

CHAPTER 9**ROTOR SYSTEMS**

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CHAPTER 9**ROTOR SYSTEMS**9.000 Description

Refer to Chapter 26 for main rotor description.

The tail rotor has two all-metal blades and a teetering hub with a fixed coning angle. The pitch change bearings have self-lubricated liners. The teeter hinge bearings are elastomeric or have self-lubricated liners. The tail rotor blades are constructed with aluminum skins and root fittings. Maintaining the paint finish will reduce corrosion and erosion.

9.100 Main Rotor

This section has been moved to Chapter 26 Main Rotor.

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9.200 Tail Rotor

9.210 Tail Rotor Assembly Removal

1. Mark or tag each pitch link and corresponding blade for reinstallation. Remove hardware securing pitch links to tail rotor blades, noting hardware removed.

NOTE

Tail rotor pitch link-to-blade attach bolts may be different lengths and/or have different washers installed under nut for balancing.

2. Remove nut and A141-14 washer securing A119-1 bumper to tail rotor gearbox output shaft.
3. Remove teeter hinge bolt, then slide tail rotor assembly and bumper, and A130-1 spacers (A030-1 hub assembly only), off of shaft.

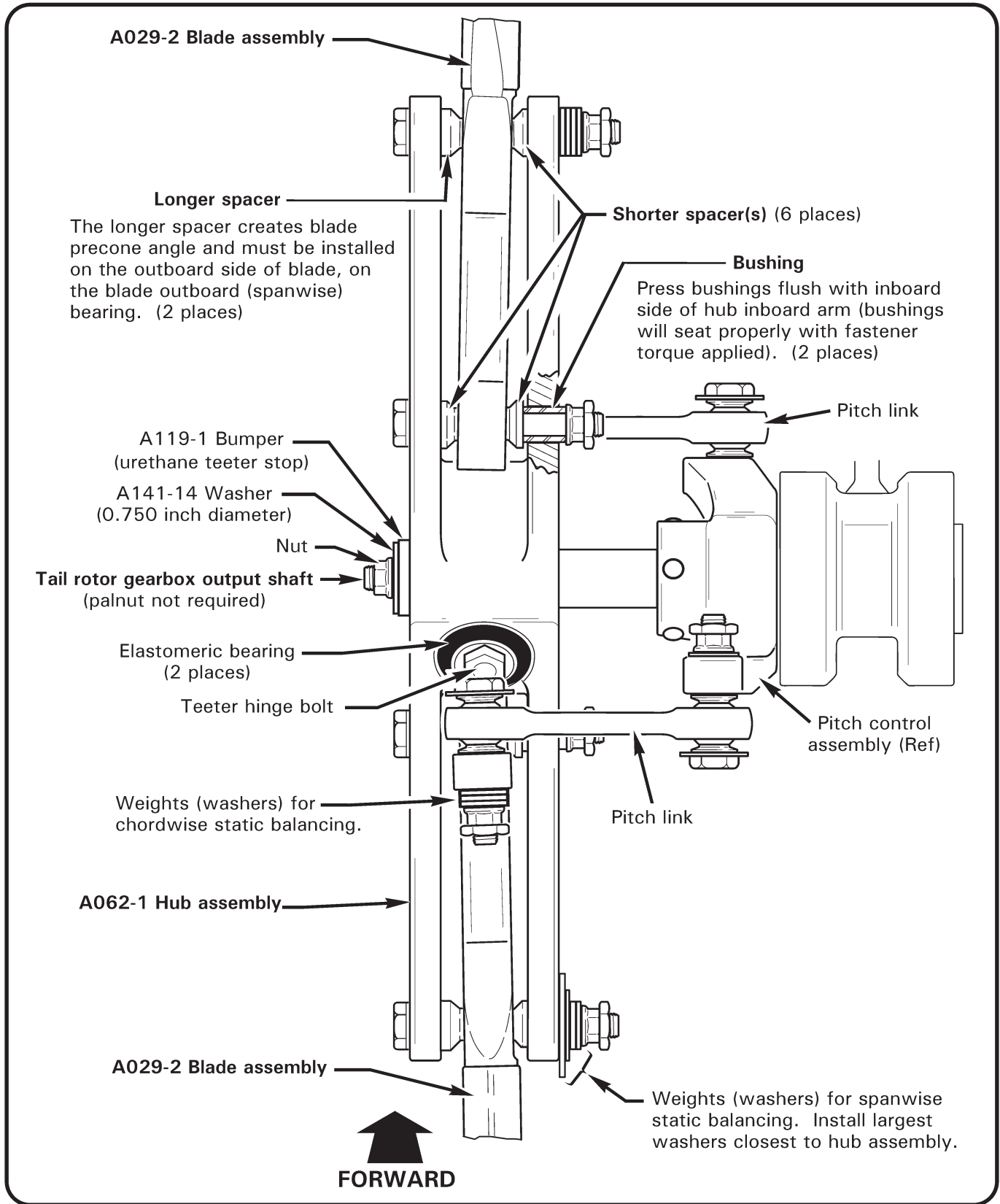


FIGURE 9-11 TAIL ROTOR ASSEMBLY INSTALLATION (A008-4 ASSEMBLY SHOWN)

9.212 Tail Rotor Installation with Spherical Teeter Bearings
(see Section 9.213 if tail rotor has elastomeric teeter bearings)

1. Before hub installation, inspect:
 - a. A130-1 Spacers: Worn faces or deep indentations from bearing ball are cause for replacement.
 - b. Tail rotor gearbox output shaft: Shaft worn at flats for A130-1 spacer or elongated bolt hole requires output shaft replacement. A021-1 tail rotor gearbox output shafts may be replaced by an RHC-authorized component overhaul facility. B021-1 tail rotor gearboxes must be returned to RHC for output shaft replacement.
 - c. Teeter bearings in hub: If inner ball is tight, move ball in bearing to work-in and reduce stiffness.
2. Align tail rotor blades with same pitch change link from which removed.
3. Place A130-1 spacers inside hub and install hub assembly on tail rotor gearbox output shaft per Figure 9-12.

WARNING

Ensure blades are installed in proper direction of rotation, and large A137-2 spacers installed per Figure 9-11.

NOTE

Tail rotor hub teeter bearings may have to be pressed back slightly to allow installation on tail rotor gearbox output shaft. Place two small sockets inside hub against bearing outer races, insert screwdriver between sockets, and carefully spread bearings apart for reinstallation.

4. Install tail rotor teeter (delta) hinge bolt and nut. Torque nut per Section 1.330. Install palnut, torque per Section 1.320, and torque stripe.

NOTE

No washers are installed under teeter hinge nut or bolthead on hubs using spherical teeter hinge bearings.

WARNING

Failure to check tail rotor for proper installation per step 5 can result in failure of teeter hinge bolt and loss of tail rotor.

9.212 Tail Rotor Hub Installation with Spherical Teeter Bearings (cont'd)

5. After torquing teeter bolt, check tail rotor hub bearings, bolt as follows:
 - a. Place a line on exposed portion of each bearing ball using a felt pen or grease pencil.
 - b. Teeter tail rotor assembly while observing marked lines relative to output shaft of tail rotor gearbox.
 - c. Teeter bolt, nut, bearing inner balls, and spacers must remain rigid (stationary) to output shaft when teetering tail rotor.
 - d. Teeter bearing outer races are press fit in hub and must not move relative to hub.

NOTE

If bearing ball, bolthead, and/or nut are moving with hub and blade assembly, insufficient clamp-up is indicated. Possible causes and corrective action for insufficient clamp-up are:

- i. Worn A130-1 spacers - replace spacers.
 - ii. Hub teeter bearing stiff - manually work-in bearing by moving ball.
 - iii. Output shaft flats worn at bolt hole - return gearbox to RHC for repair.
 - iv. Metal at bottom of hub bore is preventing bearing outer races seating - remove bearings, clean bore and reinstall bearings.
 - v. Force required to teeter tail rotor assembly not to exceed 3 lb, measured at blade tip, before first forward flight. After 6 hours of forward flight, teeter forces must not exceed 1 lb.
6. Install bumper, A141-14 washer, and nut on output shaft. Torque nut per Section 1.320, install palnut, and torque stripe.
 7. Connect pitch links blades. Torque fasteners per Section 1.320 and torque stripe.
 8. Dynamically balance tail rotor per Section 10.240.

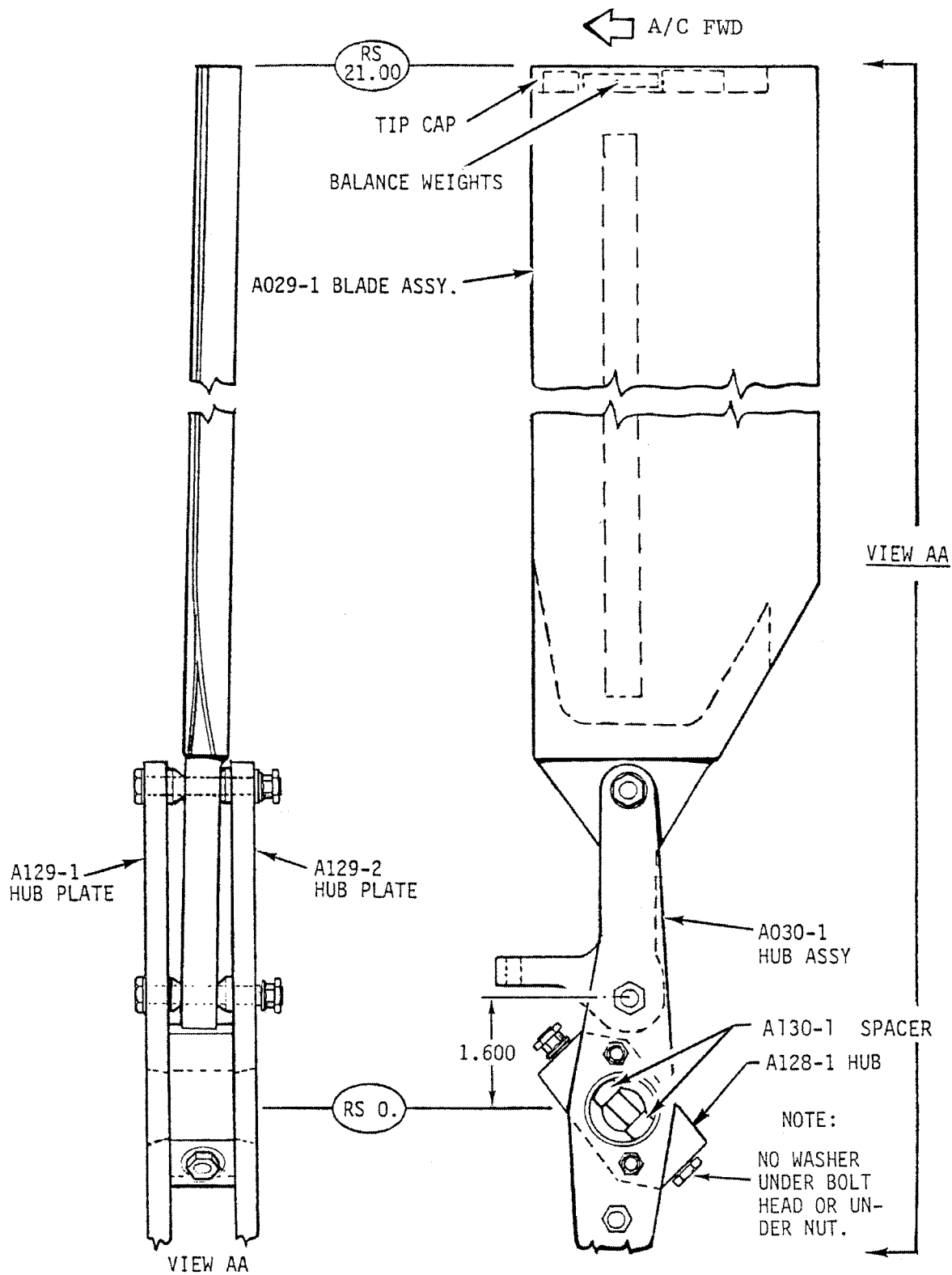


FIGURE 9-12 TAIL ROTOR ASSEMBLY (SPHERICAL TEETER BEARINGS)

9.213 Tail Rotor Installation with Elastomeric Teeter Bearings
(see Section 9.212 if tail rotor has spherical teeter bearings)

1. Align tail rotor blades with same pitch link from which removed. Install tail rotor on tail rotor gearbox output shaft, and verify counterclockwise direction of rotation (when viewed from left side of aircraft).
2. See Figure 9-11. Verify blades cone toward tail rotor gearbox.
3. Install tail rotor teeter hinge bolt, washers, and nut. Tighten nut until elastomeric bearing metal spacers contact output shaft (See Figure 9-12).
4. Connect pitch links to blades and torque fasteners per Section 1.320.
5. See Figure 10-7. With tail rotor horizontal, tape a tracking stick to tailcone at blade tip.

NOTE

A tracking stick can be made from sheet metal approximately 1 inch wide x 12 inches long with a 90 degree bend 2 inches from one end.

6. Rotate drive train at clutch shaft. Mark tracking stick where forward drain hole of each blade tip passes.
7. Reposition (teeter) tail rotor on output shaft until both blade tips pass the same point on the tracking stick ± 0.125 inch.
8. Torque teeter hinge bolt per Section 1.330. Recheck track per step 6 and adjust per step 7, if required, and retorque teeter hinge bolt.
9. When track is satisfactory, install palnut on teeter hinge bolt, torque per Section 1.330, and torque stripe per Figure 2-1.
10. Remove tracking stick.
11. Teeter tail rotor back and forth. Verify teeter hinge bolt, bearing metal spacers, washers, and nuts remain stationary when tail rotor is teetered.

WARNING

Movement of teeter hinge bolt, washer(s), spacer(s), or nut(s) indicate insufficient clamp-up, which can result in loss of tail rotor.

12. Install urethane bumper, washer, and nut. Torque nut per Section 1.330, and torque stripe per Figure 2-1.
13. Dynamically balance tail rotor per Section 10.240.

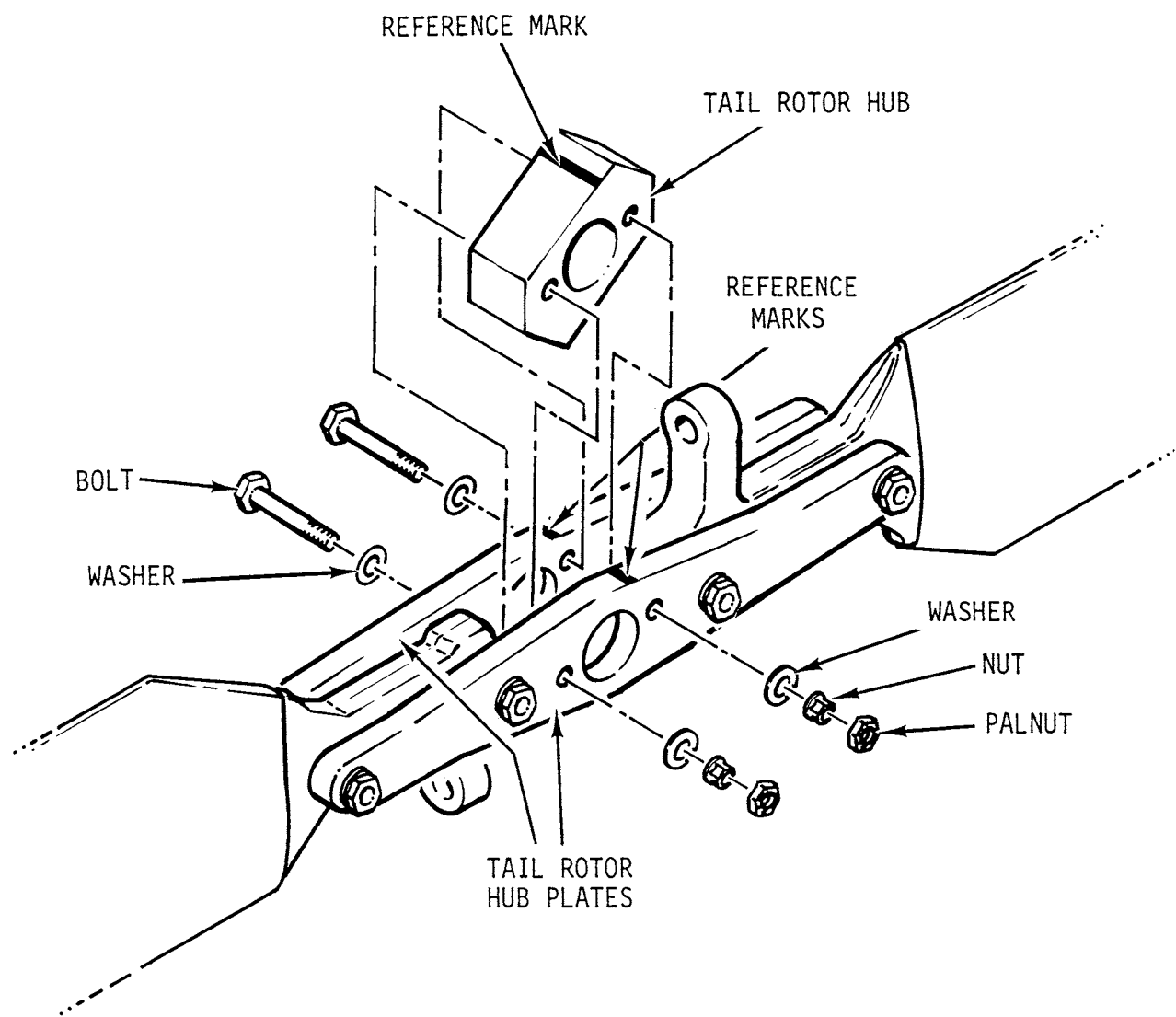


FIGURE 9-13 TAIL ROTOR HUB REMOVAL FOR BEARING REPLACEMENT

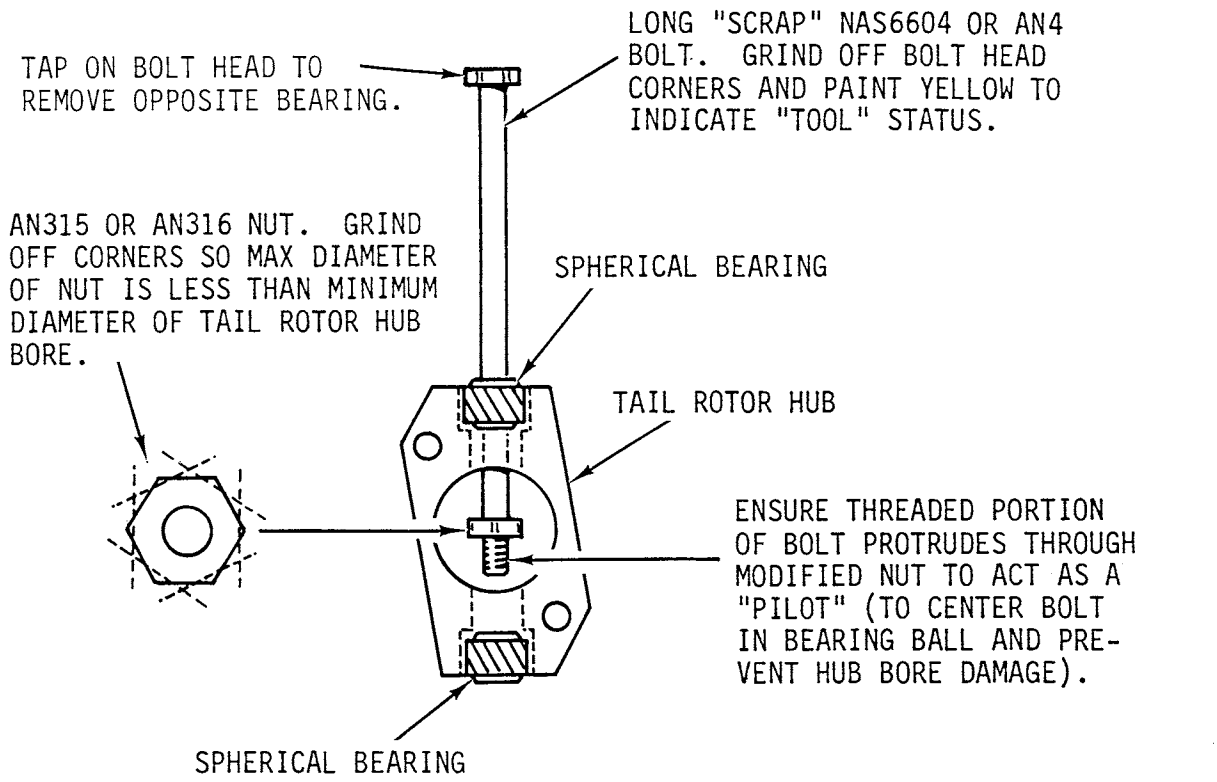


FIGURE 9-13A TAIL ROTOR HUB SPHERICAL BEARING REMOVAL

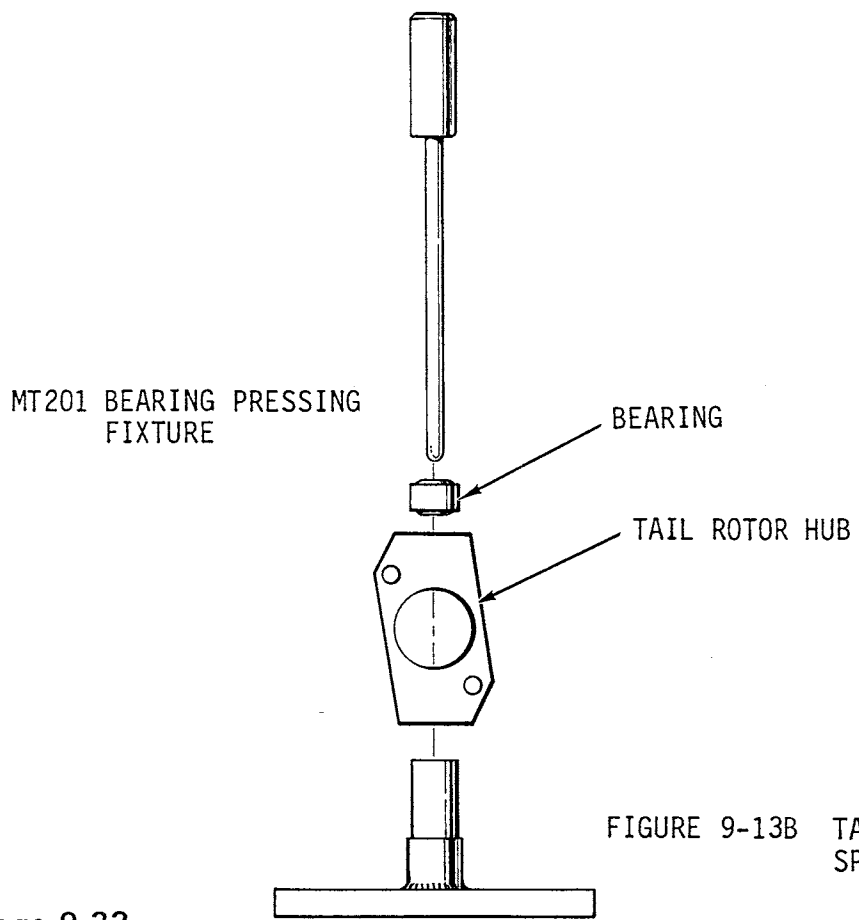


FIGURE 9-13B TAIL ROTOR HUB SPHERICAL BEARING REPLACEMENT

9.214 Tail Rotor Hub Spherical Bearing Replacement

NOTE

Some early-model tail rotors have one hub bearing swaged into hub. This bearing is nonreplacable and, if worn, hub assembly must be replaced.

1. Remove tail rotor per Section 9.210.
2. Mark hub per Figure 9-13.
3. Loosen four blade retaining bolts. Remove two center bolts securing hub between hub plates and remove hub (see Figure 9-13).
4. See Figure 9-13A. Press out worn bearing(s).
5. Clean hub bore, removing old primer or metal shavings which might prevent bearings from seating at bottom of bores.

CAUTION

Bearings are a slight press fit in hub bores. Inspect bores for fretting. If fretting is found, tail rotor hub assembly is **UNAIRWORTHY**.

6. See Figure 9-13B. Using special tool MT201, install bearings into hub as follows:

NOTE

Hub may be heated to 170°F maximum to ease bearing insertion and help prevent installation damage.

Apply Section 1.450-approved primer to original primed bore. Bearing is to be installed to bottom of hub bore. Apply primer or A257-7 lubricant to remaining bore and install bearing flush with top of hub. If bearing is installed too far, spacers and hub will not fit over gearbox output shaft.

NOTE

Install tail rotor without delay if using primer in both bearing bores.

7. Reinstall hub between hub plates per reference mark (see Figure 9-13). Torque two center hub and four blade retaining bolts per Section 1.320, install palnuts, and torque stripe.
8. Install tail rotor per Section 9.212.

9.215 Tail Rotor Hub Elastomeric Bearing Replacement

1. Remove tail rotor per Section 9.210.
2. Remove four blade retaining bolts and remove blades.
3. See Figure 9-13C. Using special tool MT556, press out worn bearing.
4. Clean hub bore, removing old primer or metal shavings which might prevent bearing from seating at bottom of bore.

CAUTION

Bearings are a slight press fit in hub bores. Inspect bores for fretting. If fretting is found, tail rotor hub assembly is **UNAIRWORTHY**.

5. Coat bottom of bearing bore with Section 1.450-approved primer. While primer is still wet, press bearing fully into hub using special tool MT556 per Figure 9-13D.
6. Repeat steps 1 thru 5 to replace opposite bearing, if required.
7. Seal between circumference of each bearing and hub with primer as required in two places.
8. Assemble blades to hub. Verify counterclockwise direction of rotation. Verify correct orientation of bolts and correct location/orientation of A137-1 & A137-2 spacers per Figure 9-11. Torque bolts per Section 1.320, install palnuts, and torque stripe.
9. Install tail rotor per Section 9.213.

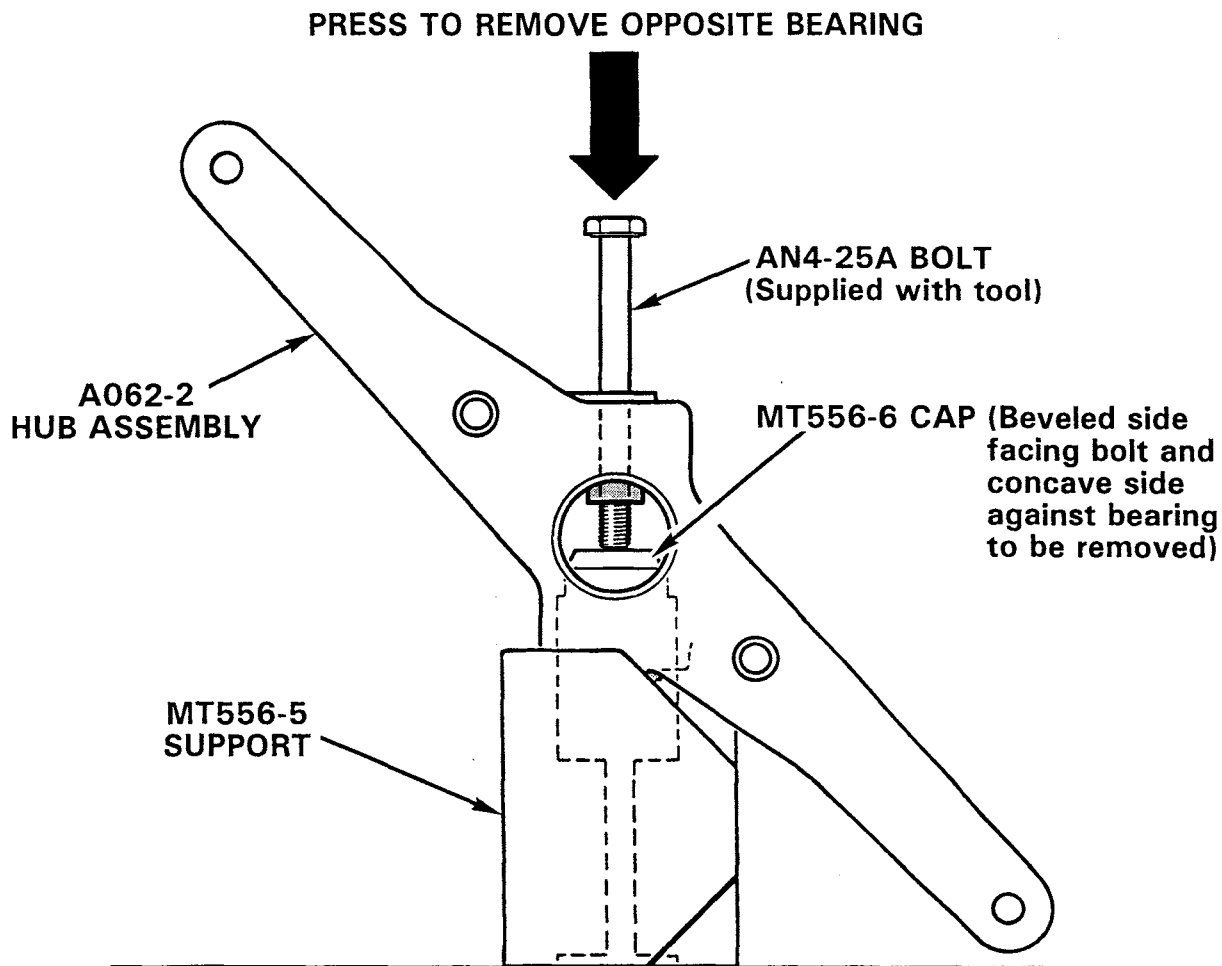


FIGURE 9-13C ELASTOMERIC BEARING REMOVAL

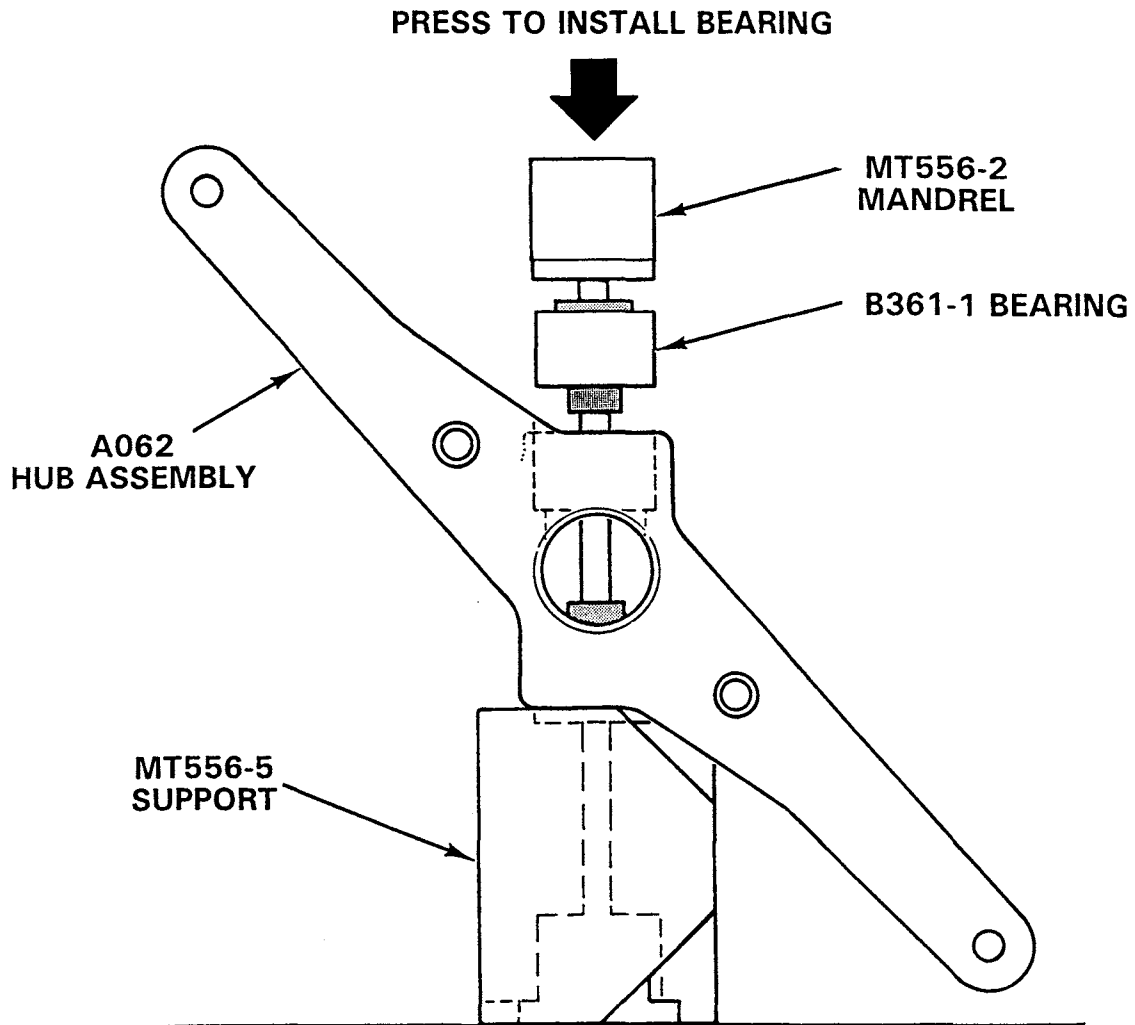


FIGURE 9-13D ELASTOMERIC BEARING INSTALLATION

9.220 Inspection and Repair of Tail Rotor Blades

This procedure outlines the inspection and repair limits for tail rotor blades. Repairs are limited to blending out mechanical scratches, dents, nicks, removing corrosion and refinishing the blades.

WARNING

Any damaged tail rotor blade that cannot be repaired within the limits of this section must be declared NON-AIRWORTHY and be removed from service immediately.

Inspection:

- a) Scratches and Corrosion: Blade skins may be polished out with a .10 inch blend radius within the following limits:
1. Outboard of 6 inches from the blade tip. The maximum depth allowed is .008 inch.
 2. Inboard of 6 inches from the blade tip. The maximum depth is .004 inch for any corrosion or scratches running in a direction more than 15° from the spanwise direction. The maximum depth less than 15° is .006 inch.
- b) Dents on Skins (See Figure 9-14): Smooth, round-bottomed dents which have a .06 inch minimum radius and occur from the leading edge to a point .75 inch aft of the leading edge are limited to .010 inch. Aft of .75 inch from the leading edge dents are acceptable within the following limits:
1. Outboard of 6 inches from the blade tip, dents cannot exceed .06 inch.
 2. Inboard of 6 inches from the blade tip dents cannot exceed .02 inch.
 3. Dents within .5 inch of the trailing edge or tip cannot be repaired.
 4. Dents over the skin-to-root-fitting bond joint cannot be repaired.

9.220 Inspection and Repair of Tail Rotor Blades(cont'd)**CAUTION**

Do not repair any dent that has a sharp cut or break in the skin. If necessary, locally penetrant inspect keeping penetrant materials away from bond joints.

- c) Nicks and Notches in Trailing Edge: Blend all nicks and notches in the extreme trailing edge up to a maximum of .05 inch. The blend must extend for 1.0 inch each side of the nick or notch.
- d) Erosion of the Leading Edge: Replace any blade where erosion has caused deformation or ripples in the leading edge.
- e) Dents, Scratches, and Corrosion on the Root Fitting: Damage on root fittings must be blended out using .10 inch radius within the following limits:
 - 1. No repairs allowed within .5 inch diameter circle from the center of the bearings.
 - 2. Maximum depth of .040 inch all other areas.
- f) Rework Process and Measurement of Material Removed: See Main Rotor Blade Repair, Section 9.130.
- g) Painting (See Figure 9-14):
 - 1. Clean with M.E.K. and wipe lint-free with a tack rag.
 - 2. Apply a 2 to 3-inch-wide strip of epoxy primer along all exposed bond joints.
 - 3. Apply two full coats of epoxy primer to all exterior surfaces. Time limits are 10 minutes minimum, 8 hours maximum between coats. If 8 hours is exceeded, scuff with 600 grit, M.E.K. wipe and mist primer before applying next coat.
 - 4. Spray finish coat flat black.
 - 5. Spray trim stripes.

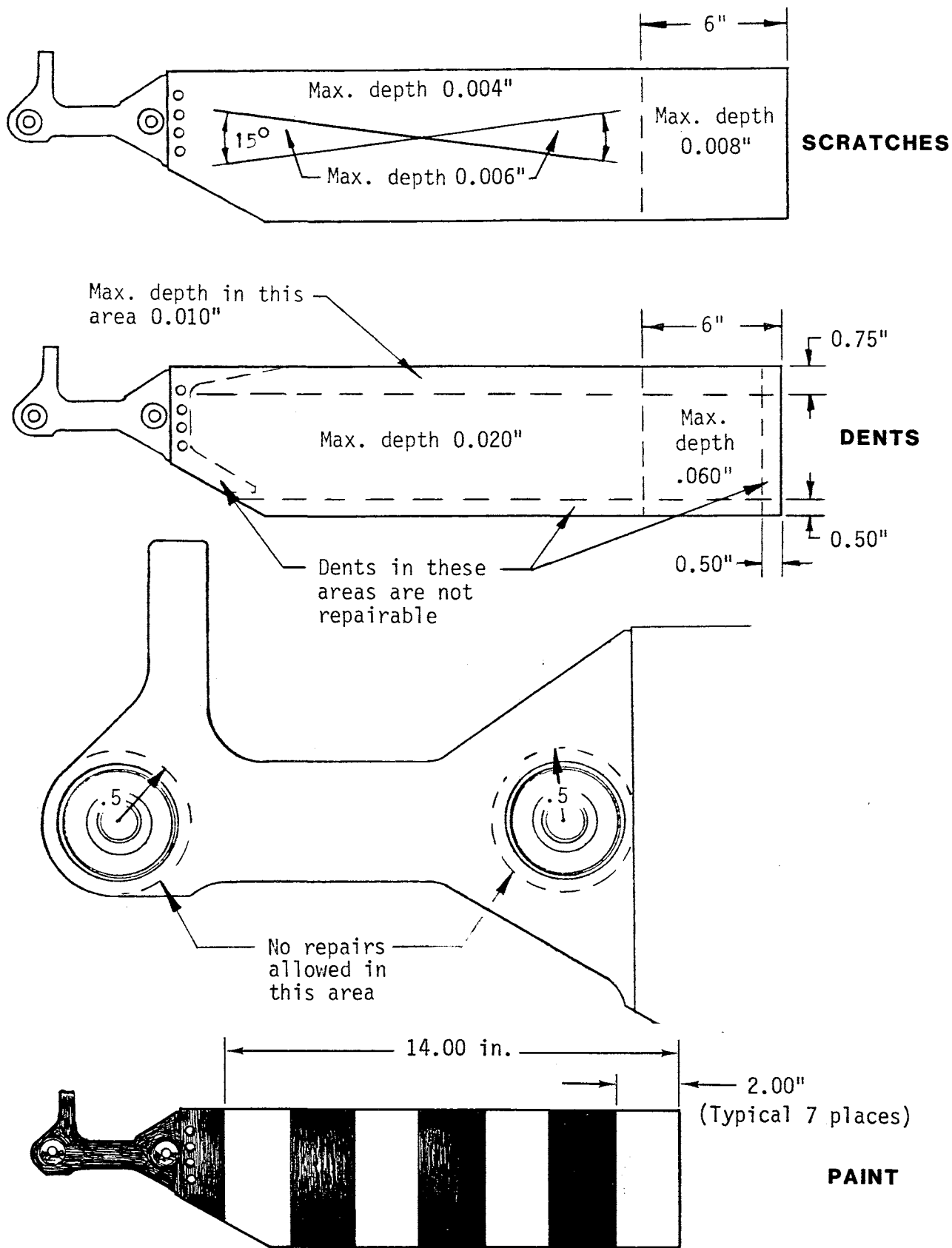


FIGURE 9-14 INSPECTION/REPAIR OF TAIL ROTOR BLADES

