ROBINSON HELICOPTER COMPANY

R44 MAINTENANCE MANUAL
AND INSTRUCTIONS FOR CONTINUED AIRWORTHINESS
RTR 460 VOLUME I

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OFFICE HOURS

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

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

CUSTOMER SUPPORT AND SPARES ORDERS

Please visit https://robinsonheli.com for Customer Support contact information. Procure parts from any R44 Dealer or Service Center, or order directly from RHC Customer Service via email, fax, or phone.

PUBLICATIONS

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

SUBSCRIPTION ORDER AND RENEWAL FORMS

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

WARRANTY INFORMATION

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

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TABLE 1 SCHEDULED INSPECTIONS, DEFAULT*** Consult latest revision of listed publications for specific applicability.	First 10 hours	First 25 hours	First 100 hours	Every 50 hours*	Every 100 hours*	Every 300 hours*	Every 500 hours*	Every 2200/2400 hours*	Every 4 months*	Every 12 months*	Every 24 months*	Every 3 years*	Every 5 years*	Every 12 years*	Every 15 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 SB 301**** *Maintenance Procedures and Service Limitations for Valves.*			●			●									
Perform **Lycoming SB 342 (IO-540 Only)** *Fuel Line (Stainless Steel Tube Assy.) and Support Clamp Inspection & Installation. Reference AD 2015-19-07.*					●										
Perform **Lycoming SB 388**** (also applies to replacement cylinders) *Procedure to Determine Exhaust Valve and Guide Condition.*			●			●									
Perform **Lycoming SB 480 (and R44 SL-83, as applicable)** *I. Oil & Filter Change & Screen Cleaning / II. Oil Filter/Screen Content Inspection. NOTE: Oil filters on D723-1 adapters do not require safety wire.*		●		●					●						
Perform **Lycoming SB 650 (IO-540 Only)** *Intake Pipe and Flange Inspection*				●											
Perform **CMI SB 643, as applicable** *Maintenance Intervals for All CMI/TCM/Bendix Magnetos & Related Equipment.*					●		●							●	
Perform **CMI SB 663** *Two-Wire Magneto Tach. Breaker Contact (Points) Assy. P/N 10-400507.*							●						●		
Perform 100-hour/annual inspection per § 2.400.					●					●					
Perform main rotor blade tip maintenance per § 28-60.					●					●					
Replace hydraulic filter per § 1.170.						●									
Lubricate C181-3 bearing per § 1.140.						●						●			
Drain and flush gearboxes per §§ 1.120 & 1.130.							●								
Clean gearbox chip detectors per § 1.115.							●			●					
Perform clutch assembly lubricant inspection & servicing per § 7.210.							●								
Verify magneto (or EIS) drive cushion pliability (must tolerate 180° bend).							●						●		
Perform 2200-hour/2400-hour/12-Year inspection per § 2.600.								●						●	
Replace cockpit camera battery per § 37-140 Part C.										●					
Perform pressure relief valve leakage check per § 12-83.										●					
Perform pop-out float leak check per § 5.630.										●					
Perform pop-out float inflation check per § 5.640.													●		
Perform pop-out float pressure cylinder hydrostatic test (per U.S. DOT-SP 10915).													●		
Pop-out float pressure cylinder maximum life.															●

* Recurring inspection.

** Gray square indicates a shorter interval than published on referenced document.

*** Helicopters on a Part 91 Approved Inspection Program (AIP), a Part 135 Approved Aircraft Inspection Program (AAIP), or an equivalent foreign-approved inspection program, must refer to & comply with that program. Refer to current revisions of FAA Advisory Circulars 91-90 & 135-10.

1.102 Additional Component Maintenance (continued)

A. 12 YEARS (continued)

Part Number	Description	Action
B173-2, -3, or -6	V-Belt – Alternator	Replace with new.
B173-4	V-Belt – A/C Compressor Drive	Replace with new.
B283-1	Hose Assembly (oil pressure sender)	Replace with new.
B283-3	Hose Assembly (fuel; various)	Replace with new.
B283-7	Hose Assembly (fuel control to flow divider)	Replace with new.
B283-10	Hose Assembly (engine-driven pump to fuel control)	Replace with new.
B283-11	Hose Assembly (fuel return)	Replace with new.
C005-4	Main Rotor Hub (C154-1) & Bearing Assembly	Perform inspection and repair per § 28-22, return to RHC for inspection and repair, or replace with new.
C005-12	C016-7 Main Rotor Blade & C158-1 Spindle Assembly	Submit to RHC-authorized component maintenance facility for 12-year service, or replace with new or overhaul exchange. 12-year maintenance includes blade replacement (as required), pitch horn screw replacement, boot and O-ring replacement, and inspection.
C006-3, -6, or -8	Main Rotor Gearbox Assembly	Submit to RHC Repair Station for 12-year service, or replace with new or overhaul exchange. 12-year maintenance includes pinion seal replacement, O-ring replacement, sealed bearing replacement, rubber mount replacement, and inspection.
C007-5	Fanshaft Assembly	Inspect C181-3 bearing per § 2.502 step 3. Lubricate per § 1.140.
C008-4	Tail Rotor Assembly	Replace with new C008-9 tail rotor assembly.
C008-9	Tail Rotor Assembly	Disassemble. Remove bushings and teeter hinge bearings. Inspect hub; verify no fretting or corrosion. Fluorescent penetrant inspect hub. Replace blades as required. Replace teeter hinge bearings and blade attach bolts.
C011-2 & -3	Arm Assembly – Throttle (forward & aft, R44)	Visually inspect. Replace with D756 if corrosion is evident. Verify bearing rotates smoothly without noise.
C014-X	Landing Gear Assembly	Perform 12-year service per § 2.650 Part A.
C015-1	Cabin Assembly	Remove B270-1 sealant from aft-side of aluminum C259 panels at junction of steel horizontal firewall and inspect panels for corrosion. Repair as required. Replace sealant.
C017-4	Swashplate Assembly	Perform 12-year service per § 2.640, or replace with new or overhaul exchange C017-6 swashplate.

1.102 Additional Component Maintenance (continued)

A. 12 YEARS (continued)

Part Number	Description	Action
C017-6	Swashplate Assembly	Perform 12-year service per § 2.640, or replace with new or overhaul exchange.
C018-2 or -3	Clutch Assembly (C166-4 shaft)	Replace with new or overhaul exchange C018-4 or -5 clutch assembly.
C018-4 or -5	Clutch Assembly (C166-5 shaft)	Submit to RHC-authorized component maintenance facility, or replace with new or overhaul exchange. 12-year maintenance includes plug, seal and O-ring replacement, C184 bearing lubrication, and inspection.
C020-1 or -2	C020-1 (standard) or C020-2 (tie-down provisions) Upper Frame Assembly	Visually inspect for corrosion. If corrosion is found, remove paint per § 23-71 and MPI per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per §§ 23-75 & 23-77.
C021-1	Tail Rotor Gearbox Assembly	Perform 12-year service per § 2.610, or replace with new or overhaul exchange.
C031-1	Tail Rotor Pitch Control	Replace with new.
C041-11	Bearing Assembly – TRDS Damper	Replace with new.
C046-1, -19, -21, or -23	Lower Frame Assembly – LH	Visually inspect for corrosion. If corrosion is found, remove paint per § 23-71 and MPI per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per §§ 23-75 & 23-77.
C046-2	Lower Frame Assembly – RH	Visually inspect for corrosion. If corrosion is found, remove paint per § 23-71 and MPI per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per §§ 23-75 & 23-77.
C051-1 or -2	Clutch Actuator Assembly	Submit to RHC Repair Station for 12-year service, or replace with new or overhaul exchange.
C119-2	Bumper – Tail Rotor	Replace with new.
C121-1, -3 or -30, -19, & -24 or -28	Push-Pull Tube Assembly – Main Rotor	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
C121-9, -15, & -17	Push-Pull Tube Assembly – Tail Rotor	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
C121-21	Push-Pull Tube Assembly – Throttle	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
C121-25 or -31	Push-Pull Tube Assembly – Swashplate	Measure & record overall length. Remove rod ends and visually inspect, including tube interior. Replace if corrosion is evident.
C169-3, -32, -36, or -38	Muffler Assembly	Visually inspect muffler interior; verify no obvious damage and no loss of material.
C174-1 Revision A thru F	Support (engine mount at prop governor pad; constant 0.5-inch dia. vertical tube)	Replace with Revision G or H support; OR replace with C174-7 support weldment, C174-11 plate & C592-4 mount assembly.

1.102 Additional Component Maintenance (continued)

A. 12 YEARS (continued)

Part Number	Description	Action
C174-1 Revision G or subsequent	Support (engine mount at prop governor pad; vertical tube lower portion is 0.562 inch dia.)	Remove rod ends and visually inspect, including tube interiors. Replace if corrosion is evident.
C174-7	Support Weldment	Remove rod ends and visually inspect, including tube interiors. Replace if corrosion is evident. Coat tube interiors with B270-21 protectant.
C258-1	Main Rotor Pitch Link Assembly	Replace with new C258-5 link assembly.
C258-5	Main Rotor Pitch Link Assembly	Perform inspection per § 2.630, or replace with new.
C315-9	Support Weldment – Lower Aft Flight Controls	Visually inspect. If exterior corrosion is evident, remove and inspect tube interior. Repair or replace as required.
C319-5	Torque Tube – Cyclic	Visually inspect. If exterior corrosion is evident, remove and inspect tube interior. Repair or replace as required.
C334-4	Bellcrank Assembly (Collective)	Visually inspect. If exterior corrosion is evident, remove and inspect tube interior. Repair or replace as required. Verify bearings rotate smoothly without noise.
C336-1	Push-Pull Tube Assembly, Throttle (R44)	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
C339-1 or -10	Jackshaft Weldment	Visually inspect. Repair or replace as required.
C343-1*, -9, & -11 (*R44 SL-43 refers)	Push-Pull Tube Assembly – Tail Rotor	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
C343-8	Tube – Aft Servo	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
C348-1	Anchor Assembly – Collective Stop	Visually inspect. If exterior corrosion is evident, remove and inspect tube interior. Repair or replace as required.
C348-5	Anchor Assembly – Seat Belt (Forward)	Replace if seat buckle attaching lugs are less than 0.073 inch thick. Visually inspect. If exterior corrosion is evident, remove and inspect tube interior. Repair or replace as required.
C480-1	Swashplate Boot	Replace with new.
C608-1	Support Weldment – Throttle Bellcrank	Visually inspect. If exterior corrosion is evident, remove and inspect tube interior. Repair or replace as required.
C649-1	Oil Cooler	Replace with new or overhauled C649-2 oil cooler.
C649-2 & -3	Oil Cooler	Flush & 400-psi pressure test or overhaul or replace with new.

1.102 Additional Component Maintenance (continued)

A. 12 YEARS (continued)

Part Number	Description	Action
C792-4 or -5	Dual Tachometer	Submit to RHC Repair Station for 12-year service, or replace with new or overhaul exchange.
C907-1 or -2 Revision A thru G (weldment)	Yoke – Clutch Shaft Forward (1.43-inch dia. center hole between arms)	Replace with C907-1 or -2 Revision H or subsequent yoke.
C907-1 or -2 Revision H or subsequent (forging)	Yoke – Clutch Shaft Forward (1.471-inch dia. bore)	Replace with new, or comply with FAA AD 2025-11-07 (see current revision of R44 Service Letter SL-91).
C918-15	Elastic Cord – Collective	Replace with new A918-20 cord.
C947-1 & -3	Flex Plate Assembly (bonded)	Visually inspect with 10x magnification. Replace if corrosion is evident. Replace if any bonded washer evidences separation (8 places).
D046-1 or -2 (LH), & D046-3 (RH)	Strut Weldments	Visually inspect for corrosion; replace if pitted. If non-pitting, surface corrosion is found, remove corrosion & paint per § 23-71 and MPI per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per §§ 23-75 & 23-77.
D151-2	Stop (teeter, 2 each)	Replace with new.
D174-2	Fanwheel	Perform 12-year service per § 2.620, or replace with new or overhaul exchange.
D201-5	Support Assembly – Hydraulic Servos (fwd)	Replace D201-5 with D201-6 support assembly.
D203-1	Support Assembly – LH (aft servo)	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
D204-8	Support Assembly – RH (aft servo)	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
D207-1	Strut Weldment – Jackshaft, Forward	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
D208-1	Strut Weldment – Jackshaft, Aft	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
D211-1 or -2	Hydraulic Reservoir	Perform 12-year service per § 2.660, or replace with new or overhaul exchange.
D212-1	Hydraulic Servo Actuators	Remove upper clevis, scissor, and D200-3 washer from servo, as applicable. Visually inspect threaded bore in piston shaft with borescope. Replace servo if corrosion is evident.
D224-1 or -2	Tail Rotor Drive Shaft	Remove yoke(s) and inspect shaft interior using borescope. Replace shaft if corrosion is evident.
D278-1 or -2	Governor Controller	Submit to RHC Repair Station for 12-year service, or replace with new or overhaul exchange.

1.102 Additional Component Maintenance (continued)

A. 12 YEARS (continued)

Part Number	Description	Action
D321-1	Valve – Pressure Relief (Fuel)	Replace with new D321-1 or D321-4 valve assembly.
D731-1	Bellcrank Assembly – Throttle, R44 II	Visually inspect. If exterior corrosion is evident, remove and inspect tube interior. Verify bearings rotate smoothly without noise. Repair or replace as required.
D731-9	Bellcrank Assembly – Throttle, R44 II (fuel control)	Visually inspect. Replace if corrosion is evident. Verify bearing rotates smoothly without noise.
D756-1	Bellcrank Assembly (forward, R44 II)	Visually inspect. Replace if corrosion is evident. Verify bearing rotates smoothly without noise.
D756-3 & -4	Bellcrank Assembly (forward & aft, R44)	Visually inspect. Replace if corrosion is evident. Verify bearing rotates smoothly without noise.
D778-1	Cartridge – Air Conditioning Pulley Drive (R44 II or Cadet only)	Replace with new.
D918-1 & -2	Elastic Cords – Cyclic	Replace with new.
NAS1149E0363R	Washer (corrosion resistant, mixture arm, 2 each)	Replace with new C141-26 washers, per R44 SL-80.
21FKF-518	Nut (exhaust riser, 12 each)	Replace with new.
21FKF-813	Jam Nut (MR pitch link, 2 each)	Replace with new.

1.102 Additional Component Maintenance (continued)

B. 2200/2400 Hours

Perform action indicated on the following components when they have accumulated 2200 hours (R44 S/Ns 0001 thru 9999 & R44 II S/Ns 10001 thru 29999) or 2400 hours (R44 Cadet S/Ns 30001 & subsequent) time in service since new or since last overhaul:

Part Number	Description	Action
A120-3	Tail Rotor Bellcrank	Replace with new.
A130-21	Spacer (at R44 and R44 Cadet powerplant controls)	Replace with new.
A130-48	Spacer	Replace with new, per R44 SL-80.
A190-3	V-Belt Set	Replace with new.
A336-6, -9	Push-Pull Tube – Throttle (R44 II)	Replace with new.
A462-4	Fitting	Replace with new.
A522-7	Control Cable – Mixture (carburetor)	Replace with new.
A522-13	Control Cable – Mixture (fuel control)	Replace with new.
A595-1	Seal – Vertical Firewall (neoprene)	Replace with new.
A595-2	Seal – Vertical Firewall (Teflon®)	Replace with new.
A650-2 or -4	Fitting – MRGB Mount	Visually inspect, including bore. Replace if worn or corroded. Magnetic particle inspect per § 23-41.
A729-33	Tube (aux fuel pump drain)	Replace with new.
A785-6	Hose (bulkhead to MRGB)	Replace with new.
A785-7	Hose (alternator cooling)	Replace with new.
A785-10	Hose (carb heat scoop to airbox)	Replace with new.
A785-11	Hose (engine LH cowling to airbox)	Replace with new.
A785-12	Hose (scroll to muffler shroud)	Replace with new.
A785-13	Hose (muffler shroud to cabin heat inlet)	Replace with new.
A785-16	Hose (scroll to MRGB)	Replace with new.
A785-17	Hose (scroll to bulkhead)	Replace with new.
A785-19	Hose (magneto cooling)	Replace with new.
A785-28	Hose (bulkhead to hydraulic reservoir)	Replace with new.
A785-31	Hose (R44 II engine air intake)	Replace with new.
A918-1 thru -8	Elastic Cord – Tail Rotor	Replace with new. Dash number is selected during flight test evaluation.
A947-2	Flex Plate Assembly (intermediate)	Replace with new.
B173-2, -3, or -6	V-Belt – Alternator	Replace with new.
B173-4	V-Belt – A/C Compressor Drive	Replace with new.
B277-024	Clamp	Replace with new.
B277-036	Clamp	Replace with new.

1.102 Additional Component Maintenance (continued)

B. 2200/2400 Hours (continued)

Part Number	Description	Action
B283-1	Hose Assembly (oil pressure sender)	Replace with new.
B283-3	Hose Assembly (fuel; various)	Replace with new.
B283-7	Hose Assembly (fuel control to flow divider)	Replace with new.
B283-9 or -11	Hose Assembly (fuel return)	Replace with new B283-11 hose assembly.
B283-10	Hose Assembly (engine-driven pump to fuel control)	Replace with new.
B345-4	Pitch Link (tail rotor)	Replace with new.
B350-3	Spring Pin (fanwheel retaining nut)	Replace with new.
C005-4	C154-1 Main Rotor Hub Assembly	Replace with new.
C005-12	C016-7 Main Rotor Blade & C158-1 Spindle Assembly	Replace with new or overhaul exchange C005-12 main rotor blade & spindle assembly, as required.
C006-3, -6, or -8	Main Rotor Gearbox Assembly	Replace with new or overhaul exchange C006-8 main rotor gearbox assembly.
C007-5	Fanshaft Assembly	Replace with new.
C008-4 or -9	Tail Rotor Assembly	Replace with new C008-9 tail rotor assembly.
C014-X	Landing Gear Assembly	Perform 2200-Hour/2400-Hour service per § 2.650 Part B.
C017-4 or -6	Swashplate Assembly	Replace with new or overhaul exchange C017-6 swashplate assembly.
C018-2 or -3	Clutch Assembly (C166-4 shaft)	Replace with new or overhaul exchange C018-4 or -5 clutch assembly.
C018-4 or -5	Clutch Assembly (C166-5 shaft)	
C020-1	Upper Frame Assembly (standard)	Replace with new.
C020-2	Upper Frame Assembly (with tie-downs)	Replace with new.
C021-1	Tail Rotor Gearbox Assembly	Replace with new or overhaul exchange.
C031-1	Tail Rotor Pitch Control	Replace with new.
C046-1, -19, -21, or -23	Lower Frame Assembly – LH	Remove paint per § 23-71 and MPI per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per §§ 23-75 & 23-77.
C046-2	Lower Frame Assembly – RH	Remove paint per § 23-71 and MPI per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per §§ 23-75 & 23-77.
C051-1 or -2	Clutch Actuator Assembly	Replace with new or overhaul exchange.
C106-X	Journal, Main Rotor Hub	Replace with new, or: Visually inspect using 10x magnification for obvious damage; magnetic particle inspect per § 23-41.

1.102 Additional Component Maintenance (continued)

B. 2200/2400 Hours (continued)

Part Number	Description	Action
C119-2	Bumper (tail rotor)	Replace with new.
C121-17	Push-Pull Tube (tailcone)	Replace with new.
C121-25 or -31	Push-Pull Tube Assembly – Swashplate	Disassemble, remove paint per § 23-71, fluorescent penetrant inspect per § 23-42, and replace as required. Clean, prime, & paint per § 23-60.
C152-1	Thrust Washer	Replace with new, or: Visually inspect using 10x magnification for obvious damage; magnetic particle inspect per § 23-41.
C169-1 or -35	Exhaust Muffler Assembly	Replace with new C169-35 assembly.
C169-31 or -37	Exhaust Muffler Assembly	Replace with new C169-37 assembly.
C174-1 Revision A thru F	Support (engine mount at prop governor pad; constant 0.5-inch dia. vertical tube)	Replace C174-1 support, C592-2 link & C592-3 mount with C174-7 support, C174-11 plate & C592-4 mount.
C174-1 Revision G or subsequent	Support (engine mount at prop governor pad; vertical tube lower portion is 0.562 inch dia.)	Strip paint using § 23-71 approved materials. Magnetic particle inspect support per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per § 23-60.
C174-7	Support Weldment	Liquid-strip paint using § 23-71 approved materials only. Magnetic particle inspect support per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per § 23-60. Fill and drain tube interiors using B270-21 protectant.
C174-11	Plate Weldment	Strip paint using § 23-71 approved materials. Magnetic particle inspect plate per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per § 23-60.
C182-1	Nut (fanwheel retaining)	Replace with new.
C189-14	Nut (MR hub bolt)	Replace with new.
C258-1	Main Rotor Pitch Link Assembly	Replace with new C258-5 link assembly.
C258-5	Main Rotor Pitch Link Assembly	Replace with new, or perform inspection per § 2.630 and magnetic particle inspect barrel.
C339-1 or -10	Jackshaft Weldment	Visually inspect. Repair or replace as required.
C343-1*, -9, & -11 (*R44 SL-43 refers)	Push-Pull Tube Assembly – Tail Rotor	Visually inspect. If exterior corrosion is evident, record length, disassemble, and inspect tube interior. Repair or replace as required.
C348-5	Anchor Assembly – Seat Belt (Forward)	Replace if seat buckle attaching lugs are less than 0.073 inch thick. Visually inspect. If exterior corrosion is evident, remove and inspect tube interior. Repair or replace as required.

1.102 Additional Component Maintenance (continued)

B. 2200/2400 Hours (continued)

Part Number	Description	Action
C480-1	Swashplate Boot	Replace with new.
C522-7	Control Cable – Carburetor Heat	Replace with new.
C568-1	Scoop Assembly (carburetor heat)	Replace with new.
C615-1	Gasket (airbox-to-carburetor)	Replace with new.
C627-4, -5, or -6	4-/5-point Harness Assembly	Replace with new.
C628-5, -6, -7, or -8	Connector Assembly	Replace with new.
C649-1	Oil Cooler	Replace with new or overhauled C649-2 oil cooler.
C649-2 & -3	Oil Cooler	Flush & 400-psi pressure test or overhaul or replace with new.
C749-1	Nozzle Assembly (MRGB cooling)	Replace with new.
C792-4 or -5	Dual Tachometer	Replace with new or overhaul exchange.
C907-1 or -2 Revision A thru G (weldment)	Yoke – Clutch Shaft Forward (1.43-inch dia. center hole between arms)	Replace with C907-1 or -2 Revision H or subsequent yoke.
C907-1 or -2 Revision H or subsequent (forging)	Yoke – Clutch Shaft Forward (1.471-inch dia. bore) Yoke is heat-treated steel & cadmium-plated; do not remove gold-colored cadmium plating.	Replace with new, or comply with FAA AD 2025-11-07 (see current revision of R44 Service Letter SL-91)
C918-15	Elastic Cord (collective)	Replace with new A918-20 cord.
C947-1 & -3	Flex Plate Assembly (forward & aft)	Replace with new.
D046-1 & -2	Strut Weldment – LH	Remove paint per § 23-71. MPI per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per §§ 23-75 & 23-77.
D046-3	Strut Weldment – RH	Remove paint per § 23-71. MPI per § 23-41. Powder coat per § 23-76 (preferred), or prime & paint per §§ 23-75 & 23-77.
D079-1	Tail Rotor Guard Assembly	Replace with new.
D082-1	Tube Assembly (weldment, TR guard)	Replace with new, or: liquid-strip paint per § 23-71, MPI per § 23-41, & prime per § 23-60.
D174-2	Fanwheel	Replace with new or overhaul exchange.
D201-5	Support Assembly – Hydraulic Servos (fwd)	Replace with new D201-6 support assembly.
D201-6	Support Assembly – Hydraulic Servos (fwd)	Visually inspect including interior of tube for corrosion. If corrosion is found, replace with new.

1.102 Additional Component Maintenance (continued)

B. 2200/2400 Hours (continued)

Part Number	Description	Action
D203-1	Support Assy, LH – Aft Hydraulic Servo	Remove paint per § 23-71. MPI per § 23-41. Clean, prime, & paint per § 23-60.
D204-8	Support Assy, RH – Aft Hydraulic Servo	Remove paint per § 23-71. MPI per § 23-41. Clean, prime, & paint per § 23-60.
D211-1 or -2	Hydraulic Reservoir	Replace with new or overhaul exchange.
D212-1	Hydraulic Servo Actuators	Replace with new or overhaul exchange.
D224-1 & -2	Tail Rotor Drive Shaft Assembly	Replace with new.
D270-1	Governor Controller (with EMU)	Replace with new or overhaul exchange.
D278-1 or -2	Governor Controller	Replace with new or overhaul exchange.
D321-1	Valve – Pressure Relief (Fuel)	Replace with new D321-1 or D321-4 valve assembly.
D333-3	Fitting (carb heat control cable)	Replace with new.
D500-1	Hydraulic Pump	Replace with new or overhaul exchange.
D543-2	Spacer (fuel control throttle bellcrank)	Replace with new.
D730-8	Brace (fuel control)	Replace with new.
D735-1	Sleeve – Fuel Control Inlet Fitting (orange, insulated)	Replace with new.
D743-1, -2, -3 or -4	Pump – Fuel (electric)	Replace with new D743-3 pump. For helicopter S/N 13158 and prior equipped with D743-1, -2, or -4 aux fuel pump, also order KI-206-3 Provisions Kit.
D778-1	Cartridge – Air Conditioning Pulley Drive (R44 II or Cadet only)	Replace with new.
D918-1 & -2	Elastic Cords – Cyclic	Replace with new.
D930-1	Mixture Spring (fuel control)	Replace with new.
F628-1	Connector Assembly	Replace with new.
F628-3	Connector Assembly	Replace with new.
F628-7	Buckle Assembly	Replace with new.
KI-6604	C017-5 Swashplate Installation Parts Kit Instructions	Replace existing parts with kit parts.
21FKF-518	Nut (exhaust riser, 12 each)	Replace with new.
AN3-41A	Bolt (oil cooler retaining)	Replace with new.
AN3-44A	Bolt (oil cooler retaining)	Replace with new.
AN735-4	Clamp (mixture cable-to-C577-2 bracket)	Replace with new.
MS16562-4	Spring Pin (in D333-3 fitting)	Replace with new.
MS20002-24	Washer (thick, fanwheel retaining nut)	Replace with new.
NAS1149E0363R	Washer (corrosion resistant, mixture arm, 2 each)	Replace with new C141-26 washers, per R44 SL-80.

1.102 Additional Component Maintenance (continued)

B. 2200/2400 Hours (continued)

Part Number	Description	Action
NAS1149F2432P	Washer (thin, fanwheel retaining nut)	Replace with new.
NAS634-105	Bolt (MR hub)	Replace with new.

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 R44 Maintenance Manual or accessory manufacturer's instructions as required.

1.115 Chip Detector Cleaning

NOTE

During normal operation of gearboxes using A257-2 oil, an insulating film of varnish can accumulate on a chip detector's magnet which could prevent metallic debris from illuminating the chip warning light. Proper cleaning of chip detectors per the following steps is critical to chip detector function.

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. Remove and discard safety wire, if applicable, securing chip detector. Disconnect chip detector wiring from airframe harness at connectors. For tail gearbox, place suitable drain container below gearbox to catch oil and remove chip detector.
2. Clean chip detector using a toothbrush and approved solvent (refer to § 23-72). 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 appropriate gearbox caution light illuminates. Turn battery switch off. Disconnect chip detector wiring from airframe harness at connectors.
4. Install chip detector. Special torque threaded-type chip detector per § 23-33; install safety wire as required (refer to R44 SL-45). Connect chip detector wiring to airframe harness at connectors.
5. Turn battery switch on. Depress push-to-test button(s) and verify appropriate gearbox caution light illuminates. Turn battery switch off.

1.120 Main Rotor Gearbox Drain And Flush

1. Run-up helicopter for approximately five minutes at 60–70% RPM per applicable 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. Check for oil leaking from chip detector housing. Leakage indicates housing is defective and must be replaced. If leakage occurs, immediately install main rotor gearbox drain assembly to minimize oil spillage.

CHAPTER 2

INSPECTION

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CHAPTER 2

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CHAPTER 2

INSPECTION

2.000 Introduction

The R44 helicopter must be inspected periodically to verify it is in airworthy condition; refer to Table 1. 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.

NOTE

Helicopters on a Part 91 Approved Inspection Program (AIP), a Part 135 Approved Aircraft Inspection Program (AAIP), or an equivalent foreign-approved inspection program, must refer to & comply with that program. Refer to current revisions of FAA Advisory Circulars 91-90 & 135-10.

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.

NOTE

Unless directed by Service Bulletin, parts which were not listed as requiring replacement during previous compliance with a 12-year or 2200-hour/2400-hour Inspection may remain in service until next 12-year or 2200-hour/2400-hour Inspection (whichever occurs first).

2.100 General Procedures

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

2.110 Ball and Roller Bearings

The first indication of bearing failure is usually an increase in bearing noise. Noise will almost always start several hours before bearing failure or any increase in bearing temperature. Listen to drive system during start-up and shutdown. A failing bearing will produce a loud whine, rumble, growl, or siren sound. Upon hearing an unusual noise, thoroughly inspect all bearings before further flight. A failing bearing may have a distorted seal or be exuding a large amount of grease. Do not rely on Telatemps to detect failing bearings as temperature increase may occur only seconds before bearing disintegrates. Refer to § 2.501.

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 roller 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 retensioning in flight (on for 1-8 seconds then off). Flight should not be resumed until cause of the flickering clutch light has been determined.

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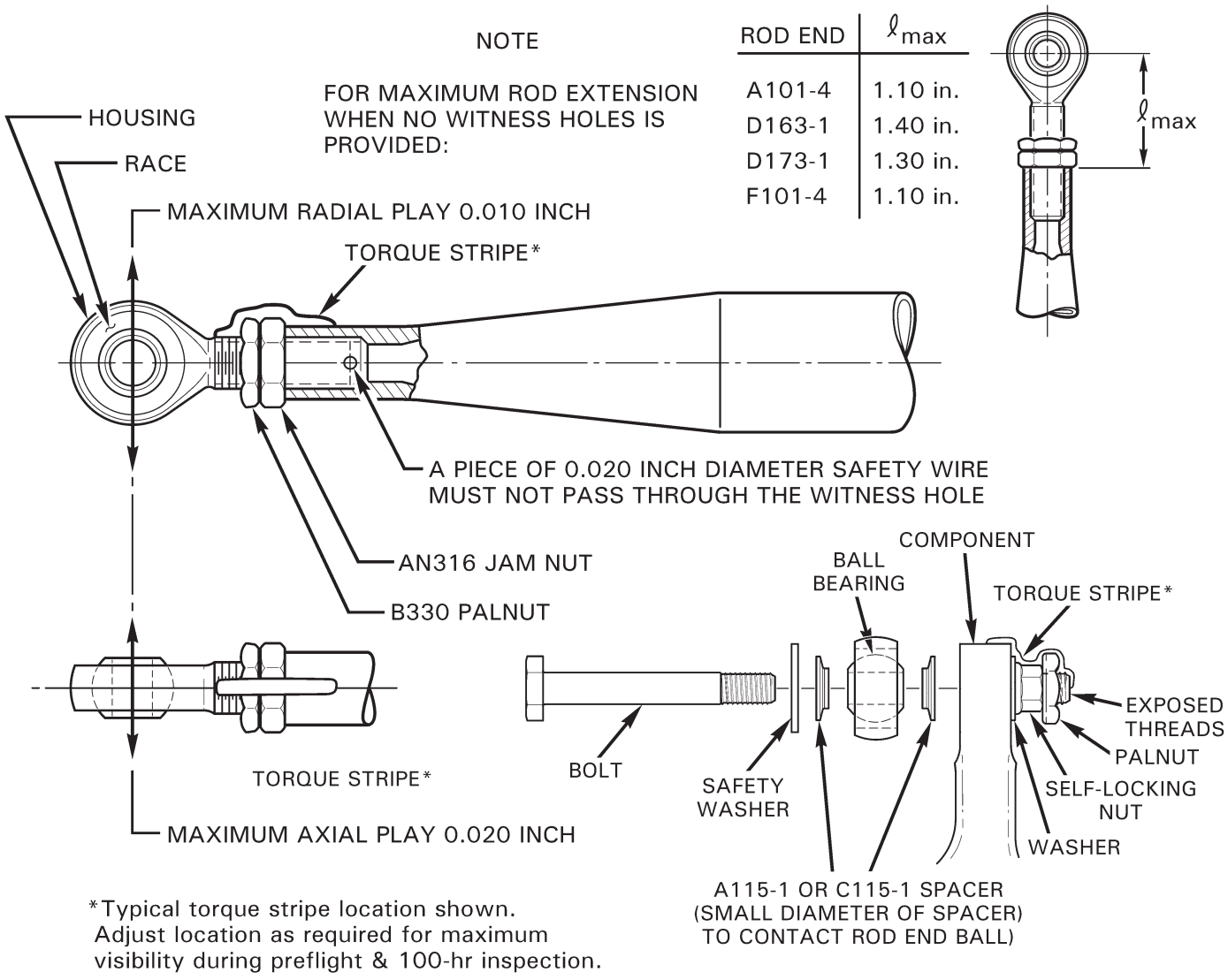

FIGURE 2-1 ROD END AND SPHERICAL BEARING PLAY LIMITS AND TORQUE STRIPE APPLICATION

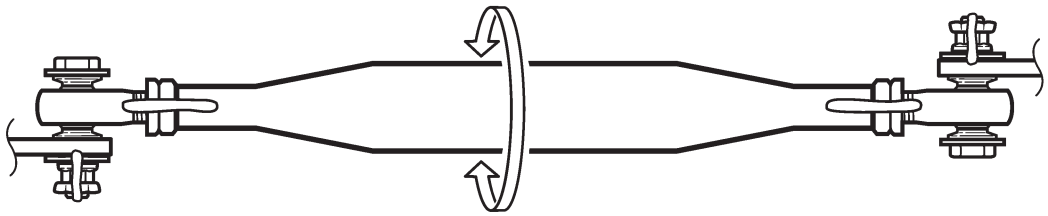

FIGURE 2-1A ROD END CENTERING
(Position rod ends for maximum rotation)

2.300 Airframe Preparation for 100-Hour/Annual Inspection

The helicopter must be thoroughly cleaned prior to inspection in accordance with U.S. 14 CFR Part 43, Appendix D, Paragraph (a). If needed, use a mild soap (pH between 7 & 9) and water solution per Chapter 23.

CAUTION

During pre-inspection cleaning, prior to removing any residue, note and identify both residue & source for follow-up examination. Residue may be fuel, oil, grease, paint, plastic, magnetic-metal, non-magnetic-metal, etc, including combinations; metal residue may indicate structural damage and requires careful attention. Residue may be visible on adjacent structure and not on the source part itself.

CAUTION

Do not spray magnetos, main rotor hub, tail rotor gearbox vent, hydraulic reservoir vent, swashplate area, or bearing seals with high-pressure water or solvent as water or solvent may enter and cause corrosion and breakdown of lubricants.

2.400 100-Hour/Annual Airframe Inspection

CAUTION

If pop-out floats are installed, ensure safety on pilot's red inflation lever is in LOCKED position when working on helicopter.

WARNING

Pop-out float pressure cylinder contents are under extreme pressure. If pop-out floats are installed, install locking pin in pressure cylinder valve (see Figure 5-6) when working in forward left baggage compartment, during cylinder removal or installation, and when working on floats or inflation hoses. Remove locking pin when work is completed. Avoid excessive heat (>200 degrees F) as thermal relief valve will activate.

Perform 100 hour or annual airframe inspections per § 2.410. RHC recommends keeping a copy of the most recently performed checklist with the aircraft's maintenance records.

2.410 Inspection Procedures and Checklist

R44 Serial No.: _____ Technician name: _____

Registration No.: _____ Technician

Hourmeter Indication: _____ Certificate number: _____

Aircraft Total Time: _____

Numbers in parentheses indicate access location per Figures 2-4 and 2-4A.

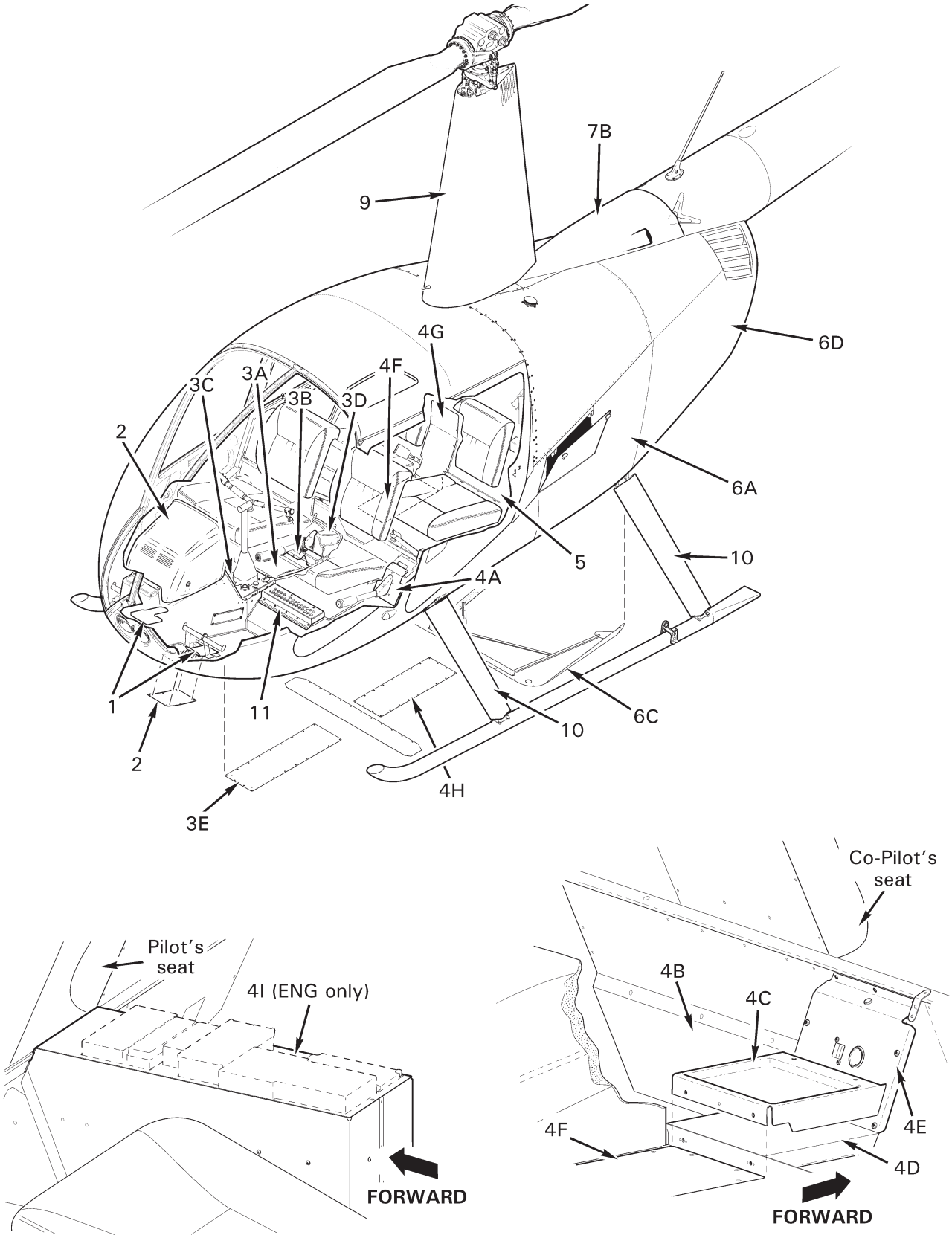

FIGURE 2-4 ACCESS AND INSPECTION PANELS

2.410 Inspection Procedures and Checklist (continued)

6. Remove Engine Aft (6D), Belly (6C), and both side (6A & 6B) Cowlings (continued)

Aft Engine Mount: Inspect all welds for cracks. Verify no corrosion. Verify no contact between rod ends and C020 upper frame tabs per Figure 6-2. _____

Lead-Acid Battery Installations (under left front seat, left-side engine compartment, or mounted to tailcone): Refer to § 37-11. Inspect condition. Verify no cracks or corrosion on or near battery terminals. As required, perform capacity test per manufacturer's instructions or replace battery. Verify battery cable security. Verify no corrosion in surrounding structure. _____

Lithium-Ion Battery Installation (if equipped; under left front seat or left-side engine compartment): Refer to § 37-12. Inspect condition. Verify no cracks or corrosion on or near battery terminals. Verify vent hose, comm connector wiring, and battery cable security. Perform scheduled maintenance as required. Verify no corrosion in surrounding structure. _____

7. Open Cowling Doors (7A), Remove Tailcone Cowling (7B) & Mast Fairing (9)

Cowling Door: Inspect hinges and latches for condition and security. _____

Tailcone cowling: Verify no cracks, air inlet obstructions, or loose rivets. _____

Electrical and Antenna Wires: Inspect condition. Verify security and no chafing, kinks or tight bends. _____

Emergency Locator Transmitter (ELT; if installed): In accordance with local regulation, test per ELT manufacturer instructions. If 406 Mhz ELT, confirm programming tag matches helicopter registration. If RHC installation, inspect condition of both primary hook & loop strap and secondary buckle strap or ty-rap; replace strap(s) if damaged or deteriorated. Verify ELT security and clearance to drive train. _____

MRGB Input Yoke: Inspect condition. Verify security and operating clearance. Verify security of magnets. _____

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2.410 Inspection Procedures and Checklist (continued)

7. Open Cowling Doors (7A), Remove Tailcone Cowling (7B) & Mast Fairing (9) (cont'd)

Actuator (CO51): Verify clearance to structure and drive train when fully disengaged. Turn master switch on and engage clutch switch. While actuator is engaging, depress extension limit switch lever (refer to Figure 7-15) and verify gearmotor stops; release lever and verify gearmotor resumes running. Verify integrity of activating cable for extension limit switch. 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 clearance to structure and drive train when fully engaged. Verify down-limit stop screw jam nut is tight. _____

Check actuator for failed-closed spring switch as follows (actuator electrical harness must be equipped with "Test" plug per Figure 2-6):

a. With BATTERY switch on and actuator fully engaged, connect one end of MT558-1 tool to actuator test plug and verify gearmotor remains off. _____

CAUTION

If gearmotor activates when installing MT558-1 tool then a spring switch has failed in closed position; immediately remove MT558-1 to prevent actuator damage.

b. Disconnect MT558-1 tool, connect opposite end to actuator test plug, and verify gearmotor remains off. _____

c. Disengage clutch and turn BATTERY switch off. _____

d. MT558-1 pins 1 & 2 jumper tests wire 98 spring switch; pins 2 & 3 jumper tests wire 91 spring switch (see Figure 14-1D). Replace any malfunctioning switch per § 7.550 before further flight. _____

Gearmotor Assembly Torque Stripe: Refer to Figure 2-6A. Verify torque stripe is not broken or missing. Renew deteriorated torque stripe as required. _____

Lower Drive Sheave: Inspect lower sheave. Replace any sheave showing corrosion pitting or flaking of metalized coating, wear grooves, roughness, or sharp ridges. _____

Sheave Alignment: Verify sheave alignment per § 7.230. Adjust as required. _____

2.410 Inspection Procedures and Checklist (continued)

7. Open Cowling Doors (7A), Remove Tailcone Cowling (7B) & Mast Fairing (9) (cont'd)

Hydraulic Reservoir: Inspect condition. Verify security and no significant leakage. If required by § 1.101, replace filter per § 1.170. Drain and flush hydraulic system per § 1.180 if oil has turned dark or emits bad odor. Add fluid as required. _____

CAUTION

Cleanliness of hydraulic fluid is vital to proper system operation. Use only clean fluid from sealed containers and avoid contamination from dirty funnels, tubing, etc.

Hydraulic Reservoir Cooling Hose: Inspect condition. Verify hose is secure and is directed at center of reservoir cooling fins. _____

Hydraulic Pump: Inspect condition. Pump temperature indication should not exceed gearbox temperature indication. Verify security and no significant leakage. _____

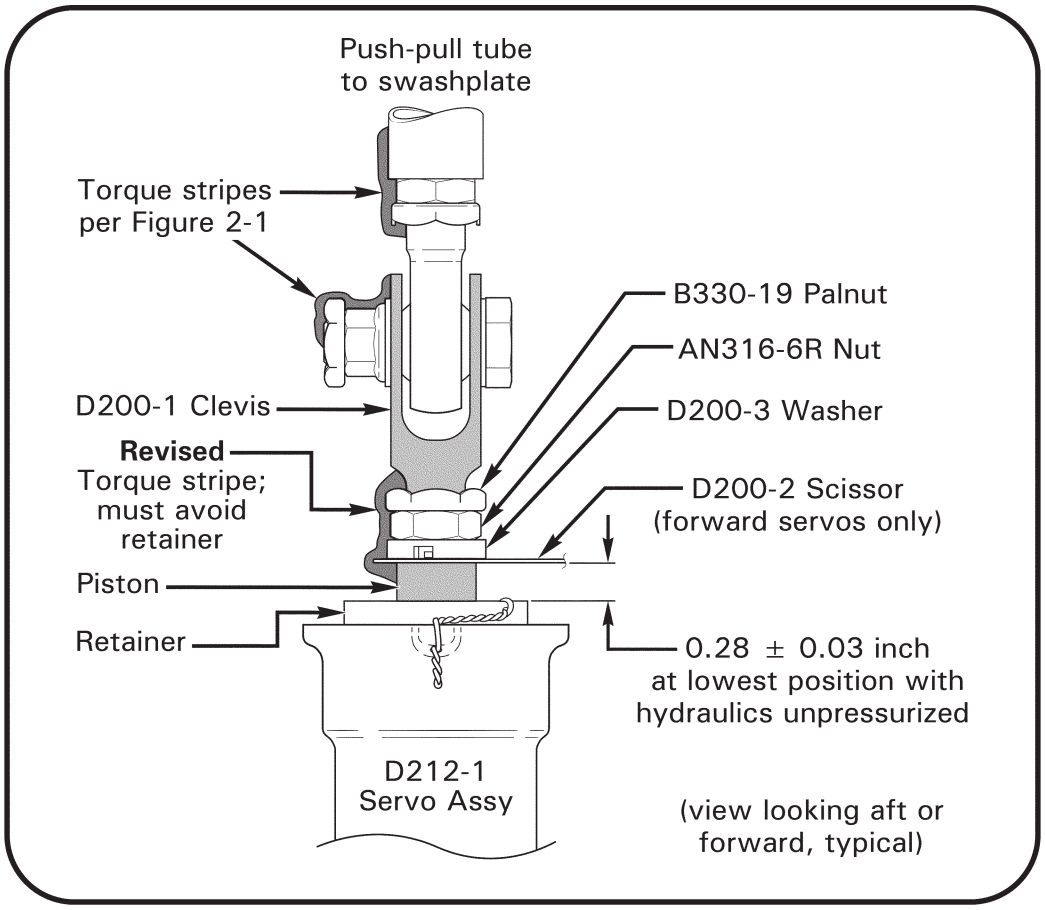

FIGURE 2-7 CLEVIS TORQUE STRIPE

2.410 Inspection Procedures and Checklist (continued)

7. Open Cowling Doors (7A), Remove Tailcone Cowling (7B) & Mast Fairing (9) (cont'd)

Forward Hydraulic Servos: Inspect condition; verify no obvious defects. Hydraulic fluid seepage is permissible ("seepage" is evidence of fluids without flow, drips, or runs) provided fluid does not contaminate MRGB rubber mounts. Verify servo input rod end/clevis area is clean; cleanse area with non-residue, non-alcoholic solvent as required. Verify approximately 0.040 inch total free-play at servo valve input. Inspect rod ends per § 2.120. Verify valve clearance to surrounding structure while flight controls are moved through full range of travel. Inspect condition and verify security of scissors at upper clevis of servos. Inspect clevis security and torque stripe per Figure 2-7. _____

CAUTION

Use LPS PreSolve to clean hydraulic parts. Do not use alcohol.

Aft Hydraulic Servo: Inspect condition; verify no obvious defects. Hydraulic fluid seepage is permissible ("seepage" is evidence of fluids without flow, drips, or runs) provided fluid does not contaminate MRGB rubber mounts. Verify servo input rod end/clevis area is clean; cleanse area with non-residue, non-alcoholic solvent as required. Verify approximately 0.040 inch total free-play at servo valve input. Inspect rod ends per § 2.120. Verify valve clearance to surrounding structure while flight controls are moved through full range of travel. Inspect clevis security and torque stripe per Figure 2-7. _____

Hydraulic-Servo Absorbent Pad (Recent Servos Only): If installed, examine white absorbent pad(s); replace pad if damaged. If pad is discolored, remove pad from tray, then use a roller to squeeze out absorbed fluid, or replace pad. Clean tray & install pad. _____

Aft Hydraulic Servo Supports: Inspect RH and LH support rod ends per § 2.120. Inspect attachment to sheet metal; verify no cracks. Verify security. _____

Hydraulic Lines & Fittings: Inspect condition. Verify valve clearance to surrounding structure while flight controls are moved through full range of travel. Verify security and no leakage. Verify minimum 0.25 inch clearance between pump hoses and aux fuel tank. _____

Fasteners and 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)

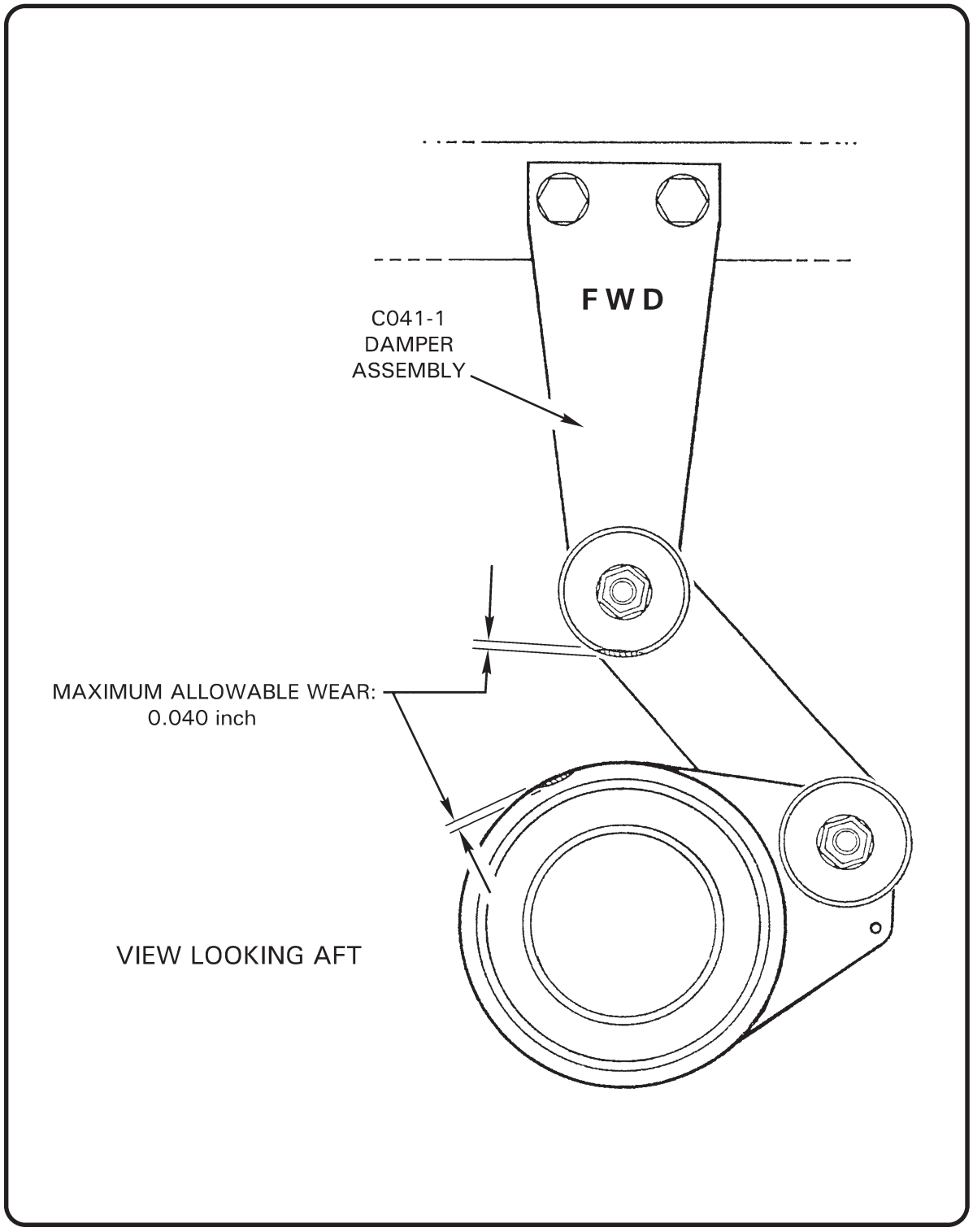

FIGURE 2-8 TAIL ROTOR DRIVE SHAFT DAMPER BEARING INSPECTION

2.410 Inspection Procedures and Checklist (continued)

8. Remove Tailcone Plugs (8A) & Aft Plastic Cover (8B)

NOTE

Aft plastic cover (8B) is secured with two MS27039C0806 screws on Rev L and subsequent tailcones. On Rev K and prior tailcones ensure screws securing plastic cover are short enough to prevent interference in aft flex plate area.

Tail Rotor Drive Shaft Assembly: Examine accessible portion through inspection holes with inspection light and mirror. Verify no cracks, corrosion, or fretting in fore and aft bonded sleeves. Verify no evidence of drive shaft contact with tailcone bays. Verify no bends, bowing, dents, cracks, or corrosion. Perform tail rotor drive shaft runout per § 7.340. Verify proper installation, security, and operating clearance. _____

CAUTION

Bends, bowing, dents, cracks and corrosion are cause for immediate replacement of tail rotor drive shaft.

Tail Rotor Push-Pull Tube & Forward Bellcrank: Examine accessible portion through inspection holes with inspection light and mirror. Inspect condition per § 2.121. Verify no nicks, scratches, dents, cracks, or corrosion. Inspect rod end bearings per § 2.122; verify rod ends are centered and palnut and jam nut are tight. Check witness holes for proper thread engagement. Inspect bellcrank and bellcrank mount for nicks, scratches, dents, cracks, or corrosion. Inspect spherical bearings per § 2.122. Verify proper installation, security, and operating clearance. Verify tail rotor guard mounting screw shanks clear push-pull tube. _____

Tail Rotor Drive Shaft Damper Assembly: Verify no obvious damage. Verify integrity of bearing seals. Inspect bearing housing for excessive wear (see Figure 2-8). Verify bearing's inner race-to-drive shaft torque stripe is intact and no evidence of bearing slippage. Verify proper orientation, security, and smooth operation. _____

Aft Flex Plate (refer to Figure 2-5): Inspect condition. Verify no obvious damage. If fretting is detected, replace flex plate. Verify bonded washers are installed on both sides of each flex plate arm. Verify security and operating clearance. _____

Tail Rotor Drive Shaft Aft Yoke: Using inspection hole, check yoke for cracks, fretting, and corrosion. _____

2.410 Inspection Procedures and Checklist (continued)

8. Remove Tailcone Plugs (8A) & Aft Plastic Cover (8B)

Tailcone Interior: Inspect condition. Verify no cracks in damper mount angle. Verify wear at push-pull tube & bulkhead bushing (6 places) is not excessive. Remove debris. _____

Tailcone Exterior: Inspect condition. Verify drain hole in each bay is clear. Verify no cracks at antenna mounts and battery attachment (if on tailcone). _____

Tailcone Battery (if installed): Inspect condition. Verify no debris between battery box cover and tailcone. Verify security. _____

F050-2 Horizontal Stabilizer (if installed): Inspect condition. Verify security. _____

Strobe Light: Inspect lens and strobe light mount for cracks, loose rivets, and security. If split red/clear lens is installed, verify clear half of lens faces aft. _____

Antennas: Inspect condition. Verify no cracks where antennas mount to tailcone. Verify security. _____

Tailcone Attachment: Inspect condition and security of four bolts attaching tailcone to upper frame. _____

Empennage: Inspect condition. Verify no evidence of tail skid strike. Verify drain holes in lower vertical stabilizer and tail skid are clear. Verify proper installation and security. _____

Tail Rotor Guard: Inspect condition. Verify no cracks or corrosion at attach points. Verify security. _____

Float Stabilizer (if installed): Inspect condition and security. _____

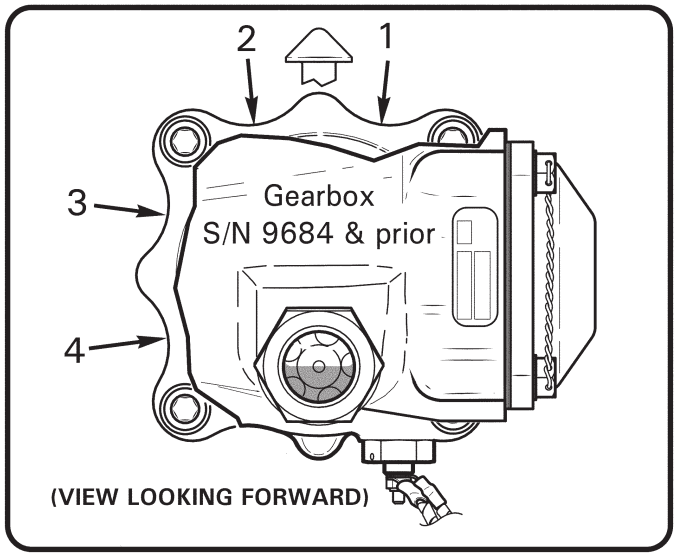

FIGURE 2-8A TRGB INPUT CARTRIDGE INSPECTION

2.410 Inspection Procedures and Checklist (continued)

9. Tail Rotor Gearbox and Tail Rotor

Input Shaft Yoke: Inspect flange and weld for cracks and corrosion. _____

Input Seal: Inspect for leakage. _____

Gearbox: Inspect general condition. Look for leakage. Check oil quantity and cleanliness through sight gage and adjust or flush as required. Check gearbox-to-tailcone mounting security. Inspect output shaft for nicks, scratches and corrosion. Check safety wire on applicable gearbox bolts. Check Telatemp. Gearbox S/Ns 9684 & prior: using 10X magnification, visually inspect four curved surfaces on input cartridge per Figure 2-8A; if cracking is detected, remove gearbox from service and perform C148 Bulkhead Inspection per § 2.595. _____

NOTE

At 500 hours time-in-service or annually, whichever occurs first, remove chip detector and clean varnish from detector's magnetic probe and adjacent metal body (a toothbrush dampened with solvent works well). Also, drain and flush gearboxes at intervals not to exceed 500 hours time-in-service (refer to § 1.101).

Pitch Control Assembly and C121-17 Push-Pull Tube: Check pitch control assembly for free movement throughout its entire range and for looseness on output shaft (0.25 inch maximum rotational play measured at pitch link attach bolt). Inspect bellcrank for cracks and ensure free movement. Pay special attention to spherical bearing atop stud protruding from underside of pitch control; it is permissible to have a single radial crack in the spherical bearing ball. Inspect aft end of C121-17 push-pull tube for cracks and check rod end for excessive looseness (refer to R44 SB-43A). _____

Pitch Links: Check rod ends for excessive looseness. If equipped with one-piece pitch links, disconnect and rotate 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 both bolt heads at pitch control. _____

Tail Rotor Blades: Confirm blades are P/N C029-3 Rev R or subsequent. Inspect blade surfaces and verify no nicks, scratches, cracks, corrosion, voids, debonding, or excessive erosion. Verify tail rotor blade root fitting bearings are not fretting or loose; loose bearing outer race in root fitting requires blade replacement. Verify blades cone toward gearbox. Perform tail rotor blade care per § 30-37. _____

2.410 Inspection Procedures and Checklist (continued)

9. Tail Rotor Gearbox and Tail Rotor

Hub Plates and Hub: Inspect for cracks and corrosion, paying special attention to areas around blade and hub mounting bolts. Ensure teeter hinge bearing outer races move with hub and bearing inner balls and retaining nut and bolt remain stationary when hub is teetered. Hub should move freely on bearings without stiffness or jerkiness. Check teeter hinge bearings for excessive play. For elastomeric bearings inspect per § 2.125. _____

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

10. Open Mast Fairing (9)

Mast Fairing: Inspect condition, especially where stiffeners intersect ribs. _____

Lower Swashplate Scissors: Inspect condition of scissors. Check rod end and bearing play. Check jam nut. _____

Vertical Push-Pull Tubes: Inspect for general condition and corrosion. For manual controls, inspect push-pull tube sleeves at rollers and guide. _____

Rod Ends: Check push-pull tube rod ends per § 2.120. _____

Plastic Rollers and Guide (manual controls): Inspect plastic rollers and guide for cleanliness, security, and deterioration. _____

Pitot Tube: Inspect pitot line and tube, giving special attention to connecting area, for bending, cracking and kinking. Verify pitot tube elbow drain hole is unobstructed. _____

Fuel Tank Vents: Inspect condition and security of fuel tank vent tube clamps. Ensure pitot line is not chafing fuel vent tubes. Check tube connections. Verify tubes are unobstructed and are not kinked, pinched, or chafing. _____

Mast Fairing Ribs: Inspect for cracks especially around mast tube attachments. _____

11. Rotor Hub Area

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

Swashplate Upper Scissors: Inspect condition. Inspect rod ends and spherical bearings per § 2.120. Measure scissors play per Figure 2-9. 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. _____

2.410 Inspection Procedures and Checklist (continued)

15. Exhaust System

Muffler: Remove muffler heater shroud screws, and open shroud. Inspect muffler outer wall for cracks, deformation, and ruptures. Pay particular attention to tailpipe and riser attachment areas, welds, clamps, supports, riser flanges and gaskets. Pressurize muffler with low pressure air and inspect for leakage. Close and secure heater shroud. _____

16. Landing Gear

Skids and Shoes: Inspect left and right landing gear skids and skid shoes; minimum allowable shoe thickness is 0.05 inch. Verify drain holes are open (not applicable to float landing gear). _____

Struts and Elbows (open fairings if installed): Inspect for cracks and corrosion, especially at elbow joints. Inspect weld area at bottom of strut for cracks. _____

Landing Gear Fairings (if installed): Inspect for cracks and loose rivets. Verify security. _____

Crosstubes: Inspect, especially at elbow joints, for cracks and corrosion. With helicopter on level ground, measure distance from ground to tail skid. If dimension is less than 30 inches, one or both cross tubes must be replaced (see Chapter 5). _____

Landing Gear Attach Points: Check forward attach points for loose rivets, cracks, buckling, and fretting. Check bearing mounts for loose swages and worn bearings. _____

Utility Floats (if installed): Inspect for damage. Refer to applicable Pilot's Operating Handbook for proper inflation pressure. _____

Pop-out Floats (if installed) Pressure Cylinder & Valve: Inspect condition. Verify security. Verify pressure gage indicates correct pressure for ambient temperature; refer to placard on cylinder for limits. _____

Pop-out Floats (if installed) Inflation Manifold: Inspect condition. Verify no chafing or pinching of hoses, especially where hoses pass thru structure. _____

Pop-out Floats (if installed): Inspect condition of stowed floats. Verify no holes, cuts, tears, abrasion thru, or unraveling of, float covers. If cover damage is found, inflate and inspect floats. Verify all float cover snaps and hook-and-loop fasteners are properly secured. Verify float-to-skid attachment security. _____

NOTE

Annually apply A257-7 dry-film lubricant (see § 23-78) to float cover snap mating surfaces. Annually perform § 5.630 leak check. Every three years, perform § 5.640 emergency inflation test.

2.410 Inspection Procedures and Checklist (continued)

17. Cabin

General interior: Inspect condition. Verify general cleanliness of cabin and seat compartment interior. Verify no loose objects or equipment, which could foul controls, or injure occupants in a hard landing. Verify legibility of placards and markings. Verify serviceable condition of switches, knobs, handles, and other controls. _____

Rear Seat-Bottom Suspension Straps: Inspect condition and security. _____

Seat Belts and Shoulder Harnesses: Inspect for fraying and broken stitching. Check inertia reels for proper operation by pulling harness quickly to verify locking function. Check buckles for proper operation. Check belt and reel attach points for security. _____

NOTE
TSO tag not required on factory installed harnesses.

Heated Seats (if installed): Perform heated seats inspection per § 15.240 Part D. _____

Cyclic Guard (if installed): Inspect condition of cyclic guard. Inspect all welds for cracks. Verify no corrosion. Verify security and proper operation. _____

Cockpit Camera (if installed): Inspect condition. Verify camera lens is clean. Perform functional check per § 37-140 Part D. _____

Exterior: Inspect condition. Inspect cabin exterior for nicks, scratches, dents, cracks, corrosion, fretting, or loose rivets. Loose rivets may be indicated by cracked paint and/or black residue around heads. Verify general cleanliness. _____

Windshields & Windows: Inspect condition. Verify no significant UV yellowing. Minor defects or imperfections that do not impair pilot visibility are acceptable. Refer to § 27-30 for damage and repair limits. Verify security. _____

Yaw String: Inspect condition. Verify minimum string length is 3 inches on each side of clip. Verify security. _____

Doors: Inspect for cracks around hinges and latches. Check vents for operation. Ensure hinge pins are secured with cotter pins. Check tightness of hinge mounting screws. Verify proper operation of door latching and locking mechanisms. _____

Skin: Inspect skin for damage. Inspect for loose rivets, indicated by cracked paint and/or black residue around heads. _____

2.410 Inspection Procedures and Checklist (continued)

17. Cabin (continued)

Static Ports: Inspect static ports for obstructions. If fixed utility floats are installed, verify air dam installed aft of both static ports. _____

Left & Right Navigation Lights: Inspect condition. Verify no cracks where right and left navigation lights mount to fuselage. Verify red left, green right, lens cleanliness, clarity, and security. Verify proper operation. _____

Landing & Taxi Lights: Inspect condition. Verify lens cleanliness, clarity, and security. Verify proper operation. _____

Landing Light Retainer & Support: Inspect condition. Verify no cracks where retainer mounts to support. Verify security. _____

Chin Drains (R44 Clipper): Verify no obstructions. _____

18. Special Equipment (if installed)

Peak Beam Searchlight: Check for proper operation. Align beams by focusing both lights to smallest spot possible and shining against a wall at least 100 feet away. Verify both spots hit same point within one foot. _____

Nose Gimbal and Monitors: Turn power on and verify infrared units complete cool down sequence in manufacturer's recommended time. Verify gimbal steers smoothly in azimuth and elevation. Check focus and zoom of infrared/video. Check for clear images on monitors. Verify retractable monitor retracts without interference. _____

Spectrolab Searchlight: Verify light starts and cooling fan operates. Verify searchlight steers smoothly in azimuth and elevation. For slaved units, turn on slaving and verify light follows nose gimbal approximately. _____

FM Radios: Verify radios transmit and receive properly and control head programs radios properly. _____

Video Tape Recorder: Verify all video tape recorder modes operate properly and remote control correctly controls modes. _____

Overhead Light: Verify overhead light on/off. _____

Transmit and Intercom Switches: Verify proper operation of special transmit and intercom switches. _____

Talent Light: Verify talent light on/off, acceptable friction. _____

Micro Cameras: Verify all micro cameras are selectable from video switcher and produce focused, upright images on monitors. _____

TV Tuner: Verify TV tuner receives broadcasts (video clear on monitors, audio clear in headset). _____

2.410 Inspection Procedures and Checklist (continued)

18. Special Equipment (if installed) (continued)

Microwave Antenna: Verify omnidirectional microwave antenna extends/retracts properly. Verify up/down indicator lights function properly. _____

Electromagnetic and Radio Frequency Interference: With all special equipment turned on, check for EMI/RFI with tach, COM, intercom, compass, or other systems. _____

19. Life-Limited Parts, Additional Component Maintenance, ADs, & SBs

Life-Limited Parts: Refer to helicopter maintenance records and § 3.300. Replace life-limited parts as required. Verify components installed have sufficient time remaining for projected operations. _____

Airworthiness Directives: Verify applicable airframe, engine, and accessory Airworthiness Directives (ADs) have been performed according to AD compliance procedures. Some aircraft may be affected by ADs that require recurring inspections at less than 100-hour or annual intervals. Recent U.S. Airworthiness Directives are available online at www.faa.gov.

Service Bulletins: Verify applicable airframe, engine, and accessory Service Bulletins (SBs) have been complied with according to manufacturers' instructions. Some aircraft may be affected by SBs that require recurring inspections at less than 100-hour or annual intervals. RHC Service Bulletins are available online at https://robinsonheli.com, under the Publications tab. _____

20. Required Documents and Placards

Documents: Check that required documents (Airworthiness Certificate, Registration, applicable Radio Station License, applicable Pilot's Operating Handbook, Equipment List/Weight & Balance Data) are on board, legible, and current. _____

Placards: Verify required placards are properly installed, legible, and current. Refer to applicable Pilot's Operating Handbook Section 2 for placard requirements. _____

21. Inspection and Access Covers

Foreign Objects Removed: Verify all tools, loose hardware, rags, and other foreign objects are removed from helicopter. _____

Covers Closed and Secure: Install/close all inspection and access covers removed in preceding steps. Verify security of all access covers. _____

Clipper I Air Box Sealed: Ensure air box cover perimeter is sealed with aluminum tape (Clipper I models only). _____

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2.520 Tail Rotor Strike

Tail rotor strike inspection is listed in two parts, A and B. Part A concerns damage received by a tail rotor blade due to contact with a small stone, tall grass, or some small object contacting rotor blade in free air. Part B is concerned with sudden stoppage of tail rotor due to ground or solid object contact causing skin penetration, or trailing-edge bending, of a tail rotor blade or blades.

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

1. Inspect blade(s) per § 30-30. _____
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. _____
3. Remove tail rotor assembly per § 30-10. _____
4. Measure TGB output shaft's radial runout at cylindrical outboard end; maximum allowable TIR is 0.005 inch. _____
5. Measure TGB output shaft's teeter bolt hole; 0.3760 inch maximum allowable diameter and no elongation. _____

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

1. Perform inspections per Part A. _____
2. Remove tail rotor assembly per § 30-10 and tail rotor gearbox per § 7.410 and return to RHC for repair, or replace. _____
3. For D196-1 aluminum shaft assembly only (if installed): Replace next higher assembly D224-2 shaft assembly. _____
4. For C196-1 steel shaft assembly only (if installed):
   a. Check tail rotor drive shaft run-out per § 7.340. If run-out exceeds 0.025 inch at any location the shaft must be replaced. _____
   b. Verify no nicks, scratches, twisting, or dents. Nicks and scratches may be polished out to a maximum of 0.003 inches deep. Replace shaft if twisted or dented. _____
   c. Strip paint back at least 2 inches from welds at forward end of drive shaft and magnetic particle inspect (refer to § 23-41) stripped area; replace shaft if cracked. _____
5. Replace aft and intermediate flex plates. _____
6. Visually inspect tailcone & empennage for evidence of a tail rotor blade strike. _____
7. Visually inspect main rotor system for collateral damage. _____
8. Perform § 2.595 C148 Bulkhead Inspection. _____

2.595 C148 Bulkhead Inspection

If C042-1 upper vertical stabilizer, C043-1 lower vertical stabilizer, or C044-1 horizontal stabilizer is dented, cracked, or torn, or if a tail skid strike or tail gearbox breakage has occurred, perform the following:

1. On associated tailcone's C148 bulkhead, strip paint from cross-hatched surfaces shown in Figure 2-18 using § 23-71 approved materials.
2. Perform fluorescent penetrant inspection (FPI) per § 23-42 of stripped surfaces. Replace tailcone if crack is indicated.
3. Conversion coat bare aluminum per § 23-51, as required. Epoxy prime (chromated-epoxy primer preferred) & topcoat stripped surfaces per § 23-60.

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

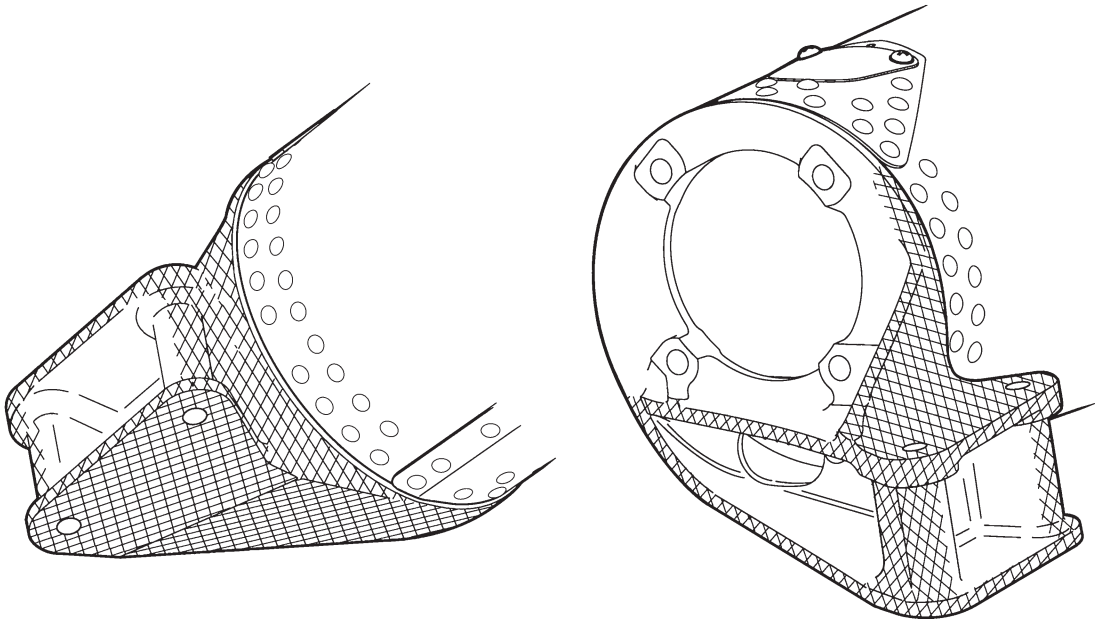


FIGURE 2-18 PENETRANT INSPECT CROSS-HATCHED SURFACES OF C148 BULKHEAD

2.600 2200-Hour/2400-Hour/12-Year Inspection

NOTE

KI-4402 R44 2200-Hour (2400-Hour for Cadet) Inspection Kit contents and KI-4403 R44 II 2200-Hour Inspection Kit contents are available online at https://robinsonheli.com for review.

NOTE

12-Year Inspection is only required for helicopters that have accumulated 12 years calendar time and less than 2200 hours (R44 S/Ns 0001 thru 9999 & R44 II S/Ns 10001 thru 29999) or 2400 hours (R44 Cadet S/Ns 30001 & subsequent) time in service since new, since last 2200-hour/2400-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, both vertical, & float stabilizers, and F044 mount, as applicable. If replacement is not required, visually inspect condition. Fluorescent penetrant inspect any suspect metal areas per § 23-42. Install stabilizers per §§ 4.500 thru 4.640.
5. Inspect cross tubes per § 5.210. Remove landing gear per § 5.110.
6. Remove steel tube frames per § 4.200, and replace as required. If replacement is not required, proceed per § 1.102 Part A or B, as appropriate. Install frames per § 4.200.
7. Visually inspect cyclic stick for corrosion. If corrosion is evident: remove cyclic stick per § 8.111. 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 § 8.111.

CHAPTER 4

AIRFRAME

4.000 Description

The R44 I & R44 II are both a four-place (R44 Cadet version is two-place, refer to Chapter 36), single-main-rotor, single-engine helicopter constructed primarily of metal and equipped with skid-type landing gear.

Primary structure is welded steel tubing and riveted aluminum. The tailcone is a monocoque structure in which aluminum skins carry most of the primary loads. Fiberglass and thermoset plastics are used in the secondary structure of the cabin, engine cooling system, and in various other ducts and fairings.

Cabin doors are removable. Four hinged cowl doors on right side provide access to main rotor gearbox, drive system and engine. A hinged cowl door on left side provides access to engine oil filler, dip stick, and battery (if installed here). For additional access to controls and other components, there are removable panels between seat cushions and seat backs, on each side and aft of engine compartment, under cabin and forward of tailcone.

The instrument console hinges up and aft for access to wiring and instrument connections and battery (if installed here). Small removable plug buttons are located on tailcone for internal inspection.

One stainless steel vertical firewall is forward of the engine and a stainless steel horizontal firewall is above the engine.

4.100 Cabin Assembly

The cabin assembly is a non-field-replaceable assembly.

4.110 Repair

1. Vertical firewall repairs may be accomplished in accordance with U.S. FAA Advisory Circular 43.13-1B paragraph 4-59. Firewall material is 0.016-inch thick, type 301, one-quarter hard corrosion-resistant (CRES) steel.
2. Keel panel replacement must be performed at the factory in a jig. Keel panel repairs may be accomplished in accordance with U.S. FAA Advisory Circular 43.13-1B. Keel panel material is 0.025-inch thick, 2024-T3 clad aluminum sheet.
3. To preserve crashworthiness, repairs to seat structure are limited to replacement of damaged components only.
4. U.S. FAA Advisory Circular 43.13-1B may be used for repair of cowlings, fairings, fiberglass chin, fiberglass roof, fiberglass doors, and roof & door windows.

4.120 Windshield Assembly

This section has been moved to Chapter 27 Doors and Windows.

4.130 Door Removal and Installation

This section has been moved to Chapter 27 Doors and Windows.

4.300 Tailcone Assembly

NOTE

Tailcones with F955-1 or -6 bracket may not be installed on R44 I helicopters if C169-1 exhaust muffler assembly (smaller, 6.0-inch diameter shroud assembly) is installed.

CAUTION

If tailcone has an F955-1 or -6 bracket, then F050-2 horizontal stabilizer must be installed.

C044-1 horizontal stabilizer may not be installed on a tailcone that has an F955-1 or -6 bracket.

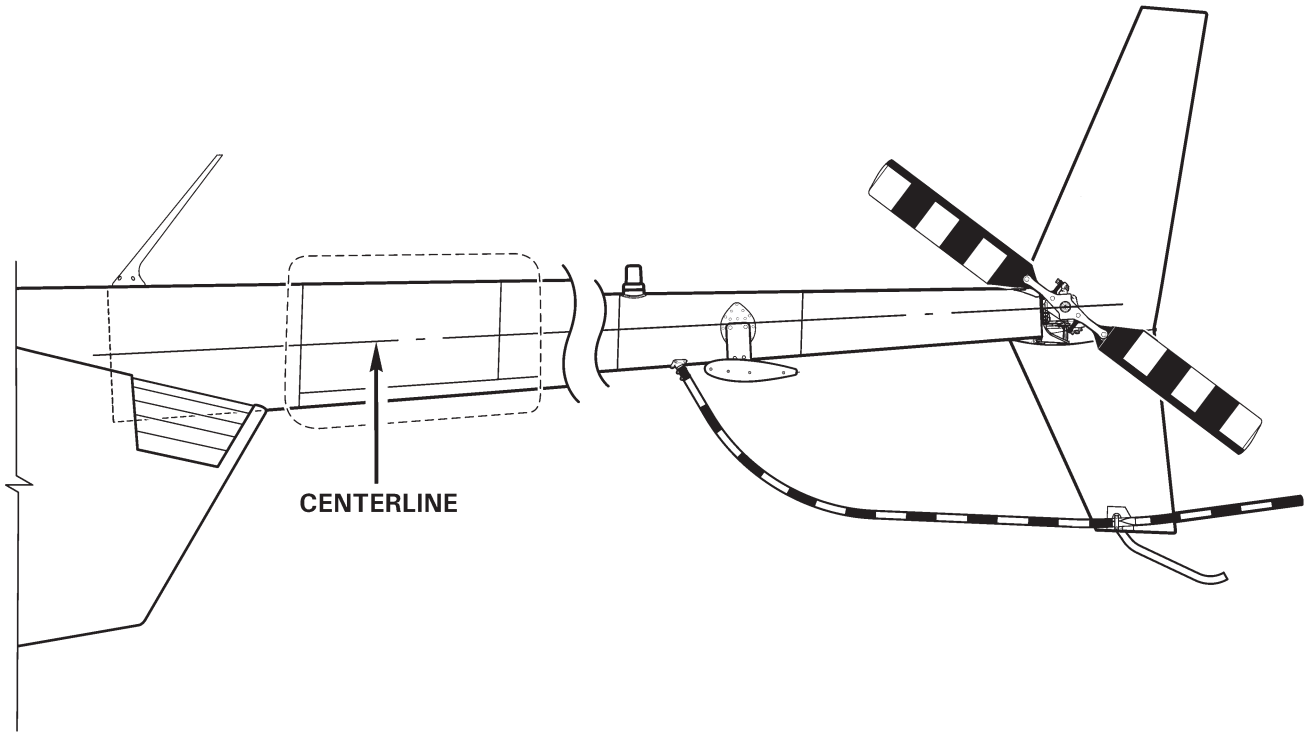
F044-1 vertical stabilizers mount assembly may only be installed on a tailcone that has an F955-1 or -6 bracket.

A. Removal

1. Pull associated circuit breakers for lights and antennas installed on tailcone, and C706-1 tailcone fairing.
2. Remove tailcone fairing and D040-1 aft cowling assemblies.
3. Refer to Figure 4-3. Cut and discard ty-raps as required and disconnect tailcone wiring at connectors. Disconnect two antenna cables inside tailcone forward bay, and cables at forward bulkhead, as required.
4. Remove hardware securing tail rotor drive shaft assembly forward yoke to A947-2 (intermediate) plate assembly. Support drive shaft using a foam block or equivalent, while drive shaft is disconnected from drive train.
5. Remove hardware securing C121-17 push-pull tube to A331-4 bellcrank assembly.
6. Remove hardware securing C023 tailcone assembly to frames and remove tailcone.
7. Cut and discard ty-raps as required and remove C237-1 tailcone-attachment frame, as required.

B. Installation

1. Refer to Figure 4-3. Install C237-1 tailcone-attachment frame, if not previously accomplished. Verify correct damper assembly orientation per Figure 7-11B.
2. Position C023 tailcone assembly on C020-1 upper frame assembly; do not pinch wiring between tailcone forward bulkhead and frames. Install hardware securing tailcone to frames, standard torque bolts per § 23-32, torque stripe per Figure 2-1.
3. Install hardware securing C121-17 push-pull tube to A331-4 bellcrank assembly. Standard torque bolt per § 23-32 and torque stripe per Figure 2-1.
4. Inspect flex plate per Figure 2-5. Perform intermediate flex plate installation and shimming per § 7.330.
5. Perform tail rotor drive shaft runout per § 7.340.



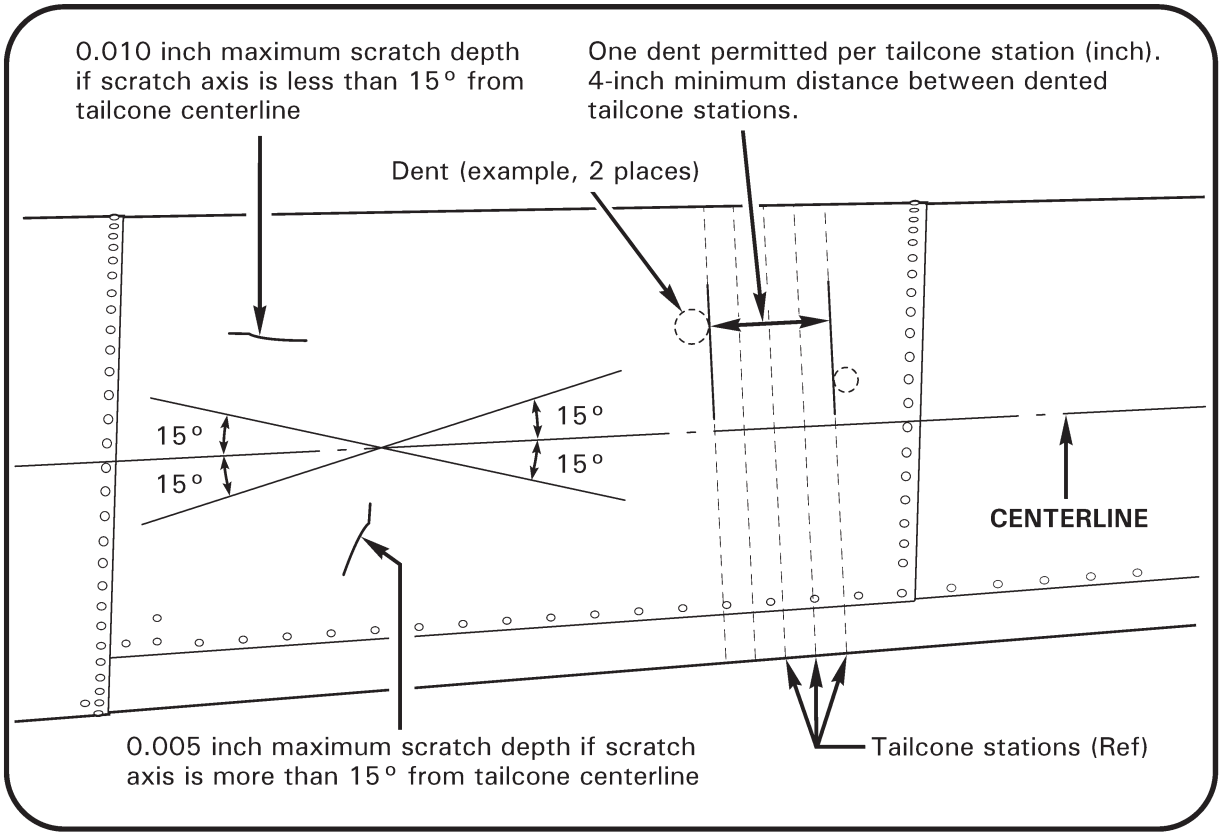


FIGURE 4-4 TAILCONE INSPECTION AND REPAIR

4.500 F050-2 Horizontal Stabilizer Assembly

NOTE

Tailcones with F955-1 or -6 bracket may not be installed on R44 I helicopters if C169-1 exhaust muffler assembly (smaller, 6.0-inch diameter shroud assembly) is installed.

CAUTION

If tailcone has an F955-1 or -6 bracket, then F050-2 horizontal stabilizer must be installed.

CAUTION

Support F050-2 horizontal stabilizer assembly during removal or installation when upper bolts are removed. F955-1 or -6 bracket is riveted to bottom of tailcone assembly.

A. Removal

1. Refer to Figure 4-6. Remove hardware securing F050-2 horizontal stabilizer assembly to F955-1 or -6 bracket.
2. Support the stabilizer, remove hardware securing stabilizer to tailcone assembly and remove stabilizer.
3. As required, install MT023-1 stabilizer bracket supports using removed hardware (recommended when stabilizer is removed).

B. Installation

1. If installed, remove hardware securing MT023-2 stabilizer bracket supports to F955-1 or -6 bracket & tailcone assembly and remove supports.
2. Support the F050-2 horizontal stabilizer assembly, install hardware securing stabilizer to tailcone and bracket. Special torque bolts per § 23-33 and torque stripe per Figure 2-1.

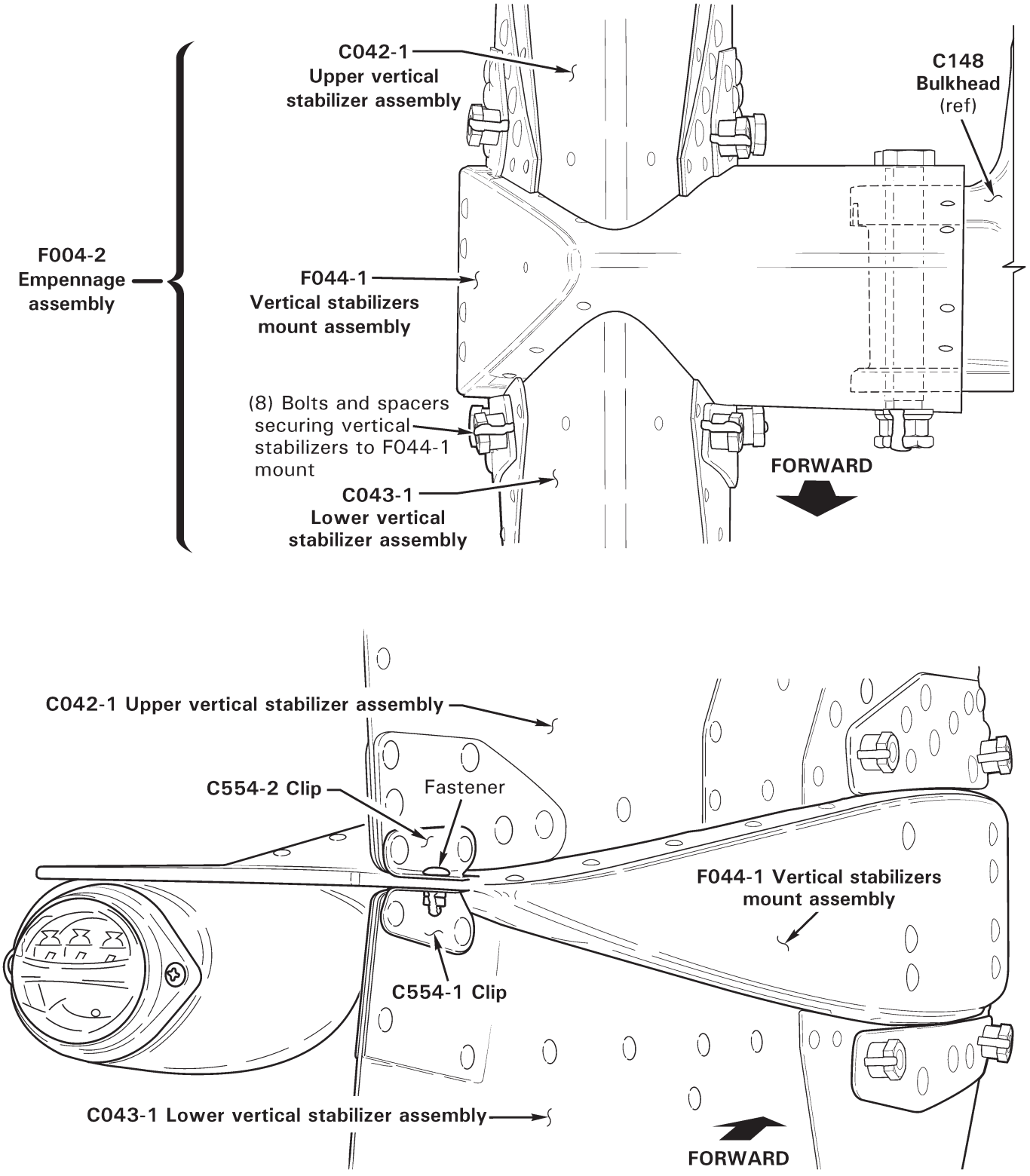


FIGURE 4-7 F004-2 EMPENNAGE ASSEMBLY

4.600 Empennage Assembly

CAUTION

If tailcone has an F955-1 or -6 bracket, then F050-2 horizontal stabilizer must be installed.

C044-1 horizontal stabilizer may not be installed on a tailcone that has an F955-1 or -6 bracket.

F044-1 vertical stabilizers mount assembly may only be installed on a tailcone that has an F955-1 or -6 bracket.

A. Removal

1. Remove tail rotor guard per § 4.400.
2. Remove hardware securing forward clamp, on position light & TGB chip detector wires, to empennage. Cut and discard ty-raps securing position light wire. Disconnect position light wire at connectors.
3. Refer to Figure 4-7 or 4-7A. Support the empennage assembly, remove hardware securing empennage to C148 bulkhead, and remove empennage.

B. Installation

1. Refer to Figure 4-7 or 4-7A. Position empennage assembly on C148 bulkhead.
   a. **If D301 (empennage ballast; ref. § 18-32) weights will not be installed:** Install (2) NAS6606-47 (or -48) bolts & associated hardware securing empennage to C148 bulkhead. Use as many NAS1149F0663P washers under nut as required to meet § 23-30 Part E.5. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
   b. **If D301 (empennage ballast; ref. § 18-32) weights will be installed:** Install (2) NAS6606-78 bolts & associated hardware securing empennage to C148 bulkhead. Use (1) or (2) NAS1149F0663P washers under nut as required to meet § 23-30 Part E.5; 1–4 threads may be exposed beyond primary nut. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
2. Connect position light wire connectors. Install forward clamp on position light & TGB chip detector wires and secure to empennage with hardware. Install ty-raps as required to secure wires and connectors together. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
3. Test and verify correct function of position and TR chip light circuits.
4. Install tail rotor guard per § 4.400.

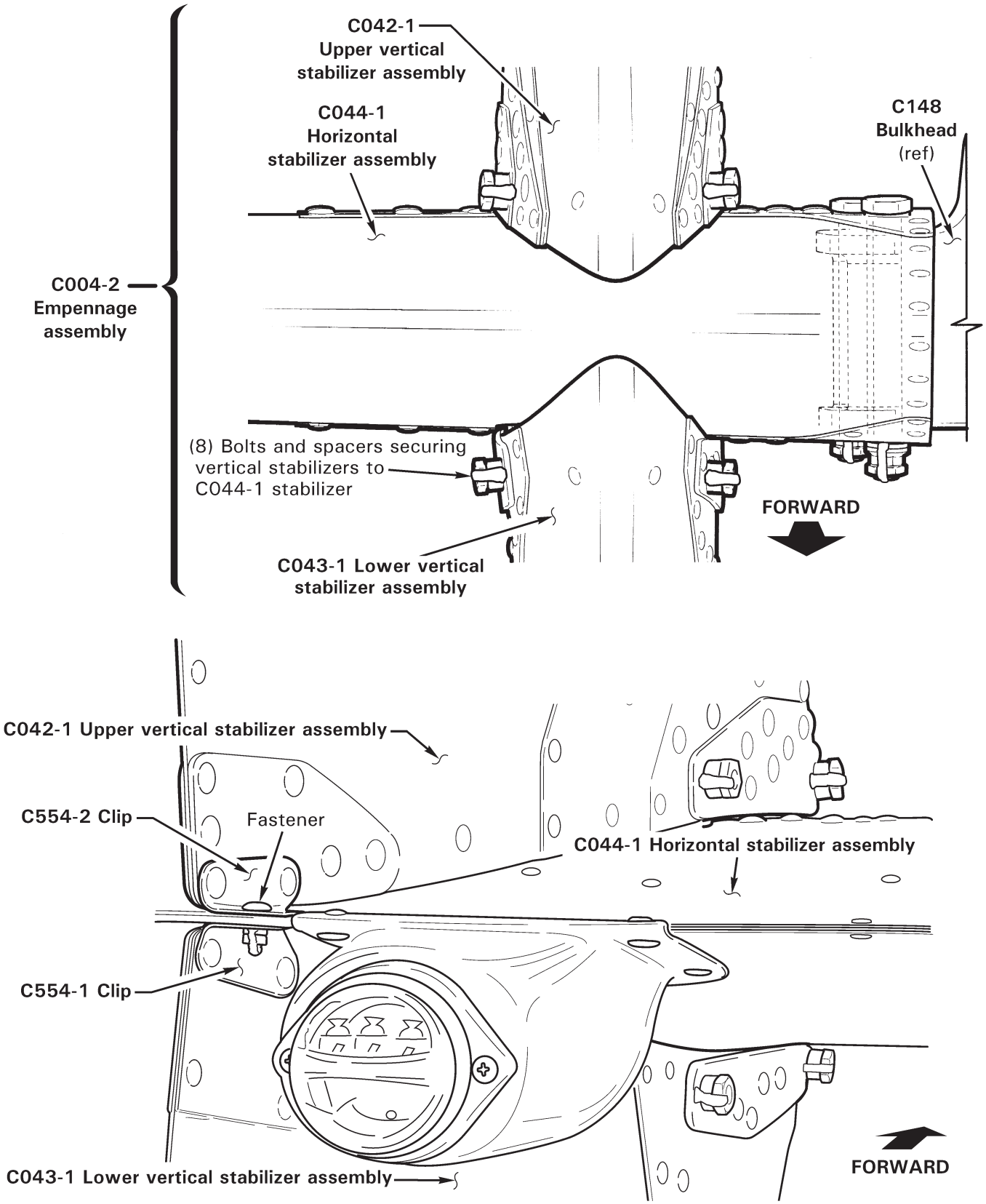


FIGURE 4-7A C004-2 EMPENNAGE ASSEMBLY

4.630 F044-1 Vertical Stabilizers Mount Assembly

A. Removal

1. Remove C042-1 & C043-1 vertical stabilizer assemblies per §§ 4.610 & 4.620.
2. Remove hardware securing forward clamp to F044-1 vertical stabilizers mount assembly. Cut and discard ty-raps securing position light and gearbox chip detector wires and connectors together. Disconnect position light at connectors.
3. Support the mount assembly, remove hardware securing mount to C148 bulkhead and remove mount.

B. Installation

CAUTION

F044-1 vertical stabilizers mount assembly may only be installed on a tailcone that has an F955-1 or -6 bracket.

1. Position F044-1 vertical stabilizers mount assembly on C148 bulkhead.
   a. **If D301 (empennage ballast; ref. § 18-32) weights will not be installed:** Install (2) NAS6606-47 (or -48) bolts & associated hardware securing empennage to C148 bulkhead. Use as many NAS1149F0663P washers under nut as required to meet § 23-30 Part E.5. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
   b. **If D301 (empennage ballast; ref. § 18-32) weights will be installed:** Install (2) NAS6606-78 bolts & associated hardware securing empennage to C148 bulkhead. Use (1) or (2) NAS1149F0663P washers under nut as required to meet § 23-30 Part E.5; 1–4 threads may be exposed beyond primary nut. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
2. Install C042-1 & C043-1 vertical stabilizer assemblies per §§ 4.610 & 4.620.
3. If mount assembly was replaced, match drill C554-1 & -2 clips 0.144-inch diameter hole through mount. Deburr hole and install fastener.
4. Connect position light at connectors. Install hardware securing forward clamp to mount assembly. Install MS3367-4-9 or -5-9 ty-raps as required to secure position light and gearbox chip detector wires and connectors together. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
5. Test and verify correct function of position and TR chip light circuits.

4.640 C044-1 Horizontal Stabilizer

A. Removal

1. Remove C042-1 & C043-1 vertical stabilizer assemblies per §§ 4.610 & 4.620.
2. Remove hardware securing forward clamp to C044-1 horizontal stabilizer assembly. Cut and discard ty-raps securing position light and gearbox chip detector wires and connectors together. Disconnect position light at connectors.
3. Support the stabilizer, remove hardware securing stabilizer to C148 bulkhead and remove stabilizer.

B. Installation

CAUTION

C044-1 horizontal stabilizer may not be installed on a tailcone that has an F955-1 or -6 bracket.

1. Position C044-1 horizontal stabilizer assembly on C148 bulkhead.
   a. **If D301 (empennage ballast; ref. § 18-32) weights will not be installed:** Install (2) NAS6606-47 (or -48) bolts & associated hardware securing empennage to C148 bulkhead. Use as many NAS1149F0663P washers under nut as required to meet § 23-30 Part E.5. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
   b. **If D301 (empennage ballast; ref. § 18-32) weights will be installed:** Install (2) NAS6606-78 bolts & associated hardware securing empennage to C148 bulkhead. Use (1) or (2) NAS1149F0663P washers under nut as required to meet § 23-30 Part E.5; 1–4 threads may be exposed beyond primary nut. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.
2. Install C042-1 & C043-1 vertical stabilizer assemblies per §§ 4.610 & 4.620.
3. If horizontal stabilizer was replaced, match drill C554-1 & -2 clips 0.144-inch diameter hole through horizontal stabilizer. Deburr hole and install fastener.
4. Connect position light at connectors. Install hardware securing forward clamp to horizontal stabilizer. Install MS3367-4-9 or -5-9 ty-raps as required to secure position light and gearbox chip detector wires and connectors together. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
5. Test and verify correct function of position and TR chip light circuits.

CHAPTER 6

POWERPLANT

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CHAPTER 6

POWERPLANT

6.000 Powerplant and Related Systems

6.001 Introduction

This section includes instructions for the removal and installation of engine, induction system, lubrication system, cooling system and exhaust system. Refer to engine and engine component manufacturers' maintenance publications for product specific inspection, repair, and maintenance procedures.

6.002 Description

R44 helicopters are powered by one Textron-Lycoming O-540-F1B5 six-cylinder, horizontally opposed, overhead-valve, air-cooled, carbureted engine with a wet sump oil system normally rated at 260 horsepower and 2800 rpm for takeoff. The engine is derated to 205 maximum continuous horsepower (MCP), with a 5-minute takeoff power rating of 225 horsepower, by limiting manifold pressure (see Pilot's Operating Handbook) and RPM. At 102% tachometer indication the engine is actually turning 2718 RPM.

R44 induction air enters through a screened opening on the right side of the aircraft and passes through a flexible duct to the carburetor-mounted air box assembly. A scoop mounted to the exhaust manifold passes heated air via a duct to the air box. A cable-operated sliding valve in the air box controlled by the pilot allows either cool or warm air to flow into the box, through the radial-flow air filter and up into the carburetor. On R44 S/N 0202 and subsequent, application of carburetor heat is correlated with changes in collective setting through a friction clutch to reduce pilot workload. Lowering collective mechanically adds carb heat and raising collective reduces carb heat. The pilot may override the friction clutch and increase or decrease carb heat as desired. A latch is provided at the control knob to lock carb heat off when not required.

R44 II helicopters are powered by one Textron-Lycoming IO-540-AE1A5 six-cylinder, horizontally opposed, overhead-valve, air-cooled, wet-sump oil system, fuel-injected engine capable of 300 horsepower and normally rated at 260 horsepower and 2800 rpm for takeoff. The engine is derated to 205 horsepower MCP, with a 5-minute takeoff power rating of 245 horsepower, by limiting manifold pressure (see Pilot's Operating Handbook) and RPM. At 102% tachometer indication the engine is actually turning 2718 RPM.

R44 II induction air enters through a screened opening on the right side of the aircraft and passes through a radial-flow filter within an air box. The air then passes through a flexible duct, through the fuel control and into the engine. A spring-loaded door on top of the air box automatically opens to supply sheltered engine compartment air should filter or intake screen blockage occur.

Cooling is supplied by a direct-drive, centrifugal fanwheel enclosed by a fiberglass scroll. The scroll directs cooling air to the drive belts and, via flexible ducts, to the muffler, the main rotor gearbox, the hydraulic reservoir, and engine-mounted sheet-metal cooling panels. The cooling panels also direct cooling air to the drive belts, and further guide cooling air to the cylinders, external oil cooler (two on R44 II), alternator, magnetos, fuel flow divider (fuel injected engines), and battery cooling hose (when battery is mounted in engine compartment).

A sheave bolted to the propeller flange transfers engine power to the clutch assembly via four double v-belts engaged by a vertically mounted electric belt tension actuator.

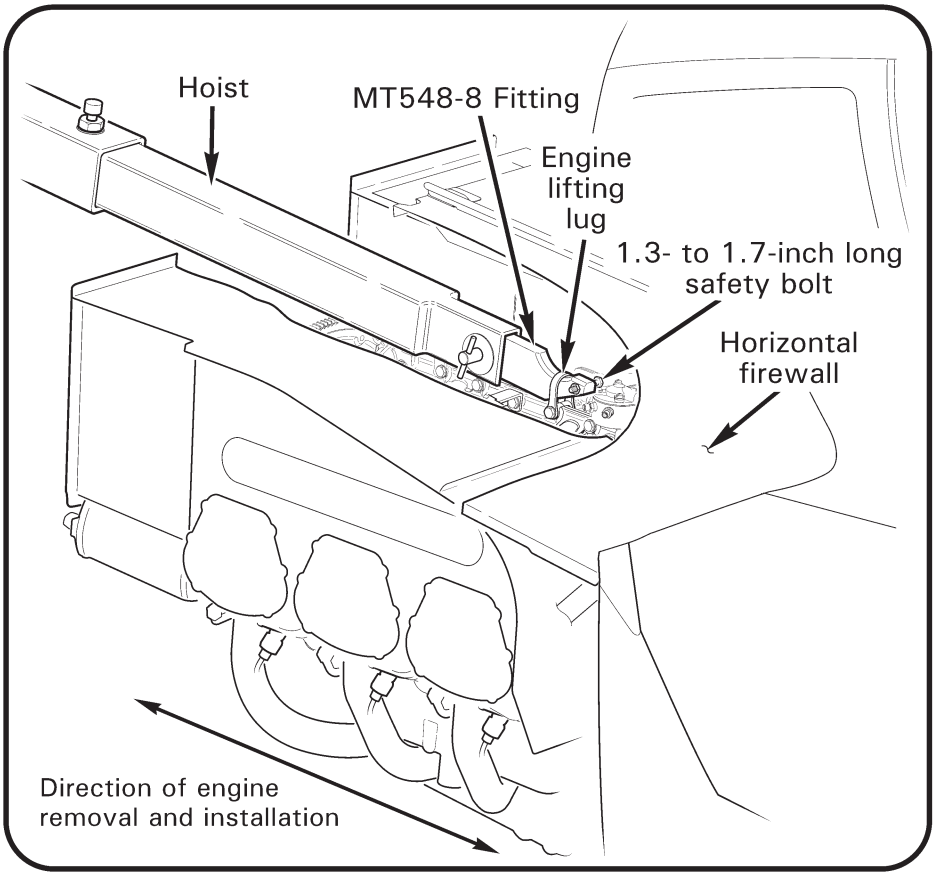

FIGURE 6-1 ENGINE HOISTING

6.100 Powerplant

NOTE

Refer to the appropriate engine and ignition manufacturers' maintenance publications for specific instructions.

6.110 Engine Removal

1. Defuel helicopter per § 1.150.
2. Remove tailcone cowling and all engine cowling.
3. Remove tailcone per § 4.300.
4. Remove fanwheel and scroll assembly per § 6.210.
5. Remove clutch assembly, belt tension actuator, and V-belts per §§ 7.200, 7.510, & 7.281.
6. Disconnect engine breather tube or (air/oil) separator assembly at hose attached to engine by removing clamp. Cap exposed connections.
7. Remove carburetor per § 6.410 or remove fuel control per § 6.490, as applicable.

6.110 Engine Removal (continued)

8. Disconnect manifold pressure line from the forward left cylinder (O-540) or intake manifold (IO-540) and cap exposed connections.
9. Disconnect oil pressure hose and cap exposed connections.
10. **O-540:** If installed, disconnect primer line at T-fitting on engine and cap exposed connections.
11. Disconnect airframe and battery ground straps from engine oil sump bolts.
12. Tag for identification and disconnect alternator wiring, starter wiring, magneto-to-airframe wiring, cylinder head temperature sender wire and oil temperature sender wire.
13. Disconnect cabin heater duct from muffler shroud.
14. Support engine at bottom of lower sheave with a floor jack using a wood or rubber block between jack & sheave to protect sheave.
15. Remove (2) bolts and associated hardware securing C174-1 or -7 engine support weldment's rod ends to C020 upper frame. Remove (2) lower bolts and associated hardware at bottom of support weldment and remove weldment.

NOTE

Avoid disconnecting rod ends from support assembly unless required. Dimensions shown in Figure 6-2 must be maintained.

16. Refer to Figure 6-1. Verify lifting lug condition and security. Support engine at lifting lug using MT548-8 fitting with a hoist. Insert a 1.3- to 1.7-inch long bolt thru end of MT548-8 fitting for added security.
17. Disconnect and remove two forward engine-mounting bolts.
18. Remove right, aft vertical strut weldment connecting lower right frame to upper frame.
19 Remove floor jack supporting engine at sheave and pull hoist & engine aft to remove from helicopter.

CAUTION

To prevent damage, have a person assist on each side of engine during removal.

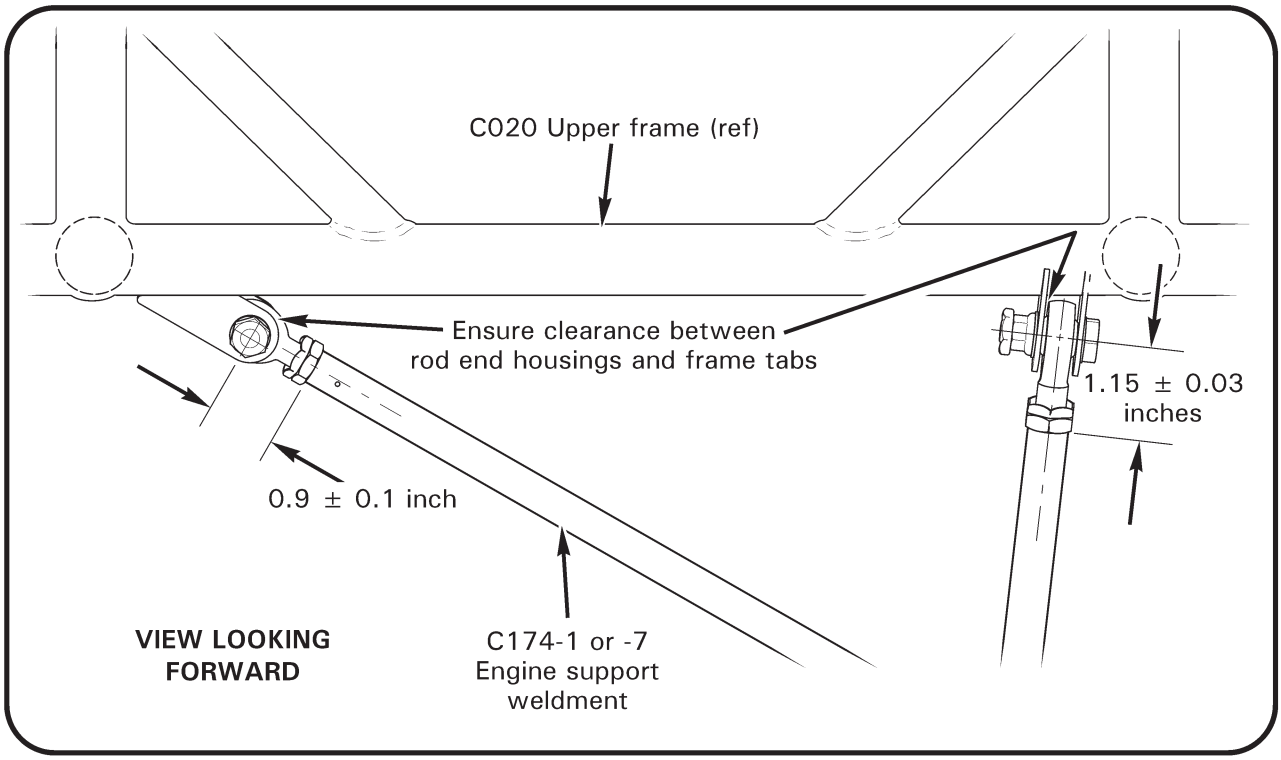

FIGURE 6-2 ENGINE SUPPORT WELDMENT

6.120 Engine Installation

NOTE
Inspect rod ends of C174-1 or -7 engine support weldment per § 2.122 prior to engine installation. Verify dimensions shown in Figure 6-2.

1. If not previously accomplished, install C592-3 mount assembly or C174-11 plate weldment and hardware on crankcase prop-governor pad. Special torque nuts per § 23-33 and torque stripe per Figure 2-1.
2. If not previously accomplished, install C593-3 (helicopter-forward) mount assemblies & hardware on crankcase. Special torque screws per § 23-33 and safety using 0.032-inch wire.
3. If applicable, install C592-4 mount assembly & hardware on C174-7 support weldment with rubber larger-diameter toward threads. Align holes in block perpendicular to flats on weldment. Special torque D210-8 nut per § 23-33 and torque stripe per Figure 2-1.
4. Refer to Figure 6-1. Connect MT548-8 fitting to engine lifting lug and insert safety bolt. Carefully hoist engine and into alignment with lower frame's mounting pads.
5. Install right, aft vertical strut weldment connecting lower right frame to upper frame. Standard torque hardware per § 23-32 and torque stripe per Figure 2-1.

6.120 Engine Installation (continued)

6. Install two forward engine-mounting bolts. Standard torque hardware per § 23-32 and torque stripe per Figure 2-1.
7. Support weight of engine at bottom of lower sheave with a floor jack using a wood or rubber block between jack & sheave to protect sheave. Remove hoist.
8. Install (2) bolts and associated hardware securing C174-1 or -7 aft support weldment rod ends to C020 upper frame. Install (2) lower bolts and associated hardware securing support weldment to engine. Standard torque bolts per § 23-32. Standard torque palnuts per § 23-32 and torque stripe per Figure 2-1.
9. Remove support from lower sheave.
10. **O-540:** Install carburetor per § 6.440.

    IO-540: Install fuel control per § 6.495.
11. Adjust throttle correlation rigging per § 10.150.
12. Connect cabin heater duct to muffler shroud.
13. Connect airframe and battery grounding straps to engine oil sump bolts and special torque per § 23-33.
14. Connect alternator wiring, starter wiring, both magneto-to-airframe wiring, cylinder head temperature sender wire and oil temperature sender wire. Ty-rap as required.
15. Connect engine breather tube or (air/oil) separator assembly at hose attached to engine.
16. **O-540:** If installed, connect D102-4 primer line to T-fitting on engine. Special torque primer line nut per § 23-33.

    IO-540: Connect fuel hose to engine-driven fuel pump inlet and connect fuel return hose to fuel control inlet T-fitting. Special torque per § 23-33.
17. Connect oil pressure hose.
18. Connect manifold pressure line.
19. Install fuel injection air box per § 6.480, if applicable.
20. Install V-belts, belt tension actuator, and clutch assembly per §§ 7.282, 7.520, and 7.220.
21. Install fanwheel per § 6.220.
22. Install tailcone per § 4.312.
23. Install all engine cowling and tailcone cowling.

6.130 Engine (Rubber) Mount Replacement

1. As required, remove engine per § 6.110.
2. Cut & discard safety wire and remove bolts securing forward C593-3 mount assemblies.
3. Remove bolts securing C592-4 mount assembly to C174-11 plate weldment, or remove nuts securing C592-3 mount assembly to engine, as required.
4. Press out & discard old C653-1 or -2 (rubber) mount from C592-1 mount, C592-5 block, or C593-4 block.
5. Clean C592-1 mount, C592-5 block, or C593-4 block using § 23-72 approved solvent.
6. Refer to Figure 6-2A. Apply a light coat of A257-8 rubber lubricant or clean, potable water to new C653-1 or -2 mount at rubber smaller-diameter and press into C592-1 mount, C592-5 block, or C593-4 block. Wipe off excess lubricant or water.

> NOTE
>
> C174-1 support weldment & C592-3 mount assembly may be replaced by C174-7 support weldment & C174-11 plate weldment & C592-4 mount assembly.

7. Remove old gasket & debris and clean mating surface of engine. Install new 72053 gasket & C592-3 mount assembly (or C174-11 plate weldment). Special torque nuts per § 23-33 and torque stripe per Figure 2-1.
8. As required, install hardware securing (aft) C592-4 mount assembly. Standard torque bolts per § 23-32 and torque stripe per Figure 2-1.
9. Install hardware securing (forward) C593-3 mount assemblies. Special torque bolts per § 23-33 and safety wire bolts using 0.032-inch diameter lockwire.
10. Install engine per § 6.120, if required.

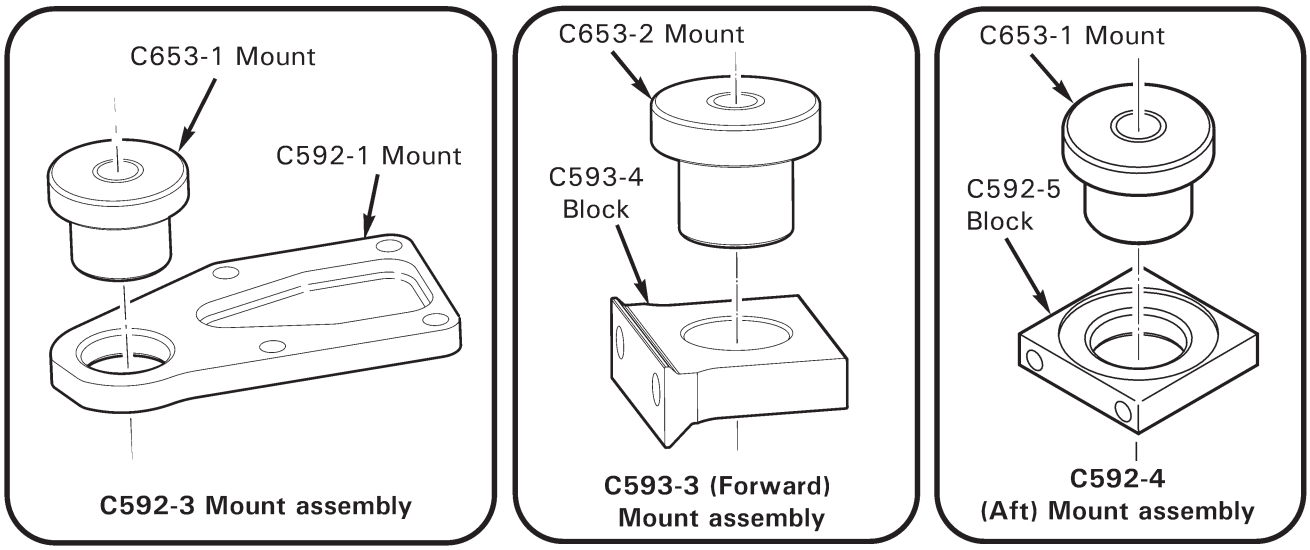

FIGURE 6-2A ENGINE MOUNT REPLACEMENT

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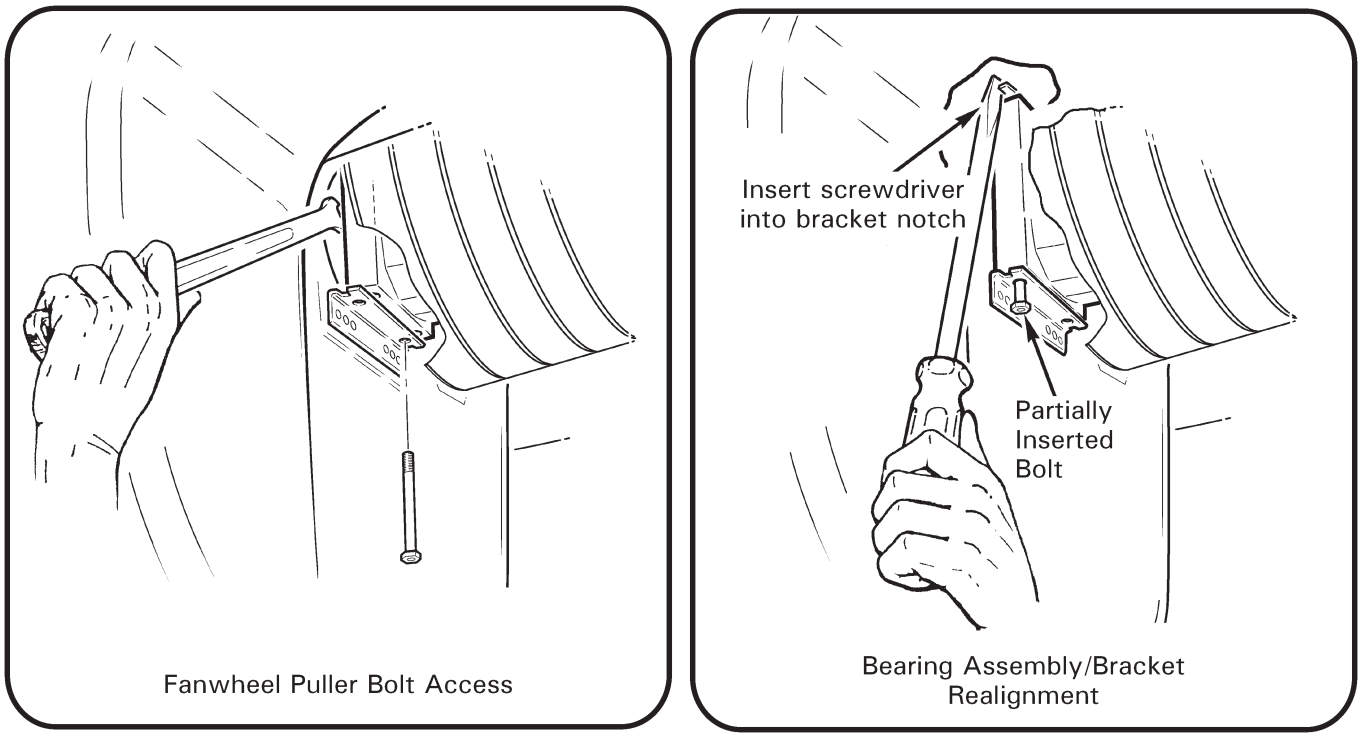

FIGURE 6-3 FANWHEEL HUB BOLT ACCESS

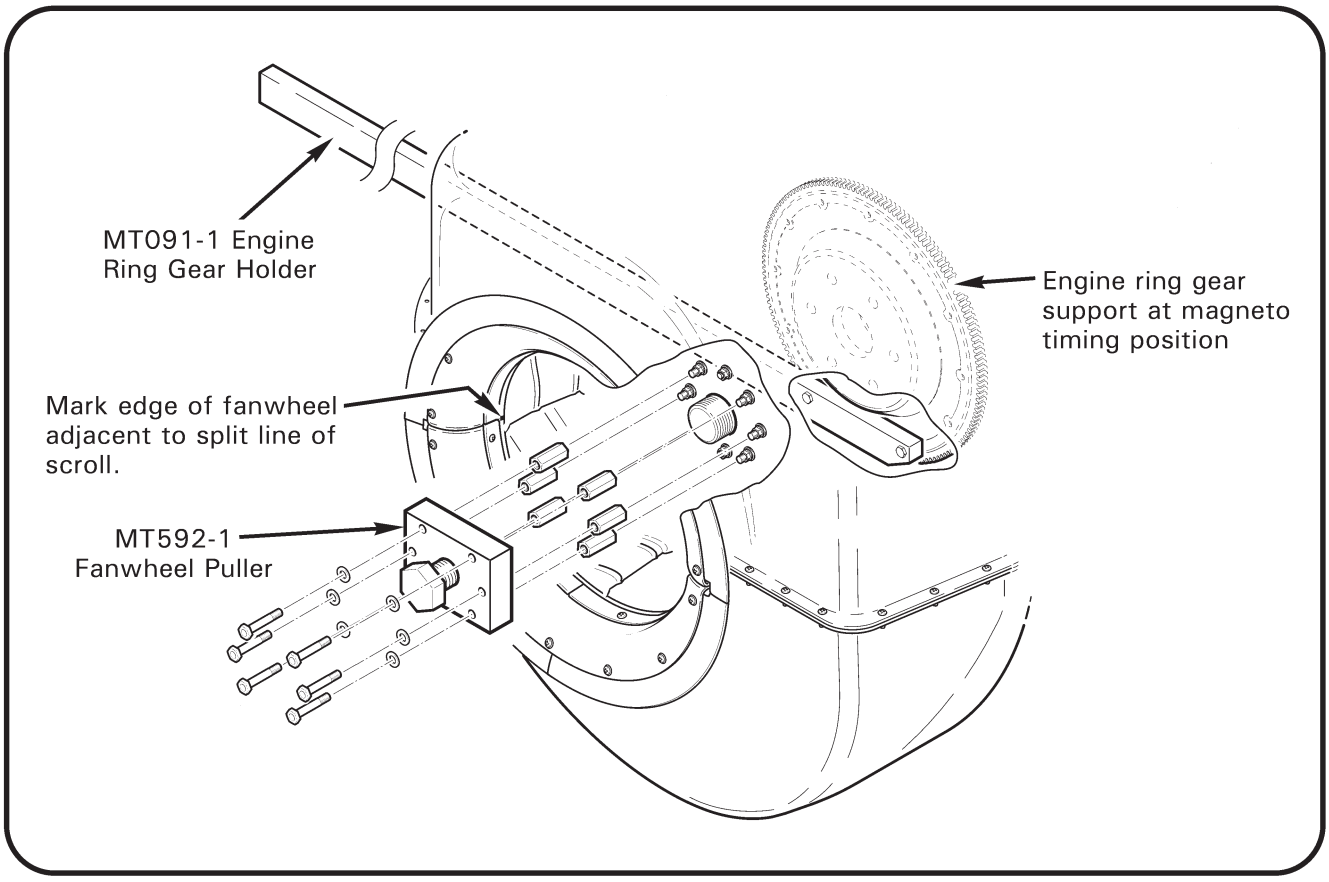

FIGURE 6-4 FANWHEEL PULLER INSTALLATION

6.480 Fuel Injection Air Box Installation

1. With intake pointing outboard, position air box below forward, right side of horizontal firewall and secure to firewall with four screws.
2. Remove fuel control air intake protective cover, if installed, and install air intake hose between air box and fuel control.
3. Verify clearance between air box, intake hose and adjacent components; adjust component position as required for clearance.
4. Install engine cowling.

6.490 Fuel Control Removal

1. Turn fuel shut-off valve off.
2. Remove right cowling.
3. Remove A785-31 air intake hose.
4. Disconnect A457-9 tee from 2577202 fitting and cap fuel openings.
5. Disconnect B283-7 hose from fuel control outlet and cap fuel openings.
6. Remove NAS6603-13 bolt and associated hardware securing A336-6 or -9 push-pull tube to D731-9 bellcrank assembly.
7. Loosen (2) MS27039C1-07 screws and A462-4 fitting securing A522-13 mixture control cable to fuel control.
8. Loosen lower, aft bolt securing fuel control to intake manifold. Remove three remaining bolts and associated hardware securing D731-9 bellcrank assembly & fuel control to D730-1 intake manifold and remove fuel control.
9. Remove old gasket from intake manifold inlet. Cover inlet if not immediately replacing fuel control.
10. If replacing fuel control, compare fittings on removed fuel control with replacement fuel control. Transfer fittings as required and special torque per § 23-33.

6.495 Fuel Control Installation

1. Compare hardware on removed fuel control with replacement fuel control. Transfer hardware as required.
2. Remove temporary shipping safety wire from mixture and throttle arms.
3. Verify correct full-open throttle arm angle per Figure 6-7 and full-lean mixture arm distance per Figure 6-8; adjust as required. Install D930-1 mixture safety spring.
4. Remove protective caps from fuel inlet and outlet. Drain all fluid.

6.495 Fuel Control Installation (continued)

5. Inspect D730-1 intake weldment; verify no cracks and no obstructions. Using new gasket and with fuel inlet pointing aft, install fuel control and D731-9 bellcrank assembly on flange of intake manifold weldment.
6. Connect fuel inlet tee to fuel control inlet. Special torque per § 23-33 and torque stripe per Figure 2-1.
7. Connect throttle push-pull tube Verify full travel (collective must be raised slightly to achieve full-open throttle).
8. Refer to Figure 6-8. Connect mixture cable housing to bracket with housing flush-to-0.25 inch extended beyond clamps. Lubricate A130 spacer with A257-1 grease and connect mixture control cable inner wire to mixture control arm. Verify full travel and 0.03-0.10 inch clearance under mixture control knob when full rich. Mixture control inner wire should protrude 0.10-0.30 inch beyond A462 fitting securing wire to mixture control arm. If wire cannot rotate relative to mixture arm the A130 spacer in fitting may be missing or damaged; replace as required.
9. Install air intake hose between air box and fuel control.
10. Electrically ground the helicopter.
11. Place a clean container beneath fuel control outlet and connect a ground wire between container and helicopter.
12. Pull CLUTCH-START circuit breaker.
13. Turn fuel shut-off valve on.
14. Turn battery switch on. Open throttle. Turn ignition key to PRIME position and hold until fluid exiting fuel control is the same color as avgas (fuel control is typically shipped with non-flammable oily preservative). Continue flushing fuel control until avgas exiting fuel control no longer exhibits oily smell and feel.
15. Close throttle and turn battery switch off.
16. Connect fuel control outlet hose. Special torque per § 23-33 and torque stripe per Figure 2-1.
17. Turn battery switch on. Turn ignition key to PRIME position and hold until AUX FUEL PUMP light extinguishes. Turn ignition key off. Inspect fuel control and attached fuel connections and verify no leakage.
18. Remove grounding wire(s).
19. Perform preflight, start engine, and run up using R44 POH checklist.
20. Set idle rpm to 58-62% rpm with engine warm and clutch engaged.
21. Shut down engine using R44 POH checklist.

6.495 Fuel Control Installation (continued)

22. Disconnect fuel control outlet hose, connect test hose if desired, and measure fuel flow rate at fuel control outlet with mixture full rich, throttle at idle, and electric fuel pump on (ignition key at PRIME position).

23. Adjust idle mixture as required to obtain 16–18 pounds/hour fuel flow (170–190 cc/minute). Clockwise rotation of idle mixture adjustment wheel (viewed from aircraft right side) enriches mixture. Re-check idle rpm after mixture adjustment and repeat as required until both rpm and mixture are within limits. With rpm and mixture set, verify smooth acceleration from idle to 102% rpm with no engine hesitation or smoke from tailpipe. Also verify smooth needle split from 102% to idle with no engine roughness or erratic rpm indications and acceptable idle quality. Note that 16–18 pounds/hour fuel flow should produce acceptable idle quality and off-idle throttle performance under sea-level standard conditions. Richer mixtures may be required for cold temperature operation and leaner mixtures may be required for hot/high altitude operation. Deviate from 16–18 pounds/hour recommendation as required for acceptable idle quality and off-idle throttle performance (smooth accelerations and needle splits).

24. Adjust throttle correlation rigging per § 10.150.

25. Install right cowling.

6.500 Exhaust System

6.510 Exhaust System Removal

1. Remove left and right side cowlings, and remove aft cowling assembly.
2. As required, loosen clamps securing shields to inlets and tail pipe and remove shields.
3. **O-540 engine:** Loosen clamps securing carburetor heat scoop to riser/collector.
4. Remove hardware securing C173 straps to tail pipe.
5. Loosen clamps securing hoses to muffler shroud.
6. Supporting C169 muffler assembly, remove nuts and washers securing risers to cylinders and remove muffler. Discard gaskets.
7. As required, remove hardware securing bead clamps to risers/collectors, remove clamps, and remove and discard A701-10 stainless-steel tape if installed.

6.520 Exhaust System Installation

1. Install new gaskets and install hardware securing C169 muffler assembly or exhaust risers/collectors (if disassembled from C169 muffler assembly) to cylinders. Draw up (12) 21FKF-518 nuts evenly prior to torquing; special torque nuts per § 23-33.
2. If exhaust risers/collectors were disassembled from C169 muffler assembly, position muffler on risers/collectors installed in step 1. Wrap joint under bead clamps with a single layer of new A701-10 stainless-steel tape with 0.25–0.75 inch overlap, and install hardware securing bead clamps. Standard torque bead clamp bolts per § 23-32. Verify security.

CAUTION

Ensure bead clamp bolt flanges are oriented so any leakage is directed away from ignition components and structure.

3. Install clamps securing hoses to muffler shroud. Verify security.
4. **O-540 engine:** Tighten clamps securing carburetor heat scoop to riser/collector. Verify security.
5. If removed, tighten clamps securing heat shields to inlets and tail pipe. Verify security.
6. Install hardware securing C173 straps to tail pipe. Shim between tail pipe ears and straps using NAS1149F0332P washers (1 minimum, 3 maximum at each fastener) to create a 0.02–0.08 inch forward preload. Verify security.
7. Install aft cowling assembly, and install left and right side cowlings.
8. Revise Weight and Balance Record in applicable Pilot's Operating Handbook (POH) Section 6 to incorporate the following data as required:

	Weight	Long. Arm	Long. Moment	Lat. Arm	Lat. Moment
C169-1 Muffler Assembly	17.6 lb	124.4 in.	2189.4 in.-lb	–1.0 in.	–17.6 in.-lb
C169-31 Muffler Assembly	17.6 lb	124.2 in.	2185.9 in.-lb	–1.2 in.	–21.1 in.-lb
C169-35 Muffler Assembly	18.6 lb	124.6 in.	2317.6 in.-lb	–0.9 in.	–16.7 in.-lb
C169-37 Muffler Assembly	18.6 lb	124.4 in.	2313.8 in.-lb	–1.1 in.	–20.5 in.-lb

CHAPTER 7

DRIVE TRAIN

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CHAPTER 7

DRIVE TRAIN

7.000 Drive Train

7.001 Introduction

This section contains the procedures for removal, installation, replacement, and maintenance of the drive train components.

7.002 Description (see Figure 7-1)

A V-belt sheave is bolted directly to the crankshaft of the engine; four double V-belts transmit power to the upper sheave, which has an overrunning clutch in its hub. The clutch shaft transmits power forward to the main rotor and aft to the tail rotor. Flexible couplings are located at the input to the main gearbox and at each end of the long tail rotor drive shaft. The main rotor gearbox contains a single-stage spiral-bevel gear set, which is splash-lubricated. The long tail rotor shaft has no hanger bearings but has a lightly-loaded damper bearing. The tail rotor gearbox also contains a splash-lubricated spiral bevel gear set. The tail rotor gearbox input and output shafts are both made of stainless steel to prevent corrosion. Later tail rotor drive shafts are made of aluminum and the remaining shafts throughout the drive system are made of alloy steel.

7.100 Main Rotor Gearbox

7.110 Main Rotor Gearbox Removal

1. Remove main rotor blades and hub per §§ 28-10 and 28-20.
2. Remove swashplate per § 8.412.
3. Remove C706-1 tailcone cowling, both engine side panels, and aft engine cowling.
4. Remove mast fairing. Remove middle and lower mast fairing ribs from mast tube.
5. Remove (3) C121-31 push pull tubes.
6. Loosen bolt securing pulley to D112-1 lever and disconnect rotor brake cable.
7. Remove main and aux fuel tanks per §§ 12-10 & 12-20. Mark all electrical connections for reinstallation.
8. Cut & discard ty-raps and remove hardware and clamps securing wiring, hoses, and tubes to gearbox and jackshaft support struts.
9. Remove hardware securing C343-8 tube's lower rod end to jackshaft and remove aft hydraulic servo from helicopter per § 8.750.
10. Refer to § 8.730. Disconnect and cap suction and pressure lines from hydraulic pump.

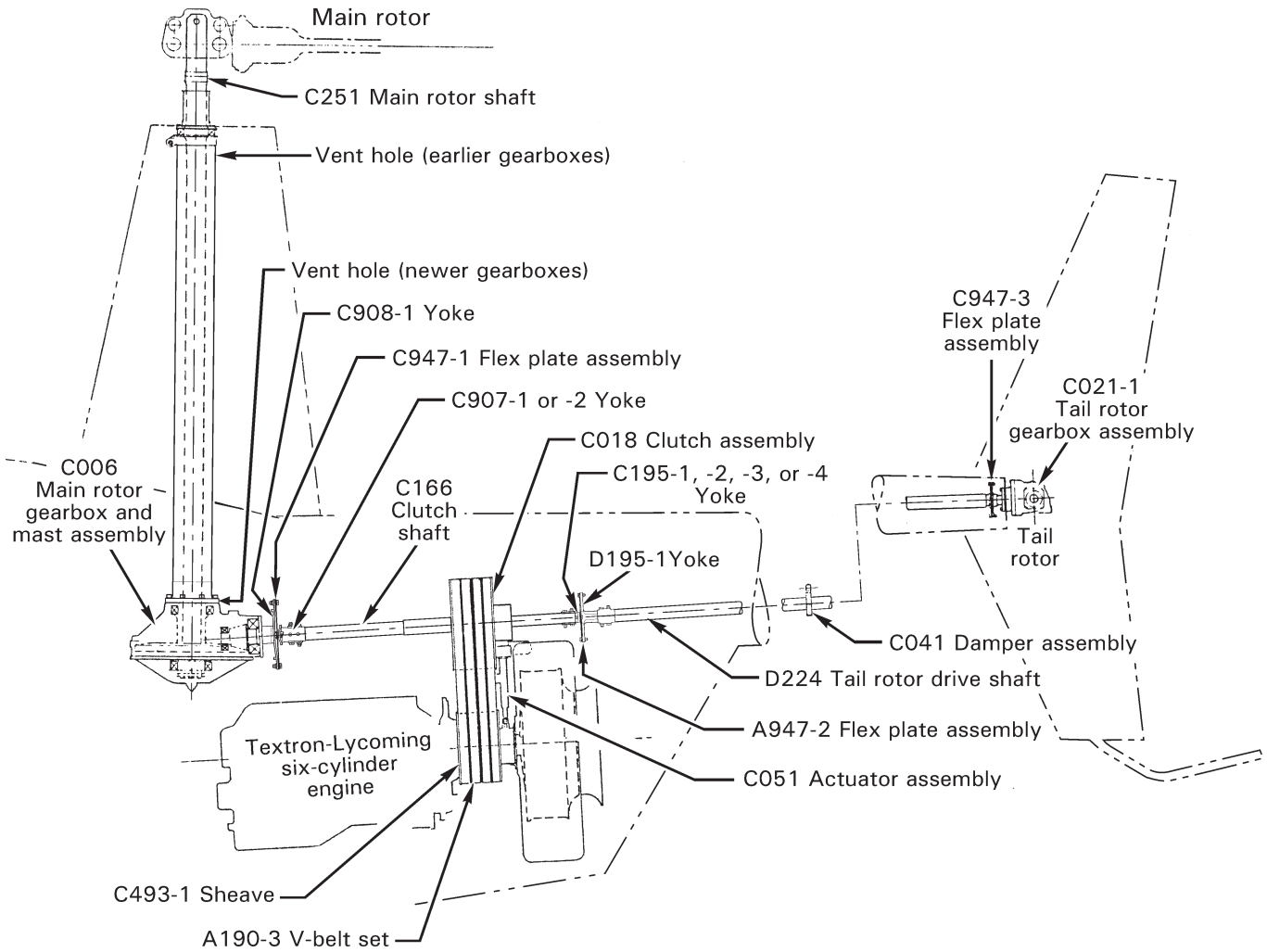

FIGURE 7-1 DRIVE SYSTEM

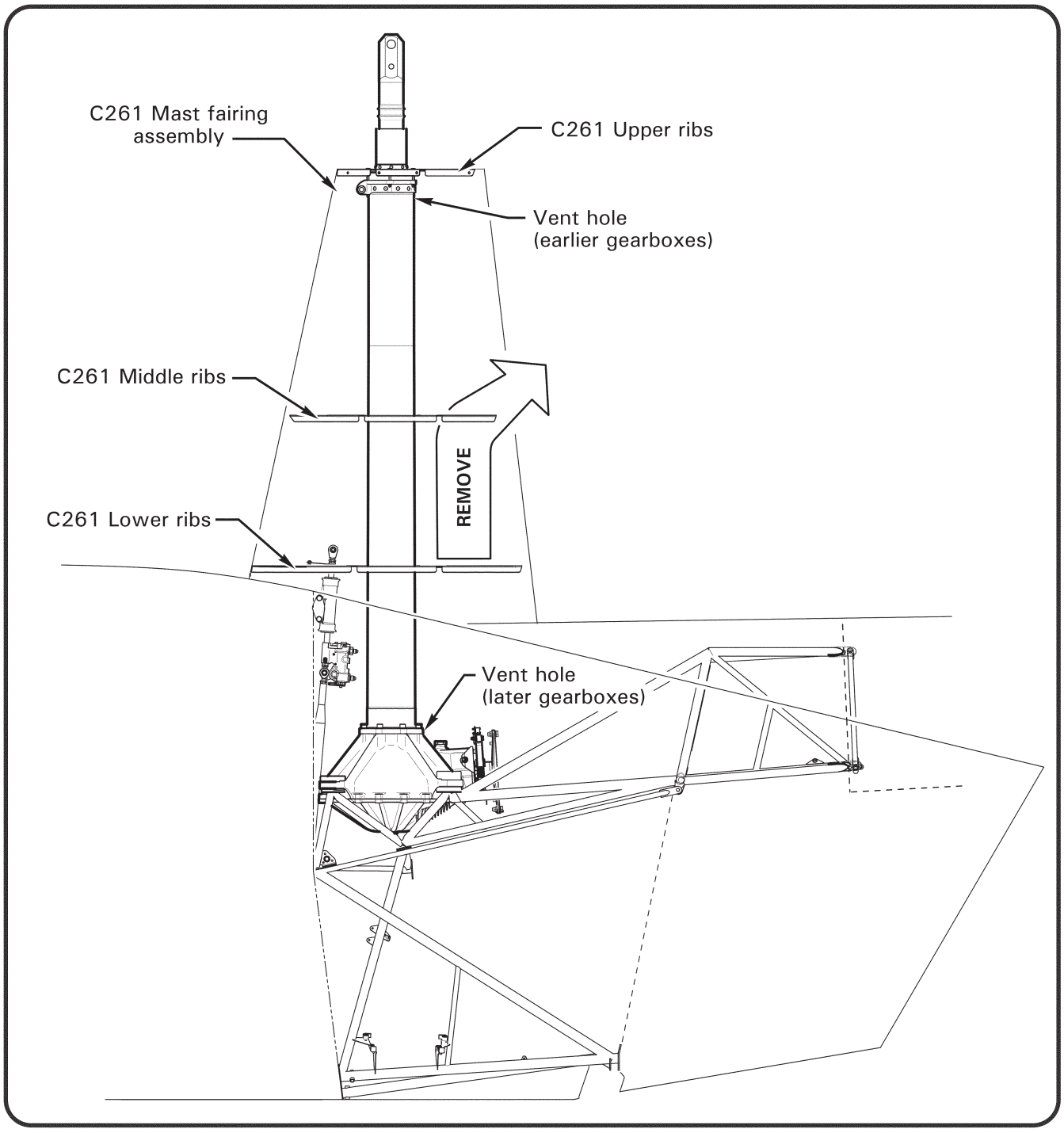

FIGURE 7-2 MAIN ROTOR GEARBOX REMOVAL

7.110 Main Rotor Gearbox Removal (continued)

11. Remove fasteners securing C559-6 (or -3) brace to cabin and record shim washers removed for reinstallation.
12. Remove jackshaft and support struts per §§ 8.311 & 8.321.
13. Remove clutch assembly per § 7.200 (alternately, rest clutch forward yoke on firewall after forward & intermediate flex plates are removed and leave clutch in helicopter).
14. Disconnect electrical wiring at chip detector, hall effect sender, overtemp sender, rotor brake switch, and ground wire. Tag wires for reassembly. Disconnect rotor brake spring from firewall angle.
15. Loosen clamp and disconnect cooling hose from gearbox.
16. Remove (4) A650-4 fittings securing gearbox to upper frame. Carefully lift gearbox up and aft to clear forward hydraulic servos (and clutch forward yoke, if installed) and remove from helicopter (ref Figure 7-2).

NOTE

Note & record location and thickness of leveling shims installed between gearbox mounts and frame mounting pads (each aft pad will have one C796-3 spacer). Mark mounting pads with shim thickness for reinstallation.

7.120 Main Rotor Gearbox Installation

1. If installing new C653-3 (aft) or A653-2 (forward) rubber mounts, apply a light coat of A257-8 lubricant or clean, potable water to rubber smaller-diameter and press into gearbox ears. Wipe off excess lubricant or water.
2. If not previously accomplished, install rotor brake per § 7.620.
3. Level MRGB mounting pads by installing original shims. If original shim thickness is unknown or suspect, or if upper frame has been replaced, level mounting pads per § 7.130.
4. Verify two C796-3 spacers are the same thickness and install one C796-3 spacer on each aft mounting pad atop any shim(s).
5. Remove foreign objects and prepare area for gearbox installation. Assistance is recommended to help position gearbox. Hoist gearbox and position on mounting pads.
6. Ensure all washers, spacers, C559-6 (or -3) brace, and C345-5 weldment are in position and install gearbox mounting hardware. Orient A650-4 fitting tabs laterally per Figure 8-9, special torque per § 23-33, and torque stripe per Figure 2-1.
7. Fill gearbox to center of sight gage using correct gearbox oil (refer to R44 Service Letter SL-73). Special torque filler plug per § 23-33.
8. Examine data plate on C251-2 shaft. If revision ("REV") letter is A thru P, then inject 6 fluid ounces of correct gearbox oil into mast tube vent hole (vent hole may be in early-upper or later-lower location).
9. Install fasteners and recorded shim washers securing C559-6 (or -3) brace to cabin.

7.120 Main Rotor Gearbox Installation (continued)

10. Install clutch assembly per § 7.200. Alternately, install forward flex plate and perform clutch sheave alignment per § 7.230, then install intermediate flex plate per § 7.330.
11. Install jackshaft support struts and jackshaft per §§ 8.322 & 8.312.
12. Refer to § 8.740. Connect suction and pressure lines to hydraulic pump.
13. Install aft hydraulic servo per § 8.760 and connect C343-8 tube's lower rod end to jackshaft.
14. Connect rotor brake spring to firewall angle. Connect electrical leads to main rotor gearbox. Install ty-raps and clamps securing wiring, hoses, and tubes to gearbox and jackshaft support struts.
15. Connect cooling hose to gearbox then position and secure clamp.
16. Install main and auxiliary fuel tanks per §§ 12-10 & 12-20.
17. Connect rotor brake cable to pulley on D112-1 lever. Standard torque bolt per § 23-32 and torque stripe per Figure 2-1.
18. Install (3) C121-31 push pull tubes.
19. Install middle and lower mast fairing ribs to mast tube. Install mast fairing and connect pitot tube.
20. Install swashplate per § 8.412.
21. Install main rotor hub and blades per §§ 28-20 and 28-10.
22. Install all cowling.
23. Bleed hydraulic system per § 1.190.
24. Perform pitot-static leak check per § 13-10.

7.130 Leveling Main Rotor Gearbox

1. Level upper frame's MRGB forward mounting pads laterally to landing gear [straight] aft cross tube. Use A796-1 shims on forward pads.
2. Level MRGB aft mounting pads laterally to landing gear [straight] aft cross tube. Use C796-2 shims on aft mounting pads.
3. Refer to Figure 4-2. Locate C046-6 tube on lower-right frame, and zero a propeller protractor to tube. Note direction protractor faces (Left or Right), and maintain this direction in following steps.
4. On upper frame, add shim(s) to right mounting pad(s) to achieve a 3.6 – 4.0 degree angle to C046-6 tube.
5. On upper frame, add shim(s) to left mounting pad(s) to achieve a 3.6 – 4.0 degree angle to C046-6 tube.
6. At least one pad must lack shims; remove an equal thickness of shims from each pad until at least one pad lacks shims. A maximum of 3 shims per pad is permissible.
7. Mark each mounting pad with needed shim thickness.

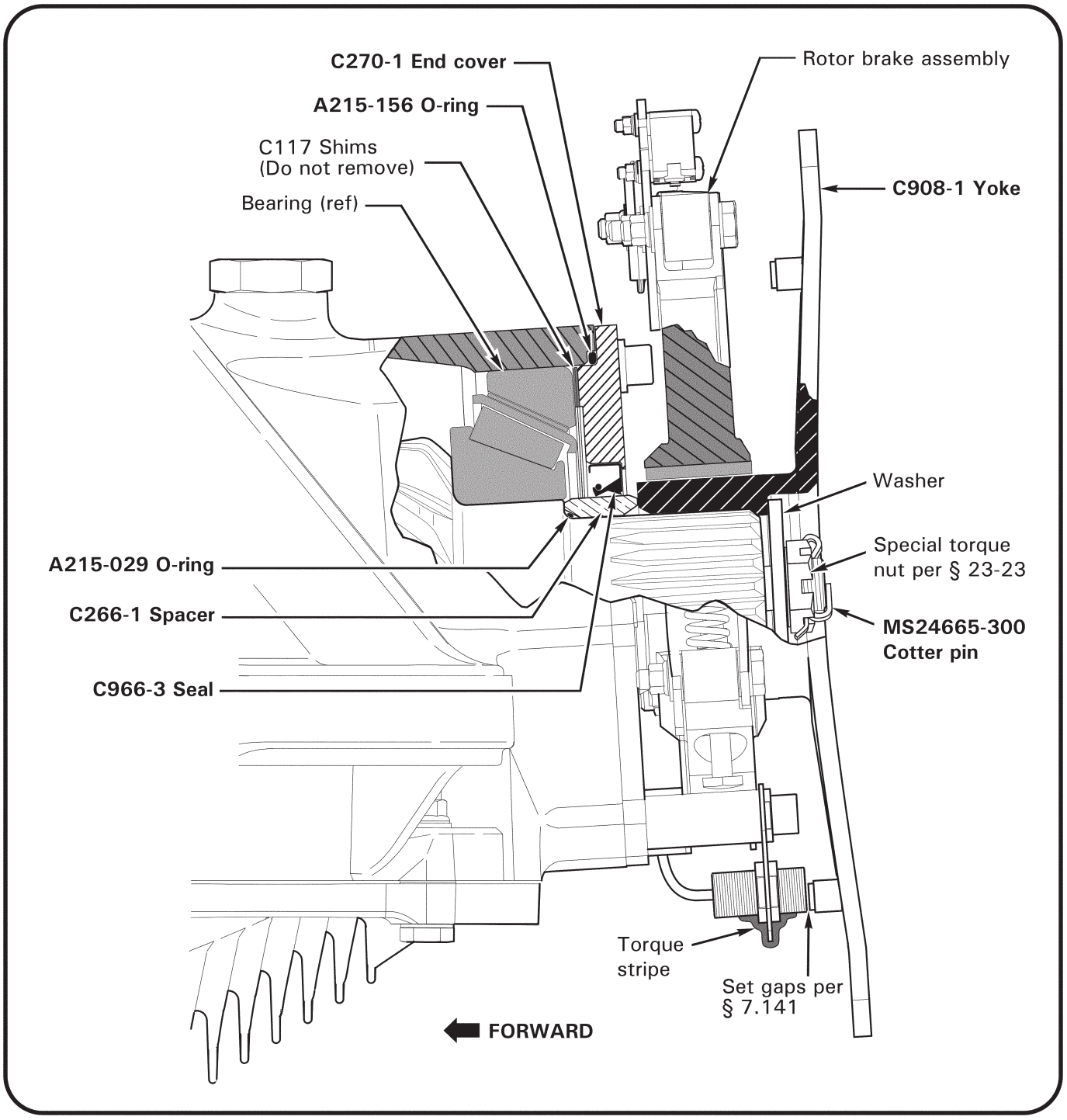

FIGURE 7-2B MAIN ROTOR GEARBOX PINION SEAL REPLACEMENT

7.140 C908-1 Yoke

A. Removal

1. Remove C947-1 flex plate and mark shims for reinstallation and remove clutch per § 7.200 or support clutch shaft per Figure 7-8.
2. Place a wood block between horizontal firewall and yoke flange to prevent yoke from rotating.
3. Remove cotter pin, nut, and washer from gearbox pinion shaft and remove yoke.

B. Installation

1. Ensure C908-1 yoke and gearbox pinion shaft splines are clean and undamaged. Apply B270-21 protectant to pinion shaft splines. While protectant is still wet, install yoke on shaft followed by a new washer.
2. Apply B270-11 adhesive to threads and install AN320-8 nut securing C908-1 yoke to shaft.

> **CAUTION**
>
> Ensure clearance between yoke magnets and rotor-RPM senders before rotating yoke.

3. Support yoke for torquing by placing a wood block between yoke flange and horizontal firewall. Special torque AN320-8 nut per § 23-33 and install new MS24665-300 cotter pin, ensure outer prong is pressed flat against end of pinion.
4. Apply B270-21 protectant to nut and exposed threads. Remove block.
5. Adjust rotor-RPM sender gaps per § 7.141.
6. Install C947-1 flex plate using recorded shim stack up or install clutch assembly per § 7.200.

7.141 Setting Rotor-RPM Sender Gap

Rotor-RPM sender-to-magnet gaps must be 0.020–0.040 inch. To adjust, loosen jam nuts on sender and adjust gap. Check gaps between both yoke magnets at each sender. Tighten jam nuts, and torque stripe per Figure 7-2B.

7.150 Replacement of Main Rotor Gearbox Pinion Seal

1. Disconnect A947-2 intermediate flex plate at tail rotor drive shaft. Mark flex plate and fasteners with a grease pencil for reinstallation.
2. Remove C908-1 yoke from gearbox pinion shaft per § 7.140 Part A.
3. Remove rotor brake assembly per § 7.610.
4. Remove remaining hardware securing hall effect sender & overtemp sender brackets and C270-1 end cover. Remove brackets and carefully slide C270-1 end cover off gearbox pinion shaft.

7.150 Replacement of Main Rotor Gearbox Pinion Seal (continued)

CAUTION

Do not remove shims under C270-1 end cover as they control bearing preload and gear backlash.

5. Slide C266-1 spacer off pinion shaft and remove old A215-029 O-ring. Clean spacer and pinion shaft using approved solvent (ref § 23-70).
6. Press old C966-3 seal out of end cover and remove old A215-156 O-ring. Clean end cover mating surfaces using approved solvent (ref § 23-70). Orient new seal with open face pointing toward gearbox and press into end cover until it seats.
7. Lubricate new O-rings using correct gearbox oil (refer to R44 Service Letter SL-73) and install on pinion shaft and end cover. Slide spacer over pinion shaft. Lubricate seal lip with correct gearbox oil and install end cover over pinion shaft.
8. Install hall effect sender and overtemp sender brackets on end cover and install rotor brake assembly per § 7.620. Special torque (6) screws per § 23-33 and safety with 0.032 inch diameter lockwire (if required), or torque stripe per Figure 2-1.
9. Install C908-1 yoke per § 7.140 Part B.
10. Connect intermediate flex plate per § 7.330.

7.155 MRGB Sump O-Ring Replacement Procedure

a. Remove MRGB per § 7.110.
b. Check and record gear backlash at and tangential to a gear tooth, accessible via sight gage or filler plug hole.
c. Carefully note and record position of each fastener, washer and shim stackup at all C263 sump-to-C264 housing attach points (an equal amount of shims is installed between sump and housing at each attach point). Also note location of ground wires and C747-1 baffle attach points. Remove, identify, and retain fasteners, washers, and shims.
d. Remove sump from helicopter. Remove O-ring and clean sump groove using approved solvent (ref § 23-70).
e. Apply A257-19 lube to new A215-382 O-ring (for C263-2 sump) or A215-279 O-ring (for C263-1 sump). Install O-ring in sump groove and ensure it does not twist.
f. Carefully assemble sump, baffle, and ground wires to housing and secure finger-tight with fasteners, washers, and shims installed in exactly the same positions recorded in step c.
g. Draw down each fastener equally before final torque.
h. Standard torque NAS1304-15 bolts per § 23-32. Special torque NAS1352-4 screws per § 23-33 and safety with 0.032 inch diameter lockwire (if required). Torque stripe screws and bolts per Figure 2-1, as required.

7.290 C007-4 Fanshaft and Bearing Assembly, Starter Ring Gear Support, Lower Sheave and Alternator Belt Replacement (continued)

CAUTION

Installing NAS6608H42 bolts with less than two NAS1149F0863P washers will prevent proper clamping of lower sheave and fanshaft & bearing assembly.

c) Refer to Lycoming Service Instruction 1129 (latest revision). Adjust belt tension as required and special torque bolts securing alternator per § 23-33.

d) Install V-belts per § 7.282.

7.300 Tail Rotor Drive Shaft

7.310 Tail Rotor Drive Shaft Removal

a) Remove tailcone per § 4.300 Part A.

b) Using 3-foot socket extension, remove NAS6603 bolts securing drive shaft damper arm to its mounting bracket.

c) Using upper aft tailcone inspection hole, disconnect C947-3 aft flex plate from tail rotor gearbox input shaft flange. Support aft end of drive shaft to protect drive shaft and tailcone from damage.

d) Remove drive shaft thru forward end of tailcone.

7.320 Tail Rotor Drive Shaft Installation

a) Refer to Figure 7-9. If not previously accomplished, install hardware securing C947-3 aft flex plate to tail rotor drive shaft's aft yoke. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1.

b) Insert tail rotor drive shaft into tailcone and support aft end of drive shaft thru upper aft tailcone inspection hole to prevent damage and for alignment purposes. Using 3-foot socket extension, insert (2) NAS6603-3 bolts & washers, 1–2 turns only, to align drive shaft damper arm to its mounting bracket.

c) Using upper aft tailcone inspection hole, install hardware securing C947-3 aft flex plate to gearbox input flange with bolt heads facing forward. Standard torque bolts and palnuts per § 23-32 and torque stripe per Figure 2-1. Remove drive shaft support from upper aft inspection hole.

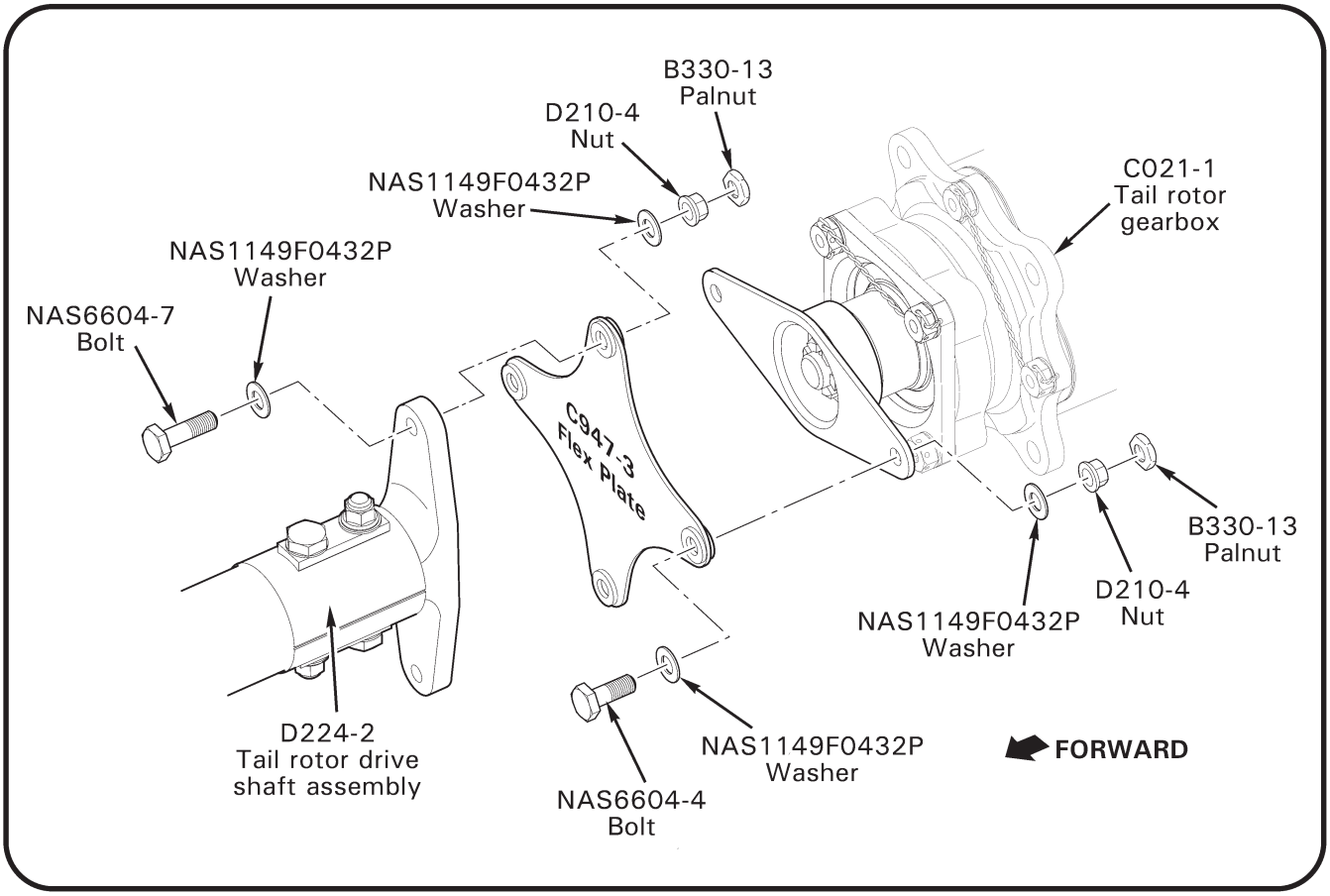

FIGURE 7-9 C947-3 AFT FLEX PLATE INSTALLATION

7.400 Tail Rotor Gearbox

7.410 Tail Rotor Gearbox Removal

NOTE

Drain tail rotor gearbox oil (ref. § 7.430) prior to gearbox removal, or keep gearbox vertical after removal to avoid oil escape thru filler-vent plug.

1. Remove tail rotor assembly per § 30-10 Part A.
2. Remove C031-1 pitch control assembly & A120-3 aft bellcrank per § 8.561.
3. Working through upper aft inspection hole of tailcone, remove hardware securing C947-3 aft flex plate to C116-1 yoke.

CAUTION

Drive shaft must be supported through upper aft inspection hole to prevent damage to flex plate and drive shaft. Do not leave any loose hardware inside tailcone.

4. Disconnect chip detector wire at bottom of gearbox. As required, remove wires from chip detector for transfer to replacement gearbox.
5. Cut & discard safety wire if installed. Remove four bolts securing tail rotor gearbox to tailcone and remove gearbox.

7.420 Tail Rotor Gearbox Installation

1. Install hardware securing tail rotor gearbox to tailcone. Special torque (4) cap screws per § 23-33. Safety screws in pairs using 0.032-inch diameter lockwire or torque stripe per Figure 2-1, as applicable.
2. Connect chip detector wire at tail rotor gearbox.
3. Install hardware securing C947-3 aft flex plate to C116-1 yoke. Standard torque bolts per § 23-32. Install palnuts and standard torque per § 23-32. Torque stripe fasteners per Figure 2-1.
4. Remove temporary support from tail rotor drive shaft and install A558-2 cover.
5. Check intermediate flex plate shimming per § 7.330.
6. Install C031-1 pitch control assembly & A120-3 aft bellcrank per § 8.562.
7. Install tail rotor assembly per § 30-10 Part B or C.

7.430 Tail Rotor Gearbox Chip Indicator

Use the following procedure to drain the gearbox and inspect the lubricant and chip detector for chips.

1. Use a clean container to catch tail rotor gearbox oil.
2. If installed, cut safety wire on chip detector and disconnect electrical wires. Remove chip detector and drain oil.
3. Strain oil and inspect for any particles found in oil or on chip detector. Examine particles for size; any particles larger (0.09 inch long or 0.02 inch wide) than fine fuzz (normal wear) should be identified as ferrous or nonferrous by using a magnet. If numerous particles are found and next running of gearbox produces more particles, a tail rotor gearbox failure may be impending and a tail rotor gearbox overhaul is required.
4. 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.
5. Using new O-ring install chip detector and special torque per § 23-33. Safety using 0.032-inch diameter lockwire or torque stripe per Figure 2-1, as required. Connect chip detector wiring and secure using MS3367-5-0 ty-raps. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
6. Turn battery on. Depress push-to-test button(s) and verify appropriate gearbox caution light illuminates. Turn battery off.
7. As required, remove filler-plug. Fill gearbox to center of sight gage using correct gearbox oil (refer to R44 Service Letter SL-73). Verify filler-plug vent holes are clear, then install filler-plug and special torque per § 23-33. Safety using 0.032-inch diameter lockwire or torque stripe per Figure 2-1, as required.

7.440 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 & sight gage and special torque per § 23-33. Safety using 0.032-inch diameter lockwire or torque stripe per Figure 2-1, as required.
2. Remove tail rotor assembly per § 30-10 Part A.
3. Remove C031-1 pitch control assembly & A120-3 aft bellcrank per § 8.561.
4. Cut & discard safety wire and remove (4) MS20074-04-06 bolts securing C112-2 cap and slide cap off output shaft.

CAUTION

Do not alter shim stack-up between cap and bearing.

5. Press old C966-2 seal out of cap and remove old A215-133 O-ring. Clean cap mating surfaces and O-ring groove using approved solvent (ref § 23-70).
6. Orient new seal with open face pointing toward gearbox and press into cap bore 0.160 inch below external flat surface.
7. Lubricate new O-ring using correct gearbox oil (refer to R44 Service Letter SL-73) and install in cap groove, ensuring O-ring has not twisted.
8. Lubricate output shaft at seal-seating area using correct gearbox oil.
9. Carefully slide cap over output shaft. Align cap and gearbox bolt holes and press cap into gearbox. Install (4) MS20074-04-06 bolts. Special torque bolts per § 23-33 and safety in pairs using 0.032-inch diameter lockwire.
10. Install C031-1 pitch control assembly & A120-3 aft bellcrank per § 8.562.
11. Install tail rotor assembly per § 30-10 Part B or C.
12. Fill gearbox to center of sight gage using correct gearbox oil (refer to R44 Service Letter SL-73). Verify filler-plug vent holes are clear. Install filler-plug and special torque per § 23-33. Safety using 0.032-inch diameter lockwire or torque stripe per Figure 2-1, as required.
13. Dynamically balance tail rotor per § 10.240, then inspect gearbox for leaks.

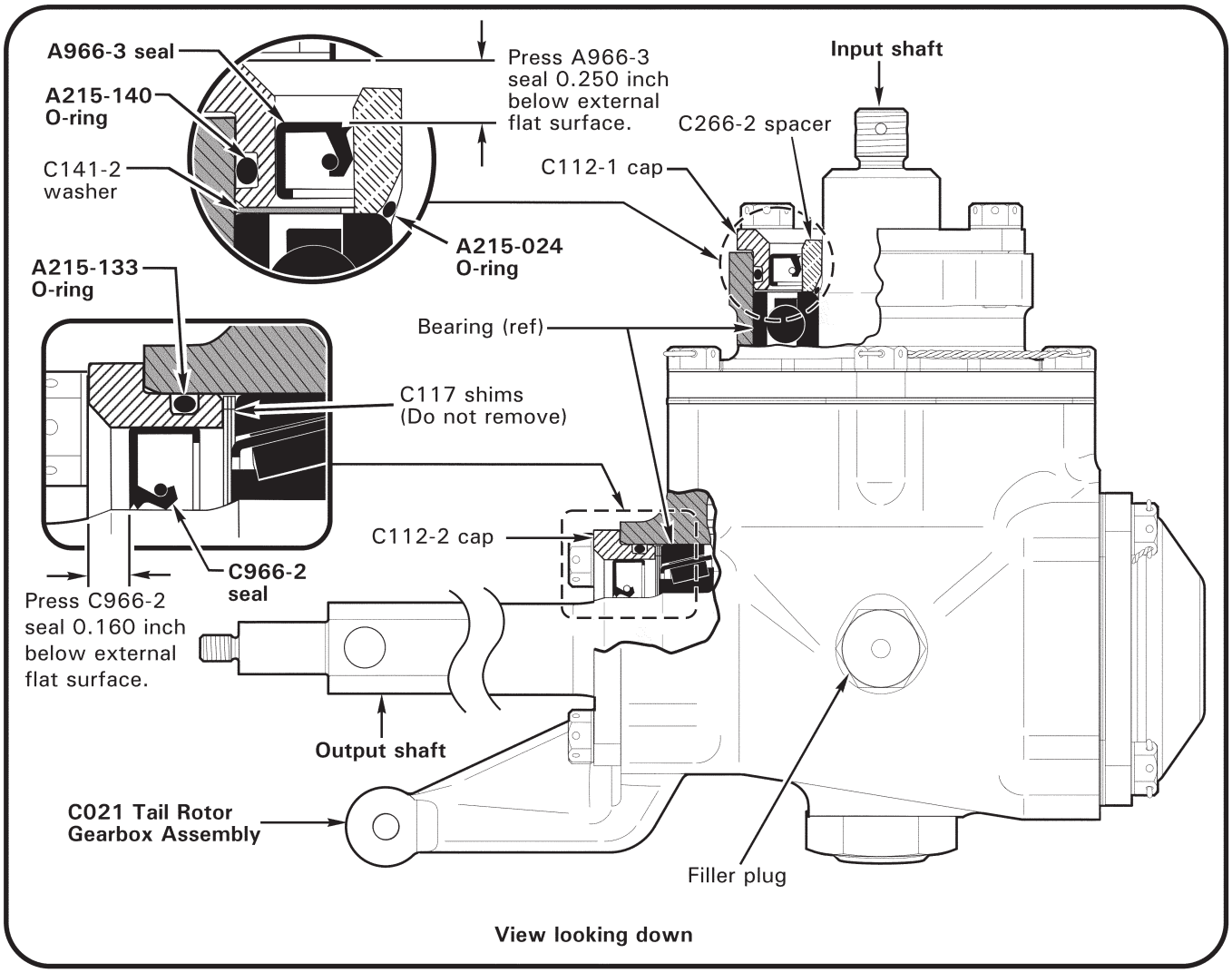

FIGURE 7-13 SHAFT SEAL REPLACEMENT

7.450 Tail Rotor Gearbox Input Shaft Seal Replacement

1. Drain tail rotor gearbox oil and remove gearbox per § 7.410. Tail rotor assembly and pitch control assembly removal are not required.
2. On a suitable work bench, place a wood block between C116-1 yoke and gearbox housing to prevent tail rotor rotation. Remove cotter pin and nut from gearbox input shaft and remove yoke.
3. Cut & discard safety wire and remove (4) MS20074-04-06 bolts securing C112-1 cap to gearbox. Remove cap, C266-2 spacer, and A215-024 O-ring.

CAUTION

Do not remove C141-2 washer between cap and bearing.

4. Press old A966-3 seal out of cap and remove old A215-140 O-ring. Clean cap mating surfaces and O-ring groove using approved solvent (ref § 23-70).
5. Refer to Figure 7-13. Orient new seal with open face pointing toward gearbox and press into cap bore 0.250 inch below external flat surface.
6. Lubricate new A215-140 O-ring using correct gearbox oil (refer to R44 Service Letter SL-73) and install in cap groove without twisting O-ring.
7. Lubricate new A215-024 O-ring with correct gearbox oil. Install O-ring and C266-2 spacer (inner-chamfered end first) on input shaft without twisting O-ring.
8. Lubricate seal lip with correct gearbox oil and slide cap over input shaft. Align cap and gearbox bolt holes and press cap into gearbox. Install (4) MS20074-04-06 bolts. Special torque bolts per § 23-33 and safety in pairs using 0.032-inch diameter lockwire.
9. Ensure yoke and gearbox input shaft splines are clean and undamaged. Apply B270-21 protectant to input shaft splines. While protectant is still wet, install yoke on shaft.
10. Install A141-10 washer and AN320-8 nut onto input shaft. Place wood block between yoke and gearbox housing to prevent tail rotor rotation and special torque nut per § 23-33. Install new MS24665-300 cotter pin.
11. Install tail rotor gearbox per § 7.420.
12. Install tail rotor assembly per § 30-10 Part B or C, if removed.
13. Fill gearbox to center of sight gage using correct gearbox oil (refer to R44 Service Letter SL-73). Verify filler-plug vent holes are clear. Install filler-plug and special torque per § 23-33. Safety using 0.032-inch diameter lockwire or torque stripe per Figure 2-1, as required.
14. Dynamically balance tail rotor per § 10.240, then inspect gearbox for leaks.

7.500 Actuator Assembly

7.510 Actuator Removal

1. Remove aft cowling assembly.
2. Fully disengage clutch.
3. Remove fanwheel & scroll per § 6.210.
4. Refer to Figure 7-8. Place a six-inch wooden block on horizontal firewall under clutch shaft just forward of upper sheave. This keeps sheave from drooping and prevents damage to forward flex plate.
5. Disconnect two wiring connections to actuator.
6. Disconnect clutch lateral centering strut from upper frame.
7. Remove the upper NAS6605 bolt & lower NAS6604 bolt connecting actuator to bearings and remove actuator.

7.520 Actuator Installation

1. Inspect upper and lower clutch actuator bearings per §§ 2.501 thru 2.503.
2. Position actuator in helicopter per Figure 7-14.
3. Install hardware (and journals) connecting clutch actuator gearmotor housing to C184 (upper) bearing. Special torque bolt per § 23-33. Install palnut, standard torque per § 23-32, and torque stripe per Figure 2-1.
4. Install lower attach bolt with head facing forward. Use one NAS1149F0432P washer under bolt head and one NAS1149F0463P washer under nut. Standard torque bolt per § 23-32. Install palnut, standard torque per § 23-32, and torque stripe per Figure 2-1.
5. If installed, remove block(s) supporting clutch assembly.
6. Connect clutch lateral centering strut. Standard torque bolt per § 23-32. Install palnut, standard torque per § 23-32, and torque stripe per Figure 2-1.
7. Install fanwheel and scroll per § 6.220.
8. Connect gearmotor and switch harness electrical leads and ty-rap as required.
9. Balance fanwheel per § 6.240.
10. Install aft cowling.

CAUTION

Do not engage actuator without scroll installed.

7.530 Actuator Gearmotor Replacement

NOTE

Actuator Gearmotor can be replaced with actuator on helicopter.

1. Disconnect gearmotor electrical leads.
2. Cut & discard safety wire if installed and remove (4) gearmotor attaching screws. Exercise care not to drop either safety wire or screws in V-belt sheaves.
3. Slowly slide gearmotor assembly from housing. An unscrewing motion may be necessary.
4. Lightly lubricate worm gear on new gearmotor assembly with A257-1 grease before installing. Install O-ring onto gearmotor nose.
5. Install new gearmotor into housing with wire leads pointing outboard. Verify no gap exists between housing and motor mounting flange before installing screws; do not use screws to draw gearmotor into housing as motor flange can break.
6. Install MS27039C1-09 screws wet with A257-9 anti-seize securing gearmotor to C501-2 housing, or install AN503-10-10 screws securing gearmotor to C501-1 housing. Standard torque screws per § 23-32. Safety AN503-10-10 screws in pairs using 0.032-inch diameter lockwire or apply torque stripe per Figure 2-1, as required.
7. Connect gearmotor electrical leads. Engage clutch, listen for binding, and verify actuator shuts off after column springs yield (indicated by “popping” sound).
8. Refer to Figure 2-6A. As required, apply torque stripe to gearmotor and install MS3367-7-0 ty-raps securing gearmotor electrical wiring. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.

CAUTION

Severe damage to actuator and drive belts can occur if gearmotor electrical leads are installed incorrectly in wiring connector (gearmotor will operate backwards and down-limit switch and spring switches will not shut off gearmotor current).

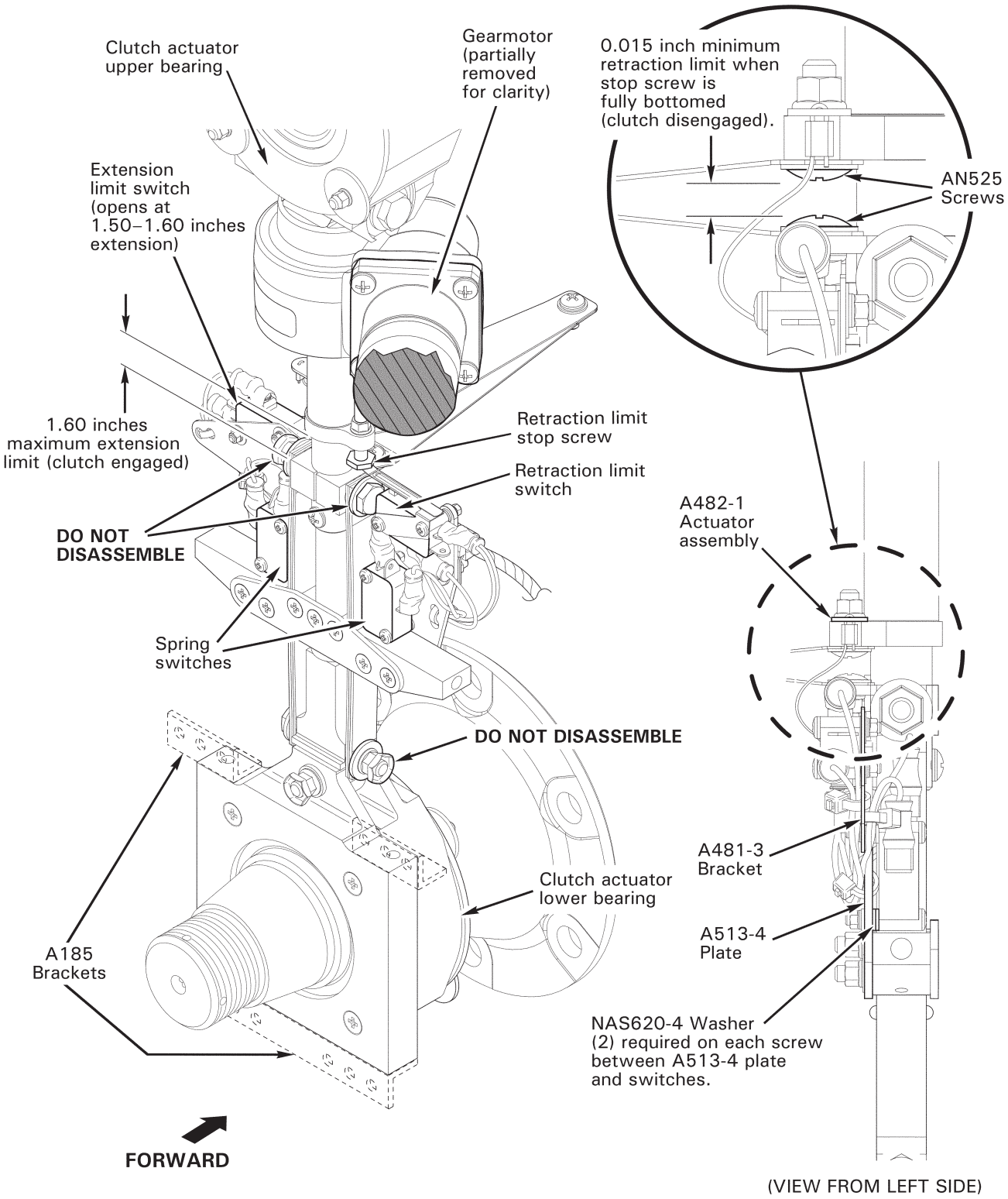

FIGURE 7-14 ACTUATOR LIMIT SWITCHES

7.540 Actuator Adjustment

A. Engaged (Extension) Limit

The actuator engaged limit is determined by column springs which control drive belt tension. Column springs may only be adjusted by the factory.

B. Disengaged (Retraction Limit) Adjustment

The retraction limit switch is activated by the retraction limit stop screw, which can be adjusted using long 3/8-inch open-end (or MT357-6) and ¼-inch box-end (or MT357-7) wrenches. Adjust retraction limit stop screw to maintain proper belt deflection per § 7.282 with actuator fully disengaged. Minimum clearance between screw heads at scissors is 0.015 inch per Figure 7-14.

C. Maximum Extension

Refer to Figure 7-14. Maximum engaged extension is 1.60 inches. The extension-limit switch activates at 1.50–1.60 inches extension. Drive V-belts must be replaced when maximum extension is encountered.

7.550 Switch and Fuse Replacement

A. Switch Replacement

NOTE

Limit switches may be replaced individually or by replacing C053-2 switches assembly.

1. Remove actuator per § 7.510.
2. Remove fasteners and spacing washers securing switch(es) to actuator assembly. If replacing individual switch, cut and remove heat shrink on switch terminal and remove terminal screw or cut wire near solder joint.

NOTE

Spacing washers may be bonded to new switch(es) to ease reassembly.

3. If replacing switches assembly, cut and discard ty-raps securing wiring and remove wiring from actuator.
4. Slide new heat shrink over each wire. Apply a drop of B270-20 adhesive to terminal screw and install screw securing wire to terminal without over-tightening (or solder wires to terminals, as required). Position heat shrink and apply heat.
5. Install fasteners securing switch(es) to actuator. Ensure (2) spacing washers are installed between switch(es) and plate. Do not over tighten screws or plastic switch housing may crack. Install MS3367-4-9 ty-raps securing wiring. Cinch ty-raps until snug without over-tightening and trim tips flush with heads.
6. Reinstall actuator per § 7.520.

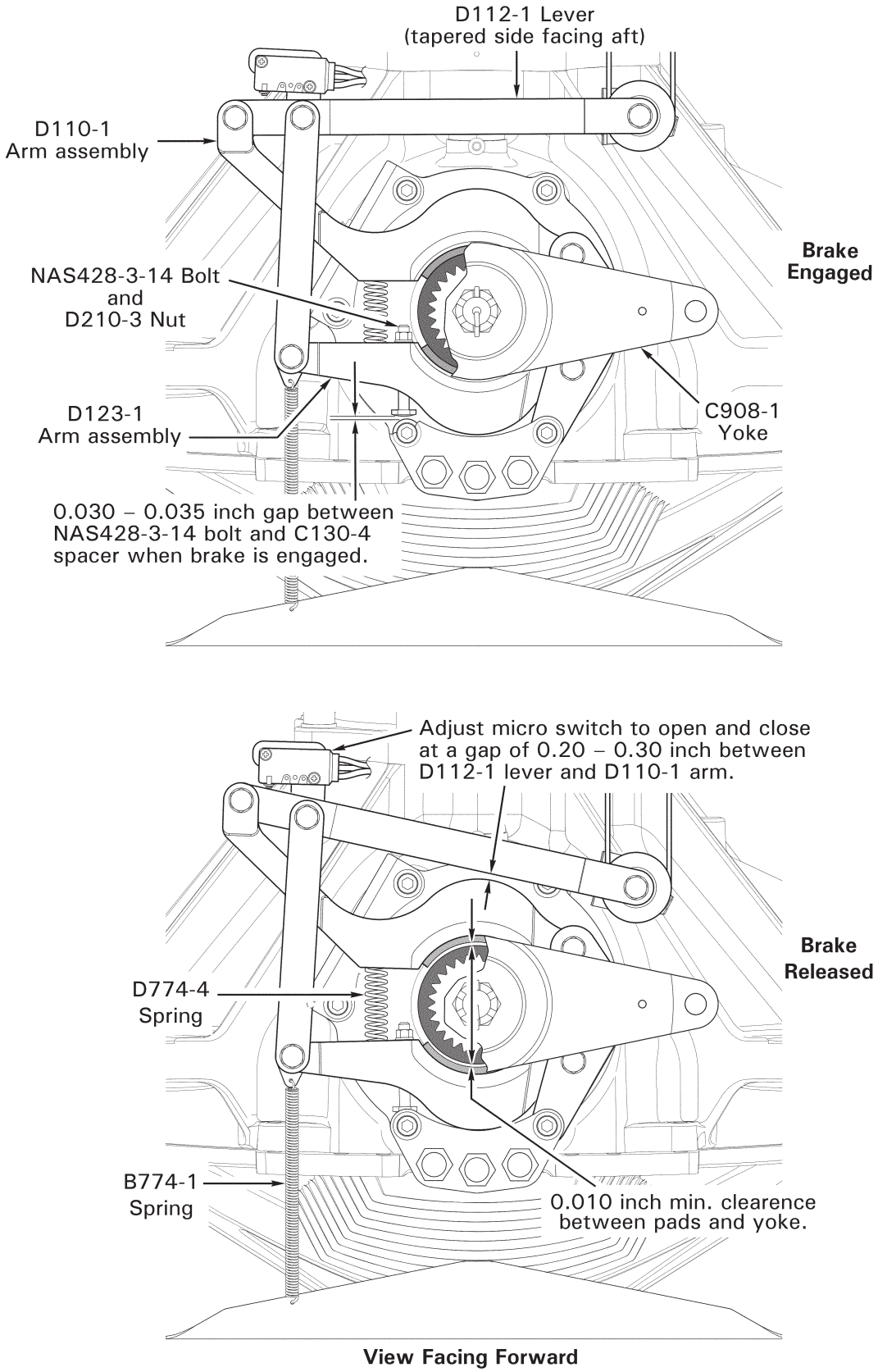

FIGURE 7-15 ROTOR BRAKE ADJUSTMENTS AND CLEARANCES

7.550 Switch and Fuse Replacement

B. Fuse Replacement

An in-line fuse holder is installed in the clutch actuator motor power circuit. R44 S/N 0106 & prior have the fuse holder ty-rapped in wire bundle above horizontal firewall in main rotor gearbox compartment. On R44 S/N 0107 and subsequent the fuse holder is mounted on the test switch panel. Replace fuse with 3.0 amp (AGC 3.0) fuse.

7.600 Rotor Brake

7.610 Rotor Brake Removal

1. Remove tailcone cowling. Remove C908-1 yoke per § 7.140.
2. Remove cable pulley from D112-1 lever. Disconnect wiring to micro switch at three-pin connector. Disconnect spring from firewall angle.
3. Cut and discard safety wire if installed. Remove (3) NAS1352-4 screws securing rotor brake assembly and D114-1 bracket to C270-1 end cover and remove rotor brake assembly.

7.620 Rotor Brake Installation

1. Measure rotor brake pad thickness. If pads are less than 0.030 inch thick, replace D110-1 & D123-1 arm assemblies per § 7.630.
2. If installing rotor brake assembly on a new gearbox, remove (3) NAS1352-4-12 screws from 3, 5, and 7 o'clock positions, as required.
3. Position rotor brake assembly over gearbox pinion shaft and insert top NAS1352-4 screw thru washer, rotor brake assembly & A130-41 spacer, and C130-3 spacer, finger tight.
4. Position D114-1 bracket on rotor brake assembly and insert bottom NAS1352-4 screw thru washer, bracket, washer, rotor brake assembly & A130-41 spacer, and C130-3 spacer, finger tight.
5. Install NAS1352-4 screw thru washer, bracket, and C130-4 spacer, finger tight.
6. Special torque (3) NAS1352-4 screws per § 23-33 and safety with 0.032 inch diameter lockwire (if required), or torque stripe per Figure 2-1.
7. Install C908-1 yoke per § 7.140.
8. Install cable pulley to D112-1 lever. Connect micro switch wiring at three-pin connector. Attach spring to firewall angle.
9. Refer to Figure 7-15. Engage rotor brake. Adjust gap between NAS428-3-14 bolt head on D123-1 arm and C130-4 spacer to 0.030–0.035 inch. Standard torque D210-3 nut to lock adjustment.
10. Release rotor brake. Measure gap between D112-1 lever and D110-1 arm assembly. Adjust length of bead chain as required to obtain 0.030–0.170 inch gap.

7.620 Rotor Brake Installation (continued)

11. Adjust micro switch to open and close at 0.20–0.30 inch gap between D112-1 lever and D110-1 arm.
12. Install tailcone cowling.

7.630 Rotor Brake Pad Replacement

NOTE

Minimum pad thickness is 0.030 inch.

1. Remove rotor brake assembly per § 7.610.
2. Remove hardware securing D110-1 arm assembly and D123-1 arm assembly to D111-1 brackets, D113-1 & -2 links, and D112-1 lever. Remove and retain A130-39 & -40 spacers and discard arm assemblies.
3. Clean spacers & bores using approved solvent (ref. § 23-70) and allow to dry. Apply A257-1 grease to spacers and install in new arm assemblies and lever.
4. Position D774-4 spring between arm assemblies and install hardware securing both arms to brackets, links, and lever.
5. Install NAS428-3-14 bolt and D210-3 nut on D123-1 arm assembly (adjustment performed in rotor brake installation).
6. Install rotor brake per § 7.620.

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FLIGHT CONTROLS

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CHAPTER 8

FLIGHT CONTROLS

8.000 Flight Controls

8.001 Introduction

This section covers removal and installation procedures for cyclic controls, collective controls, tail rotor controls, and related components.

WARNING

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

8.002 Description (see Figures 8-1 and 8-2)

Dual controls, which are removable on the left side, are standard equipment. All primary controls are actuated through push-pull tubes and bellcranks. Bearings used throughout the control system are either sealed ball bearings or have self-lubricated Teflon® liners.

R44 flight controls operate conventionally. The cyclic stick appears different, but the grip moves as in other helicopters. The cyclic grip is free to move vertically allowing the pilot to rest his forearm on his knee if he chooses. Electric trim-equipped aircraft include strain gages mounted to the cyclic stick to sense control forces, and electric trim motors at the base of the stick which automatically minimize these forces.

The collective stick is conventional with a twist grip throttle. When the collective control is raised, the engine throttle is opened automatically by an interconnecting linkage. Additionally, an electronic throttle governor adjusts throttle position to maintain RPM.

8.003 Hydraulic Flight Controls

WARNING

Except as instructed in this manual, service on the hydraulic system is limited to component removal and replacement.

CAUTION

Cleanliness of hydraulic fluid is vital to proper system operation. Use only clean fluid from sealed containers and avoid contamination from dirty funnels, tubing, etc. Do not use alcohol to clean hydraulic components.

NOTE

Recent hydraulic servos include an absorbent pad. Any combination of servos with or without an absorbent pad is approved.

8.003 Hydraulic Flight Controls (continued)

The hydraulic flight control system consists of a pump mounted to the main rotor gearbox, a servo at each of the three push-pull control tubes supporting the main rotor swashplate, a reservoir assembly, interconnecting lines, A257-15 hydraulic fluid (see § 23-78). An elastic cord replaces the collective trim spring and balances the weight of the collective stick.

Figure 8-1A shows the hydraulic control system. A schematic diagram of the system is given in Figure 8-1B.

8.004 Hydraulic Pump Description

The R44 hydraulic system uses a single stage, positive displacement gear pump. The pump drive shaft is splined to a pinion gear which is driven by the main rotor gearbox ring gear. The pump gears are supported by needle bearings. The pump drive shaft is designed to shear to protect the main gearbox if pump were to seize. Dual seals prevent cross-contamination of gearbox and hydraulic fluids. A vent hole between the seals also acts as a drain to indicate if either seal has failed.

8.005 Hydraulic Reservoir Description

The reservoir assembly includes a filter, pressure relief valve, pump bypass solenoid, return shut-off valve, and ports to and from the pump and to and from the servos. Reservoir capacity is 1.3 pints. A sight glass for pre-flight fluid level checks is also provided along with a removable filler-vent to allow addition of fluid. A 1.25 inch diameter hose directs cooling air from the engine-driven fanwheel to the reservoir cooling fins.

The filter is a disposable cartridge rated at 10 microns (P/N AN6235-1A), to be replaced at intervals specified in Table 1 Scheduled Inspections (ref. § 1.101). Full-flow filtration is provided for all flow from the pump.

The pressure relief valve regulates system pressure to 450–500 psi. Since the pump provides enough flow to meet servo requirements during severe flight conditions, excess flow is available under normal flight conditions. The excess fluid flows through the pressure relief valve directly back into the reservoir.

The pump bypass solenoid allows the pilot to shut off hydraulic pressure to the servos. Switching off the hydraulics at the pilot's cyclic control grip energizes the solenoid, which opens a valve to the reservoir and depressurizes the system. Since electric power is only required to switch the system off, an electrical system failure does not affect hydraulic operation. The solenoid valve is provided primarily to allow pilot training with hydraulics off.

The return shut-off valve closes the return from the actuators whenever system pressure drops below 80 psi. The valve assures that the irreversible feature of the actuators functions properly by preventing hydraulic fluid from leaving the servos if system pressure is lost. The valve includes a thermal relief feature to prevent excessive pressure due to thermal expansion of the fluid.

8.006 Hydraulic Servo Description

The purpose of the servo is to provide output motion equivalent to pilot input motion without transmitting main rotor feedback forces to the pilot's controls. The clevis at the input end has an over-sized hole to allow pilot input to move the control valve while also providing a direct mechanical link if hydraulic pressure is lost. With hydraulic pressure, servo output immediately matches input. Absent hydraulic pressure, the servo input clevis allows 0.040 inch total travel ("freeplay") prior to causing servo output. An irreversible feature is included to reduce pilot control forces with hydraulics off. A 40-micron filter is located at the pressure port to prevent contamination during maintenance. The pressure and return ports are different sizes to prevent incorrect installation of hydraulic lines.

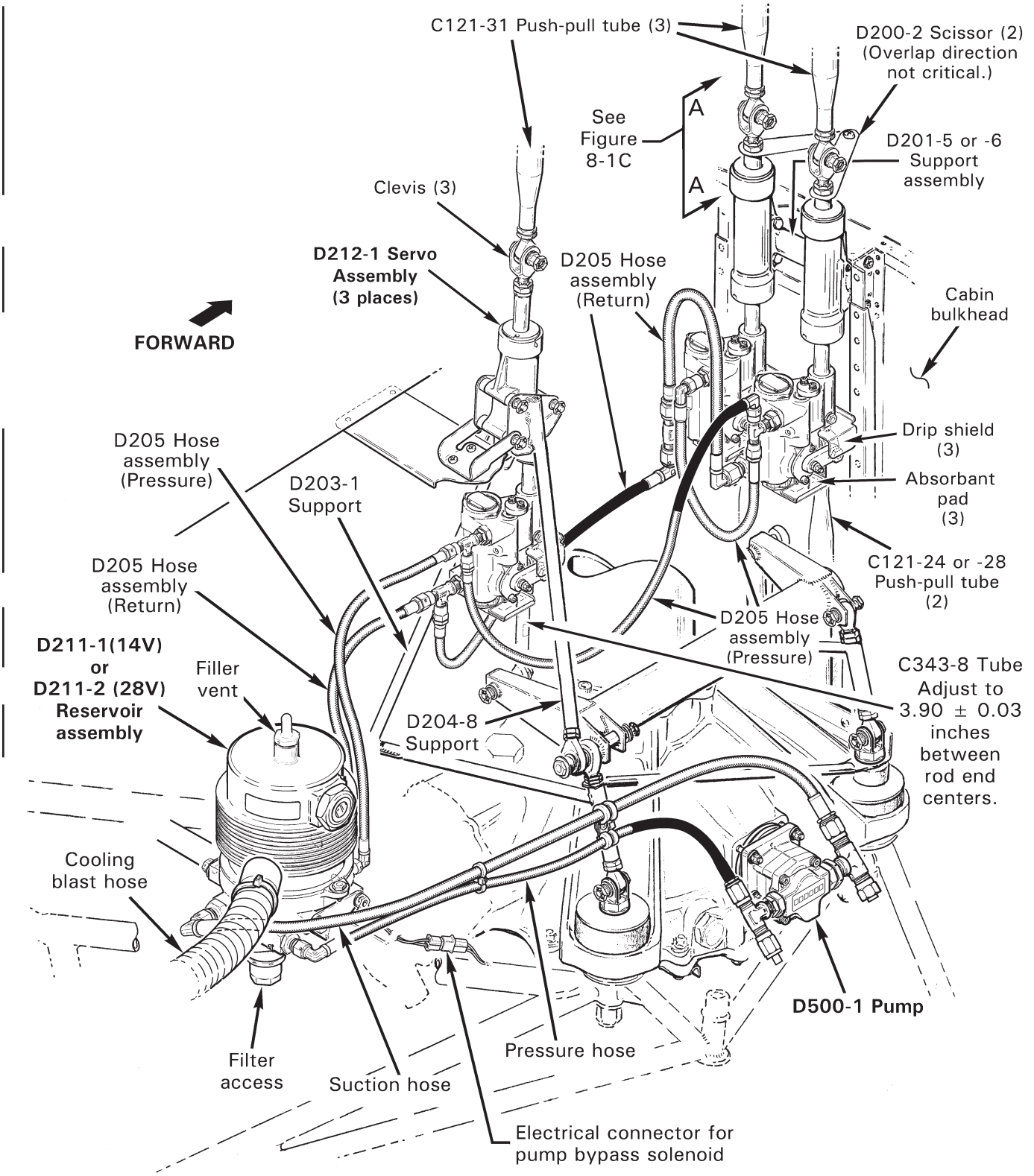

FIGURE 8-1A HYDRAULIC FLIGHT CONTROL SYSTEM

23-33 Special Torques

Special torques supersede standard torques listed 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
AIR CONDITIONING	(2) AN824-8D nuts on D792-2 and D793-2 lines at firewall	360 in.-lb
	(3) D782-5 bolt, D782-4 bracket-to-engine	360 in.-lb
	D799-2 or -9 high pressure cutout switch	90 in.-lb
	D799-3 low pressure cutout switch	90 in.-lb
	MS21042L6 nut, compressor drive pulley retaining	300 in.-lb
	(4) nuts (engine mounting), D778-1 cartridge assembly	204 in.-lb
	nut, D792-2 line assy-to-evaporator	150 in.-lb wet with A257-20
	nut, D793-2 line assy-to-evaporator	210 in.-lb wet with A257-20
	nut, D794-1 hose assy-to-D793-2 line assy	210 in.-lb
	nut, D794-1 hose assy-to-D777-1 compressor assy	300 in.-lb wet with A257-20
	nut, D810-1 or -2 line assy-to-D777-1 compressor assy	210 in.-lb wet with A257-20
	nut, D810-1 or -2 line assy-to-D783-1 condenser	150 in.-lb wet with A257-20
	nut, D811-1 or -2 line assy-to-D783-1 condenser	150 in.-lb wet with A257-20
	nut, D811-1 or -2 line assy-to-D793-2 line assy	150 in.-lb
	(4) valve cores (on servicing and cutout switches fittings)	4 in.-lb
CYCLIC STICK	(2) NAS1352-3H14 screws, C683-4 damper (manual-controls)	40 in.-lb
DOOR HINGES AND GAS SPRINGS	(16) MS51861-37C screws, securing door hinge assemblies	36 in.-lb
	(2) 21FKF-518 (or 94830A030) nuts, securing C394-2 ball studs at aft doors	100 in.-lb
	(2) C394-2 ball stud, at forward doors, to frame (B270-10 adhesive on threads)	150 in.-lb
	(2) D575-2 and (2) D575-3 ball joints, at forward door D573-4 rods	37 in.-lb

23-33 Special Torques (continued)

AREA	(QUANTITY) FASTENER	TORQUE
DRIVE SYSTEM	C182-1 nut (2-inch socket) on C007-5 or -6 shaft assembly Note: Shaft assemblies with smaller nuts are obsolete	450–550 FT-LB wet with A257-9. Retorque after first engine run after installation.
	(6) NAS6608-42H bolts, lower sheave	900 in.-lb
	(1) NAS6605-38 bolt securing C051 actuator to C184 upper bearing	190 in.-lb
ELECTRICAL	(2) bolts, lead-acid Concorde battery terminals	70 in.-lb
	(2) bolts, lithium-ion True-Blue battery terminals	65 in.-lb
EMPENNAGE	NAS1352-3-14P screw, D079-1 guard assembly	40 in.-lb
	(8) NAS6604-6 bolts, vertical stabilizer attach	185 in.-lb
FANWHEEL & SCROLL ASSEMBLIES	C182-1 nut – see DRIVE SYSTEM (above)	
	(16) D210-3 nuts, cone-to-fanwheel	70 in.-lb
	(8) D210-5 nuts, hub	300 in.-lb
	(12) D216-1 screw (or 91266A192 screw), A185 brackets	25 in.-lb
FLOATS, POP-OUT	(10) inlet check valve base	75–85 in.-lb
	(10) inlet check valve pivot (hose fitting) retainer	110–120 in.-lb
	(22) nuts on D674-1, -2, -3, -4, -5, & -6 hoses	230–260 in.-lb
	(4) nuts on D674-7 hoses	110–130 in.-lb
	D770-1, -2, -3, & -4 valve assemblies	40 in.-lb
	(1) AN924-8D nut at AN834-8D tee	360 in.-lb
FUEL SYSTEM (See also PRIMER SYSTEM)	(1) A457-11 or 6505-04-06-SS adapter, gascolator outlet (NPT threads)	285 in.-lb wet with B270-6
	(1) B254-3 strainer assembly, main tank	200 in.-lb wet with A257-9
	(1) B283-3 hose assembly, gascolator-to-carburetor (O-540)	120 in.-lb
	(1) B283-3 hose assembly, engine-driven-to-electric fuel pump (IO-540)	120 in.-lb
	(5) B289-1 screws/bolts, fuel quantity sender, self-sealing	37 in.-lb
	(1) nut, fuel quantity sender, ground wire	9 in.-lb
	(1) nut, fuel quantity sender, center stud	11 in.-lb
	(2) B330-25 palnuts, electric fuel pump elbows (IO-540)	75 in.-lb
	(1) C595-4 hose assembly, relief valve-to-D453-4 [CRES] tee; insert black D453-5 jet in tee (IO-540)	120 in.-lb
	(1) C741-1 line assembly, gascolator-to-fuel valve	285 in.-lb
	(1) D205-28 or D205-38 hose assembly, main tank-to-fuel valve	120 in.-lb
	(1) D205-29 hose assembly or C595-2 or -3 hose assembly, aux tank-to-main tank	120 in.-lb
	(1) D205-30 hose assembly, main tank-to-drain	100 in.-lb
	(1) D205-31 hose assembly, relief valve-to-D453-3 [aluminum] tee; insert black D453-5 jet in tee (IO-540)	120 in.-lb; orient D205-31 hose assy elbow horizontal ± 5°

23-33 Special Torques (continued)

AREA	(QUANTITY) FASTENER	TORQUE
FUEL SYSTEM (continued)	(1) D210-4 nut, A455-1 plug-to-gascolator	70 in.-lb
	(1) D321-1 relief valve in A457-13 connector (IO-540)	150 in.-lb
	(2) D452-6 nuts, electric fuel pump elbows (IO-540)	150 in.-lb
	(1) D453-4 [CRES] tee, aux tank	200 in.-lb; orient in line with D321 relief valve within 5°
	(1) AN316-7R nut, securing D321-4 relief valve, or securing combined D321-1 relief valve & A457-13 connector, to firewall (IO-540)	150 in.-lb ; orient valve's hose fitting 80° ± 5° aft for D205-31 hose, or 55° ± 5° aft for C595-4 [breakaway] hose
	(1) AN815-3D union or A880-933 or -963 union, main tank	100 in.-lb
	(1) AN815-6D union or A880-936 or -966 union, main tank	200 in.-lb
	(1) AN924-3D nut or A880-1003 nut, A761-1 drain-to-D255-1 connector	100 in.-lb
	(1) AN924-5D or A880-1005 nut, low fuel switch assy-to-D250-1 cover assy	150 in.-lb
	(1) CAV-110H-4 drain valve, or A761-1 drain valve, B416-3 bowl, A666-1 gascolator assy	60 in.-lb
	(1) HTM-300 clamp, electric fuel pump-to-D742-1 support assembly (IO-540)	100 in.-lb
	(1) MS21900D6 adapter or D319-4 fitting, engine-driven fuel pump (IO-540)	150 in.-lb
	(1) MS27769D2 plug, gascolator (O-540)	60 in.-lb
FUSELAGE	(2) NAS1351-6H20P bolts securing B253-2 anchor, with safety wire	150 in.-lb
	(2) NAS1351-6LE20P bolts securing B253-2 anchor, no safety wire	200 in.-lb
	(3) A964-2 eyebolts	250 in.-lb
	(1) D210-5 nut, ground handling ball	240 in.-lb
	(1) B277-072 clamp, mast fairing lower rib to mast tube	50 in.-lb
	(4) NAS6604-3 bolts, securing F050-2 stabilizer to tailcone	185 in.-lb
	(4) NAS6603-2 bolts, securing F050-2 stabilizer to F955-1 or -6 bracket	70 in.-lb
HYDRAULIC HOSES & FITTINGS	(2) B330-19 palnuts	30 in.-lb
	(3) B330-21 palnuts	45 in.-lb
	(1) B330-25 palnuts	75 in.-lb
	(1) AN820-4 cap, AN834-4D tee at hydraulic pump	60 in.-lb
	(1) AN820-6 cap, AN834-6D tee at hydraulic pump	120 in.-lb
	(2) D452-3 nuts	60 in.-lb
	(3) D452-4 nuts	90 in.-lb
	(1) D452-6 nut	150 in.-lb

23-33 Special Torques (continued)

AREA	(QUANTITY) FASTENER	TORQUE
HYDRAULIC HOSES & FITTINGS (continued)	(1) D205-3, (1) -12, (1) -14 hose assemblies & (2) AN815-3D unions	95–105 in.-lb
	(1) D205-7, (1) -11, (2) -16 hose assemblies & (3) AN815-4D unions	135–150 in.-lb
	(1) D205-15 hose assembly & (1) AN815-6D union	190–210 in.-lb
HYDRAULIC PUMP	Hydraulic pump-to-gearbox mounting nuts (see MAIN ROTOR GEARBOX)	
HYDRAULIC RESERVOIR	(1) B563-3 sight gage	150 in.-lb
	(1) D487-3 vent asembly	100 in.-lb
	(1) D516-1 cap, filter	150 in.-lb
	(4) NAS1352-4-8P screw, reservoir-to-frame	80 in.-lb
HYDRAULIC SERVOS	MS27039C0806 screw attaching D200-2 scissors	25 in.-lb
	B330-6 palnut on above screw	5–10 in.-lb
LANDING GEAR	(8) B227-28 clamps, strut fairings	15 in.-lb
	(8) HTM-200 clamps, strut fairings	100 in.-lb wet with B270-10
	(4) NAS6604-46 bolts, ground handling wheel supports	70 in.-lb
	(4) NAS6607P20 bolts, gear attach (earlier ships) Note: NAS6607-20 bolts are standard torque per § 23-32.	66 ft-lb
MAIN ROTOR BLADE	(2) A722-4 screws, tip balance weight	40 in.-lb wet with A257-9
	(2) B289-2 bolts, self-sealing	70 in.-lb
	(1) C165-1 clamp, inner	Tighten to 2.850 ± 0.005 inch outside diameter (OD)
	(2) NAS1351N3-12P screws, tip cover-to-blade	40 in.-lb wet with A257-9
MAIN ROTOR FLIGHT CONTROLS	(2) MS35206-324 screws, low rotor RPM horn V3-1 switch	5 in.-lb
	(1) A430-3 tube, governor assembly linkage	20 in.-lb
MAIN ROTOR GEARBOX	(4) A650-4 fittings, gearbox mounting or (4) D210-10 nuts	50 ft-lb wet with A257-9, torqued from bolt head or nut
	(1) B563-2 sight gage	150 in.-lb
	(1) B566-1 chip detector housing	150 in.-lb
	chip detector (threaded type)	Approximately 75 in.-lb
	(4) D210-4 nuts, hydraulic pump-to-gearbox (or cover)	40 in.-lb
	(1) AN320-8 nut, gearbox pinion (retains C908 yoke)	35–45 ft-lb wet with B270-11
	(1) AN814-8D filler plug	150 in.-lb
	(6) NAS1352-4H screws, end cover (safety wire is required)	120 in.-lb
	(6) NAS1352-4 screws, end cover (safety wire not required)	140 in.-lb

23-33 Special Torques (continued)

AREA	(QUANTITY) FASTENER	TORQUE
MAIN ROTOR GEARBOX (continued)	(6) NAS1352-4H16P screws, sump-to-housing (safety wire is required)	120 in.-lb at head
	(6) NAS1352-4-16 screws, sump-to-housing (safety wire not required)	140 in.-lb at head
MAIN ROTOR HUB	(1) NAS634-105 bolt, teeter hinge and (2) NAS634-105 bolts, coning hinges **WARNING** **Scrap bolt & nut if bolt is elongated more than 0.024 inch during tightening.**	New bolt: 0.021–0.022 inch elongation, wet with A257-9 Used bolt: 0.020–0.022 inch elongation, wet with A257-9, and cotter pin holes must align
PITCH LINKS	21FKF-813 self-locking jam nut, main rotor pitch link	300 in.-lb
POWERPLANT	(4) bolts, air box-to-carburetor	30 in.-lb
	(2) bolts, engine-to-ground strap	96 in.-lb
	(6) bolts, D730-1 manifold weldment-to-engine	96 in.-lb
	(4) engine hardware, securing C592-3 mount assembly or C174-11 plate weldment to crankcase prop-governor pad	204 in.-lb
	(1) D210-8 nut securing C592-4 mount assy to support weldment	400 in.-lb
	(6) engine nuts, securing C357-1 clips	96 in.-lb
	(1) hardware, securing alternator to B200-3 or D728-1 arm	204 in.-lb
	(4) nuts, carburetor-to-engine (O-540)	96 in.-lb initial, 204 in.-lb final; torque in crisscross pattern
	(1) nut, A457-9 tee	140 in.-lb
	(1) nut, A462 fitting on mixture control arm	27 in.-lb
	(12) spark plugs	420 in.-lb wet with A257-16
	(1) A058-10 probe	36–48 in.-lb
	(1) A723-15 line assembly, nuts	40 ft-lb
	(1) B173 v-belt, tension at alternator	150–170 in.-lb initial drag at pulley
	(1) B283-7 hose assembly, nuts	140 in.-lb
	(1) B283-10 hose assembly, nuts	140 in.-lb
	(1) B283-11 hose assembly, nuts	140 in.-lb
	(1) C740-4 line assembly, nuts	30 in.-lb
	(1) D740-1 line assembly, nuts	30 in.-lb
	(1) D753-1 line assembly, nuts	40 ft-lb
	(1) D753-2 line assembly, nuts	40 ft-lb
	(2) MS20074-05-04 bolt, alternator	204 in.-lb
	(1) MS20074-05-11 bolt, alternator	204 in.-lb
	(1) MS20074-06-07 bolt, alternator	280 in.-lb

23-33 Special Torques (continued)

AREA	(QUANTITY) FASTENER	TORQUE
POWERPLANT (continued)	(4) NAS1352-6H48P screw, securing C593-3 mount assy	280 in.-lb
	(3) STD-1411 nuts, securing C357-3 clips	96 in.-lb
	(12) 21FKF-518 nuts, exhaust flange (draw up evenly prior to torquing)	200–220 in.-lb
	(1) 3080-38 cylinder head temperature probe (1-wire)	75 in.-lb
	(1) A760-2 cylinder head temperature probe (3-wire)	50 in.-lb
PRIMER SYSTEM (See also FUEL SYSTEM)	(1) D101-3, (1) D102-4, (2) D103-3, (1) D104-3, (1) D105-3, (1) D106-3, and (1) D107-3 line assembly, nuts	20–30 in.-lb
	(1) AN894D4-2 Bushing, at gasoclator	50–65 in.-lb
	(1) AN894D6-4 Bushing, at gasoclator	110–130 in.-lb
STEEL TUBE FRAME	(2) C722-2 5/8-inch internal-wrenching screws	120–125 ft-lb wet with A257-9
	(2) S14119 screw and (2) A31007 nut	10 in.-lb
SWASHPLATE	(18) AN503-8-8 fillister-head screws	17 in.-lb
	(26) NAS1352-08H8P socket-head screws	30 in.-lb
	(26) NAS1352N08-8 screws	35 in.-lb wet with A257-9
	(1) NAS6605-8 bolt clamping C203-1 yoke	190 in.-lb (opposite clamping bolt must be torqued first)
TAIL ROTOR	(1) NAS6606-53 bolt, elastomeric teeter (delta) hinge	420 in.-lb
TAIL ROTOR GEARBOX	(1) A610-1 vent assembly	100 in.-lb
	(1) B563-4 sight gage	150 in.-lb
	(1) B566-2 chip detector	100 in.-lb
	(1) D210-4 nut, securing C119-2 bumper to TRGB output shaft	120 in.-lb
	(1) D210-5 nut, pitch control housing stud	240 in.-lb
	(1) AN320-8 nut, C116-1 input yoke	35–45 ft-lb
	(4) MS20074-04-06 bolts, input cap	60 in.-lb
	(8) MS20074-04-06 bolts, input cartridge and output cap	100 in.-lb
	(4) NAS1352-5H12P drilled-head bolts, gearbox-to-tailcone attaching	200 in.-lb
	(4) NAS1352-5-12P bolts (undrilled), gearbox-to-tailcone attaching	240 in.-lb
WINDSHIELD	(22) AN526C832R12 screw, thru center brace	16 in.-lb
	(66) B526-6 screw, polycarbonate windshield	24 in.-lb

CHAPTER 28

MAIN ROTOR

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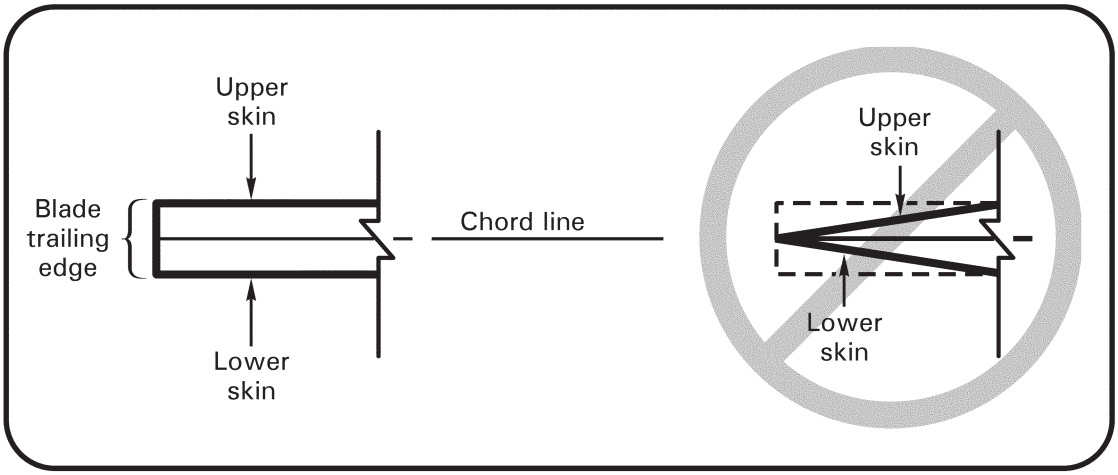


FIGURE 28-18 FILING EDGES SQUARE WITH SKINS

28-51 Trimming

Refer to Figures 28-17 & 28-18. 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 § 28-50 steps 2 thru 7. File trailing edge or trim tab edges square with skins (do not file into a point). Verify minimum chord dimension.

28-52 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 abrasive paper. Do not remove metal.
3. Clean bare metal to be painted with a lint-free cloth dampened with an approved solvent (ref. § 23-70).
4. Refer to Figure 28-19. Mask blade(s) as required, and protect helicopter to prevent overspray contamination.
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 an approved solvent (ref. § 23-70) prior to applying second coat.

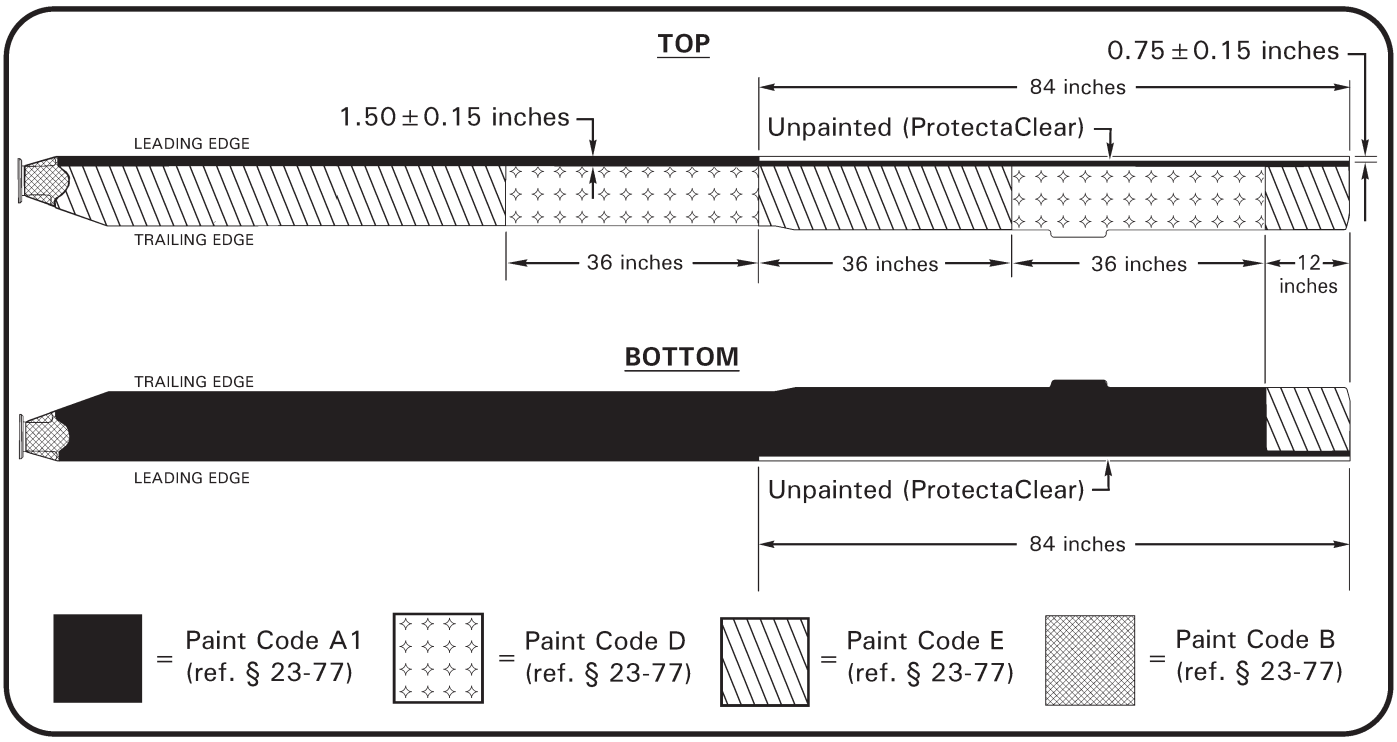


FIGURE 28-19 C016-7 MAIN ROTOR BLADE PAINT SCHEME

28-52 Painting (continued)

6. Refer to Figure 28-19. Apply dark gray, 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. Remove masking materials.
8. Using 320-grit or finer aluminum-oxide abrasive paper, carefully break leading edges (upper & lower) of paint spanwise.
9. Install screws, wet with A257-9 anti-seize, securing tip covers. Special torque screws per § 23-33; ensure cover edges are flush with blade profile.

28-53 Leading Edge Care

NOTE

Blades with painted outboard leading edge may be paint-stripped per Part C to match new-blade paint scheme, if desired.

A. Unpainted Outboard Leading Edge

1. Remove any oxidation from unpainted leading edges using maroon-colored Scotch-Brite™ pad (3M General Purpose Hand Pad 7447).
2. Clean surface to be coated using mild soap and water (acetone may be used as necessary; do not use MEK or alcohol). Water-rinse immediately and allow to dry.
3. Wearing a nitrile glove, apply a coat of ProtectaClear using lint-free cloth and allow to dry (approximately one hour).
4. A second coat may be applied for additional protection.

B. Painted Leading Edge

Refer to Figure 28-19. Repaint leading edge per § 28-52 as required. Outboard leading edge may be refinished per Part C.

C. Leading Edge Refinishing

CAUTION

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

NOTE

Earlier blades with painted outboard leading edge may be refinished per Part C for improved appearance and protection against erosion.

1. Remove main rotor blade tip cover(s). Clean the blade(s).
2. Using a felt-tip marker, draw a straight line on blade's top and bottom surfaces: 0.80-inch aft of leading edge, from blade-tip to 84 inches inboard of blade-tip.
3. Support blade while sanding to avoid pushing blade down. Remove paint, without removing metal, forward & outboard of marked lines using 220-grit or finer wet-or-dry aluminum-oxide abrasive paper by hand-sanding blade spanwise and feather paint edges.
4. Clean feathered-paint edges and surfaces of blade requiring touch-up with a lint-free cloth dampened with an approved solvent (ref. § 23-70).

28-53 Leading Edge Care (continued)

C. Leading Edge Refinishing (continued)

5. Refer to Figure 28-19. Using 3M vinyl tape (or equivalent), apply masking to blade(s) along 0.75-inch dimension and aft of feathered paint. Protect blade(s) and helicopter from overspray contamination.
6. Wipe area to be painted using PreKote wipes (or equivalent adhesion promoter) and allow to air dry.
7. Apply light coat of approved primer (chromate primer preferred; refer to § 23-75) to feathered paint.
8. Apply black paint (ref. § 23-77), as required.
9. Remove masking materials.
10. Using 320-grit or finer aluminum-oxide abrasive paper, feather leading edge of black paint spanwise without exposing primer.
11. Wipe bare metal leading edge using PreKote wipes (or equivalent adhesion promoter) and allow to air dry.
12. Wearing a nitrile glove, apply a coat of ProtectaClear using lint-free cloth and allow to dry (approximately one hour).
13. A second coat of ProtectaClear may be applied per step 12 for additional protection.
14. Install screws, wet with A257-9 anti-seize, securing tip covers. Special torque screws per § 23-33; ensure cover edges are flush with blade profile.

28-60 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

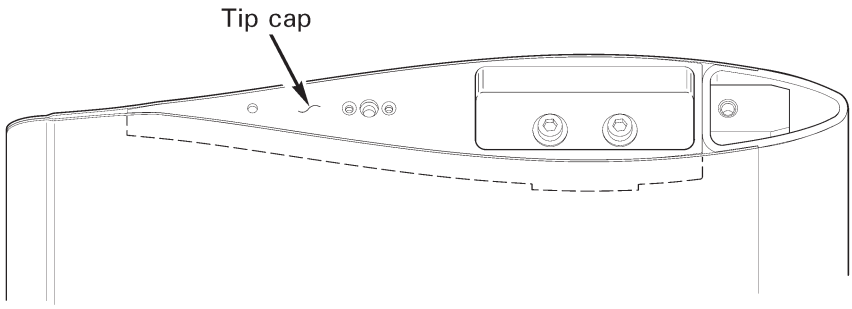
Review appropriate Safety Data Sheet (SDS) when working in proximity to hazardous materials. Specific recommendations for use of personal protective equipment are located in the SDS.

CAUTION

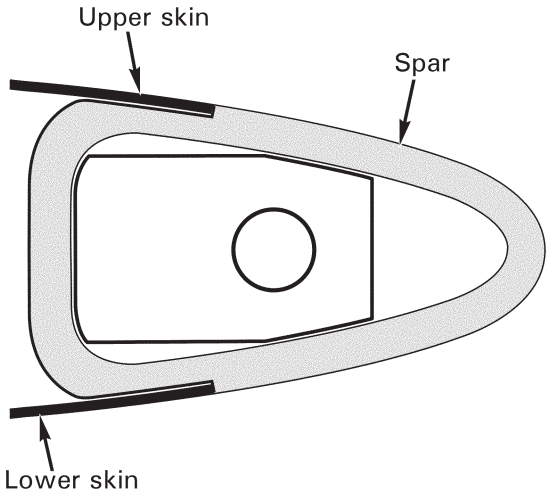
Do NOT use power tools or chemical paint strippers to remove blade paint.

28-60 Main Rotor Blade Tip Maintenance (continued)

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.



3. Clean bare metal area with lint-free cloth dampened with an approved solvent (ref. § 23-70) 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 screws, wet with A257-9 anti-seize, securing tip covers. Special torque screws per § 23-33; ensure cover edges are flush with blade profile.

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CHAPTER 30

TAIL ROTOR

Section	*Title*	*Page*
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30-10	Tail Rotor Assembly	30.1
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CHAPTER 30

TAIL ROTOR

30-00 Description

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

30-10 Tail Rotor Assembly

A. Removal

1. Refer to Figure 30-1 or Figure 30-2. Mark or tag each pitch link and corresponding blade for reinstallation. Remove hardware securing pitch links to tail rotor blades, noting hardware removed.

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

2. Remove nut and A141-14 washer securing C119-2 bumper to tail rotor gearbox output shaft.
3. Remove teeter hinge bolt, then slide tail rotor assembly and bumper, and C130-1 spacers (C030 hubs only), off of shaft.

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

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

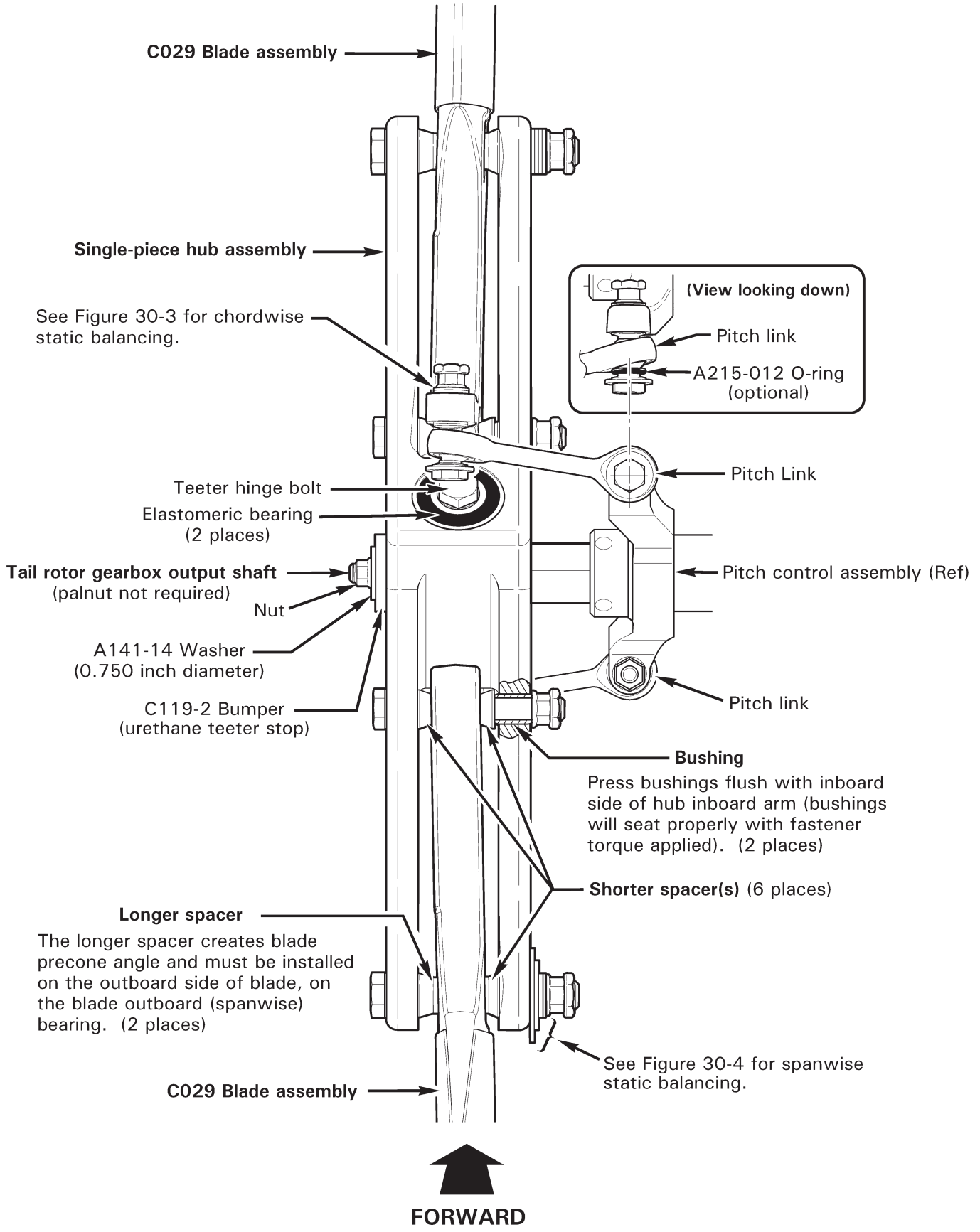


FIGURE 30-1 SINGLE-PIECE HUB TAIL ROTOR ASSEMBLY INSTALLATION

30-10 Tail Rotor Assembly (continued)

B. Installation of Single-Piece Hub (Elastomeric Bearing) Tail Rotor Assembly

CAUTION

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

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

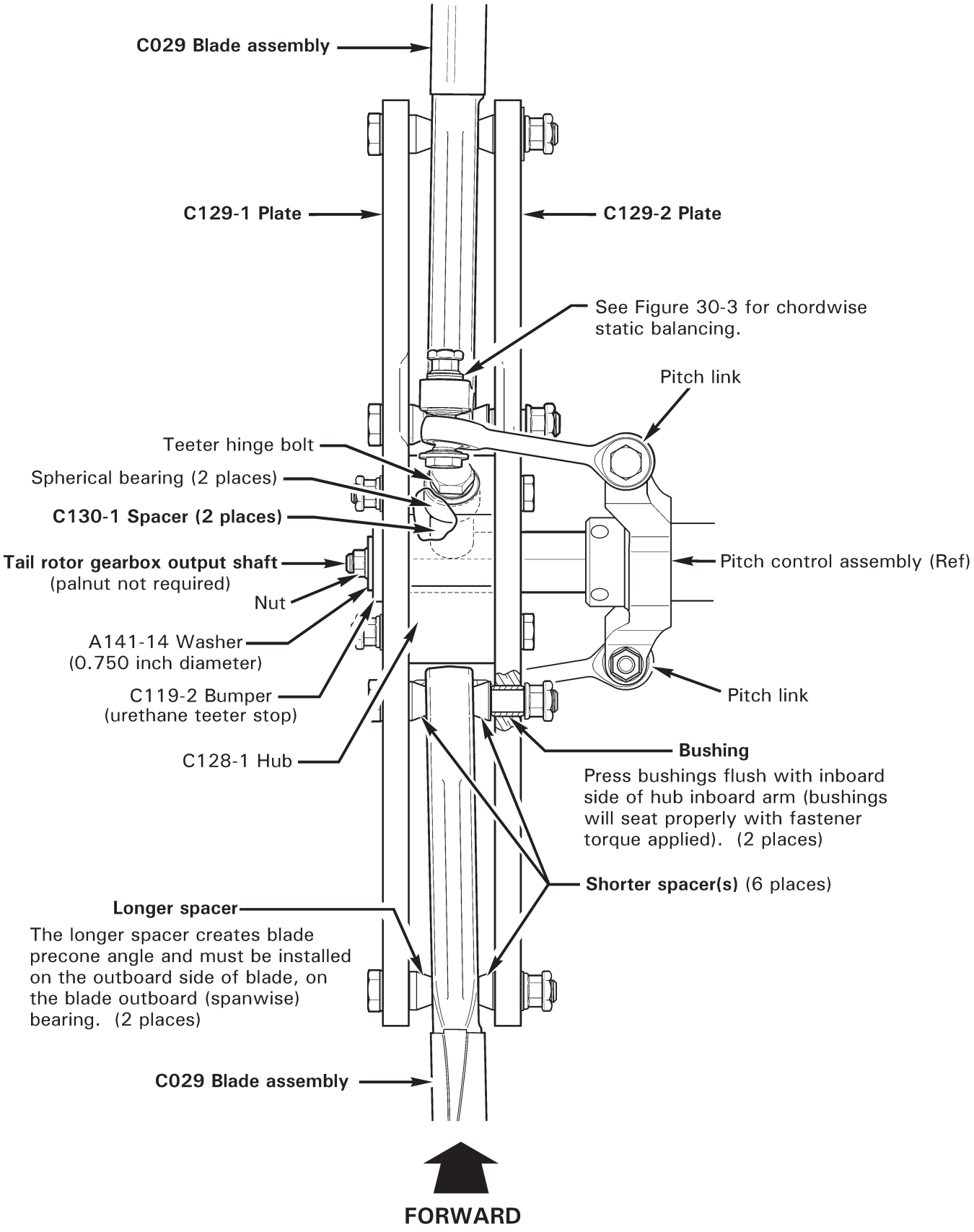


FIGURE 30-2 THREE-PIECE HUB TAIL ROTOR ASSEMBLY INSTALLATION

30-10 Tail Rotor Assembly (continued)

C. Installation of Three-Piece Hub (Spherical Bearing) Tail Rotor Assembly

CAUTION

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

1. a. Verify C130-1 spacer faces are not worn.

   b. Verify tail rotor gearbox output shaft flats are not worn. Verify output shaft teeter hinge bolt hole is not elongated.

2. Clean tail rotor gearbox output shaft and elastomeric bearing spacer clamping surfaces with mild soap (pH between 7 & 9) and warm water. Water-rinse to remove all soap residue, dry with lint-free cloth.

3. Refer to Figure 30-2. Position C130-1 spacers inside hub and install tail rotor assembly on tail rotor gearbox output shaft, matching tail rotor blades to corresponding pitch links. Verify tail rotor is installed for clockwise rotation when viewed from left side of aircraft.

4. Install teeter hinge bolt and special torque per § 23-33. Install palnut on teeter hinge bolt, standard torque per § 23-32, and torque stripe per Figure 2-1. Verify blades cone toward tail rotor gearbox.

WARNING

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

5. a. Mark a line on exposed portion of each bearing ball using a felt pen or grease pencil.

   b. While teetering tail rotor, observe marked line in relation to output shaft. Verify bolt, nut, bearing balls, and spacers remain stationary in relation to output shaft. Teeter tail rotor and verify bearing outer races do not move inside hub.

   c. If bearing outer races rotate within hub bore, insufficient clamp-up is indicated. Replace tail rotor hub.

6. Install hardware securing tail rotor blades to pitch links as removed, or as determined by static balancing. Standard torque nuts & palnuts per § 23-32, and torque stripe per Figure 2-1.

7. Install C119-2 bumper, A141-14 washer, and nut. Special torque nut per § 23-33 and torque stripe per Figure 2-1.

8. Dynamically balance tail rotor per § 10.240.

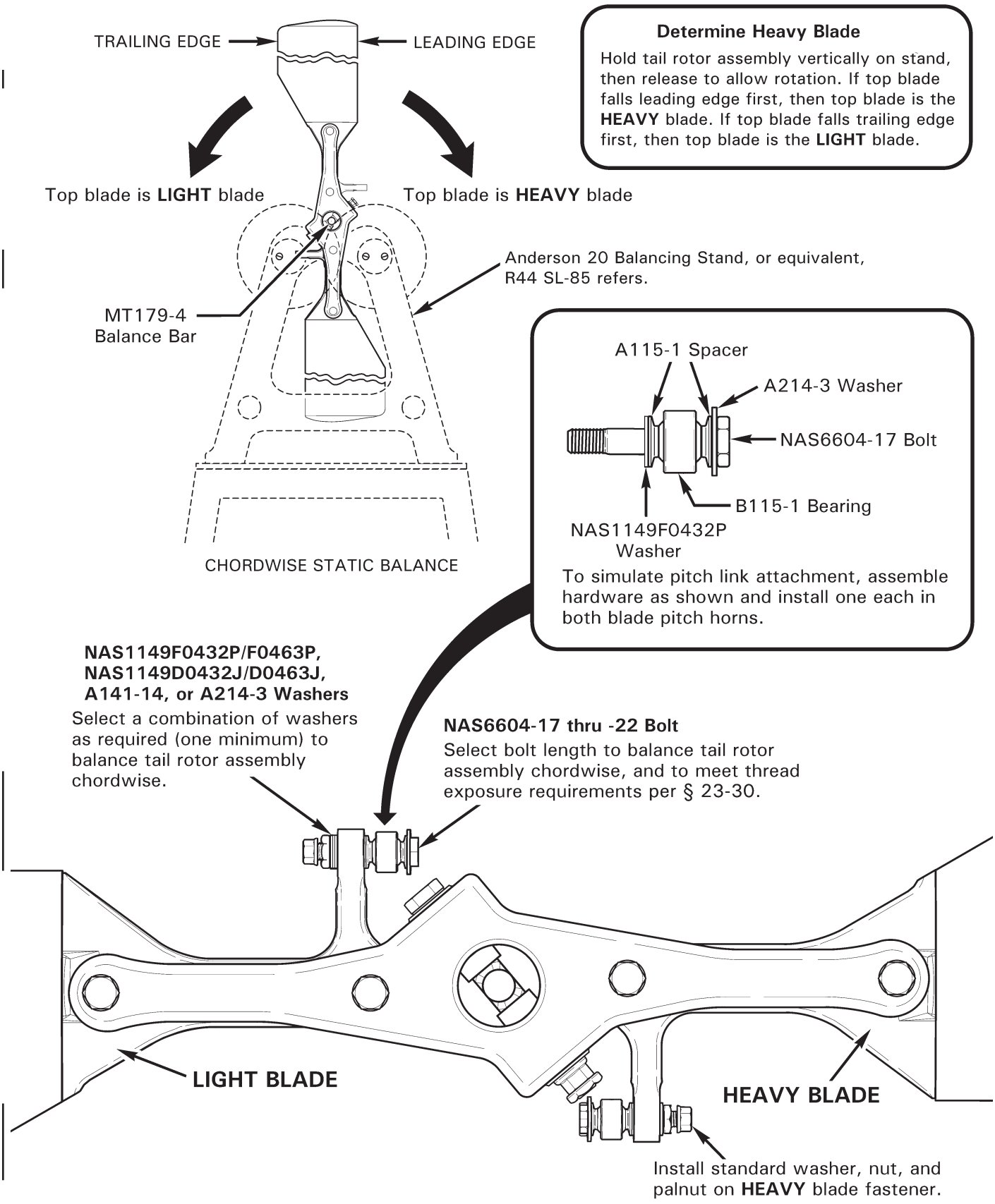


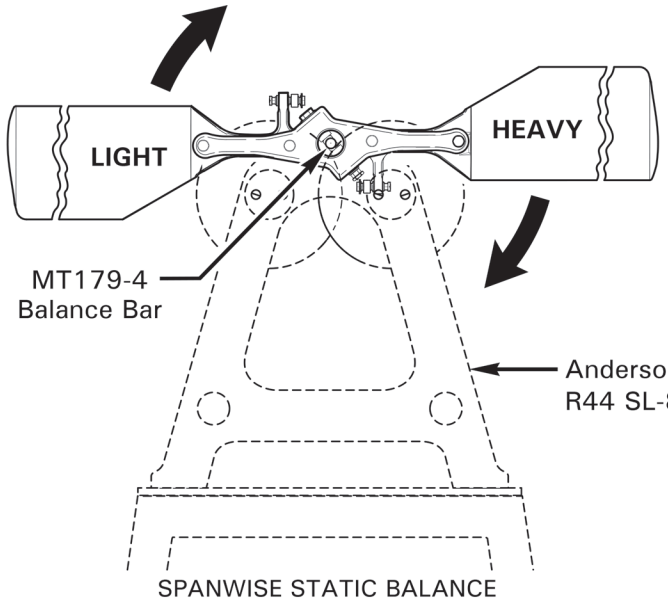
FIGURE 30-3 CHORDWISE STATIC BALANCE
(C008-9 Tail Rotor Assembly Shown)

30-11 Static Balance

NOTE

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

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



Determine Heavy Blade

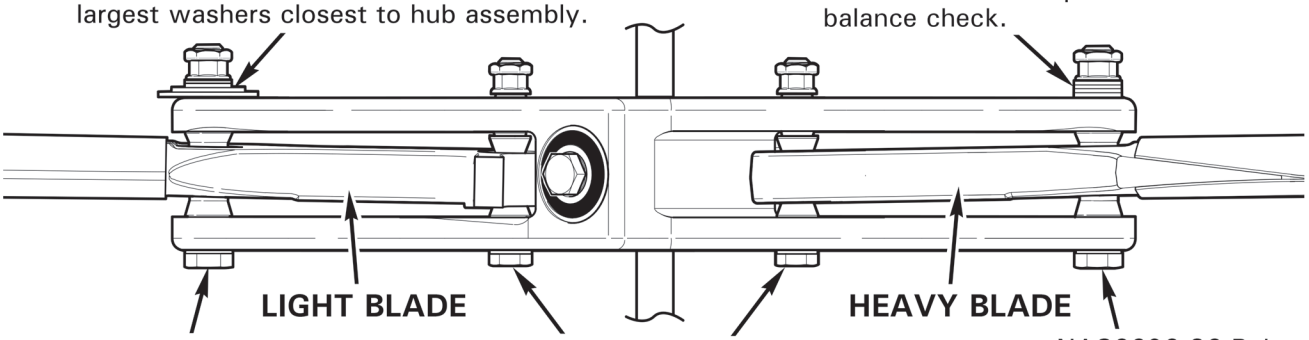
Hold tail rotor assembly horizontally on stand, then release to allow rotation. The falling blade is the **HEAVY** blade; the rising blade is the **LIGHT** blade.

C008-9 TAIL ROTOR ASSEMBLY

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

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

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



C008-4 TAIL ROTOR ASSEMBLY

(4) NAS1149D0532K/D0563K, NAS1149F0563P/AN970-5, or A141-20 Washers

See above description.

(4) NAS1149D0563K

See above description.

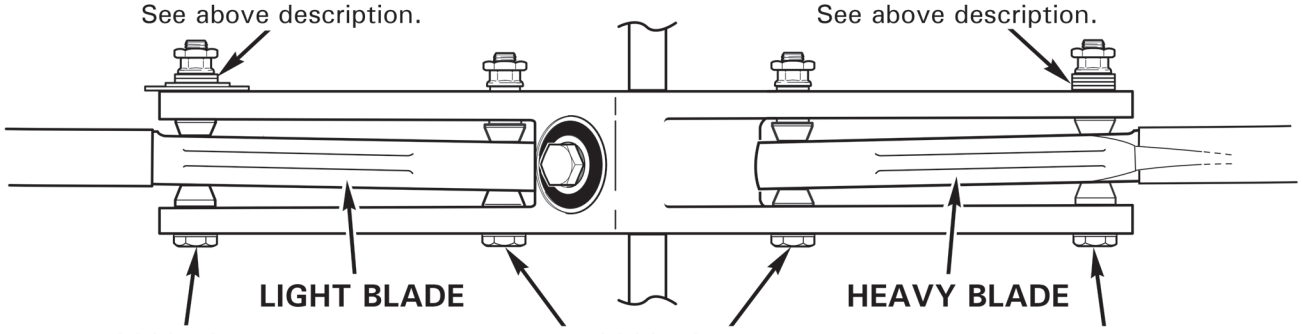


FIGURE 30-4 SPANWISE STATIC BALANCE

30-20 Tail Rotor Blades

NOTE

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

A. Removal

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

B. Installation

CAUTION

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

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

CAUTION

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

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

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CHAPTER 37

ELECTRICAL SYSTEM

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37-00	Description	37.1
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37-12	Lithium-Ion Battery Installation	37.2B
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37-130 Audio Alerts

All R44 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 speakers 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 108%. 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 warnings, traffic warnings, and autopilot modes.

37-140 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 inserted in the front of the camera housing. The internal memory retains only the most recent 3 hours of video and is not user-accessible. 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.

37-140 Cockpit Camera (continued)

Complete instructions are provided in the Cockpit Camera User Guide on the Robinson website https://robinsonheli.com. The guide also provides camera lens cleaning instructions, additional playback suggestions, instructions for visualizing GPS data, setting user preferences, 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.

A. Removal

1. Turn battery & camera switches off.
2. **Remove F039-2 camera assembly per the following:**
   a. Remove (3) screws securing camera assembly to cabin.
   b. Cut & discard ty-raps securing wiring. Disconnect wiring at connectors. Disconnect F714-2 antenna assembly from camera assembly and remove camera assembly from helicopter.
3. **Remove F039-3 camera assembly per the following:**
   a. Remove MS27039C0807 screw securing D796-3 duct assembly and slide duct forward to release from cabin. Cut & discard ty-raps as required and disconnect electrical wiring at connectors. Remove duct from helicopter.
   b. Remove A701-1 tape securing F714-3 antenna assembly wire to duct assembly. Temporarily mark antenna location using felt-tip marker. Using a plastic razor blade, detach antenna from duct assembly.
   c. Disconnect RV-BATT-LIPO500 battery from RV-10251C extension harness.
   d. Remove (4) screws and associated hardware securing camera assembly to duct assembly and remove camera assembly.

B. Installation

1. **Install F039-2 camera assembly per the following:**
   a. Connect camera assembly wiring at connectors and lock connectors using MS3367-4-9 ty-rap. Cinch ty-rap until snug without over-tightening and trim tip flush with head. Connect F714-2 antenna assembly to camera assembly.
   b. Position camera assembly and install (3) screws securing camera to cabin.
2. **Install F039-3 camera assembly per the following:**
   a. Install (4) screws and associated hardware securing camera assembly to D796-3 duct assembly.
   b. Clean mating surfaces of duct assembly and F714-3 antenna assembly using alcohol wipe. Secure antenna to duct assembly using A701-7 tape where marked during removal. Install strip of A701-1 tape securing antenna wire.

37-140 Cockpit Camera (continued)

B. Installation (continued)

c. Connect RV-BATT-LIPO500 battery to RV-10251C extension harness or install new battery per Part C.

d. Position duct assembly in helicopter and connect electrical wiring at connectors. Lock connectors and secure wiring using MS3367-4-9 ty-raps, as required. Cinch ty-raps until snug without over-tightening and trim tips flush with heads. Align duct assembly, slide aft, and secure using MS27039C0807 screw.

3. Perform functional check per Part D and verify video image is approximately level.

4. To adjust video image loosen (2) NAS1352-04-4 screws securing lens. Rotate lens clockwise to rotate video image counterclockwise or rotate lens counterclockwise to rotate video image clockwise. Tighten screws. Repeat steps 3 and 4 as required.

C. Battery Replacement

1. Remove camera assembly per Part A.

NOTE

Batteries secured to D796-3 duct assembly may be replaced without removing F039-3 camera assembly from duct assembly.

2. Gently separate RV-BATT-LIPO500 battery connector from circuit board or disconnect at RV-10251C extension harness.

NOTE

Do not remove circuit board to access battery. If battery is internally installed in F039-3 camera assembly, gently unplug battery connector at circuit board and stow wire. Also order RV-10251C extension harness to relocate new battery.

3. Pull tab on 1024A38 tape to release battery. If battery is secured using A701-7 tape, use a plastic razor blade to separate battery from F039-2 camera assembly housing or D796-3 duct assembly. Remove old tape and clean mating surfaces using an alcohol wipe.

4. Install new battery using 1024A38 tape and carefully connect camera battery to circuit board or RV-10251C extension harness.

5. Install camera assembly per Part B.

37-140 Cockpit Camera (continued)

D. Functional Check

NOTE

Refer to cockpit camera user guide online at https://robinsonheli.com. Only use USB drives that meet criteria listed in Section 8 of the user guide.

1. Turn helicopter battery switch off.
2. Insert a compatible USB drive into camera assembly USB port.
3. Ensure camera assembly Record and Audio switches are set to ON.
4. Turn helicopter battery switch on, wait 60 seconds then turn switch off.
5. Wait 5 seconds, then remove USB drive from camera assembly.
6. Refer to Sections 2.2 and 2.4 of the cockpit camera user guide for video playback instructions. Insert USB drive into a computer and verify camera recorded a playable video during 60 second test.

37-150 Overspeed Protection

An engine start-up overspeed protection circuit is standard electrical equipment on R44 S/Ns 2625 thru 9999, R44 II S/Ns 14364 and 14412 thru 29999, and R44 Cadet S/Ns 30061 and 30071 thru 39999.

R44 S/Ns 2625 thru 2777, R44 II S/Ns 14364 & 14412 thru 14712, and R44 Cadet S/Ns 30061 & 30071 thru 30099 factory-installed circuit activates when C792-5 dual tachometer [internally] grounds pin 2 for 3s-5s (refer to Figure 14-21A [C024 Rev AS schematic]).

R44 S/Ns 2778 thru 9999, R44 II S/Ns 14713 thru 29999, and R44 Cadet S/Ns 30100 thru 39999 factory-installed circuit activates when D270-1 governor controller [internally] grounds pin 12 (of 44-pin connector) for 3s-5s (refer to Figure 14-21 [C024 Rev AT schematic]).

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

The start-up overspeed protection circuit is only active if the following 3 statements are true:

Engine start-up overspeed protection, activated by C792 dual tachometer, requires: (refer to C024 Revision AS schematic)	Engine start-up overspeed protection, activated by D270 governor, requires: (refer to C024 Revision AT schematic)
C792 Engine RPM indicates above 90 ± 3%	D270 Engine RPM signal is above 85% ± 3%
C792 Rotor RPM indicates below 50 ± 10%	D270 Rotor RPM signal is below 50% ± 10%
Clutch switch is Disengaged i.e. wire -66 is routing power to wire -3003	

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

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

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

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

37-160 Lycoming Electronic Ignition System (EIS)

Some aircraft are equipped with a Lycoming Electronic Ignition System (EIS). The EIS replaces the engine-left retard magneto & start booster. The remaining engine-right magneto provides redundant ignition, which eliminates the need for a back-up battery system.

Refer to Lycoming SI 1569 (current revision) for EIS instructions for continued airworthiness.

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REVISION LOG

AUG 2025

The R44 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 https://robinsonheli.com to verify the issue or revision date is current.

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i	AUG 2025	1.7	OCT 2006	2.7	JUL 2008
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iv	AUG 2019	1.8B	OCT 2006	2.10	DEC 2021
v	AUG 2019	1.8C	JUL 2004	2.11	JAN 2021
vi	AUG 2019	1.8D	06 Dec 99	2.12	JAN 2021
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1.ii	FEB 2024	1.8G	DEC 2021	2.15	DEC 2021
1.1	AUG 2022	1.8H	DEC 2021	2.16	DEC 2021
1.2	AUG 2022	1.9	11 Jun 93	2.17	FEB 2024
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1.2B	FEB 2024	1.10A	1 Jun 97	2.18A	DEC 2021
1.3	FEB 2024	1.10B	1 Jun 97	2.18B	DEC 2021
1.3A	FEB 2024	1.11	OCT 2006	2.19	AUG 2022
1.3B	AUG 2025	1.12	OCT 2006	2.20	AUG 2022
1.3C	AUG 2025	1.13	FEB 2024	2.20A	AUG 2025
1.3D	AUG 2022	1.14	FEB 2024	2.20B	AUG 2025
1.3E	AUG 2022	1.15	FEB 2024	2.21	JUL 2008
1.3F	AUG 2025	1.16	FEB 2024	2.22	JUL 2008
1.3G	AUG 2025	1.17	FEB 2024	2.23	FEB 2024
1.3H	AUG 2025	1.18	FEB 2024	2.24	FEB 2024
1.3I	AUG 2025			2.25	AUG 2025
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1.3M	AUG 2025	2.1A	AUG 2025	2.27	AUG 2025
1.3N	AUG 2025	2.1B	AUG 2025	2.28	AUG 2025
1.3O	AUG 2025	2.2	AUG 2025	2.29	AUG 2025
1.3P	AUG 2025	2.3	FEB 2024	2.30	AUG 2025
1.4	AUG 2025	2.4	FEB 2024	2.30A	JUL 2021
1.5	OCT 2006	2.5	JAN 2021	2.30B	JUL 2021
1.6	OCT 2006	2.6	JAN 2021	2.31	DEC 2021

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2.34	DEC 2021
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2.36	AUG 2025
2.36A	AUG 2025
2.36B	AUG 2025
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3.3	DEC 2024
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3.6	DEC 2024
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4.2	AUG 2025
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5.5	11 Jun 93
5.6	12 Dec 94
5.7	11 Jun 93
5.8	12 Dec 94
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5.10	06 Dec 99
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5.12	JUL 2008
5.13	06 Dec 99
5.14	06 Dec 99
5.15	06 Dec 99
5.16	06 Dec 99
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5.19	06 Dec 99
5.20	06 Dec 99
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5.22	OCT 2006
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5.26	JUL 2005
5.27	JUL 2005
5.28	JUL 2005
5.29	JUL 2005
5.30	JUL 2005

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6.2	AUG 2025
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7.8	AUG 2025
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7.29	06 Dec 99
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8.iii	AUG 2025
8.iv	AUG 2025
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8.1B	AUG 2025
8.2	AUG 2025
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8.8	06 Dec 99
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8.12	15 Jun 98
8.13	15 Jun 98
8.14	15 Jun 98
8.15	15 Jun 98

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8.16	15 Jun 98	8.51	2 Jul 93	10.14	11 Jun 93
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Page	Date
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14.3C	JUN 2014
14.3D	JUN 2014

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14.20B	15 Jun 98
14.20C	18 MAR 99
14.20D	15 Jun 98
14.20E	JUL 2004
14.20F	18 MAR 99
14.20G	JUL 2004
14.20H	JUL 2004
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14.20J	DEC 2011
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14.20N	JUN 2014
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14.20P	JUN 2014
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15.15	DEC 2021
15.16	DEC 2021

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18.2	FEB 2024
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18.12	FEB 2024
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19.2	AUG 2019
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20.ii	AUG 2019
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20.2	AUG 2019
21.i	AUG 2019
21.ii	AUG 2019
21.1	AUG 2019
21.2	AUG 2019
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22.ii	AUG 2019
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22.2	AUG 2019
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24.8	AUG 2022
24.9	AUG 2022
24.10	AUG 2022
24.11	SEP 2023

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26.6	FEB 2024	28.11	DEC 2021	29.1	AUG 2019
		28.12	DEC 2021	29.2	AUG 2019
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27.16	SEP 2023	28.30	DEC 2021	30.15	DEC 2021
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33.ii	AUG 2019
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37.15	AUG 2019
37.16	AUG 2019
37.17	DEC 2021
37.18	DEC 2021
37.19	AUG 2019
37.20	AUG 2019
37.21	AUG 2019
37.22	AUG 2019
37.23	AUG 2019
37.24	AUG 2019
37.25	AUG 2019
37.26	AUG 2019
37.27	AUG 2019
37.28	AUG 2019
37.29	AUG 2019
37.30	AUG 2019
37.31	AUG 2019
37.32	AUG 2019
37.33	AUG 2025
37.34	AUG 2025
37.35	AUG 2025
37.36	AUG 2025
37.37	AUG 2025
37.38	AUG 2025
38.i	AUG 2019
38.ii	AUG 2019
38.1	AUG 2019
38.2	AUG 2019
38.3	AUG 2019
38.4	AUG 2019
38.5	AUG 2019
38.6	AUG 2019
38.7	AUG 2019
38.8	AUG 2019
38.9	AUG 2019
38.10	AUG 2019
38.11	AUG 2019
38.12	AUG 2019
38.13	AUG 2019
38.14	AUG 2019
38.15	AUG 2019
38.16	AUG 2019
38.17	AUG 2019
38.18	AUG 2019
38.19	AUG 2019
38.20	AUG 2019
38.21	AUG 2019

REVISION LOG

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Page	*Date*
38.22	AUG 2019
38.23	AUG 2019
38.24	AUG 2019
38.25	AUG 2019
38.26	AUG 2019
38.27	AUG 2019
38.28	AUG 2019
38.29	AUG 2019
38.30	AUG 2019
39.i	AUG 2019
39.ii	AUG 2019
39.1	AUG 2019
39.2	AUG 2019
40.i	AUG 2019
40.ii	AUG 2019
40.1	AUG 2019
40.2	AUG 2019
41.i	DEC 2021
41.ii	DEC 2021
41.1	AUG 2025
41.2	AUG 2025
41.3	AUG 2025
41.4	AUG 2025
41.5	AUG 2025
41.6	AUG 2025
41.7	AUG 2025
41.8	AUG 2025
41.9	AUG 2025
41.10	AUG 2025