ROBINSON HELICOPTER COMPANY

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

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OFFICE HOURS

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Lunch hour is 11:30 a.m. to 12:30 p.m.

HOLIDAYS

Please visit www.robinsonheli.com for a list of holidays and company shutdowns.

CUSTOMER SUPPORT AND SPARES ORDERS

Please visit www.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 www.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 www.robinsonheli.com.

WARRANTY INFORMATION

Helicopter and parts warranty information is located at www.robinsonheli.com.

CHAPTER 1

GENERAL

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CHAPTER 1

GENERAL

1.000 Introduction

The R22 Maintenance Manual contains instructions necessary for proper maintenance, servicing, and handling of R22-series helicopters. The R22 Instructions for Continued Airworthiness (ICA) includes the R22 Maintenance Manual (MM), R22 Illustrated Parts Catalog (IPC), R22 Service Bulletins (SBs), R22 Service Letters (SLs), Lycoming O-320-series and O-360-series Operator's Manuals, applicable Lycoming technical publications, and applicable component manufacturer technical publications.

Service Bulletins are issued by Robinson Helicopter Company (RHC), Lycoming, and component manufacturers. RHC Service Bulletin compliance is mandatory; comply with other applicable Service Bulletins as directed. RHC technical publications are available online at www.robinsonheli.com. Recent technical publications are available from Lycoming at www.lycoming.com, and from Continental Motors, Inc. (CMI) at www.continentalmotors.aero.

Kit instructions are issued for field installation of either optional or mandatory (due to Service Bulletin or parts obsolescence) equipment upgrades, or provisions for upgrades. Kit instruction issued by RHC either implement approved type design data, or are approved as type design data.

A list of chapters is located in the *Introduction*. Chapters are separated by tab dividers and chapter contents are listed in the chapter front pages.

CAUTION

Always read instructions completely before performing a task.

1.001 RHC Maintenance Manuals and Illustrated Parts Catalogs Updates

RHC Maintenance Manuals (MMs) and Illustrated Parts Catalogs (IPCs) are available digitally at www.robinsonheli.com, under the Publications tab. Access to these publications does not require an account and is free of charge.

Viewing MMs & IPCs online is recommended to ensure use of current data.

Viewing MMs & 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.

Sign up for free email notification of revisions to MMs & IPCs by sending an email to subscriptions@robinsonheli.com with "Subscribe email" in the subject line. Within the email, include name, email address, physical address, and helicopter model(s) of interest.

1.002 R22 Maintenance Authorization

Only appropriately certificated mechanics who have successfully completed an R22 factory-sponsored maintenance course, or are under direct supervision of the above-stated mechanic, may perform maintenance, repairs, or inspections on R22-series helicopters. Annual inspections of U.S.-registered light helicopters must be performed by holders of an Inspection Authorization (IA) certificate or by repair stations certificated by the Federal Aviation Administration (FAA). The daily preflight and some preventive maintenance may be performed by the above-stated mechanics, or by the pilot/owner after receiving appropriate instruction in accordance with the R22 Pilot's Operating Handbook and applicable aviation regulations.

1.003 Component Maintenance Authorization

Only appropriately certificated mechanics who have successfully completed both a factory-sponsored maintenance course and component maintenance course, and who possess technical data supplied by RHC, are authorized to perform maintenance specified in the Component Maintenance Manual (CMM). Component maintenance may only be performed at an RHC-authorized Service Center that has the Component Maintenance special tools (ref. R22 SL-81).

1.004 Maintenance Record

The Airframe Maintenance Record is available online at www.robinsonheli.com.

Airframe Maintenance Record blank PDF forms may be used for R22-series, R44-series, and R66-series helicopters. Component Record blank PDF forms may be used for life-limited or TBO components. Blank paper copies are available for purchase (P/N R8478 Airframe Maintenance Record and P/N R8479 Component Record [pack of 20]).

A Component Record is a maintenance record of the removals, installations, or maintenance performed on a life-limited or TBO component. When a life-limited or TBO component is installed in the helicopter, the Component Record card is inserted in the Airframe Maintenance Record. When a life-limited or TBO component is removed from the helicopter, remove the Component Record card and keep the card with the Component. Major assemblies may contain one or more life-limited or TBO component.

RHC encourages operators to utilize Component Record cards to assist in tracking time on interchangeable parts since service lives may be different between models.

RHC does not create Component Record cards for spares, however, operators may create their own.

RHCs Repair Station does not require a Component Record card in order to perform work on a component, unlike a Component/Return Authorization form.

RHC recommends using a toner-based laser, or a pigment-based inkjet, color printer and 65 lb white (96 bright) premium card stock for Maintenance Record or Component Record card production. Maintenance Record binders and tab sets are available separately (P/N R8656 Maintenance Record Binder and P/N R8650 Maintenance Record Tabs).

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
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
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
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 www.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 www.robinsonheli.com for Customer Support contact information.

1.009 Assembly Instructions for R22-series Helicopter Crated for Export

NOTE

Aircraft assembly to be performed by a certificated mechanic.

1. Remove all components from tailcone crate and all accessible components from cabin crate. Assemble landing gear per §§ 5.220 (float gear only) and 5.320.

CAUTION

Do not lift helicopter and attached crate using main rotor hub; damage to main rotor gearbox and frames could result.

2. Attach a hoist to main rotor hub per § 17-20. Lift aft end of crate while taking up slack in hoist. When main rotor shaft is vertical, remove bolts at landing gear attach points and remove crate. Install landing gear per § 5.120. Lower helicopter on ground.
3. Install front cross tube cover panel. For float landing gear, set float pressure per Mariner supplement of Pilot's Operating Handbook and verify float stabilizer is being used in place of tail skid.
4. Install tailcone per § 4.312. Install tail rotor visual warning guard.
5. Install empennage assembly per § 4.322.
6. Install exhaust system per § 6.520. Install lower half of cooling fan scroll.
7. Remove preservative plugs from engine cylinder upper spark plug holes. Install upper spark plugs and special torque per § 23-33. Connect ignition leads.
8. Fill engine oil to six quart mark on dipstick, as required.
9. Install main rotor blades per § 26-10. Match color coded markings on blades, hub bolts, hub, and pitch links. Attach upper end of pitch links to pitch horns.
10. Install tail rotor per §§ 9.212 or 9.213, as applicable.
11. If required, fill battery with electrolyte and charge.
12. Fill main and tail gearboxes to center of sight gage using correct gearbox oil (refer to § 22-10 Part C). For helicopters shipped "on-side": earlier main gearboxes that have a vent hole atop static mast tube require 6 ounces correct gearbox oil injected into vent hole (later helicopters with vent hole located at base of mast tube do not require 6 ounce injection).
13. Fuel helicopter and drain a small amount of fuel through gascolator.

1.009 Assembly Instructions for R22-series Helicopter Crated for Export (continued)

14. If ship is equipped with artificial horizon, directional gyro, or vertical card magnetic compass, install as follows:

    Artificial Horizon and/or Directional Gyro:

    a. Remove amber ALT light and red OIL light from B050 console. Pull out A777-1, A981-1, or B197-1 instrument face by removing perimeter mounting screws. Place a pad under face to prevent scratches.

    b. Install required instrument(s) using screws provided.

    CAUTION

    Directional gyro mounting screws must not exceed 1 inch in length or unit will be damaged.

    c. Connect straight multi-pin connector to directional gyro and/or angled connector to artificial horizon ensuring that angled strain relief points down. Ensure that connectors lock in place. Ty-rap excess wiring.

    d. Install instrument face, ALT light, and OIL light.

    Vertical Card Magnetic Compass:

    Locate two wires extending from windshield bow. Slide one piece of heat-shrink tubing (provided) over each wire. Connect compass pins to wire sockets (polarity not critical). Position heat-shrink tubing over connections and apply heat. Install compass using two screws provided.

15. Install battery (Negative Ground System).

    NOTE

    This must be performed by a qualified pilot and a certificated mechanic.

16. Perform preflight inspection per Pilot's Operating Handbook and inspection per §§ 2.205 and 2.210.

17. Check tail rotor balance per § 10.240.

18. Perform hover checks in § 2.220.1. DO NOT proceed into forward flight at this time.

19. Track and balance main rotor per § 10.230.

20. While climbing at takeoff power per placard and 50 KIAS:

    a. Evaluate roughness at maximum and minimum power-on RPM.

    b. At minimum power-on RPM perform 30° left yaw to check for adequate directional control.

1.009 Assembly Instructions for R22-series Helicopter Crated for Export (continued)

21. During level flight at 3000 feet pressure altitude (if able), MCP, with right trim and governor on:

    a. Verify longitudinal and lateral cyclic control forces are neutralized (no tendency of cyclic to creep longitudinally or laterally).

    b. Verify collective control forces are neutralized (no tendency of collective to creep up or down).

    c. Verify throttle correlation. Set MAP to 22 inches and turn governor off. Without twisting throttle, lower collective to 12 inches MAP then raise it to 22.5 inches MAP. RPM must stay in green arc.

22. Evaluate roughness at minimum power-on RPM, takeoff power per placard, and V_{ne} per placard.

23. Check all instruments, gauges, and avionics for proper operation.

24. During autorotation at 50 KIAS and 90% rotor RPM, perform 30° right yaw to check for adequate directional control.

TABLE 1 SCHEDULED INSPECTIONS Consult latest revision of listed publications for specific applicability.	First 25 hours	First 100 hours	Every 50 hours	Every 100 hours	Every 300 hours	Every 500 hours	Every 800 hours	Every 2200 hours	Every 4 months	Every 12 months	Every 24 months	Every 4 years	Every 12 years
Perform inspection per Lycoming Operator's Manual.*	●		●	●	●								
Perform **Lycoming SI 1129** *Methods of Checking DC Alternator and Generator Belt Tension.*	●			●									
Perform **Lycoming SI 1191** *Cylinder Compression.*				●									
Perform **Lycoming SI 1080** *Maintenance Items for Special Attention.*			●	●									
Perform **Lycoming SB 301*** *Maintenance Procedures and Service Limitations for Valves.*		●			●								
Perform **Lycoming SB 366, as applicable** *Carburetor Throttle Body Screw Inspection.*			●										
Perform **Lycoming SB 388** (also applies to replacement cylinders) *Procedure to Determine Exhaust Valve and Guide Condition.*		●			●								
Perform **Lycoming SB 480** *I. Oil & Filter Change & Screen Cleaning / II. Oil Filter/Screen Content Inspection.*	●		●						●				
Perform **CMI SB 643, as applicable** *Maintenance Intervals for All CMI/TCM/Bendix Magnetos & Related Equipment.*				●		●						●	●
Perform **CMI SB 658** *Distributor Gear Maintenance.*						●						●	
Perform **CMI SB 663** *Two-Wire Magneto Tach. Breaker Contact (Points) Assy. P/N 10-400507.*						●						●	
Perform **CMI SB 670** *Replacement and maintenance of Magneto Distributor Block.*						●						●	
Perform 100-hour/annual inspection per § 2.400.				●						●			
Perform main rotor blade tip maintenance per § 26-60.				●						●			
Lubricate A181-4 Revision K, L, and M bearings per § 22-42.					●					●			
Lubricate A181-4 Revision N and subsequent bearings per § 22-42.							●					●	
Lubricate A184 bearing per § 22-41.					●					●			
Perform clutch assembly lubricant inspection & servicing per § 22-30.						●							
Drain and flush gearboxes per §§ 22-13 & 22-23.						●							
Clean gearbox chip detectors per §§ 22-11 & 22-21.						●				●			
Perform FAA AD 88-26-01 R2 (A158-1 spindles only).						●							
Perform 2200-hour/12-year inspection per § 2.600.								●					●
Inspect emergency locator transmitter (ELT) per U.S. 14 CFR § 91.207.										●			
Test and inspect transponder per U.S. 14 CFR § 91.413.											●		

* Shorter interval than published on referenced document.

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 or -5	Fanshaft Assembly	Replace with new A007-5 fanshaft assembly.
A008-2 or -4	Tail Rotor Assembly	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.
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)	

1.102 Additional Component Maintenance (continued)

A. 12 YEARS (continued)

Part Number	Description	Action
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.
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.
A650-1 or -3	Main Gearbox Mount Fittings	Visually inspect exterior and interior. Verify no corrosion.
A649-1, -2, or C649-1	Oil Cooler	Replace with new or overhaul exchange C649-1 oil cooler.

1.102 Additional Component Maintenance (continued)

A. 12 YEARS (continued)

Part Number	Description	Action
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 or -4	Dual Tachometer	Replace with new or overhaul exchange A792-4 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 (Rev J or subsequent)	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.
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 or -5	Fanshaft Assembly	Replace with new A007-5 fanshaft assembly.
A008-2 or -4	Tail Rotor Assembly	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.
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.

1.102 Additional Component Maintenance (continued)

B. 2200 Hours (continued)

Part Number	Description	Action
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.
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.
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.
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 or -4	Dual Tachometer	Replace with new or overhaul exchange A792-4 dual tachometer.

1.102 Additional Component Maintenance (continued)

B. 2200 Hours (continued)

Part Number	Description	Action
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 (Rev J or subsequent)	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.
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 Airbox 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

CHAPTER 2

INSPECTION (Continued)

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

Unless otherwise specified, the following general procedures apply to R22 inspection. 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.

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.

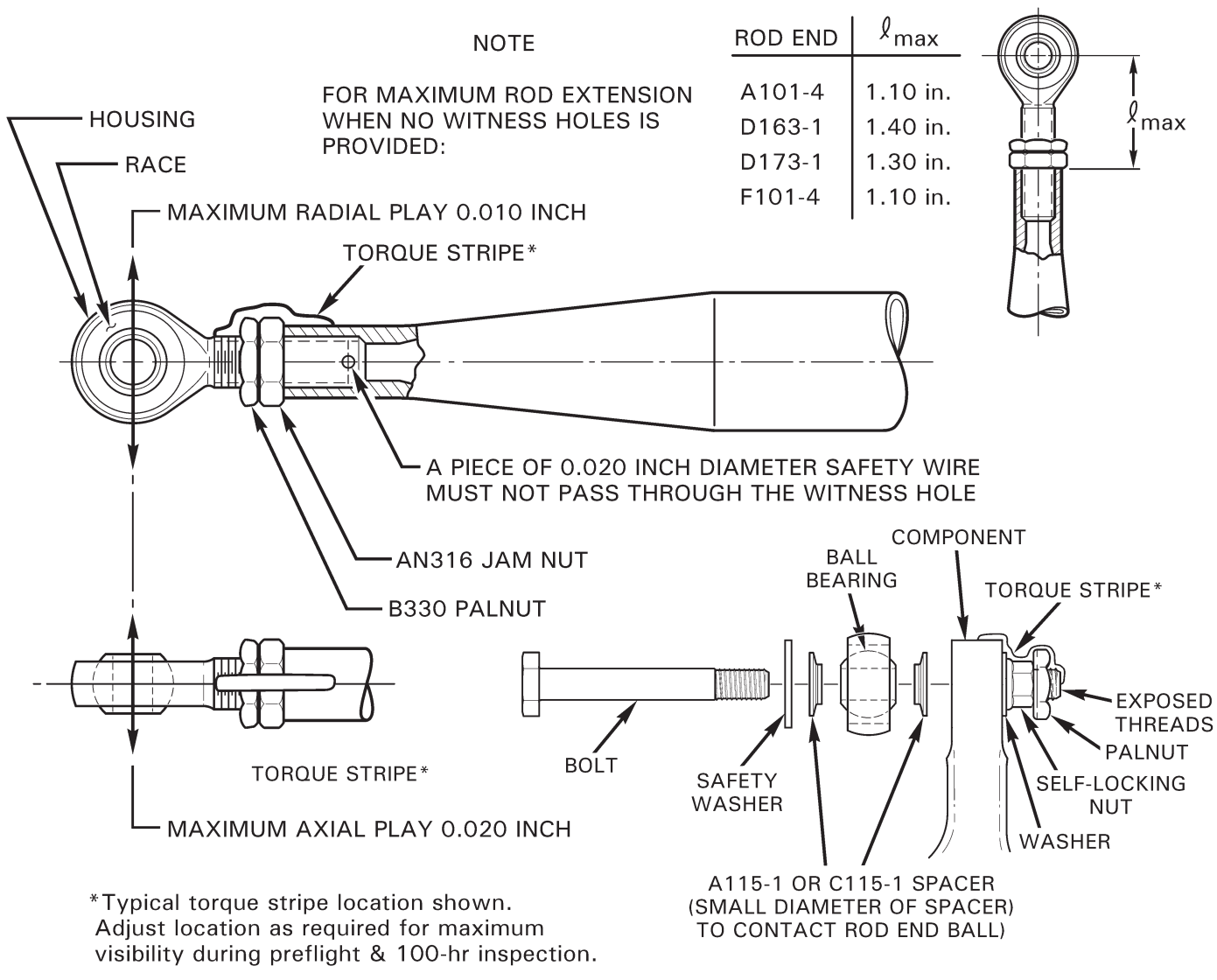

FIGURE 2-1 ROD END AND SPHERICAL BEARING PLAY LIMITS AND TORQUE STRIPE APPLICATION

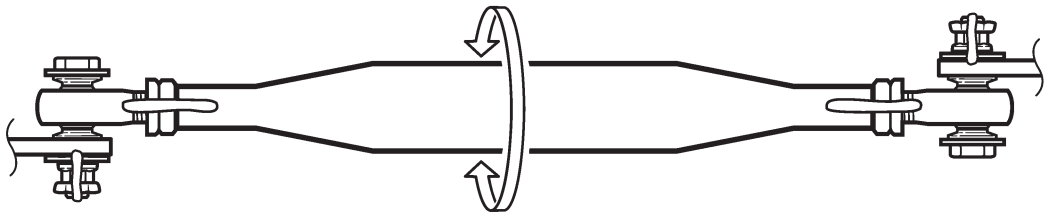

FIGURE 2-1A ROD END CENTERING
(Position rod ends for maximum rotation)

2.410 Inspection Procedures and Checklist (continued)

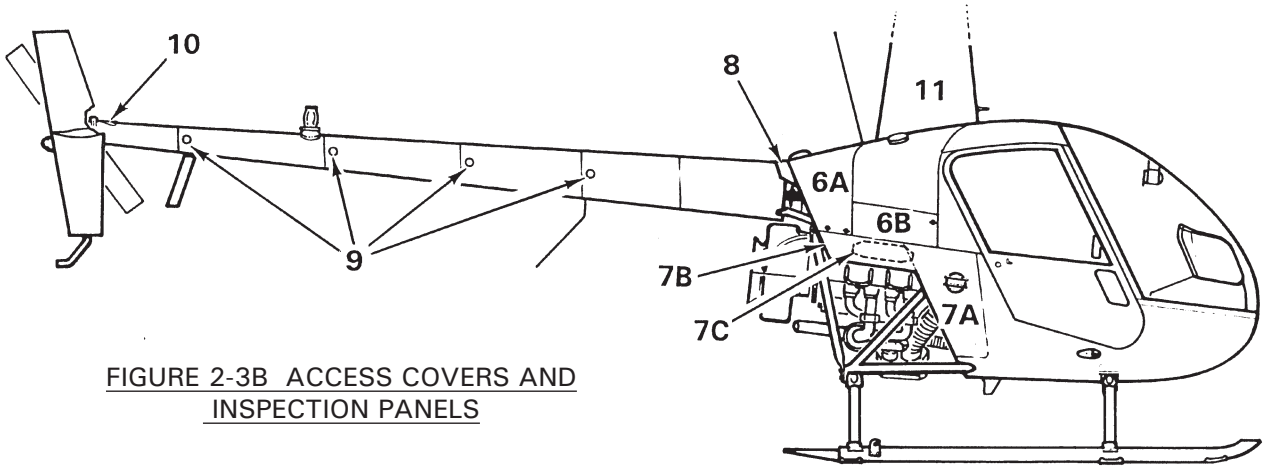

FIGURE 2-3B ACCESS COVERS AND INSPECTION PANELS

2. Remove or open upper console assembly per § 13-70:

CAUTION
Instrument console removal (§ 13-70) is not required for scheduled inspections. Sufficient access for inspection is gained by removing the landing light retainer and/or removal of installed avionics, as required (refer to Chapter 34).

Upper Console Assembly: Inspect condition. Verify hinge security. _____

Instruments and Instrument connections: Inspect condition. Verify security. _____

Strobe Power Supply and Wiring (alternate locations – atop horizontal firewall or behind right seat back): Inspect condition. Verify no cracks in mounting area. Verify security. _____

B255-1 Bracket (10-hole instrument console only): Inspect condition of grommet and bracket contacting brace assembly between windshields. _____

Tail Rotor Push-Pull Tubes: Inspect condition of visible portions. Verify operating clearance. _____

Battery and Box (if installed in nose): Inspect condition. Check battery cell fluid level and specific gravity (non-sealed battery only). Verify security of connections. Verify no corrosion in surrounding structure. _____

Radio Tray(s): Inspect condition. Verify security. Verify no loose or poor wire connections. _____

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

Wiring: Inspect condition. Verify neatness, security, and no chafing. _____

2.410 Inspection Procedures and Checklist (continued)

3. Open Circuit Breaker Panel (3)

WARNING
Ensure electrical system remains off while circuit breaker panel is open.

Wiring: Inspect condition. Verify neatness, security, and no chafing. _____

Connections: Inspect condition. Verify security and no corrosion. _____

Circuit Breakers: Inspect condition. Verify security. Check airworthiness directive applicability. Verify red button (collar) on CLUTCH circuit breaker button. _____

Copper Bus Bars: Inspect condition. Verify no corrosion. Verify bus bars are not bent and will not contact surrounding structure. _____

Circuit Breaker Box Interior: Inspect condition. Verify cleanliness. _____

Close and Secure: Circuit breaker panel. _____

4. Remove Horizontal Cover (4A), Cyclic Box Cover (4B), Belly Panel (4C) and Vertical Panel (4D)

To remove cyclic box cover, unscrew trim adjustment knob, remove spring pin in cyclic friction knob, and, on ships equipped with carburetor heat assist, unscrew carburetor heat knob.

Covers: Inspect condition. Verify placard legibility. _____

Cyclic Box Assembly: Inspect condition. Verify no cracks, loose rivets, or corrosion. Verify security. _____

Cyclic Stick Assembly: Inspect condition. Verify no cracks in weld areas. Verify security and operating clearance. Verify no more than 0.015 inch wear in plates at bottom of stick from A121-1 push-pull tube's forward rod end housing. _____

Cyclic Pivot (forward end of torque tube): Inspect condition. Inspect bearings per § 2.120. Verify security and operating clearance. _____

Cyclic Right Trim: Rotate main rotor blades until pitch links are located fore and aft. Grip cyclic and activate right trim. Trim should produce a right cyclic stick force. Move cyclic stick fully left and verify right trim spring coils do not bind. Verify security and operating clearance. _____

2.410 Inspection Procedures and Checklist (continued)

5. Remove Seat Backs (5A & 5B) & Collective Spring Guard (5C under left seat)

Seat Backs and Collective Spring Guard: Inspect condition. Verify upholstery security. _____

Upper Frame Assembly: Inspect condition of visible portions. Verify security. _____

Electrical and Antenna Wiring: Inspect condition. Verify security. Verify no chafing. Check grommets for proper installation. _____

Pitot and Static Lines: Inspect condition. Verify no chafing or kinks. _____

Collective Stick Assembly: Inspect condition. Inspect bearings per § 2.120. Verify security and operating clearance. Verify no cracks in welds. Verify security of removable stick (if installed). If applicable, verify A783-1 retainer is secured to collective stick with ty-raps per Figure 2-4. _____

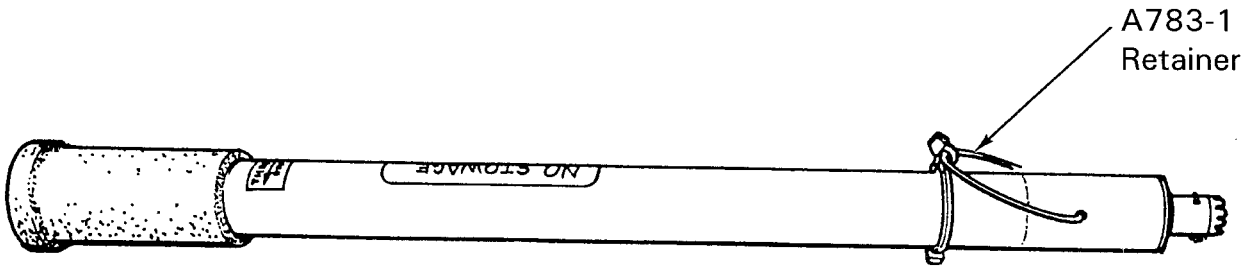

FIGURE 2-4 A783-1 RETAINER SECURITY

Throttle Connecting Rod: Inspect condition. Verify no cracks. Verify security and operating clearance. _____

Governor: Inspect condition. Inspect rod ends per § 2.120. Verify security and operating clearance. Verify sufficient wiring slack with full up collective. _____

Collective Spring: Inspect condition. Inspect rod ends per § 2.120. Verify no binding or roughness during operation. Verify lubrication of guide rods. Verify spring coils do not touch each other when collective is full down. Verify no elongation of lower cap guide rod holes. Verify security and operating clearance. _____

2.410 Inspection Procedures and Checklist (continued)

5. Remove Seat Backs (5A & 5B) & Collective Spring Guard (5C under left seat) (continued)

Firewall Drains: Inspect condition. Verify drains are unobstructed. Verify tubing clamps are not cutting tubing. Verify security. _____

Governor Controller/Engine Monitoring Unit (EMU; later helicopters) and Wiring: Inspect condition. Refer to § 33-137 for EMU description; refer to EMU Technician's Guide and EMU User Guide online at www.robinsonheli.com for data access. Verify security. _____

Main Fuel Tank Outlet & Fuel Hose: Inspect condition. Verify no leakage. Verify security. Verify smooth operation of fuel valve. _____

Fuel Shut-Off Valve: Inspect condition. Verify no leakage. Verify security. Verify smooth operation of fuel valve. _____

Aux Fuel Tank Fuel Hose: Inspect condition. Verify clearance to structure. Verify no leakage. Verify security. _____

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

6. Open Cowling Door(s) (6A & 6B) & Remove aft Cowling (6C)

Cowling Doors: Inspect condition. Verify proper operation of fasteners. _____

Electrical Wiring: Inspect condition. Verify no loose, broken, or chafed wires. Verify neatness and security. _____

Actuator Fuse(s) and Holder(s): Inspect condition. Verify no corrosion. Verify correct AGC-1½ fuse(s), twist-to-lock function, and security. _____

Antennas and Connections: Inspect condition. Verify security of antenna(s) and antenna connection(s). _____

Emergency Locator Transmitter (ELT; if installed): Inspect condition. Comply with U.S. 14 CFR 91.207 (d), if required. Verify proper installation, security, and clearance from drive train components. Verify D693-4 strap assembly is installed and buckled securely. _____

Pitot Line and Static Vent: Inspect condition. Verify no chafing, kinks, or tight bends. Verify static vent is clean and unobstructed. _____

Fuel Tanks: Inspect condition of visible portion. Verify no leaks. Verify security. Check interior for foreign objects and cracks in baffle. _____

Aux Fuel Tank Fuel Hose: Inspect condition. Verify clearance to structure. Verify no leakage. Verify security. If hose is C595-1 "breakaway" style (later helicopters), visually inspect coupling and verify no leakage, four rivets are installed and secure, and gap is not excessive (0.005 inch max.). _____

Fuel Gage Sender(s) and Wiring: Inspect condition. Verify no fuel leaks. _____

2.410 Inspection Procedures and Checklist (continued)

8. Remove Tailcone Fairing (8)

Tailcone Fairing: Inspect condition. _____

Upper Steel Tube Frame: Inspect condition. Verify no cracks or corrosion. If corrosion is found, inspect and repair per § 2.560. Use an inspection light & mirror to inspect all parts of each weld. _____

CAUTION

Upper steel tube frame is fatigue loaded and therefore susceptible to fatigue cracks. Inspect all joints thoroughly.

Tailcone-to-Upper Frame Attachment: Inspect condition. Verify security. _____

Upper Frame Protective Clamp: Inspect clamp protecting right side upper frame tube from drive belt contact; replace if wear has penetrated clamp. If clamp is not installed, verify no more than 0.0049 inch wear into frame tube due to drive belt rubbing. Protective clamp may be installed per Figure 2-4C on any R22 if desired. _____

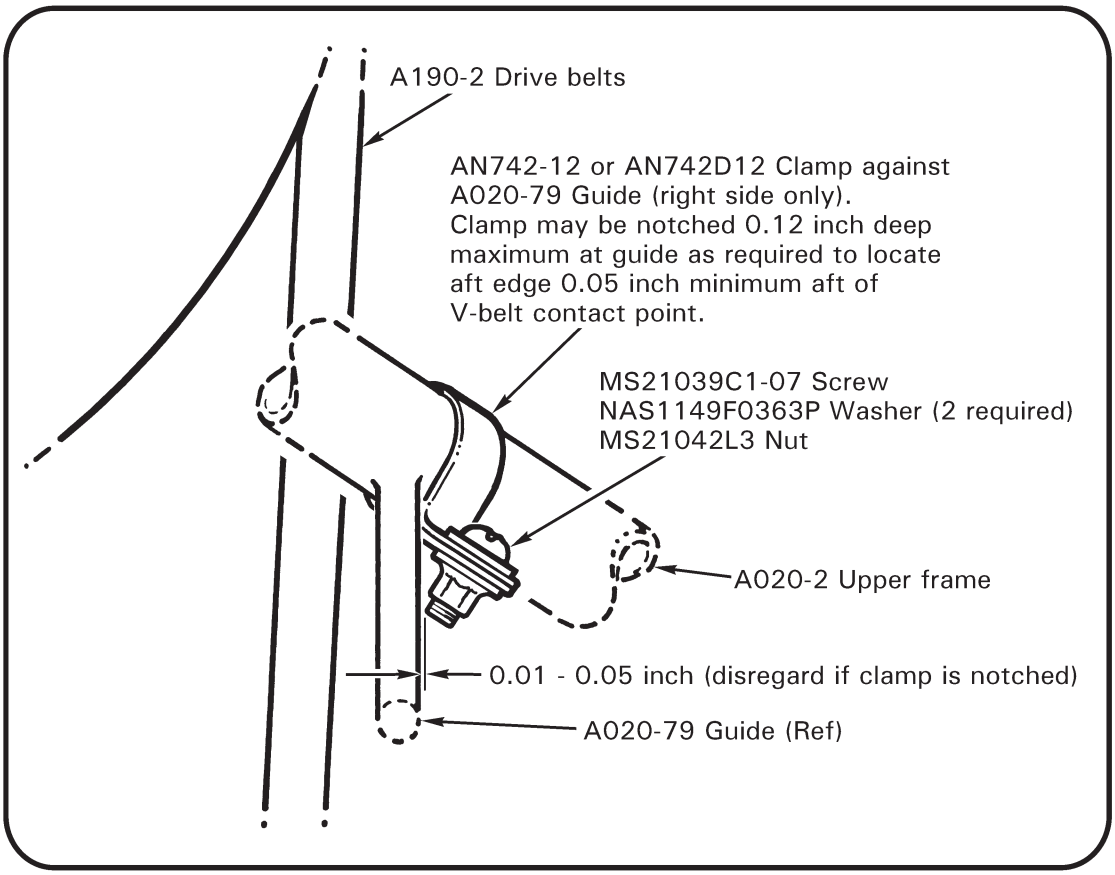

FIGURE 2-4C UPPER FRAME PROTECTIVE CLAMP INSTALLATION
(View looking forward)

2.410 Inspection Procedures and Checklist (continued)

8. Remove Tailcone Fairing (8) (continued)

Actuator Upper Bearing: Inspect condition. Verify no more than 0.060 inch axial play. Verify no fretting between bearing inner race and clutch shaft. Verify bearing inner race has not slipped relative to clutch shaft. Inspect Telatemp per § 2.130. Perform § 22-41 bearing inspection if unexplainable Telatemp increase has occurred. _____

CAUTION

A184 bearing requires periodic lubrication per § 1.101.

Actuator Upper Bearing Lubrication: Perform as required. _____

Clutch Lateral Centering Strut Assembly: Inspect condition. Inspect rod ends per § 2.120. Verify security. _____

Intermediate Flex Plate and Yokes: 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 an A947 flex plate, flex plate is unairworthy and cannot be repaired.

Tail Rotor Push-Pull Tubes and A331-1 Bellcrank: Inspect condition. Verify no cracks at tube ends. Inspect rod ends per § 2.120. Verify security and operating clearance. _____

Drive V-Belts: Inspect per § 2.507. _____

Fanshaft: Inspect condition. Perform 360° visual inspection of exposed fanshaft for cracks. Verify security and safety wiring of attaching bolts. _____

Actuator Lower Bearing: Inspect condition, verify bearing inner race has not slipped relative to fanshaft. Inspect Telatemps per § 2.130. Perform § 22-42 bearing inspection if unexplainable Telatemp increase has occurred. _____

CAUTION

A181-4 bearing requires periodic lubrication per § 1.101.

Actuator Lower Bearing Lubrication: Perform as required. _____

2.410 Inspection Procedures and Checklist (continued)

8. Remove Tailcone Fairing (8) (continued)

Actuator Lower Bearing Lubrication: Perform as required.

Lower Bearing Brackets: Refer to Figure 2-4D. Visually inspect A185 brackets and attaching rivets for evidence of fretting or looseness. If evidence of looseness is found repair per R22 SL-74A. On lower A185 bracket, apply torque seal in a horizontal stripe across both outboard rivets to lower scroll to facilitate future inspections.

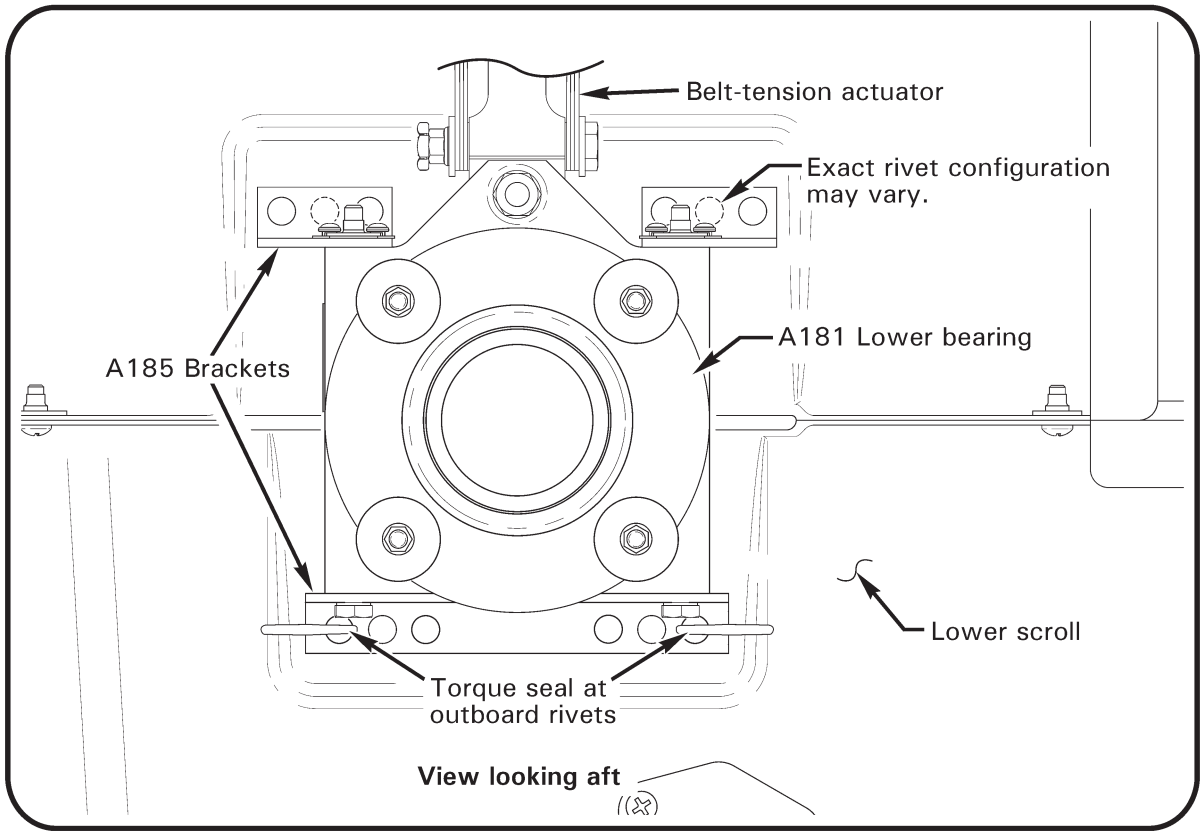

FIGURE 2-4D ACTUATOR LOWER BEARING A185 BRACKETS

Fiberglass Scroll: Inspect condition. Verify no damage to vane assembly in upper right scroll. Verify security. Verify drain hole is unobstructed.

Scroll Metal Inlet Lips & Gap (if installed): Inspect condition. Verify 0.020 to 0.100 inch gap between lips and fanwheel inlet. (Attach holes in lips may be elongated to facilitate gap adjustment.)

Fanwheel Assembly: Inspect condition. Verify no cracks or corrosion. Check leading edge of vanes for damage. Verify alignment of roll pin and slippage marks on fanwheel. If marks and roll pin do not align, remove fanwheel and inspect hub and shaft for damage. Verify security.

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2.410 Inspection Procedures and Checklist (continued)

8. Remove Tailcone Fairing (8) (continued)

Actuator (A051-1): Turn master switch on and engage clutch switch. While actuator is engaging, depress extension limit switch lever and verify gear motor stops; release lever and verify gear motor resumes running. Use an inspection mirror to observe column springs at end of belt-tensioning cycle; springs should snap outward simultaneously. Verify maximum engaged extension limit per Figure 7-15 is not exceeded. Verify security of attachment to A181 and A184 bearings. Verify gear motor security and minimum 0.030 inch clearance to upper frame. _____

Actuator Spring Switches: Check using either of following two methods, as appropriate:

Method 1 – (actuator electrical harness must be equipped with "Test" plug)

CAUTION

When using MT558-1 plug assembly (see Figure 2-5), if gear motor does not shut off when column springs snap outward then spring switch has failed in closed position; immediately remove MT558-1 to prevent actuator damage.

a. Disengage actuator. Connect one end of MT558-1 to actuator test plug. Engage actuator and verify gear motor shuts off when column springs snap outward. _____

b. Disengage actuator. Connect opposite end of MT558-1 to actuator test plug. Engage actuator and verify gear motor shuts off when column springs snap outward. _____

c. MT558-1 pins 1-2 jumper tests the wire 98 spring switch; the pins 2-3 jumper tests the wire 91 spring switch (see Figure 14-4A). If either switch does not function properly, replace switch section per § 7.551 before further flight. _____

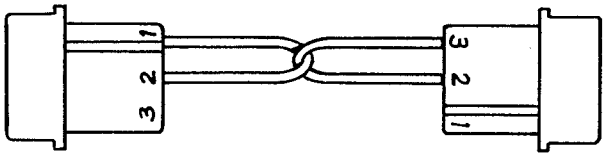


FIGURE 2-5 MT558-1

2.410 Inspection Procedures and Checklist (continued)

8. Remove Tailcone Fairing (8) (continued)

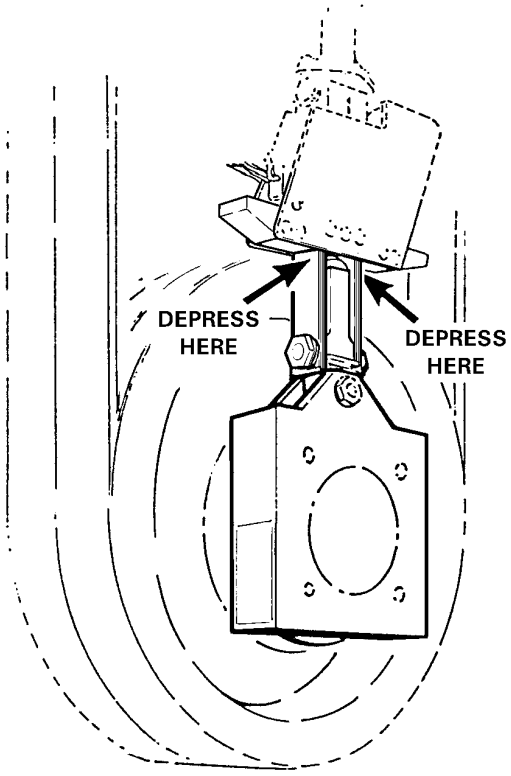
Actuator Spring Switches (continued):

Method 2 – (use if actuator electrical harness is not equipped with "Test" plug)

a. Refer to Figure 2-5A. Depress column springs on one side of actuator until springs snap inward (use large screwdriver or similar tool with several layers to tape over end to protect actuator). Hold springs inward for at least one second. Actuator motor should not run. If motor starts, allow motor to run approximately two seconds, then release pressure on column springs. Depress column springs again. If motor starts again, opposite spring switch does not function properly. _____

b. Disengage and re-engage actuator. Repeat step a. on opposite-side column springs. _____

c. If either switch does not function properly, replace switch per § 7.551 before further flight.



Fanwheel and scroll not shown.

FIGURE 2-5A ACTUATOR FUNCTION TEST

Lower Sheave: Inspect condition. Verify smoothness of drive belt contact surfaces. Remove any surface corrosion and refinish with approved primer (chromate primer preferred; refer to § 23-75). Replace any sheave showing corrosion-pitting or flaking of metalized coating, roughness, or sharp ridges. _____

2.410 Inspection Procedures and Checklist (continued)

10. Remove Plastic Cover (10) (continued)

Tail Rotor Pitch Control Assembly and Aft Bellcrank: Inspect condition. Inspect spherical bearing in underside of pitch control per § 2.120; it is permissible to have a single radial crack in this spherical bearing ball. Verify no excessive looseness on output shaft (0.25 inch maximum rotational play measured at pitch link attaching bolt head). Verify operating clearance and assembly slides freely on output shaft. Verify no leakage at bearing seals. Verify security. _____

WARNING

A031-1 Rev. J or prior pitch control assemblies require repetitive inspection per R22 Service Bulletin SB-90A every 300 hours or annually, whichever occurs first.

Pitch Links: Inspect condition. Inspect rod ends and spherical bearings per § 2.120. Remove and reinstall pitch links with outboard end inboard and inboard end outboard as required to obtain maximum service life; additionally, an optional A215-012 o-ring may be installed on A115-1 spacer under bolt head at pitch control. Reinstall chordwise weights at respective attachment points for balance purposes. Verify proper installation, security, and operating clearance. _____

Tail Rotor Blades: Inspect condition. Refer to § 9.220 for damage limitations. Inspect bearings per § 2.120. Verify no looseness between feathering bearing outer races and root fittings. Verify security. Verify blade tip drain holes (2 per A029-1 blade, 1 per A029-2 blade) are unobstructed. Verify no corrosion. Tap test bonded areas per § 26-44. _____

WARNING

Structural damage may occur if compressed air is applied to blade tip drain holes.

Tail Rotor Hub: Inspect condition. Inspect spherical teeter hinge bearings per § 2.120; inspect elastomeric teeter hinge bearings per § 2.125. Verify hub teeters without binding. Verify teeter hinge bearing balls (P/N A030-1 hubs only), spacers contacting output shaft, nuts, and bolt remain stationary when teetering hub. Verify no cracks or corrosion. Verify operating clearance. _____

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)

11. Open Mast Fairing (11)

Mast Fairing: Inspect condition. Verify no cracks, dents, or corrosion. Verify no yielding or cracking of A665-1 restraint. Yielding can be caused by overtightening screws in restraint nutplates. _____

Upper and Lower Ribs: Inspect condition. Verify security, especially tightness of lower rib clamp. _____

Three Vertical Push-Pull Tubes (Two A121-7 and One A121-5): Inspect condition. Inspect rod ends per § 2.120. Verify no cracks at upper ends. With collective full up and cyclic full aft, verify no wear of A121-7 tubes or sleeves, especially where sleeves rub inside guide assembly. Verify security and operating clearance. _____

Pitot Tube and Line: Inspect condition. Verify no cracking, chafing, or kinking. Ensure drain hole on bottom of elbow behind pitot tube is clear. Verify security. _____

Fuel Tank Vent Metal Lines and Plastic Tubes: Inspect condition. Verify no kinking or obstructions. Verify security. _____

Swashplate Upper Scissors: Inspect condition. Inspect rod ends and spherical bearings per § 2.120. Measure scissors play per Figure 2-8. Observe scissor linkage while having someone raise and lower collective. Verify bolt, journals (or spherical bearing balls and spacers), and arm rotate together at each scissor linkage pivot. Verify operating clearance. _____

Swashplate Lower Scissors: Inspect condition. Inspect rod ends per § 2.120. Verify security. _____

Swashplate Slider Tube: Inspect condition. Verify no cracks at rivet holes or corrosion on base. Verify no damage to, or wear through, anodized tube surface. When viewed under 10X magnification, minute “checkerboarding” of anodized surface is normal. _____

Remove Swashplate Boot Lower Ty-rap: Lift boot from swashplate. Using an inspection mirror, inspect area between main rotor drive shaft and inside of slider tube. Verify no corrosion and no debris. Verify no boot damage. _____

Swashplate: Inspect condition. Verify 0.020 inch maximum radial play between swashplate ball and slider tube. Rotate rotor by hand and verify operating clearance and no rough or dry bearings. _____

Swashplate Shimming: Observe swashplate ball from below and have someone move collective stick slowly up & down. Verify swashplate ball immediately moves with swashplate when swashplate reverses direction. Movement of swashplate without attendant ball movement indicates axial play between ball and swashplate; shim swashplate per § 8.416. _____

Install Swashplate Boot Lower Ty-rap: Verify correct boot position and security and no boot damage. _____

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)

11. Open Mast Faring (11) (continued)

Main Rotor Drive Shaft: Inspect condition of accessible portion. Verify no corrosion. _____

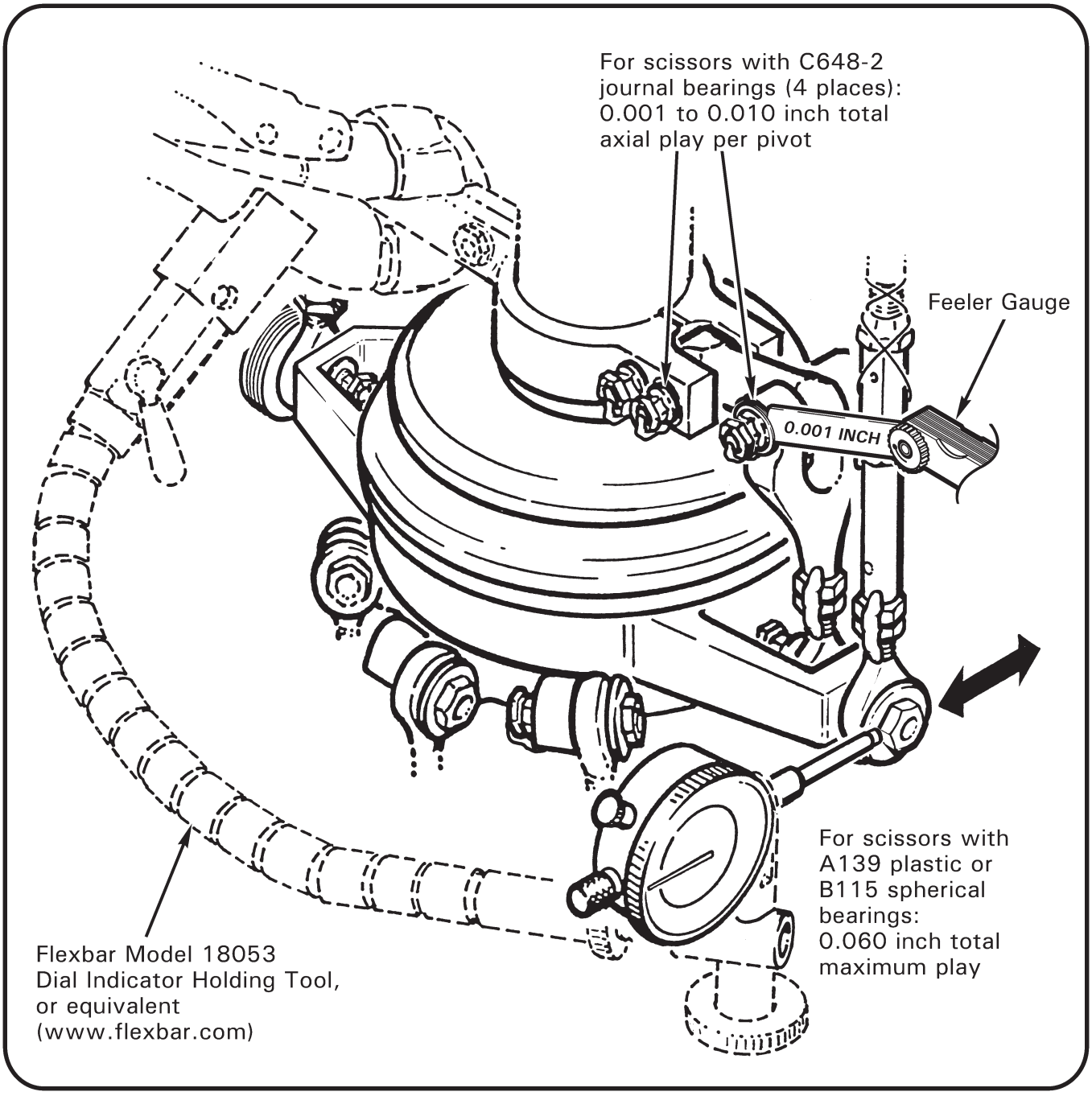


FIGURE 2-8 MEASURING UPPER SWASHPLATE SCISSORS PLAY
(Identify scissors bearing type and measure as shown)

2.410 Inspection Procedures and Checklist (continued)

12. Rotor Hub and Hinge Bolts

Hub: Inspect condition. Verify no nicks, scratches, gouges, or corrosion. If main rotor imbalance is suspected, check teeter and coning hinge friction per § 26-32. Verify no brown or black residue (indicates bearing wear). _____

Hinge Bolts (three): Inspect condition; corrosion is prohibited. Verify cotter pins are in place and secure. Verify bolt heads and nuts are torque striped to thrust washers. _____

Pitch Links and Rod Ends: Inspect condition. Inspect rod ends per § 2.120, including centering. Verify security, including jam nut tightness and proper safety wiring. _____

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

13. Main Rotor Blades

Blade Boots: Inspect condition. Verify no boot damage or oil leakage. Verify proper boot position and security. Verify sufficient clearance from hub assembly through full control travel. _____

Blade Spindles & Root Fittings: Inspect area for damage per § 26-43. Comply with FAA Airworthiness Directive 88-26-01 (current revision) as required (A158-1 spindles only). Verify proper installation and security of visible fasteners. Renew deteriorated torque stripes per Figure 2-1. _____

Main Rotor Blade Tip Maintenance: Perform main rotor blade tip maintenance per § 26-60. _____

Main Rotor Blade Inspection: Inspect skins and doublers for scratches and corrosion per § 26-41. Inspect blades for dents and local deformations per § 26-42 and for voids per § 26-44. As required, wax blades with soft cleaning cloths using carnauba-type wax (such as SC Johnson® Paste Wax). Ensure tip cover and blade tip drain holes are unobstructed. _____

WARNING

Structural damage may occur if compressed air is applied to blade tip drain holes.

2.410 Inspection Procedures and Checklist (continued)

14. Cabin

General: Verify no loose equipment that might interfere with controls. _____

Seat Belts: Inspect condition. Verify no fraying, broken stitching, holes, or rotting. Verify no significant discoloration due to UV damage. Check inertia reels for proper operation. Check buckles for proper operation. Verify security. _____

NOTE
TSO tag not required on factory-installed harnesses.

Windows: Inspect condition. Verify no significant UV damage (yellowing). Minor defects or imperfections that do not impair pilot's visibility are considered acceptable. Acceptable defects include:

One nick, no more than 0.010 inch deep and no larger than 0.25 by 0.50 inch per square foot. _____

Scratches no more than 0.010 inch deep and 5 inches long. _____

Any surface defect such as small spots or stains that can be removed with light polishing. _____

For cracks and crazing adjacent to windshield edges refer to § 25-20. _____

Yaw String: Inspect condition. Minimum 3 inches long each side. Verify security. _____

2.410 Inspection Procedures and Checklist (continued)

14. Cabin (continued)

Exterior: Inspect condition. Verify no cracks, corrosion, or damage. Verify no loose rivets. Loose rivets may be indicated by cracked paint and/or black residue around heads. _____

Left and Right Navigation Lights: Inspect condition. Verify red left, green right, lens cleanliness, and security. _____

Doors: Inspect condition. Verify no structural cracks around hinges or door latches. Check door vents for operation. Ensure door hinge pins are secured with cotter pins. Check tightness of hinge mounting screws. Verify proper operation of door latching and locking mechanisms. _____

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

15. Landing Gear

Skid Tubes and Shoes: Inspect condition. Verify no more than 0.5 inch wide flat area on underside of skid tube due to wear. Verify longitudinal scratches are not more than 0.030 inch deep, and circumferential scratches are not more than 0.030 inch deep & are less than 0.50 inch long. Verify drain holes are open (not applicable to float landing gear). Verify security of rain caps. Verify minimum 0.05 inch shoe thickness. _____

Struts and Elbows: Inspect condition. Verify no cracks or corrosion, especially where joined and in weld areas at bottom of struts. Verify security. If helicopter routinely performs running landings, torque check strut-to-skid-tube bolts. _____

Cross Tubes: Inspect condition. Verify minimum tail skid height per § 5.210. Verify no corrosion. Verify security of rain caps. If a rain cap is loose, verify no internal corrosion. Verify no fretting at elbows. _____

Landing Gear Attach Points: Inspect condition. Verify no loose fasteners, cracks, buckling, or fretting. Inspect mounts and verify no loose swages or worn bearings. _____

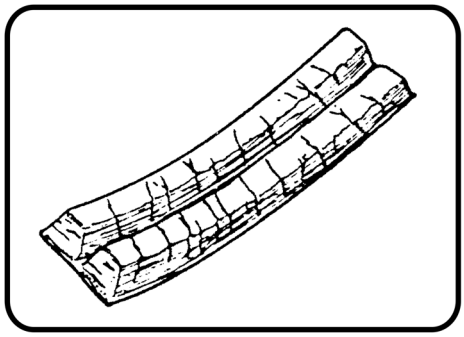
Floats (if installed): Perform relief valve and bulkhead tests per § 2.580 (2) and (3). Verify proper inflation pressure per R22 POH. Inspect condition. Verify security. _____

Float Skid Tubes (if installed): Remove drain plugs at aft end of skid extensions. With ground handling wheels installed, pull down on tailcone to drain any trapped moisture. Install drain plugs. _____

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

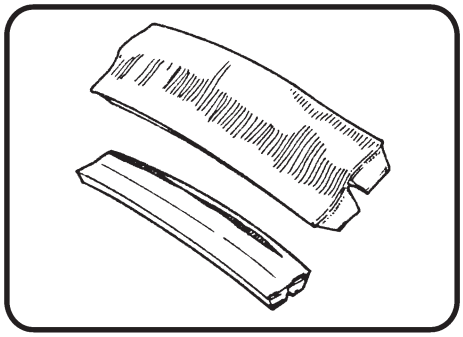
2.507 V-Belt Inspection

The most common V-belt discrepancies and courses of corrective action are given below.



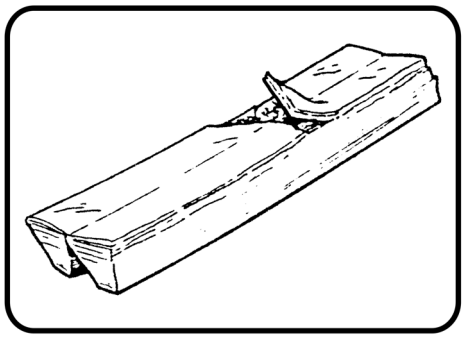
1. Belts Cracking:

CAUSE	REMEDY
Belt is old.	Replace belts per § 7.280.
Belt slipping causing heat buildup and gradual hardening of undercord.	Replace belts per § 7.280. Replace actuator per § 7.500.



2. Top of Tie Band Frayed or Damaged:

CAUSE	REMEDY
Obstruction interfering with normal belt operation.	Remove obstruction, and replace belts per § 7.280.

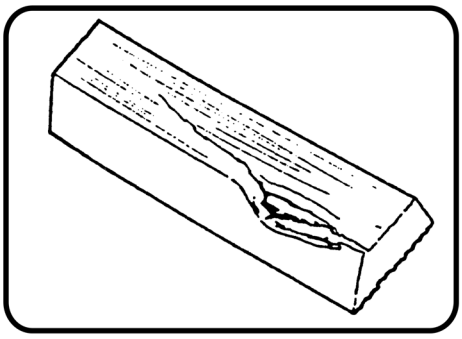


3. Top of Tie Band Blistered or Perforated:

CAUSE	REMEDY
Dirt or sand accumulating between belts and sheave.	Replace belts per § 7.280. Periodically wash inside of replacement belts.
Belts worn out.	Replace belts per § 7.280.

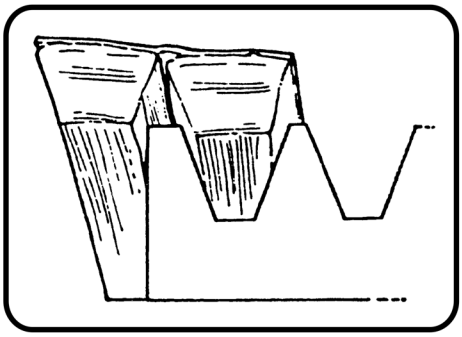
FIGURE 2-10 V-BELT DISCREPANCIES

2.507 V-Belt Inspection (continued)



4. Belt Cut on Inside:

CAUSE	REMEDY
Belt forced over sheave flange during installation without proper slack.	Replace belts per § 7.280.
Foreign material fell into belt drive.	Replace foreign material and replace belts per § 7.280.



5. Belt Riding Outside Sheave Groove:

CAUSE	REMEDY
Belt forced over sheave flange during installation without proper slack.	Replace belts per § 7.280.

FIGURE 2-10A V-BELT DISCREPANCIES

2.508 Lower Sheave V-Belt Wear Pattern Inspection

Observe wear patterns in paint primer in all four lower sheave grooves. The eight wear patterns (both sides of all four grooves) should appear very similar and be consistent around sheave circumference.

If wear pattern is noticeably different from groove to groove, measure width of narrowest and widest wear patterns. See Figure 2-11. If ratio exceeds 3:1, replace V-belts per § 7.280.

CAUTION

RHC does not recommend using A170-1 or -2 Revision N or prior upper sheaves with A493-1 Revision T or later lower sheaves. Such combinations may cause excessive drive belt vibration. Refer to Figure 7-3D.

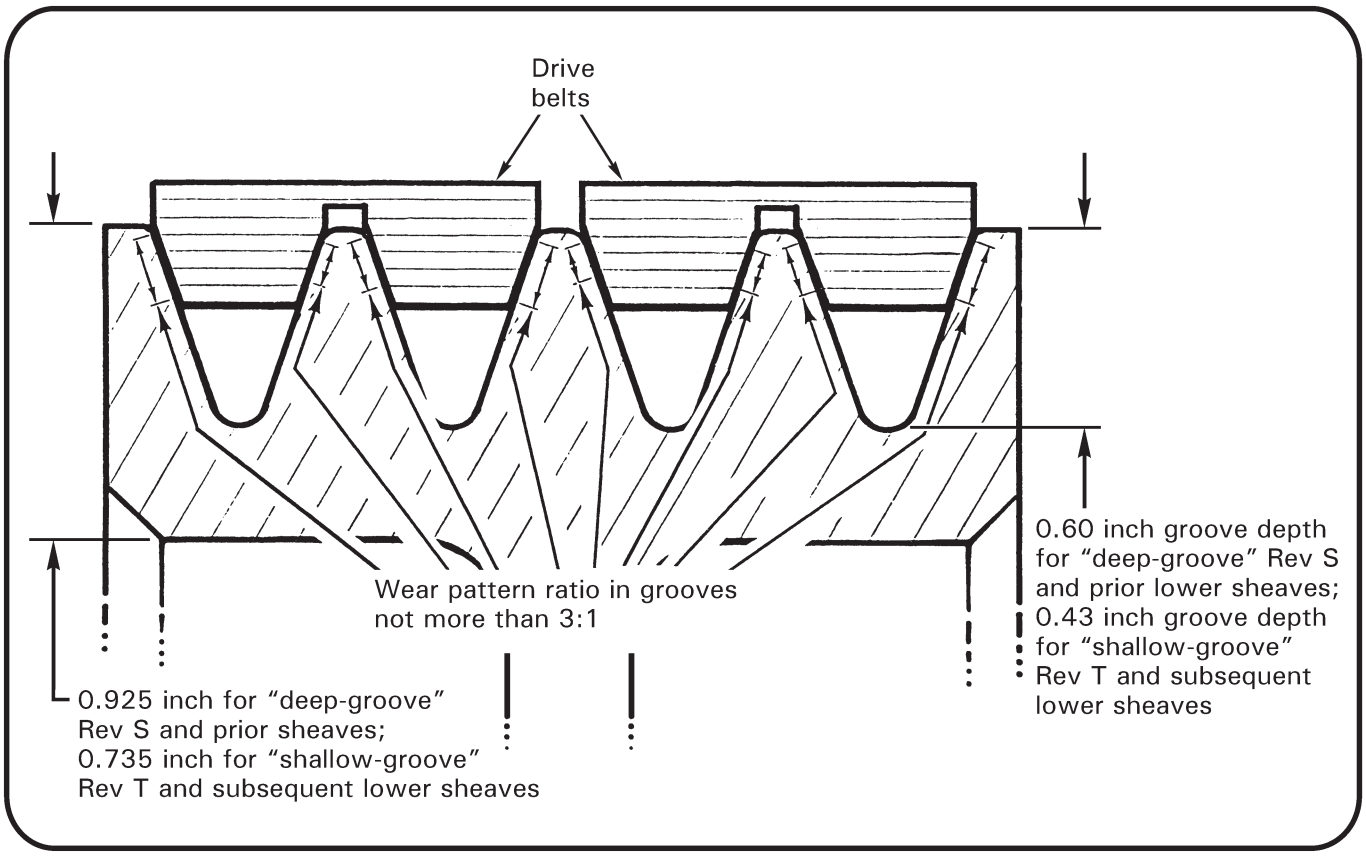


FIGURE 2-11 LOWER SHEAVE V-BELT WEAR PATTERN

2.510 Tail Skid Strike

A. Scuffing or Slight Bending of Tail Skid

1. Visually inspect tail rotor blades. Verify no evidence of solid object or ground contact. If tail rotor damage is found, inspect tail rotor per § 2.520.
2. Visually inspect lower vertical stabilizer. Verify no buckling, cracks, or loose rivets at tail skid and lower vertical to horizontal stabilizer attach points.
3. Visually inspect horizontal stabilizer to tailcone attach points. Verify no buckling, loose rivets, or cracking.
4. Visually inspect tailcone. Verify no damage. Also inspect tailcone-to-upper steel tube frame attach points and verify no buckling or loose attach bolts.

B. Buckling or Breaking of Tail Skid and/or Lower Vertical Stabilizer

1. Perform inspections per § 2.510.A.
2. Inspect tail rotor drive shaft run-out per § 7.340.
3. Remove tailcone and:
   a. Visually inspect tailcone attach points. Verify any elongated holes are no greater than 0.265 inch across at widest point.
   b. See Figure 2-12. Using an approved paint stripper (ref. § 23-71), remove paint from and within 2 inches of tailcone attach points on upper frame.
   c. Fluorescent penetrant inspect (ref. § 23-42) upper steel tube frame at tailcone attach points.
4. Remove stabilizer assembly and:
   a. Visually inspect horizontal stabilizer. Verify any elongated holes at attach points are no greater than 0.265 inch across at widest point. Verify no loose rivets or buckling.
   b. Using an approved paint stripper (ref. § 23-71), remove paint from tailcone casting exterior surfaces.
   c. Fluorescent penetrant inspect (ref. § 23-42) casting.
5. Remove lower vertical stabilizer from horizontal stabilizer and visually inspect. Verify no buckling, cracks, or loose rivets. Buckling or cracks require replacement of stabilizer. Loose rivets may be drilled out and replaced. Verify any elongated holes at attach points on either stabilizer are no greater than 0.200 inch across at widest point.

2.520 Tail Rotor Strike

A. Contact with Small Stone, Tall Grass, or Other Small Object in Free Air

1. Inspect tail rotor per § 9.220.
2. Check tail rotor drive shaft run-out per § 7.340. If run-out exceeds 0.025 inch at any location, shaft must be replaced or repaired.

B. Sudden Stoppage of Tail Rotor due to Ground or Solid Object Contact (Causing Bending or Shearing of Blade(s))

1. Perform inspections per § 2.520.A.
2. Using an approved paint stripper (ref. § 23-71), strip paint surrounding and at least 2 inches from tail rotor drive shaft forward holes and aft weld. Fluorescent penetrant inspect (ref. § 23-42) stripped areas. If cracks are found, drive shaft must be replaced.
3. Visually inspect drive shaft. Verify no deformation, nicks, dents, or scratches. Nicks and scratches may be polished out per § 7.360. Deformation or dents require replacement of drive shaft.
4. Remove tail rotor and tail rotor gearbox and return to RHC for overhaul.
5. Replace aft and intermediate flex plates.
6. Visually verify tail rotor blades have not struck tailcone and empennage.
7. Visually inspect main rotor system. Verify no nicks, dents, or scratches.

2.530 Main Rotor Strike

A. Contact with Small Objects in Free Air

1. Inspect main rotor blades per § 26-40.
2. Verify no buckling or bending of trailing edge.

WARNING

Any main rotor blade buckling or spar bending is considered sudden stoppage and requires compliance with Part B.

B. Sudden stoppage of Main Rotor Due to Ground or Solid Object Contact

1. Check tail rotor drive shaft run-out per § 7.340.
2. Remove following components and return to a RHC authorized overhaul facility for inspection and/or repair.
   a. A005-2 Main Rotor Blade and Spindle Assemblies
   b. A005-4 Main Rotor Hub and Bearings
   c. A017-2 Swashplate Assembly
   d. A018-1 or -2 Clutch Assembly
   e. A106 Main Rotor Journals
   f. A152-1 Thrust Washers
   g. A907-4 or -5 Yoke
   h. A908-4 or A006-5 Yoke
3. Replace A947-1 forward flex plate.
4. Return main rotor gearbox to RHC for overhaul.
5. Inspect engine per engine manufacturer's sudden stoppage instructions.

2.540 Rotor/Engine Overspeed

A. Rotor Overspeed Between 110 and 116%

NOTE

Refer to Part C if a power-on overspeed occurs.

1. Check main rotor and tail rotor dynamic balance. Compare pre-overspeed and post-overspeed balance.

CAUTION

Any change in rotor dynamic balance greater than 0.3 ips requires inspection per Part B.

2. Remove main rotor blades. Drain pitch bearing housings. Remove outer blade boot clamps and fold boots away from pitch horns. Rotate spindles to verify no brinelling of pitch bearings.

NOTE

Bearings have a high preload; slight roughness is normal. If roughness is evident, return blade and spindle assembly to RHC-authorized overhaul facility for repair.

3. Visually inspect main and tail rotor blades.
4. Check tail rotor drive shaft run-out per § 7.340.

2.540 Rotor/Engine Overspeed (continued)

B. Rotor Overspeed at or Above 116%

NOTE
For power-on overspeeds, Part C must also be performed.

1. Perform inspection per Part A steps 2, 3, and 4.
2. Return blades and hub to an RHC-authorized overhaul facility for NOT inspection of spindles and hub.
3. Replace any cracked or bent bolts, thrust washers, and journals. Magnetic particle inspect any parts not replaced.

C. Engine overspeed

Percent engine overspeed is determined from tachometer indication as follows:

$$\% \text{ Engine Overspeed} = \frac{\text{Engine Tach Indication (\%) x 2550}}{2700} - 100$$

NOTE
104% Engine Tach Indication = 2652 Actual Engine RPM. Engine is rated at 2700 RPM.

Refer to Lycoming SB 369 (current revision) for engine overspeed inspection requirements.

2.550 Hard Landing

A. Yielding of Cross Tubes Due to Hard Landings Without Side Loads

NOTE

Side loads are indicated by buckling and bending of steel tube frame or sheet metal.

1. Visually inspect steel tube frames. Verify no yielding or cracks. Pay particular attention to lower steel tube frame aft vertical struts.
2. Check tail rotor drive shaft run-out per § 7.340.
3. Visually inspect main rotor blades per § 26-40.
4. Place rotorcraft on level ground and measure from tail skid or bottom of float stabilizer to ground. Aft cross tube must be replaced if dimension is less than:

   24 inches for Standard or HP.
   34 inches for Alpha, Beta, Beta II, Mariner, or Mariner II measured from tail skid.
   37 inches for Mariner or Mariner II, measured from float stabilizer.

   Replace forward cross tube if it contacts cross tube cover.
5. Check and adjust upper and lower sheave alignment per § 7.230.

B. Hard Landings That May Impose Side Loads on Landing Gear

NOTE

Side loads are indicated by buckling and bending of steel tube frame or sheet metal.

1. Perform inspection per Part A.
2. Visually inspect fuselage landing gear attach points, vertical firewall, and horizontal firewall. Verify no buckling or cracks. Pay attention to engine mount strut-to-vertical firewall attach points.
3. Remove tailcone per § 4.311.
4. See Figure 2-12. Using an approved paint stripper (ref. § 23-71), remove paint from and within 2 inches of tailcone attach points on upper frame. Fluorescent penetrant inspect (ref. § 23-42) upper steel tube frame at tailcone attach points.
5. Visually inspect tailcone. Verify no buckling or loose rivets.
6. Visually inspect landing gear elbows. Verify no yielding, nicks, or cracks.

2.550 Hard Landing (continued)

B. Hard Landings That May Impose Side Loads on Landing Gear (continued)

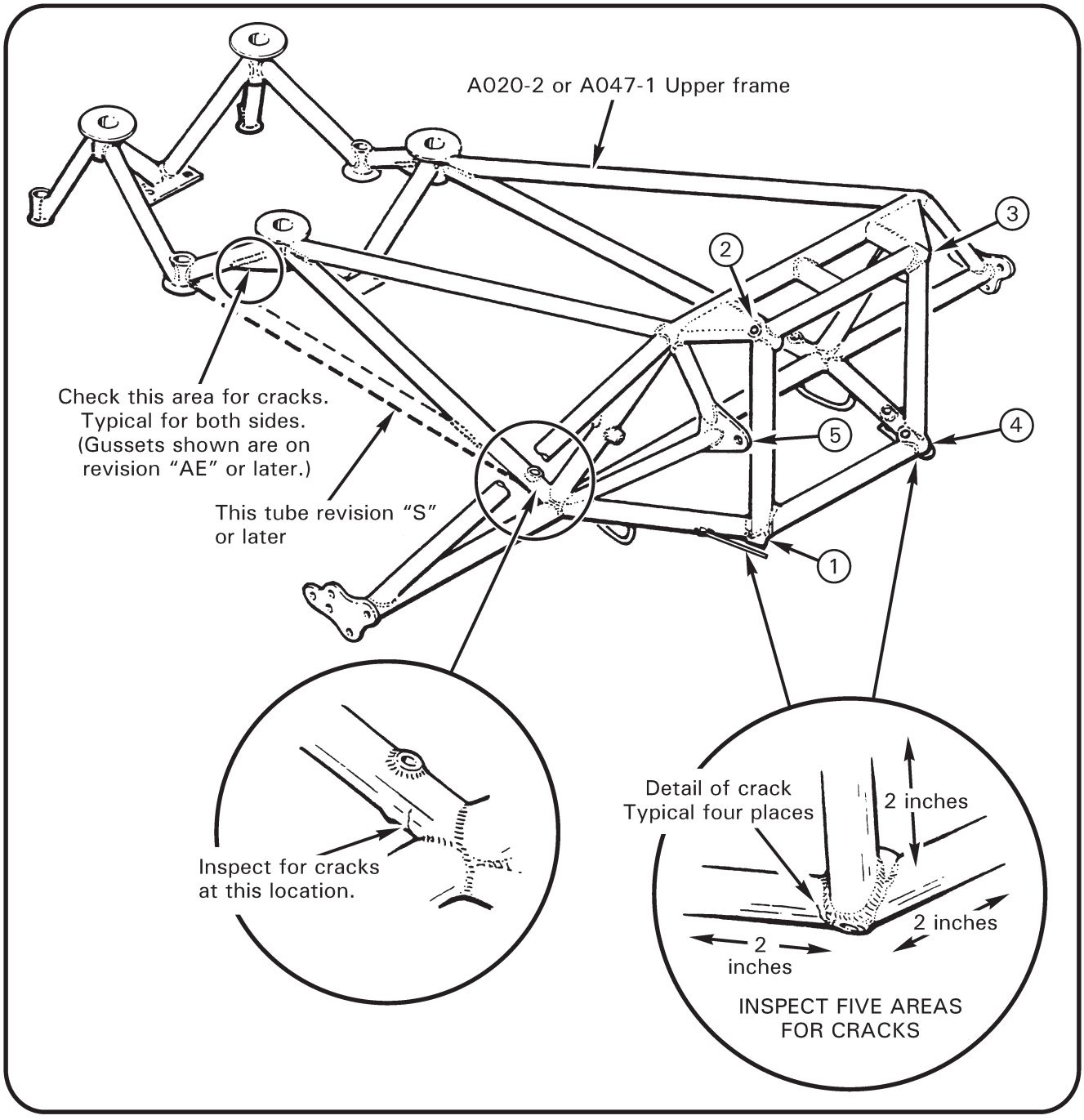


FIGURE 2-12 UPPER FRAME CRACK INSPECTION

2.560 Steel Tube Frame Corrosion

1. For large areas of corrosion, remove frame and strip paint using an approved paint stripper (ref. § 23-71) to determine full extent of corrosion. If corrosion exceeds Figure 2-13 limits, replace frame.
2. Measure and record diameter of frame member at corroded area(s).
3. Polish out corrosion with 320-grit or finer wet-or-dry sandpaper. Measure frame member diameter at polished area(s). Compare with measurement(s) from step 2, and verify polish depth is within Figure 2-13 limits.
4. Clean, prime, and paint frame (see § 23-71). Install frame if removed in step 1.

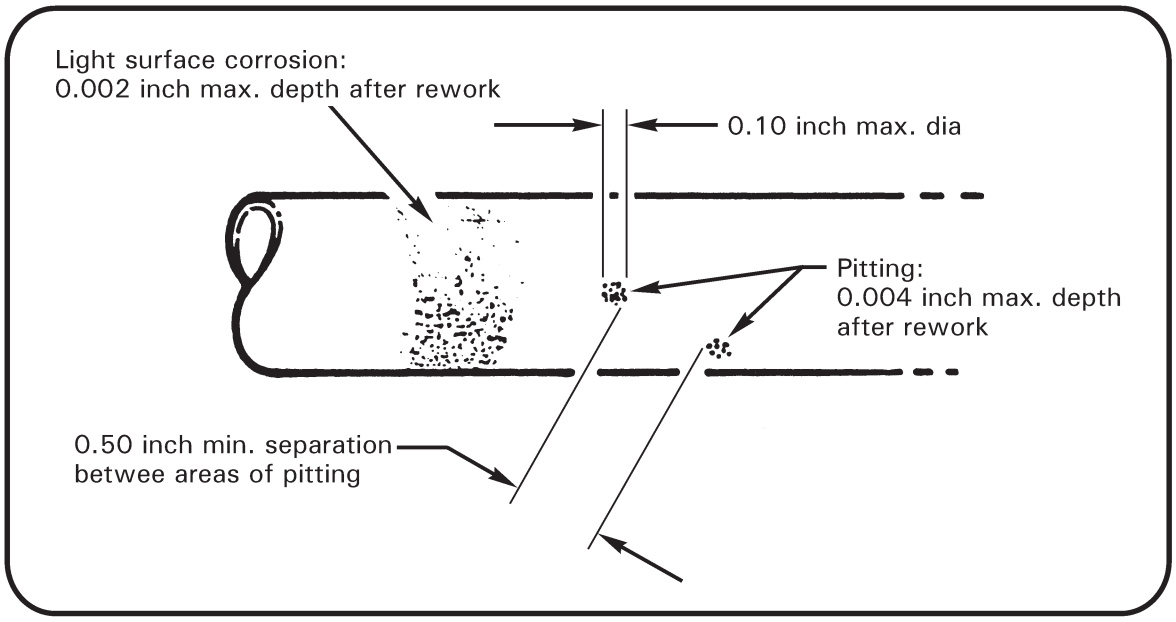


FIGURE 2-13 FRAME CORROSION AND REPAIR LIMITS

2.570 [Deleted]

2.580 Float Inspection and Testing

1. Inspection Intervals and Float Replacement

   Perform Relief Valve Test and Bulkhead Test during each 100-hour or annual inspection. Floats must be repaired or replaced on condition, or upon failure of Relief Valve or Bulkhead Test.

2. Relief Valve Test

CAUTION

When filling floats, open inflation valve prior to applying air pressure; do not apply air pressure against a closed valve.

CAUTION

Prior to test, inspect float bag uninflated and with each compartment individually inflated to 0. 75 to 1.0 psig. Verify no cuts, tears, punctures, abrasion, delamination (blistering), or seam separation.

   a. Use filtered oil-free dry air to inflate float compartments to 5.0 psig. Inflate by using a manifold or inflate chambers individually in 0.5 psig increments.

   b. Fill relief valve apertures with clean water. Slowly increase pressure and observe relief valves; bubbles indicate opening. Record opening pressures, then reduce pressure until bubbles stop, indicating relief valves are closed. Record closing pressures.

CAUTION

Do not exceed 7 psig in float compartments.

   c. Replace any valve not meeting the following criteria:

      Opening pressure: 5.5 to 6.5 psig
      Closing pressure: 5.5 psig minimum

3. Bulkhead Test

   a. Deflate all float chambers, then inflate forward chamber and second chamber from rear to 3 psig.

   b. Repair or replace floats if pressure in inflated chambers after 1 hour, at constant temperature, is less than 2.75 psig minimum.

   c. Deflate all float chambers, then inflate aft chamber and second chamber from front to 3 psig. Repeat step b.

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2.600 2200-Hour/12-Year Inspection

NOTE

KI-2202 (for R22-series Helicopter S/N 2570 & prior) and KI-2203 (for R22-series Helicopter S/N 2571 & subsequent) 2200-Hour Inspection Kit contents are available online at www.robinsonheli.com for review.

NOTE

12-Year Inspection is only required for helicopters that have accumulated 12 years in service and less than 2200 hours time in service since new, since last 2200-hour inspection, or since last 12-year inspection.

1. Refer to helicopter maintenance records and § 3.300; replace life-limited parts, or next higher assemblies, as required.
2. Refer to helicopter maintenance records and § 1.102; perform additional component maintenance, as required.
3. Remove engine, engine cooling panels, fanwheel, scroll, air induction system, carburetor heat system, oil lines, and all hoses. Overhaul or inspect, as required, magnetos, alternator, and carburetor per appropriate manufacturer's maintenance publications and service bulletins.
4. Remove horizontal and vertical stabilizers per § 4.320, and replace as required. If replacement is not required, visually inspect stabilizers and verify no cracks, corrosion, loose rivets, dents, or deformation. Fluorescent penetrant inspect any suspect areas per § 23-42. Install stabilizers per § 4.320.
5. Remove landing gear assembly per § 5.100, and replace as required. If replacement is not required, completely disassemble gear and remove paint. Visually inspect parts and verify no cracks, corrosion, or deformation. Magnetic particle and fluorescent penetrant inspect per §§ 23-41 and 23-42. Clean, prime, and paint per § 23-60. Assemble gear if disassembled. Install landing gear assembly per § 5.100.
6. Remove steel tube frames per § 4.200, and replace as required. If replacement is not required, remove paint. Visually inspect frames and verify no cracks or corrosion. Magnetic particle inspect per § 23-41. Clean, prime, and paint per § 23-60. Install frames per § 4.200.
7. Remove cyclic stick per § 8.110. Remove wiring harness. Remove paint via dry media blasting. Visually inspect and verify no cracks or corrosion. Magnetic particle inspect per § 23-41. Clean, prime, and paint per § 23-60. Install wiring harness. Install cyclic stick per § 8.110.

2.600 2200-Hour/12-Year Inspection (continued)

8. Remove A121 push-pull tube assemblies per Chapter 8. Remove paint. Visually inspect and verify no cracks or corrosion. Fluorescent penetrant inspect per § 23-42. Clean, prime, and paint per § 23-60. Install push-pull tubes per Chapter 8.
9. Magnetic particle inspect A650 and F650-3 main gearbox mount fittings and bolt, and A337-1 jackshaft per § 23-41.
10. Inspect airframe wiring condition. Verify no corrosion, insulation deterioration, or other damage. Verify correct wires attached to correct circuit breakers.
11. Remove main and aux tank fuel bladders per § 12.110 and § 12.120. Visually inspect; verify no cracking or delamination of rubber and rubber-to-metal joints. Visually inspect threaded inserts and fittings for damage. Pressurize to 1 psi max and check for leaks with mild soap & water mixture. Visually inspect tank structures for evidence of bladder leakage. Install bladders per § 12.110 and § 12.120.
12. Perform clutch sheave alignment per § 7.230 and intermediate flex plate shimming per § 7.330.
13. Perform main rotor flight control and blade angle rigging per § 10.110 and § 10.120.
14. Perform tail rotor flight control and blade rigging per § 10.130 and § 10.140.
15. Perform 100-hour/annual inspection per § 2.400.
16. Weigh helicopter per § 18-20.

NOTE

Extended low-power operation with new piston rings may prevent proper piston ring seating.

17. Balance tail rotor per § 10.240. Track and balance main rotor per § 10.230. Perform ground check, run up, and flight checks per §§ 2.205, 2.210, and 2.220.
18. Drain and flush main and tail rotor gearboxes per § 22-13 and § 22-23.
19. Make appropriate maintenance record entries. Enter maintenance performed (such as part replacement, equipment adjustments, weighing, servicing, and lubrication) and inspection data. Data must include a description of (or reference to data acceptable to the Administrator) the work performed, date, helicopter total time in service, signature, certificate type and certificate number of person approving aircraft return to service.

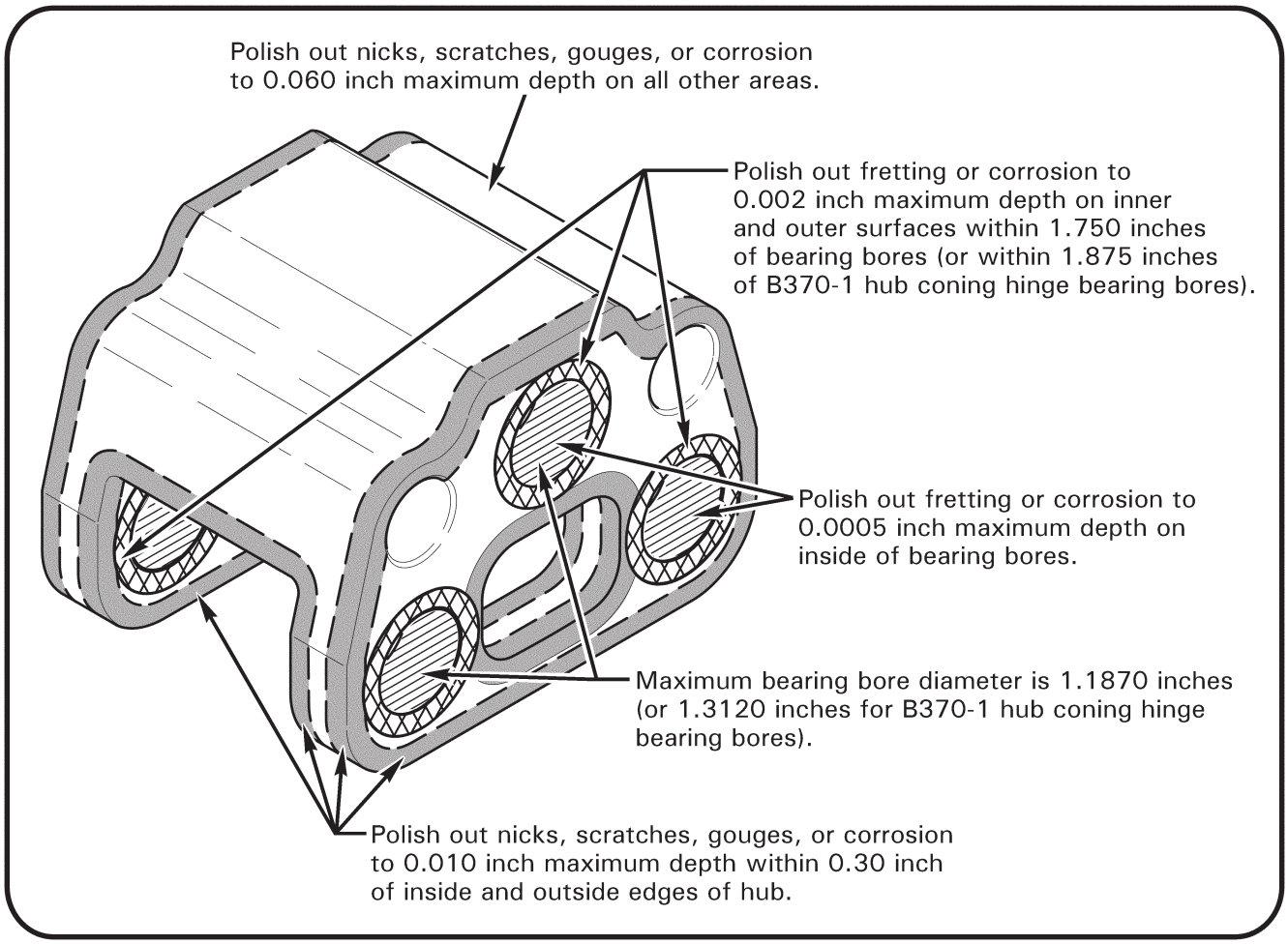

FIGURE 2-17 MAIN ROTOR HUB REPAIR LIMITS

2.610 Main Rotor Hub Inspection and Repair

1. Remove main rotor hub bearings per § 26-21 steps 1 and 2.
2. Remove hub paint by plastic or baking soda media blasting.
3. Refer to Figure 2-17. If required, polish surfaces using 320-grit or finer aluminum-oxide abrasive paper to 0.25 inch minimum blend radius.
    a. Visually inspect hub bearing bores and verify no scoring, scratches, or other obvious damage. Polish out fretting or corrosion to 0.002 inch maximum depth on inner and outer surfaces within 1.750 inches of bearing bores (or within 1.875 inches of B370-1 hub coning hinge bearing bores). Polish out fretting or corrosion to 0.0005 inch maximum depth on inside of bearing bores; maximum bearing bore diameter is 1.1870 inches (or 1.3120 inches for B370-1 hub coning hinge bearing bores).
    b. Visually inspect all other areas of hub for obvious damage. Polish out nicks, scratches, gouges, or corrosion to 0.010 inch maximum depth within 0.30 inch of inside and outside edges of hub. Polish out nicks, scratches, gouges, or corrosion to 0.060 inch maximum depth on all other areas.

2.610 Main Rotor Hub Inspection and Repair (continued)

4. Fluorescent penetrant inspect hub per § 23-42.
5. Prime hub per § 23-60.
6. Install bearings per § 26-21 steps 4 and 5.
7. Mask bearings and topcoat hub assembly per § 23-60.
8. When top coat has sufficiently cured, remove masking.

2.620 Tail Rotor Gearbox 12-Year Maintenance

1. If installed, drain and flush B021-1 tail rotor gearbox assembly per § 22-23 steps 1 thru 8.
2. If installed, remove tail rotor gearbox per § 7.410.
3. Remove hardware securing B546-1 yoke to B545 input gear. Visually inspect yoke and replace yoke if damaged. Visually inspect input gear splines; return gearbox to RHC if splines are damaged, including wear steps. Replace input shaft seal per § 7.470 steps 6 thru 17.
4. Remove sight gage and clean glass. Visually inspect gear set; return gearbox to RHC if corrosion or other damage is detected. Install sight gage and special torque gage per § 23-33.
5. Replace output shaft seal per § 7.460 steps 4 thru 9.
6. Install tail rotor gearbox per § 7.420 steps 1 thru 3.
7. Remove filler-plug. Fill gearbox to center of sight gage using correct gearbox oil (refer to § 22-10 Part C). Rotate rotor system by hand for several revolutions and pull down on tail rotor gearbox several times. Check gearbox oil level and adjust as required. Install filler-plug in gearbox and special torque plug per § 23-33.
8. Connect tail light and chip detector wiring to airframe harness at connectors. Turn battery on. Verify tail light illuminates with position lights turned on. Depress push-to-test TR CHIP button and verify TR CHIP caution light illuminates. Turn battery off.
9. Install tail rotor per § 9.213.

2.630 Fanwheel 12-Year Maintenance

1. If installed, remove B174-1 fanwheel assembly per § 6.210.
2. Mark fanwheel assembly parts, including balancing hardware, for identical reassembly.
3. Refer to Figure 2-19. Remove hardware securing A187-4 cone assembly, A186-2 hub, and A178-2 spacer(s) to fanwheel and remove parts, noting relative locations for identical reassembly.
4. Visually inspect all components for obvious damage. Verify no elongation of fastener holes. Replace parts as required.
5. Assemble fanwheel wet with approved primer (chromate primer preferred; refer to § 23-75) between all clamping surfaces; while primer is wet, special torque NAS6603 bolts to 70 in.-lb and NAS6605 bolts to 300 in.-lb.

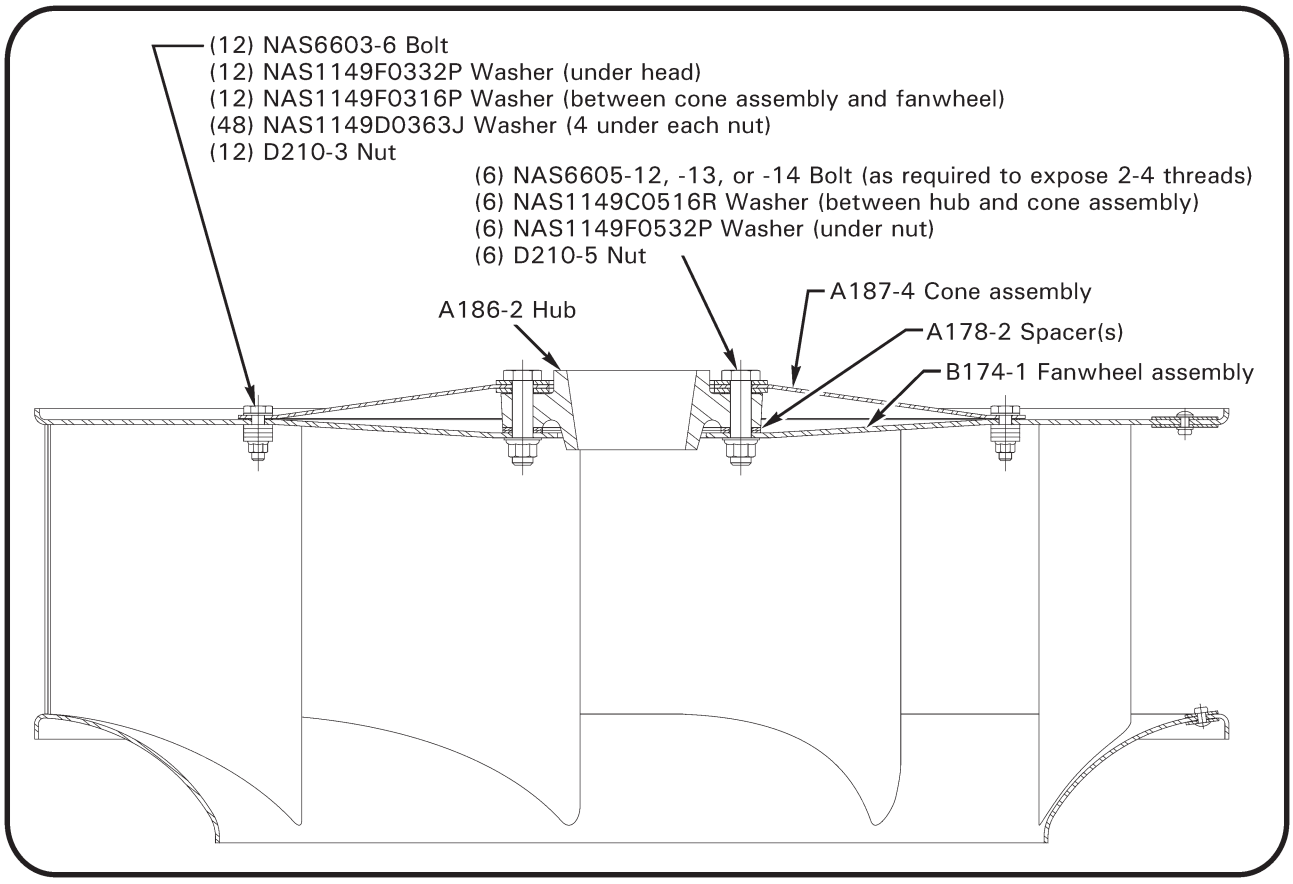

FIGURE 2-19 B174-1 FANWHEEL ASSEMBLY

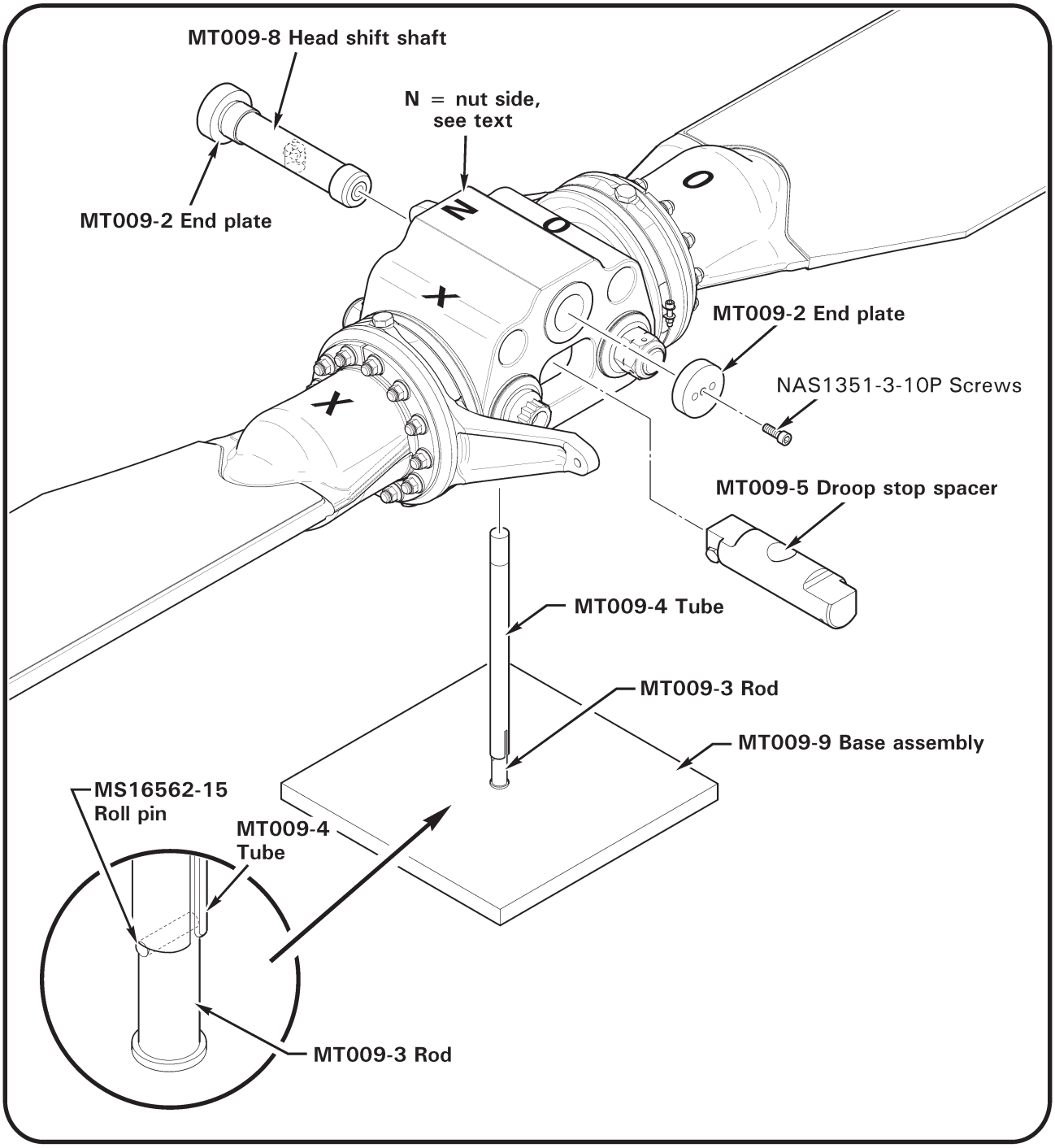

FIGURE 2-20 MT009-10 MAIN ROTOR STATIC BALANCE FIXTURE ASSEMBLY

2.640 Main Rotor Blade Static Balance

CAUTION

Ensure surfaces contacting blade skins and trailing edges are sufficiently cushioned to prevent blade damage.

1. Refer to Table 26-1. Assemble main rotor blade & spindle assembly to main rotor hub by selecting a combination of A106 coning hinge journals and A117 coning hinge shims (if used) to obtain total axial clearance between 0.002–0.006 inch. Install same length journal (dash number) on leading edge side of both coning hinges.

2. Install nuts (dry); tighten nuts on hinge bolts until journals and thrust washers are firmly seated (snug). Measure gaps between thrust washers and hub bearing faces per Figure 26-8; verify total axial clearance at each hinge is between 0.002–0.006 inch.

3. Refer to Figure 2-20. Install MT009-10 main rotor static balancing fixture assembly in hub as shown. Hoist main rotor assembly and position on MT009-9 base assembly.

4. Refer to Figure 2-21. Verify blade pitch angles are approximately equal with pitch horns adjusted as shown. If blade pitch angles are not equal, then pitch horn(s) are not correctly installed.

5. Place a spirit level chordwise (parallel with teeter and coning hinges) atop main rotor hub. Level by adjusting NAS1351-3-10P screws.

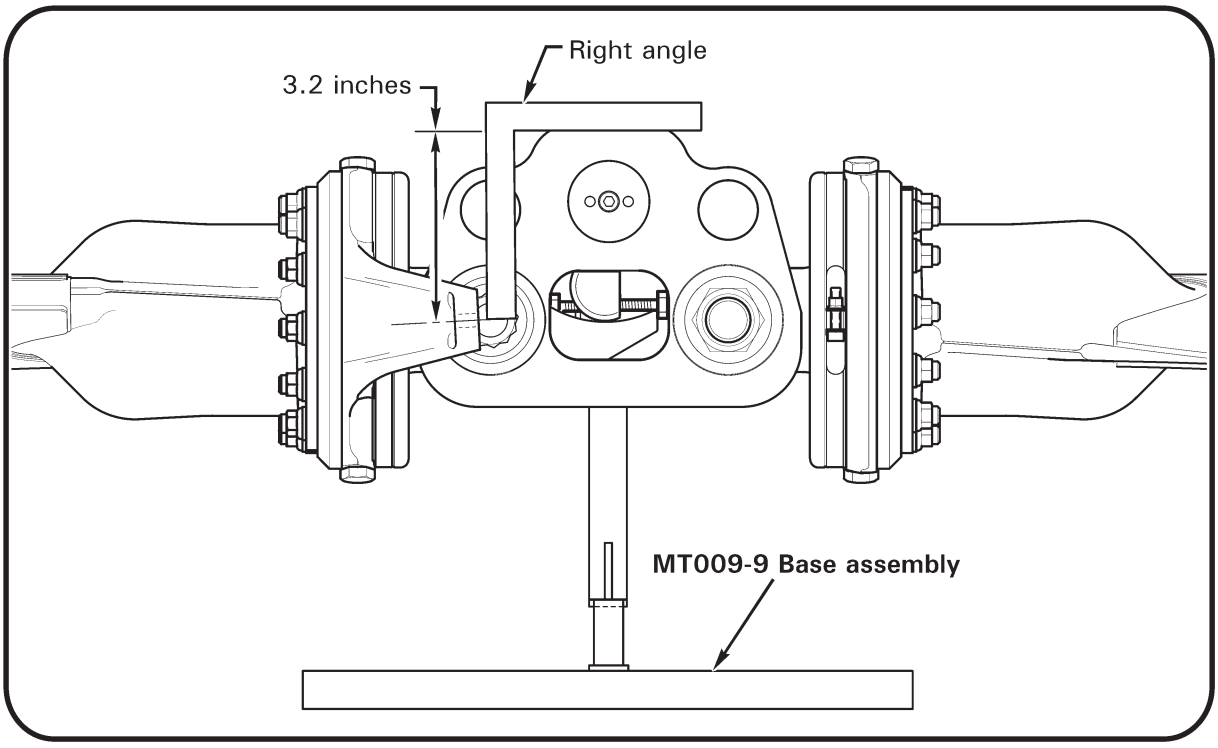

FIGURE 2-21 EQUALIZING BLADE PITCH

2.640 Main Rotor Blade Static Balance (continued)

6. Refer to Figure 2-22. Using a depth micrometer or calipers, measure distance between MT009-2 end plate and MT009-8 shaft thru (either) end plate hole on both sides of main rotor hub. On side of hub with smaller measured distance, mark top of hub with letter "N" to indicate nut-side of teeter hinge bolt.

7. Place a spirit level spanwise (perpendicular to teeter and coning hinges) atop main rotor hub. Place tip cover, tip cover attach screws, and two A722-4 screws as close to blade tip as possible. Level rotor system by adding A298 balance strips, NAS1149F0332P washers, and/or NAS1149F0363P washers as required. Final balance to be within one NAS1149F0332P washer.

8. Apply light coat A257-9 anti-seize to threads and install screws securing tip weights to blade; special torque screws to 40 in.-lb. Apply light coat A257-9 anti-seize to threads and install screws securing tip cover to blade; special torque screws to 40 in.-lb. Recheck spanwise and chordwise balance.

9. Conspicuously mark rotor assembly with colored "X" and "O" on hub, blade roots, and coning bolts (consistent marking on each side of hub) as reference for correct assembly on helicopter. Disassemble main rotor assembly.

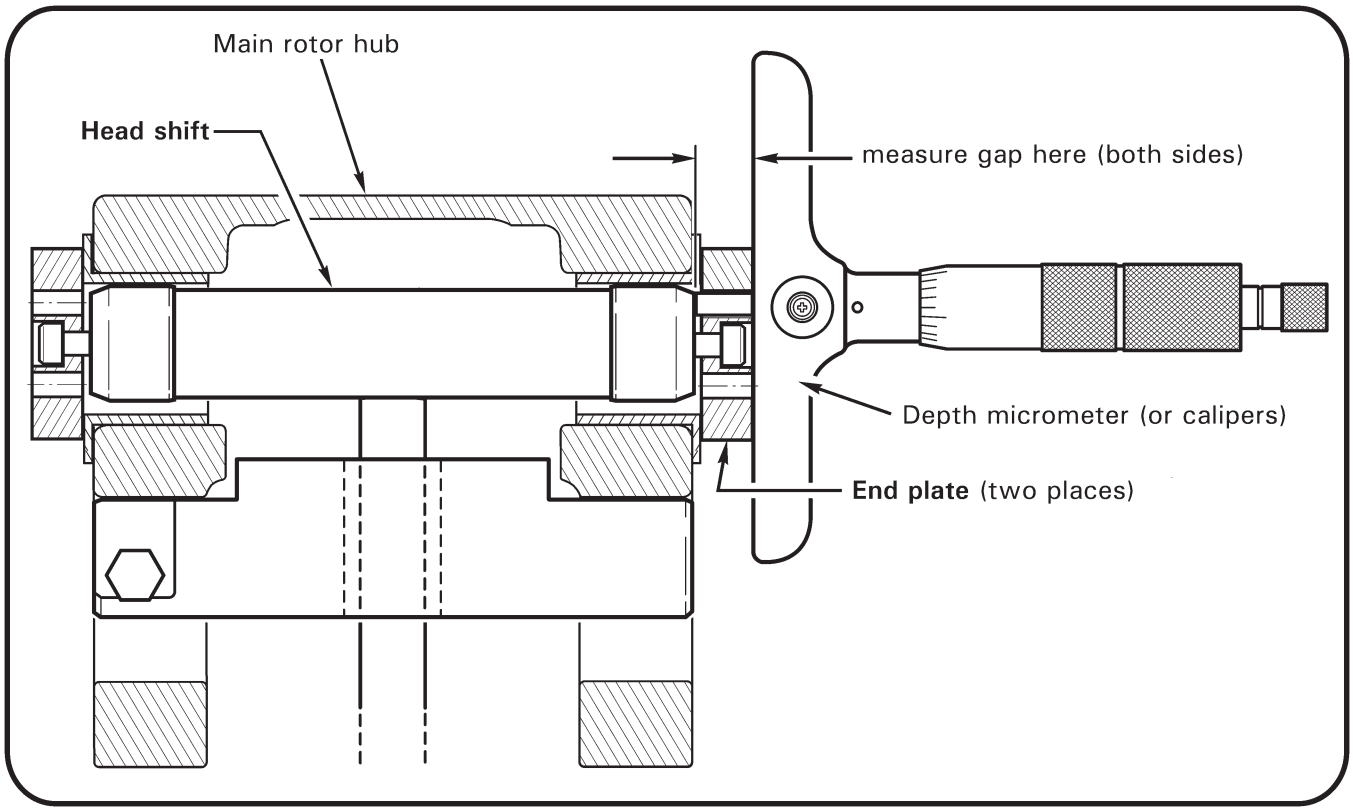

FIGURE 2-22 MEASURING GAP BETWEEN THRUST WASHER AND HUB BEARING

2.650 A258-5 Main Rotor Pitch Link Assembly Inspection

1. Temporarily mark each pitch link and associated swashplate ear with unique color. Record overall lengths of both links.
2. Remove pitch links.
3. Disassemble pitch links, keeping parts from each link separate from the other.
4. Evaluate rod ends per § 2.122 and replace as required.
5. Visually inspect parts with 10X magnification for obvious damage. Replace damaged parts.
6. Visually inspect interior of barrels with borescope for obvious damage. Replace damaged barrels.
7. Assemble pitch links and adjust to recorded lengths. Torque jam nut & adjacent palnut per § 23-32. Special torque self-locking jam nut per § 23-33.
8. Install pitch links to associated swashplate ear and, if installed, main rotor blade. Torque fasteners per § 23-32 and torque stripe per Figure 2-1.

2.700 Additional Special Inspections

2.710 Volcanic Ash Recommendations

Flight in visible volcanic ash conditions ("ash cloud") is detrimental to the helicopter and should be avoided. If helicopter has been operated in visible volcanic ash conditions:

1. Refer to Lycoming SI 1530. Wearing suitable protective equipment, use vacuum cleaner followed by compressed air to remove as much debris as possible. Do not use compressed air near main rotor blade drain holes.
2. Refer to R22 Pilot's Operating Handbook (POH) Section 8. Thoroughly clean, wash, and rinse helicopter, including inner circumference of drive belts.
3. Remove main rotor blade tip covers and clean blade tips.
4. Using 10X magnification, visually inspect any exposed main rotor blade skin-to-spar bond line (adhesive) for gaps (empty space between skin and spar). Blade is unairworthy if any gap, including "pin hole(s)", is detected in the bond line. Refinish blade as required.
5. Inspect condition of drive belt sheaves. Replace any sheave having corrosion pitting, flaking, wear thru metalized or anodized coatings, roughness, or sharp ridges. Replace drive belts if either sheave has sharp ridge(s) on drive belt contact surface.
6. Disconnect alternator drive belt from alternator. Spin alternator pulley by hand and verify rotor bearings and brushes operate smoothly; repair alternator as required if roughness or unusual noise is encountered (volcanic ash can enter via unfiltered cooling air). Inspect alternator and ring gear support pulleys and verify no wear steps; replace alternator belt and pulley(s) if wear steps exist. Perform Lycoming SI 1129 alternator belt tension check and adjust as required.
7. Clean airbox interior and:
    a. Inspect air filter and clean or replace as required.
    b. Inspect induction system downstream of air filter (a clean, white glove is beneficial). If volcanic ash is found then:
        i. Clean induction system, disassembling as required.
        ii. Disassemble carburetor or fuel injection servo, as applicable, inspect for internal contamination, and overhaul as required.
        iii. Perform Lycoming SI 1191 Cylinder Compression check.
        iv. Perform Lycoming SB 388 Procedure to Determine Exhaust Valve and Guide Condition.
        v. Inspect spark plug condition; service as required.

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 300º 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:

1. On associated tailcone's aft casting, strip paint from cross-hatched surfaces shown in Figure 2-23.
2. Fluorescent penetrant inspect (ref. § 23-42) stripped surfaces. Replace tailcone if crack is indicated.
3. Prime & paint stripped surfaces per § 23-60.

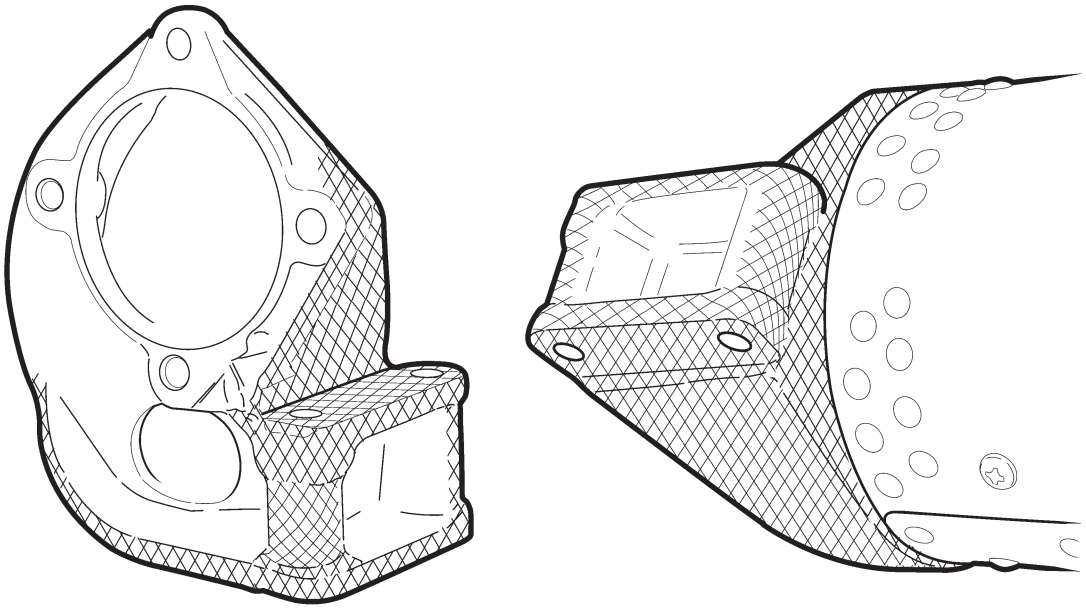

FIGURE 2-23 CROSS-HATCHED SURFACES OF TAILCONE'S AFT CASTING

CHAPTER 3

LIFE-LIMITED COMPONENTS

3.100 Life-Limited Components

3.110 Time-In-Service Records

It is the operator's responsibility to maintain a record of time in service for the airframe, engine, and life-limited components. R22s are equipped with either an oil-pressure-activated hourmeter which records engine run time or a collective-activated hourmeter which records flight (collective up) time. Either method may be used to track time in service, however numerical values for service lives depend on the tracking method used (refer to § 3.300).

Calendar time in service for the airframe and engine begins on the date of the original RHC-issued Export (or Standard) Certificate of Airworthiness for the helicopter. For spares without a storage limit specified in § 23-85, calendar time in service begins on the date of the RHC-issued Airworthiness Approval Tag (Authorized Release Certificate) issued with the invoice.

If a component or an inspection is scheduled for hourly and calendar intervals, comply with whichever requirement comes first, then reset interval unless otherwise specified.

When installing a life-limited part or a part with an overhaul requirement, record in the helicopter maintenance record the installation date, part number, part name, serial number, helicopter total time, and time in service accumulated by part since new or since last overhaul, as applicable.

WARNING

Components with mandatory overhaul times or life limits whose time in service is not reliably documented cannot be considered airworthy and must be removed from service.

3.120 Fatigue Life-Limited Parts

The Airworthiness Limitations Section (ref. § 3.300) lists the mandatory replacement schedule for fatigue life-limited parts.

Listed items (ref. § 3.300) must be removed from the helicopter at the specified intervals and permanently retired from service, preferably by destroying or damaging each part so it cannot inadvertently be returned to service. Fatigue lives are based upon normal flight service, including 6 rotor stop-starts and 10 autorotation entries per hour.

3.200 Type Certificate Data Sheet (TCDS)

The Robinson R22-series Type Certficate Data Sheet (TCDS) reprinted on the following pages is subject to revision.

Visit the FAA Aircraft Certification Regulatory and Guidance Library to determine TCDS revision status at: http://rgl.faa.gov.

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4.142 Mast Fairing

CAUTION

Mast fairing must be installed for flight.

The mast fairing upper rib is mounted to swashplate tube assembly. The lower rib is clamped to main rotor gearbox mast assembly.

The pitot tube is mounted on lower front of mast fairing.

The fuel tank vent is installed through lower rib of mast fairing. (Vent should have approximately 0.30 inch clearance from the aft cowling.)

4.143 Aft Cowling

CAUTION

Aft cowling must be installed for flight.

The aft cowling is a two-piece, sheet-aluminum structure with a removable tailcone rain guard.

4.144 Cabin Inspection Panels

CAUTION

All cabin inspection panels must be installed for flight. With the exception of side skirts, all panels may be left off for run-up.

1. Seat Backs: Left side seat back has fuel valve attached. Back cushions are installed using blind rivets.
2. Cyclic Control Inspection Panels – 4 panels:
   a. Center belly panel
   b. Inside center of cabin (2 each horizontal: 1 each vertical).
   c. Instrument console (refer to Chapter 13 Instrument System).
   d. Forward cross tube inspection panel.

CHAPTER 6

POWERPLANT

CHAPTER 6

POWERPLANT (Continued)

6.120 Engine Installation (cont'd)

e) Reconnect throttle linkage to middle position of carburetor bellcrank. Refer to § 10.150 for throttle rigging. Reconnect mixture control and carburetor heat control and rig these controls for 1/16" springback at each end of the control travel (See Chapter 10 for rigging of throttle).

f) Reconnect engine grounding strap and torque engine oil sump bolts per § 23-33. Connect oil line to oil pressure sender. Connect manifold pressure line to engine and firewall connections.

g) Reconnect all electrical leads to oil temperature sender, cylinder head temperature sender, alternator, magnetos, etc.

h) Install cabin heater ducting and all wire and oil line clamp connections.

i) Connect fuel line to carburetor and inspect engine compartment for proper installation of all electrical connections, control attachment, ducting and routing.

j) Reinstall clutch assembly. (See § 7.200).

k) Reinstall engine access panels, compartment panels and aft cowling.

l) Before running engine, check following components for proper alignment:

1) Sheave alignment per § 7.230.

2) Tail rotor drive shaft shimming per § 7.330.

3) Cooling shroud-to-tailcone clearance 0.250 inch minimum.

4) Intermediate flex plate to tail rotor bellcrank clearance 0.250 inch minimum with belts over 10 hours, 0.125 inch minimum with new belts.

5) Clutch shaft angle per § 7.240.

6) Upper sheave centering per § 7.250.

NOTE
Fill engine to proper oil level.

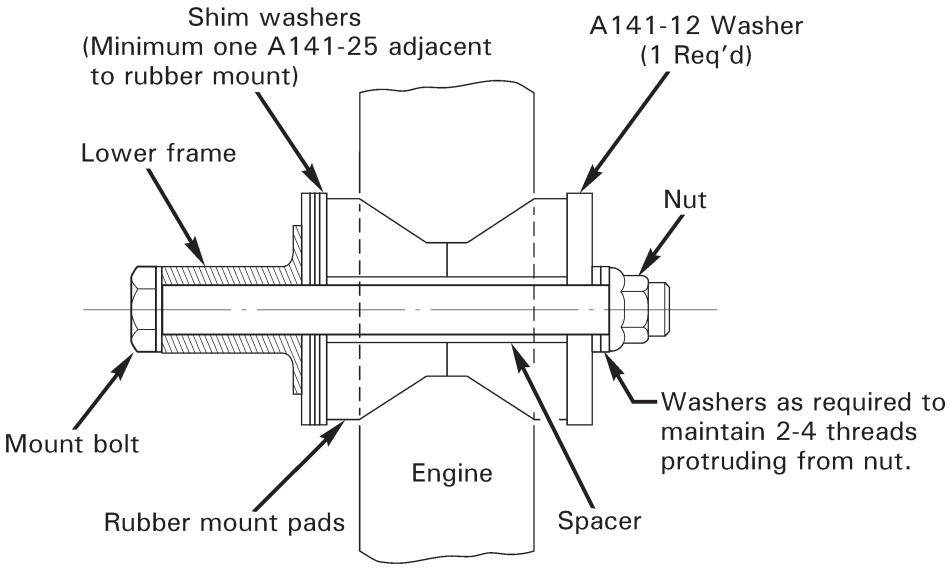
6.130 Engine Shimming

To facilitate sheave proper alignment, the engine must be shimmed to 3.55/3.75 inches, measured between ring gear top and bottom of upper frame's long cross tube with clutch engaged.

1. Engage clutch.
2. Measure ring gear-to-upper frame cross tube dimension as shown in Figure 6-2. If dimension exceeds 3.75 inches, an equal amount of shims must be added between lower frames and both the lower-left and the lower-right engine rubber mount pads. Use following formula to calculate required maximum shim thickness:

$$\frac{\text{(Measured ring gear-to-upper frame dimension)} - 3.55}{2} = \text{Calculated shim thickness}$$

   Select shim(s) as required up to, but not exceeding, calculated shim thickness. Shims are available in thicknesses of 0.032 inch, 0.063 inch, and 0.190 inch. Removing an equal amount of shims from between both lower frames and the lower-left and the lower-right engine rubber mount pads will increase ring gear-to-upper frame cross tube dimension.
3. Disengage clutch.
4. Remove side skirts.
5. Loosen upper-left and lower-left engine mount bolts. Leaving right engine mounts torqued, install selected shim(s) between lower-left frame and lower-left engine mount pad. Slotted shims, if used, may be stacked together but must be installed between unslotted shims and safetied. See Figure 6-2A.
6. Torque engine-mount bolts per § 23-32.
7. Remove right-side spark plug inspection panel. Loosen upper-right and lower-right engine mount bolts. Leaving left engine mounts torqued, install selected shim(s) between lower-right frame and lower-right engine mount pad.
8. Torque engine-mount bolts per § 23-32.
9. Engage clutch. Verify ring gear-to-upper frame cross tube dimension as shown in Figure 6-2. Adjust as required.
10. Torque stripe nuts per Figure 2-1.



Add shim washers A141-12 (0.190 inch), A141-24 (0.032 inch), B155 (0.032 inch), A141-25 (0.063 inch) as required to shim engine. B155 shims, if used, shall be between A141 washers (ref. Figure 6-2A).

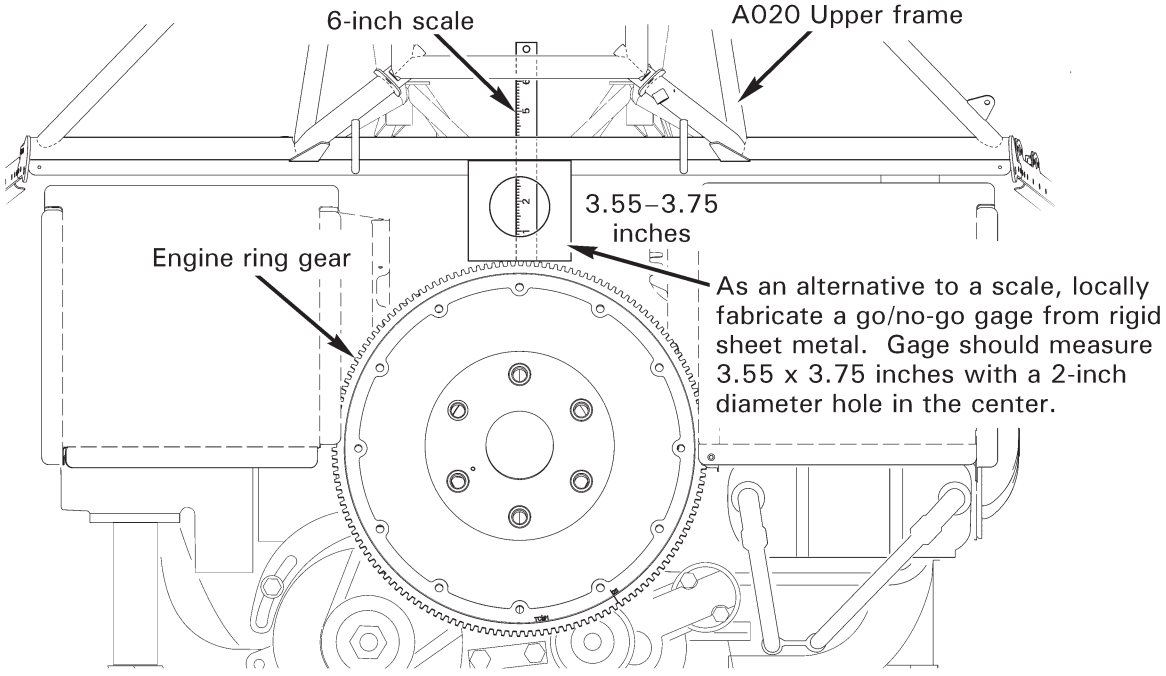


FIGURE 6-2 ENGINE INSTALLATION

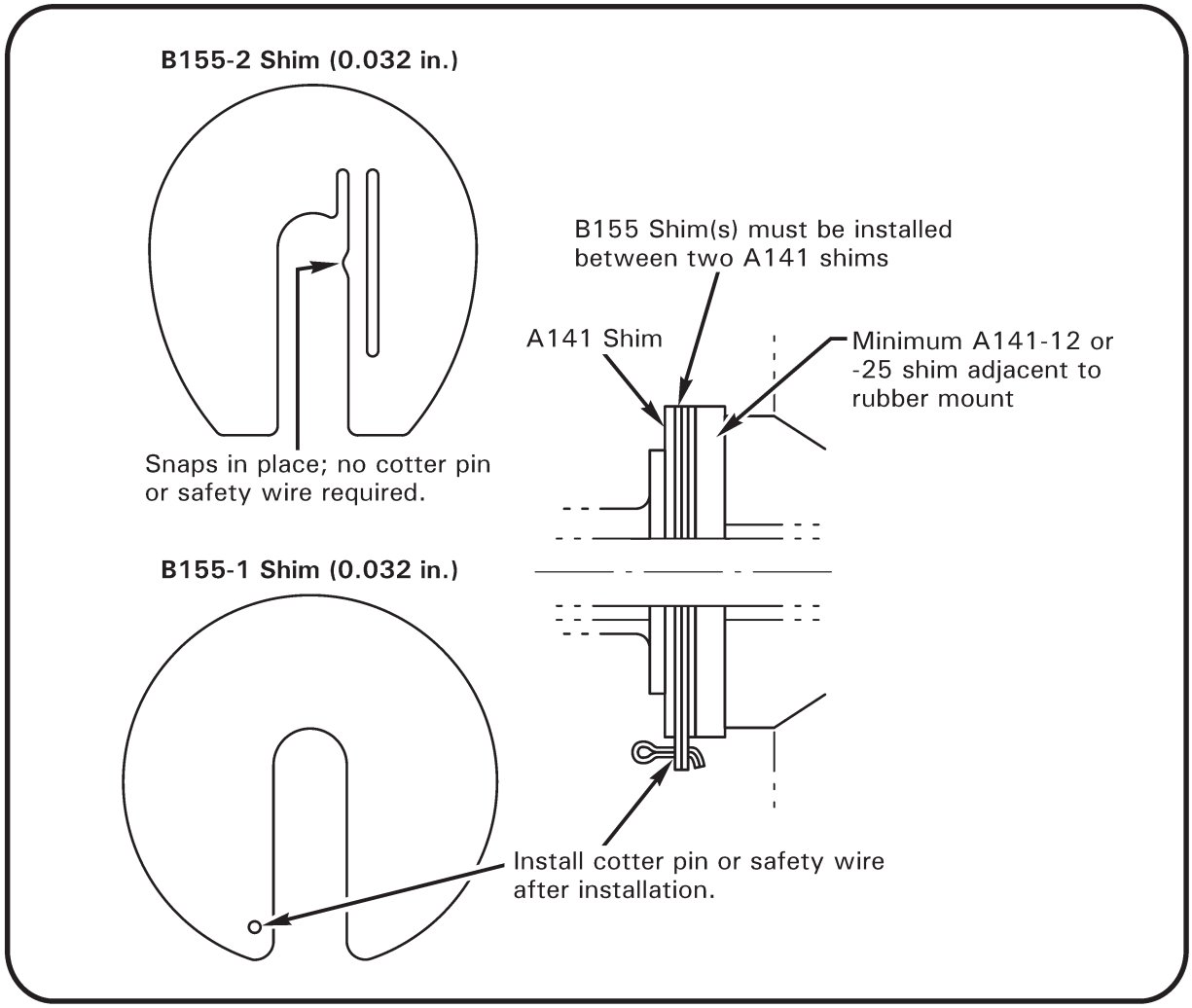


FIGURE 6-2A B155 ENGINE SHIM

NOTE

Engine mounting shims added or subtracted at two botttom engine mounts will change engine ring-gear-to-frame dimension by approximately twice the thickness of engine mount shim.

Example: Adding a 0.032-inch thick shim at each bottom engine mount will raise rear of engine approximately 0.064 inch.

6.435 Air Filter Cleaning

NOTE
Replace B771-1 air filters after 5 years or 600 flight hours, whichever occurs first.

1. Remove B771-1 air filter from airbox. Visually inspect filter and verify no obvious damage. Inspect filter's pleated media for cleanliness. If the media contains only dust, clean media using compressed air or water. Clean heavily soiled media using a mild soap & water solution.

   a. Compressed air: Maintain at least one-inch distance between air nozzle and pleated media and apply less than 40 psi compressed air thru media opposite the normal direction of airflow.

   b. Water: Apply less than 40 psi water stream thru media opposite the normal direction of airflow. Dry filter thoroughly using less than 160°F warm air.

   c. Mild soap & water solution: Apply less than 40 psi water stream thru media opposite the normal direction of airflow. Soak filter in a mild soap and water solution for more than 15 minutes but less than 4 hours. Gently agitate filter in soap solution to help remove dirt. Apply less than 40 psi water stream thru media in both directions. Dry filter thoroughly using less than 160°F warm air.

2. Using a bright light, examine pleated media and verify no holes or tears.

3. Verify filter sealing surfaces are a smooth, continuous circle and flat.

NOTE
Do not install a wet air filter. Do not apply oil to filter media.

4. Install filter in airbox.

6.440 Carburetor Installation

1. With carburetor butterfly bellcrank on left, install carburetor and new gasket on mounting studs of engine sump and secure with washers and nuts. Special torque nuts per § 23-33. Install palnuts, standard torque per § 23-32, and torque stripe.
2. Connect throttle push-pull tube to middle hole of carburetor butterfly bellcrank. Standard torque bolt per § 23-32. Install palnut, torque per § 23-32, and torque stripe.
3. See Figure 6-7. Connect mixture control cable inner wire to carburetor mixture control arm. Lightly tighten A462 fitting, but do not torque; fitting will be torqued in following step.
4. Install air box per § 6.430.
5. Verify idle RPM and idle mixture per § 2.210.
6. Check throttle correlation rigging per § 10.150.

6.450 Carburetor Heat Scoop Removal

1. Disconnect hose from carburetor heat scoop.
2. 0-320 engine: Remove six screws securing curved sheet metal and remove sheet.

   0-360 engine: Remove two B277 clamps securing scoop assembly to exhaust manifold and remove scoop.
3. 0-320 engine: Remove four bolts securing scoop assembly to bead clamp on exhaust riser and remove scoop assembly. Remove additional clamp from exhaust riser above bead clamp.

6.460 Carburetor Heat Scoop Installation

1. 0-320 engine: Install A694 clamp and angle on #4 cylinder exhaust riser and lightly tighten. Attach scoop assembly on bead clamp and lightly tighten.

   0-360 engine: Install scoop assembly, secure with B277 clamps, and lightly tighten.
2. Connect air inlet hose to scoop assembly.
3. 0-320 engine: Position sheet on mounts. Move A694 clamp and rotate bead clamp (with attached scoop assembly) as required to minimize preload and ensure clearance from surrounding structure. Tighten A694 clamp. Standard torque bolts per § 23-32. Install sheet with six screws.

   0-360 engine: Move scoop assembly as required to minimize preload and ensure clearance with surrounding structure. Special torque scoop attach clamps to 30 in.-lb.

6.500 Exhaust System

6.510 Exhaust System Removal

1. Remove carburetor heat hose and, if installed, disconnect heater hoses from muffler shroud.
2. Protect landing gear aft cross tube with suitable covering. Disconnect exhaust flanges at cylinder heads and remove exhaust system and gaskets.

6.520 Exhaust System Installation

> NOTE
>
> Do not use stainless tape beneath exhaust bead clamps which incorporate integral barriers.

1. Position a gasket on each exhaust port.
2. Protect landing gear aft cross tube with suitable covering. Position exhaust system on engine and connect riser exhaust flanges to cylinder heads with washers and nuts. Remove protective cover from cross tube.
3. Loosen bead clamp on each riser. If required, remove curved metal sheet from carb heat scoop assembly.
4. Special torque exhaust flange nuts per § 23-33. Install palnuts and standard torque per § 23-32.
5. Install carburetor heat hose and connect heater hoses, if installed.
6. Standard torque bead clamp AN3 bolts per § 23-32. If removed, install curved metal sheet on carburetor heat scoop assembly and reposition clamps as required to minimize preload and ensure clearance from surrounding structure.

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6.620 High Cylinder Head Temperature (CHT) Indication

1. For any helicopter indicating unusually high CHTs, verify:
   a. Proper fuel grade.
   b. Cooling scroll inlet metal lips-to-fanwheel clearance is within 0.020–0.100 inch.
   c. Mixture control at carburetor is at full-rich position when mixture knob is fully in.
   d. Integrity of engine baffles and cooling panels.
   e. Cooling hoses are properly routed, secured, and in good condition.
   f. Correct spark plugs (Lycoming Service Instruction 1042 refers).
   g. Magnetos are properly timed.
   h. No excessive leakage from exhaust riser-to-cylinder head gaskets.

NOTE
Cylinder head temperatures may be higher during engine break-in until oil change and switch from mineral to ashless dispersant oil.

2. If preceding steps and corrective actions do not improve CHT indications, the CHT gage may be indicating erroneously high. Refer to § 33-131-2 Part E.

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7.130 Leveling Main Rotor Gearbox

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

> NOTE
>
> Ensure at least one pad has no shims. As required after leveling, remove equal number of shims from each pad.

3. Install main rotor gearbox per § 7.120.

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7.150 Replacement of Main Rotor Gearbox Pinion Seal (continued)

c) Rest forward end of clutch shaft on firewall. Remove yoke from pinion shaft per § 7.140.

d) Cut safety wire securing pinion bearing end cover bolts and remove bolts.

e) Remove Hall Effect sender bracket(s) and gearbox overtemp sender bracket.

f) Carefully slide pinion bearing end cover off pinion shaft.

CAUTION

Do not remove shims under pinion bearing end cover as they control bearing preload and gear backlash.

g) Press seal out of bearing end cover and press in new seal until it seats.

NOTE

Open face of seal lip must point toward gearbox.

h) Position bearing end cover on pinion shaft. Install Hall Effect and overtemp sender brackets and remaining end cover bolts.

i) Torque bolts per § 23-33 and safety wire.

j) Adjust Hall Effect sender gap per § 7.141.

k) Install A947-1 forward flex plate and connect A947-2 intermediate flex plate, ensuring correct ship placement.

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

a) Drain MRGB.

b) Remove MRGB per § 7.110.

c) Check and record MRGB gear backlash at and tangential to a gear tooth, accessible via sight gage or filler-plug hole.

d) Carefully note and record position of each fastener, washer and shim stack-up at all A263-1 sump-to-A264-1 housing attach points (an equal number of shims is installed between sump and housing at each attach point). Remove, identify and retain fasteners, washers and shims.

e) Remove sump and o-ring.

f) Prelubricate new A214-172 o-ring with correct gearbox oil (refer to § 22-10 Part C) and install on sump. Ensure o-ring is not twisted in sump groove.

7.155 Replacement of Main Rotor Gearbox (MRGB) Sump 0-Ring (continued)

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

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

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

h) Torque fasteners as follows:

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

i) Check MRGB gear backlash exactly as performed in step c). Backlash should be within 0.001 inch of value recorded in step c).

j) Install MRGB per § 7.120.

k) Fill MRGB with correct gearbox oil (refer to § 22-10 Part C).

7.160 Main Rotor Gearbox Overtemp Inspection

a) If "MR TEMP" warning light illuminates AND Telatemp indicates abnormally high operating temperature:

1. Inspect gearbox cooling duct for obstructions and conditions. Clear obstructions or replace duct as required.
2. Remove chip detector and inspect for chips. Return gearbox to RHC if chips are found.
3. Drain gearbox oil and remove sight gage and filler-plug. Observe gear tooth surfaces thru filler-plug and sight gage holes while rotating gearbox pinion and inspect for damage. Return gearbox to RHC if damage is detected or if gearbox does not rotate smoothly. If no damage is noted, refill gearbox.
4. Replace Telatemp. Ensure old Telatemp adhesive is removed and new Telatemp makes good contact with gearbox.
5. If gearbox overtemp indications continue, return gearbox to RHC.

7.260 A907 Yoke Removal and Installation

To remove yoke:

1. Remove clutch assembly per § 7.210.
2. Remove bolts and clamping blocks securing A907 yoke to clutch shaft. Mark which set of yoke attachment holes are used.
3. Remove A907 yoke:
   a. (Preferred method) If a press is available, position clutch assembly in press per Figure 7-6A. Ensure brass or aluminum drift fits against outer rim of clutch shaft and not against inner spacer. Press clutch shaft out of yoke.

> **CAUTION**
>
> Ensure clutch assembly does not fall when yoke is removed.

   b. If a press is not available, apply penetrating oil to yoke-shaft juncture. Gently clamp A907 yoke in a padded vise per Figure 7-6B. Twist clutch shaft out of yoke by turning upper sheave. If difficulty is encountered, discontinue attempt and arrange use of press as described in preceding step.

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

To install yoke:

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

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

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

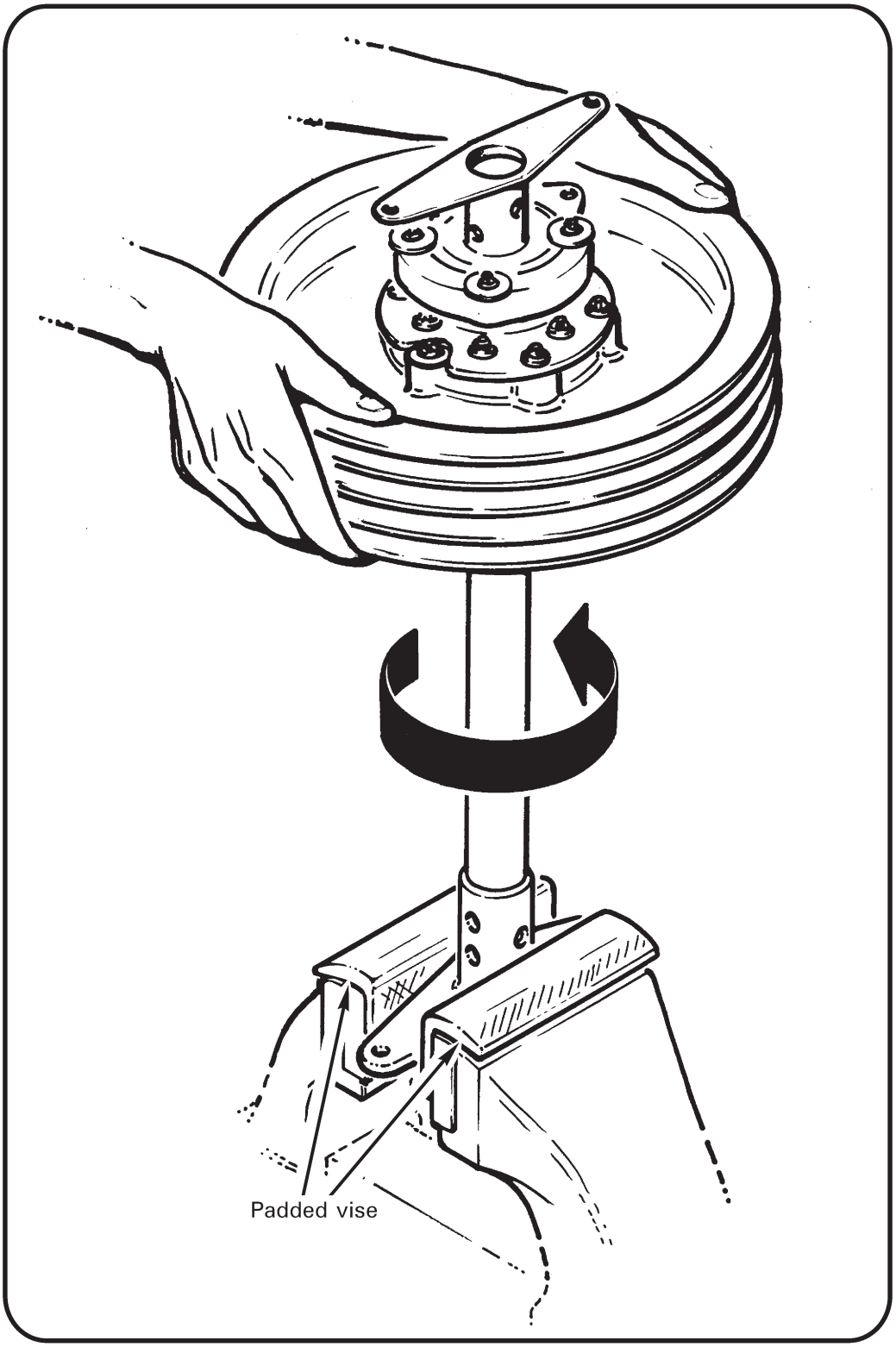

FIGURE 7-6B A907 YOKE REMOVAL

7.270 A195 Yoke Removal and Installation

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

CAUTION

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

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

To install yoke:

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

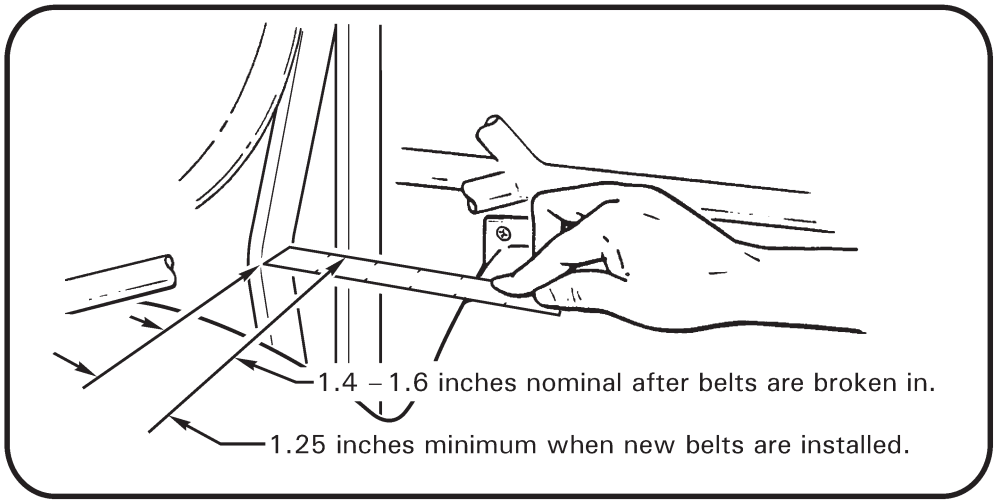

FIGURE 7-7A V-BELT DEFLECTION (ACTUATOR DISENGAGED)

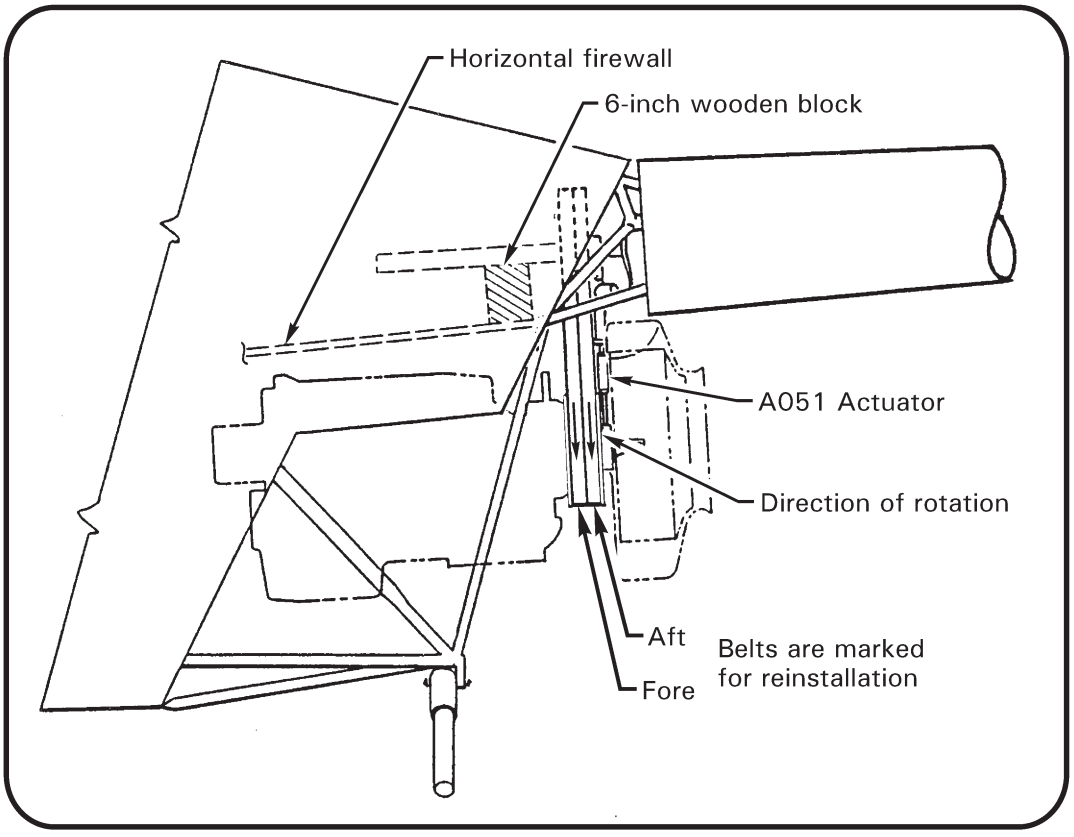

FIGURE 7-8 V-BELT AND ACTUATOR REMOVAL

7.280 V-Belts

7.281 V-Belt Removal

a. Remove fanwheel per § 6.210.

b. Fully disengage belt tension actuator. Place a six-inch wooden block between clutch shaft and horizontal firewall per Figure 7-8. Block will prevent excessive sheave drop and protect forward flex plate.

c. Disconnect clutch lateral centering strut from upper frame and remove intermediate flex plate.

d. Mark drive belts for "fore" and "aft" position and direction of rotation if they will be reinstalled.

CAUTION

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

e. Loosen belt guide and position guide to remove v-belts.

f. Disconnect actuator wiring.

g. Remove belts from sheave and pull over aft yoke.

7.282 V-Belt Installation

1. Evaluate alternator belt(s) condition and replace as required.

2. Inspect upper and lower actuator bearings per §§ 2.502 & 2.503 (lubricate as required).

3. Identify type (deep-groove or shallow-groove) of upper and lower sheaves. Refer to Figures 7-3D & 2-11.

CAUTION

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

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

CAUTION

Rough or corroded grooves in the upper or lower sheave can cause V-belts to roll, break, or come off.

7.282 V-Belt Installation (continued)

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

WARNING

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

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

CAUTION

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

NOTE

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

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

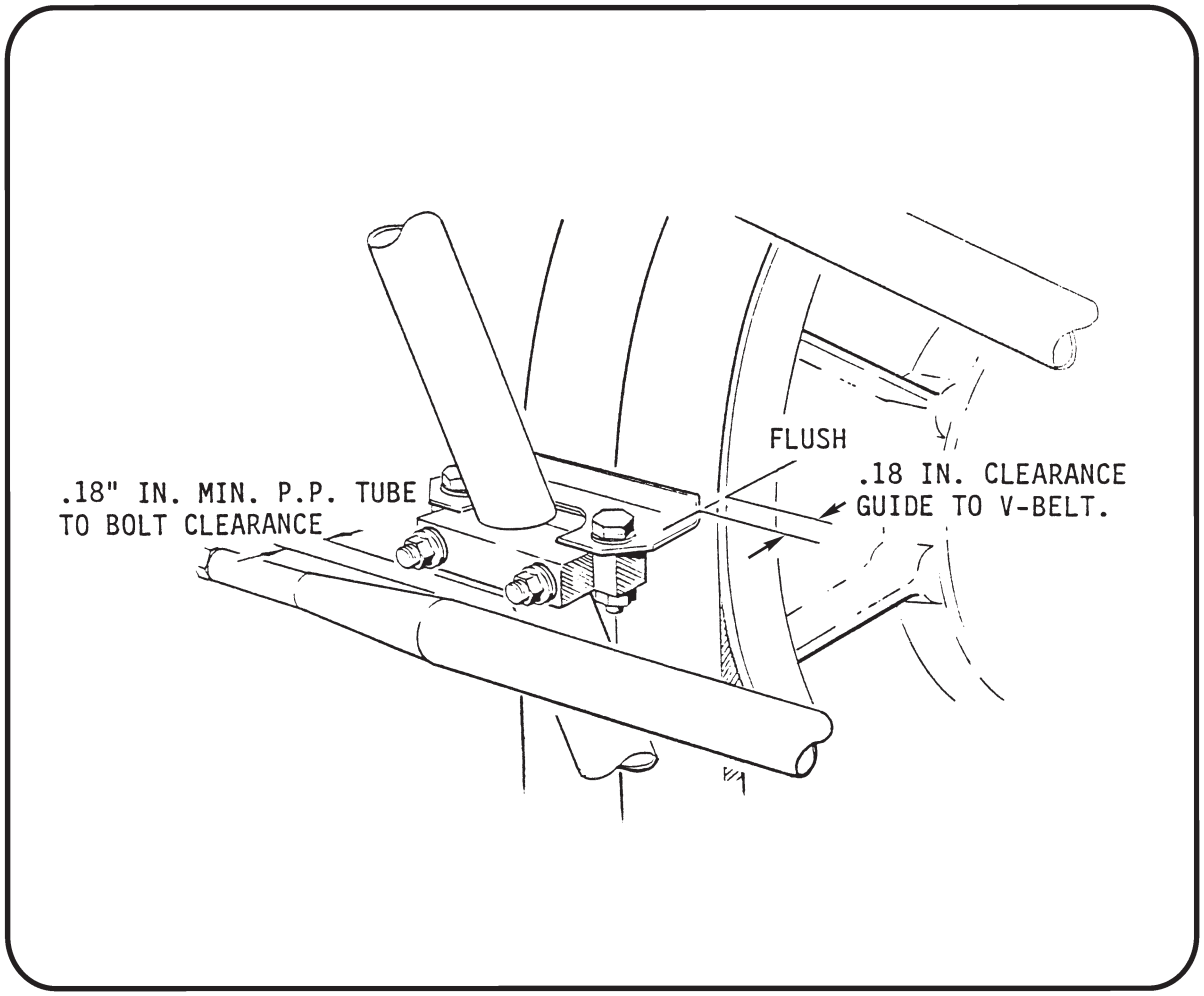

FIGURE 7-8A V-BELT GUIDE

7.282 V-Belt Installation (continued)

CAUTION

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

NOTE

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

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

7.291 Removal

a. Remove fanwheel and fiberglass scroll per § 6.210.

> NOTE
>
> Fanwheel and fiberglass scroll may be removed without splitting scroll.

b. Support clutch shaft assembly at horizontal firewall with a wooden block. Remove lower bolt connecting belt tension actuator to A181-4 lower bearing assembly.

c. Label drive belts (forward & aft) for reinstallation.

d. Cut safety wire and remove bolts and washers.

e. Remove A007-3 or -5 fanshaft and bearing assembly. Temporarily secure lower sheave if it is not to be removed.

f. To remove lower sheave, tap it with a soft mallet while pulling.

g. Removal of starter ring gear support is required to change alternator belt or gain access to engine nose section.

   1. Loosen alternator belt tension.
   2. Note “O” mark on the starter ring gear support at one crankshaft flange bushing. Mark this bushing to ease reinstallation.
   3. Remove starter ring gear support.

7.292 Installation

a. Install new and spare alternator belts if required. Install starter ring gear support. Align “O” mark on ring gear support with marked bushing. Bushing and hole marked “O” are slightly larger than other five holes.

b. Install lower sheave and fanshaft assembly. Install (6) NAS6606H23 bolts and (6) NAS1149F0632P washers, or (6) NAS6606H24 bolts, (6) NAS1149F0632P washers, and (6) NAS1149F0663P washers (washer positions optional), as required. Special torque bolts per § 23-33 in a crossing pattern. Safety wire bolts in pairs with 0.041 inch diameter stainless steel safety wire.

7.450 A021 Tail Rotor Gearbox Output Shaft Seal Replacement

1. Drain gearbox oil. Clean and inspect chip detector. Clean sight gage as required. Reinstall chip detector and sight gage, torque per § 23-33 and safety wire.
2. Remove tail rotor per § 9.210.
3. Remove pitch control per § 8.561 and clean gearbox output shaft.
4. Verify tailcone-to-upper frame attach bolts are torqued per § 23-32.
5. See Figures 7-13A and 7-13B. Slide MT295-10 mandrel on output shaft until it contacts seal. Tape mandrel to gearbox to maintain position when punching holes in seal.
6. Using small holes in MT295-10 mandrel as a guide, punch four holes in output shaft seal with MT295-3 punch.

CAUTION

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

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

CAUTION

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

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

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

11. Remove MT295-6 screw and old seal from MT295-10 mandrel and slide mandrel on output shaft until it contacts seal.
12. See Figures 7-13A and 7-13B. Determine if gearbox output shaft seal installation is recessed type or flush type. Install flush-type seal until it is flush with seal bore; install recessed-type seal until MT295-10 mandrel contacts gearbox face. Lightly tap end of mandrel with soft-face hammer until seal is properly positioned.
13. Remove mandrel.
14. Fill gearbox to center of sight gage using correct gearbox oil (refer to § 22-10 Part C). Verify filler-plug vent holes are clear. Install filler-plug and torque per § 23-33.
15. Install pitch control per § 8.562.
16. Install tail rotor per §§ 9.212 or 9.213, as applicable.
17. Inspect seal for leaks after dynamic balancing tail rotor.

7.460 B021 Tail Rotor Gearbox Output Shaft Seal Replacement

1. Drain gearbox oil. Clean and inspect chip detector. Clean sight gage as required. Using new o-ring(s) install chip detector and sight gage, torque per § 23-33, and safety wire.
2. Remove tail rotor per § 9.210.
3. Remove pitch control per § 8.561 and clean gearbox output shaft.
4. Cut safety wire and remove four drilled-head bolts securing B552-1 retainer and slide retainer off output shaft.

CAUTION

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

5. Remove seal and o-ring from B552-1 retainer.
6. Carefully clean and dry retainer seal seating surface and 0-ring groove.
7. With seal lip toward gearbox, press new A966-4 seal into retainer bore 0.140/0.160 inch below external flat surface. Lubricate new o-ring with correct gearbox oil (refer to § 22-10 Part C) and install in retainer groove without twisting.
8. Lubricate seal seating area of output shaft with correct gearbox oil (refer to § 22-10 Part C).
9. Carefully slide retainer over output shaft. Align retainer and gearbox bolt holes and press retainer into gearbox. Install four drilled-head bolts, torque per § 23-33, and safety wire.

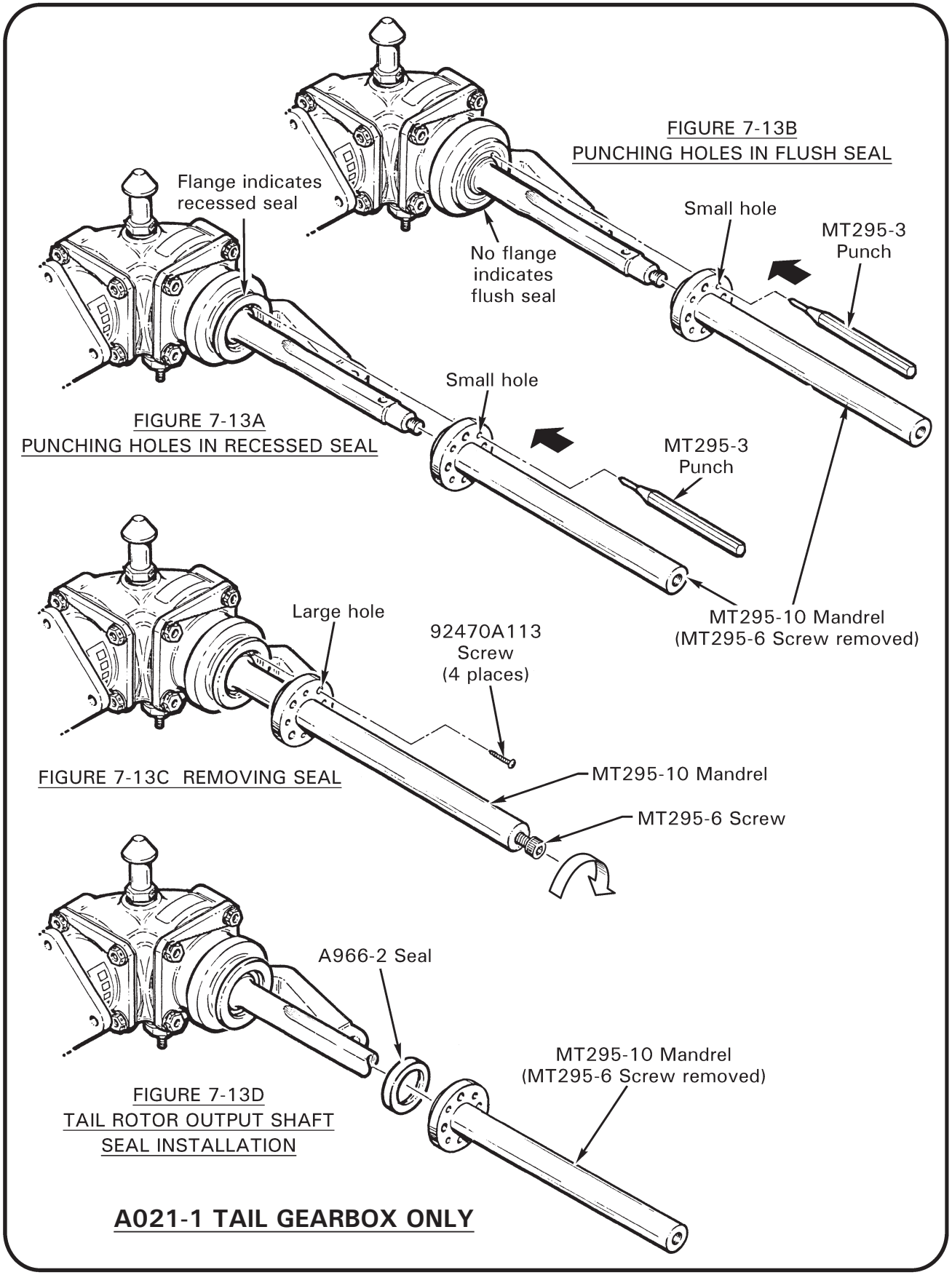

FIGURE 7-13B
PUNCHING HOLES IN FLUSH SEAL

FIGURE 7-13A
PUNCHING HOLES IN RECESSED SEAL

FIGURE 7-13C REMOVING SEAL

FIGURE 7-13D
TAIL ROTOR OUTPUT SHAFT
SEAL INSTALLATION

A021-1 TAIL GEARBOX ONLY

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

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

7.470 B021 Tail Rotor Gearbox Input Shaft Seal Replacement

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

CHAPTER 8

FLIGHT CONTROLS

CHAPTER 8

FLIGHT CONTROLS (Continued)

8.230 RPM Governor System

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.

8.231 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 www.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. Remove right seat back assembly (D270-1 governor controller) or left seat back assembly (B286-2 governor controller) per § 15-22.
2. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
   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.

8.232 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.
3. 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 overtightening 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.

8.233 Governor Assembly Removal

The governor assembly is behind the left seat back assembly, attached to the collective stick.

1. Remove collective stick per § 8.211.

CHAPTER 10

RIGGING, TRACK AND BALANCE

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CHAPTER 10

RIGGING, TRACK AND BALANCE

10.000 Rigging, Track and Balance

10.001 Introduction

This section contains the procedures necessary to rig the main rotor flight controls, tail rotor flight controls and throttle correlation. The track and balance procedures in this section are to be used in conjunction with Chadwick-Helmuth balancing equipment instructions.

10.002 Rod End Adjustment Procedures For Rigging

Refer to § 23-34 Push-Pull Tube Rod End Adjustment.

10.100 Rigging

10.110 Main Rotor Flight Controls

10.111 Cyclic Controls

The cyclic control travel is non-adjustable and is controlled by A211-1 stop plate attached to the cyclic box assembly.

> NOTE
>
> If the A121-1 push-pull tube length has been changed or the length of the A205 fork was changed, they must be readjusted to the dimensions shown in Figure 8-3.

a. Place the cyclic stick against the aft stop and the collective control full down.

b. Adjust the A121-3 push-pull tube to obtain a clearance of .130 inch between the aft arm of the jack shaft and the main rotor gearbox upper cap flange.

10.222 Tail Rotor Equipment Installation (continued)

c. Place a target tape on tail rotor hub inboard surface approximately 1 inch in from on blade's outboard attach bolt.

CAUTION

Ensure cables cannot become entangled in tail rotor.

d. Refer to Figures 10-9C and 10-9D. Install and secure photocell and mounting bracket to velocimeter bracket as shown. Connect extension cable to photocell and wrap cable several times around tailcone and secure with duct tape.

e. Connect cables to balancer.

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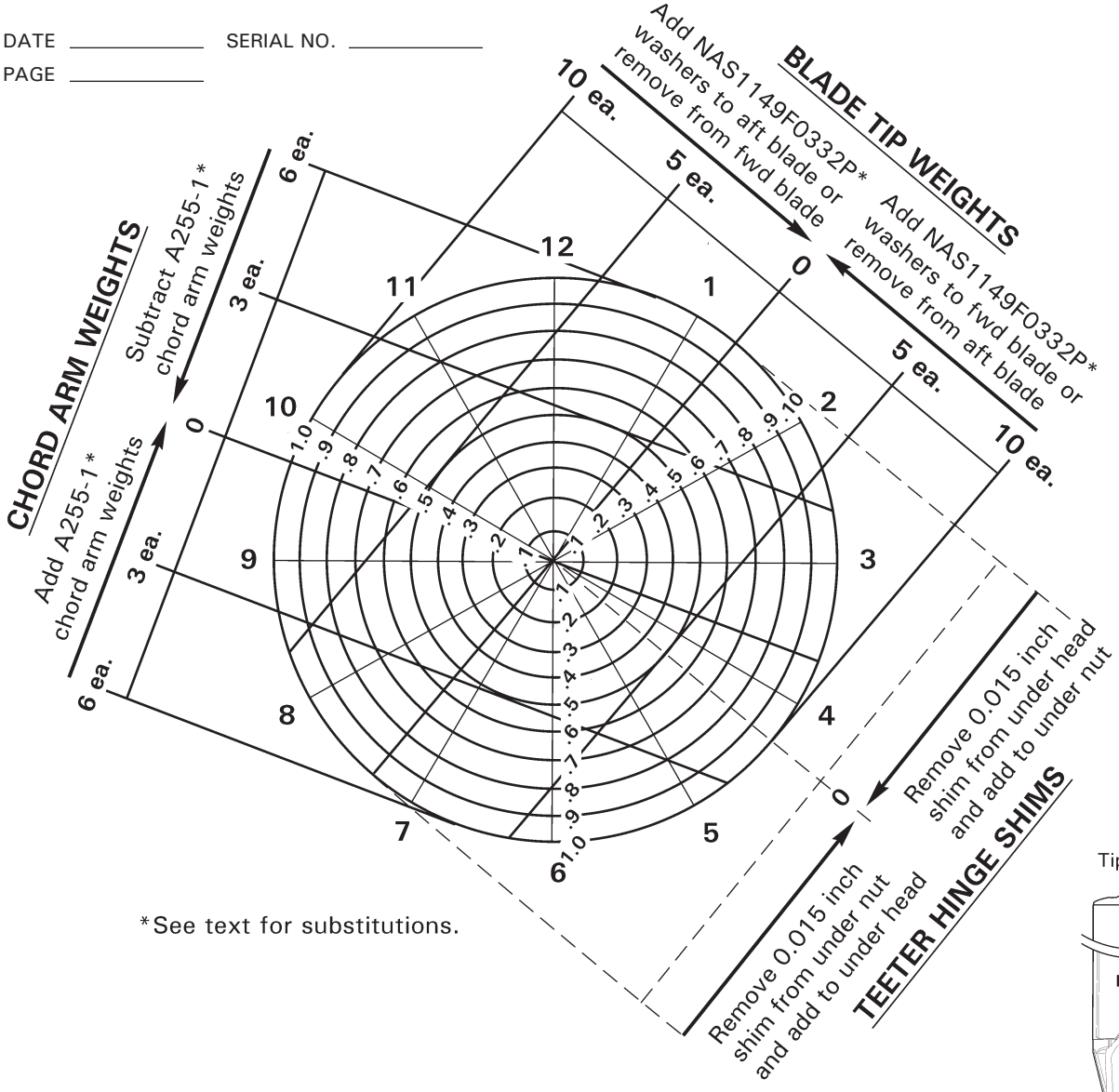

*See text for substitutions.

BALANCE		TRACK (KNOTS)						
CLOCK	IPS	HOVER	50	60	70	80	90	100

Adjustment: _____

CLOCK	IPS	HOVER	50	60	70	80	90	100

Adjustment: _____

CLOCK	IPS	HOVER	50	60	70	80	90	100

Adjustment: _____

CLOCK	IPS	HOVER	50	60	70	80	90	100

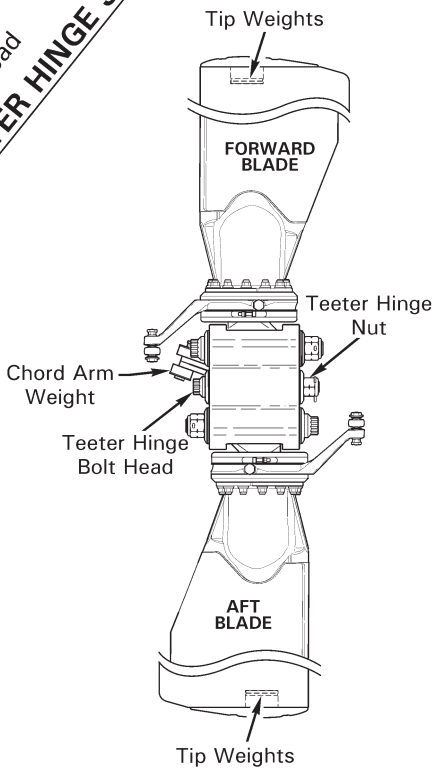

FIGURE 10-10 MAIN ROTOR TRACK AND BALANCE CHART

10.230 Main Rotor Track and Balance Procedure

NOTE

Prior to installing balancing equipment, verify blades are clean and smooth, rod ends & spherical bearings & scissors play are within limits, correct upper (rotating) scissors friction, correct swashplate tilting friction, and coning hinge frictions. Verify interrupter is opposite chord arm.

In-flight track and balance is accomplished using the following testing and adjustment sequence:

1. Check main rotor track in a hover and record data. Adjust track by shortening high blade pitch link per § 10.232 to bring track within 0.25 inch.
2. Check main rotor balance in a hover and record data. Adjust balance as indicated by main rotor balance chart to within 0.2 IPS (inches per second).
3. Fly helicopter at 50, 60, 70, 80, 90, and 100 knots. Check track at each airspeed and record.

WARNING

Do not exceed V_{NE} of helicopter when checking in-flight track.

4. Make slight tab adjustment to correct for a climbing blade by bending trim tab down per § 10.233.
5. Repeat steps 3 & 4 as required until track is within 3/8 inch at all airspeeds.
6. Readjust main rotor balance in a hover to no greater than 0.2 IPS.
7. Check autorotational RPM per § 10.250. Adjust as required.
8. Evaluate collective trim, longitudinal cyclic trim, and lateral cyclic trim. Adjust as required.
9. Check main rotor balance in a hover. Verify no greater than 0.2 IPS. Adjust as required.

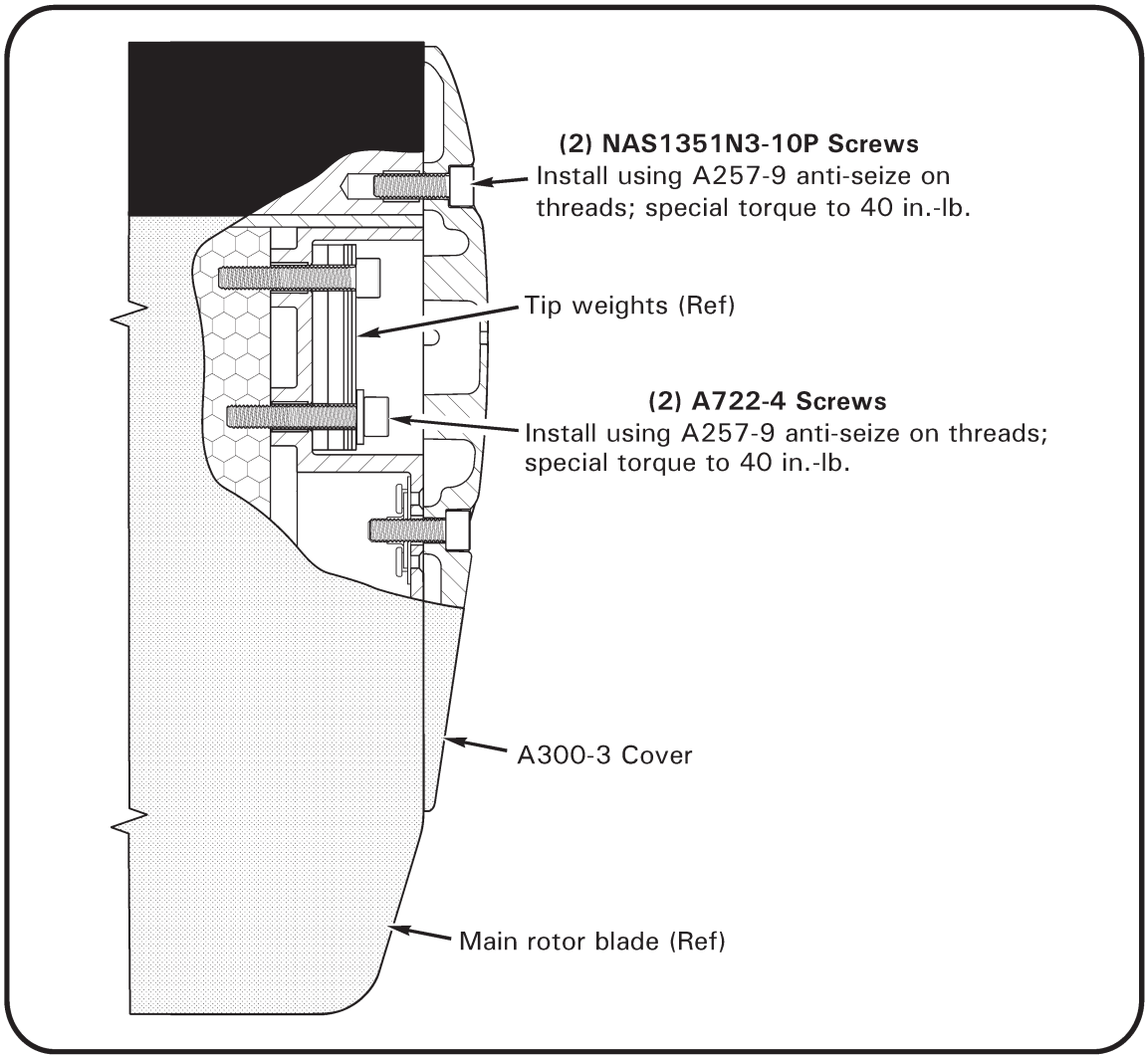

FIGURE 10-11 MAIN ROTOR BLADE TIP

10.231 Main Rotor Balance Adjustments

WARNING

A rotor which is smooth after balancing but goes out of balance within a few flights is suspect and must be examined by RHC before further flight.

A. Tip Weights (Spanwise Balance Adjustment)

1. Remove screws securing tip cover to blade. Balance rotor assembly spanwise by adjusting tip weights as required per Figure 10-10. Washers may be trimmed. Refer to Figure 10-11. Apply light coat A257-9 anti-seize to threads and install screws securing tip weights to blade; special torque screws to 40 in.-lb. Apply light coat A257-9 anti-seize to threads and install screws securing tip cover to blade; special torque screws to 40 in.-lb.

   (1) AN960-10 or NAS1149F0363P Washer = (2) AN960-10L or NAS1149F0332P Washers
   (1) A298-2 Weight = 0.034 lb
   (1) A298-3 Weight = 0.009 lb

B. Teeter Hinge Bolt Shims (Chordwise Balance Adjustment – Coarse Adjustment)

1. Remove and discard teeter hinge nut cotter pin. Remove nut, thrust washer, and any shims.
2. Have two people cone the main rotor blades. Push out teeter hinge bolt (and any shims) with another bolt.
3. Balance rotor assembly chordwise by moving (or exchanging) existing teeter hinge shims to other side of bolt (under head or under nut) as required per Figure 10-10. Install teeter hinge bolt per § 26-10.

C. Chord Arm Weight (Chordwise Balance Adjustment – Fine Adjustment)

1. Balance rotor assembly chordwise by adjusting chord arm weights or washers per Figure 10-10. Total weight not to exceed two A255-2 weights (or equivalent).

   (1) A255-1 Weight = (8) AN970-4 Washers
   (1) A255-2 Weight = (3) A255-1 Weights

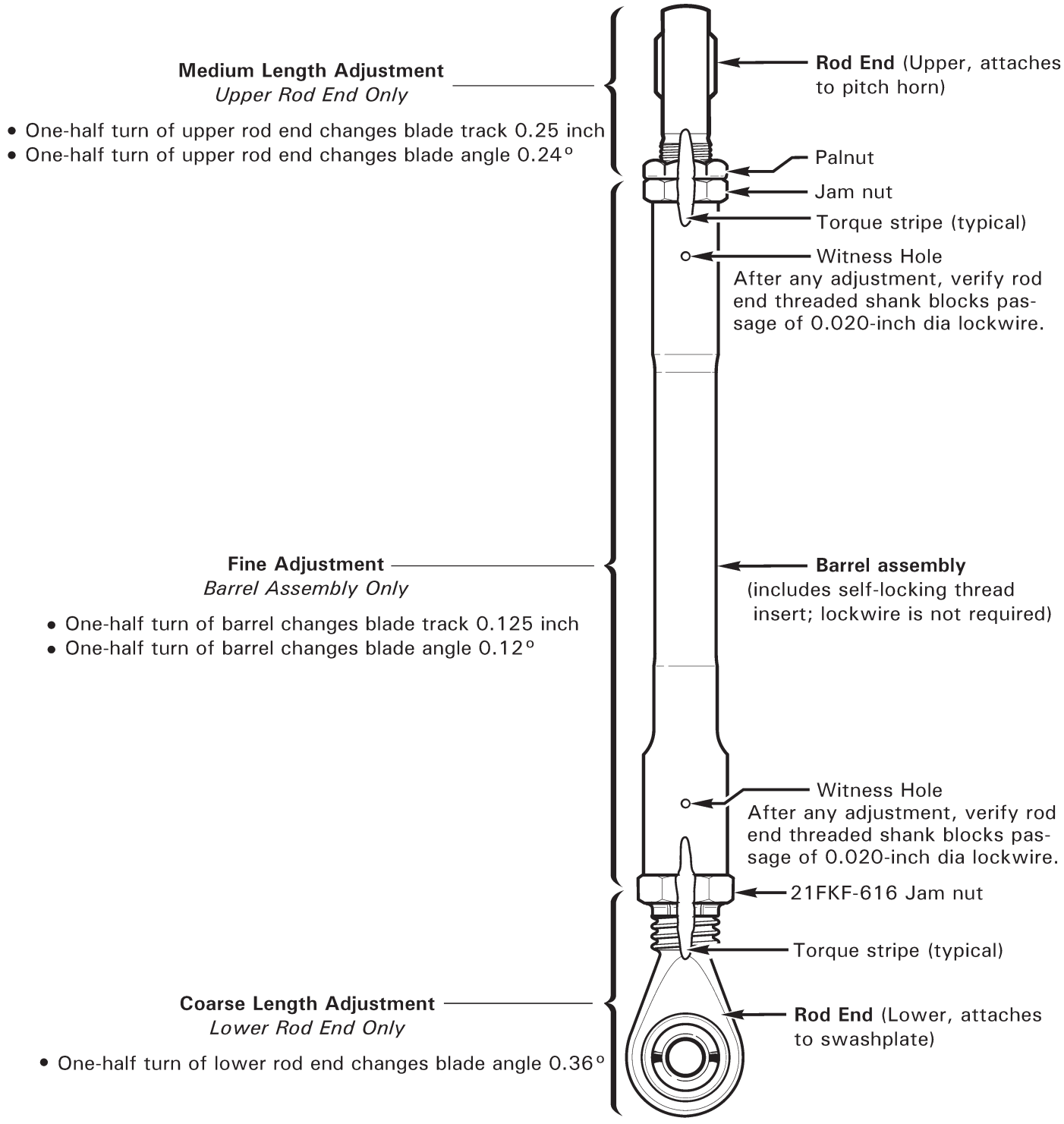

FIGURE 10-12A A258-5 MAIN ROTOR PITCH LINK

10.232 Main Rotor Pitch Link Adjustment

A. Main Rotor Blade Pitch Link

NOTE
Shorten high pitch blade when adjusting track in a hover.

NOTE
During rigging, adjust both pitch links exactly the same for collective adjustments.

1. For fine adjustment:

   a. A258-5 Pitch Link: Adjust barrel assembly only per the following steps:

      i. Refer to Figure 10-12A. Using backup wrench on barrel assembly, loosen 21FKF-616 nut at lower rod end, and upper rod end palnut and jam nut.

      ii. Rotate barrel assembly to shorten or lengthen pitch link as required. One-half turn of barrel changes blade track approximately 0.125 inch. One-half turn of barrel changes blade angle approximately 0.12°. For finer adjustment, rotate less than one-half turn as required.

      iii. Refer to Figure 2-1. Verify rod end threaded shank blocks passage of 0.020-inch diameter lockwire through barrel assembly witness holes.

      iv. Position rod ends to allow as much pitch link rotation as possible without binding. Using backup wrench on barrel assembly, special torque 21FKF-616 nut per § 23-33, and standard torque upper rod end jam nut and palnut per § 23-32.

      v. Repeat steps on opposite pitch link as required; torque stripe per Figure 2-1.

   b. A258-1 Pitch Link: Adjust fitting only per the following:

      i. Refer to Figure 10-12B. Cut and discard pitch link assembly safety wire. Using backup wrench on link assembly, loosen 21FKF-616 nut; using backup wrench on fitting, loosen upper rod end palnut and jam nut.

      ii. Rotate fitting to shorten or lengthen pitch link as required. One-half turn of fitting changes blade track approximately 0.125 inch. One-half turn of fitting changes blade angle approximately 0.12°. For finer adjustment, rotate less than one-half turn as required.

      iii. Refer to Figure 2-1. Verify rod end threaded shank blocks passage of 0.020-inch diameter lockwire through pitch link witness holes.

      iv. Using backup wrench on link assembly, special torque 21FKF-616 nut per § 23-33. Using backup wrench on fitting, standard torque upper rod end jam nut and palnut per § 23-32. Safety fitting to link assembly using 0.032-inch diameter lockwire.

      v. Repeat steps on opposite pitch link as required; torque stripe per Figure 2-1.

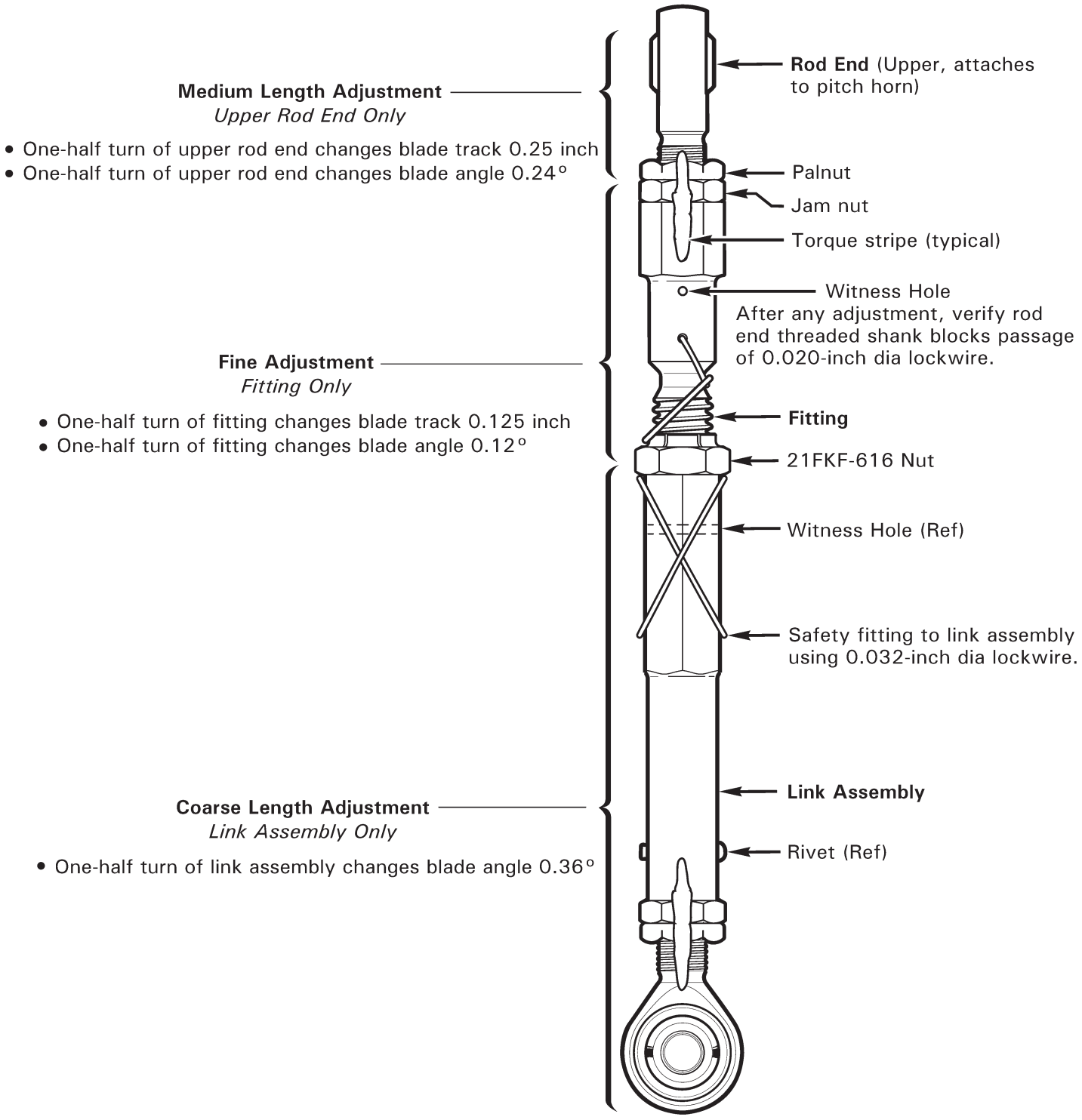

FIGURE 10-12B A258-1 MAIN ROTOR PITCH LINK

10.232 Main Rotor Pitch Link Adjustment (continued)

A. Main Rotor Blade Pitch Link (continued)

2. For medium length adjustment, adjust upper rod end per the following:

   a. Refer to Figure 10-12A or 10-12B. Using backup wrench on barrel assembly or fitting, loosen upper rod end palnut and jam nut. Remove hardware securing rod end to pitch horn.

   b. Rotate upper rod end to shorten or lengthen pitch link as required. One-half turn of upper rod end changes blade track approximately 0.25 inch. One-half turn of upper rod end changes blade angle by approximately 0.24°.

   c. Refer to Figure 2-1. Verify rod end threaded shank blocks passage of 0.020-inch diameter lockwire through barrel asssembly (upper), or fitting, witness hole. Install hardware securing rod end to pitch horn and standard torque fasteners per § 23-32.

   d. Position rod ends to allow as much pitch link rotation as possible without binding. Using backup wrench on barrel assembly or fitting, standard torque upper rod end jam nut and palnut per § 23-32.

   e. Repeat steps on opposite pitch link as required; torque stripe per Figure 2-1.

3. For coarse length adjustment:

   a. A258-5 Pitch Link: Adjust lower rod end per the following:

      i. Refer to Figure 10-12A. Using backup wrench on barrel assembly, loosen 21FKF-616 nut at lower rod end. Remove hardware securing lower rod end to swashplate.

      ii. Rotate lower rod end to shorten or lengthen pitch link as required. One-half turn of lower rod end changes blade angle by approximately 0.36°.

      iii. Refer to Figure 2-1. Verify rod end threaded shank blocks passage of 0.020-inch diameter lockwire through barrel asssembly (lower) witness hole. Install hardware securing rod end to swashplate and standard torque fasteners per § 23-32.

      iv. Position rod ends to allow as much pitch link rotation as possible without binding. Using backup wrench on barrel assembly, special torque 21FKF-616 nut per § 23-33.

      v. Repeat steps on opposite pitch link as required; torque stripe per Figure 2-1.

10.232 Main Rotor Pitch Link Adjustment (continued)

A. Main Rotor Blade Pitch Link (continued)

3. For coarse length adjustment (continued):

b. A258-1 Pitch Link: Adjust link assembly per the following:

i. Refer to Figure 10-12B. Cut and discard pitch link assembly safety wire. Using backup wrench on link assembly, loosen 21FKF-616 nut. Remove hardware securing lower rod end to swashplate.

ii. Rotate link assembly to shorten or lengthen pitch link as required. One-half turn of link assembly changes blade angle by approximately 0.36°.

iii. Refer to Figure 2-1. Verify rod end threaded shank blocks passage of 0.020-inch diameter lockwire through link assembly witness hole. Install hardware securing rod end to swashplate and standard torque fasteners per § 23-32.

iv. Position rod ends to allow as much pitch link rotation as possible without binding. Using backup wrench on link assembly, special torque 21FKF-616 nut per § 23-33. Safety fitting to link assembly using 0.032-inch diameter lockwire.

v. Repeat steps on opposite pitch link as required; torque stripe per Figure 2-1.

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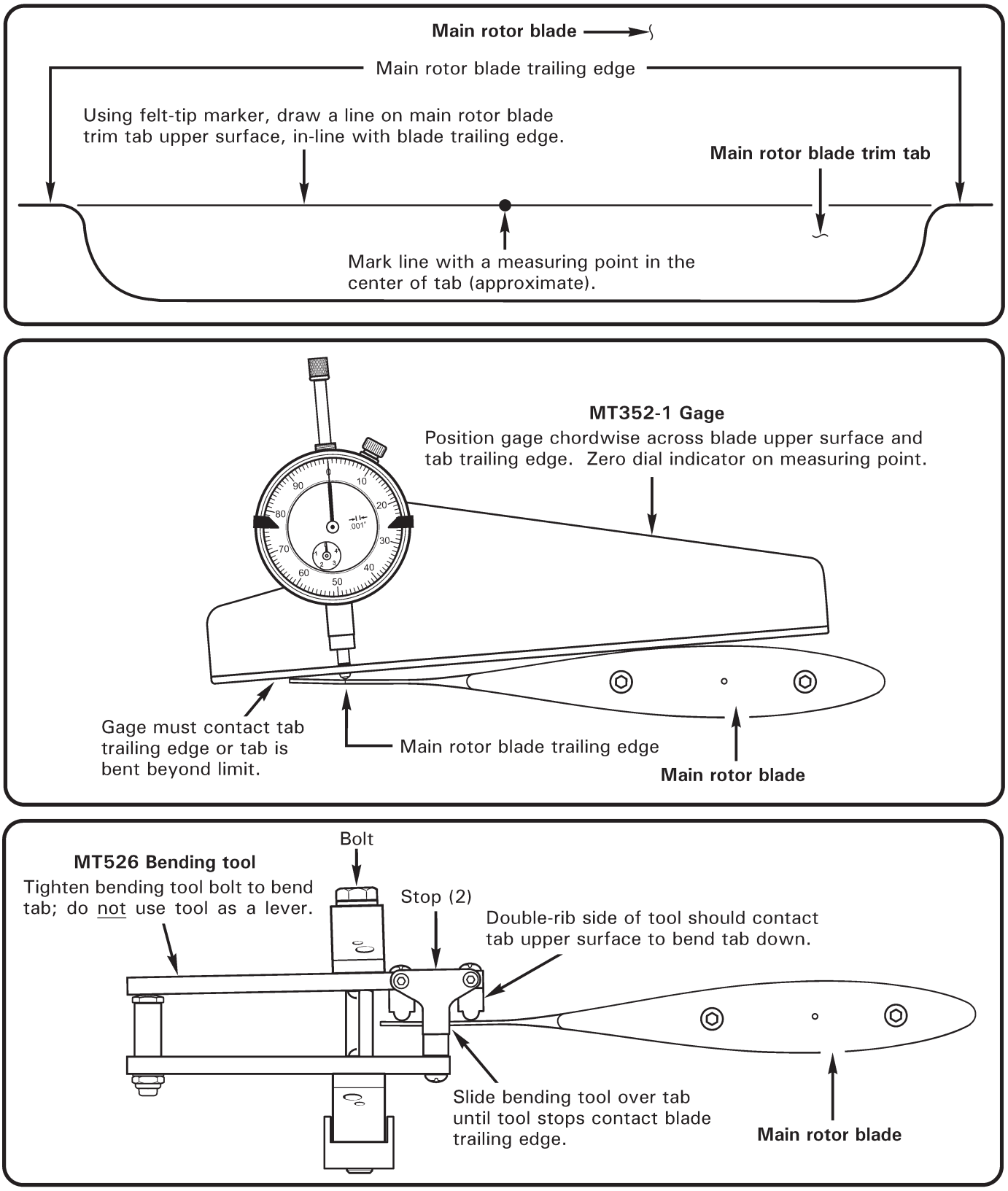

FIGURE 10-13 MAIN ROTOR BLADE TRIM TAB ADJUSTMENT

10.233 Main Rotor Blade Trim Tab Adjustment

NOTE

To correct for a "climbing" blade condition (blade spread that exceeds 3/8 inch with forward airspeed), bend high blade trim tab down.

CAUTION

Do not use other helicopter manufacturers' trim tab bending tools. Use of these tools will damage Robinson blades.

CAUTION

MT352-1 gage must contact trim tab trailing edge. If gage does not contact tab trailing edge, tab is bent beyond limit.

CAUTION

Tighten MT526-1 or MT526-8 trim tab bending tool bolt to bend tab; do not use tool as a lever.

CAUTION

Bend tab upward only when absolutely necessary; bending tab upward can increase rotor vibration.

CAUTION

MT526-1 trim tab bending tool (for A016-4 [stainless steel skin] blades) and MT526-8 trim tab bending tool (for A016-6 [aluminum skin] blades) are not interchangeable. Use of wrong bending tool can result in blade damage. MT090-1 trim tab bending tool (for earlier blades) is obsolete.

1. Using felt tip marker, ink mark main rotor blade trim tab per Figure 10-13. Mark line with a measuring point in the center of the tab (approximate).
2. Position MT352-1 gage chordwise across blade upper surface and tab trailing edge. Zero dial indicator on measuring point.
3. Position MT526-1 (trim tab bending tool (for A016-4 [stainless steel skin] blades) or MT526-8 trim tab bending tool (for A016-6 [aluminum skin] blades) on tab per Figure 10-12. Slide tool completely over tab until tool stops contact blade trailing edge. Double-rib side of tool should contact tab upper surface to bend tab down. Double-rib side of tool should contact tab bottom surface to bend tab up.
4. Tighten MT526 bending tool bolt to bend tab. Make slight bends and re-measure tab with MT352-1 gage. Bend trim tab 0.015 inch (down) to effect dynamic movement of main rotor blade tip approximately 0.2 inch (downward).

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12.300 Drain Valves (continued)

B. Installation

1. Actuate A761-1 drain valve to expose stem, and install new o-ring in stem seat.
2. Lightly coat valve threads using B270-6 sealant. Remove tape and install valve in connector, tank, or gascolator assembly. Standard torque valve per § 23-32 and torque stripe per Figure 2-1.
3. Push A729 tube onto valve. Wrap tube with two turns 0.032-inch diameter lockwire and safety tube to valve, as required.
4. Fuel helicopter per R22 Pilot's Operating Handbook Section 2 and inspect fuel system for leaks. Install engine right cowling, if removed.

12.400 Fuel Quantity

12.410 Fuel Quantity Senders

CAUTION

Rotation of fuel sender center stud or base nut is not permitted.

WARNING

Do NOT apply system voltage to installed fuel quantity senders.

A. Removal

1. a. Bladder Tanks: If removing D252-3 fuel quantity sender, remove main fuel tank per § 12.110. If removing D252-4 fuel quantity sender, defuel helicopter per § 22-52.

   b. All-Aluminum Tanks: Defuel helicopter per § 22-52 until level is below fuel quantity sender mounting hole. Cut & discard ty-raps as required and disconnect sender wiring from airframe harness at connectors. Remove nuts securing wiring to sender if connectors are not installed.

2. Remove hardware securing fuel quantity sender to cover assembly or tank. Carefully pull sender lever through opening, then tape opening.

B. Installation

1. Perform fuel quantity sender check per Part C.
2. Inspect condition of sender gasket and replace as required. Remove tape from opening, position gasket on sender, and carefully insert sender lever through opening. Install hardware, special torque bolts in criss-cross pattern per § 23-33, and torque stripe per Figure 2-1.
3. Bladder Tanks: If removed, install main fuel tank per § 12.110.
4. Connect sender wiring to airframe harness at connectors. Install nuts securing wiring to sender if connectors are not installed. Install ty-raps as required.
5. Check fuel quantity indication per § 12.420. Verify no leaks.

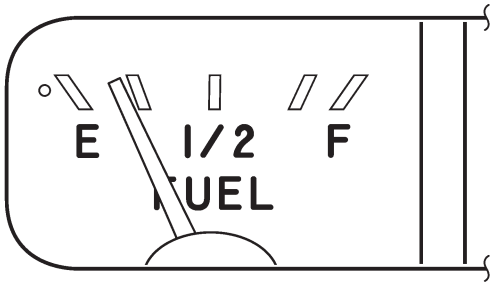
12.410 Fuel Quantity Senders (continued)

C. Check

1. Remove fuel quantity sender per Part A.
2. Simulate mounting position of appropriate sender per Figure 12-3. Position float arm as shown and measure the resistance with a multimeter. Verify resistance is within tolerance in the four positions given.
3. If resistance is out of tolerance at any of the four positions given, bend the float arm up for a sender with excessive resistance, or bend the float arm down for a sender with too little resistance. Repeat steps until sender resistance is within tolerance.
4. Install fuel quantity sender per Part B.

12.420 Fuel Quantity Indication

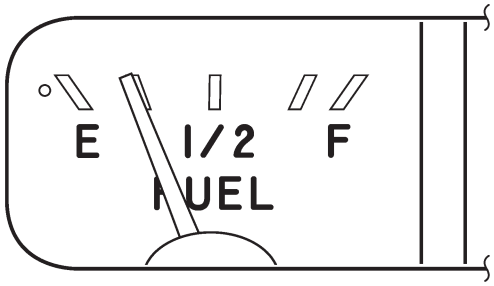
1. Defuel helicopter per § 22-52. Turn fuel shut-off valve off.
2. Fuel main tank with exactly 6.2 gallons (if equipped with main and aux bladder tanks), 5.6 gallons (if equipped with main bladder tank only), 6.3 gallons (if equipped with main and aux all-aluminum tanks), or 5.4 gallons (if equipped with main all-aluminum tank only) of fuel per R22 Pilot's Operating Handbook Section 2. Wait five minutes for fuel levels to equalize. Inspect for leaks.
3. Turn battery switch on and read fuel quantity gage. Verify fuel gage indicates one half to one and one half needle-widths below a quarter of a tank, as shown in Figure 12-4.
4. If indication is beyond allowable limit, perform fuel quantity sender check per § 12.410. If sender resistance is within tolerance, adjust fuel gage per § 33-110 Part D, or replace fuel gage as required and repeat check.



Main Tank Gage

MINIMUM ALLOWABLE INDICATION

1½ Needle-widths below ¼ of a tank



Main Tank Gage

MAXIMUM ALLOWABLE INDICATION

½ Needle-width below ¼ of a tank

FIGURE 12-4 FUEL QUANTITY INDICATION CHECK

CHAPTER 13

INSTRUMENT SYSTEM

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13-23 Dual Tachometer

A. Description

CAUTION

Installation of electrical devices can affect accuracy and reliability of electronic tachometers.

An electronic engine and rotor dual tachometer is standard. Engine tachometer signal is provided by magneto breaker points. Rotor tachometer signal is provided by two magnetic senders at the main gearbox drive yoke. Each tachometer is on a separate circuit with its own circuit breaker. With battery and alternator switches off, the tachometers continue to receive power from the battery through a bypass circuit as long as the clutch actuator switch is in the engage position.

NOTE

Do not stow helicopter with clutch switch engaged. The tachometers are powered with the clutch engaged and will discharge the battery.

NOTE

Do not use magnetized tools.

CAUTION

Protect instrumentation using foam padding or equivalent. Handle instruments like eggs.

B. Removal

1. Turn battery switch off and pull TACHS E (2 amp) and R (2 amp) circuit breakers at panel.
2. Remove perimeter screws securing instrument face to console and pull face aft.
3. Remove screws securing console harness connector to A792 dual tachometer and unplug connector.
4. Supporting instrument, remove screws securing tachometer to face, and remove tachometer.

C. Installation

NOTE

When replacing an A792-4 tachometer with an A792-5 tachometer, install B792-1 dual tachometer harness assembly between tachometer & airframe harness, and tighten two screws on both connectors. Secure B792-1 harness as required with ty-raps.

13-23 Dual Tachometer (continued)

C. Installation (continued)

1. Turn battery switch off and pull TACHS E (2 amp) and R (2 amp) circuit breakers at panel.
2. Install screws securing A792 dual tachometer to instrument face. Verify security.
3. Plug in console harness connector to tachometer and install connector screws. Verify security.
4. Install perimeter screws securing face to console. Verify security.
5. Perform accuracy check and needle synchronization per Part D.

D. Adjustment

NOTE
Adjust rotor tachometer if engine and rotor tachometer needles are not within 1% of each other at 104% RPM.

1. Remove screws securing instrument face panel to upper console and carefully pull panel aft.
2. Run-up helicopter per R22 Pilot's Operating Handbook (POH) Section 6 at 104% engine tachometer indication.
3. Turn adjustment screw on back of tachometer (apply 1/8 turns) clockwise to increase and counterclockwise to decrease rotor tachometer indication. Adjust rotor tachometer to indicate 104%.
4. Shutdown helicopter per POH Section 6. Tighten screws securing instrument panel to upper console.

E. Scheduled Maintenance and Inspections

Refer to § 2.400 100-Hour/Annual Inspection.

Refer to § 1.102 for additional component maintenance.

F. Special Maintenance and Inspections

1. Perform adjustment as required per Part D.
2. If tachometer cannot be adjusted, remove tachometer per Part B, and return to RHC for inspection.
3. Install airworthy tachometer per Part C.

13-60 Electronic Flight Displays

13-61 Aspen PFD Installation

A. Description

The Aspen PFD (Primary Flight Display) is an LCD unit with displays for attitude, altitude, airspeed, heading, and optional NAV (HSI/CDI). The Aspen PFD is a situational awareness aid, to be used in conjunction with required VFR instruments (altimeter, airspeed indicator, and magnetic compass).

The standard Aspen PFD installation configures the lower half of the display as a directional gyro. An optional installation configures the lower half of the display to a Horizontal Situation Indicator (HSI).

B. Schematic

Refer to Figure 14-43 & 14-44 for C800-1 Aspen PFD electrical schematic.

C. Removal

1. Turn battery switch off and pull EFIS circuit breaker (7.5 amp) at panel.
2. Gently depress blue tab at top of Aspen PFD to release display from mounting bracket.
3. Disconnect pitot and static lines from display using quick-disconnect couplers. Temporarily cap pitot and static line fittings at display and in aircraft to prevent contamination.
4. Loosen screws securing airframe wiring harness connector to display, unplug connector, and remove display.

D. Installation

1. Turn battery switch off and pull EFIS circuit breaker (7.5 amp) at panel.
2. Plug airframe wiring harness connector into Aspen PFD display and tighten screws. Verify security.
3. Remove temporary fitting caps and connect pitot and static lines to display using quick-disconnect couplers.
4. Insert display into mounting bracket until blue tab snaps into place. Verify security.
5. Push-in EFIS circuit breaker (7.5 amp) at panel. Turn battery & avionics switches on.
6. Perform appropriate functional checks per Aspen EFD1000H PFD Pilot's Guide. Turn battery and avionics switches off.
7. Perform pitot-static leak check.

13-61 Aspen PFD Installation (continued)

E. Antenna

Refer to § 16-70 for antenna locations & R22 Illustrated Parts Catalog (IPC) Chapter 6.

> NOTE
>
> Do not use magnetized tools.

Removal

1. Turn battery switch off and pull EFIS circuit breaker (7.5 amp) at panel.
2. Using plastic scraper, remove B270-1 sealant from around EFIS antenna at corners where it attaches to tailcone.
3. Cut and discard ty-raps as required and disconnect antenna cable at connectors (secured to frame). Remove screws securing antenna and antenna ground wire to tailcone and remove antenna.

Installation

1. Turn battery switch off and pull EFIS circuit breaker (7.5 amp) at panel.
2. Remove paint and primer from antenna and antenna ground wire mating surfaces to ensure electrical ground.
3. Install screws securing antenna and antenna ground wire to tailcone. Verify security.
4. Apply small bead B270-1 sealant (0.1 inch max in height) around antenna at corners where it attaches to tailcone and allow to dry.
5. Connect antenna cable to antenna at connectors; secure to frame using ty-raps. Verify security.
6. Perform ground checks per Part D steps 5 and 6.

F. Scheduled Maintenance and Inspections

The internal battery must be tested for proper operation every 12 months. No calibration is necessary. Other maintenance is on condition. Contact Aspen Avionics at www.aspenavionics.com for instructions for continued airworthiness.

> NOTE
>
> Refer to § 34-60 for avionics software information.

13-70 Console Assemblies

NOTE

Refer to R22 Pilot's Operating Handbook Section 7 for views of typical instrument panels, and the Optional Avionics Supplement for views of panels with electronic flight displays.

A. Opening Console

Upper instrument panels that do not include Electronic Flight Displays (EFDs) or other avionics may be "opened" by removing screws securing console assembly to forward keel panels and hinging console aft. Secure console by hinging forward and installing screws. If an EFD or any other avionics are installed in the upper instrument panel, remove console per Part B.

B. Removing Console

1. Remove EFD if installed per § 13-60.
2. Remove avionics if installed and located in upper instrument console per Chapter 34.
3. Remove perimeter screws securing instrument face to console.
4. Disconnect instrument pitot-static lines. Plug lines.
5. Remove screws securing console assembly to forward keel panels. Remove console and disconnect console harness from airframe harness.

C. Installing Console

1. Connect console assembly harness to airframe harness and install screws securing console to forward keel panels.
2. Position instrument face in helicopter, remove plugs, and connect pitot-static lines.
3. Install perimeter screws securing face to console. Verify security.
4. Install avionics per Chapter 34, if removed.
5. Install EFD per § 13-60, if removed.
6. Perform pitot-static system leak check per § 13-10.

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14.800 Avionics Schematics

Basic communications wiring common to all the COM radio configurations include: Pilot and Co-Pilot cyclic stick switches (Transmit and Intercom), and an overhead COM box housing Pilot and Co-Pilot headphone jacks and relays. The intercom system operates through installed COM radio or audio selector panel.

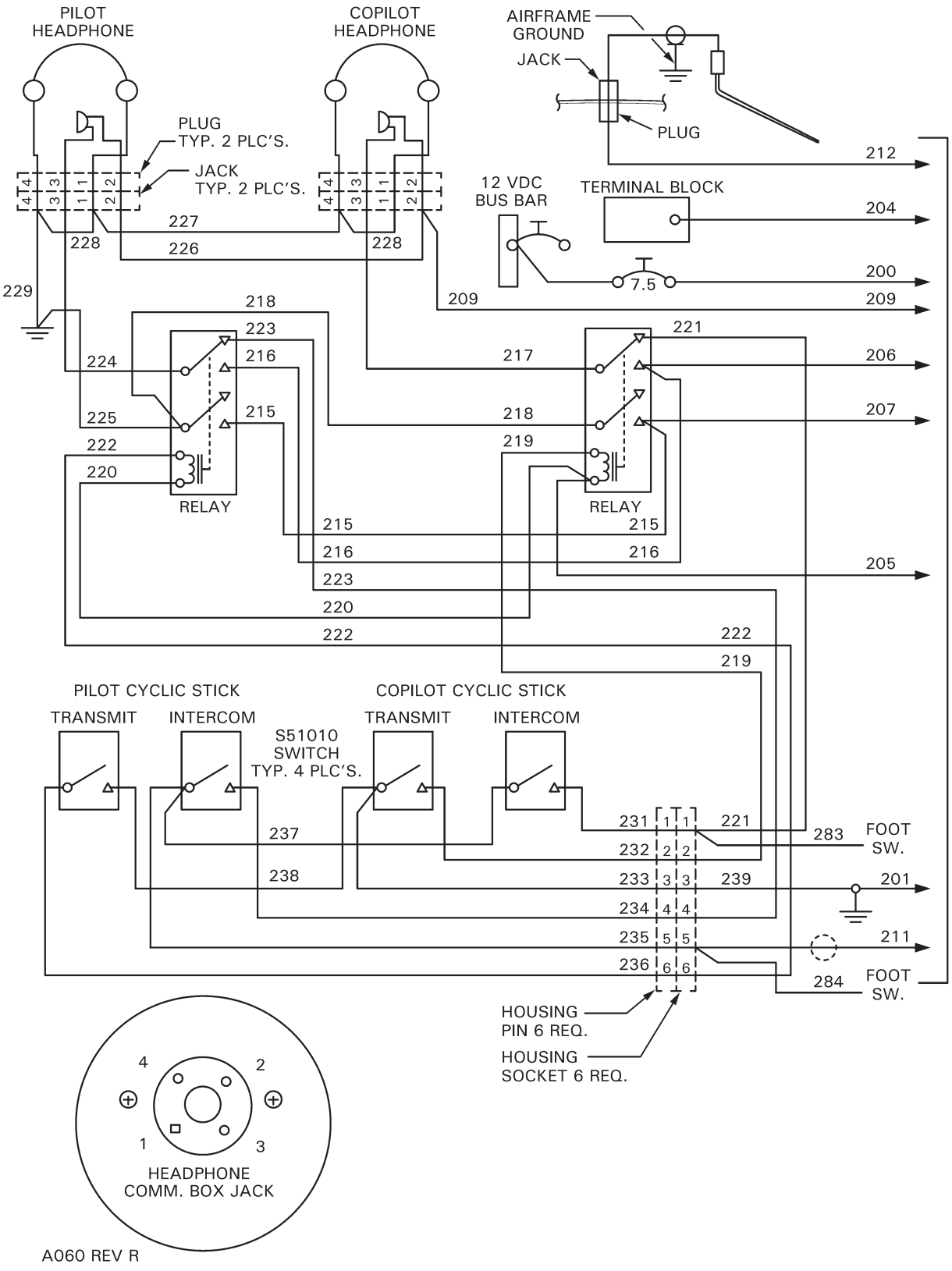


FIGURE 14-8 INTERCOM SYSTEM (EARLIER SHIPS)

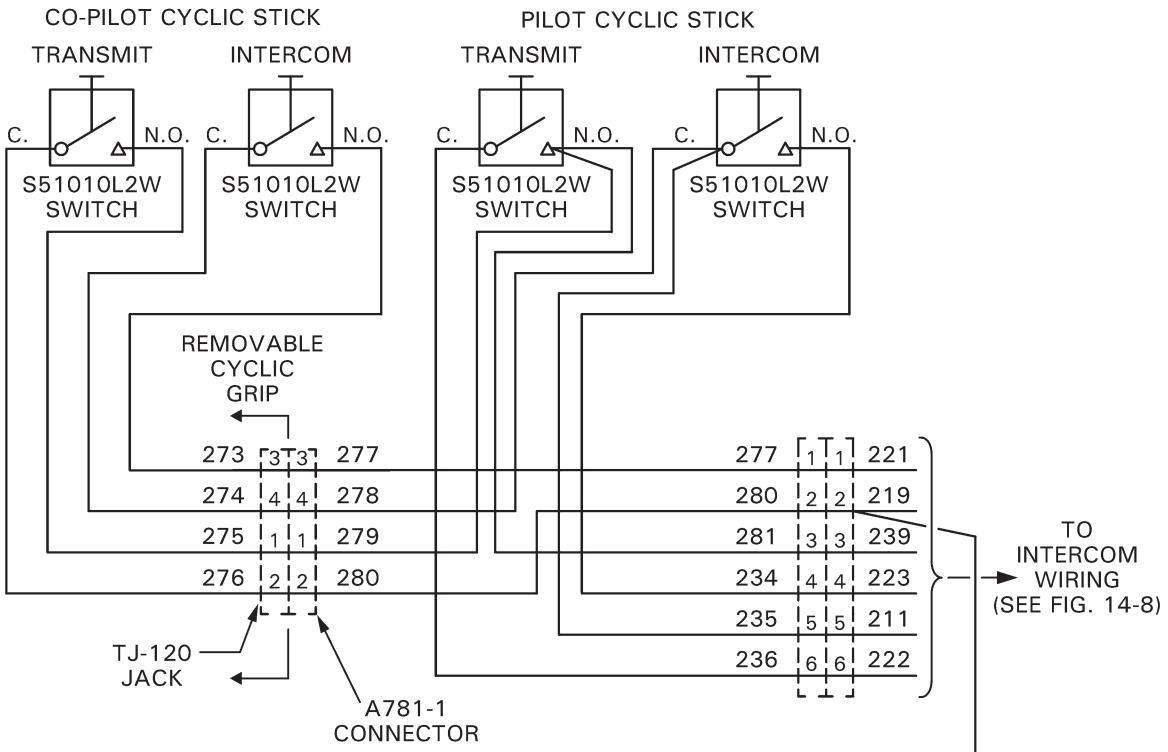


FIGURE 14-8A INTERCOM SCHEMATIC WITH REMOVABLE CYCLIC GRIP (EARLIER SHIPS)

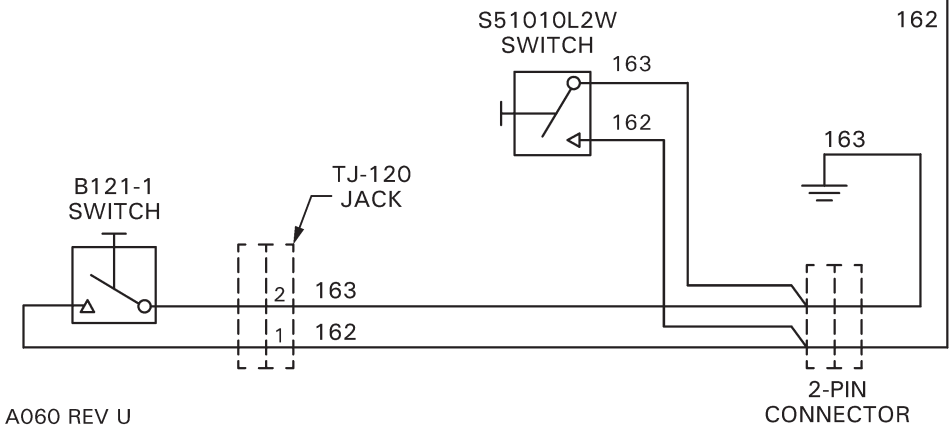


FIGURE 14-8B REMOTE CYCLIC SWITCH WIRING DIAGRAM (R22 MARINER; EARLIER SHIPS)

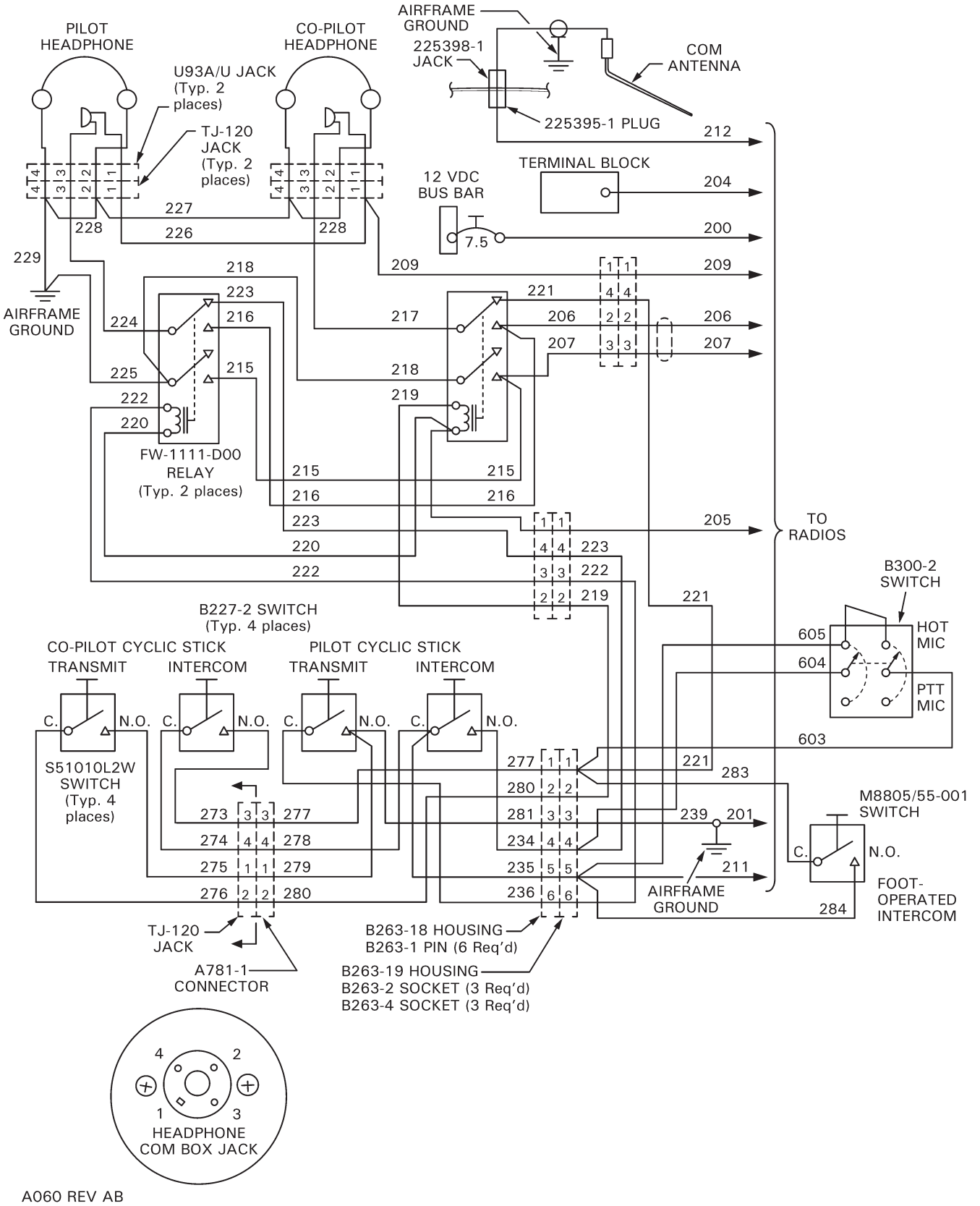


FIGURE 14-8C INTERCOM SCHEMATIC WITH HOT MIC SWITCH (EARLIER SHIPS)

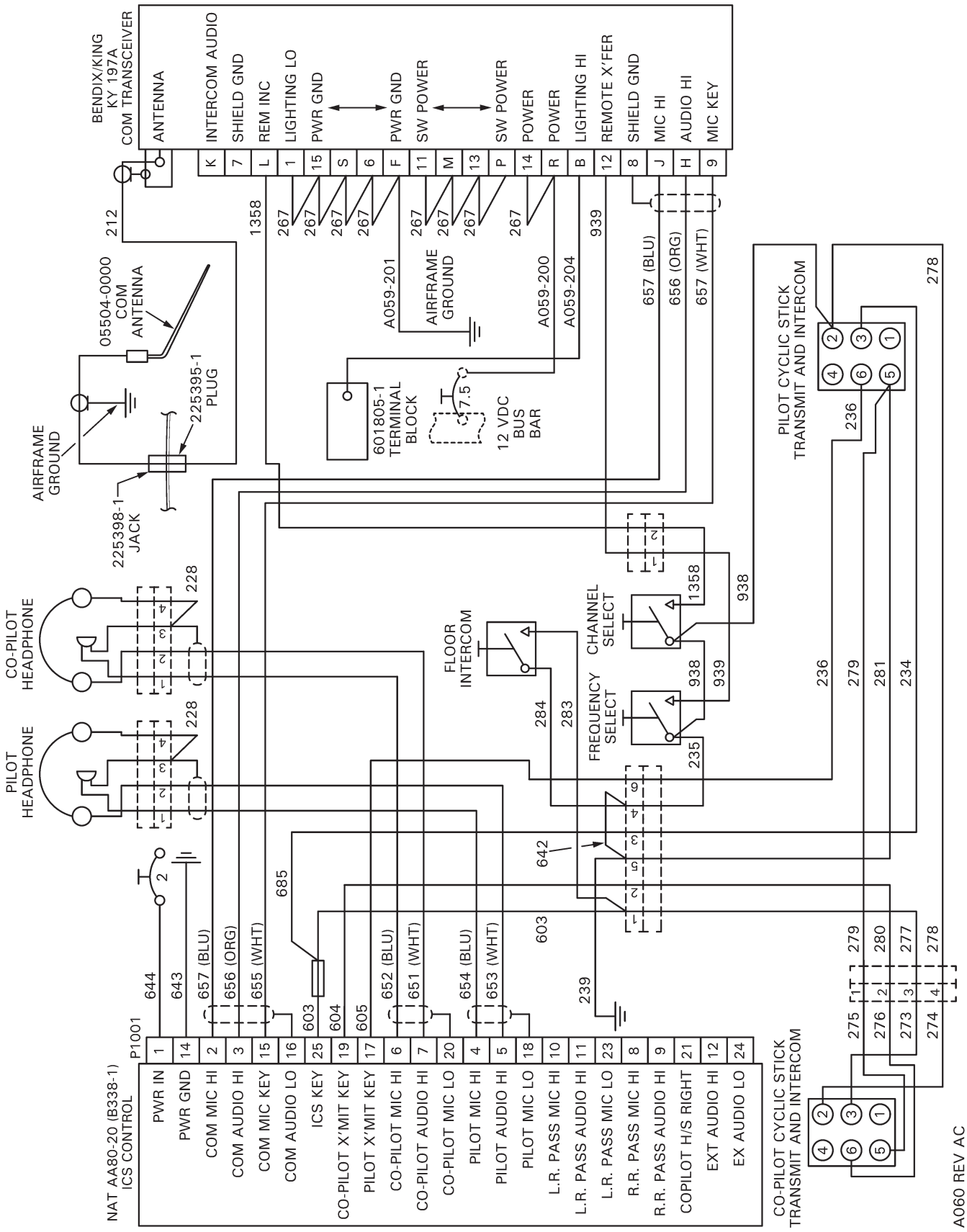
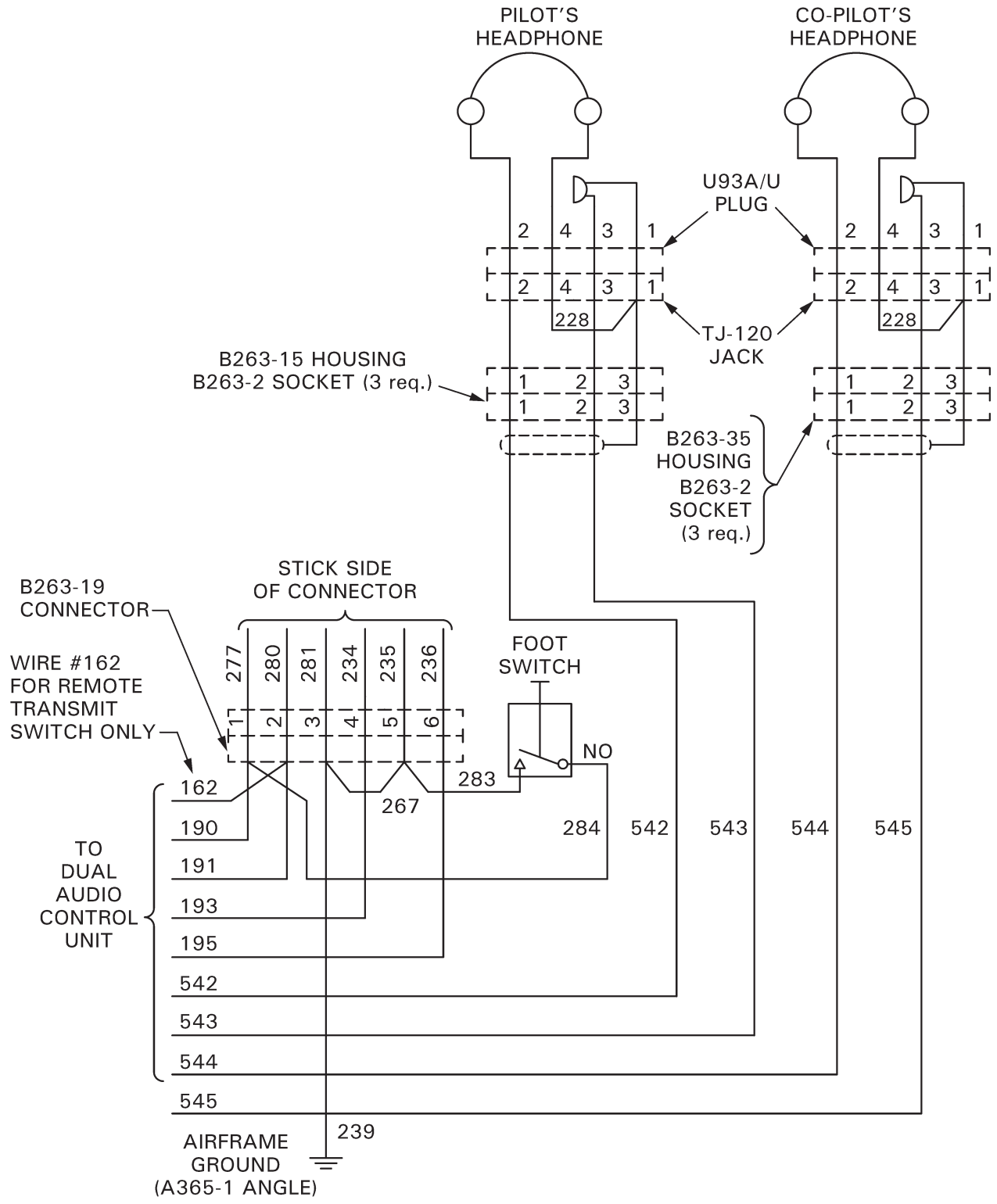


FIGURE 14-8D INTERCOM SCHEMATIC WITH B338-1 (NAT AA80-020) ICS CONTROL
(SHIP S/N 2967 & ON; EARLIER SHIPS)



A060 REV AB

FIGURE 14-8E DUAL AUDIO CONTROL INTERCOM SCHEMATIC
(FOR R22s WITH A692-3 [AIR COMM ACS 300] DUAL AUDIO CONTROL; EARLIER SHIPS)

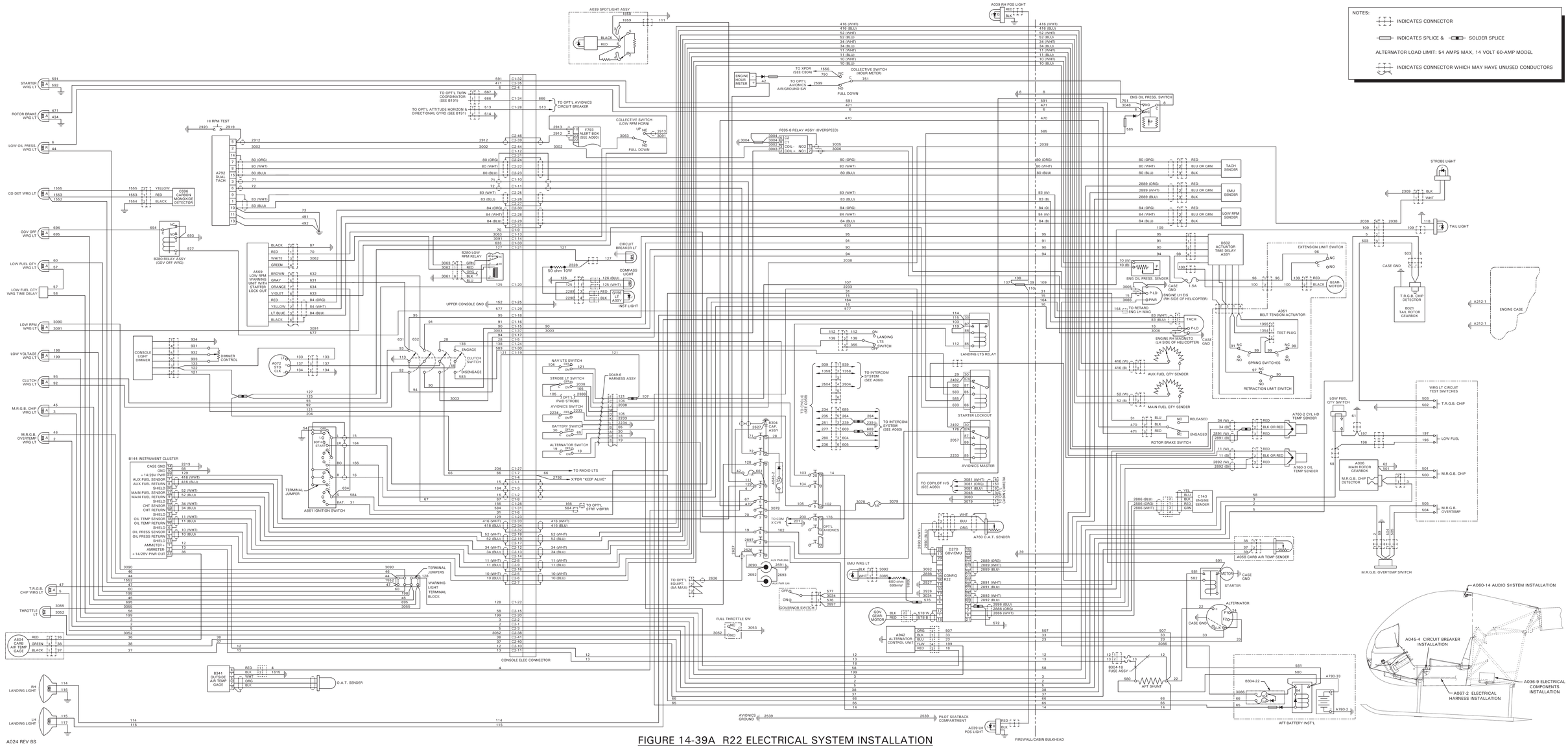


FIGURE 14-39A R22 ELECTRICAL SYSTEM INSTALLATION
(A024 Revision BS shown)

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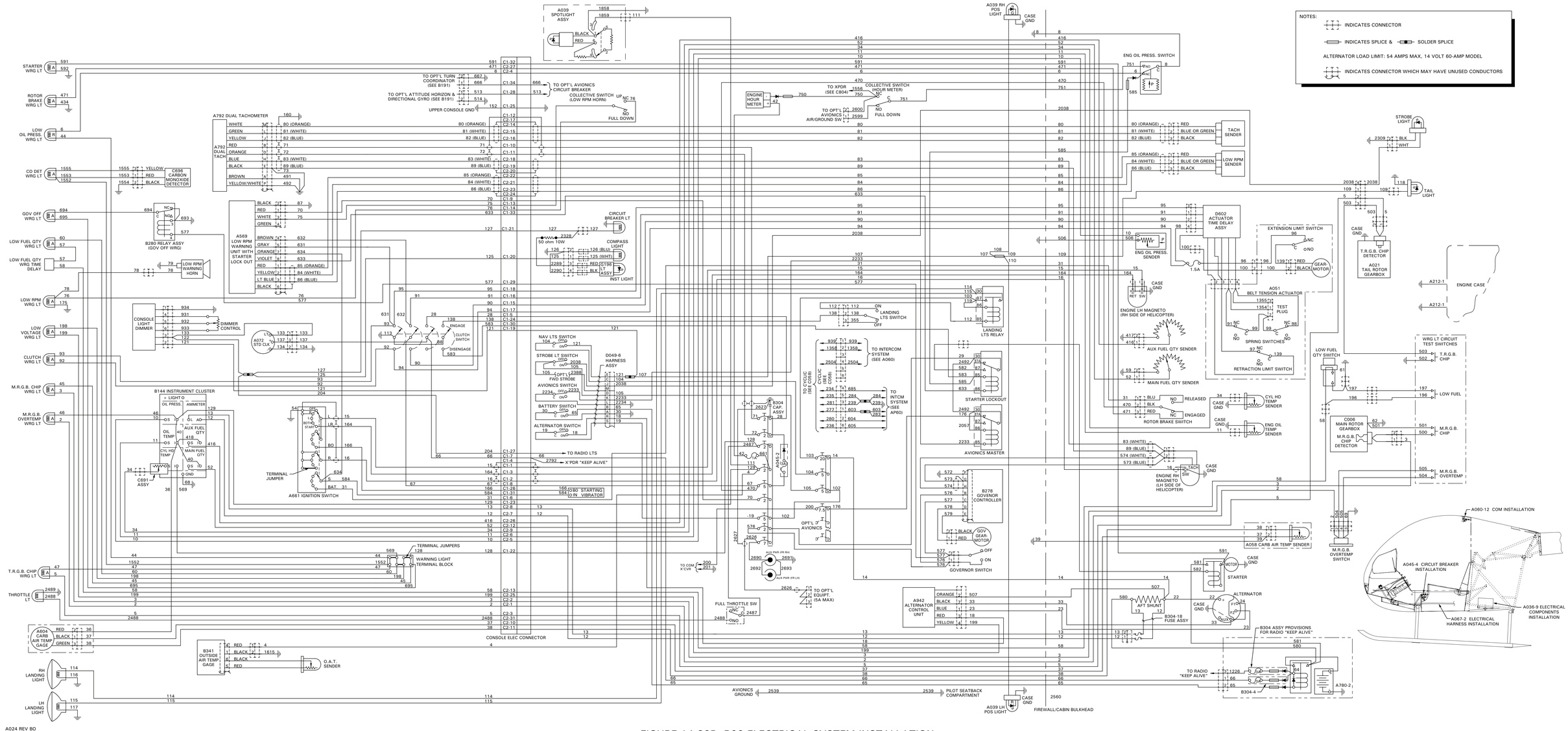


FIGURE 14-39B R22 ELECTRICAL SYSTEM INSTALLATION
(A024 Revision BO shown)

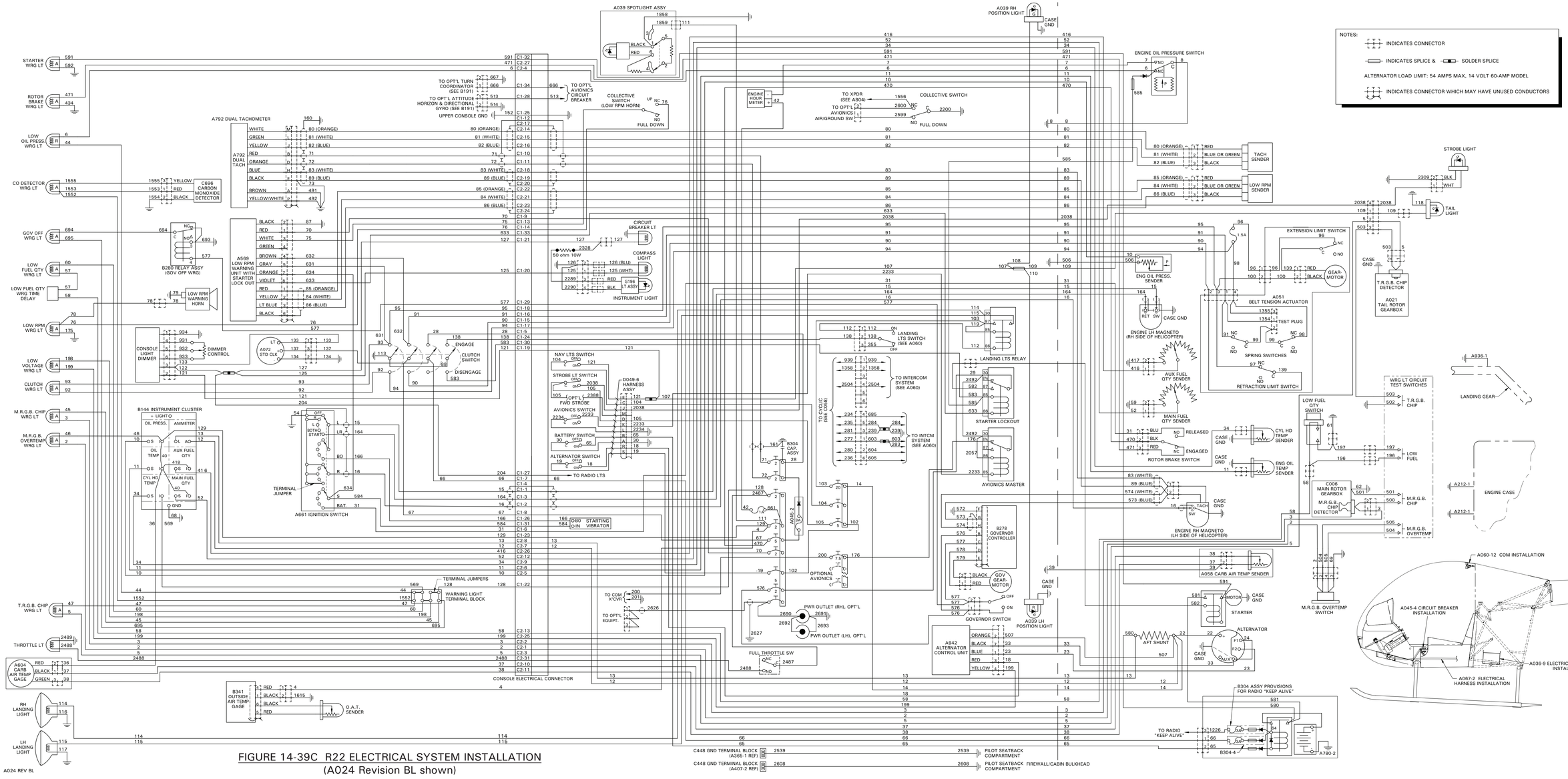
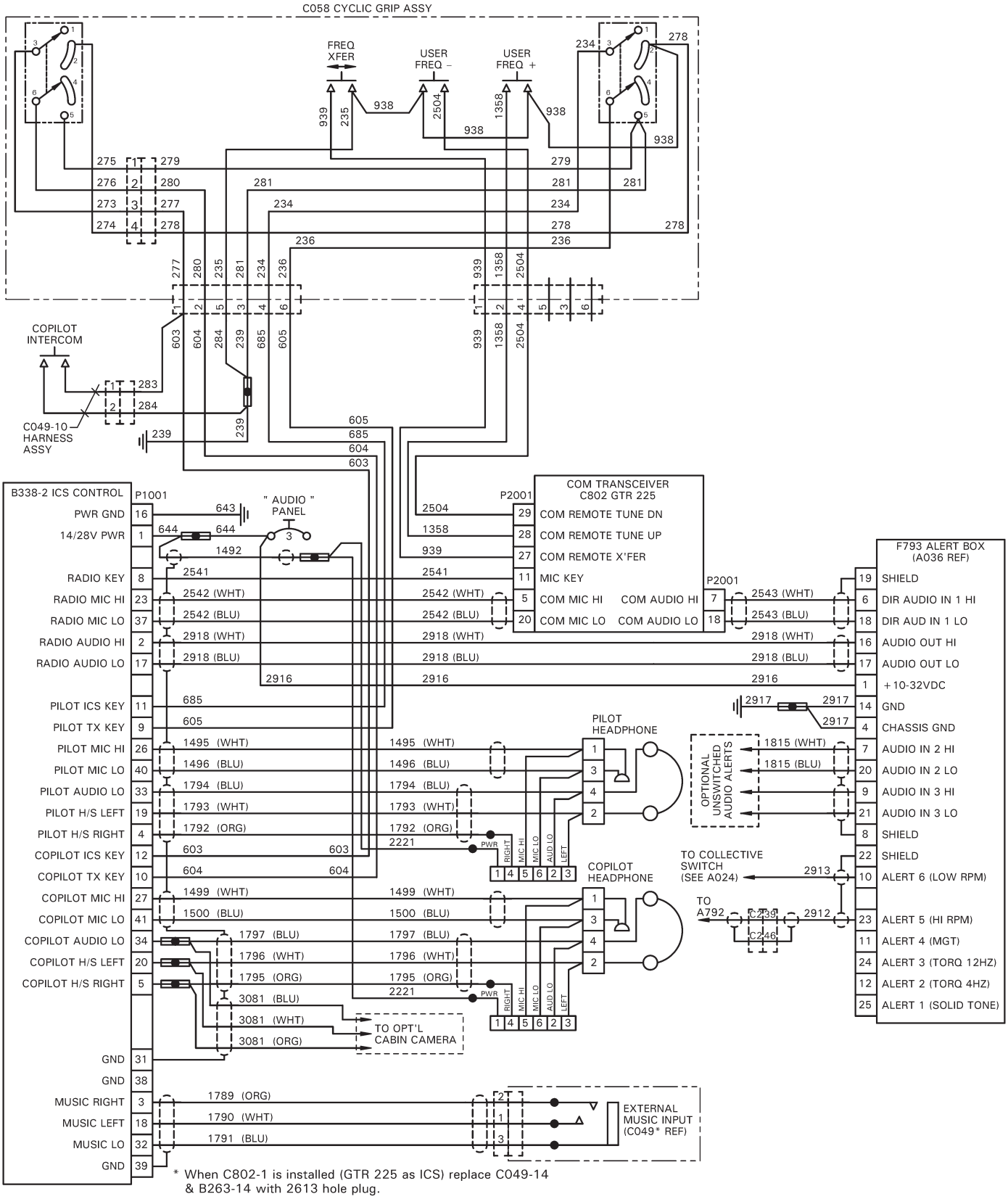


FIGURE 14-39C R22 ELECTRICAL SYSTEM INSTALLATION
(A024 Revision BL shown)



A060 REV AQ

FIGURE 14-40 A060-14 AUDIO SYSTEM INSTALLATION

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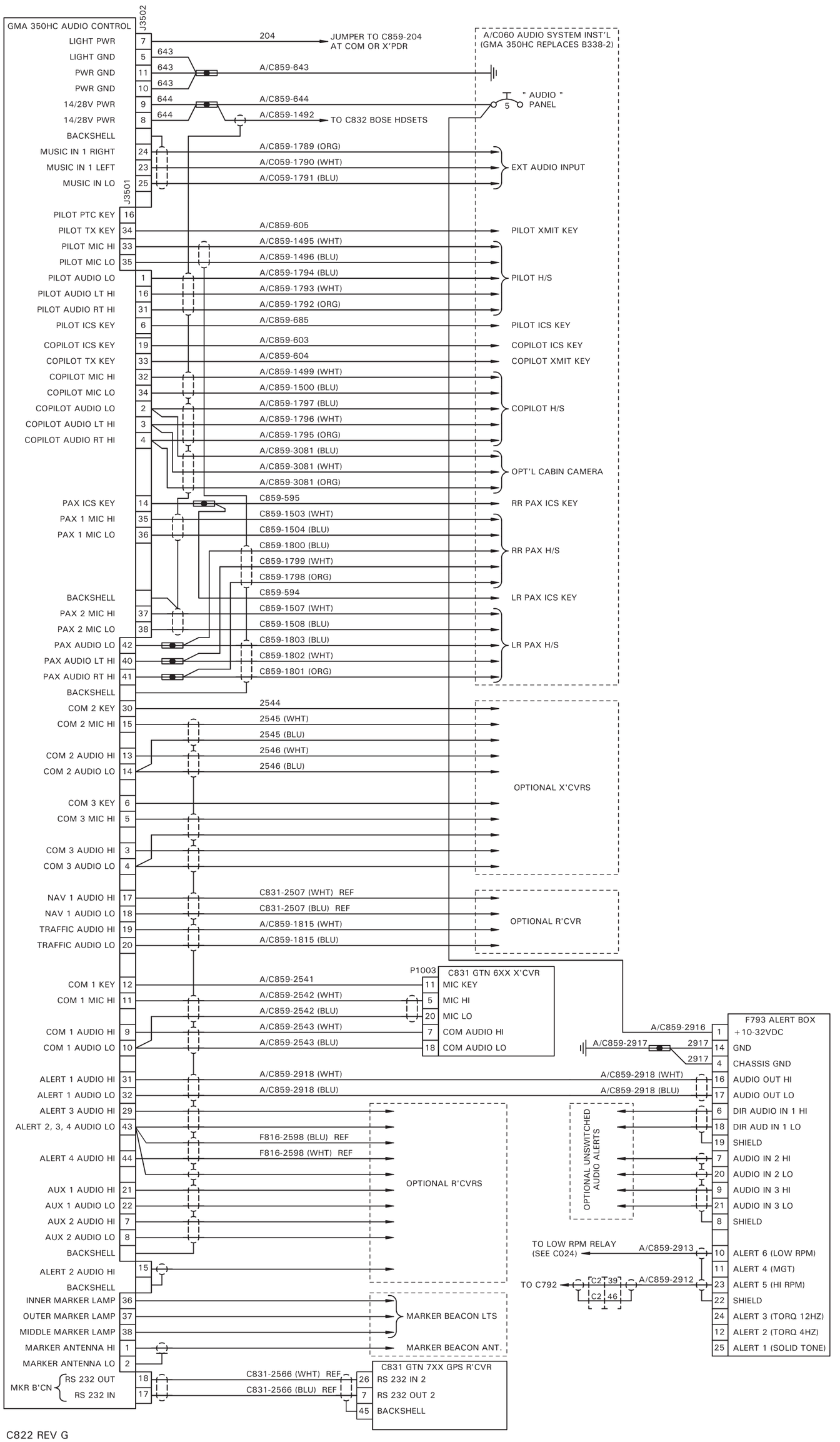

C822 REV G

FIGURE 14-47 C822-1 AUDIO CONTROL SCHEMATIC (GARMIN GMA 350HC)

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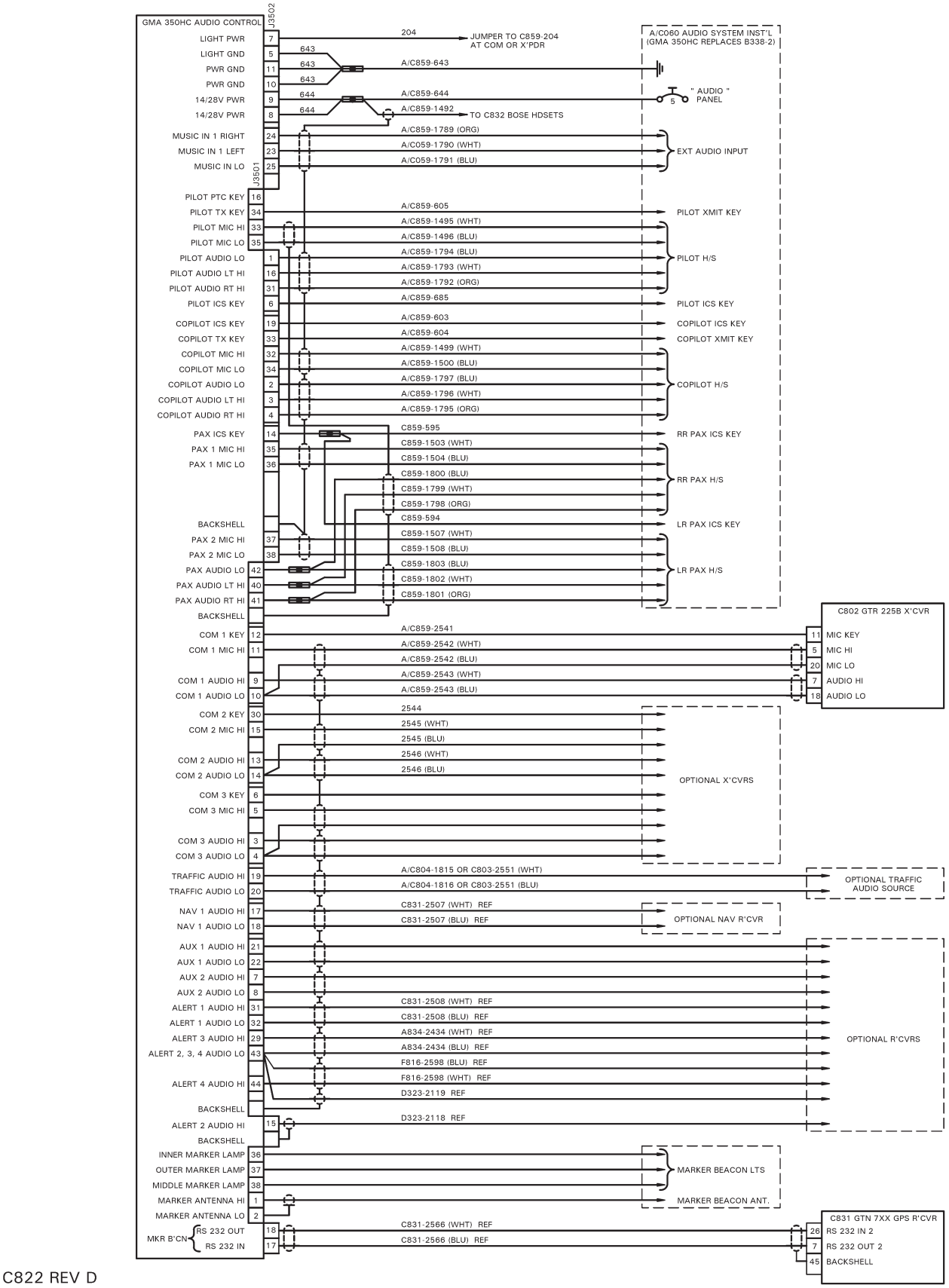
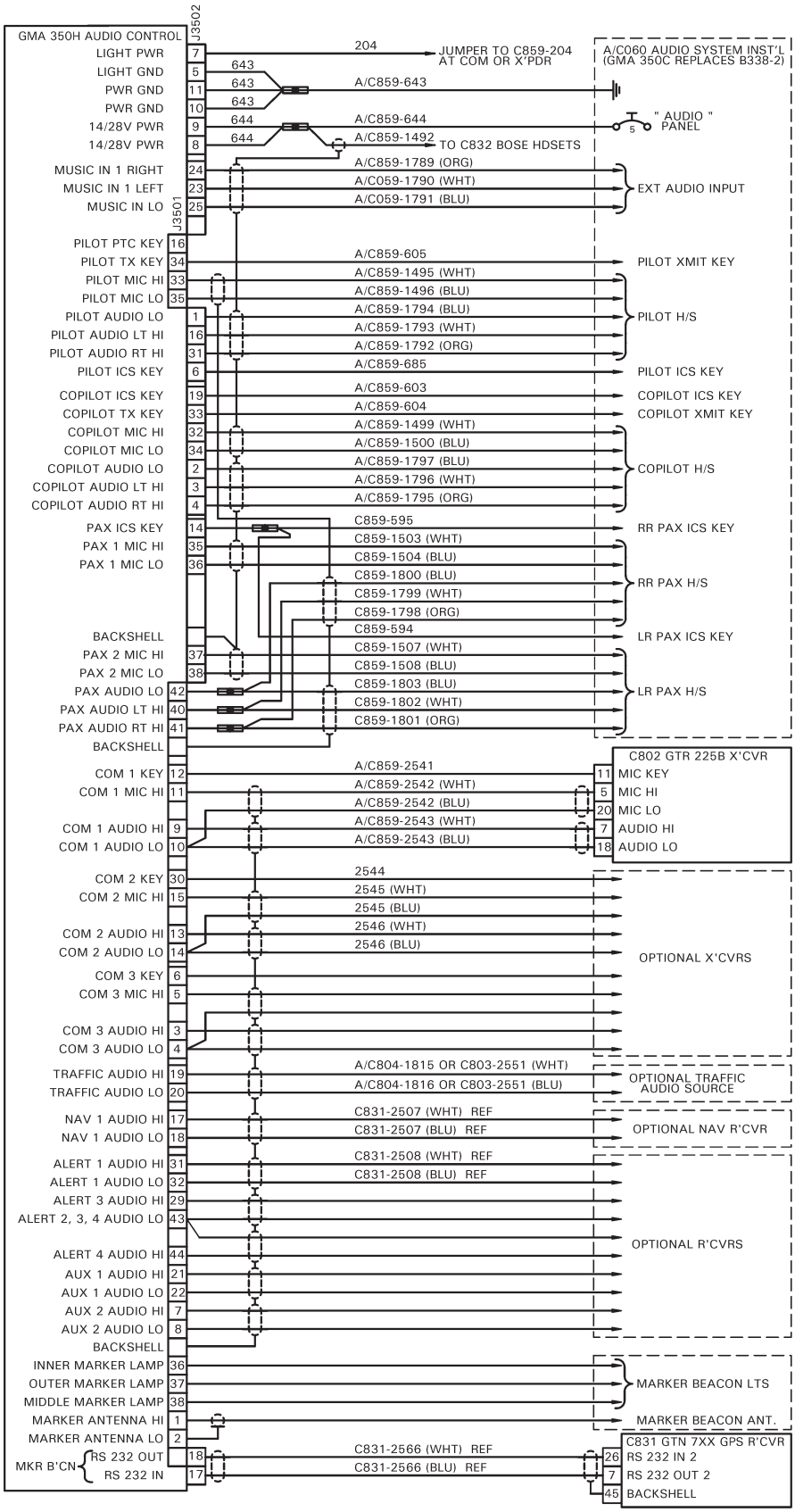


C822 REV D

FIGURE 14-48A C822-1 AUDIO CONTROL SCHEMATIC (GARMIN GMA 350HC)



C822 REV C

FIGURE 14-48B C822-1 AUDIO CONTROL SCHEMATIC (GARMIN GMA 350H; EARLIER SHIPS)

CHAPTER 15

FURNISHINGS

15-00 Description

The seats are not adjustable but each helicopter is delivered with a cushion which can be placed behind the pilot to position him farther forward. This allows shorter pilots to reach the pedals, the cyclic grip in its most forward position, and controls on the center console.

Each seat is equipped with a combined lap belt and inertia reel shoulder strap. The inertia reel is normally free but will lock if there is sudden movement as would occur in an accident.

A baggage compartment is located under each seat. Seat cushions hinge forward for access.

15-10 Seat Harnesses

A. Removal

1. Hinge seat assemblies forward.
2. Remove hardware securing F628-8 buckle assemblies to inboard anchors. Remove hardware securing lap belt fittings to outboard anchors.
3. Remove shoulder strap guide covers. Remove hardware securing guides to A259 bulkhead.
4. Remove inertia reel covers. Remove hardware securing reels to bulkhead. Remove A628-6 connector assemblies.

B. Installation

1. Install hardware securing A628-6 connector assembly inertia reels to A259 bulkhead. Install reel covers. Verify security.
2. Install hardware securing shoulder strap guides to bulkhead. Standard torque bolts per § 23-32. Install guide covers. Verify security.
3. Install hardware securing F628-8 buckle assemblies to inboard anchors; rotate buckles 20° forward from vertical. Standard torque bolts per § 23-32. Verify security.
4. Install hardware securing lap belt fittings to outboard anchors. Standard torque bolts per § 23-32. Verify security.

15-20 Seat and Seat Back Assemblies

15-21 Seat Assemblies

A. Removal

Remove hardware securing seat assembly to support and remove seat.

B. Installation

Position seat assembly on support and install hardware. Verify security.

15-22 Seat Back Assemblies

A. Removal

Left Seat Back

1. Remove screws securing pilot's collective boot and ring to A465-4 (vertical) panel assembly, remove ring, and unsnap boot. Remove screws securing panel to cabin and remove panel.
2. Remove screws securing A670-1 (fuel) valve's A798 plates to A003-13 seat back assembly and remove A798-1 plate.
3. Tilt seat assembly forward and remove screws securing co-pilot's collective boot and ring to seat back, remove ring, and unsnap boot. Remove screws securing seat back to cabin and remove seat back. (Remove A798-3 plate.)

Right Seat Back

1. Remove screws securing pilot's collective boot and ring to A465-4 (vertical) panel assembly, remove ring, and unsnap boot. Remove screws securing panel to cabin and remove panel.
2. Remove screws securing A003-14 seat back assembly to cabin and remove seat back.

15-60 Emergency Equipment

15-61 Emergency Locator Transmitter (ELT)

A. Description

The ELT activates when subjected to a significant change in velocity (as in an accident), by remote control switch located on the cyclic control panel, or by a switch on the ELT transmitter. Refer to § 33-80 for system description.

Refer to Kannad Aviation AF Integra / AF-H Integra or 406 AF-Compact/406 AF-Compact (ER) ELT Installation and Operation Manual for maintenance requirements and procedures. Refer to § 1.101 for scheduled maintenance and inspections.

Register an ELT when first purchased, when contact information changes, or when aircraft ownership, or tail number changes. Registration information is available online at: www.cospas-sarsat.org.

Dongles contain a memory chip that must be programmed with aircraft-specific information prior to installation for the ELT to function. The dongle may be removed and shipped to RHC or a Kannad Service Center for reprogramming. Kannad Aviation's Programming Data Sheet is available online at: www.robinsonheli.com.

B. Transmitter

Removal

1. Release D693-4 strap assembly or B359-2 (reusable) ty-rap.
2. Release Velcro strap; disconnect dongle and antenna wiring from transmitter at connectors and remove transmitter.

Installation

1. Connect dongle and antenna wiring to transmitter at connectors. Verify security.
2. Position transmitter on mounting bracket and secure with Velcro strap. Secure D693-4 strap assembly or install B359-2 (reusable) ty-rap around transmitter and bracket. Verify security.

C. Dongle

Removal

Cut and discard ty-raps as required, disconnect dongle from transmitter and airframe harness at connectors, and remove dongle.

Installation

1. Connect programmed dongle to transmitter and airframe harness at connectors.
2. Install ty-raps as required. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads. Verify security.

15-62 Fire Extinguisher

CAUTION

Extinguisher is rated for a storage and operating temperature of 120°F (49°C). If operating conditions would expose extinguisher to higher temperatures (e.g. long term parking in the sun in a hot climate), remove extinguisher and store it in a cooler area between flights.

A. Inspection

Every month: Visually inspect fire extinguisher and perform weight check (a scale with 1 gram precision or better is required). Remove extinguisher from service if total weight falls below 500 grams. If desired, order one G654-15 decal (blank maintenance log) and attach to extinguisher, to record weight checks.

Every 12 years: Remove fire extinguisher from service. Year of manufacture is labeled on bottom of extinguisher; remove extinguisher from service at end of 12th year from labeled date.

B. Bracket Removal

1. Unlatch fire extinguisher bracket and remove extinguisher.
2. Remove hardware securing bracket to chin and remove bracket.

C. Bracket Installation

1. Install hardware securing fire extinguisher bracket to chin. Select screw length as required to provide 0.00–0.06 inch thread exposure. Verify security.
2. Install fire extinguisher and latch bracket.

18-12 Leveling at Main Rotor Hub

> NOTE
>
> Use this leveling method for all R22 models.

1. Place a bubble level atop MR hub.

> NOTE
>
> Level must be parallel to teeter hinge bolt.

2. Rotate main rotor until teeter hinge bolt is aligned with longitudinal axis of helicopter.
3. Level helicopter longitudinally by placing shims under landing gear skid tubes or jacks under outboard edge of aft cross tube.
4. Rotate main rotor until teeter hinge bolt is aligned with lateral axis of helicopter.
5. Level helicopter laterally by placing shims under landing gear skid tubes or jacks under outboard edge of aft cross tube.

> NOTE
>
> Jacks may be used under aft cross tube 1 inch inboard from each elbow.

6. Recheck level per steps 2 & 4 and adjust as required.

18-13 Leveling at Keel Panels

> NOTE
>
> Use this leveling method for all R22 models.

1. Remove horizontal panel between seat bottoms and remove cyclic box cover.
2. Place a bubble level on top edge of right keel panel per Figure 18-1 Detail A.
3. Level helicopter longitudinally by placing shims under landing gear skid tubes or jacks under outboard edge of aft cross tube.
4. Place a bubble level across two keel panels per Figure 18-1 Detail B.
5. Level helicopter laterally by placing shims under landing gear skid tubes or jacks under outboard edge of aft cross tube.
6. Recheck level per steps 2 & 4 and adjust as required.

18-20 Weighing and CG Calculation

Reweigh helicopter when helicopter empty weight and empty weight center of gravity have been modified and if the accuracy of additional calculations is suspect.

Maintain a continuous record of the helicopter's weight and balance using the Weight and Balance Record in R22 Pilot's Operating Handbook (POH) Section 6.

NOTE

Verify scales are calibrated. Operate scales according to scale manufacturer's instructions.

NOTE

Never weigh the helicopter in the wind. Weigh helicopter on a level, flat, hard surface in a zero-wind environment for accurate scale readings.

18-21 Preparing Helicopter for Weighing

1. Defuel helicopter per § 22-52.
2. Service engine oil per R22 Pilot's Operating Handbook (POH) Section 8. Fill main and tail gearboxes to center of sight gage using correct gearbox oil (refer to § 22-10 Part C).
3. Clean aircraft per POH Section 8. Verify helicopter is completely dry.
4. Remove items that are not installed equipment (tools, rags, charts, etc.) from baggage compartments and stowage areas.
5. Verify cowlings, removable panels, cabin doors, removable controls, and POH are installed.
6. Verify Equipment List/Weight and Balance Data sheet (RF 134) and modifications recorded in the Weight and Balance Record correspond with installed equipment and recorded equipment locations.

20-11 Parking in High Wind or Turbulent Air (continued)

B. Extreme Conditions

In extreme conditions, at the operator's discretion:

1. Remove main rotor blades per § 26-10. Remove tail rotor assembly per § 9.210. Store main rotor blades and tail rotor assembly in hangar or safe area.
2. Remove main rotor pitch links per steps below, or temporarily secure links together using ty-rap(s) or safety wire:
   a. Mark an "X" on one pitch link lower rod end and corresponding swashplate ear using a colored grease pencil. Mark an "O" on opposite link and corresponding swashplate ear.
   b. Remove hardware securing pitch links to swashplate assembly.
3. Remove tail rotor pitch links per steps below:
   a. Refer to Figure 9-11. Tag each pitch link with corresponding blade serial number. Disconnect pitch links from tail rotor blades; keep associate balancing hardware with each link.
   b. Remove hardware securing pitch links to tail rotor pitch control assembly.

20-12 Main Rotor Blade Tie-Downs

CAUTION

Overtightening tie-down straps can damage main rotor blades. Maximum tie-down tension is 5 lb.

1. Park helicopter per § 20-10.
2. Refer to Figure 20-1. Slide MT290-1 tie-down jacket over forward (lowered) main rotor blade tip, white lettering facing down. Tie strap to windshield center post or thread strap through post and secure hook and loop tape. Push up on secured blade to remove slack in tie-down strap.
3. As required, install MT290-1 tie-down on aft main rotor blade. Slide jacket over blade tip, white lettering facing down. Wrap strap around tailcone forward of strobe light, then tie around strobe light base or secure hook and loop tape around strobe light base. Push up on secured blade to remove slack in tie-down strap.

20-13 Main Rotor Blade Supports

Reserved.

20-20 Storage (Greater than 30 days)

1. Record the date helicopter is prepared and placed in storage.

CAUTION

To minimize risk of electrical discharge: when disconnecting battery, disconnect negative (ground) cable from battery first, then the positive cable. When connecting battery, connect positive cable to battery first, then the negative (ground) cable.

2. Turn battery off. Remove cotter rings and wing nuts securing battery box cover to box and remove cover. Remove hardware securing cables to battery. Remove battery. Inspect and service battery according to battery manufacturer's instructions.
3. Preserve engine for storage per Lycoming Service Letter no. L180 (current revision).
4. Fill main and tail gearboxes to center of sight gage using correct gearbox oil (refer to § 22-10 Part C).
5. Fuel helicopter per R22 Pilot's Operating Handbook (POH) Section 8.

NOTE

Fuel lubricates bladder inner liner and keeps it from drying out or cracking. Refuel helicopter after run-ups during storage.

6. Clean aircraft per POH Section 8. Verify helicopter is completely dry.
7. Refinish main rotor blades per § 26-52. Refinish tail rotor blades per § 9.220. If blade painting is not feasible, wax blades.
8. Position helicopter in a hangar or protected environment.
9. Apply suitable non-drying corrosion preventive compound to A166 clutch shaft adjacent to seals (where shaft enters and exits upper sheave).
10. Open door vents or remove doors to ventilate cabin as required.
11. Close and latch access doors.

NOTE

During storage, periodically inspect helicopter for corrosion; helicopters stored in humid environments will require more frequent inspection.

CHAPTER 22

SERVICING

22-10 Main Rotor Gearbox

NOTE

Inspect main rotor gearbox for leaks when "top off" is required.

NOTE

Verify aircraft is on level ground when evaluating gearbox oil level.

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. Draining Oil

1. Run-up helicopter for approximately five minutes at 70–75% RPM per R22 Pilot's Operating Handbook (POH) Section 4 as required to warm oil and expedite draining.
2. Disconnect chip detector wiring from airframe harness at connectors. Remove chip detector from housing.
3. Refer to Figure 22-1B. Insert MT054-1 drain assembly (or MT053-1 drain assembly for threaded chip detector) into housing. Position drain hose overboard into a suitable drain container. Jam wedge between firewall and drain assembly to open valve and drain oil. Remove drain assembly after oil has drained.

B. Adding Oil

1. Install chip detector in housing, if removed. (Special torque threaded chip detector per § 23-33.) Connect chip detector wiring to airframe harness at connectors.
2. Remove gearbox filler-plug. Fill gearbox to center of sight gage using correct gearbox oil (refer to Part C). Rotate rotor system by hand for several revolutions and pull down on tail rotor gearbox several times. Check gearbox oil level and adjust as required. Install gearbox filler-plug and special torque plug per § 23-33.
3. Run-up helicopter approximately five minutes at 70–75% RPM per R22 Pilot's Operating Handbook (POH) Section 4.
4. Check gearbox oil level, and adjust as required.

22-10 Main Rotor Gearbox (continued)

C. Main and Tail Gearbox Oil

R22 helicopters S/N 4825 and subsequent were delivered with P/N A257-22 (semi-clear amber, synthetic) gear oil in main and tail gearboxes; earlier helicopters were delivered with P/N A257-2 (blue or blue-green) gear oil in main and tail gearboxes.

Certain gearbox features are required to use A257-22 oil. Older gearboxes should continue to use A257-2 oil.

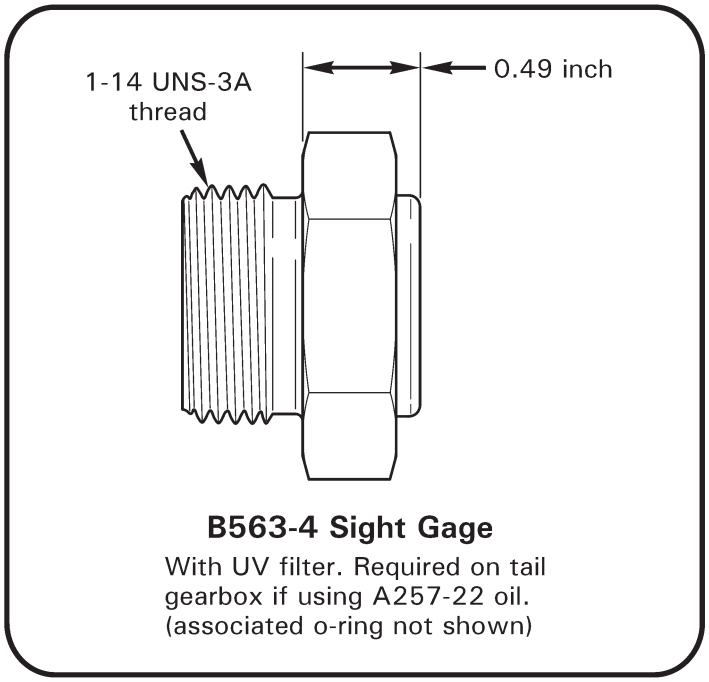
All R22 gearboxes (including new) may use A257-2 (traditional, blue) oil if more convenient or desired. Drain and flush per § 22-13 (main gearbox) and/or § 22-23 (tail gearbox) if converting from A257-22 oil.

Tail gearboxes are eligible for A257-22 oil provided a B563-4 sight gage is installed (refer to Figure 22-1A); not all tail gearboxes can be retrofitted with the B563-4 sight gage (due to thread differences).

A006 main gearboxes with A146-1 Revision Q & subsequent pinion are eligible for A257-22 oil. A146-1 pinion data plate is adjacent A006 gearbox data plate.

Ensure proper decal (F654-14 decal specifies A257-2 [blue] oil; F654-50 decal specifies A257-22 [amber] oil) is installed on aft wall of aux fuel tank (decal will need to be replaced if changing oil types). The same oil should be used in main and tail gearboxes to conform with the appropriate decal.

Do not mix A257-22 and A257-2 oil. If inadvertent mixture of oils occurs, drain and flush affected gearbox per § 22-13 (main) and/or § 22-23 (tail) followed by servicing with correct gearbox oil.



B563-4 Sight Gage
With UV filter. Required on tail gearbox if using A257-22 oil. (associated o-ring not shown)

FIGURE 22-1A TAIL GEARBOX SIGHT GAGE AND GEAR OIL

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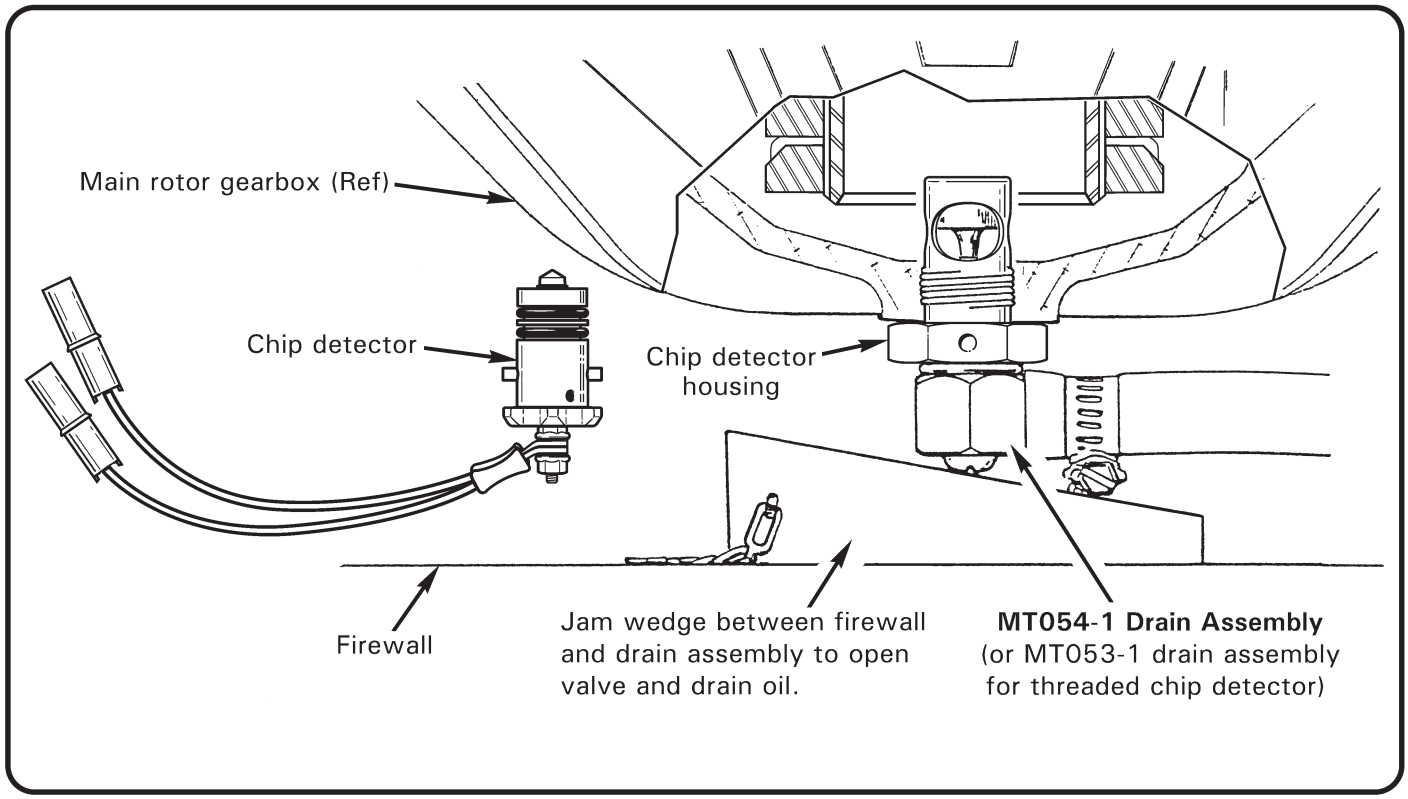

FIGURE 22-1B DRAINING MAIN ROTOR GEARBOX

22-11 Cleaning Chip Detector and Chip Detector Housing

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.

1. Disconnect chip detector wiring from airframe harness at connectors. For tail gearbox chip detector, place suitable drain container below gearbox. Remove chip detector from housing or gearbox.
2. Clean chip detector using a toothbrush and approved solvent (refer to § 23-70). Remove debris using compressed air or masking tape; do not use a magnet. Dry chip detector using compressed air or a lint-free cloth. Inspect condition.
3. Connect chip detector wiring to airframe harness at connectors. Turn battery on. Touch detector's magnet to airframe and verify appropriate gearbox caution light illuminates. Turn battery off. Disconnect chip detector wiring from airframe harness at connectors.
4. Install chip detector in housing or gearbox. Special torque threaded chip detector per § 23-33. Connect chip detector wiring to airframe harness at connectors.
5. Turn battery on. Depress push-to-test button(s) and verify appropriate gearbox caution light illuminates. Turn battery off.
6. As required, remove filler-plug. Fill gearbox to center of sight gage using correct gearbox oil (refer to § 22-10 Part C). Rotate rotor system by hand for several revolutions and pull down on tail rotor gearbox several times. Check gearbox oil level and adjust as required. Install filler-plug in gearbox and special torque plug per § 23-33.

22-12 Cleaning Sight Gage

1. Drain main rotor gearbox oil per § 22-10.
2. Remove sight gage from gearbox.
3. Clean sight glass using a toothbrush and approved solvent (refer to § 23-70). Dry sight gage using compressed air or a lint-free cloth. Inspect condition.
4. Install sight gage in gearbox and special torque gage per § 23-33. Verify security.

22-13 Main Rotor Gearbox Drain And Flush

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.

1. Run-up helicopter for approximately five minutes at 70-75% RPM per R22 Pilot's Operating Handbook (POH) Section 4 as required to warm oil and expedite draining.
2. Disconnect chip detector wiring from airframe harness at connectors. Remove chip detector from housing.
3. Refer to Figure 22-1B. Insert MT054-1 drain assembly (or MT053-1 drain assembly for threaded chip detector) into housing. Position drain hose overboard into a suitable drain container. Jam wedge between firewall and drain assembly to open valve and drain oil.
4. Remove drain assembly after oil has drained. Install chip detector (special torque threaded chip detector per § 23-33). Connect chip detector wiring to airframe harness at connectors.
5. Remove filler-plug. Fill gearbox to center of sight glass using SAE30, SAE40, SAE50, or SAE20W50 mineral oil. Install filler-plug and special torque plug per § 23-33.
6. Run-up helicopter for approximately five minutes at 70-75% RPM per POH Section 4.
7. After shutdown, drain mineral oil per steps 2 thru 4. Remove drain assembly after oil has drained.
8. Remove chip detector housing. Clean chip detector and housing using a toothbrush and approved solvent (refer to § 23-70). Remove debris using compressed air or masking tape; do not use a magnet. Dry chip detector and housing using compressed air or a lint-free cloth. Inspect condition.
9. Connect chip detector wiring to airframe harness at connectors. Turn battery on. Touch detector's magnet to firewall and verify MR CHIP caution light illuminates. Turn battery off. Disconnect chip detector wiring from airframe harness at connectors.
10. Install chip detector housing in gearbox and special torque housing per § 23-33. Install chip detector in housing. (Special torque threaded chip detector per § 23-33.) Connect chip detector wiring to airframe harness at connectors.
11. As required, remove sight gage and clean glass using approved solvent (refer to § 23-70). Install sight gage and special torque gage per § 23-33.
12. Remove filler-plug. Fill gearbox to center of sight gage using correct gearbox oil (refer to § 22-10 Part C). Rotate rotor system by hand for several revolutions and pull down on tail rotor gearbox several times. Check gearbox oil level and adjust as required. Install filler-plug in gearbox and special torque plug per § 23-33.
13. Turn battery on. Depress push-to-test MR CHIP button and verify caution light illuminates. Turn battery off.

22-20 Tail Rotor Gearbox

NOTE

Inspect tail rotor gearbox for leaks when "top off" is required.

NOTE

Verify aircraft is on level ground when evaluating gearbox oil level.

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. Draining Oil

1. Cut and discard ty-raps as required and disconnect chip detector wiring from airframe harness at connectors.
2. Place a suitable drain container under tail rotor gearbox to catch oil, then remove chip detector.

B. Adding Oil

1. Install chip detector in tail gearbox and special torque detector per § 23-33.
2. Connect chip detector wiring and install ty-raps, as required. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
3. Turn battery switch on. Verify TR CHIP caution light illuminates when test button is depressed. Turn battery switch off.
4. Remove gearbox filler-plug and fill gearbox to center of sight gage using correct gearbox oil (refer to § 22-10 Part C). Rotate rotor system by hand for several revolutions and pull down on tail rotor gearbox several times. Check gearbox oil level and adjust as required.
5. Install filler-plug in gearbox and special torque plug per § 23-33.

C. Main and Tail Gearbox Oil

Refer to § 22-10 Part C.

22-21 Cleaning Chip Detector

1. Drain tail rotor gearbox oil per § 22-20.
2. Clean chip detector using a toothbrush and approved solvent (refer to § 23-70). Remove debris using compressed air or masking tape; do not use a magnet. Dry chip detector using compressed air or a lint-free cloth. Inspect condition.
3. Connect chip detector wiring to airframe harness at connectors. Turn battery switch on. Touch detector's magnet to airframe and verify TR CHIP caution light illuminates. Turn battery switch off. Disconnect chip detector wiring from airframe harness at connectors.
4. Install chip detector in gearbox and special torque detector per § 23-33. Connect chip detector wiring to airframe harness at connectors. Verify security.
5. Turn battery switch on. Depress push-to-test button and verify TR CHIP caution light illuminates. Turn battery switch off.

22-22 Cleaning Sight Gage

1. Drain tail rotor gearbox oil per § 22-20.
2. Remove sight gage from gearbox.
3. Clean sight gage using a toothbrush and approved solvent (refer to § 23-70). Dry sight gage using compressed air or a lint-free cloth. Inspect condition.
4. Install sight gage in gearbox and special torque gage per § 23-33. Verify security.

22-23 Tail Rotor Gearbox Drain And Flush

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.

1. Run-up helicopter for approximately five minutes at 70–75% RPM per R22 Pilot's Operating Handbook (POH) Section 4 as required to warm oil and expedite draining.
2. Disconnect chip detector wiring from airframe harness at connectors. Place a suitable drain container below tail rotor gearbox and remove chip detector.
3. After oil has drained, install chip detector in gearbox and special torque detector per § 23-33. Connect chip detector wiring to airframe harness at connectors.
4. Remove filler-plug. Fill gearbox to center of sight gage using SAE30, SAE40, SAE50, or SAE20W50 mineral oil. Install filler-plug and special torque plug per § 23-33.
5. Run-up helicopter for approximately five minutes at 70–75% RPM per POH Section 4.
6. After shutdown, drain mineral oil per step 2.
7. Clean chip detector using a toothbrush and approved solvent (refer to § 23-70). Remove debris using compressed air or masking tape; do not use a magnet. Dry chip detector and housing using compressed air or a lint-free cloth. Inspect condition.
8. Connect chip detector wiring to airframe harness at connectors. Turn battery on. Touch detector's magnet to airframe and verify TR CHIP caution light illuminates. Turn battery off. Disconnect chip detector wiring from airframe harness at connectors.
9. Install chip detector in gearbox and special torque detector per § 23-33. Connect chip detector wiring to airframe harness at connectors.
10. As required, remove sight gage and clean glass using approved solvent (refer to § 23-70). Install sight gage and special torque gage per § 23-33.
11. Remove filler-plug. Fill gearbox to center of sight gage using correct gearbox oil (refer to § 22-10 Part C). Rotate rotor system by hand for several revolutions and pull down on tail rotor gearbox several times. Check gearbox oil level and adjust as required. Install filler-plug in gearbox and special torque plug per § 23-33.
12. Turn battery on. Depress push-to-test TR CHIP button and verify caution light illuminates. Turn battery off.

22-30 Clutch Assembly Lubricant Inspection and Servicing

A. Clutch Assemblies with A168-4 (Forward) Retainer

WARNING

Avoid contaminating drive belts and sheaves with lubricant. Clean contaminated surfaces with mild soap and water solution, followed by a warm water rinse. Place a clean, absorbent rag beneath MT147-2 fittings, when installed, to catch any drips.

1. Open main rotor gearbox compartment access doors.
2. Rotate clutch shaft until bolts securing yokes to shaft are vertical. Engage rotor brake.
3. Remove A168-4 (forward) retainer's top B289-3 screw and install clean MT147-2 fitting. Attach drain hose.
4. Rotate sheave until fitting and attached drain hose are on bottom. Route drain hose into a suitable, clean container. Remove top B289-3 screw and allow lubricant to drain into container.
5. Install second clean MT147-2 fitting at top of retainer and connect a clean supply of A257-4 lubricant to fitting. Flush sprag clutch housing until exiting lubricant is obviously red. Disconnect lubricant supply and allow lubricant to drain completely into container.
6. Strain all lubricant from container through a 180-200 micron paint filter/strainer. Fluid may be dark, and may sparkle with very fine metallic debris; this is normal. If metallic debris is trapped in the filter/strainer, remove clutch assembly and return it to RHC, or an R22 Service Center authorized to overhaul clutch assemblies, for disassembly and inspection.
7. If metallic debris is not found in the filter, attach drain hose to top fitting. Route drain hose into a suitable container. Connect a clean supply of A257-4 lubricant to bottom fitting. Fill sprag clutch housing thru bottom fitting until no air bubbles are visible in drain hose. Shut-off fluid flow.
8. Remove top fitting and install screw. Rotate sheave until opposite fitting is on top. Remove fitting and verify lubricant level contacts threads; add lubricant as required. Install forward screw.
9. Close main rotor gearbox compartment access doors.

B. Clutch Assemblies with Retainer without B289-3 Screws

1. Perform clutch assembly (aft) seal replacement per § 7.213.

CHAPTER 23

STANDARD PRACTICES

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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 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 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 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.
5. Scratches can be removed from acrylic windshields by rubbing with jeweler's rouge followed by hand polishing with commercial plastic polish. Use a figure eight motion with polishing. Polishing polycarbonate (optional, impact-resistant) windshields is not recommended as it may thin the protective hardcoat finish.

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.

23-20 Lubrication

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.

Most bearings are sealed or self-lubricated and do not require periodic lubrication. Bearings with scheduled lubrication intervals are listed in Table 1 (see Chapter 1).

Engine lubrication requirements are located in the R22 Pilot's Operating Handbook, the appropriate model Lycoming Operator's Manual, and Lycoming Service Instruction No. 1014 (current revision).

Main and tail gearboxes require servicing when indicated by sight gage level. Additionally, change gearbox oil and clean respective sight gage when oil becomes so dirty its level cannot be determined.

WARNING

Use approved gearbox oils only (refer to § 22-10 Part C).

When installing a new or overhauled gearbox, drain and flush gearbox after the first 4 hours of flight or first chip light, whichever occurs first. Thereafter, change gearbox oil at intervals listed in Table 1 (see Chapter 1).

Given	Symbols
Y = Unknown	Y = Torque wrench setting
T = 135 in.-lb	T = Torque applied to fastener
L = 10 in.	L = Length of torque wrench
A = 1.5 in.	A = Length of adapter

When using an adapter that lengthens torque wrench effective length, calculate torque wrench setting using the formula below:

EXAMPLE

$$\textbf{Solve for Y} = \frac{\textbf{T x L}}{\textbf{L + A}} = \frac{\textbf{135 x 10}}{\textbf{10 + 1.5}} = \frac{\textbf{1350}}{\textbf{11.5}} = \textbf{117.39}$$

Set torque wrench to 117 in.-lb to torque fastener to 135 in.-lb.

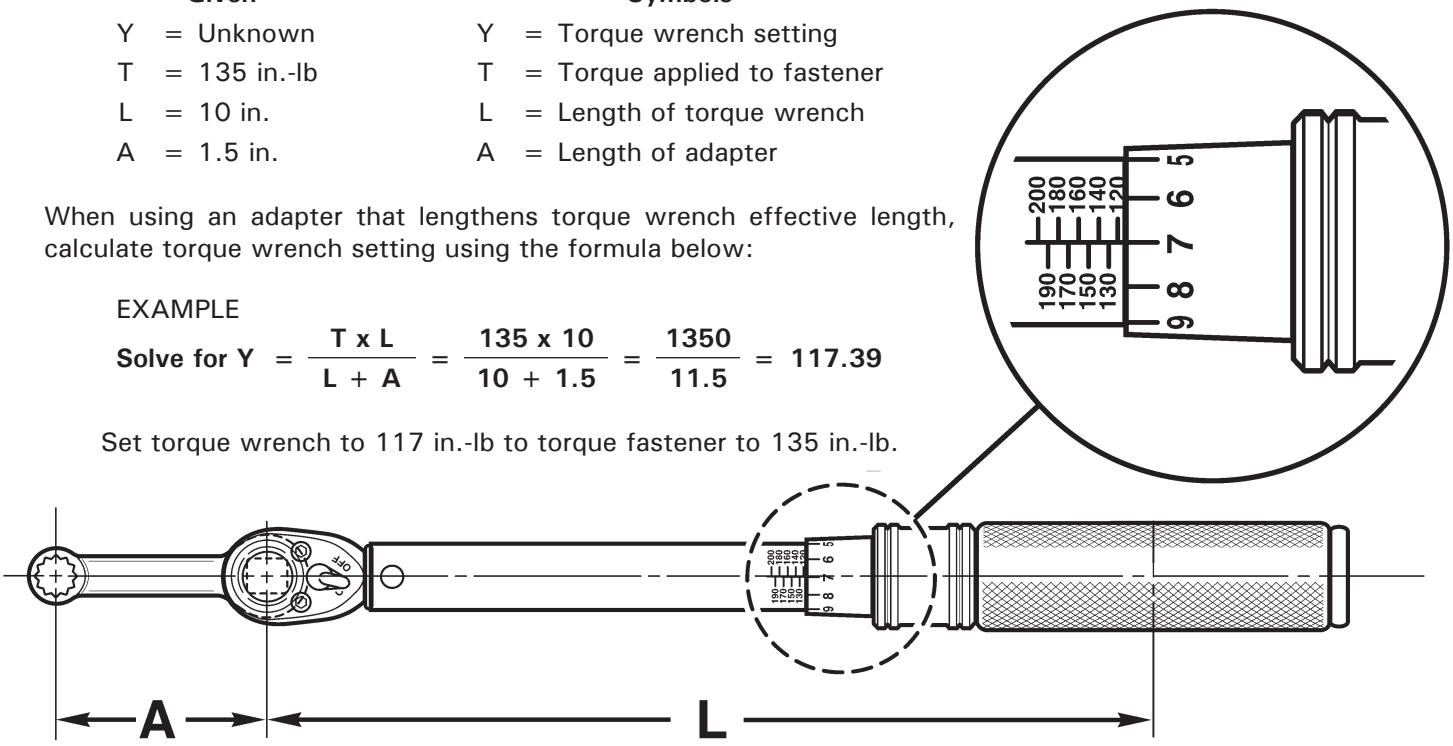


FIGURE 23-1 LENGTHENING TORQUE WRENCH EFFECTIVE LENGTH

Given	Symbols
Y = Unknown	Y = Torque wrench setting
T = 135 in.-lb	T = Torque applied to fastener
L = 10 in.	L = Length of torque wrench
A = 1.5 in.	A = Length of adapter

When using an adapter that shortens the torque wrench effective length, calculate torque wrench setting using the formula below:

EXAMPLE

$$\textbf{Solve for Y} = \frac{\textbf{T x L}}{\textbf{L – A}} = \frac{\textbf{135 x 10}}{\textbf{10 – 1.5}} = \frac{\textbf{1350}}{\textbf{8.5}} = \textbf{158.82}$$

Set torque wrench to 159 in.-lb to torque fastener to 135 in.-lb.

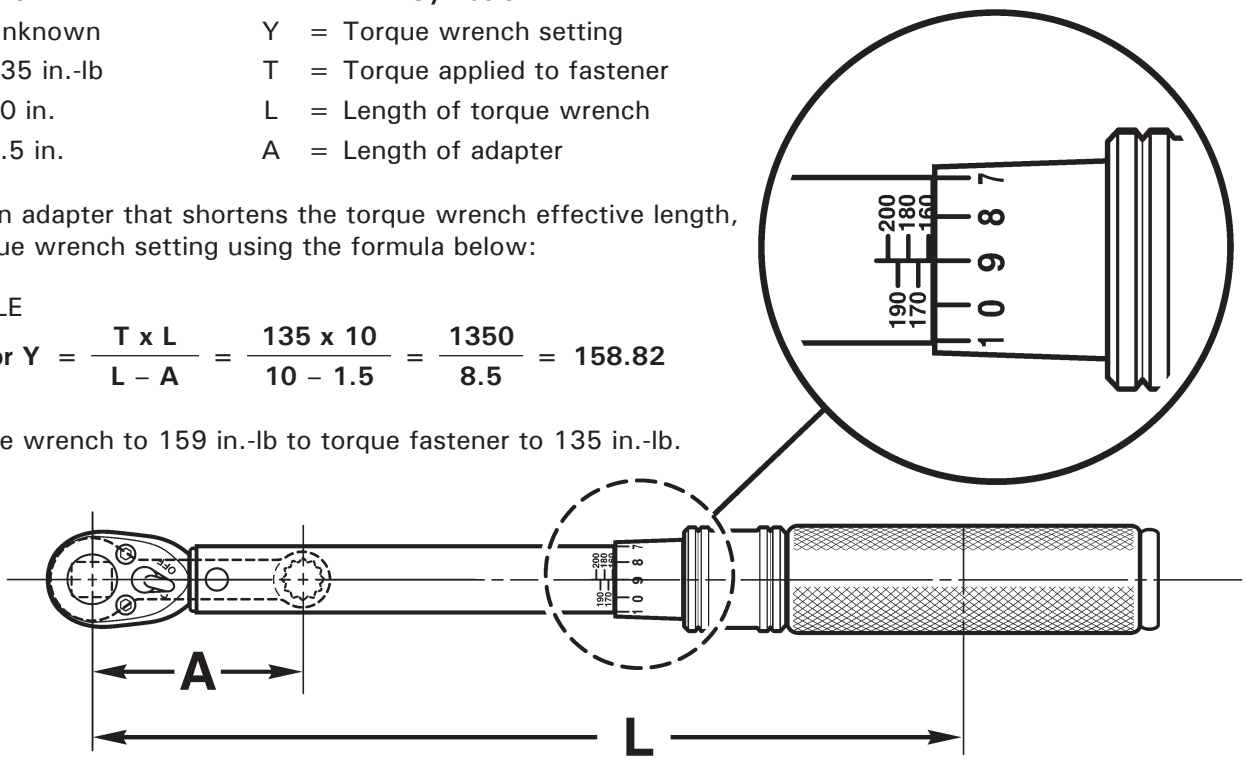


FIGURE 23-2 SHORTENING TORQUE WRENCH EFFECTIVE LENGTH

23-30 Torque Requirements

A. Tool Calibration

Dimensions and tolerances given in this manual are critical. Calibrate measuring tools per manufacturer's recommendation at least once a year, when tool is dropped, misused, or calibration is suspect. Measuring tools include torque wrenches, micrometers, calipers, dial indicators, spring scales, protractors, and balancing equipment.

WARNING

Proper torque is critical. Always use calibrated wrenches and undamaged, properly lubricated (where applicable) hardware. Ensure clamping surfaces are clean, and clamp only bare metal or wet-primed surfaces. Improper torque or dirty or painted clamping surfaces may result in loss of clamp-up, hardware or part damage, and premature failure.

B. Torque Value

Torque fasteners to standard dry values listed in § 23-32 unless otherwise specified. If torque is applied by rotating bolt, increase torque value by 10% to account for higher friction at bolt head and shank.

For example, the torque wrench setting for an NAS6605 bolt used with an MS21075 nutplate is determined as follows:

NAS6605 bolt (5 indicates 5/16 inch size) dry torque per § 23-32	240 in.-lb
Add 10% because torque must be applied at bolt head	+ 24 in.-lb
Torque wrench setting	264 in.-lb

C. Secondary Locking Mechanism

A secondary locking mechanism is required on all critical fasteners. B330 stamped nuts (palnuts) serve as the secondary locking mechanism in most areas on the helicopter, and are torqued per § 23-32. Palnuts must be replaced when removed. The R22 Illustrated Parts Catalog (IPC) lists secondary locking mechanisms for specific fasteners.

23-30 Torque Requirements (continued)

D. Critical Fastener

CAUTION

D210-series nuts, which supersede MS21042L-series and NAS1291-series nuts, are required on critical fasteners.

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 he has assembled.

A critical fastener is one which, if removed or lost, would jeopardize safe operation of the helicopter. This includes joints in the primary control system, and non-fail-safe structural joints in the airframe, landing gear, and drive system.

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

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
DRIVE SYSTEM	(1) AN320-15 nut (1 ½ inch socket) on A007-3 shaft assembly	183–233 ft-lb wet
	(1) AN320-18 nut ($1^{11}/_{16}$ inch socket) on A007-5 shaft assembly	340–400 ft-lb wet
	(6) NAS6606H23 or (6) NAS6606H24 bolts, lower sheave	300 in.-lb
EMPENNAGE	(4) NAS6603-2 & (4) NAS6603-5 bolts, vertical stabilizer attach	70 in.-lb
FANWHEEL	(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 in.-lb
	(6) NAS6605-12, -13, or -14 bolts, hub	300 in.-lb, and retorque after first engine run after installation
FUEL SYSTEM	(1) A457-15 bulkhead union and nut	285 in.-lb
	(1) A657-1 nut, fuel valve elbow-to-bulkhead union	120 in.-lb
	(1) A726-1 line assembly, bulkhead union-to-gascolator	285 in.-lb
	(1) A880-934, A880-964, or AN815-4D union, main tank, drain hose	145 in.-lb
	(1) A880-936, A880-966, or AN815-6D union, main tank, tank interconnect hose	200 in.-lb
	(1) A880-1004 or AN924-4D nut, main tank, drain valve	145 in.-lb
	(1) A880-1005 or AN924-5D nut, low-fuel warning switch	150 in.-lb
	(2) B254-3 strainer assembly, tank outlets	200 in.-lb wet
	(1) B283 hose assembly nuts, gascolator-to-carburetor	120 in.-lb
	(5) B289-1 bolts, fuel sender (torque in criss-cross pattern)	37 in.-lb
	(2) B330-5 palnut, fuel sender ground stud	9 in.-lb
	(2) B330-6 palnut, fuel sender center stud	11 in.-lb
	(1) C595-1 or D205-33 hose assembly nuts, tank interconnect	120 in.-lb
	(1) D205-32 hose assembly nuts, main tank-to-fuel valve	120 in.-lb
	(1) D205-34 hose assembly nuts, main tank drain	60 in.-lb
	(1) D210-4 nut, gascolator mounting plug	70 in.-lb
	(16) AN805 nuts, fuel primer line	20–30 in.-lb
	(1) AN894D4-2 bushing, primer system	50–65 in.-lb

23-33 Special Torques (continued)

AREA	(QUANTITY) FASTENER	TORQUE
FUEL SYSTEM (CONT'D)	(1) AN894D6-4 bushing, primer system	110–130 in.-lb
	(4) MS27039C1-06 screws, fuel valve	16 in.-lb
	(4) MS27039DD1-26 screws, air bypass door	24 in.-lb
	(1) MS27769D2 plug, gascolator	60 in.-lb
	Primer system line assembly nuts, flared end fittings	20–30 in.-lb
FUSELAGE	(1) B277-052 clamp, lower rib	50 in.-lb
	(1) D210-5 nut, tow ball	240 in.-lb
	(8) MS51861-37C screws, door hinges	36 in.-lb
LANDING GEAR	(4) AN4-25A bolts, ground handling support	70 in.-lb
	(56) NAS6604 bolts, floats to skids and skid extensions	50 in.-lb
MAIN ROTOR BLADE	(2 per blade) A722-4 screw, tip weight retaining	40 in.-lb wet
	(2 per blade) B289-2 self-sealing bolts in pitch horn	70 in.-lb
	(2 per blade) NAS1351N3-10P screw, cover retaining	40 in.-lb wet
MAIN ROTOR GEARBOX	(1) AN320-8 nut, gearbox pinion	290–410 in.-lb
	(1) AN10-41A bolt, gearbox mounting (3) A650-1 fittings, gearbox mounting (requires MS21044N10 nuts)	90 ft-lb dry torqued from bolt head or nut
	(1) F650-3 bolt, gearbox mounting (3) A650-3 fittings, gearbox mounting (requires D210-10 nuts)	50 ft-lb, wet torque from bolt head or nut
	(6) NAS1352-4-14 screws in end cover	140 in.-lb
	(1) chip detector (threaded, non-quick-disconnect type)	Large nut 150 in.-lb Small nut 75 in.-lb
	(1) chip detector housing	150 in.-lb
	(1) nut, chip detector wiring	4–6 in.-lb
	(1) filler-plug	150 in.-lb
	(1) sight gage	150 in.-lb
MAIN ROTOR HUB	(1) NAS630-80 (or MS21250-10080) teeter hinge bolt; (2) NAS630-80 (or MS21250-10080) coning hinge bolts in A154-1 hub	New bolt: 0.016–0.017 inch elongation (stretch), wet Used bolt: 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	New bolt: 0.011–0.012 inch elongation (stretch), wet Used bolt: 0.010–0.012 inch elongation, wet, & cotter pin holes must align
OVERTRAVEL SPRING	(1) A486 screw, upper rod end	37 in.-lb
POWERPLANT	(1) A058-5 carburetor air temp probe	36–48 in.-lb
	(2) A740-1 manifold pressure line nuts	25–35 in.-lb
	(1) A760-1 oil temperature sender, single	300 in.-lb
	(1) A760-2 cylinder head temperature sender	50 in.-lb
	(1) A760-3 oil temperature sender, dual	300 in.-lb

23-33 Special Torques (continued)

AREA	(QUANTITY) FASTENER	TORQUE
POWERPLANT (CONT'D)	(1) B200-4 lug, bolt supplied with engine	96 in.-lb
	(1) C143-1 sensor assembly	96 in.-lb
	(2) B277-024 clamps, carb heat scoop	30 in.-lb
	(4) AN818-8 nuts, oil cooler line (stainless-steel lines)	40 ft-lb
	(4) AN818-8 nuts, oil cooler line (aluminum lines)	230–260 in.-lb
	(1) AN894D4-3 bushing, manifold pressure line, at firewall	135–150 in.-lb
	(4) MS20074-04-04 bolts, airbox-to-carburetor	30 in.-lb
	(1) 3080-00038 cylinder head temperature probe	70–80 in.-lb
	(1) bolt, alternator belt tension	204 in.-lb
	(4) bolts, D723-1 oil adapter	90–100 in.-lb
	(4) carburetor-to-engine nuts	96 in.-lb initial, 204 in.-lb final, torque in a crisscross pattern
	(8) exhaust riser flange nuts, plain	160–180 in.-lb
	(8) exhaust riser flange nuts, self-locking	200–220 in.-lb
	(2) ground strap-to-engine nuts	96 in.-lb
	(1) nut, B315-1 clip for magneto harness clamp	60 in.-lb
	(1) nut on A462-1 carburtetor heat control wire-to-slider valve attach fitting	25–30 in.-lb
	(1) nut on A462-4 mixture control wire-to-carburetor mixture arm attach fitting	25–30 in.-lb
	(8) spark plugs	35 ft-lb wet with A257-16 oil
	(1) thermostatic oil cooler bypass valve	290–310 in.-lb
	(6 per cover) NAS1352-4H10P valve cover retaining screws when used with clean, dry, red silicon gasket on clean, dry valve cover and cylinder head mating surfaces	25 in.-lb cold engine, 20 in.-lb warm engine
	(1) terminal retaining nut, alternator output terminal (use back-up wrench on stud retaining nut to prevent loss of stud clamp-up)	50 in.-lb
	(2) terminal retaining nuts, D748-3 alternator field and aux terminals (use back-up wrench on stud retaining nuts to prevent loss of stud clamp-up)	14 in.-lb
	(2) terminal retaining nuts, D748-4 alternator field and aux terminals (use back-up wrench on stud retaining nuts to prevent loss of stud clamp-up)	20 in.-lb
	(1) terminal retaining nut, oil temperature sender	20 in.-lb
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 in.-lb with B270-1 on shank to seal strut holes
SWASHPLATE	(2) NAS1352N08-6 screws, magnetic pick-up bracket	35 in.-lb
	(16) NAS1352N08-8 screws	35 in.-lb
	(1) NAS6605-8 bolt clamping early revision A203 yokes	190 in.-lb

23-33 Special Torques (continued)

AREA	(QUANTITY) FASTENER	TORQUE
SWASHPLATE (CONT'D)	(1 per link) 21FKF-616 jam nut, main rotor pitch link barrel	100 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 in.-lb
	(1) D210-4 nut, A119-1 bumper retainer	120 in.-lb
	(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 in.-lb
	(8) MS20074-04-06 bolts on A021 gearbox	60 in.-lb
	(12) MS20074-04-06 bolts on B021 gearbox	100 in.-lb
	(1) NAS1304-38 bolt, spherical tail rotor teeter (delta) hinge	150 in.-lb
	(1) NAS6604-38 bolt, elastomeric tail rotor teeter (delta) hinge	150 in.-lb
	(1) chip detector on A021 gearbox	100 in.-lb
	(1) chip detector on B021 gearbox	60 in.-lb
	(1) nut, chip detector wiring on B021 gearbox	4–6 in.-lb
	(1) filler-plug vent assembly	100 in.-lb
	(1) sight gage on A021 gearbox	150 in.-lb
	(1) B563-4 (flat, UV filter) sight gage on B021 gearbox	150 in.-lb
	(1) B563-1 (bubble) sight gage on B021 gearbox	100 in.-lb
WINDSHIELD	(24) AN526C832R12 screw, thru center brace	16 in.-lb
	(64) B526-6 screw, polycarbonate windshield fasteners	24 in.-lb
	(1) B295-2 clip, yaw string	16 in.-lb

23-34 Push-Pull Tube Rod End Adjustment

> NOTE
>
> Refer to § 10.232 to adjust A258 main rotor pitch links.

The following procedure is standard for adjusting push-pull tube rod ends:

1. Loosen palnut and jam nut on rod end shank.
2. Remove hardware securing push-pull tube rod end to attachment point per respective instructions.
3. Screw rod end in or out of push-pull tube as required to obtain proper rigging adjustment. Apply B270-21 (corrosion) protectant to exposed threads.
4. After any rod end adjustment, verify rod end threaded shank blocks passage of 0.020-inch diameter wire thru the witness hole in the push-pull tube per Figure 2-1. When no witness hole is provided, refer to Figure 2-1 for maximum rod end extension.
5. Install fastener securing push-pull tube to attachment point per respective instructions.
6. Refer to Figure 2-1A. Position rod ends to allow as much push-pull tube rotation as possible without binding. Standard torque jam nuts & palnuts per § 23-32 & torque stripe per Figure 2-1.

23-35 D210-series Nuts on Critical Fasteners

When performing maintenance that involves disassembly of a critical fastener (joints with a secondary lock), reassemble the fastener using a D210-series nut.

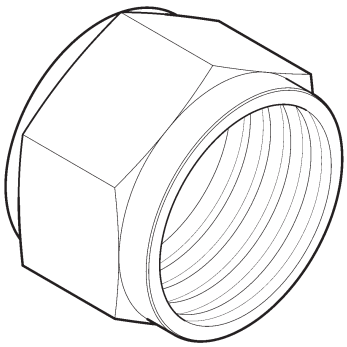
If a fastener is disassembled that has an MS21042L-series or NAS1291-series nut with a B330-series palnut or B332-series lockwasher (secondary lock),

replace MS21042L08 nut or NAS1291-08 nut with D210-08 nut,
replace MS21042L3 nut or NAS1291-3 nut with D210-3 nut,
replace MS21042L4 nut or NAS1291-4 nut with D210-4 nut,
replace MS21042L5 nut or NAS1291-5 nut with D210-5 nut,
replace MS21042L6 nut or NAS1291-6 nut with D210-6 nut,
replace NAS1291-7 nut with D210-7 nut,
replace NAS1291-8 nut with D210-8 nut, or
replace NAS1291-10 nut with D210-10 nut.

23-36 A880 Flared Tube Components

A. Nuts – Flare

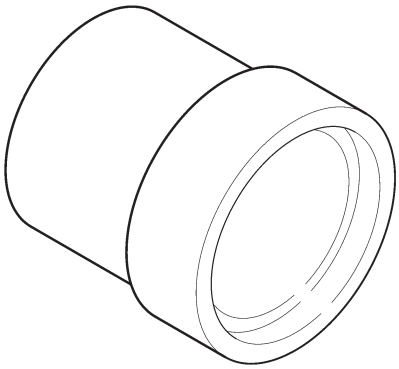
Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-102	AN818-2D, AN818-2W, AS5175W02	AL	1/8-inch
-103	AN818-3D, AN818-3W, AS5175W03	AL	3/16-inch
-104	AN818-4D, AN818-4W, AS5175W04	AL	1/4-inch
-105	AN818-5D, AN818-5W, AS5175W05	AL	5/16-inch
-106	AN818-6D, AN818-6W, AS5175W06	AL	3/8-inch
-108	AN818-8D, AN818-8W, AS5175W08	AL	1/2-inch
-110	AN818-10D, AN818-10W, AS5175W10	AL	5/8-inch
-202	AN818-2J, AS5175J02	CRES	1/8-inch
-203	AN818-3J, AS5175J03	CRES	3/16-inch
-204	AN818-4J, AS5175J04	CRES	1/4-inch
-205	AN818-5J, AS5175J05	CRES	5/16-inch
-206	AN818-6J, AS5175J06	CRES	3/8-inch
-208	AN818-8J, AS5175J08	CRES	1/2-inch
-210	AN818-10J, AS5175J10	CRES	5/8-inch



23-36 A880 Flared Tube Components (continued)

B. Sleeves

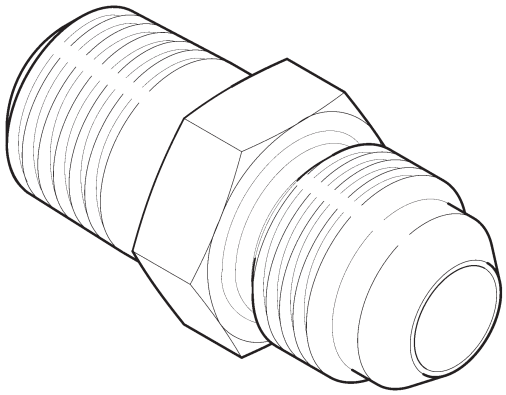
Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-302	MS20819-2D, AS3220D02, AS3220W02	AL	1/8-inch
-303	MS20819-3D, AS3220D03, AS3220W03	AL	3/16-inch
-304	MS20819-4D, AS3220D04, AS3220W04	AL	1/4-inch
-305	MS20819-5D, AS3220D05, AS3220W05	AL	5/16-inch
-306	MS20819-6D, AS3220D06, AS3220W06	AL	3/8-inch
-308	MS20819-8D, AS3220D08, AS3220W08	AL	1/2-inch
-310	MS20819-10D, AS3220D10, AS3220W10	AL	5/8-inch
-402	MS20819-2J, AS5176J02	CRES	1/8-inch
-403	MS20819-3J, AS5176J03	CRES	3/16-inch
-404	MS20819-4J, AS5176J04	CRES	1/4-inch
-405	MS20819-5J, AS5176J05	CRES	5/16-inch
-406	MS20819-6J, AS5176J06	CRES	3/8-inch
-408	MS20819-8J, AS5176J08	CRES	1/2-inch
-410	MS20819-10J, AS5176J10	CRES	5/8-inch



23-36 A880 Flared Tube Components (continued)

C. Adapters – NPT to Flare

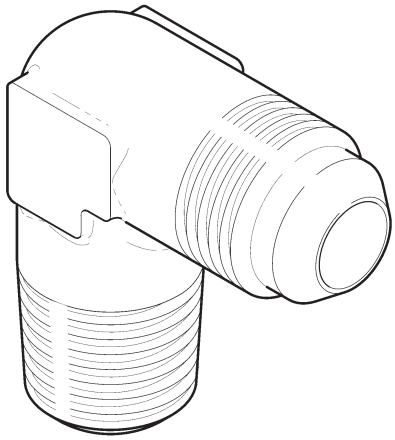
Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-502	AN816-2D, AS5194D0202	AL	1/8-inch
-503	AN816-3D, AS5194D0302	AL	3/16-inch
-504	AN816-4D, AS5194D0402	AL	1/4-inch
-505	AN816-5D, AS5194D0502	AL	5/16-inch
-506	AN816-6D, AS5194D0604	AL	3/8-inch
-508	AN816-8D, AS5194D0806	AL	1/2-inch
-510	AN816-10D, AS5194D1008	AL	5/8-inch
-532	AN816-2J, AS5194J0202	CRES	1/8-inch
-533	AN816-3J, AS5194J0302	CRES	3/16-inch
-534	AN816-4J, AS5194J0402	CRES	1/4-inch
-535	AN816-5J, AS5194J0502	CRES	5/16-inch
-536	AN816-6J, AS5194J0604	CRES	3/8-inch
-538	AN816-8J, AS5194J0806	CRES	1/2-inch
-540	AN816-10J, AS5194J1008	CRES	5/8-inch
-562	AN816-2, AS5194-0202	STL	1/8-inch
-563	AN816-3, AS5194-0302	STL	3/16-inch
-564	AN816-4, AS5194-0402	STL	1/4-inch
-565	AN816-5, AS5194-0502	STL	5/16-inch
-566	AN816-6, AS5194-0604	STL	3/8-inch
-568	AN816-8, AS5194-0806	STL	1/2-inch
-570	AN816-10, AS5194-1008	STL	5/8-inch



23-36 A880 Flared Tube Components (continued)

D. Elbows – 90°, NPT to Flare

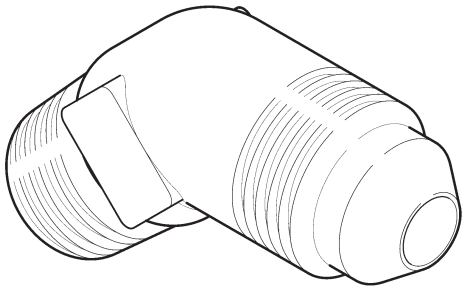
Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-602	AN822-2D, MS20822-2D, AS5195W0202	AL	1/8-inch
-603	AN822-3D, MS20822-3D, AS5195W0302	AL	3/16-inch
-604	AN822-4D, MS20822-4D, AS5195W0402	AL	1/4-inch
-605	AN822-5D, MS20822-5D, AS5195W0502	AL	5/16-inch
-606	AN822-6D, MS20822-6D, AS5195W0604	AL	3/8-inch
-608	AN822-8D, MS20822-8D, AS5195W0806	AL	1/2-inch
-610	AN822-10D, MS20822-10D, AS5195W1008	AL	5/8-inch
-632	AN822-2J, MS20822-2J, AS5195J0202	CRES	1/8-inch
-633	AN822-3J, MS20822-3J, AS5195J0302	CRES	3/16-inch
-634	AN822-4J, MS20822-4J, AS5195J0402	CRES	1/4-inch
-635	AN822-5J, MS20822-5J, AS5195J0502	CRES	5/16-inch
-636	AN822-6J, MS20822-6J, AS5195J0604	CRES	3/8-inch
-638	AN822-8J, MS20822-8J, AS5195J0806	CRES	1/2-inch
-640	AN822-10J, MS20822-10J, AS5195J1008	CRES	5/8-inch
-662	AN822-2, MS20822-2, AS5195-0202	STL	1/8-inch
-663	AN822-3, MS20822-3, AS5195-0302	STL	3/16-inch
-664	AN822-4, MS20822-4, AS5195-0402	STL	1/4-inch
-665	AN822-5, MS20822-5, AS5195-0502	STL	5/16-inch
-666	AN822-6, MS20822-6, AS5195-0604	STL	3/8-inch
-668	AN822-8, MS20822-8, AS5195-0806	STL	1/2-inch
-670	AN822-10, MS20822-10, AS5195-1008	STL	5/8-inch



23-36 A880 Flared Tube Components (continued)

E. Elbows – 45°, NPT to Flare

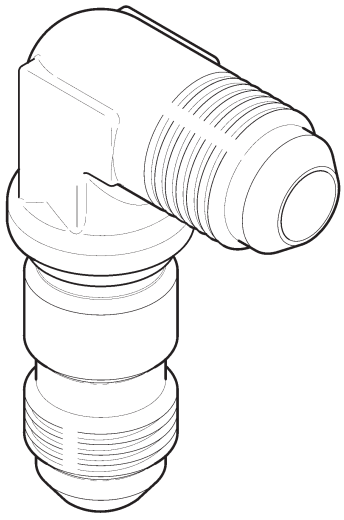
Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-702	AN823-2D, MS20823-2D, AS5196W0202	AL	1/8-inch
-703	AN823-3D, MS20823-3D, AS5196W0302	AL	3/16-inch
-704	AN823-4D, MS20823-4D, AS5196W0402	AL	1/4-inch
-705	AN823-5D, MS20823-5D, AS5196W0502	AL	5/16-inch
-706	AN823-6D, MS20823-6D, AS5196W0604	AL	3/8-inch
-708	AN823-8D, MS20823-8D, AS5196W0806	AL	1/2-inch
-710	AN823-10D, MS20823-10D, AS5196W1008	AL	5/8-inch
-732	AN823-2J, MS20823-2J, AS5196J0202	CRES	1/8-inch
-733	AN823-3J, MS20823-3J, AS5196J0302	CRES	3/16-inch
-734	AN823-4J, MS20823-4J, AS5196J0402	CRES	1/4-inch
-735	AN823-5J, MS20823-5J, AS5196J0502	CRES	5/16-inch
-736	AN823-6J, MS20823-6J, AS5196J0604	CRES	3/8-inch
-738	AN823-8J, MS20823-8J, AS5196J0806	CRES	1/2-inch
-740	AN823-10J, MS20823-10J, AS5196J1008	CRES	5/8-inch
-762	AN823-2, MS20823-2, AS5196-0202	STL	1/8-inch
-763	AN823-3, MS20823-3, AS5196-0302	STL	3/16-inch
-764	AN823-4, MS20823-4, AS5196-0402	STL	1/4-inch
-765	AN823-5, MS20823-5, AS5196-0502	STL	5/16-inch
-766	AN823-6, MS20823-6, AS5196-0604	STL	3/8-inch
-768	AN823-8, MS20823-8, AS5196-0806	STL	1/2-inch
-770	AN823-10, MS20823-10, AS5196-1008	STL	5/8-inch



23-36 A880 Flared Tube Components (continued)

F. Elbows – 90°, Bulkhead Flare to Flare

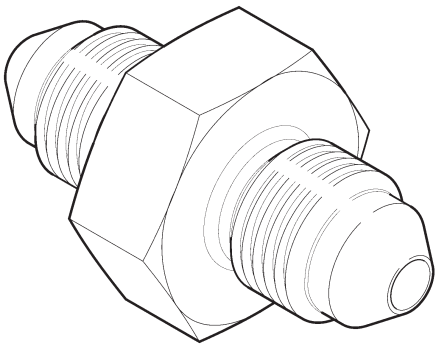
Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-802	AN833-2D, AS1038D0202, AS1038W0202	AL	1/8-inch
-803	AN833-3D, AS1038D0303, AS1038W0303	AL	3/16-inch
-804	AN833-4D, AS1038D0404, AS1038W0404	AL	1/4-inch
-805	AN833-5D, AS1038D0505, AS1038W0505	AL	5/16-inch
-806	AN833-6D, AS1038D0606, AS1038W0606	AL	3/8-inch
-808	AN833-8D, AS1038D0808, AS1038W0808	AL	1/2-inch
-810	AN833-10D, AS1038D1010, AS1038W1010	AL	5/8-inch
-832	AN833-2J, AS1038J0202	CRES	1/8-inch
-833	AN833-3J, AS1038J0303	CRES	3/16-inch
-834	AN833-4J, AS1038J0404	CRES	1/4-inch
-835	AN833-5J, AS1038J0505	CRES	5/16-inch
-836	AN833-6J, AS1038J0606	CRES	3/8-inch
-838	AN833-8J, AS1038J0808	CRES	1/2-inch
-840	AN833-10J, AS1038J1010	CRES	5/8-inch
-862	AN833-2, AS1038-0202	STL	1/8-inch
-863	AN833-3, AS1038-0303	STL	3/16-inch
-864	AN833-4, AS1038-0404	STL	1/4-inch
-865	AN833-5, AS1038-0505	STL	5/16-inch
-866	AN833-6, AS1038-0606	STL	3/8-inch
-868	AN833-8, AS1038-0808	STL	1/2-inch
-870	AN833-10, AS1038-1010	STL	5/8-inch



23-36 A880 Flared Tube Components (continued)

G. Unions – Flare to Flare

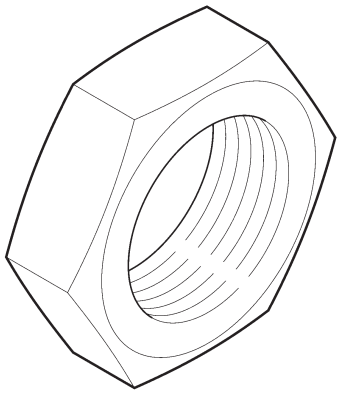
Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-902	AN815-2D, AS5174D0202, AS5174W0202	AL	1/8-inch
-903	AN815-3D, AS5174D0303, AS5174W0303	AL	3/16-inch
-904	AN815-4D, AS5174D0404, AS5174W0404	AL	1/4-inch
-905	AN815-5D, AS5174D0505, AS5174W0505	AL	5/16-inch
-906	AN815-6D, AS5174D0606, AS5174W0606	AL	3/8-inch
-908	AN815-8D, AS5174D0808, AS5174W0808	AL	1/2-inch
-910	AN815-10D, AS5174D1010, AS5174W1010	AL	5/8-inch
-932	AN815-2J, AS5174J0202	CRES	1/8-inch
-933	AN815-3J, AS5174J0303	CRES	3/16-inch
-934	AN815-4J, AS5174J0404	CRES	1/4-inch
-935	AN815-5J, AS5174J0505	CRES	5/16-inch
-936	AN815-6J, AS5174J0606	CRES	3/8-inch
-938	AN815-8J, AS5174J0808	CRES	1/2-inch
-940	AN815-10J, AS5174J1010	CRES	5/8-inch
-962	AN815-2, AS5174-0202	STL	1/8-inch
-963	AN815-3, AS5174-0303	STL	3/16-inch
-964	AN815-4, AS5174-0404	STL	1/4-inch
-965	AN815-5, AS5174-0505	STL	5/16-inch
-966	AN815-6, AS5174-0606	STL	3/8-inch
-968	AN815-8, AS5174-0808	STL	1/2-inch
-970	AN815-10, AS5174-1010	STL	5/8-inch



23-36 A880 Flared Tube Components (continued)

H. Nuts – Hex

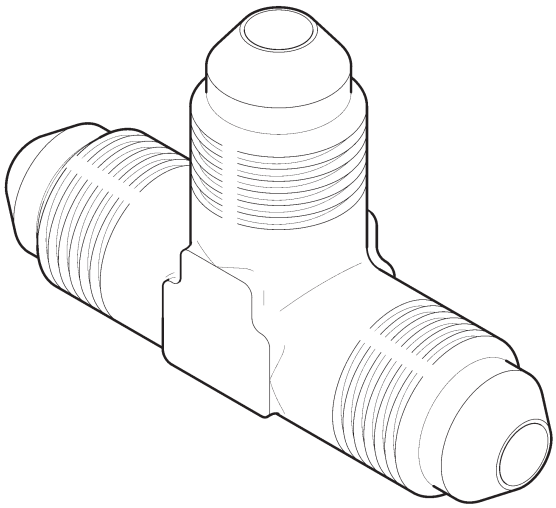
Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-1002	AN924-2D, AN924-2W, AS5178W02	AL	1/8-inch
-1003	AN924-3D, AN924-3W, AS5178W03	AL	3/16-inch
-1004	AN924-4D, AN924-4W, AS5178W04	AL	1/4-inch
-1005	AN924-5D, AN924-5W, AS5178W05	AL	5/16-inch
-1006	AN924-6D, AN924-6W, AS5178W06	AL	3/8-inch
-1008	AN924-8D, AN924-8W, AS5178W08	AL	1/2-inch
-1010	AN924-10D, AN924-10W, AS5178W10	AL	5/8-inch
-1032	AN924-2J, AS5178J02	CRES	1/8-inch
-1033	AN924-3J, AS5178J03	CRES	3/16-inch
-1034	AN924-4J, AS5178J04	CRES	1/4-inch
-1035	AN924-5J, AS5178J05	CRES	5/16-inch
-1036	AN924-6J, AS5178J06	CRES	3/8-inch
-1038	AN924-8J, AS5178J08	CRES	1/2-inch
-1040	AN924-10J, AS5178J10	CRES	5/8-inch
-1062	AN924-2, AS5178-02	STL	1/8-inch
-1063	AN924-3, AS5178-03	STL	3/16-inch
-1064	AN924-4, AS5178-04	STL	1/4-inch
-1065	AN924-5, AS5178-05	STL	5/16-inch
-1066	AN924-6, AS5178-06	STL	3/8-inch
-1068	AN924-8, AS5178-08	STL	1/2-inch
-1070	AN924-10, AS5178-10	STL	5/8-inch



23-36 A880 Flared Tube Components (continued)

I. Tees – NPT to Flare

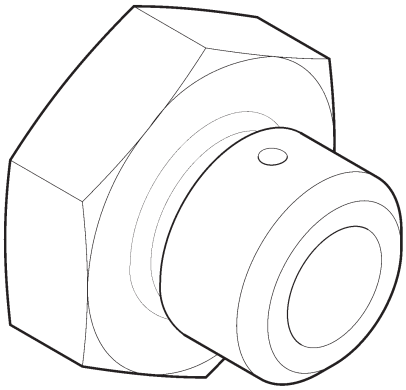
Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-1102	AN826-2D, MS20826-2D, AS5198W020202	AL	1/8-inch
-1103	AN826-3D, MS20826-3D, AS5198W030203	AL	3/16-inch
-1104	AN826-4D, MS20826-4D, AS5198W040204	AL	1/4-inch
-1105	AN826-5D, MS20826-5D, AS5198W050205	AL	5/16-inch
-1106	AN826-6D, MS20826-6D, AS5198W060406	AL	3/8-inch
-1108	AN826-8D, MS20826-8D, AS5198W080608	AL	1/2-inch
-1110	AN826-10D, MS20826-10D, AS5198W100810	AL	5/8-inch
-1132	AN826-2J, MS20826-2J, AS5198J020202	CRES	1/8-inch
-1133	AN826-3J, MS20826-3J, AS5198J030203	CRES	3/16-inch
-1134	AN826-4J, MS20826-4J, AS5198J040204	CRES	1/4-inch
-1135	AN826-5J, MS20826-5J, AS5198J050205	CRES	5/16-inch
-1136	AN826-6J, MS20826-6J, AS5198J060406	CRES	3/8-inch
-1138	AN826-8J, MS20826-8J, AS5198J080608	CRES	1/2-inch
-1140	AN826-10J, MS20826-10J, AS5198J100810	CRES	5/8-inch
-1162	AN826-2, MS20826-2, AS5198-020202	STL	1/8-inch
-1163	AN826-3, MS20826-3, AS5198-030203	STL	3/16-inch
-1164	AN826-4, MS20826-4, AS5198-040204	STL	1/4-inch
-1165	AN826-5, MS20826-5, AS5198-050205	STL	5/16-inch
-1166	AN826-6, MS20826-6, AS5198-060406	STL	3/8-inch
-1168	AN826-8, MS20826-8, AS5198-080608	STL	1/2-inch
-1170	AN826-10, MS20826-10, AS5198-100810	STL	5/8-inch



23-36 A880 Flared Tube Components (continued)

J. Plugs without Holes

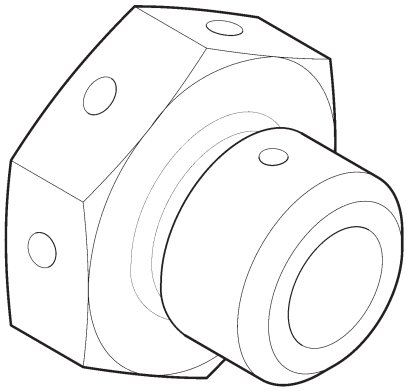
Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-1202	AN814-2D, AN814-2W, AS5169D02, AS5169W02	AL	1/8-inch
-1203	AN814-3D, AN814-3W, AS5169D03, AS5169W03	AL	3/16-inch
-1204	AN814-4D, AN814-4W, AS5169D04, AS5169W04	AL	1/4-inch
-1205	AN814-5D, AN814-5W, AS5169D05, AS5169W05	AL	5/16-inch
-1206	AN814-6D, AN814-6W, AS5169D06, AS5169W06	AL	3/8-inch
-1208	AN814-8D, AN814-8W, AS5169D08, AS5169W08	AL	1/2-inch
-1210	AN814-10D, AN814-10W, AS5169D10, AS5169W10	AL	5/8-inch
-1232	AN814-2J, AS5169J02	CRES	1/8-inch
-1233	AN814-3J, AS5169J03	CRES	3/16-inch
-1234	AN814-4J, AS5169J04	CRES	1/4-inch
-1235	AN814-5J, AS5169J05	CRES	5/16-inch
-1236	AN814-6J, AS5169J06	CRES	3/8-inch
-1238	AN814-8J, AS5169J08	CRES	1/2-inch
-1240	AN814-10J, AS5169J10	CRES	5/8-inch
-1262	AN814-2, AS5169-02	STL	1/8-inch
-1263	AN814-3, AS5169-03	STL	3/16-inch
-1264	AN814-4, AS5169-04	STL	1/4-inch
-1265	AN814-5, AS5169-05	STL	5/16-inch
-1266	AN814-6, AS5169-06	STL	3/8-inch
-1268	AN814-8, AS5169-08	STL	1/2-inch
-1270	AN814-10, AS5169-10	STL	5/8-inch



23-36 A880 Flared Tube Components (continued)

K. Plugs with Holes

Dash Numbers	Allowable Part Numbers	Material REF	Tube OD REF
-1302	AN814-2DL, AN814-2WL, AS5169D02L, AS5169W02L	AL	1/8-inch
-1303	AN814-3DL, AN814-3WL, AS5169D03L, AS5169W03L	AL	3/16-inch
-1304	AN814-4DL, AN814-4 WL, AS5169D04L, AS5169W04L	AL	1/4-inch
-1305	AN814-5DL, AN814-5WL, AS5169D05L, AS5169W05L	AL	5/16-inch
-1306	AN814-6DL, AN814-6WL, AS5169D06L, AS5169W06L	AL	3/8-inch
-1308	AN814-8DL, AN814-8WL, AS5169D08L, AS5169W08L	AL	1/2-inch
-1310	AN814-10DL, AN814-10WL, AS5169D10L, AS5169W10L	AL	5/8-inch
-1332	AN814-2JL, AS5169J02L	CRES	1/8-inch
-1333	AN814-3JL, AS5169J03L	CRES	3/16-inch
-1334	AN814-4JL, AS5169J04L	CRES	1/4-inch
-1335	AN814-5JL, AS5169J0SL	CRES	5/16-inch
-1336	AN814-6JL, AS5169J06L	CRES	3/8-inch
-1338	AN814-8JL, AS5169J0BL	CRES	1/2-inch
-1340	AN814-10JL, AS5169J10L	CRES	5/8-inch
-1362	AN814-2L, AS5169-02L	STL	1/8-inch
-1363	AN814-3L, AS5169-03L	STL	3/16-inch
-1364	AN814-4L, AS5169-04L	STL	1/4-inch
-1365	AN814-5L, AS5169-05L	STL	5/16-inch
-1366	AN814-6L, AS5169-06L	STL	3/8-inch
-1368	AN814-8L, AS5169-08L	STL	1/2-inch
-1370	AN814-10L, AS5169-10L	STL	5/8-inch



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23-40 Non-Destructive Testing

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.

23-41 Magnetic Particle Inspection

Ferromagnetic steel parts are inspected for structural defects using magnetic particle inspection. Steel parts covered by this specification are inspected per ASTM E1444 wet continuous process with ultra-violet light. Applicable requirements and limitations of the above standard apply.

Procedures and equipment used to perform the inspection shall conform to requirements of ASTM E1444. A magneto test penetrameter or a 30–60 gauss meter is used to verify the direction and effectiveness of all magnetic fields produced. Whenever possible, parts shall be inspected with both circular and longitudinal magnetization, but at least in two directions at right angles to each other. Minimum duration of application is ½ second.

Pre- and post-solvent clean parts using PCBTF or similar solvent. Demagnetizing is accomplished using AC ± 3 oersteds maximum. Verify part is demagnetized using a magnetic field strength indicator which does not exceed an absolute value above three gauss.

Area of part to be examined, position of part, directions of magnetization to be used and method of establishing the magnetization are presented within the inspection section of individual parts. Record the size and location of all rejectable indications.

A. Inspection Criteria

Parts (except gears) which are inspected by magnetic particle inspection shall be accepted or rejected according to the following criteria:

Acceptable indications:

- Indications smaller than 0.015 inch are not considered rateable.
- Indications caused by sharp changes in cross-section or part geometry.

Rejectable indications:

- Indications interpreted as cracks, seams, laps, shuts, or any flaws which are open to the surface.
- Indications oriented at an angle of more than 15 degrees from the longitudinal axis with length exceeding 0.125 inch.
- Circumferential indications on any shoulder or fillet (changes in diameter).
- Any indications which break over an edge, shoulder, fillet radius, keyway, spline, or an adjacent area of part more than 0.015 inch.
- Indications caused by undercuts at the toe of a weld.
- Indications caused by cracks in the weld or parent metal.
- Indications caused by inclusions in weld material exceeding 0.1 inch in length.

23-42 Fluorescent Penetrant Inspection

This specification provides for surface inspection of parts fabricated from nonmagnetic materials to detect discontinuities open to the surface, such as cracks, cold shuts, laps, porosity and other surface defects.

Applicable requirements and limitations of ASTM E1417 shall apply. After inspection is complete, solvent clean parts.

The step-by-step procedure and equipment used to perform the inspection shall be accomplished per ASTM E1417.

A. Inspection Criteria

Parts inspected by fluorescent penetrant method shall be accepted or rejected on basis of acceptance limits specified. If acceptance limits are not specified, rejectable surface defects and any of the following:

- Cracks
- Seams
- Cold shuts or laps
- Surface inclusions
- In castings, aligned discontinuous surface indications other than cracks, cold shuts and inclusions are rejectable if more than 3/8 inch in length.

23-50 Corrosion Control

[Reserved].

23-60 Priming and Painting

This specification outlines preparation and application requirements for primers and topcoat. Primers provide corrosion protection and a final finish or a base for topcoat. Use only approved materials listed in § 23-70.

Do not prime or paint with a topcoat finish the following areas (unless directed):

- Sliding friction joints.
- Stainless steel parts.
- Swivel joints and adjustable rod ends.
- Plastic, rubber, electrical components and wires or similar materials.
- Bolted joints where torque is a specific requirement for clamping action.
- Bearing press fit or close tolerance slip fit joints (except where wet chromate primer is part of the assembly procedure).

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. Priming

1. Cleaning

   a. Alkaline clean is the preferred method for cleaning aluminum and stainless steel except where immersion is not practical. Do not immerse assembled components.

   b. Do not alkaline clean steel as it may cause a corrosive reaction. Clean steel using QSOL 220 or equivalent solvent.

   c. Extremely greasy or dirty parts may be pre-cleaned in a solvent vapor bath or hand wiped with QSOL 220 or equivalent solvent.

   d. Air dry. Do not touch cleaned parts with bare hands.

2. Surface Preparation

   Unless otherwise specified, chemical conversion coating is the standard treatment before priming aluminum. However, if bare or clad aluminum is primed without conversion coating, the following procedure must be used:

   a. Alkaline clean if immersion is practical, otherwise wipe clean with QSOL 220 or equivalent degreasing agent.

   b. Lightly scuff the surface with Scotch-Brite pads.

   c. Wipe with a tack rag to remove any foreign material or damp wipe with QSOL 220 or equivalent solvent.

   d. Air dry. Do not touch parts with bare hands.

23-60 Priming and Painting (continued)

A. Priming (continued)

3. Primer Application

Apply approved primer (chromate primer preferred; refer to § 23-75) after mixing per manufacturers recommendations. Allowable thickness of primer is 0.0005 – 0.0020 inch, per coat. For parts with internal openings, such as tubes, prime the inside as follows:

a. Thin primer to watery consistency using required reducer.

b. Pour in primer, slosh around, then drain immediately.

c. Dry parts at least six hours before using.

4. Inspection

Inspect for complete coverage and (excessive thickness) runs in paint. If primer has runs, strip part and re-prime.

NOTE

Primed areas that have been sanded to bare metal must have conversion coating (if required) and primer re-applied prior to topcoat to restore anti-corrosion properties.

B. Painting

Prior to liquid topcoat application, ensure surfaces have been cleaned and primed. In general, most parts will be cleaned and primed as detail parts. However, in some cases, such as the gearbox assembly, this is not practical and primer and topcoat are applied on the assembled component.

Previously primed surfaces, or primed surfaces that have completely cured require the following preparation before paint:

1. Lightly sand using 220-grit or finer aluminum-oxide abrasive paper.
2. Lightly scuff with Scotch-Brite pads (optional).
3. Wipe with clean cloth and QSOL 220 or equivalent solvent.
4. Wipe with tack cloth.
5. Apply topcoat.

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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

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
Cee-Bee Stripper A-292	McGean-Rohco: Cee-Bee Division Downey, CA	Metal parts, except blades and flex plates.
Plastic Media Blasting System	Pauli & Griffin Co. Vacaville, CA	Metal parts except blades and unsupported sheet metal less than 0.040 inch thick.

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	" "
3821S Low VOC Cleaner	Axalta, Wilmington, DE	" "
Final Klean 3909S	Du Pont Chemical Los Angeles, CA	" "
SP Aerospace Prep Surface Cleaner	AkzoNobel, Waukegan, IL	" "
EM-Citro*	LPS Laboratories, Inc. Tucker, GA	Remove adhesive residue on cabin and windshield.
Lacolene (Aliphatic Hydrocarbon)	Any	Windshield and plastic cleaning.
Plexus®	B.T.I. Chemical Co. Oak Park, CA	" "
Presolve	LPS Laboratories, Inc. Tucker, GA	Hydraulic components only.
Tetrachloroethylene (Perchloroethylene)	Any	Vapor degreaser.

23-72 Solvents and Cleaners (continued)

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
815 GD	Brulin Corporation Indianapolis, IN	Ultrasonic cleaning, general use.**
SF50	L&R Mfg. Co. Kearny, NJ	" "
#112 Ammoniated or #222 Nonammoniated cleaning & rinse solution	L&R Mfg. Co. Kearny, NJ	Ultrasonic cleaning, avionics components only.
Cleanup Wipe E-4365	Sontara Candler, NC	Cleaning and drying.
Snoop Liquid Leak Detector	Swagelok Solon, 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
05096 Glazing Putty 05860 Dry Guide Coat 31180 Finishing Glaze	3M St. Paul, MN	Minor surface imperfections.
SBF1191 Filler	Gearhead Products Indianapolis, IN	" "
FE-351 Cream Hardener	Catalyst Systems Gnadenhutten, OH	" "

23-74 Torque Seal

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

23-75 Primers

A. Non-chromate Primers

	Corlar 13580S*	Desoprime CA7502*	Desoprime CA7422*
Manufacturer	Axalta	PPG	PPG
Base	Corlar 13580S Epoxy Primer	CA7502A	CA7422A
Activator	Corlar 13180S Epoxy Activator	CA7502B	CA7422B
Reducer	13756S VOC-Exempt Reducer	CA7502C	CA7422C
Base: Activator: Reducer	4:1:1	4:4:1	4:4:1
Viscosity	17-21 sec in Zahn #2	15-19 sec in Zahn #2	15-19 sec in Zahn #2
Induction time	30 minutes	2 hours at 55–70°F 1 hour at 71–80°F 30 minutes > 70°F	2 hours at 55–68°F 1 hour at 69–95°F
Pot life	8 hours at 70°F	4 hours at 70°F	4 hours at 70°F
Flash off time	None	30 minutes	30 minutes
Dry time	2 hours at 70°F 1 hour at 130°F	3 hours at 70°F 30 minutes at 120°F	3 hours at 70°F 30 minutes at 120°F
Recoat window	48 hours	48 hours	48 hours

* Shelf life per manufacturer's recommendation.

B. Chromate Primers

	44GN007*	10P20-44*
Manufacturer	PPG	AkzoNobel
Base	44GN007	10P20-44
Activator	44GN007CAT	EC-265 or EC-273
Reducer	Distilled or deionized water	TR-114 or TR-102
Base: Activator: Reducer	3:1:8	3:1:1
Viscosity	18–22 seconds in Zahn #2	13–19 seconds in Zahn #2
Induction time	None	None
Pot life	4 hours at 70°F	4 hours at 77°F
Flash off time	15 minutes	30 minutes
Dry time	2 hours at 70°F 45 minutes at 120°F	30 minutes at 140°F
Recoat window	24 hours	24 hours

* Shelf life per manufacturer's recommendation.

23-76 Powder Coat

PRODUCT	MANUFACTURER
Interpon 100-AL101QF Gray Zinc Rich Epoxy Powder*	AkzoNobel Santa Fe Springs, CA
81-2158 Vitralon Gray Zinc Rich Epoxy Powder*	Pratt & Lambert Chemical Coatings Buffalo, NY
39/80020 Smooth Matte Black Polyester Topcoat Powder*	Tiger Drylac USA Cucamonga, CA
49/72460 Smooth Glossy Gray RAL 7043 Polyester Topcoat Powder*	" "
49/22460 Smooth Glossy Yellow RAL 1028 Polyester Topcoat Powder*	" "
PFWF104S9 White Polyester Topcoat Powder*	Dupont Co. Wilmington, DE

* Shelf life is 12 months from date of manufacture at ambient temperature.

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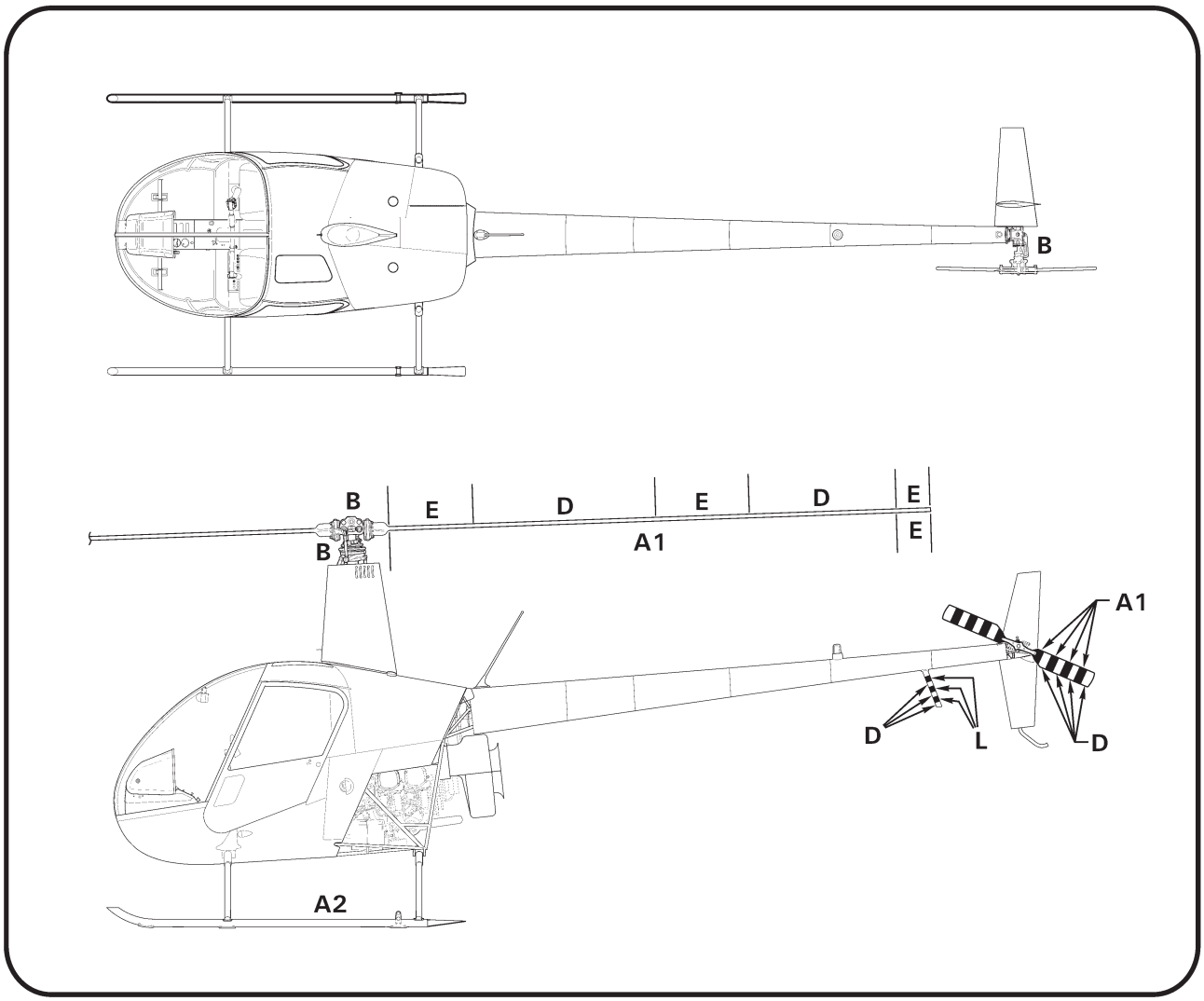

FIGURE 23-12 PAINT CODES

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

23-77 Paints

Refer to Figures 23-12 & 23-13 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	557Z7038B005	Interior, skid tube, windshield, & window trim black
	Aerofine 8250 Topcoat	Thinner: water	AkzoNobel; Waukegan, IL	A8250	

23-77 Paints (continued)

FINISH CODE	MATERIAL*	ADDITIVES	MANUFACTURER	RHC PART NO.	APPLICATION
A3	Cardinal A-2000 Flat Black	/	Cardinal; Cleveland, OH	A2000-BKE-30-903	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 grey
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	/	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 Activator D-121 Tint D-101 Tint 2100-P 2.1 Binder 9T20 Flattener	Axalta; Wilmington, DE	9T00-A D121 D101 2100-P 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-017L Slow Retarder 10-03432	Deco; Orance, CA	7509005 7508005 7501205, 7503005	Silkscreen
L	Red Imron AF400/AF700	13100S Activator 13110S Activator	Axalta; Wilmington, DE	N0759EP	Red
O	Light Gray Imron AF400/AF700	13100S Activator 13110S Activator	Axalta; Wilmington, DE	N0020	Baggage compartment
P	Silver Bullet AM Tracer Black 20-452AM-F1	16-CURE-F4 Activator	Burke; Ridgefield, WA	20-452AM-F1	R66 Middle seat
Q	ProtectaClear		Everbrite; Rancho Cordova, CA	Protecta	Optional on bare area of MR spar

* Shelf life per manufacturer's recommendation.

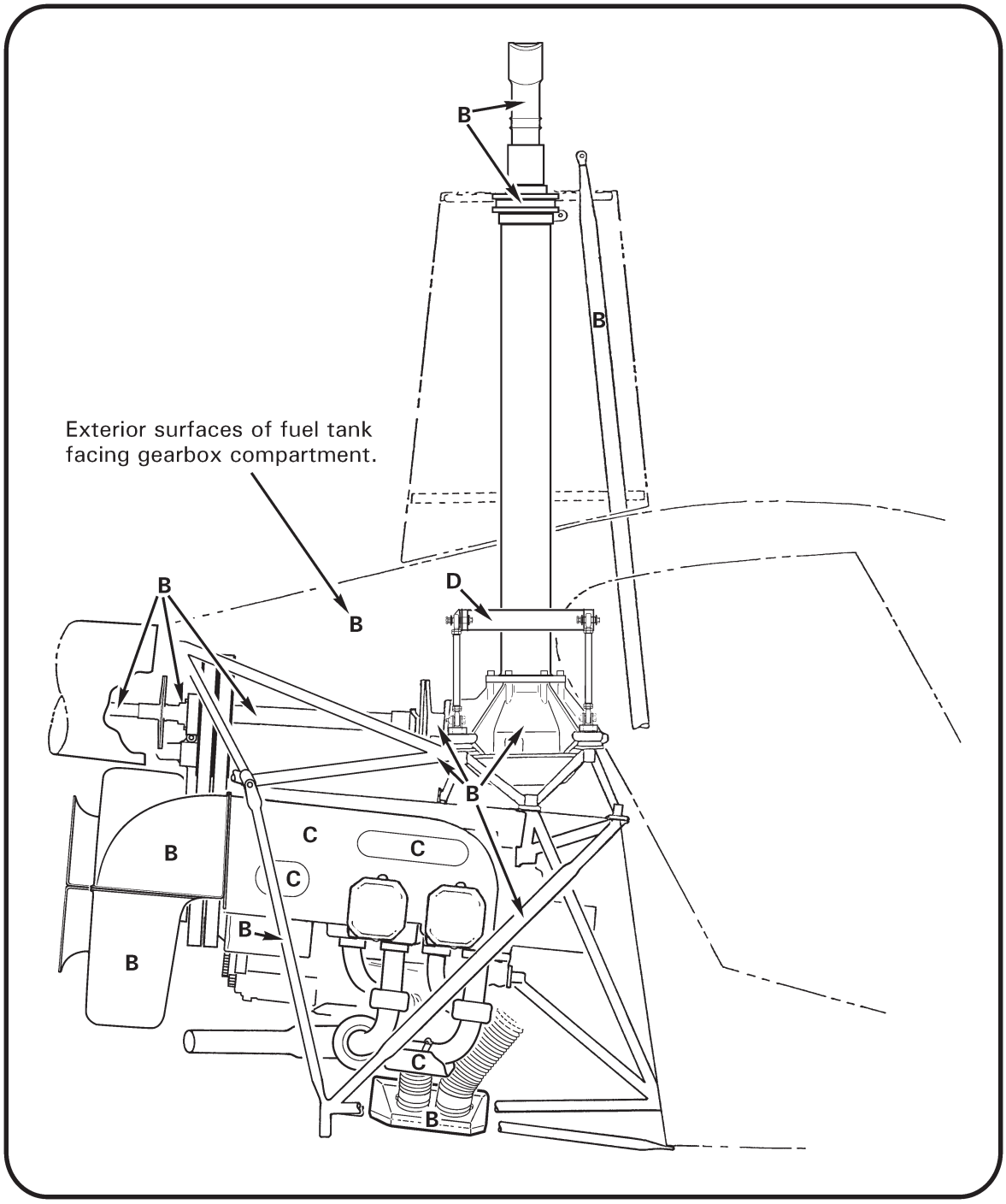

FIGURE 23-13 PAINT CODES

23-78 Lubricants

RHC PART NO.	LUBRICANT TYPE	MANUFACTURER'S PART NO.	MANUFACTURER
A257-1	Grease (general purpose)	101	Southwestern Petroleum Corp. Fort Worth, TX
A257-2	Gear oil	201 SAE 90	Southwestern Petroleum Corp. Fort Worth, TX
A257-3	Grease	Aero Shell 14 MIL-G-25537	Shell Oil Co.
A257-4	Oil (automatic transmission fluid)	Dexron II or Dexron II/Mercon or Dexron III/Mercon or Dex/Merc	Any
A257-6	Grease (fuel resistant)	Fuelube EZ Turn	Fleet Supplies Inc. Cleveland, OH United-Erie Div. of Interstate Chemical Co. Erie, PA
A257-7	Dry film lubricant	Lubri-Kote Type A 1040 CR	Mealey Ind. Lubricants Cleveland, OH
A257-8	Rubber lubricant	P-80	International Products Corp. Trenton, NJ
A257-9	Anti-seize	Silver Grade	Loctite Corp. Newington, CT
A257-10	Substitute A257-16		
A257-12	Grease	MobilGrease 28 MIL-PRF-81322	Exxon Mobil Corp., Fairfax, VA
A257-16	Engine Oil Approved for 0–90° F ambient). Substitute A257-24 as required.	SAE 20W-50, SAE J1966	Any
A257-17	Substitute A257-19		
A257-19	Valve lubricant and sealant compound	111	Dow Corning Corp. Midland, MI
A257-22	Gear oil, synthetic	Mobil SHC 629	Exxon Mobil Corp., Fairfax, VA
A257-24	Engine oil (Approved for >60°F ambient)	SAE 50, SAE J1966	Any

23-79 Adhesives and Sealants

RHC PART NO.	DESCRIPTION	COLOR	MFR. PART NO.	MANUFACTURER
B270-1	Sealant – manganese-cured, fuel resistant (2-part)	Gray	AC-730 B-*	3M Co. St. Paul, MN
B270-2	Substitute B270-1			
B270-4	Substitute B270-13			
B270-5	Sealant – synthetic rubber putty (1-part)	White Light Gray	Q4-2805 94-031	Dow Corning Corp. Midland, MI
B270-6	Sealant & lubricant – thread (1-part)	Gray	80631, 80632, 80633	Permatex, Inc. Solon, OH
			Titeseal 55	Radiator Spec. Co. Charlotte, NC
B270-7	Substitute B270-14			
B270-8	Adhesive – rubber, nitrile/acetone (1-part)	Tan	C 160	Stabond Corp. Gardena, CA
		Dark Brown	847	3M Co. St. Paul, MN
B270-9	Adhesive – epoxy, structural, flexible (2-part)	Gray	2216 B/A	3M Co. St. Paul, MN
B270-10	Adhesive/sealant – threadlocker, anaerobic, tight-fits (1-part)	Red	271	Henkel Loctite Corp. Rocky Hill, CT
B270-11	Adhesive/sealant – threadlocker, anaerobic, loose-fits (1-part)	Red	277	Henkel Loctite Corp. Rocky Hill, CT
B270-12	Sealant – electrical potting (1-part epoxy)	Gray	50-3122RGR15 (1-qt can) 50-3122RGR33 (syringe)	Epoxies Etc., Cranston, RI
B270-13	Sealant – silicone rubber, noncorrosive (1-part)	Translucent	3145	Dow Corning Corp. Midland, MI
B270-14	Substitute B270-8			
B270-15	Adhesive – plastic, for vinyl (1-part)	Clear	2262	3M Co. St. Paul, MN
B270-16	Substitute B270-14			
B270-17	Adhesive – cyanoacrylate, instant (1-part)	Clear	Super Bonder 495	Henkel Loctite Corp. Rocky Hill, CT
B270-18	Adhesive – weatherstrip (1-part)	Black	051135-08008	3M Co. St. Paul, MN
B270-19	Adhesive – epoxy structural, rigid (2-part)	Green	1838 B/A	3M Co. St. Paul, MN
B270-20	Adhesive/sealant – threadlocker, anaerobic, non-permanent (1-part)	Purple	222 or 222MS	Henkel Loctite Corp. Rocky Hill, CT

23-79 Adhesives and Sealants (continued)

RHC PART NO.	DESCRIPTION	COLOR	MFR. PART NO.	MANUFACTURER
B270-21	Protectant – corrosion, non-drying (1-part)	Amber	Max Wax	Corrosion Technologies Corp. Garland, TX
		Lt. Amber	LPS 3	LPS Laboratories, Inc. Tucker, GA
B270-22	Substitute B270-21			
	Protectant – corrosion, drying (1-part)	Amber	LPS Hardcoat	LPS Laboratories, Inc. Tucker, GA
B270-23	Sealant – gasket (1-part)	Purple	515	Henkel Loctite Corp. Rocky Hill, CT
B270-24	Activator/primer – anaerobic adhesive (1-part)	Translucent Green	7649	Henkel Loctite Corp. Rocky Hill, CT
B270-25	Clear coat – automotive touch up, brush in bottle (1-part)	Clear	Clear Coat Touch up Bottle	Automotive Touchup Harahan, LA
B270-26	Sealant – polysulfide, window glazing (2-part)	Black	AC-251 B-1	3M Co. St. Paul, MN
B270-27	Adhesive – epoxy, high strength structural, flexible (2-part)	Translucent Red Blue	EA 9309NA EA 9309.2NA	Henkel Loctite Corp. Rocky Hill, CT
B270-28	Substitute B270-27			

* Dash number for minimum hours application life may be -½, -2, -6, or -12.

23-80 Miscellaneous Practices

23-81 Part Interchangeability

Refer to R22 Illustrated Parts Catalog for part interchangeability information.

23-82 Thermal Fitting Parts

General Procedures for using heat to fit parts during assembly or evaluating parts that may have been overheated in service:

Aluminum parts must not be heated above 200º F for more than 5 minutes. Higher temperatures or longer times adversely affect strength and corrosion properties. Scrap any aluminum parts suspected of going above 325º F regardless of time at temperature.

Steel parts (bare) – Maximum temperature 300º F. Higher temperature can reduce the strength or cause temper brittleness in some alloys.

Steel parts (cadmium plated) – Maximum temperature 300º F. Higher temperatures will melt the plating and adversely affect steel strength by a process called liquid metal embrittlement.

Bearings and carburized parts such as gears, clutch shafts, and clutch housings should not be heated above 300º F. Higher temperatures will reduce the surface hardness and increase wear rates.

Always heat parts in an oven with temperature control set no greater than the maximum temperature allowed for the part.

Always attach a pyrometer and thermocouple to the smallest aluminum part in the oven. Never depend on the oven control to determine part temperature.

Cooling a part for thermal fitting at assembly is not recommended. Water vapor from the air will condense on the part and frequently introduce water into the assembly causing severe internal corrosion over time.

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 23-14.

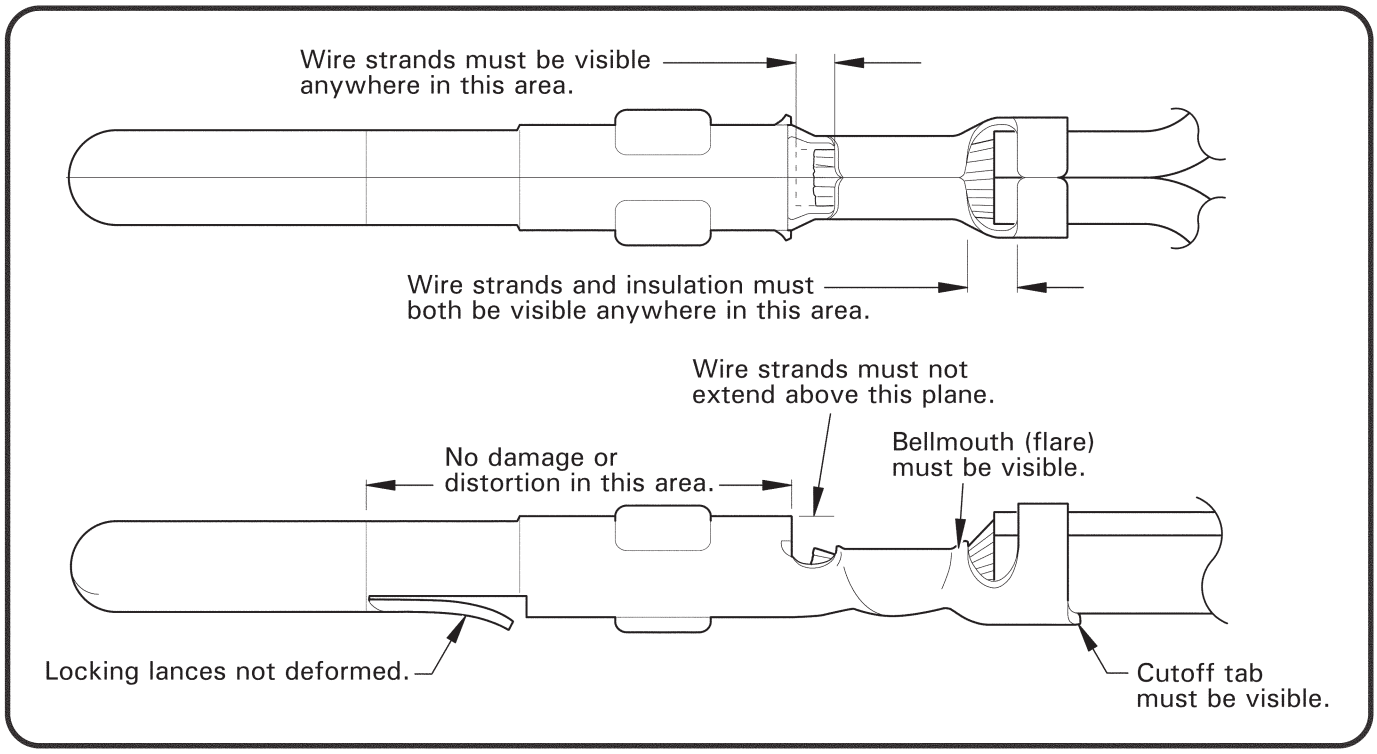

FIGURE 23-14 CRIMP INSPECTION

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 85º F (30º 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

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.

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

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

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

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

NOTE

B526 screws are compatible with T20 or 20IP drivers.

CHAPTER 25

DOORS AND WINDOWS

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CHAPTER 25

DOORS AND WINDOWS

25-00 Description

Both cabin doors may be removed and installed by maintenance personnel or pilots.

Two windshield halves are retained in aluminum frames and an aluminum tubular bow oriented vertically along the helicopter's centerline. A standard (acrylic) windshield installation and an impact-resistant (polycarbonate) windshield installation are available. Refer to § 25-20 for detailed description.

25-10 Door Assembly

A. Cleaning

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

B. Removal

Remove cotter pins from door hinge pins. Open door and lift door pins from door frame hinge assemblies and remove door. Adjust weight and balance per R22 Pilot's Operating Handbook Section 6.

C. Installation

WARNING

Failure to install a cotter pin in each door's two hinge pins may allow door to depart aircraft in flight.

1. Align and insert door hinge pins in door frame hinge assemblies; latch door.
2. Install a cotter pin in both upper and lower door hinge pins.
3. Adjust weight and balance per R22 Pilot's Operating Handbook Section 6.

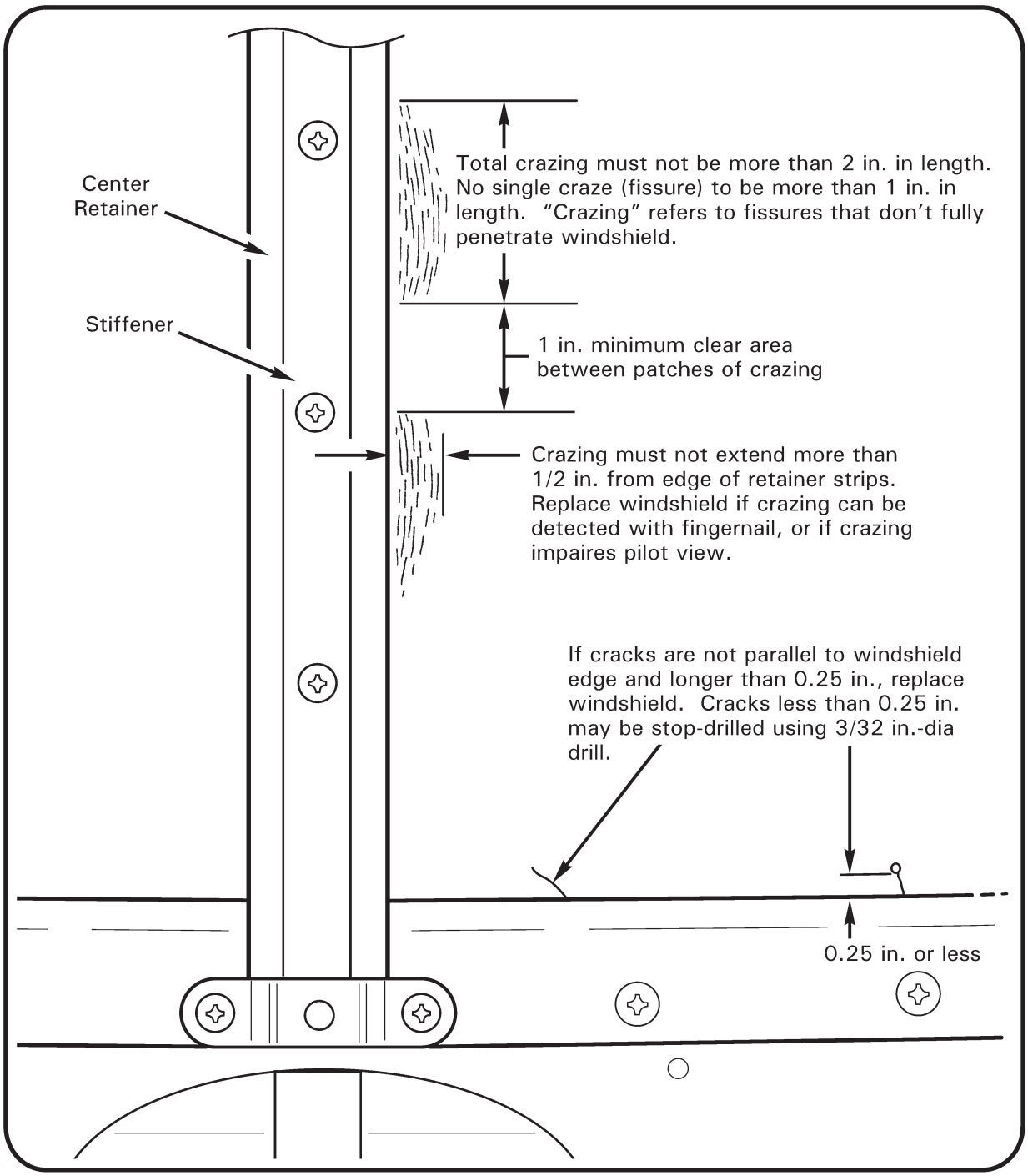

FIGURE 25-1 WINDSHIELD INSPECTION (ACRYLIC WINDSHIELD SHOWN)

25-20 Windshield Installation

25-21 Standard (Acrylic) Windshield Installation

A. Description

Acrylic windshields are sandwiched between thin aluminum retainers that are screwed to the door and windshield frames. An adhesive/sealant is applied between the retainers and the windshields for security and weatherproofing.

B. Cleaning

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

C. Inspection

Inspect both windshields for cracks and crazing adjacent to retainers per Figure 25-1. If cracks exceed these limits, replace damaged windshield per § 25-21 Part F.

Minor defects or imperfections that do not impair pilot visibility or indicate impending structural failure are acceptable.

D. Removal

1. Remove door assembly per § 25-10 Part B. Remove hardware securing A228-1 (upper) hinge assembly to door frame and remove hinge.

> NOTE
>
> If windshield is to be reinstalled, prior to removal, tape protective paper or film to the inside and outside of the windshield to prevent damage.

2. Remove hardware securing A238-17 or A238-18 (side) retainer to door frame and remove retainer.
3. Install upper hinge assembly, and install door assemblies for cabin structure support with windshield removed.
4. Support windshield. With a second person inside cabin to remove nuts, latch doors. Remove hardware securing A238-16 (upper) retainer, B409-5 gusset, D805-3 restraint (if installed), B409-7 (lower) retainers, B295-1 clip with trim string, B410-3 stiffener, and B410-1 (center) retainer to cabin and remove parts. Remove windshield.
5. Remove sealant from cabin and parts.
6. If windshield is to be reinstalled, remove sealant from windshield.
7. Repeat steps to remove opposite-side windshield, as required.

25-21 Standard (Acrylic) Windshield Installation (continued)

E. Installation

NOTE
Prior to installation, if not previously accomplished, tape protective paper or film to the inside and outside of the windshield to prevent damage.

1. Verify sealant has been removed from cabin, parts, and windshield.
2. Position windshield on helicopter and cleco retainers to frames.
3. Attach 1/2″-wide masking tape to windshield along edge of retainers to catch sealant squeeze-out during retainer installation.
4. Remove A238-17 or A238-18 (side) retainer and install A228-1 (upper) door hinge assembly. Install door assemblies for cabin structure support during windshield installation.
5. Remove B410-1 (center) retainer. Run a bead of B270-26 sealant along entire edge of tape line. Install hardware securing center retainer, B410-3 stiffener, and B295-1 clip with trim string to cabin. Special torque screws per § 23-33. Remove tape and wipe off excess sealant with cheesecloth wet with lacolene.
6. Remove B409-7 (lower) retainers. Run a bead of B270-26 sealant along entire edge of tape line. With a second person inside cabin to tighten nuts, latch doors. Install hardware securing lower retainers to cabin. Remove tape and wipe off excess sealant with cheesecloth wet with lacolene.
7. Remove A238-16 (upper) retainer. Run a bead of B270-26 sealant along entire edge of tape line. With a second person inside cabin to tighten nuts, latch forward doors. Install hardware securing upper retainer and B409-5 gusset to cabin. Remove tape and wipe off excess sealant with cheesecloth wet with lacolene.
8. Remove door and hinge assembly. Run a bead of B270-26 sealant along entire edge of tape line. Install hardware securing side retainer and D805-3 restraint (if installed) to cabin. Remove tape and wipe off excess sealant with cheesecloth wet with lacolene.
9. Reinstall hinge assembly, and install door assembly per § 25-10 Part C.
10. Ensure all fasteners are tight. Wipe off excess sealant with cheesecloth wet with lacolene.
11. Allow sealant to dry according to manufacturer’s instruction.
12. Remove protective paper or film from inside and outside of the windshield.
13. Repeat steps to install opposite-side windshield, as required.

25-21 Standard (Acrylic) Windshield Installation (continued)

F. Replacement

NOTE

Prior to installation, if not previously accomplished, tape protective paper or film to the inside and outside of the windshield to prevent damage.

1. Verify sealant has been removed from cabin and parts.
2. Cleco retainers to frames, checking for proper alignment. Remove retainers, except A238-17 or A238-18 (side) retainer.
3. Install A228-1 (upper) door hinge assembly, and install door assemblies for cabin structure support during windshield installation.
4. Lay out masking tape on frames to identify location for windshield edge (estimate edge where side retainer is clecoed to frame). Hold oversized windshield in place by hand and verify it overlaps masking tape on all frames and retainer. When satisfied with alignment, lay out masking tape on windshield for trimming.

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.

5. A band saw with a blade containing at least 24 teeth per inch is recommended for initial trimming. Tape cardboard to band saw table to prevent scratching of windshield. Trim windshield carefully to prevent binding of saw blade and cracking windshield. Finish initial cut using an orbital sander, as required.
6. Hold windshield in place and check for fit. Re-trim as necessary.
7. After windshield is fitted, use sanding block with 100-grit paper to smooth edges. Finish edge and bevel corners using a triangular machinist's scraping tool. Verify all edges are clean and free of notches.
8. Remove trimming debris from windshield and cabin.
9. Install windshield per § 25-21 Part E.

25-22 Impact-Resistant (Polycarbonate) Windshield Installation

A. Description

The polycarbonate windshield installation is similar to the acrylic windshield installation, but the windshields fasten to the door and windshield frames via small stainless steel straps.

While polycarbonate has superior strength and flexibility properties when compared with acrylic, it is also more susceptible to ultraviolet (UV) degradation, and has a low scratch resistance. A hardcoat is applied during manufacturing to protect against UV damage and scratching, however, further effort must be made by the operator to maximize windshield service life. Follow instructions closely to avoid scratching windshield during cleaning (refer to § 23-10 Part B). Exposure to incompatible cleaning agents or solvents can result in embrittlement or crazing. Use a cabin cover when parking helicopter outdoors, or store helicopter in hanger when possible.

B. Cleaning

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

C. Inspection

Inspect both windshields for cracks and crazing adjacent to retainers per Figure 25-1. Also inspect areas adjacent to fasteners and stainless steel straps for cracks and crazing. If cracks exceed these limits, replace damaged windshield per § 25-21 Part F.

Inspect windshields for any significant discoloration or cloudiness. Minor defects or imperfections that do not impair pilot visibility or indicate impending structural failure are acceptable.

Touch up perimeter paint using flat black (refer to § 23-77).

D. Removal

1. Perform § 25-21 Part D steps 1 thru 3.
2. Support windshield. With a second person inside cabin to remove nuts and washers, latch doors. Remove hardware securing G367 ties and straps to windshield near center bow (all other hardware installed in windshield may remain in place during windshield removal).
3. Remove hardware securing A238-16 (upper) retainer, B409-5 gusset, D805-3 restraint (if installed), B409-7 (lower) retainers, B295-1 clip with trim string, B410-3 stiffener, and B410-1 retainer to cabin and remove parts. Remove windshield.
4. Remove sealant from cabin and parts.
5. If windshield is to be reinstalled, remove sealant from windshield but leave hardware and G367 ties, straps, pads, and tabs installed. If replacing windshield, remove hardware and G367 ties, straps, pads, and tabs, as required.
6. Repeat steps to remove opposite-side windshield, as required.

25-22 Impact-Resistant (Polycarbonate) Windshield Installation (continued)

E. Installation

NOTE

Prior to installation, if not previously accomplished, tape protective paper or film to the inside and outside of the windshield to prevent damage.

NOTE

Inspect condition of G367 ties, straps, pads, and tabs to be installed. Verify no obvious damage, deformation, or stretching. If windshield is being replaced due to bird strike or other impact which could deform ties, straps, pads, or tabs, replacement of these items is recommended.

NOTE

Refer to R22 Illustrated Parts Catalog Chapter 52. Note location of G367 ties, straps, pads, and tabs on work table or by marking on tape at fasteners to facilitate installation.

1. Verify sealant has been removed from cabin, parts, and windshield.
2. Position windshield on helicopter and cleco G367 ties, straps, tabs, and retainers to frames. Also, cleco G367 ties, straps, and tabs to windshield at center bow, if drilled.
3. Install A228-1 (upper) door hinge assembly. Install forward door assemblies for cabin structure support during windshield installation.
4. If windshield is drilled and has hardware, G367 ties, straps, pads, and tabs installed:
   a. With a second person inside cabin to tighten nuts, latch forward doors. Remove clecoes and install hardware securing G367 ties and straps to windshield at center bow; special torque screws per § 23-33.
   b. Attach 1/2″-wide masking tape to windshield along edge of retainers to catch sealant squeeze-out during retainer installation.
   c. Remove B410-1 (center) retainer. Run a bead of B270-26 sealant along entire edge of tape line. Install hardware securing center retainer, B410-3 stiffener, and B295-1 clip with trim string to cabin; special torque screws per § 23-33. Remove tape and wipe off excess sealant with cheesecloth wet with lacolene.
   d. Perform § 25-21 Part E steps 6 thru 13.

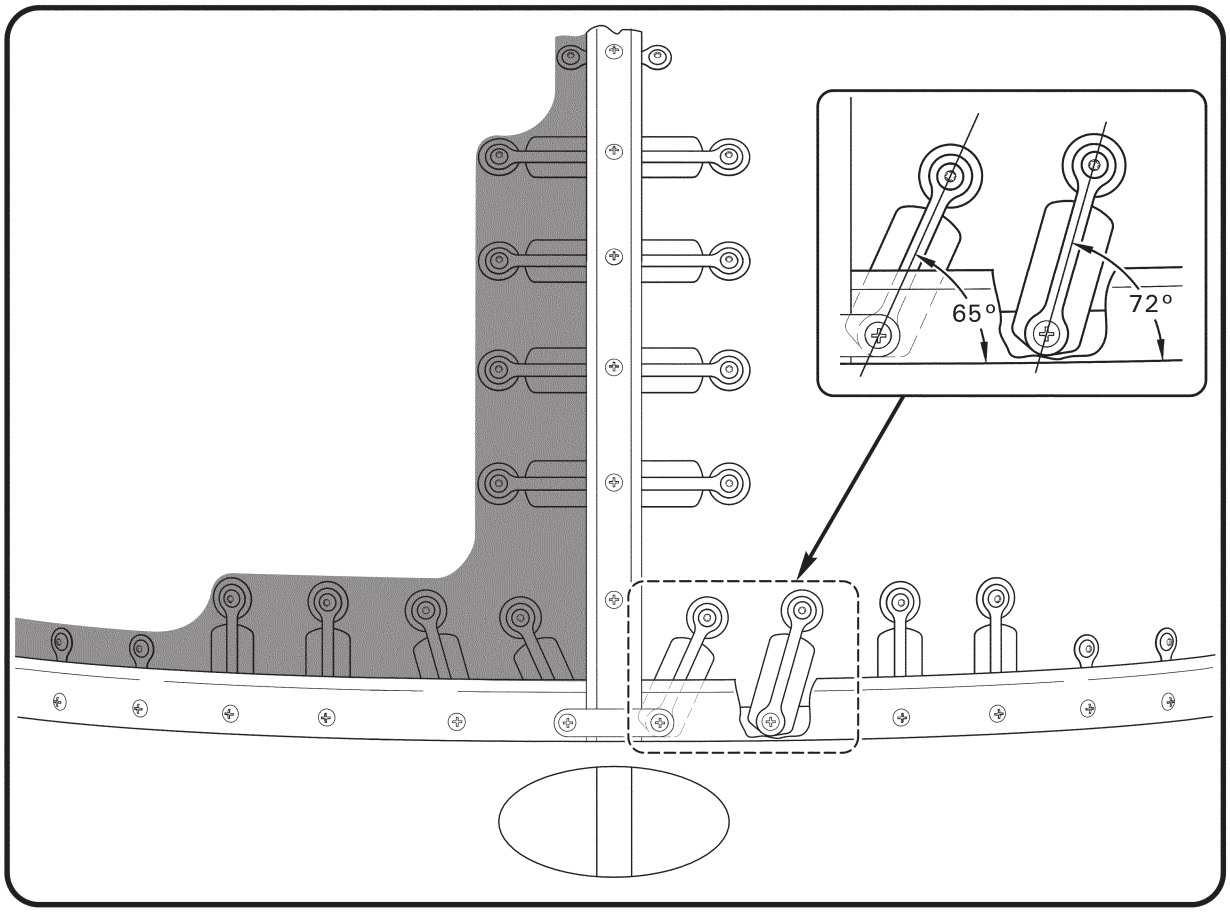

FIGURE 25-2 G367 TIES AND STRAPS INSTALLATION

25-22 Impact-Resistant (Polycarbonate) Windshield Installation (continued)

E. Installation (continued)

5. Refer to Figure 25-2. Align G367 ties and straps perpendicular to retainers within 2°, except at locations shown. Install B410-3 stiffener and special torque screws per § 23-33. Match drill #40 pilot holes through windshield and install clecos.
6. At center bow:
   a. Remove B410-3 stiffener and B410-1 (center) retainer. Remove G367 ties and straps and expand pilot holes to 0.169–0.175 inch diameter holes thru windshield. Finish holes with reamer; deburr back side of holes using plastic razor. Clean up debris.
   b. Apply B270-26 sealant to G367 tabs and pads and position on windshield. Run a bead of B270-26 sealant along entire edge of windshield. Install hardware securing center retainer, B410-3 stiffener, and B295-1 clip with trim string to cabin. Special torque screws per § 23-33.
   c. With a second person inside cabin to tighten nuts, latch doors and install hardware securing G367 ties and straps to windshield; special torque screws per § 23-33. Wipe off excess sealant with cheesecloth wet with lacolene.

25-22 Impact-Resistant (Polycarbonate) Windshield Installation (continued)

E. Installation (continued)

7. At lower retainers:

   a. Remove B409-7 (lower) retainers. Remove G367 straps and expand pilot holes to 0.169–0.175 inch diameter holes thru windshield. Finish holes with reamer; deburr back side of holes using plastic razor. Clean up debris.

   b. Apply B270-26 sealant to G367-12 tabs and position on windshield. Run a bead of B270-26 sealant along entire edge of windshield. With a second person inside cabin to tighten nuts, latch doors, and install hardware securing lower retainers to cabin. Install hardware securing G367 straps to windshield; special torque screws per § 23-33. Wipe off excess sealant with cheesecloth wet with lacolene.

8. At upper retainer:

   a. Remove A238-16 (upper) retainer. Remove G367 straps and expand pilot holes to 0.169–0.175 inch diameter holes thru windshield. Finish holes with reamer; deburr back side of holes using plastic razor. Clean up debris.

   b. Run a bead of B270-26 sealant along entire edge of windshield. With a second person inside cabin to tighten nuts, latch forward doors, and install hardware securing upper retainer and B409-5 gusset to cabin. Install hardware securing G367 straps and ties to windshield; special torque screws per § 23-33. Wipe off excess sealant with cheesecloth wet with lacolene.

9. At door frame:

   a. Remove door and hinge assembly. Remove G367 straps and expand pilot holes to 0.169–0.175 inch diameter holes thru windshield. Finish holes with reamer; deburr back side of holes using plastic razor. Clean up debris.

   b. Run a bead of B270-26 sealant along entire edge of windshield. Install hardware securing side retainer and D805-3 restraint to cabin. Install hardware securing G367 straps and ties to windshield; special torque screws per § 23-33. Wipe off excess sealant with cheesecloth wet with lacolene.

10. Reinstall hinge assembly, and install door assembly per § 25-10 Part C.

11. Ensure all fasteners are tight. Wipe off excess sealant with cheesecloth wet with lacolene.

12. Allow sealant to dry according to manufacturer's instruction.

13. Remove protective paper or film from inside and outside of the windshield.

14. Repeat steps to install opposite-side windshield, as required.

25-22 Impact-Resistant (Polycarbonate) Windshield Installation (continued)

F. Replacement

1. Perform § 25-21 Part F steps 1 thru 4.

> **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.**

2. A band saw with 20°–30° clearance angle, 0–5° rake angle, 600–1000 m/min rotation speed, and 1.5–4 mm tooth spacing is recommended for initial trimming. Tape cardboard to band saw table to prevent scratching of windshield. Trim windshield carefully to prevent binding of saw blade and cracking windshield. Finish initial cut using an orbital sander, as required.
3. Hold windshield in place and check for fit. Re-trim as necessary.
4. After windshield is fitted, use sanding block with 100-grit paper to smooth edges. Verify all edges are clean and free of notches.
5. Remove trimming debris from windshield and cabin.
6. Install windshield per § 25-22 Part E.

CHAPTER 26

MAIN ROTOR

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26-10 Main Rotor Blades (continued)

B. Installation (continued)

10. a. A154-1 hub with NAS630-80 (or MS21250-10080) coning hinge bolts:

    i. If bolt elongation is 0.015–0.017 inch, remove tool and install a new cotter pin wet with approved primer (chromate primer preferred; refer to § 23-75).

    ii. If bolt elongation is not 0.015–0.017 inch, remove old nut and old bolt and install a new bolt and a new nut. Stretch new bolt per § 23-33, and drill new nut and bolt per § 26-34. Install a new cotter pin wet with approved primer.

    b. B370-1 hub with NAS632-82 (or MS21250-12082) coning hinge bolts:

    i. If bolt elongation is 0.010–0.012 inch, remove tool and install a new cotter pin wet with approved primer (chromate primer preferred; refer to § 23-75).

    ii. If bolt elongation is not 0.010–0.012 inch, remove old nut and old bolt and install a new bolt and a new nut. Stretch new bolt per § 23-33, and drill new nut and bolt per § 26-34. Install a new cotter pin wet with approved primer.

11. Install hardware securing main rotor pitch link to pitch horn. Standard torque hardware per § 23-32 and torque stripe per Figure 2-1.

12. Perform steps 8 thru 11 on opposite blade.

13. Track and balance main rotor blades per § 10.230.

CAUTION

When fitting a replacement main rotor blade(s), remove both main rotor blade tip covers after initial run-up and clean out debris.

26-11 Blade Boots

A. Removal

1. Remove main rotor blades per § 26-10.
2. Place a suitable drain container below pitch horn. Remove two B289-2 bolts and drain fluid.
3. Remove outer boot clamp and hold boot back to expose inner boot clamp. Remove inner clamp and peel boot from spindle.

B. Installation

1. Visually inspect and verify boot is undamaged. Carefully stretch new boot over spindle.
2. Solvent-clean surfaces clamped by boot inner lip. Properly position boot inner lip; install A165-1 (inner) clamp assembly and tighten clamp to 2.330 ± 0.005 inch outside diameter. Rotate spindle and verify adequate clearance between clamp assembly and pitch horn.

> NOTE
>
> When installing inner clamp, ensure that shoulder of boot inner lip is not wedged beneath clamp or clamp may loosen in service. Inspect boot interior and verify no cuts or punctures.

3. Stretch boot outer lip over pitch horn flange. Rotate spindle and align pitch horn bolt hole with spindle bolt hole per Figure 26-3. Install A165-7 (outer) clamp assembly and tighten clamp. Verify security.
4. Fill root fitting per § 26-12.

26-20 Main Rotor Hub (continued)

B. Installation (continued)

4. Coat nut face and bolt threads with A257-9 anti-seize compound, install and tighten nut, then loosen nut until both thrust washers can be freely rotated. Ensure journals do not "pinch" droop stops and fully contact drive shaft.

> **WARNING**
>
> **Do not allow anti-seize compound to contaminate drive shaft, journals, shims, or thrust washer inner faces. Contamination prevents proper joint clamp-up and may cause failure.**

5. Refer to Figure 26-2. Install MT122 main rotor bolt elongation (stretch) tool on teeter bolt. Zero dial indicator by rotating dial face and lock dial. Remove tool.

6. Using wrenches with at least 150 ft-lb torque capacity, tighten nut until drilled holes in nut and bolt align. Install MT122 tool and measure bolt elongation:

   a. If bolt elongation is 0.015–0.017 inch, remove tool and verify correct teeter hinge friction per § 26-32. Adjust teeter hinge friction as required.

   b. If bolt elongation is not 0.015–0.017 inch, remove old nut and old bolt and install a new bolt and a new nut. Stretch new bolt per § 23-33 and verify correct teeter hinge friction per § 26-32. Adjust teeter hinge friction as required. Drill new nut and bolt per § 26-34.

> **WARNING**
>
> **Do not under-stretch or over-stretch teeter or coning hinge bolts to obtain proper clamping force. Under-stretching or over-stretching can cause failure.**

7. Install a new cotter pin wet with approved primer (chromate primer preferred; refer to § 23-75).

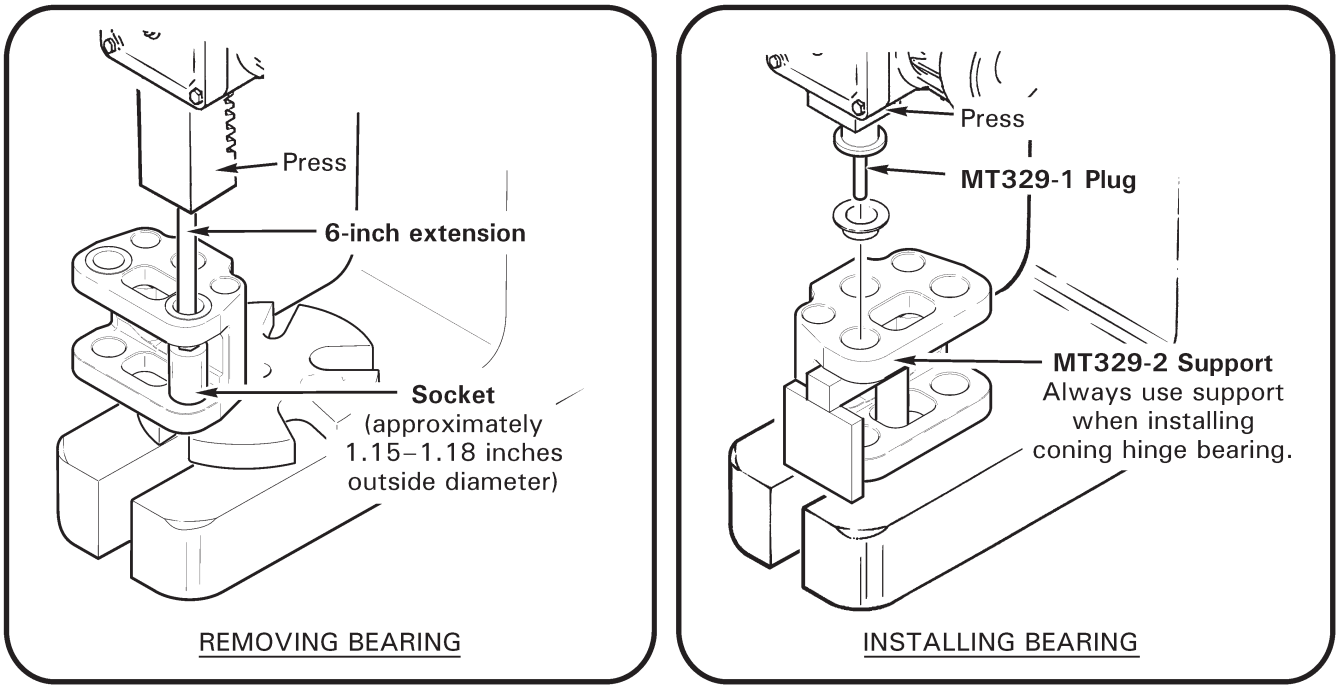

FIGURE 26-4 MAIN ROTOR HUB BEARING REPLACEMENT

26-21 Bearing Replacement

1. Remove main rotor hub per § 26-20.
2. Refer to Figure 26-4. Verify tooling surfaces are smooth to avoid damaging hub and bearings. Press A648-1 and/or A648-3 bearing(s) from hub using MT329-1 plug assembly (Rev H or subsequent) with MT329-10 tube. Press A648-2 bearing(s) from hub using MT329-11 plug assembly with MT329-10 tube.
3. Visually inspect hub bearing bore(s) per § 2.610 step 3a.

> NOTE
>
> Do not allow primer to contact bearing's Teflon liner.

4. Verify bearing mating surfaces are smooth and clean and apply light coat of approved primer (chromate primer preferred; refer to § 23-75). If visible, orient coning hinge bearing's Teflon liner seam toward top of hub. While approved primer is wet, press in new A648-1 and/or A648-3 bearing(s) using MT329-1 plug assembly or A648-2 bearing(s) using MT329-11 plug assembly (always use MT329-13 or MT329-2 [A154-4 Hub] support when replacing coning hinge bearing) until bearing flange is completely seated against hub.
5. Using a syringe, seal between bearing's outboard flange and hub and bearing's inboard edge and hub with small fillet of approved primer.

26-31 Journal and Shim Calculations (continued)

B. Coning Hinge Calculation (continued)

A154-1 Hub:

1. Measure main rotor hub width across the coning hinge bearing faces: _____ in.
2. Subtract measured width of blade spindle at coning hinge bolt hole: – _____ in.

   Calculated empty space: = _____ in.

CAUTION

Initial coning hinge hardware stack-up must be adjusted to 0.003/0.006 inch greater than calculated empty space. A smaller initial stack-up could damage thrust washers and hub bearings during installation.

3. To accommodate dimensional change due to clamping force, add: + 0.003/0.006 in.

   Sum: = _____ in.

4. Select a combination of A106-1, -2, -3, or -6 journals whose combined measured lengths equal Sum. The same journal dash number must be used under the head of both coning hinge bolts to maintain symmetry.
5. Adjust journal combination as required to meet coning hinge axial gap requirement per Figure 26-8 and to maintain teeter friction requirement as follows: It must be possible to manually cone each blade without teetering the hub when blades are held up off the droop stops and lifted at tip.

26-32 Adjusting Hinge Friction

A. Teeter Hinge Friction Adjustment

1. Remove main rotor blades per § 26-10.
2. Refer to Figure 26-5 and Table 26-1. Remove cotter pin, nut, thrust washer, and nut-side A117 shims. Adjust teeter hinge friction by changing nut-side shim stack thickness in small increments; reducing shim stack thickness increases friction, increasing shim stack thickness reduces friction. Install shims, thrust washer, and nut.
3. Refer to Figure 26-9. While torquing teeter hinge bolt per § 23-33, check teeter hinge friction frequently. To check friction, install MT354 teeter friction tool into coning hinge bearings on one side of main rotor hub and measure moving force (not breakaway force) required to teeter main rotor hub with a spring scale. Teeter friction must be less than 15 ft-lb.
4. Install a new bolt and nut per § 26-20.

B. Coning Hinge Friction Adjustment

1. Refer to Figure 26-6 and Table 26-1. Remove cotter pin, nut, thrust washer, and cone blade to remove nut-side journal.
   a. B370-1 Hub: Adjust coning hinge friction by changing trailing-edge shim stack thickness in small increments; reducing shim stack thickness increases friction, increasing shim stack thickness reduces friction. Coning hinge friction is zero when there is a measurable axial gap per Figure 26-8. Install shims, thrust washer, and nut.
   b. A154-1 Hub: Adjust coning hinge friction by changing trailing-edge journal length in small increments; using a shorter journal increases friction, using a longer journal reduces friction. Coning hinge friction is zero when there is a measurable axial gap per Figure 26-8. Install journal, thrust washer, and nut.
2. Install a new bolt and nut per § 26-20, steps 5 thru 7. Repeat steps for opposite blade.
3. Check coning hinge friction by lifting blades until spindle tusks clear droop stops. Hold one blade level and cone opposite blade. Rotor hub must not teeter as blade is coned. Repeat check on opposite blade.
4. Using a feeler gage, measure gap between thrust washers and bearing faces at coning hinge bolt head and nut. Verify 0.002-0.006 inch total gap per hinge.
5. Drill nut and bolt per § 26-34. Install a new cotter pin wet with approved primer (chromate primer preferred; refer to § 23-75).

26-40 Inspection of Main Rotor Blades

NOTE

Main rotor blades are 14 CFR § 27.602 critical parts. Notify RHC Technical Support when voids exceeding the limits specified in the instructions below are found, providing blade serial number, helicopter serial number, time in service for the rotor blade, and location and size of the voids that exceed the limits.

NOTE

The inspection criteria in this section applies to blade damage that occurs after blade manufacturing (including shipping and handling and time in service). Damage after blade manufacturing usually exhibits paint scuffing, scratches, or freshly-exposed metal in the form of scratches in the finish. If a blade manufacturing irregularity is suspected, contact RHC Technical Support.

CAUTION

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

CAUTION

Any blade that encounters inspection-penetrant (dye or fluorescent) of a blade bond joint is scrap.

A. Measuring Damage

1. Refer to Figure 26-10. Measure blade damage using a straight edge and a thickness gage. Keep straight edge parallel with the leading and trailing edges.
2. If blades are installed on the helicopter, measure damage using the shortest straight edge possible to span damaged area. Using a straight edge of excessive length will cause a false reading due to natural droop of the blade.

B. Measuring Material Removed After Repair

1. Use calipers or micrometers and compare measurements before and after repair to estimate amount of material removed.
2. Use a straight edge and thickness gage to measure repaired areas less than 2 inches across in the blade skins and spar.

26-41 Scratches and Corrosion on Blade Skins and Doublers

1. Refer to Figure 26-11. Damage may not exceed the following limits after rework:

A016-6 Blades:

a. 0.004 inch maximum depth for scratches more than 15° from spanwise axis.
b. 0.006 inch maximum depth for scratches less than 15° from spanwise axis.
c. 0.012 inch maximum corrosion between RS 127.0 and RS 151.1.
d. 0.008 inch maximum corrosion between RS 75.5 and RS 127.0.
e. 0.006 inch maximum corrosion between RS 21.0 and RS 75.5.
f. 0.010 inch maximum corrosion between RS 10.4 and RS 21.0.

A016-4 Blades:

a. 0.002 inch maximum depth for scratches more than 15° spanwise.
b. 0.003 inch maximum depth for scratches less than 15° spanwise.

2. Refer to § 26-50 for repair procedures for damage within limits. Polish out scratches and corrosion greater than 0.0005 inch deep using a 0.10 inch blend radius.

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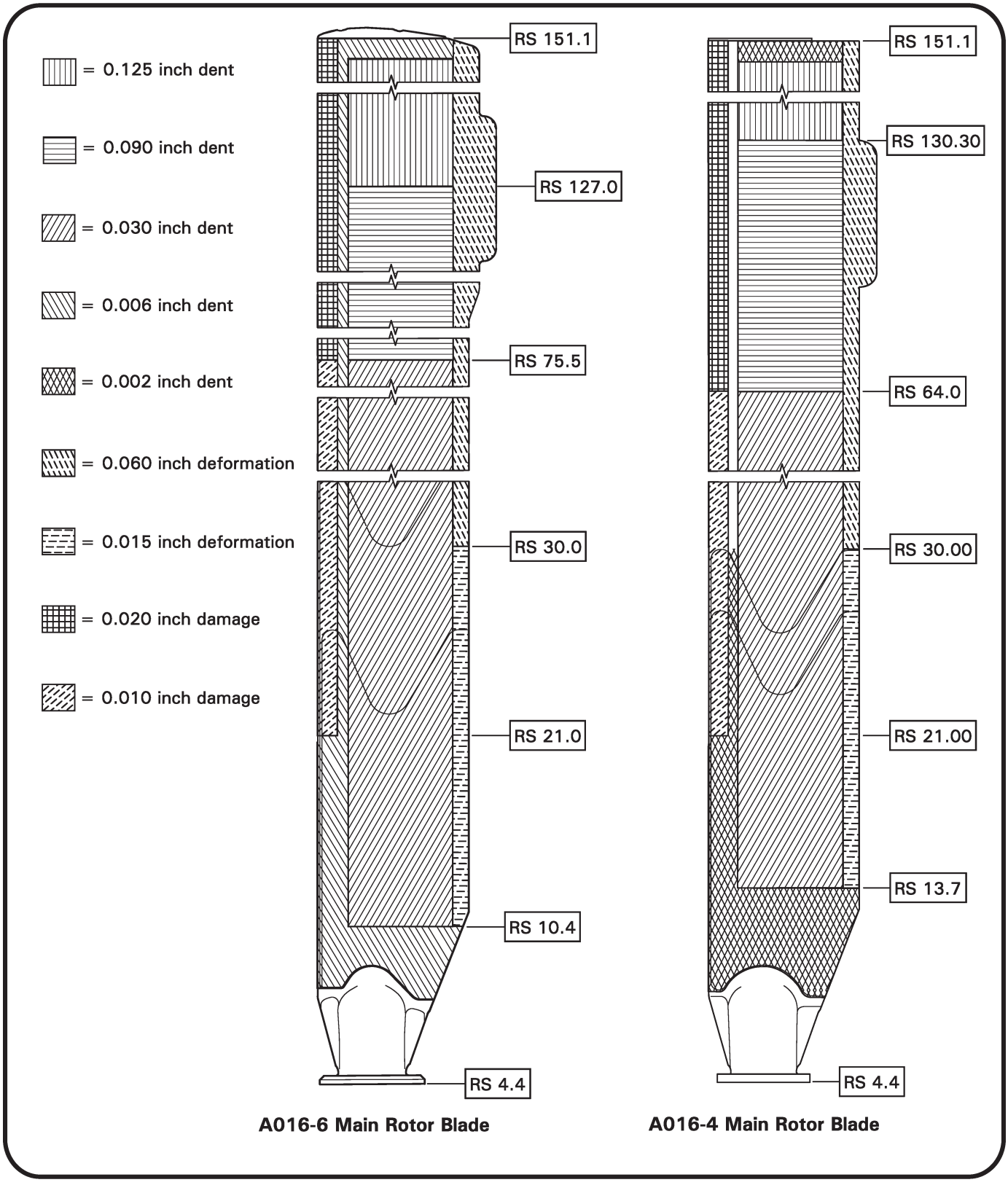


FIGURE 26-12 DENTS AND LOCAL DEFORMATIONS

26-50 Repair of Main Rotor Blades

WARNING

Unauthorized repairs to rotor blades have caused fatal crashes.

CAUTION

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

NOTE

Refer to § 23-70 for approved materials.

1. Measure damage per § 26-40.
2. Remove damage at trailing edges, trim tab edges, tip cap, and/or tip corner by trimming per § 26-51 as required.
3. Polish out 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. A fine-toothed file may be used along the spar and trailing edge, provided the area is finished with 320 grit or finer wet-or-dry abrasive paper. Sand or file in spanwise direction. Remove only the material necessary to remove the damage and blend to the radius or dimension specified. Maintain squareness of trailing edge per Figure 26-16. Visually inspect and verify damage is removed.
4. Measure material removed per § 26-40. Verify repair does not exceed limit specified.
5. Seal or fill as required per the following:
   a. Clean area to be sealed or filled using approved solvent (refer to § 23-70).
   b. Apply approved primer (chromate primer preferred; refer to § 23-75) to bond joints with pin holes or other openings. Mix primer per manufacturer's instructions. Allow a minimum of 24 hours cure time.
   c. Using 220-grit or finer wet-or-dry aluminum-oxide or silicon-carbide abrasive paper, hand-sand cured adhesive in spanwise direction to a smooth, aerodynamic finish, congruent with the blade airfoil. Do not remove metal.
   d. Hand-sand surrounding painted surface until 25% primer remains. Keep bare metal to a minimum.
6. Paint per § 26-52 as required.
7. Track and balance main rotor per § 10.230 as required.

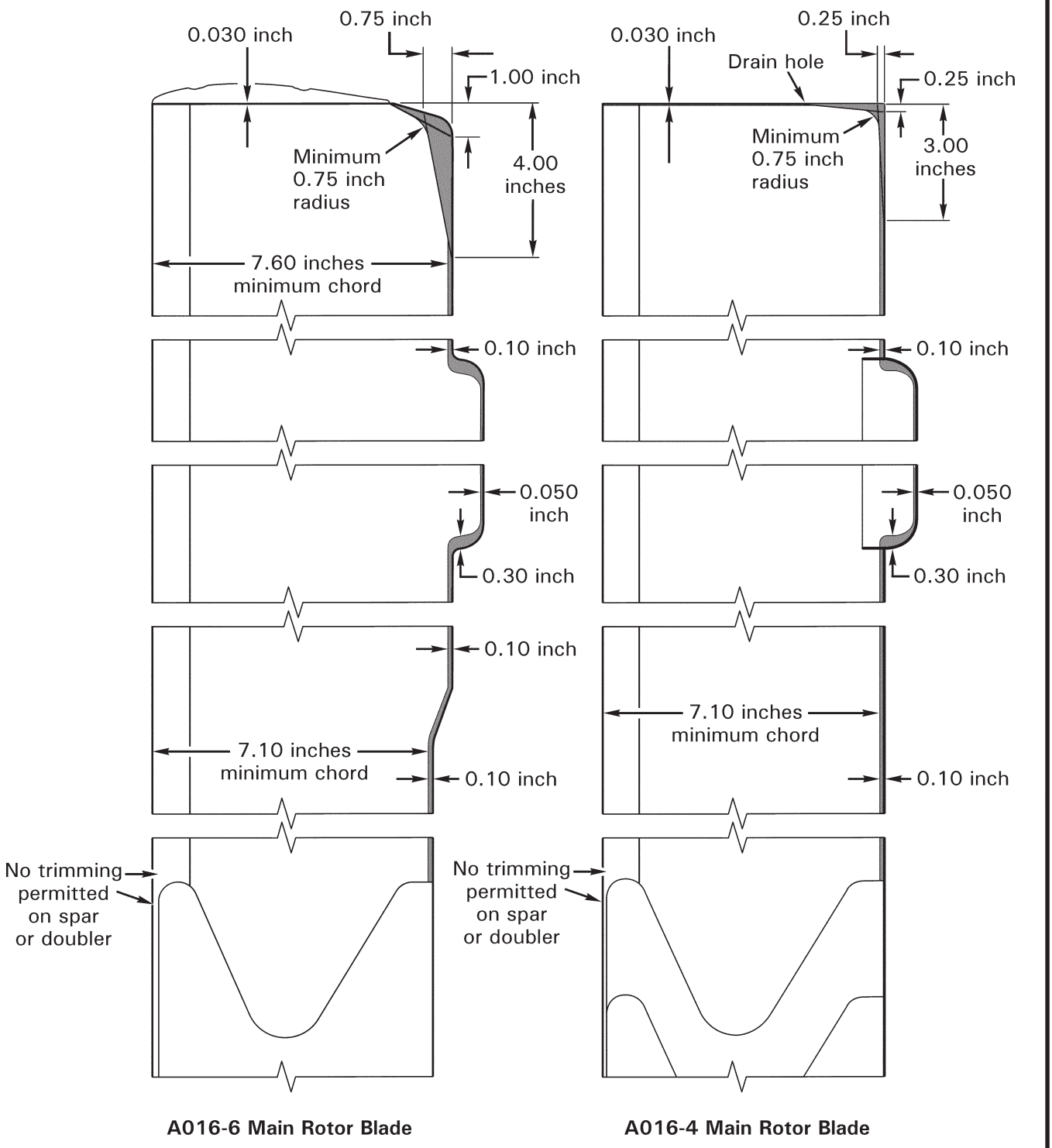


FIGURE 26-15 TRIM LIMITS

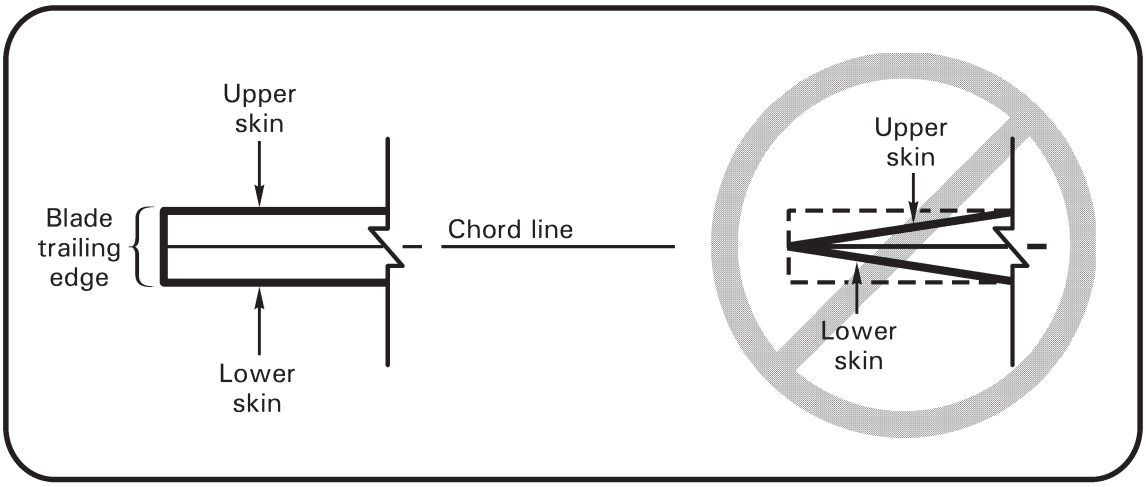


FIGURE 26-16 SANDING/FILING SKIN EDGES SQUARE

26-51 Trimming

Refer to Figures 26-15 & 26-16. Trimming may be performed on the trailing edge of main rotor blade skins and trim tab edges within limits shown. (Alternately, a trailing edge nick or notch may be blended out 1.0 inch minimum spanwise, each side of nick or notch within limits shown.) Trimming is not permitted on spar or doublers.

Tip cap and tip corner may be trimmed within limits shown.

Finish repair per § 26-50 steps 2 thru 7. File trailing edge or trim tab edges square with skins (do not file into a point). Verify minimum chord dimension.

26-52 Painting

Refer to § 23-70 for approved materials. Refer to paint manufacturer's recommendations.

CAUTION

If force-drying paint, do not exceed 175° F surface temperature on blade; monitor blade temperature.

1. Remove main rotor blade tip cover(s) as required. Clean the blade(s).
2. Feather edge of paint bordering bare metal by hand-sanding spanwise with 220-grit or finer wet-or-dry aluminum-oxide or silicon-carbide abrasive paper. Do not remove metal.
3. Mask area to prevent overspray contamination.
4. Clean bare metal to be painted with a lint-free cloth dampened with enamel cleaner.
5. Prime bare metal, including bare metal under tip cover(s) as required, with at least two coats approved primer (chromate primer preferred; refer to § 23-75). Scuff first coat of primer with 320-grit abrasive paper (or very fine Scotch-Brite), and wipe down with a lint-free cloth dampened with enamel cleaner prior to applying second coat.

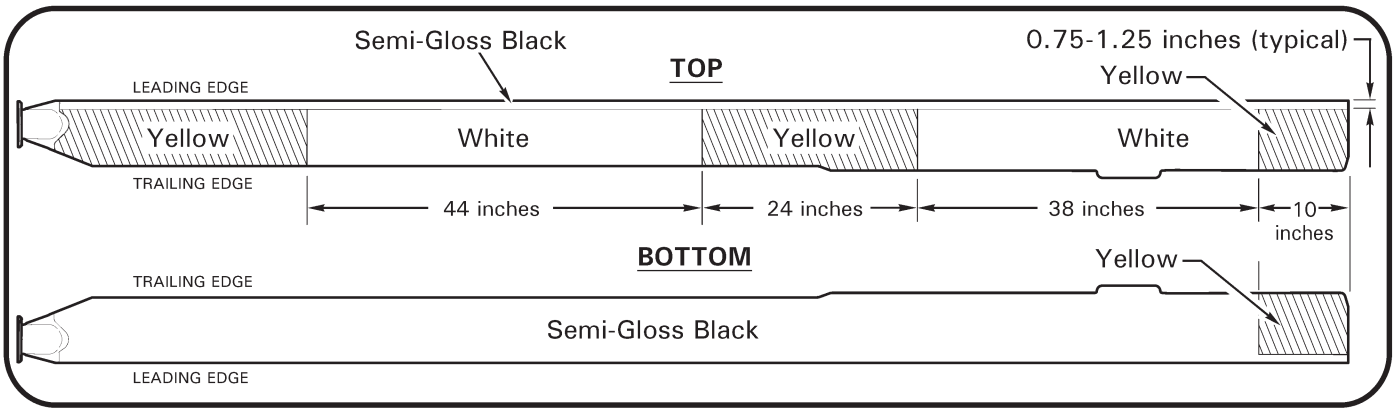


FIGURE 26-17 MAIN ROTOR BLADE PAINT SCHEME (A016-6 BLADE SHOWN)

26-52 Painting (continued)

6. Refer to Figure 26-17. Apply dark gray (root), flat black, white, and/or yellow polyurethane enamel, as required, to primed area in accordance with paint manufacturer's recommendations.

NOTE
Allow Imron paint to cure at least 72 hours before flying in erosive conditions (such as drizzle, rain, or dust).

7. Install blade tip cover(s) if removed.
8. Remove masking materials.

26-60 Main Rotor Blade Tip Maintenance

After removing rounded tip covers, use 10X magnification when visually inspecting blade tip to verify no loose or blistered paint, white-powder corrosion products, or pitting of skins aft of skin-to-spar bond lines (upper & lower). If bare metal (other than spar leading edge) or corrosion is detected, proceed as follows:

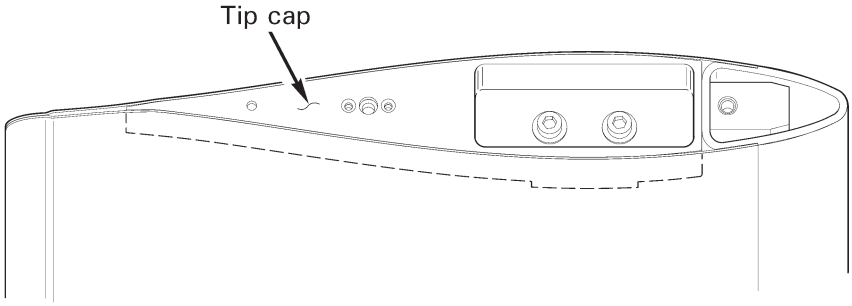
WARNING

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.

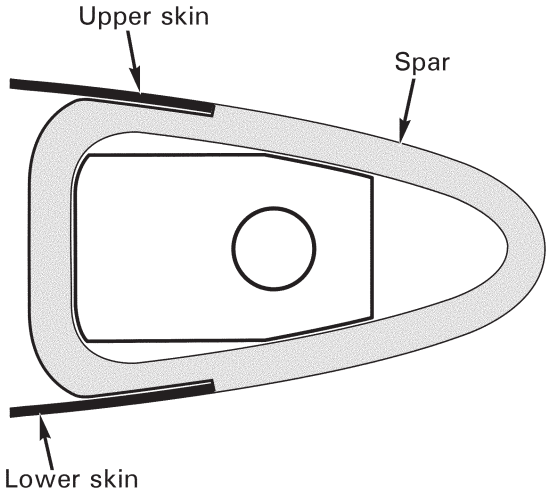
CAUTION

Do NOT use power tools or chemical paint strippers to remove blade paint.

1. Remove any corrosion and loose paint on tip cap and outboard edges of blade skins by hand-sanding vertical surface in a chordwise direction; use a hard, flat block with 220-grit aluminum-oxide abrasive paper, then finish sand with 320-grit aluminum-oxide abrasive paper. Remove only material necessary to eliminate corrosion.



2. Remove any corrosion and loose paint from skins on upper or lower surface of blade, aft of skin-to-spar bond joint, 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.



26-60 Main Rotor Blade Tip Maintenance (continued)

3. Clean bare metal area with lint-free cloth dampened with acetone and allow to dry.
4. Seal exposed bond joints, including bond joints on vertical surfaces, with smooth layer of B270-1 sealant (poly-sulfide, refer to § 23-79) and allow to cure.
5. Prime remaining exposed metal with two coats of epoxy primer (chromated epoxy preferred).
6. Apply yellow paint topcoat within 2–48 hours of primer application. For best performance, allow paint to cure 48 hours before flight.
7. Install tip covers and special torque screws to 40 in.-lb wet with A257-9 anti-seize; ensure cover edges are flush with blade profile.

CHAPTER 33

ELECTRICAL SYSTEM

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CHAPTER 33

ELECTRICAL SYSTEM

33-00 Description

CAUTION

The installation of electrical devices can affect the accuracy and reliability of the electronic tachometer.

The electrical system includes a 14-volt, 60 ampere alternator (standard, 70 ampere optional), battery relay, alternator control unit and 14-volt battery.

The battery is in a fiberglass container normally located on the lower left steel tube frame. An optional location is in the nose under the upper console. Some R22 HP models may have the battery in the left-seat baggage compartment.

Circuit breakers are located on the ledge just forward of the forward left seat. The breakers are marked to indicate their function and amperage and are of the push-to-reset type.

The master battery switch, located on the console, controls the battery relay which disconnects the battery from all circuits except the tachometer and the clock. The tachometer and clock receive power directly from the battery via a Clutch switch terminal.

The alternator control unit (ACU) senses system voltage at the ammeter shunt via a remote sense wire. The ACU has three functions: it regulates alternator output voltage to maintain a battery voltage of 13.4–13.9 volts, warns of low-voltage by illuminating the ALT warning light if voltage decreases to 12.55–12.95 volts, and protects against over-voltage by shutting off alternator field if voltage increases to 15.75–16.25 volts.

The clutch actuator circuit incorporates a low-amperage fuse, in addition to its circuit breaker, to prevent a motor overload from tripping the circuit breaker and turning off the clutch light prematurely.

The lighting system includes the anti-collision light, navigation lights, landing lights, post and internal lights for the instruments and an overhead map light. Landing lights are wired through the clutch switch, turning the lights off when the clutch switch is disengaged. Warning lights on the instrument panel include clutch, low oil pressure, low fuel, main rotor and tail rotor gearbox chip lights, main rotor gearbox over-temp, low rotor RPM light, low voltage, rotor brake (if installed), governor off and starter on.

The gage cluster includes an ammeter and oil pressure, oil temperature, cylinder head temperature, and main and auxiliary fuel quantity gages. Included on the gages circuit are the carburetor air temperature and outside air temperature gages. The map light is also on the gages circuit as a “back-up” in the event of a short and failure of the lighting circuit.

33-00 Description (continued)

The tachometer is an electronic engine and rotor dual tachometer. The sensor for the engine tach is breaker points in the magneto on the left side of the helicopter. A Hall Effect sensor for the rotor tachometer senses the passage of two magnets on the main rotor gearbox input yoke. The signals from these sensors are conditioned by solid state circuits inside the dual tachometer. Each tachometer circuit has a separate circuit breaker and is completely independent of the other. They can be powered by either the alternator or the battery and receive current from two redundant sources. Power to the tachometer is interrupted only when the master battery and alternator switches are off and the clutch switch is disengaged.

33-10 Battery

NOTE

Refer to Concorde Battery Corporation's Owner/Operator's Manual, and Instruction for Continued Airworthiness for battery maintenance procedures.

CAUTION

To minimize risk of electrical discharge: When disconnecting battery, disconnect negative (ground) cable from battery first, then the positive cable. When connecting battery, connect positive cable to battery first, then the negative (ground) cable.

A. Disconnecting Battery

1. Verify battery switch is off.
   a. Aft Battery: Remove engine left side skirt, as required. Remove cotter rings and wing nuts to release rods attaching battery box assembly to lower frames. Remove cover.
   b. Nose battery: Open upper console and remove battery box cover.
2. Remove hardware securing negative (ground) cable to battery negative terminal.
3. Remove hardware securing positive cable to battery positive terminal.

B. Removing and Installing Battery

If removing battery, disconnect battery per Part A, and carefully remove battery. If installing battery, position battery in battery box, and connect battery per Part C.

C. Connecting Battery

1. Verify battery switch is off.
2. Connect battery cables. Special torque terminal bolts as noted on battery label and torque stripe per Figure 2-1.
3. Install cover.
   a. Aft Battery: Install wing nuts and cotter rings to secure rods attaching battery box assembly to lower frames. Verify security. Install engine left side skirt, if removed.
   b. Nose battery: Secure upper console.

33-130 Governor System for R22 Helicopter S/N 4825 & subsequent

33-131 A760 Temperature Senders

33-131-1 A760-1 (Single) and A760-3 (Dual) Oil Temperature Senders

A. Description

A760-1 Oil temperature sender (single) is for use with the B144-3 (14V) instrument cluster. A760-3 oil temperature sender (dual) is for use with the B144-5 (10–32V) instrument cluster.

B. Schematic

Refer to Figure 14-39 for A024 electrical system schematic.

C. Removal

1. Remove left side engine cowling.
2. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
3. Using backup wrench, remove nut securing C049 harness assembly's wire terminal to A760 oil temperature sender stud.
4. Cut and discard lockwire securing sender to thermostatic oil cooler bypass valve. Remove sender from D723-1 adapter assembly.

D. Installation

1. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
2. Install gasket supplied with A760 oil temperature sender, and sender, in D723-1 adapter assembly. Special torque sender to 300 in.-lb and torque stripe per Figure 2-1. Safety sender to thermostatic oil cooler bypass valve using 0.032-inch diameter lockwire.
3. Attach C049 harness assembly's wire terminal to sender; using backup wrench, install nut securing wire terminal to sender. Special torque nut to 20 in.-lb and torque stripe per Figure 2-1.
4. Install left side engine cowling. Push in GOV (2 amp) circuit breaker on circuit breaker panel.

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33-131-2 A760-2 Cylinder Head Temperature (CHT) Sender

A. Description

A760-2 Cylinder head temperature sender is for use with the B144-5 (10–32V) instrument cluster. 3080-00038 cylinder head temperature probe is for use with the B144-3 (14V) instrument cluster.

B. Schematic

Refer to Figure 14-39 for A024 electrical system schematic.

C. Removal

1. Remove right side engine cowling.
2. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
3. Using backup wrench, remove palnut and brass nut securing C049 harness assembly's -34 wire terminal to A760-2 or 3080-00038 cylinder head temperature sender/probe stud (one brass nut remains on stud). Discard palnut.
4. Remove sender/probe from cylinder head (forward, RH [#4]).

D. Installation

1. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
2. Install gasket supplied with A760-2 or 3080-00038 cylinder head temperature sender/probe, and sender/probe, in cylinder head (forward, RH [#4]). Special torque sender/probe to 70–80 in.-lb and torque stripe per Figure 2-1.
3. Calibrate cylinder head temperature gage per Part E, as required.
4. Attach C049 harness assembly's -34 wire terminal to sender/probe. Using backup wrench, install brass nut securing wire terminal to sender/probe; tighten nut. Install new B330-2 palnut; tighten palnut. Torque stripe per Figure 2-1.
5. Install right side engine cowling. Push in GOV (2 amp) circuit breaker on circuit breaker panel.

33-131-2 A760-2 Cylinder Head Temperature (CHT) Sender (continued)

E. Calibration

NOTE

C691-1 Circuit board assembly must be installed on B144 instrument cluster to perform calibration. For earlier helicopters, order and install KI-249 CHT Gage Calibration Kit, as required (refer to R22 Service Letter SL-73).

1. Turn battery switch off and pull all circuit breakers.
2. Remove right side engine cowling, as applicable.
3. Using backup wrench, remove palnut and brass nut securing C049 harness assembly's -34 wire terminal to A760-2 or 3080-00038 cylinder head temperature sender/probe stud (one brass nut remains on stud). Discard palnut.
4. Open instrument console for access to back side of CHT gage in B144 instrument cluster.
5. Refer to Figure 33-2. Adjust resistance decade box to 32 ±0.4 ohms and verify resistance with multimeter. Alternately, a 32.0 ±0.4 ohm resistor may be used instead of decade box. Connect a low-impedance (<1 ohm) test lead to one terminal on decade box and clamp opposite end of lead to hexagonal body of CHT probe; do not connect lead to center conductor of sender/probe. Connect -34 wire to remaining terminal on decade box.

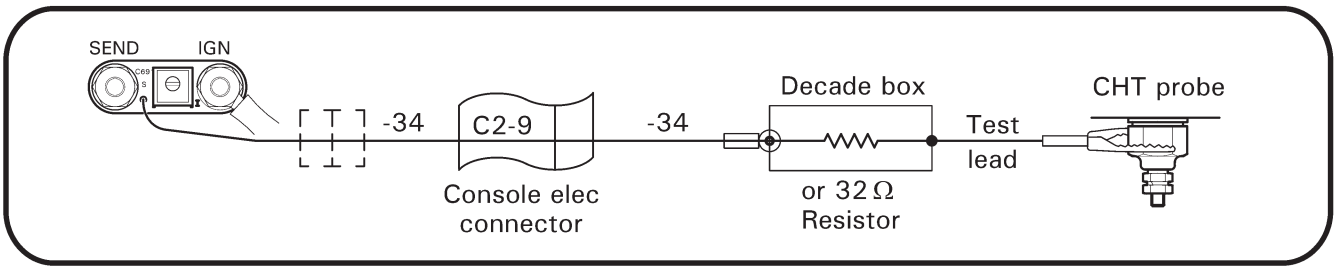

FIGURE 33-2 CYLINDER HEAT TEMPERATURE GAGE CALIBRATION

6. Refer to Figure 33-3. Push in GAGES 2-amp circuit breaker. Turn battery switch on and observe CHT gage. Adjust potentiometer screw on C691-1 circuit board assembly until gage indicates within limits shown with console in closed position (CHT probe resistance is 32 ±0.4 ohms at 500° F).
7. Cut small square of A701-1 aluminum tape sized to fit potentiometer face. Apply tape to potentiometer and press tape tight against adjustment screw to prevent rotation (pressing with a pencil eraser works well). Verify CHT needle has not moved. If movement is noted, remove tape and repeat step 6 as required. Turn battery switch off.

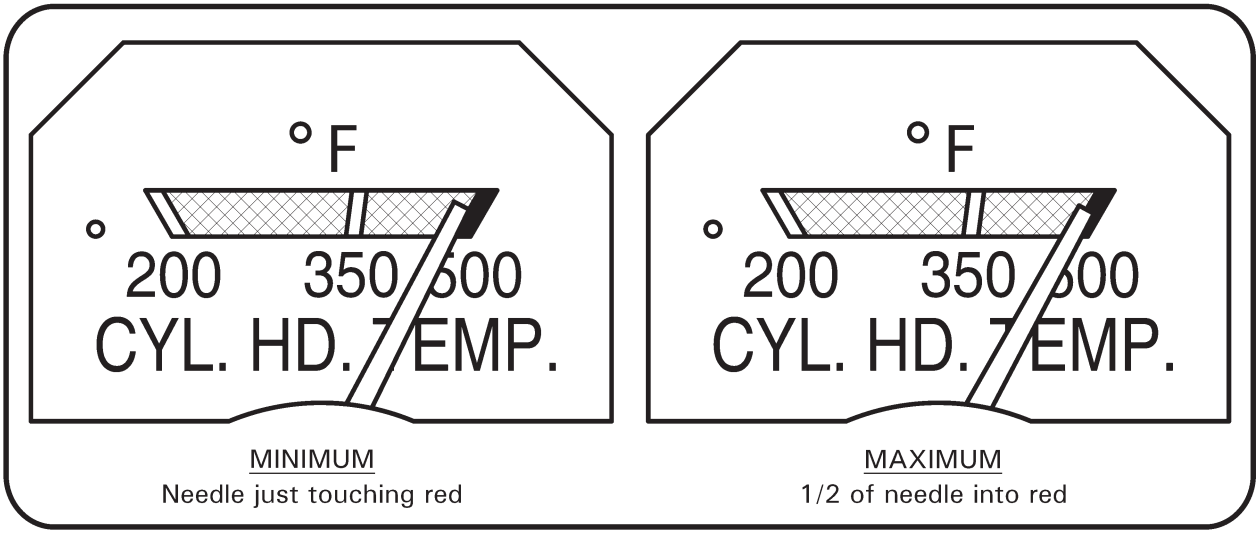

FIGURE 33-3 CYLINDER HEAT TEMPERATURE GAGE CALIBRATION

33-131-2 A760-2 Cylinder Head Temperature (CHT) Sender (continued)

E. Calibration (continued)

8. Close and secure instrument console. Push in all remaining circuit breakers.
9. Attach C049 harness assembly's -34 wire terminal to sender/probe. Using backup wrench, install brass nut securing wire terminal to sender/probe; tighten nut. Install new B330-2 palnut; tighten palnut. Torque stripe per Figure 2-1.
10. Install engine side cowling.

33-132 A760-4 Outside Air Temperature (OAT) Sender

A. Description

The A760-4 OAT sender is the data input for the D270-1 governor/engine monitoring unit; the B341-2 OAT sender is the data input for the B341-1 OAT gage.

B. Schematic

Refer to Figure 14-39 for A024 electrical system schematic.

C. Removal

1. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
2. Cut and discard ty-raps as required and disconnect A760-4 OAT wiring from airframe harness at connectors; remove hardware securing ground wire. Using backup wrench, remove nut and lockwasher securing sender probe to cabin.

D. Installation

1. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
2. Install lockwasher and nut securing A760-4 OAT sender probe to cabin. Using backup wrench, special torque nut to 18 in.-lb. Verify security.
3. Connect OAT sender wiring to airframe harness at connectors; install hardware securing ground wire. Verify security. Install ty-raps as required to securing wiring; cinch ty-raps until snug without overtightening and trim tips flush with heads.
4. Install forward belly panel. Push in GOV (2 amp) circuit breaker on circuit breaker panel.

33-133 A024 Electrical System Installation

Refer to Figure 14-39 for A024 electrical system schematic.

33-134 A060-14 Audio System Installation

Refer to Figure 14-40 for A060-14 audio system schematic.

33-135 C143-1 Hall Effect Sensor Assembly

A. Schematic

Refer to Figure 14-39 for A024 electrical system schematic.

B. Removal

1. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
2. Remove engine left side cowling.
3. Cut and discard ty-raps as required and disconnect C143-1 hall effect sensor assembly wiring from airframe harness at connectors.
4. Remove engine-supplied hardware securing sensor assembly and engine-supplied gasket to engine; remove sensor assembly and gasket.

C. Installation

1. Turn battery switch off & pull GOV (2 amp) circuit breaker on circuit breaker panel.
2. Install engine-supplied gasket and C143-1 hall effect sensor assembly on engine and install engine-supplied hardware. Special torque nuts to 96 in.-lb. Verify security.
3. Connect sensor assembly wiring to airframe harness at connectors and install ty-raps, as required. Cinch ty-raps until snug without overtightening and trim tips flush with heads.
4. Install engine left side cowling. Push in GOV (2 amp) circuit breaker on circuit breaker panel.

33-136 C822-1 Audio Control (Garmin GMA 350HC) Installation

Refer to Figures 14-47 & 14-48 for C822-1 audio control installation schematic.

33-137 D270-1 Governor Controller and Engine Monitoring Unit (EMU)

Refer to § 8.230 for D270-1 governor controller maintenance procedures. Refer to the EMU Technician's Guide and EMU User Guide online at www.robinsonheli.com for data access.

Later aircraft are equipped with an Engine Monitoring Unit (EMU), which is a digital recording device within the engine RPM governor control box. The EMU continuously monitors engine and rotor speed, engine oil temperature, and cylinder head temperature.

EMU status is indicated by an amber light located in the right-side baggage compartment on the aft seat support panel. The EMU requires approximately ten seconds to complete a self-test after the aircraft battery is switched on. Once the self-test is complete, steady illumination of the light means normal EMU operation. A slowly flashing light (once every two seconds) or no light means there is a fault in the EMU's senders or circuitry. A fast flashing light (four times per second) indicates the EMU has detected an exceedance. EMU data can be downloaded to a computer with the appropriate software. A fault or exceedance should be investigated and the indication reset by a qualified mechanic prior to the next flight. Current exceedances may be reviewed (but not reset) using the Robinson EMU App on an Apple iPad (download the EMU App from www.robinsonheli.com or from the Apple App Store).

The EMU is intended to be used only as a maintenance aid. It remains the pilot's responsibility to report any observed exceedances.

33-138 F793-1 Audio Alert Box

A. Schematic

Refer to Figure 14-39 for A024 electrical system schematic.

B. Removal

1. Turn battery switch off and pull all circuit breakers.
2. Open instrument console for access to F793-1 audio alert box.
3. Loosen screws securing audio system harness receptacle to alert box connector and disconnect receptacle from connector.
4. Remove hardware securing alert box to keel panel and remove alert box.

C. Installation

1. Turn battery switch off and pull all circuit breakers.
2. Open instrument console.
3. Install hardware securing F793-1 audio alert box to right side keel panel; verify security.
4. Connect audio system harness receptacle to alert box connector and tighten screws. Verify security.
5. Close and secure instrument console. Push in all circuit breakers.

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 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.

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 www.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.

CHAPTER 37

REVISION LOG

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REVISION LOG

NOV 2020

The R22 Maintenance Manual (MM) list of effective pages and effective dates are given below. If a previously issued page is not listed below, it is no longer an effective page and must be discarded. The issue or revision date is in bold at the top of each revision log page.

Please visit www.robinsonheli.com to verify the issue or revision date is current.

Page	*Date*
i	NOV 2020
ii	NOV 2020
iii	OCT 2018
iv	OCT 2018
v	OCT 2018
vi	OCT 2018
1.i	NOV 2020
1.ii	NOV 2020
1.1	NOV 2020
1.2	NOV 2020
1.3	OCT 2018
1.4	OCT 2018
1.5	NOV 2020
1.6	NOV 2020
1.7	NOV 2020
1.8	NOV 2020
1.9	NOV 2020
1.10	NOV 2020
1.11	NOV 2020
1.12	NOV 2020
1.13	NOV 2020
1.14	NOV 2020
1.15	NOV 2020
1.16	NOV 2020
1.17	NOV 2020
1.18	NOV 2020
2.i	NOV 2020
2.ii	NOV 2020
2.1	NOV 2020
2.2	NOV 2020
2.3	OCT 2018
2.4	OCT 2018

Page	*Date*
2.5	OCT 2018
2.6	OCT 2018
2.7	OCT 2018
2.8	OCT 2018
2.9	APR 2007
2.10	JUN 2006
2.11	JUN 2006
2.12	JUN 2006
2.13	NOV 2020
2.14	NOV 2020
2.15	JUN 2006
2.16	JUN 2006
2.17	NOV 2020
2.18	NOV 2020
2.19	OCT 2018
2.20	OCT 2018
2.21	OCT 2018
2.22	OCT 2018
2.23	OCT 2018
2.24	OCT 2018
2.25	NOV 2020
2.26	NOV 2020
2.26A	NOV 2020
2.26B	NOV 2020
2.27	NOV 2020
2.28	NOV 2020
2.29	OCT 2018
2.30	OCT 2018
2.31	OCT 2018
2.32	OCT 2018
2.33	NOV 2020
2.34	NOV 2020
2.35	NOV 2020
2.36	NOV 2020

Page	*Date*
2.37	NOV 2020
2.38	NOV 2020
2.39	OCT 2018
2.40	OCT 2018
2.41	OCT 2018
2.42	OCT 2018
2.43	NOV 2020
2.44	NOV 2020
2.45	NOV 2020
2.46	NOV 2020
2.47	NOV 2020
2.48	NOV 2020
2.49	NOV 2020
2.50	NOV 2020
2.51	NOV 2020
2.52	NOV 2020
2.53	NOV 2020
2.54	NOV 2020
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2.62	NOV 2020
2.63	NOV 2020
2.64	NOV 2020
2.65	NOV 2020
2.66	NOV 2020
2.67	NOV 2020
2.68	NOV 2020
3.i	OCT 2018

REVISION LOG

NOV 2020

Page	Date
3.ii	OCT 2018
3.1	NOV 2020
3.2	NOV 2020
3.3	OCT 2018
3.4	OCT 2018
3.5	OCT 2018
3.6	OCT 2018
3.7	OCT 2018
3.8	OCT 2018
3.9	OCT 2018
3.10	OCT 2018
4.i	OCT 2018
4.ii	OCT 2018
4.1	OCT 2018
4.2	OCT 2018
4.3	OCT 2018
4.4	OCT 2018
4.5	NOV 2020
4.6	NOV 2020
4.7	5/22/87
4.8	5/22/87
4.9	5/22/87
4.10	JAN 2005
4.11	5/22/87
4.12	APR 2007
4.13	5/22/87
4.14	29 MAR 93
4.15	JAN 2005
4.16	JAN 2005
4.17	JUN 2000
4.18	30 JUN 99
4.19	26 JUL 96
4.20	30 JUN 99
4.21	JUN 2006
4.22	JUN 2006
4.23	7 AUG 92
4.24	7 AUG 92
4.25	7 AUG 92
5.i	OCT 2018
5.ii	OCT 2018
5.1	OCT 2018
5.2	OCT 2018
5.3	OCT 2018
5.4	OCT 2018
5.5	OCT 2018
5.6	OCT 2018
5.7	5/22/87
5.8	28 JUL 89
5.9	28 JUL 89
5.10	28 JUL 89
5.11	28 JUL 89
5.12	JUN 2000
5.13	28 JUL 89
6.i	NOV 2020
6.ii	NOV 2020
6.1	OCT 2014
6.2	OCT 2014
6.3	APR 2007
6.4	APR 2007
6.5	NOV 2020
6.6	NOV 2020
6.7	NOV 2020
6.8	NOV 2020
6.9	OCT 2018
6.10	OCT 2018
6.11	26 JUL 96
6.12	30 JUN 99
6.13	19 SEP 97
6.14	19 SEP 97
6.15	JAN 2005
6.16	26 JUL 96
6.16A	7 AUG 92
6.16B	JAN 2005
6.16C	7 AUG 92
6.16D	7 AUG 92
6.17	APR 2007
6.18	APR 2007
6.19	APR 2007
6.20	APR 2007
6.21	NOV 2020
6.22	NOV 2020
6.22A	NOV 2020
6.22B	NOV 2020
6.23	MAR 2004
6.24	MAR 2004
6.24A	NOV 2020
6.24B	NOV 2020
6.25	APR 2007
6.26	APR 2007
6.27	APR 2007
6.28	APR 2007
6.29	APR 2007
6.30	APR 2007
7.i	OCT 2018
7.ii	OCT 2018
7.1	OCT 2014
7.2	OCT 2014
7.3	JUN 2006
7.4	5/22/87
7.5	NOV 2020
7.6	NOV 2020
7.7	OCT 2018
7.8	OCT 2018
7.9	NOV 2020
7.9A	NOV 2020
7.9B	19 SEP 97
7.10	JUN 2000
7.11	5/22/87
7.12	3 MAR 99
7.13	3 MAR 99

REVISION LOG

NOV 2020

Page	Date
7.14	JUN 2000
7.15	OCT 2018
7.16	OCT 2018
7.17	APR 2005
7.18	MAR 2004
7.19	OCT 2018
7.20	OCT 2018
7.21	OCT 2018
7.22	OCT 2018
7.23	OCT 2018
7.24	OCT 2018
7.25	NOV 2020
7.26	NOV 2020
7.27	OCT 2018
7.28	OCT 2018
7.29	NOV 2020
7.29A	NOV 2020
7.29B	NOV 2020
7.30	NOV 2020
7.31	OCT 2018
7.32	OCT 2018
7.33	NOV 2020
7.33A	NOV 2020
7.33B	MAR 2004
7.34	5/22/87
7.35	26 JUL 96
7.36	MAR 2004
7.37	26 JUL 96
7.38	26 JUL 96
7.38A	26 JUL 96
7.38B	26 JUL 96
7.39	19 SEP 97
7.40	19 SEP 97
7.41	19 SEP 97
7.42	19 SEP 97
7.43	19 SEP 97
7.44	19 SEP 97
7.44A	4/15/88
7.44B	5 JUL 90
7.44C	26 JUL 96
7.44D	7 AUG 92
7.45	OCT 2018
7.46	OCT 2018
7.47	NOV 2020
7.48	NOV 2020
7.48A	NOV 2020
7.48B	NOV 2020
7.49	OCT 2018
7.50	OCT 2018
7.51	OCT 2018
7.52	OCT 2018
7.53	OCT 2018
7.54	OCT 2018
7.55	OCT 2018
7.56	OCT 2018
7.57	31 JAN 89
8.i	NOV 2020
8.ii	NOV 2020
8.iii	OCT 2014
8.iv	OCT 2014
8.1	OCT 2014
8.2	OCT 2014
8.3	5/22/87
8.4	5/22/87
8.5	5/22/87
8.6	5/22/87
8.7	5/22/87
8.8	5/22/87
8.9	5/22/87
8.10	5/22/87
8.11	5/22/87
8.12	5/22/87
8.13	5/22/87
8.14	4/15/88
8.15	5/22/87
8.16	5/22/87
8.17	5/22/87
8.18	7 AUG 92
8.19	12 JAN 90
8.20	12 JAN 90
8.21	5/22/87
8.22	5/22/87
8.23	5/22/87
8.24	5/22/87
8.25	5/22/87
8.26	MAR 2004
8.27	26 JUL 96
8.28	MAR 2004
8.29	5/22/87
8.30	MAR 2004
8.31	19 SEP 97
8.32	5 JUL 90
8.33	OCT 2018
8.34	OCT 2018
8.34A	NOV 2020
8.34B	NOV 2020
8.34C	MAR 2004
8.34D	MAR 2004
8.35	5/22/87
8.36	5/22/87
8.37	JUN 2006
8.38	JUN 2006
8.39	OCT 2018
8.40	OCT 2018
8.41	OCT 2018
8.42	OCT 2018
8.43	OCT 2018
8.44	OCT 2018
8.45	OCT 2018
8.46	OCT 2018
8.47	19 SEP 97
8.48	26 JUL 96
8.49	MAR 2004

REVISION LOG

NOV 2020

Page	Date
8.50	5/22/87
8.51	5/22/87
8.52	5/22/87
8.53	5/22/87
8.54	5/22/87
8.55	JAN 2005
8.56	JAN 2005
8.57	5/22/87
8.58	5/22/87
8.59	JUN 2006
8.60	JUN 2006
8.61	22 JAN 93
8.62	22 JAN 93
8.63	APR 2005
8.64	APR 2005
9.i	OCT 2018
9.ii	OCT 2018
9.1	OCT 2018
9.2	OCT 2018
9.26C	OCT 2014
9.26D	OCT 2014
9.27	JUN 2000
9.28	JUN 2000
9.29	JUN 2006
9.30	JUN 2006
9.31	31 DEC 98
9.32	31 DEC 98
9.32A	JUN 2000
9.32B	JUN 2000
9.32C	MAR 2004
9.32D	JUN 2000
9.33	5/22/87
9.34	5/22/87
9.35	19 SEP 97
10.i	NOV 2020
10.ii	NOV 2020
10.1	NOV 2020
10.2	NOV 2020
10.3	5/22/87
10.4	5/22/87
10.5	APR 2005
10.6	APR 2007
10.7	APR 2005
10.8	5/22/87
10.9	5/22/87
10.10	5/22/87
10.11	5/22/87
10.12	5/22/87
10.13	5/22/87
10.14	5/22/87
10.15	APR 2007
10.16	APR 2007
10.17	5/22/87
10.18	5/22/87
10.19	5/22/87
10.20	MAR 2004
10.21	OCT 2018
10.22	OCT 2018
10.23	28 JUL 89
10.24	30 JUN 99
10.25	5/22/87
10.25A	28 JUL 89
10.25B	28 JUL 89
10.26	28 JUL 89
10.26A	JUN 2006
10.26B	JUN 2006
10.27	NOV 2020
10.28	NOV 2020
10.29	NOV 2020
10.30	NOV 2020
10.31	NOV 2020
10.32	NOV 2020
10.32A	NOV 2020
10.32B	NOV 2020
10.32C	NOV 2020
10.32D	NOV 2020
10.32E	NOV 2020
10.32F	NOV 2020
10.32G	NOV 2020
10.32H	NOV 2020
10.33	5/22/87
10.34	5/22/87
10.35	JAN 2005
10.36	JAN 2005
10.37	JAN 2005
10.38	JAN 2005
10.39	JAN 2005
10.40	JAN 2005
11.i	OCT 2018
11.ii	OCT 2018
11.1	OCT 2018
11.2	OCT 2018
11.3	OCT 2018
11.4	OCT 2018
11.5	OCT 2018
11.6	OCT 2018
12.i	OCT 2018
12.ii	OCT 2018
12.1	OCT 2018
12.2	OCT 2018
12.3	OCT 2014
12.4	OCT 2014
12.5	OCT 2014
12.6	OCT 2014
12.7	OCT 2014
12.8	OCT 2014
12.9	OCT 2018
12.9A	OCT 2018
12.9B	OCT 2018
12.10	OCT 2018

REVISION LOG

NOV 2020

Page	Date
12.11	OCT 2014
12.12	OCT 2014
12.13	NOV 2020
12.14	NOV 2020
12.15	OCT 2014
12.16	OCT 2014
12.17	OCT 2014
12.18	OCT 2014
13.i	NOV 2020
13.ii	NOV 2020
13.1	OCT 2018
13.2	OCT 2018
13.3	OCT 2018
13.4	OCT 2018
13.5	OCT 2018
13.6	OCT 2018
13.7	NOV 2020
13.8	NOV 2020
13.9	OCT 2018
13.10	OCT 2018
13.11	OCT 2018
13.12	OCT 2018
13.13	OCT 2018
13.14	OCT 2018
13.15	OCT 2018
13.16	OCT 2018
13.17	OCT 2018
13.18	OCT 2018
13.19	OCT 2018
13.20	OCT 2018
13.21	NOV 2020
13.22	NOV 2020
13.23	NOV 2020
13.24	NOV 2020
14.i	OCT 2018
14.ii	OCT 2018
14.1	OCT 2018
14.2	OCT 2018
14.11B	OCT 2018
14.12	OCT 2018
14.13	5/22/87
14.14	5/22/87
14.15	5/22/87
14.16	12 JAN 90
14.16A	12 JAN 90
14.16B	12 JAN 90
14.17	12 JAN 90
14.17A	12 JAN 90
14.17B	12 JAN 90
14.17C	12 JAN 90
14.17D	12 JAN 90
14.18	5/22/87
14.18A	30 JUN 99
14.18B	30 JUN 99
14.19	OCT 2018
14.20	OCT 2018
14.20A	OCT 2018
14.20B	OCT 2018
14.21	30 JUN 99
14.21A	30 JUN 99
14.21B	30 JUN 99
14.22	5/22/87
14.23	OCT 2018
14.23A	OCT 2018
14.23B	OCT 2018
14.23C	OCT 2018
14.23D	OCT 2018
14.23E	OCT 2018
14.23F	OCT 2018
14.23G	OCT 2018
14.23H	OCT 2018
14.24	OCT 2018
14.25	NOV 2020
14.26	NOV 2020
14.26A	NOV 2020
14.26B	NOV 2020
14.26C	NOV 2020
14.26D	NOV 2020
14.26E	JUN 2000
14.26F	JUN 2000
14.26G	JUN 2000
14.26H	JUN 2000
14.26I	JUN 2000
14.26J	JUN 2000
14.26K	MAR 2004
14.26L	MAR 2004
14.27	5 JUL 90
14.28	5/22/87
14.28A	5 JUL 90
14.28B	5 JUL 90
14.29	5/22/87
14.30	5/22/87
14.31	5/22/87
14.32	5/22/87
14.33	5/22/87
14.34	5/22/87
14.35	5/22/87
14.36	5/22/87
14.37	5/22/87
14.38	5/22/87
14.39	28 JUL 89
14.40	5/22/87
14.40A	JUN 2000
14.40B	JUN 2000
14.40C	JUN 2000
14.40D	JUN 2000
14.41	9/25/87
14.42	9/25/87
14.43	5/22/87
14.44	5/22/87
14.45	5/22/87
14.46	5/22/87

REVISION LOG

NOV 2020

Page	Date
14.47	5/22/87
14.48	5/22/87
14.49	9/25/87
14.50	5/22/87
14.51	7 AUG 92
14.52	5/22/87
14.53	5/22/87
14.54	4/22/87
14.55	5/22/87
14.56	5/22/87
14.57	5/22/87
14.58	5/22/87
14.59	5/22/87
14.60	5/22/87
14.61	5/22/87
14.62	5/22/87
14.63	5/22/87
14.64	19 SEP 97
14.65	NOV 2020
14.65A	NOV 2020
14.65B	NOV 2020
14.65C	NOV 2020
14.66	NOV 2020
14.66A	NOV 2020
14.67	OCT 2018
14.68	OCT 2018
14.69	OCT 2018
14.70	OCT 2018
14.71	OCT 2018
14.72	OCT 2018
14.73	NOV 2020
14.73A	NOV 2020
14.74	NOV 2020
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14.75	OCT 2018
14.76	OCT 2018
14.77	OCT 2018
14.78	OCT 2018
15.i	OCT 2018
15.ii	OCT 2018
15.1	NOV 2020
15.2	NOV 2020
15.3	OCT 2018
15.4	OCT 2018
15.5	OCT 2018
15.6	OCT 2018
15.7	NOV 2020
15.8	NOV 2020
16.i	OCT 2018
16.ii	OCT 2018
16.1	OCT 2018
16.2	OCT 2018
16.3	OCT 2018
16.4	OCT 2018
16.5	OCT 2018
16.6	OCT 2018
16.7	OCT 2018
16.8	OCT 2018
17.i	OCT 2018
17.ii	OCT 2018
17.1	OCT 2018
17.2	OCT 2018
17.3	OCT 2018
17.4	OCT 2018
17.5	OCT 2018
17.6	OCT 2018
18.i	OCT 2018
18.ii	OCT 2018
18.1	OCT 2018
18.2	OCT 2018
18.3	NOV 2020
18.4	NOV 2020
18.5	OCT 2018
18.6	OCT 2018
18.7	OCT 2018
18.8	OCT 2018
18.9	OCT 2018
18.10	OCT 2018
19.i	OCT 2018
19.ii	OCT 2018
19.1	OCT 2018
19.2	OCT 2018
19.3	OCT 2018
19.4	OCT 2018
19.5	OCT 2018
19.6	OCT 2018
19.7	OCT 2018
19.8	OCT 2018
20.i	OCT 2018
20.ii	OCT 2018
20.1	OCT 2018
20.2	OCT 2018
20.3	NOV 2020
20.4	NOV 2020
21.i	OCT 2018
21.ii	OCT 2018
21.1	OCT 2018
21.2	OCT 2018
22.i	OCT 2018
22.ii	OCT 2018
22.1	NOV 2020
22.1A	NOV 2020
22.1B	NOV 2020
22.2	NOV 2020
22.3	NOV 2020
22.4	NOV 2020

REVISION LOG

NOV 2020

Page	Date
22.5	NOV 2020
22.6	NOV 2020
22.7	NOV 2020
22.8	NOV 2020
22.9	OCT 2018
22.10	OCT 2018
22.11	OCT 2018
22.12	OCT 2018
22.13	OCT 2018
22.14	OCT 2018
23.i	NOV 2020
23.ii	NOV 2020
23.1	NOV 2020
23.2	NOV 2020
23.3	NOV 2020
23.4	NOV 2020
23.5	NOV 2020
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23.7	NOV 2020
23.8	NOV 2020
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24.2	OCT 2018
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25.2	NOV 2020
25.3	NOV 2020
25.4	NOV 2020
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25.6	NOV 2020
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26.14	OCT 2018
26.15	OCT 2018
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26.18	OCT 2018
26.19	NOV 2020
26.20	NOV 2020
26.21	OCT 2018
26.22	OCT 2018
26.23	NOV 2020
26.23A	NOV 2020
26.23B	NOV 2020
26.24	NOV 2020
26.25	OCT 2018
26.26	OCT 2018
26.27	OCT 2018
26.28	OCT 2018
26.29	OCT 2018
26.30	OCT 2018
26.31	NOV 2020
26.32	NOV 2020

REVISION LOG

NOV 2020

Page	Date
26.33	NOV 2020
26.34	NOV 2020
26.35	NOV 2020
26.36	NOV 2020
27.i	OCT 2018
27.ii	OCT 2018
27.1	OCT 2018
27.2	OCT 2018
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28.ii	OCT 2018
28.1	OCT 2018
28.2	OCT 2018
29.i	OCT 2018
29.ii	OCT 2018
29.1	OCT 2018
29.2	OCT 2018
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30.1	OCT 2018
30.2	OCT 2018
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31.ii	OCT 2018
31.1	OCT 2018
31.2	OCT 2018
32.i	OCT 2018
32.ii	OCT 2018
32.1	OCT 2018
32.2	OCT 2018
33.i	NOV 2020
33.ii	NOV 2020
33.1	NOV 2020
33.2	NOV 2020
33.3	OCT 2018
33.4	OCT 2018
33.5	OCT 2018
33.6	OCT 2018
33.7	OCT 2018
33.8	OCT 2018
33.9	OCT 2018
33.10	OCT 2018
33.11	OCT 2018
33.12	OCT 2018
33.13	OCT 2018
33.14	OCT 2018
33.15	OCT 2018
33.16	OCT 2018
33.17	OCT 2018
33.18	OCT 2018
33.19	OCT 2018
33.20	OCT 2018
33.21	OCT 2018
33.22	OCT 2018
33.23	NOV 2020
33.24	NOV 2020
33.25	NOV 2020
33.26	NOV 2020
33.27	NOV 2020
33.28	NOV 2020
33.29	NOV 2020
33.30	NOV 2020
33.31	NOV 2020
33.32	NOV 2020
34.i	OCT 2018
34.ii	OCT 2018
34.1	OCT 2018
34.2	OCT 2018
34.3	OCT 2018
34.4	OCT 2018
34.5	OCT 2018
34.6	OCT 2018
34.7	OCT 2018
34.8	OCT 2018
34.9	OCT 2018
34.10	OCT 2018
35.i	OCT 2018
35.ii	OCT 2018
35.1	OCT 2018
35.2	OCT 2018
36.i	OCT 2018
36.ii	OCT 2018
36.1	OCT 2018
36.2	OCT 2018
36.3	OCT 2018
36.4	OCT 2018
36.5	OCT 2018
36.6	OCT 2018
36.7	OCT 2018
36.8	OCT 2018
36.9	OCT 2018
36.10	OCT 2018
37.i	NOV 2020
37.ii	NOV 2020
37.1	NOV 2020
37.2	NOV 2020
37.3	NOV 2020
37.4	NOV 2020
37.5	NOV 2020
37.6	NOV 2020
37.7	NOV 2020
37.8	NOV 2020