aluminum Ext
S1620-64151-1	Fitting		2014	QQ-A-367 CL 5	Aluminum Forging
S1620-64151-2	Fitting		2014	QQ-A-307 CL 5	Aluminum Forging
S1620-64152	Fitting		2014	QQ-A-367 CL 5	Aluminum Forging
S1620-64154-4	Fork	159-176	4130	MIL-S-6758 Cond C	Steel Bar
S1620-64154-5	Fork	159-176	4130	MIL-S-6758 Cond C	Steel Bar
S1620-64175-1	Hinge Pin	Case 315 Core 168-186	9310	AMS-6260	Steel Rod
S1620-64175-2	Washer	159-176	4130	MIL-S-6758 Cond C	Steel Rod
S1620-65159-3	Handle		AZ80-A	QQ-M-40 Cond F	Mag Casting
S1620-65159-5	Handle		AZ80-A	QQ-M-40 Cond F	Mag Casting
S1620-65176-2	Hinge		7075	QQ-A-277 Cond T6	Aluminum Ext
S1620-65201-5	Handle		ZX60	MIL-M-26696 Cond 60	Mag Bar
S1620-65204-10	Cam		4130	MIL-S-18729 Cond N	Steel Sheet
S1625-50109	Bushing	159-176	4130	MIL-S-6758 Cond C	Steel Rod
S1625-50121	Bearing			MIL-B-6946	Aluminum Bronze Rod
S1625-50129	Guide			HH-P-256 Type II GRC	Phenolic
S1625-50135	Cylinder		2024	QQ-A-268 Cond O	Aluminum Bar
S1625-50143	Spacer		2024	MIL-T-5063 Cond T3	Aluminum Tube
S1625-50144	Bearing		2024	MIL-T-5063 Cond T3	Aluminum Tube
S1625-50148	Nut		2024	MIL-T-5063 Cond T3	Aluminum Tube
S1625-50166	Ring	201-219	4340	MIL-S-5000 Cond C	Steel Forging
S1625-50167	Spacer	159-176	4130	MIL-S-6758 Cond C	Steel Rod
S1625-50506	Fork		7075	NMS-4139	Aluminum Forging
S1625-50515	Bushing	127-154		MIL-S-6758 Cond C	Steel Rod
S1625-50516	Axle	181-201	4130	MIL-S-6758 Cond C	Steel Rod

PART NO.	NAME	H.T. 1000/SQ IN	COMM DESIGN	SPEC	MATERIAL
S1625-50517	Bushing	127-154	4130	MIL-S-6758 Cond C	Steel Rod
S1625-50518	Shaft		ASTM B235-56T		Aluminum Tube
S1625-50519	Cap		AZ91	QQ-M-56 Cond HTA	Mag Casting
S1625-50524	Housing	127-154	4130	MIL-S-6758 Cond C	Steel Rod
S1625-50529	Plate	127-154	4130	MIL-S-18729 Cond N	Steel Sheet
S1625-50539	Orifice			MIL-B-6946	Aluminum Bronze Rod
S1625-50540	Bearing		2024	MIL-T-5063 Cond T3	Aluminum Tube
S1625-50541	Spacer		2024	MIL-T-5063 Cond T3	Aluminum Tube
S1625-50543	Nut		2024	MIL-T-5063 Cond T3	Aluminum Tube
S1625-50553	Bushing	159-176	4130	MIL-S-6758 Cond C	Steel Rod
S1630-61027	Handle		AZ91	MIL-M-4204 Cond HTA	Mag Casting
S1630-61121	Adapter	127-154	4130	MIL-S-6758 Cond C	Steel Forging
S1630-61144	Pulley		ZK60	MIL-M-26696 Cond EA	Mag Rod
S1630-61606	Lever	127-154	4130	MIL-S-6258 Cond C	Steel Bar
S1630-62124	Fitting		356	QQ-A-601	Aluminum Casting
S1630-62126-1	Fitting		356	QQ-A-601 Comp 3	Aluminum Casting
S1630-62126-2	Fitting		356	QQ-A-601 Comp 3	Aluminum Casting
S1630-62135	Fitting		356	QQ-A-601 Comp 3	Aluminum Casting
S1630-62172-2	Fitting		AZ92	QQ-M-55 Cond HTA	Mag Casting
S1630-62226	Adapter		2024	QQ-M-268 Cond T4	Aluminum Bar
S1630-63040-2	Housing		356	QQ-A-601 Comp 3	Aluminum Casting
S1630-80410-6	Bar		4130	MIL-S-18729 Cond N	Steel Sheet
S1630-80431	Bushing		FM 10001		Nylon
S1630-80702	Shaft	127-154	4130	MIL-S-6758 Cond D	Steel Rod
S1630-80703-1	Shaft	127-154	4130	MIL-S-6758 Cond C	Steel Rod
S1630-80704-3	Lever		7075	AMS-4139	Aluminum Forging
S1630-80705-3	Lever		7075	AMS-4139	Aluminum Forging
S1630-80706-3	Lever	127-154	4130	AMS-4139	Steel Forging
S1630-80707-3	Lever	127-154	4130	MIL-S-6758	Steel Forging
S1630-80734	Liner		FM 10001		Nylon

PART NO.	NAME	H.T. 1000/SQ IN	COMM DESIGN	SPEC	MATERIAL
S1630-80811-1	Pad		2024	QQ-A-268 Cond T4	Aluminum Bar
S1630-80811-3	Pad		2024	QQ-A-268 Cond T4	Aluminum Bar
S1630-80829	Bushing		4130	MIL-S-6758 Cond N	Steel Bar
S1635-20026	Spline Coupling	315 Case 142-186 Core	9310	AMS-6260	Steel Forging
S1635-20026-2	Spline Coupling	315 Case 142-186 Core	9310	AMS-6260	Steel Forging
S1635-20124	Bushing	127-154	Type 410	QQ-S-763 Cond A	Stainless Steel Rod
S1635-20172	Housing		356	QQ-A-601 Cond T6	Aluminum Casting
S1635-20182	Nut-Splined Shaft	127-176	4130	MIL-S-18729 Cond N	Steel Plate
S1635-20182-1	Nut-Splined Shaft	127-176	4130	MIL-S-18729 Cond N	Steel Plate
S1635-20205-1	Cover		AZ91	QQ-M-56	Mag Casting
S1635-20214-1	Liner	315 Case (Brg Area) 142-212 Core	9310	AMS-6260	Steel Bar
S1635-61110	Pulley		Type FBM	MIL-P-15035	Phenolic
S1635-61209	Bushing		4130	MIL-T-6736 Type 1, Cond N	Steel Tube
S1635-61219	Hub		2014	QQ-A-367 CL 5	Aluminum Forging
S1635-61220	Hub		2012	QQ-A-367 CL 5	Aluminum Forging
S1635-61222	Drive Shaft		2024	WW-T-785 Cond T3	Aluminum Tube
S1635-63311-1	Main Shaft	181-196	4130	MIL-T-6736 Cond C	Steel Tube
S1635-63316	Washer		2024	QQ-A-268 Cond 4	Aluminum Sheet
S1635-63321-1	Outer Spacer	127-154	4130	MIL-T-6736 Cond N	Steel Tube
S1635-63321-2	Inner Spacer	127-154	4130	MIL-T-6736 Cond N	Steel Tube
S1653-63322	Bearing Retainer	127-154	4130	MIL-S-6758 Cond C	Steel Sheet
S1635-63333	Guide Shaft		Type FBG	MIL-P-79 Form R	Phenolic
S1635-63350	Flange		2014	QQ-A-367 Comp 5	Aluminum Forging
S1635-63351	Bushing	127-154	4130	MIL-S-6758 Cond C	Steel Rod
S1635-63352	Wedge	127-154	4130	MIL-S-6758 Cond C	Steel Rod
S1653-64117	Liner		Timken 112NM 4720		Steel Tubing
S1635-64118	Liner		Timken 112NM 4720		Steel Tubing

PART NO.	NAME	H.T. 1000/SQ IN	COMM DESIGN	SPEC	MATERIAL
S1635-64120	Flange	156-176	4130	MIL-S-6758 Cond C	Steel Forging
S1635-64311	Disconnect Shaft		2024	MIL-T-5063 Cond T3	Aluminum Tube
S1635-91033	Nut	159-176	4130	MIL-S-6758 Cond C	Steel Rod
S1635-91088	Fan Blade		2014	QQ-A-367 Comp 5	Aluminum Forging
S1635-92004-4	Spacer		2024	QQ-A-355 Cond T3	Aluminum Plate
S1635-92004-5	Spacer		2024	QQ-A-355 Cond T3	Aluminum Sheet
S1635-92004-6	Spacer		2024	QQ-A-355 Cond T3	Aluminum Sheet
S1635-92005	Drive Shaft		2014	QQ-A-367 CL 5	Aluminum Forging
S1635-92006	Flange		7075	AMS-4139	Aluminum Forging
S1640-61105	Nut		AZ31X	QQ-M-31	Mag Rod
S1640-61183	Universal		AZ80A	QQ-M-40 Cond B	Mag Forging
S1640-61184	Rod End		2014	QQ-A-367 CL 5	Aluminum Forging
S1640-61185	Spacer		4130	MIL-T-6736 Type 1 Cond N	Steel Tube
S1640-61186	Spacer		4130	MIL-T-6736 Cond N	Steel Tube
S1640-61687	Arm		2024	QQ-A-268 Cond T4	Aluminum Bar
S1640-61211	Shaft	159-176	4130	MIL-S-6736 Type 1 Cond A	Steel Tube
S1640-61212	Nut	127-154	4130	MIL-S-6736 Type 1 Cond A	Steel Tube
S1640-61227	Link	127-154	4130	MIL-S-6758 Cond F	Steel Bar
S1640-61371	Quadrant		AZ80A	QQ-M-40 Cond F	Mag Forging
S1640-61455	Spacer		4130	MIL-S-6758 Cond C	Steel Rod
S1640-61465	Adapter		7075	QQ-A-277 Cond T6	Aluminum Tube
S1640-61490	Nut		4130	MIL-S-6758 Cond D	Steel Bar
S1640-61688	Spacer		2024	QQ-A-268 Cond T4	Aluminum Rod
S1640-61713	Bushing	127-154	416	QQ-S-763 Class 6 Type C	Stainless Steel Rod
S1640-61732	Shaft	159-176	4130	MIL-T-6736 Type 1 Cond A	Steel Tube
S1640-61742-2	Lever		4130	MIL-S-18729 Cond N	Steel Sheet
S1650-61118	Pin	159-176	4130	MIL-S-6758 Cond C	Steel Rod

PART NO.	NAME	H.T. 1000/SQ IN	COMM DESIGN	SPEC	MATERIAL
S1650-61118-1	Pin	159-176	4130	MIL-S-6758 Cond C	Steel Rod
S1650-61131	Lock Pin	127-154	4130	MIL-S-6758	Steel Rod
S1650-61301	Fitting		AZ1X	QQ-M-31	Mag Ext
S1650-61302	Fitting		AZ1X	QQ-M-31	Mag Ext
S1650-61303	Fitting		AZ1X	QQ-M-31	Mag Ext
S1650-61304	Fitting		AZ1X	QQ-M-31	Mag Ext
S1650-61305	Fitting		AZ1X	QQ-M-31	Mag Ext
S1650-61307	Fitting		2024	QQ-A-268 Cond T4	Aluminum Bar
S1650-61319-1	Fitting	127-154	4130	MIL-S-18729 Cond A	Steel Sheet
S1650-61319-2	Fitting	127-154	4130	MIL-S-18729 Cond A	Steel Sheet
S1650-61325	Fitting		7075	QQ-A-277 Cond T6	Aluminum Ext
S1650-61326	Fitting		2024	QQ-A-268 Cond T4	Aluminum Bar
S1650-61327	Fitting		2024	QQ-A-268 Cond T4	Aluminum Bar
S1650-61716-2	Fitting		7075	AMS 4139	Aluminum Forging
S1650-61717-3	Fitting		145	QQ-A-367 CL 5	Aluminum Forging
S1665-20023	End Cap		2024	QQ-A-268 Cond T4	Aluminum Rod
S1665-20076	Reservoir		AZ91	QQ-M-56 Cond HTA	Mag Casting
S1665-61565	Rod		4130	MIL-S-6758 Cond C	Steel Rod
S1665-61630	Adapter		ZK60	MIL-M-26696 Cond EA	Mag Bar
S1665-61632	Lock Lever		7075	QQ-A-282 Cond T6	Aluminum Bar
S1665-61677	Rod		2024	WW-T-785 Cond T3	Aluminum Tube
S1665-61678	Rod End		2024	QQ-A-268 Cond T4	Aluminum Bar

SECTION X

TYPICAL REPAIR ILLUSTRATIONS

10–1. DESCRIPTION.

10–2. The repairs outlined in this section are for main rotor blade pockets, stabilizer skin, and sheet and metal formed members of the helicopter.

10–3. PATCHING WITH BONDED ALUMINUM. (See figure 10–1.)

a. Trim hole in pocket skin with snips to remove jagged edges and round off all sharp corners. Trim that portion of honeycomb core of blade pocket which protrude above pocket skin.

b. Use a fine file to remove sharp or burred edge of trimmed hole. Bend and smooth edge of hole to conform with pocket contour.

c. Cut a piece of 2024-T or 2024-O aluminum sheet, 0.012-inch thick, to desired shape to cover trimmed hole, providing an overlap not less than 1/2-inch on all sides. Square patches should be cut with 1/2-inch minimum radius at each corner.

d. Use a fine file to remove sharp or burred edges of patch.

Note

If 0.012-inch thick 2024-T or 2024-O material is not available, then any thickness of 2S shim stock up to 0.012-inch maximum thickness may be used.

e. Clean patch area around trimmed hole with thinner, (Military Specification MIL-T-6095) and allow thinner to evaporate.

WARNING

Do not allow thinner to come in contact with bonding adhesive in the areas where pocket is bonded to spar, or where honeycomb core is bonded to pocket skin. Thinner is a solvent and will weaken bond.

Note

Keep cleaned area of pocket and patch free of fingerprints and all other foreign matter.

f. Immediately after thinner has evaporated, brush one coat of cement, (EC 750 or EC 847) around trimmed area or pocket skin and on patch. Allow cement to dry at least 30 minutes at room temperature.

g. Brush second coat of cement over previous applications and allow to dry at least 10 minutes at room temperature.

h. Smooth patch in place over trimmed area of pocket allowing 1/2-inch minimum overlap on all sides. Allow cement to cure at least 8 hours at room temperature.

i. Carefully clean excess cement from patched areas with clean cloth moistened with thinner, (Military Specification MIL-T-6095).

WARNING

Do not allow any thinner to come in contact with bonding adhesive under patch, or in areas where pocket is bonded to spar. Thinner is a solvent and will weaken bond.

j. Spray patch area with light coat of primer, (Military Specification MIL-P-8585). Allow primer to dry at least 30 minutes.

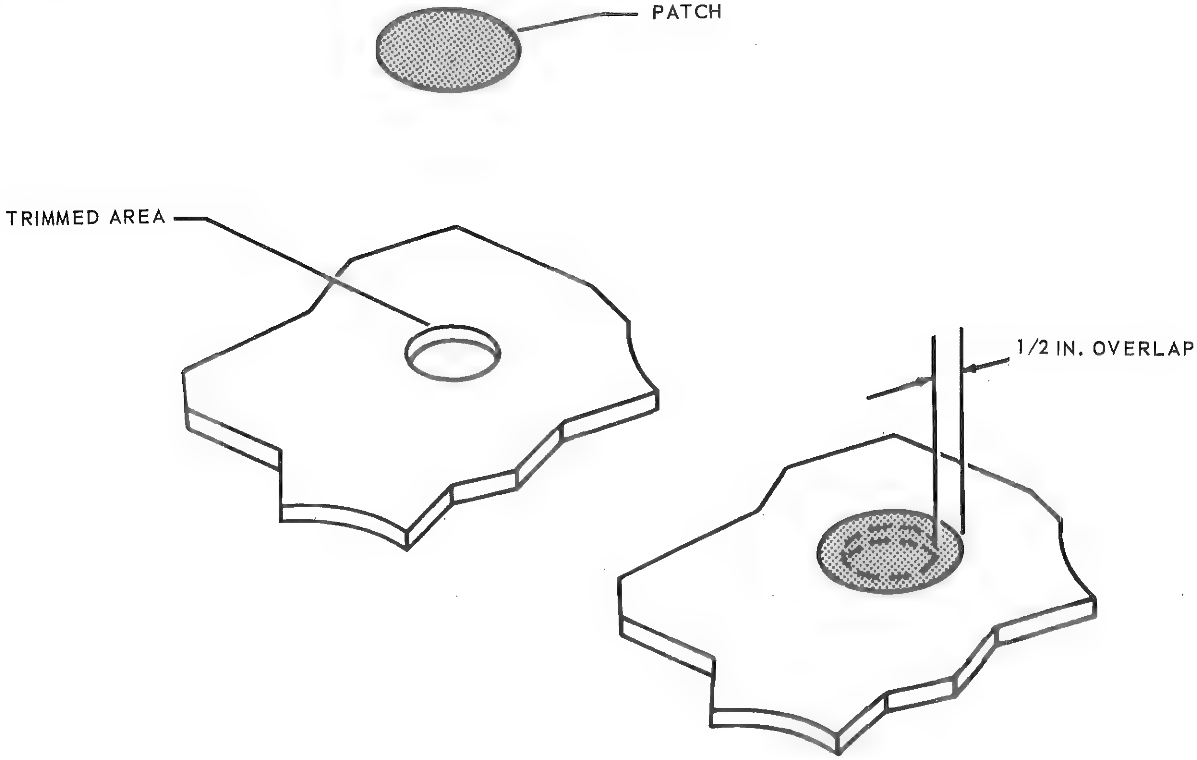
k. For refinishing main rotor blade surfaces, refer to paragraph 2–16.

10–4. PATCHING WITH BONDED FABRIC. (See figure 10–1.)

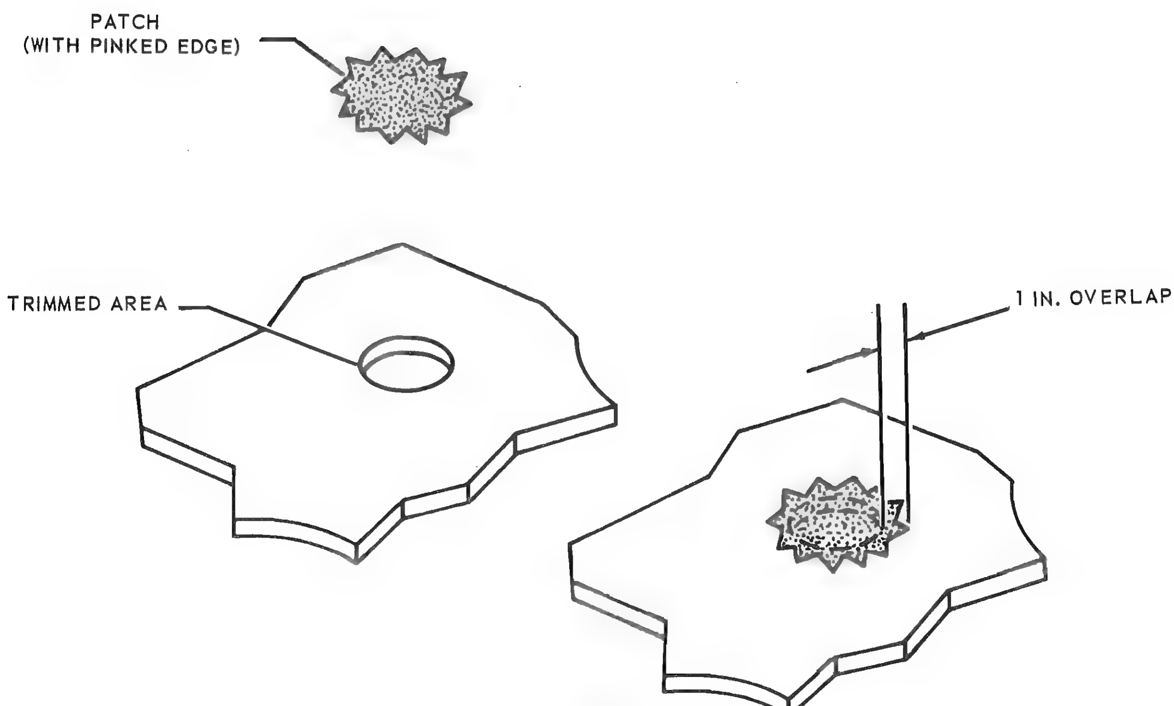
a. Refer to paragraph 10–3, steps *a* and *b.*

b. Prepare patch by cutting a piece of airplane cotton cloth, (Military Specification MIL-C-5646), with pinking shears to desired shape and large enough to overlap trimmed hole in pocket skin no less than 1 inch on all sides.

c. Clean patch area on pocket skin with thinner, Military Specification MIL-T-6095, and allow thinner to evaporate.



ALUMINUM



FABRIC

Figure 10–1. Bonded Patch Repair

WARNING

Do not allow thinner to come in contact with bonding adhesive in areas where pocket is bonded to spar, or where honeycomb core is bonded to pocket skin. Thinner is a solvent and will weaken bond.

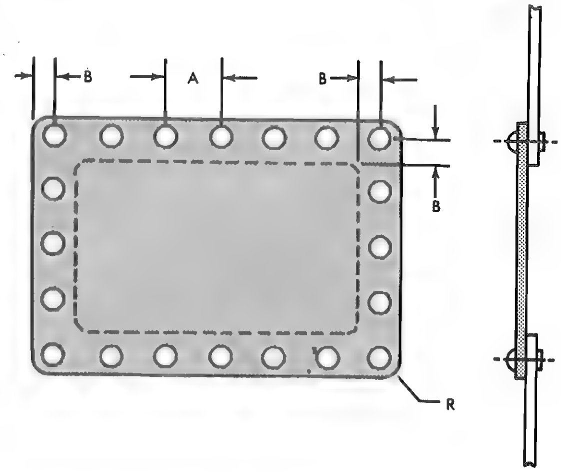
d. Brush coat patch area on pocket skin and a 1-inch margin on edge of fabric patch with dope, Military Specification MIL-D-5553.

e. Immediately place patch in position over trimmed area of pocket allowing a 1-inch minimum overlap on all sides. Allow dope to dry at least 30 minutes.

f. Brush two more coats of dope, Military Specification MIL-D-5553, over entire patch and slightly past edges of fabric. Allow each coat to dry at least 30 minutes before applying next coat.

g. For surface finishing, refer to paragraph 10–3, steps *j.* and *k.*

10–5. Typical repairs for all sheet and metal formed members of the helicopter, with the exception of the main rotor blades and the stabilizer, are illustrated in figures 10–2 through 10–13. For repair of the main rotor pockets and the stabilizer skin, refer to paragraphs 10–1 through 10–4.



KEY

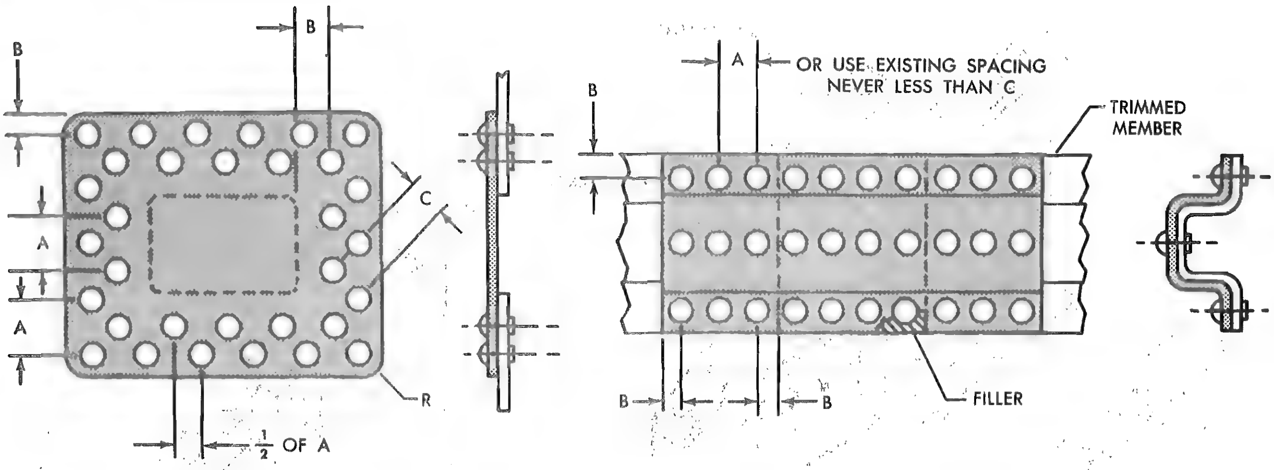
A — RIVET SPACING
B — MINIMUM EDGE DISTANCE
R — CORNER RADII $\frac{1}{4}$-INCH MINIMUM

RIVET TABLE			
PATCH GAGE	RIVET DIAMETER	A INCHES	B INCHES
0.012	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$
0.016	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$
0.020	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$
0.025	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$
0.032	$\frac{1}{8}$	$\frac{7}{8}$	$\frac{1}{4}$
0.040	$\frac{5}{32}$	$\frac{7}{8}$	$\frac{5}{16}$
0.050	$\frac{5}{32}$	$\frac{7}{8}$	$\frac{5}{16}$
0.063	$\frac{3}{16}$	1	$\frac{3}{8}$
0.071	$\frac{3}{16}$	1	$\frac{3}{8}$
0.080	$\frac{3}{16}$	1	$\frac{3}{8}$
0.090	$\frac{3}{16}$	1	$\frac{3}{8}$
0.125	$\frac{3}{16}$	1	$\frac{3}{8}$

NOTES

1. USE AN470AD FOR ALUMINUM ALLOY.
2. USE AN470B RIVETS FOR MAGNESIUM ALLOY.
3. USE AN435M RIVETS FOR STAINLESS STEEL OR TITANIUM.
4. REFER TO PARAGRAPH 1-33 FOR BLIND RIVET INFORMATION.

Figure 10–2. Secondary Structure Skin Patch



NON-FLUSH SURFACE PATCH

NON-FLUSH FORMED SHEET PATCH

KEY

A — RIVET SPACING
B — MINIMUM EDGE DISTANCE
C — MINIMUM SPACING
R — CORNER RADII $\frac{1}{4}$-INCH MINIMUM

RIVET TABLE NON-FLUSH SURFACE PATCH				
PATCH GAGE	RIVET DIAMETER	A INCHES	B INCHES	C INCHES
0.012	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{2}$
0.016	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{2}$
0.020	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{2}$
0.025	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{2}$
0.032	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{2}$
0.040	$\frac{5}{32}$	$\frac{7}{8}$	$\frac{5}{16}$	$\frac{5}{8}$
0.050	$\frac{5}{32}$	$\frac{7}{8}$	$\frac{5}{16}$	$\frac{5}{8}$
0.063	$\frac{3}{16}$	1	$\frac{3}{8}$	$\frac{3}{4}$
0.071	$\frac{3}{16}$	1	$\frac{3}{8}$	$\frac{3}{4}$
0.080	$\frac{3}{16}$	1	$\frac{3}{8}$	$\frac{3}{4}$
0.090	$\frac{3}{16}$	1	$\frac{3}{8}$	$\frac{3}{4}$
0.125	$\frac{3}{16}$	1	$\frac{3}{8}$	$\frac{3}{4}$

RIVET TABLE NON-FLUSH FORMED SHEET PATCH				
PATCH GAGE	RIVET DIAMETER	A INCHES	B INCHES	C INCHES
0.012	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$
0.016	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$
0.020	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$
0.025	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$
0.032	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$
0.040	$\frac{5}{32}$	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{5}{8}$
0.050	$\frac{5}{32}$	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{5}{8}$
0.063	$\frac{3}{16}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$
0.071	$\frac{3}{16}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$
0.080	$\frac{3}{16}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$
0.090	$\frac{3}{16}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$
0.125	$\frac{3}{16}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$

NOTES

1. USE AN470AD RIVETS FOR ALUMINUM ALLOY.
2. USE AN470B RIVETS FOR MAGNESIUM ALLOY.
3. USE AN435M RIVETS FOR STAINLESS STEEL OR TITANIUM.
4. REFER TO PARAGRAPH 1-33 FOR BLIND RIVET INFORMATION.

Figure 10-3. Primary Structure Skin Patch

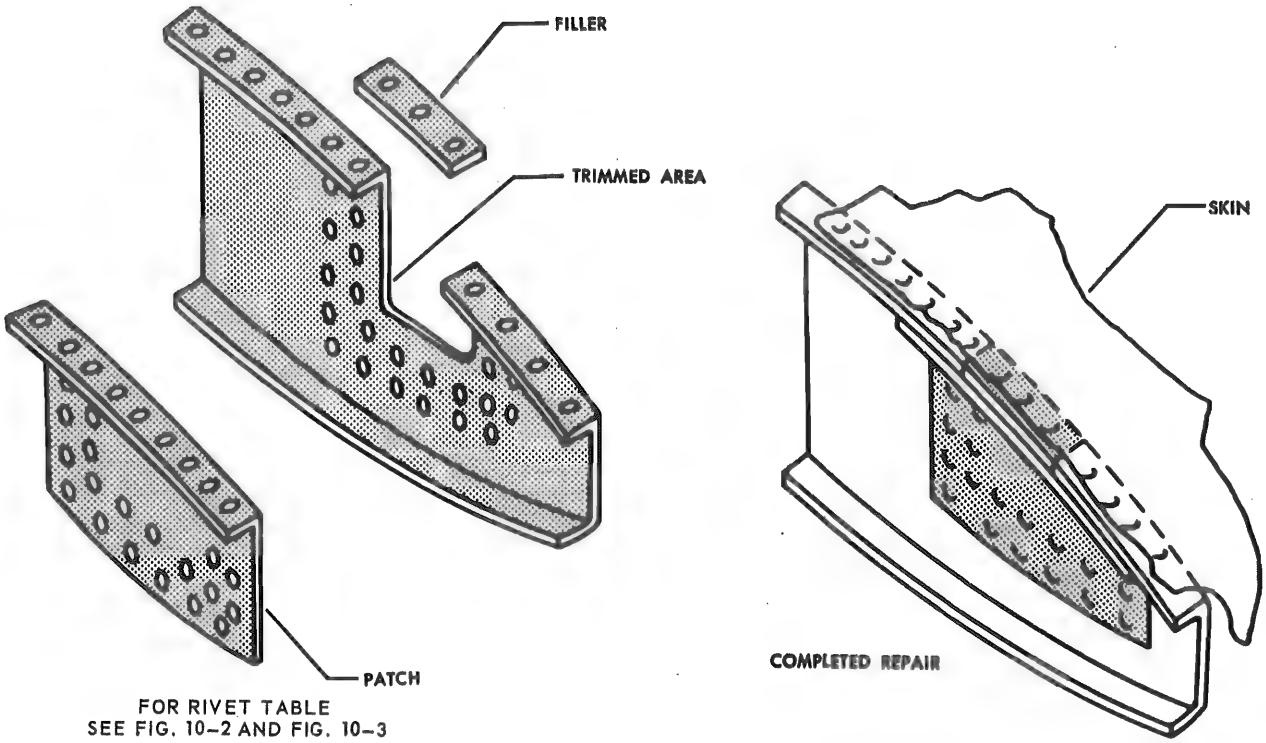


Figure 10-4. Repair of Damaged Former

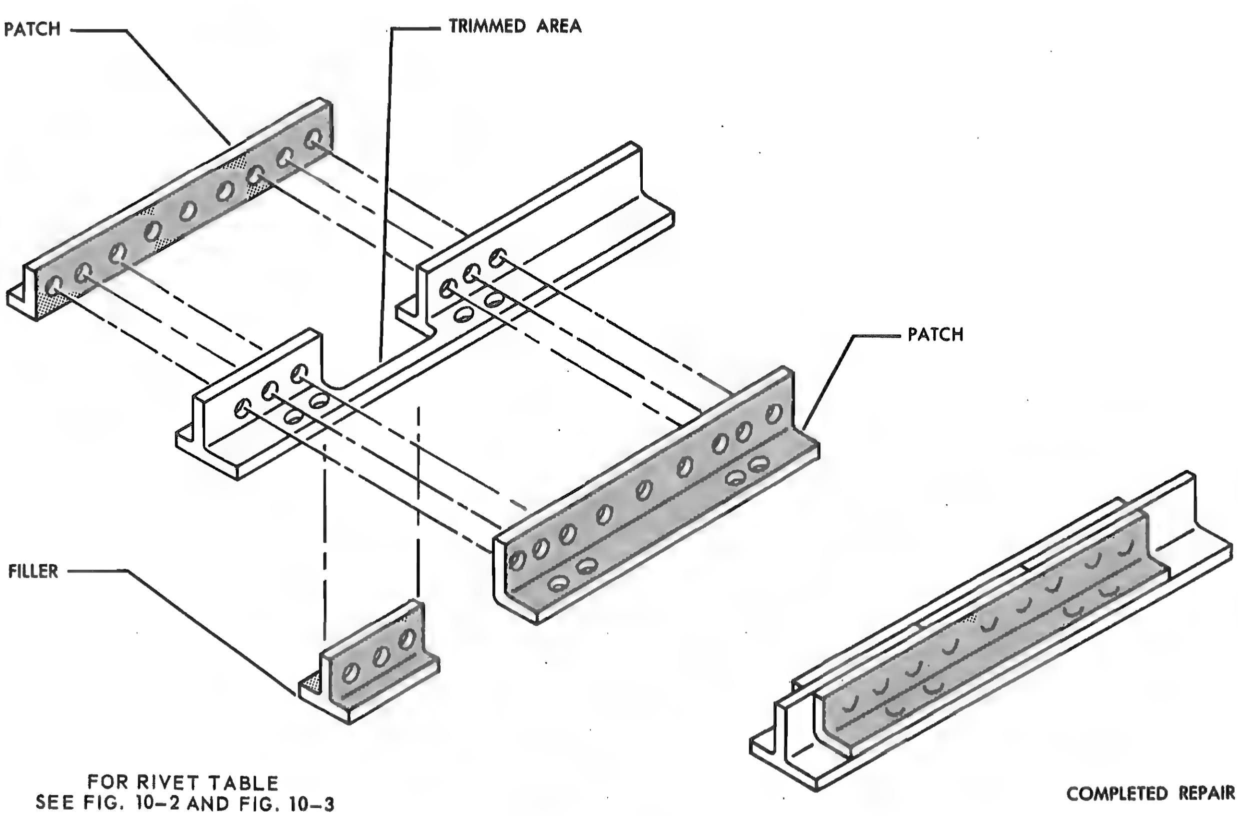


Figure 10-5. Repair of Damaged Cap Strip

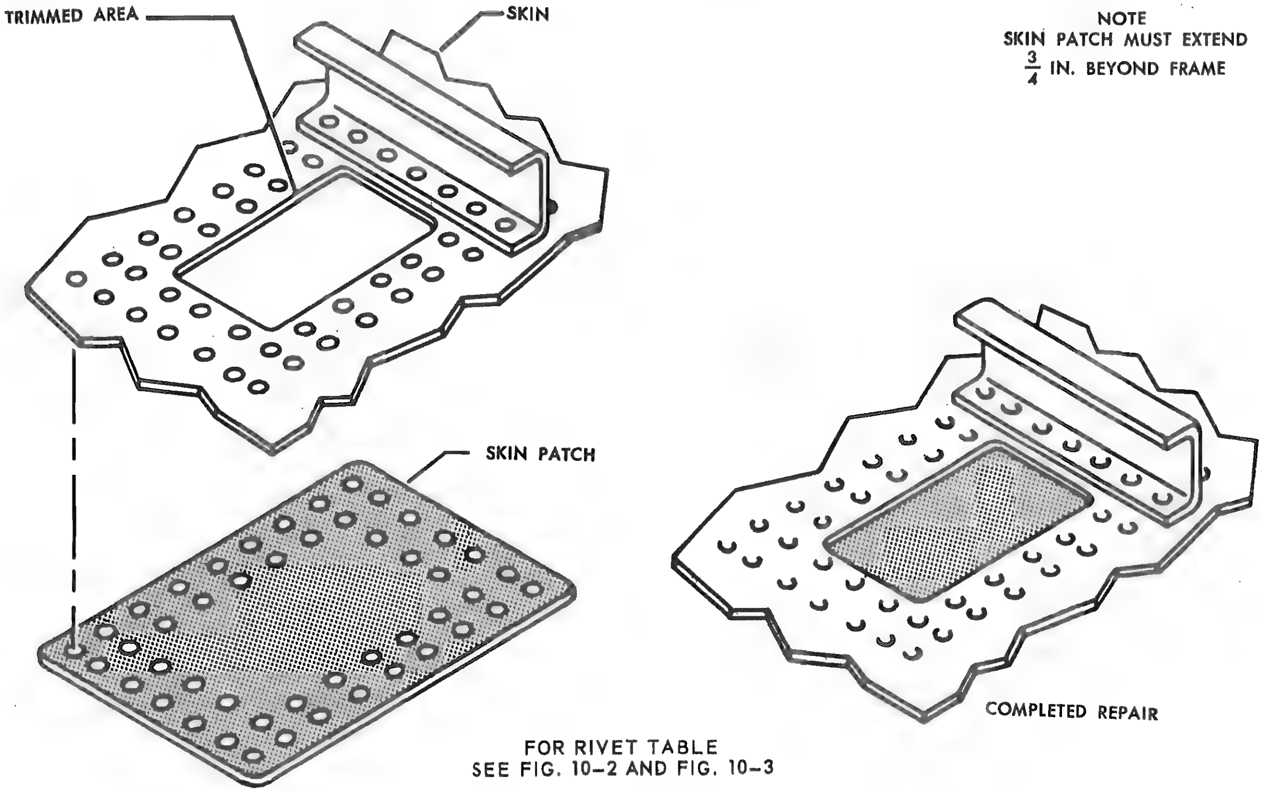


Figure 10-6. Repair of Damaged Skin Close to a Frame

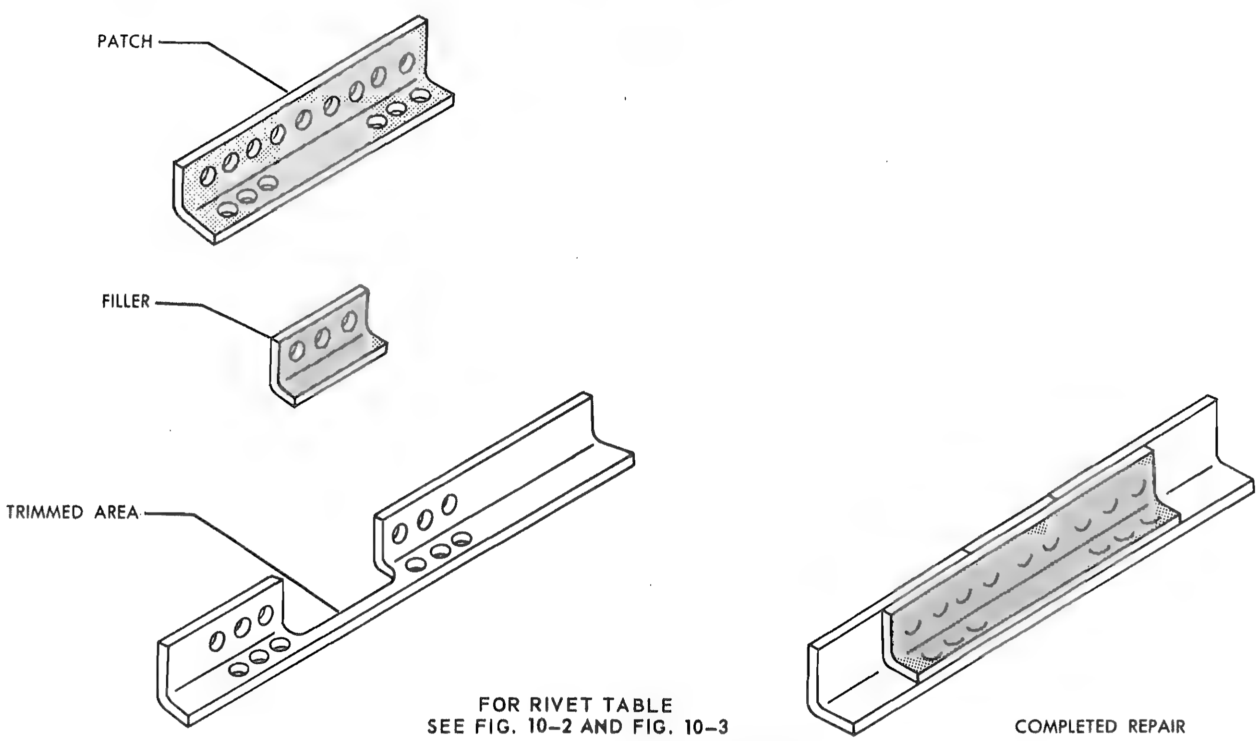


Figure 10-7. Repair of Damaged Angles

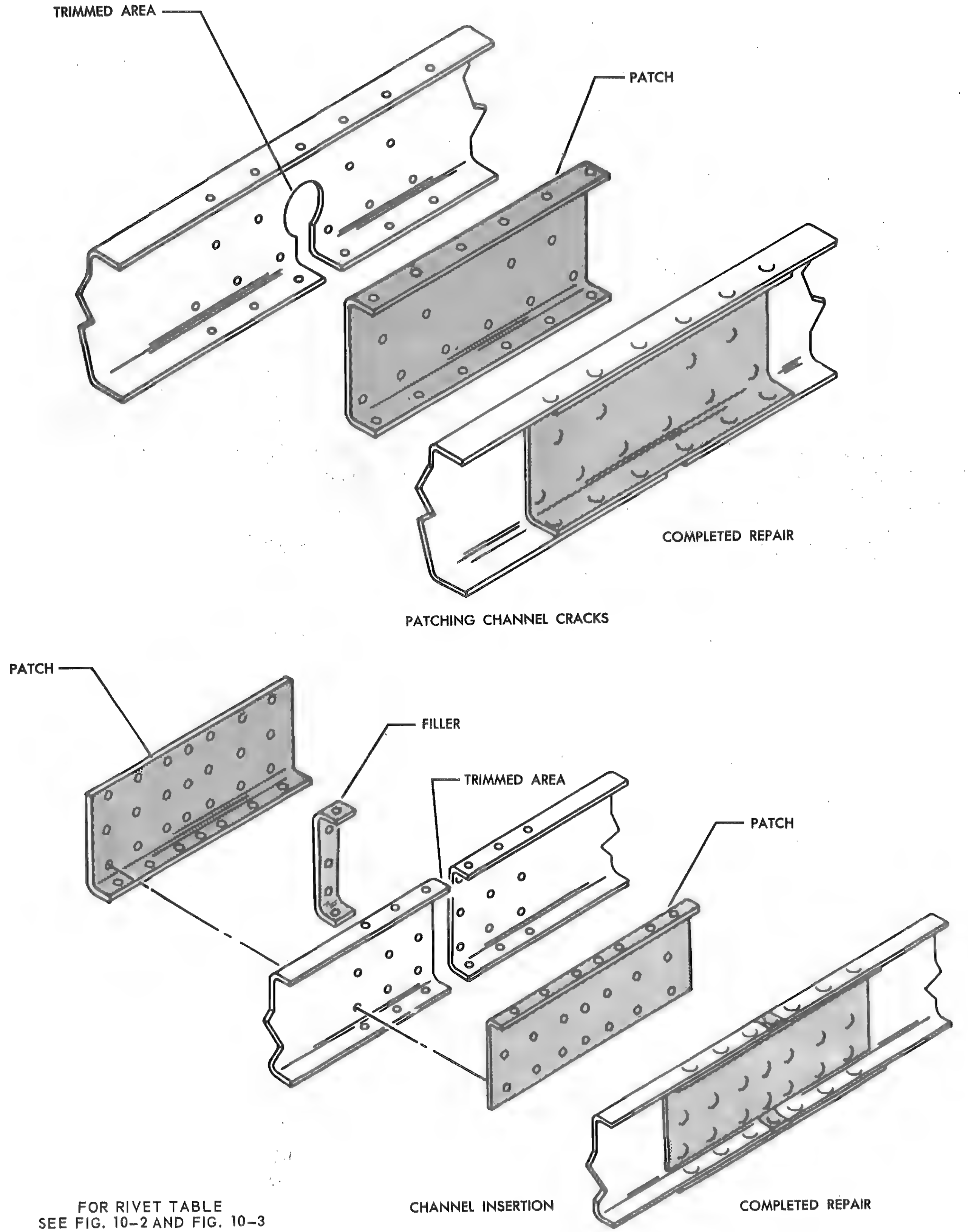
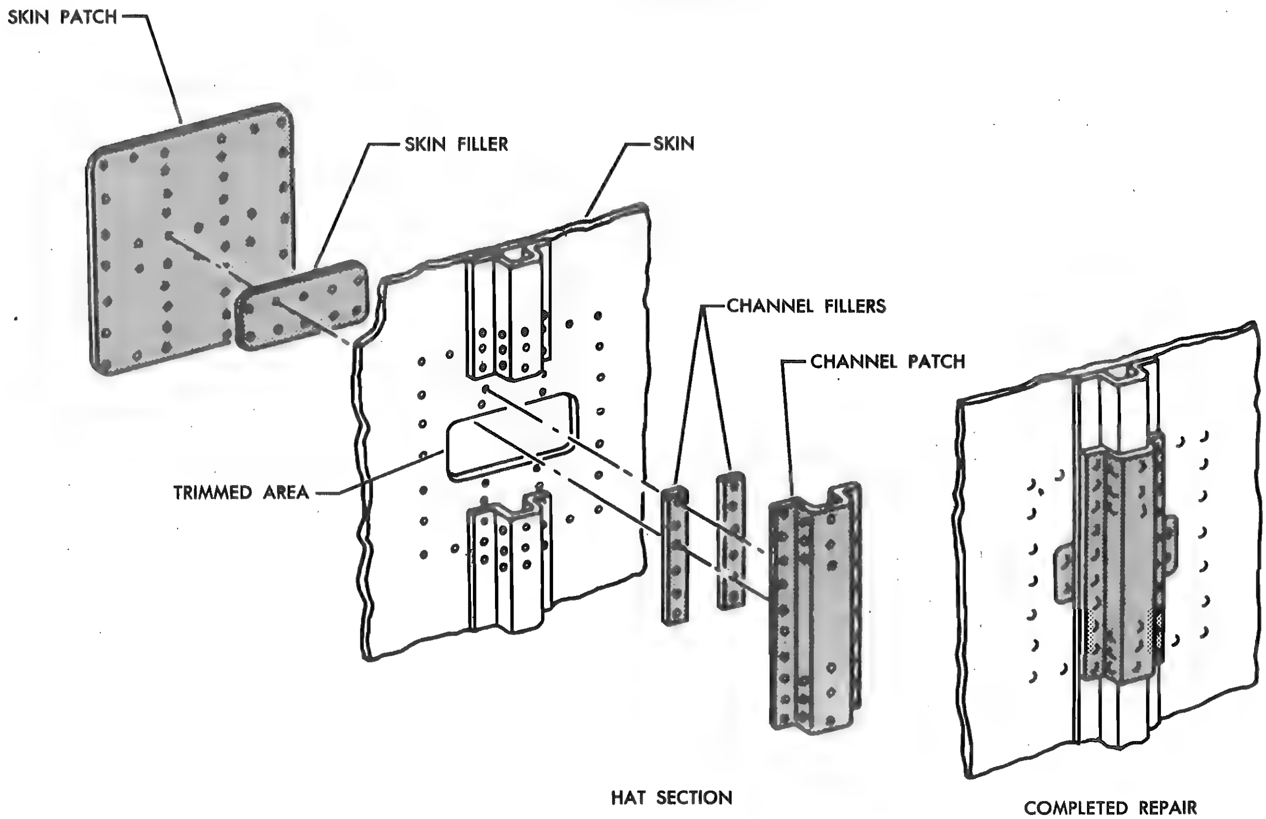
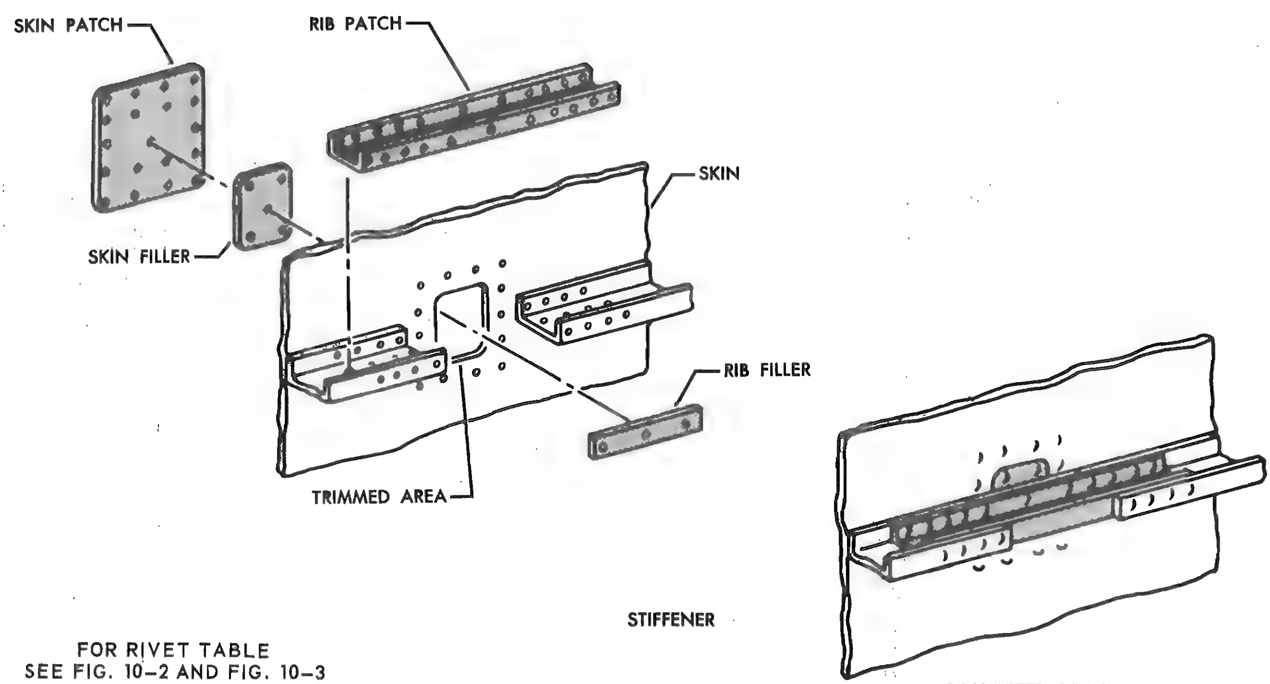


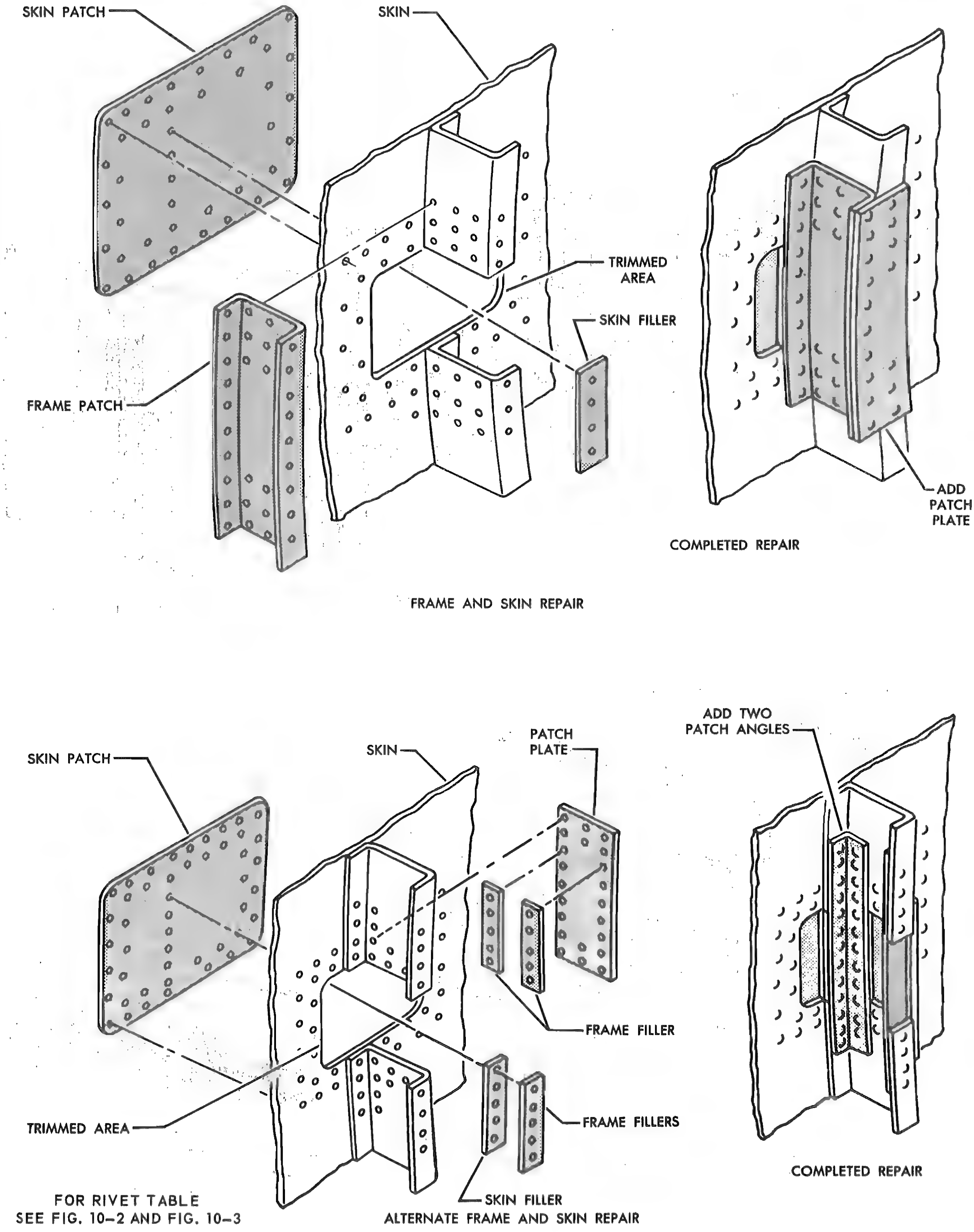
Figure 10-8. Repair of Damaged Channels





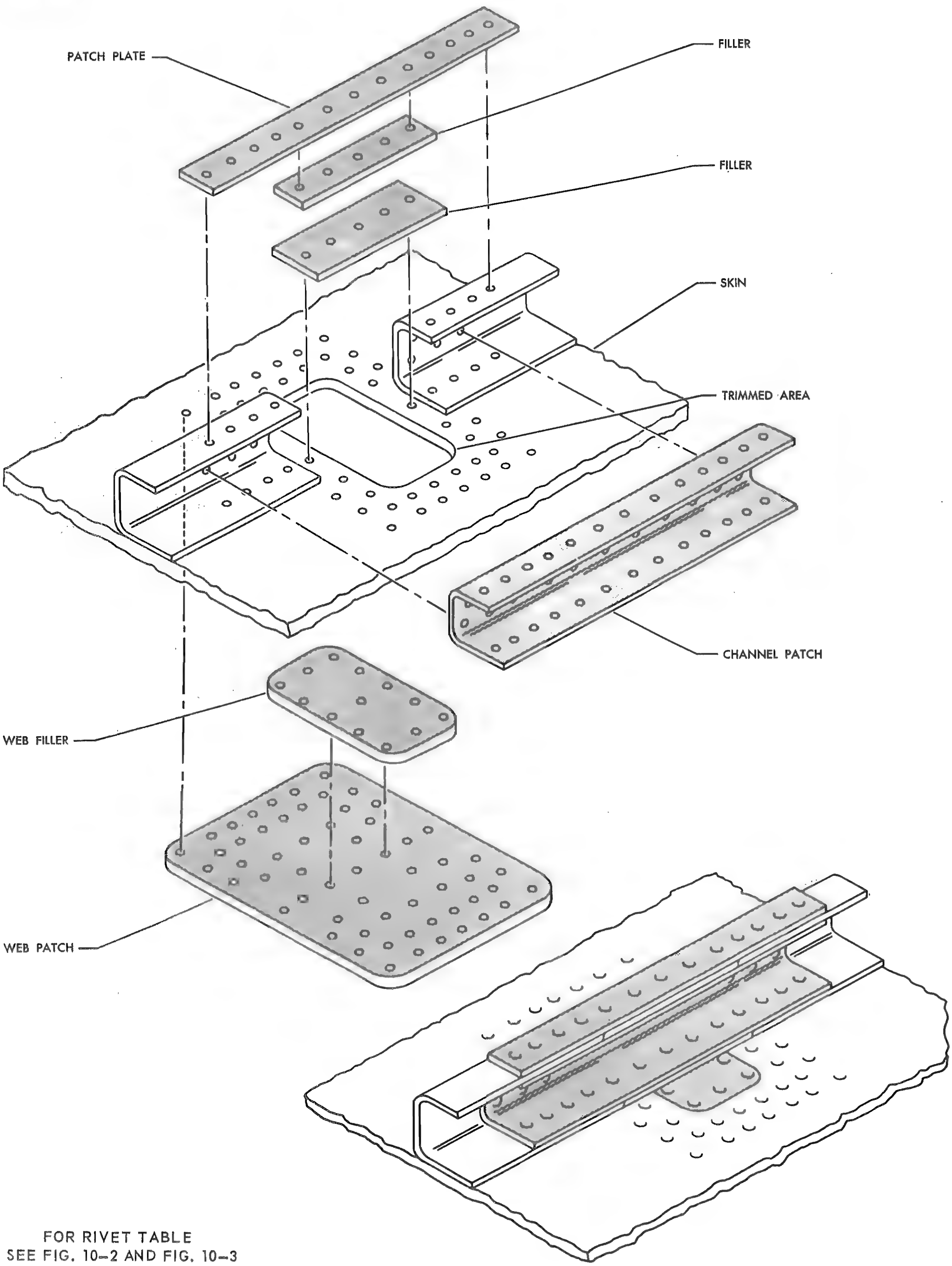
FOR RIVET TABLE
SEE FIG. 10–2 AND FIG. 10–3

Figure 10–9. Stiffener and Hat Section Repair



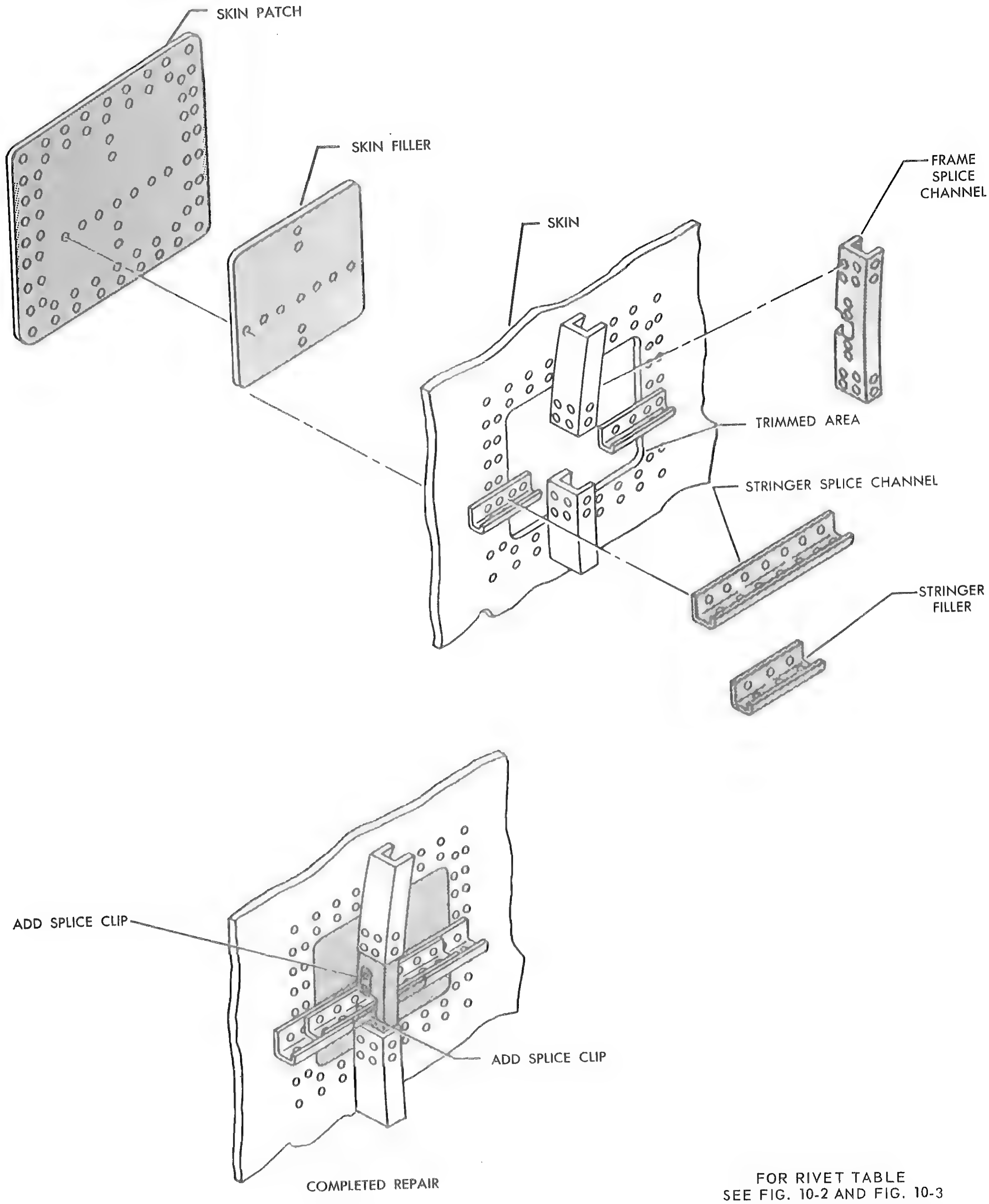
FOR RIVET TABLE
SEE FIG. 10-2 AND FIG. 10-3

Figure 10-10. Skin and Frame Repair



FOR RIVET TABLE
SEE FIG. 10-2 AND FIG. 10-3

Figure 10-11. Repair of Heavily Stressed Support and Stiffener



FOR RIVET TABLE
SEE FIG. 10-2 AND FIG. 10-3

Figure 10–12. Repair of Frame and Stringer Joint

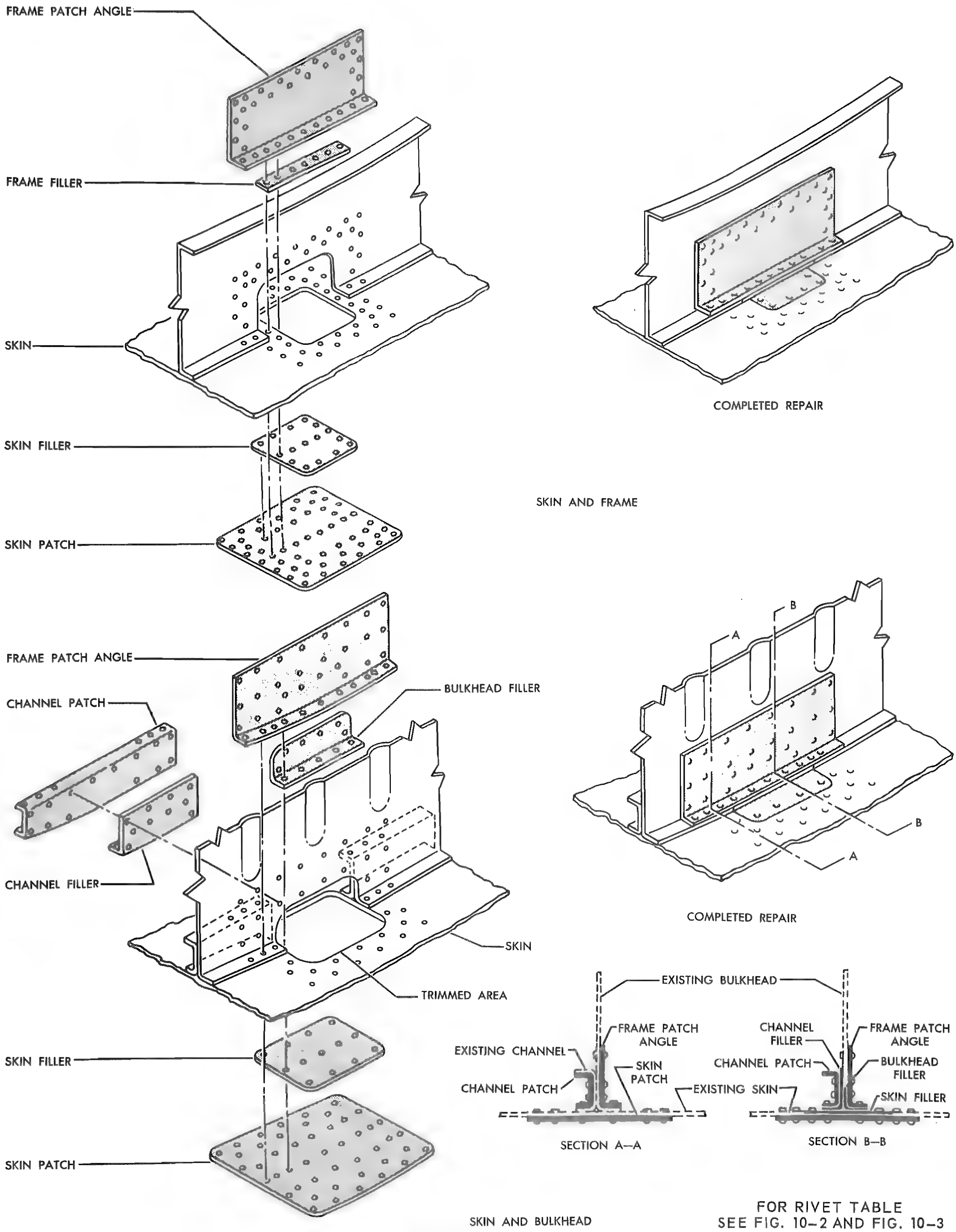


Figure 10–13. Repair of Bulkhead Web and Skin

CHAPTER 4
REPAIR MATERIALS

STOCK DESCRIPTION	GAGE	COMMERCIAL DESIGNATIONS	SPECIFICATION
Extrusion	Alcoa K-44777	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-16074	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-54837	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-16440	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-62564	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-30420	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-2008	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-2401	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-2402	2024-T Al Alloy	QQ-A-267
Extrusion	AND10136-2404	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-44027	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-40039	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-52428	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa 78Y	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-16074	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-1288	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-22220	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa 12447	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-22991	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-13662	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-23992	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-14064	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-24698	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-44542	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa 77B	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa 30845	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa 78F	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-40039	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-11637	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-54837	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-12447	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-62564	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-14030	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-51243	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-51251	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-23993	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-24575	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-11096	7075-T Al Alloy	QQ-A-277

STOCK DESCRIPTION	GAGE	COMMERCIAL DESIGNATIONS	SPECIFICATION
Extrusion	Alcoa K-65711	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa 65535	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-65712	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-65709	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-15045	2024-T Al Alloy	QQ-A-267
Extrusion	Alcoa K-65710	7075-T Al Alloy	QQ-A-277
Extrusion	Alcoa K-65708	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-0601	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-0602	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-0701	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-0702	2024-T Al Alloy	QQ-A-267
Extrusion	AND10133-0702	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-1001	2024-T Al Alloy	QQ-A-267
Extrusion	AND10133-1002	2024-T Al Alloy	QQ-A-267
Extrusion	AND10133-1002	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-1003	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-1201	2024-T Al Alloy	QQ-A-267
Extrusion	AND10133-1202	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-1203	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-1403	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-1601	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-2002	7075-T Al Alloy	QQ-A-277
Extrusion	AND10133-2401	2024-T Al Alloy	QQ-A-267
Extrusion	AND10134-0501	2024-T Al Alloy	QQ-A-267
Extrusion	AND10134-0601	2024-T Al Alloy	QQ-A-267
Extrusion	AND10134-0702	2024-T Al Alloy	QQ-A-267
Extrusion	AND10134-1201	2024-T Al Alloy	QQ-A-277
Extrusion	AND10134-1408	2024-T Al Alloy	QQ-A-277
Extrusion	AND10134-1603	2024-T Al Alloy	QQ-A-277
Extrusion	AND10134-1604	2024-T Al Alloy	QQ-A-277
Extrusion	AND10134-2401	2024-T Al Alloy	QQ-A-267
Extrusion	AND10134-2401	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-1401	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-1501	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-1601	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-1706	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-2002	2024-T Al Alloy	QQ-A-267
Extrusion	AND10136-2002	2024-T Al Alloy	QQ-A-267
Extrusion	AND10136-2003	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-2006	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-2405	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-2406	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-2407	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-2409	2024-T Al Alloy	QQ-A-267

STOCK DESCRIPTION	GAGE	COMMERCIAL DESIGNATIONS	SPECIFICATION
Extrusion	AND10136-2409	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-3005	7075-T Al Alloy	QQ-A-277
Extrusion	AND10136-3006	7075-T Al Alloy	QQ-A-277
Extrusion	Dow Chemical DC624	AZ31 Mag Alloy	QQ-M-31
Extrusion	Dow Chemical DC2108	ZK60A Mag Alloy	MIL-M-26696
Extrusion	Dow Chemical DC2112	ZK60A Mag Alloy	MIL-M-26696
Extrusion	Dow Chemical DC2113	ZK60A Mag Alloy	MIL-M-26696
Extrusion	Alcoa K-28883	2024-T4 Al Alloy	QQ-A-267
Extrusion	AND10134-0702	7075-O-Al Alloy	QQ-A-277
Extrusion	AND10134-1003	7075-T6 Al Alloy	QQ-A-277
Extrusion	Sikorsky S1605-2015	7075-T6 Al Alloy	QQ-A-277
Extrusion	Sikorsky S1605-2061	7075-T Al Alloy	QQ-A-277
Extrusion	Sikorsky S1605-2129	2024-T4 Al Alloy	QQ-A-267
Extrusion	Sikorsky S1605-5095	2024-T4 Al Alloy	QQ-A-267
Fabric Cloth		No. 181	
Foil	0.003	Aluminum	QQ-A-561
Foil	0.003 x 1	Aluminum	MIL-A-148
Foil	0.003 x 8	Aluminum	MIL-A-148
Sheet	0.016	2024-O Al Alloy	QQ-A-355
Sheet	0.032	2024-O Al Alloy	QQ-A-355
Sheet	0.040	2024-O Al Alloy	QQ-A-355
Sheet	0.050	2024-T Al Alloy	QQ-A-355
Sheet	0.063	2024-O Al Alloy	QQ-A-355
Sheet	0.071	2024-O Al Alloy	QQ-A-355
Sheet	0.020	2024-T6 Al Alloy	QQ-A-355
Sheet	0.032	2024-T3 Al Alloy	QQ-A-355
Sheet	0.040	2024-T3 Al Alloy	QQ-A-355
Sheet	0.050	2024-T4 Al Alloy	QQ-A-355
Sheet	0.063	2024-T3 Al Alloy	QQ-A-355
Sheet	0.080	2024-T3 Al Alloy	QQ-A-362
Sheet	0.090	2024-T3 Al Alloy	QQ-A-355
Sheet	0.012	2024-O Al Alloy	QQ-A-355
Sheet	0.016	2024-O Alclad	QQ-A-362
Sheet	0.020	2024-O Alclad	QQ-A-362
Sheet	0.025	2024-O Alclad	QQ-A-362
Sheet	0.040	2024-O Alclad	QQ-A-362
Sheet	0.050	2024-O Alclad	QQ-A-362
Sheet	0.063	2024-O Alclad	QQ-A-362
Sheet	0.071	2024-O Alclad	QQ-A-362
Sheet	0.090	2024-T3 Alclad	QQ-A-362
Sheet	0.020	2024-O Alclad	QQ-A-362
Sheet	0.025	2024-T3 Alclad	QQ-A-362
Sheet	0.032	2024-T4 Alclad	QQ-A-362
Sheet	0.032	2024-T3 Alclad	QQ-A-362

STOCK DESCRIPTION	GAGE	COMMERCIAL DESIGNATIONS	SPECIFICATION
Sheet	0.040	2024-T3 Alclad	QQ-A-362
Sheet	0.050	2024-O Alclad	QQ-A-362
Sheet	0.071	2024-T3 Alclad	QQ-A-362
Sheet	0.080	2024-T3 Alclad	QQ-A-362
Sheet	0.063	2024-T3 Alclad	QQ-A-362
Sheet	0.090	2024-T3 Alclad	QQ-A-362
Sheet	0.125	2024-T3 Alclad	QQ-A-362
Sheet	0.016	6061-O Al Alloy	QQ-A-327
Sheet	0.025	6061-O Al Alloy	QQ-A-327
Sheet	0.032	6061-O Al Alloy	QQ-A-327
Sheet	0.040	6061-O Al Alloy	QQ-A-327
Sheet	0.050	6061-O Al Alloy	QQ-A-327
Sheet	0.063	6061-O Al Alloy	QQ-A-327
Sheet	0.090	6061-O Al Alloy	QQ-A-327
Sheet	0.125	6061-O Al Alloy	QQ-A-327
Sheet	0.012	6061-T6 Al Alloy	QQ-A-327
Sheet	0.020	6061-T4 Al Alloy	QQ-A-327
Sheet	0.020	6061-T6 Al Alloy	QQ-A-327
Sheet	0.032	6061-T6 Al Alloy	QQ-A-327
Sheet	0.040	6061-T6 Al Alloy	QQ-A-327
Sheet	0.050	6061-T6 Al Alloy	QQ-A-327
Sheet	0.063	6061-T6 Al Alloy	QQ-A-327
Sheet	0.063	6061-T6 Al Alloy	QQ-A-327
Sheet	0.080	6061-T6 Al Alloy	QQ-A-327
Sheet	0.090	6061-T6 Al Alloy	QQ-A-327
Sheet	0.125	6061-T6 Al Alloy	QQ-A-327
Sheet	0.071	6061-T6 Al Alclad	QQ-A-327
Sheet	0.032	7075-O Alclad	QQ-A-287
Sheet	0.040	7075-O Alclad	QQ-A-287
Sheet	0.050	7075-O Alclad	QQ-A-287
Sheet	0.063	7075-O Alclad	QQ-A-287
Sheet	0.071	7075-O Alclad	QQ-A-287
Sheet	0.080	7075-O Alclad	QQ-A-287
Sheet	0.090	7075-O Alclad	QQ-A-287
Sheet	0.016	7075-T6 Alclad	QQ-A-287
Sheet	0.025	7075-T6 Alclad	QQ-A-287
Sheet	0.032	7075-T6 Alclad	QQ-A-287
Sheet	0.040	7075-T6 Alclad	QQ-A-287
Sheet	0.050	7075-T6 Alclad	QQ-A-287
Sheet	0.063	7075-T6 Alclad	QQ-A-287
Sheet	0.071	7075-T6 Alclad	QQ-A-287
Sheet	0.080	7075-T6 Alclad	QQ-A-287
Sheet	0.090	7075-T6 Alclad	QQ-A-287
Sheet	0.090	7075-T6 Alclad	QQ-A-287

STOCK DESCRIPTION	GAGE	COMMERCIAL DESIGNATIONS	SPECIFICATION
Sheet	0.100	7075-T6 Alclad	QQ-A-287
Sheet	0.125	7075-T6 Alclad	QQ-A-287
Sheet	0.020	AZ31X Mag Alloy	QQ-M-44
Sheet	0.025	AZ31X Mag Alloy	QQ-M-44
Sheet	0.032	AZ31X Mag Alloy	QQ-M-44
Sheet	0.040	AZ31X Mag Alloy	QQ-M-44
Sheet	0.050	AZ31X Mag Alloy	QQ-M-44
Sheet	0.063	AZ31X Mag Alloy	QQ-M-44
Sheet	0.071	AZ31X Mag Alloy	QQ-M-44
Sheet	0.080	AZ31X Mag Alloy	QQ-M-44
Sheet	0.090	AZ31X Mag Alloy	QQ-M-44
Sheet	0.100	AZ31X Mag Alloy	QQ-M-44
Sheet	0.125	AZ31X Mag Alloy	QQ-M-44
Sheet	0.156	AZ31X Mag Alloy	QQ-M-44
Sheet	0.187	AZ31X Mag Alloy	QQ-M-44
Sheet	0.016	Titanium T1-75	Commercial
Sheet	0.025	Titanium RC-70	Commercial
Sheet	0.036	Titanium T1-75A	Commercial
Sheet	0.100	Plexiglas 55	MIL-P-8184
Sheet	0.150	Plexiglas 55	MIL-P-8184
Sheet	Sikorsky S1620-65108	Laminated Glass	MIL-G-8602
Sheet	0.375	302-304 CRES	MIL-S-5059
Sheet	0.016	321 CRES	MIL-S-6721
Sheet	0.020	302-304 CRES	MIL-S-5059
Sheet	0.020	321 CRES	MIL-S-6721
Sheet	0.020	321 CRES	MIL-S-6721
Sheet	0.025	321 CRES	MIL-S-6721
Sheet	0.028	321 CRES	MIL-S-6721
Sheet	0.031	321 CRES	MIL-S-6721
Sheet	0.032	321 CRES	MIL-S-6721
Sheet	0.035	321 CRES	MIL-S-6721
Sheet	0.038	321 CRES	MIL-S-6721
Sheet	0.040	321 CRES	MIL-S-6721
Sheet	0.049	302-304 CRES	MIL-S-5059
Sheet	0.058	302-304 CRES	MIL-S-5059

CHAPTER 5
STORAGE OF AIRCRAFT

The storage of Aircraft will be found in TM 55-1520-202-20, Chapter 4.

APPENDIX

REFERENCES

AR 750-5	Organization, policies, and responsibilities for maintenance operations
DA Pam 310-1	Index of administrative publications
DA Pam 310-2	Index of blank forms
DA Pam 310-4	Index of technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders
SM 55-135-1-series	Supply manual (stock list of all items)
TB 746-3-2	Painting and marking of Army aircraft
TB AVN 25-14	Inspection and repair procedures, oil cooler assembly
TM 1-2R-R1820-43	Overhaul instructions, models R-1820-84, 84A, and 84B, aircraft engines
TM 1-4BA1-22-3	Overhaul instructions with parts breakdown, rotor brake master brake cylinder
TM 1-5E6-2-26-3	Overhaul instructions with parts breakdown, dual tachometer indicator
TM 1-5F3-4-2-23	Overhaul instructions, sensitive altimeters
TM 1-5L14-3-5-163	Overhaul instructions, capacitor type fuel quantity gage tank units
TM 1-5P2-2-1-51	Operation, service, and overhaul instructions with parts catalog, oil and hydraulic pressure gages
TM 1-5P2-2-3-13	Overhaul instructions and test procedure for type D-18 manifold pressure gage
TM 1-6R2-9-13	Overhaul instructions with parts breakdown, fuel strainer assembly U-959
TM 1-6R9-9-1-53	Overhaul instructions, selector valves
TM 1-6R9-9-1-54	Illustrated parts breakdown, selector valves
TM 1-7R-1-73	Overhaul instructions, oil temperature regulators, oil coolers, valves
TM 1-7R-1-74	Parts catalog, oil temperature regulators, oil coolers, valves
TM 1-7R4-2-7-3	Overhaul instructions, hydro clutch hydraulic oil pumps
TM 1-7R5-9-3	Overhaul with parts breakdown, oil temperature regulator
TM 1-8D6-4-3-3	Overhaul instructions, direct current generator
TM 1-8E2-8-3-3	Overhaul instructions, starting vibrator
TM 1-8S2-2-3-23	Overhaul instructions with parts breakdown, pressure switch
TM 1-15H3-2-26-93	Overhaul instructions with parts breakdown, Axivane aircraft fan
TM 3-220	Chemical, biological, and radiological decontamination
TM 55-405-4	Aircraft structural repair
TM 55-405-5	Aircraft engines
TM 55-1560-202-50	Depot maintenance manual, oil cooler assembly
TM 55-1650-223-50	Depot maintenance manual, stratopower hydraulic pump
TM 55-1660-201-50	Depot maintenance manual, ignition unit
TM 55-1660-203-50	Depot maintenance manual, aircraft heater
TM 55-2915-200-50	Depot maintenance manual, injection carburetor
TM 55-2915-210-50	Depot maintenance manual, motor-operated gate valve
TM 55-2915-213-50	Depot maintenance manual, engine-driven fuel pump
TM 55-2915-219-50	Depot maintenance instructions, totally submerged fuel booster pump
TM 55-2915-224-50	Depot maintenance manual, totally submerged fuel booster pump

TM 55-2915-236-50	Depot maintenance instructions, engine-driven fuel pump
TM 55-2925-210-50	Depot maintenance manual, type D9LN-2 magneto
TM 55-6605-200-50	Depot maintenance manual, gyro magnetic compass indicator
TM 55-6605-205-50	Depot maintenance manual, magnetic compass
TM 55-6610-200-50	Depot maintenance manual, remote attitude indicator
TM 55-6610-202-50	Depot maintenance manual, turn and slip indicator assembly
TM 55-6610-215-50	Depot maintenance manual, attitude horizon indicator
TM 55-6610-217-50	Depot maintenance manual, rate of climb indicator
TM 55-6610-224-50	Depot maintenance manual, airspeed indicator
TM 55-6610-227-50	Depot maintenance manual, pressure altimeter
TM 55-6620-223-50	Depot maintenance manual, synchro style oil pressure indicator
TM 55-6625-201-50	Depot maintenance instructions, direct current ammeter
TM 55-6645-200-50	Depot maintenance manual, type A-13A aircraft clock
TM 55-6680-206-50	Depot maintenance manual, capacitor type fuel quantity gage indicator
TM 55-6680-209-50	Depot maintenance manual, tachometer generator
TM 55-6685-203-50	Depot maintenance manual, electrical resistance temperature indicator
TM 55-6685-204-50	Depot maintenance manual, electrical resistance temperature indicator
TM 55-6685-218-50	Depot maintenance manual, synchro style multi-purpose pressure indicator

APPENDIX II
MAINTENANCE ALLOCATION CHART

The Maintenance Allocation Chart will be found only in TM 55-1520-202-20, Appendix II of the technical manual.

APPENDIX III
REPAIR PARTS AND SPECIAL TOOLS LIST

The Repair Parts and Special Tools will be found in TM 55-1520-202-34P, Field Maintenance Repair Parts and Special Tool Lists.

APPENDIX IV
WEIGHT AND BALANCE
SECTION I
INTRODUCTION

1–1. This appendix contains data specifically applicable to the CH-34A and CH-34C helicopters. Sufficient data is provided so that field maintenance has the necessary instructions to perform their phase of this maintenance operation.

1–2. PURPOSE.

1–3. The Weight and Balance Date provides the service activities with a standard system of field weight and balance control. It contains brief instructive information and is to be used with the forms and charts which provide for continuous control of weight and balance of the helicopter. The data to be inserted on the charts and forms are applicable only to the individual helicopter, the serial number of which appears on the various forms and charts. This data is to remain with the helicopter in accordance with existing directives. The charts and forms referred to herein may differ in nomenclature and arrangement from those shown in previously published copies, since these charts are revised from time to time; however, the general principle of use will not change.

1–4. CHARTS AND FORMS.

1–5. The standard system of field weight and balance control requires the use of several different charts and forms. They are identified as follows:

a. Record of Weight and Balance Personnel, DD Form 365.

b. Chart A-Basic Weight Check List, DD Form 365A.

c. Airplane Weighing Record, DD Form 365B.

d. Chart C-Basic Weight and Balance Record, DD Form 365C.

e. Chart E-Loading Data, Charts and Graphs.

f. Weight and Balance Clearance Form F, DD Form 365F.

1–6. RESPONSIBILITY.

1–7. The helicopter manufacturer inserts all identifying data on the various charts and forms. He completes all charts, including one sample Weight and Balance Clearance Form F, if applicable, at time of delivery. This record constitutes the basic weight and balance data of the helicopter at delivery. The maintenance officer's responsibility is to maintain the Weight and Balance Data records. This data will be maintained in a permanent binder for each helicopter. This binder will reflect the model and the helicopter's serial number. All DD-365 series forms, charts, and any other pertinent weight and balance data will be maintained therein. All subsequent changes in weight and balance are compiled by the weight and balance technician in accordance with instructions contained herein.

1–8. HELICOPTER WEIGHINGS.

1–9. The helicopter must be weighed:

a. Periodically as required by pertinent directives.

b. When major modifications or repairs are made.

c. When the pilot reports unsatisfactory flight characteristics (nose or tail heaviness).

d. When the basic weight data is suspected to be in error.

SECTION II
DEFINITION

2–1. TARE.

2–2. Tare is the weight of equipment necessary for weighing the helicopter (chocks, blocks, slings, jacks, etc) which is included in the scale readings (or reactions) but is not a part of the helicopter weight.

SECTION III

INSTRUCTION FOR USE OF THE FORMS AND CHARTS

3–1. GENERAL.

3–2. There are two parts to the weight and balance problem. First, one must have correct information as to the basic weight and moment. Second, gross weight and balance must be maintained within weight and cg limits with the addition of load. The first part is controlled by charts A and C after the basic weight and balance have been determined by weighing the helicopter. The second part is carried out on Form F with the aid of a balance computer of Chart E.

Note

The DD-365 series of forms shall have no security classification until filled in. The forms, when filled in, shall take on the security classification of the Charts A, C, and E of the helicopter for which they are used.

3–3. RECORD OF WEIGHT AND BALANCE PERSONNEL, DD FORM 365. (See figure 3–1.)

3–4. Listed at the top of this form are the helicopter model and serial number. The form provides a continuous record of the name and grade (civilian or military) of weight and balance personnel responsible for the records, the station, the date assigned and the date relieved. All entries should be complete and legible.

3–5. PRELIMINARY WEIGHING INSTRUCTIONS.

a. Assemble the necessary equipment, including scales, hoisting equipment, jacks, cribbing, leveling bars and level, measuring tape, plumb bobs, and string.

b. Remove dirt, grease, moisture, etc, from the helicopter.

c. Drain fuel from all tanks, using tank drains, with the helicopter in its normal attitude on the ground. If impracticable to drain due to fire hazard or local regulations, fill to capacity. Since the weight of fuel varies with temperature, determine actual weight per gallon by use of a hydrometer. Multiply by gallons capacity, obtained from Chart E, for total fuel weight. Never weigh with partially filled tanks.

d. Drain oil from the oil tanks, using the tank drains, or fill to operating capacity.

e. Fill hydraulic reservoirs to normal level.

f. Inflate or deflate main landing gear oleo struts to normal extension or to the anticipated desired height. It may be helpful for leveling and in jacking to lash a rope around the torque arm of the tail wheel oleo, or to apply a stiffner so that the strut will not extend when the helicopter is lifted.

g. Conduct an inventory of the fixed operating equipment actually installed in the helicopter. This shall be accomplished on the Chart A-Basic Weight Check List.

Note

A basic weight without the equipment inventory is of no value to the activity receiving the helicopter.

h. Release the brakes before the helicopter is placed on the scales so as to reduce the possibility of side loads and thrusts on the scales which may give erroneous weighing results.

Note

The helicopter must be weighed in a closed hangar.

3–6. AIRPLANE WEIGHING RECORD, DD FORM 365B. (See figure 3–2.)

3–7. Using instructions provided with the scales selected for the weighing, complete DD Form 365B in the following manner:

a. Fill in the identifying data and enter the actual scale readings in the first columns.

b. Subtract tare, if any, from the scale readings to obtain the net weight.

c. Measure dimensions B and D during the weighing. Using these dimensions and location of jig point, determine arms E and F from the measurements recorded. For checking purposes only, approximate dimensions are normally listed on Chart E. Be sure to read the measuring tape graduations correctly. The tape may be graduated in feet and inches, or feet and tenths of feet.

d. Multiply the subtotal net weight of the main wheels, and the net weight of the tail wheel, by

RESTRICTED (When filled in)

RECORD OF WEIGHT AND BALANCE PERSONNEL				FOR USE IN AN 01-1B-40
AIRPLANE MODEL CH-34A		SERIAL NUMBER 56-4316		
NAME	GRADE	STATION	DATE ASSIGNED	DATE RELIEVED
Jones, Thomas A.	Sfc.	Fort X	10 Jan 62	1 Jun 62
Doe, John R.	Civ.	Fort X	1 Jun 62	

DD FORM 1 AUG 50 365

RESTRICTED (When filled in)

Figure 3–1. Record of Weight and Balance Personnel

AIRPLANE WEIGHING RECORD

FOR USE IN T.O. 1-1B-40 & AN 01-1B-40

DATE WEIGHED	MODEL	SERIAL NUMBER
22 July 1958	CH-34A	00-0000

PLACE WEIGHED	WEIGHING PERSONNEL
Fort X	J. R. Doe, Civilian

REACTION (Wheels, jackpoints, etc.)	SCALE READING	TARE	NET WEIGHT	ARM	MOMENT
LEFT MAIN	3875	-4	3871		
RIGHT MAIN	3750	-10	3740		
SUB-TOTAL (Both Main)	7625	-14	7611	E 79.00	601,269
NOSE OR TAIL	1755	-9	1746	F 426.20	744,145
TOTAL (As Weighed)	9380	-23	9357	H 143.79	1,345,414

MEASUREMENTS

B = 0.00 the distance from the jig point, to the center line of the main reactions. Obtain by measurement.

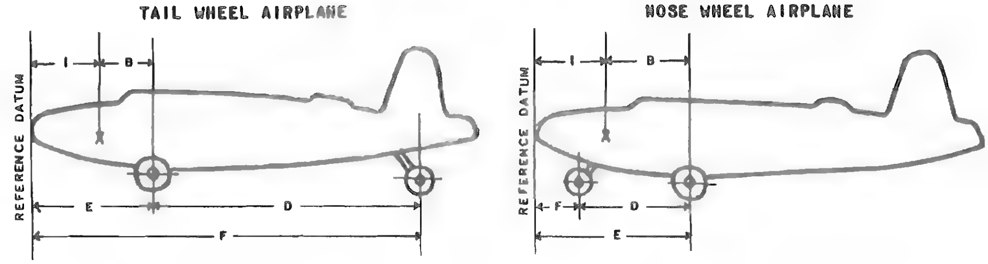
I = 79.00 the distance from the reference datum to the jig point of the airplane, from which a plumb bob can be dropped to the ground. Obtain from the airplane diagram in Chart E.

E = 79.00 1/ the distance from the reference datum to the center line of the main reactions.
E = I + B
E = I - B *(If the jig point is aft of the center line of the main reactions.)*

D = 347.20 the wheel base *(or the distance between fore and aft reactions.)* Obtain by measurement.

F = 426.20 1/ the distance from the reference datum to the center line of the nose or tail reaction.
F = E - D *(For nose wheel type aircraft)*
F = E + D *(For tail wheel type aircraft)*

TAIL WHEEL AIRPLANE   NOSE WHEEL AIRPLANE



DIAGRAMS FOR MEASURING VARIOUS TYPES OF AIRPLANES TO DETERMINE ARM OF SUPPORT POINTS.

1/ Check dimensions E and F against approximate dimensions listed on Chart E.

DD FORM 1 SEPT 54 365B Previous editions of this form may be used until stocks are exhausted.

Figure 3-2. Airplane Weighing Record (Sheet 1 of 2)

AIRPLANE WEIGHING RECORD				FOR USE IN T.O. 1-1B-40 & AN 01-1B-40
DESCRIPTION	NET WEIGHT	ARM	MOMENT	1/ INDEX OR MOM/ 100
TOTAL *(As Weighed)*	9357	143.79	1,345,414	
OIL IN AIRPLANE	– 79	64.00	– 5,056	
TOTAL OF ITEMS WEIGHED BUT NOT PART OF BASIC WEIGHT *(From Col. I below)*	– 1552		– 266,574	
TOTAL OF BASIC ITEMS NOT IN AIRCRAFT WHEN WEIGHED *(From Col. II below)*	+ 88		+ 21,620	
BASIC AIRPLANE *(Post to Chart C)*	7814	140.18	1,095,404	10954.0

COLUMN I				COLUMN II			
ITEMS WEIGHED BUT NOT PART OF BASIC WEIGHT	WEIGHT	ARM	MOMENT	BASIC ITEMS NOT IN AIRPLANE WHEN WEIGHED	WEIGHT	ARM	MOMENT
Fuel (263 Gal)	1552		266574	First Aid Kits (2)	4.0		700
				Headsets H-101/U			
				(3)	4.0		440
				Battery	80.0		20480
TOTAL	1552		266574	TOTAL	88.0		21620

REACTIONS USED
MAIN: Fwd. Jack Pads located at Fus. Sta. 79.0
TAIL: Tail Jack Pad located at Fus. Sta. 426.2

TYPE SCALES
Electric Weighing Kit
Type C-1, Model CS-7, Ser. No. 1122
Last Calibrated 28 May 1958

REMARKS
(1) Helicopter weighed in closed hangar as per TM 55-405-9.
(2) Fuel Density - 5.9 lb/gal.
(3) Tare values obtained by setting initial load switch to zero after load was removed as per instruction manual applicable to Electronic Weighing Kit.

1/ Enter constant used.

Figure 3–2. Airplane Weighing Record (Sheet 2 of 2) their respective arms (dimensions E and F) to obtain their moments.

e. Add the net weights and moments of the main wheels and tail wheel.

f. Divide the total moment by the total net weight to obtain the (As Weighed) cg position in inches from the reference datum (H).

g. Transfer the TOTAL (As Weighed) weight, arm, and moment to the back of the weighing form.

h. Subtract the oil weight and moment from the TOTAL (As Weighed) total. (Arm of oil may be found in Chart E.)

i. Subtract the total weight and moment of items entered in column I. These items should not be checked on Chart A as IN AIRCRAFT.

j. Add the total weight and total moment of the items listed in Column II. These items must be checked on Chart A as IN AIRCRAFT to indicate their inclusion in the basic weight. If the helicopter is weighed after overhaul with a completely dry fuel or oil system, include trapped fuel or oil in column II.

k. Enter the new basic weight and moment/constant on Chart C. All subsequent helicopter loadings will be based on the latest figures entered on Chart C.

l. Fill in reactions and type scales used.

m. Include under REMARKS information as to the attitude of the helicopter when weighed, method of support, etc.

3–8. CHART A – BASIC WEIGHT CHECK LIST, DD FORM 365A. (See figure 3–3.)

Note

Figure 3–3 is a typical form. A list must be made for each compartment.

3–9. The Basic Weight Check List is a tabulation of all operating equipment that is or may be installed and for which provision or fixed stowage has been made in a definite location in the helicopter. It gives the weight, arm and moment/constant of the individual items for use in correcting the basic weight and moment on Chart C as changes are made in this equipment. When check marks are entered in the IN AIRCRAFT column, it serves as the inventory of equipment included in the basic weight and moment/constant.

3–10. Inventories should be made periodically, but are required specifically when:

a. The helicopter undergoes modification, major overhaul, or repair.

b. The helicopter is received at a new base.

c. Changes in equipment are made for a different type of operation or mission.

d. The helicopter is reweighed.

e. The pilot reports unsatisfactory flight characteristics (tail or nose heaviness).

3–11. The manufacturer of the helicopter placed check marks in the DELIVERY EQUIPMENT column to identify the items of equipment in the helicopter for the delivery condition. This delivery inventory shows equipment included in the initial basic weight entry on Chart C.

3–12. Subsequent check list inventories shall be carried on as follows:

a. Inspect the helicopter for equipment actually installed, placing check marks in the next unused IN AIRCRAFT column. A check (X) in the column headed IN AIRCRAFT indicates the presence of the item in the helicopter on the date at the head of the column, and a zero (0) indicates its absence. Items should not be checked unless they are installed, and items marked zero are not to be included in the basic weight and balance tabulated on Chart C for the corresponding date. During this inventory, note whether any new items of equipment have been installed, and if so, enter item number and the name or description, together with other data required through column Moment/Constant, including the date in parentheses following the description.

b. Compare this inventory with that under the last CHECK heading, noting any changes in the items of equipment installed in the helicopter. Refer to Chart C to ascertain whether the necessary weight and moment corrections have been made. If so, place check marks opposite such items in the CHART C ENTRY column. If not, correct the basic weight and moment/constant data on Chart C and then enter the CHART C ENTRY column check marks.

c. Check marks are made only at the time of a complete inventory. Never change the check marks or add new ones under a previously accomplished check heading. Use the next CHECK column. When an inventory is included as part of a weighing, the procedure outlined in the preceding paragraph should not be omitted since this correction makes possible the comparison of calculated and actual weight figures. Check marks in the CHART C ENTRY column indicate only a calculated change in the basic Chart C figures.

d. Make sure that the same date is entered over the CHECK heading on Chart A and in the date

FOR USE IN T. O. 1-1B-40 & AN 01-1B-40

CHART A - BASIC WEIGHT CHECK LIST

PAGE 3 OF PAGES | AIRPLANE MODEL CH-34A | SERIAL NUMBER 00-0000 | DELIVERY DATE 10 Jan 58

RECORD OF CHECKING (Enter date): 1 — 23 Mar 58; 2 — 22 July 58

COMPARTMENT AND ITEM NUMBER	ITEMS AND LOCATION (Grouped by Compartment)	WEIGHT	ARM	1/ MOMENT / 100	DELIVERY EQUIPMENT	CHECK 1 IN AIRPLANE	CHECK 1 CHART C ENTRY	CHECK 2 IN AIRPLANE	CHECK 2 CHART C ENTRY	CHECK 3 IN AIRPLANE	CHECK 3 CHART C ENTRY	CHECK 4 IN AIRPLANE	CHECK 4 CHART C ENTRY	CHECK 5 IN AIRPLANE	CHECK 5 CHART C ENTRY	CHECK 6 IN AIRPLANE	CHECK 6 CHART C ENTRY	CHECK 7 IN AIRPLANE	CHECK 7 CHART C ENTRY	CHECK 8 IN AIRPLANE	CHECK 8 CHART C ENTRY
C	CABIN (82-246) (Cont)																				
C-9	Safety Belts (3) (FDC-1650-27) (22 Mar 58)	2	115	2.3	O	X	X	X													
C-10	Fire Extinguisher (A-20) (22 Mar 58)	9	117	10.5	O	X	X	X													
C-11	Cargo Door Harness - Safety (22 Mar 58)	4	139	5.6	O	X	X	X													
C-12	Four-Way Valve-Hoist	4	140	5.6	X	X		X													
C-13	Soundproofing (20 Jul 58)	14	143	20.0	O	O		X	X												
C-14	Hydraulic Pump Hoist	5	146	7.3	X	X		X													
C-15	Hatch Cover-External	3	146	4.4	X	X		X													
C-16	Litter Straps (2) (22 Mar 58)	15	148	22.2	X	O	X	O													
C-17	Filter, Hoist	2	148	3.0	X	X		X													
C-18	Generator-Tachometer (AN5547-2)	2	150	3.0	X	X		X													
C-19	Troop Seat Fittings	27	151	40.8	X	X		X													
C-20	Oil-Main Gear Box	42	152	63.8	X	X		X													
C-21	Troop Seat (1 Man) (ACA-1141-14) (20 Jul 58)	4	156	6.2	X	X		O	X												
C-22	Troop Seat (1 Man) (ACA-1141-21) (20 Jul 58)	3	156	4.7	O	O		X	X												
C-23	Seat Belt (1) (C-3)	3	156	4.7	X	X		X													
C-24	Hydraulic Pump (67WB200)	8	156	12.5	X	X		X													
C-25	Camera, K-38 (36" Lens) (1) and Case (22 Mar 58) (20 Jul 58)	63	157	98.9	O	X	X	O	X												

1/ Enter constant used below line.

DD FORM 1 SEPT 54 365A Previous editions of this form may be used until stocks are exhausted.

U. S. GOVERNMENT PRINTING OFFICE : 1954 O - 315289

Figure 3-3. Chart A – Basic Weight Check List

CHART C—BASIC WEIGHT AND BALANCE RECORD

(CONTINUOUS HISTORY OF CHANGES IN STRUCTURE OR EQUIPMENT AFFECTING WEIGHT AND BALANCE)

FOR USE IN T. O. 1-1B-40 & AN 01-1B-40

AIRPLANE MODEL: CH-34A | SERIAL NO.: 00-0000 | PAGE NO.:

DATE	ITEM NO. IN	ITEM NO. OUT	DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE ADDED (+) WEIGHT	ADDED (+) ARM	ADDED (+) MOMENT[1]	REMOVED (–) WEIGHT	REMOVED (–) ARM	REMOVED (–) MOMENT[1]	RUNNING TOTAL BASIC AIRPLANE WEIGHT	MOMENT[1] / 100	INDEX[2]
10Jan58			Basic Weight as Delivered							7784	10907.8	
22Mar58	C-9		Safety Belts (3) (FDC-1650-27)	2	115	2.3						
	C-10		Fire Extinguisher (A-20)	9	117	10.5						
	C-11		Cargo Door Harness - Safety	4	139	5.6						
		C-16	Litter Straps (2)				15	148	22.2			
	C-25		Camera, K-38 (36" Lens) (1) and Case	63	157	98.9						
			Totals	78		117.3	15		22.2			
23Mar58			Basic Weight as Modified (Calc.)							7847	11002.9	
20Jul58	C-13		Soundproofing	14	143	20.0						
		C-21	Troop Seat (1 man) (ACA-1141-14)				4	156	6.2			
	C-22		Troop Seat (1 man) (ACA-1141-21)	3	156	4.7						
		C-25	Camera, K-38 (36" Lens) (1) and Case				63	157	98.9			
			Flooring Modification									
		X	Structure Removed				7	260	18.2			
	X		Structure Added	11	262	28.8						
			Totals	28		53.5	74		123.3			
22Jul58			Basic Weight as Calculated							7801	10933.1	
22Jul58			Actual Basic Weight as Weighed							7814	10954.0	

[1] Enter constant used below line. [2] Balance computer index.

DD FORM 1 SEP 54 365 C — PREVIOUS EDITIONS OF THIS FORM MAY BE USED UNTIL STOCKS ARE EXHAUSTED. 16—70876-1 U. S. GOVERNMENT PRINTING OFFICE

Figure 3–4. Chart C – Basic Weight and Balance Record column on Chart C for the corresponding corrected basic weight and moment/constant.

3–13. CHART C – BASIC WEIGHT AND BALANCE RECORD, DD FORM 365C. (See figure 3–4.)

3–14. Chart C is a continuous history of the basic weight, moment and balance computer index resulting from structural and equipment changes in service. At all times the last weight, moment/constant and index entry is considered the current weight and balance status of the basic helicopter. The basic index for the balance computer can be determined by means of the index scale or index formula on the computer.

3–15. At time of delivery of a new helicopter, the manufacturer entered on this chart the basic weight, moment/constant, and index of the helicopter. The itemized list of the equipment included therein is shown and checked on Chart A in the DELIVERY EQUIPMENT column.

3–16. Make additions or subtractions to the basic weight and moment in Chart C:

a. When equipment is added to or removed from the helicopter. If the item is listed on Chart A, enter the identical item number, description and applicable weight, arm, and moment data on Chart C. If the item is not listed on Chart A, determine its actual weight and arm and record this information on both Chart A and Chart C.

Note

Do not enter check marks on Chart A for these items until a complete inventory is made, but enter the date in parentheses following the description.

When a complete inventory reveals equipment changes not previously recorded. Post equipment changes as noted in preceding step *a.* Date the newly calculated basic weight and moment to correspond with the date entered at the head of the CHECK column on Chart A identifying the equipment content of the new figures. It is also helpful to record the check column number which substantiates this new basic weight and moment.

c. When structural changes are made in the helicopter, if the structural changes are provisions for equipment, list them separately from the equipment to be installed thereon.

d. When the helicopter is reweighed. Before weighing, make a complete inventory and bring calculated Chart C figures up-to-date. Enter the new (As Weighed) basic weight and moment from the Airplane Weighing Record.

3–17. Any change or modification which is caused by a specific order should carry a reference to the order number and date which authorizes the change.

Note

The date entered on Chart C must be consistent with the Delivery Date or the date entered on the top of the CHECK column on Chart A, and with the date on DD Form 365F (Airplane Weighing Record) if used.

3–18. CHART E – LOADING DATA, CHARTS AND GRAPHS.

3–19. Instructions for the use of Chart E are contained in TM 55-1520-202-10, Chapter 12.

3–20. WEIGHT AND BALANCE CLEARANCE FORM F, DD FORM 365F.

3–21. Instructions for the use of Weight and Balance Clearance Form F are contained in TM 55-1520-202-10, Chapter 12.

INDEX