

CHAPTER 7

DRIVE TRAIN

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CHAPTER 7

DRIVE TRAIN

7.000 Drive Train7.001 Introduction

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

7.002 Description (See Figure 7-1)

A steel-coated multiple-grooved aluminum pulley, known as the lower sheave, is bolted directly to the crankshaft. Two banded-pair V-belts transmit power to the anodized aluminum upper sheave; a steel-coated upper sheave is optional. The upper sheave has an overrunning sprag clutch, also known as a freewheeling unit, in its hub through which passes the clutch shaft. The clutch shaft receives power from the sprag clutch and transmits power forward to the main rotor gearbox and aft to the tail rotor driveshaft. Flexible couplings are located at input to the main rotor gearbox and at each end of the long tail rotor driveshaft. The main rotor gearbox contains a single-stage spiral-bevel gear set which is splash-lubricated. The tail rotor driveshaft has no hanger bearings but has a lightly-loaded damper bearing. The tail rotor gearbox also contains a splash-lubricated spiral-bevel gear set. Tail rotor gearbox input and output shafts are made of stainless steel to resist corrosion. Other shafts throughout drive system are made of alloy steel.

7.100 Main Rotor Gearbox7.110 Main Rotor Gearbox Removal

1. Remove main rotor per §§ 9.111 & 9.121.
2. Remove swashplate per § 8.411.
3. Remove mast fairing and aft cowl.
4. Disconnect rotor brake cable from brake lever.
5. Remove fuel tank(s) per § 12.100. Mark all wires for reassembly.
6. Remove jackshaft and support struts per §§ 8.311 & 8.321.
7. Remove clutch assembly per § 7.210.
8. Disconnect chip detector, Hall Effect senders, rotor brake switch and overtemp sender at quick disconnects. Disconnect ground wire. Mark all wires for reassembly.
9. Remove gearbox cooling hose and nozzle.
10. Remove four main rotor gearbox mounting bolts. Carefully lift gearbox up to clear forward push-pull tubes and remove gearbox (see Figure 7-2).

WARNING

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

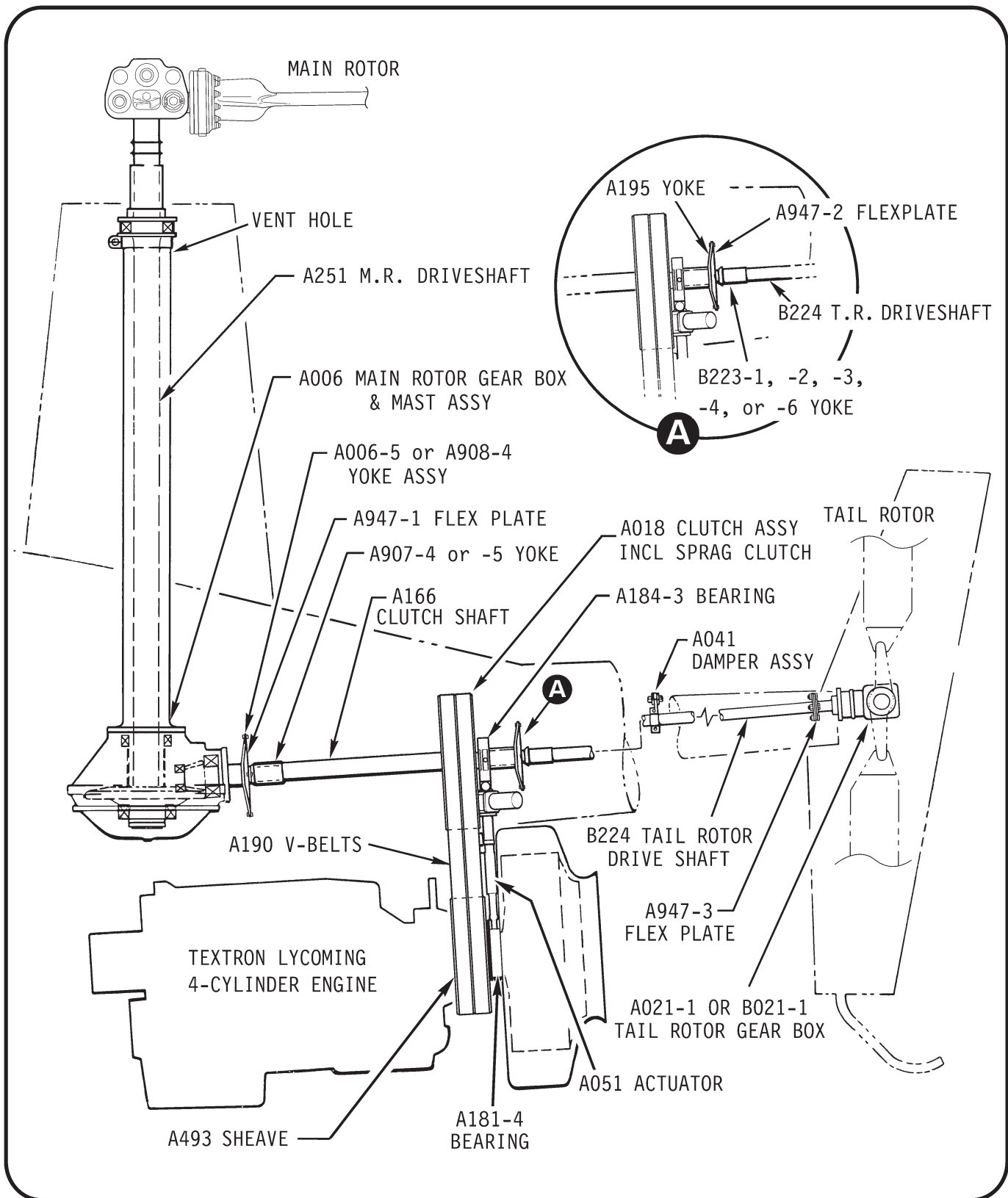


FIGURE 7-1 DRIVE TRAIN

7.120 Main Rotor Gearbox Installation

1. Ensure area is clear for installation of gearbox. One or two other people are needed to help position gearbox.
2. If original shims unknown or a new upper frame has been installed, Level main rotor gearbox mounting pads per Section 7.130. Install proper shims on main rotor gearbox mount pads before gearbox installation. Install main rotor gearbox attach bolts and A650 fittings and torque per Section 1.330.
3. Install clutch assembly per Section 7.220.
4. Install jackshaft support and jackshaft per Sections 8.312 and 8.322.
5. Install main rotor gearbox cooling hose and nozzle.
6. Install fuel tank(s) per Section 12.130 and 12.170.
7. Connect rotor brake cable to brake lever. Torque bolt per Section 1.320 and torque stripe per Figure 2-1. Verify rotor brake switch activates per Figure 7-16A dimension.
8. Connect electrical leads at fuel tank(s) and main rotor gearbox.
9. Install aft cowling and clamp static line.
10. Install fairing lower rib and ensure it is aligned with helicopter's longitudinal axis. Connect pitot tube to pitot line and install mast fairing.
11. Install swashplate assembly per Section 8.412.
12. Install main rotor system per Sections 9.112 and 9.122
13. Refer to Section 1.110 for new or overhauled gearbox servicing instructions.

CAUTION

Prior to operation of a new, overhauled, or repaired gearbox, or if gearbox has ever been laid horizontally, 6 ounces of A257-2 gear oil must be injected into vent hole (see Figure 7-1) on top aft side of mast tube. Gearbox must remain vertical during and after injecting oil. Fill gearbox with oil, via fill port, to level indicated on sight glass decal.

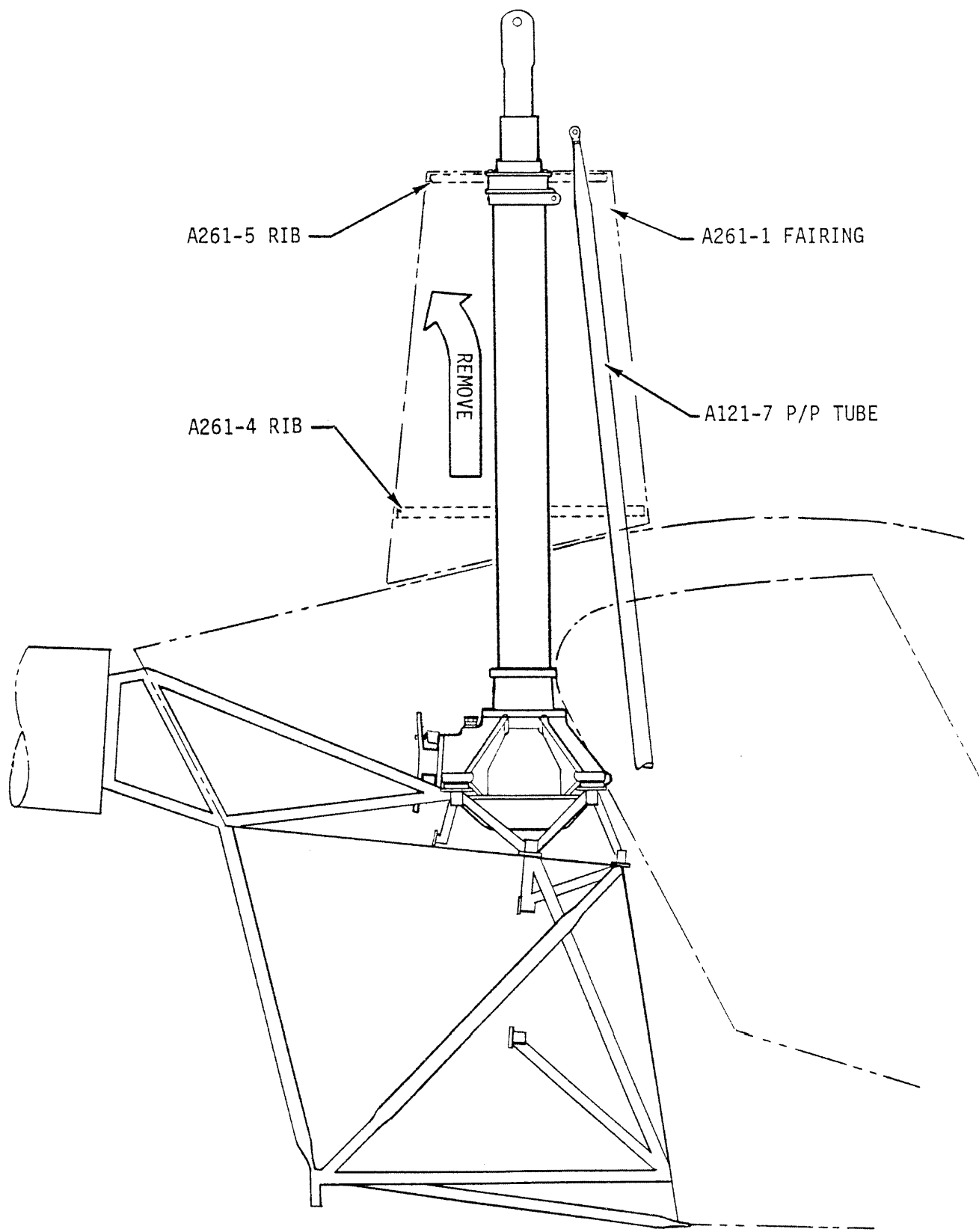


FIGURE 7-2 MAIN ROTOR GEARBOX REMOVAL

7.130 Leveling Main Rotor Gearbox

1. Level aircraft per § 18-13.
2. Place A796 shims as required on upper frame MRGB mounting pads such that a level laid laterally or longitudinally between any two pads indicates $\pm 0.20^\circ$ or less. If unable to obtain $\pm 0.20^\circ$, level to within one 0.020 inch thick shim. Maximum six shims per pad.

<p style="text-align: center;">NOTE</p> <p>Ensure at least one pad has no shims. As required after leveling, remove equal number of shims from each pad.</p>

3. Install main rotor gearbox per § 7.120.

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7.140 A006-5 or A908-4 Yoke Removal and Installation

Yoke Removal:

- a) Remove A947-1 flex plate and remove clutch per § 7.210 or support clutch shaft per Figure 7-8.
- b) Place a wooden block between horizontal firewall and yoke flange to counteract torque when loosening nut.
- c) Remove cotter pin and nut from main rotor gearbox pinion shaft and remove yoke.

Yoke Installation:

- a) Install A006-5 or A908-4 yoke on main rotor gearbox pinion shaft. Install A141-10 washer and AN320-8 castellated nut.
- b) Special torque nut per § 23-33 and install cotter pin. Place a wood block between yoke flange and horizontal firewall to counteract torque.
- c) Install clutch assembly, if removed, and connect forward flex plate per § 7.220.

WARNING

A193 flex plates, which do not have bonded washers, are obsolete and must be replaced with A947 flex plates having bonded washers. If a bonded washer separates from an A947 flex plate, flex plate is unairworthy and cannot be repaired. Ensure A947-1 forward flex plate is Rev E or subsequent (identified by letter "E" or subsequent letter on two arms of flex plate).

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

7.141 Setting Hall Effect Sender Gap

Hall Effect sender-to-magnet gap is 0.020 inch \pm 0.005 inch. Gap is adjustable by loosening sender jam nuts. Check gaps between bolt magnets at each sender. After setting gap, tighten jam nuts and torque-stripe.

7.150 Replacement of Main Rotor Gearbox Pinion Seal

- a) Ensure belt tension actuator is fully disengaged. Disconnect A947-2 intermediate flex plate at tail rotor drive shaft. Note shim location(s) for reinstallation.
- b) Remove A947-1 forward flex plate. Note shim location(s) for reinstallation.

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7.150 Replacement of Main Rotor Gearbox Pinion Seal (continued)

- c) Rest forward end of clutch shaft on firewall. Remove yoke from pinion shaft per § 7.140.
- d) Cut safety wire securing pinion bearing end cover bolts and remove bolts.
- e) Remove Hall Effect sender bracket(s) and gearbox overtemp sender bracket.
- f) Carefully slide pinion bearing end cover off pinion shaft.

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 lip must point toward gearbox.

- h) Position bearing end cover on pinion shaft. Install Hall Effect and overtemp sender brackets and remaining end cover bolts.
- i) Torque bolts per § 23-33 and safety wire.
- j) Adjust Hall Effect sender gap per § 7.141.
- k) Install A947-1 forward flex plate and connect A947-2 intermediate flex plate, ensuring correct ship placement.

7.155 Replacement of Main Rotor Gearbox (MRGB) Sump O-Ring

- a) Drain MRGB.
- b) Remove MRGB per § 7.110.
- c) Check and record MRGB gear backlash at and tangential to a gear tooth, accessible via sight gage or filler-plug hole.
- d) Carefully note and record position of each fastener, washer and shim stack-up at all A263-1 sump-to-A264-1 housing attach points (an equal number of shims is installed between sump and housing at each attach point). Remove, identify and retain fasteners, washers and shims.
- e) Remove sump and o-ring.
- f) Prelubricate new A214-172 o-ring with correct gearbox oil (refer to § 22-10 Part C) | and install on sump. Ensure o-ring is not twisted in sump groove.

7.155 Replacement of Main Rotor Gearbox (MRGB) Sump O-Ring (continued)

- g) Carefully assemble sump to housing and secure finger-tight with fasteners, washers and shims installed in same positions recorded in step d).

NOTE

Install ground wires under nut located aft of forward right mount.

CAUTION

Verify all sump bolts have same shim stack as noted during removal.

- h) Torque fasteners as follows:

Eight nuts on AN4 bolts:	90 in.-lb (incl nut self-lock torque)
Two MS20074 cap screws:	60 in.-lb and safety wire
A7260 chip detector housing:	150 in.-lb and safety wire
A7260 chip detector:	75 in.-lb and safety wire

- i) Check MRGB gear backlash exactly as performed in step c). Backlash should be within 0.001 inch of value recorded in step c).
- j) Install MRGB per § 7.120.
- k) Fill MRGB with correct gearbox oil (refer to § 22-10 Part C).

7.160 Main Rotor Gearbox Overtemp Inspection

- a) If "MR TEMP" warning light illuminates AND Telatemp indicates abnormally high operating temperature:
1. Inspect gearbox cooling duct for obstructions and conditions. Clear obstructions or replace duct as required.
 2. Remove chip detector and inspect for chips. Return gearbox to RHC if chips are found.
 3. 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.
 4. Replace Telatemp. Ensure old Telatemp adhesive is removed and new Telatemp makes good contact with gearbox.
 5. If gearbox overtemp indications continue, return gearbox to RHC.

7.160 Main Rotor Gearbox Overtemp Inspection (cont'd)

- b) If "MR TEMP" warning light illuminates but Telatemp indicates normal operating temperature, replace gearbox overtemp sender and perform steps a) 1, 2, & 5 above.
- c) If Telatemp indicates 240°F/116°C but "MR TEMP" warning light does not illuminate, test "MR TEMP" warning circuit and perform steps a) 1, 2, 4, & 5 above.

NOTE

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

7.170 Main Rotor Gearbox Chip Light Indicator

If "MR CHIP" light illuminates:

- a) 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.
- b) 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.
- c) If "MR CHIP" illuminates again within next 100 hours time-in-service a gearbox failure may be imminent. Return gearbox to RHC for repair.

7.180 (Reserved)

7.200 CLUTCH ASSEMBLY

7.210 Clutch Assembly Removal

1. Remove A947-2 intermediate flex plate.
2. Turn Master Battery switch on and disengage clutch switch. Adjust actuator down-limit stop screw (see Figure 7-15) for maximum drive belt slack. Turn Master Battery switch off.

CAUTION

Belt tension actuator must be fully disengaged prior to removing clutch assembly.

3. Disconnect A947-1 forward flex plate.

WARNING

A193 flex plates, which do not have bonded washers, are obsolete and must be replaced with A947 flex plates having bonded washers. If a bonded washer separates from an A947 flex plate, flex plate is unairworthy and cannot be repaired.

4. Disconnect A184 upper actuator bearing assembly from actuator.
5. Disconnect clutch lateral centering strut from upper frame.
6. Disconnect actuator wiring.
7. Pivot actuator to right. Lower clutch to allow drive belt removal.

CAUTION

Mark drive belt fore and aft positions and direction of rotation per Figure 7-8 if reinstalling drive belts.

8. Remove drive belts from clutch and remove clutch per Figure 7-3.
9. When returning clutch to RHC, remove and retain both yokes, centering strut, and attaching hardware.

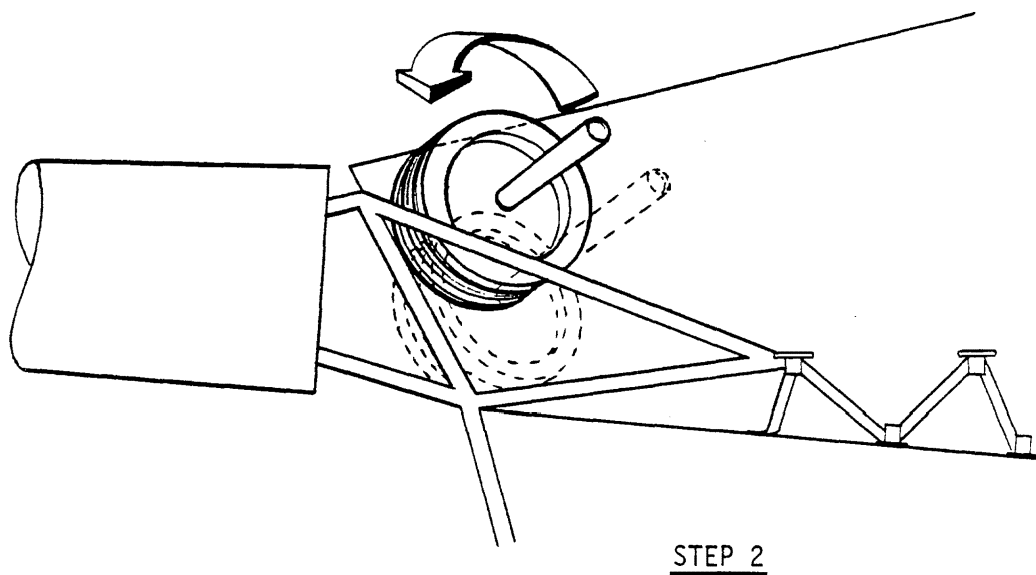
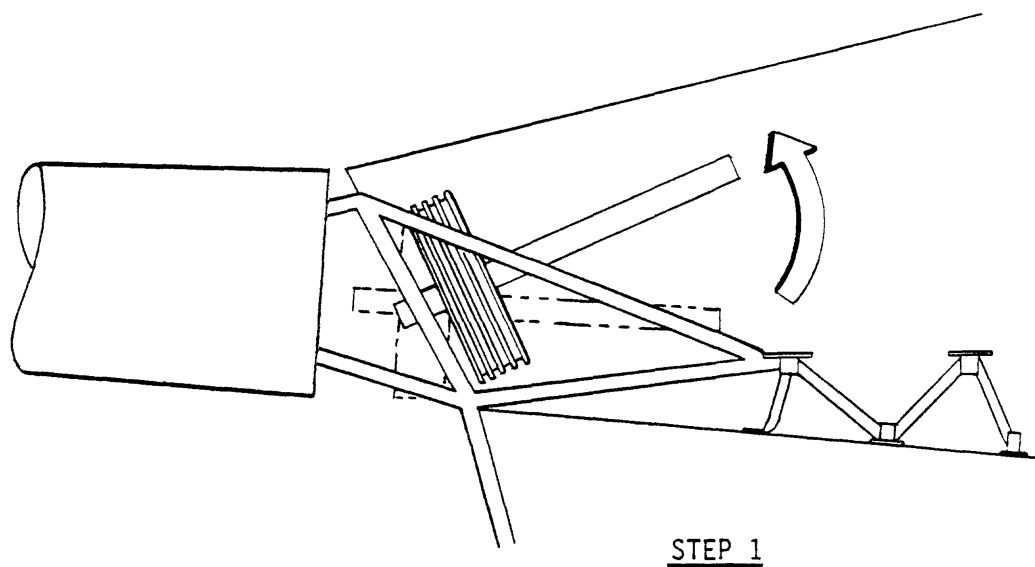


FIGURE 7-3 CLUTCH REMOVAL

7.211 A184 Bearing Removal

- a. Refer to Figures 7-3A and 7-3B. Remove A184 bearing:
 1. If a press is available, assemble MT303-5 lower puller assembly between A184 bearing and upper sheave per Figure 7-3A. Press clutch shaft out of bearing.

CAUTION

Ensure A018 assembly does not fall when bearing is removed.

2. If press is not available, assemble MT303-2 upper puller assembly with MT303-5 lower puller assembly on clutch per Figure 7-3B. Install MT303-16 plug in short end of clutch shaft and secure with MT303-13 pin. Ensure extractor bolt threads are lubricated with anti-seize. Remove bearing by holding handle and tightening extractor bolt.

WARNING

A647-4 bearing in A184-3 upper bearing assembly has internal clearance modified by RHC. **DO NOT SUBSTITUTE.**

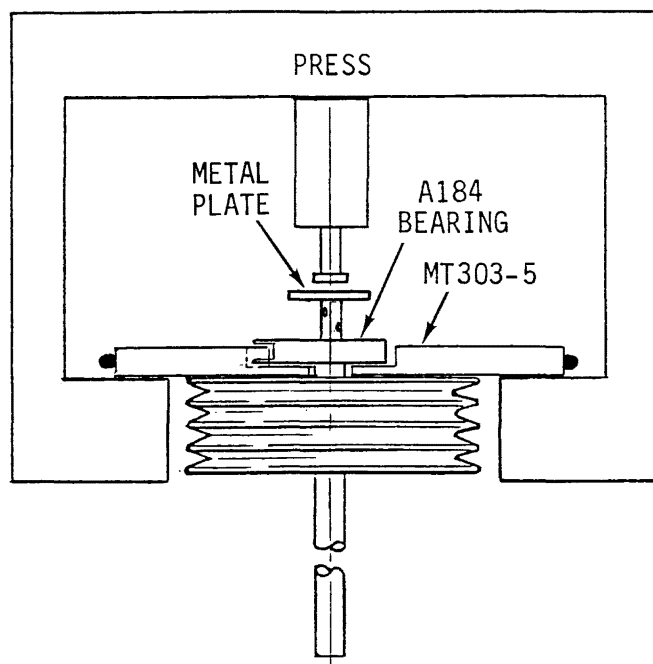


FIGURE 7-3A

Removing A184 Bearing in shop using hydraulic press and MT303-5 Lower Puller Assembly.

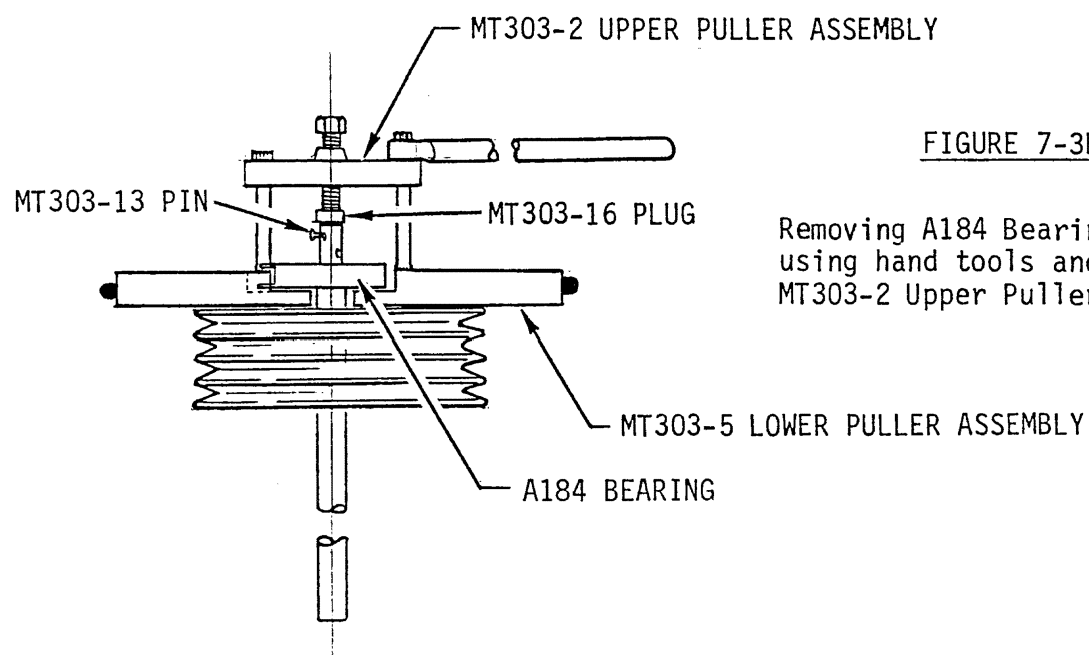


FIGURE 7-3B

Removing A184 Bearing in field using hand tools and MT303-5 and MT303-2 Upper Puller Assembly.

7.212 A184 Bearing Installation

1. Remove loose paint and clean mating area on shaft.
2. Heat A184 bearing assembly. A heat lamp placed one foot from bearing may be used. Ensure temperature of bearing does not exceed 180° F by monitoring Telatemp installed on bearing.
3. Apply zinc-chromate or epoxy primer, or B270-10 adhesive, to bearing mating area of shaft. While primer or adhesive is still wet, install bearing on clutch shaft:

NOTE

Ensure bearing is installed with lateral centering strut attachment ear to left side and actuator attachment on bottom per Figure 7-3F.

- I. If press is available: If installed, remove A907 forward yoke. Position MT303-19 tube against A184 bearing assembly inner race and press assembly onto clutch shaft per Figure 7-3E until bearing is at dimension shown in Figure 7-3D.

CAUTION

Do **NOT** support clutch assembly by sheave while pressing or internal bearing will be damaged.

Do **NOT** press bearing beyond dimension shown in Figure 7-3D.

- II. If press is not available: Install MT303-4 bearing press assembly and handle from MT303-2 upper puller assembly per Figure 7-3G. Lubricate threaded shaft portion of MT303-4 bearing press assembly with anti-seize compound then insert drilled end into clutch shaft. Align clutch shaft holes with threaded shaft hole and insert MT303-13 pin. Hold handle and tighten nut on MT303-4 bearing press assembly until bearing is at dimension shown in Figure 7-3D.
4. Remove bearing press tooling.
 5. Check bearing for smooth operation.
 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 new Telatemp on A184 bearing housing if original was altered by heating.

7.213 Clutch Assembly Seal Replacement

1. Remove clutch assembly per § 7.210.
2. If replacing aft seal, remove A184-3 bearing assembly from clutch shaft per § 7.211. Remove loose paint and clean shaft.

NOTE

Orient clutch assembly vertically with leaking seal up.

3. Remove inner circle of six (6) bolts from leaking seal retainer.
 - a. If seal retainer is circular with two opposing half-moon-shaped cutouts: Remove four (4) bolts in outer row, but not two (2) bolts with large-area washers (which holds inner clutch assembly together).

NOTE

DO NOT REMOVE two bolts holding the inner clutch assembly together. Further disassembly is not approved.

- b. If seal retainer has two socket-head cap screws: Remove six bolts in outer row, and two socket-head cap screws.
4. Lift retainer plate with seal off shaft per Figure 7-3C. Remove exposed O-ring from clutch housing and discard.
5. Press damaged seal out of retainer.
6. Measure retainer seal bore. If bore measures over 1.687 inches, retainer must be replaced.
7. For "National" brand seals coat seal bore of retainer with B270-3 sealant and press seal in at room temperature. For "CR" brand seal with green coating on seal outer diameter, heat retainer to 150°F and press seal in dry. Press new seal into retainer flush with outside lip.
8. Fill sprag and bearing cavity with A257-4 oil until oil level is flush with top of bearing races (see Figure 7-3D). Rotate shaft while filling to ensure complete filling of inner shaft and sprag assembly.
9. Lightly lubricate new O-ring with A257-4 oil and place it in clutch housing groove.
10. Lightly lubricate seal inner lip with A257-4 oil and slide retainer over shaft.

7.213 Clutch Assembly Seal Replacement (continued)

11. a. If seal retainer is circular with two opposing half-moon shaped cutouts: Position retainer so cut outs fit over two (2) A141-14 washers holding clutch assembly together. Install six (6) inner and remaining four (4) outer bolts in retainers with heads toward shorter end of clutch shaft.

b. If seal retainer has provisions for two socket-head cap screws: Install cap screws with washers and tighten only enough to clamp retainer to o-ring. Install six inner and six outer bolts with heads toward shorter end of clutch shaft.
12. Using a criss-cross pattern, standard torque nuts per § 23-32 and torque stripe.
13. If installed, fully tighten cap screws and torque stripe.
14. If removed, install A184-3 bearing assembly per § 7.212.
15. Install clutch assembly per § 7.220.

7.214 Clutch Assembly Lubricant Inspection and Servicing

| This section has been moved to § 22-30.

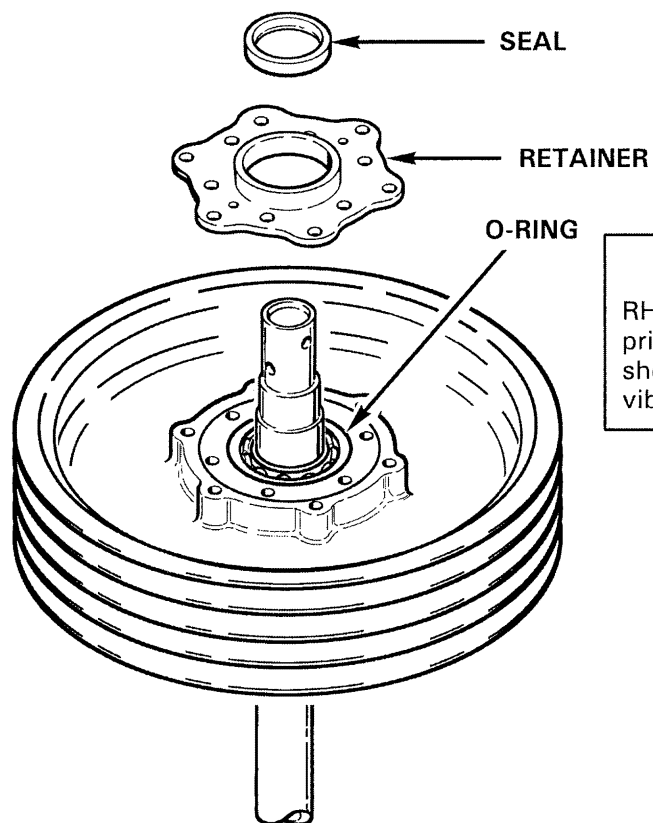


FIGURE 7-3C

CAUTION

RHC does not recommend using A170-1 or -2 Revision N or prior upper sheaves with A493-1 Revision T or later lower sheaves. Such combinations may cause excessive drive belt vibration. Refer to Figure 2-9.

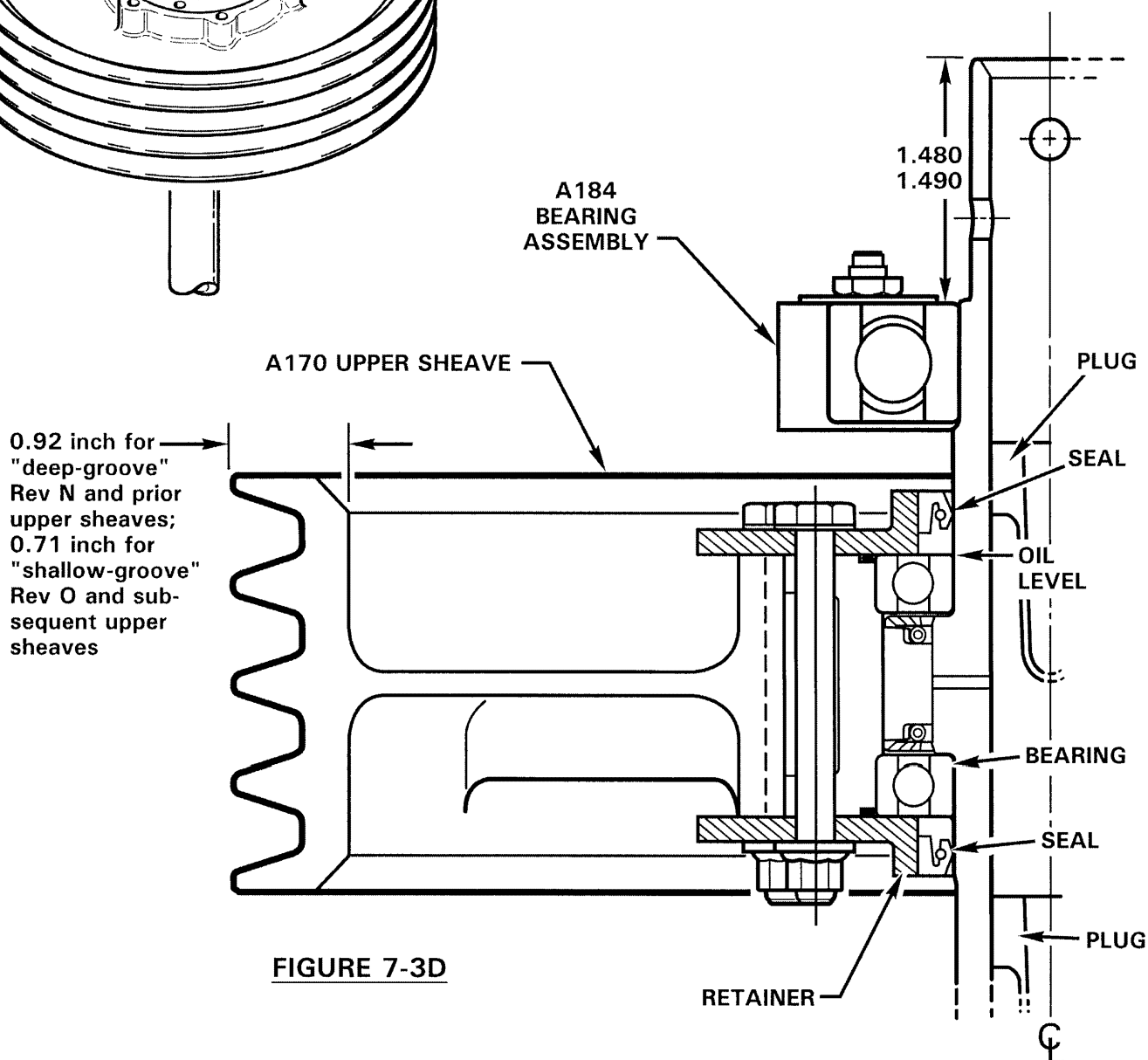
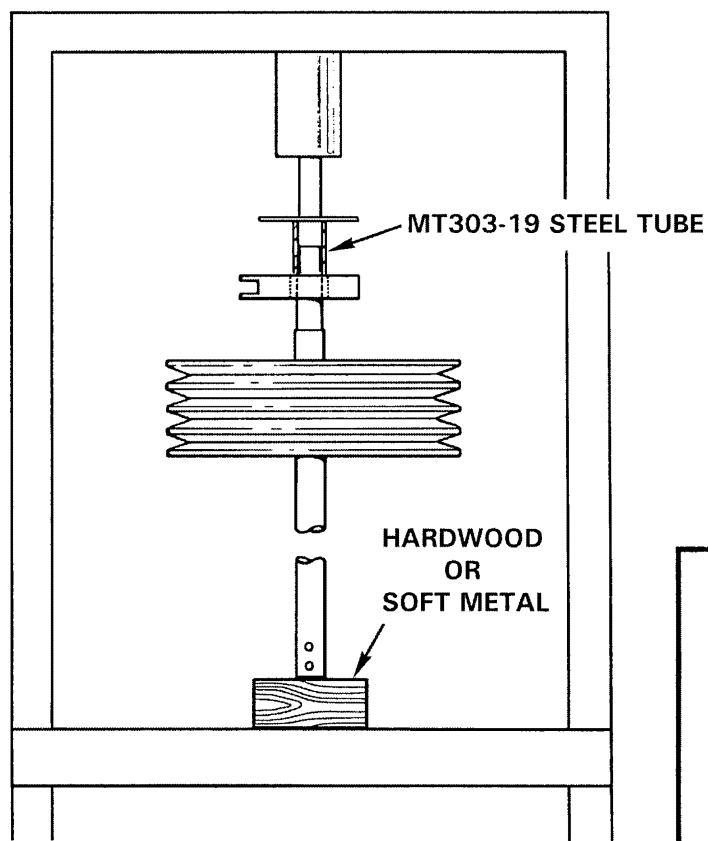


FIGURE 7-3D

FIGURE 7-3E

**INSTALLING A184 BEARING USING
MT303-19 BEARING PRESSING TOOL**



WARNING

Do not press across sheave or
bearings will be damaged.

FIGURE 7-3F

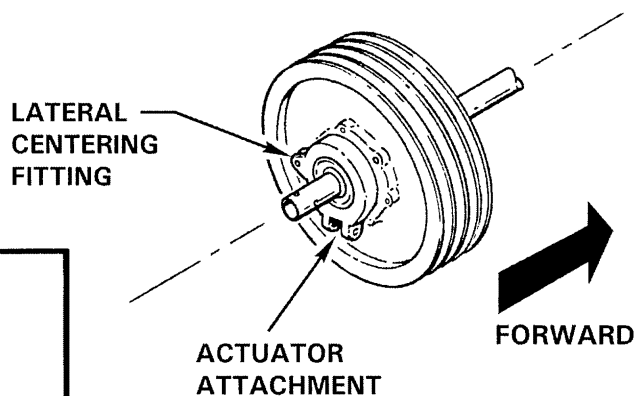
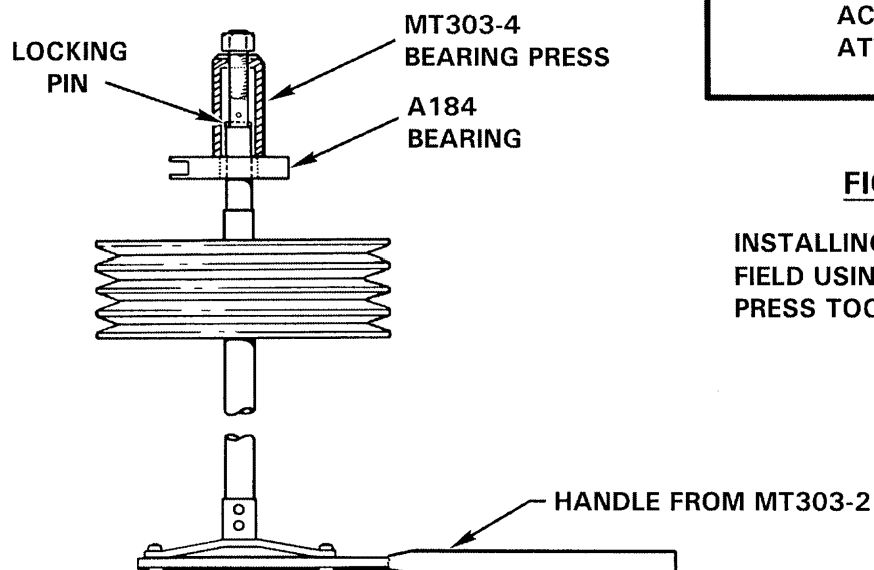


FIGURE 7-3G

**INSTALLING A184 BEARING IN THE
FIELD USING MT303-4 BEARING
PRESS TOOL**



7.220 Clutch Assembly Installation

1. If removed, install A195 and/or A907 yokes per §§ 7.260 & 7.270.
2. If removed, connect clutch lateral centering strut to A184 bearing assembly and standard torque fasteners per § 23-32.
3. Ensure actuator is fully disengaged.
4. Identify type (deep-groove or shallow-groove) of upper and lower sheaves. Refer to Figures 7-3D & 2-11.

CAUTION

RHC does not recommend using A170-1 or -2 Revision N or prior upper sheaves with A493-1 Revision T or later lower sheaves. Such combinations may cause excessive drive belt vibration.

5. Install clutch assembly and pull belts over clutch aft yoke. Install belts in proper fore/aft order with proper direction of rotation.
6. Attach clutch assembly to clutch actuator. Standard torque fasteners per § 23-32.
7. Install A947-1 flex plate. Standard torque fasteners per § 23-32.

WARNING

A193 flex plates, which do not have bonded washers, are obsolete and must be replaced with A947 flex plates having bonded washers. If a bonded washer separates from an A947 flex plate, flex plate is unairworthy and cannot be repaired. A947-1 flex plate must be marked with letter "E" (or subsequent letter) on two adjacent arms.

8. Connect clutch lateral centering strut from clutch assembly to upper frame. Standard torque fasteners per § 23-32.
9. Check clutch sheave alignment per § 7.230 and adjust as required.
10. Install A947-2 intermediate flex plate per § 7.330.
11. Adjust actuator down-limit stop screw (see Figure 7-15) for V-belt deflection shown in Figure 7-7A.
12. Perform run-up per § 2.210. Adjust actuator down-limit stop screw as required and tighten down-limit stop screw jam nut.
13. Torque stripe fasteners per Figure 2-1.

7.230 Clutch Sheave Alignment

1. Check engine shimming installation limits per § 6.130. Ring-gear-to-frame dimension must be within specified limits before sheave alignment is checked.
2. Engage clutch (fan and scroll must be installed).
3. Check clutch shaft angle per § 7.240.
4. Hold MT331-4 sheave alignment bar against aft face of lower sheave extending bar upward to horizontal center line of clutch assembly upper sheave.
5. Measure left and right gaps per Figure 7-5. Both gaps must be within noted limits and left gap must be 0.010–0.030 inch larger than right gap. If left gap is not 0.010–0.030 inch larger than right gap, adjust clutch lateral centering per § 7.250 or adjust engine shims.

If either gap exceeds maximum limit, clutch assembly is too far forward or engine is too far aft. Engine may be moved forward by removing an equal amount of shims from each engine mount, subject to § 6.130 minimum shim requirement. Alternatively, the clutch assembly may be moved aft by shimming at forward flex plate and/or adjusting A907 yoke length. Shimming is accomplished by installing a maximum of one AN960-516L washer between A947-1 flex plate and both arms of A907 and/or A908 yoke; AN960-516L washers installed on either yoke will decrease right and left gaps an amount equal to the washer's thickness. A907-4 and -5 yokes each have two sets of mounting holes which change effective yoke length by 0.120 inch. A907-5 yoke is 0.120 inch or 0.240 inch longer than long position of A907-4 yoke, depending on mounting holes used. Right and left gaps will decrease by 0.120 inch with each 0.120 inch increase in A907 yoke length.

If either gap is smaller than minimum limit, clutch assembly is too far aft or engine is too far forward. Engine may be moved aft by adding an equal amount of shims to each engine mount, subject to § 6.130 maximum shim allowance. Alternatively, clutch assembly may be moved forward by removing shims (if installed) at forward flex plate and/or adjusting A907 yoke length. Removing AN960-516L washers from between A947-1 flex plate and both arms of A907 and/or A908 yoke will increase both gaps an amount equal to washer's thickness. A907-4 and -5 yokes each have two sets of mounting holes which change effective yoke length by 0.120 inch. A907-4 yoke is 0.120 inch or 0.240 inch shorter than short position of A907-5 yoke, depending on mounting holes used. Right and left gaps will each increase by 0.120 inch with each 0.120 inch decrease in A907 yoke length.

CAUTION

Disengage clutch prior to shimming A947-1 flex plate.

A907-4 yoke replaces A907-1 and -2 yokes. A907-5 yoke replaces A907-3 yoke and includes an additional set of mounting holes.

7.230 Clutch Sheave Alignment (continued)

6. Check intermediate flex plate shimming per § 7.330 if shims were added or removed at A947-1 flex plate or if A907 yoke position changed.
7. Adjust V-belt guide per Figure 7-8A.
8. Check throttle correlation rigging per § 10.150 and adjust as required.

NOTE

Shortening clutch lateral centering strut simultaneously increases left gap and decreases right gap. Lengthening clutch lateral centering strut decreases left gap and increases right gap.

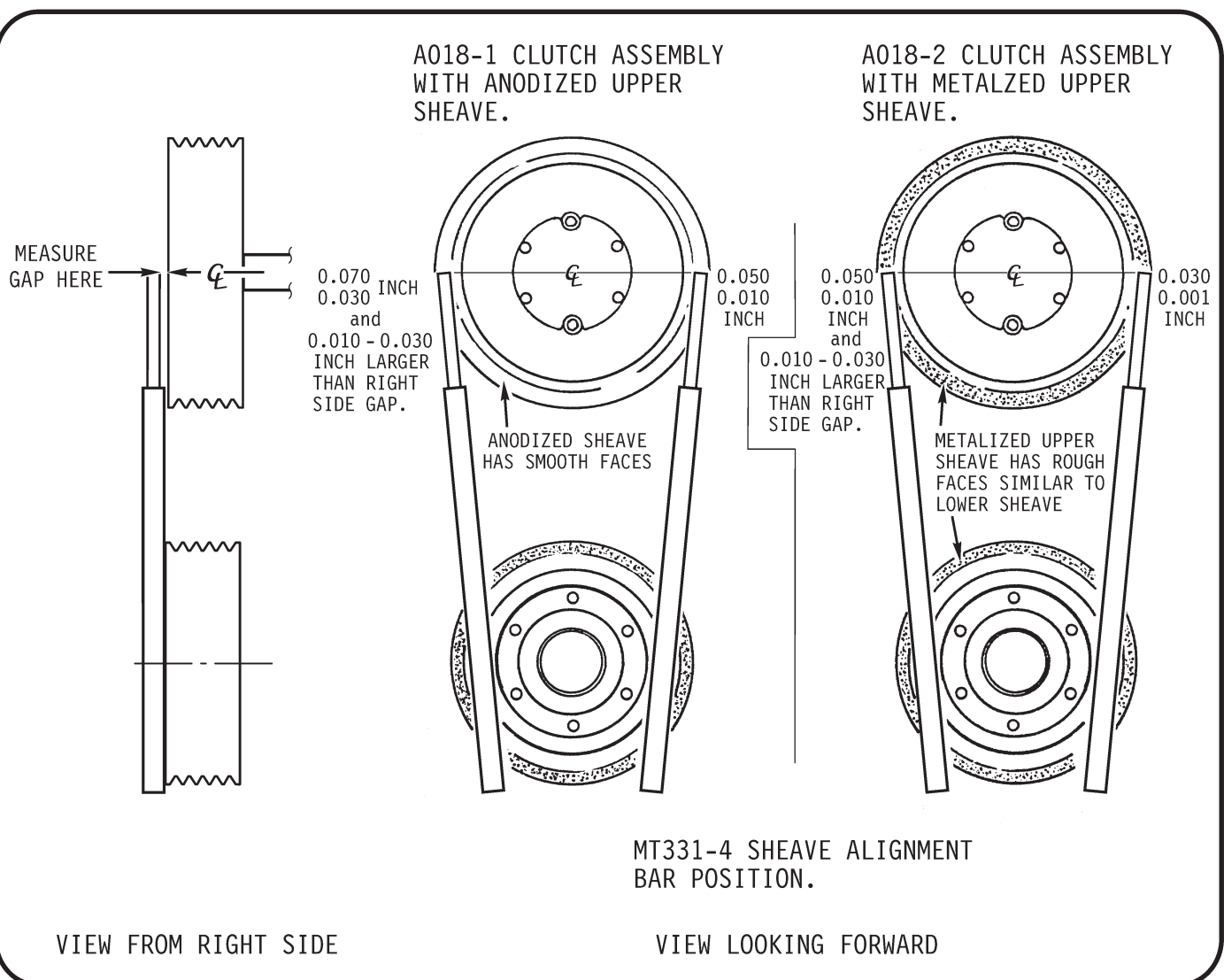


FIGURE 7-5 SHEAVE ALIGNMENT

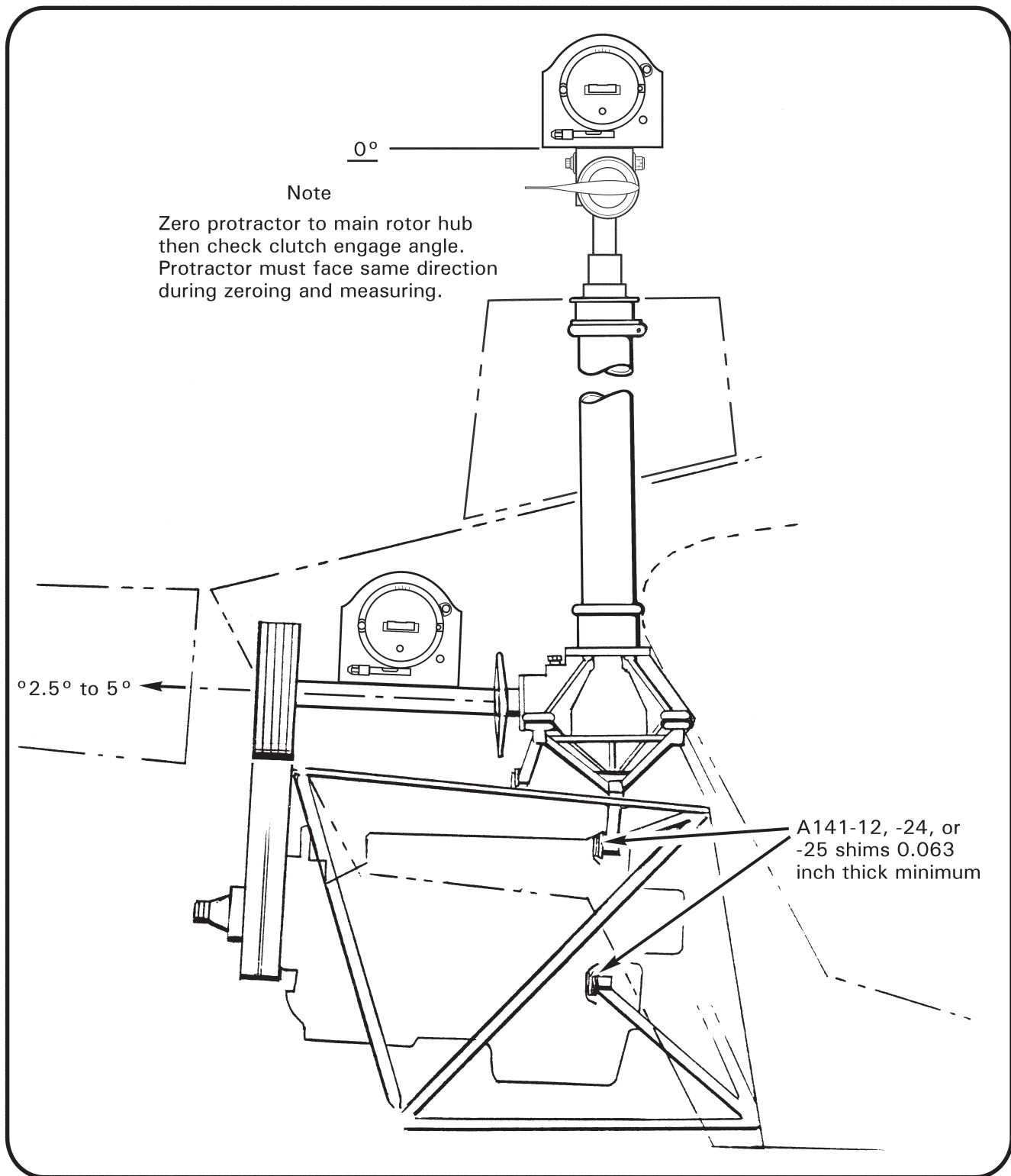


FIGURE 7-6 MEASURING CLUTCH SHAFT ANGLE

7.240 Clutch Shaft Angle

Verify correct engine shimming per § 6.130 prior to checking clutch shaft angle.

1. See Figure 7-6. Orient main rotor blades perpendicular to centerline of helicopter. Position protractor atop main rotor hub facing right side of helicopter as shown. Zero protractor to main rotor hub.
2. Turn master switch on and engage clutch. Check angle of clutch shaft per Figure 7-6.
3. Clutch shaft angle limits with clutch engaged are 2.5 to 5.0 degrees.

Flex plate has zero vertical misalignment when angle is 3.5 degrees. If clutch shaft angle is not within limits, drive V-belts must be replaced.

7.250 Clutch Lateral Centering

1. Clutch actuator fully engaged.
2. Check sheave alignment on left and right side per Figure 7-5.
3. To facilitate sheave alignment, left gap should be 0.010 to 0.030 inch larger than right gap. Clutch lateral centering strut may be adjusted (with clutch engaged) to obtain gap differential provided following clearances are met:
 - a. Minimum 0.030 inch between clutch actuator motor and upper frame tube.
 - b. Minimum 0.150 inch between V-belts and right side frame guard (actuator engaged).
4. If alignment cannot be adjusted within required measurements, contact Robinson Helicopter Company Technical Support.
5. Standard torque attach bolts and jam nuts per § 23-32.

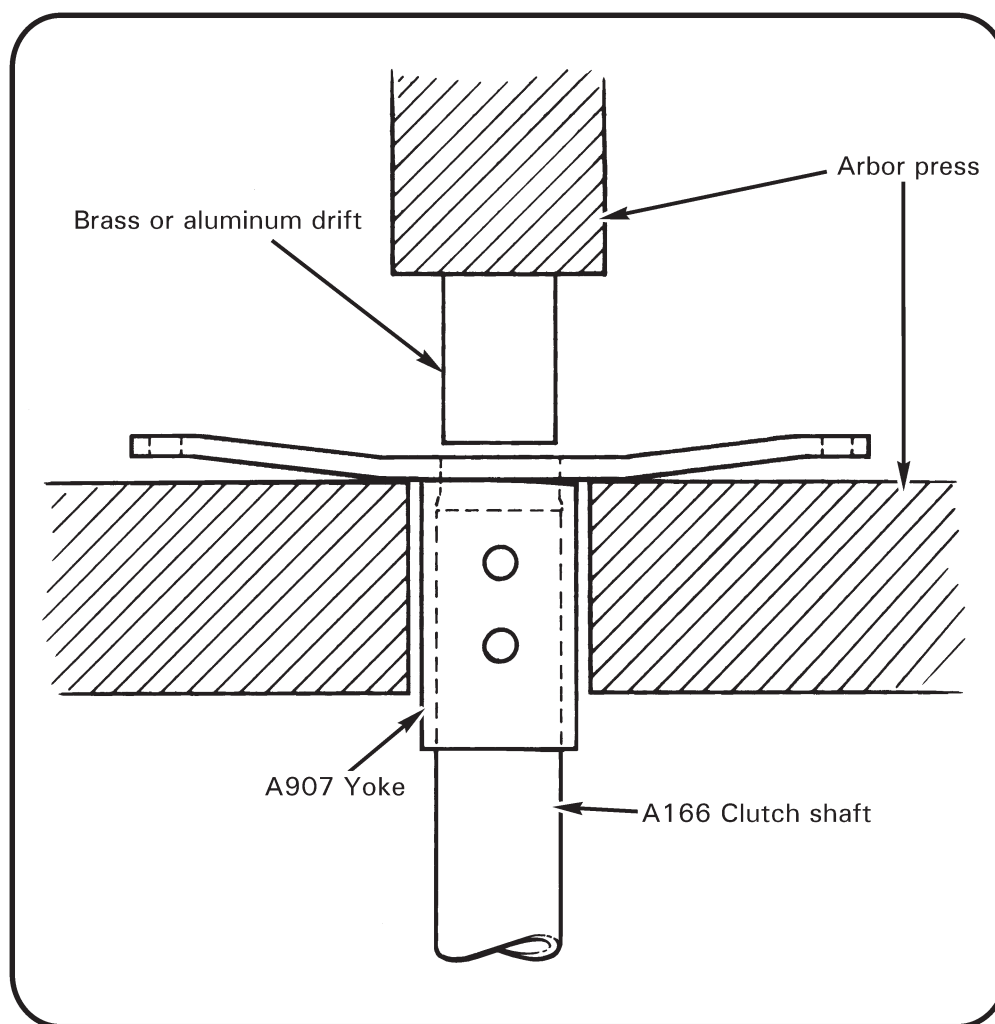


FIGURE 7-6A A907 YOKE REMOVAL

7.260 A907 Yoke Removal and Installation

To remove yoke:

1. Remove clutch assembly per § 7.210.
2. Remove bolts and clamping blocks securing A907 yoke to clutch shaft. Mark which set of yoke attachment holes are used.
3. Remove A907 yoke:
 - a. (Preferred method) If a press is available, position clutch assembly in press per Figure 7-6A. 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, apply penetrating oil to yoke-shaft juncture. Gently clamp A907 yoke in a padded vise per Figure 7-6B. Twist clutch shaft out of yoke by turning upper sheave. If difficulty is encountered, discontinue attempt and arrange use of press as described in preceding step.

CAUTION

Avoid bending loads on clutch shaft when A907 yoke is clamped in vise as yoke can be damaged.

To install yoke:

1. Remove paint from and clean mating area on clutch shaft.
2. Remove paint from A907 yoke bore, from A907 yoke exterior at clamping block attachment areas, and from clamping surfaces of clamping blocks.
3. Coat A907 yoke bore and mating portion of clutch shaft with approved primer (chromate primer preferred; refer to § 23-75). While primer is still wet, install yoke on clutch shaft and align marked holes on yoke (if applicable) with clutch shaft holes.

CAUTION

Use only specified primers to install yoke; do not use any other lubricants.

4. While yoke primer is still wet, secure yoke to shaft with clamping blocks coated with approved primer and bolts. Standard torque bolts per § 23-32. Install palnuts and standard torque per § 23-32.
 5. Clean all exposed bare metal fasteners and joints, and prime with approved primer. Ensure formation of primer fillets at all joints for sealing out moisture.
 6. Torque stripe fasteners.

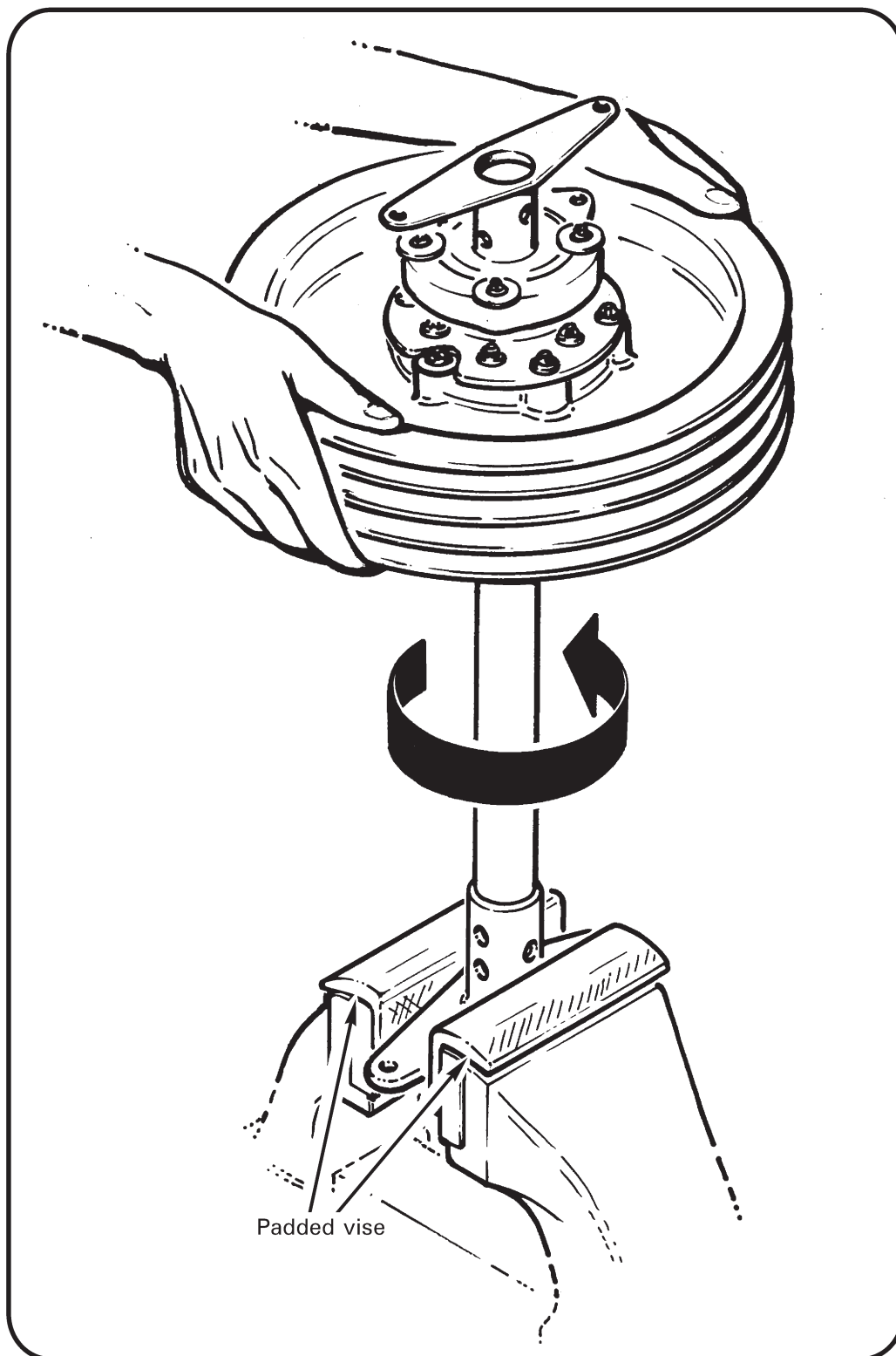


FIGURE 7-6B A907 YOKE REMOVAL

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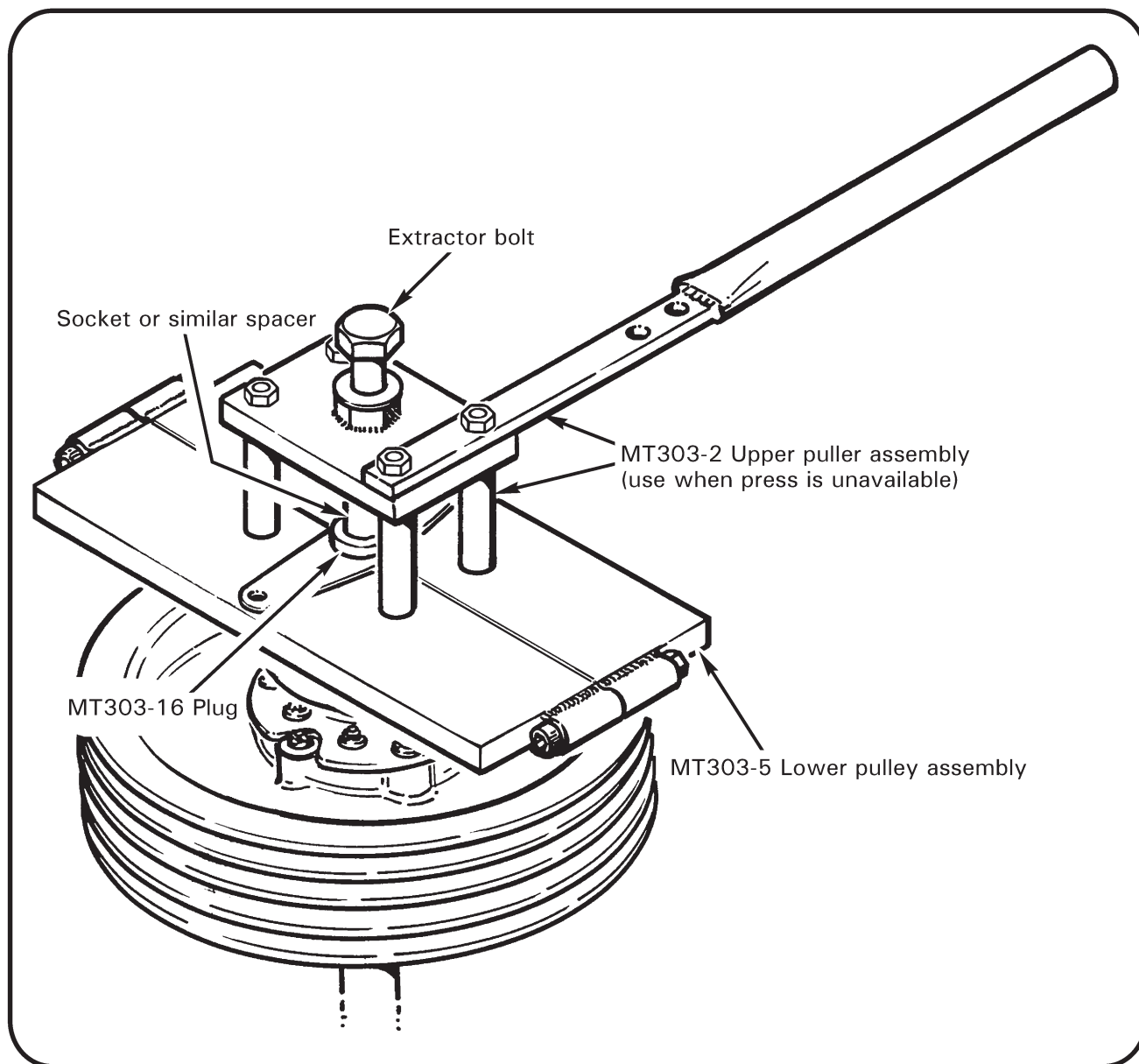


FIGURE 7-6C A195 YOKE REMOVAL

7.270 A195 Yoke Removal and Installation

1. Remove clutch assembly per § 7.210.
2. Remove bolts and clamping blocks securing A195 yoke to clutch shaft.

CAUTION

A195 yoke arms are easily bent. Exercise care when removing or installing yoke. Always remove A195 yoke when shipping or transporting clutch assembly.

3. Remove A195 yoke:
 - a. If a press is available, assemble MT303-5 lower puller assembly around clutch shaft between A184 bearing and A195 yoke. Flat face of puller must be towards yoke. Refer to Figure 7-6C. Insert MT303-16 plug thru A195 yoke bore into clutch shaft and press shaft out of yoke.
 - b. If a press is not available, assemble MT303-5 lower puller assembly with MT303-2 upper puller assembly per Figure 7-6C. Flat face of puller must be towards yoke. Insert MT303-16 plug thru A195 yoke bore into clutch shaft. Place a deep socket (or similar) between MT303-16 plug and extractor bolt. Tighten bolt and remove A195 yoke.

To install yoke:

1. Remove paint from and clean mating area on shaft.
2. Remove paint from A195 yoke bore, from A195 yoke exterior at clamping block attachment areas, and clamping surfaces of clamping blocks.
3. Coat inside of A195 yoke and mating portion of clutch shaft with approved primer (chromate primer preferred; refer to § 23-75). While primer is still wet, slide A195 yoke onto clutch shaft and align mounting holes.
4. While yoke primer is still wet, secure yoke to shaft with clamping blocks coated with approved primer (chromate primer preferred) and bolts. Standard torque bolts per § 23-32. Install palnuts and standard torque per § 23-32.
5. Clean all exposed bare metal fasteners and joints, and prime with approved primer (chromate primer preferred). Ensure formation of primer fillets at all joints for sealing out moisture.
6. Torque stripe fasteners.

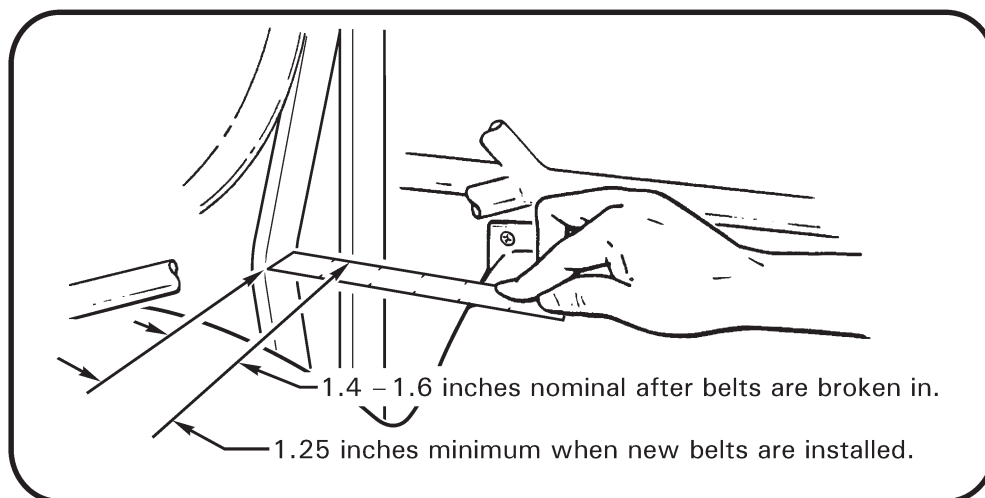


FIGURE 7-7A V-BELT DEFLECTION (ACTUATOR DISENGAGED)

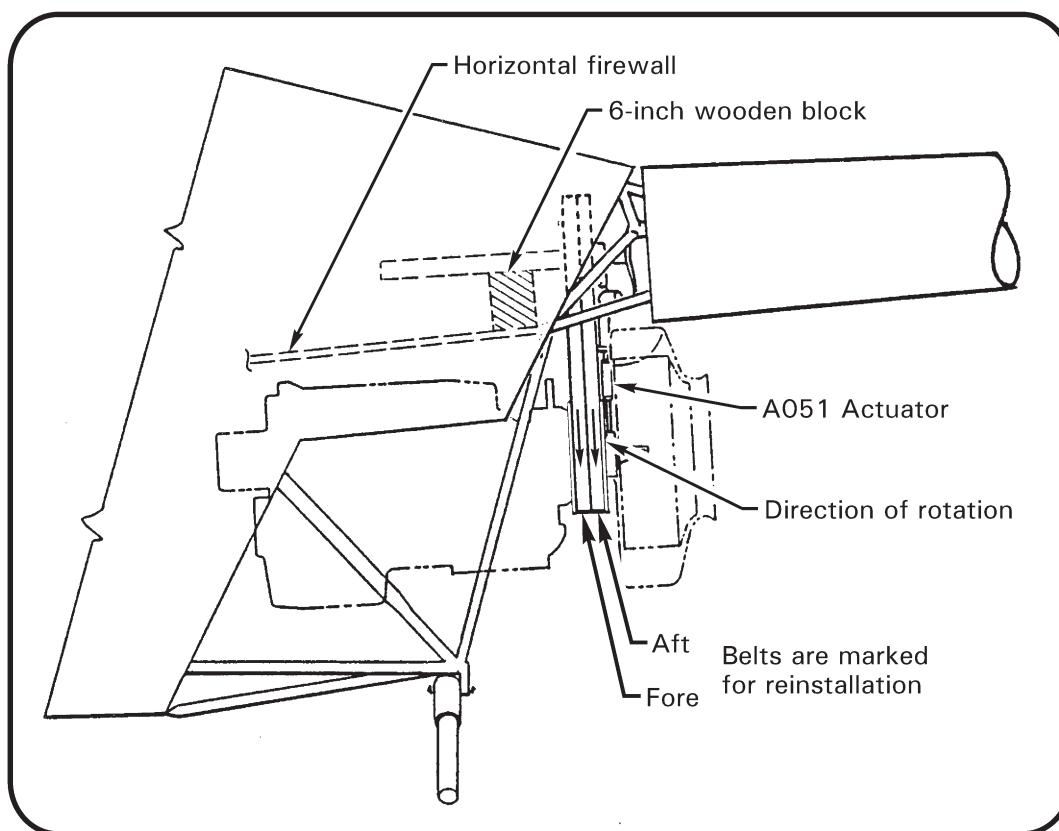


FIGURE 7-8 V-BELT AND ACTUATOR REMOVAL

7.280 V-Belts

7.281 V-Belt Removal

- a. Remove fanwheel per § 6.210.
- b. Fully disengage belt tension actuator. Place a six-inch wooden block between clutch shaft and horizontal firewall per Figure 7-8. Block will prevent excessive sheave drop and protect forward flex plate.
- c. Disconnect clutch lateral centering strut from upper frame and remove intermediate flex plate.
- d. Mark drive belts for “fore” and “aft” position and direction of rotation if they will be reinstalled.

CAUTION

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

- e. Loosen belt guide and position guide to remove v-belts.
- f. Disconnect actuator wiring.
- g. Remove belts from sheave and pull over aft yoke.

7.282 V-Belt Installation

1. Evaluate alternator belt(s) condition and replace as required.
2. Inspect upper and lower actuator bearings per §§ 2.502 & 2.503 (lubricate as required).
3. Identify type (deep-groove or shallow-groove) of upper and lower sheaves. Refer to Figures 7-3D & 2-11.

CAUTION

RHC does not recommend using A170-1 or -2 Revision N or prior upper sheaves with A493-1 Revision T or later lower sheaves. Such combinations may cause excessive drive belt vibration.

4. Inspect both sheaves. Replace any sheave showing corrosion, pitting or flaking of the metalized or anodized coatings, wear through anodized coating, grooves, 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.

7.282 V-Belt Installation (continued)

5. Paint lower sheave grooves with a thin coating of approved primer (chromate primer preferred; refer to § 23-75). Sheave may be primed without removal by using an aerosol can or air brush.
6. Inspect belts per § 2.507.
7. Install belts on sheaves. Ensure belts are installed in proper fore/aft order with proper direction of rotation.

WARNING

V-belts are a matched set. Only install V -belts as matched set.

8. Connect actuator wiring.
9. Connect lateral centering strut bolts and standard torque per § 23-32.
10. Install fanwheel and scroll per § 6.220.
11. Measure belt deflection with actuator disengaged. Using a scale and finger pressure, belts must deflect inward 1.4–1.6 inches per Figure 7-7A. Adjust actuator down-limit stop screw (see Figure 7-15) as required to obtain correct dimension. Tighten down-limit stop screw jam nut.

CAUTION

Belts which are too tight can damage flex plates during start and belts which are too loose can jump out of grooves during engagement.

NOTE

A delay of more than 5 seconds between clutch switch engagement and rotor turning indicates excessive slack. If rotor rotates when cranking engine, belts may not have enough slack. Actuator down limit screw adjustments are required more frequently with new belts.

12. Check clutch sheave alignment per § 7.230.
13. Shim and connect intermediate flex coupling per § 7.330.
14. Rotate drive train by hand with actuator disengaged. Verify minimum 0.125 inch clearance with new belts (0.25 inch after approximately 10 hours) between intermediate flex coupling and A331-1 tail rotor bellcrank-to-A121-17 push-pull tube attach bolt. If clearance less than minimum, shim engine per § 6.130.
15. Position V-belt guide to maintain clearance specified in Figure 7-8A. Standard torque attach hardware per § 23-32.

7.282 V-Belt Installation (continued)

16. If required, install protective clamp on upper frame per Figure 2-4C. |
17. Ground run or hover helicopter for at least one-half hour.
18. At end of half-hour run, inspect primer wear pattern in lower sheave grooves. A similar wear pattern in all four grooves indicates compatible belt/sheave combination. A noticeably different wear pattern from groove to groove indicates combination is not compatible. Refer to § 2.508 for allowable wear pattern limits.
19. If 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 lower sheave. Wear pattern in all four grooves must be similar before aircraft is released for flight.
20. Check clutch shaft angle per § 7.240.

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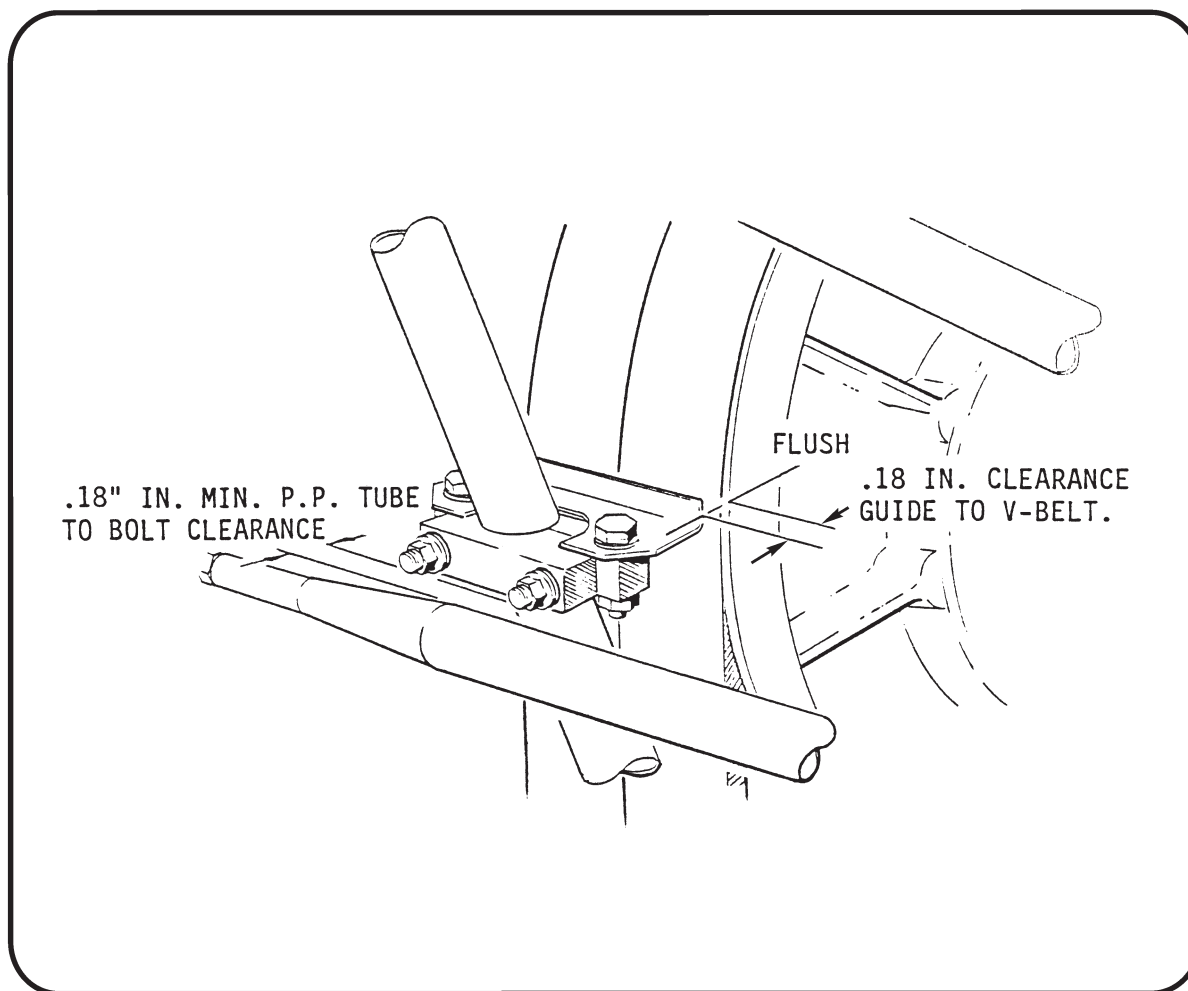


FIGURE 7-8A V-BELT GUIDE

7.282 V-Belt Installation (continued)

CAUTION

Position guide to 0.18 inch clearance with clutch engaged. Guide to be flushed with front face of sheave. Maintain 0.18 inch clearance between P/P tube and guide attach bolts.

NOTE

A020-2 upper frame S/N 0501 and subsequent have guide bracket welded to frame.

7.290 A007-3 & -5 Fanshaft and Bearing Assembly, Starter Ring Gear Support, Lower Sheave and Alternator Belt Replacement

7.291 Removal

- a. Remove fanwheel and fiberglass scroll per § 6.210.

NOTE

Fanwheel and fiberglass scroll may be removed without splitting scroll.

- b. Support clutch shaft assembly at horizontal firewall with a wooden block. Remove lower bolt connecting belt tension actuator to A181-4 lower bearing assembly.
- c. Label drive belts (forward & aft) for reinstallation.
- d. Cut safety wire and remove bolts and washers.
- e. Remove A007-3 or -5 fanshaft and bearing assembly. Temporarily secure lower sheave if it is not to be removed.
- f. To remove lower sheave, tap it with a soft mallet while pulling.
- g. Removal of starter ring gear support is required to change alternator belt or gain access to engine nose section.
 1. Loosen alternator belt tension.
 2. Note "O" mark on the starter ring gear support at one crankshaft flange bushing. Mark this bushing to ease reinstallation.
 3. Remove starter ring gear support.

7.292 Installation

- a. Install new and spare alternator belts if required. Install starter ring gear support. Align "O" mark on ring gear support with marked bushing. Bushing and hole marked "O" are slightly larger than other five holes.
- b. Install lower sheave and fanshaft assembly. Install (6) NAS6606H23 bolts and (6) NAS1149F0632P washers, or (6) NAS6606H24 bolts, (6) NAS1149F0632P washers, and (6) NAS1149F0663P washers (washer positions optional), as required. Special torque bolts per § 23-33 in a crossing pattern. Safety wire bolts in pairs with 0.041 inch diameter stainless steel safety wire.

7.290 A007-3 & -5 Fanshaft and Bearing Assembly, Starter Ring Gear Support,
Lower Sheave and Alternator Belt Replacement (cont'd)

7.292 Installation (cont'd)

CAUTION

RHC does not recommend using A170-1 or -2 Revision N or prior upper sheaves with A493-1 Revision T or later lower sheaves. Such combinations may cause excessive drive belt vibration. Refer to Figures 2-9 and 7-38.

- c) Place drive belts in correct forward and aft order on upper and lower sheaves. Install lower bolt connecting belt tension actuator to lower actuator bearing assembly, and torque per Section 1.320.
- d) Install fanwheel per Section 6.220.
- e) Remove wooden block supporting clutch assembly. Adjust alternator belt tension per Lycoming Service Instruction 1129 (current revision).

WARNING

Bearings in A007-3 and A007-5 fanshaft bearing assemblies have internal clearance modified by RHC. **DO NOT** **SUBSTITUTE** any other bearing.

7.300 TAIL ROTOR DRIVESHAFT**7.310 Tail Rotor Driveshaft Removal**

- a) Disconnect the tail rotor shaft at the intermediate flexplate. Leave the flexplate connected to the aft clutch yoke. Use 4-inch block under the driveshaft near the forward end to support the driveshaft in the tailcone. This prevents damage to the aft flexplate.
- b) Remove the tailcone per Section 4.311.
- c) Use a 3-foot socket extension with a 3/8-inch socket to disconnect the two NAS1303 bolts which hold the driveshaft to its mounting bracket.
- d) Disconnect tail rotor push-pull tube from tail rotor gearbox bellcrank arm. If push-pull tube length is not changed, rerigging is not required.
- e) Remove the four bolts (one NAS1304-8, three MS20074-04-06) that hold the tail rotor gearbox to the tailcone casting. Hold the forward end of the driveshaft while the gearbox is pulled out of the tailcone casting far enough to allow removal of the flex coupling bolts.
- f) Mark aft end of driveshaft and flexplate for reassembly. Disconnect driveshaft from flexplate, leaving flexplate connected to gearbox. Reinstall bolts, spacers and nuts on flexplate so none will be lost or misplaced.
- g) The driveshaft can now be pulled out of the forward end of the tailcone.

7.320 Tail Rotor Drive Shaft Installation

Also applies to Tail Rotor Gearbox Installation to Tailcone.

- a) Insert tail rotor drive shaft into tailcone and pull aft end of shaft through tailcone's aft casting.
- b) Reconnect flex plate to tail rotor gearbox. Bonded washers on flex plate must be directly against flange of gearbox input shaft. Torque NAS1304 bolts per Section 1.320. (See Figure 7-9)

CAUTION

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

- c) Support forward end of drive shaft and push flex coupling forward through aft casting.
- d) Reconnect the four bolts that hold the gearbox to the casting. Torque NAS1304 bolt per Section 1.320. Torque the MS20074-04-06 bolts per Section 1.330 and safety with 0.032 inch diameter safety wire.
- e) Connect damper assembly to tailcone frame and torque attach bolts per Section 1.320. Through inspection holes on side of tailcone, determine longitudinal alignment of damper clip (or arm) with tailcone's attachment bracket. If clearance or interference between clip (or arm) and bracket is greater than 0.12 inch, contact RHC Technical Support. Ensure damper is oriented per Figure 7-11B.
- f) Install tailcone per Section 4.312.
- g) Connect the A121-17 aft push-pull tube and torque fastener per Section 1.320.
- h) Install and shim intermediate flex plate per Section 7.330.
- i) Perform tail rotor drive shaft run-out check per Section 7.340.

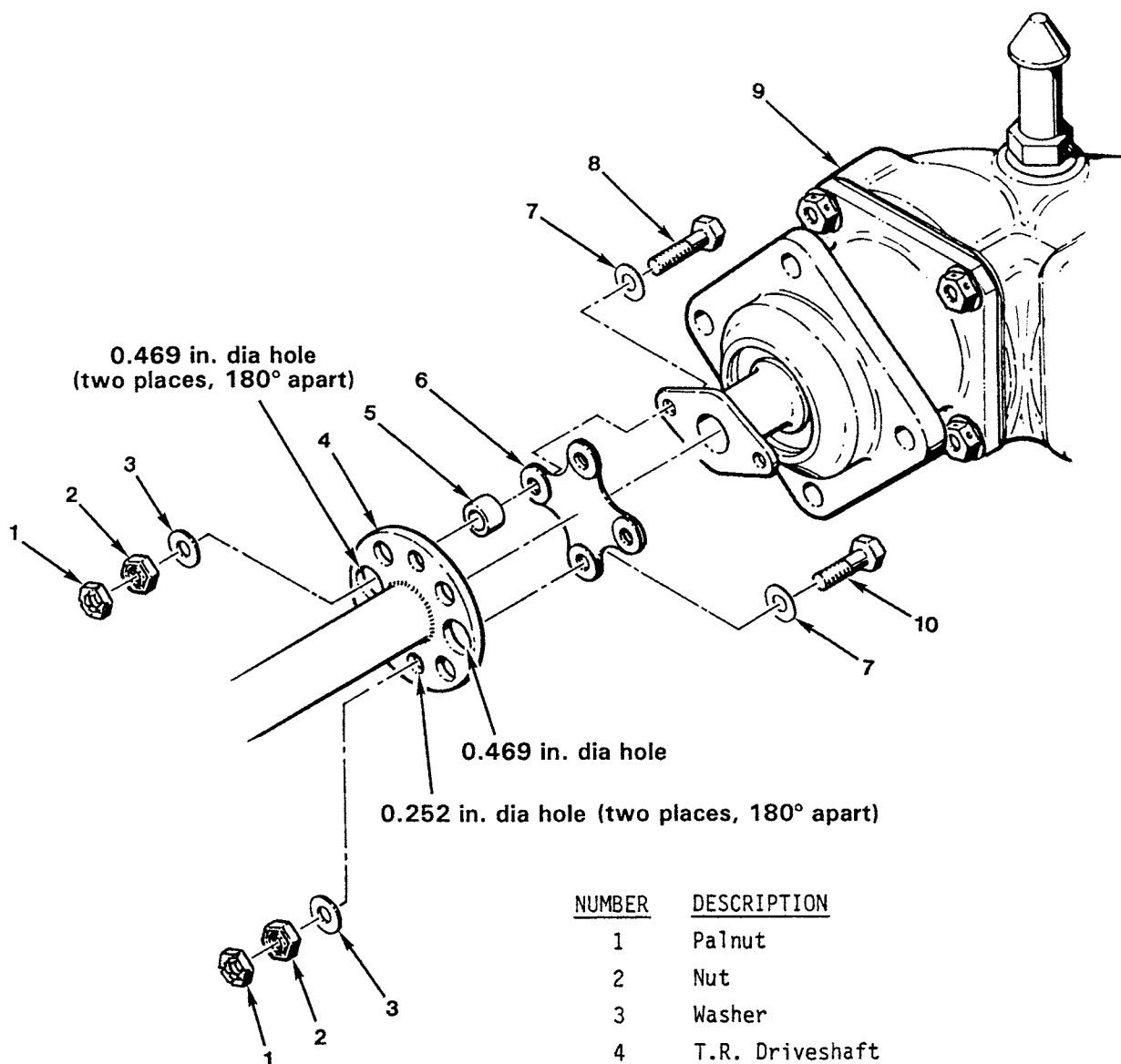


FIGURE 7-9
AFT FLEXPLATE INSTALLATION

NUMBER	DESCRIPTION
1	Pin nut
2	Nut
3	Washer
4	T.R. Driveshaft
5	Spacer
6	Flexplate
7	Washer
8	Bolt
9	T.R. Gearbox Assy.
10	Bolt

*A197 T.R. Driveshaft no longer available. See R22 Parts Catalog for replacement with proper B224-1 T.R. Driveshaft and B223 Yoke combination.

7.321 Adjustment of Damper Friction

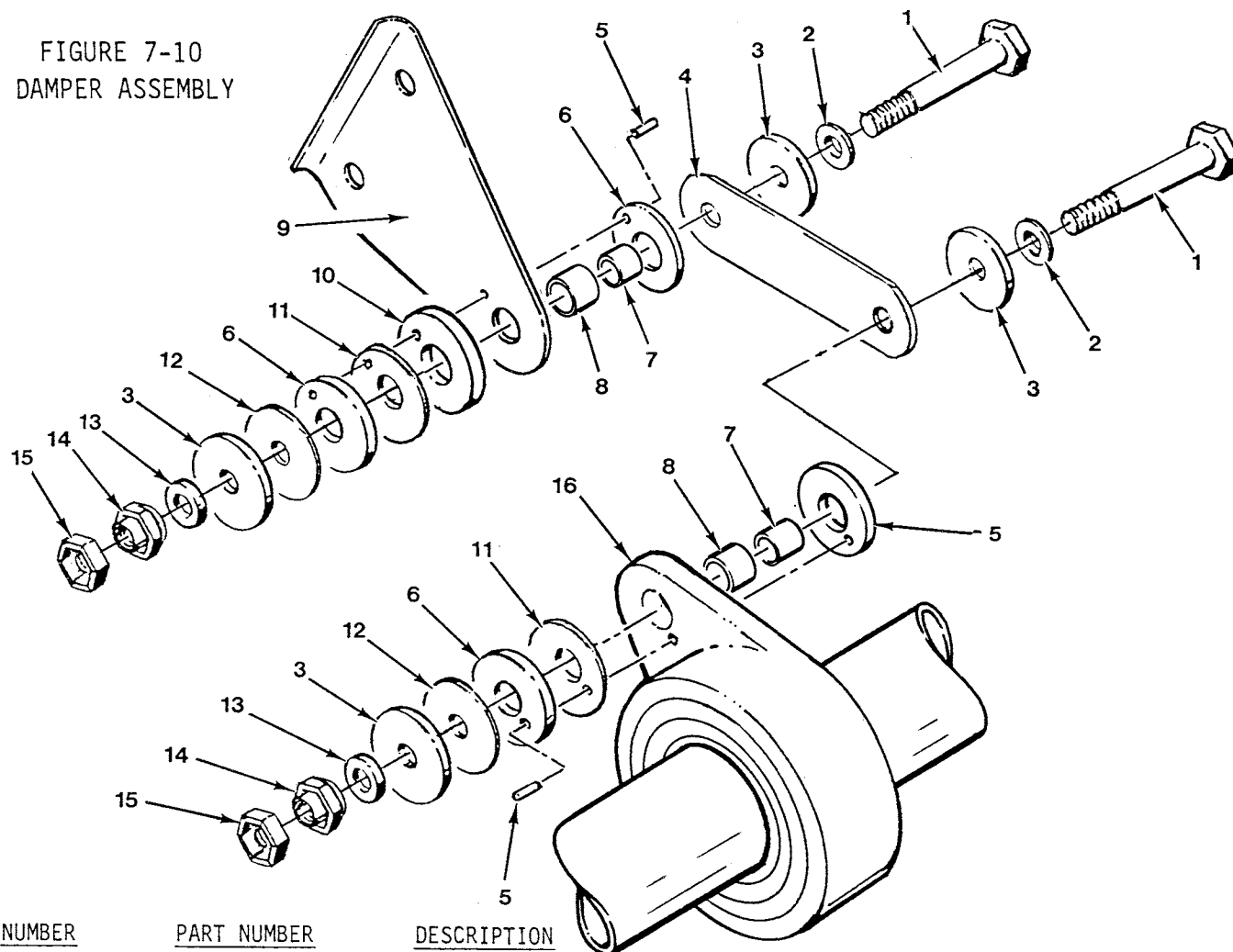
- a) Remove tail rotor drive shaft from tailcone per Section 7.310.
- b) Disassemble damper per Figure 7-10 or Figure 7-10A, as applicable.
- c) Inspect the following parts for wear and replace worn parts:
 1. Inspect A041-5 DU washers for worn Teflon® coating (dark gray face).
 2. Inspect A141-15 washers and A041-3 arm for indications of wear or grooving.
- d) Assemble damper per Figure 7-10 or Figure 7-10A, as applicable. Install spring washers with concave face toward A041-5 DU washers.

CAUTION

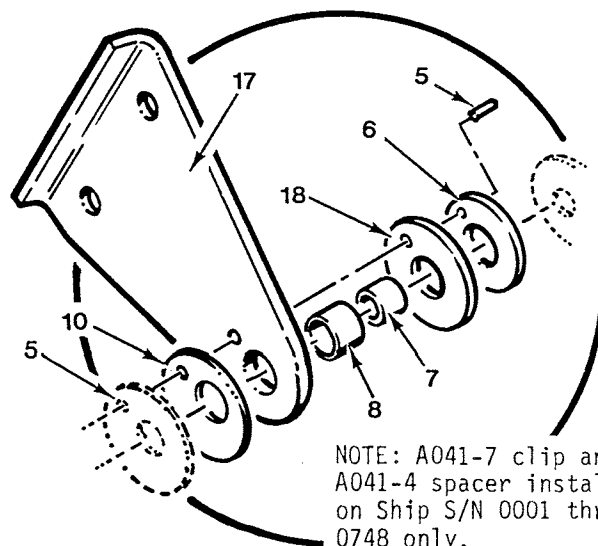
The Teflon® (dark gray) face of the A041-5 DU washer must be placed against the A141-36 washer or A041-3 arm. Remove plastic or tape coating, if installed.

- e) Torque nuts per Section 1.320.
- f) Using a spring scale or dead weight, measure pivot frictions per Figure 7-11A. If friction is less than specified, bend A041-6 spring washer until it has a 0.070 ± 0.010 inch total height. If spring washer height is within limits but friction is still too low, lap metal from end of A105-9 journal. If friction is greater than specified, flatten A041-6 spring washer slightly or replace A105-9 journal.

FIGURE 7-10
DAMPER ASSEMBLY



NUMBER	PART NUMBER	DESCRIPTION
1	NAS6603-8	Bolt
2	AN960-10L	Washer
3	A141-18	Washer
4	A041-3	Arm
5	A041-10	Dowel Pin
6	A041-5	DU Washer
7	A105-9	Journal
8	04DU04	Bushing
9	A041-8	Clip
10	A041-9	Spacer
11	A041-6	Spring Washer
12	A041-15	Washer
13	AN960-10	Washer
14	NAS679A3	Nut
15	B330-7	Palnut
16	A041-11	Bearing Assembly
17	A041-7*	Clip
18	A041-4*	Spacer



NOTE: A041-7 clip and A041-4 spacer installed on Ship S/N 0001 thru 0748 only.

*No longer available. Order A041-9 spacer along with A041-8 clip for replacement.

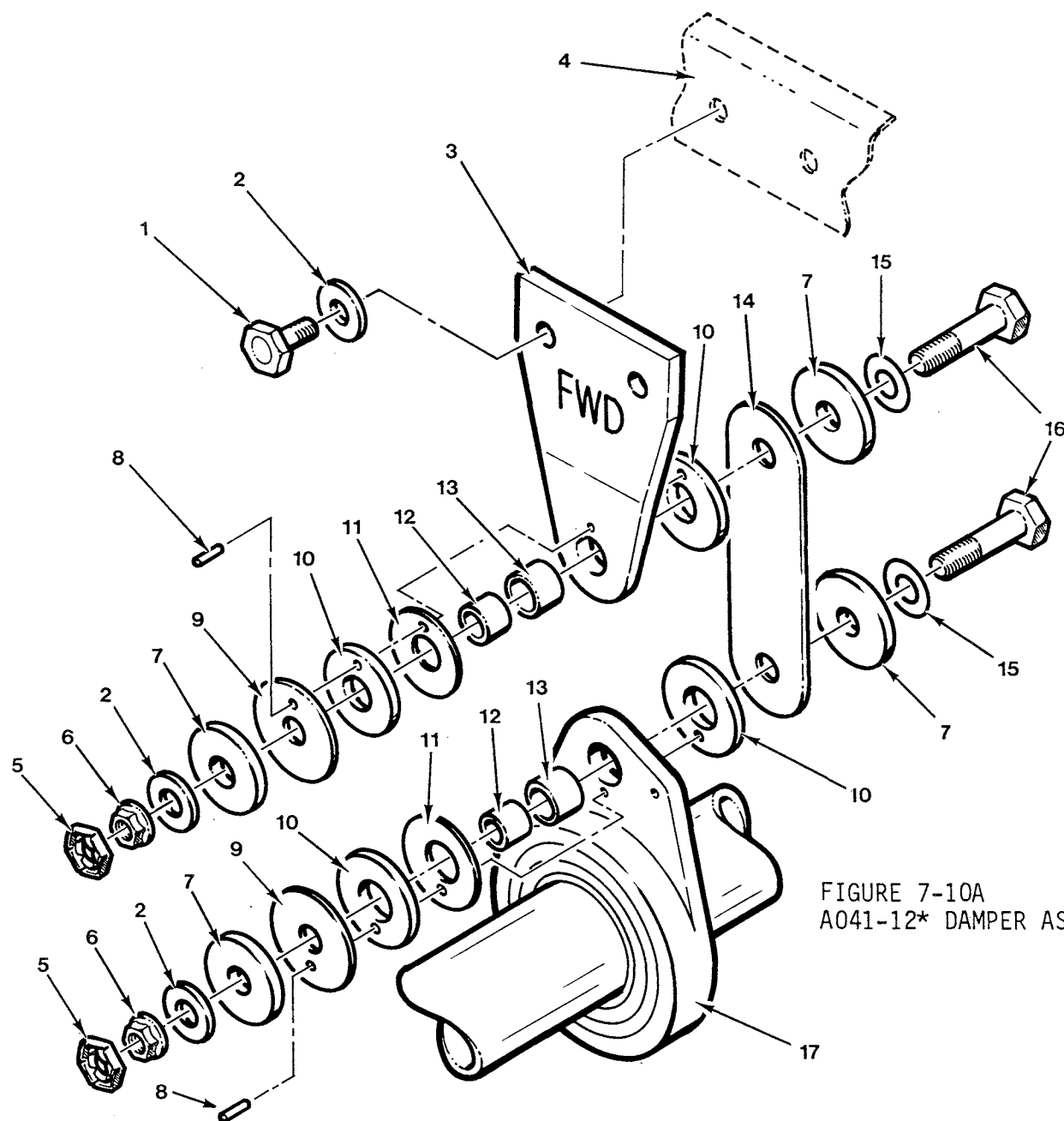


FIGURE 7-10A
A041-12* DAMPER ASSEMBLY

NUMBER	PART NUMBER	DESCRIPTION	NUMBER	PART NUMBER	DESCRIPTION
1.	NAS6603-3	Bolt	11	A041-6	Spring Washer
2	AN960-10	Washer	12	A105-9	Journal
3	A041-13	Arm	13	04DU04	Bushing
4	B288-8	Support (Ref)	14	A041-3	Arm
5	B330-7	Palnut	15	AN960-10L	Washer
6	MS21042L3	Nut	16	NAS6603-8	Bolt
7	A141-18	Washer	17	A041-11	Bearing Assembly
8	A041-10	Dowel Pin	18	A041-12*	Damper Assembly (Includes items 3, and 5-17)
9	A141-15	Washer			
10	A041-5	DU Washer			

*Ship S/N 2571 and on, and
ships equipped with A023-22
or A023-23 tailcones.

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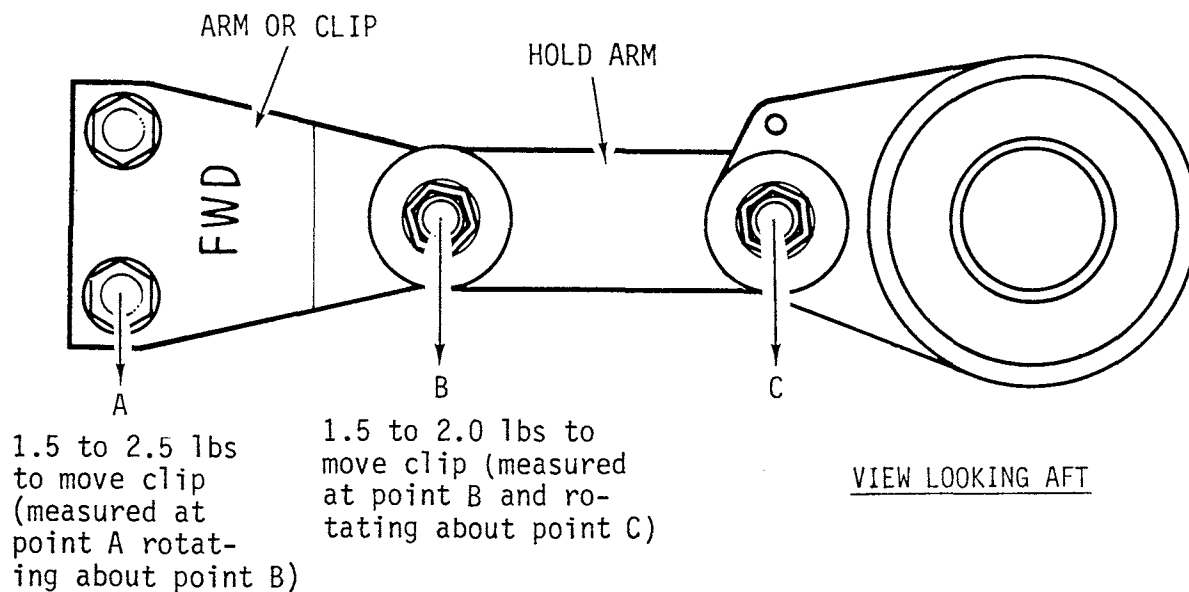


FIGURE 7-11A

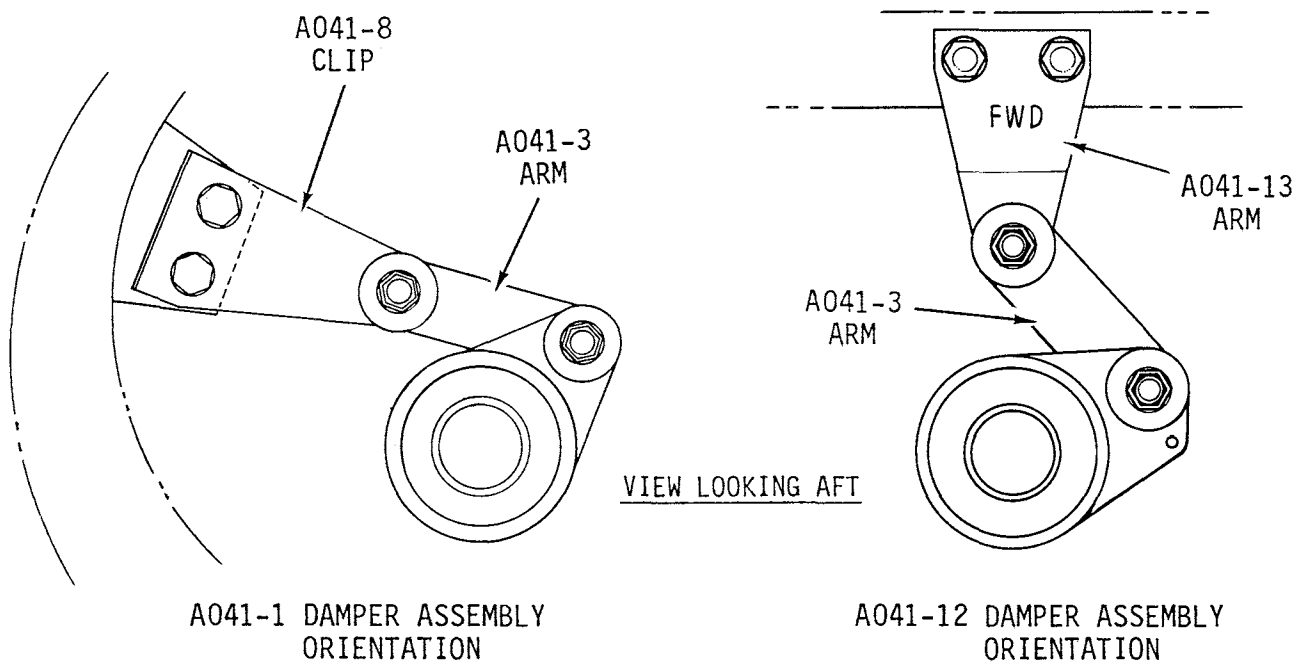


FIGURE 7-11B

7.321 Adjustment of Damper Friction (cont'd)**CAUTION**

Do not adjust damper drag by changing bolt torque.

- f) Torque MS21042L4 nut per Section 1.320 and recheck damper drag. Install B330-13 palnut and torque stripe.
- g) 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 tail rotor drive shaft yoke and A195 yoke so yoke arms are horizontal.
- c) Insert NAS1304 bolt through tail rotor shaft yoke and A195 yoke at 9 o'clock position. Measure gap between yoke arms at 3 o'clock position.
- d) Insert bolt at 3 o'clock, remove bolt at 9 o'clock, and measure gap at 9 o'clock. Measurements in sequence c and d are measurement 1.
- e) Remove bolt and rotate tail rotor drive shaft 180 degrees. Repeat steps c) and 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) Record difference between 3 o'clock and 9 o'clock gaps in measurement 1 and in measurement 2. Difference between 3 o'clock and 9 o'clock gap must not exceed 0.050 inch in either measurement 1 or measurement 2. If difference exceeds 0.050 inch adjust clutch lateral centering strut length as required and align sheaves per Section 7.230.
- g) Use following formula to obtain calculated dimensions for proper intermediate flex plate shimming.

TABLE 7-1
INTERMEDIATE FLEX PLATE SHIM TABLE

	CLUTCH SIDE	TR DRIVE SHAFT SIDE
Calculated dimension in inches from Section 7.330(g)	Shim required between A947-2 flex plate and A195-1 yoke 2 places.	Shim required between A947-2 flex plate and B223-X yoke 2 places.
0.135 or more	Remove TRGB shims or shim A947-1 flex plate** or change A907 yoke length** or install longer B223 yoke	
0.134 to 0.105	AN960-416 washer	AN960-416 washer
0.104 to 0.075	AN960-416 washer	AN960-416L washer
0.074 to 0.045	AN960-416L washer	AN960-416L washer
0.044 to 0.015	AN960-416L washer	None
0.014 to -0.015	None	None
-0.016 or greater negative number	Shim TRGB aft (max. 0.080 inch*) or remove shims at A947-1 flex plate** or change A907 yoke length** or install shorter B223 yoke	

*When shimming tail rotor gearbox, replace MS20074-04-04 bolts with MS20074-04-06 bolts. If over 0.040 inch shims used, change washers under bolt heads to AN960-416L. Total shims must not exceed 0.080 inch. Torque bolts per Section 1.330.

**Requires clutch sheave alignment check per Section 7.230.

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

NOTE

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

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

*Measure A947-2 flex plate thickness across bonded washers four places and average.

Shim as required per Table 7-1.

NOTE

When shims are installed or removed between tail rotor gearbox and tailcone casting, lengthen A121-17 push-pull tube by 1/2 turn of rod end for each 0.018 inch that tail rotor gearbox is shimmed aft; shorten A121-17 push-pull tube by 1/2 turn of rod end for each 0.018 inch of shims removed.

- h) Install A947-2 flex plate using shims determined above. Torque attach bolts per Section 1.320. Install palnut and torque stripe.

NOTE

Use AN960-416L or AN960-416 washers under nuts as required to expose two to four threads beyond nut.

WARNING

A193 flex plates, which do not have bonded washers, are obsolete and must be replaced with A947 flex plates having bonded washers. If a bonded washer separates from an A947 flex plate, flex plate is unairworthy and cannot be repaired.

- i) Check clearance between A331 bellcrank-to-A121-17 push-pull tube forward rod end attach bolt and flex plate (0.250 inch minimum) with actuator disengaged.

7.340 Checking Tail Rotor Drive Shaft Runout

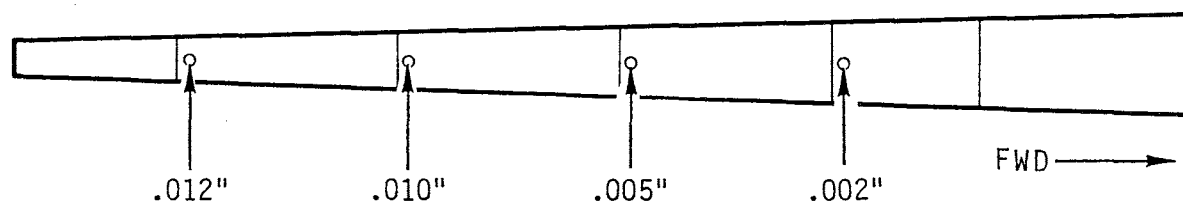
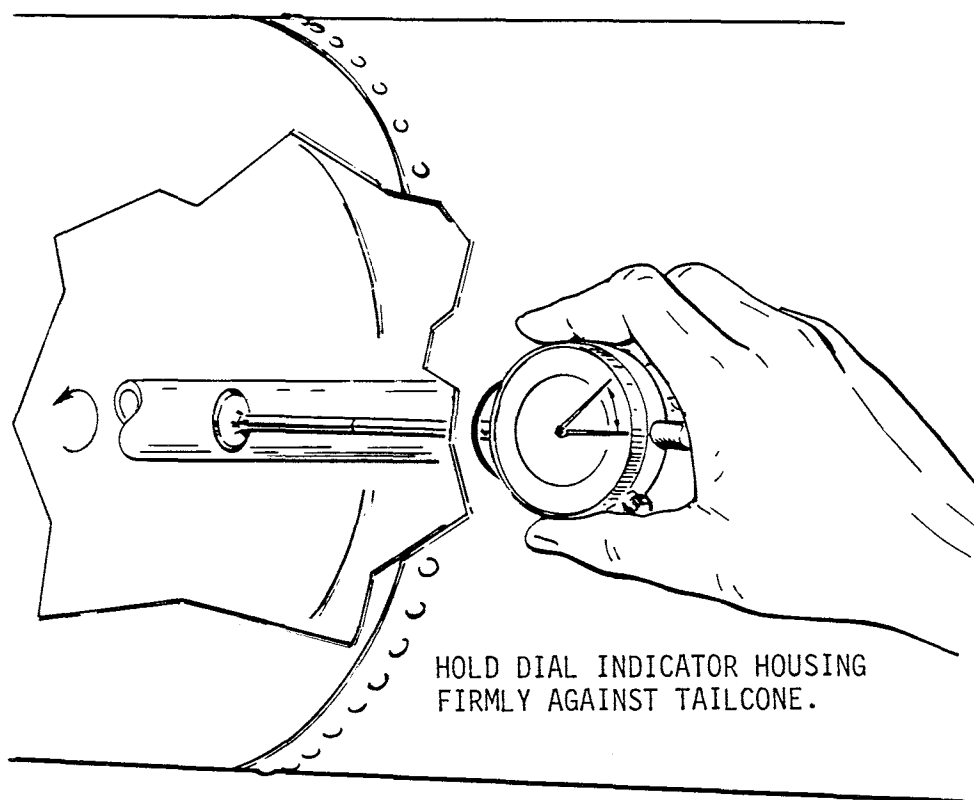
Excessive tail rotor drive shaft runout can cause intermediate flex coupling or damper assembly failure. To check runout:

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

NOTE

The dial indicator included in the Robinson MT122 bolt stretch gauge can be used.

- c) Insert dial indicator through farthest aft inspection hole on right side of tailcone. Press dial indicator firmly against tailcone with extension riding on drive shaft.
- d) Have someone rotate drive train at A166 clutch shaft at least three full revolutions. Dial indicator may vary somewhat with each revolution so it will be necessary to take an average.
- e) Repeat procedure in steps c) and d) at next inspection hole forward.
- f) Remove extension from MT260 tool and, using longer extensions, check drive shaft at remaining inspection holes.
- g) Maximum runout at any location must not exceed 0.025 inch. If runout is excessive, drive shaft must be repaired or replaced.



Sample of measurements taken.

FIGURE 7-12 TAIL ROTOR DRIVESHAFT RUNOUT CHECK

7.350 Two-Piece Tail Rotor Driveshaft

- a) The two-piece tail rotor driveshaft consists of a B224-1 driveshaft, B223-1, -2, -3, or -4 yoke assembly, A041-1 damper bearing assembly, A553-2 block and two A207-4 blocks. See Figure 7-12A.
- b) The A041-1 damper bearing assembly is field replaceable only with the two-piece tail rotor driveshaft.
- c) The B224-1 driveshaft is produced in one length only. The overall length of the driveshaft assembly may be adjusted with various length B223 yokes. The yokes are produced in .150 inch length increments. See Figure 7-12B.
- d) A197-1 one-piece driveshaft assemblies may be replaced with the two-piece driveshaft per the table below:

<u>One-Piece Driveshaft</u>	<u>Overall Length (inches)</u>	<u>B223 Yoke Req. w/ B224 D.S.</u>
A197-7	140.25	-1
A197-4	140.40	-2
A197-5	140.55	-3
A197-6	140.70	-4
A197-1	Varies	As Required

- e) If the length of the driveshaft cannot be measured or is unknown, use the following procedure to determine the correct B223 yoke to use:
 1. Install the intermediate flexplate onto the A195-1 yoke on the clutch shaft. For this measurement procedure, no shims should be installed between the beveled washers or the bonded washers on the flexplate and the A195-1 yoke.
 2. Install the A553-2 block into the forward end of the driveshaft. Align the two bolt holes in the block and the driveshaft.
 3. Consult the appropriate section of this manual for the following installation steps. Connect the B224-1 driveshaft to the aft flexplate and the tail rotor gearbox input yoke. Install the gearbox on the tailcone. Connect the damper assembly to the clip on the inside of the tailcone. Install the tailcone on the upper steel tube frame. Engage the actuator.

7.350 Two-Piece Tail Rotor Driveshaft (cont'd)

4. Hold the driveshaft centered on the intermediate flexplate. Measure the distance from the flexplate to the center of the forward hole on the driveshaft. Subtract .032 inches from this measurement, which is the thickness of the beveled washer or the bonded washer. This will be the Calculated Dimension. Select the B223 yoke which is closest to but does not exceed the Calculated Dimension. Shims may be added or subtracted between the tail rotor gearbox and the tailcone aft casting to adjust the driveshaft-to-flexplate dimension. See Figure 7-12B. The difference between the Calculated Dimension and the length of the B223 yoke will be taken up with shims per Section 7.330 of this manual.
5. Install A553-2 block in yoke end of T.R. driveshaft. Removal of primer to install block is allowed. If primer is removed, swab wet primer inside the T.R. driveshaft before installing block. After installation, prime inside of T.R. driveshaft to cover tube and seal edges of block.
6. Install the correct length B223 yoke onto the forward end of the driveshaft. Align the two bolt holes. Install two NAS1304-21 bolts with a washer and a B207-4 block under the bolt heads and the nuts. Torque the nuts to 100 inch-pounds plus nut drag (add 10% for the total torque-110 inch-pounds). Install and tighten the palnuts.
7. Use Zinc Chromate or epoxy primer to form fillets at all joints for sealing moisture out. Paint as required.

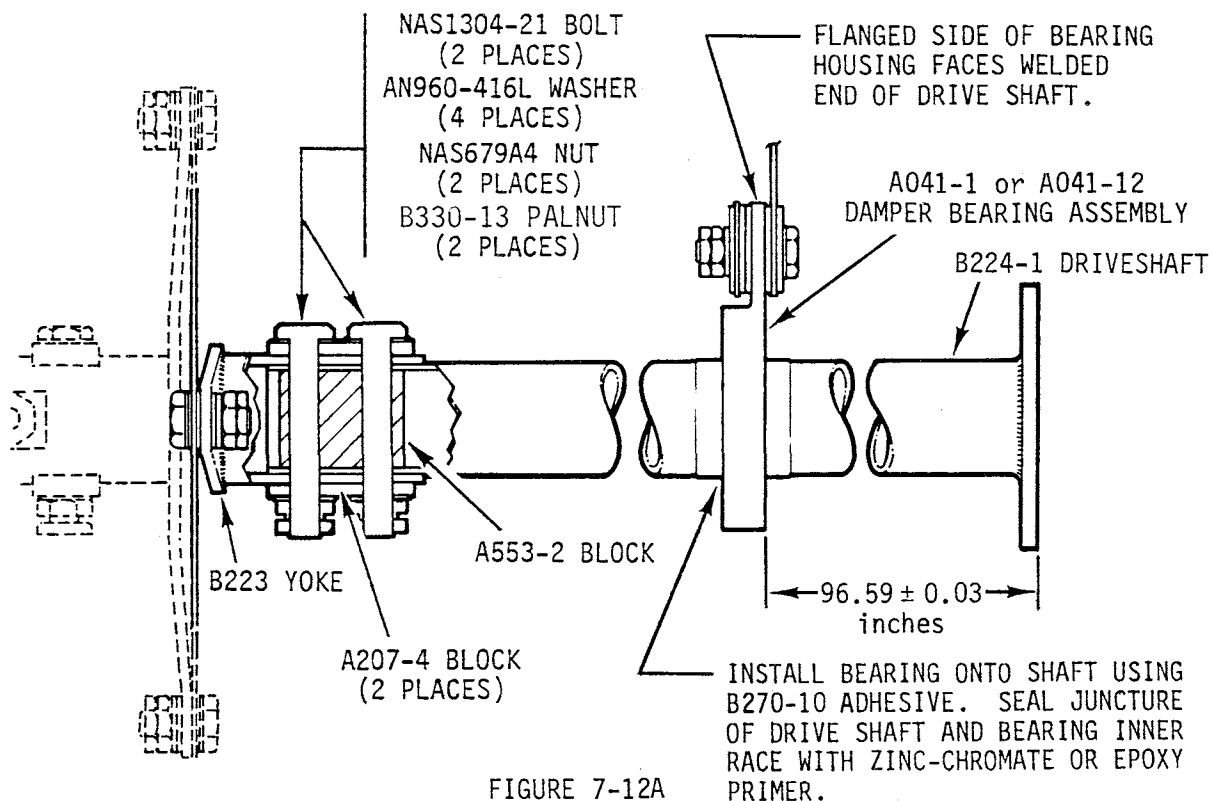


FIGURE 7-12A

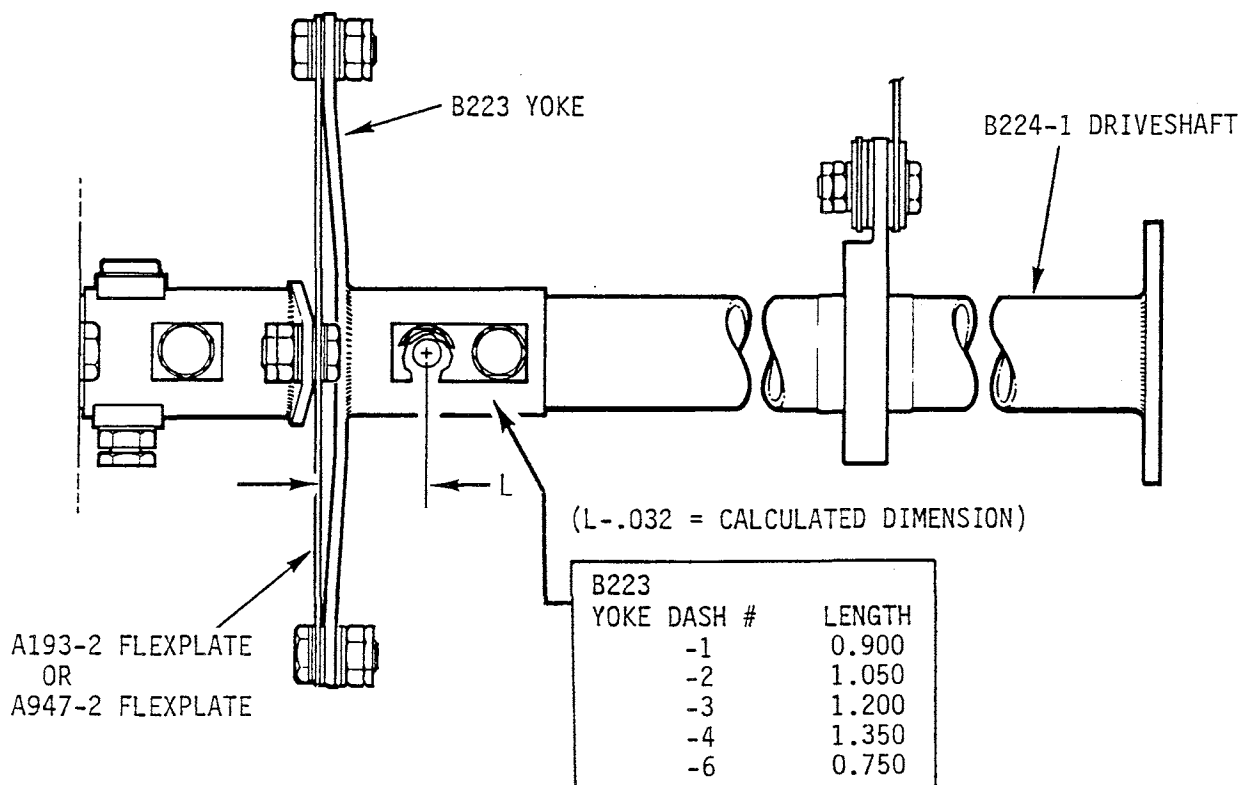
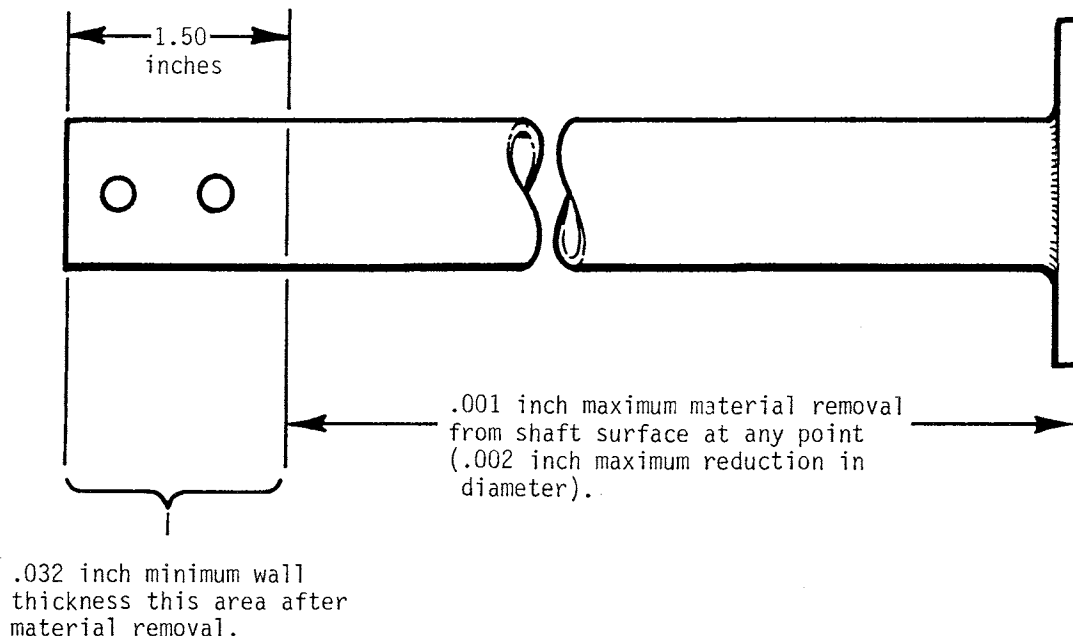


FIGURE 7-12B

7.360 B224-1 Tail Rotor Driveshaft Corrosion Removal

- a) No power tools allowed.
- b) Remove only the minimum amount of material necessary to clean up damage; do not exceed limitations shown.
- c) Sand or polish parallel to the shaft's long axis.
- d) Polish reworked areas with 400 grit or finer wet-or-dry sandpaper.
- e) Zinc chromate or epoxy prime bare metal surfaces.

7.400 Tail Rotor Gearbox

7.410 Tail Rotor Gearbox Removal

1. Mark 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 tail rotor if push-pull tube lengths are not altered.
2. Remove tail rotor assembly. Leave pitch control links attached to tail rotor blades.
3. Disconnect A120-1 bellcrank from push-pull tube.
4. Disconnect A120 bellcrank from gearbox and reassemble bellcrank hardware to bellcrank. Slide pitch control, with bellcrank attached, off gearbox output shaft.
5. Disconnect gearbox chip detector wire at quick disconnect.
6. Remove tail rotor driveshaft per § 7.310.
7. Remove aft flex plate from gearbox. Reinstall bolts, spacers, and nuts on flex plate to prevent loss.

7.420 Tail Rotor Gearbox Installation

1. Install tail rotor drive shaft per § 7.320. |

<p>WARNING</p>

<p>A193 flex plates, which do not have bonded washers, are obsolete and must be replaced with A947 flex plates having bonded washers. If a bonded washer separates from an A947 flex plate, flex plate is unairworthy and cannot be repaired.</p>
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2. Install tail rotor pitch control and bellcrank. Check bellcrank to pitch control shimming per § 8.562. |
3. Connect A121-17 push-pull tube to aft bellcrank.
4. Install tail rotor assembly per § 9.213.

7.430 Tail Rotor Gearbox Shimming

Shimming of gearbox at mounting flange is only required when intermediate flexplate gap between clutch shaft yoke and tail rotor drive shaft forward yoke is too small to allow installation of flexplate. Gearbox may be shimmed aft a maximum of 0.080 inch. If shims are installed (3) MS20074-04-06 and (1) NAS1304-8 bolts must be used for gearbox-to-casting installation. If more than 0.040 inch shims are used, change NAS1149F0463P washers under bolt heads to NAS1149F0432P. If tail rotor system is rigged and shims are subsequently installed, extend A121-17 push-pull tube aft rod end 1/2 turn for each 0.018 inch the gearbox is shimmed aft; retract rod end 1/2 turn for each 0.018 inch of shims removed.

7.440 Tail Rotor Gearbox Chip Indicator

If "TR CHIP" light illuminates:

1. Drain and flush gearbox per § 22-23 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 0.09 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 gearbox to RHC for repair along with particles. If particles are non-ferrous, drain and flush gearbox per § 22-23.
3. If "TR CHIP" illuminates again within next 100 hours time-in-service a gearbox failure may be imminent. Return gearbox to RHC for repair.

7.450 A021 Tail Rotor Gearbox Output Shaft Seal Replacement

1. Drain gearbox oil. Clean and inspect chip detector. Clean sight gage as required. Reinstall chip detector and sight gage, torque per § 23-33 and safety wire.
2. Remove tail rotor assembly per § 28-10.
3. Remove pitch control per § 8.561 and clean gearbox output shaft.
4. Verify tailcone-to-upper frame attach bolts are torqued per § 23-32.
5. See Figures 7-13A and 7-13B. Slide MT295-10 mandrel on output shaft until it contacts seal. Tape mandrel to gearbox to maintain position when punching holes in seal.
6. Using small holes in MT295-10 mandrel as a guide, punch four holes in output shaft seal with MT295-3 punch.

CAUTION

MT295-10 mandrel is designed to guide and limit MT295-3 punch protrusion into gearbox. Punching seal using other tools may damage gearbox case, output shaft, and/or bearings.

7. Remove tape holding MT295-10 mandrel. Rotate mandrel to align large holes in flange with punched holes in output shaft seal. Install a 92470A113 screw thru each large hole in flange into matching hole in seal. Tighten screws until heads contact mandrel flange; do not overtighten screws.

CAUTION

Do not use screws longer than 0.75 inch; longer screws may damage bearing.

8. See Figure 7-13C. Lubricate MT295-6 screw threads with anti-seize and install in end of MT295-10 mandrel. Tighten screw to remove seal. Remove mandrel and seal.
9. Carefully clean seal seating surfaces in gearbox and on output shaft with a solvent dampened cloth, dry, and inspect for damage. Verify output shaft shoulder has a smooth edge and will not damage seal lip. Do not polish or alter seal seating surfaces. Return gearbox to RHC for repair if damage is noted.
10. See Figure 7-13D. Lubricate new A966-2 seal inner lip and output shaft seal seat area with correct gearbox oil (refer to § 22-10 Part C). Do not lubricate seal outside edge and its mating surface in gearbox; they must remain clean and dry. Slide seal on output shaft with cupped face toward gearbox until seal contacts gearbox.

7.450 A021 Tail Rotor Gearbox Output Shaft Seal Replacement (continued)

11. Remove MT295-6 screw and old seal from MT295-10 mandrel and slide mandrel on output shaft until it contacts seal.
12. See Figures 7-13A and 7-13B. Determine if gearbox output shaft seal installation is recessed type or flush type. Install flush-type seal until it is flush with seal bore; install recessed-type seal until MT295-10 mandrel contacts gearbox face. Lightly tap end of mandrel with soft-face hammer until seal is properly positioned.
13. Remove mandrel.
14. Fill gearbox to center of sight gage using correct gearbox oil (refer to § 22-10 Part C). Verify filler-plug vent holes are clear. Install filler-plug and torque per § 23-33.
15. Install pitch control per § 8.562.
16. Install tail rotor assembly per § 28-10.
17. Inspect seal for leaks after dynamic balancing tail rotor.

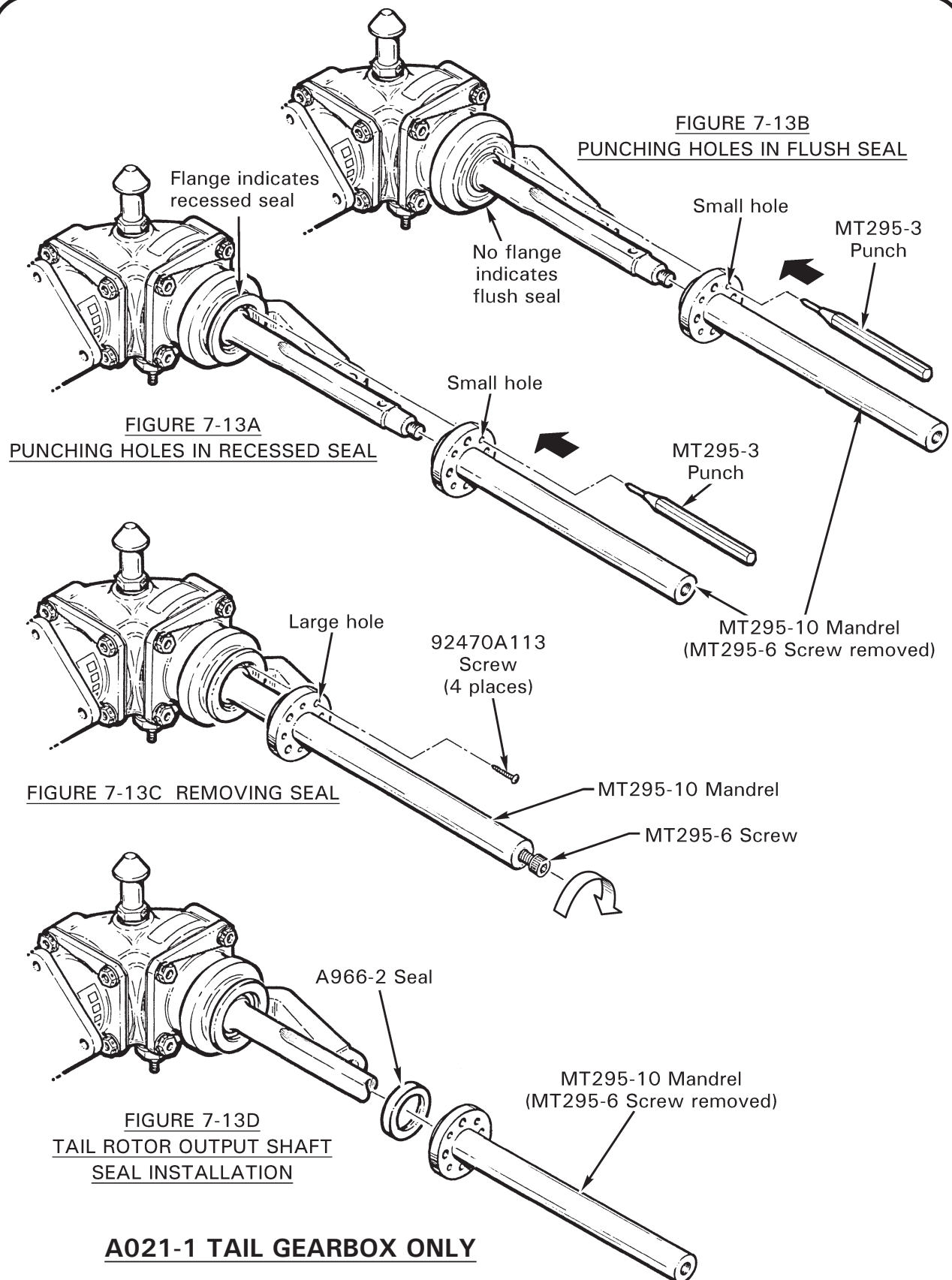
7.460 B021 Tail Rotor Gearbox Output Shaft Seal Replacement

1. Drain gearbox oil. Clean and inspect chip detector. Clean sight gage as required. Using new o-ring(s) install chip detector and sight gage, torque per § 23-33, and safety wire.
2. Remove tail rotor assembly per § 28-10.
3. Remove pitch control per § 8.561 and clean gearbox output shaft.
4. Cut safety wire and remove four drilled-head bolts securing B552-1 retainer and slide retainer off output shaft.

CAUTION

Do not alter shim stack-up between retainer and bearing or bearing preload may be adversely affected.

5. Remove seal and o-ring from B552-1 retainer.
6. Carefully clean and dry retainer seal seating surface and O-ring groove.
7. With seal lip toward gearbox, press new A966-4 seal into retainer bore 0.140/0.160 inch below external flat surface. Lubricate new o-ring with correct gearbox oil (refer to § 22-10 Part C) and install in retainer groove without twisting.
8. Lubricate seal seating area of output shaft with correct gearbox oil (refer to § 22-10 Part C).
9. Carefully slide retainer over output shaft. Align retainer and gearbox bolt holes and press retainer into gearbox. Install four drilled-head bolts, torque per § 23-33, and safety wire.



7.460 B021 Tail Rotor Gearbox Output Shaft Seal Replacement (continued)

10. Install pitch control per § 8.562.
11. Install tail rotor per §§ 9.212 or 9.213, as applicable.
12. Inspect for leaks after dynamically balancing tail rotor.

7.470 B021 Tail Rotor Gearbox Input Shaft Seal Replacement

1. Drain tail rotor gearbox lubricant.
2. Remove tailcone per § 4.311.
3. Remove tail rotor driveshaft per § 7.310.
4. Remove aft flex plate from gearbox.
5. Remove nut & washer securing splined B546 input yoke on gearbox input shaft. Remove yoke.
6. Cut safety wire from B549 retainer and remove retainer and adjacent A117 shim from gearbox.
7. Remove and discard seal and o-ring from retainer.
8. Remove A266 spacer and underlying o-ring from input shaft. Discard o-ring.
9. Clean parts and inspect. Verify no grooves in A266 spacer, no scoring on A117 shim (such as from rotating), and no wear steps on input yoke & shaft splines.
10. Coat input shaft splines with B270-21 protectant and allow to dry.
11. Press new A966 seal 0.030 inch deep beyond flush into chamfered inner end of B549 retainer, with solid side of seal toward opposite hexagonal end.
12. Prelubricate new o-ring with correct gearbox oil (refer to § 22-10 Part C) and install in groove around B549 retainer.
13. Slide A117 shim over input shaft until it contacts input bearing outer race.
14. Prelubricate new o-ring with correct gearbox oil and slide over input shaft until it contacts input bearing inner race.
15. Lubricate outside diameter of A266 spacer with correct gearbox oil and slide it, inner-chamfered end first, over input shaft until spacer inner chamfer seats on o-ring.
16. Coat threads of B549 retainer with A257-9 anti-seize and install on gearbox. Torque retainer per § 23-33 and safety wire.
17. Install input yoke on input shaft. Apply B270-11 adhesive to input shaft threads and install washer and nut. While adhesive is still wet, torque nut per § 23-33 and torque stripe.

7.500 Actuator Assembly

7.510 Actuator Removal

1. Remove tailcone fairing.
2. Full disengage clutch.
3. Remove fanwheel per § 6.210.
4. Put a four-inch wood block under clutch shaft just forward of upper sheave on horizontal firewall. This keeps sheave from drooping and prevents damage to forward flex plate per Figure 7-8.
5. Disconnect two wiring connections to actuator.
6. Remove upper and lower NAS6604 bolts connecting actuator to bearings and remove actuator.

7.520 Actuator Installation

1. Connect actuator to A184 bearing and standard torque bolt per § 23-32. Install | palnut, standard torque per § 23-32, and torque stripe per Figure 2-1.
2. Install lower attach bolt with head facing aft. Use one NAS1149F0432P washer under bolt head and one NAS1149F0463P washer under nut. Standard torque bolt per § 23-32. Install palnut, standard torque per § 23-32, and torque stripe per Figure 2-1. Remove wooden block.
3. Install fanwheel per § 6.220.
4. Connect motor and switch assembly electrical leads.

CAUTION

Do not engage actuator without scroll installed.
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7.530 Actuator Gearmotor Replacement

Actuator Gearmotor can be replaced with actuator on helicopter.

1. Disconnect gearmotor electrical leads.
2. Cut safety wire from and remove four gearmotor attaching screws. Exercise care not to drop either safety wire or screws in V-belt sheaves.
3. Slowly slide gearmotor assembly from housing. An unscrewing motion may be necessary.
4. Lightly lubricate worm gear on new gearmotor assembly with A257-1 grease before installing. Install o-ring onto gearmotor nose piece.

7.530 Actuator Gearmotor Replacement (continued)

5. Install new gearmotor into housing with wire leads pointing down. Verify no gap exists between housing and gearmotor mounting flange before installing screws; do not use screws to draw gearmotor into housing as motor flange can break.
6. Secure gearmotor to housing with four mounting screws and safety wire with 0.020-inch diameter wire using single strand method.
7. Connect gearmotor electrical leads. Engage clutch, listen for binding, and verify actuator fully tensions drive belts.
8. Seal all fasteners, seams and openings around gearmotor with B270-8 sealant.
9. Ty-rap gearmotor electrical leads as required.

CAUTION

Severe damage to actuator and drive belts can occur if gearmotor electrical leads are installed incorrectly in wiring connector (gearmotor will operate backwards and down-limit switch and spring switches will not shut off gearmotor current).

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.

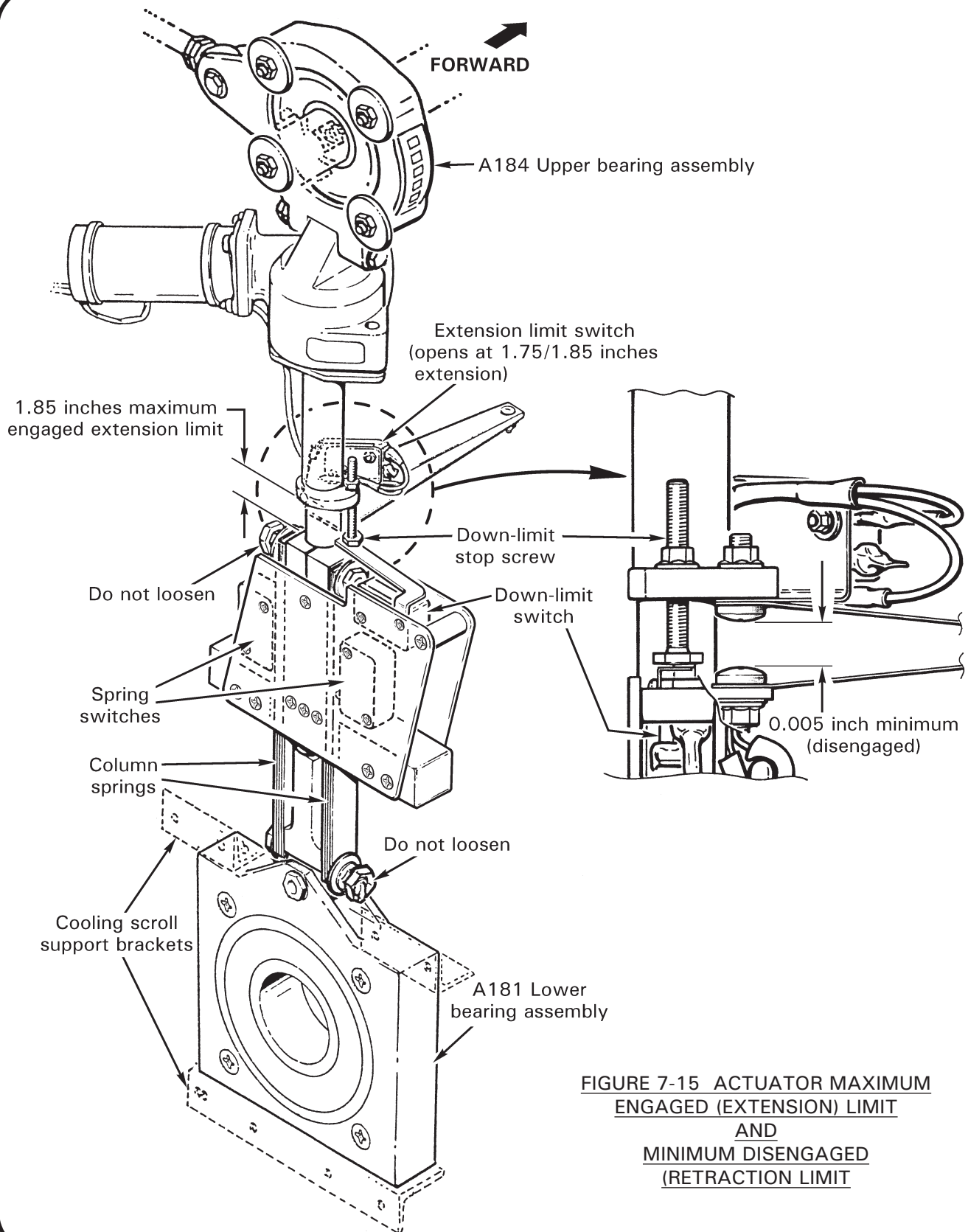
2. Disengaged Down-Limit Adjustment (see Figure 7-15)

The down-limit switch is activated by the down-limit stop screw which can be adjusted using long 3/8-inch open-end and 1/4-inch box-end wrenches. Adjust down-limit stop screw to maintain proper belt deflection per § 7.282 with actuator fully disengaged. Minimum clearance between screw heads at scissors is 0.005 inch.

3. Maximum Extension (see Figure 7-15)

Maximum engaged extension is 1.85 inches measured between top of column spring block and bottom of screw housing. Drive V-belts must be replaced when maximum extension is encountered.

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7.550 Switch and Fuse Replacement

7.551 Switch Replacement

1. Remove actuator from helicopter per § 7.510.

NOTE

Switches may be replaced as a complete harness assembly or replaced individually by soldering wire connection and installing heat shrink.

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

NOTE

Bond the four spacing washers to the new switch(es), if necessary, to ease reassembly.

3. Replace complete switch and wire harness assembly or, if installing a single switch, cut faulty switch from harness wiring. Cut wires as close to switches as possible.
4. Slide 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 on helicopter per § 7.520.

7.552 Fuse Replacement

An in-line fuse holder is installed in clutch actuator motor power circuit. Fuse holder is mounted on test switch panel. Replace fuse with 1.5 amp (AGC 1.5) fuse.

7.600 Rotor Brake

7.610 Rotor Brake Removal

1. Remove tailcone cowling. Remove forward flex plate. Mark and record any shim washers installed between flex plate and main rotor gearbox input yoke and/or clutch shaft yoke.

WARNING

A193 flex plates, which do not have bonded washers, are obsolete and must be replaced with A947 flex plates having bonded washers. If a bonded washer separates from an A947 flex plate, flex plate is unairworthy and cannot be repaired. Ensure A947-1 forward flex plate is Rev E or subsequent (identified by letter "E" or subsequent letter on two adjacent arms of flex plate both sides).

2. Remove cotter pin and nut securing input yoke on main rotor gearbox. Remove yoke. Disconnect brake spring from firewall angle.
3. Disconnect cable from lever. Disconnect wiring to micro switch at three-pin connector.
4. Cut and remove safety wire, then remove three bolts securing rotor brake. Remove rotor brake assembly.

7.620 Rotor Brake Installation

1. Place rotor brake assembly over splined input pinion shaft of main rotor gearbox.
2. Place one each of two small (A130-41) spacers in place between rotor brake assembly and pinion end cover. Install one each NAS1149F0432P washer on three NAS1352-4H30P bolts. Insert first bolt through rotor brake assembly and A130-41 spacer. Insert second bolt through Hall Effect sender plate, rotor brake assembly and A130-41 spacer.
3. Insert third bolt through Hall Effect sender plate and long A130-41 spacer. Finger tighten three bolts into gearbox, then special torque bolts per § 23-33 and safety with 0.032 inch diameter safety wire. Attach spring to the firewall angle.
4. Coat splines of pinion shaft with B270-21 protectant before installing yoke. Place A908-4 yoke on pinion shaft. Install one each A141-10 washer and AN320-8 nut on pinion shaft. Special torque nut per § 23-33 as required to align castellations on nut with hole through pinion shaft. Do not exceed 410 in.-lbs. Install one MS24665-210 cotter pin.
5. Set Hall Effect sender-to-magnets gap per § 7.141.
6. Attach cable to lever. Reconnect wiring to micro switch at three-pin connector.

7.620 Rotor Brake Installation (continued)

7. With brake engaged, adjust gap between NAS428-3-12 bolthead on B109-1 arm and A130-43 spacer to 0.030–0.035 inch. Lock adjustment by tightening MS21042L3 nut.
8. With brake in the released position, measure gap between B112-1 lever and B110-1 arm assembly. The gap measurement should be 0.030–0.170 inch. Adjust length of bead chain as required to obtain proper gap. One bead is approximately 0.150 inch.
9. Adjust micro switch to open and close at a gap of 0.20–0.30 inch between B112-1 lever and B110-1 arm.
10. Install forward flex plate.
11. Check clutch sheave alignment per § 7.230.
12. Install intermediate flex plate per § 7.330.

7.630 Rotor Brake Pad Replacement

1. Minimum pad thickness is 0.030 inch.
2. Brake pad replacement is accomplished by replacing B110-1 and B109-1 arm assemblies.

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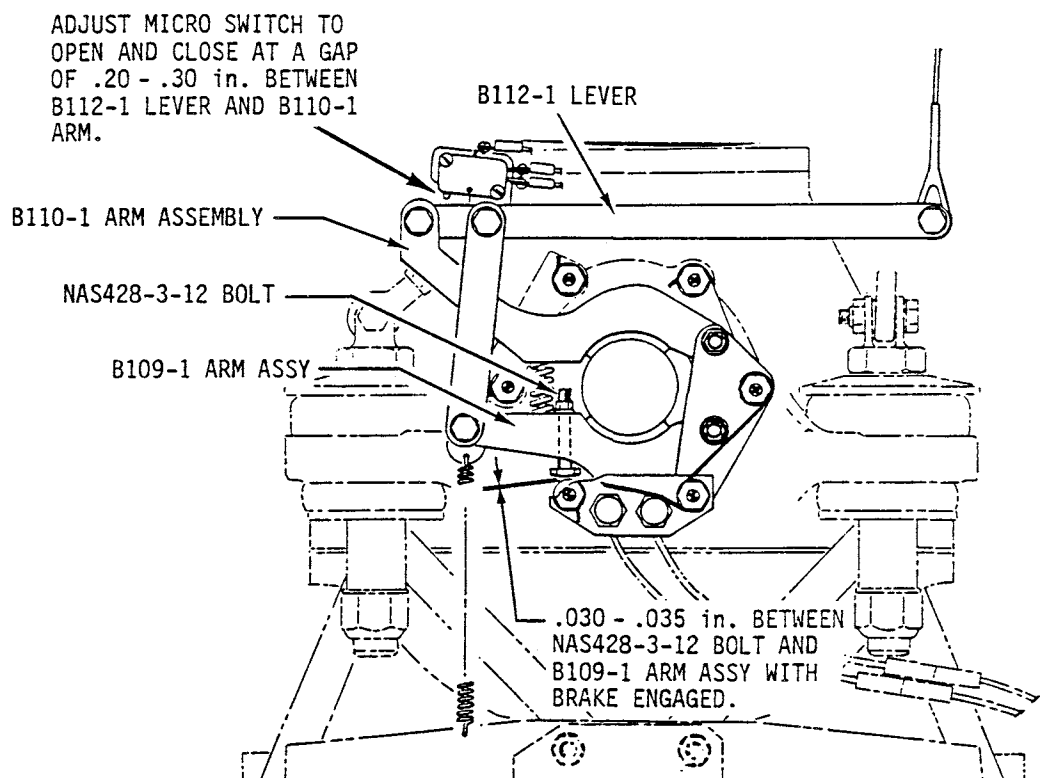


FIGURE 7-16A ROTOR BRAKE ADJUSTMENTS AND CLEARANCES

