

CHAPTER 7

DRIVE TRAIN

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CHAPTER 7

DRIVE TRAIN

7.000 Drive Train7.001 Introduction

This section contains the procedures for removal, installation, replacement, and maintenance of the drive train components.

7.002 Description (see Figure 7-1)

A V-belt sheave is bolted directly to the crankshaft of the engine; four double V-belts transmit power to the upper sheave, which has an overrunning clutch in its hub. The clutch shaft transmits power forward to the main rotor and aft to the tail rotor. Flexible couplings are located at the input to the main gearbox and at each end of the long tail rotor drive shaft. The main rotor gearbox contains a single-stage spiral-bevel gear set, which is splash-lubricated. The long tail rotor shaft has no hanger bearings but has a lightly-loaded damper bearing. The tail rotor gearbox also contains a splash-lubricated spiral bevel gear set. The tail rotor gearbox input and output shafts are both made of stainless steel to prevent corrosion. The other shafts throughout the drive system are made of alloy steel.

7.100 Main Rotor Gearbox7.110 Main Rotor Gearbox Removal

- a) Remove the C706-1 tailcone cowling, both engine side panels, and the aft engine cowling.
- b) Remove the mast fairing per Section 4.142. Remove the middle and lower mast fairing ribs from the mast tube.
- c) Remove the main rotor per Section 9.111.
- d) Disconnect the rotor brake cable pulleys on the arm and aux tank. Remove the cable housing clamp on the aux tank channel.

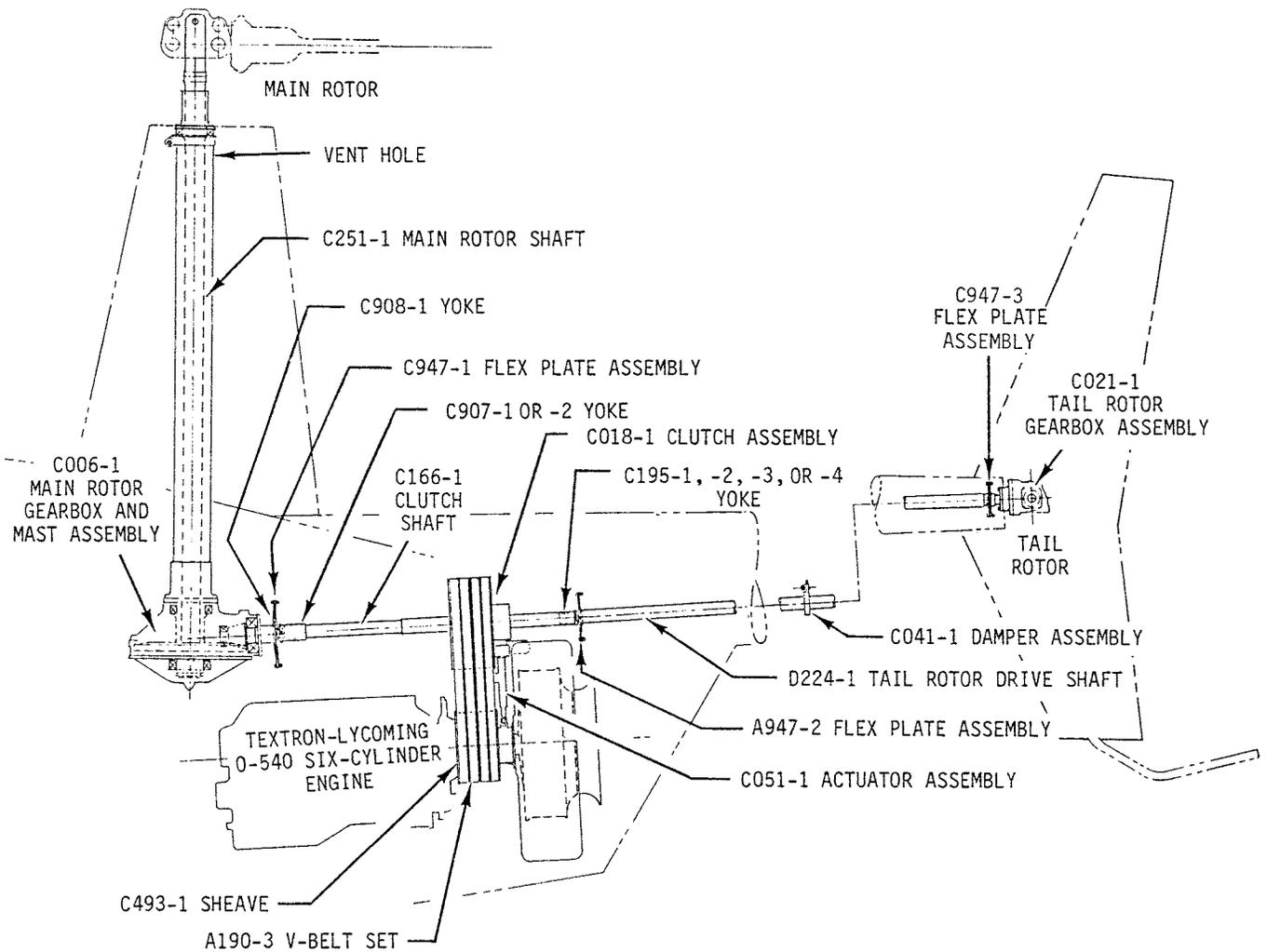


FIGURE 7-1 DRIVE SYSTEM

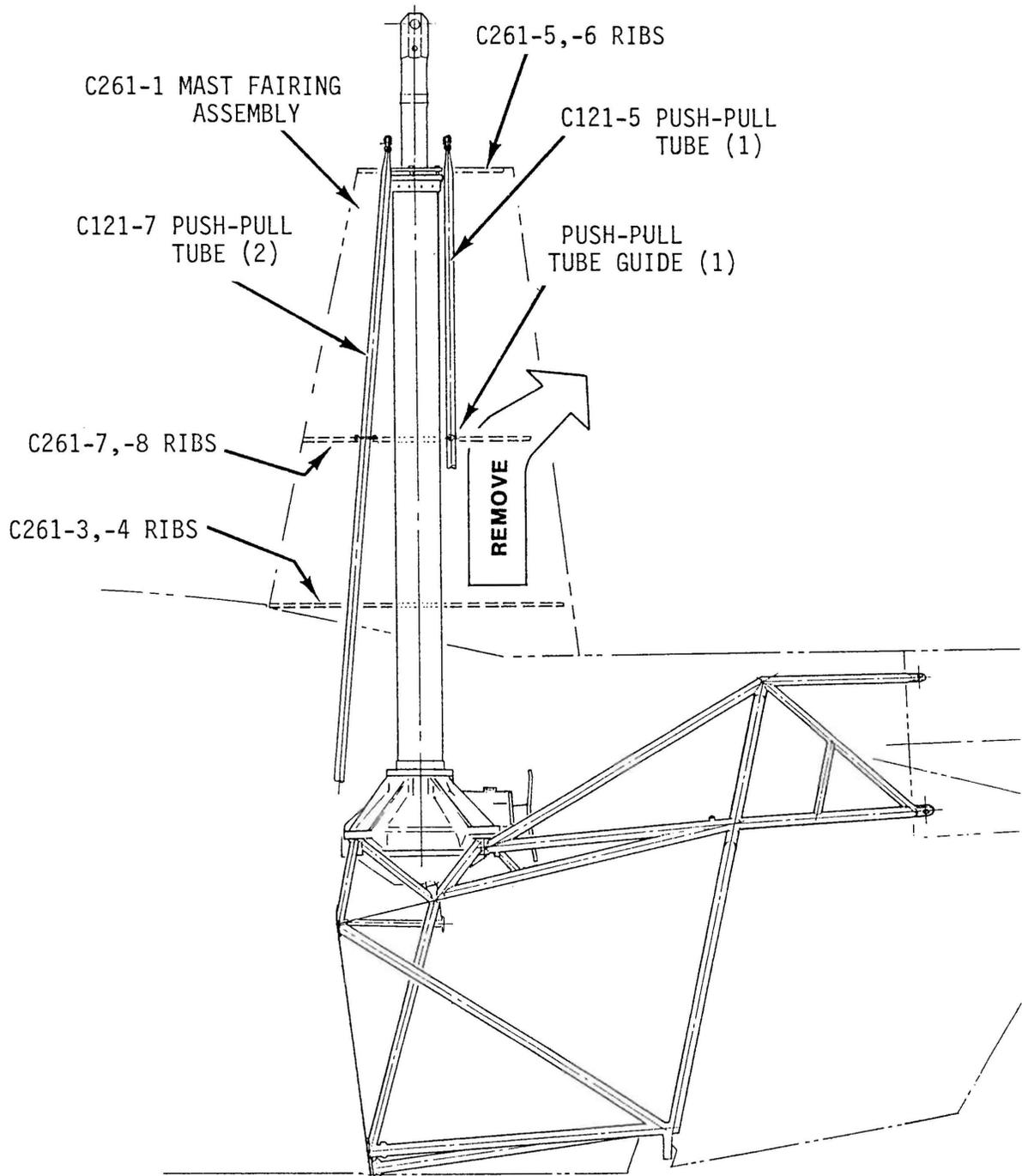


FIGURE 7-2 MAIN ROTOR GEARBOX REMOVAL

7.110 Main Rotor Gearbox Removal (cont'd)

- e) Remove the main and auxiliary fuel tanks per Section 12.110. Mark all electrical connections for reinstallation.
- f) Disconnect the jackshaft (C337-1) from the forward and aft push-pull tubes and the support struts.
- g) Remove the jackshaft support struts (see Section 8.300).
- h) Disconnect forward flex plate from gearbox yoke and note the washer stack up on each bolt.
- i) Disconnect the chip detector, Hall Effect sender, overtemp sender leads, and ground wire. Tag wires for reassembly.
- j) Remove the gearbox left and right cooling hoses and nozzle.
- k) Remove the four main rotor gearbox mounting bolts. Carefully lift the gearbox up to clear the forward push-pull tubes and remove (see Figure 7-2).
 - 1) It is recommended that the transmission be hoisted using the MT527-1 helicopter lifting fixture.

CAUTION

Leveling shims may be installed between the gearbox mounts and the frame mounting pads. These should remain attached or mark mounting pads with shim thickness for reinstallation.

- l) Remove the droop stops and disconnect the lower scissors at the mast. Slide the swashplate assembly off the slider tube.

7.120 Main Rotor Gearbox Installation**CAUTION**

Prior to operation of a new, overhauled or repaired gearbox, 6 ounces of A257-2 gear oil must be injected into the vent hole (see Figure 7-1) on the top aft side of the mast tube. Fill gearbox with oil to the level indicated on the sight glass decal. The gearbox must remain vertical during and after filling.

7.120 Main Rotor Gearbox Installation (cont'd)

1. Level MRGB mounting pads by installing original shims. If original shim thickness is unknown, level mounting pads per Section 7.130.
2. Verify two C796-3 spacers are the same thickness and install one C796-3 spacer on each aft mounting pad atop any shim(s).
3. Remove foreign objects and prepare area for gearbox installation. Assistance is desirable to help position gearbox. Position MRGB on mounting pads.
4. Install MRGB mounting hardware per Figure 7-2A. Orient A650 fitting tabs laterally per Figure 8-9, special torque per Section 1.330, and torque stripe per Figure 2-1.
5. Connect forward flex plate, using previously recorded shim washer positions. Standard torque fasteners per Section 1.320.
6. Install jackshaft support struts and jackshaft (see Section 8.300).
7. Connect main rotor gearbox cooling hoses and nozzle.
8. Install fuel tanks per Sections 12.130 and 12.140.
9. Connect electrical leads to fuel tanks and main rotor gearbox. Reinstall rotor brake upper pulley and cable and connect pulley to arm. Install rotor brake cable clamp to auxiliary tank channel. Position cable end fitting on outboard side of pulley on aux tank.
10. Install main rotor per Section 9.000.
11. Install mast fairing and connect pitot tube.
12. Check clutch sheave alignment per Section 7.230.
13. Check intermediate flex plate shimming per Section 7.330.
14. Install all cowling.

7.130 Leveling Main Rotor Gearbox

Level main rotor gearbox mounting pads laterally to landing gear aft cross tube and longitudinally at $3.8^\circ \pm 0.2^\circ$ angle to C046-6 tube (ref Figure 4-2). Use A796-1 shims on forward pads and C796-2 shims on aft pads, maximum 3 shims per pad (shims are 0.020 inch thick).

7.140 C908-1 Yoke Replacement

Yoke Removal

1. Remove clutch per section 7.210 or remove forward flex plate and let forward end of clutch shaft rest on firewall per Figure 7-8. Place a wood block between horizontal firewall and yoke flange to prevent yoke from rotating, or engage rotor brake.
2. Remove cotter pin, nut, and C141-10 washer from main rotor gearbox pinion shaft.
3. Slide yoke off gearbox pinion shaft.

Yoke Installation

1. Ensure yoke and gearbox splines are clean and undamaged. Install C908-1 yoke on main rotor gearbox pinion shaft. Install C141-10 washer and AN320-8 castellated nut.
2. Support yoke for torquing by placing a wood block between yoke flange and horizontal firewall. Special torque AN320-8 nut per Section 1.330 and install cotter pin. Remove block.

CAUTION

Check Hall Effect sender-to-yoke magnet gap per Section 7.141 before run-up or turning blades.

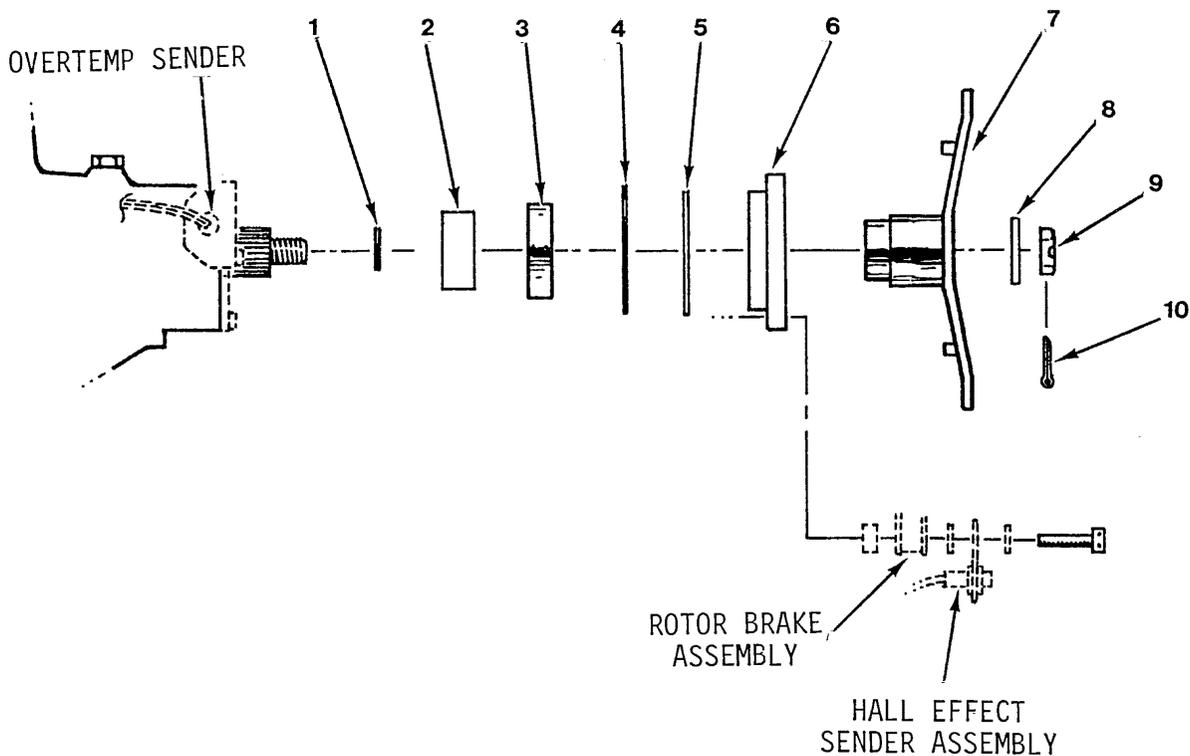
3. Install clutch assembly and/or forward flex plate per Section 7.220.

7.141 Setting Hall Effect Sender Gap

If Hall Effect Sender gap is not 0.030 ± 0.010 inch, loosen jam nuts on sender and adjust gap. Check gaps between both yoke magnets at both senders.

7.150 Replacement of Main Rotor Gearbox Pinion Seal (see Figure 7-2B)

- a. Disconnect A947-2 intermediate flex plate at tail rotor drive shaft. Mark flex plate and fasteners with a grease pencil for reinstallation.
- b. Disconnect C947-1 forward flex plate.
- c. Rest forward end of clutch on firewall. Remove the C908-1 yoke from pinion shaft per Section 7.140.
- d. Cut safety wire and remove rotor brake assembly per Section 7.610.
- e. Remove Hall Effect sender bracket and gearbox overtemp sender bracket.
- f. Carefully slide pinion bearing end cover off pinion shaft.



<u>NUMBER</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
1	C215-029	"O"-RING
2	C266-1	SPACER
3	C966-3	SEAL
4	C215-156	"O"-RING
5	C117	SHIM
6	C270-1	END COVER
7	C908-1	YOKE ASSEMBLY
8	C141-10	WASHER
9	AN320-8	NUT
10	MS25665-210	COTTER PIN

FIGURE 7-2B MAIN ROTOR GEARBOX PINION SEAL REPLACEMENT

7.150 Replacement of Main Rotor Gearbox Pinion Seal (cont'd)**CAUTION**

Do not remove shims under pinion bearing end cover as they control bearing preload and gear backlash.

- g. Press seal out of bearing end cover and press in new seal until it seats.

NOTE

Open face of seal must point toward gearbox.

- h. Install bearing end cover over pinion shaft. Place Hall Effect sender bracket and overtemp sender bracket on cover and install rotor brake assembly per Section 7.620.
- i. Torque screws per Section 1.330 and safety with 0.032 inch diameter safety wire.
- j. Check Hall Effect sender gap per Section 7.141.

7.155 MRGB Sump O-Ring Replacement Procedure

- a. Remove MRGB per Section 7.110.
- b. Check and record gear backlash at and tangential to a gear tooth, accessible via sight gage or filler plug hole.
- c. Carefully note and record position of each fastener, washer and shim stack-up at all C263-1 sump-to-C264-1 housing attach points (an equal amount of shims is installed between sump and housing at each attach point). Also note location of ground wires and C747-1 baffle attach points. Remove, identify and retain fasteners, washers and shims.
- d. Remove sump and o-ring.
- e. Prelubricate new C215-279 o-ring with A257-2 oil and install on sump. Ensure o-ring is not twisted in sump groove.
- f. Carefully assemble sump, baffle and ground wires to housing and secure finger-tight with fasteners, washers and shims installed in exactly the same positions recorded in step c.
- g. Prior to torquing fasteners, position those shims used on NAS1352 series (internal-wrenching) screws against C264-1 housing to prevent shims from interfering with bolt threads and deforming.
- h. Torque bolts per Section 1.320. Torque NAS1352 screws per Section 1.330 and safety wire per MS33540.

7.155 MRGB Sump O-Ring Replacement Procedure (continued)

- i) Check gear backlash exactly as performed in step b. Backlash should be within 0.001 inch of value recorded in step b.
- j) Install MRGB per Section 7.120.

7.160 Main Rotor Gearbox Overtemp Inspection

1. Perform the following if MR TEMP warning light illuminates, and gearbox Telatemp indicates abnormally high operating temperature:
 - a. Inspect gearbox cooling duct for obstructions and conditions. Clear obstructions or replace duct as required.
 - b. Remove chip detector and inspect for chips. Return gearbox to RHC if chips are found.
 - c. Drain gearbox oil and remove sight gage and filler plug. Observe gear tooth surfaces thru filler plug and sight gage holes while rotating gearbox pinion and inspect for damage. Return gearbox to RHC if damage is detected or if gearbox does not rotate smoothly. If no damage is noted, refill gearbox.
 - d. Replace Telatemp. Ensure old Telatemp adhesive is removed and new Telatemp makes good contact with gearbox.
 - e. If gearbox overtemp indications continue, return gearbox to RHC.
2. If MR TEMP warning light illuminates but Telatemp indicates normal operating temperature, replace gearbox overtemp sender and perform steps 1a, 1b, and 1e.
3. If Telatemp indicates 240°F/116°C but MR TEMP warning light does not illuminate, test MR TEMP warning circuit and perform steps 1a, 1b, 1d, and 1e.

NOTE

Light illuminates at $240 \pm 5^\circ\text{F}$.

7.170 Main Rotor Gearbox Chip Light Indicator

If MR CHIP light illuminates:

1. Drain and flush gearbox per Section 1.120 except strain oil (a paint filter works well) while draining and examine any particles found in oil or on chip detector.
2. Particles larger than 0.12 inch long or 0.02 inch wide are cause for concern and should be identified as ferrous or non-ferrous with a magnet. If particles are ferrous return main rotor gearbox to RHC for repair along with particles. If particles are non-ferrous, drain and flush gearbox per Section 1.120.
3. If MR CHIP illuminates again within next 100 hours time-in-service a gearbox failure may be imminent. Return gearbox to RHC for repair.

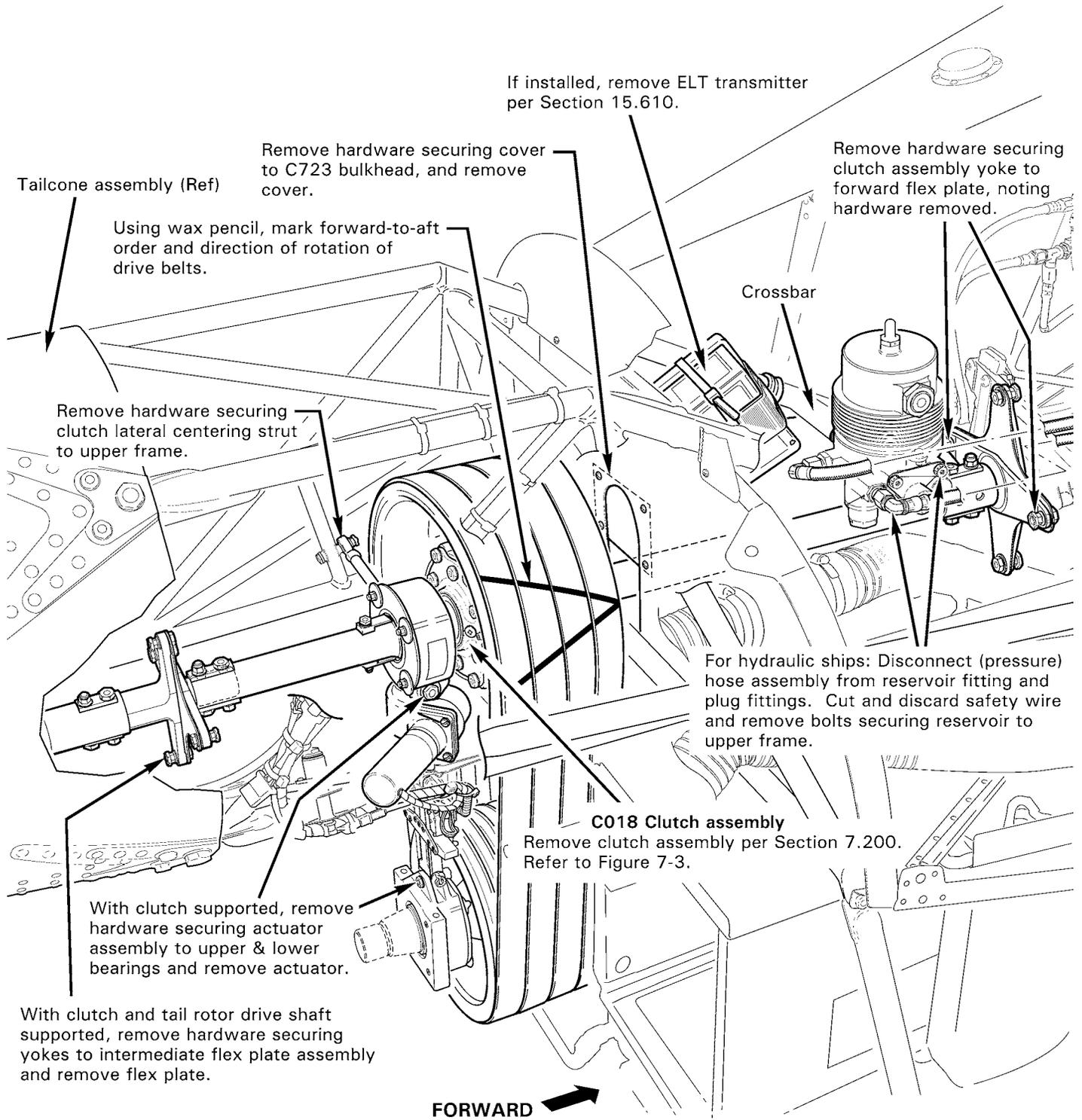


FIGURE 7-2C CLUTCH ASSEMBLY REMOVAL
(Shown with fanwheel and scroll removed)

7.200 Clutch Assembly

A. Removal

1. Turn BATTERY switch ON and verify actuator is fully disengaged. Turn BATTERY switch OFF.
2. Remove C706-1 tailcone fairing assembly.
3. Remove fanwheel and scroll per Section 6.210.
4. Refer to Figure 7-2C. Remove hardware securing C018 clutch assembly and D224 tail rotor drive shaft assembly yokes to A947-2 (intermediate) flex plate assembly, noting locations of hardware removed. Remove plate assembly. Support drive shaft using a foam block, or equivalent, while drive shaft is disconnected from drive train.
5. Remove hardware securing clutch assembly yoke to C947-1 (forward) flex plate assembly, noting locations of hardware removed. Protect forward flex plate from damage. Support clutch assembly by installing ty-raps around forward and aft yokes, and securing ty-raps to upper frame.
6. For hydraulic ships: Disconnect D205-1 or -11 (pressure) hose assembly from hydraulic reservoir elbow or union, and plug fittings. Cut and discard safety wire, and remove bolts securing reservoir to upper frame. Support reservoir.
7. If installed, remove ELT transmitter per Section 15.610.
8. Remove hardware securing C723-6 cover to C723 bulkhead, and remove cover.
9. Remove hardware securing clutch lateral centering strut to upper frame.
10. Cut and discard ty-raps as required and disconnect actuator wiring from airframe harness at connectors. Remove hardware securing actuator to upper & lower bearings and remove actuator.
11. Remove and discard palnuts securing C907 (forward) yoke and C195 (aft) yoke to clutch shaft. (Palnuts in these locations are no longer required.) Tape clutch shaft, yokes, and yoke hardware as required to protect component from damage during removal.
12. Using wax pencil, mark forward-to-aft order and direction of rotation of drive belts. Support clutch assembly, cut and discard ty-raps securing clutch to upper frame, and remove drive belts.
13. Refer to Figure 7-3. Have a second person support the forward end of the clutch shaft, and the hydraulic reservoir, if installed. Move clutch aft, until forward yoke is aft of upper frame crossbar, then move clutch forward (at an angle) over top of crossbar. Move clutch aft (at an angle), until sheave is clear of the tailcone. Carefully maneuver forward yoke aft through C723 bulkhead.
14. If sending clutch assembly to RHC for repair, remove clutch lateral centering strut, and clutch forward and aft yokes per Sections 7.260 and 7.270.

B. Installation

1. On C018 clutch assembly, install clutch lateral centering strut, and C907 (forward) yoke and C195 (aft) yoke per Sections 7.260 and 7.270, if removed. (Palnuts securing yokes to clutch shaft are no longer required.)

7.200 Clutch Assembly (continued)**B. Installation (continued)**

2. Tape clutch shaft, yokes, and yoke hardware as required to protect component from damage during installation. If not previously accomplished, protect forward flex plate from damage.
3. Refer to Figures 7-2C and 7-3. Have a second person support the hydraulic reservoir, if installed, and prepared to support the forward end of the clutch shaft. Carefully maneuver clutch forward yoke forward through C723 bulkhead. Move clutch forward (at an angle), over top of upper frame crossbar, until sheave and aft yoke are clear of the tailcone. Move sheave and aft yoke up then aft, until forward yoke is aft of crossbar. Move clutch forward into mounting position.
4. Refer to Figure 7-2C. Observe markings and install drive belts in proper forward-to-aft order and direction of rotation (as removed). Support clutch assembly by installing ty-raps around forward and aft yokes, and securing ty-raps to upper frame.
5. Install actuator per Section 7.520, steps a thru d.
6. Install hardware securing clutch assembly yoke to C947-1 (forward) flex plate assembly, using hardware removed. Standard torque nuts and palnuts per Section 1.320, and torque stripe per Figure 2-1.
7. Install hardware securing clutch lateral centering strut to upper frame. Standard torque nut and palnut per Section 1.320, and torque stripe per Figure 2-1. Cut and discard ty-raps securing clutch to upper frame.
8. Install C723-6 cover on C723 bulkhead. Verify security.
9. If removed, install ELT transmitter per Section 15.610.
10. For hydraulic ships: Install bolts securing hydraulic reservoir to upper frame and special torque bolts per Section 1.330. Install 0.032-inch diameter lockwire and safety bolts together in pairs.
11. For hydraulic ships: Torque check hydraulic reservoir union, or elbow jam nut and palnut, per Section 1.330. Remove plugs and connect D205-1 or -11 (pressure) hose assembly to reservoir elbow or union. Special torque hose B-nut per Section 1.330 and torque stripe per Figure 2-1.
12. Perform fanwheel and scroll installation per Section 6.220, steps 1 thru 11.
13. Connect actuator wiring to airframe harness at connectors. Install ty-raps as required to secure wire harness to frame. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
14. Perform clutch sheave alignment per Section 7.230.
15. Inspect A947-2 (intermediate) flex plate assembly per Section 2.410. Perform intermediate flex plate installation and shimming per Section 7.330.
16. Install C706-1 tailcone fairing assembly.

NOTE

During initial fanwheel balance, perform "Starting Engine and Run-up" per Pilot's Operating Handbook Section 4, with hydraulics off and cyclic neutralized, to purge air from system.

17. Balance fanwheel per Section 6.240.

7.210 Clutch Assembly Lubricant Inspection and Servicing

NOTE

To retrofit older clutch assemblies with C168-5 retainers, order KI-202 kit. Each C168-5 retainer has a B289-3 screw; screws must be installed on opposite sides of the clutch shaft (when one screw is on top, opposite screw must be on bottom). With C168-5 retainers installed, clutch lubricant inspection and servicing may be performed without clutch removal.

NOTE

Sprag clutch housing capacity is approximately 4 fl oz (118 ml).

A. Clutch Assemblies with C168-5 Retainers

WARNING

Avoid contaminating drive belts and sheaves with lubricant. Clean contaminated surfaces with mild soap and water solution, followed by a warm water rinse. Place a clean, absorbent rag beneath MT147-2 fittings, when installed, to catch any drips.

1. Remove C706-1 tailcone fairing assembly. Remove hardware securing C723-6 cover to C723 bulkhead and remove cover.
2. Rotate clutch shaft until bolts securing yokes to shaft are vertical. Engage rotor brake.
3. Rotate sheave until forward retainer B289-3 screw is on top. Remove screw and install clean MT147-2 fitting. Attach drain hose.
4. Rotate sheave until fitting and attached drain hose are on bottom. Route drain hose into a suitable, clean container. Remove aft retainer B289-3 screw and allow lubricant to drain into container.
5. Install second clean MT147-2 fitting in aft retainer and connect a clean supply of A257-4 lubricant to fitting. Flush sprag clutch housing until exiting lubricant is obviously red. Disconnect lubricant supply and allow lubricant to drain completely into container.
6. Strain all lubricant from container through a 180-200 micron paint filter/strainer. Fluid may be dark, and may sparkle with very fine metallic debris; this is normal. If metallic debris is trapped in the filter/strainer, remove clutch assembly and return it to RHC, or an R44 Service Center authorized to overhaul clutch assemblies, for disassembly and inspection.
7. If metallic debris is not found in the filter, attach drain hose to (top) aft retainer fitting. Route drain hose into a suitable container. Connect a clean supply of A257-4 lubricant to (bottom) forward retainer fitting. Fill sprag clutch housing thru bottom fitting until no air bubbles are visible in drain hose. Shut-off fluid flow.

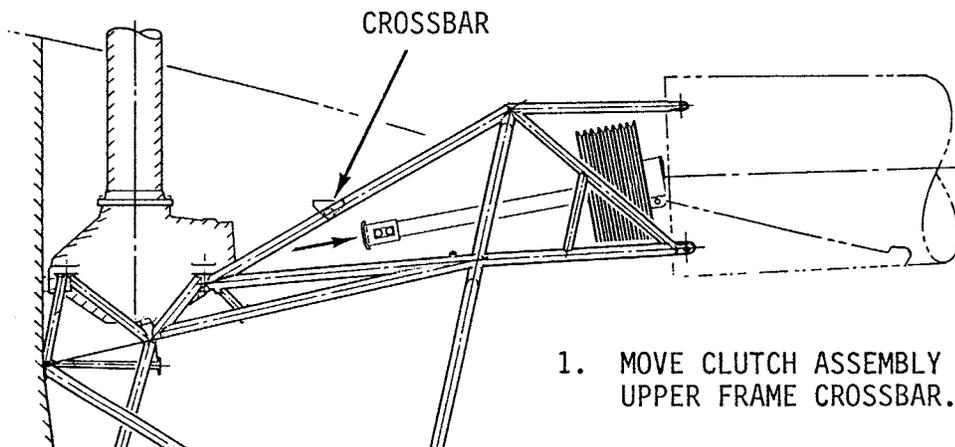
7.210 Clutch Assembly Lubricant Inspection and Servicing (continued)**A. Clutch Assemblies with C168-5 Retainers (continued)**

8. Remove (top) aft retainer fitting and install screw. Rotate sheave until forward retainer fitting is on top. Remove fitting and verify lubricant level contacts threads; add lubricant as required. Install forward screw.
9. Install C723-6 cover on C723 bulkhead. Install C706-1 tailcone fairing assembly.

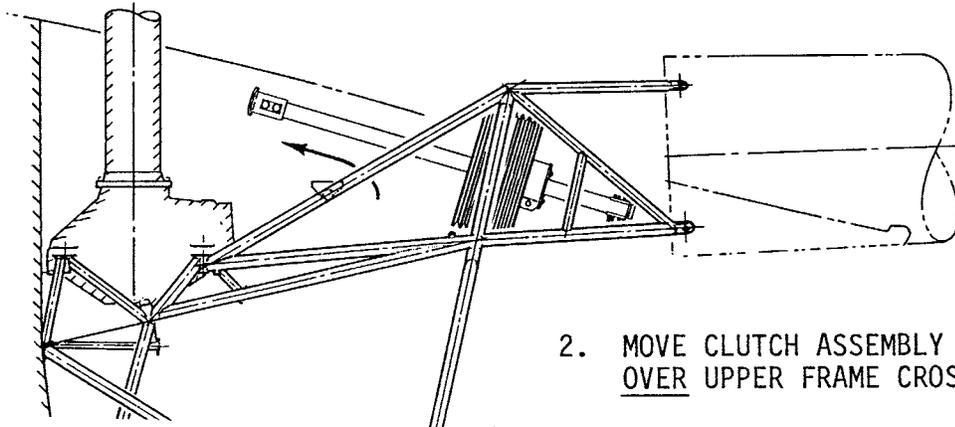
B. Clutch Assemblies with Retainers without B289-3 Screws

1. Perform clutch assembly (aft) seal replacement per Section 7.213.

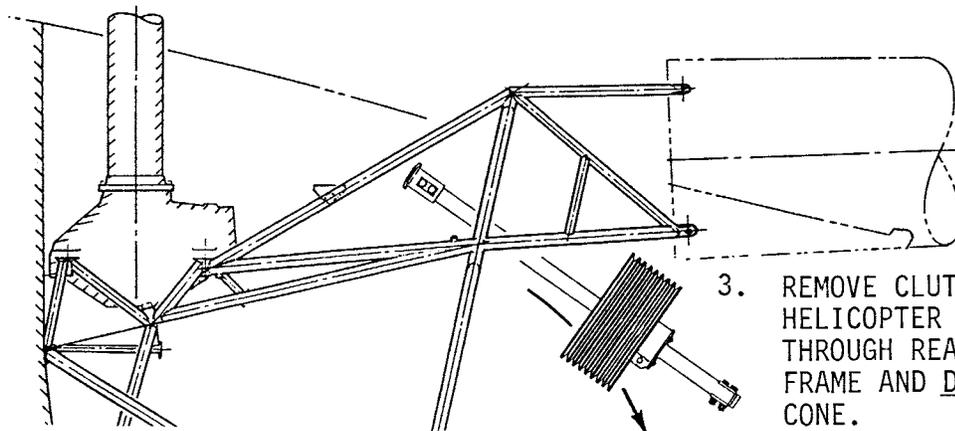
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1. MOVE CLUTCH ASSEMBLY AFT AND UNDER UPPER FRAME CROSSBAR.



2. MOVE CLUTCH ASSEMBLY FORWARD UP AND OVER UPPER FRAME CROSSBAR.



3. REMOVE CLUTCH ASSEMBLY FROM HELICOPTER BY LOWERING AFT THROUGH REAR SECTION OF UPPER FRAME AND DOWN BELOW TAIL CONE.

FIGURE 7-3 CLUTCH REMOVAL

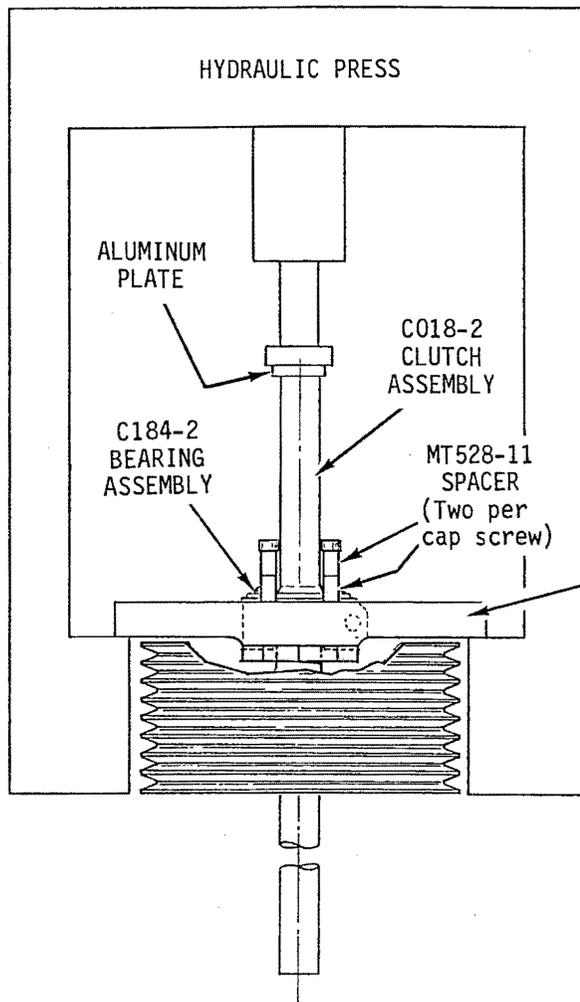


FIGURE 7-3A

REMOVAL OF C184-2 BEARING ASSEMBLY USING HYDRAULIC PRESS AND MT528-1 REMOVAL TOOLS.

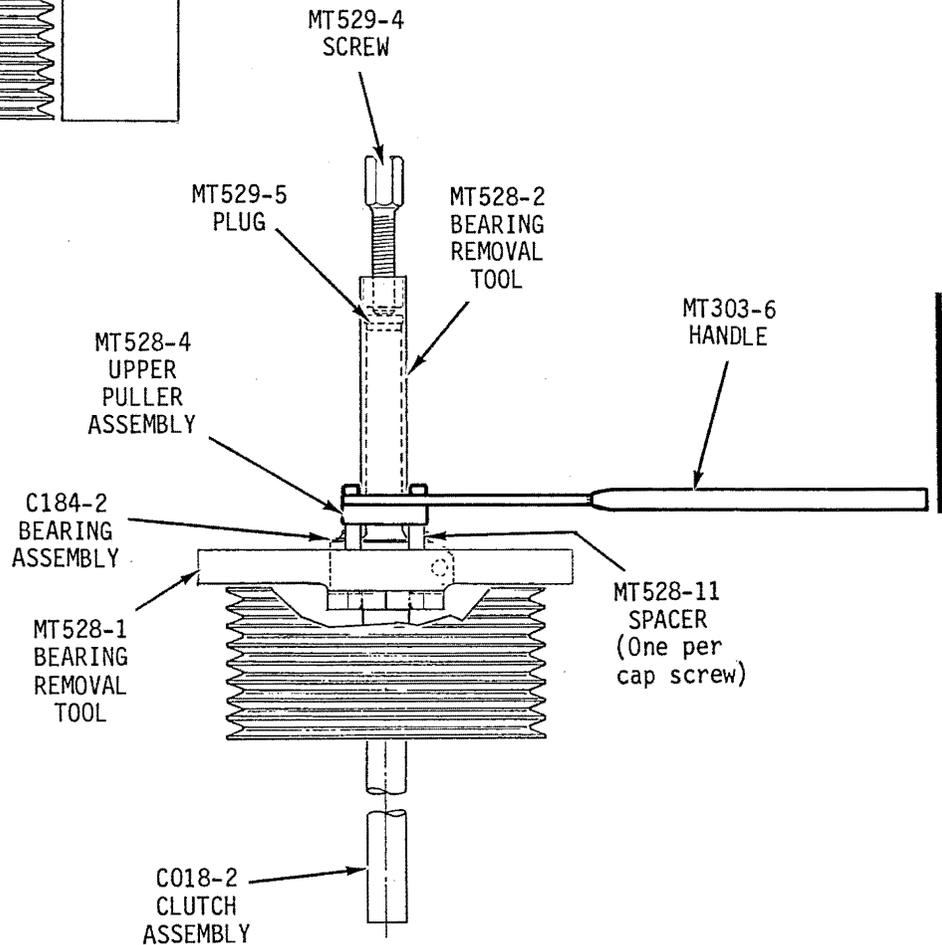


FIGURE 7-3B

REMOVAL OF C184-2 BEARING ASSEMBLY WHEN HYDRAULIC PRESS IS NOT AVAILABLE; USE MT528-1 AND MT528-2 REMOVAL TOOLS.

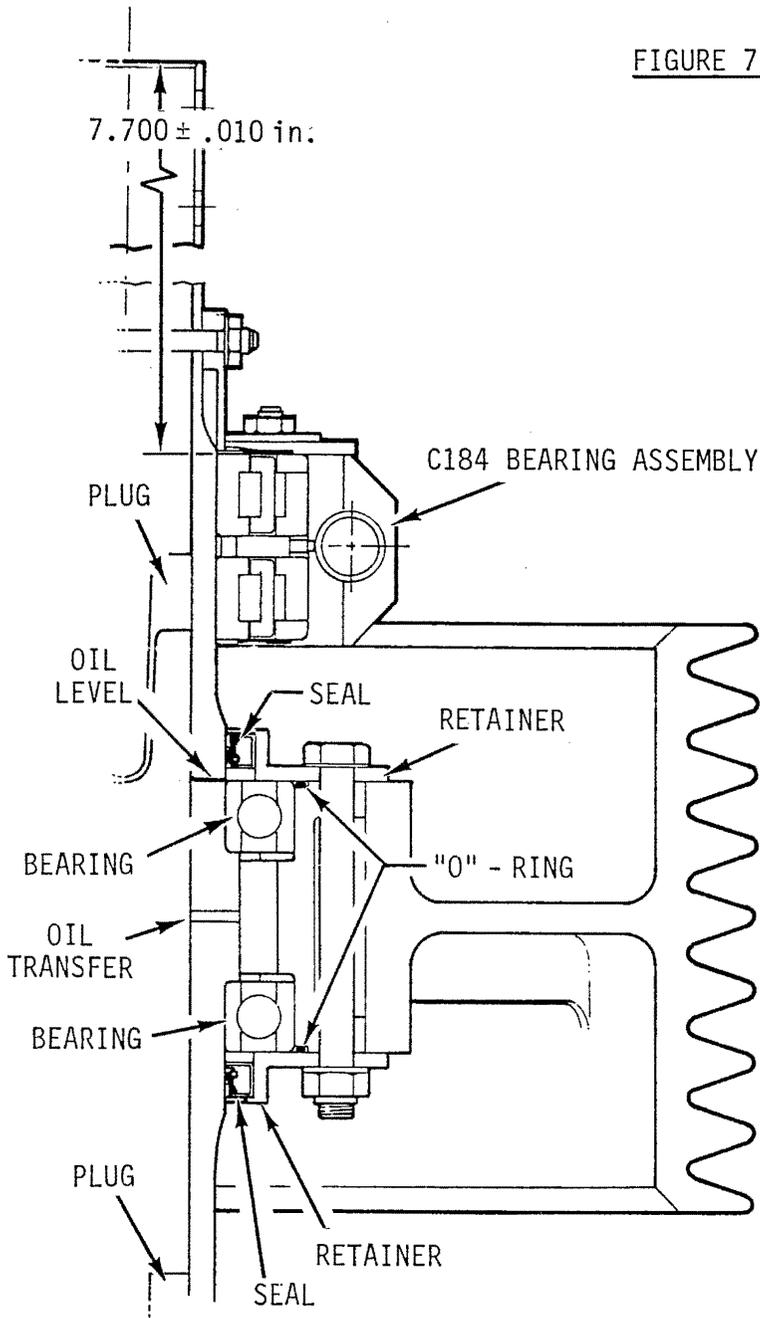


FIGURE 7-3C

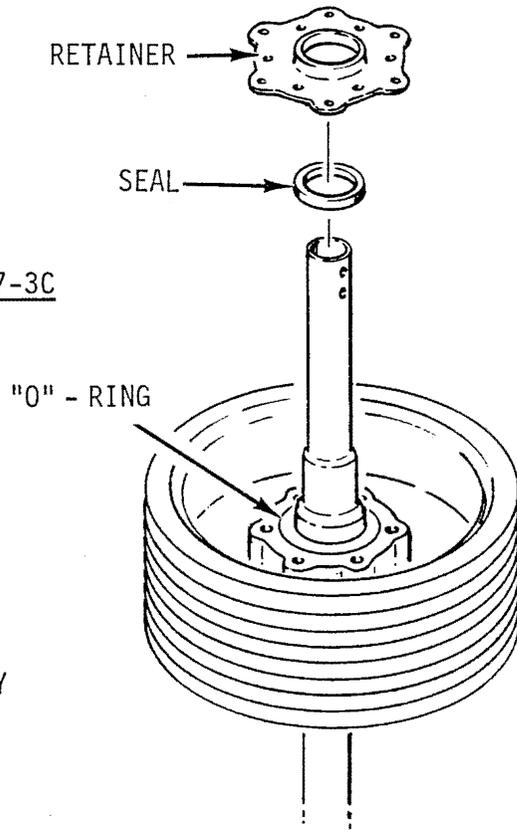


FIGURE 7-3D

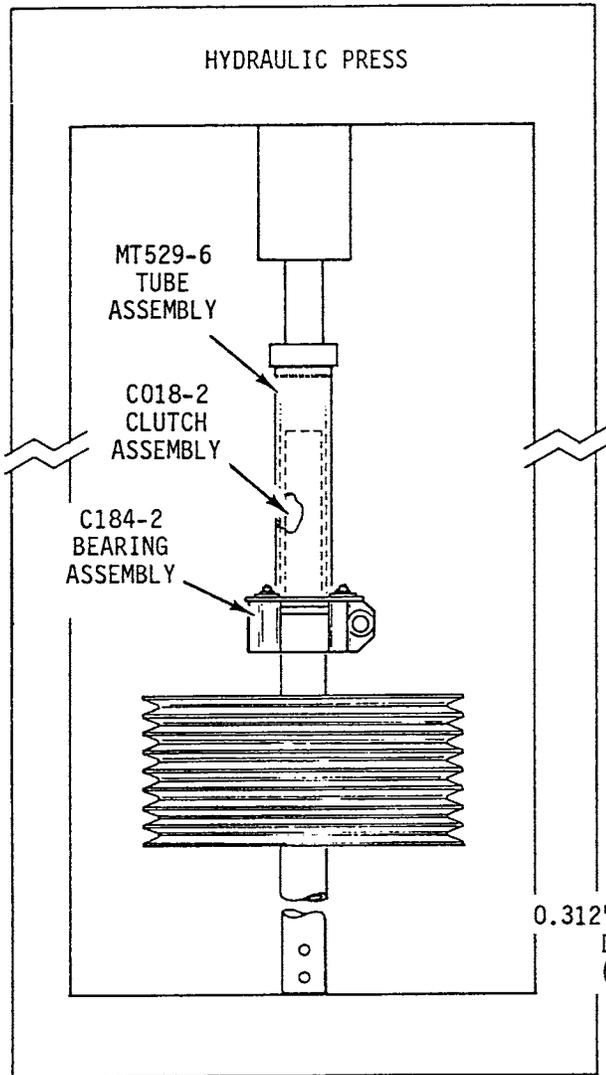


FIGURE 7-3G

INSTALLATION OF C184-2 BEARING WHEN HYDRAULIC PRESS IS UNAVAILABLE; USE MT528-1 AND MT528-2 INSTALLATION TOOLS.

FIGURE 7-3E

INSTALLATION OF C184-2 BEARING USING HYDRAULIC PRESS AND MT528-1 INSTALLATION TOOLS.

WARNING
DO NOT PRESS ACROSS SHEAVE OR BEARINGS WILL BE DAMAGED.

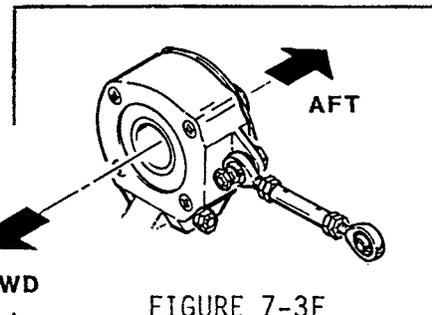
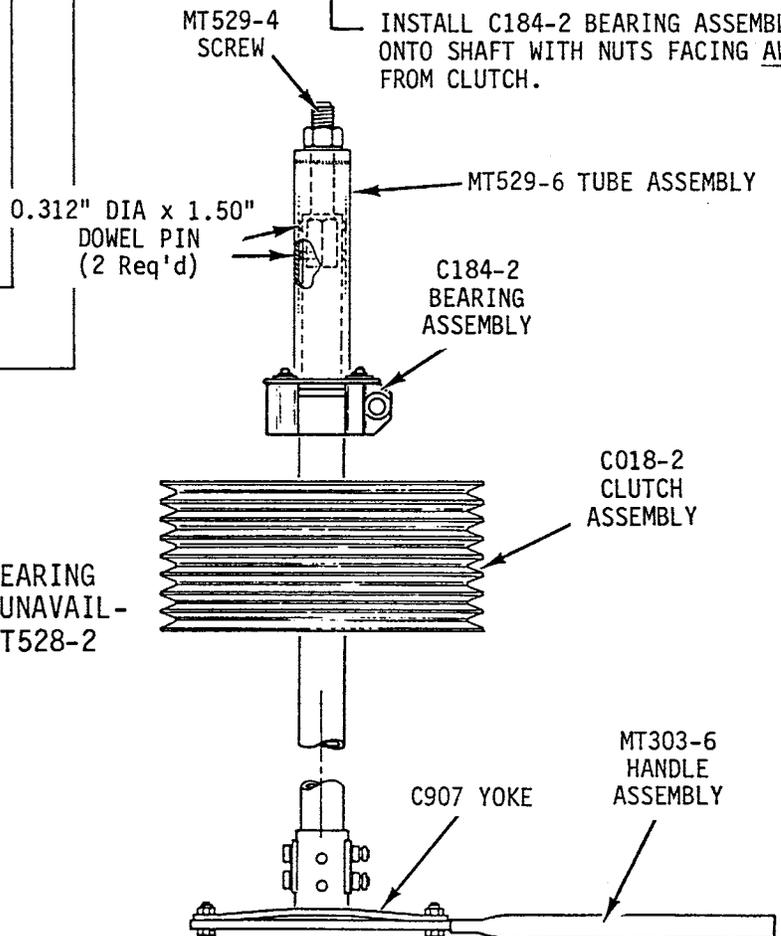


FIGURE 7-3F

INSTALL C184-2 BEARING ASSEMBLY ONTO SHAFT WITH NUTS FACING AWAY FROM CLUTCH.



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7.211 C184 Bearing Assembly Removal

- a. Remove clutch assembly per Section 7.210.
- b. Remove C195 yoke per Section 7.270.
- c. Remove C191-5 stops.
- d. Remove bearing assembly as follows:

Using a hydraulic press:

1. Install MT528-1 bearing removal tool per Figure 7-3A.
2. Support MT528-1 bearing removal tool on hydraulic press per Figure 7-3A.
3. Install aluminum plate between clutch shaft and press ram per Figure 7-3A to protect end of shaft.
4. Press until C184-2 bearing is removed from the shaft.

CAUTION

Hold clutch assembly to prevent clutch from falling to the floor.

Without a hydraulic press:

1. Install MT528-1 and MT528-2 bearing removal tools per Figure 7-3B. Use only one MT528-11 spacer at each cap screw. Ensure MT529-4 screw threads are coated with anti-seize.
2. Remove bearing assembly by holding handle and tightening screw.

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7.212 C184 Bearing Assembly Installation

1. Remove loose paint and clean mating area on clutch shaft. If reusing a bearing assembly, inspect condition of seals and inner races.
2. Heat C184 bearing assembly to 200° F maximum (approximately 5 minutes in 200°F oven). Monitor bearing temperature with a pyrometer or a telatemp.
3. Coat bearing shoulder on clutch shaft with zinc-chromate or epoxy primer. While primer is still wet, install bearing assembly on clutch shaft:

NOTE

Do NOT install bearing with B270-10 adhesive.

NOTE

Be sure to put side of C184 bearing assembly with nuts facing away from clutch (see Figure 7-3F).

- a. Using a hydraulic press: Support clutch assembly at forward end of clutch shaft. Place MT529-6 tube assembly on clutch shaft per Figure 7-3E. Center tube assembly over inner race of bearing assembly. Press bearing assembly until MT529-6 tube assembly bottoms on end of clutch shaft (bearing assembly should be at dimension shown in Figure 7-3D).

CAUTION

Do NOT support clutch assembly at sheave or internal bearings will be damaged.

- b. Without hydraulic press: Use MT529-6 tube assembly (included in MT528-1 tool set) and MT528-2 tool set as shown in Figure 7-3G. Center tube assembly over inner race of C184 bearing assembly. Tighten nut onto MT529-4 screw (coat nut face and screw with anti-seize) until MT529-6 tube assembly bottoms on end of clutch shaft (bearing assembly should be at dimension shown in Figure 7-3D).
4. Remove bearing press tooling.
 5. Check bearing for smooth rotation.
 6. Seal bearing inner race-to-shaft juncture with primer to minimize corrosion.
 7. Torque stripe inner race of bearing to clutch shaft two places, 180° apart.
 8. Install C191-5 stops. Torque bolts per Section 1.130 and torque stripe.
 9. Install new telatemp on C184 bearing housing if original was altered by heating.
 10. Install clutch assembly C195 aft yoke per Section 7.270.

7.213 Clutch Assembly Seals Replacement

NOTE

To retrofit older clutch assemblies with C168-5 retainers, order KI-202 kit.

1. Remove clutch assembly per Section 7.200.
2. a. If replacing aft seal, remove C184 bearing per Section 7.211.
b. If replacing forward seal, remove C907 yoke per Section 7.260. If C168 retainers lack B289-3 screws, also remove C184 bearing per Section 7.211 due to lubricant filling requirements.
3. Remove loose paint from clutch shaft, then thoroughly clean entire clutch assembly.

NOTE

Sprag clutch housing capacity is approximately 4 fl oz (118 ml). Retain drained lubricant in a suitable, clean container.

CAUTION

Some clutch assemblies have roller bearings and require two bearing-preload shims under each retainer; do NOT lose shims when removing retainer(s).

4. Position clutch assembly horizontally with upper sheave resting in a clean, non-marking container. Remove bolts and associated hardware and both NAS1352 screws securing affected seal retainer. Remove retainer and keep both shims (used with roller bearings only) in place. Discard o-ring. Rotate clutch shaft until yoke attachment holes are vertical and allow lubricant to drain into container (shaft oil transfer holes are parallel with yoke attachment holes).
5. Flush cavity containing bearings and sprag clutch with clean A257-4 lubricant until lubricant draining into container is obviously red.
6. Strain all lubricant from container through a 180-200 micron paint filter/strainer. Lubricant may be dark, and may sparkle with very fine metallic debris; this is normal. However, if metallic debris is trapped in the filter, submit clutch assembly to RHC, or an R44 Service Center authorized to overhaul clutch assemblies, for repair.
7. Press old seal out of retainer and discard seal. Clean and dry retainer bore.
8. Press new seal, with flat face outboard, into retainer until it seats against retainer lip.

NOTE

If C168-5 retainers are installed, B289-3 screws must be on opposite sides of the clutch shaft (when one screw is on top, opposite screw must be on bottom).

7.213 Clutch Assembly Seals Replacement (cont'd)

9. If replacing forward seal, position clutch assembly vertically with long end of shaft pointing up. Lightly lubricate new o-ring and seal inner lip with A257-4 lubricant, install o-ring in clutch housing forward groove, and slide retainer over clutch shaft forward end. If installed, ensure both shims are properly positioned against roller bearing outer race. Align retainer and housing screw holes and install NAS1352 screws.
10. Position clutch assembly vertically with short end of shaft pointing up.
11.
 - a. If retainers lack B289-3 screws, remove aft retainer and keep both shims (used with roller bearings only) in place. Discard o-ring. Lightly lubricate new o-ring with A257-4 lubricant and install in clutch housing aft groove.
 - b. If retainers have B289-3 screws and aft retainer has not been removed, remove B289-3 screw from aft retainer.
12. With clutch assembly remaining vertical, fill housing with A257-4 lubricant until lubricant level is flush with top of bearing races per Figure 7-3D.
13.
 - a. If retainers lack B289-3 screws, lightly lubricate aft retainer seal inner lip with A257-4 lubricant and slide retainer over clutch shaft aft end. If installed, ensure both shims are properly positioned against roller bearing outer race. Align retainer and housing screw holes and install NAS1352 screws.
 - b. If retainers have B289-3 screws, install B289-3 screw in aft retainer.
14. Position clutch assembly horizontally and rotate clutch shaft until yoke attachment holes are vertical. Allow lubricant to transfer internally for two minutes.
15. Repeat steps 10 thru 14 until no more lubricant can be added.
16. Install bolts and associated hardware securing C168 retainers to sheave. Using a criss-cross pattern, standard torque bolts per Section 1.320 and torque stripe per Figure 2-1.
17. Tighten four cap screws securing retainers to sheave and torque stripe per Figure 2-1.
18. Install C184 bearing assembly per Section 7.212, as required. Install C907 yoke per Section 7.260, as required.
19. Install clutch assembly per Section 7.200, as required.

7.220 (Reserved)

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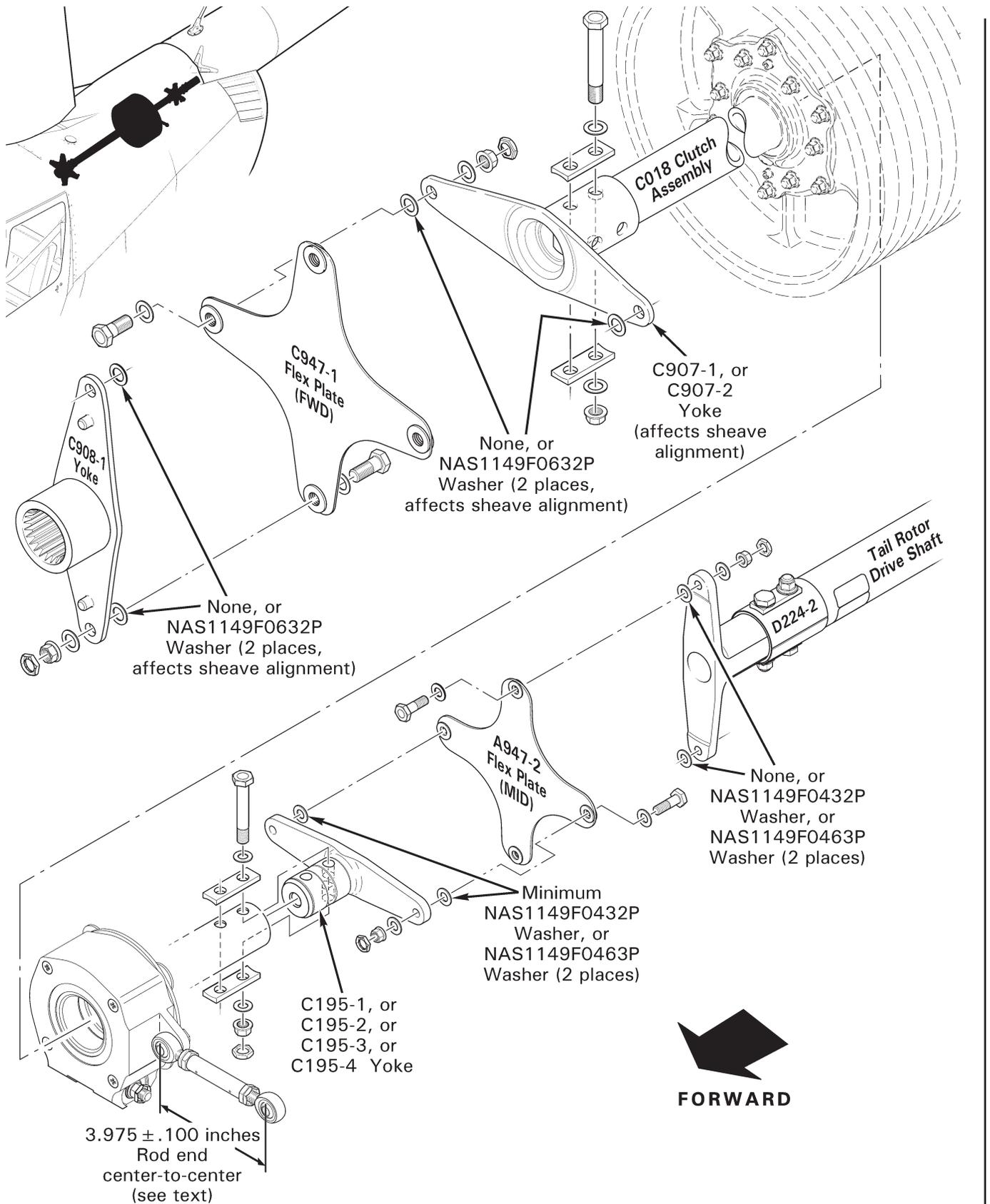


FIGURE 7-4 FORWARD AND INTERMEDIATE FLEX PLATE INSTALLATION

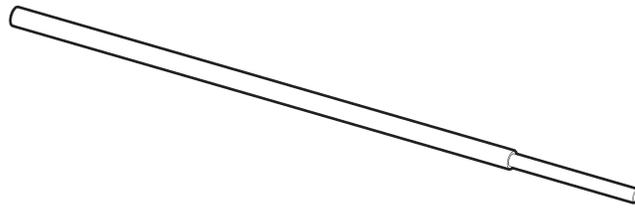


FIGURE 7-5 MT331-4 SHEAVE ALIGNMENT BAR

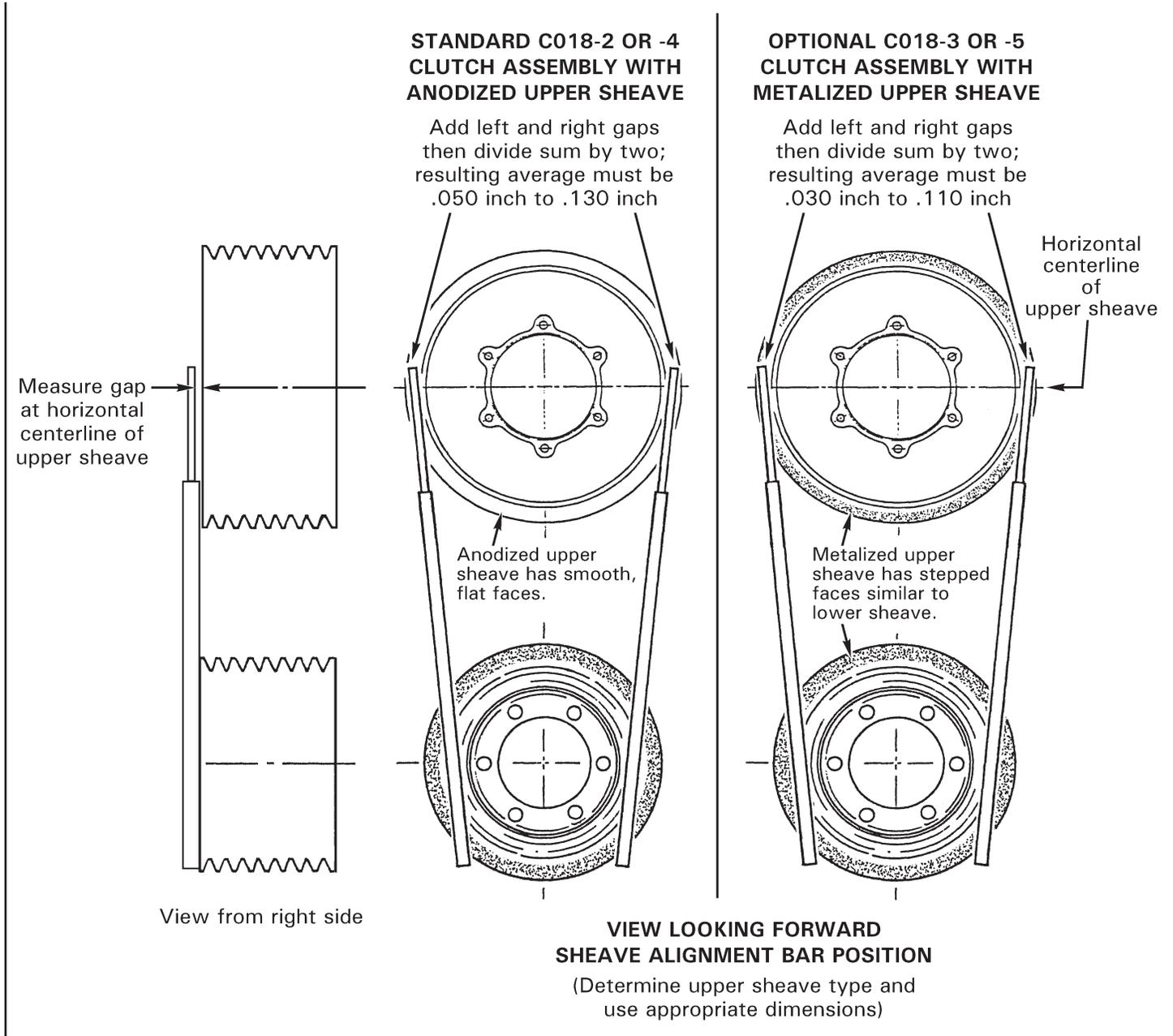


FIGURE 7-6 SHEAVE ALIGNMENT DIMENSIONS

7.230 Clutch Sheave Alignment

Checking sheave alignment:

1. Engage clutch.
2. Adjust length of lateral centering strut, if required, to center upper sheave in steel tube frame. If length was adjusted, standard torque attach bolts, jam nuts, and palnuts per § 23-32 and torque stripe per Figure 2-1.
3. Hold MT331-4 Sheave Alignment Bar against aft face of lower sheave extending bar upward to horizontal center line of upper sheave.
4. Measure left and right gaps per Figure 7-6. Average of both gaps must be within noted limits.

If average gap exceeds maximum limit then upper sheave is too far forward and must be moved aft by:

- Shimming forward flex plate, and/or
- Adjusting C907 yoke length.

Shimming is accomplished by installing a maximum of one NAS1149F0632P washer between C947-1 flex plate and both arms of C907 and/or C908 yoke; NAS1149F0632P washers installed on either yoke will decrease gap an amount equal to washer thickness. Each C907 yoke has two sets of mounting holes which change the effective yoke length by 0.120 inch. The C907-2 yoke is either 0.120 inch or 0.240 inch longer than the long position of the C907-1 yoke. Gap will decrease by 0.120 inch with each 0.120 inch increase in C907 yoke length.

If average gap is smaller than minimum limit then upper sheave is too far aft and must be moved forward by:

- Removing shims (if installed) at forward flex plate, and/or
- Adjusting C907 yoke length.

Removing NAS1149F0632P washers from between C947-1 flex plate and both arms of C907 and/or C908 yoke will increase gap an amount equal to washer thickness. Each C907 yoke has two sets of mounting holes which change the effective yoke length by 0.120 inch. The C907-1 yoke is either 0.120 inch or 0.240 inch shorter than the short position of the C907-2 yoke. Gap will increase by 0.120 inch with each 0.120 inch decrease in C907 yoke length.

5. Check intermediate flex plate shimming per § 7.330 if shim washers were added or removed at C947-1 flex plate or if C907 yoke length was altered.
6. Rotate drive train by hand. Verify operating clearance with belt tension actuator disengaged, and with belt tension actuator engaged.

7.240 Clutch Shaft Angle

No check of the clutch shaft angle is required.

7.250 [Reserved.]

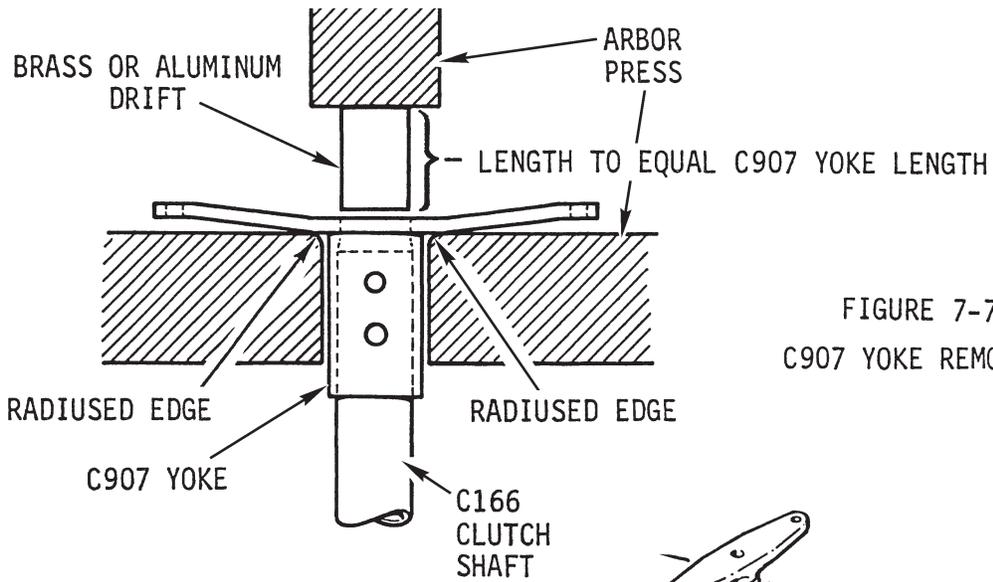
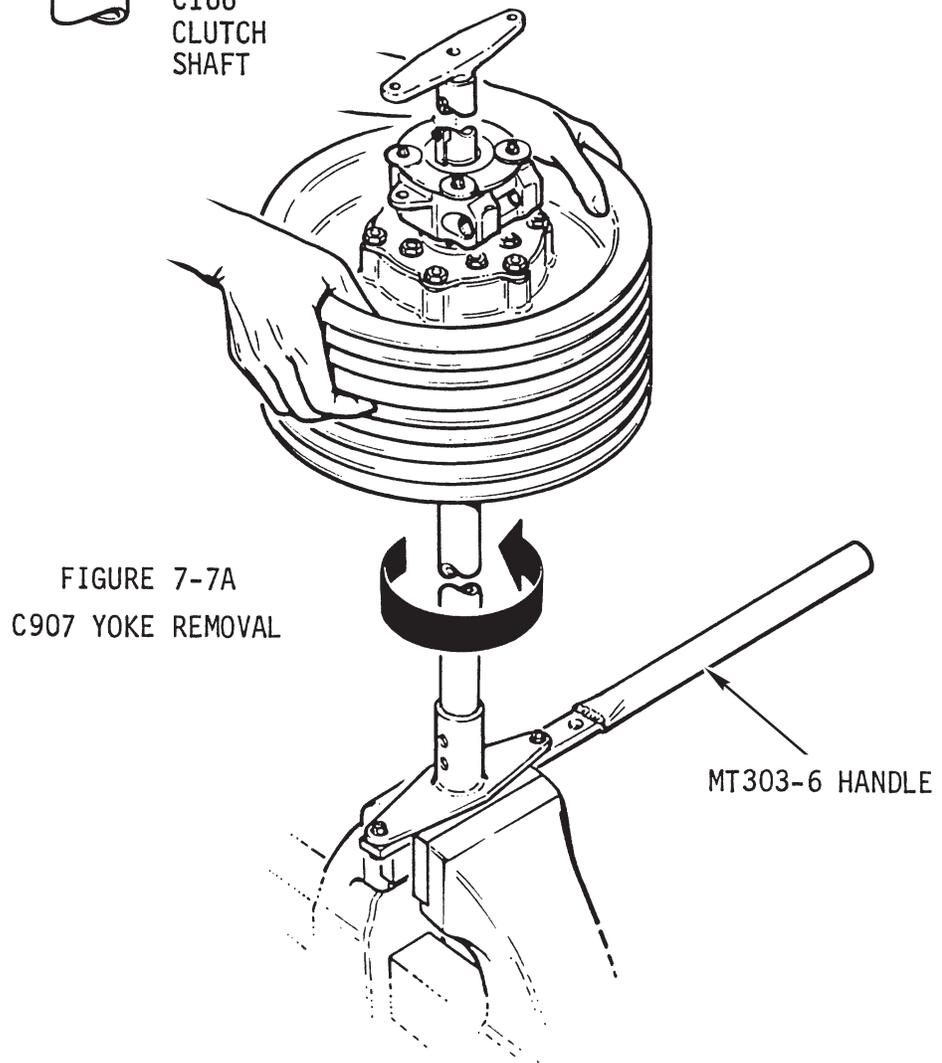


FIGURE 7-7
C907 YOKE REMOVAL



7.260 C907 Yoke Removal and Installation

A. Removal

1. Remove the clutch assembly per § 7.210.
2. Remove bolts and clamping blocks securing C907 yoke to clutch shaft. Mark which set of yoke attachment holes are used.
3. Remove C907 yoke:
 - a. (Preferred method). If press is available, position clutch assembly in press per Figure 7-7. Ensure brass or aluminum drift fits against outer rim of clutch shaft and not against inner spacer. Press clutch shaft out of yoke.

CAUTION

Ensure clutch assembly does not fall when yoke is removed.

- b. If a press is not available, tightly secure C907 yoke arms to MT303-6 handle using NAS6606 bolts. Refer to Figure 7-7A. Clamp handle in a vise and twist clutch shaft out of yoke by turning upper sheave. Apply penetrating oil to yoke-shaft juncture as required. If difficulty is encountered, remove handle and arrange to use a press as described in preceding step.

CAUTION

Avoid bending loads on clutch shaft when handle is clamped in vise as C907 yoke can be damaged.

B. Installation

1. Remove loose paint and clean mating area on shaft with non-residue solvent. |
2. Coat inside of C907 yoke and mating portion of clutch shaft with zinc-chromate or epoxy primer. While primer is still wet, install yoke on clutch shaft and align marked holes on yoke (if applicable) with clutch shaft holes.
3. Secure yoke to shaft with clamping blocks and bolts. Standard torque bolts per § 23-32 and torque stripe per Figure 2-1. |

7.270 C195 Yoke Removal and Installation**A. Removal****NOTE**

Yoke may be removed without clutch removal.

1. Remove intermediate flex plate.
2. Remove bolts and clamping blocks securing C195 yoke to clutch shaft.
3. Twist yoke out of clutch shaft.

B. Installation

1. Remove loose paint and clean mating area inside shaft with non-residue solvent.
2. Coat inside of clutch shaft and shank of C195 yoke with zinc-chromate or epoxy primer. While primer is still wet, slide yoke into clutch shaft and align holes.
3. Install clamping blocks and bolts. Standard torque bolts per § 23-32 and torque stripe per Figure 2-1.
4. Install intermediate flex plate per § 7.330.

CAUTION

There must be (1) NAS1149F0432P or (1) NAS1149F0463P washer between each arm of C195 yoke and A947-2 flex plate. Refer to § 7.330.

7.280 V-Belts**7.281 V-Belt Removal**

- a) Remove tailcone cowling.
- b) Lower clutch actuator to its fully disengaged position.
- c) Mark the back of each belt with a felt pen. Use numbers or a v-mark to indicate direction and order so they will be in the same positions if they are to be reinstalled. Mark the direction of rotation on each belt so that they cannot be reversed.
- d) Mark and disconnect the intermediate flex plate from clutch. Disconnect the centering strut from clutch to upper frame at frame end.
- e) Remove fan and scroll per Section 6.200.
- f) Remove actuator assembly per Section 7.510.
- g) Remove belts from sheave.

CAUTION

Used belts must be reinstalled in proper order due to individual differences in belt stretch.

7.282 V-Belt Installation**WARNING**

Install V-belts only in matched sets. Do Not install used V-belts from another helicopter.

- a) Before installation of new belts, inspect the sheave grooves. Replace any sheave showing corrosion, pitting or flaking of the metalized or anodized coatings, wear through the anodized coating, roughness, or sharp ridges.

CAUTION

Rough or corroded grooves in the upper or lower sheave can cause V-belts to roll, break, or come off. Refer also to Section 2.160.

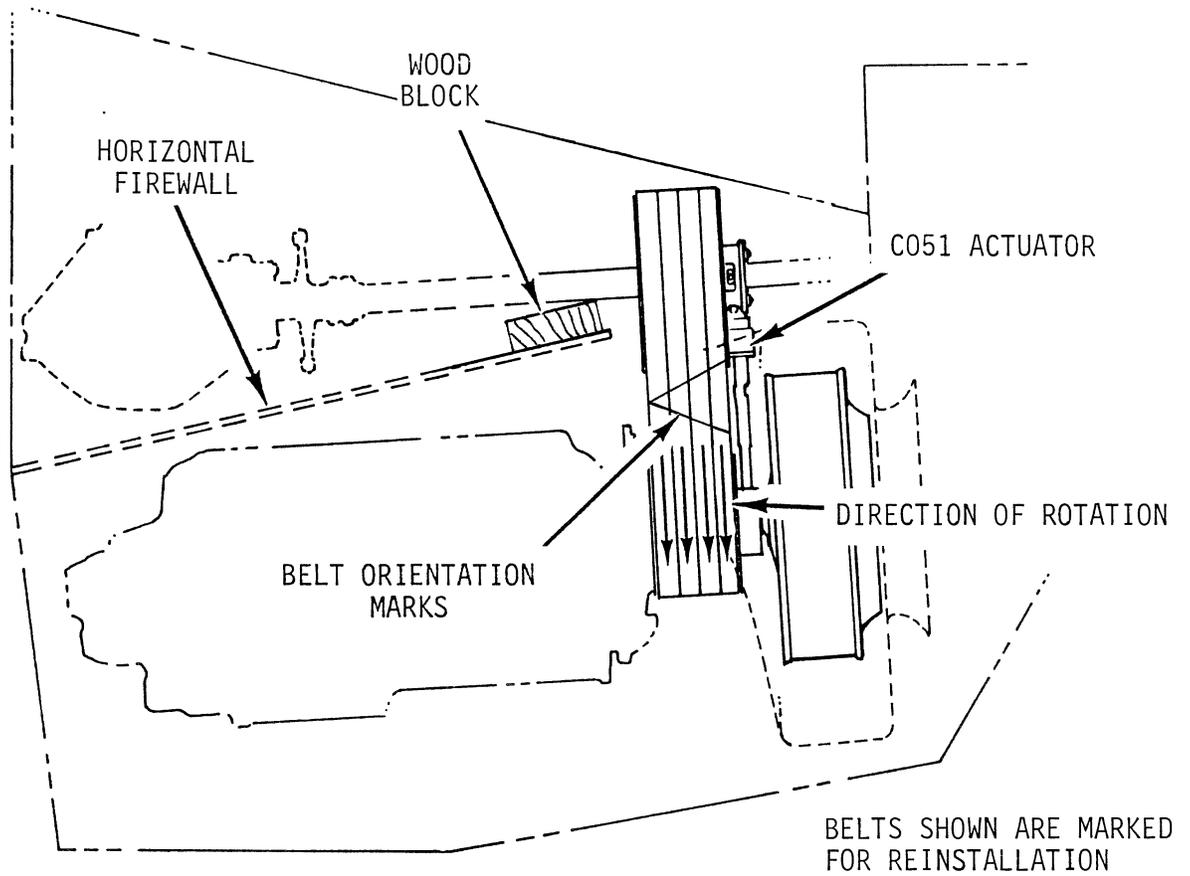


FIGURE 7-8 V-BELT AND ACTUATOR REMOVAL

7.282 V-Belt Installation (cont'd)

- b) Paint the grooves in the lower sheave with a thin coating of zinc chromate or epoxy primer per Section 1.400.
- c) Install belts on sheaves. If used belts are reinstalled, inspect them for damage per Section 2.150. Make sure they are in their proper order with respect to fore/aft position and proper direction of rotation.
- d) Install the actuator assembly per Section 7.520.
- e) Connect the intermediate flex plate to the clutch.
- f) Install fan and scroll per Section 6.200.
- g) Check clutch sheave alignment per Section 7.230.
- h) Shim and connect intermediate flex plate per Section 7.330.
- i) Adjust the actuator's down-limit stop screw so when the actuator is engaged at start up there is a delay of less than 5 seconds before rotor starts turning.

NOTE

First adjustments of the actuator down limit screw, to regulate new belt disengage slack, occur relatively soon with longer periods between later adjustments. Recheck.

A delay between clutch switch engagement and the rotor starting to turn of more than 5 seconds indicates excessive slack. If rotor rotates when cranking engine with starter motor, belts may not have enough slack.

CAUTION

During start up and engagement, belts too tight can damage flex plates and belts too loose can jump out of grooves.

- j) Ground run or hover the helicopter for at least 20 minutes.
- k) At the end of the ground run, inspect the sheave grooves for the contact pattern in the primer. A similar contact pattern in all eight grooves indicates the belt/sheave combination is compatible. A noticeably different contact pattern from groove to groove indicates the combination is not compatible.
- l) If the belt/sheave combination is not compatible, re-check sheave alignment, replace belts, and repeat installation procedure. If belt/sheave combination is still not compatible, it may be necessary to replace the lower sheave. The wear pattern in all eight grooves must be similar before the aircraft is released for flight.

7.283 Belt Tension

No procedure for checking belt tension on the helicopter is required.

7.290 C007 Fanshaft and Bearing Assembly, Starter Ring Gear Support, Lower Sheave and Alternator Belt Replacement.

7.291 Removal

- a) Remove V-belts per Section 7.281.
- b) Cut the safety wire and remove the six NAS6608 bolts holding the fanshaft.
- c) Remove the C007 fanshaft and bearing assembly. Temporarily secure the lower sheave with one of the removed bolts if it is not to be removed.
- d) To remove the lower sheave, the use of a soft mallet may be required to tap the sheave while pulling it off.
- e) Removal of the starter ring gear support is required to change alternator belt or gain access to the nose section of the engine.
 - 1) Loosen the alternator belt tension.
 - 2) Note the zero mark on the starter ring gear support at one propeller flange bushing. Mark this bushing to ease reinstallation.
 - 3) Remove the starter ring gear support.

7.292 Installation

- a) Install a new alternator belt at this time if required. Reinstall the starter ring gear support. Align the zero mark on the ring gear support with the marked bushing. The bushing and matching hole are slightly larger than the five other holes. This makes the incorrect installation of the starter ring gear support difficult but not impossible.
- b) Install the lower sheave and fanshaft assembly. Check that two AN960-816 washers are installed under each NAS6608-42H bolt. Lightly snug the bolts. Check for clearance between the lower sheave and starter ring gear support's conical surface. Insert a 0.005 inch feeler gauge at 6 places between the attachment bolts. Lack of clearance indicates the wrong starter ring gear support is installed or that the ring gear support is improperly installed. Torque the bolts per Section 1.330 in a star pattern followed by a circular pattern. Safety wire the bolts in pairs with 0.041 inch diameter stainless steel safety wire.

7.290 C007-4 Fanshaft and Bearing Assembly, Starter Ring Gear Support, Lower Sheave and Alternator Belt Replacement (cont'd)**CAUTION**

Reinstalling the bolts with less than two AN960-816 washers may cause the bolt shank to bottom on the engine propeller flange bushing. This condition would not clamp the lower sheave and fanshaft assembly securely to the engine flange.

- c) Tension the alternator belt at the pulley nut at this time. The slip torque at the pulley nut for a new belt is 11-13 ft-lb; for a used belt, the slip torque is 7-9 ft-lb.
- d) Reinstall V-belts per Section 7.282.

7.300 TAIL ROTOR DRIVE SHAFT**7.310 Tail Rotor Drive Shaft Removal**

- a) Remove the tailcone per Section 4.311.
- b) Use a 3-foot socket extension with a 3/8-inch socket to disconnect the two NAS6603 bolts which hold the drive shaft damper arm to its mounting bracket.
- c) Using the upper aft tailcone inspection hole, disconnect the C947-3 aft flex plate from tail rotor gearbox input shaft flange. Support the aft end of the drive shaft so it cannot fall and damage the drive shaft or tailcone.
- d) The drive shaft can now be pulled out of the forward end of the tailcone

7.320 Tail Rotor Drive Shaft Installation

- a) Insert tail rotor drive shaft into tailcone.

NOTE

If aft flex plate was disconnected from tail rotor gearbox and removed, first connect flex plate to the drive shaft and then insert the drive shaft into tailcone. Torque the NAS6604 bolts per Section 1.320.

- b) Support drive shaft through upper aft tailcone inspection hole to prevent damage and for alignment purposes.
- c) Using the upper aft tailcone inspection hole, connect the C947-3 aft flex plate to gearbox with the bolt heads against the flex plate. Use one AN960-416L washer under the bolt head. Torque to per Section 1.320.

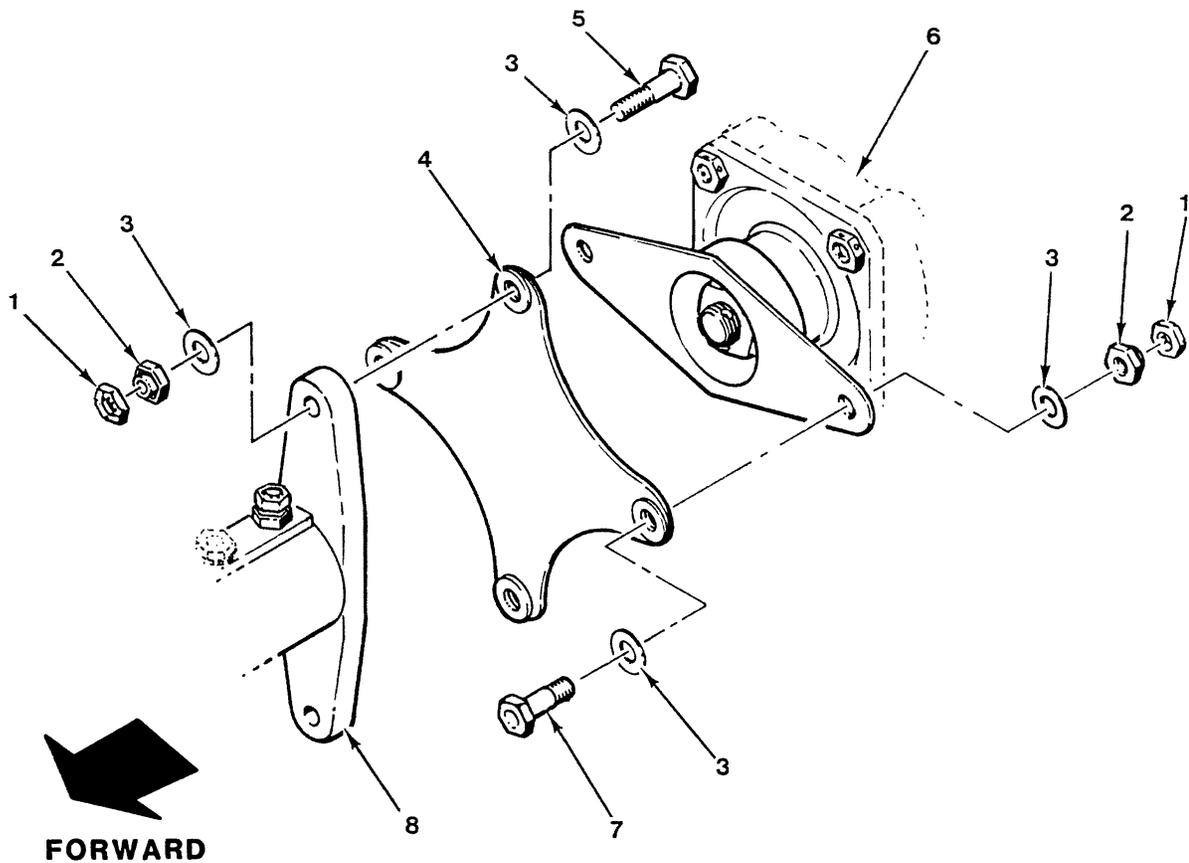


FIGURE 7-9 AFT FLEX PLATE INSTALLATION

<u>NUMBER</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
1	B330-13	PALNUT
2	NAS679A4	NUT
3	AN960-416L	WASHER
4	C947-3	FLEX PLATE (AFT)
5	NAS6604-7	BOLT
6	C021-1	TAIL ROTOR GEARBOX
7	NAS6604-4	BOLT
8	D224-1	TAIL ROTOR DRIVE SHAFT ASSEMBLY

7.320 Tail Rotor Drive Shaft Installation (cont'd)**CAUTION**

Improper installation of flex plate can damage tail rotor drive shaft and gearbox.

- d) Through inspection holes on side of tailcone, determine longitudinal alignment of damper arm with tailcone attachment bracket. If clearance or interference between arm and bracket is greater than 0.12 inches, contact Robinson Helicopter Technical Support Department. If clearance or interference is less than 0.12 inch, connect damper assembly to tailcone cross member. Torque bolts per Section 1.320.
- e) Install tailcone per Section 4.312.
- f) Install and shim intermediate flex plate per Section 7.330.
- g) Perform tail rotor drive shaft run-out check per Section 7.340.

7.321 Adjustment of Damper Friction

- a) Remove tail rotor drive shaft from tailcone per Section 7.310.
- b) Disassemble damper per Figure 7-10.
- c) Inspect C041-5 DU washers for worn Teflon® coating (dark gray face) and replace as required.
- d) Inspect A141-37 washers and C041-3 arm for indications of wear or grooving. Replace as required.
- e) Reassemble damper per Figure 7-10. Torque pivot bolts per Section 1.320.

CAUTION

Teflon® (dark gray) face of C041-5 DU washer must be placed against A141-36 washer or C041-3 link. Remove plastic or tape coating if installed.

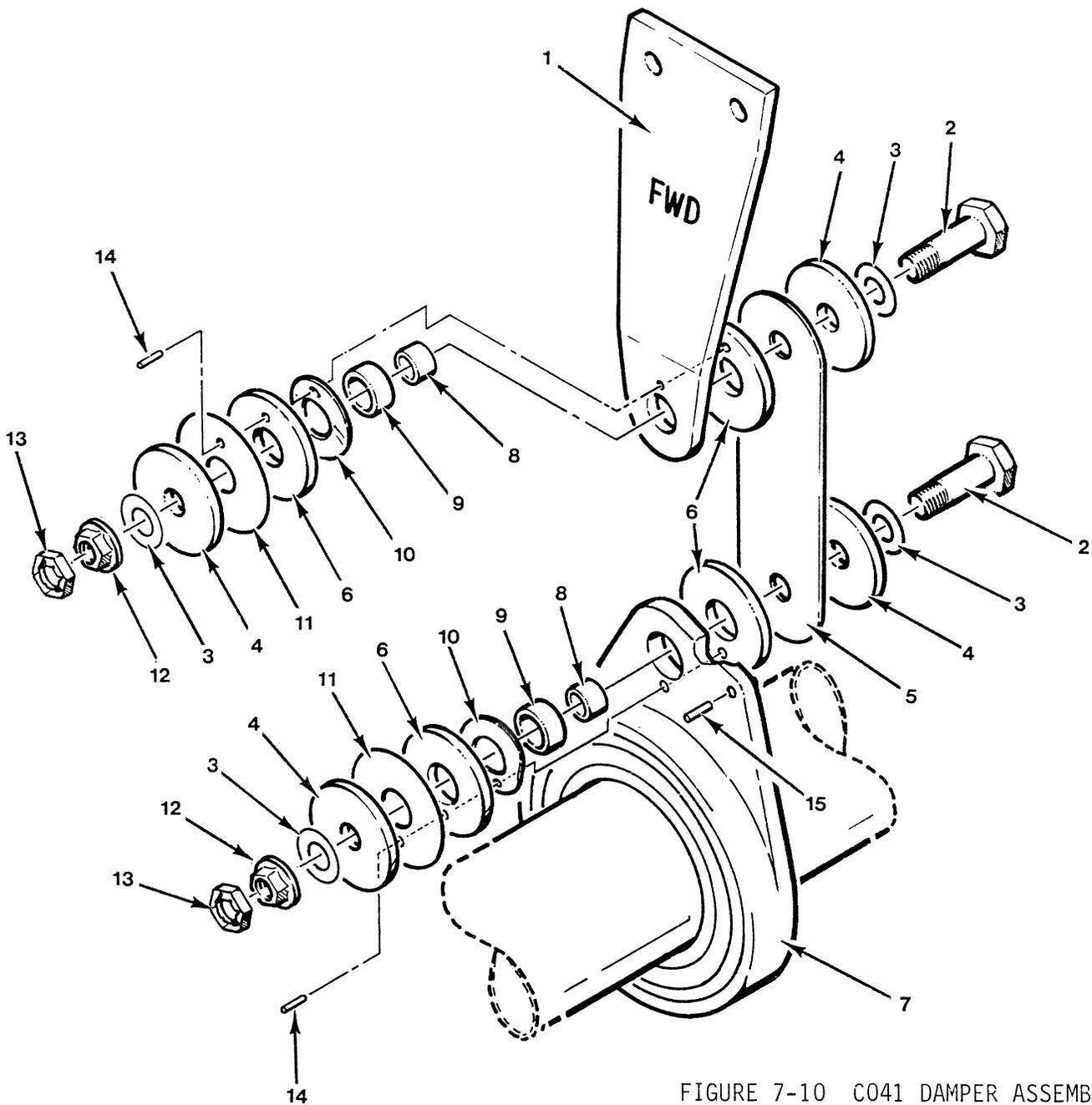
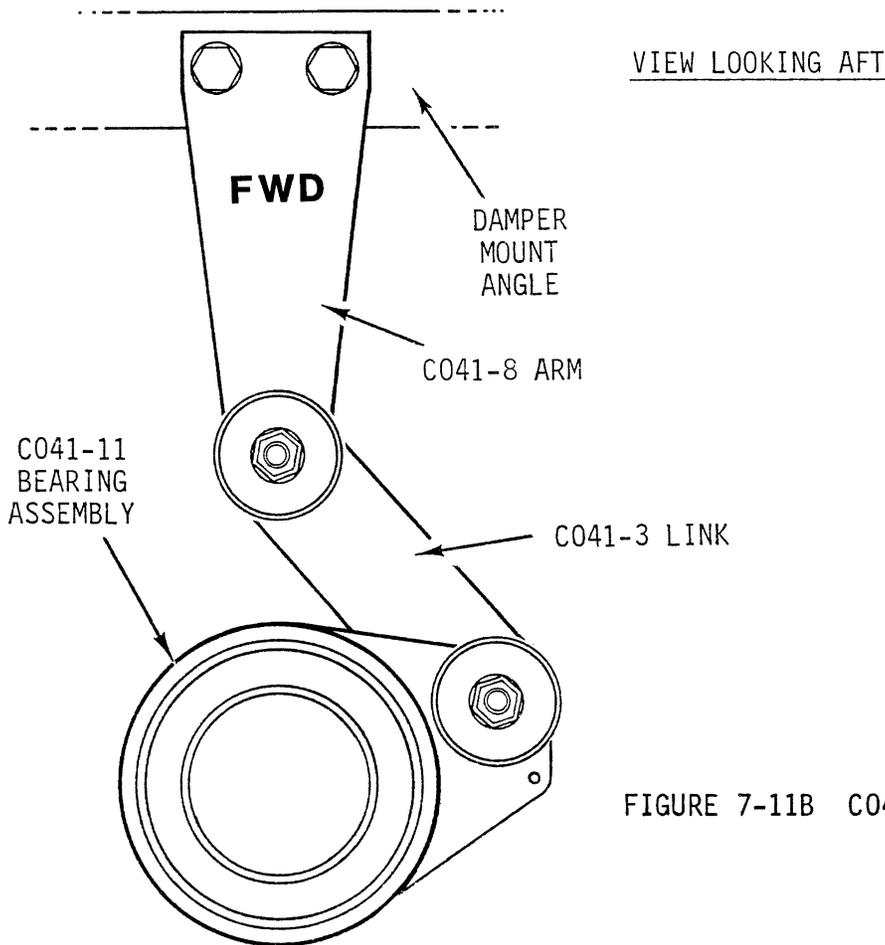
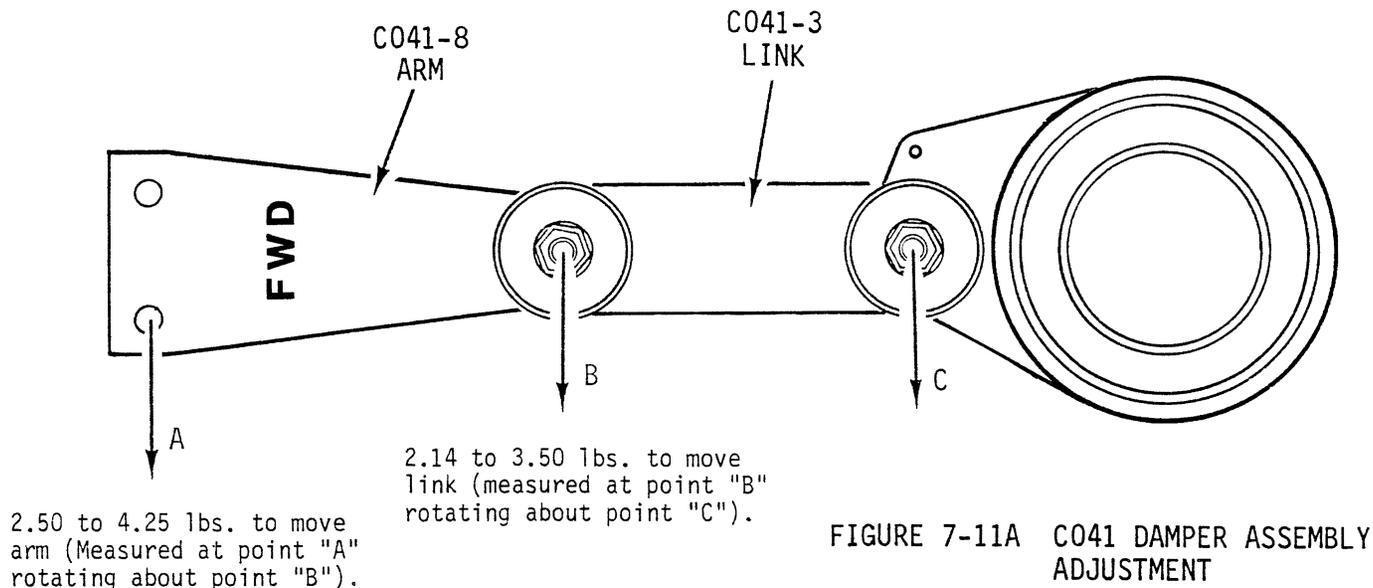


FIGURE 7-10 C041 DAMPER ASSEMBLY

NUMBER	PART NUMBER	DESCRIPTION	NUMBER	PART NUMBER	DESCRIPTION
1	C041-8	Arm	9	05DU04	Bushing
2	NAS6604-6	Bolt	10	C041-6	Spring Washer
3	AN960PD416L	Washer	11	A141-36	Washer
4	A141-37	Washer	12	NAS679A4	Nut
5	C041-3	Link	13	B330-13	Palnut
6	C041-5	Washer	14	A041-10	Dowel Pin
7	C041-11	Bearing Assembly	15	MS16562-11	Roll Pin
8	A105-12	Journal			



7.321 Adjustment of Damper Friction (cont'd)

- f) Refer to Figure 7-11A. Hold C041-3 link and attach a spring scale or dead weight to one bolt hole in C041-8 arm. It should take 2.50 to 4.25 lb to move arm. Check bearing housing pivot friction with spring scale or dead weight at link bolt. It should take 2.14 to 3.50 lb to move link.

If drag is less than specified, check C041-6 spring washer and bend washer until it has a total height of 0.065 - 0.078 inch. If spring washer is correct height, but drag is still too low, lap end of A105-12 journal. If drag is greater than specified, flatten spring washer slightly.

CAUTION

DO NOT ADJUST DAMPER DRAG BY CHANGING BOLT TORQUE.

- g) Torque MS21042L4 nut per Section 1.320 and recheck damper frictions per Step f). Install B330-13 palnuts and torque stripe.
- h) Install tail rotor drive shaft per Section 7.320.

7.330 Intermediate Flex Plate Installation and Shimming

Measurements taken with intermediate flex plate removed.

- a) Engage clutch actuator.
- b) Rotate drive flanges of tail rotor shaft and C195 yoke horizontal.
- c) Insert NAS1304 bolt through tail rotor shaft and C195 aft clutch yoke at 9 o'clock position. Measure and record gap between flanges at 3 o'clock position. Remove bolt.
- d) Insert bolt at 3 o'clock position. Measure and record gap at 9 o'clock position. Measurements in sequence C and D are Measurement 1.
- e) Remove bolt and rotate tail rotor shaft 180 degrees. Repeat steps C & D. This will be Measurement 2.

NOTE

Measurement 1 and 2 should be similar. If measurements are not similar, one or both yokes are bent.

- f) Determine difference between 3 o'clock and 9 o'clock gap in Measurement 1. Determine difference between 3 o'clock and 9 o'clock gap in Measurement 2.

7.330 Intermediate Flex Plate Installation and Shimming (cont'd)

- g) Use following formula to obtain the calculated dimensions for proper shimming required at the intermediate flex plate.

NOTE

Use the measurement with the smaller difference between 3 and 9 o'clock readings.

9 o'clock reading + 3 o'clock reading	=	
Divide above sum by 2	=	
Subtract *		*
Calculated Dimension	=	

*Average thickness of the A947-2 flex plate measured at the bonded washers.

Shim as required per Table 7-1.

- h) Reinstall the flex plate using the shims determined above. Torque the attach bolts per Section 1.320. Install palnut and torque stripe. Refer to Figure 7-4.

7.340 Checking Tail Rotor Drive Shaft Runout

The runout check described below is to prevent excessive runout on the tail rotor drive shaft which can cause a failure in the intermediate flex coupling or damper assembly.

- a) Remove all the tailcone inspection covers on the tailcone right side. Engage the clutch.
- b) Assemble the Robinson Tool Number MT260-6 tool and a suitable dial indicator.

NOTE

The dial indicator included in the Robinson MT122 bolt stretch gauge is recommended for this tool.

7.340 Checking Tail Rotor Drive Shaft Runout (cont'd)

- c) Insert the dial indicator through the inspection hole farthest aft on the right side of the tailcone. Press the dial indicator firmly against the tailcone when the extension is riding on the drive shaft.
- d) Have someone rotate the drive shaft at the C166 clutch shaft at least three full revolutions. The indicator may vary somewhat with each revolution so it will be necessary to take an average.
- e) Repeat procedure in steps C & D at the next inspection hole forward.
- f) Remove the extension from the MT260 tool and, using the longer extensions, check the drive shaft at each of the other two inspection holes.
- g) The maximum amount of runout at any of the locations must not exceed 0.025 inch. If the runout is excessive, the drive shaft must be repaired or replaced.

7.350 Two-Piece Tail Rotor Drive Shaft

- a) The two-piece tail rotor drive shaft consists of one C196-1 shaft, one C195-5 yoke, one C041-1 damper assembly, two C191-2 clamping blocks and associated hardware. See Figure 7-12A .
- b) The C041-1 damper bearing assembly is field replaceable; refer to Figures 7-12A and 7-12B for appropriate dimensional criteria.
- c) The D224-1 drive shaft is produced in one length only.

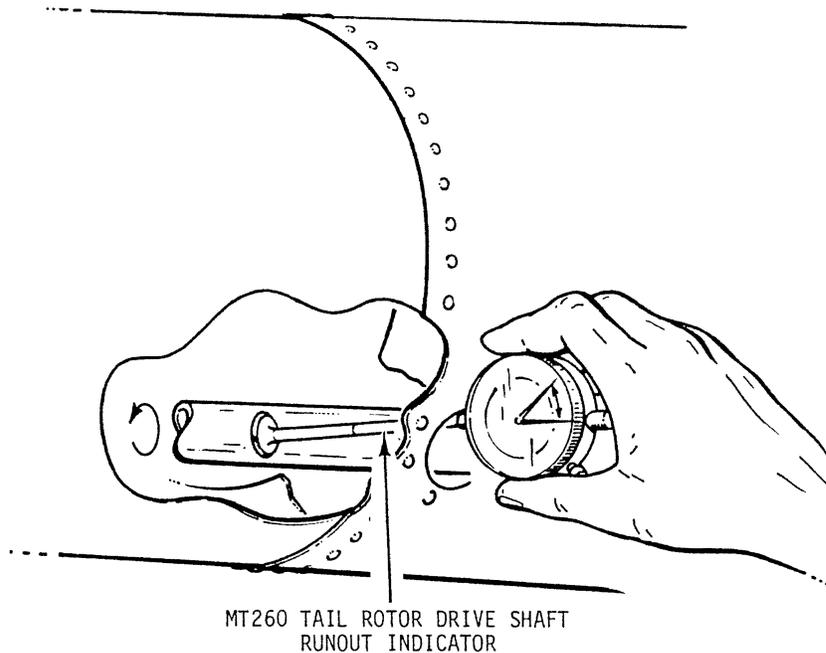


FIGURE 7-12 TAIL ROTOR DRIVE SHAFT RUNOUT CHECK

Calculated dimension from § 7.330 (g)	<u>Total shims required between flex plate and clutch shaft's aft C195 yoke</u>	<u>Total shims required between flex plate and TR drive shaft's forward yoke</u>
0.137 inch or more	Measurement is over limit and a longer C195 yoke is required.	Measurement is over limit and a longer C195 yoke is required.
0.136 inch to 0.107 inch	1 each NAS1149F0463P washer substituted for NAS1149F0432P (required 2 places)	1 each NAS1149F0463P washer (required 2 places)
0.106 inch to 0.077 inch	1 each NAS1149F0432P washer (required 2 places)	1 each NAS1149F0463P washer (required 2 places)
0.076 inch to 0.047 inch	1 each NAS1149F0432P washer (required 2 places)	1 each NAS1149F0432P washer (required 2 places)
0.046 inch to 0.017 inch	1 each NAS1149F0432P washer (required 2 places)	No washers for shimming
0.016 inch or less	Shorter C195 yoke is required	Shorter C195 yoke is required

CAUTION

There must be an NAS1149F0432P or NAS1149F0463P washer between each arm of C195 yoke and A947-2 flex plate.

TABLE 7-1 A947-2 INTERMEDIATE FLEX PLATE SHIM TABLE

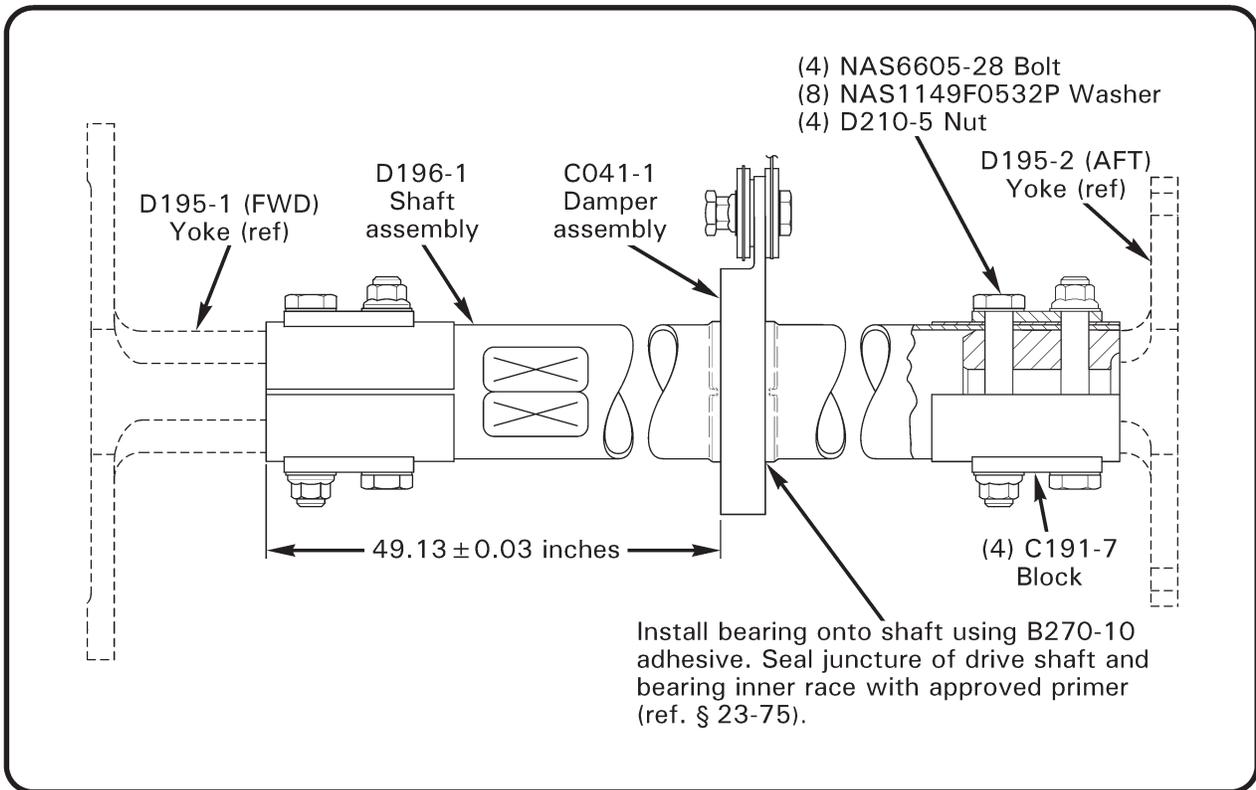


FIGURE 7-12A D196-1 TAIL ROTOR DRIVE SHAFT

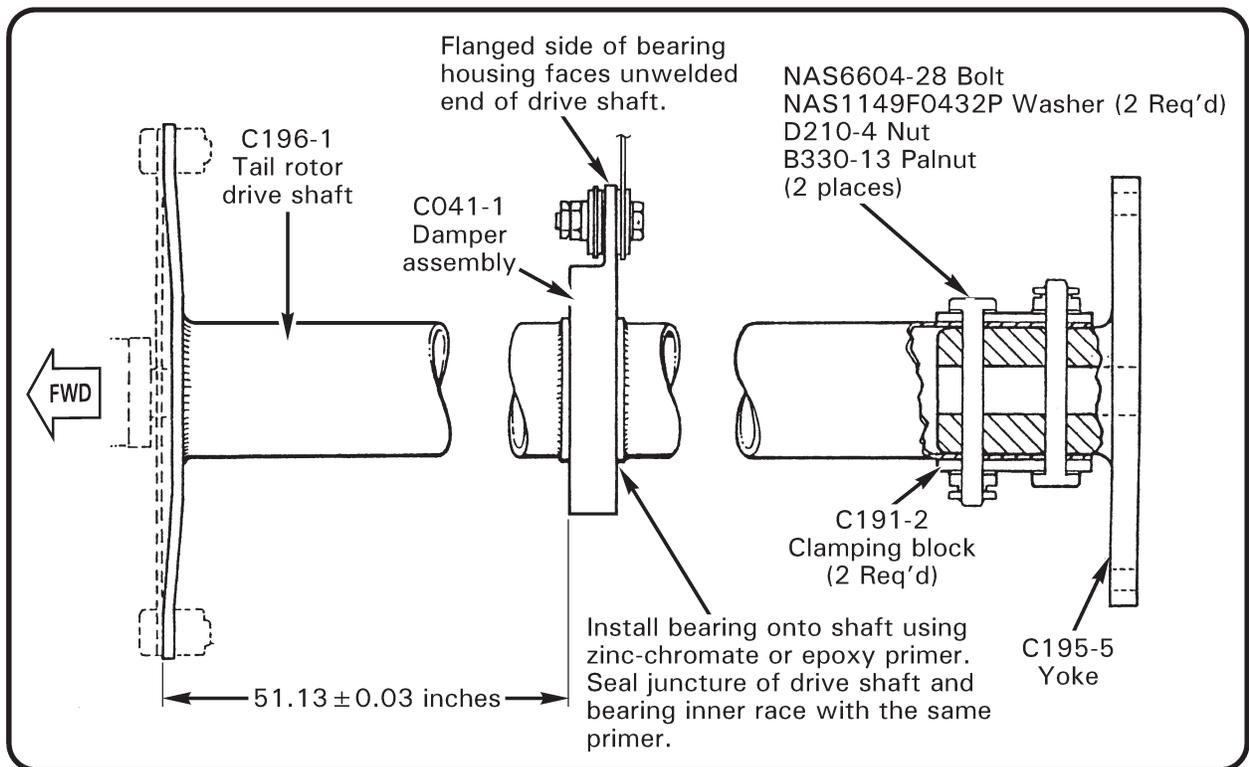


FIGURE 7-12B C196-1 TAIL ROTOR DRIVE SHAFT

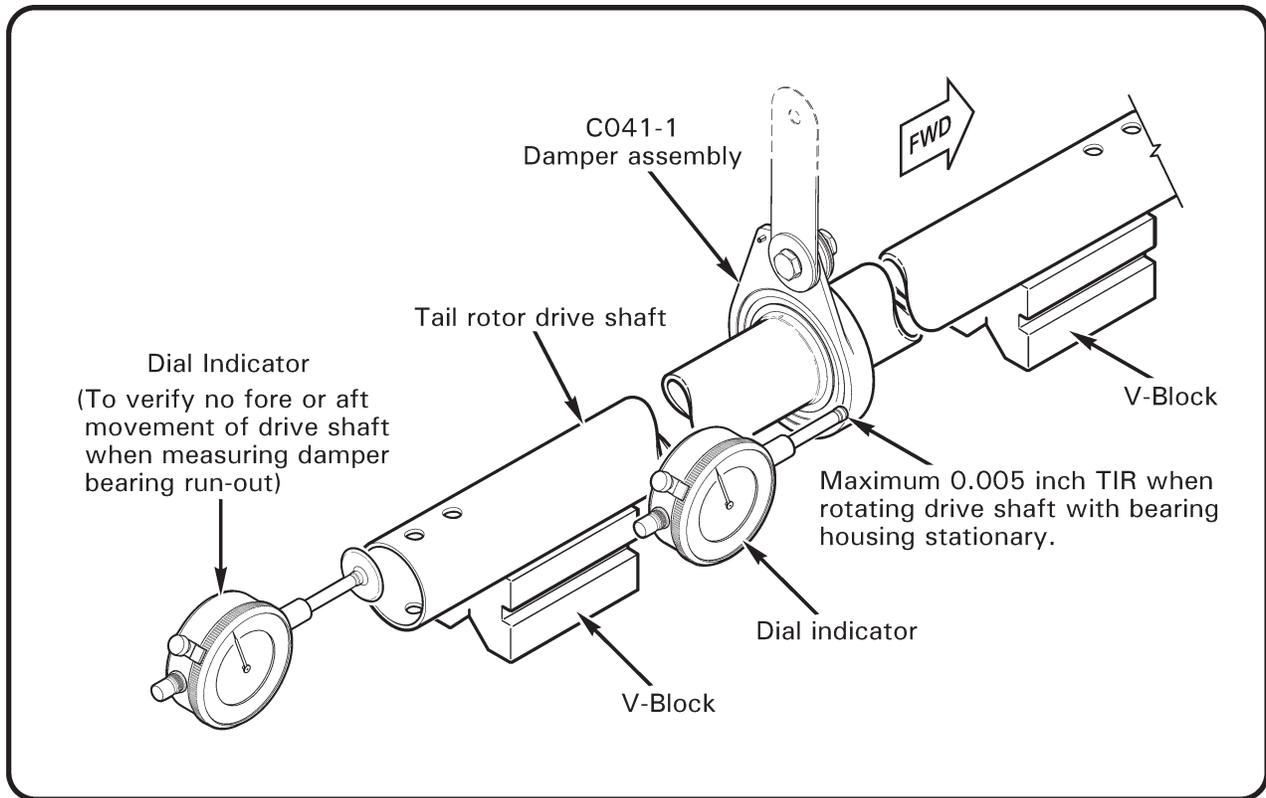


FIGURE 7-12C DAMPER BEARING RUN-OUT INSPECTION

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7.400 TAIL ROTOR GEARBOX

7.410 Tail Rotor Gearbox Removal

- a) Mark the tail rotor hub and blades and tail rotor pitch links to their respective pitch control arms before disassembly. This will facilitate reinstallation and eliminate re-rigging the tail rotor if push-pull tube lengths are not altered.
- b) Remove the tail rotor hub and blades. Leave the pitch control links attached to the tail rotor blades.
- c) Disconnect the A120 bellcrank from the push-pull tube.
- d) Remove A120-3 bellcrank and pitch control from tail rotor gearbox. Disconnect A120-3 bellcrank attach bolt from the gearbox output cartridge and slide pitch control, with the bellcrank attached, off the gearbox output shaft. Reassemble bellcrank hardware to bellcrank.
- e) Working through upper aft inspection hole of tailcone, disconnect the aft flex coupling from gearbox input shaft flange.

CAUTION

Drive shaft must be supported through the upper aft inspection hole to prevent damage to flex plate and drive shaft. Do not leave any loose hardware inside the tailcone.

- f) Disconnect chip detector wire at bottom of gearbox.
- g) Cut the safety wire and remove four bolts holding the tail rotor gearbox to the tailcone. Careful handling of gearbox on removal is required to prevent damage to input shaft or the threads on the output shaft.

7.420 Tail Rotor Gearbox Installation

- a) Install the tail rotor gearbox to the tailcone and torque four cap screws per Section 1.330. Safety wire screws in pairs with 0.032 inch diameter safety wire.
- b) Connect the chip detector wire at the tail rotor gearbox.
- c) Connect flex plate to tail rotor gearbox. Torque bolts to per Section 1.320.
- d) Tail rotor drive shaft support can now be removed.

7.420 Tail Rotor Gearbox Installation (cont'd)

- e) Check intermediate flex plate shimming per Section 7.330.
- f) Install the tail rotor pitch control and bellcrank. Re-shim per Section 8.560 if original stack lost or binding occurs when assembly is moved.
- g) Reconnect C121-17 push-pull tube to aft bellcrank.
- h) Install tail rotor hub and blades.
- i) Connect pitch links to the pitch control arms.
- j) Ensure all bolts are torqued per Section 1.300.

7.430 Tail Rotor Gearbox Chip Indicator

Use the following procedure to drain the gearbox and inspect the lubricant and chip detector for chips.

- a) Use a clean container to catch tail rotor gearbox oil.
- b) Cut safety wire on chip detector and disconnect the electrical wires. Remove chip detector and drain oil.
- c) Strain the oil and inspect any particles found in the oil or on the chip detector. Examine the particles for size; any particles larger (0.09 inch long or 0.02 inch wide) than fine fuzz (normal wear) should be identified as ferrous or non-ferrous by using a magnet. If numerous particles are found and the next running of the gearbox produces more particles, a tail rotor gearbox failure may be impending and a tail rotor gearbox overhaul is required.
- d) See Section 1.130 for flushing and refilling of the gearbox.

7.440 Tail Rotor Gearbox Output Shaft Seal Replacement (ref Figure 7-13)

- a) Remove tail rotor and pitch control bearing per Section 7.410.

NOTE

Mark all attachments for proper re-assembly.

- b) Cut the safety wire and remove four MS20074-04-06 bolts securing the C112-2 cap.
- c) Slide C112-2 cap over the output shaft and remove the seal and 'O'-ring.

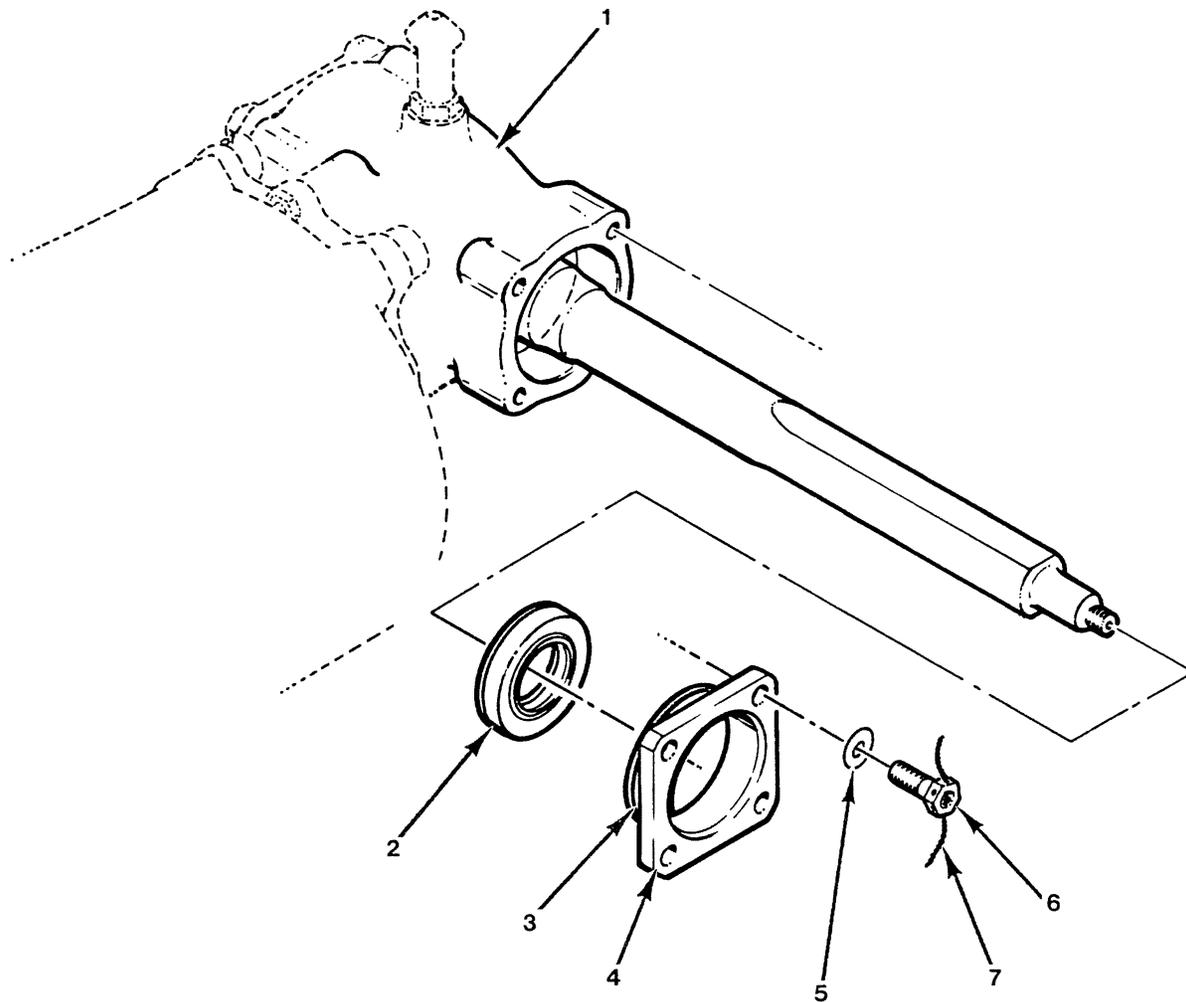


FIGURE 7-13 TAIL ROTOR GEARBOX OUTPUT SHAFT SEAL REPLACEMENT

<u>NUMBER</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
1	C109-1	Housing
2	C966-2	Seal
3	C215-133	O-Ring
4	C112-2	Cap
5	AN960-416L	Washer
6	MS20074-04-06	Bolt
7	-	0.032 in. dia Safety Wire

7.440 Tail Rotor Gearbox Output Shaft Seal Replacement (cont'd)**CAUTION**

Be careful not to lose or change shim stack-up between the cap and the gearbox. Any change to the shim stack-up will change factory-set preload drag.

- d) Carefully clean seal seating surface and O-ring groove and dry.
- e) Press a new C966-2 seal into the cap bore 0.160 inches below the external surface with seal lip toward the gearbox. Lubricate a new C215-133 O-ring with A257-2 gear oil and install in groove in cap.
- f) Lubricate the seal seating area of the output shaft with A257-2 gear oil.
- g) Slide the cap over the output shaft and reinstall on the gearbox. Torque the four bolts to 60 in.-lb and safety wire in pairs with 0.032 inch diameter safety wire.
- h) Reassemble pitch control bearing and tail rotor per Section 8.562.

7.450 Tail Rotor Gearbox Input Shaft Seal Replacement (Ref Figure 7-13A)**NOTE**

It is not necessary to remove pitch control assembly and tail rotor for this procedure.

- a) Remove gearbox from tailcone per Section 7.410.
- b) Remove MS24665-210 cotter pin from the nut at the center of C116-1 input yoke.
- c) Place the gearbox assembly on a bench and put a 2-inch thick wood block between one arm of the C116-1 yoke and the gearbox housing.
- d) Remove the AN320-8 castellated nut and remove the yoke.
- e) Cut the safety wire on and remove four MS20074-04-06 bolts.
- f) Remove C112-1 cap. Be sure not to lose the C141-2 washer that is located between cap and bearing. Remove the O-ring.
- g) Press out old seal and clean the seal seating surface and O-ring groove.

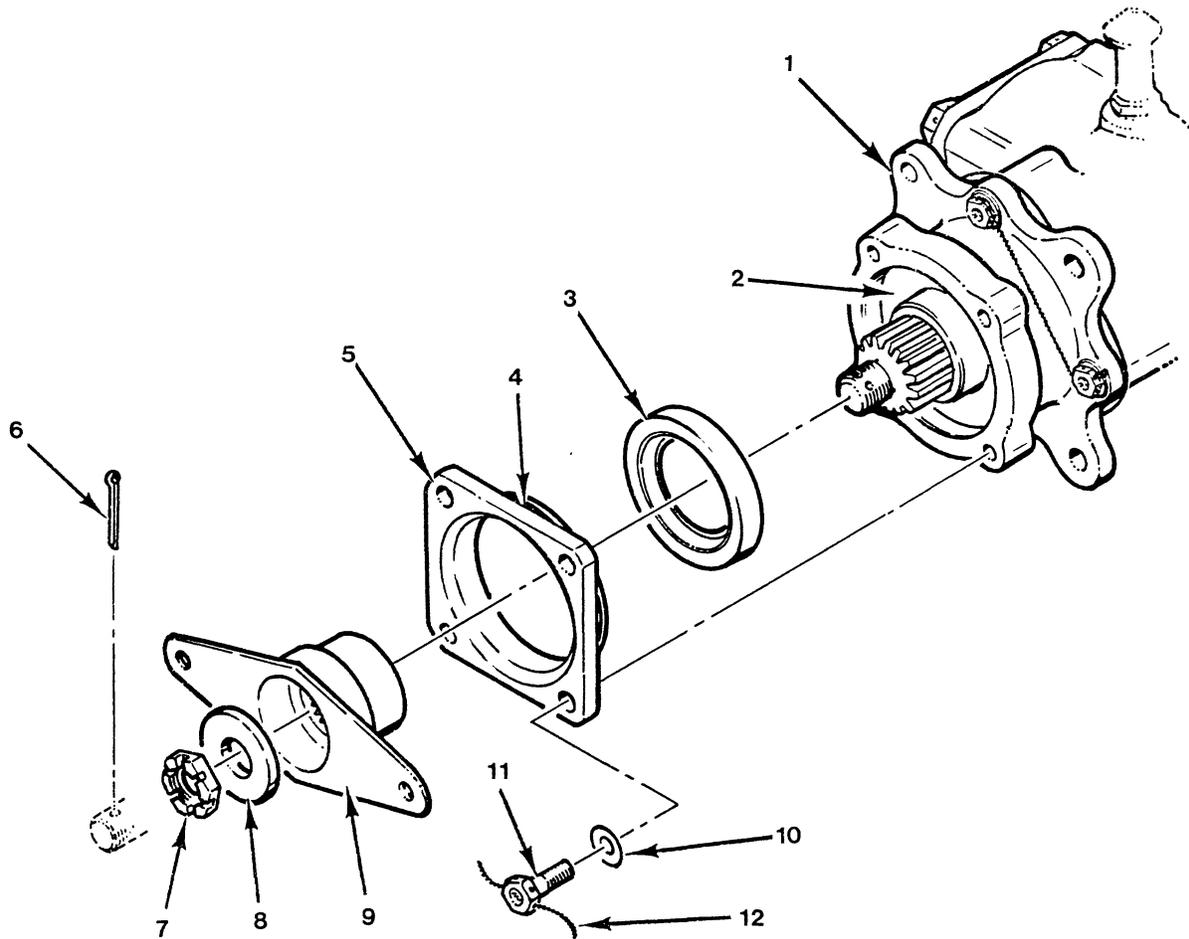


FIGURE 7-13A TAIL ROTOR GEARBOX INPUT SHAFT SEAL REPLACEMENT

<u>NUMBER</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
1	C110-1	Input Cartridge
2	C141-2	Washer (between cap & input cartridge)
3	A966-3	Seal
4	C215-140	O-Ring
5	C112-1	Cap
6	MS24665-210	Cotter Pin
7	AN320-8	Nut
8	A141-10	Washer
9	C116-1	Yoke
10	AN960-416L	Washer
11	MS20074-04-06	Bolt
12	-	0.032 in. dia Safety Wire

7.450 Tail Rotor Gearbox Input Shaft Seal Replacement (cont'd)

- h) Press a new A966-3 seal into cap 0.250-inch from external surface with seal lip toward gearbox. Lubricate a new C215-140 O-ring with A257-2 gear oil and install in groove in cap.
- i) Install C141-2 washer and cap into C110-1 cartridge. Install four MS20074-04-06 bolts with AN960-416L washers under head. Torque to 60 in.-lb and safety wire in pairs with 0.032-inch diameter safety wire.
- j) Install C116-1 yoke, A141-10 washer, and AN320-8 nut onto gear shaft.
- k) Hold the gearbox and support yoke flange with a 2-inch wooden block.
- l) Torque the nut to 290-410 in.-lb and secure with a new MS24665-210 cotter pin.
- m) Install gearbox per Section 7.420.

7.500 ACTUATOR ASSEMBLY**7.510 Actuator Removal**

- a) Remove aft cowling assembly.
- b) Disengage clutch to its fullest disengaged position.
- c) Remove cooling fan and scroll per Section 6.200.
- d) Put a six-inch wooden block under the clutch shaft just forward of the upper sheave on the horizontal firewall. This keeps the sheave from drooping and prevents damage to the forward flex plate (see Figure 7-8).
- e) Disconnect two wiring connections to actuator.
- f) Disconnect the clutch lateral centering strut from the upper frame.
- g) Remove the upper NAS6605 and lower NAS6604 bolts and remove actuator.

7.520 Actuator Installation

- a) Inspect upper and lower clutch actuator bearings per Section 2.140.B.
- b) Position actuator for installation.
- c) Install lower attach bolt with head facing aft. Use one AN960-416L washer under bolt head and one AN960-416 washer under nut. Torque per Section 1.320, install palnut and torque stripe.

7.520 Actuator Installation

- d) Connect actuator gearmotor housing to C184 bearing per Figure 7-14. Standard torque bolt per Section 1.320, install & torque palnut, and torque stripe per Figure 2-1.
- e) If installed, remove block(s) supporting clutch assembly.
- f) Connect clutch lateral centering strut, standard torque bolt per Section 1.320, install palnut, and torque stripe per Figure 2-1.
- g) Install fanwheel and scroll per Section 6.220.
- h) Connect gearmotor and switch harness electrical leads and ty-rap as required.
- i) Balance fanwheel per Section 6.240.
- j) Install aft cowling.

CAUTION

Do not engage actuator without scroll installed.

7.530 Actuator Gearmotor Replacement

Actuator gearmotor can be replaced with actuator on helicopter.

1. Disconnect gearmotor electrical leads.
2. Cut safety wire from four gearmotor attach screws.
3. Remove screws, using care not to drop them in V-belt drive.
4. Slowly slide gearmotor assembly from housing. An unscrewing motion may be necessary.
5. Lightly lubricate worm gear on new gearmotor assembly with A257-1 grease before installing. Install O-ring onto gearmotor nose.
6. Install new gearmotor into housing with wire leads pointing outboard. Verify no gap exists between housing and motor mounting flange.
7. Install and tighten (4) mounting screws into housing and safety in pairs with 0.032 inch diameter safety wire.
8. Connect gearmotor electrical leads. Engage clutch, listen for binding, and verify actuator shuts off after column springs yield (indicated by "popping" sound).

CAUTION

If gearmotor electrical pins are reversed in connector, gearmotor will operate backward and down-limit switch and spring switches **WILL NOT** shut off power; damage to actuator and drive belts can occur.

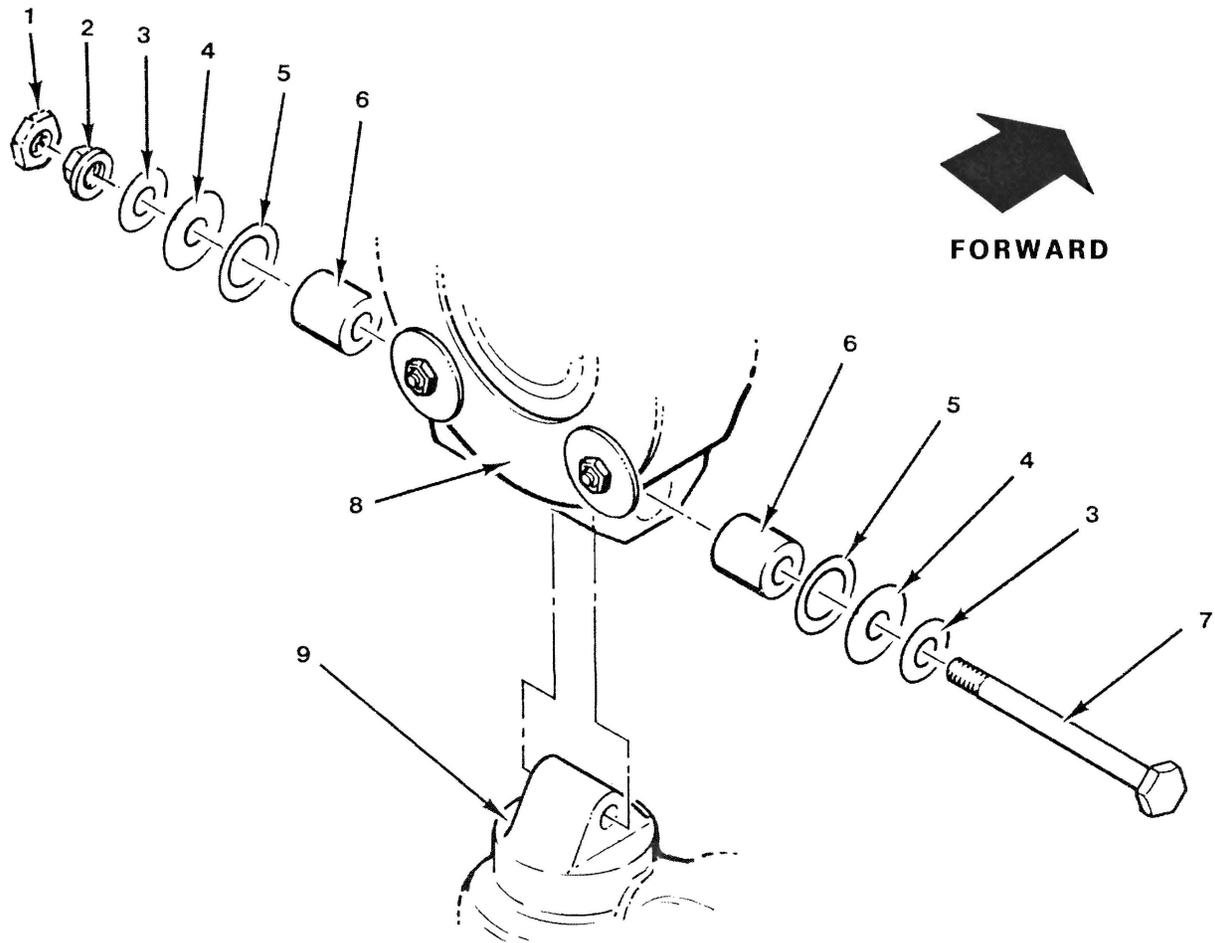


FIGURE 7-14 ACTUATOR ASSEMBLY INSTALLATION

<u>NUMBER</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
1	B330-16	PALNUT
2	MS21042L5	NUT
3	C141-1	WASHER
4	AN960-516L	WASHER
5	CA214-8	THRUST WASHER
6	C105-2	JOURNAL
7	NAS6605-38	BOLT
8	C184-2	UPPER BEARING ASSEMBLY
9	C051-1	ACTUATOR ASSEMBLY

7.540 Actuator Adjustment

1. Engaged Limit

The actuator engaged limit is determined by column springs which control drive belt tension. Column springs may only be adjusted by the factory.

2. Disengaged (Down-Limit) Adjustment

The down-limit switch is activated by the down-limit stop screw, which can be adjusted using long 3/8-inch open-end (MT357-6) and 1/4-inch box-end (MT357-7) wrenches. Adjust down-limit stop screw to maintain proper belt deflection per Section 7.282 with actuator fully disengaged. Minimum clearance between screw heads at scissors is 0.015 inch per Figure 7-15.

3. Maximum Extension

Maximum engaged extension is 1.60 inches, measured as shown in Figure 7-15. The extension-limit switch activates at 1.50/1.60 inches extension. Drive V-belts must be replaced when maximum extension is encountered.

7.550 Switch and Fuse Replacement

7.551 Switch Replacement

1. Remove actuator per Section 7.510.

NOTE

Switches may be replaced as a complete switches & harness assembly, or replaced individually by installing heat shrink and soldering wire connections.

2. Remove desired switch by removing attaching screw, nut, washer, and spacing washers between switch and plate.

NOTE

Spacing washers may be bonded to new switch(es) to ease reassembly.

3. Replace complete switches and wire harness assembly or, if installing a single switch, cut wires from faulty switch as close to switches as possible.
4. Slide new heat shrink over each cut wire. Solder wires to switch and install heat shrink over solder connection.
5. Reassemble switch(es) to plate. Two spacing washers are installed between switch and plate at each attach screw and one under nut. Do not over tighten screws or plastic switch housing may crack.
6. Reinstall actuator per Section 7.520.

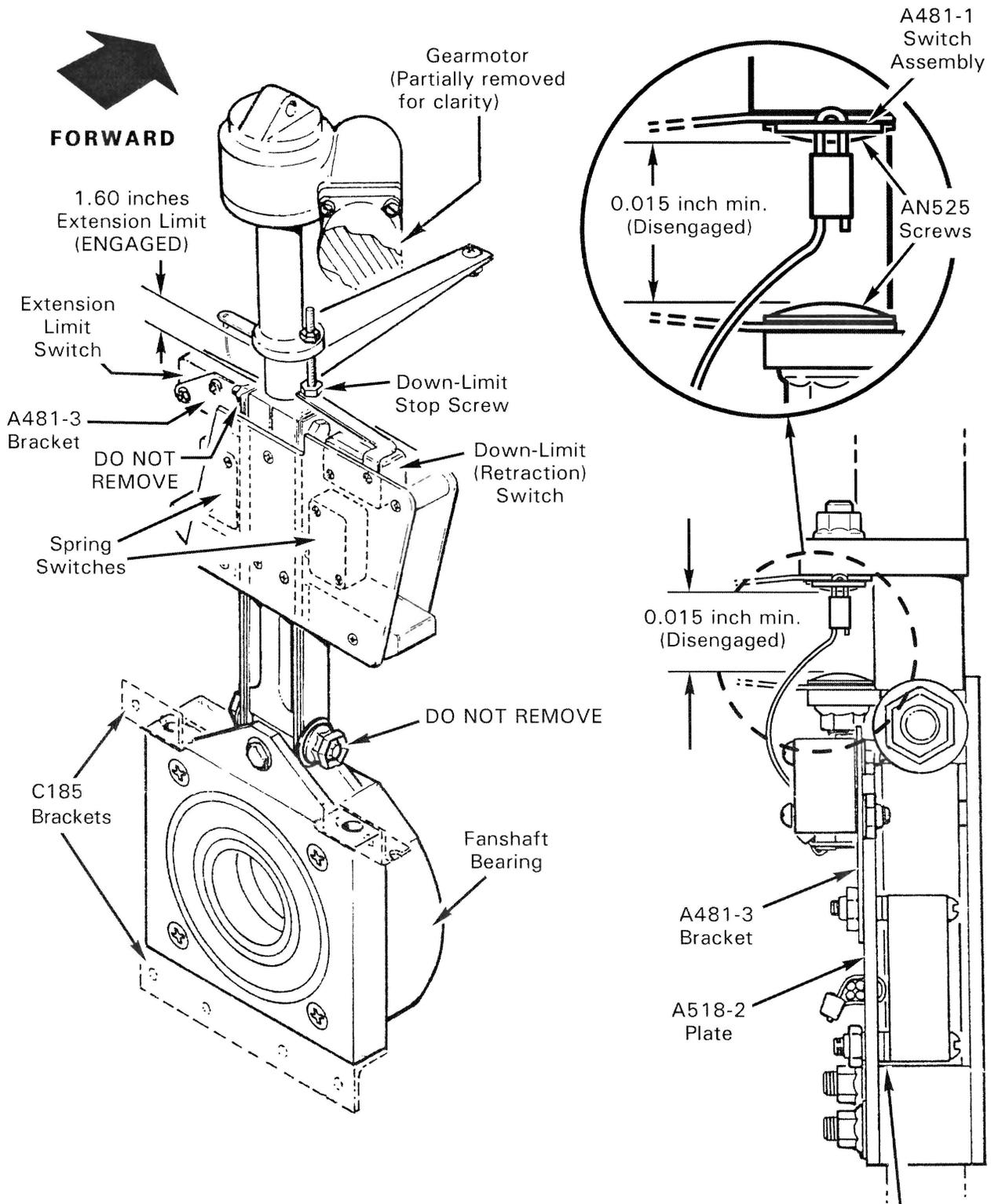


FIGURE 7-15 ACTUATOR LIMIT SWITCHES

2 required on each screw between A513-2 plate and spring switches)
(VIEW FROM LEFT SIDE)

7.551 Switch Replacement (cont'd)

- d) Slide heat shrink over each cut wire. Solder wires to switch and install heat shrink over solder connection.
- e) Reassemble switch(es) to plate. Two spacing washers are installed between switch and plate at each attach screw and one under nut. Do not overtighten screws or plastic switch housing may crack.
- f) Reinstall actuator on helicopter per Section 7.520.

7.552 Fuse Replacement

An in-line fuse holder is installed in the clutch actuator motor power circuit. R44 S/N 0106 & prior have the fuse holder ty-rapped in the wire bundle above the horizontal firewall in the main rotor gearbox compartment. On R44 S/N 0107 and subsequent the fuse holder is mounted on the test switch panel. Replace fuse with 3.0 amp (AGC 3.0) fuse.

7.600 ROTOR BRAKE**7.610 Rotor Brake Removal**

- a) Remove tailcone cowling. Remove the forward flex plate. Mark and record any shim washers installed between the flex plate and the input yoke to the main rotor gearbox or the yoke on the clutch shaft.
- b) Remove the cotter pin and the nut securing the input yoke on the main rotor gearbox. Remove the yoke. Disconnect the spring from the firewall angle.
- c) Remove the cable pulley from the lever. Disconnect the wiring to the micro switch at the three-pin connector.
- d) Cut and remove the safety wire, then remove the three bolts securing the rotor brake. Record the position of the two small and one long spacers for reinstallation. Remove the rotor brake assembly.

7.620 Rotor Brake Installation

- a) Place the rotor brake assembly over the splined input pinion shaft of the main rotor gearbox.
- b) Place one each of the two small (C130-3) spacers in place between the rotor brake assembly and the pinion end cover. Install one each AN960-416L washer on the three NAS1352-4H30P bolts. Insert the first bolt through the rotor brake assembly and the A130-41 spacer. Insert the second bolt through the Hall Effect sender plate, rotor brake assembly and the A130-41 spacer. Place one AN960-416 washer between the Hall Effect sender plate and the rotor brake bracket.

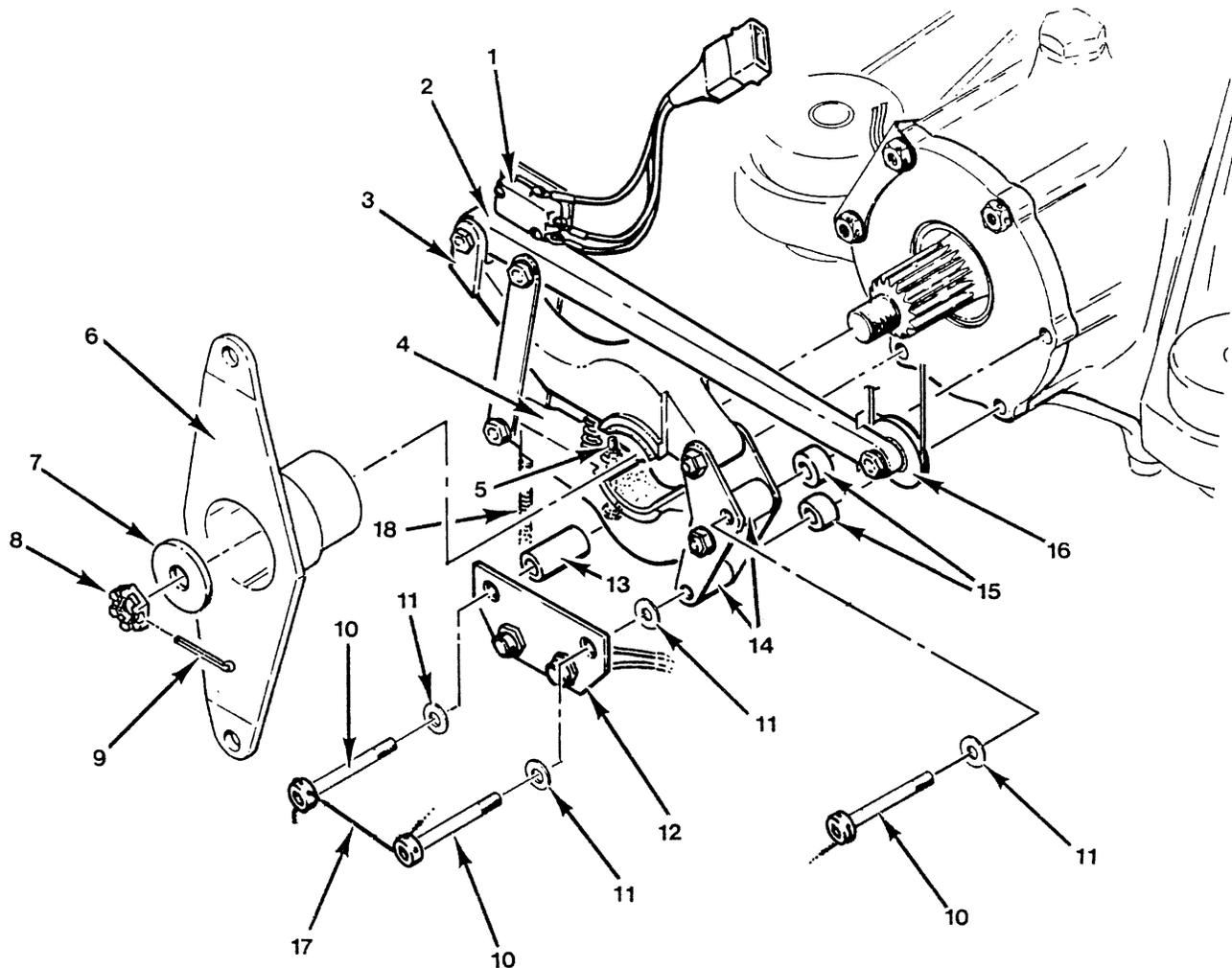


FIGURE 7-16 ROTOR BRAKE INSTALLATION

<u>NUMBER</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>NUMBER</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
1	-	Micro Switch	12	D114-1	Bracket
2	D112-1	Lever	13	C130-4	Spacer
3	D110-1	Arm Assembly	14	A130-41	Spacer
4	D123-1	Arm Assembly	15	C130-3	Spacer
5	NAS428-3-14	Bolt	16	AN210-1A	Pulley
	NAS1291-3	Nut	17	-	0.032 in. dia Safety Wire
6	C908-1	Yoke Assembly	18	E0240-037-3500S	Spring
7	C141-10	Washer			
8	AN320-8	Nut			
9	MS24665-210	Cotter Pin			
10	NAS1352-4H30P	Screw			
11	AN960-416	Washer			

7.620 Rotor Brake Installation (cont'd)

- c) Insert the third bolt through the Hall Effect sender plate and the long C130-4 spacer. Finger tighten the three bolts into the gearbox, then torque the bolts to 120 in.-lb and safety with 0.032 inch diameter safety wire. Attach the spring to the firewall angle.
- d) Place the C908-1 yoke on the pinion shaft. Install one each C141-10 washer and AN320-8 nut on the pinion shaft. Torque the nut to a minimum of 290 in.-lbs. Align the castellations on the nut with the hole through the pinion shaft. Do not exceed 410 in.-lbs. Install one MS24665-210 cotter pin.
- e) Set the Hall Effect sender-to-magnet gap per Section 7.141.
- f) Attach the cable pulley to the lever. Reconnect the wiring to the micro switch at the three-pin connector.
- g) With the brake engaged, adjust the gap between the NAS428-3-14 bolthead on the D123-1 arm and the C130-4 spacer to 0.030-0.035 inch. Lock the adjustment by tightening the MS21042L3 nut (see Figure 7-16A).
- h) With the brake in the released position, measure the gap between the D112-1 lever and the D110-1 arm assembly. The gap measurement should be 0.030 - 0.170 inch. Adjust the length of the bead chain as required to obtain proper gap.
- i) Adjust the micro switch to open and close at a gap of 0.20 - 0.30 inch between the D112-1 lever and the D110-1 arm.
- j) Install the forward flex plate. Check the clutch sheave alignment per Section 7.230. Check the intermediate flex plate installation and shimming per Section 7.330.

7.630 Rotor Brake Pad Replacement

- a) Minimum pad thickness is 0.030 inch.
- b) Brake pad replacement is accomplished by replacing the D110-1 and D123-1 arm assemblies.

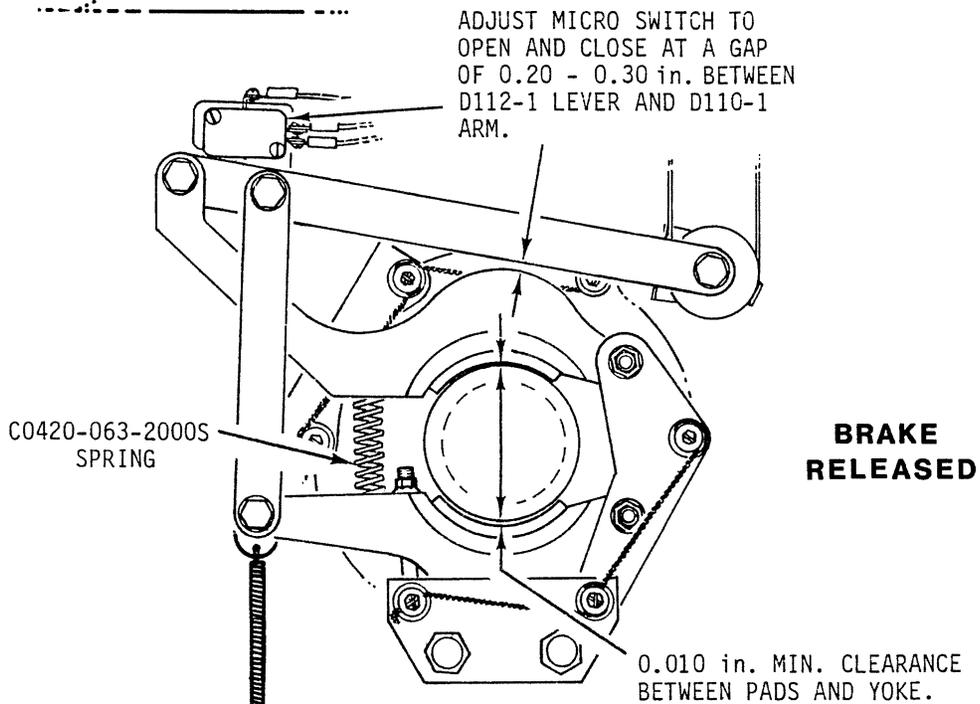
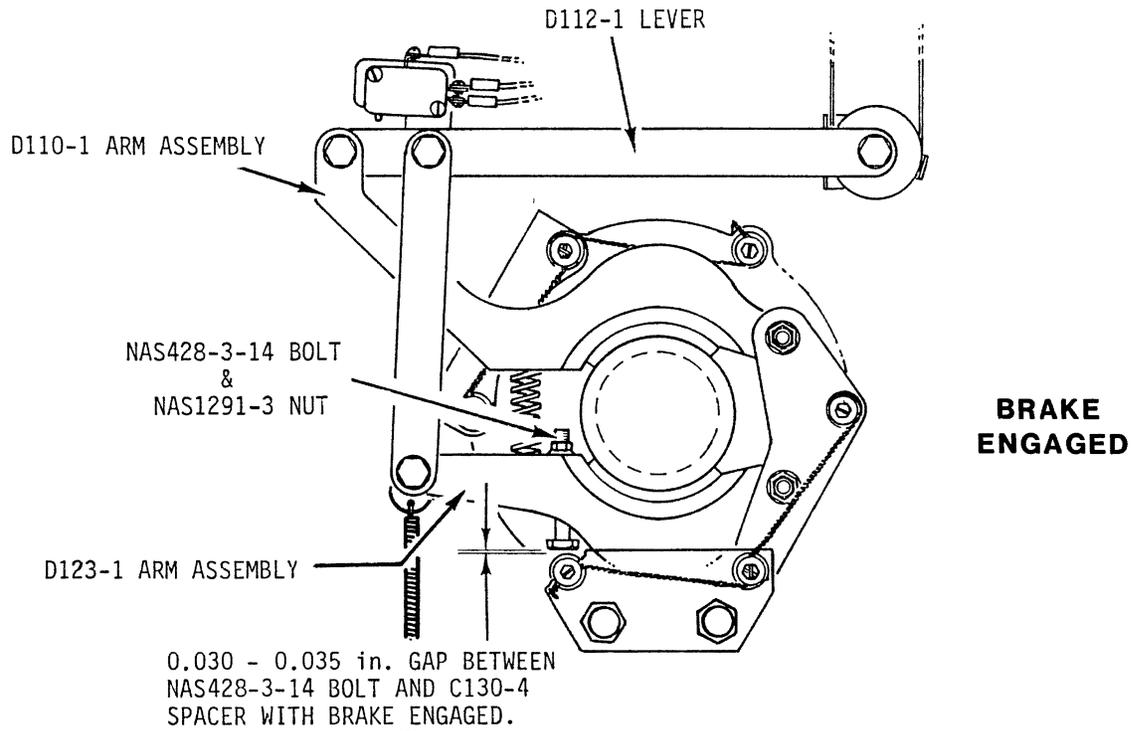


FIGURE 7-16A
ROTOR BRAKE ADJUSTMENTS AND CLEARANCES