CHAPTER 28

TAIL ROTOR

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CHAPTER 28

TAIL ROTOR

28-00 Description

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

28-10 Tail Rotor Assembly

A. Removal

1. Refer to Figure 28-1. Tag each pitch link with corresponding blade serial number. Disconnect pitch links from tail rotor blades; keep associated hardware with each link.

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

2. Remove nut and A141-14 washer securing A119-1 bumper to tail rotor gearbox output shaft.
3. Mark hub with teeter hinge bolt orientation for reinstallation. Remove teeter hinge bolt, then slide tail rotor assembly and bumper off of shaft.

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

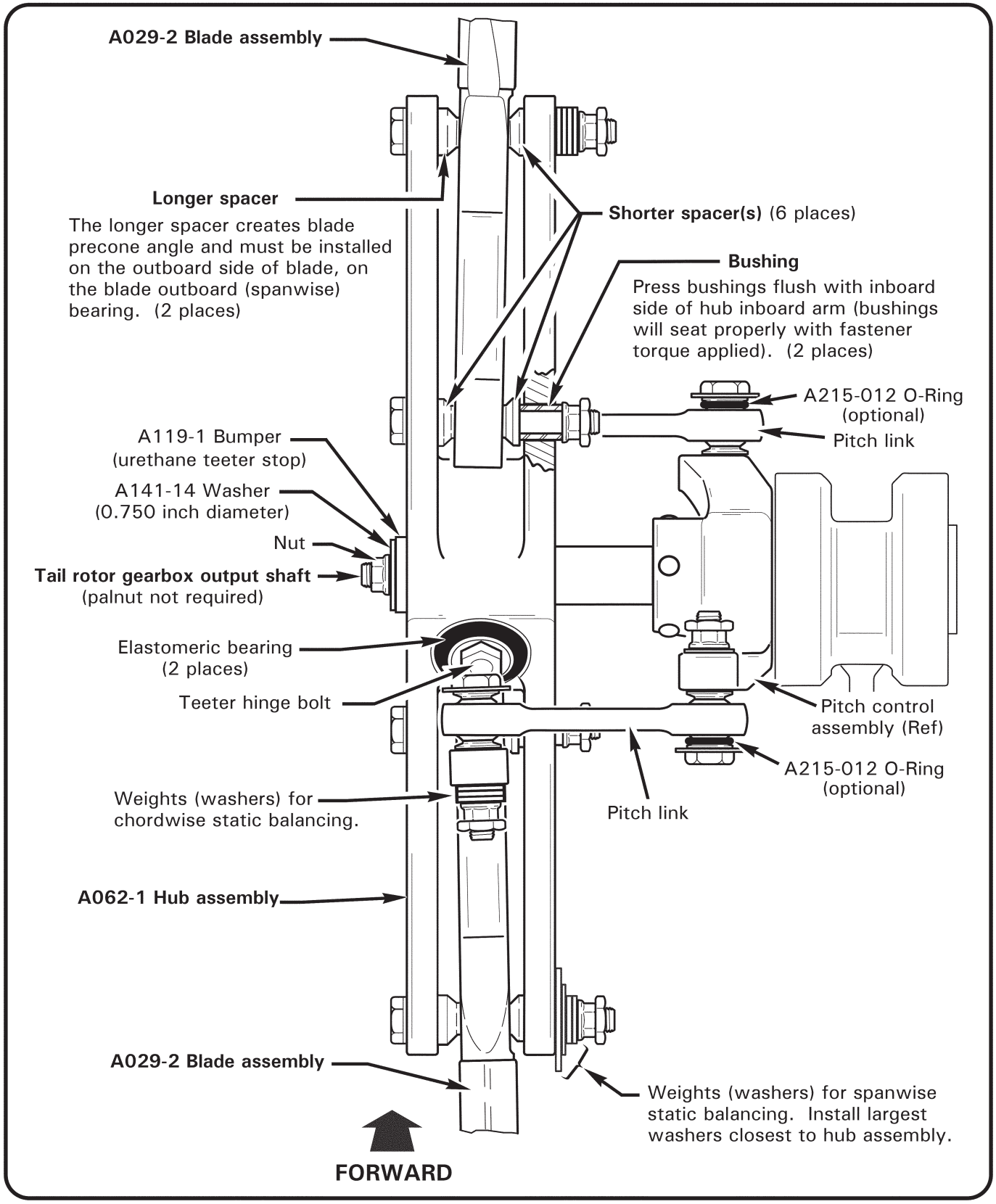


FIGURE 28-1 TAIL ROTOR ASSEMBLY INSTALLATION

28-10 Tail Rotor Assembly (continued)

A. Installation

1. Refer to Figure 28-1. Position tail rotor assembly on tail rotor gearbox output shaft, matching tail rotor blades to corresponding pitch links. Verify tail rotor is installed for counter-clockwise rotation when viewed from left side of aircraft.
2. 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.

> **CAUTION**
>
> If balancing hardware information is unknown, perform static balance per § 28-11.

3. 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.
4. Fabricate a tracking aid using 1x12-inch aluminum sheet; make a 90º bend 2 inches from one end. With tail rotor horizontal, tape tracking aid to tailcone near blade tip.
5. 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.
6. Install palnut on teeter hinge bolt, standard torque per § 23-32, and torque stripe per Figure 2-1. Remove tracking aid.
7. Teeter tail rotor hub back and forth. Verify teeter hinge bolt, bearing metal spacers, washers, and nuts remain stationary when tail rotor is teetered.
8. Install A119-1 bumper, A141-14 washer, and nut. Standard torque nut per § 23-32 and torque stripe per Figure 2-1.
9. Dynamically balance tail rotor per § 10.240.

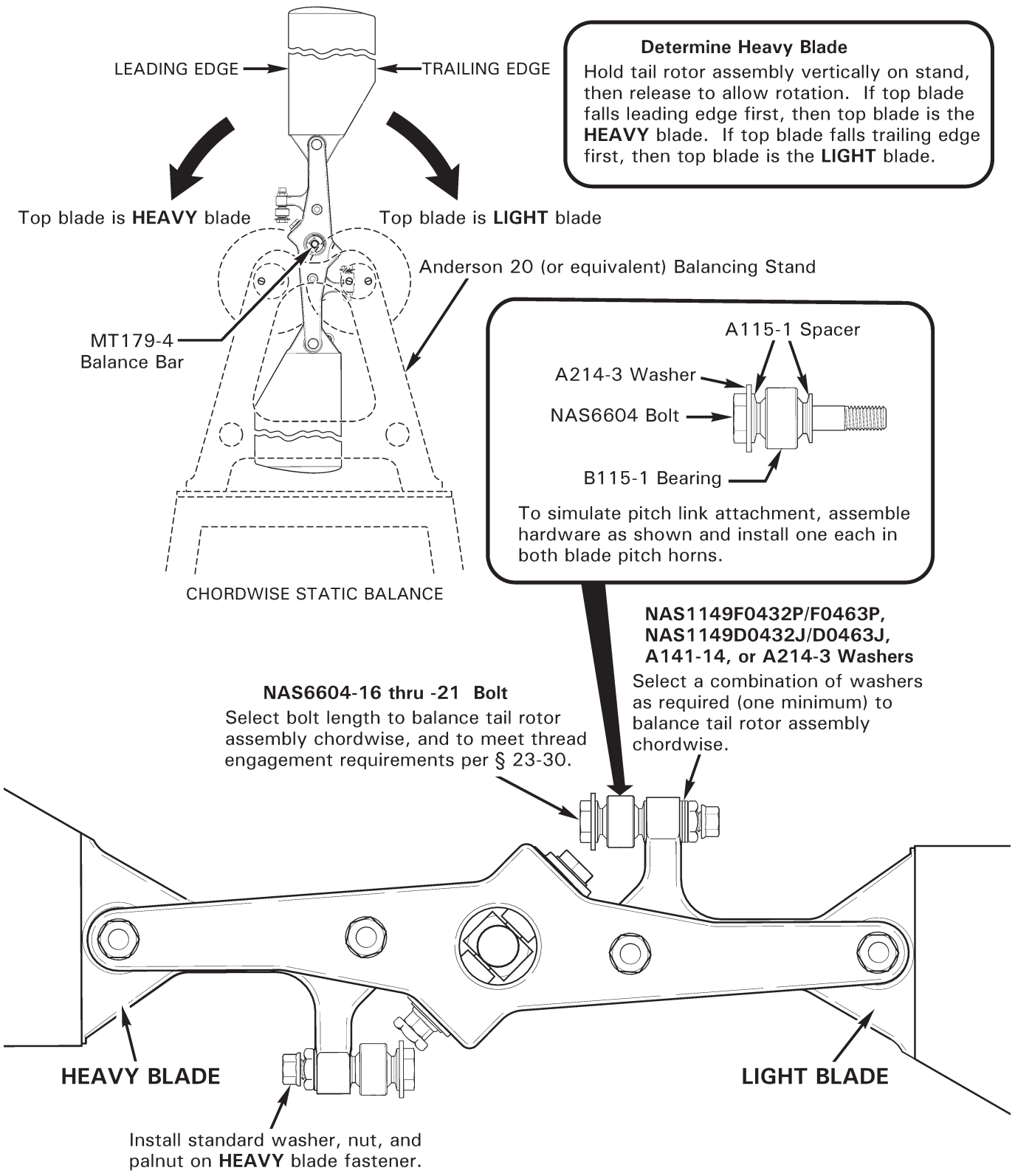
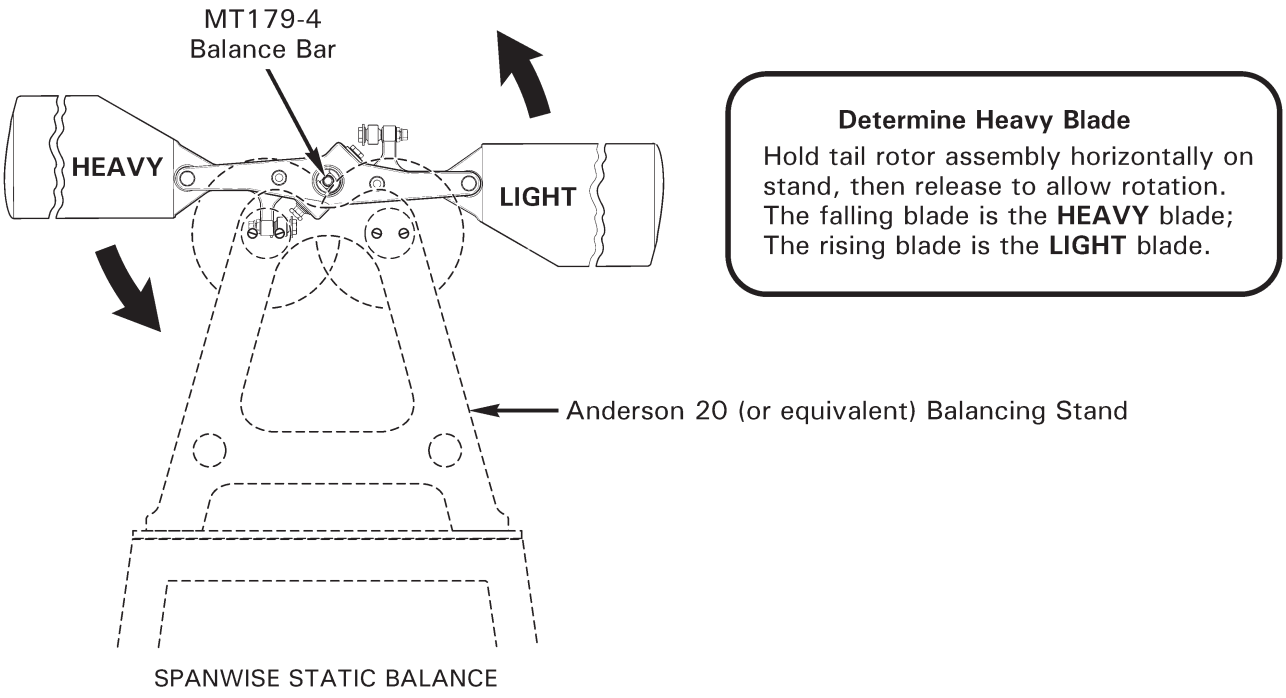


FIGURE 28-2 CHORDWISE STATIC BALANCE

28-11 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 28-2. Install MT179-4 balance bar into tail rotor assembly. Install teeter hinge bolt thru smaller hole, install nut and tighten until elastomeric bearing metal spacers contact bar. 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. Mark hub with teeter hinge bolt orientation for reinstallation.
2. Using NAS6604-16 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 on Anderson 20 or equivalent 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. Place tail rotor assembly with balance bar 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.

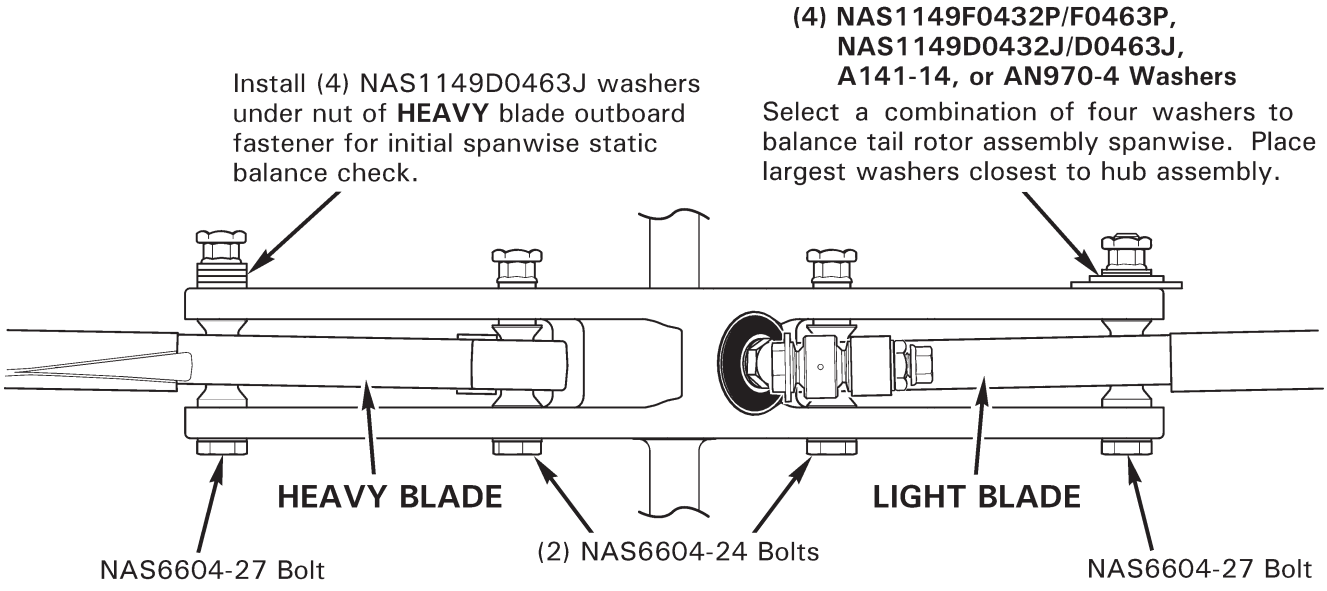


FIGURE 28-3 SPANWISE STATIC BALANCE

28-20 Tail Rotor Blades

NOTE

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

A. Removal

1. Remove tail rotor assembly per § 28-10.
2. Refer to Figure 28-1. Remove hardware securing A029-2 blade assemblies to A062-1 hub assembly. Remove blades, spacers, and hardware; do not remove A138-1 bushings unless required.

B. Installation

CAUTION

A029 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. Refer to Figure 28-1. If removed, apply light coat of approved primer per § 23-75 to outer surface of A138-1 bushings; while primer is wet, press bushings flush with inboard side of hub inboard arm (bushings will seat properly with fastener torque applied).

CAUTION

A137-2 spacer creates blade precone angle and must be installed on the outboard side of blade, on the blade outboard (spanwise) bolt.

2. Install tail rotor blades and spacers in hub. Assemble blades for counter-clockwise rotation when viewed from left side of aircraft, and so blades will cone toward tail rotor gearbox. Install hardware securing blades to hub; standard torque per § 23-32, and torque stripe inboard nuts only.
3. Perform tail rotor assembly static balance per § 28-11.

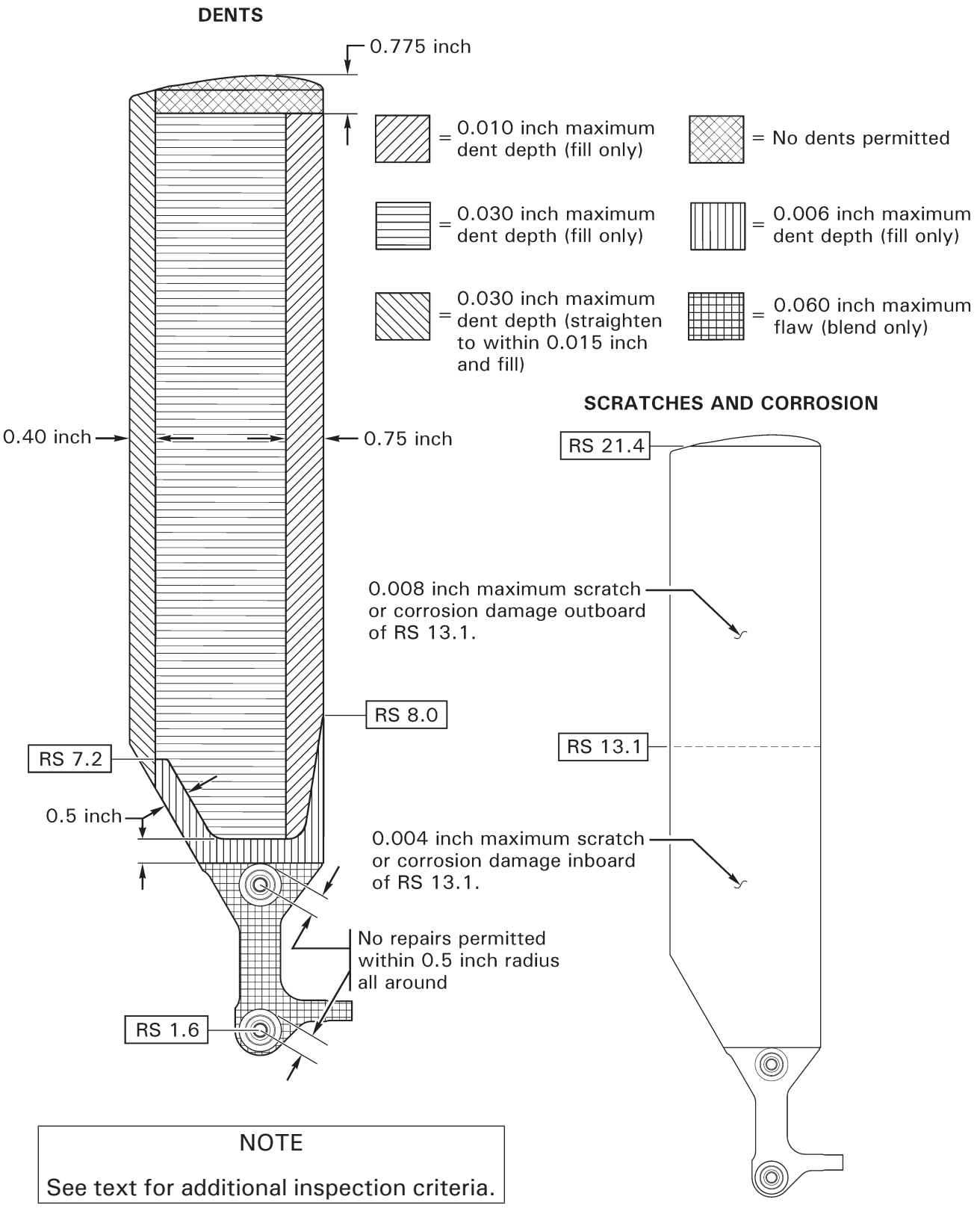


FIGURE 28-4 TAIL ROTOR BLADE INSPECTION CRITERIA

28-30 Tail Rotor Blade Inspection and Repair

WARNING

Unauthorized repairs to rotor blades have caused fatal crashes.

CAUTION

Do NOT use power tools, chemical paint strippers, or chemical corrosion removers to repair rotor blades.

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.

28-31 Scratches and Corrosion

A. Limits

1. Refer to Figure 28-4. Measure damage in blade skins per § 26-40; verify damage does not exceed the following limits:
   a. 0.004 inch maximum damage inboard (spanwise) of RS 13.1.
   b. 0.008 inch maximum damage outboard (spanwise) of RS 13.1.
2. If damage is within limits, repair blade skins per Part B but do not exceed limits.

B. Repair

1. Blend out scratches or corrosion on blade skins in spanwise direction with a 0.10 inch blend radius minimum. Use 220-grit or finer wet-or-dry aluminum-oxide abrasive paper, and finish with 320-grit or finer wet-or-dry abrasive paper.
2. Measure material removed per § 26-40; verify repair does not exceed limits per Part A.
3. Refinish blade repairs per § 28-36.

28-32 Dents

CAUTION

Tap-test dented areas in honeycomb. If any voids are found associated with dents, contact RHC Technical Support.

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 fluorescent 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. Limits

1. Measure dents in blade skin per § 26-40.
2. Refer to Figure 28-4. Smooth, round bottom dents with 0.060 inch minimum radius may be repaired when damage does not exceed the following limits:
   a. Forward of 0.75 inch (chordwise) from leading edge:
      i. 0.010 inch maximum dent depth.
   b. Aft of 0.75 inch (chordwise) from leading edge, and forward of 0.40 inch (chordwise) from trailing edge:
      i. 0.030 inch maximum dent depth.
   c. Aft of 0.40 inch (chordwise) from trailing edge:
      i. 0.030 inch maximum dent depth (repair: straighten to within 0.015 inch depth before fill).
   d. Dents over the skin-to-root fitting bond joint:
      i. 0.006 inch maximum dent depth.
3. No dents are permitted on visible portion of tip cap or on blade skin within 0.775 inch of blade tip.
4. If damage is within limits, repair blade skins per Part B.

28-32 Dents (continued)

B. Repair

1. Using 10X magnification, visually inspect blade skin dented area for cracked metal; remove blade from service if metal is cracked.
2. Remove cracked paint by hand-sanding spanwise with 220-grit or finer wet-or-dry aluminum-oxide abrasive paper, and finishing with 320-grit or finer wet-or-dry abrasive paper. Avoid removing metal.
3. Refinish dented area per § 28-36.

28-33 Erosion

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

28-34 Root Fitting Damage

A. Limits

1. Measure damage in root fitting per § 26-40.
2. Refer to Figure 28-4. All damage must be repaired within the following limits:
   a. No repairs permitted within 0.5-inch radius from center of spherical feathering bearings.
   b. Pitch horn clamping surfaces:
      i. 0.010 inch deep each side.
      ii. Parallel to each other within 0.002 inch.
      iii. Perpendicular to 0.250 inch diameter hole within 0.002 inch.
   c. 0.250 inch diameter hole may be enlarged to 0.252 inch diameter maximum.
   d. 0.060 inch maximum depth on other root fitting exposed areas.
3. If damage is within limits, repair root fitting per Part B.

B. Repair

1. All damage on root fitting must be hand-blended spanwise using a 0.10 inch blend radius minimum within Part A limits.
2. Use 220-grit or finer wet-or-dry aluminum-oxide abrasive paper, and finish with 320-grit or finer wet-or-dry abrasive paper. Remove minimum material necessary for damage removal and meet specified blend radius.
3. Conversion coat and prime (chromated epoxy primer preferred) bare aluminum per § 23-60. Do not allow conversion coat chemical to contact blade bond joint.
4. Paint root fitting per § 28-37.

28-35 Nicks and Notches (Trailing Edge)

A. Limits

1. Measure damage per § 26-40. Verify damage (or repair) does not exceed the following limits:
   a. 0.050 inch maximum depth in trailing edge.
   b. Overall chord length 3.950 inches minimum.
   c. Blended area to extend 1.0 inch minimum to each side of damage with a 2.0 inch radius minimum.
2. If damage is within limits, repair blade skins per Part B but do not exceed limits.

B. Repair

1. Trailing edge must remain square with skins; skin must not taper. Refer to Figure 26-16.
2. Polish out blade damage using 220-grit or finer wet-or-dry aluminum-oxide abrasive paper, and finish with 320-grit or finer wet-or-dry abrasive paper. Hand-sand in spanwise direction.
3. A fine-toothed file may be used along trailing edge, provided the area is finished with 320-grit or finer wet-or-dry abrasive paper. Hand-sand or file in spanwise direction only.
4. Remove only the material necessary to reach the bottom of the damage, and to blend the reworked area to the radius or dimension required. Visually inspect and verify all damage is removed.
5. Measure reworked area and verify material removed and/or new chord dimension is permissible per Part A.
6. Apply B270-27 sealant to exposed bond joints.
7. Refinish blade per § 28-36, as required.

28-36 Blade Refinishing

1. Using 320-grit or finer wet-or-dry aluminum-oxide abrasive paper, feather existing paint around blade repairs. Do not remove metal.
2. Conversion coat and prime (chromated epoxy primer preferred) bare aluminum per § 23-60.
3. In areas where damage or repair has affected blade airfoil, apply layers of Corlar 13580S Epoxy Primer (or equivalent high-build primer) to build up airfoil.
4. Hand-sand cured epoxy primer (or block sand) in spanwise direction to a smooth, aerodynamic finish, congruent with blade airfoil.
5. Paint blade per § 28-37.

28-37 Painting

1. Perform § 28-36 as required.
2. Apply two coats of Desoprime CA7502 epoxy primer (or equivalent) to required areas. Scuff primer prior to applying second coat. 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.
3. Reference § 23-77. Apply white Imron polyurethane enamel or equivalent paint to required areas. Allow to dry before masking for trim stripes.
4. Refer to Figure 28-5. Apply masking to bearings and white trim stripes. Apply black paint to black trim stripes and root fitting.
5. Remove all masking materials.

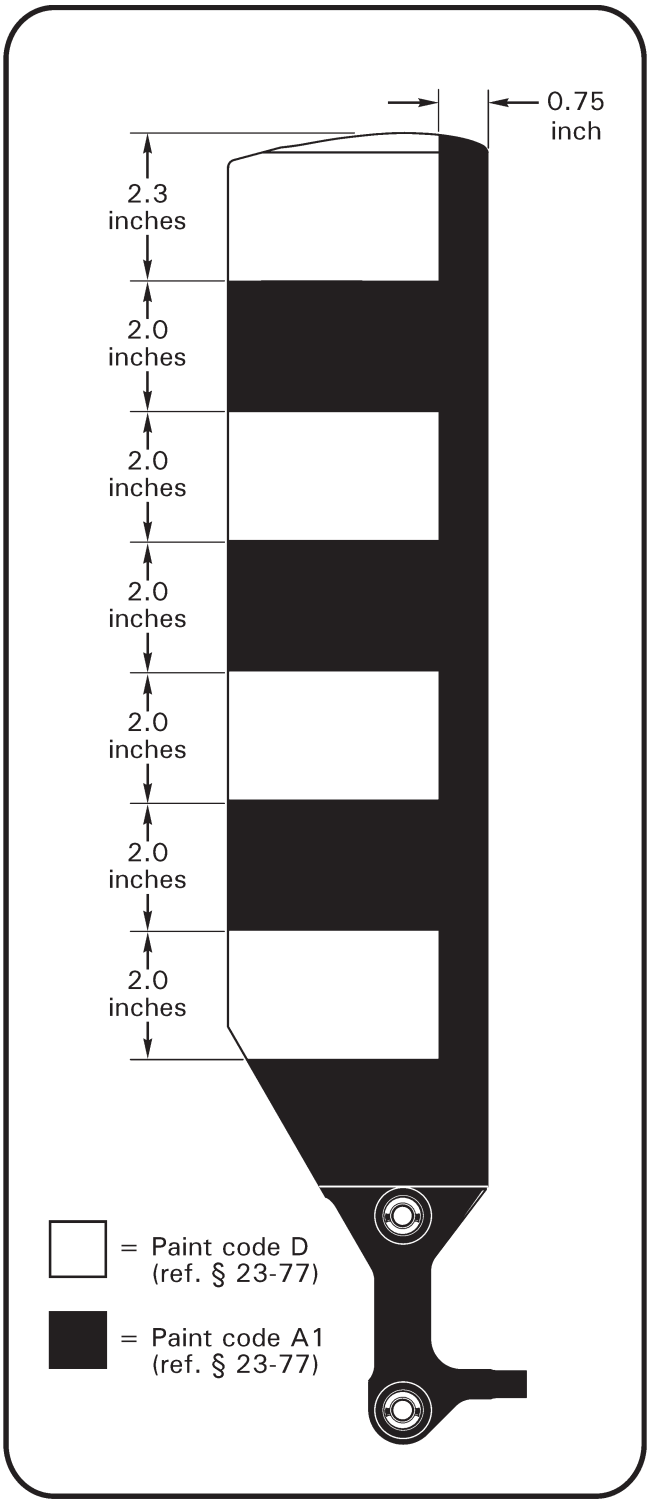


FIGURE 28-5 TAIL ROTOR BLADE PAINT SCHEME

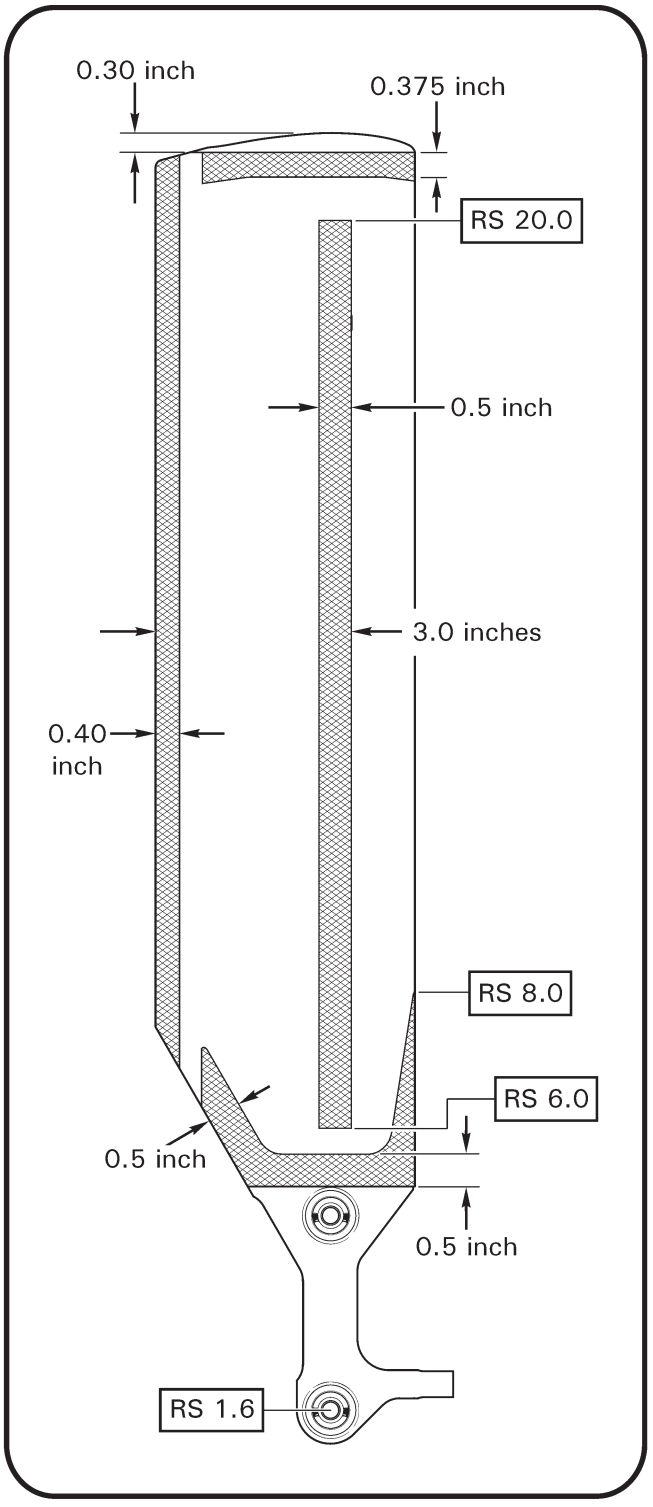


FIGURE 28-6 TAIL ROTOR BLADE BONDED AREAS

28-38 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. Bubbled paint can be an indication of underlying corrosion. If bubbled paint is observed at or adjacent to tip cap bond line, or if bond line is exposed, perform following maintenance prior to further flight.

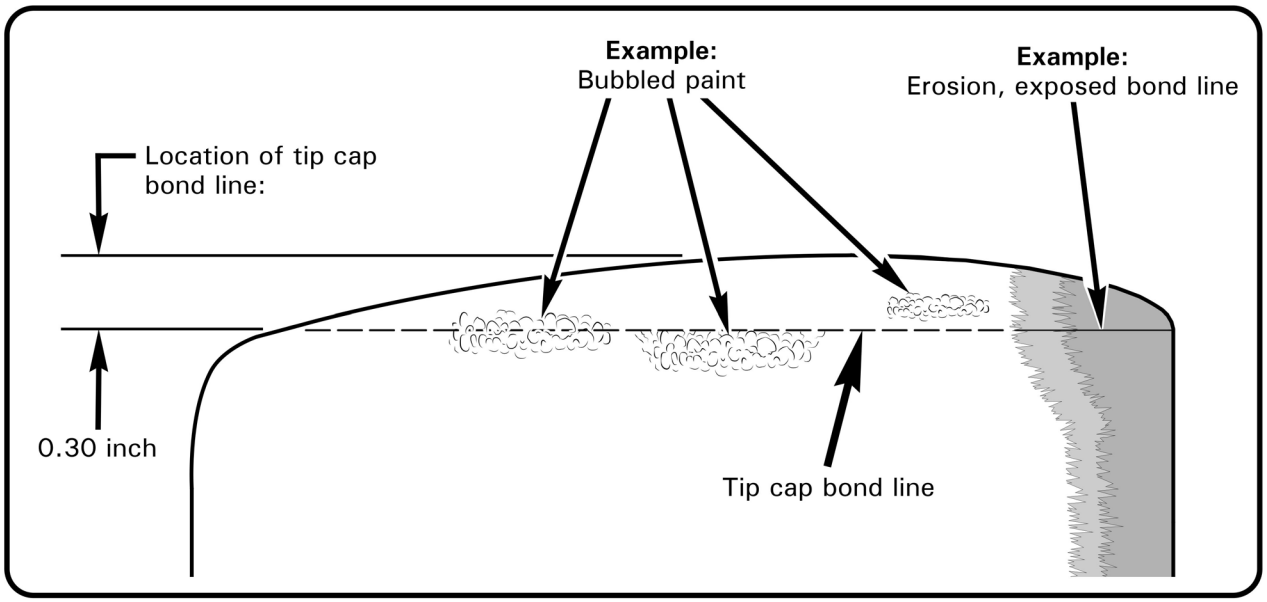


FIGURE 28-7 TAIL ROTOR BLADE TIP CAP BOND LINE

2. Maintain blade condition as follows:

   a. At, or adjacent to, tip cap bond line: Remove loose or bubbled paint with fingernail or plastic scraper. Using minimum 10X magnification, examine bond line for both presence of adhesive & no corrosion (white powder and/or pitting). Metal-to-metal contact of tip cap to skin is permissible, but any gaps in remaining bond line due to missing blue (or brown) adhesive requires blade replacement. Any evidence of corrosion at bond line requires blade replacement. If blade(s) require replacement, contact RHC Technical Support with part number & serial number of affected and opposite blades.

   b. At areas away from tip cap bond line: Remove any corrosion, and bubbled or 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.

28-38 Tail Rotor Blade Condition and Care (continued)

2. c. 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 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 28-5) 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.

3. Balance tail rotor per § 10.240 after any corrosion removal or painting.

4. When operating in a corrosive environment, clean tail rotor daily per POH 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®.

5. Refer to Figure 28-6. 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

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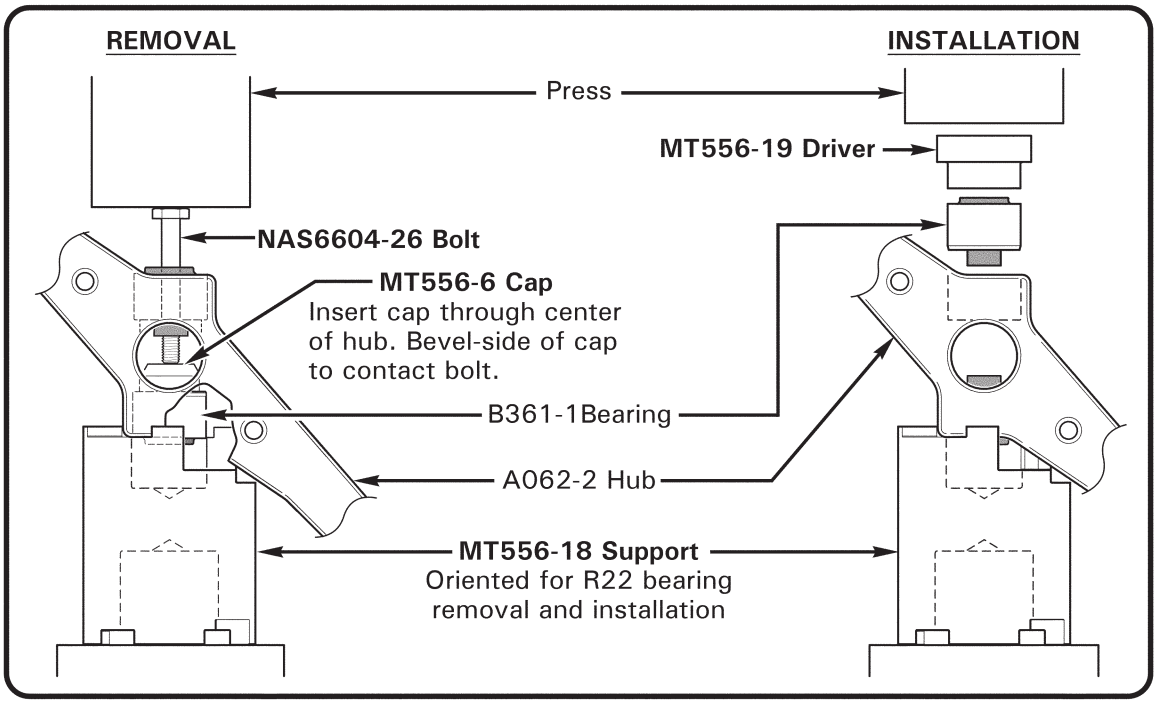

FIGURE 28-8 MT556-17 (ALL-MODEL) TAIL ROTOR HUB BEARING REPLACEMENT TOOL KIT

(Kit includes [1] MT556-6 Cap [R22], [1] MT556-16 Cap [R44 & R66], [1] MT556-18 Support, [1] MT556-19 Driver, [1] NAS6604-26 Bolt [R22], and [1] NAS6606-36 Bolt [R44 & R66])

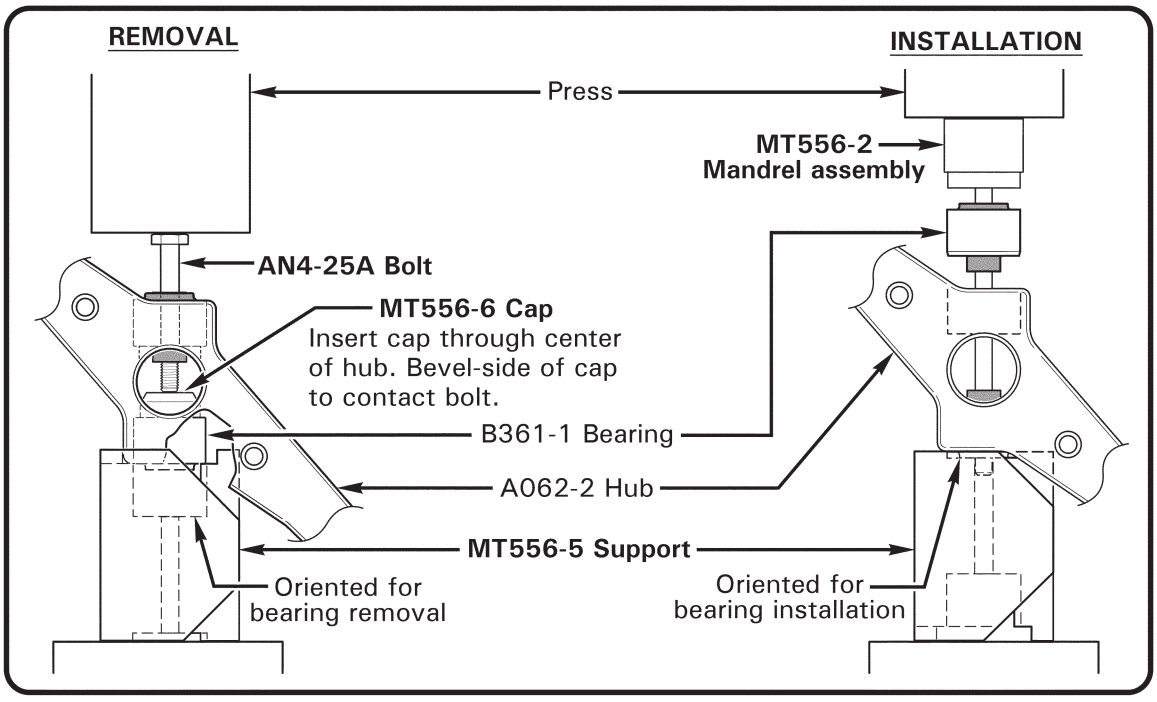

FIGURE 28-9 (EARLIER) MT556-1 (R22) TAIL ROTOR HUB BEARING REPLACEMENT TOOL KIT

(Kit includes [1] MT556-2 Mandrel assembly, [1] MT556-5 Support, [1] MT556-6 Cap, and [1] AN4-25A Bolt)

28-40 Tail Rotor Hub

28-41 Bearing Replacement

A. Removal

1. Remove tail rotor assembly per § 28-10.
2. Remove tail rotor blades per § 28-20.
3. Refer to Figures 28-8 or 28-9, as applicable. Press bearing(s) from hub using MT556-17 or MT556-1 bearing replacement tools as shown.

B. Installation

1. Inspect tail rotor hub per § 28-42.

> **CAUTION**
>
> Elastomeric bearings are a slight press fit in tail rotor hub bores. Inspect bores for fretting; if fretting is detected, hub is unairworthy.

2. Refer to Figures 28-8 or 28-9, as applicable. Using a cotton or foam tipped applicator, apply light coat of approved primer per § 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(s) into hub using MT556-17 or MT556-1 bearing replacement tools as shown. Wipe away excess primer.

28-42 Inspection

1. Remove tail rotor blades per § 28-20, and inspect blades per § 28-30.
2. Remove elastomeric bearings per § 28-41.
3. Clean A062-1 tail rotor hub using approved solvent per § 23-70.
4. Visually inspect for indications of damage, wear, nicks, dings, and corrosion. Check arms for straightness, bolt holes for elongation, and bearing bores for fretting or galling. Corrosion is not permitted on clamp-up surfaces.
5. For suspect areas, locally remove paint from hub using approved paint stripper per § 23-70; dye penetrant or fluorescent penetrant inspect per § 23-40.
6. Touch-up bare metal using approved materials per § 23-70.
7. Install elastomeric bearings per § 28-41.
8. Install tail rotor blades per § 28-20.

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