

## CHAPTER 30

## TAIL ROTOR

<u>Section</u>	<u>Title</u>	<u>Page</u>
30-00	Description . . . . .	30.1
30-10	Tail Rotor Assembly . . . . .	30.1
30-11	Static Balance . . . . .	30.7
30-20	Tail Rotor Blades . . . . .	30.9
30-30	Tail Rotor Blade Inspection and Repair . . . . .	30.13
30-31	Scratches and Corrosion . . . . .	30.13
30-32	Dents . . . . .	30.14
30-33	Erosion . . . . .	30.15
30-34	Root Fitting Damage . . . . .	30.15
30-35	Nicks and Notches . . . . .	30.15
30-36	Painting . . . . .	30.17
30-37	Tail Rotor Blade Condition and Care . . . . .	30.19
30-40	Tail Rotor Hub . . . . .	30.21
30-41	Elastomeric Bearing Replacement . . . . .	30.21
30-42	Spherical Bearing Replacement . . . . .	30.23
30-43	Inspection . . . . .	30.24

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## CHAPTER 30

## TAIL ROTOR

30-00 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 either have self-lubricated liners or are elastomeric. The tail rotor blades are constructed with aluminum skins and root fittings. Maintaining the paint finish will reduce corrosion and erosion.

30-10 Tail Rotor Assembly**A. Removal**

1. Refer to Figure 30-1 or Figure 30-2. 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 C119-2 bumper to tail rotor gearbox output shaft.
3. Remove teeter hinge bolt, then slide tail rotor assembly and bumper, and C130-1 spacers (C030 hubs only), off of shaft.

**NOTE**

Protect tail rotor assembly from damage when maintenance is performed on workbench.

4. If removing tail rotor due to gearbox breakage, then perform C148 bulkhead inspection per § 2.595.

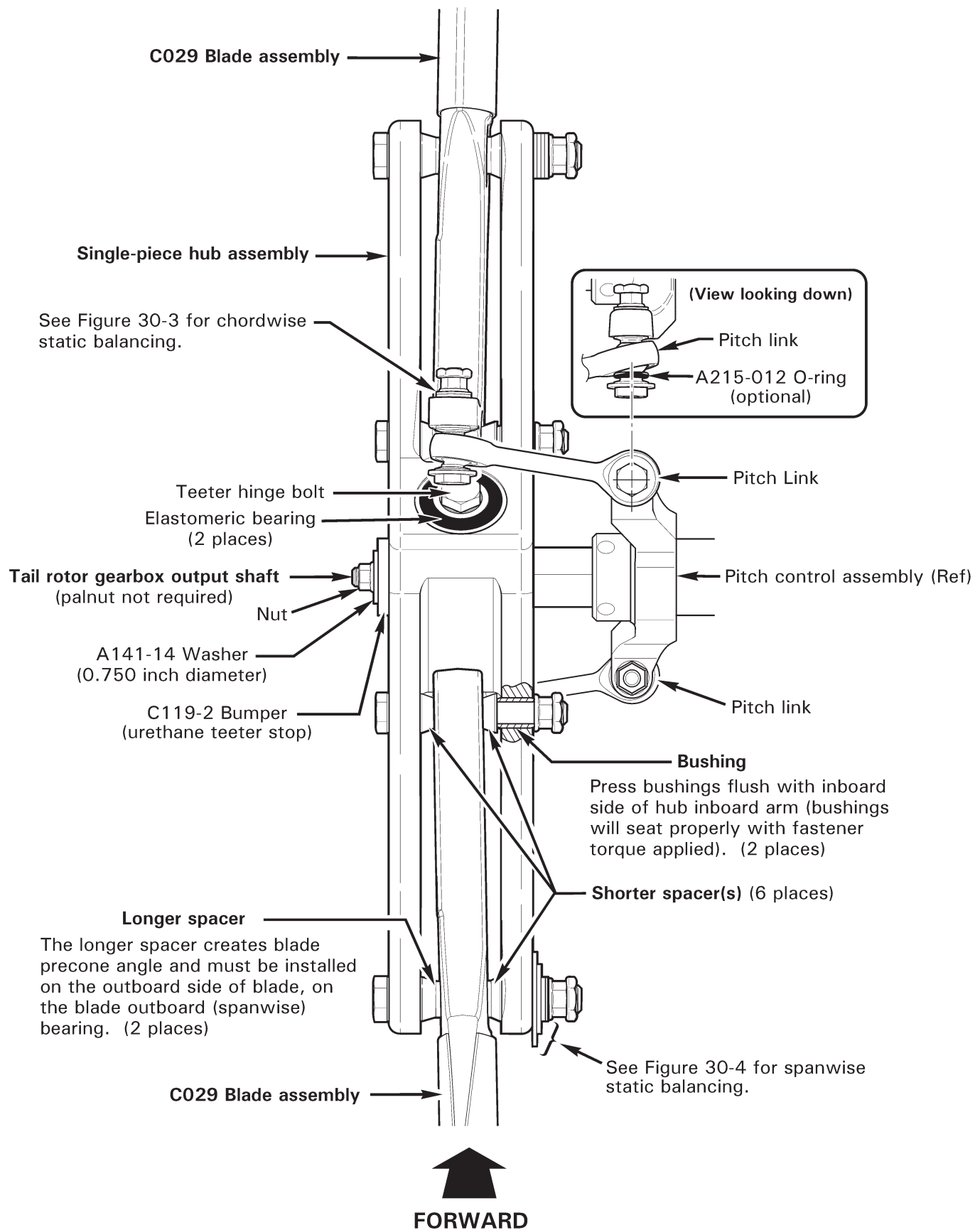


FIGURE 30-1 SINGLE-PIECE HUB TAIL ROTOR ASSEMBLY INSTALLATION

30-10 Tail Rotor Assembly (continued)**B. Installation of Single-Piece Hub (Elastomeric Bearing) Tail Rotor Assembly****CAUTION**

Perform static balance per § 30-11 if balancing hardware information is unknown, if blade(s) or hub bearing(s) were replaced, or if any rework has changed mass of rotor assembly.

1. Inspect elastomeric bearings per § 2.125.
2. Clean tail rotor gearbox output shaft and elastomeric bearing spacer clamping surfaces with mild soap (pH between 7 & 9) and warm water. Water-rinse to remove all soap residue, dry with lint-free cloth.
3. Refer to Figure 30-1. Position tail rotor assembly on tail rotor gearbox output shaft, matching tail rotor blades to corresponding pitch links. Verify tail rotor is installed for clockwise rotation when viewed from left side of aircraft.
4. Install teeter hinge bolt and tighten nut until elastomeric bearing metal spacers contact output shaft, but do not torque. Verify blades cone toward tail rotor gearbox.
5. Remove tags. Install hardware securing tail rotor blades to pitch links as removed, or as determined by static balancing. Standard torque nuts & palnuts per § 23-32, and torque stripe per Figure 2-1.
6. Fabricate a tracking aid using 1x12-inch aluminum sheet; make a 90° bend 2 inches from one end. With tail rotor horizontal, tape tracking aid to tailcone near blade tip.
7. Rotate tail rotor drive shaft and mark tracking aid where each blade tip drain hole passes. Adjust (teeter) tail rotor until both blade tips pass the same point within 0.125 inch. Special torque teeter hinge bolt per § 23-33. Recheck track. Repeat step until blades are tracked.
8. Install palnut on teeter hinge bolt, standard torque per § 23-32, and torque stripe per Figure 2-1. Remove tracking aid.
9. Teeter tail rotor hub back and forth. Verify teeter hinge bolt, bearing metal spacers, washers, and nuts remain stationary when tail rotor is teetered.
10. Install C119-2 bumper, A141-14 washer, and nut. Special torque nut per § 23-33 | and torque stripe per Figure 2-1.
11. Dynamically balance tail rotor per § 10.240.

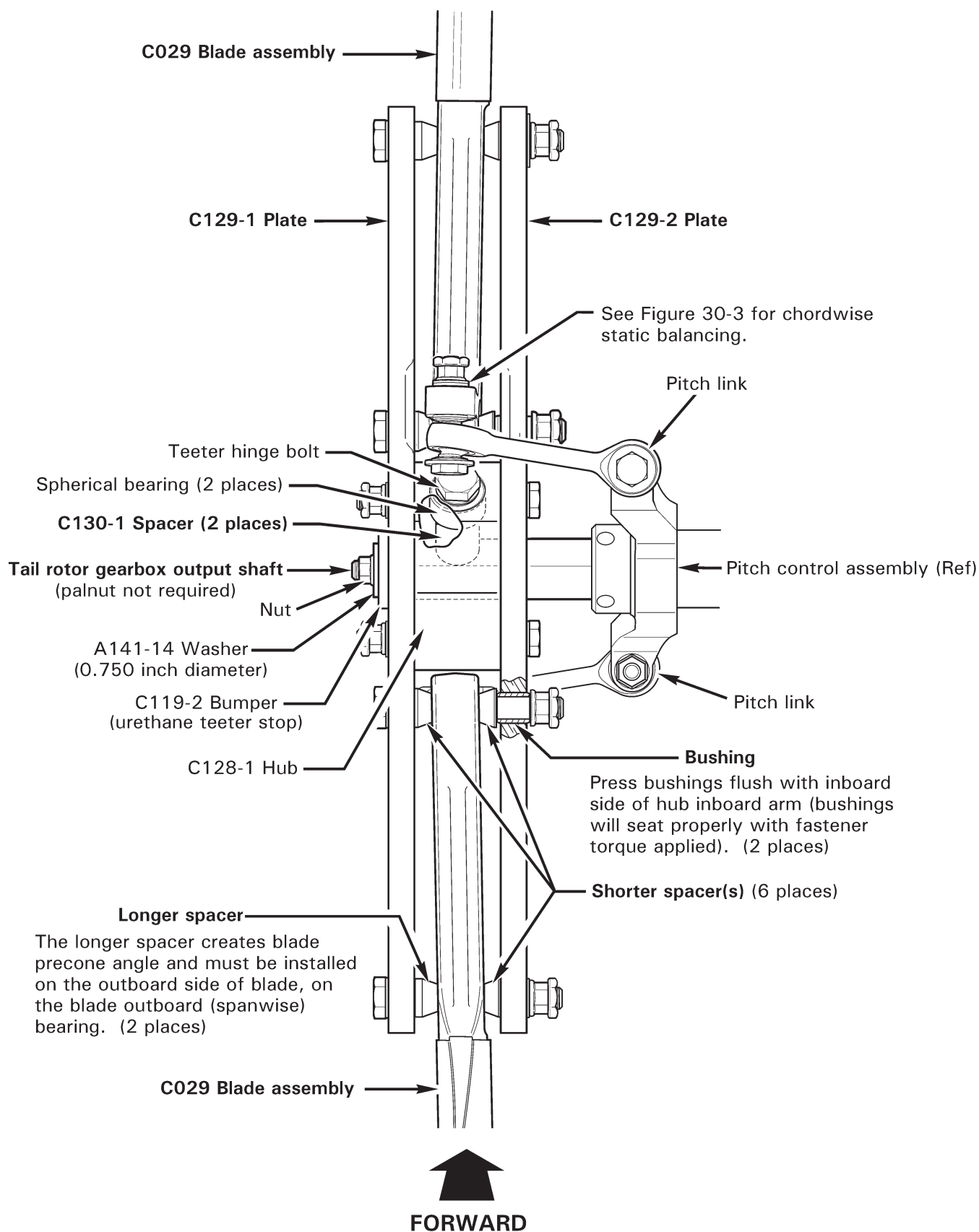


FIGURE 30-2 THREE-PIECE HUB TAIL ROTOR ASSEMBLY INSTALLATION

30-10 Tail Rotor Assembly (continued)**C. Installation of Three-Piece Hub (Spherical Bearing) Tail Rotor Assembly****CAUTION**

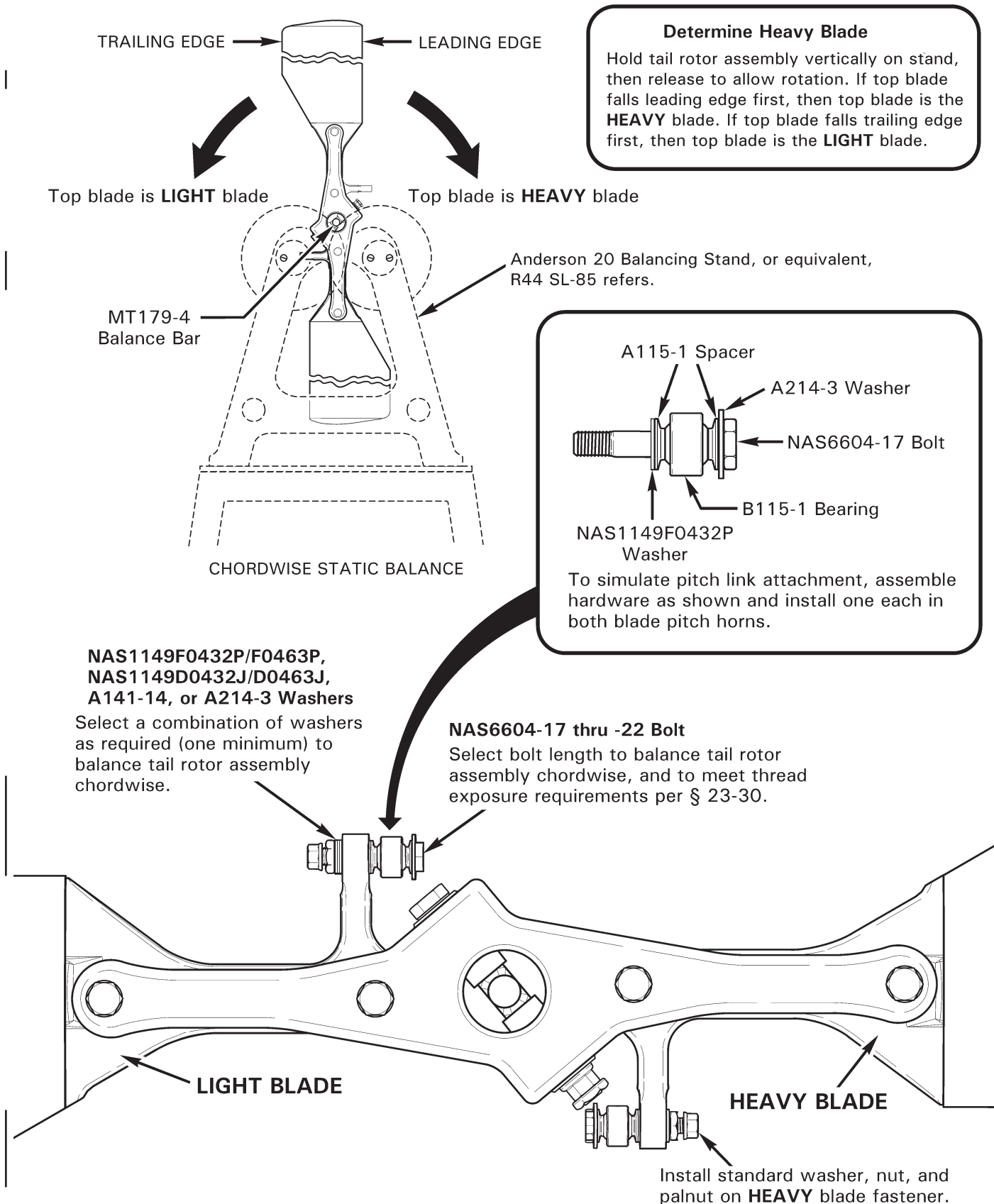
Perform static balance per § 30-11 if balancing hardware information is unknown, if blade(s) or hub bearing(s) were replaced, or if any rework has changed mass of rotor assembly.

1. a. Verify C130-1 spacer faces are not worn.  
b. Verify tail rotor gearbox output shaft flats are not worn. Verify output shaft teeter hinge bolt hole is not elongated.
2. Clean tail rotor gearbox output shaft and elastomeric bearing spacer clamping surfaces with mild soap (pH between 7 & 9) and warm water. Water-rinse to remove all soap residue, dry with lint-free cloth.
3. Refer to Figure 30-2. Position C130-1 spacers inside hub and install tail rotor assembly on tail rotor gearbox output shaft, matching tail rotor blades to corresponding pitch links. Verify tail rotor is installed for clockwise rotation when viewed from left side of aircraft.
4. Install teeter hinge bolt and special torque per § 23-33. Install palnut on teeter hinge bolt, standard torque per § 23-32, and torque stripe per Figure 2-1. Verify blades cone toward tail rotor gearbox.

**WARNING**

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

5. a. Mark a line on exposed portion of each bearing ball using a felt pen or grease pencil.  
b. While teetering tail rotor, observe marked line in relation to output shaft. Verify bolt, nut, bearing balls, and spacers remain stationary in relation to output shaft. Teeter tail rotor and verify bearing outer races do not move inside hub.  
c. If bearing outer races rotate within hub bore, insufficient clamp-up is indicated. Replace tail rotor hub.
6. Install hardware securing tail rotor blades to pitch links as removed, or as determined by static balancing. Standard torque nuts & palnuts per § 23-32, and torque stripe per Figure 2-1.
7. Install C119-2 bumper, A141-14 washer, and nut. Special torque nut per § 23-33 and torque stripe per Figure 2-1.
8. Dynamically balance tail rotor per § 10.240.



**FIGURE 30-3 CHORDWISE STATIC BALANCE**  
(C008-9 Tail Rotor Assembly Shown)

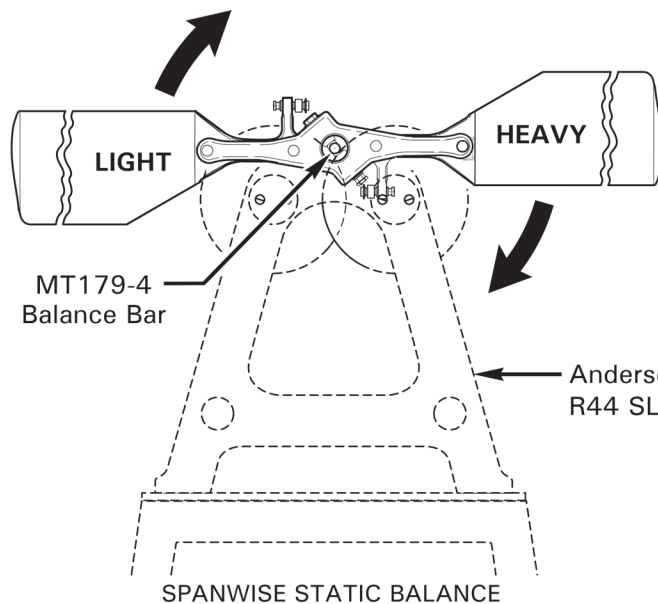


30-11 Static Balance

## NOTE

Tail rotor assemblies received from RHC are static balanced at factory. Perform static balance in calm-air environment.

1. Refer to Figure 30-3. Install MT179-4 balance bar into tail rotor assembly. Install teeter hinge bolt thru larger hole, install nut and tighten until elastomeric bearing metal spacers contact bar (or until bearing spacers firmly clamp bar then install palnut finger-tight; three-piece hubs only). Using a protractor or square, adjust balance bar until approximately perpendicular to hub. While maintaining perpendicularity, special torque nut per § 23-33; install palnut finger-tight (single-piece hubs only). Mark hub with teeter hinge bolt orientation for reinstallation.
2. Using NAS6604-17 bolts, assemble hardware as shown in blade pitch horns using bearing to simulate pitch link. Install standard washer, palnut, and nut on each bolt hand-tight.
3. Place tail rotor assembly, with balance bar, vertically on balancing stand. Adjust pitch of both blades so they are similar. Hold tail rotor assembly vertically, then release to allow rotation. If top blade falls leading edge first, then top blade is the heavy blade. If top blade falls trailing edge first, then top blade is the light blade.
4. Chordwise balancing is achieved by varying NAS6604 bolt length and nut-side washers at light blade pitch horn. Select bolt length & washers for balancing, and to meet thread engagement requirements per § 23-30 Part E step 5, and install hand-tight.
5. Repeat steps 3 & 4 until top blade does not fall (or falls very slowly) when tail rotor is positioned vertically on balancing stand. Balance within one thin steel washer.
6. Refer to Figure 30-4. Place tail rotor assembly, with balance bar, horizontally on balancing stand. Hold tail rotor horizontally, then release to allow rotation. The falling blade is the heavy blade; the rising blade is the light blade.
7. Spanwise balancing is achieved by varying nut-side washer mass on light blade's outboard blade-to-hub attach bolt. Four washers are required under nut on outboard blade-to-hub attach bolt; place largest washers closest to hub. Select washers for balancing, standard torque hardware per § 23-32, and repeat step 6.
8. Repeat steps 6 & 7 until tail rotor does not rotate (or rotates very slowly) when positioned horizontally on balancing stand. Balance within one thin aluminum washer.
9. From each blade pitch horn, remove A214-3 washer, two A115-1 spacers, & B115-1 bearing from bolt; install palnut & nut finger-tight to retain bolt and washer(s) in the correct pitch horn.
10. Remove MT179-4 balance bar. Install teeter hinge bolt & washers in hub, and install palnut & nut finger-tight on bolt.
11. As required, touch-up bolt heads using § 23-77 approved paint.

**Determine Heavy Blade**

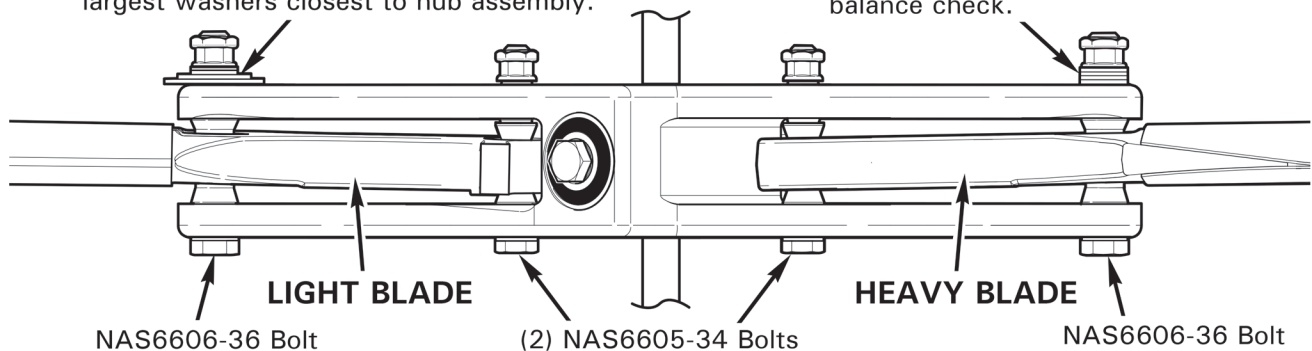
Hold tail rotor assembly horizontally on stand, then release to allow rotation. The falling blade is the **HEAVY** blade; the rising blade is the **LIGHT** blade.

**(4) NAS1149F0632P/F0663P,  
NAS1149D0632J/D0663J,  
C141-23, or C141-24 Washers**

Select a combination of four washers to balance tail rotor assembly spanwise. Place largest washers closest to hub assembly.

**C008-9 TAIL ROTOR ASSEMBLY**

Install (4) NAS1149D0663J washers under nut of **HEAVY** blade outboard fastener for initial spanwise static balance check.



**(4) NAS1149D0532K/D0563K,  
NAS1149F0563P/AN970-5,  
or A141-20 Washers**  
See above description.

**C008-4 TAIL ROTOR ASSEMBLY**

**(4) NAS1149D0563K**  
See above description.

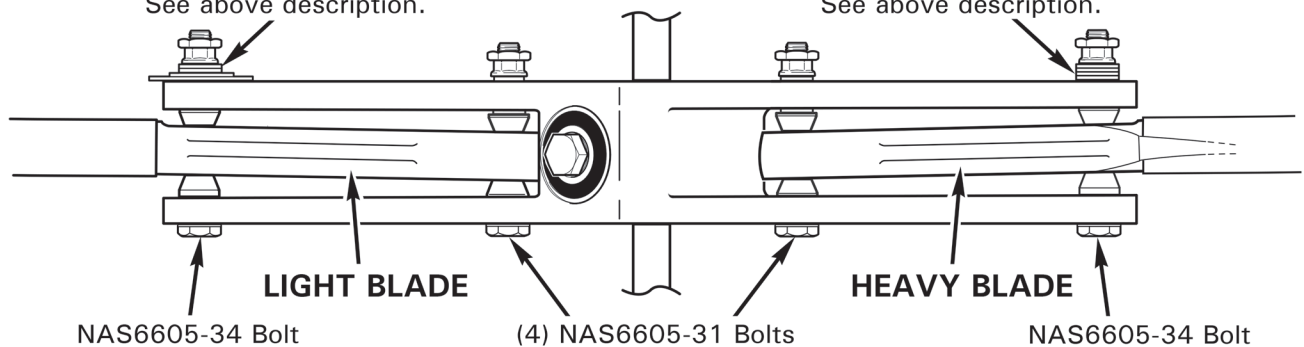


FIGURE 30-4 SPANWISE STATIC BALANCE

### 30-20 Tail Rotor Blades

**NOTE**

Protect tail rotor assembly from damage when maintenance is performed on workbench.

#### **A. Removal**

1. Remove tail rotor assembly per § 30-10.
2. Refer to Figure 30-1 or Figure 30-2. Mark three-piece tail rotor hub assembly across the hub and plates for reinstallation.
3. Remove hardware securing tail rotor blades to hub assembly. Remove blades, spacers, and hardware. Remove bushings if required.

#### **B. Installation**

**CAUTION**

C029 tail rotor blades are a matched set from RHC. If only one blade is being replaced, contact RHC Customer Service with airworthy blade serial number for a matching replacement blade.

1. Inspect tail rotor hub per § 30-40, as required.
2. Refer to Figure 30-1 or Figure 30-2. If removed, apply light coat of approved primer (see § 23-70) to outer surface of bushings; while primer is wet, press bushings flush with inboard side of hub inboard arm (bushings will seat properly with fastener torque applied).

**CAUTION**

The longer spacer creates blade precone angle and must be installed on the outboard side of blade, on the blade outboard (spanwise) fitting.

3. Install tail rotor blades and spacers in hub. Assemble blades (if viewed from left side of aircraft) for clockwise rotation, to cone toward tail rotor gearbox. Install hardware securing blades to hub; install standard hardware on outboard fasteners for initial tail rotor assembly static balance check. Standard torque bolts per § 23-32, and torque stripe inboard bolts per Figure 2-1.
4. Perform tail rotor assembly static balance per § 30-11.

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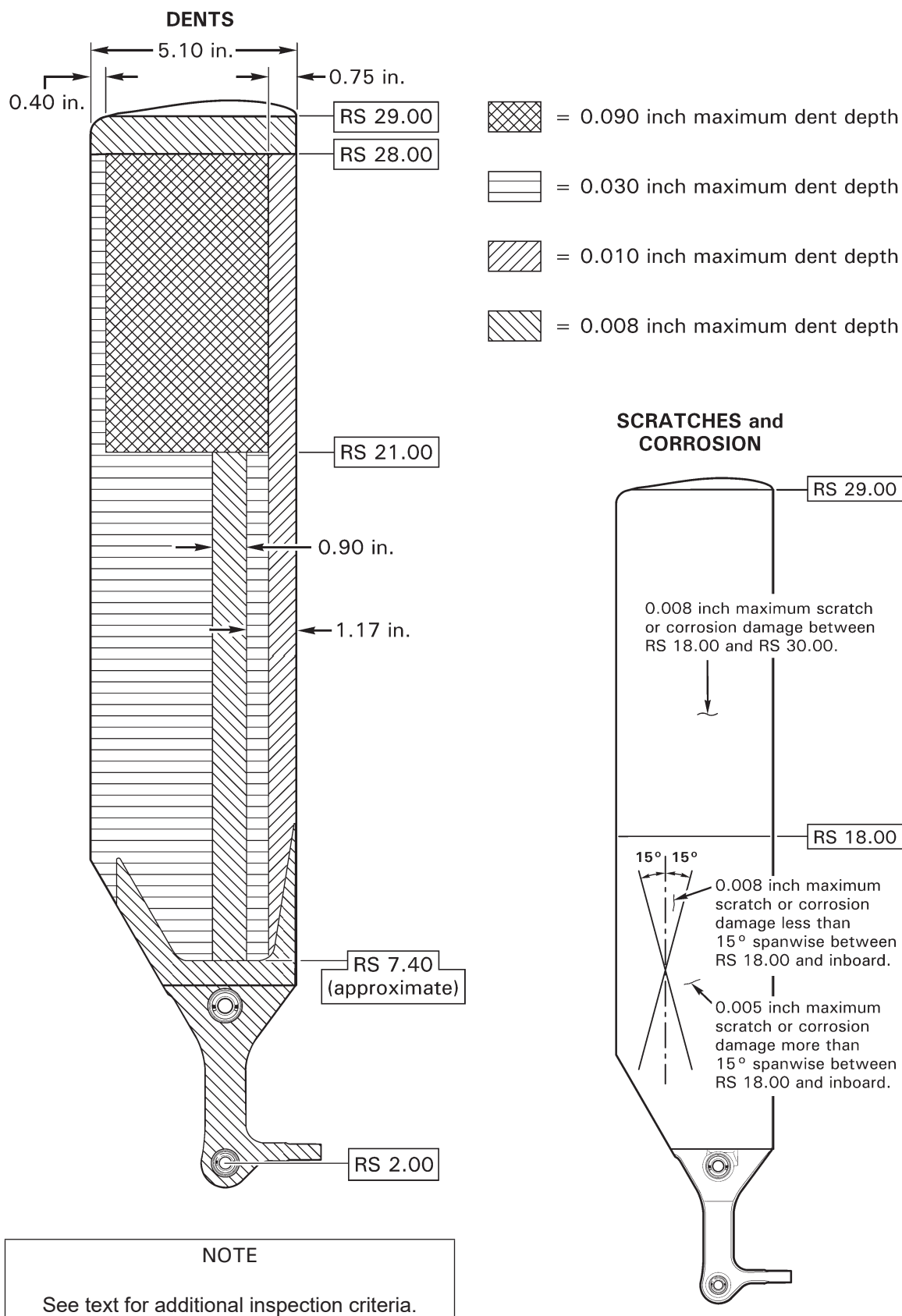


FIGURE 30-5 TAIL ROTOR BLADE INSPECTION CRITERIA

### 30-30 Tail Rotor Blade Inspection and Repair

This blade repair procedure outlines the repair limits, methods and materials used for repairing tail rotor blades. Repairs are limited to blending out scratches, dents, nicks, removing corrosion, and refinishing the blades. The inspections, repairs and limitations contained herein refer to damage sustained in service, including damage during shipping and handling (manufacturing irregularities are treated separately by the factory). In-service damage will generally exhibit paint scuffing or scratches and often times freshly-exposed metal in the form of scratches in the finish. If there are any questions as to the possibility of a manufacturing irregularity, contact RHC Technical Support.

#### **CAUTION**

A blade may be repaired more than one time. However, in no case can more than the maximum material be removed or the maximum dent depth be exceeded in any one location.

Refer to § 28-40 for measuring blade damage.

### 30-31 Scratches and Corrosion

1. Refer to Figure 30-5. Verify damage does not exceed the following limits:
  - a. 0.008 inch maximum damage between RS 18.00 and RS 29.00.
  - b. 0.005 inch maximum damage more than 15° spanwise between RS 18.00 and inboard.
  - c. 0.008 inch maximum damage less than 15° spanwise between RS 18.00 and inboard.
2. Refer to § 28-50 (main rotor) for repair procedures for damage within limits. Blend out scratches or corrosion on skins with a minimum 0.10 inch blend radius.

30-32 Dents**CAUTION**

Tap-test dented areas in honeycomb. If any voids are found associated with dents, replace blade.

Tap-test voids, debonds, and dents in blades using an AN970-4 washer or 1965, or later, U.S. quarter-dollar coin in good condition.

**CAUTION**

When dented areas are found, inspect opposite side of the blade for a bulge. Replace blade with a bulge greater than 0.010 inch opposite a dent.

**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.

**WARNING**

**Any damaged tail rotor blade that cannot be repaired within the limits of this section must be removed from service immediately and marked "scrap."**

**A. Skins**

1. Refer to Figure 30-5. Smooth, round bottom dents with 0.060 inch minimum radius may be repaired when damage does not exceed the following limits:
  - a. 0.010 inch maximum depth between leading edge and 0.75 inch aft (chordwise).
  - b. 0.75 inch aft (chordwise) of leading edge:
    - i. 0.090 inch maximum dent depth between RS 21.00 and RS 29.00.
    - ii. 0.030 inch maximum dent depth between RS 21.00 and inboard.
  - c. 0.030 inch maximum depth between trailing edge and 0.40 inch forward (chordwise).
  - d. 0.008 inch maximum depth between RS 28.00 and RS 29.00.
  - e. 0.008 inch maximum depth over the skin-to-root fitting bond joint and inboard honeycomb.
2. Refer to § 28-50 (main rotor) for repair procedures for damage within limits.



### 30-33 Erosion

Replace any blade where erosion has caused deformation or ripples in the leading edge.

### 30-34 Root Fitting Damage

1. Verify damage does not exceed the following limits:
  - a. No repairs permitted within 1.5-inch diameter circle from center of spherical bearing.
  - b. 0.040 inch maximum depth on other root fitting exposed areas.
2. Refer to § 28-50 (main rotor) for repair procedures for damage within limits. Blend out root fitting damage with a minimum 1.0 inch blend radius.

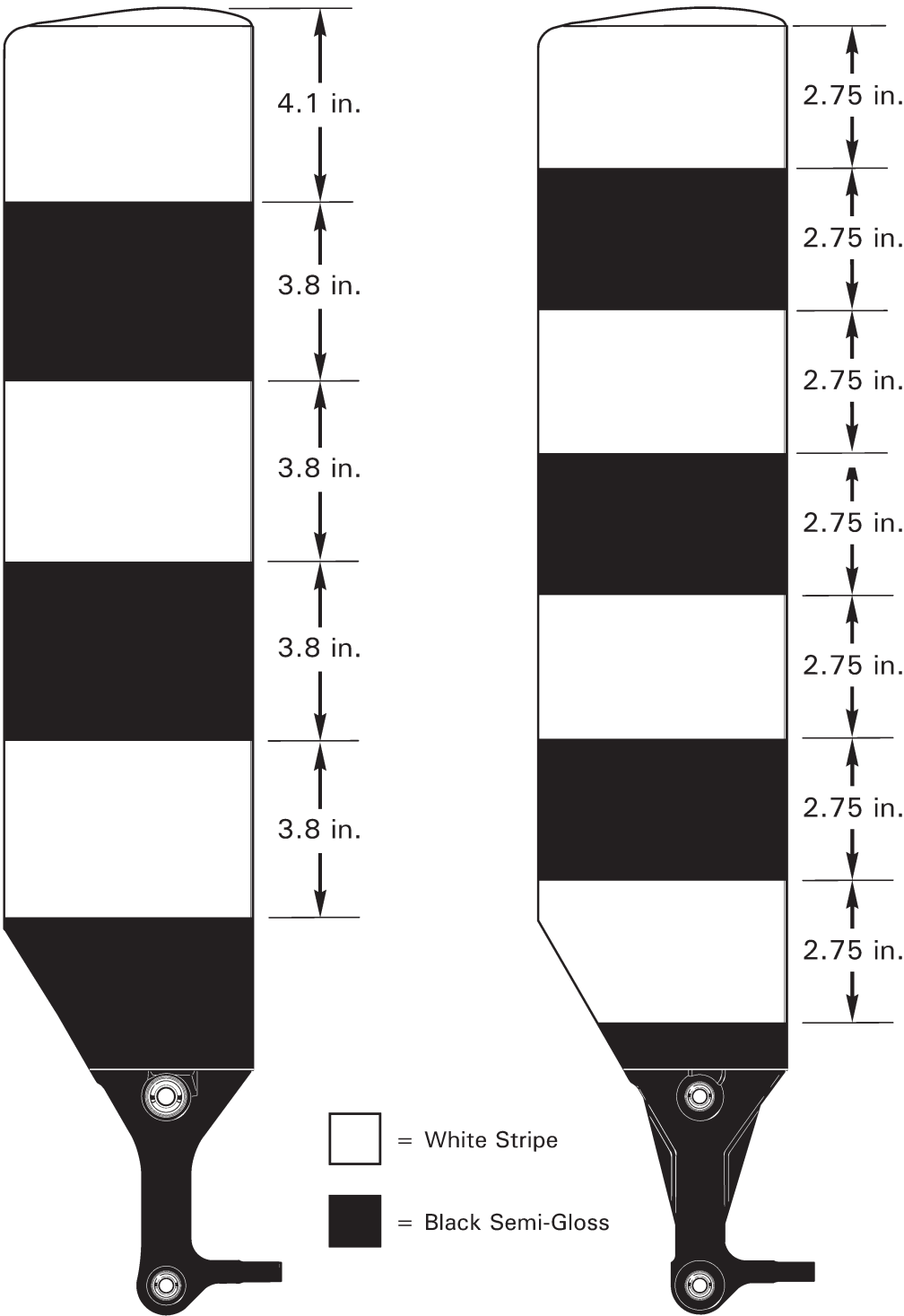
### 30-35 Nicks and Notches

#### **A. Trailing Edge**

1. Verify damage does not exceed the following limits:
  - a. 0.050 inch maximum in the extreme trailing edge.
2. Refer to § 28-50 (main rotor) for repair procedures for damage within limits. Blend out nicks and notches in blade trailing edge for 1.0 inch minimum each side of nick or notch.

**C029-3 Tail Rotor Blades**

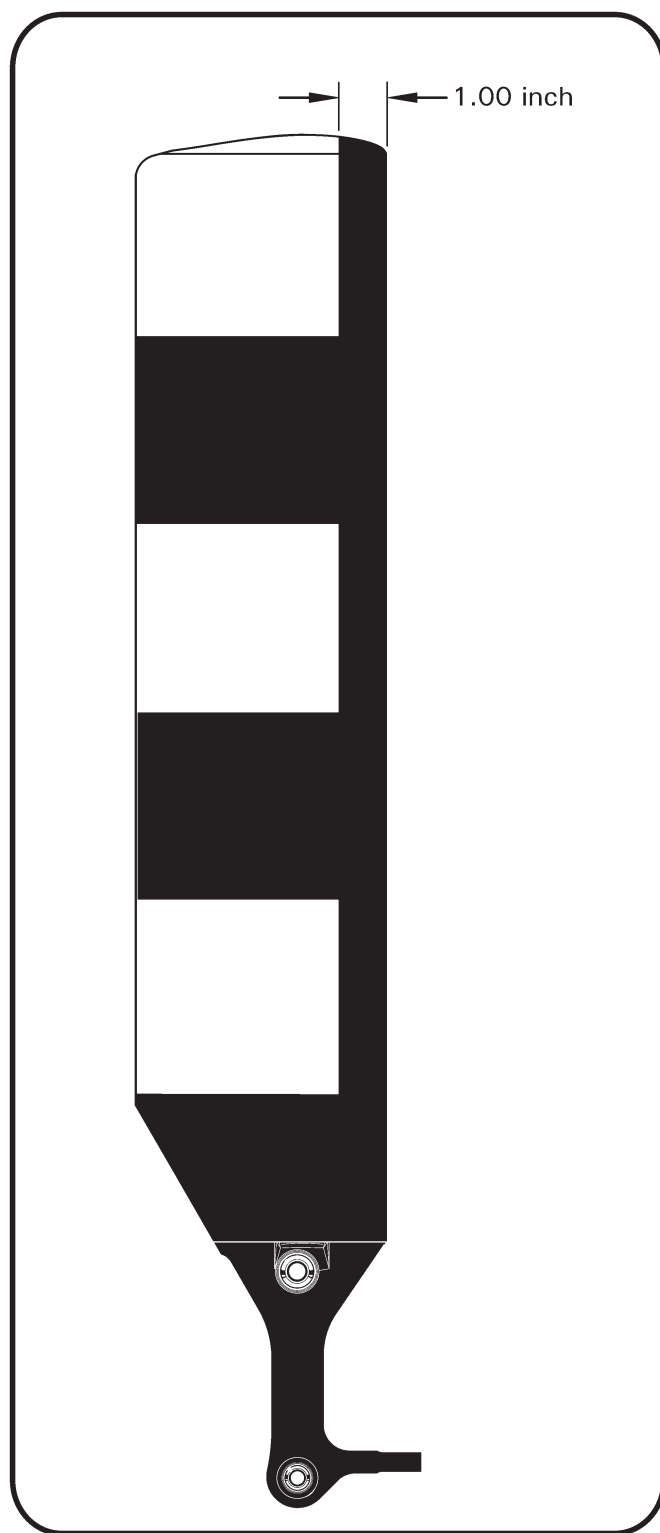
**C029-1 and -2 Tail Rotor Blades**



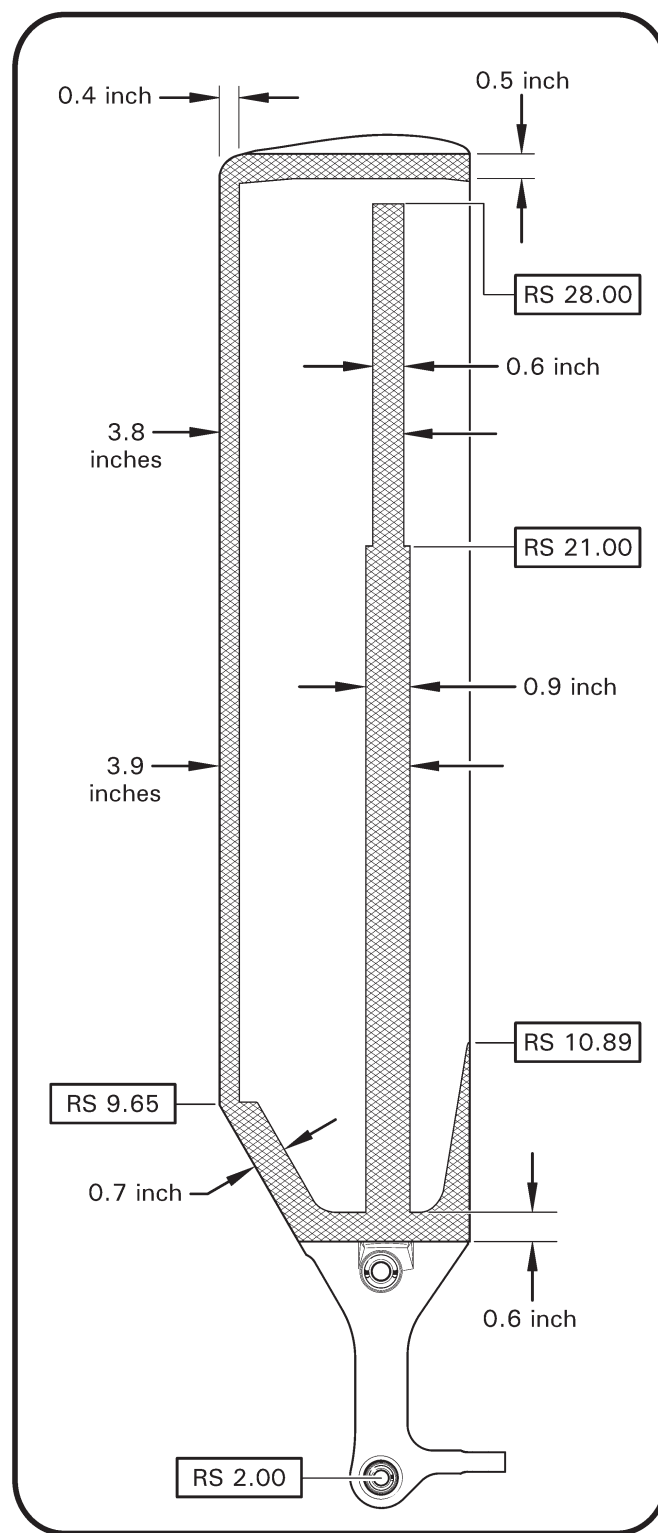
**FIGURE 30-6 TAIL ROTOR BLADE PAINT SCHEME**

30-36 Painting

1. Clean with QSOL 220 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 wet-or-dry aluminum oxide abrasive paper in a spanwise direction, QSOL 220 wipe and mist primer before applying next coat.
4. Spray white all over and allow to dry before masking for trim stripes. See Figure 30-6.
5. Spray finish coat semi-gloss black stripes and root fitting.
6. Remove all masking materials.



30-7A TAIL ROTOR BLADE LEADING EDGE PAINT



30-7B TAIL ROTOR BLADE BONDED AREAS

### 30-37 Tail Rotor Blade Condition and Care

Regular preventive maintenance of tail rotor blades is imperative for continued safe operation. Leading edge pitting or degradation of the bond at the tip cap can result if regular preventive maintenance is not performed; additional care may be required in corrosive environments such as coastal or shipboard operations. The following maintenance is recommended to prevent and mitigate the effects of corrosion:

1. Remove any corrosion and loose paint by hand-sanding in a spanwise direction using 220-grit aluminum-oxide abrasive paper and minimum 0.1 inch blend radius; finish sand with 320-grit aluminum-oxide abrasive paper. Remove only material necessary to eliminate corrosion; any hole that completely penetrates blade skin requires blade replacement.

Feather edge of paint bordering any bare metal by hand-sanding spanwise with 320-grit or finer wet-or-dry aluminum-oxide abrasive paper. Do not remove bare metal when feather sanding.

Preferred blade condition is with fully painted leading edge. Use two coats of Desoprime CA7502 epoxy primer (or equivalent). Scuff primer prior to applying second coat. Use Dupont Imron polyurethane enamel or equivalent paint. Refer to § 23-77 for specific paint codes. Blades with striped leading edges may be painted with solid black leading edge (ref. Figure 30-7A) if desired for ease of application.

Paint offers the best protection against leading edge corrosion. If painting blades is impractical, at least a single coat of primer on leading edges provides some protection.

2. Balance tail rotor per § 10.240 after any corrosion removal or painting.
3. When operating in a corrosive environment, even if leading edge paint/primer is intact, clean tail rotor daily per applicable Pilot's Operating Handbook Section 8, Cleaning Helicopter (mild soap means a pH between 7 & 9). If waxing blades is impractical, wipe blade leading edges with standard WD-40® brand light oil or equivalent; do not use ACF-50® lubricant or "Specialist" versions of WD-40® on blades, and do not use Salt-Away®.
4. Refer to Figure 30-7B. At each 100-hour inspection, tap test bonded areas shown to verify bond integrity, paying special attention to tip cap. Reference tap test instructional video at: [https://robinsonheli.com/wp-content/uploads/2021/06/taptest\\_05\\_apr\\_2010.mp4](https://robinsonheli.com/wp-content/uploads/2021/06/taptest_05_apr_2010.mp4)

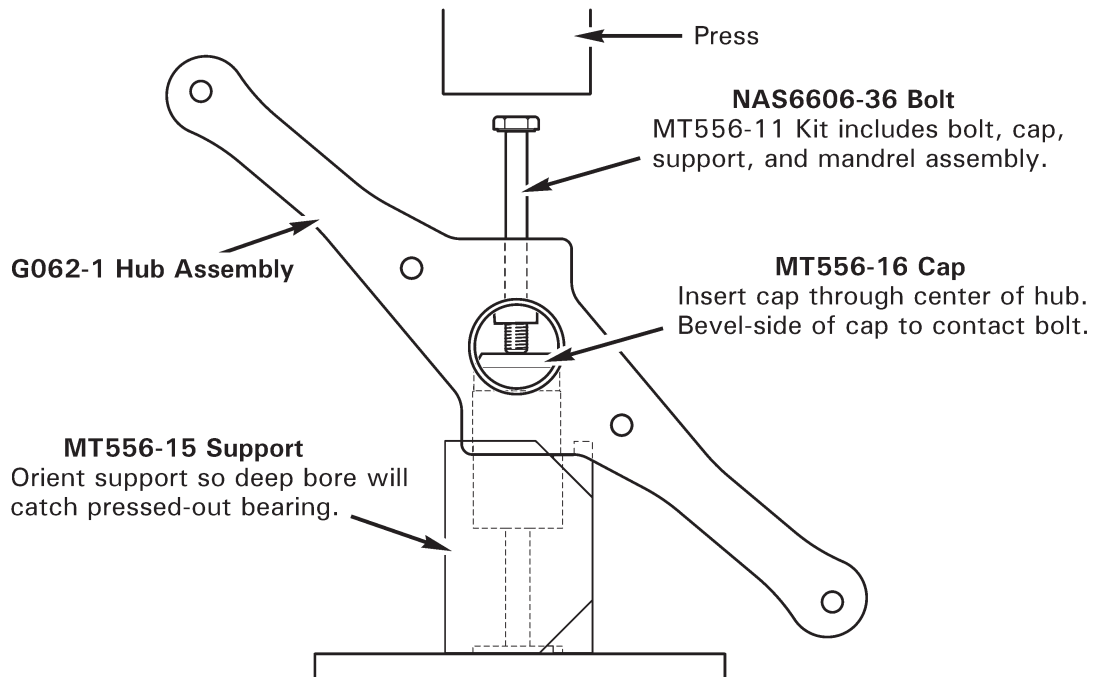


FIGURE 30-8 ELASTOMERIC BEARING REMOVAL

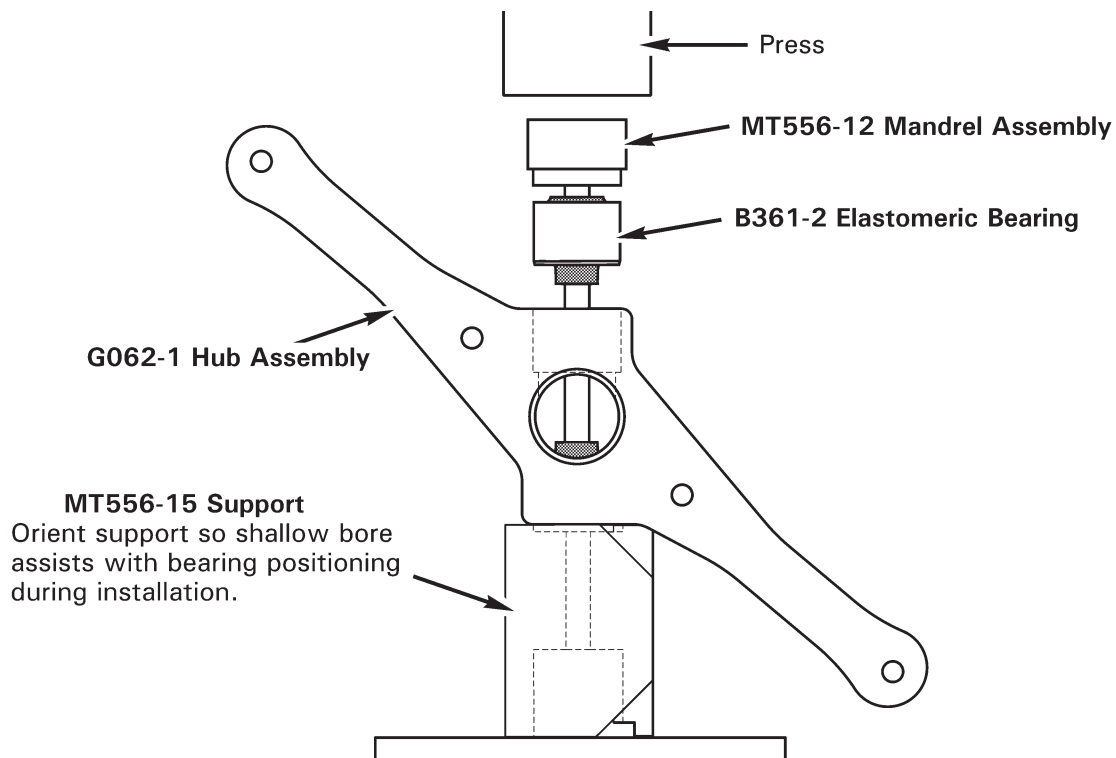


FIGURE 30-9 ELASTOMERIC BEARING INSTALLATION

### 30-40 Tail Rotor Hub

#### 30-41 Elastomeric Bearing Replacement

##### **A. Removal**

1. Remove tail rotor assembly per § 30-10.
2. Remove tail rotor blades per § 30-20.
3. Refer to Figure 30-8. Press bearing(s) from hub using MT556-11 bearing removal (and installation) tools.

##### **B. Installation**

1. Inspect tail rotor hub per § 30-43.

<p style="text-align: center;"><b>CAUTION</b></p>
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<p>Bearings are a slight press fit in tail rotor hub bores. Inspect bores for fretting; if fretting is detected, hub is unairworthy.</p>
--

2. Refer to Figure 30-9. Using Q-tip, apply light coat of approved primer (see § 23-70) to bottom of hub bearing bore. Apply a thin line of primer to center of bearing outside diameter. While primer is wet, press bearing into hub using MT556-11 bearing removal and installation tools. Wipe away excess primer.
3. Repeat steps for second bearing, as required.

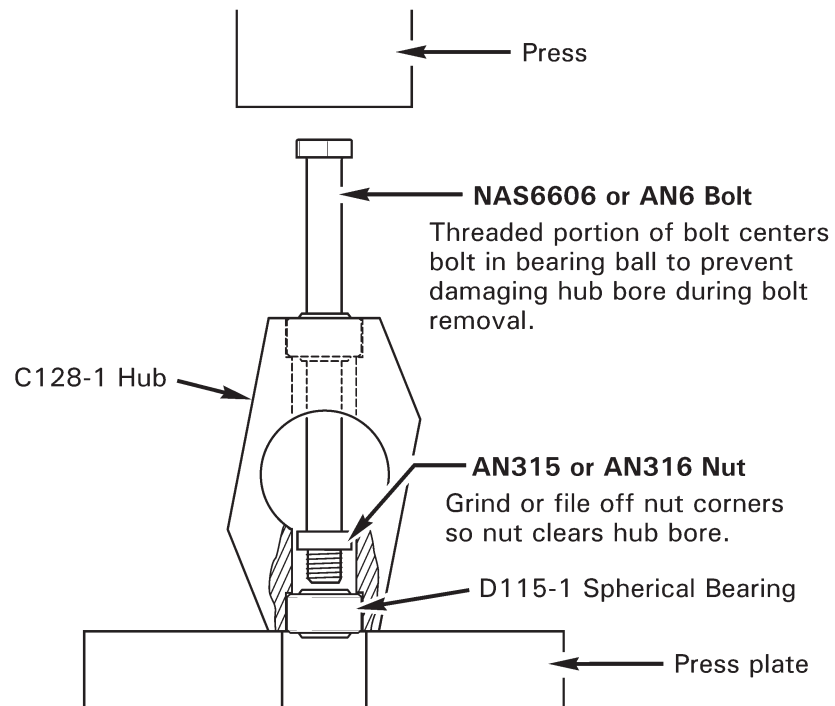


FIGURE 30-10 SPHERICAL BEARING REMOVAL

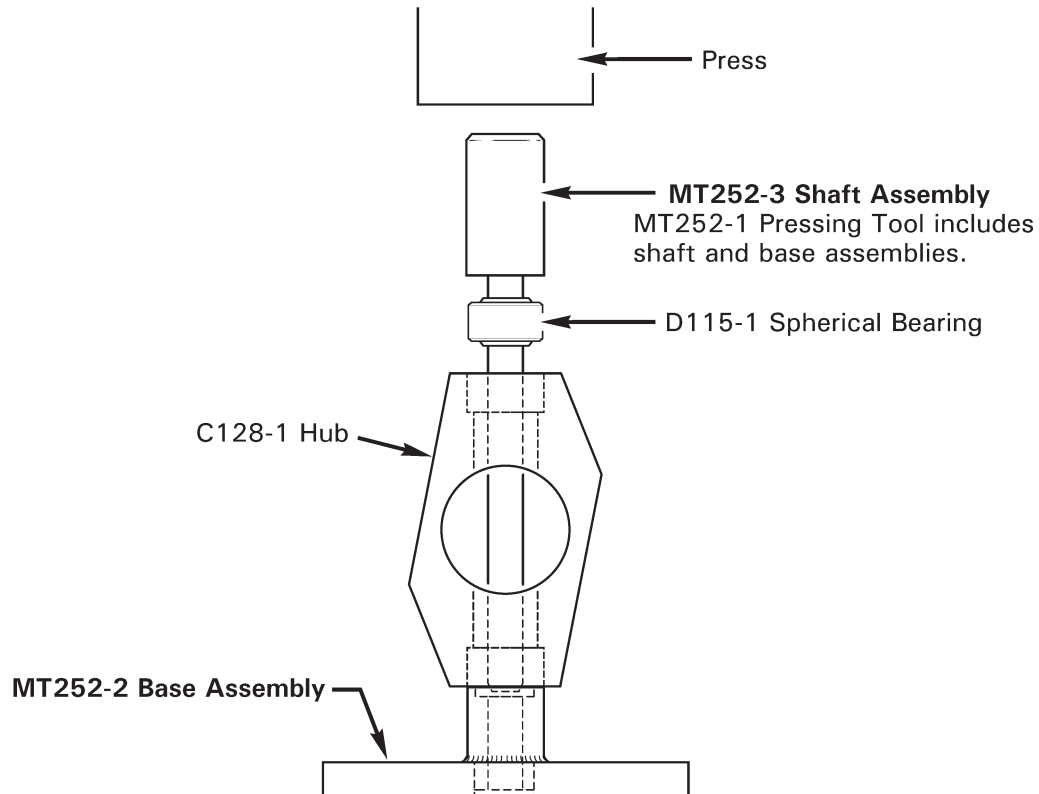


FIGURE 30-11 SPHERICAL BEARING INSTALLATION



### 30-42 Spherical Bearing Replacement

#### A. Removal

1. Remove tail rotor assembly per § 30-10.
2. Remove tail rotor blades per § 30-20.
3. Refer to Figure 30-10. Press bearing(s) from hub as shown.

#### B. Installation

1. Inspect tail rotor hub per § 30-43.

#### CAUTION

Bearings are a slight press fit in tail rotor hub bores. Inspect bores for fretting; if fretting is detected, hub is unairworthy.

#### NOTE

Heat tail rotor hub to 170° F maximum as required to facilitate bearing installation and help prevent installation damage.

#### NOTE

Immediately install tail rotor assembly before bearing-bore primer cures.

#### NOTE

If spherical bearings are installed too far into hub, spacers and hub will not fit over gearbox output shaft.

2. Refer to Figure 30-11. Using Q-tip, apply light coat of approved primer (see § 23-70) to bottom of hub bearing bore. Apply a thin line of primer to center of bearing outside diameter. While primer is wet, press bearing flush with top of hub using MT252-1 bearing installation tools. Wipe away excess primer.
3. Repeat steps for second bearing, as required.
4. Align marked line and install hub between hub plates as removed. Install hardware, standard torque nuts & palnuts per § 23-32, and torque stripe per Figure 2-1.
5. Install tail rotor blades per § 30-20.

**30-43 Tail Rotor Hub Inspection**

1. Remove tail rotor blades per § 30-20, if not previously accomplished. Inspect blades per § 30-30.
2. Remove teeter bearings per §§ 30-41 or 30-42, as appropriate.
3. Clean tail rotor hub using approved solvent (see § 23-70). Remove old primer and/or metal shavings from hub which might prevent new bearings from seating properly.
4. Visually inspect for indications of damage, wear, nicks, dings, and corrosion. Verify arm straightness, no elongation of bolt holes, and no fretting or galling of bearing bores. Corrosion is not permitted.
5. Touch-up bare metal using approved materials (see § 23-70).
6. Install new teeter bearings per §§ 30-41 or 30-42, as appropriate.
7. Install tail rotor blades per § 30-20.