# ROBINSON HELICOPTER COMPANY

## R22 MAINTENANCE MANUAL
## AND INSTRUCTIONS FOR CONTINUED AIRWORTHINESS
## RTR 060 VOLUME I

Production Certificate Number 424WE
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### OFFICE HOURS

Monday through Friday, 7:30 a.m. to 4:30 p.m., Pacific Time.
Lunch hour is 11:30 a.m. to 12:30 p.m.

### HOLIDAYS

Please visit https://robinsonheli.com for a list of holidays and company shutdowns.

### CUSTOMER SUPPORT AND SPARES ORDERS

Please visit https://robinsonheli.com for Customer Support contact information. Procure parts from any R22 Dealer or Service Center, or order directly from RHC Customer Service via email, fax, or phone.

### PUBLICATIONS

Viewing RHC Maintenance Manuals (MMs) and Illustrated Parts Catalogs (IPCs) online at https://robinsonheli.com is recommended to ensure use of current data. Viewing MMs and IPCs offline via paper or digital download requires verification that the data is current. Refer to the online MM or IPC Revision Log for the list of current pages.

## SUBSCRIPTION ORDER AND RENEWAL FORMS

Subscription order and renewal forms are located at https://robinsonheli.com.

## WARRANTY INFORMATION

Helicopter and parts warranty information is located at https://robinsonheli.com.

## 1.005 Notations

The following notations will be found throughout the manual:

**NOTE**

A NOTE provides emphasis or supplementary explanation.

**CAUTION**

Equipment damage can result if a **CAUTION** is not followed.

**WARNING**

**Personal injury or death can result if a WARNING is not followed.**

## 1.006 Maintenance Manual and Illustrated Parts Catalog References

Maintenance Manual and Illustrated Parts Catalog Section and Figure references are subject to relocation and renumeration. Effort will be made at the time of RHC technical document revisions to correct superseded references, however, certain documents may not otherwise require revision and superseded references may remain. A keyword or part number search in online documents (Ctrl + F [PC] or Command + F [Mac]) may help to locate applicable data.

## 1.007 Definitions and Abbreviations

Refer to R22 Pilot's Operating Handbook (POH) Section 1 for additional definitions and abbreviations.

### A. Definitions

**14 CFR § 27.602 Critical Part:** A016-x main rotor blades & A029-x tail rotor blades are critical parts as defined by 14 CFR § 27.602 and are subject to special inspection requirements & reporting described in chapters 26 & 28. Contact RHC Technical Support if questions arise concerning special inspection or reporting requirements.

**12 years:** With respect to a 12 year inspection or life-limit, 12 years means 12 years from the date of the:

- factory-issued airworthiness certificate,
- factory-issued authorized release certificate (FAA Form 8130-3, Airworthiness Approval Tag), or
- last 12-year inspection.

**Annually:** With respect to an annual inspection, annually means within the preceding 12 calendar months.

**Datum:** An imaginary vertical plane from which all horizontal measurements are taken for balance purposes with the aircraft in level flight attitude. Refer to § 16-20 for R22 datum location.

**Empty Weight:** Standard empty weight of a standard helicopter including unusable fuel, full operating fluids, and full engine oil. Basic empty weight is standard empty weight plus weight of installed optional equipment. Refer to R22-series Type Certificate Data Sheet (TCDS) H10WE at: https://drs.faa.gov. Refer to Equipment List/Weight and Balance Data Sheet (RF 134) and Weight and Balance Record in R22 POH Section 6 for installed equipment.

**Life-Limited Part:** Refer to Chapter 3. Any part for which a mandatory replacement limit is specified in the type design, the Instructions for Continued Airworthiness, or the maintenance manual.

**Time in Service:** With respect to maintenance time records, time in service means the time from the moment an aircraft leaves the surface of the earth until it touches it at the next point of landing.

1.007 Definitions and Abbreviations (continued)

## B. Abbreviations

| | |
|---|---|
| 14 CFR: | Title 14 of the Code of Federal Regulations. The Federal Aviation Regulations (FARs) are part of the CFR. |
| AOG: | Aircraft on Ground |
| Assy: | Assembly (component consisting of more than one part) |
| ATA-100: | Air Transport Association of America Specification No. 100 |
| BL: | Butt Line Station locations |
| CO: | Carbon Monoxide |
| CRA: | Component Return/Authorization |
| ELT: | Emergency Locator Transmitter |
| EMU: | Engine Monitoring Unit |
| FS: | Fuselage Station locations |
| HID: | High Intensity Discharge |
| HS: | Horizontal Stabilizer Station locations |
| ICA: | Instructions for Continued Airworthiness |
| LBL: | Left Butt Line Station locations |
| LED: | Light Emitting Diode |
| LH: | Left-hand |
| LRU: | Line-Replaceable Unit |
| MR: | Main Rotor |
| MRB: | Main Rotor Blade |
| MRDS: | Main Rotor Drive Shaft |
| MRGB or MGB: | Main Rotor Gearbox or Main Gearbox |
| OEM: | Original Equipment Manufacturer |
| R22 IPC: | R22 Illustrated Parts Catalog |
| R22 MM: | R22 Maintenance Manual |
| R22 POH: | R22 Pilot's Operating Handbook |
| RBL: | Right Butt Line Station locations |
| RH: | Right-hand |
| RHC: | Robinson Helicopter Company |
| RS: | Rotor Station locations |
| SB: | Service Bulletin |
| SDS: | Safety Data Sheet |
| SL: | Service Letter |
| TBO: | Time Between Overhaul |
| TCDS: | Type Certificate Data Sheet |
| TIR: | Total Indicator Reading |
| TR: | Tail Rotor |
| TRB: | Tail Rotor Blade |
| TRDS: | Tail Rotor Drive Shaft |
| TRGB or TGB: | Tail Rotor Gearbox or Tail Gearbox |
| TS: | Tailcone Station locations |
| TSN: | Time Since New |
| TSO: | Time Since Overhaul |
| WL: | Water Line Station locations |

## 1.008 Service Information

### A. Part Designation

RHC parts are designated with an alphanumeric part number beginning with letter “A”, “B”, “C”, etc., followed by three digits and a dash number.

A revision letter or letters follow(s) the stamped or ink-marked part number. Revision progression is A thru Z, followed by AA thru AZ, followed by BA thru BZ, etc. Unless otherwise specified, any revision of the same part number is interchangeable, such as “A101-1 A” and “A101-1 D”.

A change in dash number indicates a change in form, fit, and/or function (e.g. part number C339-1 is not interchangeable with part number C339-10 even though both are jackshaft weldments for [hydraulic] R44s). Similarly, part numbers F049-6 and F049-06 are not interchangeable because the dash numbers are different.

### B. Returning Parts

All parts shipped to RHC must include a signed Component Return/Authorization (CRA) Form available online at https://robinsonheli.com.

### C. Ordering and Shipping

Procure parts from any R22 Dealer or Service Center, or order directly from assigned RHC Customer Service Representative via email, fax, or phone.

### D. Warranty Claims

Complete CRA Form (refer to Part B) and, in the Warranty Claim section, indicate if rotorcraft or component is under warranty. If claim is for parts or for labor allowance due to a Service Bulletin issued against rotorcraft or component, write in “per SB-XX” adjacent to requested warranty action.

### E. Customer Support

Please visit https://robinsonheli.com for Customer Support contact information.

## 1.100 Helicopter Servicing

### 1.101 Scheduled Maintenance and Inspections

Required maintenance and inspection intervals are given in Table 1. Publications listed are subject to revision.

Also consult the following for specific applicability, as some aircraft may require maintenance and inspections in addition to the requirements in Table 1:

- Aircraft maintenance records
- Manufacturers' Service Bulletins (SBs)
- Aviation regulations
- Airworthiness Limitations
- Airworthiness Directives (ADs)

Preventive maintenance is required between scheduled inspections. Fluid leaks, discoloration, fretting, galling, chafing, nicks, scratches, dents, cracks, and corrosion all warrant further investigation. Unairworthy items must be replaced or repaired as allowed by RHC.

## 1.102 Additional Component Maintenance

> NOTE
>
> RHC-manufactured parts not listed in § 1.102 as requiring additional component maintenance, or replacement per § 3.300, are "on condition".

### A. 12 YEARS

Remove the following components when they have accumulated 12 years time in service and less than 2200 hours time in service since new, since last overhaul, or since last 12-year maintenance, and perform action indicated:

| Part Number | Description | Action |
|---|---|---|
| A005-4 | A154-1 Main Rotor Hub & Bearing Assembly | Perform inspection and repair per MM § 2.610, return to RHC for inspection and repair, or replace with new. |
| A005-12 | B370-1 Main Rotor Hub & Bearing Assembly | |
| A005-6 | A016-4 Main Rotor Blade & A158-1 Spindle Assembly | Submit to RHC-authorized component maintenance facility for 12-year maintenance, or replace with new or overhaul exchange. 12-year maintenance includes blade replacement (as required), spindle bearing replacement (as required), pitch horn screw replacement, boot and O-ring replacement, and inspection. |
| A005-7 | A016-6 Main Rotor Blade & A158-1 Spindle Assembly | |
| A005-14 | A016-6 Main Rotor Blade & A158-3 Spindle Assembly | |
| A006-1 & -6 | Main Rotor Gearbox Assembly | Submit to RHC-authorized component maintenance facility for 12-year maintenance, or replace with new or overhaul exchange. 12-year maintenance includes pinion seal replacement, O-ring replacement, sealed bearing replacement, rubber mount replacement, additional bearings replacement (as required), and inspection. |
| A007-3, -5 or -6 | Fanshaft Assembly | Replace with new A007-6 fanshaft assembly. |
| A008-2 or -4 | Tail Rotor Assembly | Disassemble. Replace hub and/or blades as required. Remove bushings and teeter hinge bearings. Inspect hub; verify no fretting or corrosion. Fluorescent penetrant inspect hub if corrosion found. Replace teeter hinge bearings. Or replace with new A008-4 tail rotor assembly. |
| A014-8 | Landing Gear Assembly originally installed on R22 S/N 0002 thru 0487. | Replace with new. |
| A017-2 | Swashplate Assembly | Submit to RHC-authorized component maintenance facility for 12-year maintenance, or replace with new or overhaul exchange. 12-year maintenance includes inspection and repair as necessary. |

## 1.102 Additional Component Maintenance (continued)

### A. 12 YEARS (continued)

| Part Number | Description | Action |
|---|---|---|
| A018-1 | Clutch Assembly (anodized) | Submit to RHC-authorized component maintenance facility for 12-year maintenance, or replace with new or overhaul exchange. 12-year maintenance includes seal and O-ring replacement, bearing replacement, and inspection. |
| A018-2 | Clutch Assembly (metalized) | |
| A020-2 | Upper Frame Assembly S/N 0399 and prior (originally installed on R22 S/N 0002 thru 0311). | Replace with new. Note: Frame replacement may require tailcone forward bay replacement. |
| A021-1 | Tail Rotor Gearbox Assembly | Replace with new or overhaul exchange B021-1 tail rotor gearbox assembly. |
| A031-1 | Tail Rotor Pitch Control | Replace with new. |
| A041-11 or -12 | Tail Rotor Drive Shaft Damper Bearing Assembly | Replace with new A041-11 or -12 damper bearing assembly or replace with new B224-1 or -3 drive shaft. |
| A044-1 | Horizontal Stabilizer Rev M and prior (originally installed on R22 S/N 0002 thru 0631). | Replace with new. |
| A051-1 or A051-3 | Clutch Actuator Assembly (A051-1 includes gearmotor assembly) | Replace with new or overhaul exchange. |
| A120-1 | Tail Rotor Bellcrank | Replace with new. |
| A169-1, -2, or -4 | Muffler with Risers Rev J and prior (baffled muffler with straight tailpipe, originally installed on R22 S/N 0002 thru 0500). | Replace with new, revision K or subsequent muffler with risers. |
| A169-6 or -35 | Muffler with Risers (O-320 engine) | Visually inspect muffler interior; verify no obvious loss of material. |
| A169-24 or -37 | Muffler with Risers (O-360 engine) | Visually inspect muffler interior; verify no obvious loss of material. |
| A190-1 or -2 | V-Belt Set | Replace with new A190-2 v-belt set. |
| A193-2 | Flex Plate | Replace with new A947-2 flex plate assembly. |
| A193-3 | Flex Plate | Replace with new A947-3 flex plate assembly. |
| A197-1 thru -7 | Tail Rotor Drive Shaft Assembly originally installed on R22 S/N 0002 thru 0747. | Replace with B224-1 drive shaft & appropriate B223 yoke. |
| A258-1 | Main Rotor Pitch Link Assemblies | Replace with new A258-1 or A258-5 link assembly. |
| A258-5 | Main Rotor Pitch Link Assemblies | Disassemble. 10X visually inspect barrel; verify no corrosion. |
| A343-1 | Strut – Jackshaft (vertical) | Record length and disassemble. Inspect interior and exterior for corrosion, replace if corrosion found. |
| A347-1 | Strut – Jackshaft (horizontal) | |
| A347-5 | Strut – Jackshaft (aft, diagonal) | |

1.102 Additional Component Maintenance (continued)

**A. 12 YEARS (continued)**

| Part Number | Description | Action |
|---|---|---|
| A480-1 | Swashplate Boot | Replace with new. |
| A493-1 | Lower Sheave Rev H and prior (anodized, originally installed on R22 S/N 0002 thru 0294). | Replace with new, revision I or subsequent (steel-sprayed) lower sheave. |
| A649-1, -2, or C649-1 | Oil Cooler | Replace with new or overhaul exchange C649-1 oil cooler. |
| A650-1 or -3 | Main Gearbox Mount Fittings | Visually inspect exterior and interior. Replace if worn or corroded. |
| A785-1 | Hose – Air (intake) | Replace with new. |
| A785-2 | Hose – Air (hot air inlet) | Replace with new. |
| A785-6 | Hose – Air (engine cooling) | Replace with new. |
| A785-7 | Hose – Air (alternator cooling) | Replace with new. |
| A785-26 | Hose – Air (hot air inlet) | Replace with new. |
| A785-32 | Hose | Replace with new. |
| A792-2, -4 or -5 | Dual Tachometer | Replace with new A792-5 dual tachometer. |
| B021-1 | Tail Rotor Gearbox Assembly | Perform 12-year maintenance per MM § 2.620, or replace with new or overhaul exchange. |
| B173-1 | V-belt – Alternator | Replace with new. |
| B174-1 | Fanwheel | Perform 12-year maintenance per MM § 2.630, or replace with new or overhaul exchange. |
| B283-1 | Hose Assembly (fuel system) Revision A thru P | Replace with new. |
| B283-2 | Hose Assembly (fuel system) Revision A thru P | Replace with new. |
| B283-6 | Hose Assembly (fuel system) Revision A thru P | Replace with new. |
| B286-2 | Governor Controller | Replace with new or overhaul exchange. |
| D270-1 | Governor Controller | Replace with new or overhaul exchange. |
| D756-2 (or A011-2) | Bellcrank Assembly – Throttle | Replace with new. |
| F650-3 | Main Gearbox Mount Bolt | Visually inspect exterior and interior. Verify no corrosion. |

1.102 Additional Component Maintenance (continued)

**B. 2200 Hours**

Remove the following components when they have accumulated 2200 hours time in service since new or since last overhaul, and perform action indicated:

| Part Number | Description | Action |
|---|---|---|
| A005-4 | A154-1 Main Rotor Hub & Bearing Assembly | Perform inspection and repair per MM § 2.610, return to RHC for inspection and repair, or replace with new. |
| A005-12 | B370-1 Main Rotor Hub & Bearing Assembly | |
| A005-6 | A016-4 Main Rotor Blade & A158-1 Spindle Assembly | Replace with new or overhaul exchange A005-7 or A005-14 main rotor blade and spindle assembly. |
| A005-7 | A016-6 Main Rotor Blade & A158-1 Spindle Assembly | |
| A005-14 | A016-6 Main Rotor Blade & A158-3 Spindle Assembly | |
| A006-1 & -6 | Main Rotor Gearbox Assembly | Replace with new or overhaul exchange A006-6 main rotor gearbox assembly. |
| A007-3, -5 or -6 | Fanshaft Assembly | Replace with new A007-6 fanshaft assembly. |
| A008-2 or -4 | Tail Rotor Assembly | Disassemble. Replace hub and/or blades as required. Remove bushings and teeter hinge bearings. Inspect hub; verify no fretting or corrosion. Fluorescent penetrant inspect hub. Replace teeter hinge bearings and blade attach bolts. Or replace with new A008-4 tail rotor assembly. |
| A014-8 | Landing Gear Assembly originally installed on R22 S/N 0002 thru 0487. | Replace with new. |
| A017-2 | Swashplate Assembly | Submit to RHC-authorized component maintenance facility for overhaul, or replace with new or overhaul exchange. |
| A018-1 | Clutch Assembly (anodized sheave) | Replace with new or overhaul exchange. |
| A018-2 | Clutch Assembly (metalized sheave) | |
| A020-2 | Upper Frame Assembly S/N 0399 and prior (originally installed on R22 S/N 0002 thru 0311). | Replace with new. Note: Frame replacement may require tailcone forward bay replacement. |
| A021-1 | Tail Rotor Gearbox Assembly | Replace with new or overhaul exchange B021-1 tail rotor gearbox assembly. |
| A031-1 | Tail Rotor Pitch Control | Replace with new. |
| A041-11 or -12 | Tail Rotor Drive Shaft Damper Bearing Assembly | Replace with new A041-11 or -12 damper bearing assembly or replace with new B224-1 or -3 drive shaft. |
| A044-1 | Horizontal Stabilizer Rev M and prior (originally installed on R22 S/N 0002 thru 0631). | Replace with new. |

1.102 Additional Component Maintenance (continued)

**B. 2200 Hours (continued)**

| Part Number | Description | Action |
|---|---|---|
| A051-1 or A051-3 | Clutch Actuator Assembly (A051-1 includes gearmotor assembly) | Replace with new or overhaul exchange. |
| A120-1 | Tail Rotor Bellcrank | Replace with new. |
| A121-17 | Push-Pull Tube Assembly | Replace with new. |
| A169-1, -2, or -4 | Muffler with Risers Rev J and prior (baffled muffler with straight tailpipe, originally installed on R22 S/N 0002 thru 0500). | Replace with new, revision K or subsequent muffler with risers. |
| A169-6 or -35 | Muffler with Risers (O-320 engine) | Replace with new A169-35 muffler. |
| A169-24 or -37 | Muffler with Risers (O-360 engine) | Replace with new A169-37 muffler. |
| A189-10 | Nut – Double Lock | Replace with new. |
| A190-1 or -2 | V-Belt Set | Replace with new A190-2 v-belt set. |
| A193-2 | Flex Plate | Replace with new A947-2 flex plate assembly. |
| A193-3 | Flex Plate | Replace with new A947-3 flex plate assembly. |
| A197-1 thru -7 | Tail Rotor Drive Shaft Assembly originally installed on R22 S/N 0002 thru 0747. | Replace with new B224-1 drive shaft & appropriate B223 yoke. |
| A258-1 | Main Rotor Pitch Link Assembly | Replace with new A258-5 link assembly. |
| A258-5 | Main Rotor Pitch Link Assembly | Replace with new, or perform inspection per § 2.650 and magnetic particle inspect barrel. |
| A347-1 | Strut – Jackshaft (horizontal) | Replace with A347-5 (aft, diagonal). |
| A426-6 | Cap – Collective Spring | Replace with new. |
| A480-1 | Swashplate Boot | Replace with new. |
| A493-1 | Lower Sheave Rev H and prior (anodized, originally installed on R22 S/N 0002 thru 0294). | Replace with new, revision I or subsequent (steel-sprayed) lower sheave. |
| A615-1 | Gasket – Carburetor-to-Air Box | Replace with new. |
| A628-6 | Connector Assembly – Harness | Replace with new. |
| A636-2 | Support (O-320 engine) | Replace with new. |
| A649-1 or -2 | Oil Cooler | Replace with new or overhaul exchange C649-1 oil cooler. |
| A650-1 or -3 | Main Gearbox Mount Fittings | Visually inspect exterior and interior. Replace if worn or corroded. Magnetic particle inspect per § 23-41. |
| A723-1 | Oil Line Assembly | Replace with new A723-5 oil line assembly. |
| A723-2 | Oil Line Assembly | Replace with new A723-6 oil line assembly. |
| A780-33 | Cable Assembly | Replace with new. |
| A785-1 | Hose – Air (intake) | Replace with new. |

## 1.102 Additional Component Maintenance (continued)

### B. 2200 Hours (continued)

| Part Number | Description | Action |
|---|---|---|
| A785-2 | Hose – Air (hot air inlet) | Replace with new. |
| A785-6 | Hose – Air (engine cooling) | Replace with new. |
| A785-7 | Hose – Air (alternator cooling) | Replace with new. |
| A785-26 | Hose – Air (hot air inlet) | Replace with new. |
| A785-32 | Hose | Replace with new. |
| A792-2, -4 or -5 | Dual Tachometer | Replace with new A792-5 dual tachometer. |
| A947-1 | Flex Plate Assembly – Forward | Replace with new. |
| A947-2 | Flex Plate Assembly – Intermediate | Replace with new. |
| A947-3 | Flex Plate Assembly – Aft | Replace with new. |
| B021-1 | Tail Rotor Gearbox Assembly | Replace with new or overhaul exchange. |
| B173-1 | V-belt – Alternator | Replace with new. |
| B174-1 | Fanwheel | Replace with new or overhaul exchange. |
| B224-1 | Tail Rotor Drive Shaft | Replace with new. |
| B224-3 | Tail Rotor Drive Shaft | Replace with new. |
| B283-1 | Hose Assembly (fuel system) | Replace with new. |
| B283-2 | Hose Assembly (fuel system) | Replace with new. |
| B283-6 | Hose Assembly (fuel system) | Replace with new. |
| B286-2 | Governor Controller | Replace with new or overhaul exchange. |
| B350-2 | Pin – Spring (fanshaft nut) | Replace with new. |
| C636-2 | Support (O-360 engine) | Replace with new. |
| C649-1 | Oil Cooler | Replace with new or overhaul exchange. |
| D270-1 | Governor Controller | Replace with new or overhaul exchange. |
| D756-2 (or A011-2) | Bellcrank Assembly – Throttle | Replace with new. |
| F628-8 | Buckle Assembly | Replace with new. |
| KI-217-1 | R22 Bladder Fuel Tank Installation Kit | Required for helicopter S/N 0002 thru 4620 per R22 SB-109, if not previously accomplished. |
| KI-2207 | A017-1 Swashplate Installation Kit | Replace existing parts with kit parts. |
| KI-2208 | R22 A057-2 Air box Assembly Installation Kit | Required for helicopter S/N 2571M thru 2664 if not previously accomplished. |
| AN320-18 | Nut – Fanshaft | Replace with new. |
| MS16562-15 | Pin – Spring | Replace with new. |
| MS20002-18 | Washer | Replace with new. |
| NAS1149F1832P | Washer | Replace with new. |
| NAS630-80 | Bolt | Replace with new. |
| NAS6604-38 | Bolt | Replace with new. |

1.102 Additional Component Maintenance (continued)

**C. Engine Maintenance**

Refer to latest revisions of Textron Lycoming Service Instruction No. 1009 and Lycoming Service Bulletin No. 240.

**D. Airframe and Engine Accessory Maintenance**

Refer to accessory manufacturer's instructions for continued airworthiness for accessory maintenance. Remove accessories per R22 Maintenance Manual or accessory manufacturer's instructions as required.

# CHAPTER 2

# INSPECTION

## 2.000 Introduction

The R22 helicopter must be inspected periodically to verify it is in airworthy condition. Required inspection intervals are maximum 100 hours time in service or 12 calendar months (annually), whichever occurs first; the inspection interval may be extended up to 10 hours, without accumulation, if allowed by local regulations. Fluid leaks, discoloration, dents, scratches, nicks, cracks, galling, chafing, fretting, and corrosion all warrant further investigation. Unairworthy items must be replaced or repaired as allowed by Robinson Helicopter Company. This section contains procedures for performing the required periodic airframe inspections.

## 2.100 General Procedures

Refer to U.S. FAA AC 43.13-1B Chapter 5 Section 2 for Visual Inspection guidance, and Chapter 11 Section 8 paragraph 11-97 for Wiring Replacement guidance. When required, magnetic particle inspection may be performed in accordance with ASTM E 1444 and MIL-STD-1907. Fluorescent penetrant inspection may be performed in accordance with ASTM E 1417 and MIL-STD-1907. For following components, use accompanying inspection criteria unless otherwise specified.

### 2.110 Ball and Roller Bearings

The first indication of bearing failure is usually an increase in bearing noise. Noise will almost always start several hours before bearing failure or any increase in bearing temperature. Listen to drive system during start-up and shutdown. A failing bearing will produce a loud whine, rumble, growl, or siren sound. Upon hearing an unusual noise, thoroughly inspect all bearings before further flight. A failing bearing may have a distorted seal or be exuding a large amount of grease. Do not rely on Telatemps to detect failing bearings as temperature increase may occur only seconds before bearing disintegrates. Refer to § 22-40.

The failure of either actuator bearing in flight could cause loss of power to the rotor system and could result in a serious accident. The actuator upper ball bearing is on the clutch shaft aft of the upper sheave; the actuator lower roller bearing is on the fanshaft aft of the lower sheave. Just before complete failure of an actuator bearing, the clutch light may flicker constantly (on and off in less than one second). This should not be confused with its normal on-off re-tensioning in flight (on for 1-8 seconds then off). Flight should not be resumed until cause of the flickering clutch light has been determined.

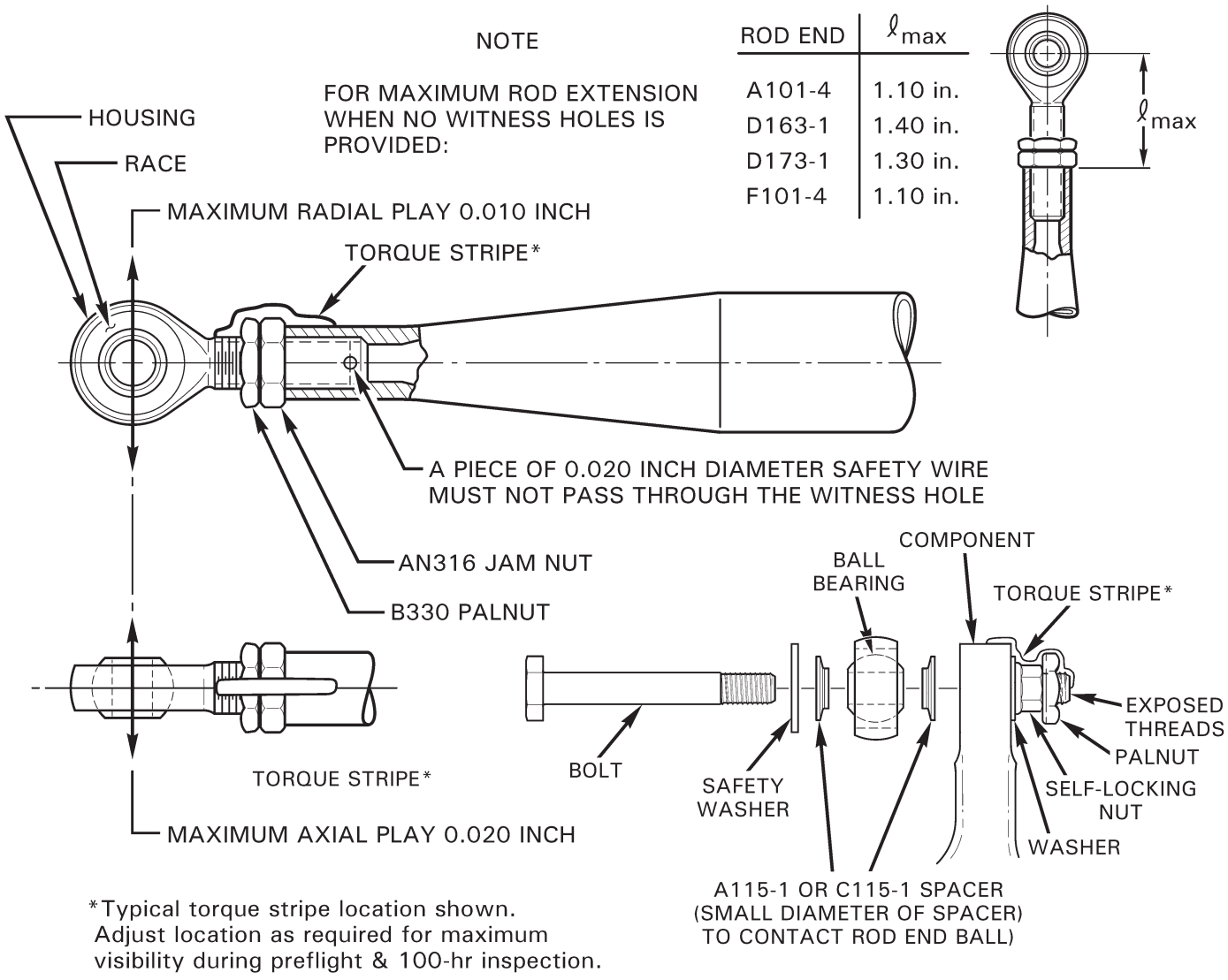


FIGURE 2-1 ROD END AND SPHERICAL BEARING PLAY LIMITS AND TORQUE STRIPE APPLICATION

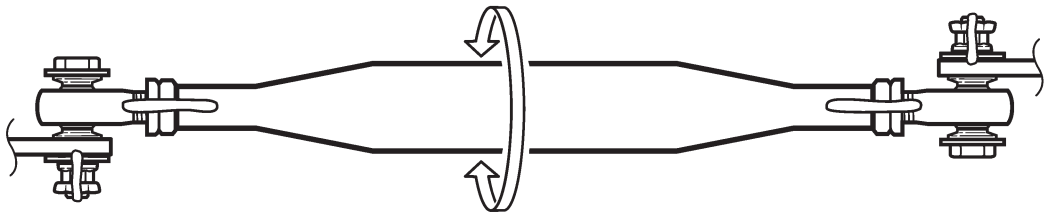

FIGURE 2-1A ROD END CENTERING
(Position rod ends for maximum rotation)

2.410 Inspection Procedures and Checklist (continued)

**8. Remove Tailcone Fairing (8) (continued)**

**Engine Height**: Check per § 6.130 and adjust as required. _____

**Clutch Shaft Angle**: Check per § 7.240. Replace drive belts as required. _____

**Sheave Alignment**: Check per § 7.230 and adjust as required. _____

**Throttle Correlation Rigging**: Check per § 10.150 and adjust as required. _____

**Fasteners & Torque Stripes**: Inspect condition and verify security of all fasteners. Renew deteriorated torque stripes per Figure 2-1. _____

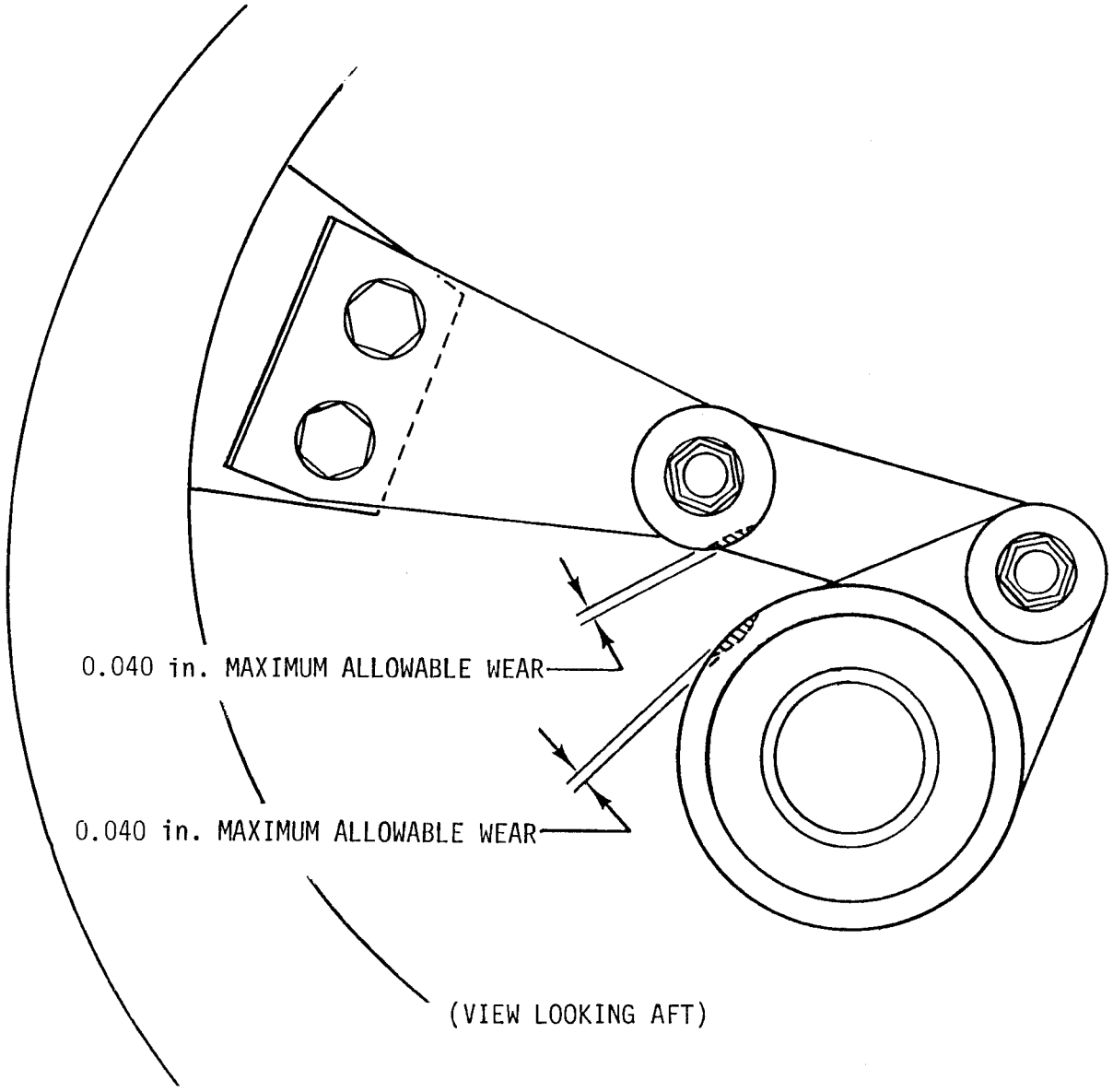


FIGURE 2-6 DAMPER BEARING HOUSING WEAR LIMITS

2.410 Inspection Procedures and Checklist (continued)

**9. Remove 4 Tailcone Inspection Covers (9)**: Verify nutplate self-locking feature when removing.

**Inspection Covers**: Inspect condition. _____

**Tail Rotor Drive Shaft**: Inspect condition. Verify no cracks, bends, or contact with inside of tailcone. Refer to Figure 7-12C for corrosion limitations. Check runout per § 7.340. _____

**Tail Rotor Push-Pull Tube**: Inspect condition. Inspect rod ends per § 2.120. Verify wear does not exceed § 2.120 limits. Verify no cracks in ends. Verify operating clearance. Verify tail rotor guard mounting screw shanks clear push-pull tube. _____

**Damper**: Inspect condition. Verify security. Verify bearing housing wear is within Figure 2-6 limits. _____

**Tailcone Interior**: Inspect condition. Verify no loose rivets or corrosion. Verify no excessive wear in tail rotor push-pull tube bushings. Verify no cracks, especially at damper-to-tailcone attachment. _____

**Lower, Whip Antenna (if installed)**: Remove four screws securing antenna mounting plate to tailcone. Verify no cracks or corrosion on mounting plate or tailcone mount. Inspect antenna and wiring condition. Install antenna. Verify security. _____

**Upper Antenna(s) (if installed)**: Inspect antenna and wiring condition. Verify security and no cracks at attachment to tailcone. _____

**Tailcone Exterior**: Inspect condition. Refer to § 4.310. Inspect tailcone exterior for nicks, scratches, dents, cracks, corrosion, fretting or loose rivets. Verify no obstructions in drain hole at forward edge of each bay (except forward bay). Inspect tailcone for cracks in vicinity of antenna mounts. _____

**B375-2 Horizontal Stabilizer**: Inspect condition. Verify no nicks, scratches, dents, cracks, corrosion, fretting, or loose rivets. Verify security. _____

**Tail Rotor Visual Warning Guard**: Inspect condition. Verify no cracks or corrosion, especially at tailcone attachment. Verify security. _____

**Strobe Light**: Inspect condition. Verify cleanliness and security. _____

**Fasteners & Torque Stripes**: Inspect condition and verify security of all fasteners. Renew deteriorated torque stripes per Figure 2-1. _____

2.410 Inspection Procedures and Checklist (continued)

**10. Remove Plastic Cover (10)**

**Plastic Cover**: Remove and clean. Inspect condition. Replace as required and install. Verify nutplate self-locking feature when installing. _____

**Empennage**: Inspect condition. Verify security. Verify no cracks or loose fasteners. Verify lower vertical stabilizer and tail skid drain holes are unobstructed. Refer to special inspection section for tail skid strike inspection criteria. _____

**Aft Navigation Light**: Inspect condition. Verify cleanliness, clear lens, and security. _____

**Aft Flex Plate**: Refer to Figure 2-4B. Inspect condition. Verify no distortion, nicks, scratches, cracks, corrosion, or fretting. If fretting is detected, contact RHC Technical Support. Verify bonded washers are installed on both sides of each flex plate ear. Verify proper installation, security, and operating clearance. _____

**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 a A947 flex plate, flex plate is unairworthy and cannot be repaired.**

**Tail Rotor Gearbox**: Inspect condition, including seals. Verify proper oil level and no leakage. Verify security and safety wire integrity. Verify output shaft cleanliness. _____

NOTE

At 500 hours time in service or annually, whichever occurs first, remove chip detector and clean any varnish accumulation from detector's magnetic probe and adjacent metal body using a toothbrush and approved solvent per § 22-21. Drain and flush gearbox at intervals not to exceed 500 hours time in service (refer to § 22-23).

2.710 Volcanic Ash Recommendations (continued)

8. Remove each magneto's distributor gear inspection plug and inspect visible internal portion for contamination; overhaul magnetos if volcanic ash is found inside (magneto vent plugs are unfiltered).

9. Inspect engine oil condition. Regardless of oil time-in-service if oil smells bad, is opaque (or is not obviously brown), or if particulates are detectable on the dipstick, change engine oil & oil filter, inspect suction screen and old oil filter, and perform Lycoming SI 1191 Cylinder Compression check if not previously accomplished in step 6.

2.720 Lightning Strike

Lightning strikes are extremely rare for helicopters operating in VFR conditions.

If a lightning strike does occur, RHC recommends performing a 100-hour inspection per § 2.400 and following recommendations for aircraft struck by lightning per Lycoming Service Bulletin No. 401.

High voltage that is well conducted through the aircraft structure will dissipate and cause minimal damage. High voltage that is not well conducted through the aircraft structure can result in excessive heat, which can bake, burn, char, or even melt certain materials. Heat damage may or may not be detectable by visual inspection. A component may not exhibit obvious damage, but temperatures above 300° F can alter the strength of some materials and thus affect a component's service life and airworthiness.

Visually inspect main rotor blades, landing gear, drive train, airframe, and flight controls thoroughly for obvious damage such as electrical arcing or burns, pitting, or cracking. Particular attention should be given to rod ends, journals, etc., where the conductive path is most susceptible. If obvious damage is detected in any of the above-mentioned systems, additional components may require replacement. Contact RHC Technical Support with detailed documentation for further guidance prior to approving aircraft for return to service.

## 2.730 Inspection After Stabilizer Damage

For damage to an installed A042-1 upper vertical stabilizer, A043-1 lower vertical stabilizer, and/or A044-1 horizontal stabilizer that results in denting, tearing, or cracking of stabilizer metal, or if a tail skid strike has occurred, perform the following:

1. On associated tailcone's A148 bulkhead, strip paint from cross-hatched surfaces shown in Figure 2-23 using § 23-71 approved materials.
2. Perform fluorescent penetrant inspection (FPI) per § 23-42 of stripped surfaces. Replace tailcone if crack is indicated.
3. Conversion coat bare aluminum per § 23-51, as required. Epoxy prime (chromated epoxy primer preferred) & topcoat stripped surfaces per § 23-60.

**NOTE**

Do not apply primer or topcoat to tail rotor gearbox attachment surfaces.

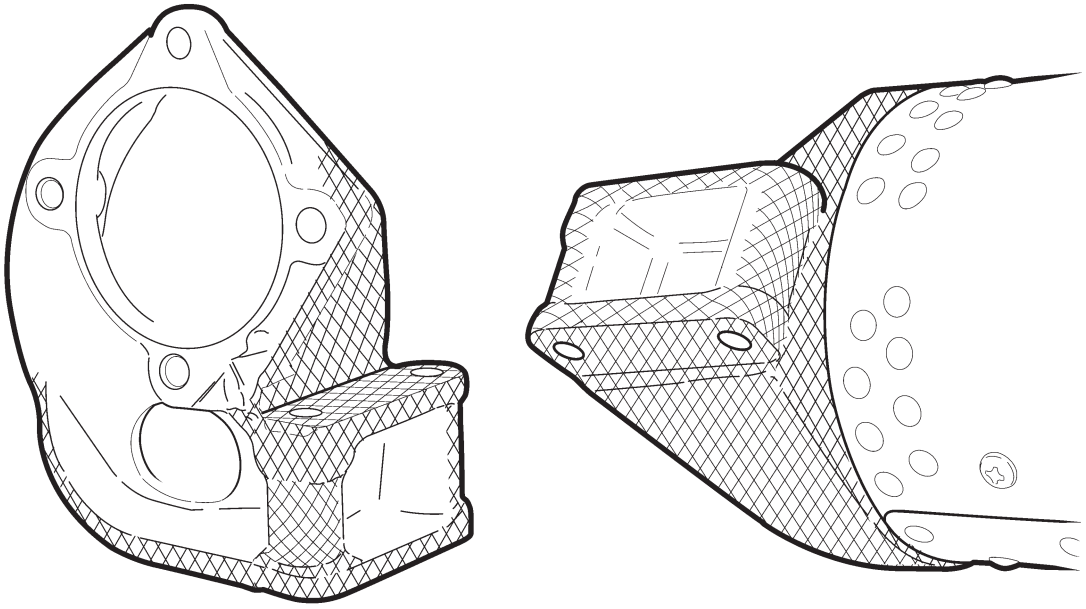

FIGURE 2-23 PENETRANT INSPECT CROSS-HATCHED SURFACES OF A148 BULKHEAD

# CHAPTER 4

# AIRFRAME

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4.232 Upper Frame Installation (continued)

n) Install main rotor gearbox per § 7.120.

o) Install tailcone per § 4.312.

> NOTE
>
> A020-2 upper frames S/N 0002 thru 0399 require A960-1 clamp assembly and A961-1 strap assembly per R22 Service Bulletin SB-26.

p) Install clutch assembly per § 7.220

q) Install seat backs and panels after verifying all attaching nuts and screws and secure.

4.240 Vertical Strut Assembly Removal and Installation

To remove strut:

a. Remove upper and lower attaching bolts.

b. Remove strut.

To install strut:

a. Line up holes in strut with upper and lower frame tabs. Lower end of strut goes on aft face of lower frame tab.

b. Install NAS6604-3 attaching bolts wet with B270-1 sealant on shanks.

> **CAUTION**
>
> Verify threads are clean and dry.

Special torque per § 23-33. Install palnuts and standard torque per § 23-32 and torque stripe per Figure 2-1.

4.300 Tailcone

**CAUTION**

If tailcone has a B379-1 or -3 bracket then A958-1 bellcranks (original equipment on helicopter S/N 0357 and subsequent) must be installed or retrofitted. Figure 8-2A refers.

If tailcone has a B379-1 or -3 bracket then B375-2 horizontal stabilizer must be installed.

Tailcone equipped with B379-1 or -3 bracket may not be installed on R22 Mariner helicopters.

A044-1 horizontal stabilizer may not be installed on a tailcone that has a B379-1 or -3 bracket.

B902-1 or -2 vertical stabilizers mount assembly may only be installed on a tailcone that has a B379-1 or -3 bracket.

**A. Removal**

1. Pull open associated circuit breakers for lights and antennas installed on tailcone.
2. Remove A706-1 fairing.
3. Cut and discard ty-raps as required and disconnect tailcone wiring at connectors. Disconnect antenna cables at forward bulkhead, as applicable.
4. Remove hardware securing tail rotor drive shaft assembly forward yoke to A947-2 (intermediate) plate assembly. Support drive shaft using a conspicuous foam block or equivalent, while drive shaft is disconnected from drive train.

**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).**

5. Remove hardware securing A121-17 push-pull tube to A331-1 intermediate bellcrank assembly.
6. Support tailcone and remove hardware securing tailcone to upper frame. Remove tailcone from helicopter.
7. If replacing tailcone, refer to appropriate sections of this manual and remove installed components or assemblies as applicable.

4.300 Tailcone (continued)

**B. Installation**

NOTE

Install tail rotor drive shaft, tail rotor gearbox, and A121-17 push-pull tube on tailcone prior to tailcone installation.

1. Inspect tailcone interior. Remove debris. At bulkheads, verify bushings prevent push-pull tube from contacting metal, and wiring is protected by grommets. Verify correct damper assembly orientation per Figure 7-11B.
2. Position A023 tailcone assembly on upper frame assembly; do not pinch wiring between tailcone forward bulkhead and frame. Install hardware securing tailcone to frame, standard torque bolts & palnuts per § 23-32, and torque stripe per Figure 2-1.

NOTE

All R22 helicopters with upper frame A020-2 S/N 0002 thru 0399 are required to install A960-1 clamp and A961-1 strap assemblies per R22 Service Bulletin 26.

3. Install hardware securing A121-17 push-pull tube to A331-1 bellcrank assembly. Standard torque bolt & palnut per § 23-32 and torque stripe per Figure 2-1.

**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, then flex plate is unairworthy and cannot be repaired.**

4. Inspect flex plate per Figure 2-4B. Perform intermediate flex plate installation and shimming per § 7.330.
5. Measure tail rotor drive shaft runout per § 7.340.
6. Connect tailcone wiring at connectors, connect antenna cables at forward bulkhead, as applicable. Individually test and verify correct function of tail position light, strobe, and TR chip light circuits.
7. Refer to Figure 4-2D. Verify clearance between tailcone edge and upper frame.
8. As required, install B375-2 stabilizer per § 4.400 and empennage assembly per § 4.500.

4.310 Tailcone Replacement

**CAUTION**

If tailcone has a B379-1 or -3 bracket then A958-1 bellcranks (original equipment on helicopter S/N 0357 and subsequent) must be installed or retrofitted. Figure 8-2A refers.

**A. Tailcone Set-up**

1. Level helicopter longitudinally and laterally per § 18-10.
2. Verify tailcone part number is correct for helicopter model. Slide forward end of tailcone over upper frame and support aft end of tailcone with a stand.
3. Refer to Figure 4-2A. Insert two bolts of sufficient length (to support a level) in A148 bulkhead's left & right gearbox-mounting holes and place level across bolt shanks. Rotate tailcone on upper frame as required until bolts are level.

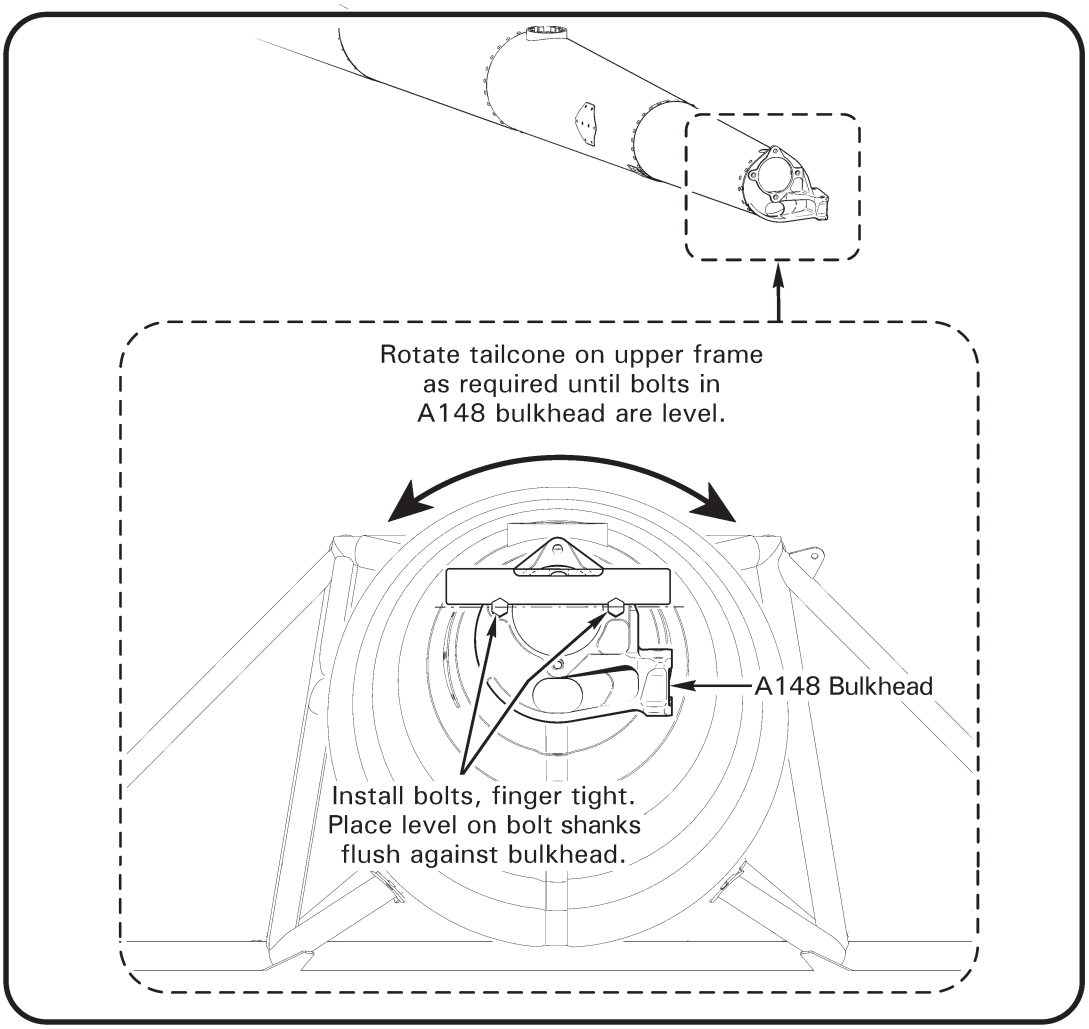



FIGURE 4-2A TAILCONE LATERAL LEVELING

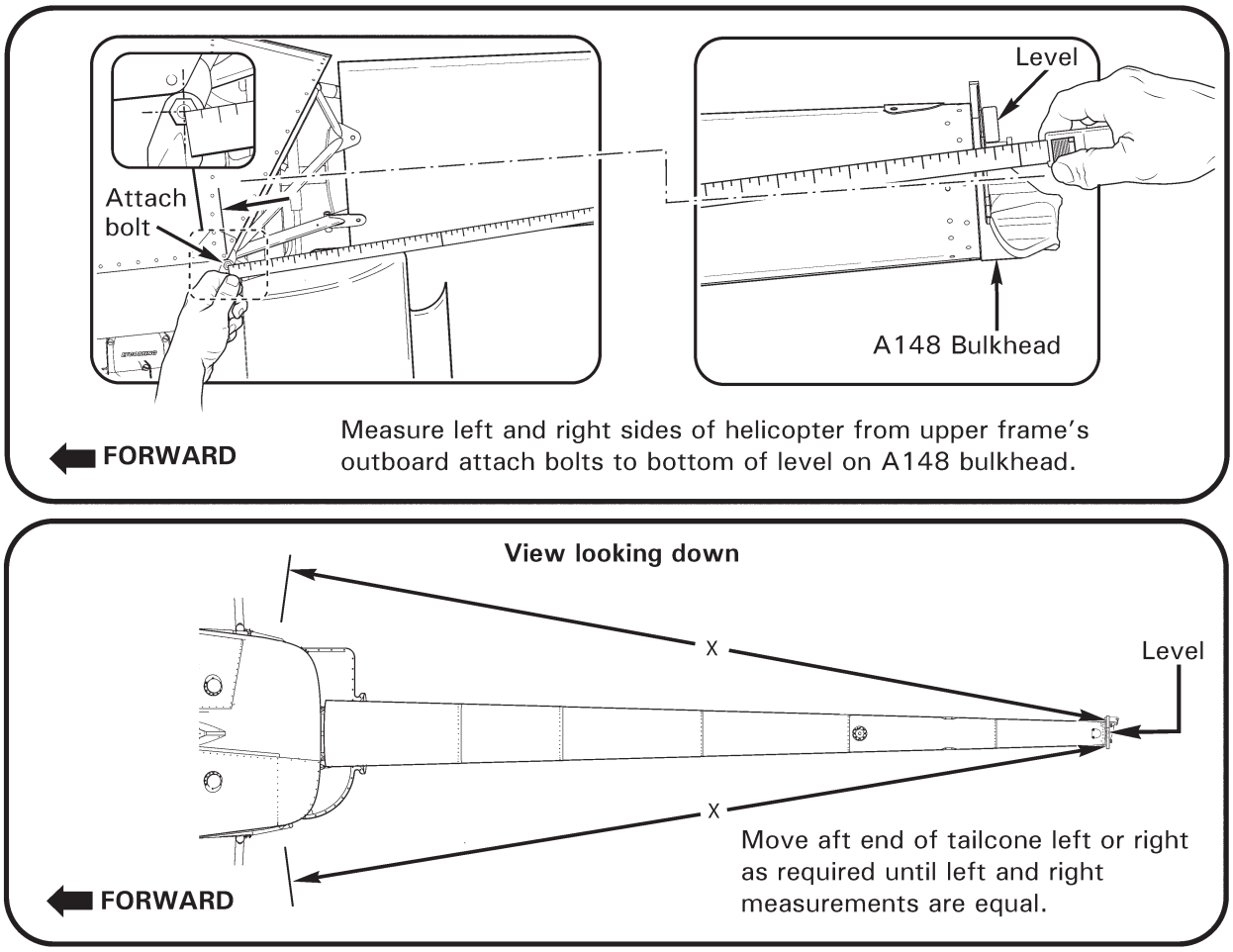



FIGURE 4-2B TAILCONE LATERAL ALIGNMENT

4.310 Tailcone Replacement (continued)

**A. Tailcone Set-up (continued)**

4. Refer to Figure 4-2B. Measure left and right sides of helicopter from upper frame's outboard attach bolts to bottom of level on A148 bulkhead. Move aft end of tailcone left or right as required until left and right measurements are equal.

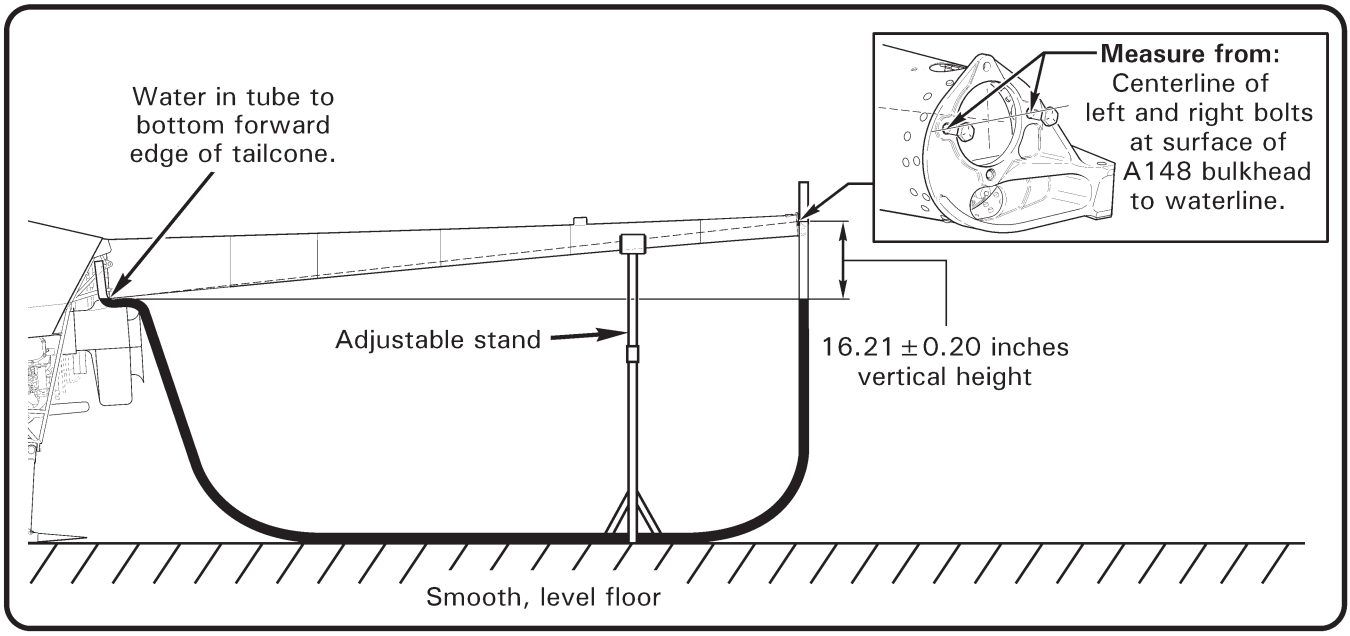



FIGURE 4-2C TAILCONE VERTICAL ALIGNMENT

4.310 Tailcone Replacement (continued)

**A. Tailcone Set-up (continued)**

5. Refer to Figure 4-2C. Use a water level and measure the difference in vertical height between forward end of tailcone (at lowest point) and centerline of left & right bolts at surface of A148 bulkhead. Using stand, adjust height of tailcone to 16.21 ± 0.20 inches.

| NOTE |
| --- |
| Due to bolt & hole tolerances, tailcone vertical height tends to decrease when supporting stand is removed. |

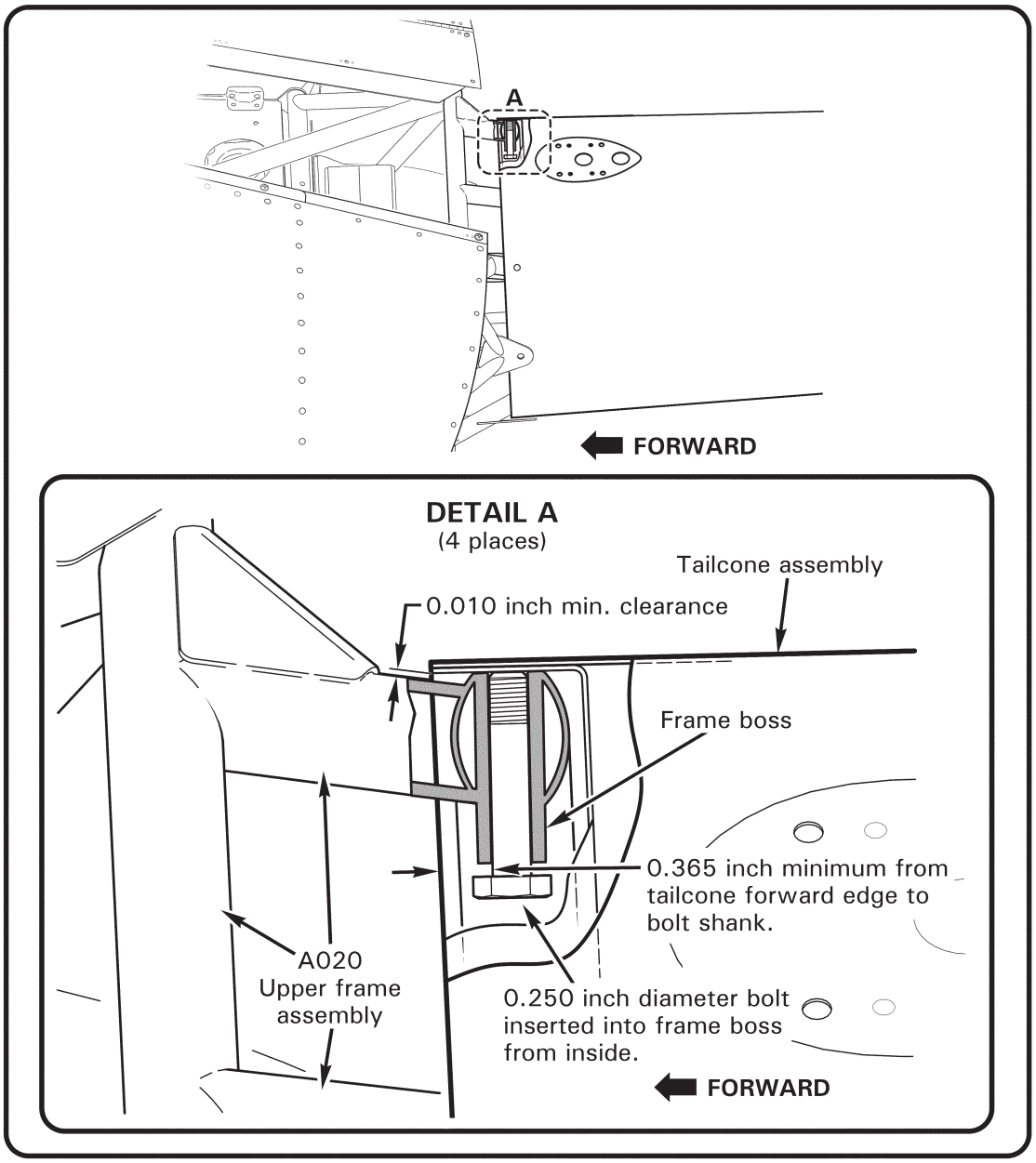



FIGURE 4-2D TAILCONE ATTACH HOLE EDGE DISTANCE

4.310 Tailcone Replacement (continued)

**A. Tailcone Set-up (continued)**

6. Refer to Figure 4-2D. Verify 0.010 inch minimum clearance between upper frame tubes and tailcone forward edge (4 places). Place a straight edge across forward face of tailcone and verify 0.365 inch minimum between straight edge and mounting bolt shank inserted in frame boss (4 places). Push tailcone forward or pull aft as required to maintain dimensions.

7. Verify tailcone leveling, lateral & vertical alignments, clearances, and minimum edge distances are correct; adjust tailcone set-up as required per steps 3 thru 6. Drill tailcone per Part B.

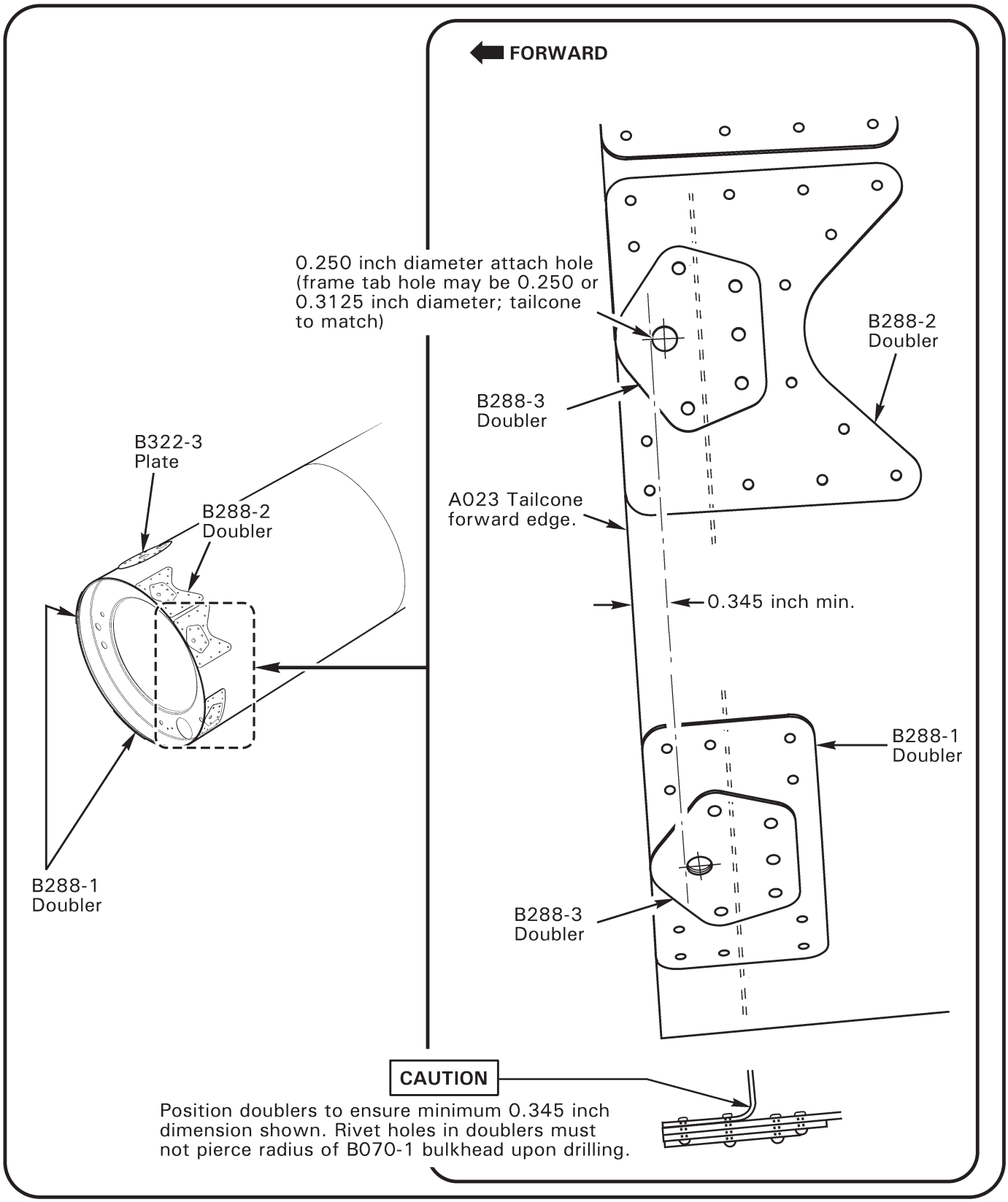



FIGURE 4-2E TAILCONE DOUBLER INSTALLATION

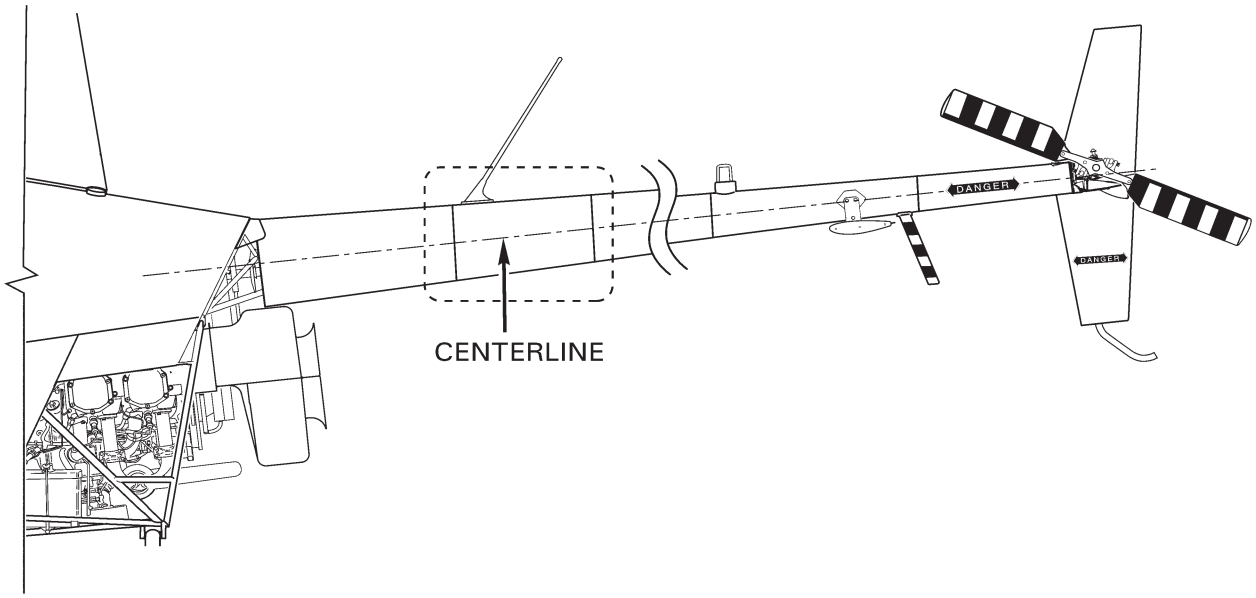
4.310 Tailcone Replacement (continued)

**B. Tailcone Drilling**

**CAUTION**

Protect drive belts from drilling debris.

1. Perform tailcone set-up per Part A.
2. Clamp tailcone at (3) mounting locations to prevent tailcone movement during drilling, do not clamp tailcone at frame tab on left side of tailcone.
3. Back drill from inside of tailcone mounting hole (without clamp) using a center drill with a 0.250 inch diameter shank, then use a 0.250 inch diameter twist drill. After drilling hole, secure tailcone to frame with appropriate fastener.
4. Remove (1) clamp from next mounting location and back drill hole per step 3, repeat process for each clamped mounting hole.
5. Match drill left-side frame tab thru tailcone. Protect steel tube frame behind tailcone skin using a piece of scrap metal before drilling.
6. Remove tailcone. Deburr drilled holes.
7. Refer to Figure 4-2E and accompanying "CAUTION" statement. Center B288-1 or -2 doublers over each tailcone mounting hole and flush with tailcone forward edge. Mark doublers from inside tailcone for drilling 0.250 inch diameter hole.
8. Refer to Figure 4-2E. Drill B288-1 or -2 doubler with a 0.250 inch diameter twist drill at spot marked in step 7. Deburr hole and secure doubler to tailcone with a NAS1304-3 bolt. Drill through existing pilot holes in doubler with a #30 drill bit and secure with clecos.
9. Remove each NAS1304-3 bolt. Install B288-3 doubler atop B288-1 or -2 doubler and secure with NAS1304-3 bolt. Drill through existing pilot holes with a #30 drill bit.
10. Remove doublers and deburr holes. Install doublers with clecos then rivet with MS20470AD4 rivets.
11. If B288-3 doubler protrudes past forward edge of tailcone skin, file doubler flush with forward edge of tailcone, as required.
12. Apply B270-1 sealant all around doublers and forward edge of tailcone skin and B070-1 bulkhead.
13. Apply zinc chromate or epoxy primer (ref. § 23-75) per § 23-60 to doublers. Apply topcoat to tailcone, as required.
14. Install tailcone per § 4.300 Part B.



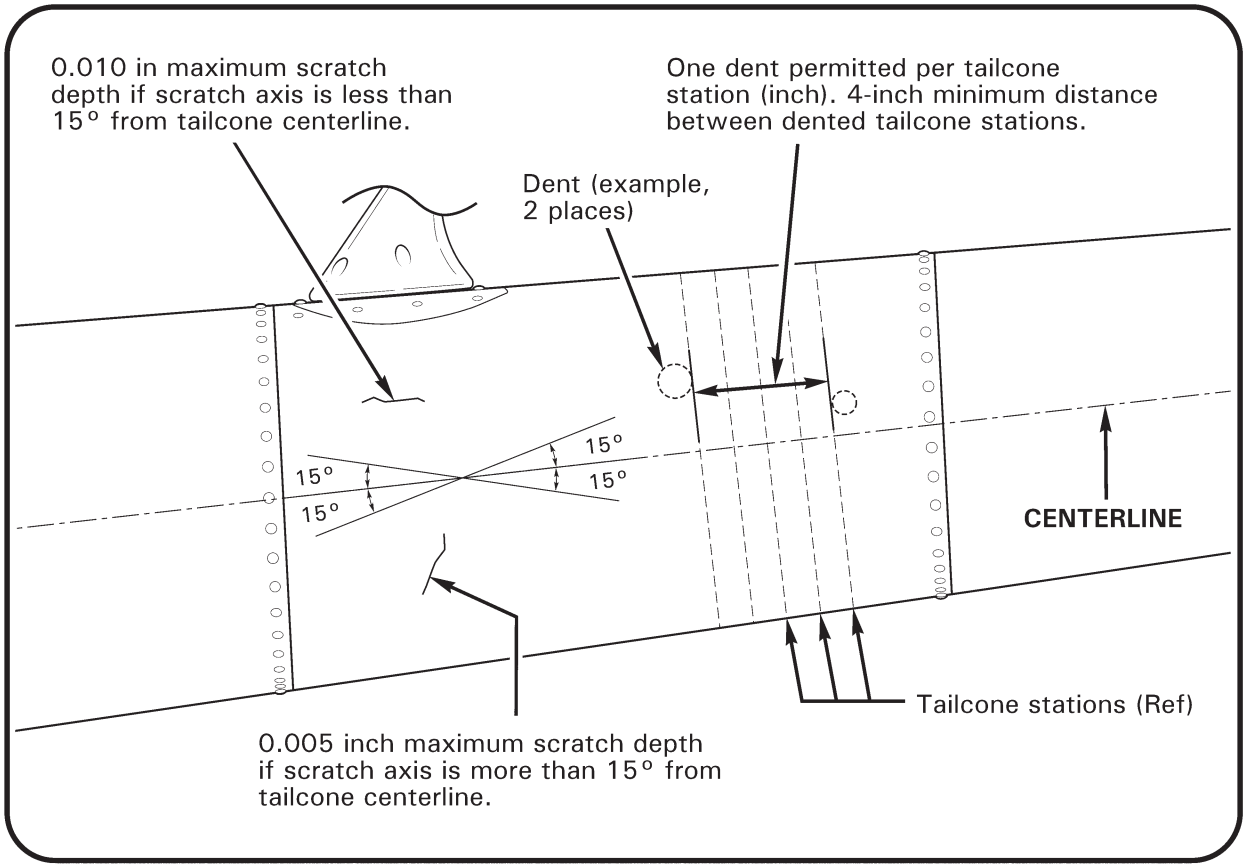




FIGURE 4-3 TAILCONE DAMAGE LIMITS

4.320 Inspection and Repair

Repairs are limited to blending out scratches within limits and refinishing skins. If allowable damage is exceeded, replace tailcone, or submit tailcone to RHC for repair.

**A. Scratches**

1. Refer to Figure 4-3. Verify damage does not exceed the following limits:
   a. 0.005 inch maximum scratch depth if scratch axis is more than 15° from tailcone centerline.
   b. 0.010 inch maximum scratch depth if scratch axis is less than 15° from tailcone centerline.
2. If damage exceeds limits, return tailcone assembly to RHC for repair. If damage is within limits, blend out scratches with a 0.10 inch minimum blend radius. Refinish skins using approved materials per § 23-70.

**B. Dents**

> NOTE
>
> 0.125 inch minimum radius can be verified with using a 0.250 inch diameter bearing ball: Place bearing ball within dent and back light with lamp; if light is visible between skin & ball (i.e. ball not contacting dent bottom) then dent radius is less than 0.125 inch.

1. Refer to Figure 4-3. Smooth, round bottom dents with 0.125 inch minimum radius without sharp nicks or cracks are acceptable when damage does not exceed the following limits:
   a. 0.030 inch maximum dent depth.
   b. 1.250 inches maximum dent diameter.
   c. One dent permitted per tailcone station (inch).
   d. 4.000 inches minimum distance between dented tailcone stations.
2. If damage exceeds limits, replace tailcone or return to RHC for repair.

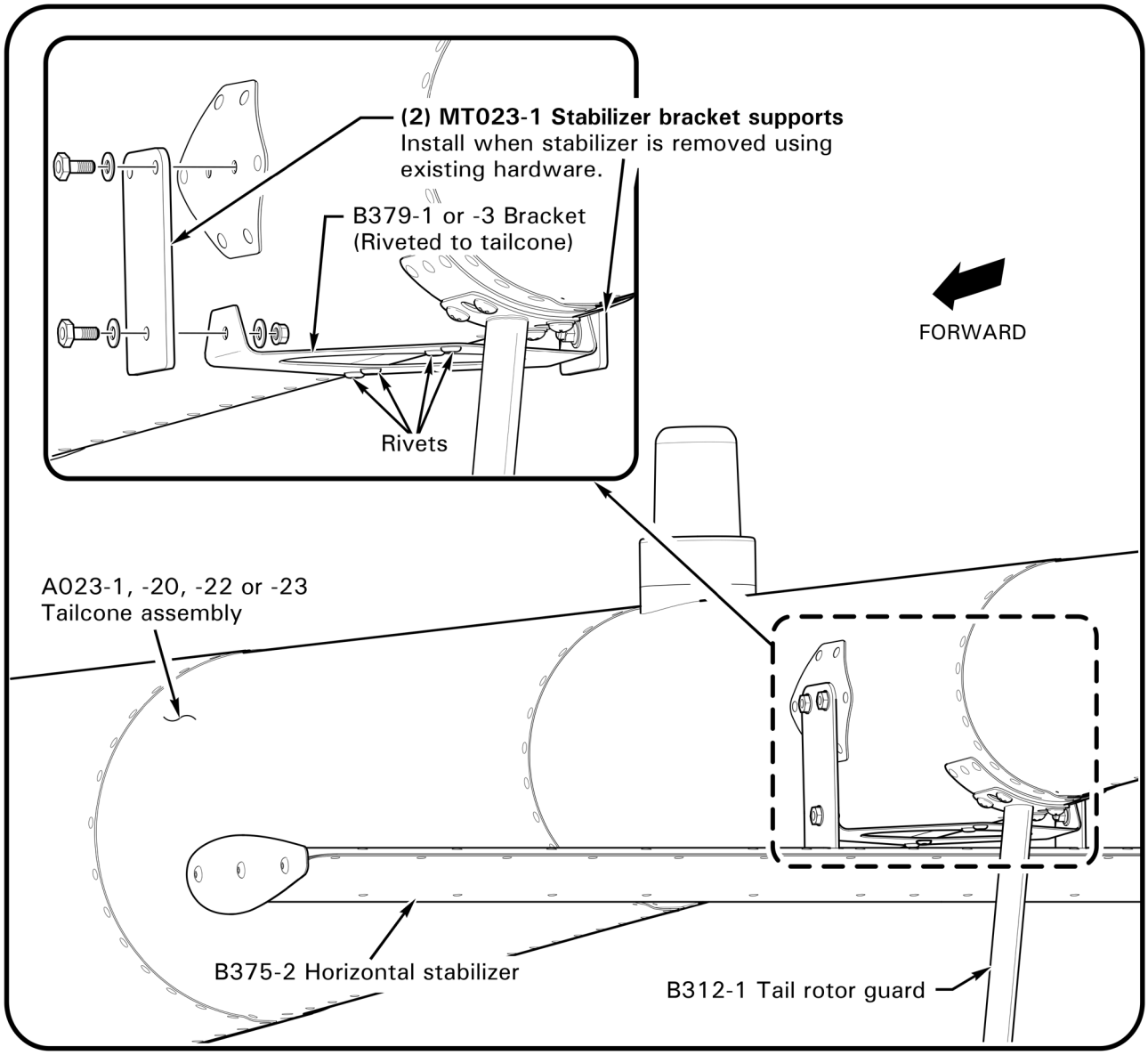



FIGURE 4-4 B375-2 HORIZONTAL STABILIZER ASSEMBLY

## 4.400 B375-2 Horizontal Stabilizer Assembly

**CAUTION**

If tailcone has a B379-1 or -3 bracket then A958-1 bellcranks (original equipment on helicopter S/N 0357 and subsequent) must be installed or retrofitted. Figure 8-2A refers.

If tailcone has a B379-1 or -3 bracket then B375-2 horizontal stabilizer must be installed.

B375-2 horizontal stabilizer may not be installed on R22 Mariner helicopters.

**CAUTION**

Support the B375-2 horizontal stabilizer assembly during removal & installation when upper bolts are removed to prevent bending B379-1 or -3 bracket that is riveted to tailcone.

### A. Removal

1. Refer to Figure 4-4. Remove hardware securing B375-2 horizontal stabilizer assembly to B379-1 or -3 bracket.
2. While supporting stabilizer, remove hardware securing stabilizer to tailcone assembly and remove stabilizer.
3. As required, install MT023-1 stabilizer bracket supports using removed hardware (recommended when stabilizer is removed).

### B. Installation

1. If installed, remove hardware securing MT023-1 stabilizer bracket supports to B379-1 or -3 bracket & tailcone assembly and remove supports.
2. While supporting B375-2 horizontal stabilizer assembly, install hardware securing stabilizer to tailcone and bracket. Special torque bolts per § 23-33 and torque stripe per Figure 2-1.

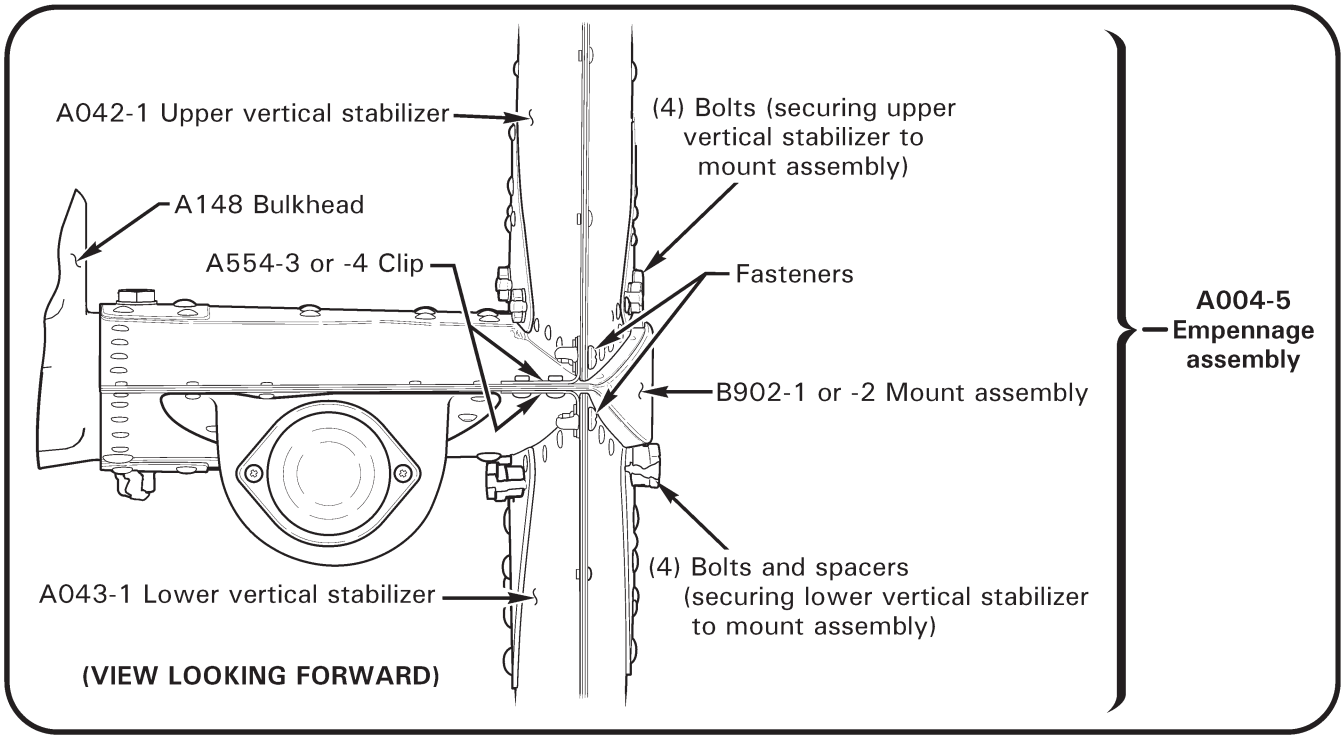



FIGURE 4-5 A004-5 EMPENNAGE ASSEMBLY INSTALLATION
(use with B375-2 horizontal stabilizer)

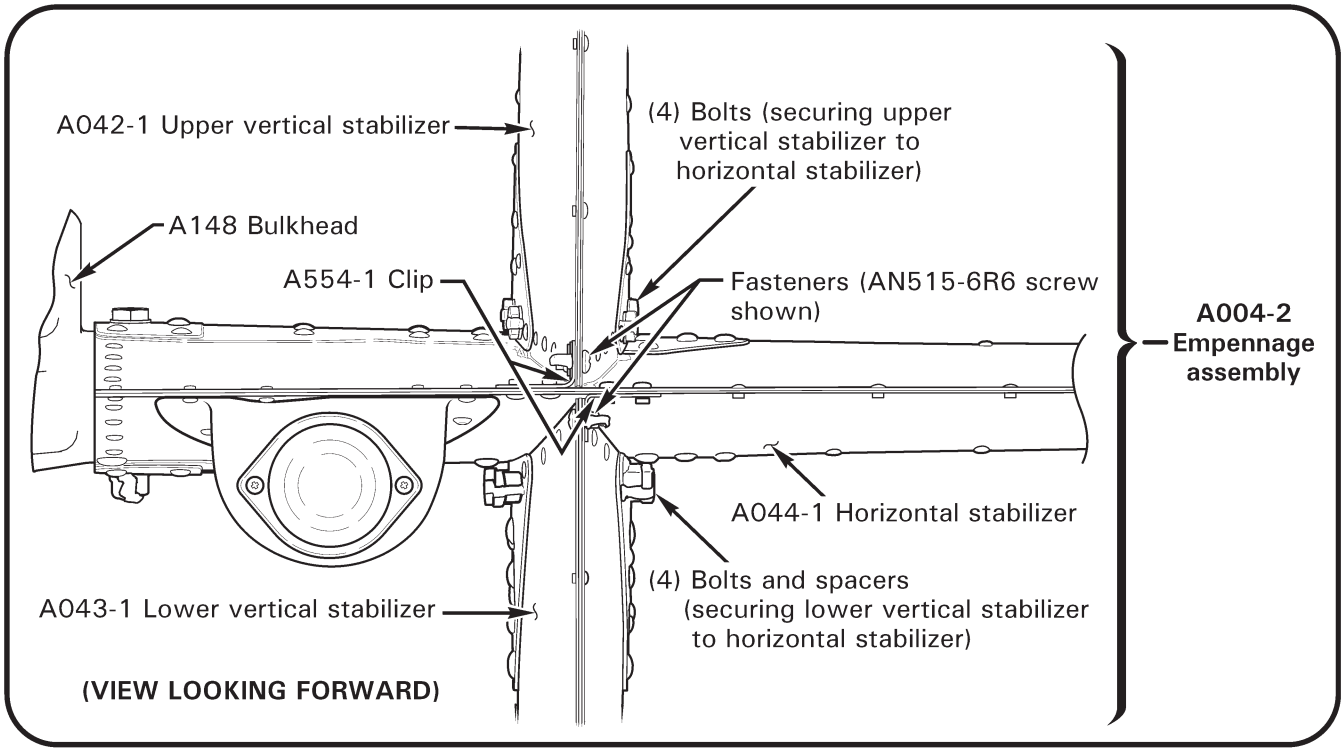



FIGURE 4-5A A004-2 EMPENNAGE ASSEMBLY INSTALLATION
(includes A044-1 horizontal stabilizer)

4.500 Empennage Assembly

**CAUTION**

If tailcone has a B379-1 or -3 bracket then A958-1 bellcranks (original equipment on helicopter S/N 0357 and subsequent) must be installed or retrofitted. Figure 8-2A refers.

If tailcone has a B379-1 or -3 bracket then B375-2 horizontal stabilizer must be installed.

A044-1 horizontal stabilizer may not be installed on a tailcone that has a B379-1 or -3 bracket.

B902-1 or -2 vertical stabilizers mount assembly may only be installed on a tailcone that has a B379-1 or -3 bracket.

**A. Removal**

1. Remove hardware securing MS21919WDG2 clamp to B902-1 (or -2) vertical stabilizers mount assembly (or A044-1 horizontal stabilizer, if installed). Cut and discard ty-raps securing position light and gearbox chip detector wires and connectors together. Disconnect position light at connectors.
2. Refer to Figure 4-5 or 4-5A. While supporting empennage assembly, remove hardware securing empennage to A148 bulkhead, and remove empennage.

**B. Installation**

1. Refer to Figure 4-5 or 4-5A. Position empennage assembly on A148 bulkhead.
   a. **If A301-5 (empennage ballast; ref. § 18-32) weight <u>will not</u> be installed:** Install (2) NAS6604-28 bolts & associated hardware securing empennage to A148 bulkhead. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
   b. **If A301-5 (empennage ballast; ref. § 18-32) weight <u>will</u> be installed:** Install (2) NAS6604-44 bolts & associated hardware securing empennage to A148 bulkhead. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
2. Connect position light wire connectors. Secure wires and install hardware securing MS21919WDG2 clamp to B902-1 (or -2) vertical stabilizers mount assembly (or A044-1 horizontal stabilizer, if installed). Install MS3367-4-9 ty-raps as required to secure wires and connectors together. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
3. Test and verify correct function of position and TR chip light circuits.

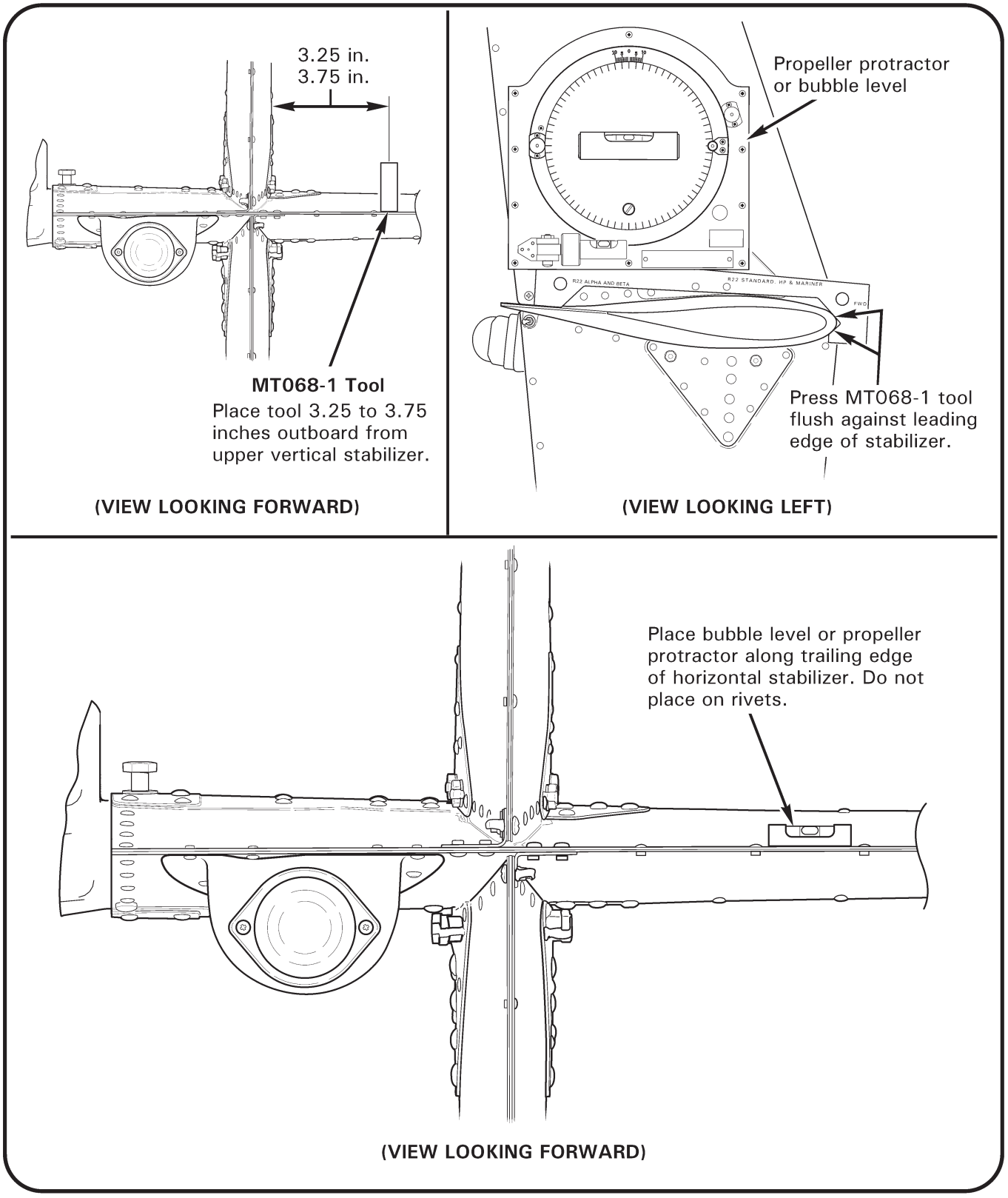



FIGURE 4-6 EMPENNAGE ASSEMBLY REPLACEMENT

4.500 Empennage Assembly (continued)

**C. Replacement (A004-2 Empennage Only)**

1. Level aircraft per § 18-10.
2. Refer to Figure 4-6. Position empennage assembly on tailcone aft bulkhead. Insert (2) NAS1304-28 bolts thru top mounting holes in A044-1 horizontal stabilizer.

> NOTE
>
> A large C-clamp and wooden blocks may be used between NAS1304 bolts to prevent empennage moving prior to drilling.

3. Place MT068-1 horizontal stabilizer rigging tool on top of horizontal stabilizer 3.25–3.75 inches from outboard edge of vertical stabilizer.
4. Place propeller protractor or bubble level atop MT068-1 forward flat surface if tailcone is A023-1 or -22 (Standard, HP, & Mariner helicopters), or aft flat surface if tailcone is A023-20 or -23 (Alpha & Beta helicopters).
5. Push forward or pull aft slightly on tail skid to adjust horizontal stabilizer angle of incidence until correct flat of MT068-1 tool is level with helicopter.
6. Place propeller protractor or bubble level along trailing edge of horizontal stabilizer. Push up or pull down slightly at outboard end of horizontal stabilizer as required to obtain $0^{o} \pm 0.5^{o}$ level laterally.
7. Verify angle of incidence performed in step 5. Adjust stabilizer per steps 5 & 6 as required.
8. Remove aft bolt from horizontal stabilizer top hole. Using existing hole as a drill guide, drill thru stabilizer's lower surface using 0.250 inch diameter drill bit. Temporarily secure stabilizer using NAS1304-28 bolt & D210-4 nut with washers in drilled hole.
9. Verify stabilizer angle of incidence and lateral level, adjust per steps 5 & 6 if required.
10. Remove forward bolt from horizontal stabilizer top hole. Using existing hole as a drill guide, drill thru stabilizer's lower surface using 0.250 inch diameter drill bit.
11. Remove aft bolt and C-clamp (if used), and remove empennage from tailcone. Deburr holes and install empennage per Part B.

4.510 Upper Vertical Stabilizer Assembly

**A. Removal**

1. Refer to Figure 4-5 or 4-5A. Remove fastener securing A554 clip to A042-1 upper vertical stabilizer assembly.
2. While supporting A042-1 vertical stabilizer, remove bolts securing vertical stabilizer to B902-1 (or -2) vertical stabilizers mount assembly or A044-1 horizontal stabilizer, as applicable, and remove A042-1 vertical stabilizer.

**B. Installation**

1. Refer to Figure 4-5 or 4-5A. Position A042-1 upper vertical stabilizer assembly on B902-1 (or -2) vertical stabilizers mount assembly or A044-1 horizontal stabilizer, as applicable. Verify 0.030–0.120 inch gap between vertical stabilizer skin edges and mount assembly (or horizontal stabilizer) upper skin. File vertical stabilizer skin edge(s) as required. Conversion coat & prime bare aluminum edges per §§ 23-51 & 23-60.
2. Install bolts securing vertical stabilizer to mount assembly (or horizontal stabilizer). Special torque bolts per § 23-33 and torque stripe per Figure 2-1.
3. If replacing vertical stabilizer, match drill A554 clip to stabilizer using 0.144 inch diameter drill. Deburr holes as required, install fastener and torque stripe per Figure 2-1.

4.520 Lower Vertical Stabilizer Assembly

**A. Removal**

1. Refer to Figure 4-5 or 4-5A. Remove fastener securing A554 clip to A043-1 vertical stabilizer.
2. While supporting A043-1 vertical stabilizer, remove bolts & spacers securing vertical stabilizer to B902-1 (or -2) vertical stabilizers mount assembly or A044-1 horizontal stabilizer, as applicable, and remove A043-1 vertical stabilizer.

**B. Installation**

1. Refer to Figure 4-5 or 4-5A. Position A043-1 lower vertical stabilizer assembly on B902-1 (or -2) vertical stabilizers mount assembly or A044-1 horizontal stabilizer, as applicable. Verify 0.030–0.120 inch gap between vertical stabilizer skin edges and mount assembly (or horizontal stabilizer) lower skin. File vertical stabilizer skin edge(s) as required. Conversion coat & prime bare aluminum edges per §§ 23-51 & 23-60.
2. Install bolts & spacers securing vertical stabilizer to mount assembly (or horizontal stabilizer). Special torque bolts per § 23-33 and torque stripe per Figure 2-1.
3. If replacing vertical stabilizer, match drill A554 clip to stabilizer using 0.144 inch diameter drill. Deburr holes as required, install fastener and torque stripe per Figure 2-1.

4.530 B902-1 or -2 Vertical Stabilizers Mount Assembly

**A. Removal**

1. Remove A042-1 & A043-1 vertical stabilizer assemblies per §§ 4.510 & 4.520.
2. Remove hardware securing MS21919WGD2 clamp to B902-1 (or -2) vertical stabilizers mount assembly. Cut and discard ty-raps securing position light and gearbox chip detector wires and connectors together. Disconnect position light at connectors.
3. While supporting mount assembly, remove hardware securing mount to A148 bulkhead and remove mount.

**B. Installation**

**CAUTION**

If tailcone has a B379-1 or -3 bracket then A958-1 bellcranks (original equipment on helicopter S/N 0357 and subsequent) must be installed or retrofitted. Figure 8-2A refers.

B902-1 or -2 vertical stabilizers mount assembly may only be installed on a tailcone that has a B379-1 or -3 bracket.

1. Refer to Figure 4-5. Position B902-1 (or -2) vertical stabilizers mount assembly on A148 bulkhead.
   a. **If A301-5 (empennage ballast; ref. § 18-32) weight will not be installed:** Install (2) NAS6604-28 bolts & associated hardware securing empennage to A148 bulkhead. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
   b. **If A301-5 (empennage ballast; ref. § 18-32) weight will be installed:** Install (2) NAS6604-44 bolts & associated hardware securing empennage to A148 bulkhead. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
2. Install A042-1 & A043-1 vertical stabilizer assemblies per §§ 4.510 & 4.520. If installing B902-2 mount assembly, match drill vertical stabilizers to A554-4 clips using 0.144 inch diameter drill. Deburr holes, install fasteners and torque stripe per Figure 2-1.
3. Connect position light at connectors. Install hardware securing clamp to mount assembly. Install MS3367-4-9 ty-raps as required to secure position light and gearbox chip detector wires and connectors together. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
4. Test and verify correct function of position and TR chip light circuits.

## 4.540 A044-1 Horizontal Stabilizer Assembly

### A. Removal

1. Remove A042-1 & A043-1 vertical stabilizer assemblies per §§ 4.510 & 4.520.
2. Remove hardware securing MS21919WGD2 clamp to A044-1 horizontal stabilizer assembly. Cut and discard ty-raps securing position light and gearbox chip detector wires and connectors together. Disconnect position light at connectors.
3. While supporting horizontal stabilizer, remove hardware securing stabilizer to A148 bulkhead and remove stabilizer.
4. If replacing horizontal stabilizer, A554-1 clips may be reused. Drill out two rivets securing each clip to stabilizer and retain clips.

### B. Installation

**CAUTION**

A044-1 horizontal stabilizer may not be installed on a tailcone that has a B379 bracket.

1. Refer to Figure 4-5A. Position A044-1 horizontal stabilizer assembly on A148 bulkhead.
   a. **If A301-5 (empennage ballast; ref. § 18-32) weight will not be installed:** Install (2) NAS6604-28 bolts & associated hardware securing empennage to A148 bulkhead. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
   b. **If A301-5 (empennage ballast; ref. § 18-32) weight will be installed:** Install (2) NAS6604-44 bolts & associated hardware securing empennage to A148 bulkhead. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
2. Install A042-1 & A043-1 vertical stabilizer assemblies per §§ 4.510 & 4.520.
3. Connect position light at connectors. Install hardware securing clamp to stabilizer. Install MS3367-4-9 ty-raps as required to secure position light and gearbox chip detector wires and connectors together. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
4. Test and verify correct function of position and TR chip light circuits.

4.540 A044-1 Horizontal Stabilizer Assembly (continued)

**C. Repair**

A single dent on A044-1 horizontal stabilizer leading edge outboard of vertical stabilizers is permitted provided:

1. Dent is no more than 0.050-inch deep.
2. Dent must have a smooth bottom, with minimum 0.125-inch radius, and no sharp nicks or cracks.
3. Dent must be less than 1.25 inches spanwise.
4. It is permissible to remove above dent via metalworking.

Skin replacement, damage to spars, and either forward or middle attachment for vertical stabilizers, is not field repairable.

To inspect spars, remove NAS1919B04S01 rivets securing B722-3 outboard rib. Only B722-3 outboard tip rib may be field replaced; all other parts require use of the factory jig.

**D. Replacement**

1. On a padded surface, install A042-1 & A043-1 vertical stabilizer assemblies on A044-1 horizontal stabilizer per §§ 4.510 & 4.520.
2. Refer to Figure 4-5A. Position A554-1 clips on horizontal stabilizer, install fastener securing each clip to upper or lower vertical stabilizer. With upper and lower vertical stabilizers in-line, match drill clips to horizontal stabilizer using #30 drill. Deburr holes and install rivets securing clips to horizontal stabilizer. Reinstall fasteners and torque stripe per Figure 2-1.
3. Perform empennage replacement per § 4.500 Part C.

4.600 Tail Skid

**A. Removal**

Remove hardware securing tail skid to A043-1 vertical stabilizer and remove skid.

**B. Installation**

Position tail skid in bottom of A043-1 vertical stabilizer. Install hardware securing skid. Standard torque bolts & palnuts per § 23-32 and torque stripe per Figure 2-1.

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# CHAPTER 8

# FLIGHT CONTROLS

## CHAPTER 8

## FLIGHT CONTROLS (Continued)

# CHAPTER 8

# FLIGHT CONTROLS

## 8.000 Description

Dual controls are standard equipment and all primary controls are actuated through push-pull tubes and bellcranks. Bearings used throughout the control system are either sealed ball bearings or have self-lubricated liners.

R22 Flight controls operate conventionally. The cyclic is center-mounted with the left and right control grips mounted to a cross tube which pivots on the center cyclic stick. On later aircraft, the pilot's cyclic grip angle can be adjusted fore and aft relative to the cross tube by a mechanic to achieve the most comfortable hand position.

The collective stick is also conventional with a twist grip throttle control. When the collective is raised, the throttle is opened by an interconnecting linkage. An electronic governor makes minor throttle adjustments required to maintain RPM. On later aircraft, a fixed (plastic) grip aft of the twist grip allows the pilot to rest their hand on the collective without inadvertently interfering with governor operation.

**WARNING**

**Assembly of flight controls is critical and requires inspection by a qualified person. If a second person is not available, RHC recommends the installer take a 5-minute break prior to inspecting flight control connections the installer has assembled.**

## 8.100 Cyclic Controls

### 8.110 Cyclic Assembly

**A. Removal**

1. Remove collective stick assembly per § 8.210.
2. If installed, remove C683 damper(s).
3. Remove screws securing mixture and carburetor heat control cable covers to cyclic box cover. If equipped with carb heat assist, unscrew carb heat knob from shaft.
4. Remove spring pin & knob from cyclic friction and right trim adjustment (if equipped); temporarily install spring pins to retain spacers. Unscrew & remove right trim actuation knob from shaft.
5. Remove screws securing cyclic box cover to cyclic box and vertical panels. Lift cyclic box cover and disconnect wiring at connectors. Temporarily secure cover up and clear of keel panels using ty-rap(s), as required.
6. Remove elastic cord per § 8.140.

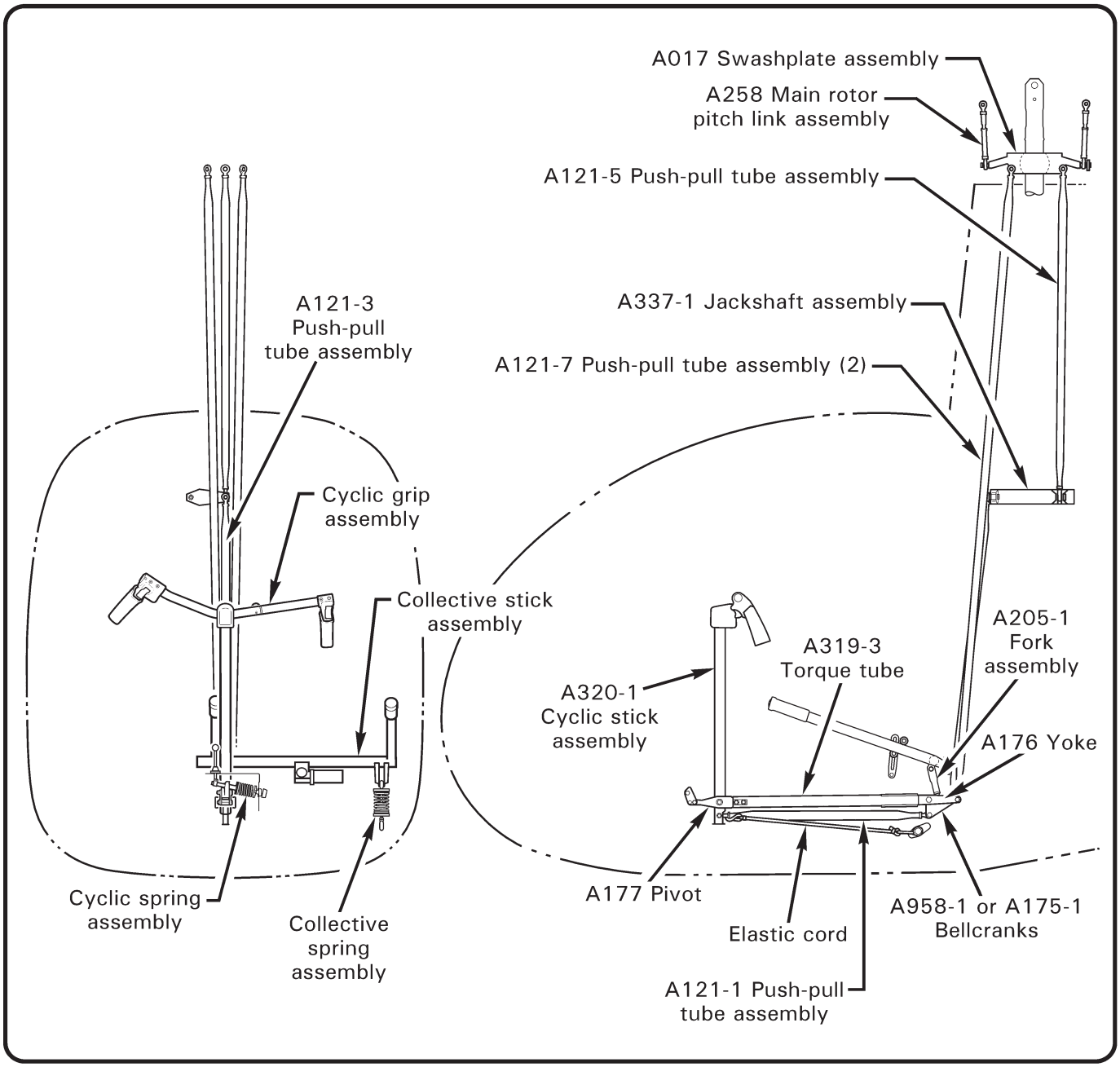


FIGURE 8-1 MAIN ROTOR FLIGHT CONTROLS

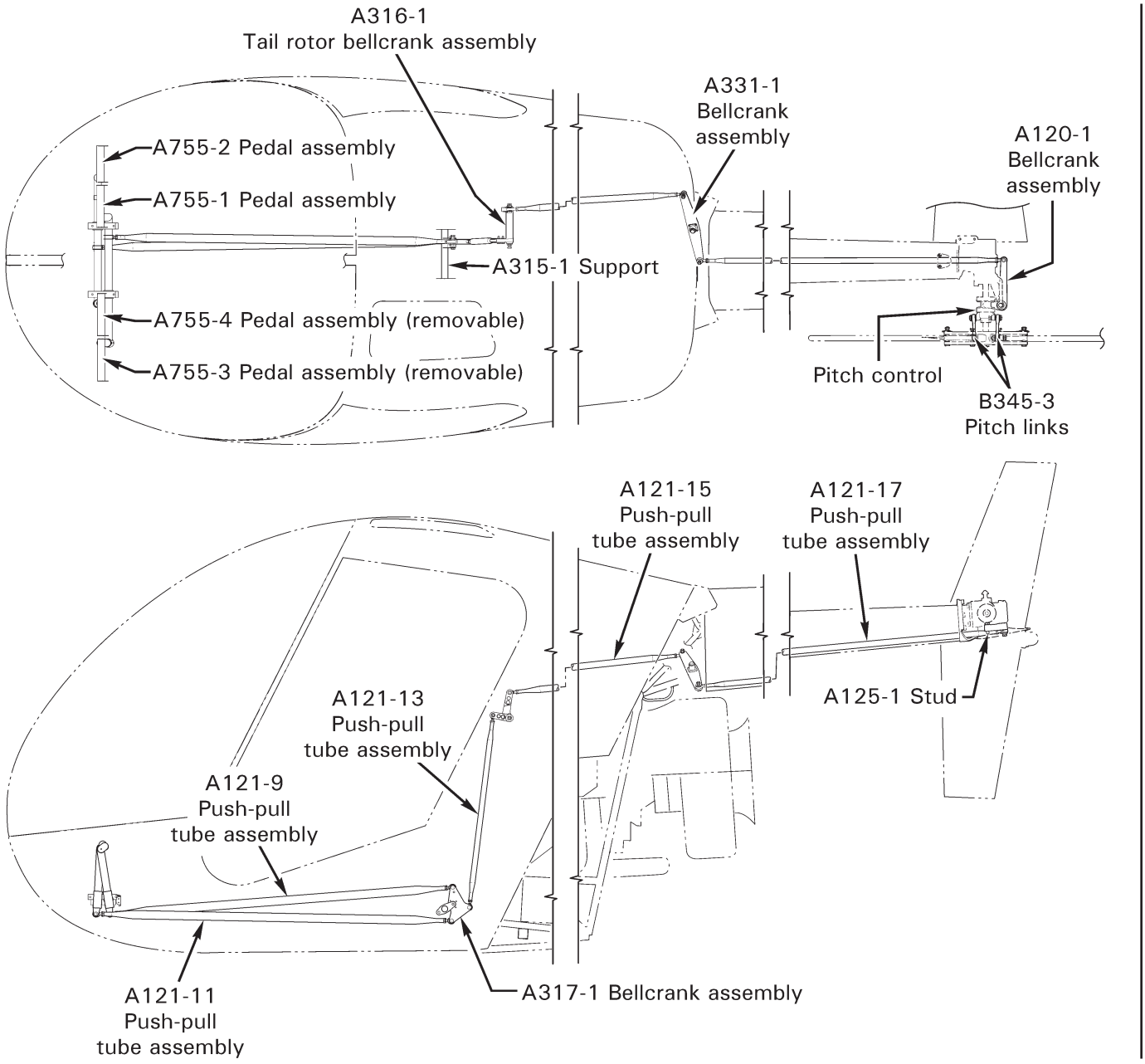


FIGURE 8-2 TAIL ROTOR FLIGHT CONTROLS

8.110 Cyclic Assembly (continued)

**A. Removal (continued)**

7. Position cyclic stick full forward. Remove bolt securing A121-3 push-pull tube to A958-1 (or A175-1) bellcranks.
8. Remove A231-9 plug assemblies from vertical firewall tunnel. Remove bolt securing left & right A121-7 push-pull tubes to cyclic pivot assembly.
9. Disconnect cyclic stick wiring at connectors.
10. Unscrew, but do not remove, bolts securing cyclic friction assembly to A500-1 plate (bolts will retain spacers between friction plates).
11. Remove screws securing cyclic box assembly to keel panels.
12. Move cyclic stick full right to relieve right trim spring compression and apply cyclic friction to hold friction assembly stackup in place. Pull cyclic box straight up from keel panels and remove cyclic assembly from helicopter.

**B. Installation**

**CAUTION**

Rigging must be checked if any of the following has occurred:

1. Replacement of cyclic assembly.
2. Replacement of A338-1 cyclic box or A320-1 cyclic stick.
3. Replacement or change of A205-1 fork assembly (connecting collective assembly to cyclic pivot assembly).
4. If A121-1, -3, -5, or -7 push-pull tube assembly rod end center-to-center dimension changes.
5. Jackshaft support length is changed.

NOTE

During cyclic installation, properly align cyclic friction stackup and apply friction to hold stackup in place.

1. Position cyclic assembly between keel panels. Ensure cyclic friction assembly and right-trim spring assembly are properly located.
2. Install screws securing cyclic box to keel panels except (4) screws that secure cyclic cover. Standard torque bolts securing cyclic friction assembly and torque stripe per Figure 2-1.
3. Assemble A121-7 push-pull tubes, A115-1 spacers, and A130-10 spacer to A176 yoke. Standard torque bolt & palnut per § 23-32 and torque stripe per Figure 2-1.
4. Position cyclic stick full forward. Assemble A121-3 push-pull tube and A115-1 spacers to A958-1 (or A175-1) bellcranks. Standard torque bolt per § 23-32 and torque stripe per Figure 2-1 (1 thread exposed minimum beyond nut is permissible).

8.110 Cyclic Assembly (continued)

**B. Installation (continued)**

5. Install elastic cord per § 8.140.
6. Attach cyclic stick electrical connector(s) to airframe harness. With cyclic friction off, move cyclic throughout full travel and verify wiring is clear of friction assembly.
7. Refer to Figure 8-3. If A205-1 fork was removed from A101-4 rod end, screw fork onto rod end between 3.50–3.60 inches from center of rod end hole to centerline of attach bolt hole. Standard torque jamnut per § 23-32 and torque stripe per Figure 2-1.

NOTE

Dimension of A205-1 fork should be 3.50–3.60 inches from center of rod end bearing to center of attaching bolt hole (no palnut required on this rod end). Verify autorotational RPM per § 10.250 if A205-1 fork dimension has changed.

8. Install collective stick per § 8.210 but do not install horizontal cover, vertical panel, or seat backs.
9. Cut and discard ty-rap(s) temporarily securing cyclic box cover. Connect post light wire & ELT connector as applicable and ty-rap clear of controls. Cinch ty-raps until snug without over-tightening and trim tips flush with heads.
10. Position cyclic box cover over keel panels, inserting right trim shaft, friction assembly shaft, fuel mixture control, and carb heat control through cover, as applicable. Install screws securing cover to keel panels.
11. Install knobs and control cover attach screws.
12. Move flight controls throughout complete travel. Verify 0.12 inch minimum clearance & no binding or interference with control movement, except the following:
    a. 0.030 inch minimum clearance permissible between A121-7 push-pull tubes and upper frame forward attach bolts & nearby surrounding cabin structure.
    b. Contact permissible between A121-3 & -7 push-pull tubes near lower ends when cyclic stick is positioned in aft corners of stop plate.
    c. Contact permissible between A121-1 push-pull tube and A327-1 overtravel spring when cyclic is positioned in forward right corner of stop plate.
    d. Contact permissible between A121-3 push-pull tube and B328-1 collective connecting rod when collective is positioned full up & cyclic is full aft.
13. Adjust friction assembly per § 8.150, as required.
14. Rig main rotor flight controls per §§ 10.110 & 10.120.
15. Install seat backs per § 15-22.
16. Install center horizontal cover & vertical panel.

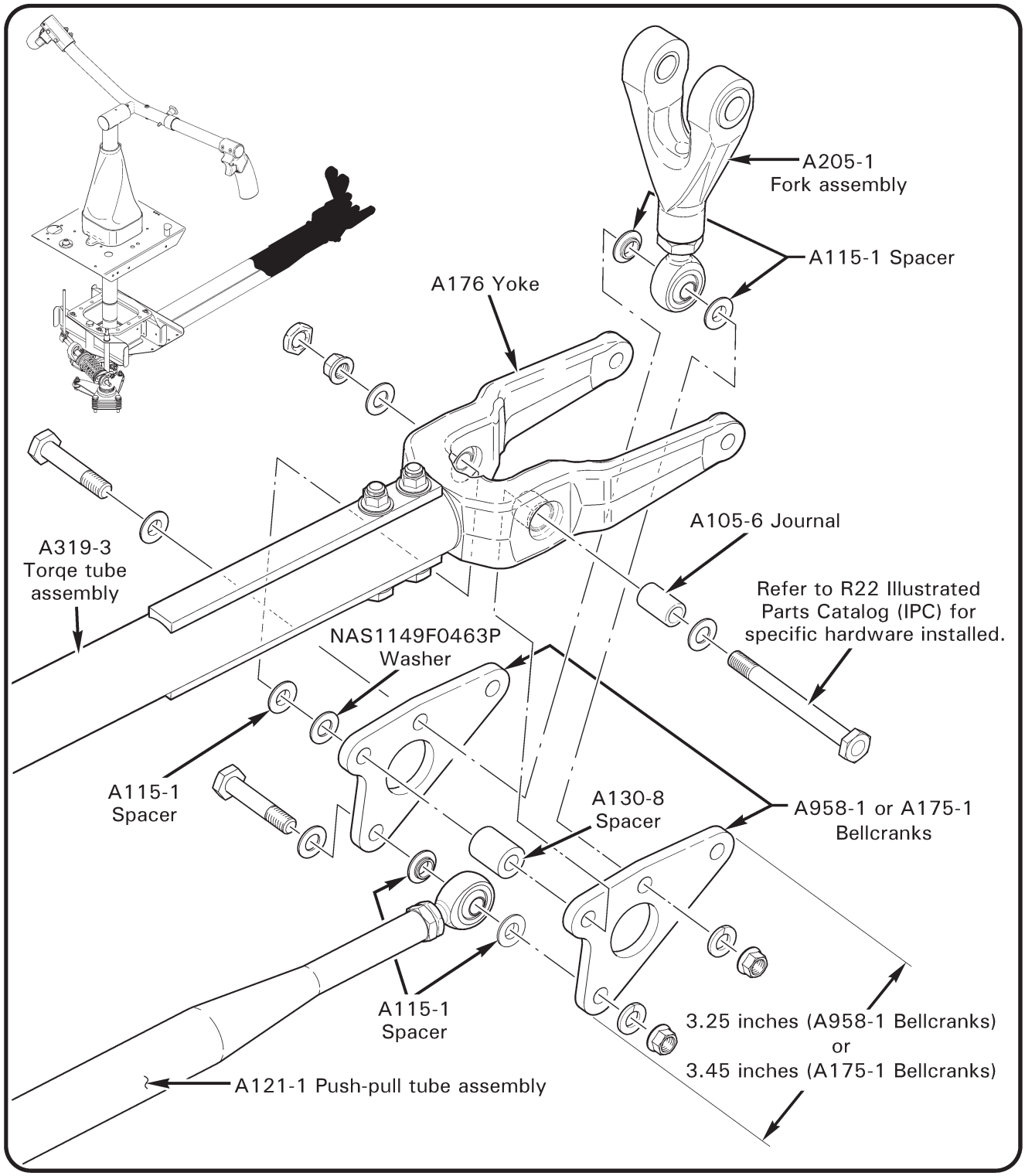


FIGURE 8-2A CYCLIC PIVOT ASSEMBLY AFT BELLCRANK

## 8.111 A958-1 or A175-1 Bellcranks

NOTE

A175-1 bellcranks are original equipment on helicopter S/N 0001 thru 0356 except S/N 0256, 0301, 0350, and 0351. A958-1 bellcranks are original equipment on helicopter S/N 0256, 0301, 0350, 0351, and 0357 and subsequent.

**CAUTION**

A958-1 bellcranks are required equipment if tailcone has B379-1 or -3 bracket installed.

### A. Removal

1. Remove cyclic assembly per § 8.110.
2. Refer to Figure 8-2A. Remove hardware securing A121-1 push-pull tube to A958-1 (or A175-1) bellcranks.
3. Remove hardware securing bellcranks to A176 yoke and remove bellcranks.
4. Remove hardware securing A205-1 fork assembly's rod end to bellcranks.
5. As required for upgrade, earlier A175-1 bellcranks may be directly replaced with A958-1 bellcranks per Part B.

### B. Installation

1. Refer to Figure 8-2A. Position A130-8 spacer between A958-1 (or A175-1) bellcranks and insert temporary bolt for alignment.
2. Install hardware securing A205-1 fork assembly's rod end and A121-1 push-pull tube to bellcranks. Standard torque bolts & palnuts per § 23-32 and torque stripe per Figure 2-1.
3. Remove temporary bolt and install hardware securing A958-1 (or A175-1) bellcranks and spacer in A176 yoke. Standard torque bolt & palnut per § 23-32 and torque stripe per Figure 2-1.
4. Install cyclic assembly per § 8.110, as required.
5. Perform main rotor rigging per § 10.120 and track and balance per § 10.230.

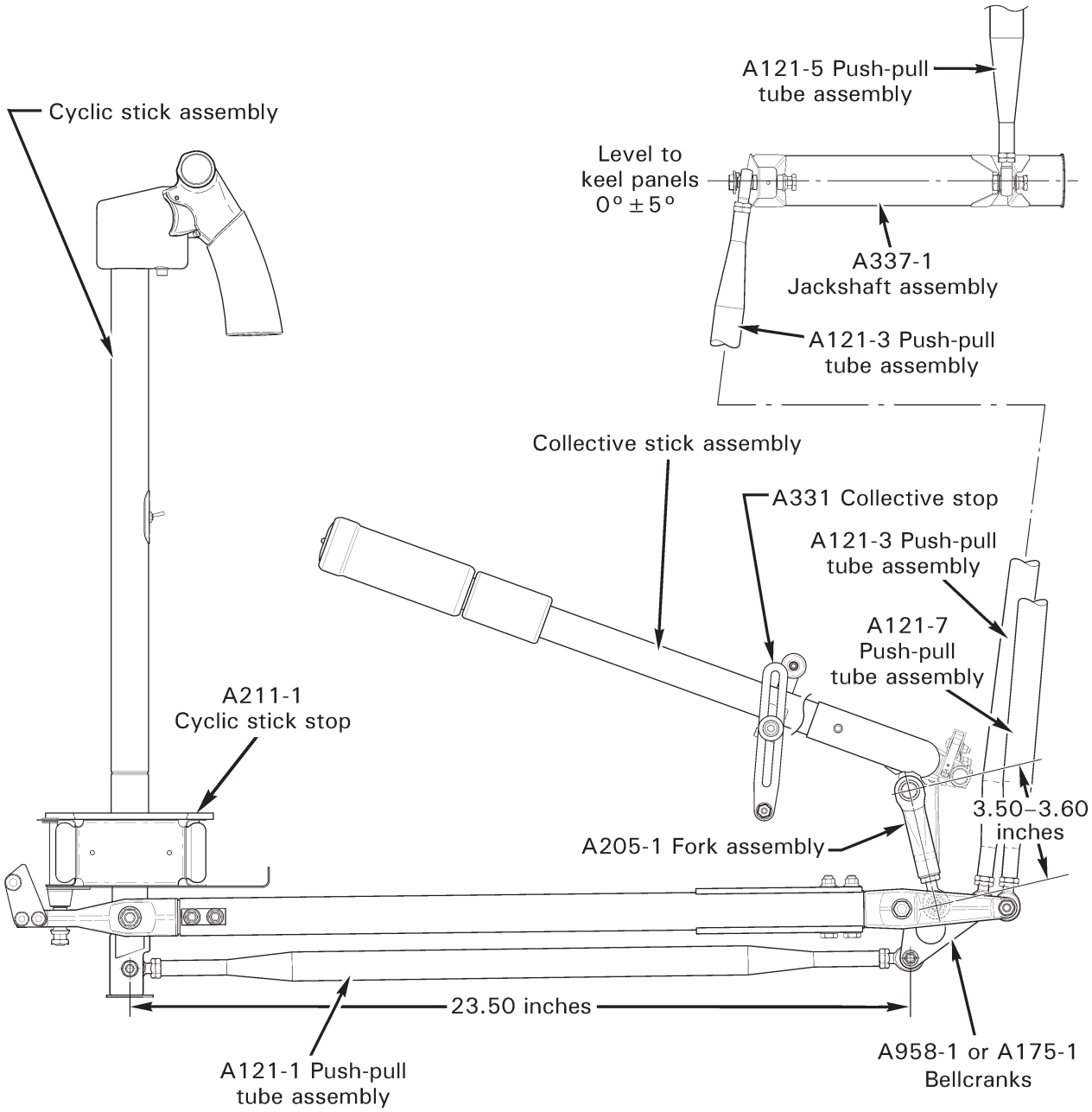


FIGURE 8-3 CYCLIC AND COLLECTIVE CONTROL

## 8.120 Cyclic Grip Assembly

### A. Removal

NOTE

This may be accomplished without removal of complete cyclic assembly from helicopter.

1. Remove bottom center inspection panel.
2. Disconnect cyclic stick electrical connectors. Using pin extractor, remove pins from housing(s), retain housing(s). Wires -112, -138, and -355 may remain installed.
3. Remove heat shrink & sleeving from wires. Attach one piece of safety wire or lace tape to each group of wires near pins.
4. Remove grommet from upper aft side of stick assembly and pull each wire group out of stick leaving safety wires or lace tapes protruding from each end of stick.

NOTE

Wires are separated into two groups of wires at bottom-right forward & aft side of cyclic stick.

5. Remove C683-9 damper assembly (if installed), B209-4 plug, cotter pin, castellated nut and A141-14 washer from cyclic grip pivot.
6. With a soft-faced hammer, gently tap cyclic grip shaft and remove cyclic grip assembly from A320-1 stick. Ensure bearings remain inside stick.

NOTE

Do not damage bearings during removal.

### B. Installation

1. Ensure B350-1 spring pin is installed in grip assembly. Ensure heat shrink, sleeving, and grommets (as applicable) are installed over grip assembly wiring.
2. Slide grip assembly thru bearings in stick assembly. Install A141-14 washer and castellated nut, tighten castellated nut until there is no axial movement of bearings and cyclic grip assembly. Install cotter pin.

**CAUTION**

Over-tightening nut will damage bearings.

3. Install B209-4 plug and C683-9 damper (as required).

8.120 Cyclic Grip Assembly (continued)

**B. Installation (continued)**

4. Separate wires into (2) groups. Attach lace tape or safety wire protruding from cyclic stick to each group of wires and pull wires thru cyclic stick. Install grommet in cyclic stick.

> NOTE
>
> One wire group will extend thru forward right side of cyclic stick; one wire group will extend thru aft right side of cyclic stick.

5. Install sleeving and heat shrink around all wires and slide heat shrink into cyclic stick as far as possible to prevent chafing of wires. Secure sleeving ends with lacing tape.
6. Refer to Figures 14-39A, 14-39B, and 14-39C for A024 electrical system schematic. Install wires in housing(s) per schematic.
7. Connect cyclic wiring at connectors and lock connectors using MS3367-4-9 ty-raps, as required. Cinch ty-raps until snug without over tightening and trim tips flush with heads. Move cyclic throughout complete travel and verify electrical wiring clearance & no binding.
8. Turn battery switch ON and verify correct function of all switches on cyclic grip and stick assemblies.
9. Install belly panel.

**C. Adjustment (D379-1 Grip)**

1. Loosen (2) 91251A194 (or NAS1352-08-8) cap screws securing pilot's grip to A756-18 weldment.
2. Rotate grip to desired position, special torque cap screws to 40 in.-lb.

> NOTE
>
> Verify full control travel prior to flight when changing grip angle.

## 8.130 Cyclic Spring (Right-Trim)

### A. Description

The function of the cyclic spring is to balance the left-stick force in cruise conditions. It is actuated by pulling up on the black knob located forward of the cyclic stick. The trim spring (two forces available) may be changed or shimmed to create the force necessary to balance the cyclic control laterally. This usually is required after a main rotor blade change.

### B. Removal

1. Remove screws securing mixture and carburetor heat control cable covers to cyclic box cover. If equipped with carb heat assist, unscrew carb heat knob from shaft.
2. Remove spring pin & knob from cyclic friction and right trim adjustment; temporarily install spring pins to retain spacers. Unscrew & remove right trim activation knob from shaft.
3. Remove screws securing cyclic box cover to cyclic box and keel panels. Lift cyclic box cover and disconnect wiring at connectors. Temporarily secure cover up and clear of keel panels using ty-rap(s), as required.
4. Remove right-trim assembly attach bolt. Firmly grasping spring assembly; tip cyclic stick right to relieve pressure from spring, pull spring up & right to remove assembly.

### C. Spring Replacement & Shimming

B056 Assemblies (in-flight adjustable)

> NOTE
>
> Changing trim spring will create a large change in trim forces. Shimming A618-1 spring (primer colored) may be required to obtain desired trim force.

1. Remove right-trim assembly per Part B.
2. Remove A584-1 bearing support and A130-46 spacer from A585-2 shaft. Unscrew A583-2 cap from shaft and remove A618 spring.
3. Adjust shims as required between A583-1 cap and A588-1 spacer. A618-1 spring (primer colored) may be shimmed a maximum thickness of (3) NAS1149F0463P washers. A618-2 spring (black colored) must not be shimmed.

> **CAUTION**
>
> Do not shim beyond allowable thickness. Trim spring may bottom preventing full left cyclic travel.

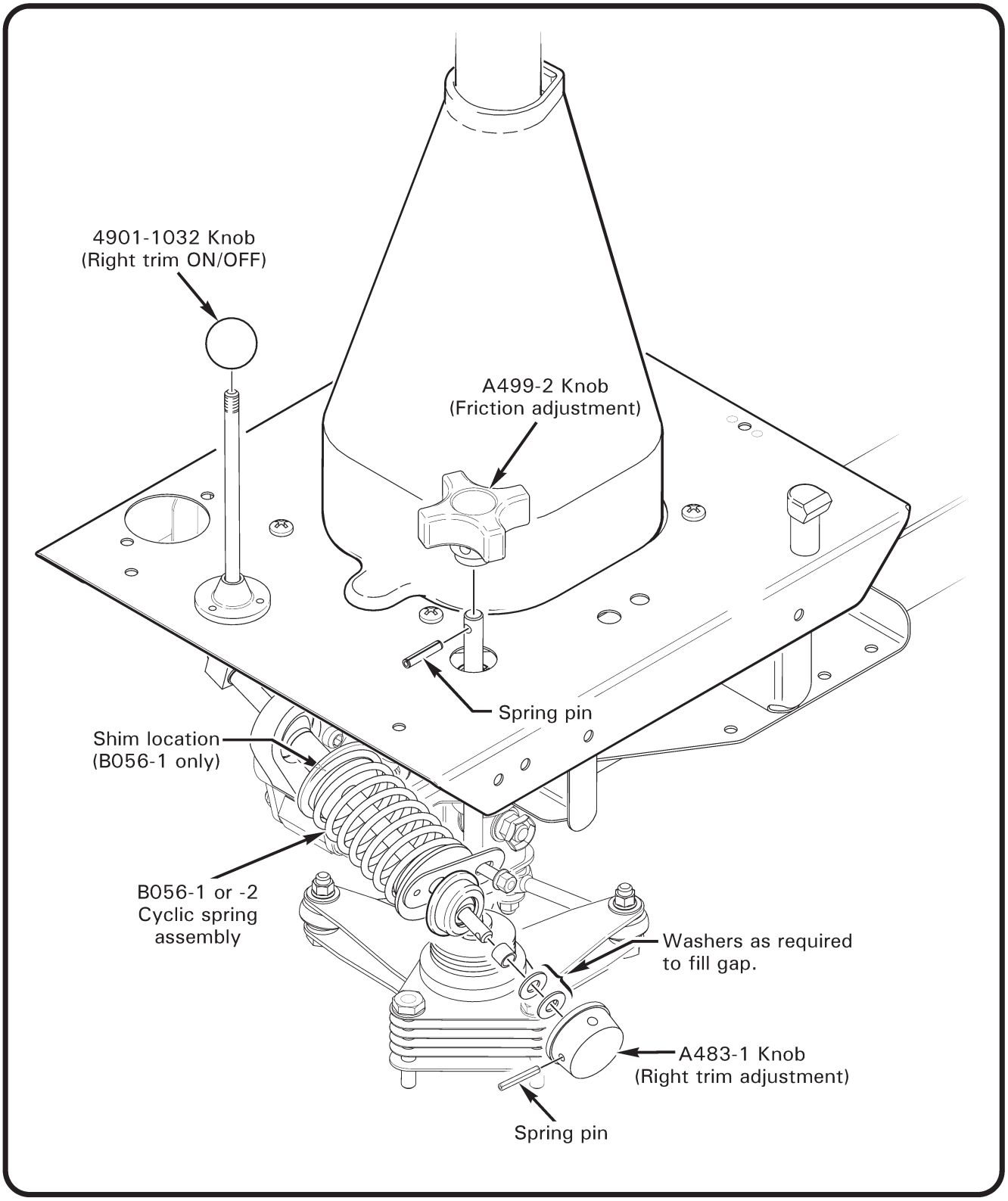


FIGURE 8-4 CYCLIC SPRING (RIGHT-TRIM)

8.130 Cyclic Spring (Right-Trim) (continued)

**C. Spring Replacement & Shimming (continued)**

B056 Assemblies (in-flight adjustable) (continued)

4. Install A618-1 (10.7 lb/in.) or A618-2 (14.5 lb/in.) spring to obtain desired trim force. Ensure light coat of A257-1 grease is applied to shaft at caps and A588-1 spacer. Thread A583-2 cap on shaft. Reinstall A130-46 spacer and A584-1 bearing support.
5. Install right-trim assembly per Part D.

A056 Assemblies (non-adjustable)

> NOTE
>
> If A056 cyclic spring assembly (originally installed on R22 helicopters S/N 0002 thru 0549) requires shimming, contact RHC Technical Support.

**D. Installation**

1. Move cyclic stick full right to minimize spring compression during installation. Insert bearing support flush into left vertical panel; ensure B160-1 pin is inserted through A594-1 tab, as required. Firmly grasp spring assembly and insert A581-1 arm in cyclic pivot assembly. Install hardware and standard torque per § 23-32.
2. For in-flight adjustable trim assemblies, install A483-1 knob and set to full trim. Verify spring does not limit full cyclic travel, or cause spring binding. Adjust shims as required per Part C.
3. Cut and discard ty-rap(s) temporarily securing cyclic box cover. Connect post light wire & ELT connector as applicable and ty-rap clear of controls. Cinch ty-raps until snug without over-tightening and trim tips flush with heads.
4. Position cyclic box cover over keel panels, inserting right trim shaft, friction assembly shaft, fuel mixture control, and carb heat control through cover, as applicable. Install screws securing cover to keel panels.
5. Install knobs and control cover attach screws.
6. Move flight controls throughout complete travel and verify no binding or interference with control movement. Adjust friction assembly per § 8.150, as required.

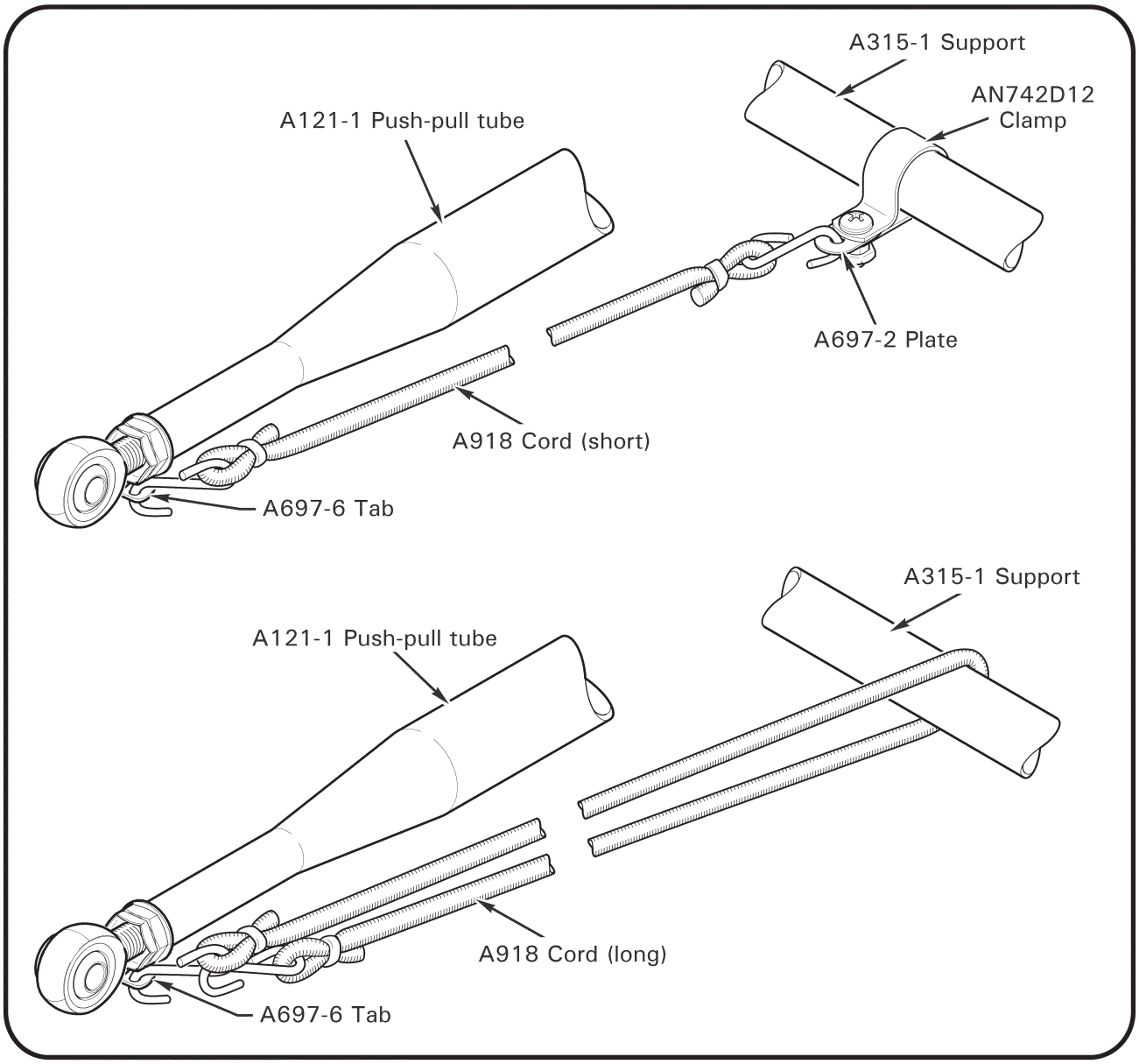


FIGURE 8-4A ELASTIC CORD (FORWARD-TRIM)

## 8.140 Elastic Cord (Forward-Trim)

### A. Description

The elastic cord is used to balance most longitudinal (fore-aft) stick forces during cruise flight. If the cyclic grip moves forward in cruise flight, a weaker elastic cord is required. If the cyclic stick grip moves aft in cruise flight, a stronger elastic cord is required. Elastic cords can be identified by an I.D. tag, or by measuring the diameter and length of the cord. Refer to R22 Illustrated Parts Catalog (IPC) for available elastic cords. Test fly helicopter after elastic cord change to evaluate trim forces in level cruise flight, repeat until desired trim forces are obtained.

### B. Removal

1. Remove A794-2 center belly panel. If transponder antenna installed in panel, pull XPDR (refer to electrical schematic) circuit breaker and disconnect antenna.
2. Position cyclic stick full forward.
3. a. Refer to Figure 8-4A. Unhook short elastic cord from forward end of A121-1 push-pull tube then unhook at A315-1 support and remove elastic cord, or

   b. Separate long elastic cord hooks from each other, then unhook from forward end of A121-1 push-pull tube and remove long elastic cord.
4. Inspect elastic cord. Stretch cord, while stretched look for voids which may indicate broken strands. Slide hooks back and verify security of locking rings.

### C. Installation

> NOTE
>
> Select A918-1 thru -13 elastic cord as determined by flight test evaluation.

1. As required for short elastic cord installation, install hardware securing A697-2 plate and AN742D12 clamp to A315-1 support.
2. Position cyclic stick full forward.
3. a. Refer to Figure 8-4A. Attach short elastic cord to A697-2 plate then attach elastic cord to A697-6 tab at forward end of A121-1 push-pull tube, or

   b. Attach long elastic cord to A697-6 tab at forward end of A121-1 push-pull tube then route over A315-1 support and attach hooks together.
4. Move cyclic throughout full travel and verify clearance of elastic cord hooks to push-pull tube, wire bundle, and cyclic stick assembly wires.
5. Connect transponder antenna (as required) and install belly panel. Push in XPDR (refer to electrical schematic) circuit breaker.

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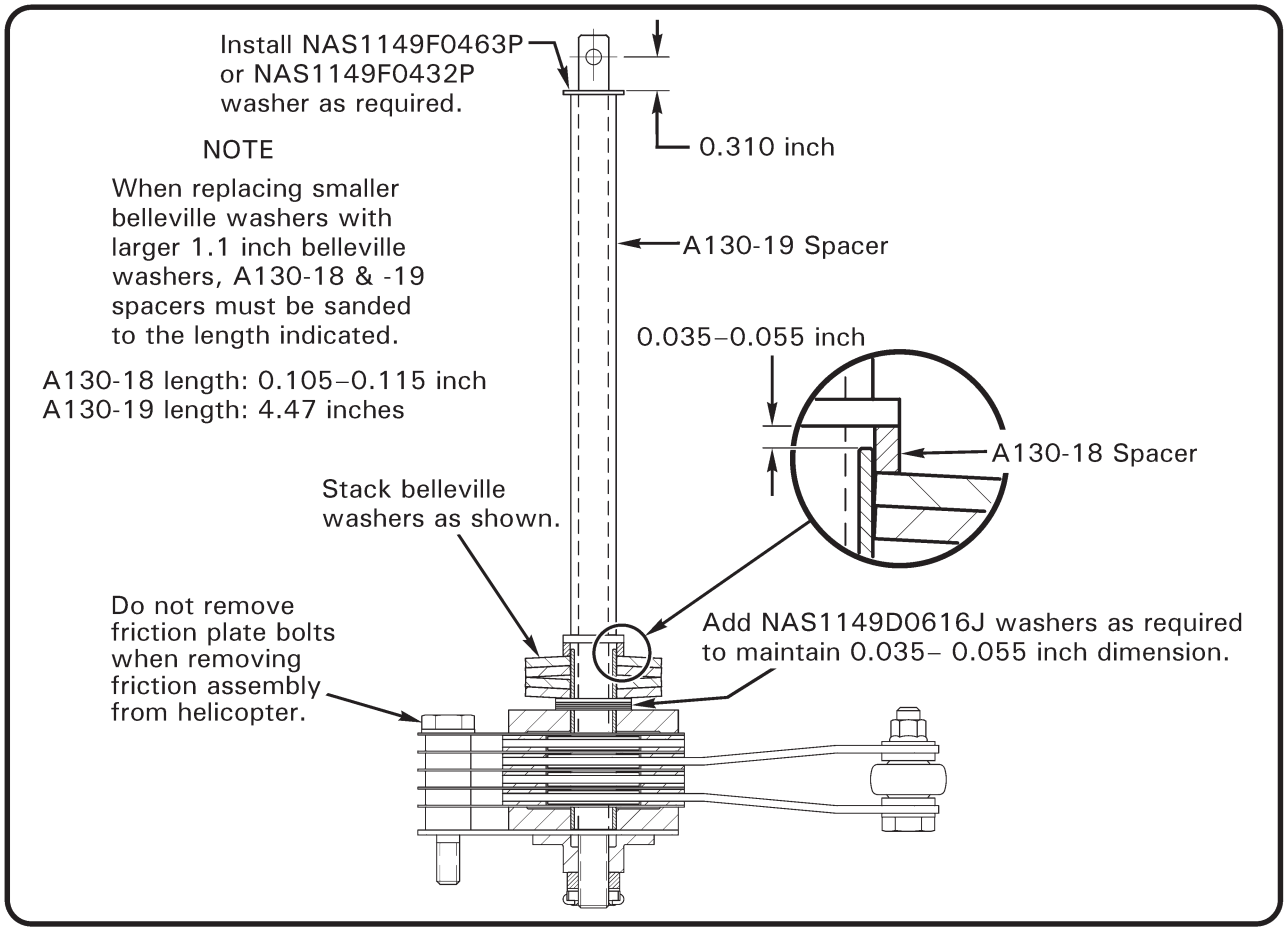


FIGURE 8-4B CYCLIC FRICTION ADJUSTMENT

## 8.150 Cyclic Friction Assembly

### A. Description

Cyclic Friction knob is located at front left corner of cyclic box cover. Turning knob clockwise applies friction to both longitudinal and lateral cyclic. If friction cannot be applied by turning knob clockwise, adjustment of friction may be required.

### B. Adjustment

1. Turn friction knob counter-clockwise until it stops. Verify knob rotates $^1/_8$ to 1 full turn before adding friction.
2. Remove elastic cord per § 8.140.
3. Rotate blades until pitch links are in right & left position to eliminate pitch link movement when measuring longitudinal cyclic friction.
4. Select right trim off. Using spring scale measure force required to move cyclic stick forward & aft. Average force required must not exceed 3 lb.
5. Rotate blades until pitch links are in forward & aft position to eliminate pitch link movement when measuring lateral cyclic friction.
6. Using spring scale measure force required to move cyclic stick left & right. Average force required must not exceed 2 lb.
7. Apply full cyclic friction and measure force required to move cyclic stick left & right. Force required must not exceed 10 lb.
8. Refer to Figure 8-4B. To adjust friction remove spring pin from friction knob and lift knob off shaft. Install NAS1149F0463P or NAS1149F0432P washer as required. Install friction knob & spring pin. Verify proper friction per preceding steps.

> NOTE
>
> If friction assembly will not tighten and does not have larger (1.1 inch) belleville washers installed (4 ea.), replace with A478-1 spring washer and change length of spacers per Figure 8-4A. Replace circular knob with A499-2, as required.

9. Move flight controls throughout complete travel. Verify operating clearance with no binding.
10. Install elastic cord per § 8.140.

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## 8.200 Collective Control

### 8.210 Collective Stick Assembly

**A. Removal**

1. Remove seat backs per § 15-22.
2. Remove center cover & vertical panel (cyclic control inspection panels).
3. Remove screws securing collective spring cover and remove cover. If spring cover aft mounting hole is slotted, screw may be loosened and left installed in vertical firewall stiffener.
4. Place collective in full down position. Install MT294-1 collective spring retainer or use 0.032 inch diameter safety wire to secure collective spring in compressed state. If safety wire is used, twist wire around rod end to rod end several times to ensure spring assembly can be removed safely.

> **WARNING**
>
> **Spring is under compression and failure to comply with above procedure can cause bodily harm and/or damage to helicopter.**

5. Remove spring lower attach bolt slowly while moving collective slightly to transfer spring compression onto restraining safety wire or MT294-1. When bolt is removed, position spring assembly forward for more clearance during removal.
6. Remove hardware securing A333-1 collective stop to A348-1 seat belt anchor, retain all hardware.

> NOTE
>
> To prevent damage, rotate collective stop slider in line with collective handle and tape in place.

7. Remove bolt and associated hardware securing A205-1 fork to collective stick.
8. Remove A486-4 (or -1) screw securing A327-1 overtravel spring to C341-3 (or C342-1) throttle arm.
9. If installed, disconnect aft end of carb heat assist push-pull tube from collective stick.
10. Cut and discard ty-raps securing electrical wiring and disconnect collective stick assembly wiring from main harness.
11. Remove (2) attach bolts and associated hardware securing collective stick and remove collective stick assembly from helicopter.

8.210 Collective Stick Assembly (continued)

**B. Installation**

1. If removed, assemble A332-2 (or-1) friction lever onto collective stick per § 8.230. Tape A333-1 collective stop in line with stick to prevent damage during installation.
2. Refer to Figure 8-3. If A205-1 fork was removed from A101-4 rod end, screw fork onto rod end between 3.50–3.60 inches from center of rod end hole to centerline of attach bolt hole. Standard torque jamnut per § 23-32 and torque stripe per Figure 2-1.

NOTE

Dimension of A205-1 fork should be 3.50–3.60 inches from center of rod end bearing to center of attaching bolt hole (no palnut required on this rod end). Verify autorotational RPM per § 10.250 if A205-1 fork dimension has changed.

NOTE

Replace A139-1 bearings in A205-1 fork per § 8.600 if bearings are damaged or worn.

3. Position collective stick in helicopter and install hardware, ensure smaller diameter of A115-1 spacer installed against A329-1 bearing block assembly. Standard torque per § 23-32 and torque stripe per Figure 2-1.
4. Install hardware securing A205-1 fork to collective stick, standard torque per § 23-32 and torque stripe per Figure 2-1. Verify smooth operation of fork pivot.
5. Assemble hardware securing lower end of A333-1 collective stop to A348-1 seat belt anchor using combination of NAS1149F0432P or NAS1149F0463P washers (as required) on A130-4 spacer to align stop and collective with 0.001 to 0.035 inch axial play. Standard torque hardware per § 23-32 and torque stripe per Figure 2-1. Verify correct axial play and no binding.
6. Raise or lower collective to align collective spring lower rod end in A476-1 support assembly and install hardware. Standard torque bolt per § 23-32 and torque stripe per Figure 2-1.
7. Lower collective stick to relieve spring tension from MT294-1 or safety wire, remove tool or cut and discard safety wire. Verify smooth operation and spring does not bind with collective full down.

**WARNING**

**Failure to remove restraining safety wire after collective spring is installed can limit control travel creating a safety-of-flight hazard.**

8.210 Collective Stick Assembly (continued)

**B. Installation (continued)**

8. Install collective spring guard.

9. Install hardware securing A327-1 overtravel spring upper rod end to throttle arm weldment. Ensure smaller diameter of A341-1 spacer is against rod end. Standard torque per § 23-32 and torque stripe per Figure 2-1.

NOTE

Use A486-1 screw for installation with C342-1 throttle arm. Use A486-4 screw for installation with C341-3 throttle arm. Screw head and smaller diameter of A341-1 spacer must be installed against rod end.

**WARNING**

**Improper installation can cause binding, rod end damage or rod end separation with subsequent loss of engine throttle control**

10. If installed, connect aft end of carb heat assist push-pull tube to flat side of collective arm. Standard torque per § 23-32 and torque stripe per Figure 2-1.

11. Attach collective stick assembly electrical connectors and ty-rap connectors to harness. Cinch ty-raps until snug without over-tightening and trim tips flush with heads.

12. Adjust throttle correlation rigging per § 10.150.

13. Install seat backs per § 15-22.

14. Install center cover & vertical panel (cyclic control inspection panels).

15. Verify autorotational RPM per § 10.250 if A205-1 fork assembly center-to-center dimension has changed.

16. Adjust collective spring per § 8.220 Part D, as determined by test flight.

## 8.220 Collective Spring Assembly

### A. Description

The collective spring assembly is installed to balance in-flight main rotor collective control forces. A038-1 thru -7 spring assemblies may be adjusted and A429 springs may be changed to obtain desired collective control forces in Part D. Test fly helicopter after collective spring adjustment to evaluate collective control forces in level cruise flight, repeat until desired forces are obtained.

**WARNING**

**Exercise extreme care when working with compressed collective springs. Always relieve spring compression slowly.**

NOTE

A038-5 spring assembly replaces A038-2 assembly. A038-6 assembly replaces A038-1, -3, & -4 assemblies.

| Assembly P/N | Spring P/N | Spring Color | Spring Constant |
|---|---|---|---|
| A038-1 | A429-1 (old) | Silver | 89 lb/in. |
| A038-2 | A429-2 (old) | Primer | 35 lb/in. |
| A038-3 or -5 | A429-3 | Grey | 50 lb/in. (weak) |
| A038-4 | A429-4 (old) | Black | 70 lb/in. |
| A038-6 | A429-5 | Gold | 50 lb/in. (standard) |
| A038-7 | A429-8 | White | 71 lb/in. (strongest) |

### B. Removal

1. Remove left seat back per § 15-22.
2. Remove screws securing collective spring cover and remove cover. If spring cover aft mounting hole is slotted, screw may be loosened and left installed in vertical firewall stiffener.
3. Place collective in full down position. Install MT294-1 collective spring retainer or use 0.032 inch diameter safety wire to secure spring in compressed state. If safety wire is used, twist wire around rod end to rod end several times to ensure spring assembly can be removed safely.

**WARNING**

**Spring is under compression and failure to comply with above procedure can cause bodily harm and/ or damage to helicopter.**

4. Remove spring lower attach bolt slowly while moving collective slightly to transfer spring compression onto restraining safety wire or MT294-1 collective spring retainer.
5. Remove spring assembly upper attach bolt and remove spring assembly.

8.220 Collective Spring Assembly (continued)

**C. Installation**

NOTE

Spring assembly must be compressed for installation to between 4.30 and 4.00 inches from center-to-center of rod ends. Orient assembly with nut end of rod guides pointing up.

**WARNING**

**When installing the A038-5, -6, or -7 spring assembly, both rod ends must be bottomed (B292-3 rod end has left-hand thread). Failure to bottom both rod ends can cause either one to run out of threads during adjustment and can cause bodily harm.**

1. Position collective spring assembly upper rod end in collective arm and install hardware. Standard torque hardware per § 23-32.
2. Raise or lower collective to align collective spring lower rod end in A476-1 support assembly and install hardware. Standard torque hardware per § 23-32.
3. Lower collective stick to relieve spring compression from MT294-1 collective spring retainer or safety wire, remove tool or cut and discard safety wire.
4. Verify smooth operation & spring does not bind with collective full down.

**WARNING**

**Failure to remove restraining safety wire after collective spring installation can limit collective control travel creating a safety-of-flight hazard.**

5. Install collective spring guard.
6. Install left seat back per § 15-22.

8.220 Collective Spring Assembly (continued)

**D. Adjustment**

**WARNING**

**Ensure that spring coils are not binding with collective stick full down after making adjustment. Binding spring coils can limit flight control travel.**

A038-1 thru -4 Spring Assemblies

1. Remove left seat back per § 15-22, as required. Remove collective spring guard.
2. Place collective in full down position. Install MT294-1 collective spring retainer or use 0.032 inch diameter safety wire to secure collective spring in compressed state. If safety wire is used, twist wire around rod end to rod end several times to ensure spring assembly can be removed safely.
3. Remove spring lower attach bolt slowly while moving collective slightly to transfer spring compression onto restraining safety wire or MT294-1 collective spring retainer.
4. Loosen palnut and jamnut on lower rod end. Screw rod end into A426-4 cap to decrease collective-up force; extend rod end to increase collective-up force. Maximum extension for bottom rod end is 1.1 inches from cap to rod end center, provided spring does not bind.
5. Standard torque jamnut and palnut per § 23-32.
6. Raise or lower collective to align collective spring lower rod end in A476-1 support assembly and install hardware. Standard torque hardware per § 23-32.
7. Lower collective stick to relieve spring compression from MT294-1 collective spring retainer or safety wire, remove tool or cut and discard safety wire.
8. Verify smooth operation & spring does not bind with collective full down.
9. Install collective spring guard.
10. Install left seat back per § 15-22, as required
11. Evaluate collective trim forces per Part A. Adjust or replace spring as required.

A038-5, -6, or -7 Spring Assemblies

1. Remove collective spring guard.
2. Loosen palnut and jamnut on lower rod end.
3. With collective up, rotate spring by hand to screw rod ends in or out of caps (lower rod end is right-hand thread; upper rod end is left-hand thread). Screwing rod ends into caps decreases collective-up force; extending rod ends increases collective-up force.

8.220 Collective Spring Assembly (continued)

**D. Adjustment (continued)**

A038-5, -6, or -7 Spring Assemblies (continued)

4. Standard torque jamnut and palnut per § 23-32.
5. Install collective spring guard.
6. Evaluate collective trim forces per Part A. Adjust or replace spring as required.

**E. A429 Spring Replacement**

1. Remove collective spring per Part B.
2. Position spring assembly in a soft-jawed vise to compress spring, ensure rod ends will not slip during disassembly. Compress spring assembly slightly to relieve spring compression from MT294-1 collective spring retainer or safety wire, remove tool or cut safety wire and discard.
3. Carefully open vise to decompress spring and remove assembly from vice. Remove spring from assembly.
4. Inspect A428-1 guide rods for scratches or nicks; if damage found, replace rods. Apply light coat of A257-1 grease to guide rods, as required.

> NOTE
>
> If replacing B292-3 or A127-3 rod ends, apply light coat of A257-1 grease to threads.

5. Refer to table in Part A. Assemble collective spring using spring required to obtain desired collective control forces as determined by test flight.
6. Place collective spring assembly in a soft-jawed vise, ensure rod ends will not slip during spring compression. While guiding A428-1 rods into A426-4 or -6 cap, slowly compress spring assembly to between 4.30 and 4.00 inches from center-to-center of rod ends. Install MT294-1 collective spring retainer or secure spring assembly in a compressed state using 0.032 inch diameter safety wire. If safety wire is used, twist wire around rod end to rod end several times. Open vise slowly and remove spring assembly.
7. Reinstall collective spring assembly per Part C.

## 8.230 Collective Friction Assembly

### A. Removal

1. Remove center horizontal cover (cyclic control inspection panel).
2. Remove hardware securing A333-1 stop to A348-1 anchor, retain hardware.
3. Loosen NAS1352-08LE8P (or -08-12P) screw in A332-2 (or -1) lever. Remove NAS1352-4-24P screw from lever and collective stick, retain washers.

### B. Installation

1. Place (2) A478-2 (or B0500-022-S) washers on NAS1352-4-24P screw with concave side of washers facing each other.
2. Insert NAS1352-4-24P screw through (1) A141-20 washer, A333-1 stop (slotted hole), then second A141-20 washer, ensure gray Teflon®-coated surface of A141-20 washers are against A333-1 stop.
3. Thread NAS1352-4-24P screw into collective stick, as screw exits collective, thread screw into A332-2 (or -1) lever. Snug screw finger tight.
4. Assemble hardware securing lower end of A333-1 stop to A348-1 seat belt anchor using combination of NAS1149F0432P or NAS1149F0463P washers (as required) on A130-4 spacer to align stop and collective with 0.001 to 0.035 inch axial play. Standard torque hardware per § 23-32 and torque stripe per Figure 2-1. Verify correct axial play and no binding.
5. Set collective friction per Part C.
6. Install center horizontal cover (cyclic control inspection panel).

### C. Adjustment

1. As required, loosen NAS1352-08LE8P (or -08-12P) screw in A332-2 (or -1) lever. Rotate friction lever aft to friction locked position.
2. Tighten NAS1352-4-24P screw to increase friction, or loosen screw to decrease friction as required to produce 12 to 20 pounds resistance measured at collective grip, using a spring scale pulling up from bottom of travel.
3. Tighten NAS1352-08LE8P (or -08-12P) screw. Verify 12 to 20 pounds of force required to raise collective measured at grip with friction locked; verify 6-10 pounds of force to raise collective with friction unlocked. Repeat steps 1 and 2 as required.

**WARNING**

**Collective friction greater than 20 pounds may prevent aircraft from entering autorotation.**

## 8.240 RPM Governor System

### A. Description

The governor maintains engine RPM by sensing changes and applying corrective throttle inputs through a friction clutch which can be easily overridden by the pilot. The governor is active only above 80% engine RPM and can be switched on or off using the toggle switch on the end of the right seat collective.

The governor is designed to assist in controlling RPM under normal conditions. It may not prevent over- or under-speed conditions generated by aggressive flight maneuvers.

**CAUTION**

When operating at high density altitudes, governor response rate may be too slow to prevent overspeed during gusts, pull-ups, or when lowering collective.

### B. Governor Controller Removal

Refer to § 33-137 for D270-1 Governor Controller and Engine Monitoring Unit (EMU) description. Refer to the EMU Technician's Guide and EMU User Guide online at https://robinsonheli.com for data access.

**WARNING**

**No external adjustment of controller is available. If controller fails to operate correctly, remove and return it to RHC.**

1. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
2. Remove right seat back assembly to access D270-1 governor controller, or left seat back assembly to access B286-2 governor controller per § 15-22.
   a. D270-1 Governor controller: Loosen screws and disconnect airframe harness connector from governor controller; disconnect 1598-01C cable from governor controller. Cut and discard ty-raps as required and disconnect MAP line from governor controller.
   b. B286-2 Governor controller: Disconnect airframe harness connector from B286-2 governor controller.
3. Remove hardware securing governor controller to right side bulkhead (D270-1 governor controller) or left seat back assembly (B286-2 governor controller) and remove governor controller.

8.240 RPM Governor System (continued)

**C. Governor Controller Installation**

1. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
2. Install hardware securing governor controller to right side bulkhead (D270-1 governor controller) or left seat back assembly (B286-2 governor controller). Verify security.
   a. D270-1 Governor controller: Connect airframe harness connector to governor controller and tighten screws; connect 1598-01C cable to governor controller. Connect MAP line to governor controller and install ty-raps. Cinch ty-raps until snug without over-tightening and trim tips flush with heads.
   b. B286-2 Governor controller: Connect airframe harness connector to B286-2 governor controller.
4. Push in GOV (2 amp) circuit breaker on circuit breaker panel.
5. Install seat back assembly per § 15-22.

**D. Governor Assembly Removal**

1. Remove collective stick per § 8.210.
2. Remove three screws securing governor assembly to collective stick.
3. Remove NAS6603-7 bolt securing governor assembly output arm to A498-1 rod end.

**WARNING**

**Adjustment of the friction clutch is NOT permitted. Field replacement of the gearmotor is NOT permitted. If friction setting is incorrect, or gearmotor operates incorrectly, remove governor assembly from collective stick and return to RHC.**

**E. Governor Assembly Installation**

1. Install hardware securing governor assembly output arm to A498-1 rod end, ensure bolt head is aligned to clear washers on arm. Standard torque bolt and palnut per § 23-32 and torque stripe per Figure 2-1.

NOTE

Link assembly length must be 2.47-2.53 inches from rod end center-to-center.

8.240 RPM Governor System (continued)

**E. Governor Assembly Installation (continued)**

2. Ensure governor assembly output arm points up toward B328-1 connecting rod. Install NAS1351-4-28P screw, (2) NAS1352N08-4 screws, and associated hardware securing governor assembly to collective stick. Standard torque screws per § 23-32.

   a. If installing (2) AN503-8-4 screws; torque to 27 in.-lb and safety wire with 0.020 inch diameter safety wire.

3. Rotate throttle grips, verify smooth operation and no interference.

4. Install collective stick per § 8.210.

**F. Governor System Troubleshooting**

The majority of governor problems are caused by the engine's right (helicopter left side) magneto tachometer contact assembly (points) being out of adjustment or faulty. Refer to TCM Master Service Manual for tachometer contact assembly installation and adjustment.

When operating in the 80% – 115% active range, the R22 governor will attempt to maintain engine rpm at 104% ± 1.5% (102.5% – 105.5%). The edges of this governed 3%-rpm wide window, called a "deadband", may be detected as follows:

1. With an appropriately rated person at controls, start engine and run-up helicopter per R22 Pilot's Operating Handbook (POH) Section 4. Collective must remain fully down during this and following steps.

2. Gently hold throttle and very slowly increase rpm (do not exceed 107%). Note and record engine rpm indication when governor input (subtle throttle resistance) is encountered.

3. Gently hold throttle and very slowly decrease rpm (do not go below 97%). Note and record engine rpm indication when governor input (subtle throttle resistance) is encountered.

4. After shutdown, subtract Step 3 indication from Step 2 indication. Result should be approximately 3%.

A result of 3% but centered beyond 104% ± 0.5% is indicative of a governor controller problem.

Results greater than 3% but still centered on 104% are usually indicative of excessive throttle linkage friction or insufficient governor friction.

8.240 RPM Governor System (continued)

**F. Governor System Troubleshooting (continued)**

Check throttle friction by disconnecting overtravel spring assembly upper rod end from C342 arm and attaching a spring scale to the rod end. With carburetor throttle arm in idle position, slowly pull up overtravel spring assembly with spring scale and note maximum 4 pounds moving friction prior to full-open throttle at carburetor. Excessive throttle linkage friction can be caused by binding rod ends, control interference, carburetor throttle shaft bushing elongation, or binding carburetor accelerator pump (typically binds in one direction only).

Check governor friction with collective down, collective friction on, overtravel spring assembly upper rod end disconnected from C342 arm, and C342 arm positioned horizontally. Attach a spring scale to hole in C342 arm and, with scale held tangential to arm, slowly pull on scale and note both the breakaway and the moving frictions. Breakaway friction is typically 0 – 0.5 pound greater than moving friction. Breakaway friction 1 pound or greater than moving friction may indicate damaged or contaminated governor friction clutch. Moving friction must be minimum 8 pounds until arm stops moving. Insufficient moving friction can be caused by wear, contamination, or loss of spring rate.

Proper governor operation requires a minimum 2:1 ratio of governor friction-to-throttle linkage friction.

Erratic operation is usually indicative of tachometer contact assembly problems or wiring damage. Wiring damage may be evidenced by crushing, pinching, or abrasion, all of which can result in grounding of one or both center wire conductor(s) to the shielding or to structure. Tachometer contact assembly problems may be caused by contamination, oxidation, or loose contact(s), in addition to installation or assembly errors.

Contamination can be caused by over-lubrication of cam follower felt, engine oil leaking past oil seal, or moisture intrusion thru vent plug. Oxidation can be caused by an obstructed vent plug or by engine oil leaking past the oil seal.

When flying in turbulence, or if the engine is lightly “loaded” (drive train almost freewheeling), a fluctuating MAP indication is expected.

Any loose connection in throttle linkage (including worn carburetor throttle shaft bushings) will result in both RPM & MAP oscillations.

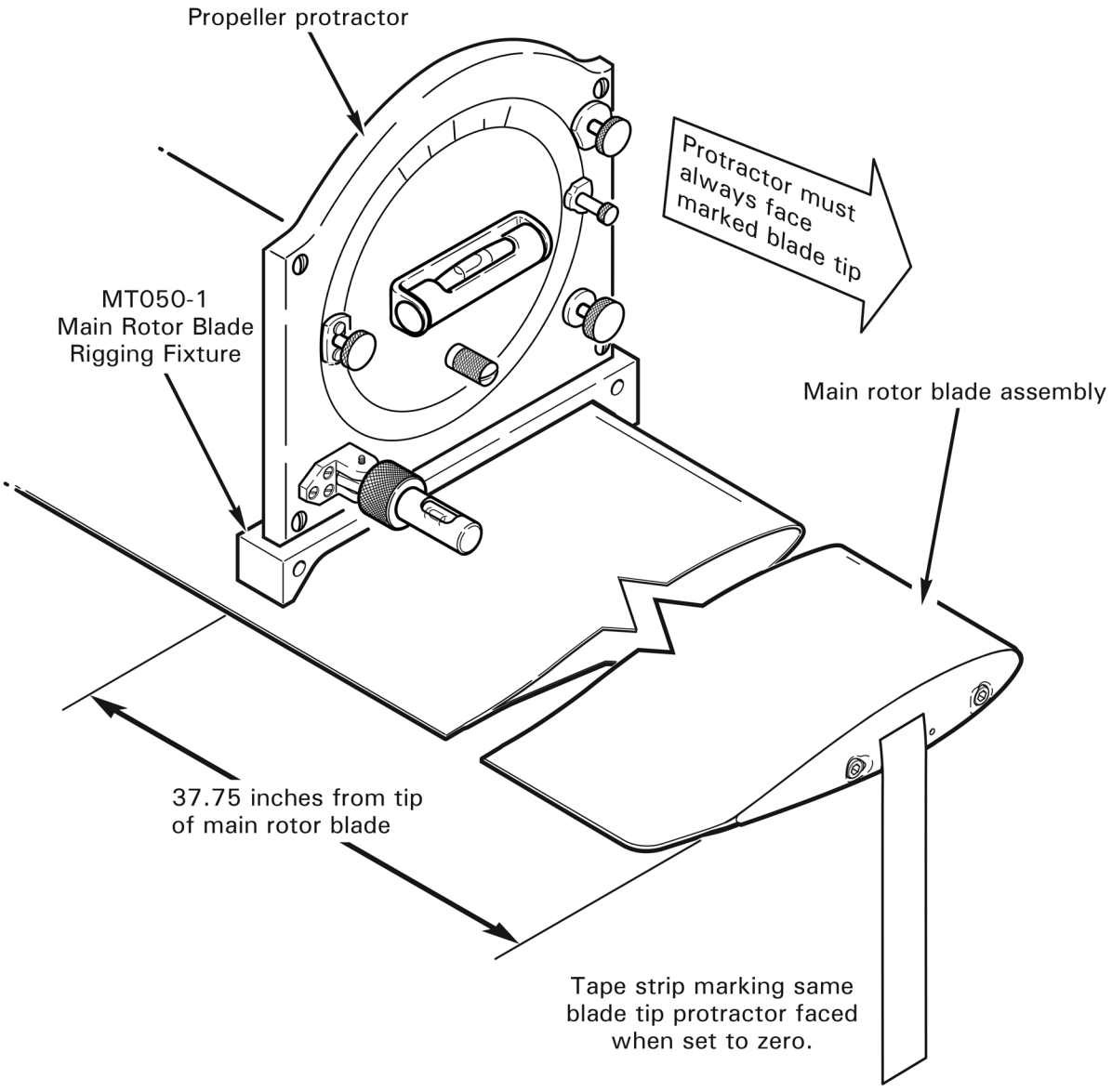


FIGURE 10-4 MAIN ROTOR BLADE RIGGING

10.121 Cyclic Travel Rigging

1. Determine if A958-1 bellcranks are installed in cyclic pivot assembly (ref. Figure 8-2A; original equipment on helicopter S/N 0256, 0301, 0350, 0351, and 0357 & subsequent).

2. Refer to Figure 10-1. Place collective control full down. Place cyclic control in neutral position laterally and hold against forward stop.

> NOTE
>
> Sand bags may be used to secure cyclic control against forward stop to ensure it will not move.

3. Rotate blades so pitch links are aligned with longitudinal axis of helicopter. Place tracking stick at tip of one blade for reference when rotating rotor.

4. Forward longitudinal cyclic:

   a. Refer to Figure 10-4. Measure blade angles and record below. Rotate rotor 180° and record blade angles below. Adjust blade angles per step 4.b.

| **BLUE BLADE** | | | **RED BLADE** | | |
|---|---|---|---|---|---|
| Pitch link aft | | _____ ° | Pitch link aft | | _____ ° |
| Pitch link forward | + | _____ ° | Pitch link forward | + | _____ ° |
| | = | _____ ° | | = | _____ ° |
| | ÷ 2 = | _____ ° | | ÷ 2 = | _____ ° |

10.5°/11.0° required, if A958-1 bellcranks are installed.

8.3°/8.8° required, if A175-1 bellcranks are installed.

   b. Adjust aft A121-5 push-pull tube at swashplate (one full turn = 0.42°) or both forward A121-7 push-pull tubes at swashplate (both must be adjusted exact same amount), as required to obtain required blade angle averages.

5. Refer to Figure 10-1. Place cyclic control in neutral position laterally and hold against aft stop.

10.121 Cyclic Travel Rigging (continued)

6. Aft longitudinal cyclic:

   a. Refer to Figure 10-4. Measure blade angles and record below. Rotate rotor 180° and record blade angles below. Adjust blade angles per step 6.b.

| **BLUE BLADE** | | | **RED BLADE** | | |
|---|---|---|---|---|---|
| Pitch link aft | | _____ ° | Pitch link aft | | _____ ° |
| Pitch link forward | + | _____ ° | Pitch link forward | + | _____ ° |
| | = | _____ ° | | = | _____ ° |
| | ÷ 2 = | _____ ° | | ÷ 2 = | _____ ° |

8.5°/9.5°required.

   b. Adjust aft A121-5 push-pull tube at swashplate (one full turn = 0.42°) or both forward A121-7 push-pull tubes at swashplate (both must be adjusted exact same amount), as required.

> NOTE
>
> If adjustment is required to obtain aft cyclic control blade angles, forward cyclic must be rechecked.

7. Refer to Figure 10-1. Place cyclic control in neutral position longitudinally (mid-travel) and hold cyclic against left stop.

8. Rotate rotor until pitch links are aligned with lateral axis of helicopter. Place tracking stick at tip of one blade for reference when rotating rotor.

9. Left lateral cyclic:

   a. Refer to Figure 10-4. Measure blade angles and record below. Rotate rotor 180° and record blade angles below. Adjust blade angles per step 9.b.

| **BLUE BLADE** | | | **RED BLADE** | | |
|---|---|---|---|---|---|
| Pitch link right | | _____ ° | Pitch link right | | _____ ° |
| Pitch link left | + | _____ ° | Pitch link left | + | _____ ° |
| | = | _____ ° | | = | _____ ° |
| | ÷ 2 = | _____ ° | | ÷ 2 = | _____ ° |

9.0°/9.5° required.

   b. Adjust right or left (forward) A121-7 push-pull tube at swashplate (one full turn = 0.6°), as required.

10.121 Cyclic Travel Rigging (continued)

10. Refer to Figure 10-1. Place cyclic control in neutral position longitudinally (mid travel) and hold against right stop.

11. Right lateral cyclic:

    a. Refer to Figure 10-4. Measure blade angles and record below. Rotate rotor 180° and record blade angles below. Adjust blade angles per step 11.b.

| **BLUE BLADE** | | | **RED BLADE** | | |
|---|---|---|---|---|---|
| Pitch link right | | _____ ° | Pitch link right | | _____ ° |
| Pitch link left | + | _____ ° | Pitch link left | + | _____ ° |
| | = | _____ ° | | = | _____ ° |
| | ÷ 2 = | _____ ° | | ÷ 2 = | _____ ° |

5.5°/6.0° required.

    b. Adjust right or left (forward) A121-7 push-pull tube at swashplate (one full turn = .6°) as required.

> NOTE
>
> If adjustment is required to obtain right cyclic control blade angles, left cyclic must be rechecked.

12. Perform collective travel rigging per § 10.122.

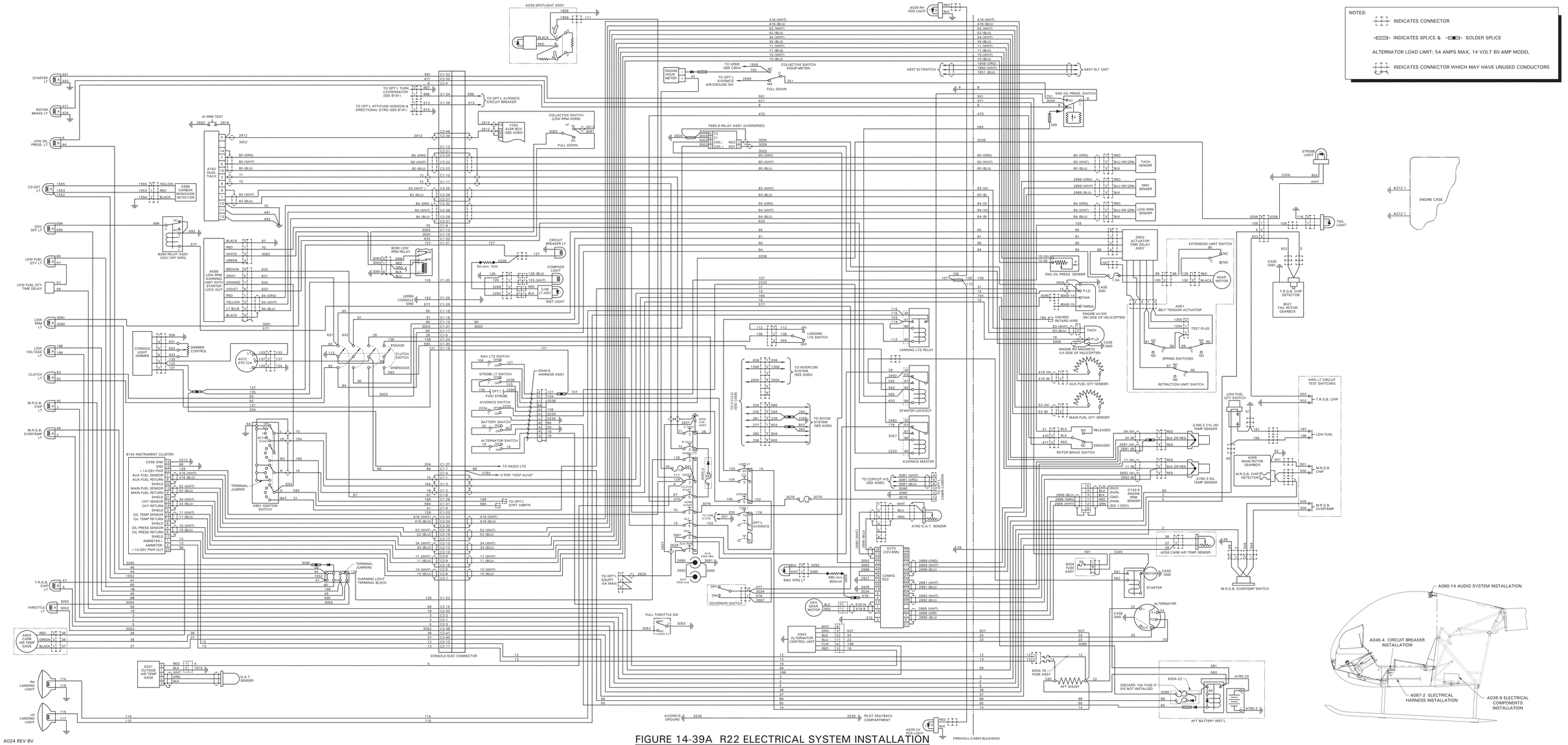


FIGURE 14-39A R22 ELECTRICAL SYSTEM INSTALLATION
(A024 Revision BV shown)

A024 REV BV

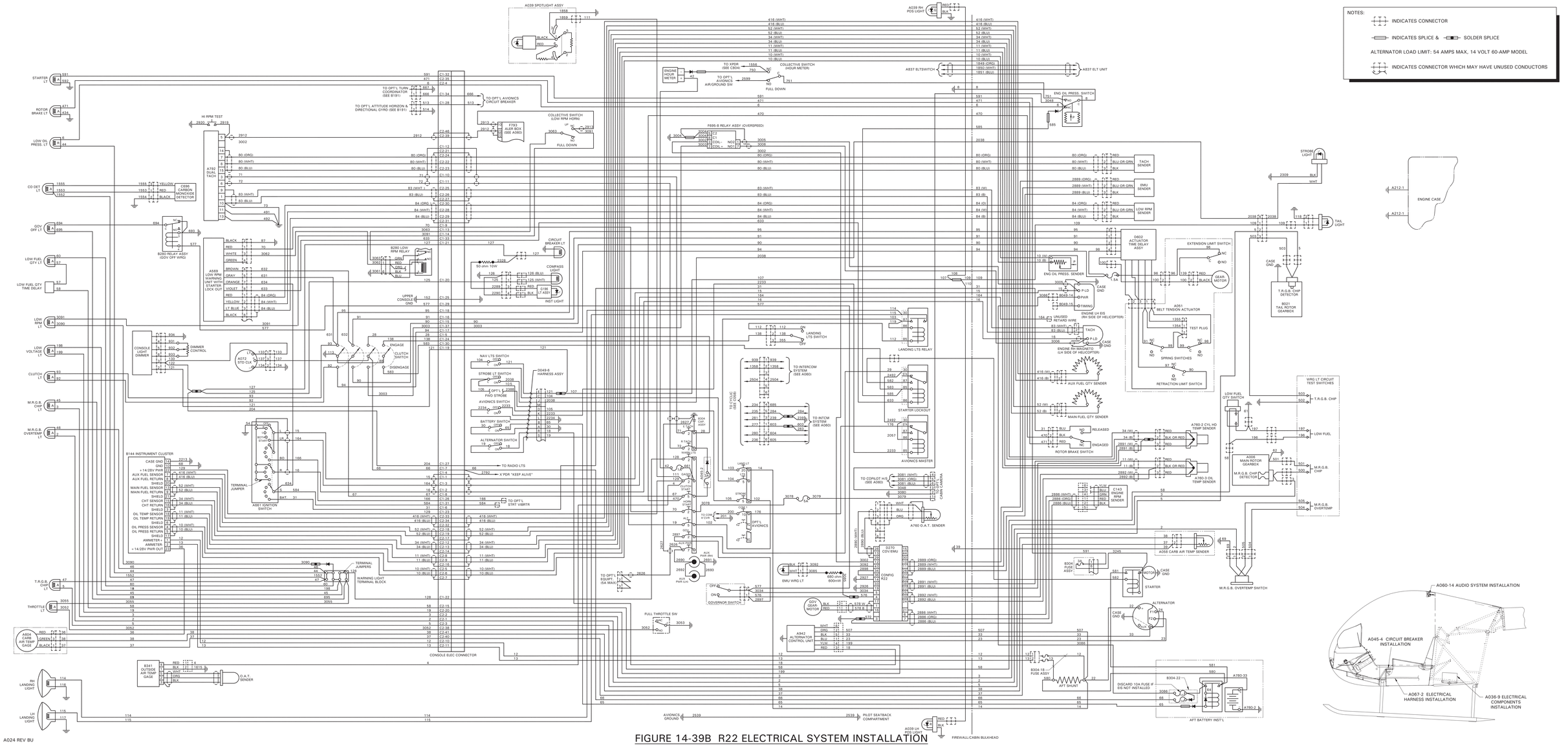


FIGURE 14-39B R22 ELECTRICAL SYSTEM INSTALLATION
(A024 Revision BU shown)

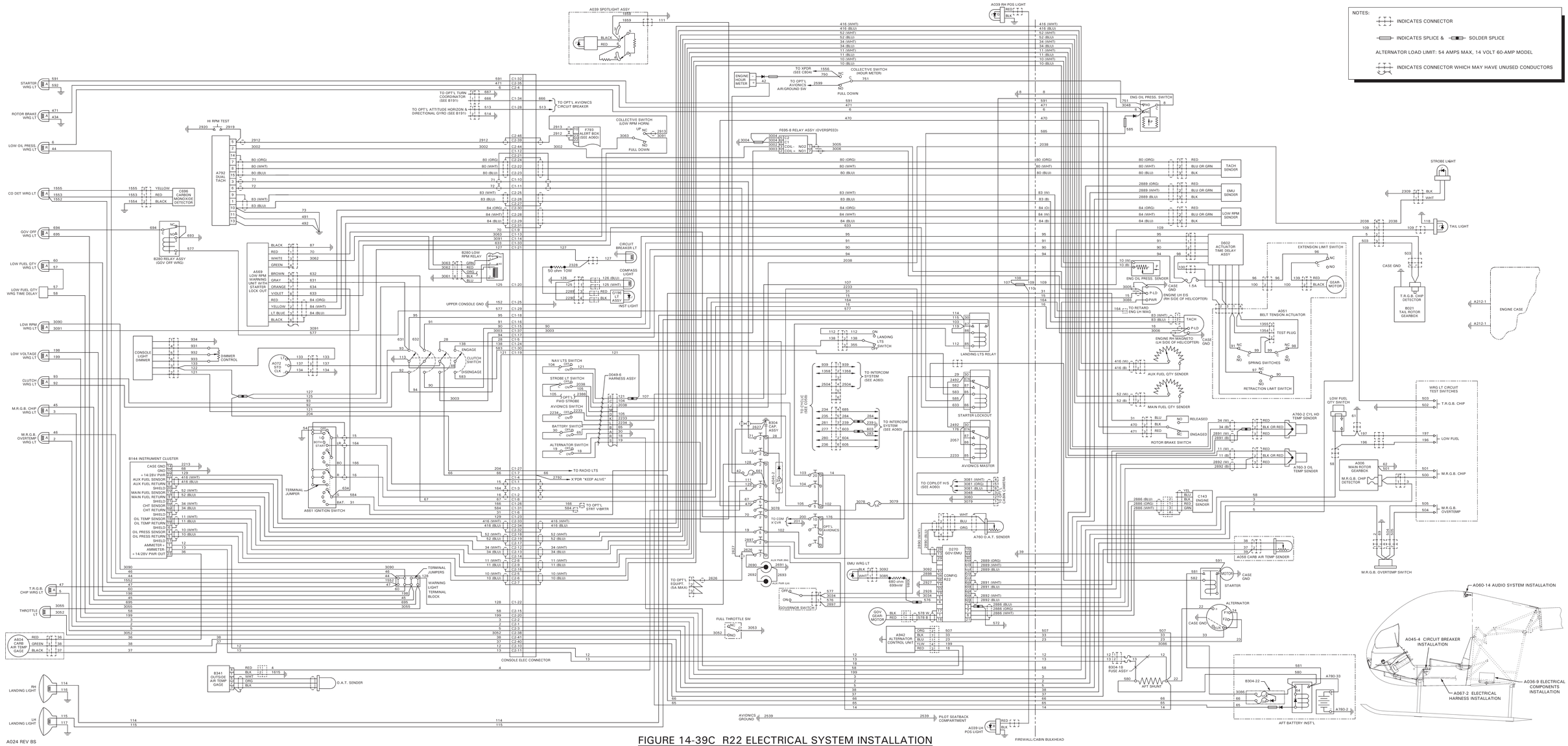


FIGURE 14-39C R22 ELECTRICAL SYSTEM INSTALLATION
(A024 Revision BS shown)

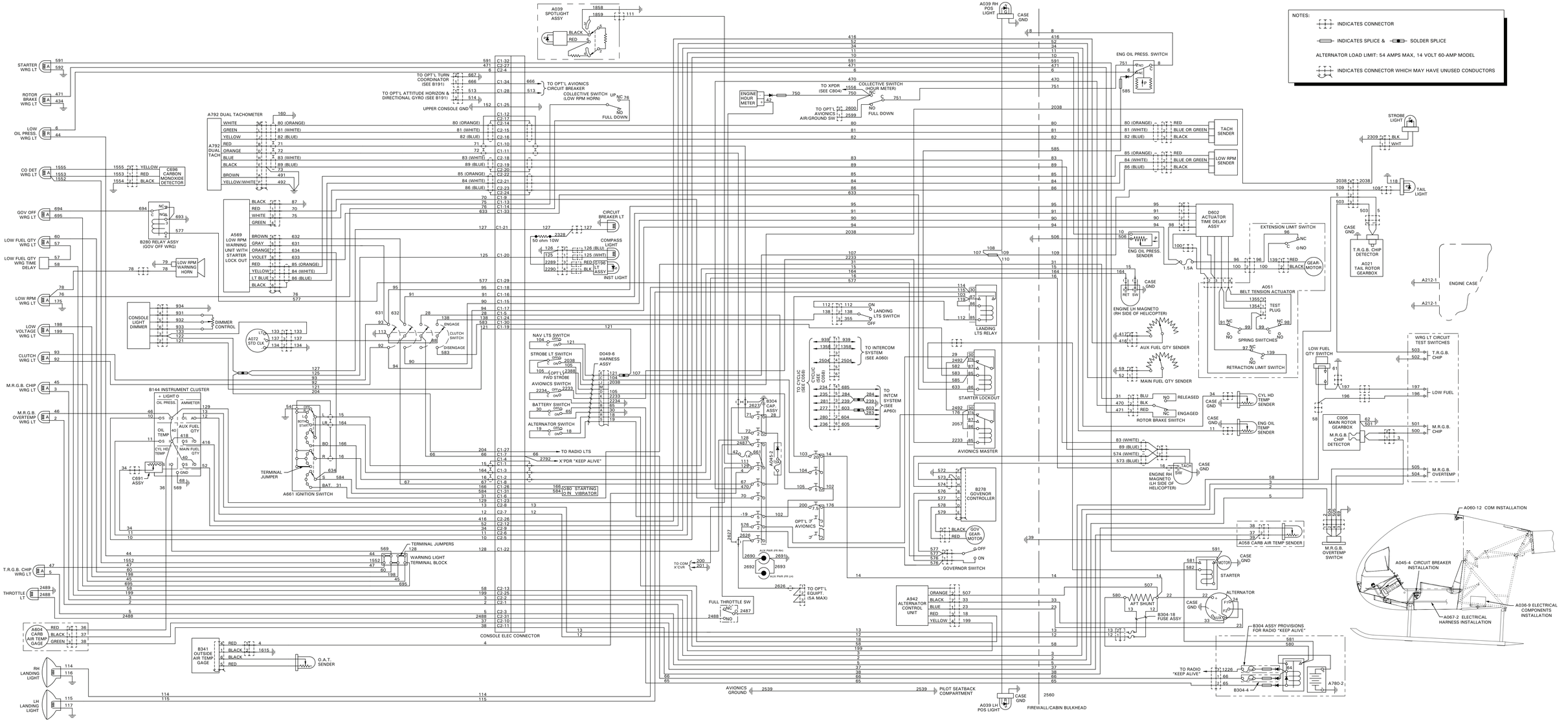


FIGURE 14-39D R22 ELECTRICAL SYSTEM INSTALLATION
(A024 Revision BO shown)

A024 REV BO

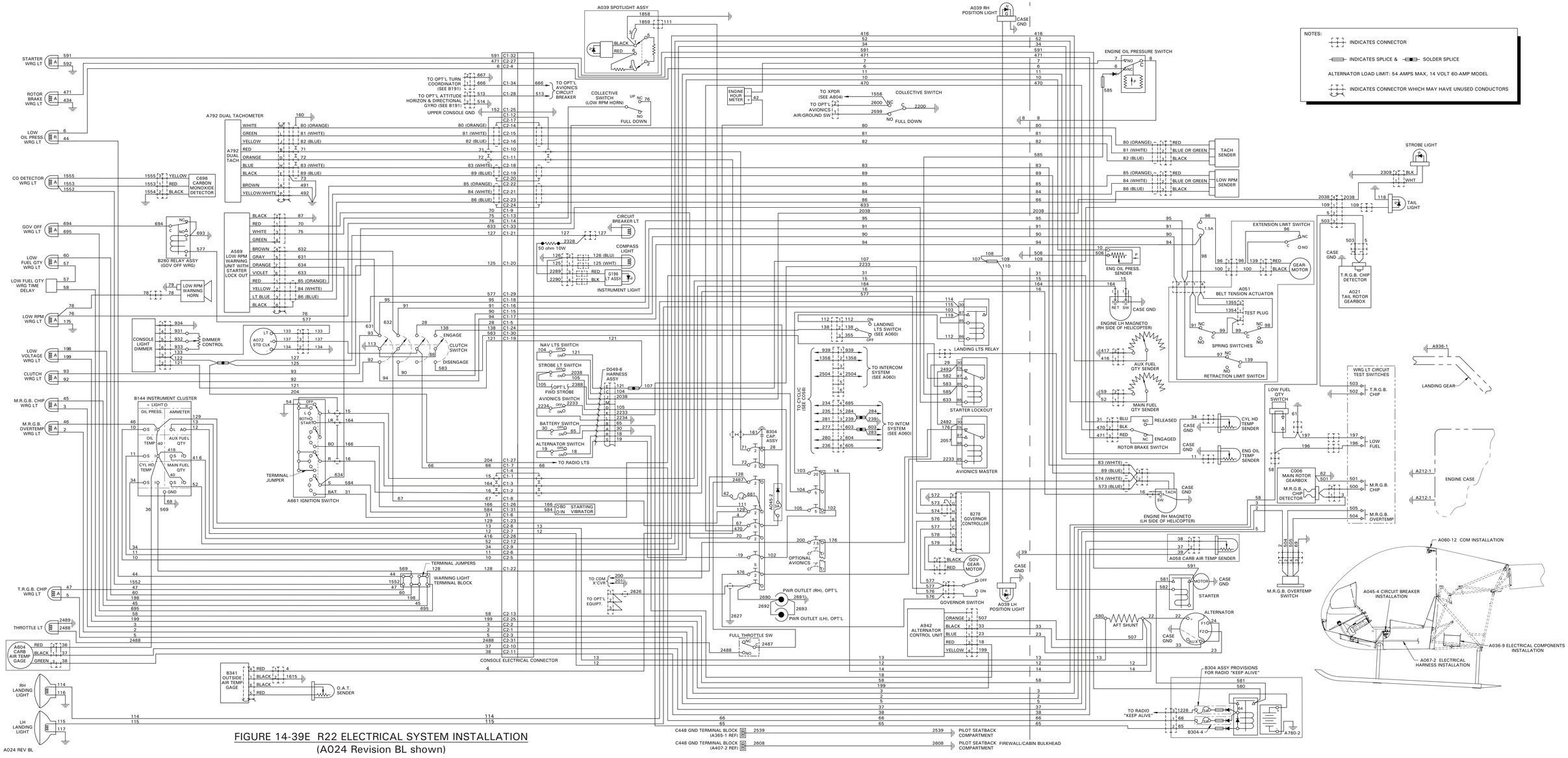


FIGURE 14-39E R22 ELECTRICAL SYSTEM INSTALLATION
(A024 Revision BL shown)

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# CHAPTER 16

# DIMENSIONS AND DESCRIPTIONS

## 16-10 Version Description

Refer to § 3.200 for Type Certificate Data Sheet.

**WARNING**

**Refer to R22 Illustrated Parts Catalog (IPC) for specific part number differences between versions.**

R22 Standard: Approved March 16, 1979. Serial numbers 0002 thru 0199, except 0175. Lycoming O-320-A2B or Lycoming O-320-A2C engine normally rated at 150 horsepower and derated to 124 horsepower. 80/87 minimum grade aviation gasoline. Gross weight 1300 pounds. A044-1 stabilizer angle 1.8–2.3 degrees nose up.

R22 HP: Serial numbers 0175, 0200 thru 0255, 0257 thru 0300, 0302 thru 0349, 0352 thru 0356. Lycoming O-320-B2C engine normally rated at 160 horsepower and derated to 124 horsepower. 100LL or 91/96 minimum grade aviation gasoline. Gross weight 1300 pounds. A044-1 stabilizer angle 1.8–2.3 degrees nose up.

R22 Alpha: Approved October 12, 1983. Serial numbers 0256, 0301, 0350, 0351, 0357 thru 0500. Lycoming O-320-B2C engine derated to 124 horsepower. Extended lower steel frames. Tailcone higher than Standard/HP. Aft battery installation. Gross weight 1370 pounds. A044-1 stabilizer angle 2.8 –3.3 degrees nose down. Auxiliary fuel tank optional for serial numbers 0457 and subsequent.

R22 Beta: Approved August 12, 1985. Serial numbers 0501 thru 2570. Lycoming O-320-B2C engine derated to 124 horsepower. 131 horsepower five-minute take off rating. Extended lower steel frames. Higher tailcone than Standard/HP. Aft battery installation. Seven-hole instrument panel. Larger oil cooler. 1370 pounds gross weight. A044-1 stabilizer angle 2.8–3.3 degrees nose down. Auxiliary fuel tank optional. A569-5 low-rpm warning unit with starter lockout feature installed in serial number 2115 and subsequent. Starter lockout prevents starter activation at less than 62% rotor rpm when actuator is not fully disengaged; starter may be activated above 69% rotor rpm to allow an in-flight engine start.

16-10 Version Description (continued)

R22 Mariner: Approved September 12, 1985. Serial numbers 0364, 0501 thru 2570 eligible (suffix "M" added to ship serial number). Similar to Beta configuration except includes utility floats and additional corrosion protection. Different tailcone with 1.8–2.3 degrees nose-up horizontal stabilizer angle. Battery in nose when floats installed. Float stabilizer on lower vertical stabilizer in place of tail skid. May be flown without floats VFR day or night. Day VFR flight only with floats installed. Auxiliary fuel tank optional. Marine radio package optional.

Instrument Trainer: Alpha, Beta, or Beta II configuration with 10-hole instrument panel. VMC operations only.

Police Helicopter: Alpha, Beta, or Beta II configuration with searchlight, police radio package, and 70 amp alternator.

R22 Beta II: Approved January 31, 1996. Serial numbers 2571 and subsequent. Lycoming O-360-J2A engine derated to 124 horsepower maximum continuous power. 131 horsepower 5-minute take-off rating. Carburetor heat assist. 1370 pounds gross weight. A044-1 stabilizer angle 2.8–3.3 degrees nose down. Throttle only engine governor standard. A569-5 low-rpm warning unit with starter lockout feature standard. Auxiliary fuel system optional.

R22 Mariner II: Approved January 31, 1996. Serial numbers 2571 thru 3414 eligible (suffix "M" added to ship serial number). Similar to Beta II configuration except includes utility floats and additional corrosion protection. Battery in nose when floats installed. Different tailcone with 1.8–2.3 degrees nose-up horizontal stabilizer angle. Float stabilizer on lower vertical stabilizer in place of tail skid. May be flown without floats VFR day or night. Day VFR flight only with floats installed. Marine radio package optional.

16-20 Datum

The datum is located 100 inches forward of main rotor centerline.

16-30 Method of Measurement

Fuselage station, tailcone station, water line station, and butt line station values are measured in inches, rounded to the nearest hundredth.

## 16-40 External Dimensions

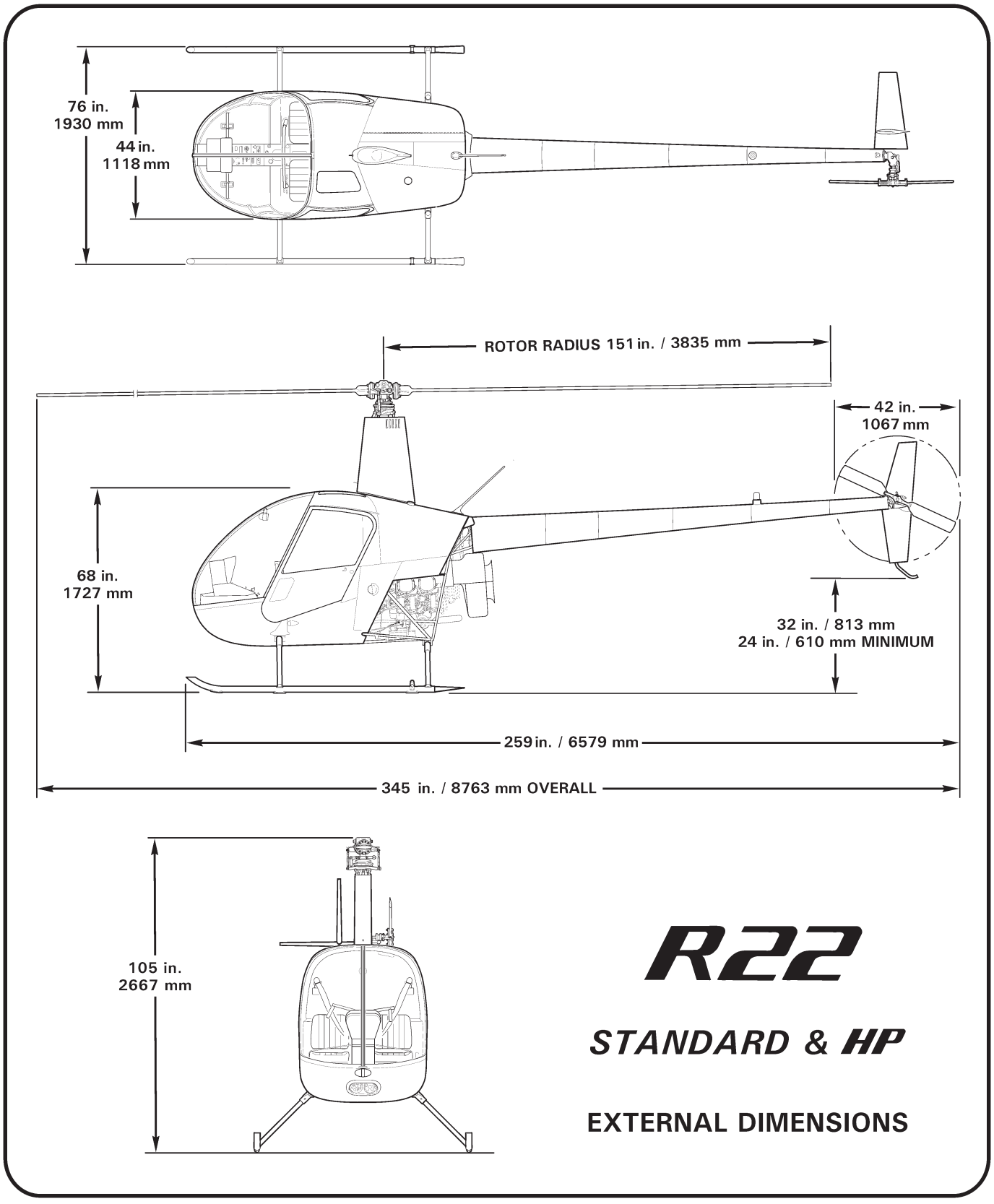


FIGURE 16-1 EXTERNAL DIMENSIONS

16-40 External Dimensions (continued)

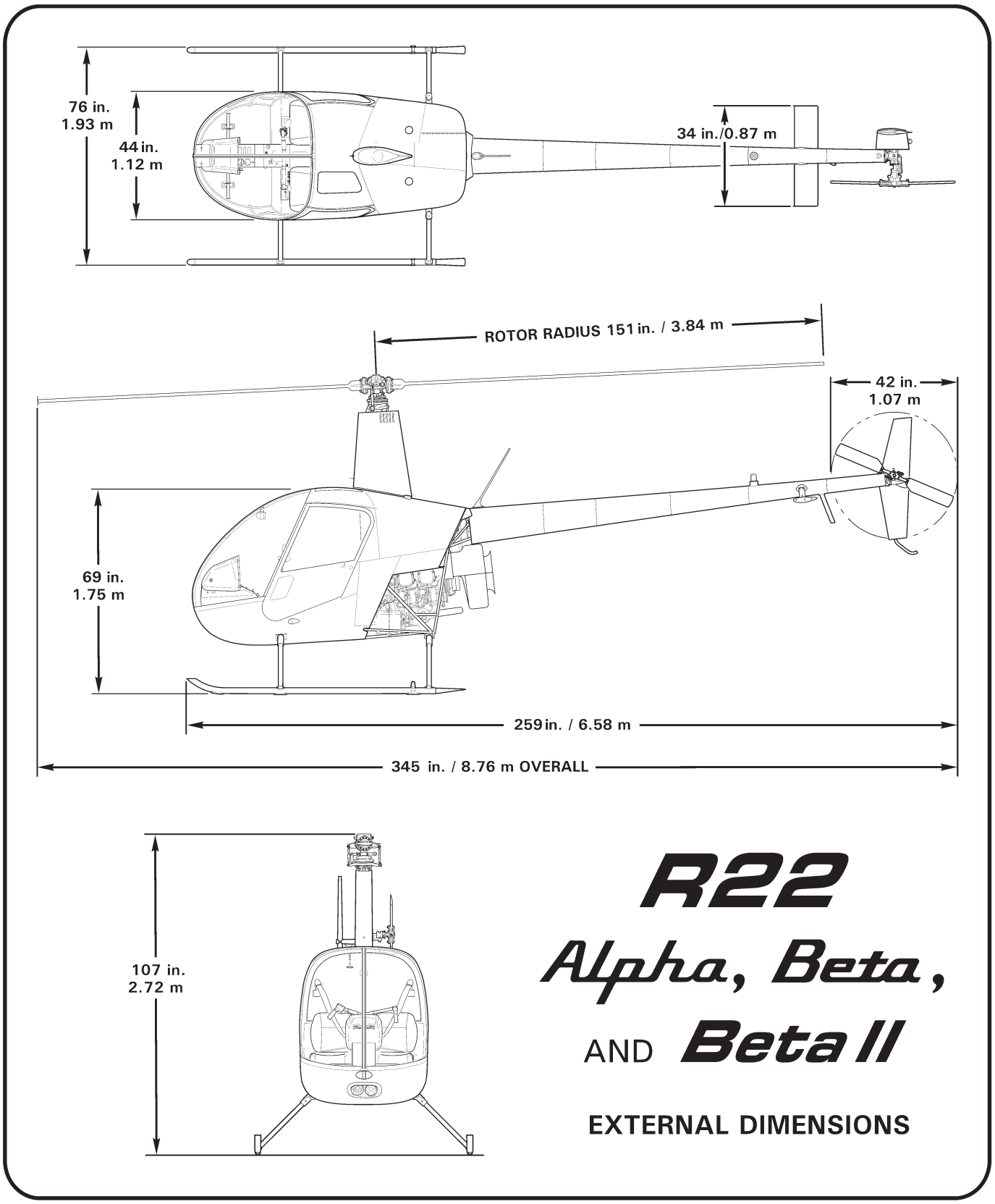


FIGURE 16-2 EXTERNAL DIMENSIONS

16-40 External Dimensions (continued)

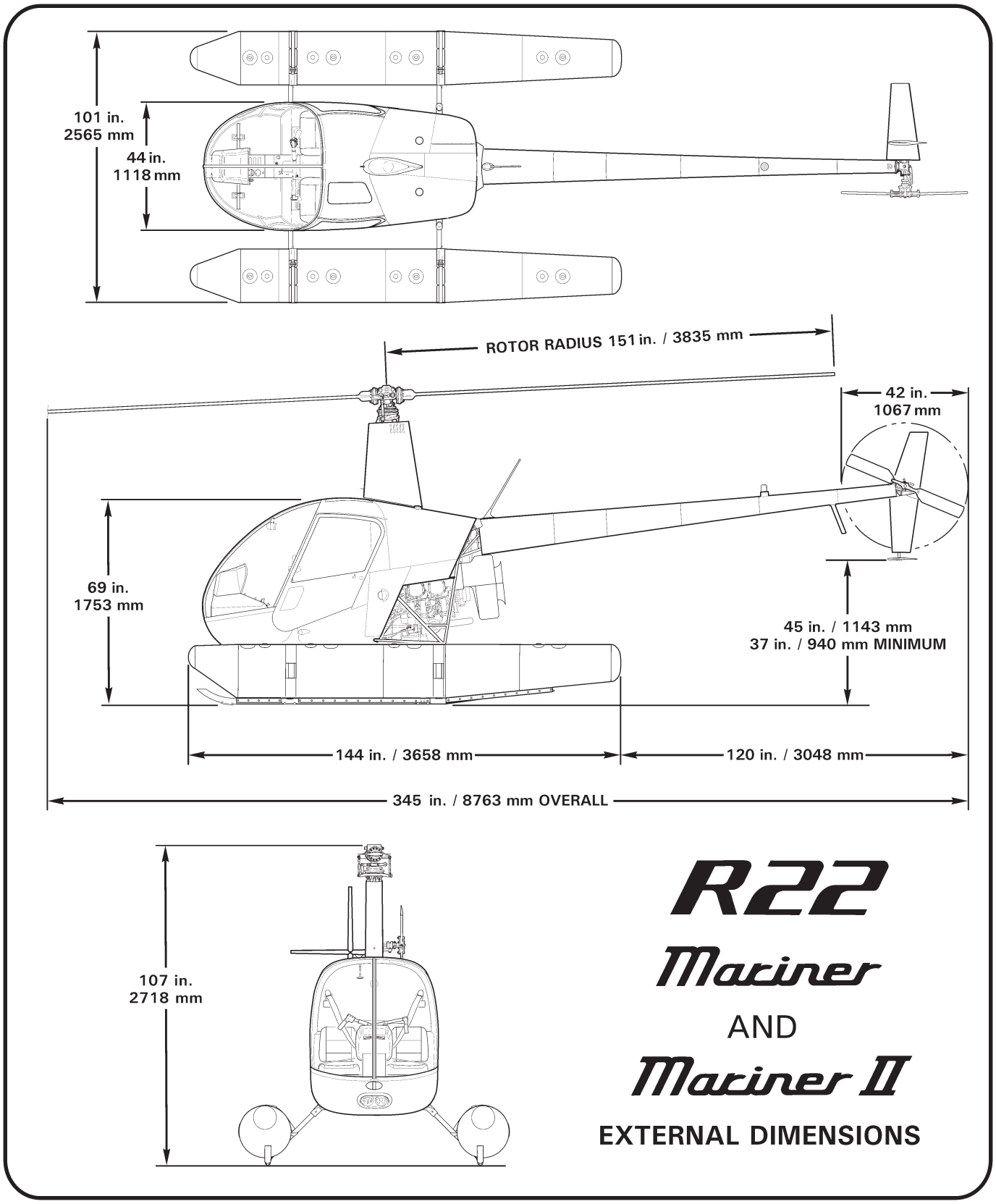


FIGURE 16-3 EXTERNAL DIMENSIONS

## 16-50 Station Locations

Reserved.

## 16-60 Access and Inspection Panels

Refer to R22 Illustrated Parts Catalog Chapter 6 for access and inspection panel locations.

### 16-61 B526 Screws and B527-08 Washers

B526 (TORX Plus®) truss head screws may be used to secure cowlings and access panels. A B527-08 nylon washer may be used under a B526 screw head to further protect thin or painted surfaces.

Following B526 screws are interchangeable with MS27039C080_ screws used to secure cowlings and access panels:

| PART: | INTERCHANGEABLE WITH: |
|---|---|
| MS27039C0806 screw | B526-6 screw |
| MS27039C0807 screw | B526-8 screw |
| MS27039C0808 screw | B526-8 screw |

Following B526 screws are interchangeable with AN525-832R_ & AN526C832R_ screws:

| PART: | INTERCHANGEABLE WITH: |
|---|---|
| AN525-832R6 or AN526C832R6 screw | B526-6 screw |
| AN525-832R7 or AN526C832R7 screw | B526-8 screw |
| AN525-832R8 or AN526C832R8 screw | B526-8 screw |

B526-66 screws (used to secure B376-3 plates to B375-2 stabilizer) are not interchangeable with other screws.

> NOTE
>
> B526 screws are compatible with T20 or 20IP drivers.

## 16-70 Antenna Locations

| NO. | ANTENNA | PART NO. |
|---|---|---|
| 1 | NAV | CI 259E |
| | NAV | CI 259E (W/DIPLEXER) |
| 2 | RH Belly FM | CI 292-3 |
| | RH Belly FM | CI 177-20 |
| | RH Belly FM | CI 273 OR CI 271 |
| | RH Belly COM | CI 122 |
| | RH Belly FM | CI 272-1 |
| 3 | LH Belly FM | CI 292-3 |
| | LH Belly FM | CI 177-20 |
| | LH Belly FM | CI 273 OR CI 271 |
| 4 | Marker Beacon | CI 102 |
| 5 | Transponder/UAT (ADS-B) | CI 105-16 OR KA60, FWD |
| | Transponder | CI 105-16 OR KA60, AFT |
| | DME | CI 105-16 OR KA60 |
| 6 | ADF | KA44B |
| 7 | Cowling GPS | GA 35 |
| 8 | Fwd Tailcone COM | CI 121 or CI 248-5 |
| | Fwd Tailcone COM/GPS | CI 2580-200 |
| 9 | RMS/GPS | 910-00003-004 (Ant) |
| | RMS/GPS | 921-00003-001 (Kit) |
| 10 | Aft Tailcone COM | CI 121 or CI 248-5 |
| | Aft Tailcone GPS/COM | CI 2580-200 |

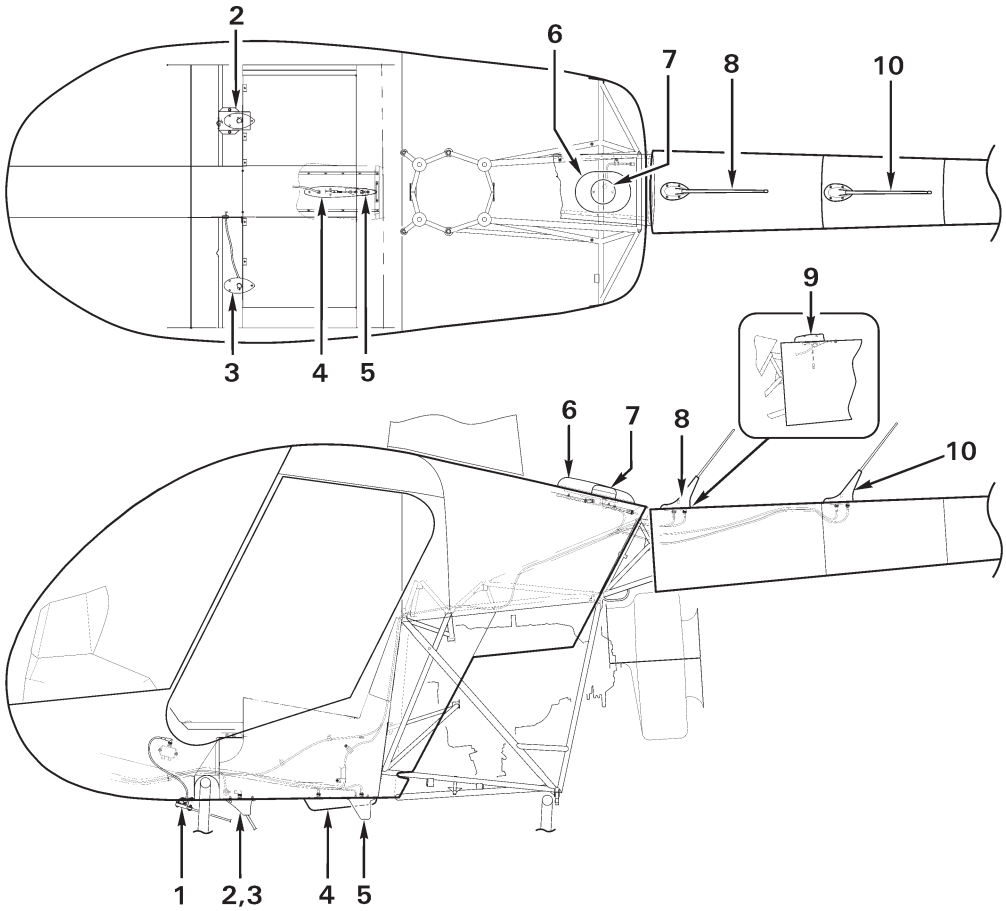


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FIGURE 16-4 ANTENNA LOCATIONS

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# CHAPTER 18

# WEIGHT AND BALANCE

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## 18-30 Fixed Ballast

### 18-31 Nose Ballast

NOTE

Maximum allowable nose ballast is 10.0 lb.

**CAUTION**

Changing fixed ballast amount affects helicopter empty weight & center of gravity (CG). If helicopter empty weight & CG historical data is suspect, weigh helicopter per § 18-20.

1. Open or remove console assembly per § 13-70.
2. Refer to Figure 8-3. Remove hardware securing A941-2 or -3 ballast plate(s), if installed, to A363-1 cover.
3. If A941 ballast attach holes are not previously drilled, use A941 ballast as template and mark hole locations. Drill 0.198 inch diameter (#8 drill size) hole at marked locations.
4. Remove or install ballast plates per calculations in § 18-22. Select NAS6603 bolt length to meet torque requirements per § 23-30 Part E. Install hardware, standard torque bolts per § 23-32, and torque stripe per Figure 2-1.
5. Install or close console assembly per § 13-70. Verify security.
6. Reweigh and/or calculate basic empty weight and CG per § 18-22.
7. Revise Weight and Balance Record in R22 Pilot's Operating Handbook (POH) Section 6 to reflect ballast removal or installation using the following data:

| Item | Weight | Longitudinal Arm | Longitudinal Moment | Lateral Arm | Lateral Moment |
|---|---|---|---|---|---|
| Nose ballast | 0–10.0 lb | 37.5 in. | Variable | 0.0 in. | 0.0 in.-lb |

18-32 Empennage Ballast

NOTE

Approved materials are listed in § 23-70.

**CAUTION**

Changing fixed ballast amount affects helicopter empty weight & center of gravity (CG). If helicopter empty weight & CG historical data is suspect, weigh helicopter per § 18-20.

**A. Removal**

**CAUTION**

Maximum allowable empennage ballast is 2.00 lb, installed under B902-1 (or -2) mount assembly or A044-1 horizontal stabilizer, as applicable.

1. Leaving NAS6604-44 bolts installed in empennage assembly, remove palnuts, nuts, washers, and A301-5 ballast weight from empennage.
2. Remove one NAS6604-44 bolt and install NAS6604-28 bolt & associated hardware, finger tight.
3. Remove second NAS6604-44 bolt and install NAS6604-28 bolt & associated hardware. Standard torque bolts securing empennage to A148 bulkhead per § 23-32. Install palnuts and standard torque per § 23-32, do not torque stripe at this time.
4. As required, solvent-clean lower surface of empennage assembly around and between attach bolts. Apply light coat zinc-chromate or epoxy primer to noted surface and hardware. Apply topcoat as desired.
5. Apply torque stripe to hardware per Figure 2-1.
6. As required, weigh helicopter or calculate basic empty weight & CG per § 18-20.
7. Revise Weight and Balance Record in R22 Pilot's Operating Handbook (POH) Section 6 to reflect ballast removal using Table 8-1.

18-32 Empennage Ballast (continued)

**B. Installation**

**CAUTION**

Maximum allowable empennage ballast is 2.00 lb, installed under B902-1 (or -2) mount assembly or A044-1 horizontal stabilizer, as applicable.

1. Remove empennage assembly per § 4.500.
2. Solvent-clean around and between 0.250 inch diameter holes on lower surface of B902-1 (or -2) mount assembly or A044-1 horizontal stabilizer, as applicable.
3. Temporarily position A301-5 weight on mount assembly or horizontal stabilizer lower surface using two NAS6604-44 bolts & associated hardware finger tight.
4. Trace outline of weight onto mount assembly or horizontal stabilizer lower surface using felt-tip marker or tape. Remove weight.
5. Remove paint within traced outlines on mount assembly or horizontal stabilizer using approved stripper (ref. § 23-71), or by block sanding (to maintain flatness) using 320-grit or finer aluminum-oxide abrasive sandpaper.
6. Remove tracing tape, if installed. Solvent-clean bare metal on mount assembly or horizontal stabilizer & weight clamping surfaces. Conversion coat lower bare metal surface of mount assembly or horizontal stabilizer per § 23-51.
7. Apply approved chromated-epoxy primer (ref. § 23-75) per § 23-60 to bare metal clamping surfaces of weight and mount assembly or horizontal stabilizer. While primer is still wet, install empennage assembly per § 4.500.
8. As required, apply primer and topcoat to exposed hardware.
9. Weigh helicopter or calculate basic empty weight and CG per § 18-20.
10. Revise Weight and Balance Record in R22 Pilot's Operating Handbook (POH) Section 6 to reflect ballast installation using Table 8-1.

| Item | Weight | Longitudinal Arm | Longitudinal Moment | Lateral Arm | Lateral Moment |
|---|---|---|---|---|---|
| Empennage Ballast | 2.0 lb | 270.7 in. | 541.4 in.-lb | 2.6 in. | 5.2 in.-lb |

TABLE 8-1 EMPENNAGE BALLAST WEIGHT AND BALANCE

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# CHAPTER 23

# STANDARD PRACTICES

## 23-10 Cleaning

**WARNING**

**Review appropriate Safety Data Sheet (SDS) when working in proximity to hazardous materials. Specific recommendations for use of personal protective equipment are located in the SDS.**

### A. Cleaning Exterior Surfaces

**CAUTION**

Refer to § 23-10 Part B for cleaning windshield and windows.

**CAUTION**

Never use high-pressure spray to clean helicopter. Never blow compressed air into main or tail rotor blade tip drain holes, pitot tube, or static ports.

**CAUTION**

Wash helicopter exterior surfaces with mild soap (pH between 7 & 9) and water. Harsh abrasives, alkaline soaps, or detergents can scratch painted or plastic surfaces, or cause corrosion of metal. Protect areas where cleaning solution could cause damage.

1. Rinse away loose dirt and debris from exterior surface with clean water.
2. Apply mild soap (pH between 7 & 9) and clean warm water solution to exterior surface using a clean, soft cloth, sponge, or soft bristle brush. Use caution near antennas and sensitive equipment.
3. Remove oil and grease using a cloth wetted with aliphatic naphtha.
4. Rinse all surfaces thoroughly.
5. If desired, polish painted surfaces with a good quality automotive wax using soft cleaning cloths, or a chamois cloth, free of abrasive debris.

23-10 Cleaning (continued)

**B. Cleaning Windshield and Windows**

1. Remove dirt, mud, and other loose particles from exterior surfaces with clean water.
2. Wash with mild soap (pH between 7 & 9) and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.
3. Remove oil and grease with a cloth moistened with isopropyl alcohol (rubbing alcohol) or aliphatic naphtha.

**CAUTION**

Do not use gasoline, other alcohols, benzene, carbon tetrachloride, thinner, acetone, or window (glass) cleaning sprays.

4. After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.

**CAUTION**

Windshield surface must be water-repellent for good visibility in rain. When using a new cleaning or polishing product on windshield, verify water beads on surface before flying.

5. On acrylic windows (standard windshield), scratches can be removed by rubbing with jeweler's rouge followed by hand polishing with commercial plastic polish. Use a figure eight motion with polishing.

NOTE

Impact-resistant windshields are made from polycarbonate with a protective hardcoat and cannot be polished.

**C. Cleaning Seat Assemblies and Back Rests**

1. Vacuum and brush, then wipe with damp cloth. Dry immediately.
2. Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Follow manufacturer's instructions. Avoid soaking or harsh rubbing.
3. Leather should be cleaned with saddle soap or a mild hard soap and water.

**D. Cleaning Carpet**

Remove loose dirt with a whisk broom or vacuum. For soiled spots and stains, use nonflammable dry cleaning liquid.

23-30 Torque Requirements (continued)

**E. Torque Requirements**

**CAUTION**

Never substitute AN bolts for NAS bolts. NAS bolts have higher tensile strength.

1. Any self-locking nut whose drag has deteriorated appreciably must be replaced. Damaged hardware must be replaced.
2. Bolt and nut are to be clean and dry except when assembly procedure specifies anti-seize or thread-locking compound.
3. If chattering or jerking occurs, disassemble and re-torque fastener.
4. If special adapters which change effective length of torque wrench are used, final torque value must be calculated using formulas in Figures 23-1 and 23-2.
5. Unless otherwise specified, proper thread engagement requires:
   a. If palnut is not required, one to four threads exposed beyond primary nut.
   b. If palnut is required, two to four threads exposed beyond primary nut.
   c. For B526-8 screws, one to five threads exposed beyond primary nut.

**WARNING**

**Proper thread engagement ensures proper locking of fastener. Exceeding maximum thread exposure beyond primary nut may allow nut to seat against unthreaded shank, resulting in insufficient joint clamping.**

6. Refer to Part A. Torque wrenches must be calibrated annually, when dropped, or when a calibration error is suspected.

23-31 Torque Stripe

**WARNING**

**Review appropriate Safety Data Sheet (SDS) when working in proximity to hazardous materials. Specific recommendations for use of personal protective equipment are located in the SDS.**

Refer to Figure 2-1. Lacquer-paint Torque Seal® is applied to all critical fasteners after palnut installation in a stripe ("torque stripe") extending from the fastener's exposed threads across both nuts and onto the component. Subsequent rotation of the nut or bolt can be detected visually. Position torque stripes for maximum visibility during preflight inspections. Approved Torque Seal® is listed in § 23-74.

## 23-32 Standard Torques

NOTE

1. Torque values are in inch-pounds unless otherwise specified.
2. Torque values include nut self-locking torque.
3. Increase torque values 10% if torqued at bolt head.
4. Wet indicates threads lubricated with A257-9 anti-seize.
5. For elbow and tee fittings which require alignment, torque to indicated value, then tighten to desired position.
6. Tolerance is ± 10% unless range is specified.
7. Unless otherwise specified, thread sizes 8-32 and smaller are not used for primary structure and do not require control of torques.

| FASTENER SERIES | | SIZE | EXAMPLE FASTENER | TORQUE (IN.-LB) |
|---|---|---|---|---|
| NAS6603 thru NAS6608 Bolts<br>NAS1303 thru NAS1308 Bolts<br>NAS623 Screws<br>NAS1351 & NAS1352 Screws<br>NAS600 thru NAS606 Screws | | 10-32 | NAS6603 | 50 |
| | | 1/4-28 | NAS6604 | 120 |
| | | 5/16-24 | NAS6605 | 240 |
| | | 3/8-24 | NAS6606 | 350 |
| | | 7/16-20 | NAS6607 | 665 |
| | | 1/2-20 | NAS6608 | 995 |
| A142 screws<br>AN3 Bolts<br>AN4 Bolts<br>AN6 Bolts<br>AN8 Bolts | AN502 Screws<br>AN503 Screws<br>AN509 Screws<br>AN525 Screws<br>MS24694 Screws<br>MS27039 Screws | 10-32 | A142-1, -3, -4, AN3 | 37 |
| | | 1/4-28 | AN4 | 90 |
| | | 3/8-24 | AN6 | 280 |
| | | 1/2-20 | AN8 | 795 |
| STAMPED NUTS<br>(PALNUTS)<br>Palnuts are to be used only once and replaced with new ones when removed. | | 10-32 | B330-7 (MS27151-7) | 6–15 |
| | | 1/4-28 | B330-13 (MS27151-13) | 11–25 |
| | | 5/16-24 | B330-16 (MS27151-16) | 20–40 |
| | | 3/8-24 | B330-19 (MS27151-19) | 29–60 |
| | | 7/16-20 | B330-21 (MS27151-21) | 42–85 |
| | | 1/2-20 | B330-24 (MS27151-24) | 54–110 |
| TAPERED PIPE THREADS | | 1/8-27 | See note 5 | 60 |
| | | | Straight fittings only | 120 |
| | | 1/4-18 | See note 5 | 85 |
| | | | Straight fittings only | 170 |
| | | 3/8-18 | See note 5 | 110 |
| | | | Straight fittings only | 220 |
| | | 1/2-14 | See note 5 | 160 |
| | | | Straight fittings only | 320 |
| | | 3/4-14 | See note 5 | 230 |
| | | | Straight fittings only | 460 |
| ROD END JAM NUTS<br>(AN315 and AN316) | | 10-32 | AN315-3 | 15 |
| | | 1/4-28 | AN316-4 | 40 |
| | | 5/16-24 | AN316-5 | 80 |
| | | 3/8-24 | AN316-6 | 110 |

## 23-33 Special Torques

These torques are non-standard and supersede those in § 23-32.

NOTE

1. Torque values are in inch-pounds unless otherwise specified.
2. Torque values include nut self-locking torque.
3. Increase torque values 10% if torqued at bolt head.
4. Wet indicates threads lubricated with A257-9 anti-seize.
5. For elbow and tee fittings which require alignment, torque to indicated value, then tighten to desired position.
6. Tolerance is ± 10% unless range is specified.
7. Unless otherwise specified, thread sizes 8-32 and smaller are not used for primary structure and do not require control of torques.

| AREA | (QUANTITY) FASTENER | TORQUE (IN.-LB) |
|---|---|---|
| COOLING SYSTEM | (8) nuts, supplied with engine, securing A484-3 plates | 300 |
| | (4) hose clamps – oil drain back tube (rotate to clear retainers) | 10 |
| | (2) NAS1352-4H14P screws, cooling panels | 96 |
| | (6) NAS1352-4H10P screws, cooling panels | 96 |
| DRIVE SYSTEM | (1) AN320-15 nut (1½ inch socket) on A007-3 shaft assembly | 183–233 FT-LB, wet |
| | (1) AN320-18 nut ($1\frac{11}{16}$ inch socket) on A007-5 or -6 shaft assembly | 340–400 FT-LB, wet. Retorque after first engine run after installation. |
| | (6) NAS6606H23 or (6) NAS6606H24 bolts, lower sheave | 300 |
| ELECTRICAL SYSTEM | (2) nuts, securing wire terminals to 1465-70-104 shunt | 18 |
| | (2) MS21044B5 nuts, securing A780 cables to B415-1 relay | 80 |
| | (2) 01003621 screws, securing wire terminals to B415-1 relay | 10 |
| | (1) nut, supplied with OAT probe | 18 |
| | (2) engine supplied bolts, securing A212-1 ground straps | 96 |
| | (2) nuts, securing wire terminals to B308-1 oil pressure sender | 10 |
| | (4) A142-5 screws, securing TJ-120 jacks (B270-20) | 2 |
| | (2) dress nuts, at D746-4 harness | 14 |
| | (1) engine supplied nut, securing A780-2 cable | 96 ± 10 |
| | (2) MS35206 screw, V3 switches collective | 4-5 |
| | (2) D262-11 fuse holders | 8-10 |
| | (1) terminal nut, starter, -581 wire (use back up wrench) | 100 |
| | (1) terminal nut, starter, -3245 wire (use back up wrench) | 60 |
| | (1) terminal nut, alternator output terminal (use back up wrench) | 50 |
| | (2) terminal nuts, D748-3 alternator, F1 & F2 terminals (use back up wrench) | 14 |
| | (1) D748-3 alternator supplied screw (B270-20 on threads) | 27 |
| | (2) terminal nuts, D748-4 alternator, F1 & F2 terminals (use back up wrench) | 20 |
| | (3) terminal nuts, TCM magneto (use back up wrench) | 15 |
| | (3) terminal nuts, EIS magneto (use back up wrench) | 10 |
| | (1) EIS supplied screw, shield drain wire | 15 |

23-33 Special Torques (continued)

| AREA | (QUANTITY) FASTENER | TORQUE (IN.-LB) |
|---|---|---|
| EMPENNAGE | (4) NAS6603-2 & (4) NAS6603-5 bolts, vertical stabilizer attach | 70 |
| FANWHEEL & SCROLL ASSEMBLIES | (1) AN320-15 or AN320-18 nut – see DRIVE SYSTEM | |
| | (8) or (12) NAS6603-3 or -6 bolts and D210-3 nuts, cone-to-fanwheel | 70 |
| | (6) NAS6605-11, -12, -13, or -14 bolts, hub<br>(3) B660-1 bolts optional equally spaced, hub | 300, and retorque after first engine run after installation |
| | (12) D216-1 screw, A185 brackets | 25 |
| FUEL SYSTEM | (1) A457-15 bulkhead union and nut | 285 |
| | (1) A657-1 nut, fuel valve elbow-to-bulkhead union | 120 |
| | (1) A726-1 line assembly, bulkhead union-to-gascolator | 285 |
| | (1) A880-934, A880-964, or AN815-4D union, main tank, drain hose | 145 |
| | (1) A880-936, A880-966, or AN815-6D union, main tank, tank interconnect hose | 200 |
| | (1) A880-1004 or AN924-4D nut, main tank, drain valve | 145 |
| | (1) A880-1005 or AN924-5D nut, low-fuel warning switch | 150 |
| | (2) B254-3 strainer assembly, tank outlets | 200, wet |
| | (1) B283 hose assembly nuts, gascolator-to-carburetor | 120 |
| | (10) B289-1 bolts, fuel sender (torque in criss-cross pattern) | 37 |
| | (2) D252 fuel sender center stud nut | 11 |
| | (2) B330-6 palnut at fuel sender center stud | 9 |
| | (2) D252 fuel sender ground stud nut | 9 |
| | (2) B330-5 palnut at fuel sender ground stud | 9 |
| | (1) C595-1 or D205-33 hose assembly nuts, tank interconnect | 120 |
| | (1) D205-32 hose assembly nuts, main tank-to-fuel valve | 120 |
| | (1) D205-34 hose assembly nuts, main tank drain | 60 |
| | (1) D210-4 nut, gascolator mounting plug | 70 |
| | (16) AN805 nuts, fuel primer line | 20–30 |
| | (1) AN894D4-2 bushing, primer system | 50–65 |
| | (1) AN894D6-4 bushing, primer system | 110–130 |
| | (4) engine supplied bolts, securing MS21333-96 clamp | 96 |
| | (4) MS27039C1-06 screws, fuel valve | 16 |
| | (4) MS27039DD1-26 screws, air bypass door | 24 |
| | (1) MS27769D2 plug, gascolator | 60 |
| | Primer system line assembly nuts, flared end fittings | 20–30 |
| FUSELAGE | (1) B277-052 clamp, lower rib | 50 |
| | (1) D210-5 nut, tow ball | 240 |
| | (8) MS51861-37C screws, door hinges | 36 |
| | (6) NAS6603-2 bolts, securing B375-2 stabilizer | 70 |
| LANDING GEAR | (4) AN4-25A bolts, ground handling support | 70 |
| | (56) NAS6604 bolts, floats to skids and skid extensions | 50, torqued from nut |

## 23-33 Special Torques (continued)

| AREA | (QUANTITY) FASTENER | TORQUE (IN.-LB) |
|---|---|---|
| MAIN ROTOR BLADE | (2 per blade) A722-4 screw, tip weight retaining | 40, wet |
| | (2 per blade) B289-2 self-sealing bolts in pitch horn | 70 |
| | (2 per blade) NAS1351N3-10P screw, cover retaining | 40, wet |
| MAIN ROTOR GEARBOX | (1) AN320-8 nut, gearbox pinion | 290–410 |
| | (1) AN10-41A bolt, gearbox mounting with (3) A650-1 fittings, gearbox mounting | 90 FT-LB torqued from nut |
| | (1) AN10-40A bolt, gearbox mounting with (3) A650-3 fittings, gearbox mounting | |
| | (1) F650-3 bolt, gearbox mounting with (3) A650-3 fittings, gearbox mounting | 50 FT-LB, wet torqued from bolt head or nut |
| | (6) NAS1352-4-14 screws, end cover (no rotor brake) | 140 |
| | (3) NAS1352-4-28 screws, end cover with rotor brake | 140 |
| | (6) MS20074-04-06 screws, end cover (no rotor brake) | 60 |
| | (3) MS20074-04-15 screws, end cover with rotor brake | 60 |
| | (1) chip detector (threaded, non-quick-disconnect type) | Large nut 150<br>Small nut 75 |
| | (1) chip detector housing | 150 |
| | (1) nut, chip detector wiring | 4–6 |
| | (1) filler-plug | 150 |
| | (1) sight gage | 150 |
| MAIN ROTOR HUB | (1) NAS630-80 (or MS21250-10080) teeter hinge bolt;<br>(2) NAS630-80 (or MS21250-10080) coning hinge bolts in A154-1 hub<br>**WARNING**<br>**Scrap bolt & nut if bolt is elongated more than 0.019 inch during tightening.** | New bolt:<br>0.016–0.017 inch elongation, wet<br><br>Used bolt:<br>0.015–0.017 inch elongation, wet, & cotter pin holes must align |
| | (2) NAS632-82 (or MS21250-12082) coning hinge bolts in B370-1 hub<br>**WARNING**<br>**Scrap bolt & nut if bolt is elongated more than 0.014 inch during tightening.** | New bolt:<br>0.011–0.012 inch elongation, wet<br><br>Used bolt:<br>0.010–0.012 inch elongation, wet, & cotter pin holes must align |
| POWERPLANT (see also cooling & electrical systems) | (1) A058-5 carburetor air temp probe | 36–48 |
| | (2) A740-1 manifold pressure line nuts | 25–35 |
| | (1) A760-1 oil temperature sender, single | 300 |
| | (1) terminal nut supplied with A760-1 | 20 |
| | (1) A760-2 cylinder head temperature sender | 50 |
| | (1) A760-3 oil temperature sender, dual | 300 |
| | (1) B200-4 lug, bolt supplied with engine | 96 |

23-33 Special Torques (continued)

| AREA | (QUANTITY) FASTENER | TORQUE (IN.-LB) |
|---|---|---|
| POWERPLANT (CONT'D) (see also cooling & electrical systems) | (1) C143-1, -3, or -5 sensor assembly | 96 |
| | (2) B277-024 clamps, carb heat scoop | 30 |
| | (4) AN818-8 or A880-108 nuts, oil cooler line (stainless-steel) | 40 FT-LB |
| | (4) AN818-8 nuts, oil cooler line (aluminum lines) | 230–260 |
| | (1) AN894D4-3 bushing, manifold pressure line, at firewall | 135–150 |
| | (4) MS20074-04-04 bolts, air box-to-carburetor | 30 |
| | (1) 3080-38 cylinder head temperature probe | 70–80 |
| | (1) bolt, alternator belt tension | 204 |
| | (4) bolts, D723-1 oil adapter | 90–100 |
| | (4) carburetor-to-engine nuts | 96 initial, 204 final, torque in a crisscross pattern |
| | (8) exhaust riser flange nuts, plain. Draw up all (8) nuts evenly prior to torquing | 160–180 |
| | (8) 21FKF-518 exhaust riser flange nuts, self-locking. Draw up all (8) nuts evenly prior to torquing | 200–220 |
| | (2) ground strap-to-engine nuts | 96 |
| | (1) nut, B315-1 clip for magneto harness clamp | 60 |
| | (8) spark plugs | 35 FT-LB, wet with A257-16 oil |
| | (1) thermostatic oil cooler bypass valve | 290–310 |
| | (6 per cover) valve cover retaining screws, when used with clean, dry, Lycoming P/N 06B26669 gasket on clean, dry valve cover and cylinder head mating surfaces screws | 35 |
| POWERPLANT CONTROLS | (4) A142-4 screw, D334-5 bellcrank assembly | 45 |
| | (1) NAS6606-16 bolt, D334-5 bellcrank assembly | 280 |
| | (1) A486 screw, overtravel spring upper rod end | 37 |
| | (1) A933-3 rod end, B364-1 push-pull tube forward rod end | 15-30 |
| | (1) castellated nut, carburetor throttle arm | 20-60 |
| | (1) nut on A462-1 carburetor heat control wire-to-slider valve attach fitting | 25–30 |
| | (1) nut on A462-4 mixture control wire-to-carburetor mixture arm attach fitting | 25–30 |
| STEEL TUBE FRAME | (2) NAS1351-8H40P internal-wrenching screws | 70–75 FT-LB, wet |
| | (3) NAS6604-3 bolts – (1) lower-left frame aft strut-to-upper frame, and (2) on removable aft, right strut | 120 with B270-1 on shank to seal strut holes |
| SWASHPLATE | (2) NAS1352N08-6 screws, magnetic pick-up bracket | 35 |
| | (16) NAS1352N08-8 screws | 35, wet |
| | (16) AN503-8-8 screws, 0.020 inch diameter safety wire, revision AL and prior swashplates | 17 |
| | (1) NAS6605-8 bolt clamping early revision A203 yokes | 190 |
| | (1 per link) 21FKF-616 jam nut, main rotor pitch link barrel | 100 |

23-33 Special Torques (continued)

| AREA | (QUANTITY) FASTENER | TORQUE (IN.-LB) |
|---|---|---|
| TAIL ROTOR GEARBOX | (1) B549-1 retainer, input seal | 70 FT-LB, wet |
| | (1) D210-4 nut, A031 pitch control housing stud | 90 |
| | (1) D210-4 nut, A119-1 bumper retainer | 120 |
| | (1) D210-8 nut retaining B546 input yoke on B021 gearbox | 70 FT-LB, wet with B270-11 |
| | (3) MS20074-04-06 bolts, gearbox-to-tailcone mounting | 100 |
| | (3) MS90725-7 cap screws, gearbox-to-tailcone mounting | 100 |
| | (8) MS20074-04-06 bolts on A021 gearbox | 60 |
| | (12) MS20074-04-06 bolts on B021 gearbox | 100 |
| | (1) NAS1304-38 bolt, spherical tail rotor teeter (delta) hinge | 150 |
| | (1) NAS6604-38 bolt, elastomeric tail rotor teeter (delta) hinge | 150 |
| | (1) chip detector on A021 gearbox | 100 |
| | (1) chip detector on B021 gearbox | 60 |
| | (1) nut, chip detector wiring on B021 gearbox | 4–6 |
| | (1) filler-plug vent assembly | 100 |
| | (1) sight gage on A021 gearbox | 150 |
| | (1) B563-4 (flat, UV filter) sight gage on B021 gearbox | 150 |
| | (1) B563-1 (bubble) sight gage on B021 gearbox | 100 |
| WINDSHIELD | (24) AN526C832R12 screw, thru center brace | 16 |
| | (64) B526-6 screw, polycarbonate windshield fasteners | 24 |
| | (1) B295-1 or-2 clip, yaw string | 16 |

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## 23-70 Approved Materials

The following items are available from the noted manufacturer(s) or their distributor(s). Check with appropriate regulatory authority(s) for allowable usage of materials.

**WARNING**

**Review appropriate Safety Data Sheet (SDS) when working in proximity to hazardous materials. Specific recommendations for use of personal protective equipment are located in the SDS.**

**CAUTION**

Follow product manufacturer's instructions for handling and storage.

## 23-71 Paint Strippers

**CAUTION**

Use of non-approved liquid-strippers may lead to part failure.

| PRODUCT | MANUFACTURER/SUPPLIER | APPLICATION |
|---|---|---|
| Cee-Bee Stripper A-292NC-M | McGean-Rohco: Cee-Bee Division. Downey, CA. https://Cee-Bee.com | Metal parts, except blades and flex plates. Do not use near mechanically fastened or bonded joints. |
| Plastic Media Blasting System, AMMO 301 size 20/30, type II (or equivalent polymer media) | Pauli Systems Inc. Fairfield, CA | Metal parts except blades and unsupported sheet metal less than 0.040 inch thick. Blast pressure for steel frames: 40–55 PSI Blast pressure for aluminum parts: 30–40 PSI |

## 23-72 Solvents and Cleaners

| PRODUCT | MANUFACTURER/SUPPLIER | APPLICATION |
|---|---|---|
| QSOL 220 | Safety-Kleen Systems, Inc. Plano, TX | General use and for cleaning prior to applying primer, topcoat, adhesive, or sealant. |
| Benzene, 1-Chloro-4 (Trifluoromethyl) PCBTF*** | Any | |
| Acetone*** | Any | |
| 220 Low VOC Cleaner | Axalta, Wilmington, DE | |
| Final Klean 3909S | Du Pont Chemical Los Angeles, CA | |
| XP Aerospace Prep Surface Cleaner | AkzoNobel, Waukegan, IL | |
| EM-Citro* | LPS Laboratories, Inc. Tucker, GA | Removing adhesive residue on cabin and polycarbonate & acrylic windshield. |
| Lacolene (Aliphatic Hydrocarbon) | Any | Windshield and plastic cleaning and general residue removal. |
| Plexus® | B.T.I. Chemical Co. Oak Park, CA | |

## 23-72 Solvents and Cleaners (continued)

| PRODUCT | MANUFACTURER/SUPPLIER | APPLICATION |
|---|---|---|
| Presolve | LPS Laboratories, Inc.<br>Tucker, GA | Hydraulic components only. |
| Tetrachloroethylene<br>(Perchloroethylene) | Any | Vapor degreaser. |
| 815 GD | Brulin Corporation<br>Indianapolis, IN | Ultrasonic cleaning, general use.** |
| SF50 | L&R Mfg. Co.<br>Kearny, NJ | |
| #112 Ammoniated or<br>#222 Nonammoniated cleaning solution | L&R Mfg. Co.<br>Kearny, NJ | Ultrasonic cleaning, avionics components only. |
| #194 rinse solution | | |
| Cleanup Wipe E-4365 | Sontara<br>Candler, NC | Cleaning and drying. |
| Snoop Liquid Leak Detector | Swagelok<br>Salon, OH | Leak detector. |

* May be used on acrylic plastic.
** Mix 5%–20% by volume; titration not required.
*** Acetone and PCBTF may be mixed 50-50.

## 23-73 Fillers and Putty

| PRODUCT | MANUFACTURER/SUPPLIER | APPLICATION |
|---|---|---|
| 05960 Glazing Putty<br>05860 Dry Guide Coat<br>31180 Finishing Glaze | 3M<br>St. Paul, MN | Minor surface imperfections. |
| SBF1191 Filler | Gearhead Products<br>Indianapolis, IN | |
| FE-351 Cream Hardener | Catalyst Systems<br>Gnadenhutten, OH | |

## 23-74 Torque Seal

| PRODUCT | MANUFACTURER/SUPPLIER | APPLICATION |
|---|---|---|
| 83314 thru 83321<br>Except 83316 (red) | Dykem Cross-Check<br>ITW Pro Brands | Torque seal. |

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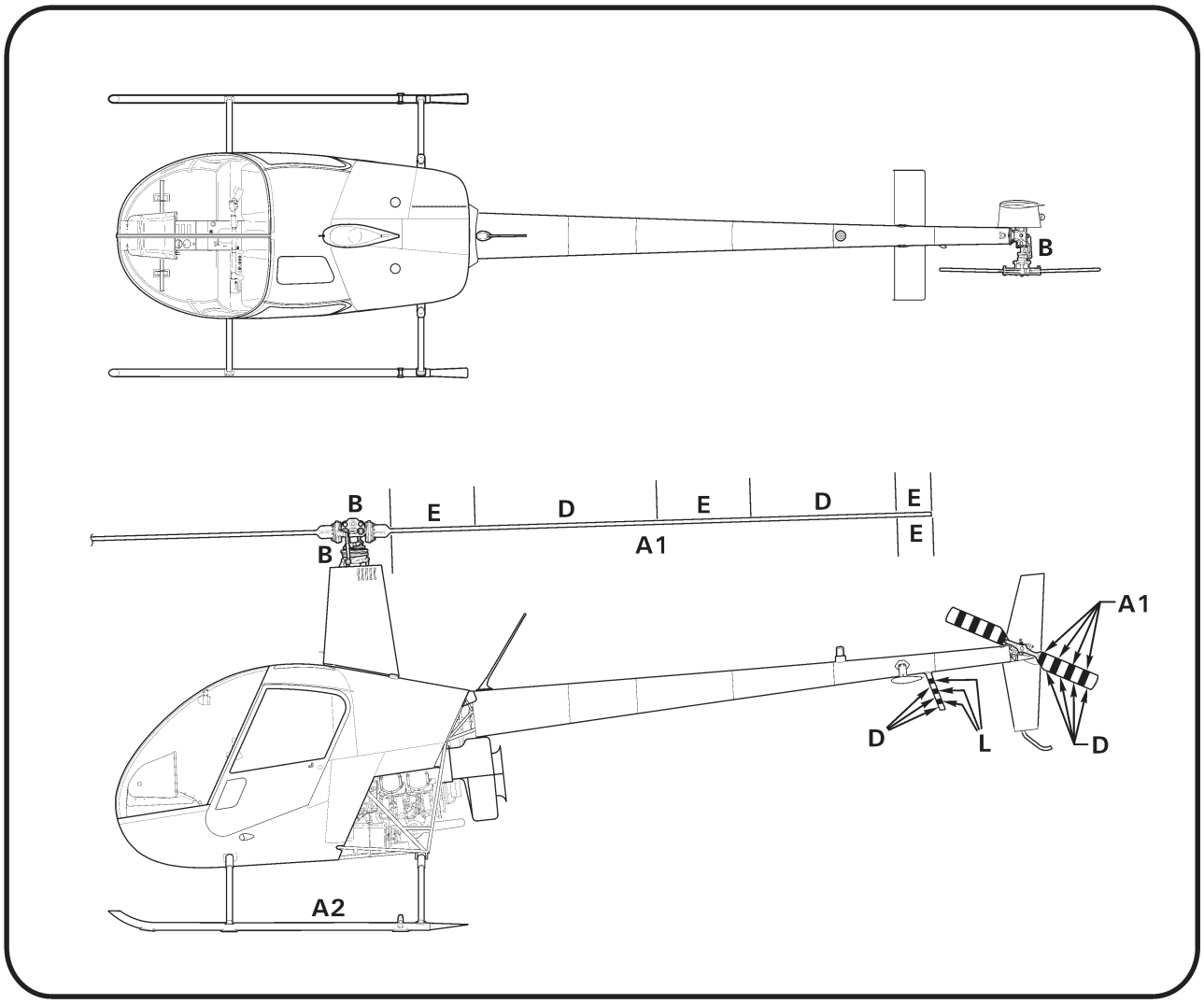


FIGURE 23-3 PAINT CODES

(Refer to Chapter 26 for rotor blade paint dimensions. Exterior surface codes are D & F unless otherwise specified.)

## 23-77 Paints

Refer to Figures 23-3 & 23-4 for paint code application. Paint codes for specific helicopter serial numbers are listed on the inside cover of Airframe Maintenance Record (logbook).

| FINISH CODE | MATERIAL* | ADDITIVES | MANUFACTURER | RHC PART NO. | APPLICATION |
|---|---|---|---|---|---|
| A1 | Flat Black 18BK006 | 18BK006CAT Catalyst | PPG Aerospace; Irvine, CA | 18BK006 | Blade black |
| | Abrasion Resistant 23T3-90 Black | PC-216 Curing Solution | AkzoNobel; Waukegan, IL | 23T3-90 | |
| A2 | FR2-55 Mat Top Coat | Thinner: water | Mapaero Pamiers, France | 557Z7038B005K | Interior, skid tube, windshield, & window trim black |
| | Aerofine 8250 Topcoat | Thinner: water | AkzoNobel; Waukegan, IL | A8250/F9007 | |

23-77 Paints (continued)

| FINISH CODE | MATERIAL* | ADDITIVES | MANUFACTURER | RHC PART NO. | APPLICATION |
|---|---|---|---|---|---|
| A3 | Cardinal A-2000 Flat Black | | Cardinal; Cleveland, OH | A-2000-BKE30903 | Interior, skid tube, windshield, & window trim Touch Up (Aerosol) |
| | Krylon 1613 Semi-Flat Black | | Krylon; Colombus, OH | 1613 | |
| B | Dark gray Imron AF400/AF700 | 13100S Activator 13110S Activator | Axalta; Wilmington, DE | DS020EP | Dark gray |
| C | Engine Gray IE-8948 | | Randolph, Chicopee, MA | IE-8948 | Engine Enamel |
| | Lycoming Gray G-5436 | | Randolph, Riverside, CA | G-5436 | |
| | Lycoming A219 | | Randolph, Cleveland, OH | A219 | |
| D | White Imron AF400/AF700 | 13100S Activator 13110S Activator | Axalta; Wilmington, DE | N0774EP | White |
| E | Yellow Imron AF400/AF700 | 13100S Activator 13110S Activator | Axalta; Wilmington, DE | N0680EP | Yellow |
| F | Imron AF400/AF700 Colors | 13100S Activator 13110S Activator | Axalta; Wilmington, DE | (Refer to logbook) | Exterior |
| G | Clear Imron AF740 | 13100S Activator 13110S Activator 13930S Reducer | Axalta; Wilmington, DE | AF740 | Clear coat |
| | 1311 Matte Clear Coat | | Krylon; Columbus, OH | 1311 | Clear coat aerosol |
| J | White Imron 2.1 FT | 9T00-A Activator D-121 Tint D-101 Tint 2100-P 2.1 Binder 9T20 Flattener | Axalta; Wilmington, DE | 9T00-A D121 D101 2100P 9T20 | Floats |
| K | Printcolor White Ink 750-9005 Printcolor Black Ink 750-8005 Printcolor Maize Yellow Ink 750-1205 Printcolor Carnation Red 750-3005 | Printcolor Glass Hardener 700 Gensolve Thinner GS-017 Slow Retarder 10-03432 | Deco; Orange, CA | 7509005 7508005 7501205, 7503005 | Silkscreen |
| L | Red Imron AF400/AF700 | 13100S Activator 13110S Activator | Axalta; Wilmington, DE | N0759EP | Red |
| Q | ProtectaClear | | Everbrite; Rancho Cordova, CA | Protecta | Optional on bare area of MR spar |

* Shelf life per manufacturer's recommendation.

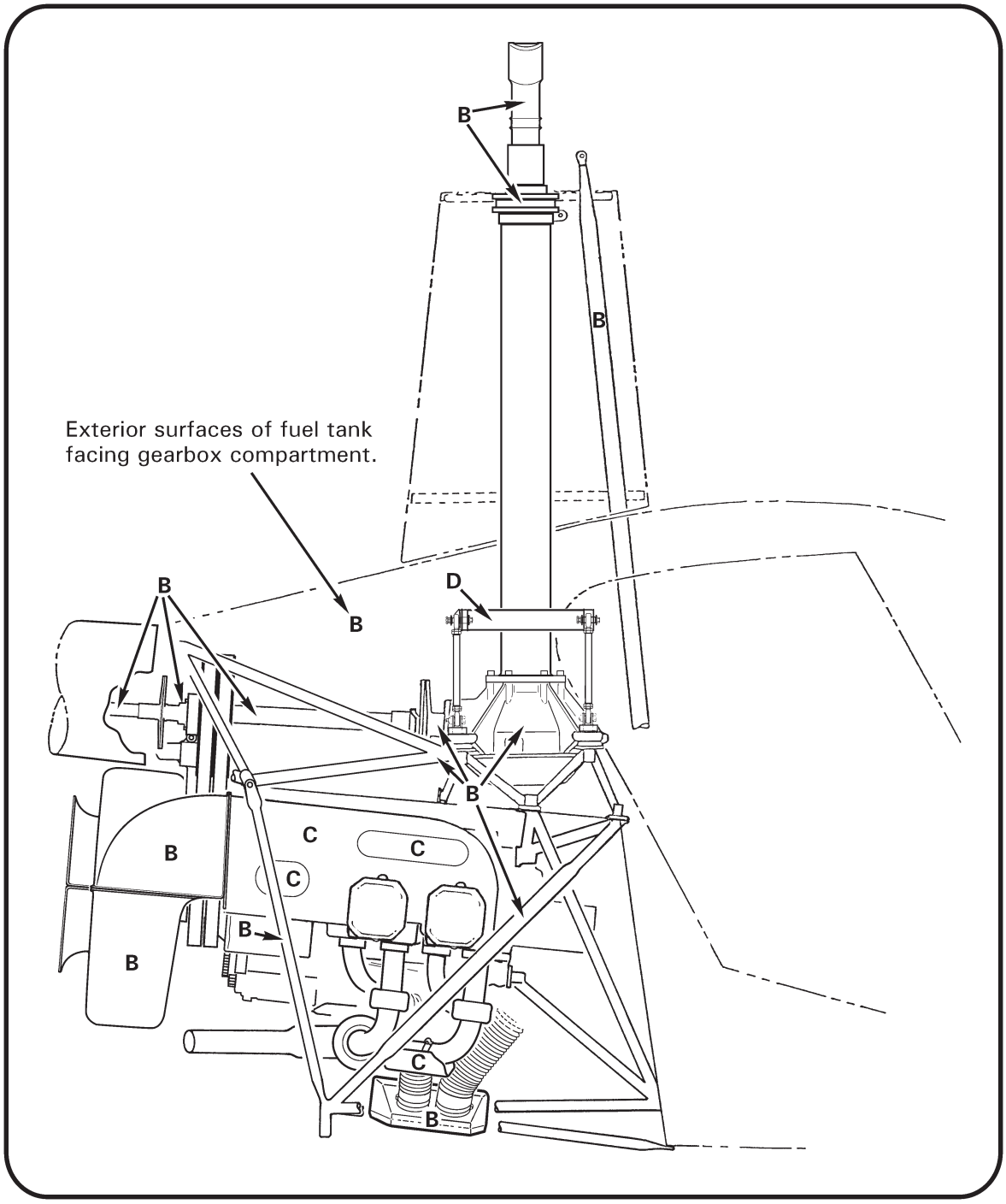


FIGURE 23-4 PAINT CODES

## 23-83 Replacement Component Identification (Data) Plates

In order to issue a replacement component identification plate for field installation, RHC must first receive the old identification plate in legible condition. If old identification plate is lost or destroyed, then RHC must have an original letter (photocopies or faxes are NOT acceptable) from customer's Civil Aviation Authority (sent via postal mail, or via electronic mail directly from authority domain, such as "faa.gov") authorizing identification plate replacement AND stating component name, part number, and serial number for each requested identification plate. There is a charge for each plate issued.

Identification plates may be carefully removed using a sharp plastic scraper. If necessary, use a heat gun to soften plate adhesive. Retain in a dry, contaminate-free area until ready for reinstallation.

Damp wipe local area with acetone or equivalent solvent prior to reinstallation. Residual adhesive on identification plate is usually sufficient for good adhesion. If necessary, use B270-9 adhesive or equivalent to secure.

## 23-84 Crimp Inspection

Refer to Figure 23-5.

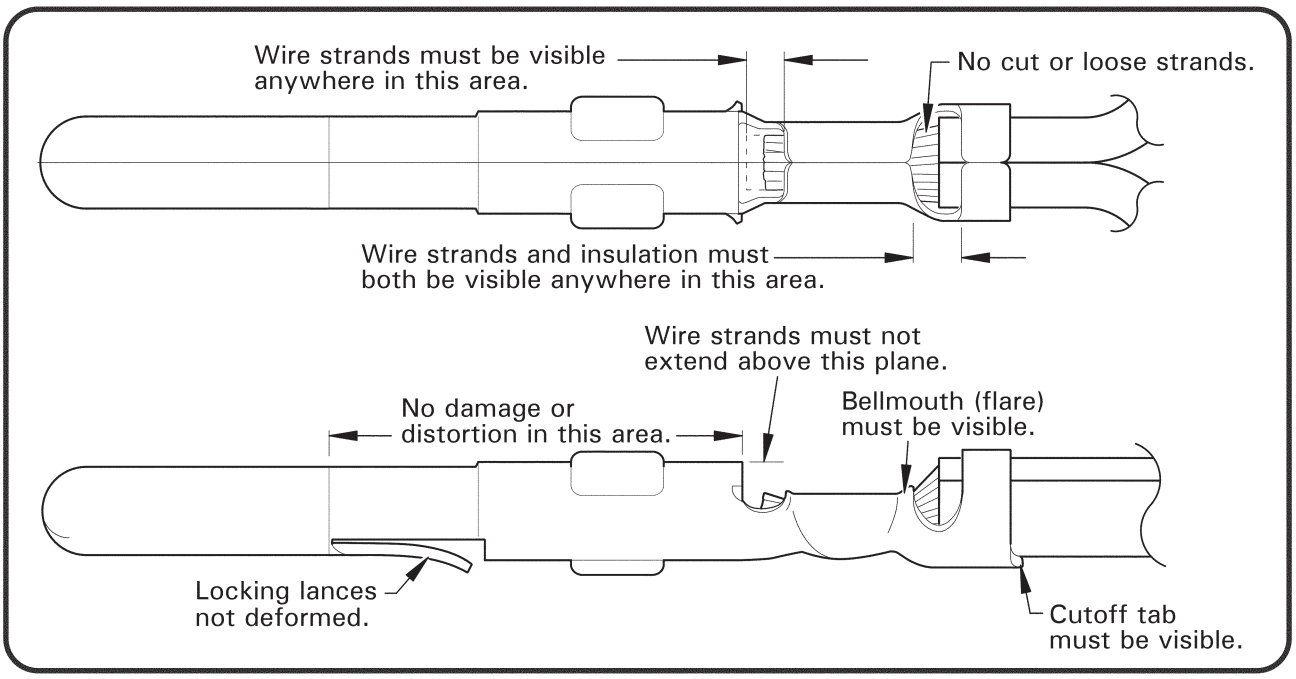


FIGURE 23-5 CRIMP INSPECTION

23-85 Storage Limits

1. B283 hoses have a shelf storage life of 5 years. Hose service life is “on condition”, with a maximum of 12 years.
2. Elastic cords have a shelf storage life of 5 years. Elastic cord service life is “on condition”, with a maximum of 12 years. Use invoice or FAA Form 8130 date as start date.
3. Store V-belts at less than 85°F (30°C), with relative humidity below 70%. Avoid solvent and oil vapors, atmospheric contaminants, sunlight, and ozone sources (electric motors, arc welding, ionizing air purifiers, etc.). Belt shelf life is 4 years if preceding recommendations are followed. Use invoice date or FAA Form 8130 date as start date.
4. Oils and greases have a 5 year shelf life when stored and kept sealed in their original container. Use invoice date or FAA Form 8130 date as start date unless the manufacturer has marked container with manufacture date (in which case use manufacture date as start date).
5. Rubber O-rings, seals, and gaskets have a twenty (20) quarter, five (5) year shelf life from the indicated cure date. Fluorocarbon (Viton) and silicon rubber products shall adhere to manufacturer’s expiration date(s). Service life is “on condition” with a maximum of 12 years.
6. Store uninstalled fuel bladder in original container (if available) at 70°F to 80°F and below 70% humidity. Coat bladder with clean, non-detergent engine mineral oil to prevent rubber from drying out and cracking. Store bladder in relaxed condition free from tension, compression, or other deformation such as creases or folds.

23-86 B526 Screws and B527-08 Washers

This section has been moved to § 16-61 B526 Screws and B527-08 Washers.

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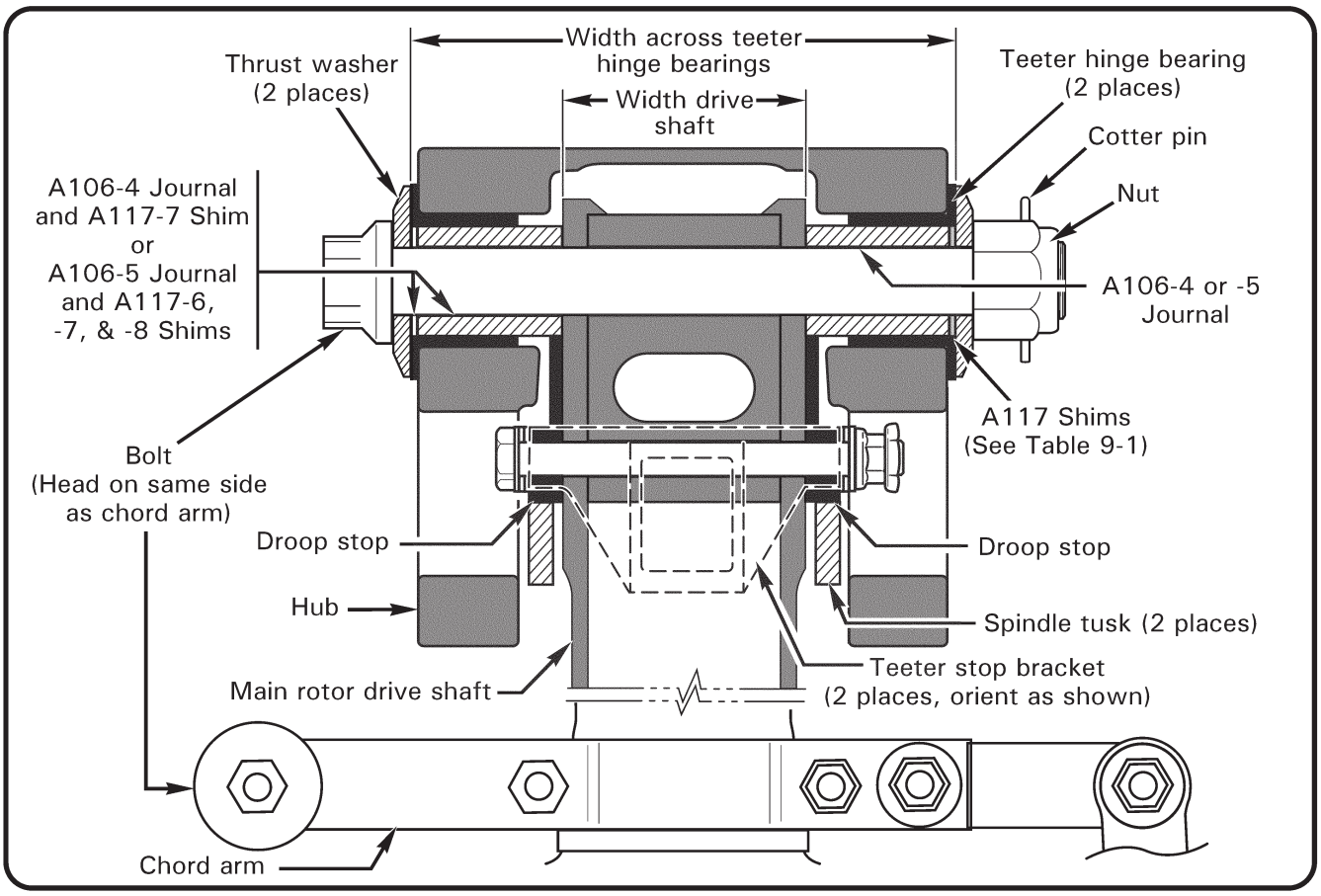


FIGURE 26-5 TEETER HINGE (HUB INSTALLATION)

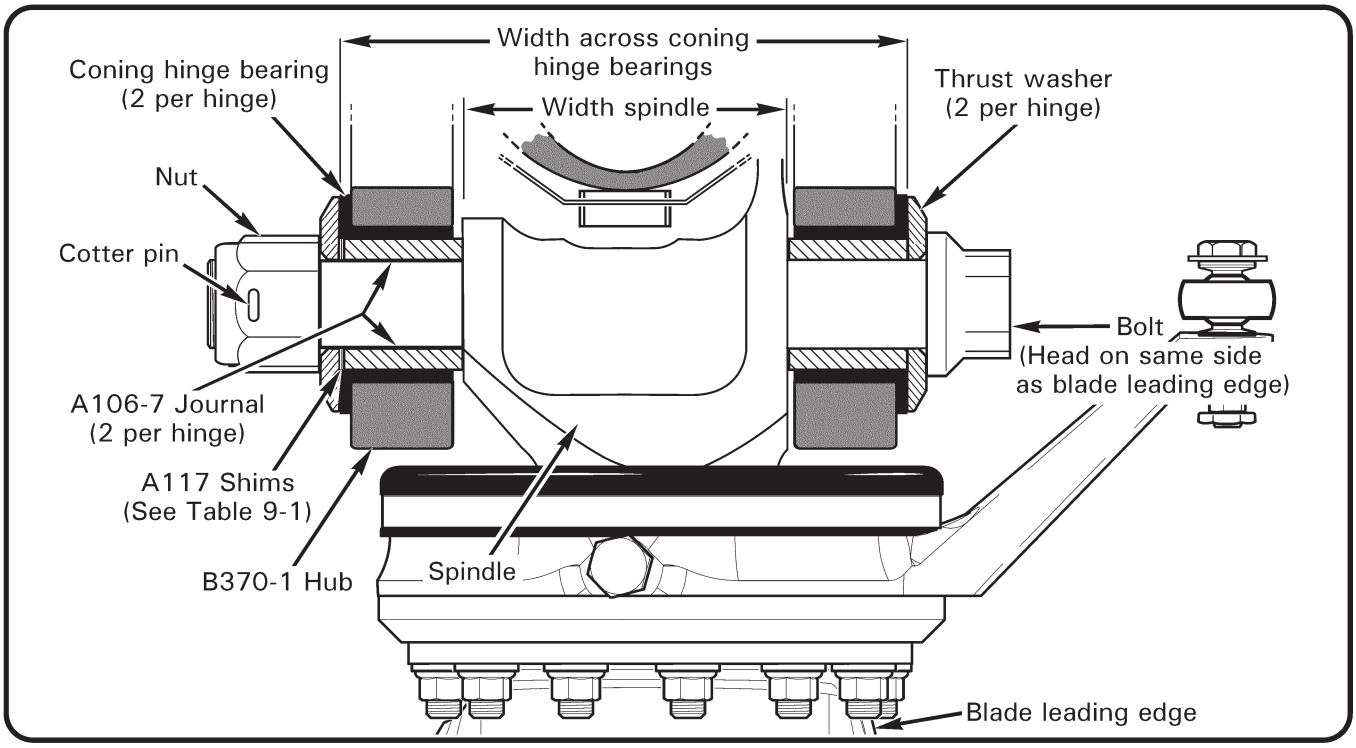


FIGURE 26-6 B370-1 HUB CONING HINGE (BLADE INSTALLATION; VIEW LOOKING DOWN)

## 26-30 Main Rotor Assembly

### 26-31 Journal and Shim Calculations

Refer to Table 26-1 and Figures 26-5, 26-6, and 26-7.

**A. Teeter Hinge Calculation**

1. Measure main rotor hub width across the teeter hinge bearing faces: _____ in.
2. Subtract measured width of A251 driveshaft at teeter hinge bolt hole: – _____ in.

   Calculated empty space: = _____ in.
3. Assemble thrust washer under teeter bolt head, and:
   a. One A117-7 shim (0.020 inch), and one A106-4 journal (1.300 inches), or
   b. One each A117-6, -7, & -8 shims (0.015, 0.020, and 0.025 inch), and one A106-5 journal (1.260 inches).

   Insert bolt thru hub and drive shaft.

   Subtract combined measured thickness of A117 shim(s) & A106-4 or -5 journal: – _____ in.

   Difference: = _____ in.
4. Subtract measured length of nut-side A106-4 or A106-5 journal: – _____ in.

   Difference: = _____ in.

> **CAUTION**
>
> Initial teeter hinge hardware stack-up must be adjusted to 0.005/0.008 inch greater than calculated empty space. A smaller initial stack-up could damage thrust washers and hub bearings during installation.

5. To accommodate dimensional change due to clamping force, add: + 0.005/0.008 in.

   Initial A117 shim stack between nut-side journal & thrust washer: = _____ / _____ in.

> NOTE
>
> Use as many different size A117 shims as possible to facilitate head shifting during balancing.

6. Refer to § 26-32. Adjust shim stack as required to meet teeter hinge friction requirement (less than 15 ft-lb).

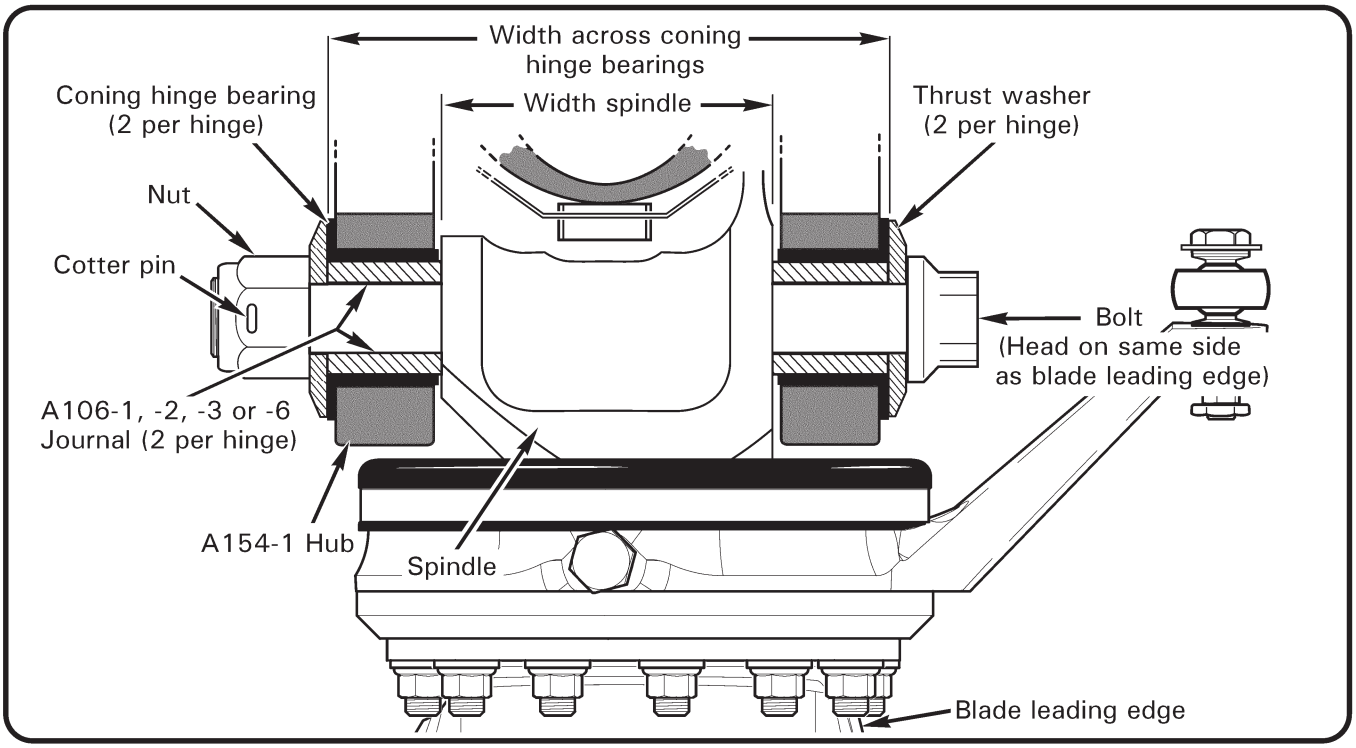


FIGURE 26-7 A154-1 HUB CONING HINGE (BLADE INSTALLATION; VIEW LOOKING DOWN)

| A106 Journal Lengths | | |
|---|---|---|
| Part No. | Length | Location |
| A106-1 | 1.000 in. | Coning hinge, no shims (A154-1 Hub) |
| A106-2 | 0.995 in. | Coning hinge, no shims (A154-1 Hub) |
| A106-3 | 0.990 in. | Coning hinge, no shims (A154-1 Hub) |
| A106-4 | 1.300 in. | Teeter hinge (two, or one + A106-5 per hinge), shims |
| A106-5 | 1.260 in. | Teeter hinge (two, or one + A106-4 per hinge), shims |
| A106-6 | 1.005 in. | Coning hinge, no shims (A154-1 Hub) |
| A106-7 | 1.005 in. | Coning hinge (B370-1 Hub) |

| A117 Shim Sizes | | |
|---|---|---|
| Part No. | Thickness | Location (Between thrust washer and journal) |
| A117-5 | 0.012 in. | Teeter hinge |
| A117-6 | 0.015 in. | Teeter hinge |
| A117-7 | 0.020 in. | Teeter hinge |
| A117-8 | 0.025 in. | Teeter hinge |
| A117-48 | 0.012 in. | Coning hinge (B370-1 Hub) |
| A117-49 | 0.015 in. | Coning hinge (B370-1 Hub) |
| A117-50 | 0.020 in. | Coning hinge (B370-1 Hub) |
| A117-51 | 0.025 in. | Coning hinge (B370-1 Hub) |

TABLE 26-1 A106 JOURNAL LENGTHS AND A117 SHIM SIZES

28-10 Tail Rotor Assembly (continued)

**B. Installation**

1. Perform static balance per § 28-11 if balancing hardware information is unknown, if blades were replaced, or if any rework has changed mass of rotor assembly.
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 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.
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 90º 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 A119-1 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.

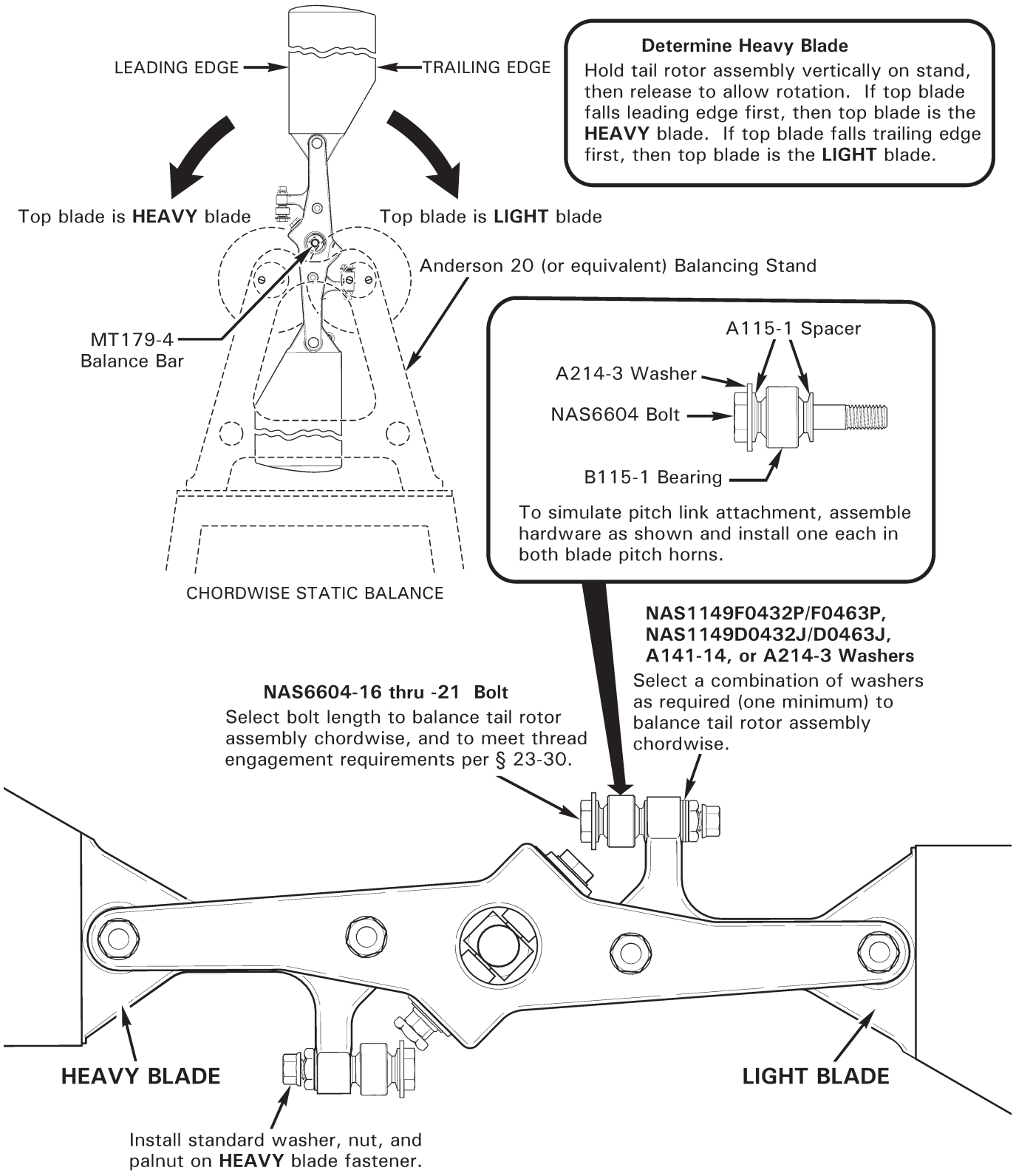


FIGURE 28-2 CHORDWISE STATIC BALANCE

## 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.

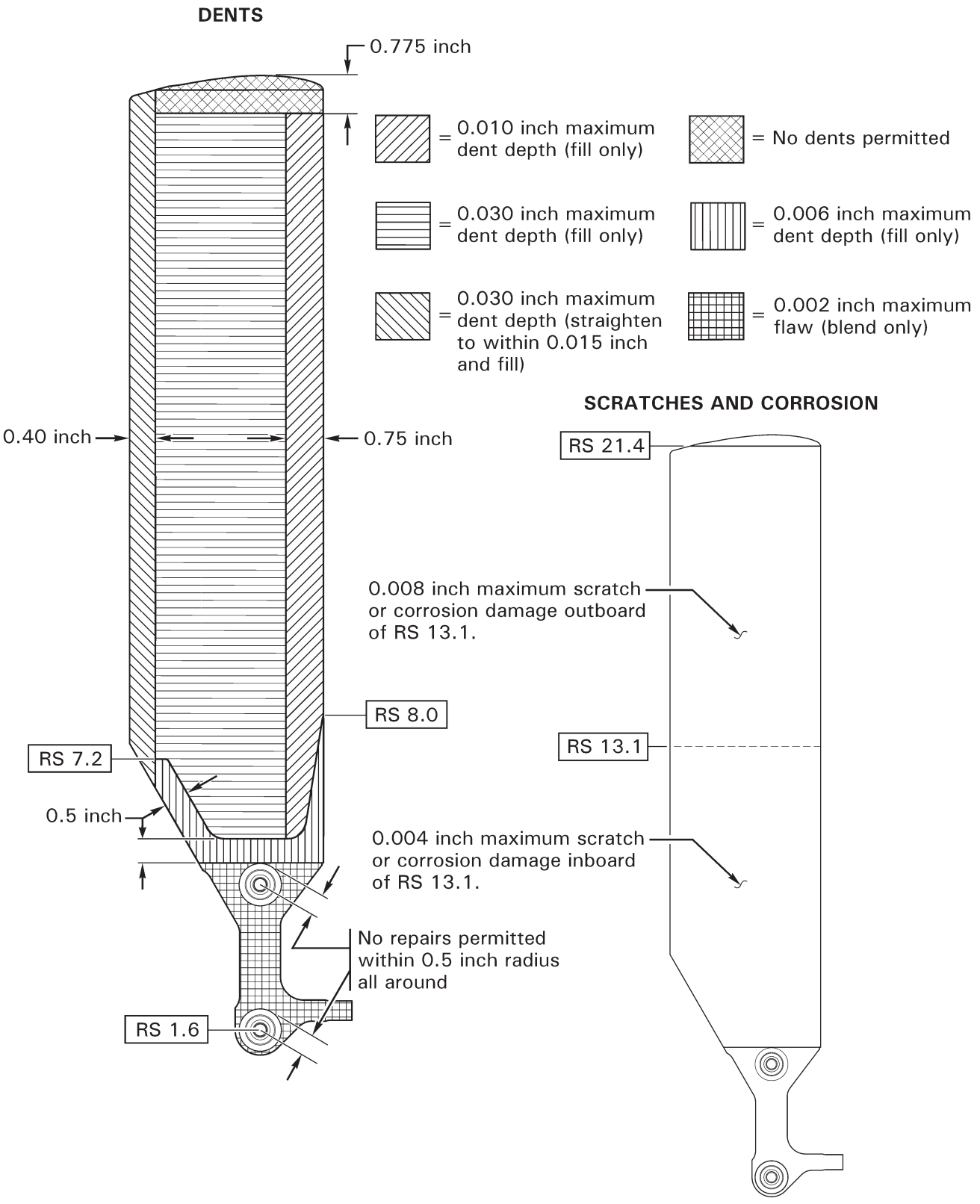


FIGURE 28-4 TAIL ROTOR BLADE INSPECTION CRITERIA

28-32 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. 0.002 inch deep each side (may only be repaired one time).
      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. 0.002 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. Refer to Figure 28-4A. Verify damage (or repair) does not exceed following limits:
   a. 0.050 inch maximum depth (chordwise) 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. Refer to Figure 28-4A. Trailing edge must remain square with skins; skin must not taper.
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.

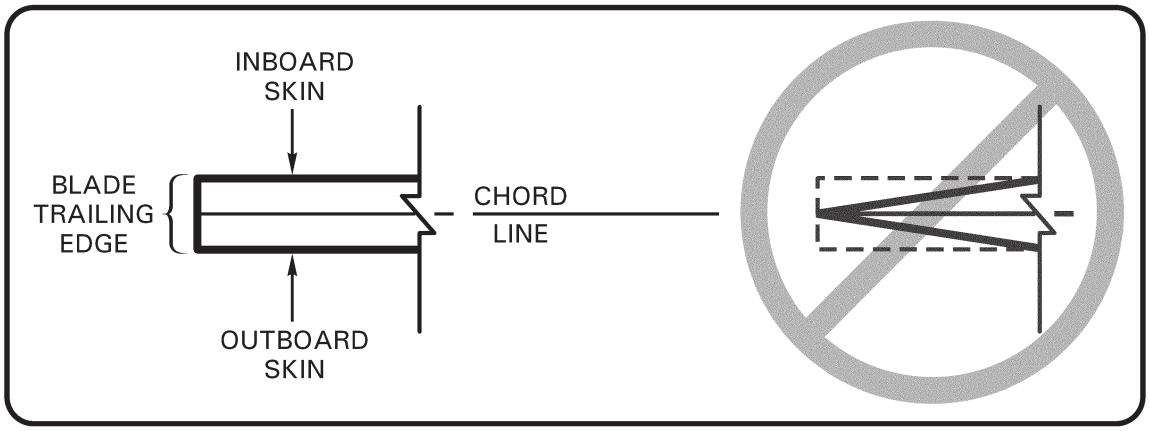


FIGURE 28-4A REPAIRS TO BLADE TRAILING EDGE

## 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.

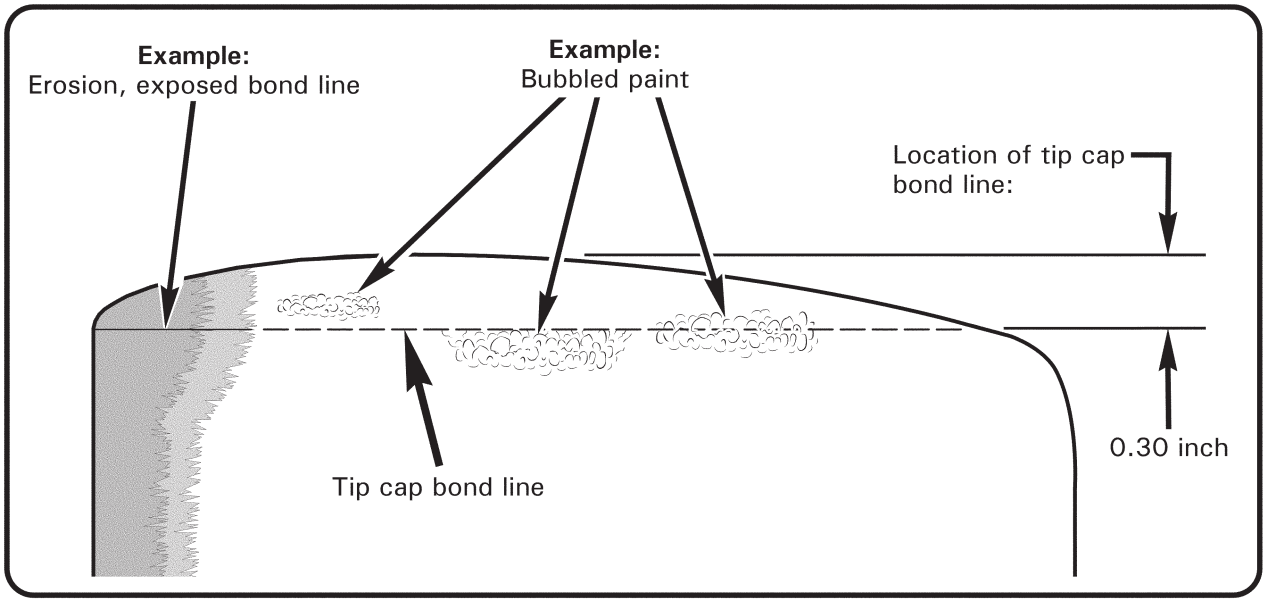


FIGURE 28-7 TAIL ROTOR BLADE TIP CAP BOND LINE

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®.

# CHAPTER 33

# ELECTRICAL SYSTEM

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## 33-140 Lycoming Electronic Ignition System (EIS)

Later aircraft are equipped with a Lycoming Electronic Ignition System (EIS) single module magneto replacement. The EIS installation replaces the left starting magneto (and starter vibrator). The remaining right magneto provides redundant ignition, which eliminates the need for a back-up battery system (required on dual module EIS installations).

Refer to Lycoming SI 1569, current revision for instructions for continued airworthiness for EIS modules. SI 1569 also provides instruction for module internal timing and module-to-engine timing for single (and dual) EIS installed.

## 33-150 Audio Alerts

All R22 helicopters have a low-RPM horn which sounds when rotor RPM is below 97%. The horn is muted when the collective is fully down. On earlier aircraft, the horn is provided by a speaker in the side of the instrument console. On later aircraft, a tone generator in the audio system provides the horn through crew headsets.

Later aircraft include a high rotor RPM alert through the headsets. A warble tone (high/low tone) indicates rotor RPM is approaching 110%. A test button on the instrument panel permits pre-flight or in-flight testing of the high-RPM alert.

Additional audio alerts may be provided in the headsets depending on optional equipment installed, such as terrain and traffic warnings.

## 33-160 Cockpit Camera

An optional video camera may be installed in the cabin ceiling. The camera records 4K video, intercom audio and radio communications, and GPS position both internally and to a removable flash drive. Recording starts automatically when the battery switch is turned on and stops when it is turned off.

Recording to the flash drive can be stopped or audio muted using the record and audio switches on the front of the camera housing. A switch in the down position turns off the associated function. Do not remove the flash drive while a recording is in progress as this will corrupt the video file. To remove a flash drive when the helicopter battery switch is on, first stop the recording using the record switch.

A blue flashing light on the camera housing indicates video is being recorded to the flash drive. A green steady light indicates the camera is powered and operating normally. The green light will change to an amber flashing light if an internal camera fault is detected, in which case video may not be recorded.

Video can be viewed on a Windows PC or Mac by removing the flash drive from the camera, inserting it into a USB port on a computer, and double clicking on the desired video file. Video is recorded in sequential 4 GB files with each file approximately 25 minutes in length. Video files are labeled HELICAM_xxxx.MP4, where xxxx is a sequential number. GPS position and altitude are recorded to files labeled HELICAM_xxxx.GPX on the flash drive, and are optionally displayed in the upper left hand corner of the video. A 128 GB flash drive (one supplied with each helicopter) will record approximately 13 hours of video. When full, the earliest video file is overwritten with the latest recording.

33-160 Cockpit Camera (continued)

| NOTE |
| --- |
| Flash drives used with the camera must meet the criteria described in the Cockpit Camera User Guide in order to function reliably. |

Complete instructions are provided in the Cockpit Camera User Guide on the Robinson website https://robinsonheli.com. The guide also provides additional playback suggestions, instructions for visualizing GPS data, setting user preferences, and updating camera software, and video post-processing and troubleshooting tips. User options include on screen display of time & date and/or GPS position, time zone and daylight saving time status, and units for on screen display of GPS altitude.

33-170 Overspeed Protection

An engine start-up overspeed protection circuit is standard electrical equipment on R22 ship S/N 4825 & subsequent.

R22 S/N 4825 thru 4880 factory installed circuit activates when A792-5 dual tachometer [internally] grounds pin 2 for 3s-5s.

R22 S/N 4881 & subsequent factory installed circuit activates when D270-1 governor controller [internally] grounds pin 12 (of 44-pin connector) for 3s-5s.

Engine start-up overspeeds typically occur if a start is initiated with the throttle open.

The start-up overspeed protection circuit is only active during the following conditions:

| R22 S/N 4825 thru 4880<br>Refer to A024 Revision BR schematic | R22 S/N 4881 & subsequent<br>Refer to A024 Revision BU schematic |
| --- | --- |
| A792 Engine rpm is above 90 ± 3% | D270 Engine RPM is above 85% ± 3% |
| A792 Rotor rpm is below 50 ± 10% | D270 Rotor RPM is below 50% ± 10% |
| Clutch switch is Disengaged i.e. wire -66 is routing power to wire -3003 | |

Start-up overspeed protection occurs when dual tachometer or governor [internally] grounds wire -3002, activating F695-9 overspeed relay's coil and in turn grounding both magnetos' p-leads.

During flight, the start-up overspeed relay is disabled because the clutch switch is in the Engage position.

No periodic maintenance of the start-up overspeed protection circuit is required.

**The start-up overspeed protection circuit cannot prevent all engine overspeeds.**

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| 23.31 | JUN 2024 |
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| 23.34 | NOV 2020 |
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