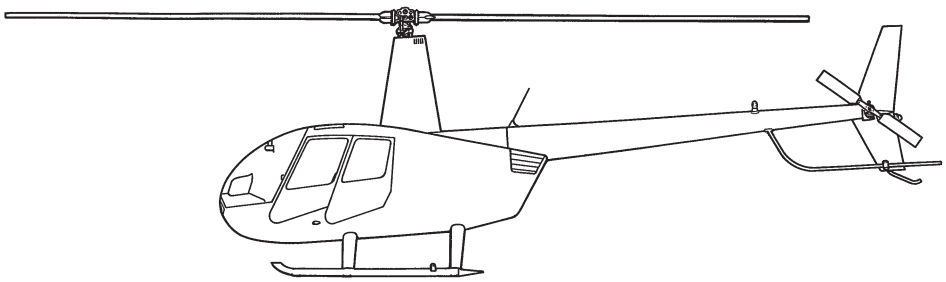
ROBINSON HELICOPTER COMPANY

R44 MAINTENANCE MANUAL

AND INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

RTR 460 VOLUME I

Type Certificate Number H11NM



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Effective R22 S/N 3318 & on; R44 S/N 1202 & on

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RHC makes no Warranty with respect to batteries, instruments, avionics or other trade accessories since they are usually warranted separately by their respective manufacturers. New aircraft are equipped with new engines which have a separate Lycoming limited warranty.

ADDITIONAL WARRANTY FOR MAIN & TAIL GEARBOXES

In addition to the warranty specified above, an extended pro-rated warranty shall apply to the main and tail gearboxes for the first 2200 hours of service or three years from the date of manufacture, whichever event occurs first. During this period, if a gearbox must be overhauled due to failure of a part which was defective when it left the factory, RHC will pro-rate the cost of the overhaul by dividing the hours in service by 2200 or the months in service by thirty-six (36), whichever fraction is greater.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IS GIVEN AND ACCEPTED IN LIEU OF ANY AND ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESS, IMPLIED, OR STATUTORY, WHETHER WRITTEN OR ORAL, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR TRADE USAGE, THE REMEDIES OF THE BUYER SHALL BE LIMITED TO THOSE PROVIDED HEREIN. IN NO EVENT WILL THE MANUFACTURER BE LIABLE FOR LOSSES RESULTING FROM LOSS OF USE OF THE HELICOPTER, COLLATERAL, CONSEQUENTIAL OR SPECIAL DAMAGES, OR ANY OTHER COSTS.

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(2) RHC will, after inspection, determine whether the material or part was defective when it left the factory and will respond accordingly. Final determination of a Warranty adjustment rests with RHC.

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Effective 1 February 2003

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CHAPTER 1

GENERAL

1.000 Introduction

The R44 Maintenance Manual contains instructions necessary for proper maintenance, servicing, and handling of R44-series helicopters certificated on U.S. FAA Type Certificate H11NM. | The R44 Instructions for Continued Airworthiness (ICA) include the R44 Maintenance Manual (MM), R44 Illustrated Parts Catalog (IPC), R44/R44 II Pilot's Operating Handbook (POH), R44 Service Bulletins (SB), R44 Service Letters (SL), Lycoming O-540/IO-540 Operator's Manuals, applicable Lycoming technical publications, and applicable component manufacturer technical publications.

Service Bulletins are issued by Robinson Helicopter Company (RHC), Lycoming, and component manufacturers. Service Bulletin compliance is mandatory. RHC technical publications are available on our website, www.robinsonheli.com, under the Publications tab. Recent technical publications are available from Lycoming at www.lycoming.com, and from Teledyne Continental Motors (TCM) at www.tcmlink.com.

CAUTION

Always read instructions completely before performing a task.

1.001 R44 Maintenance Manual Revisions

Before using the R44 Maintenance Manual, verify it consists of effective pages. The list of effective pages is located in the Revision Log in Chapter 17. When a new manual is purchased, complete and submit the Subscription Service Form located in the *Introduction*. Subscription owners receive publication revisions for a one-year period. Renew subscriptions annually. The revision status for all RHC technical publications is available on our website, www.robinsonheli.com, under the Publications tab.

1.002 R44 Maintenance Authorization

Only appropriately certificated mechanics who have successfully completed an R44 factory-sponsored maintenance course, or are under direct supervision of the above-stated mechanic, may perform maintenance, repairs, or inspections on the R44-series helicopter. Annual inspections of U.S.-registered light helicopters must be performed by holders of an Inspection Authorization (IA) or by repair stations certificated by the Federal Aviation Administration (FAA). The daily preflight and some preventive maintenance may be performed by the above-stated mechanics, or by the pilot/owner after receiving appropriate instruction in accordance with the R44/R44 II Pilot's Operating Handbook and applicable aviation regulations.

1.003 R44 Component Overhaul Authorization

Only appropriately certificated mechanics who have successfully completed an R44 factory-sponsored component overhaul course, and who possess special tools and technical data supplied by RHC, are authorized to disassemble and overhaul or repair major components as required by Chapter 3.

1.004 Maintenance Record

The Airframe Maintenance Record is available online at www.robinsonheli.com, under the Publications tab.

Airframe Maintenance Record blank PDF forms may be used for R22-series, R44-series, and R66 Turbine helicopters. Component Record blank PDF forms may be used for life-limited or TBO components. Blank paper copies are available for purchase.

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

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

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

RHC's Repair Station does not require a Component Record card in order to perform work on a component, unlike a Component/Return Authorization form. If RHC's Repair Station performs work on a component and the Component Record card is present, the Repair Station will date and make an entry on the card.

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

1.005 Notations

The following notations will be found throughout the manual:

NOTE

A NOTE provides emphasis or supplementary explanation.

CAUTION

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

WARNING

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

1.006 Definitions and Abbreviations

Refer to R44 or R44 II Pilot's Operating Handbook (POH) Section 1, as applicable, for additional definitions and abbreviations.

A. Definitions

14 CFR § 27.602 Critical Part:	A part identified as a 14 CFR § 27.602 critical part within this manual is subject to special inspection requirements. RHC Technical Support must be notified whenever the part fails to meet the special inspection requirements.
12 years:	With respect to a 12 year inspection or life-limit, 12 years means 12 years from the date of the factory-issued airworthiness certificate or factory-issued authorized release certificate (FAA Form 8130-3, Airworthiness Approval Tag).
Annually:	With respect to an annual inspection, annually means within the preceding 12 calendar months.
Datum:	An imaginary vertical plane from which all horizontal measurements are taken for balance purposes with the aircraft in level flight attitude.
Empty Weight:	Empty Weight includes the weight of the airframe, powerplant, required and installed equipment, fixed ballast, hydraulic fluid, unusable fuel, and gearbox oil. Refer to R44-Series Type Certificate Data Sheet (TCDS) in Chapter 3. Refer to Equipment List/Weight and Balance Data Sheet (RF 134) and Weight and Balance Record in R44 or R44 II POH Section 6, as applicable, for installed equipment.
Life-Limited Part:	Refer to Chapter 3. Any part for which a mandatory replacement limit is specified in the type design, the Instructions for Continued Airworthiness, or the maintenance manual.
Time in Service:	With respect to maintenance time records, time in service means the time from the moment an aircraft leaves the surface of the earth until it touches it at the next point of landing.

1.006 Definitions and Abbreviations (continued)

B. Abbreviations

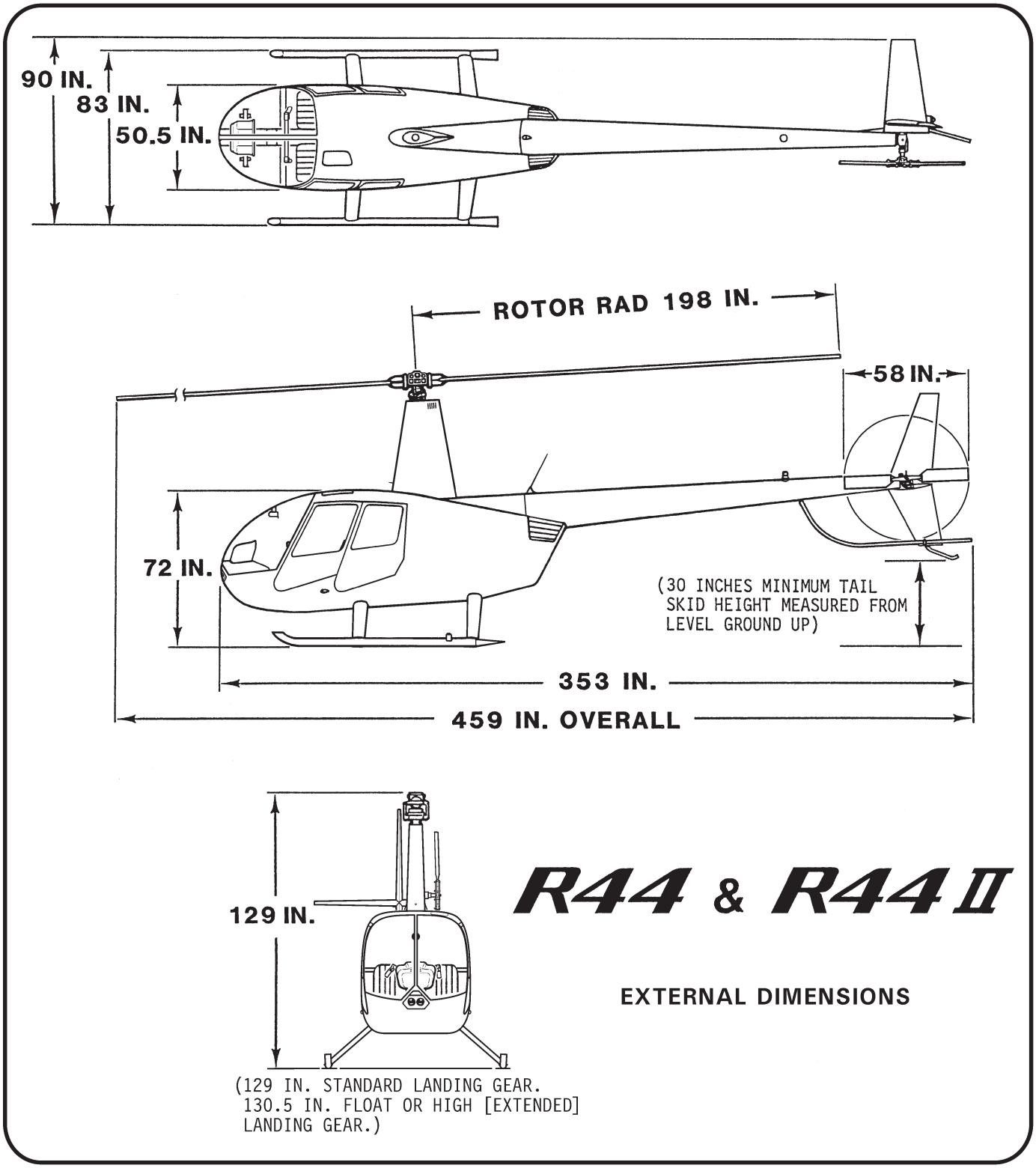
14 CFR:	Title 14 of the Code of Federal Regulations. The Federal Aviation Regulations (FARs) are part of the CFR.
AOG:	Aircraft on Ground
ATA-100:	Air Transport Association of America Specification No. 100
BL:	Butt Line Station locations
CO:	Carbon Monoxide
CRA:	Component Return/Authorization
ELT:	Emergency Locator Transmitter
FS:	Fuselage Station locations
HID:	High Intensity Discharge
LBL:	Left Butt Line Station locations
LED:	Light Emitting Diode
MRDS:	Main Rotor Driveshaft
MRGB:	Main Rotor Gearbox
OEM:	Original Equipment Manufacturer
R44 IPC:	R44 Illustrated Parts Catalog
R44 MM:	R44 Maintenance Manual
R44 POH:	R44 Pilot's Operating Handbook
R44 II POH:	R44 II Pilot's Operating Handbook
RHC:	Robinson Helicopter Company
SB:	Service Bulletin
SL:	Service Letter
TBO:	Time Between Overhaul
TCDS:	Type Certificate Data Sheet
TRDS:	Tail Rotor Driveshaft
TRGB:	Tail Rotor Gearbox
TS:	Tailcone Station locations
TSN:	Time Since New
TSO:	Time Since Overhaul
WL:	Water Line Station locations

1.007 Service Directory

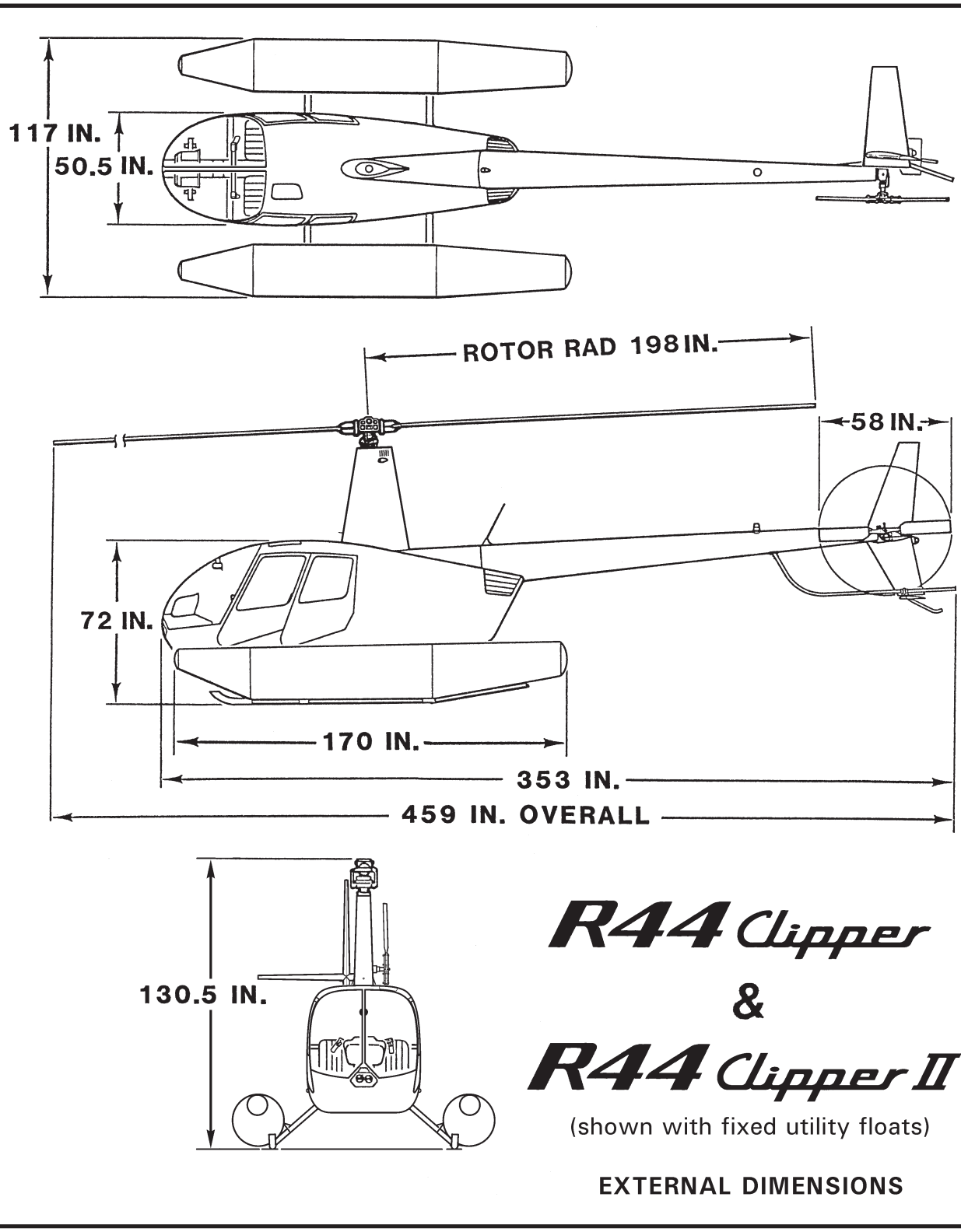
Please visit www.robinsonheli.com and click on the Customer Support tab for a complete service directory.

Procure parts from any R44 Dealer or Service Center, or order directly from assigned RHC Customer Service Representative via email, fax, or phone.

1.008 External Dimensions



1.008 External Dimensions (continued)



R44 Clipper
&
R44 Clipper II

(shown with fixed utility floats)

EXTERNAL DIMENSIONS

1.009 Version Description

Refer to Section 3.200 for Type Certificate Data Sheet.

WARNING

Refer to R44 Illustrated Parts Catalog (IPC) for specific part number differences between versions.

R44, "Astro": 4-digit serial numbers 0002, 0004 thru 0760. Lycoming O-540-F1B5 carbureted engine derated to 205 horsepower maximum continuous power with 225 horsepower 5-minute takeoff rating. Manual controls (electric automatic trim and ground-adjustable collective trim); optional hydraulic cyclic & collective controls replace manual controls. Gross weight 2400 pounds. 14-volt electrical system standard; 28-volt optional.

R44 "Clipper": Fixed or pop-out float landing gear. Additional corrosion protection. Auxiliary horizontal stabilizer installed at base of lower vertical stabilizer. Drain valves installed in chin. Additional navigation lights atop mast fairing on fixed float versions. Marine radio package optional. Optional hydraulic cyclic & collective controls replace manual controls.

R44, "Raven", "Raven I", "Clipper I": Hydraulic cyclic & collective controls standard. Adjustable pilot-side pedals. Serial number 0761 and subsequent.

R44 II, "Raven II": 5-digit serial numbers 10001 and subsequent. Lycoming IO-540-AE1A5 fuel-injected engine derated to 205 horsepower maximum continuous power with 245 horsepower 5-minute takeoff rating. Gross weight 2500 pounds. 28-volt electrical system. Solid-state start booster for retard magneto. Second oil cooler. Rounded tip main and tail rotor blades.

R44 II, "Clipper II": Based on "Raven II." Fixed or pop-out float landing gear.

Instrument Trainer: R44 or R44 II configuration with 10-hole instrument panel. VMC operations only.

E.N.G. (Electronic News Gathering): R44 or R44 II configuration. 28-volt electrical system. Nose-mounted gyro-stabilized camera with tailcone-mounted battery. Standard microwave capability.

Police: R44 or R44 II configuration. 28-volt electrical system. Includes searchlight, police radio package, and nose-mounted gyro-stabilized infrared-capable camera with tailcone-mounted battery. Optional microwave capability.

TABLE 1 SCHEDULED MAINTENANCE AND INSPECTIONS	First 10 hours	First 25 hours	First 100 hours	Every 50 hours	Every 100 hours	Every 300 hours	Every 500 hours	Every 2200 hours	Every 4 months	Every 12 months	Every 24 months	Every 3 years	Every 4 years	Every 12 years	Every 15 years
Perform maintenance & inspection per Lycoming Operator's Manual.*	●	●		●	●	●									
Perform **Lycoming SI 1129B** *Methods of Checking DC Alternator and Generator Belt Tension.*		●			●										
Perform **Lycoming SI 1191A** *Cylinder Compression.*					●										
Perform **Lycoming SI 1080C** *Maintenance Items for Special Attention.*				●	●										
Perform **Lycoming SB 301B*** *Maintenance Procedures and Service Limitations for Valves.*						●									
Perform **Lycoming SB 366B** *Carburetor Throttle Body Screw Inspection.*					●										
Perform **Lycoming SB 342F (IO-540 Only)** *Fuel Line (Stainless Steel Tube Assy.) and Support Clamp Inspection & Installation. Reference AD 2011-26-04.*					●										
Perform **Lycoming SB 388C** *Procedure to Determine Exhaust Valve and Guide Condition.*			●			●									
Perform **Lycoming SB 480E** *I. Oil & Filter Change & Screen Cleaning / II. Oil Filter/Screen Content Inspection.*		●		●					●						
Perform **TCM SB 643B** *Maintenance Intervals for All TCM & Bendix A/C Magnetos & Related Equipment.*					●		●						●		
Perform **TCM SB 658** *Distributor Gear Maintenance.*							●								
Perform **TCM SB 663A** *Two-Wire Magneto Tach. Breaker Contact (Points) Assy. P/N 10-400507.*							●						●		
Perform 100-hour/annual maintenance & inspection per § 2.400.					●					●					
Lubricate C181-3 bearing per § 1.140.						●						●			
Replace hydraulic filter per § 1.170.						●									
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.							●								
Service collective spring (manual controls) per § 8.221.							●								
Verify magneto drive cushion pliability.							●						●		
Overhaul helicopter per § 2.700.								●							
Inspect emergency locator transmitter (ELT) per 14 CFR § 91.207.										●					
Perform pop-out float leak check per § 5.630.										●					
Test and inspect transponder per 14 CFR § 91.413.											●				
Perform pop-out float inflation check per § 5.640.												●			
Perform pop-out float pressure cylinder hydrostatic test.*												●			
Perform 12-year maintenance and inspection per § 2.600.														●	
Pop-out float pressure cylinder maximum life.															●

* Shorter interval than published on referenced document/decal.

1.100 Helicopter Servicing

1.101 Scheduled Maintenance and Inspections

Required maintenance and inspection intervals are given in Table 1. Some aircraft may require maintenance and inspections in addition to the requirements in Table 1. Consult aircraft maintenance records, Service Bulletins (SB), aviation regulations, Airworthiness Limitations, and Airworthiness Directives (AD) for applicability. Publications listed are subject to revision.

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

1.105 Calibration of Tools

The dimensions and tolerances given in this maintenance manual are critical. RHC recommends measuring tools be calibrated at least once a year. This includes torque wrenches, micrometers, calipers, dial indicators, spring scales, protractors and balancing equipment.

WARNING

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

1.110 Lubrication - General

Most bearings in the R44 are sealed or self-lubricated and do not require periodic lubrication; bearings with specific lubrication intervals are noted in Table 1. Engine lubrication requirements are contained in the Pilot's Operating Handbook, Lycoming Operator's Manual and Lycoming Service Instruction No. 1014 (current revision). Main and tail rotor gearboxes require additional oil when indicated by sight plug reading.

WARNING

The only approved lubricant for use in the main rotor and tail rotor gearboxes is A257-2 lubricant.

When a new or overhauled gearbox is installed, it must be drained and the chip detector inspected after the first 4 hours of flight or first chip light, whichever occurs first. Thereafter, change gearbox oil at intervals per Section 1.101. Additionally, change gearbox oil and clean sight glass whenever oil becomes so dirty that its level cannot be determined.

1.115 Chip Detector Cleaning

During normal gearbox operation, an insulating film of varnish can accumulate on a chip detector's magnetic probe and prevent gearbox chip warning light illumination. Clean chip detector by:

1. Remove and discard safety wire (if applicable) securing chip detector. Disconnect chip detector wiring at quick-disconnect located several inches from chip detector. For tail rotor gearbox, place container beneath to catch oil. Remove chip detector from gearbox.

2. Clean and scrub chip detector with a toothbrush and cleaning solvent, followed by drying with compressed air or a lint-free cloth.

3. Check chip detector circuit function by connecting chip detector electrical wiring, turning battery switch on, and grounding detector's central magnetic probe to airframe. Verify appropriate gearbox chip warning light illuminates. Turn battery switch off.

4. Install chip detector. Torque threaded-type chip detector per Section 1.330 and safety wire. Ty-rap chip detector electrical wiring as required.

5. Turn on battery switch. Check chip detector circuit function by grounding detector's center terminal and verifying appropriate gearbox chip warning light illuminates. Turn battery switch off.

1.120 Main Rotor Gearbox Drain And Flush

To drain and flush main rotor gearbox:

1. Ground run helicopter two to five minutes at 60-70% RPM to warm main rotor gearbox oil.

2. Disconnect chip detector wiring at quick-disconnect located approximately 10 inches from chip detector. Cut safety wire securing chip detector to main rotor gearbox sump attach bolt (not applicable to quick-release chip detectors).

3. Remove chip detector. Do not remove chip detector housing.

NOTE

After removing chip detector, 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.

1.120 Main Rotor Gearbox Drain and Flush (cont'd)

4. Drain oil by installing main rotor gearbox drain assembly in chip detector housing with drain hose overboard into a suitable container. Slide wedge under drain assembly to open valve (see Figure 1-2).

5. Remove drain assembly. Remove and discard safety wire securing gearbox filler plug. Remove plug.

6. Fill gearbox with SAE30, SAE40, SAE50, or SAE20W50 straight mineral engine oil to level indicated by decal adjacent to sight gage.

7. Install filler plug, tighten, but do not safety wire.

8. Ground run helicopter for approximately five minutes at 60-70% RPM.

9. After shutting down helicopter, drain gearbox using drain assembly.

10. Remove drain assembly. Remove and discard safety wire on chip detector housing. Remove chip detector housing and immediately place a small container under gearbox to catch any residual oil.

11. Clean chip detector with a toothbrush and cleaning solvent per Section 1.115. Compressed air or masking tape may also be used to remove debris but scrubbing with solvent is mandatory to remove any varnish accumulation. Do not use a magnet to remove debris. Clean and visually inspect chip detector housing.

12. Verify chip detector function by connecting electrical leads, turning Master switch on, and touching detector's central magnetic probe to horizontal firewall. MR CHIP warning light should illuminate. Disconnect electrical wires.

13. Install chip detector housing into main rotor gearbox. Torque per Section 1.330, and safety wire.

14. Install chip detector into chip detector housing. Torque threaded-type chip detector per Section 1.330 and safety wire. Connect chip detector electrical wires and ty-rap.

15. As required, remove sight gage and clean with solvent. Reinstall sight gage, torque per Section 1.330, and safety wire.

16. Remove filler plug. Fill gearbox with Robinson A257-2 lubricant to level indicated on decal. Rotate rotor system by hand several revolutions and pull down tailcone several times. Recheck gearbox oil level. Adjust as necessary.

17. Torque filler plug per Section 1.330 (safety wire not required).

1.120 Main Rotor Gearbox Drain and Flush (cont'd)

18. Turn on MASTER switch. Check chip detector operation by grounding detector's center terminal and verifying MR CHIP warning light illuminates. Turn off MASTER switch.

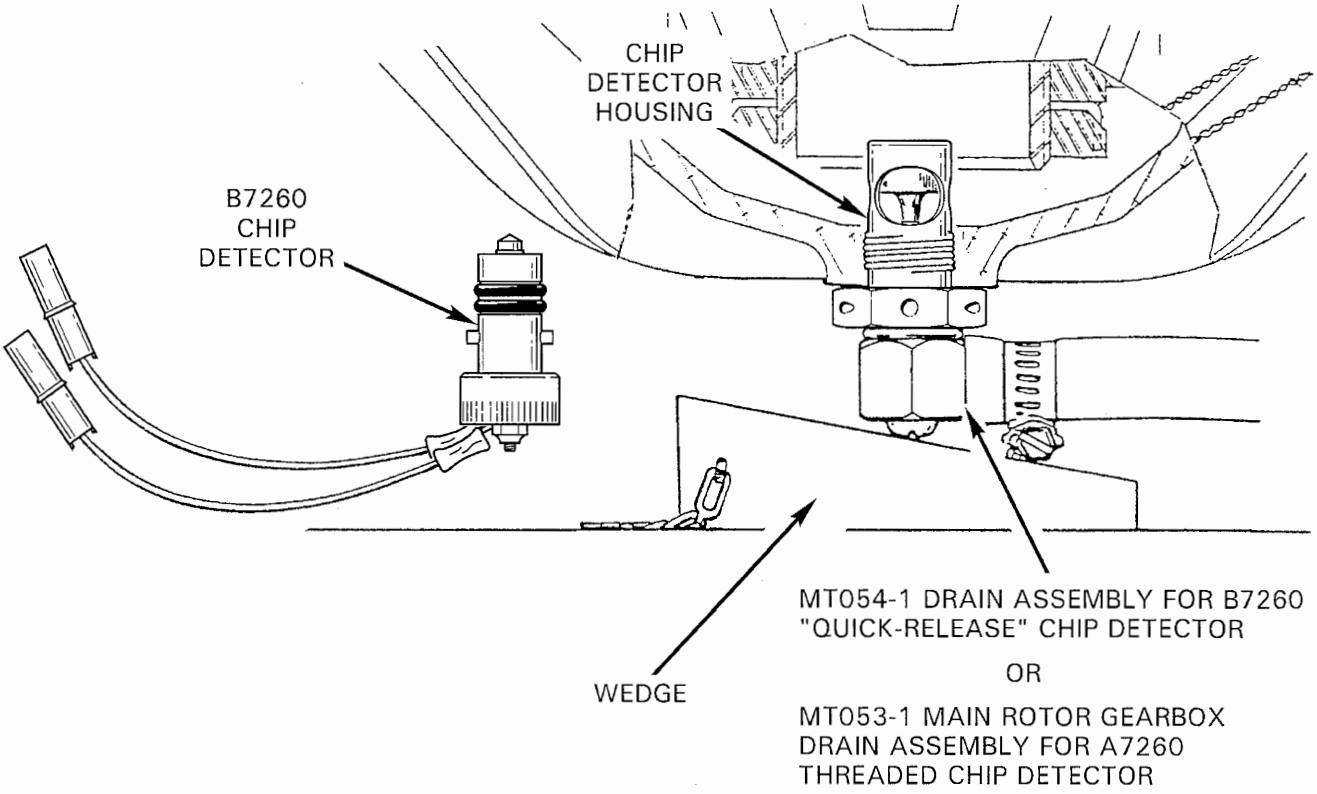


FIGURE 1-2 DRAINING MAIN ROTOR GEARBOX

1.130 Tail Rotor Gearbox Drain and Flush

1. Ground run helicopter for approximately five minutes at 60-70% RPM to warm tail rotor gearbox oil.
2. Disconnect chip detector wiring at quick-disconnect located approximately 11 inches from chip detector.
3. Remove and discard safety wire securing chip detector to sight gage.
4. Place a container under tail rotor gearbox to catch oil and remove chip detector.
5. Remove and discard safety wire securing filler-vent plug to sight gage. Remove filler-vent plug.
6. Install chip detector, torque per Section 1.330, but do not safety wire. Add approximately five ounces of SAE30, SAE40, SAE50, or SAE20W50 straight mineral engine oil.
7. Install filler plug, tighten, but do not safety wire.
8. Ground run helicopter at 60-70% RPM for approximately five minutes.
9. After shutting down helicopter, remove chip detector and drain mineral oil.
10. Clean and scrub chip detector with a toothbrush and cleaning solvent. Compressed air or masking tape may also be used to remove debris but scrubbing with solvent is mandatory to remove varnish accumulation. Do not use a magnet to remove debris.
11. Connect chip detector wiring. Turn on Master switch. Check chip detector operation by grounding detector's center terminal; TR CHIP warning light should illuminate. Turn off Master switch and disconnect chip detector wiring.
12. Install chip detector, torque per Section 1.330, and safety wire. Connect chip detector wiring and secure with Ty-raps® as required.
13. As required, remove sight gage and clean with solvent. Reinstall sight gage, torque per Section 1.330, and safety wire.

> **CAUTION**
>
> Tail rotor gearbox sight plug glass must indicate correct oil level when aircraft is on level ground.

14. Fill gearbox with Robinson A257-2 lubricant to level indicated by sight glass decal. Install filler-vent plug, torque per Section 1.330, and safety wire.
15. Turn on Master switch. Check chip detector operation. Turn off Master switch.

1.140 Clutch Actuator Lower Bearing Lubrication

NOTE

Syringe suitable for the following procedure is included in kit KI-115, available from RHC Customer Service.

1. Fill syringe with 4-5 grams of A257-12 grease (commercially available, see Section 1.470). Note: 5 grams of grease fills a 1.0 inch (25 mm) long space inside a syringe body with a 0.63 inch (16 mm) inner diameter.

2. Remove screw from left side of C181-3 bearing housing. Screw may be covered by Telatemp; remove Telatemp as required to access screw. It is not necessary to replace Telatemp. Note: aft cowling may be removed to ease bearing access.

3. Using syringe, inject grease through screw hole.

4. Install B289-3 self-sealing cross-head screw, or thoroughly clean set screw and screw hole threads and then install set screw using B270-20 sealant, wet epoxy primer, or wet zinc-chromate primer on threads. Tighten set screw only until screw is flush with bearing housing.

CAUTION

Set screw hole is through to bearing housing cavity. Tightening set screw further than flush-with-housing can result in set screw contacting and damaging internal bearing assembly components.

5. Ground run helicopter at 102% RPM for two minutes, shut down, inspect bearing, and clean off any escaped grease.

6. Install aft cowling, if removed.

1.150 Defueling

WARNING

Defueling must be done in a well-ventilated area. No smoking within 100 feet of helicopter during defueling.

NOTE

Low-fuel sender check (see Section 12.270) may be performed when defueling helicopter.

1. Turn fuel valve off and disconnect flexible fuel line at carburetor.

2. Place end of fuel line in a suitable container. Ground container to helicopter and turn fuel valve on.

3. Turn fuel valve off when the container is full and repeat as necessary to complete draining.

4. Attach fuel line to carburetor, torque per Section 1.330, and torque stripe.

1.160 Storage

For long-term (greater than 30 days) storage:

1. Defuel aircraft per Section 1.150.
2. Clean aircraft per Section 8 of R44 Pilot's Operating Handbook.
3. Paint or wax bare metal areas of main and tail rotor blades.
4. Apply suitable non-drying corrosion preventative compound to C166 clutch shaft adjacent to seals (where shaft enters and exits upper sheave).
5. Preserve engine in accordance with Lycoming Service Letter L180 (current revision).
6. Remove battery and periodically check and adjust, as required, battery charge status. Check fluid level and specific gravity of non-sealed batteries.
7. Store aircraft in a protected, dry (dehumidified) environment.
8. Periodically inspect aircraft for corrosion and correct as required.

1.170 Hydraulic Reservoir Filter 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.

1. Remove and discard safety wire from filter cap. Remove filter cap from bottom of hydraulic reservoir.
2. Remove filter and examine. If debris is found, use a magnet to determine if ferrous or non-ferrous.

NOTE

Ferrous debris may indicate pump damage. Replace filter again after one flight hour. If more ferrous debris is found, replace hydraulic pump per Section 8 and flush hydraulic system per Section 1.180.

3. Clean filter cap and replace O-ring packing. Lubricate new O-ring with A257-15 fluid (see Section 1.470).
4. Lubricate O-ring in new filter with A257-15 fluid and install filter in reservoir. Install filter cap, torque per Section 1.330, and safety wire.
5. Adjust reservoir fluid level as required. Install filler-vent and torque per Section 1.330. Safety wiring filler-vent is not required.

1.180 Draining and Flushing Hydraulic System (see Figure 8-1A)

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.

NOTE

Drain and flush hydraulic system if oil turns dark, or emits bad odor.

1. Remove reservoir filler-vent.

2. Place a one-liter container for contaminated fluid beneath D500-1 hydraulic pump at main rotor gearbox. Remove caps from pump suction and pressure T-fittings. Allow fluid in reservoir to drain through suction line into container. Pour small amount of clean A257-15 fluid (see Section 1.470) into reservoir to purge suction line. Pressure line will drain in following step when filter cap is removed.

3. Replace hydraulic reservoir filter per Section 1.170.

4. See Figure 1-2A. Connect MT384 (or similar) 0.8-1.2 gpm hydraulic test pump to T-fittings on D500-1 pump. Fittings are different sizes to ensure correct connection.

5. Dispose of drained, contaminated hydraulic fluid. Fill reservoir with A257-15 fluid.

6. Disconnect servo return line at reservoir forward elbow and place end in empty container for contaminated hydraulic fluid. Cap elbow on reservoir assembly (use cap from pump T-fitting).

7. Activate hydraulic test pump and inspect hydraulic system for leakage.

8. Simultaneously fully raise collective and move cyclic fully forward. Then simultaneously fully lower collective and move cyclic fully aft. Monitor reservoir fluid level and fill as required. Repeat procedure until return line fluid into container is clean.

WARNING

Stay clear of moving flight controls. Hydraulic forces can cause injury.

9. Simultaneously fully raise collective and move cyclic fully aft then simultaneously fully lower collective and move cyclic fully forward. Monitor reservoir fluid level and fill as required. Repeat procedure until return line fluid into container is clean.

10. Connect servo return line to reservoir forward elbow. Torque B-nut per Section 1.330 and torque stripe.

11. Bleed hydraulic system per Section 1.190.

12. Remove and inspect filter. If debris is found, repeat drain and flush procedure. If filter is clean, reinstall per Section 1.170, steps 4 & 5.

1.190 Bleeding Hydraulic System (see Figure 1-2A)

1. Disconnect cap on D500-1 hydraulic pump pressure (aft) T-fitting and connect pressure line from MT384 hydraulic test pump (or similar 0.8-1.2 gpm unit). Pressure and suction fittings are different sizes to assure correct connection.

2. Remove reservoir filler-vent and cover hole with finger to prevent fluid loss. Disconnect cap on hydraulic pump suction (forward) T-fitting and connect hydraulic test pump suction line. Fill reservoir as required.

3. Activate hydraulic test pump and inspect for leakage.

4. Simultaneously fully raise collective and move cyclic fully forward then simultaneously fully lower collective and move cyclic fully aft. Repeat procedure ten times.

WARNING

Stay clear of moving flight controls. Hydraulic forces can cause injury.

5. Simultaneously fully raise collective and move cyclic fully aft then simultaneously fully lower collective and move cyclic fully forward. Repeat procedure ten times.

6. Shut off hydraulic test pump. Verify no leaks in hydraulic system.

7. Cover reservoir filler-vent hole with finger to prevent fluid loss. Disconnect hydraulic test pump suction line from D500-1 pump forward T-fitting and install cap. Torque cap per Section 1.330 and torque stripe.

8. Disconnect hydraulic test pump pressure line from D500-1 pump aft T-fitting and install cap. Torque cap per Section 1.330 and torque stripe.

9. Adjust reservoir fluid level as required. Install filler-vent and torque per Section 1.330. Safety wire is not required.

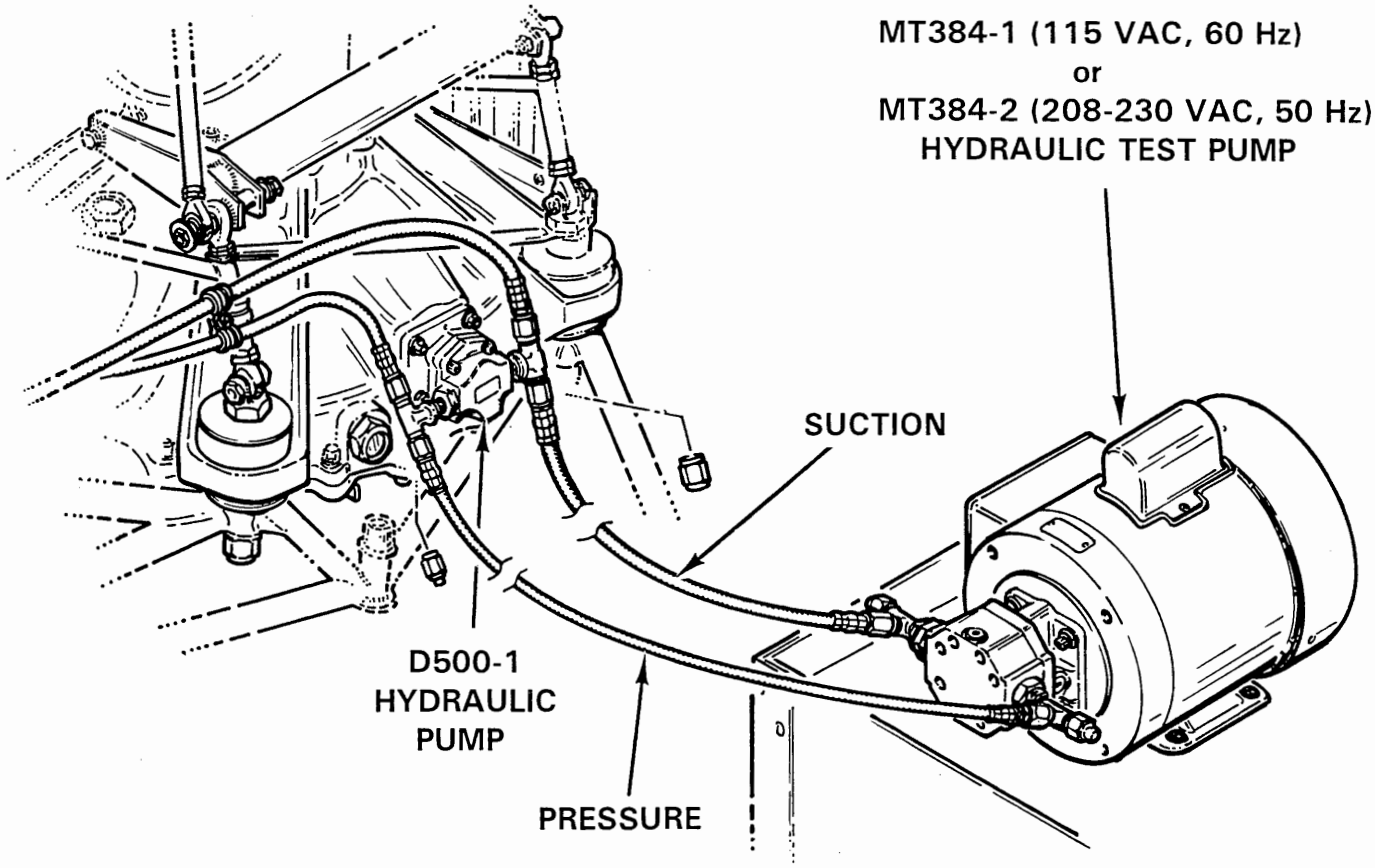


FIGURE 1-2A

MT384 HYDRAULIC TEST PUMP CONNECTION

1.200 HANDLING, JACKING, HOISTING, LEVELING, AND WEIGHING

1.210 Ground Handling

1.211 Ground Handling Wheels Installation

a) Extend the handle by depressing the handle locking pin and sliding the handle out until the pin snaps into the outer hole. Hold handle and wheel with the protruding spindle in its lowest position. Insert spindle into support mounted on skid (see Figure 1-3).

NOTE

If helicopter has not settled on its skids completely, the spindles may not go in all the way. In this case, pull down on the tail cone to spread the gear enough to allow installation.

b) Make sure that the protruding spindle is all the way in with the widened end completely past the inside of the support (see Figure 1-3A).

c) Pull handle over center to raise helicopter and lock wheel in position (see Figure 1-4).

CAUTION

When lowering the helicopter, the handle has a tendency to snap over.

NOTE

70 psi maximum tire inflation pressure.

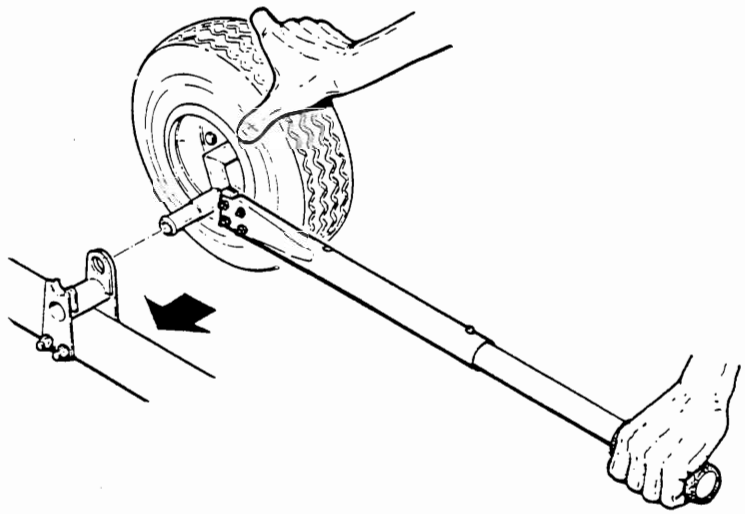


FIGURE 1-3

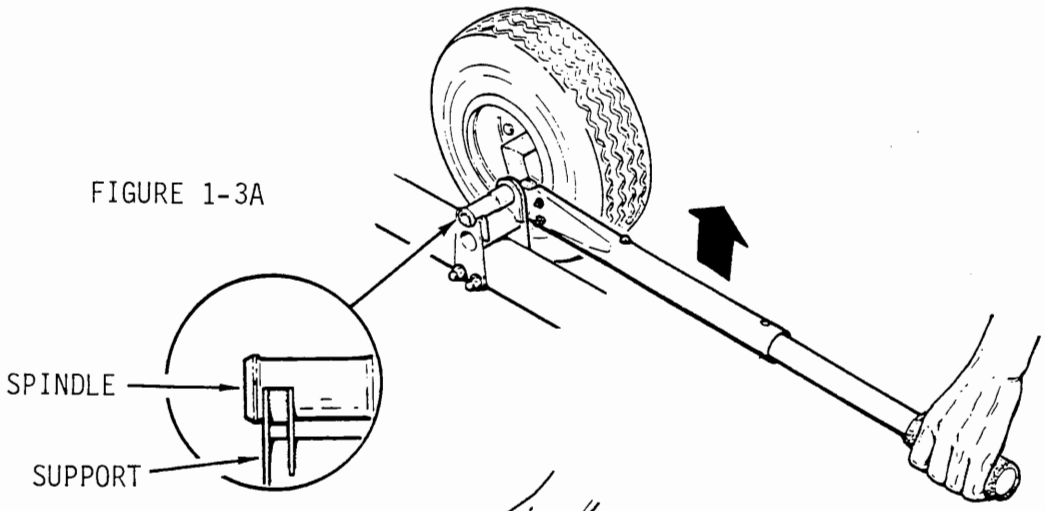


FIGURE 1-3A

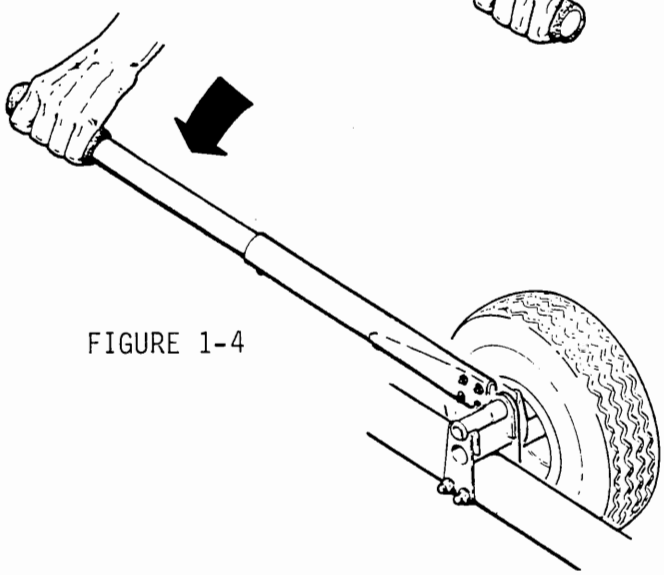


FIGURE 1-4

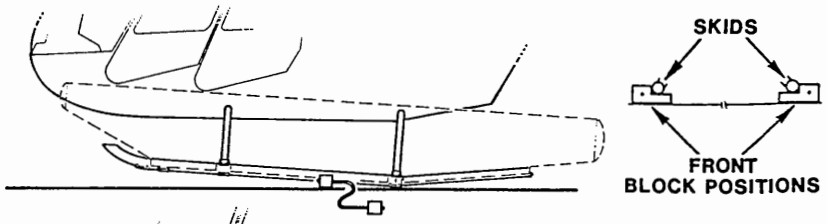
1.210 Ground Handling (cont'd)

1.212 Ground Handling Wheels - Float Ship Landing Gear

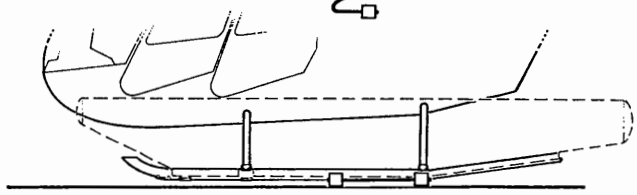
INSTALLATION:

Align aft blocks adjacent to mark on skid tube and position forward blocks to remove cord slack.

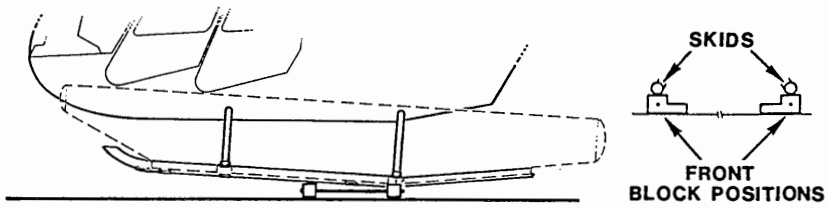
a) Pull tail down. Insert forward blocks at their lower height under both skids.



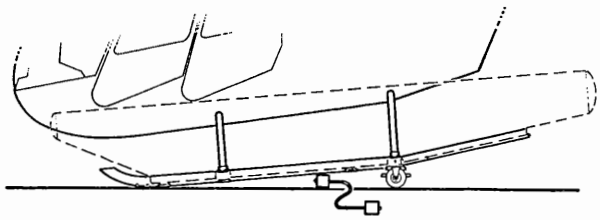
b) Push tail up. Insert rear blocks at their lower height under both skids at marks.



c) Pull tail down. Move forward blocks inward to their upper height under skid tubes.



d) Push tail up. Slide rear blocks out (upper height of rear blocks is not used) and insert wheels under skids at rear marks.



NOTE

Wheels may be placed a few inches forward to reduce force required to pull tail down.

e) Pull tail down and remove forward blocks.

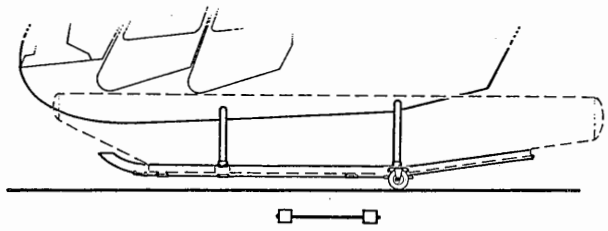
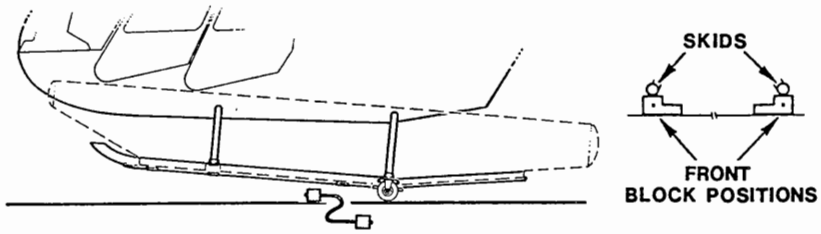


FIGURE 1-3B FLOAT SHIP GROUND HANDLING WHEELS INSTALLATION

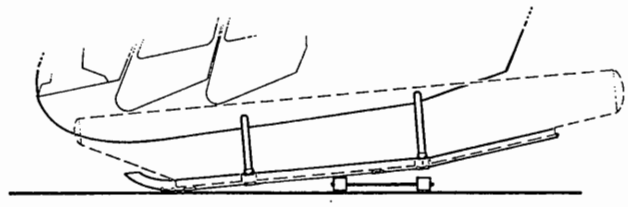
1.212 Ground Handling Wheels - Float Ship Landing Gear (cont'd)

REMOVAL:

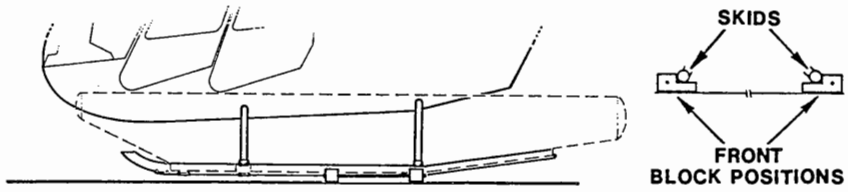
a) Pull tail down. Insert forward blocks at their upper height at forward marks under skids.



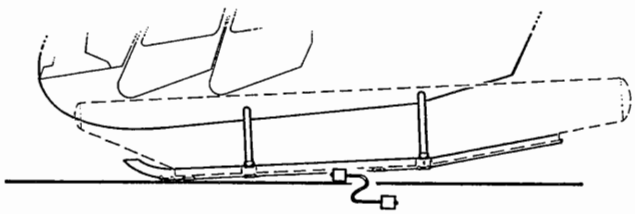
b) Push tail up. Remove wheels and insert rear blocks at their lower height (upper height on rear blocks is not used) at marks.



c) Pull tail down. Position forward blocks under skids at their lower height.



d) Push tail up. Remove rear blocks.



e) Pull tail down. Remove front blocks.

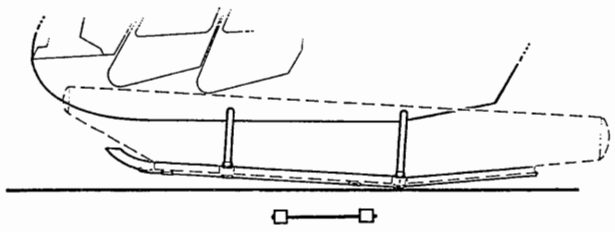


FIGURE 1-3C FLOAT SHIP GROUND WHEELS REMOVAL

1.213 Moving the Helicopter on Ground Handling Wheels

Moving the helicopter on ground handling wheels requires two people: one person to hold the tail down and steer by holding the tail rotor gearbox and another person to push on primary structure. The steel tube frame inside the aft cowl door may be used as a hand hold for pushing. Keep feet clear of skid tubes during ground handling.

CAUTION

Do not move helicopter by gripping tail rotor guard, outboard portion of horizontal stabilizer, tail rotor, or tail rotor controls.

1.214 Main Rotor Blade Tie-Downs

Install MT290-2 main rotor blade tie-downs as shown in Figure 1-5. Tie-down straps are installed by removing slack from lines to prevent blade movement.

CAUTION

Overtightening tie-down straps can damage main rotor blades.

1.215 Parking

Refer to Section 8 of the R44 Pilot's Operating Handbook for parking procedures.

1.216 Trailering

Trailering the R44 is not normally recommended. Most trailers large enough to accomodate the helicopter are designed for much heavier loads; the trailer's springs and shock absorbers will not function properly when lightly-loaded. If trailering is unavoidable the following precautions should be observed:

1. Load trailer with ballast until it is at the average weight it is designed to carry.

2. Support tailcone, taking care to prevent chafing or abrasion at the support point.

3. Remove main rotor blades. If not practical to remove, support the main rotor blades so they will not bear on droop stops. Locate supports about 5 feet in from blade tips. Supports must be cushioned to prevent blade damage.

4. Restrain tail rotor to prevent teetering.

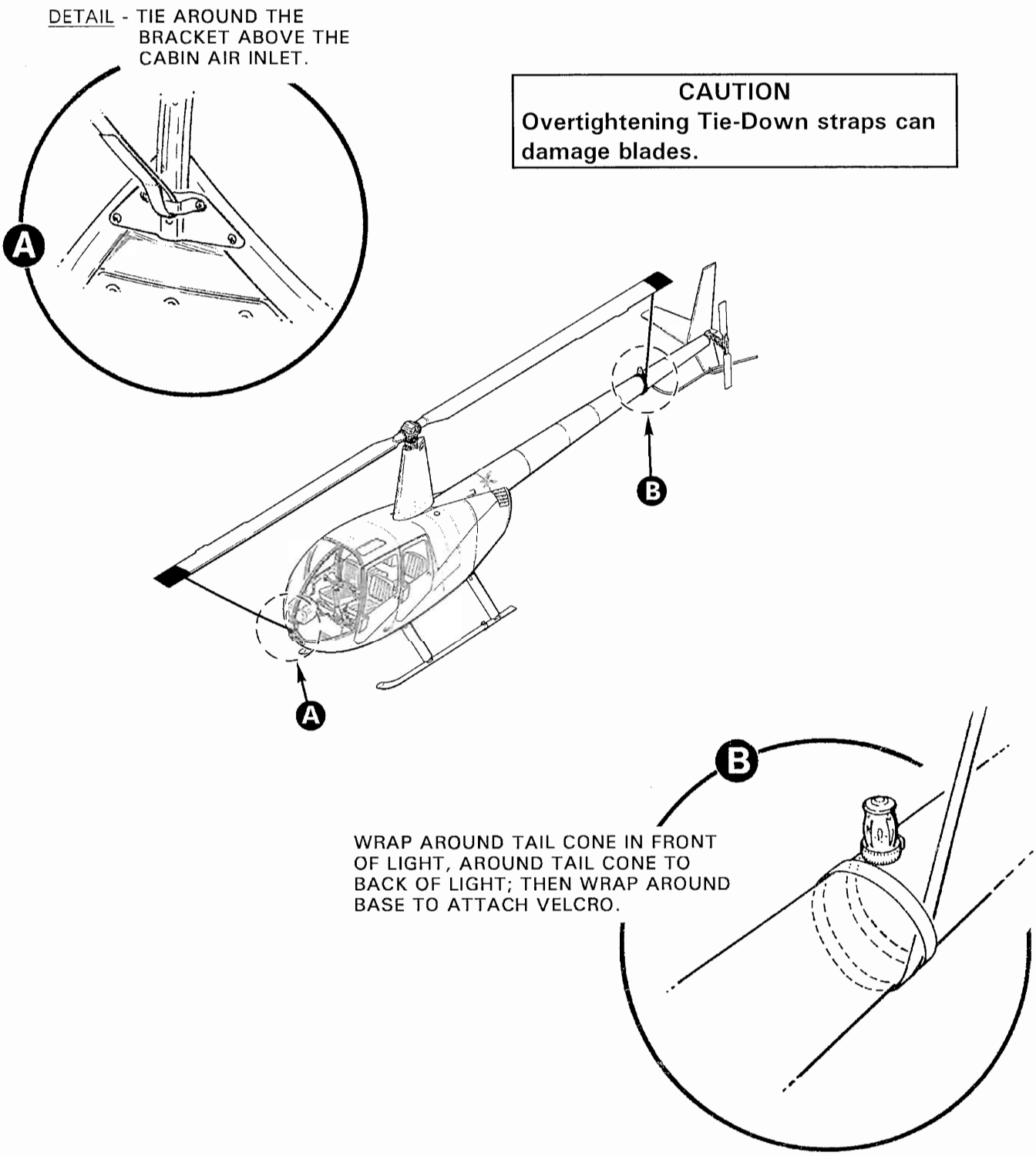


FIGURE 1-5 MAIN ROTOR BLADE TIE-DOWN INSTALLATION

1.216 Trailering (cont'd)

e) Protect helicopter's windshield, tail rotor and other vulnerable parts from highway debris damage.

f) After trailering, thoroughly inspect aircraft for possible damage, with particular attention to the steel tube structure and rotor systems.

1.220 Jacking, Hoisting and Leveling

1. Helicopter jacking is accomplished by placing a jack under each end of the aft cross tube 1 inch inboard of elbow fittings.

CAUTION
Care must be taken to prevent the helicopter from becoming dislodged from jacks.

2. Hoist helicopter using MT527-1 helicopter lifting fixture as shown in Figure 1-6A, or by passing one-inch diameter soft nylon rope through the lightening holes in main rotor hub and forming a double loop per Figure 1-6B. Rope must have a minimum tensile strength of 2,500 lb.

3. Level helicopter using either of the following methods:

   a. Leveling using tailcone and aft landing gear cross tube:

      1) Place a propeller protractor on top of forward bay of tailcone. When tailcone is 0.7 degrees nose down ship is leveled longitudinally.

      2) Level helicopter longitudinally by placing shims under landing gear skid tubes.

      3) Verify aft cross tube is not bent. Place a bubble level in center of aft cross tube.

      4) Level helicopter laterally by placing shims under landing gear skid tubes.

      5) Recheck longitudinal level per steps 1) and 2) above. Repeat steps 1) through 4) as required.

NOTE
Jacks may be used under aft cross-tube 1 inch inboard from elbows.

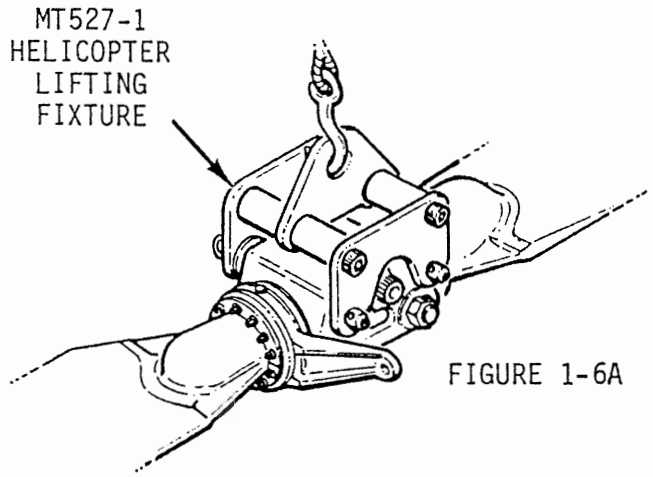


FIGURE 1-6A HELICOPTER HOISTING

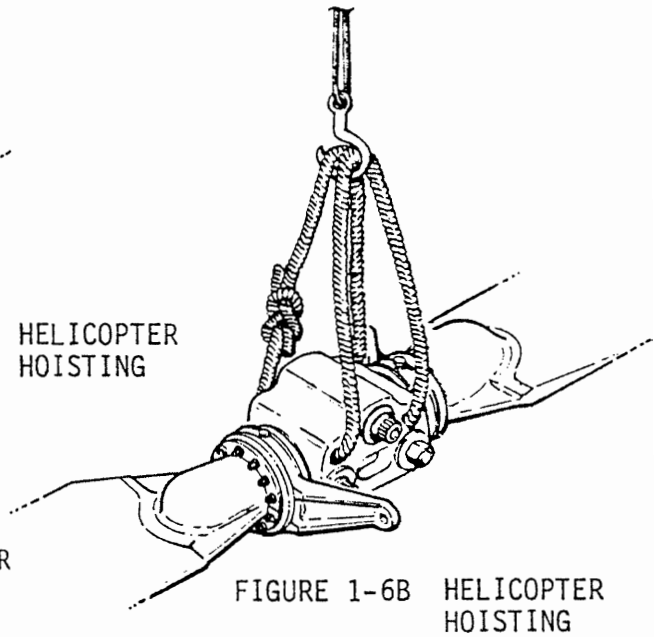


FIGURE 1-6B HELICOPTER HOISTING

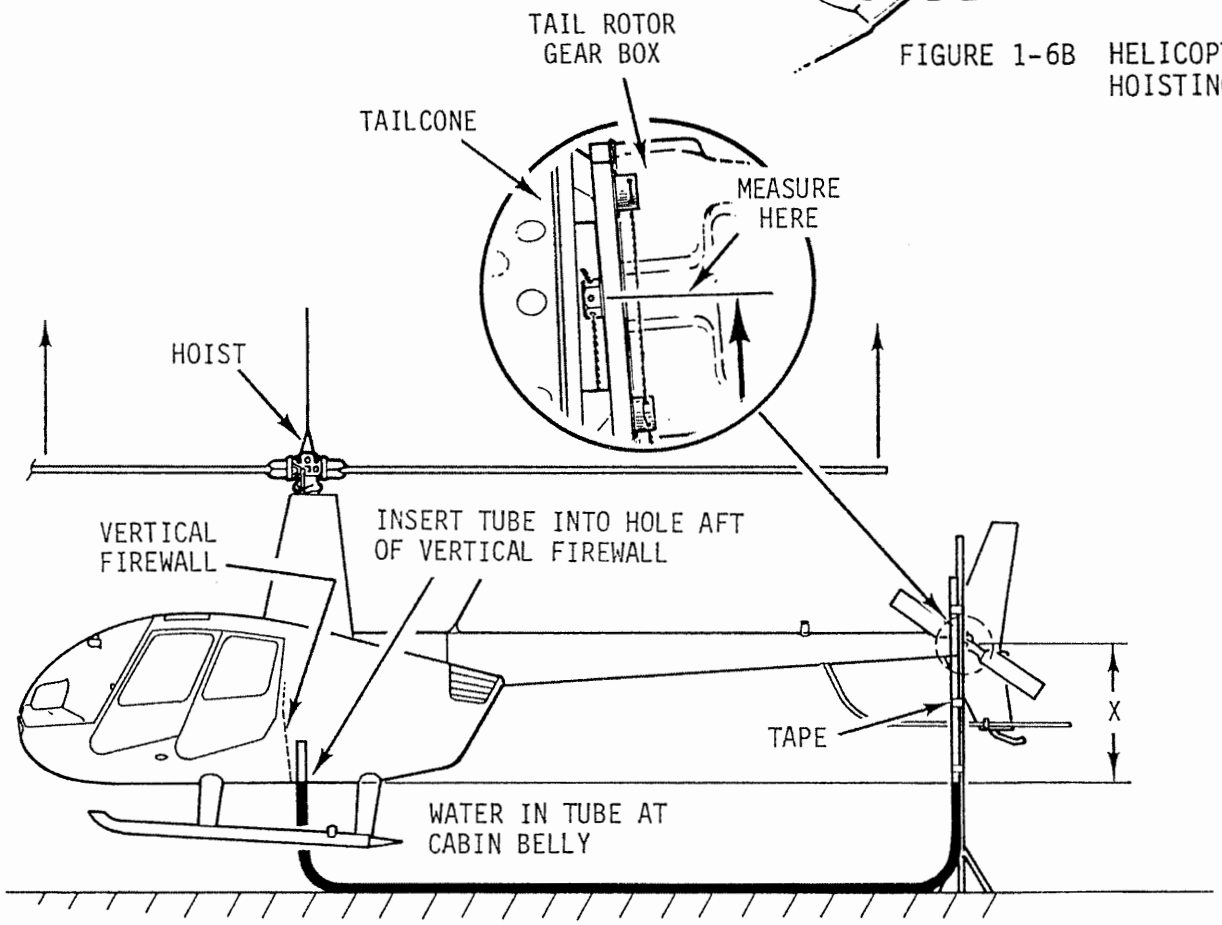


FIGURE 1-7

HELICOPTER C.G. DETERMINATION

1.220 Jacking, Hoisting, and Leveling (cont'd)

b. Leveling at the main rotor hub:

1. Rotate main rotor until teeter hinge bolt is aligned with longitudinal axis of helicopter. Place a bubble level at location marked "level here".

NOTE
Level must be on top of main rotor hub and parallel to teeter hinge bolt.

2. Level helicopter longitudinally by placing shims under landing gear skid tubes.

3. Rotate main rotor until teeter hinge bolt is aligned with lateral axis of helicopter.

4. Level helicopter laterally by placing shims under landing gear skid tubes.

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

5. Recheck longitudinal level per preceding steps. Repeat steps as required to level helicopter.

1.230 Weighing and C.G. Calculation

NOTE

The Equipment List/Weight and Balance Data form in the Pilot's Operating Handbook must be used to maintain a continuous record of the helicopter's weight and balance.

NOTE

Level must be on top of main rotor hub and parallel to teeter hinge bolt.

1.231 Helicopter Weighing Procedure

1. Drain all fuel, including gascolator and both fuel tank sumps.

2. Fill engine oil, hydraulic fluid (if applicable), and gearboxes to full marks.

3. Install and secure all doors.

4. Position main rotor blades fore/aft and approximately level and center cyclic stick.

5. Be sure all checked items on Equipment list/Weight and Balance Data form are installed in their proper locations. Correct form as required.

6. Be sure aircraft is clean and remove any foreign items such as charts, tools or rags.

7. Hoist aircraft per Section 1.220. Have one person hold tail of helicopter while it is being hoisted to stabilize aircraft.

8. With main rotor blades oriented approximately fore and aft, raise both blades off droop stops to allow hub to freely teeter.

9. With aircraft hanging freely and steadily, use a water level and measure difference in vertical height between centerline of tail rotor gearbox and cabin belly at vertical firewall. Refer to Figure 1-7.

   Record height difference to nearest tenth of inch: _____ inches (no ballast)

1.231 Helicopter Weighing Procedure (cont'd)

10. Determine uncorrected longitudinal center of gravity:

114.34 – [0.32 x (difference in height, from Step 9)] = _____ inches

11. Place a 1000-pound capacity scale under each skid. Locate center of scales approximately six inches forward of ground handling wheel mount centerline.

12. Lower aircraft until it rests entirely on scales. Aircraft must be well balanced on scales before releasing tail. Be sure aircraft is level laterally by placing level on center of aft landing gear cross tube.

13. Determine uncorrected empty weight:

Right Scale indication		_____ lb
plus Left Scale indication	+	_____ lb
minus Tare (such as lifting fixture, if installed)	–	_____ lb
Uncorrected Empty Weight	=	_____ lb

14. Determine CG with full fuel and 150 lb pilot:

$$\frac{[(\text{CG from Step 10}) \times (\text{empty weight from Step 13})] + 38840}{(\text{empty weight from Step 13}) + 451.2} = \_\_\_\_\_ \text{ inches}$$

15. If CG from Step 14 is greater than 102.5 inches, determine required nose ballast as follows:

$$\frac{[(\text{CG from Step 10} - 102.5) \times (\text{empty weight from Step 13})] - 7408}{95.5} = \_\_\_\_\_ \text{ lb}$$

Round ballast weight up to nearest 0.25 lb and install nose ballast per Section 1.240.

Record actual nose ballast installed: _____ lb

Repeat steps 7 thru 15 and revise measurements and calculations.

1.231 Helicopter Weighing Procedure (cont'd)

16. Adjust weight and balance to correct for drained unusable fuel:

ITEM	WEIGHT (lb)		CG (inches from datum)		MOMENT (in.-lb)
Ship as weighed	_____ (from Step 13)	X	_____ (from Step 10)	=	_____
Add unusable fuel	+7.2	X	96.0	=	+691
Helicopter basic empty weight and CG (includes unusable fuel and full oil)	_____	X	_____ *	=	_____

*CG location (arm) is determined by dividing total moment by total weight.

Datum is located 100 inches forward of main rotor centerline

CAUTION

Following any modification which moves empty CG aft, calculate weight and balance with 150 lb pilot and full fuel. If calculation shows CG aft of aft limit, fixed ballast must be installed in nose to comply with minimum solo pilot weight limitation in Section 2 of the Pilot's Operating Handbook.

17. Determine lateral center of gravity using step 13 data:

$$\text{Lateral C G Arm} = \frac{(\text{Right Scale} - \text{Left Scale})}{(\text{Right Scale} + \text{Left Scale})} \times 41.20 = \_\_\_\_\_ \text{ inch}$$

1.240 Fixed Ballast Installation

1. Remove screws securing upper console and open console.

2. Remove landing light retainer and landing lights.

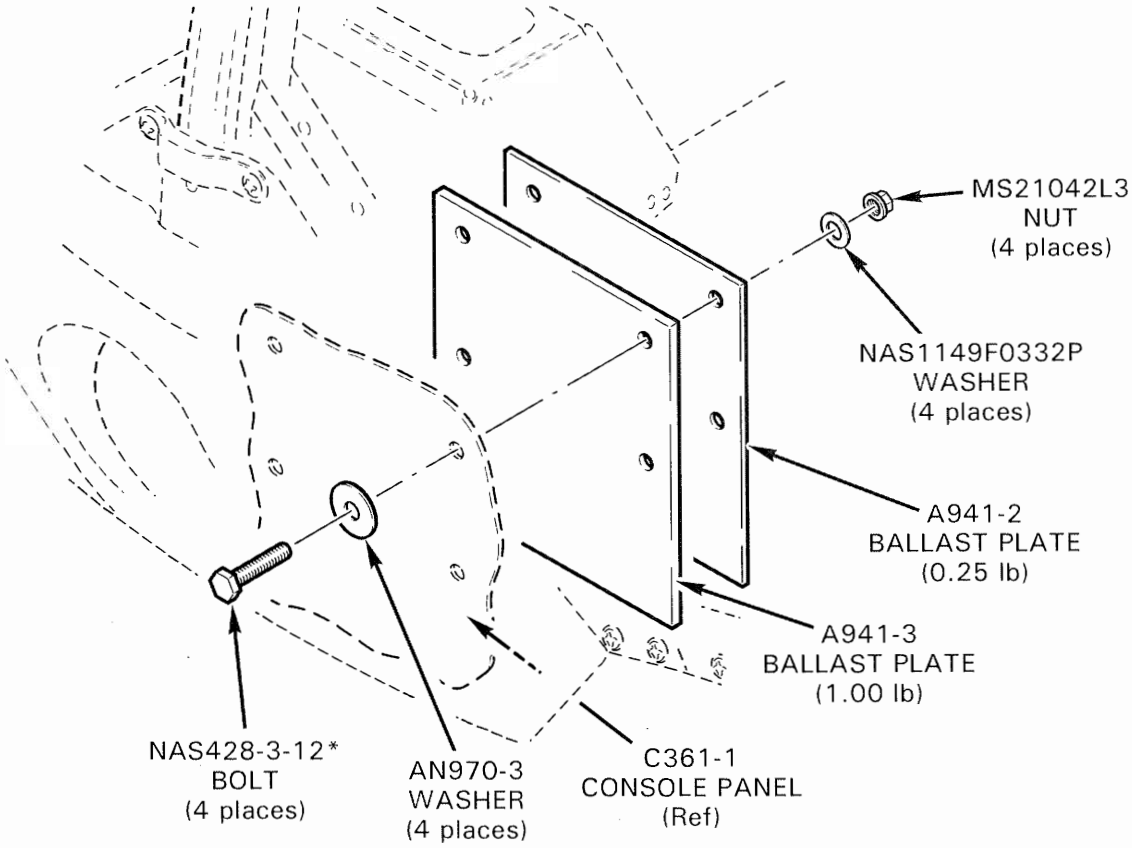
3. If required by Section 1.231, install appropriate ballast per Figure 1-8, 1-8A, or 1-8B, as applicable.

NOTE
Maximum allowable ballast is 10 pounds.

4. Torque bolts per Section 1.320 and torque stripe per Figure 2-1.

5. Close and secure upper console.

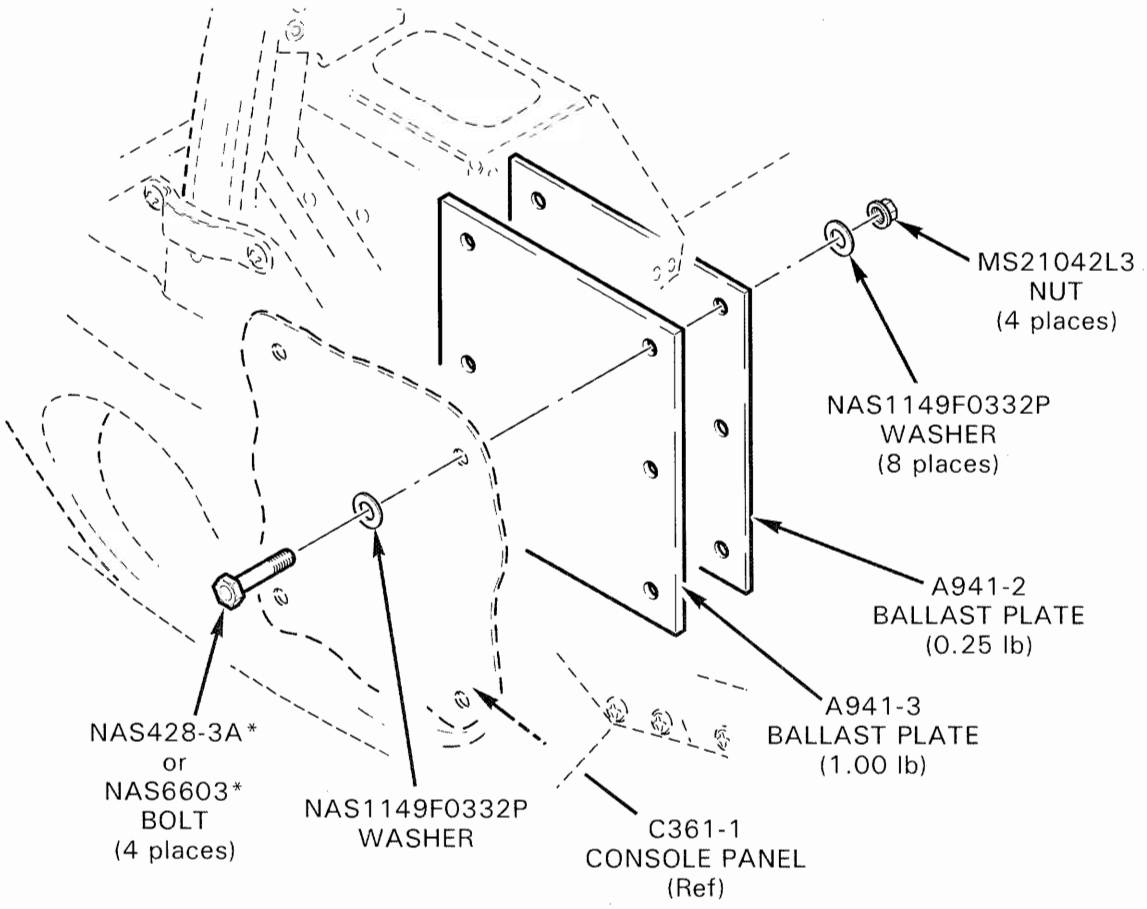
6. Reinstall landing lights and retainer. Function check landing lights.



*2 threads minimum beyond nut.

FIGURE 1-8 FIXED BALLAST INSTALLATION
(with 4-hole ballast plates)

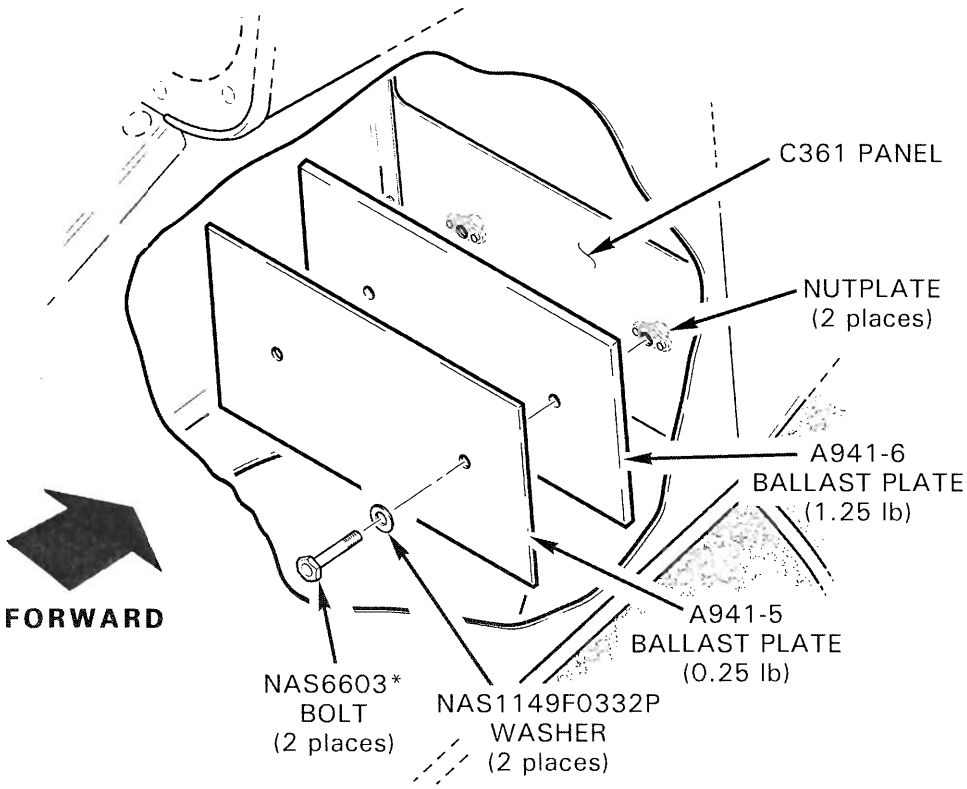
1.240 Fixed Ballast Installation (cont'd)



*Select NAS428-3A bolt length as required for 2 threads minimum beyond nut.
Select NAS6603 bolt length as required for 2 to 4 threads beyond nut.

FIGURE 1-8A FIXED BALLAST INSTALLATION
(with 6-hole ballast plates)

1.240 Fixed Ballast Installation (cont'd)



*Bolt length as required for 2-4 threads beyond nutplate.

FIGURE 1-8B FIXED BALLAST INSTALLATION
(with 2-hole ballast plates, required with H.I.D. landing lights)

1.300 FASTENER TORQUE REQUIREMENTS

WARNING

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

1.310 General

Fasteners shall be torqued to standard dry values listed in Section 1.320 unless otherwise specified. If torque is applied by rotating bolt, increase torque value by 10% to account for higher friction at bolthead and shank.

For example, the torque wrench setting for an NAS1305 bolt used with an NAS1068 nutplate is determined as follows:

NAS1305 bolt (5 indicates 5/16 inch size) dry torque per Table 1	240 in.-lb
Add 10% because torque must be applied at bolt head	24 in.-lb
Torque wrench setting	264 in.-lb

A secondary locking mechanism is required on all critical fasteners. B330 stamped nuts (palnuts) serve as secondary locking mechanisms in most areas on the helicopter, and are torqued per Table 1. The IPC lists secondary locking mechanisms for specific fasteners.

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.

CAUTION

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

NOTE

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

Torque seal (paint) is applied to all critical fasteners after palnut installation in a stripe extending from the fastener's exposed threads across both nuts onto the component (reference Figure 2-1). Any subsequent rotation of the nut or bolt can be detected visually. Approved source for torque seal is given in Section 1.460.

Any nut damaged due to handling or whose nut drag has deteriorated appreciably must be replaced.

1.310 General (continued)

WARNING

Two threads minimum must be exposed beyond nut on any installation to insure proper locking of a threaded fastener; four threads maximum may be exposed. More than four threads exposed may allow nut to seat against fastener shank, resulting in insufficient joint clamping.

CAUTION

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

Torque Requirements

1. Damaged hardware must be replaced.
2. Bolt and nut are to be clean and dry except when assembly procedure specifies anti-seize or thread-locking compound.
3. If chattering or jerking occurs, disassemble and re-torque fastener.
4. If special adapters which change effective length of torque wrench are used, final torque value must be calculated using formulas in Figures 1-9 and 1-10.
5. Proper thread engagement requires 2-4 threads exposed beyond primary self-locking nut (palnuts excepted).
6. Torque wrenches must be calibrated annually, when dropped, or when a calibration error is suspected.
7. Any self-locking nut whose drag has deteriorated appreciably must be replaced.
8. Replace palnuts when removed.

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

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

EXAMPLE

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

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

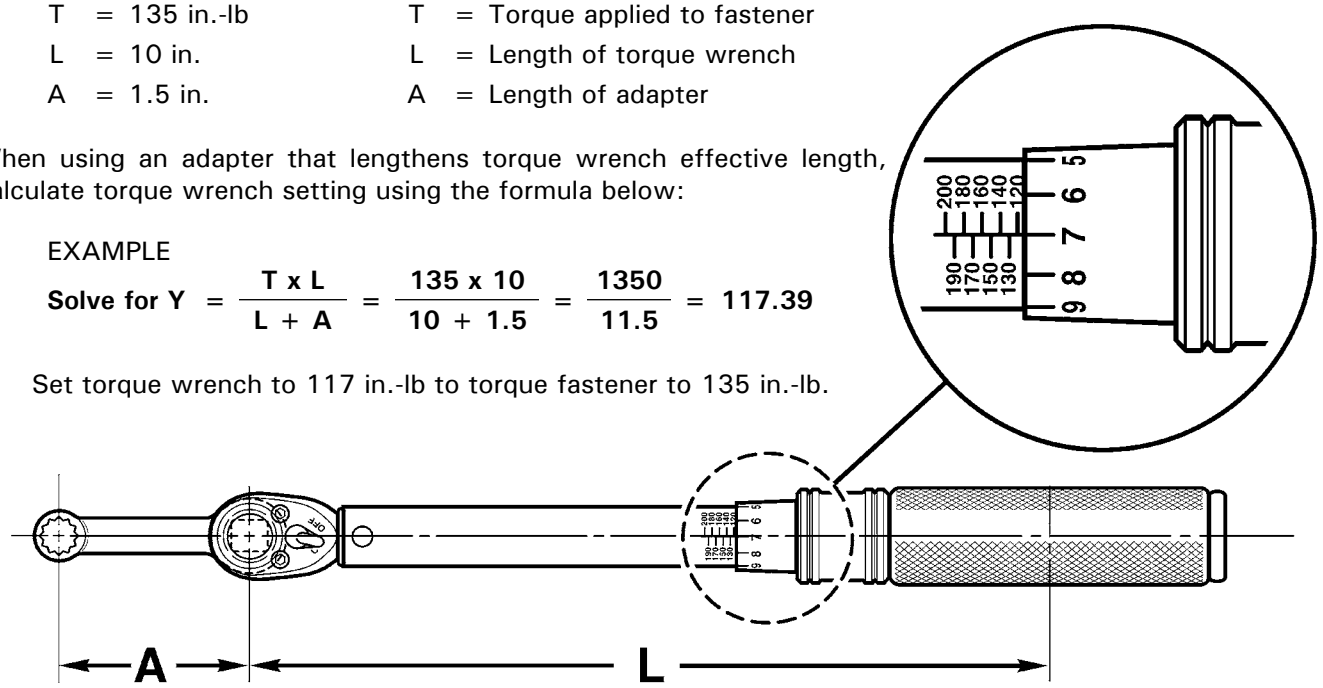


FIGURE 1-9 LENGTHENING TORQUE WRENCH EFFECTIVE LENGTH

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

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

EXAMPLE

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

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

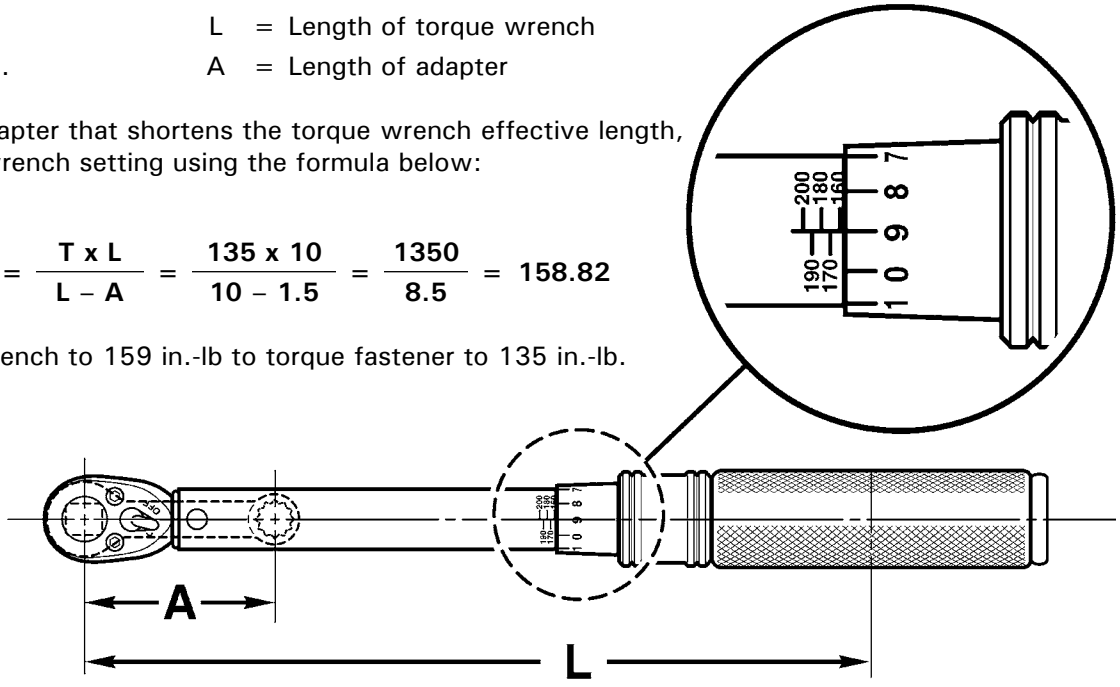


FIGURE 1-10 SHORTENING TORQUE WRENCH EFFECTIVE LENGTH

1.320 Standard Torques

FASTENER SERIES	SIZE	EXAMPLE FASTENER	DRY TORQUE (IN.-LB)
NAS 1300 Bolts NAS 6600 Bolts NAS 600 THRU 606 Screws NAS 623 Screws NAS 1351 Screws NAS 1352 Screws	10-32	NAS6603	50
	1/4-28	NAS6604	120
	5/16-24	NAS6605	240
	3/8-24	NAS6606	350
	7/16-20	NAS6607	665
	1/2-20	NAS6608	995
AN3 Bolts AN4 Bolts AN6 Bolts AN8 Bolts AN502 Screws AN503 Screws AN509 Screws AN525 Screws MS24694 Screws MS27039 Screws	10-32	AN3	37
	1/4-28	AN4	90
	3/8-24	AN6	280
	1/2-20	AN8	795
STAMPED NUTS (PALNUTS)	10-32	B330-7 (MS27151-7)	6 to 15
	1/4-28	B330-13 (MS27151-13)	11 to 25
	5/16-24	B330-16 (MS27151-16)	20 to 40
	3/8-24	B330-19 (MS27151-19)	29 to 60
	7/16-20	B330-21 (MS27151-21)	42 to 85
	1/2-20	B330-24 (MS27151-24)	54 to 110
TAPERED PIPE THREADS	1/8-27	N/A	60
	1/4-18	N/A	85
	3/8-18	N/A	110
	1/2-14	N/A	160
	3/4-14	N/A	230
ROD END JAM NUTS (AN315 and AN316)	10-32	AN315-3	15
	1/4-28	AN316-4	40
	5/16-24	AN316-5	80
	3/8-24	AN316-6	110

1. Values include nut self-locking torque.
2. Increase values 10% if torqued at bolt head.
3. For elbow & tee fittings which require alignment, torque to indicated value then tighten to desired position.
4. Values ± 10% unless range is specified.
5. Unless otherwise noted, thread sizes 8-32 & smaller are not used for primary structure & do not require specific torque.

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1.330 Special Torques

These torques are non-standard and supersede those in Section 1.320.

AREA	FASTENER	TORQUE
AIR CONDITIONING	(2) AN824-8D nuts on D792-2 and D793-2 lines at firewall	150
	D799-2 high pressure cutout switch	90
	D799-3 low pressure cutout switch	90
	MS21042L6 nut, compressor drive pulley retaining	300
	nut, D792-2 line assy-to-evaporator	150 wet w/ A257-20
	nut, D793-2 line assy-to-evaporator	210 wet w/ A257-20
	nut, D794-1 hose assy-to-D793-2 line assy	210
	nut, D794-1 hose assy-to-D777-1 compressor assy	300 wet w/ A257-20
	nut, D810-1 hose assy-to-D777-1 compressor assy	210 wet w/ A257-20
	nut, D810-1 hose assy-to-D783-1 condenser	150 wet w/ A257-20
	nut, D811-1 hose assy-to-D783-1 condenser	150 wet w/ A257-20
	nut, D811-1 hose assy-to-D793-2 line assy	150
	(4) valve cores (on servicing and cutout switches fittings)	1
CABIN	(2) NAS1351-6H20P bolts securing B253-2 anchor	150
CYCLIC STICK	(2) NAS1352-3H14 screws, C683-4 damper (manual-controls)	40
DRIVE SYSTEM	C182-1 nut (2-inch socket) on C007-5 shaft assembly Note: Shaft assemblies with smaller nuts are obsolete	450-550 ft-lb wet
	(6) NAS6608-42H bolts, lower sheave	900
EMPENNAGE	(8) NAS6604-5 bolts, vertical stabilizer attach	170
FANWHEEL	C182-1 nut - see DRIVE SYSTEM (above)	
	(16) NAS6603-6 bolts, cone-to-fanwheel	70
	(8) NAS6605-12 or -13 bolts, hub	290-310
FLOATS, EMERGENCY POP-OUT	(10) inlet check valve base	75-85
	(10) inlet check valve pivot (hose fitting) retainer	110-120
	(22) nuts on D674-1, -2, -3, -4, -5, & -6 hoses	230-260
	(4) nuts on D674-7 hoses	110-130

Continued on next page

Notes:

1. Values in inch-pounds unless otherwise specified.
2. Values include nut self-locking torque.
3. Increase 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. Values ± 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.

1.330 Special Torques (cont'd)

These torques are non-standard and supersede those in Section 1.320.

AREA	FASTENER	TORQUE
FUEL SYSTEM	(16) AN805 nuts, fuel primer lines (O-540)	20-30
	clamp, electric fuel pump (IO-540)	100, wet with B270-10 adhesive
	fuel control inlet reducer (IO-540)	150
	(2) fuel hose nuts, engine-driven fuel pump-to-fuel control inlet tee (IO-540); (2) fuel hose nuts, fuel control inlet tee-to-relief valve (IO-540); (2) fuel hose nuts, fuel control-to-flow divider (IO-540)	135-150
	(2) fuel hose nuts, gascolator-to-carburetor (O-540)	110-130
	(2) fuel line nuts, auxiliary-to-main tank; (2) fuel line nuts, main tank-to-fuel valve; (2) fuel line nuts, relief valve-to aux tank outlet tee (IO-540)	110-130
	(2) fuel line nuts, fuel valve-to-gascolator	270-300
	(5) fuel quantity sender bolts, self-sealing	37
	fuel quantity sender center stud terminal nut	10-12
	jam nut, electric fuel pump inlet elbow (IO-540); jam nut, electric fuel pump outlet tee (IO-540)	150
	jam nut, low-fuel warning sender	150
	tee, fuel control inlet (IO-540)	135-150
	inlet adapter, engine-driven fuel pump (IO-540)	150
	(4) bolts, airbox-to-carburetor (O-540)	25-35
	gascolator drain valve	54-66, wet with B270-6

Continued on next page

Notes:
1. Values in inch-pounds unless otherwise specified.
2. Values include nut self-locking torque.
3. Increase 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. Values ± 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.

1.330 Special Torques (continued)

These torques are non-standard and supersede those in Section 1.320.

AREA	FASTENER	TORQUE
HYDRAULIC HOSES & FITTINGS	(4) B330-19 palnuts, reservoir pressure elbow (if installed) & servo pressure T-fittings	30
	(2) B330-21 palnuts, reservoir pressure inlet elbow & pump pressure T-fitting (if installed)	45
	(4) B330-21 palnuts, return elbows (if installed) & T-fittings	45
	(2) B330-25 palnuts, pump suction T-fitting & reservoir suction elbow (if installed)	75
	cap, pump pressure T-fitting	60
	cap, pump suction T-fitting	120
	(4) D452-3 jam nuts, servo pressure elbows (if installed) & servo return T-fittings	60
	(2) D452-4 jam nuts, pump pressure T-fitting & reservoir pressure inlet elbow (if installed)	90
	(4) D452-4 jam nuts, return elbows (if installed) & T-fittings	90
	(2) D452-6 jam nuts, pump suction T-fitting & reservoir suction elbow (if installed)	150
	(2) nuts, pump-to-reservoir pressure hose	135-150
	(6) nuts, pressure hoses to servos (except pump)	95-105
	(2) nuts, reservoir-to-pump suction hose	190-210
	(6) nuts, return hoses from servos	135-150
HYDRAULIC PUMP	Hydraulic pump-to-gearbox mounting nuts (see MAIN ROTOR GEARBOX)	
HYDRAULIC RESERVOIR	(4) attach bolts, reservoir-to-frame	60
	filler-vent	100
	filter cap	150
	sight gage	150
HYDRAULIC SERVOS	MS27039C0806 screw attaching D200-2 scissors	25
	B330-6 palnut on above screw	5-10
LANDING GEAR	(8) clamps, strut fairings	100 wet with B270-10 thread locking adhesive
	(4) NAS6604 bolts, ground handling wheel supports	70
	(2) S144119 screws, for D310 brackets	10
	(4) NAS6607P20 bolts, gear attach	66 ft-lb
	(1) NAS6607-52 bolt, shackle to block	66 ft-lb

Notes:

1. Values in inch-pounds unless otherwise specified.
2. Values include nut self-locking torque.
3. Increase 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. Values ± 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.

1.330 Special Torques (continued)

These torques are non-standard and supersede those in Section 1.320.

AREA	FASTENER	TORQUE
MAIN ROTOR BLADE	(2) B289-2 bolts, self-sealing	60-80
	(2) C722-3 screws, tip balance weight	55
MAIN ROTOR GEARBOX	(4) A650-4 fittings, gearbox mounting or (4) NAS1291-10 nuts	90 ft-lb, dry, torqued from bolt head or nut
	AN320-8 nut, gearbox pinion (retains C908 yoke)	35-45 ft-lb
	chip detector housing	Approximately 150
	chip detector (threaded type)	Approximately 75
	filler plug	150
	(4) NAS1291-4 nuts, hydraulic pump-to-gearbox (or cover)	40
	(6) NAS1352-4 screws, end cover	120
	(6) NAS1352-4H16P screws, sump-to-housing	120 at head
	sight gage	150
MAIN ROTOR HUB	(1) NAS634-105 bolt, teeter hinge and (2) NAS634-105 bolts, coning hinges	New bolt: 0.021-0.022 inch elongation, wet Used bolt: 0.020-0.022 inch elongation, wet, and cotter pin holes must align
PITCH LINKS	(2) 21FKF-813 self-locking jam nuts, main rotor pitch links	300
POWERPLANT	(1) AN818 nut, manifold pressure line	25 to 30
	(4) or (6) AN818 nuts, oil cooler lines	450 to 500
	(2) bolts, engine-to-ground strap	96
	(4) bolts, intake manifold-to-sump (IO-540)	90-100, torque center bolts first
	(1) nut, A462 fitting on carburetor mixture control arm	25-30
	(4) nuts, carburetor-to-engine (O-540)	96 initial, 204 final, torque in crisscross pattern
	(12) nuts, exhaust flange	200-220
	(12) spark plugs	420, wet with A257-10 spark plug thread lubricant
	(4) bolts, airbox-to-carburetor	25-35

Notes:

1. Values in inch-pounds unless otherwise specified.
2. Values include nut self-locking torque.
3. Increase 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. Values ± 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.

1.330 Special Torques (continued)

These torques are non-standard and supersede those in Section 1.320.

AREA	FASTENER	TORQUE
STEEL TUBE FRAME	(2) C722-2 5/8-inch internal-wrenching screws	120 to 125 ft-lb wet
	(2) S14119 screw and A31007 nut	8 to 10
SWASHPLATE	(18) AN503-8-8 fillister-head screws	17
	(26) NAS1352-08H8P socket-head screws	30
	(26) NAS1352N08-8	35 wet
	(1) NAS6605-8 bolt clamping C203-1 yoke	190 (opposite clamping bolt must be torqued first)
TAIL ROTOR	NAS6606-53 bolt, elastomeric teeter (delta) hinge	380
TAIL ROTOR GEARBOX	(4) bolts, input cap	60
	(8) bolts, input housing and output cap	100
	chip detector	100
	filler-vent plug	100
	input yoke retaining nut	35-45 ft-lb
	MS21042L5 nut, pitch control housing stud	240
	(4) NAS1352-5H12P drilled-head bolts, gearbox-to-tailcone attaching	200
	(4) NAS1352-5-12P bolts (undrilled), gearbox-to-tailcone attaching	240
	sight gage	150

Notes:

1. Values in inch-pounds unless otherwise specified.
2. Values include nut self-locking torque.
3. Increase 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. Values ± 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.

1.400 Approved Materials

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

WARNING

Refer to appropriate Material Safety Data Sheet (MSDS) and take necessary safety precautions when working in proximity to hazardous materials.

CAUTION

Follow product manufacturer's instructions for handling and storage.

1.410 Paint Strippers

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

1.420 Solvents and Cleaners

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
QSOL 220	Safety-Kleen Systems, Inc. Plano, TX	General use for cleaning prior to applying primer, topcoat, adhesive, or sealant.
Benzene, 1-Chloro-4 (Trifluoromethyl) PCBTF	Any	" "
Final Klean 3909S	Du Pont Chemical Los Angeles, CA	" "
EM-Citro*	LPS Laboratories, Inc. Tucker, GA	" "
Acetone	Any	" "
Lacolene (Aliphatic Hydrocarbon)	Any	Acrylic plastic cleaner only.
Presolve	LPS Laboratories, Inc. Tucker, GA	Hydraulic components only.
Tetrachloroethylene (Perchloroethylene)	Any	Vapor degreaser.
815 GD	Brulin Corporation Indianapolis, IN	Ultrasonic cleaning, general use.**
SF50	L&R Mfg. Co. Kearny, NJ	" "

1.420 Solvents and Cleaners (continued)

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
#112 Ammoniated or #222 Nonammoniated cleaning & rinse solution	L&R Mfg. Co. Kearny, NJ	Ultrasonic cleaning, avionics components only.

* May be used on acrylic plastic.
** Mix 5%-20% by volume; titration not required.

1.430 Fillers and Putty

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
315 Putty & Blue Cream Hardener	DuPont Chemical Los Angeles, CA	Minor surface imperfections.
05960 Acryl - Green	3M St. Paul, MN	" "
SBF1191	Gearhead Products Indianapolis, IN	" "

1.440 Torque Seal

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
F-900 (Any color except red)	Organic Products Co. Irving, TX	Torque seal.

1.450 Primers

PRODUCT	MANUFACTURER/SUPPLIER	APPLICATION
Gray epoxy CA 7422A/B/C or CA 7501A/B	PRC - Desoto Int., Inc. Sylmar, CA	Unlimited.
Gray epoxy 4001PS001 with CS4902 curing solution	AkzoNobel Waukegan, IL	
Aviation Primer, Green, A-702 (Aerosol)*	Valspar Corporation Medina, OH	Limited or touch-up use only.

* Shelf life is two years.

1.455 Powder Coat

PRODUCT	MANUFACTURER
13-7004 Corvel Grey Zinc Rich Epoxy Powder*	AkzoNobel Santa Fe Springs, CA
81-2158 Vitralon Grey Zinc Rich Epoxy Powder*	Pratt & Lambert Chemical Coatings Buffalo, NY
39/80020 Smooth Matte Black Polyester Topcoat Powder*	Tiger Drylac USA Cucamonga, CA

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

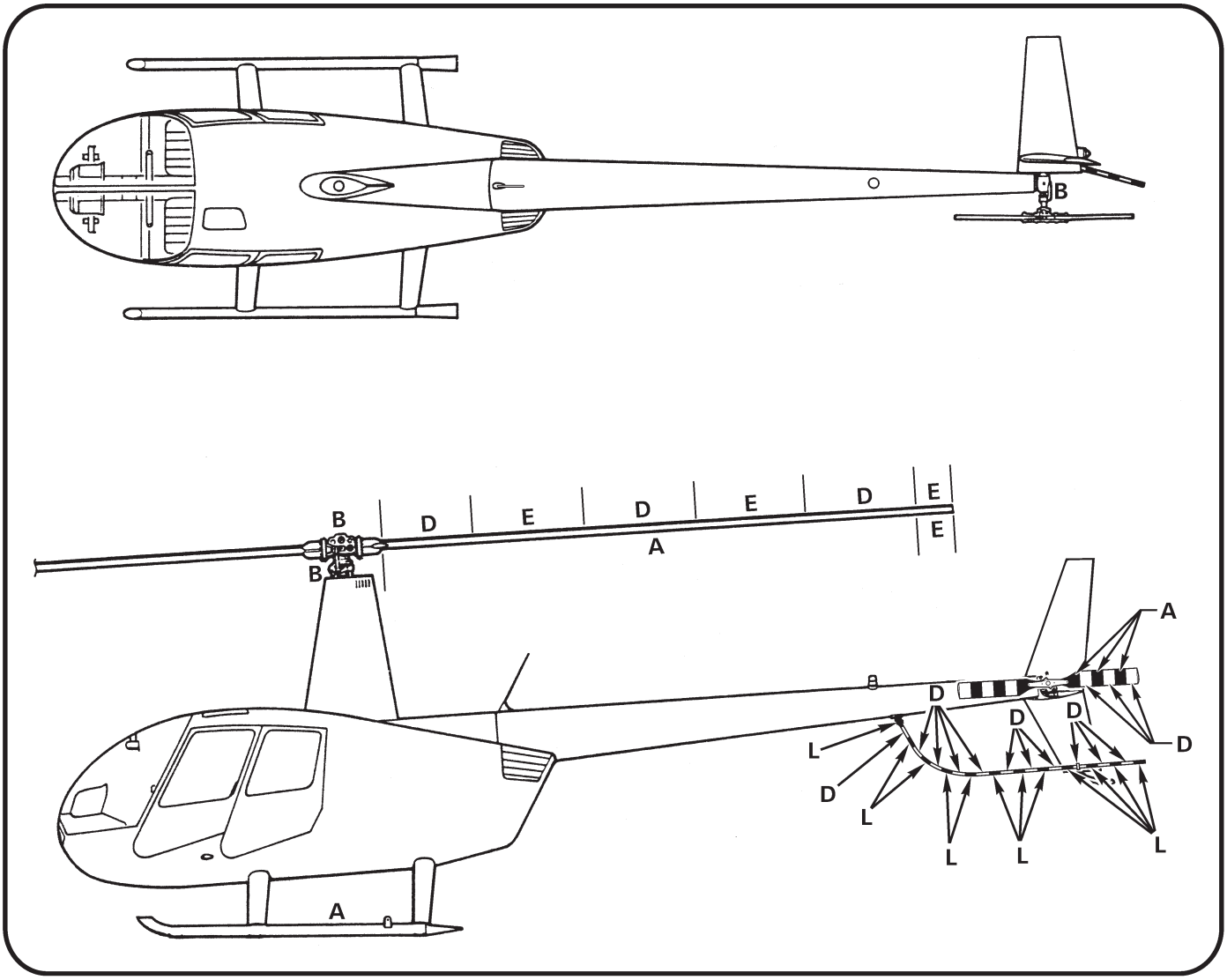


FIGURE 1-12 PAINT CODES

(Refer to Chapter 9 for rotor blade paint dimensions. Exterior surface codes are D & F unless otherwise specified.)

1.455 Powder Coat (continued)

PRODUCT	MANUFACTURER
49/72460 Smooth Glossy Gray RAL 7043 Polyester Topcoat Powder*	Tiger Drylac USA Cucamonga, CA
49/22460 Smooth Glossy Yellow RAL 1028 Polyester Topcoat Powder*	" "
PFWF104S9 White Polyester Topcoat Powder*	Dupont Co. Wilmington, DE

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

1.460 Paints

Refer to Figures 1-12 and 1-13 for paint code application. Paint codes for specific helicopter serial numbers are listed on the inside cover of factory-supplied maintenance record (logbook).

NOTE

Use fisheye eliminator, accelerator, or other additives per manufacturer's recommendations.

CODE	MATERIAL	MANUFACTURER
A	Flat Black Imron 373-P-29950	Axalta Wilmington, DE
	Semi-gloss Black 3900-05 with 39-SG catalyst and water reducer	Cardinal Industrial Finishes El Monte, CA
	Semi gloss Black 656-58-7038 with X-503 activator	AkzoNobel Waukegan, IL
B	Dark gray Imron AF400/AF700	Axalta Wilmington, DE
C	Engine gray IE-8948	Randolph Products Co. Carlstadt, NJ
	Lycoming A219 gray engine enamel (aerosol can touch-up; shelf life 2 years)	Tempo Products Cleveland, OH
D	White Imron AF400/AF700	Axalta Wilmington, DE
E	Yellow Imron AF400/AF700	" "
F	Imron AF400/AF700 Colors	" "
G	Clear Imron AF740	Axalta Wilmington, DE
H	Semi-gloss Clear 656-58-9000 with X-503 activator	AkzoNobel Waukegan, IL
J	White Imron 2.1 FT flat polyurethane enamel with FG-1333 activator and T-1021 or T-1022 thinner	Axalta Wilmington, DE
K	White Cat-L-Ink 50-100R (shelf life 3 years) 20/A Catalyst (shelf life 2 years)	Ethone, Inc. West Haven, CT
	Yellow Cat-L-Ink 50-202AR or BR (shelf life 3 years) 20/A Catalyst (shelf life 2 years)	" "
	Med Red Cat-L-Ink 50-508R (shelf life 3 years) 20/A Catalyst (shelf life 2 years)	" "
L	Red Imron AF400/AF700	Axalta Wilmington, DE
M	Orange Imron AF400/AF700	" "
N	Krylon 1311 (shelf life 2 years) Matte Clear (aerosol can)	Krylon Div. of Borden Columbus, OH
O	Light gray Imron AF400/AF700	Axalta Wilmington, DE
P	Silver Bullet AM Tracer Black 20-452AM-F1 with 16-CURE-F4 activator	Burke Industrial Coatings Ridgefield, WA

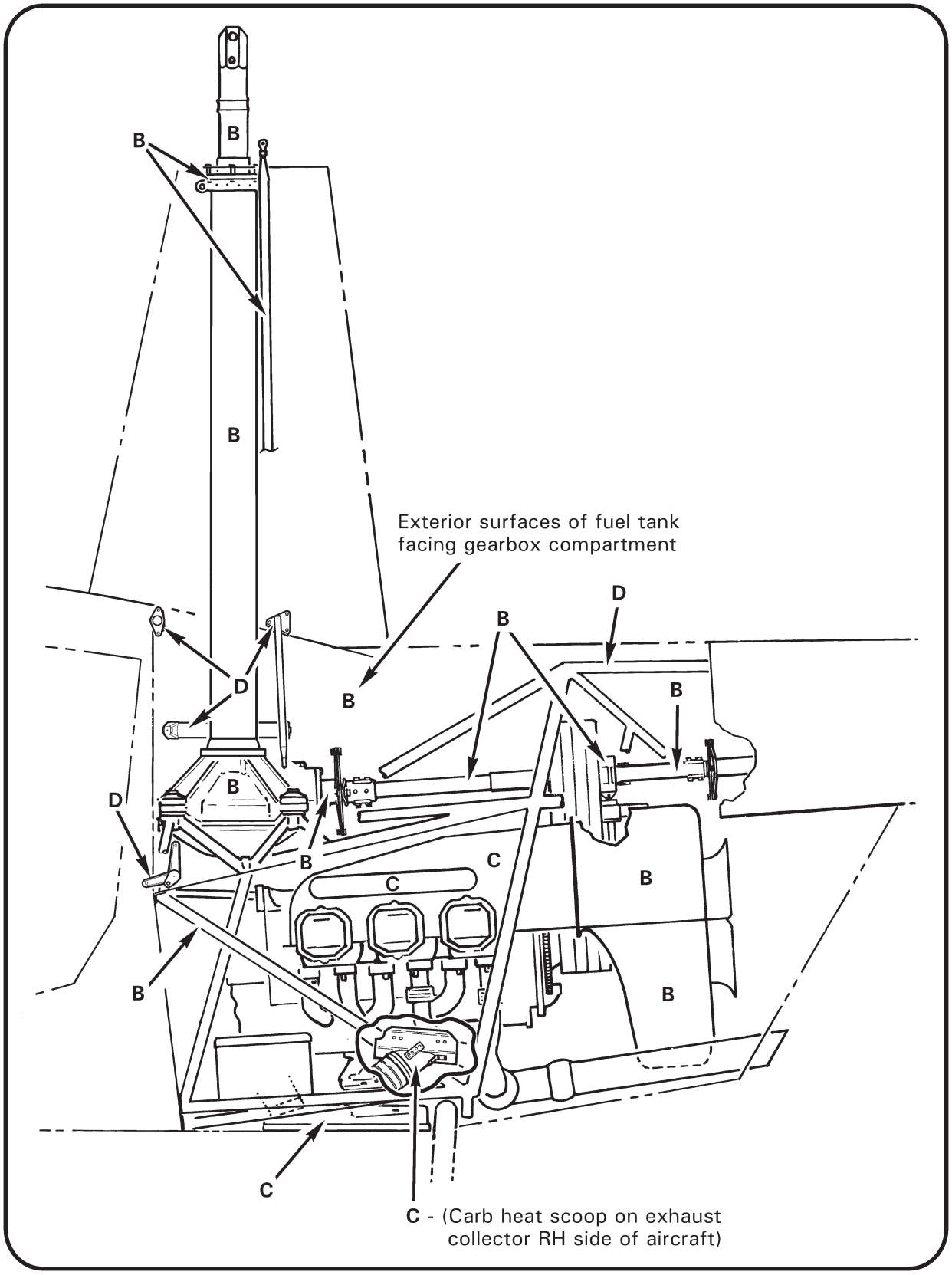


FIGURE 1-13 PAINT CODES

1.460 Paints (continued)

For limited touch-up of interior and landing gear only:

CODE	MATERIAL	MANUFACTURER
A	Krylon 1613 (shelf life 2 years) Semi-Flat Black (aerosol can)	Krylon Div. of Borden Columbus, OH
	NYBC 14 (shelf life 2 years) Semi-Flat Black	New York Bronze Powder Co. Scranton, PA
	Cardinal A-2000-05 Flat Black (aerosol can)	Cardinal Industrial Finishes So. El Monte, CA

1.470 Lubricants

RHC PART NO.	LUBRICANT TYPE	MANUFACTURER'S PART NO.	MANUFACTURER
A257-1	Grease (general purpose)	101	Southwestern Petroleum Corp. Fort Worth, TX
A257-2	Gear oil	201 SAE 90	Southwestern Petroleum Corp. Fort Worth, TX
A257-3	Grease	Aero Shell 14 MIL-G-25537	Shell Oil Co.
A257-4	Oil (automatic transmission fluid)	Dexron II or Dexron II/Mercon or Dexron III/Mercon	Quaker State or Pennzoil
A257-5	Grease (water resistant)	3120 11402	Sta-Lube, Inc. Compton, CA Lubrimatic Buffalo Grove, IL
A257-6	Grease (fuel resistant)	Fuelube EZ Turn	Fleet Supplies Inc. Cleveland, OH United-Erie Div. of Interstate Chemical Co. Erie, PA
A257-7	Dry film lubricant	Lubri-Kote Type A 1040 CR	Mealey Ind. Lubricants Cleveland, OH
A257-8	Rubber lubricant	P-80	International Products Corp. Trenton, NJ
A257-9	Anti-seize	Silver Grade	Loctite Corp. Newington, CT
A257-10	Substitute A257-16		
A257-12	Grease	Mobilgrease 28 MIL-PRF-81322	Exxon Mobil Corp.
A257-15	Hydraulic fluid	Per MIL-PRF-5606	Any
A257-16	Engine oil	Type M 20W-50, SAE J1966	Phillips 66 Co. Pasadena, TX

1.470 Lubricants (continued)

RHC PART NO.	LUBRICANT TYPE	MANUFACTURER'S PART NO.	MANUFACTURER
A257-16	Engine oil	Aviation oil 20W-50, SAE J1966	Exxon Mobil Corp. Fairfax, VA
A257-17	Substitute A257-19		
A257-18	O-ring lubricant	55	Dow Corning Corp. Midland, MI
A257-19	Valve lubricant and sealant compound	111	Dow Corning Corp. Midland, MI
A257-20	Pag oil	Daphne Hermetic PR	Apollo America Corp. Southfield, MI
A257-21	Petrolatum lubricant	P-16	Panef Corp. Milwaukee, WI

1.480 Adhesives and Sealants

RHC PART NO.	DESCRIPTION	COLOR	MFR. PART NO.	MANUFACTURER
B270-1	Sealant - polysulfide, fuel resistant (2-part)	Gray	FS-8907 B-2	PPG Aerospace Glendale, CA
	Sealant - polysulfide, fuel resistant (2-part)	Gray	WS-8032 B-2	Royal Adhesives & Sealants Wilmington, CA
	Sealant - polysulfide, fuel resistant (2-part)	Gray	AC-350 B-2	Advanced Chemistry & Technology Inc., Garden Grove, CA
B270-2	Substitute B270-1			
B270-4	Substitute B270-13			
B270-5	Sealant - synthetic rubber putty (1-part)	White Light Gray	Q4-2805 94-031	Dow Corning Corp. Midland, MI
B270-6	Sealant & lubricant - thread (1-part)	Gray	Titeseal 55	Radiator Spec. Co. Charlotte, NC
B270-7	Substitute B270-14			
B270-8	Adhesive - rubber, nitrile/acetone (1-part)	Tan	C 160	Stabond Corp. Gardena, CA
B270-9	Adhesive - epoxy, structural, flexible (2-part)	Gray	2216 B/A	3M Co. St. Paul, MN
B270-10	Adhesive/sealant - threadlocker, anaerobic, tight-fits (1-part)	Red	271	Henkel Loctite Corp. Rocky Hill, CT
B270-11	Adhesive/sealant - threadlocker, anaerobic, loose-fits (1-part)	Red	277	Henkel Loctite Corp. Rocky Hill, CT

1.480 Adhesives and Sealants (continued)

RHC PART NO.	DESCRIPTION	COLOR	MFR. PART NO.	MANUFACTURER
B270-12	Sealant - electrical potting (2-part)	Any color except red	MIL-PRF-8516 Type II, Class 2, Category A or B	Any
B270-13	Sealant - silicone rubber, noncorrosive (1-part)	Translu-cent	3145	Dow Corning Corp. Midland, MI
B270-14*	Adhesive - foam, neoprene/water (1-part)	White Lavender	100 Neutral 100 Lavender	3M Co. St. Paul, MN
B270-15	Adhesive - plastic, for vinyl (1-part)	Clear	2262	3M Co. St. Paul, MN
B270-16	Substitute B270-14			
B270-17	Adhesive - cyanoacrylate, instant (1-part)	Clear	Super Bonder 495	Henkel Loctite Corp. Rocky Hill, CT
B270-18	Adhesive - weather strip (1-part)	Black	051135-08008	3M Co. St. Paul, MN
B270-19	Adhesive - epoxy structural, rigid (2-part)	Green	1838 B/A	3M Co. St. Paul, MN
B270-20	Adhesive/sealant - threadlocker, anaerobic, non-permanent (1-part)	Purple	222 or 222MS	Henkel Loctite Corp. Rocky Hill, CT
B270-21	Protectant - corrosion, non-drying (1-part)	Lt. Amber	LPS 3	LPS Laboratories, Inc. Tucker, GA
B270-22	Protectant - corrosion, drying (1-part)	Amber	LPS Hardcoat	LPS Laboratories, Inc. Tucker, GA
B270-23	Sealant - gasket (1-part) Sealant - gasket (1-part)	Brown Brown	GM3H (Gasket Maker #4) JV66B	Perfect Seal, Inc. Cincinnati, OH Dana Corp.; Churubusco, IN (Victor Reinz Brand)
B270-24	Activator/Primer - Anaerobic adhesive (1-part)	Translu-cent Green	7649	Henkel Loctite Corp. Rocky Hill, CT
B270-25	Clear Coat - automotive touch up, brush in bottle (1-part)	Clear	Clear Coat Touch up Bottle	Automotivetouchup Harahan, LA
B270-26	Sealant - Polysulfide, window glazing (2-Part)	Black	AC-251B-1	Advanced Chemistry & Technology Inc., Garden Grove, CA

* B270-8 may be substituted for B270-14.

1.490 Storage Limits

1. P/N B283-x hoses have a shelf storage life of 5 years. Hose service life is “on condition”, with a maximum of 12 years.

2. Elastic cords have a shelf storage life of 5 years. Elastic cord service life is “on condition”, with a maximum of 12 years. Use invoice or FAA Form 8130 date as start date.

3. Store V-belts at less than 85ºF (30ºC), with relative humidity below 70%. Avoid solvent and oil vapors, atmospheric contaminants, sunlight, and ozone sources (electric motors, arc welding, ionizing air purifiers, etc.). Belt shelf life is 4 years if preceding recommendations are followed. Use invoice date or FAA Form 8130 date as start date.

4. Oils and greases have a 5 year shelf life when stored and kept sealed in their original container. Use invoice date or FAA Form 8130 date as start date unless the manufacturer has marked container with manufacture date (in which case use manufacture date as start date).

5. Rubber o-rings, seals, and gaskets have a shelf storage life of 20 quarters (5 years). Service life is “on condition” with a maximum of 12 years. Use cure date on package as start date.

6. Store fuel cell (bladder) at temperatures above 45ºF and below 75ºF.

1.500 (Reserved)

1.600 PART INTERCHANGEABILITY

The following parts are interchangeable. Unless noted otherwise, whenever one part is referred to in this manual, its substitute part is also permitted.

Part	Interchangeable with:
AN340 nut	MS35649 nut per NASM35649 except brass nut
AN345 nut	MS35650 nut per NASM35650
N364 nut	MS21083 nut per NASM21083
AN507 screw	MS24693 screw per NASM24693
AN509 screw	MS24694 screw per NASM24694
AN515 screw	MS35206 screw per NASM35206
AN515C screw	MS51957 screw
AN515UB screw	B567-__ screw
AN525 & AN526 screw	MS27039C screw per NASM27039
AN814 & MS24391 plug	AS5169 plug
AN815 & MS24392 union	AS5174 union
AN819 & MS20819 sleeve	AS5176 sleeve
AN822 & MS20822 elbow	AS5195 elbow
AN823 & MS20823 elbow	AS5196 elbow
AN825 & MS20825 tee	AS5197 tee
AN826 & MS20826 tee	AS5198 tee
AN894 & MS24398 bushing	AS5173 bushing
AN900 gasket	MS35769 gasket per AS35769
AN924 nut & MS24400 nut	AS5178 nut
AN931 grommet	MS35489 grommet
AN936 lockwasher	B332-__ lockwasher
AN960-8L washer	NAS1149FN816P washer
AN960-8 washer	NAS1149FN832P washer
AN960-10L washer	NAS1149F0332P washer
AN960-10 washer	NAS1149F0363P washer
AN960-416L washer	NAS1149F0432P washer
AN960-416 washer	NAS1149F0463P washer
AN960-516L washer	NAS1149F0532P washer
AN960-516 washer	NAS1149F0563P washer
AN960-616L washer	NAS1149F0632P washer
AN960-616 washer	NAS1149F0663P washer
AVDEL 1693 rivet	AVDEL 1691 rivet
MS20604ML4W1 rivet	MS20604M4W1 rivet per NASM20604
MS21919DG clamp	AS21919 clamp
NAS1291 nut	MS21042 nut per NASM21042
NAS1303 thru NAS1320 bolt	NAS6603 thru NAS6620 bolt*
NAS487 instrument nut	MS33737 Instrument nut per NASM33737
NAS679A_ nut	NAS1291-_ nut
NAS679C_ M nut	NAS1291C_ M nut
NAS696 nutplate	MS21071 nutplate per NASM21071
NAS698 nutplate	MS21073 nutplate per NASM21073
NAS698 nutplate	MS21073 nutplate per NASM21073

* The following bolts must be NAS1300 series only:
NAS1304-28, -35, -37, & -38, and NAS1305-35

1.700 SPECIAL INSTRUCTIONS FOR REASSEMBLING AND FLIGHT TESTING R44 SERIES HELICOPTERS AFTER CRATING FOR EXPORT

REASSEMBLY: **TO BE PERFORMED BY A CERTIFICATED MECHANIC**

1. Remove top of cabin assembly crate. Remove wall marked "A" by removing lag bolts painted black. Remove empennage assembly. Remove remaining walls. Remove all parts, except cabin assembly, from crate base. Open main rotor blade and tailcone crate.

2. Reinstall main rotor hub per Section 9.122.

3. Assemble landing gear per Section 5.320.

> NOTE
>
> Do not install strut fairings at this time.

4. Attach a hoist to main rotor hub per Section 1.220. Lift aft end of crate while at same time taking up slack in hoist. When helicopter belly is in a horizontal position, lift with hoist until cabin is supported by hoist alone. Remove lag screws and carriage bolts attaching helicopter cabin to crate. Remove crate.

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

5. Remove supports from landing gear attachment points and install assembled landing gear per Section 5.120 or Section 5 (float landing gear). Install front cross tube cover panel. If desired, install strut fairings per Section 5.420 (not applicable to utility float landing gear).

6. Remove tailcone cowling and install tailcone per Section 4.312. Install strobe light. Install communication, Loran, and GPS antennas (if equipped). Install tailcone cowling.

> **CAUTION**
>
> Make sure all foam packing material is removed from inside of tailcone before installation; damage to tail rotor drive shaft could result.

7. Install empennage assembly per Section 4.322. Install tail rotor guard per Section 4.330.

8. Fill tail rotor gearbox with A257-2 oil to full level.

9. Install tail rotor per Section 9.212. Match color coded markings on blades with pitch links.

10. Install fan and scroll per Section 6.220.

1.700 SPECIAL INSTRUCTIONS FOR REASSEMBLING AND FLIGHT TESTING R44 SERIES HELICOPTERS AFTER CRATING FOR EXPORT (cont'd)

11. Install engine exhaust per Section 6.520.

12. Install main rotor blades per Section 9.112. Match color-coded markings on blades with markings on hub and pitch links.

13. Perform tail rotor drive shaft runout per Section 7.340.

14. Fill main rotor gearbox with A257-2 oil to full level as required.

15. Fuel helicopter and drain a small amount of fuel through gascolator.

16. If ship is equipped with attitude horizon, directional gyro, turn coordinator, and/or vertical card magnetic compass, install as follows:

Attitude Horizon, Direction Gyro, and Turn Coordinator:

Remove warning lights from lower console. Pull out B197 instrument face by removing six (6) securing screws.

NOTE
Place a piece of foam under B197-1 face to prevent scratching lower face.

Install required instrument(s) by securing with hardware provided.

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

Connect existing straight connector(s) to directional gyro and/or turn coordinator. Connect angle connector to attitude horizon, ensuring strain relief points down. Ensure connectors lock in place. Ty-rap excess wiring. Reinstall B197-1 face to console. Reinstall amber FUEL FILTER (IO-540 only), AUX FUEL PUMP (IO-540 only), ALT, & GOV OFF lights and red ENG FIRE & OIL warning lights.

Vertical Card Magnetic Compass:

Remove vertical card compass from foam-protected box. Install a 2-inch length of B158-3 heat-shrink tubing over each compass wiring pin. Locate existing wires from windshield center bow. Connect pins from compass to existing sockets (polarity is not critical), cover connection with heat-shrink, then apply heat. Secure compass in mount with four screws and hide and secure wiring atop compass.

1.700 SPECIAL INSTRUCTIONS FOR REASSEMBLING AND FLIGHT TESTING R44 SERIES HELICOPTERS AFTER CRATING FOR EXPORT (cont'd)

17. Install battery (negative ground system).

18. Remove plastic dehydrator plugs from each cylinder's upper spark plug hole.

19. Lubricate provided upper spark plugs with A257-10 spark plug thread lubricant, install, and torque per Section 1.330.

20. Connect ignition leads to upper spark plugs and install spark plug access covers.

21. Disconnect ignition leads from lower spark plugs and remove lower spark plugs.

22. Place a small container under each cylinder's lower spark plug hole. With ignition switch in the OFF position, rotate engine by hand, several revolutions, to force excess preservation oil from cylinders.

23. Temporarily connect a grounding wire from each magneto's primary lead terminal to airframe ground.

24. Activate starter for no more than 12 seconds or until oil pressure is indicated on gage, whichever comes first. Allow starter to cool for 5 minutes after each activation.

25. After oil pressure is indicated remove temporary grounding wire from each magneto.

26. Lubricate lower spark plug threads with A257-10 spark plug thread lubricant, install, and torque per Section 1.330.

27. Connect ignition leads to lower spark plugs.

28. Install belly, left, right, and aft cowling assemblies.

29 Perform Section 2.205 ground check.

30. Perform Section 2.210 run-up.

1.700 SPECIAL INSTRUCTIONS FOR REASSEMBLING AND FLIGHT TESTING R44 SERIES HELICOPTERS AFTER CRATING FOR EXPORT (cont'd)

NOTE
IO-540 engines should idle at 58-62% rpm with engine warm, clutch engaged.

IO-540 IDLE ADJUSTMENT PROCEDURE

Idle rpm and mixture were set for sea-level standard conditions during factory flight test. If idle and off-idle throttle performance are not satisfactory upon reassembly, adjust as follows:

First set idle rpm to 58-62% rpm with engine warm & clutch engaged. Then, with engine off, 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 to PRIME position). 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 lb/hr recommendation as required for acceptable idle quality and off-idle throttle performance (smooth accelerations and needle splits).

1.700 SPECIAL INSTRUCTIONS FOR REASSEMBLING AND FLIGHT TESTING R44 SERIES HELICOPTERS AFTER CRATING FOR EXPORT (cont'd)

FLIGHT TEST: **TO BE DONE BY A QUALIFIED PILOT AND A CERTIFICATED MECHANIC**

1. Perform preflight inspection per the Pilot's Operating Handbook.
2. Balance fanwheel per Section 6.240.
3. Balance tail rotor per Section 10.240.
4. Perform hover checks per Section 2.220 Step 1. DO NOT proceed into forward flight at this time.
5. Track and balance main rotor per Section 10.200.
6. After completing track and balance, adjust autorotation RPM per Section 10.250. Avoid rotor overspeeds by avoiding higher gross weights and higher altitudes during autorotation checks.
7. While climbing at Maximum Continuous Power (MCP), 60 KIAS, and governor on:
   a. Evaluate roughness and controllability.
   b. Perform 30 degree left yaw to check for adequate directional control.
8. Level flight at 2000 feet density altitude (deviate as required for weather and terrain), MCP, and governor on, evaluate the following:
   a. Longitudinal and lateral cyclic control forces.
   b. Collective control forces.
9. Evaluate roughness at MCP and 130 straight and level flight.
10. Check all instruments, gauges, and avionics for proper operation.
11. During autorotation at 50 KIAS and 90% RPM, perform a 30 degree right yaw to check for adequate directional control.

1.800 REPLACEMENT COMPONENT IDENTIFICATION (DATA) PLATES

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

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CHAPTER 2

INSPECTION

2.000 Introduction

The R44 helicopter must be inspected periodically to verify it is in airworthy condition. Required inspection intervals are maximum 100 hours time-in-service or 12 calendar months (annually), whichever occurs first; the inspection interval may be extended up to 10 hours, without accumulation, if allowed by local regulations. Preventive maintenance is required between scheduled inspections. Fluid leaks, discoloration, dents, scratches, nicks, cracks, galling, chafing, fretting, and corrosion all warrant further investigation. Unairworthy items must be replaced or repaired as allowed by Robinson Helicopter Company. This section contains procedures for performing the required periodic airframe inspections.

2.100 General Procedures

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. Unless otherwise specified, the following general procedures apply to R44 inspection.

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 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 Section 2.501 for bearing inspection and lubrication.

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.

2.120 Push-Pull Tubes, Rod Ends, and Spherical Bearings

2.121 Push-Pull Tubes

1. Nicks, cuts, or scratches in tube not more than 0.010 inch deep and not more than 1/4 of tube circumference may be polished out in lengthwise direction using 320-grit or finer wet-or-dry abrasive paper and 1-inch minimum blend radius. Replace tube if depth exceeds these limits.

2. If tube is dented or flattened more than 5 percent of its diameter, it must be replaced.

2.122 Rod Ends and Spherical Bearings (see Figure 2-1)

1. Maximum axial play: 0.020 inch
   Maximum radial play: 0.010 inch

2. Looseness between bearing outer race and rod end housing is not permitted.

3. Rod ends not riveted in place must block passage of 0.020 inch diameter wire through the witness hole, if provided.

4. Rod end jam nuts and palnuts must be torqued per Section 1.320 and torque striped, per Figure 2-1, at the most visible position for pre-flight inspection. Torque stripe must extend across nuts to both rod end shank and push-pull tube (or pitch link barrel, yoke, support, strut, etc.). Torque stripes are subject to deterioration and must be periodically renewed.

5. Refer to Figure 2-1A. Rod ends must be centered, or positioned, to allow as much push-pull tube or link rotational movement as possible without binding.

CAUTION

Teflon-lined bearings must not be lubricated or solvent-cleaned.

2.122 Rod Ends and Spherical Bearings (cont'd)

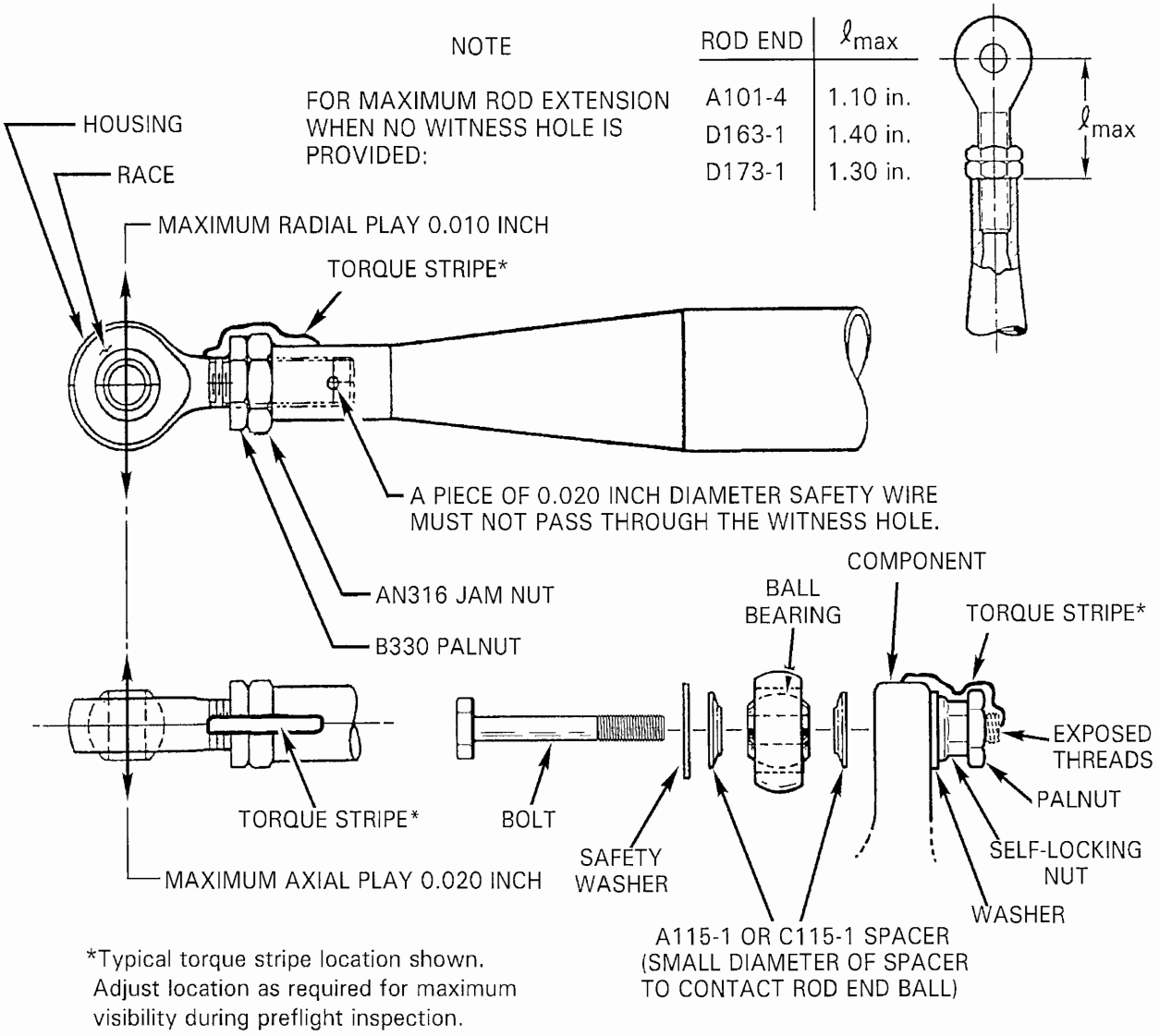
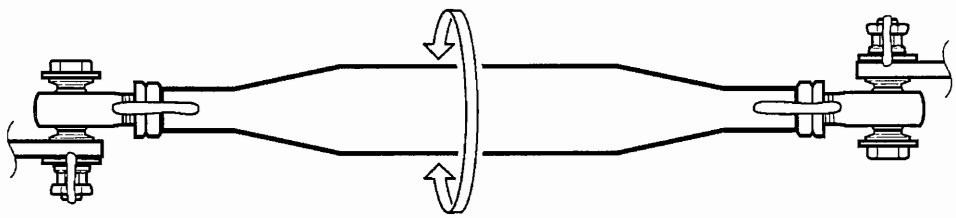


FIGURE 2-1 ROD END AND SPHERICAL BEARING PLAY LIMITS AND TORQUE STRIPE APPLICATION



Position rod ends for maximum rotation

FIGURE 2-1A ROD END CENTERING

2.125 Elastomeric Bearings

Elastomeric bearings are used in the D062-1 tail rotor hub. Fatigue, oil contamination, or overload can degrade the elastomer.

Small surface cracks (fatigue cracks) and elastomer dust or "eraser crumbs" (see Figure 2-2A) are normal and are not causes for replacement. As cracks grow, enough elastomer will be lost to cause reduced stiffness and increased vibration. If deep (greater than 0.10 inch) cracks are present over more than 25% of elastomer face, replace bearing.

Avoid exposure to oil, grease, hydraulic fluid, cleaning solvent, and rust-preventative fluids. Immediately wash off any such contaminants with detergent and water. Contaminated bearings exhibit swelling, wavy edges, or debonding (see Figure 2-2B) and must be replaced.

Overload occurs when elastomer's tensile strength or rubber-to-metal bond strength is exceeded. This can occur when normal loads are applied to a bearing weakened by fatigue or oil contamination. Overload is indicated by large extrusions from and large clean cracks in elastomer as shown in Figure 2-2C.

Elastomer may also separate (debond) from metal bushings. If separation occurs over more than 25% of bonded area, replace bearing.

2.125 Elastomeric Bearings (cont'd)

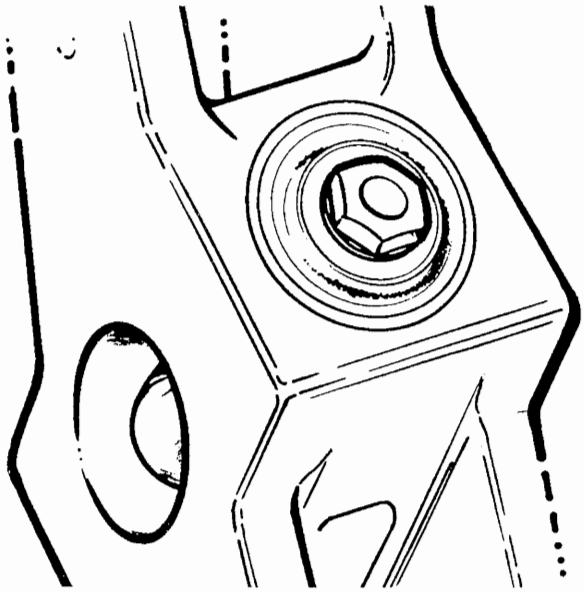


Figure 2-2A - Elastomer Fatigue

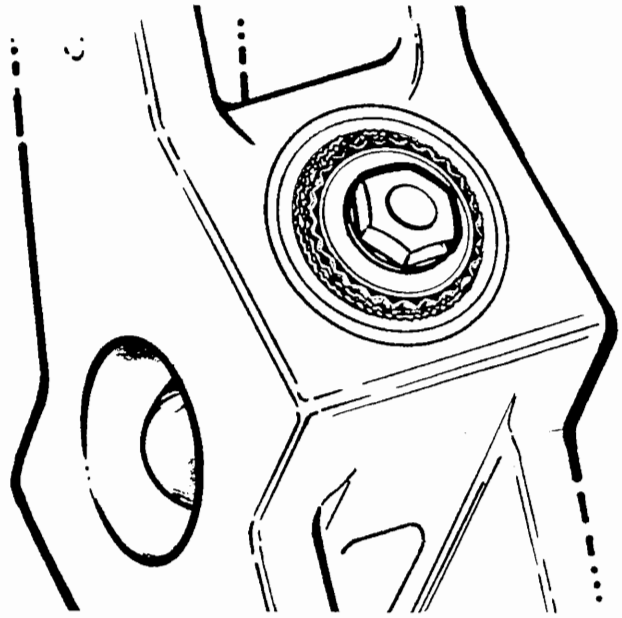


Figure 2-2B - Elastomer Oil Contamination

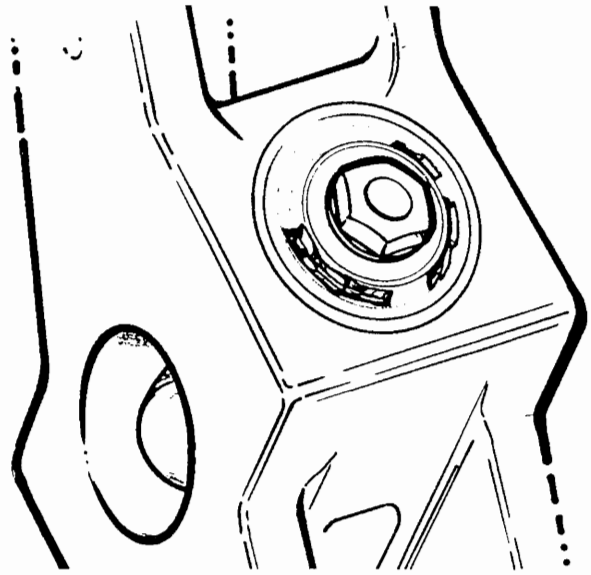


Figure 2-2C - Elastomer Overload

2.130 Telatemp Indicators

Self-adhesive Telatemp indicators record increases in operating temperatures of bearings, gearboxes, etc. To use Telatemp, draw a reference line between the highest temperature square which has darkened during normal operation and the next undarkened square. See Figure 2-3. During every check thereafter, determine if an additional block has blackened. If an indicated temperature increase cannot be accounted for by a change in operating conditions, subject component should be carefully examined before further flight.

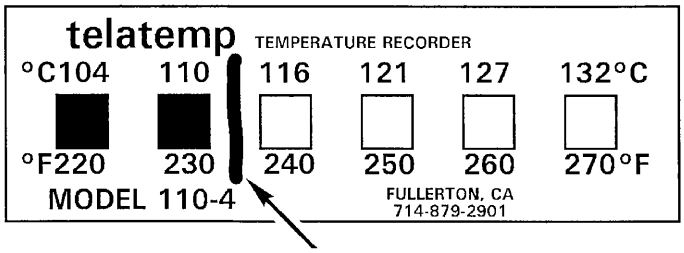


FIGURE 2-3 TELATEMP WITH DRAWN REFERENCE LINE

Telatemp	Component
110-4	Main Rotor Gearbox
110-2 or 110-3	Upper Actuator Bearing (just aft of upper sheave)
110-2	Tail Rotor Gearbox
110-4	Hydraulic Pump (if installed)

Telatemp P/Ns & Temperature Ranges:

110-2	60 degrees C/140 degrees F - 88 degrees C/190 degrees F
110-3	82 degrees C/180 degrees F - 110 degrees C/230 degrees F
110-4	104 degrees C/220 degrees F - 132 degrees C/270 degrees F

2.200 GROUND AND FLIGHT CHECK FOR 100-HOUR/ANNUAL INSPECTION

Complete following checklists in conjunction with a 100-hour or annual inspection. Note and correct any discrepancies.

2.205 Ground Check (Aircraft not running)

1. **Throttle Control**: Check for freedom of rotation with collective full down and full up. _____
2. **Throttle Overtravel Spring**: Check by twisting throttle past idle position to override stop. Release throttle and ensure it returns to normal idle position. _____
3. **Mixture Control**: Check for smoothness of operation with no binding. Check press-to-unlock button for proper function. Verify 0.03 to 0.10 inch spring-back at full rich position. _____
4. **Carburetor Heat Control (O-540 only)**: Check for smoothness of operation with no binding. Verify 0.03 to 0.10 inch spring-back at full off position. _____
5. **Cyclic Control**: With trim motors (if installed) in neutral position, verify freedom thru full travel with friction off. Verify friction knob rotates 1/8-to-1 full turn before adding friction. For hydraulic controls: Verify approximately one-half inch total longitudinal and one inch total lateral freeplay before encountering resistance. Verify normal hydraulic resistance with no binding or abnormal feel throughout control travel. _____
6. **Collective Control**: Verify freedom through full travel with friction off and on. For non-hydraulic aircraft, verify friction knob moves 0.3-0.6 inch before adding friction. For hydraulic controls: Verify approximately one-half inch total freeplay before encountering resistance. With carb heat assist (if installed) locked and friction lever fully off, verify C334 friction (between rear seats) within freeplay range is 4-5 pounds average measured at grip. With friction lever fully on, verify 18-22 pounds measured at grip. Verify normal hydraulic resistance with no binding or abnormal feel throughout control travel. _____
7. **Carb Heat Assist (if installed)**: With collective down and full carb heat, raise collective full up and verify carb heat off. Lower collective full down and verify carb heat full on. With collective friction off, push carb heat off and verify collective stays down. _____
8. **Tail Rotor Pedals**: Check for smooth operation with no binding. _____
9. **Removable Controls**: Verify security of attach fasteners. _____

2.205 Ground Check (cont'd)

10. **Lighting and Instruments**: (Master Switch on)

    a. CARBON MONOXIDE warning light flashes twice (if installed). _____

    b. Carb Air Temp approximately same as Outside Air Temp. _____

    c. ALT warning light on. _____

    d. OIL pressure warning light on. _____

    e. AUX FUEL PUMP warning light on (IO-540 only). _____

    f. Fuel quantity gages - indication of fuel level. _____

    g. Navigation and panel lights - check function. _____

    h. Strobe light - check function. _____

    i. Landing lights - check function (clutch switch must be engaged to check landing lights). _____

    j. Map light - check function. _____

    k. Ammeter - shows discharge. _____

    l. Oil temperature gage - slight needle deflection with engine cold. _____

    m. Cylinder head temp gage - slight needle deflection with engine cold. _____

    n. MR TEMP light - on when sender shorted or test switch depressed. _____

    o. MR CHIP light - on when sender shorted or test switch depressed. _____

    p. ENGINE FIRE light – on when sender shorted or test switch depressed. _____

    q. TR CHIP light - on when sender shorted or test switch depressed. _____

    r. LOW FUEL light - on (slight delay is normal) when low fuel sender in tank is depressed with clean, non-sparking rod or when test switch depressed. _____

    s. FUEL FILTER light – on when test switch depressed (IO-540 only).

11. Verify aircraft checklist laminated card is current revision (refer to Section 1.002). _____

2.210 Run Up

1. Perform POH Section 4 "Preflight" checklist. _____
2. Perform "Before Starting Engine" checklist. _____
3. IO-540 engine: Verify AUX FUEL PUMP light extinguishes during prime and illuminates after priming. Verify fuel drains from sniffle valve. _____

> NOTE
>
> Significant prime may be required before fuel drains from sniffle valve. Wait for valve to stop draining before starting engine. Engine will be hard starting/flooded while valve is draining.

4. Perform "Starting Engine and Run-Up" checklist. If less than 15 minutes has elapsed since Step 3, use minimum or no prime. _____
5. Check clutch engagement time – maximum 70 seconds. _____
6. Ammeter indicates charge, ALT light off. _____
7. Both magnetos ground (off momentarily) at 60% RPM. _____
8. Tachometer operates with alternator and battery switches off. _____
9. No unusual bearing noise when varying RPM through operating range (mechanic to listen near V-belt drive). Refer to Section 2.110 and 2.501 thru 2.503. _____
10. Set RPM at 75%, governor on. Increase to 85%, release throttle, and verify governor increases RPM to 101 to 102%. Increase RPM to 104%, release throttle, and verify governor decreases RPM to 101 to 102%. _____
11. Engine and rotor tach needles within 1% of each other at 102% RPM. _____
12. Verify alternator voltage as follows: _____

    13.4 to 13.9 vdc for A942-3 alternator control unit

    27.75 to 29.25 vdc for A942-4 alternator control unit

13. Heater operates properly. _____
14. Tachometer needles do not jump more than 2% when transmitting on 118.00, 125.00 , and 136.975 MHz with governor on. _____
15. Raise collective control 0.5 inch at grip and slowly decrease RPM. Verify low-rotor-RPM warning horn and light activate at 97% to 96% RPM and remain on as RPM is decreased to idle. _____

2.210 Run Up (cont'd)

16. Idle RPM with engine warm, clutch engaged, throttle closed-

    O-540 engine: 53% - 57% _____

    IO-540 engine: 58% - 62% _____

17. Idle mixture with engine warm, clutch engaged, throttle closed. _____

    O-540 engine: 2% to 4% RPM rise as mixture is pulled slowly to idle cut-off. Adjust idle mixture screw as required. If unable to obtain rise, set idle mixture screw 1½ turns out from fully in then adjust as required for smooth idle. _____

    IO-540 engine: Adjust idle mixture per Section 6.495, Step 23. _____

18. Check hydraulic system (if installed) operation. Using cyclic- mounted hydraulics switch, turn hydraulics OFF. Using small longitudinal cyclic inputs, there should be approximately one-half inch of freeplay before encountering stiffness and feedback. Turn hydraulics ON. Controls should be free with no feedback or uncommanded motion ("motoring"). Complete flight check with hydraulics on. _____

19. Air Conditioning: Verify system blows cold air on both low and high settings. Verify no EMI/RFI with other instruments and systems. After a flight with air conditioning on, verify water drains from drain tube in ship's belly (may be little or no water in very dry conditions). _____

2.220 Flight Check

1. Hover:

   a. All gages green. _____

   b. Controllability in left and right pedal turns. _____

   c. Cyclic electric trim (or hydraulics) zeros cyclic stick forces. _____

   d. Vibration levels satisfactory. _____

2. Level flight: Typical cruise altitude (if possible, deviate as required for weather and regulations), maximum continuous power, governor on.

   a. Vibration levels satisfactory. _____

   b. Cyclic electric trim (or hydraulics) zeros cyclic stick forces. _____

   c. Collective trim spring (electric trim system only) zeros collective forces. For hydraulic controls: Verify no feedback and collective is balanced. _____

   d. Fixed collective friction adequate to prevent "bounce" but not excessive (electric trim system only). _____

   e. Tail rotor pedal position when yaw string is centered: 0.25 to 0.75 inch right for adjustable pedals, within 0.25 inch of neutral for non-adjustable pedals. _____

   f. Tail rotor elastic trim cord zeros pedal forces (cord applies left pedal force). _____

   g. For hydraulic controls: Turn hydraulics OFF and verify no excessive feedback forces. _____

3. Autorotate at 100 KIAS with station 99 or greater CG. Verify electric trim (or hydraulics) zeros cyclic stick forces. _____

2.230 Shutdown

1. Verify rotor brake functions and ROTOR BRAKE light illuminates. _____

2. Complete shutdown per POH checklist. _____

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2.300 AIRFRAME PREPARATION FOR 100HR/ANNUAL INSPECTION

Thoroughly clean airframe prior to inspection. Wipe down main and tail rotor blades, hubs, and airframe exterior with a mild soap and water solution.

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 100HR/ANNUAL AIRFRAME INSPECTION

NOTE

Numbers in parentheses indicate location as illustrated in Figures 2-4 and 2-4A.

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 inspection per Section 2.410.

2.410 Inspection Procedures and Checklist

R44 Serial No.: _____ Technician name: _____

Registration No.: _____ Technician

Hourmeter Indication: _____ Certificate number: _____

Aircraft Total Time: _____

1. Tail Rotor Pedal Bearing Blocks

NOTE

Do not remove pedal bearing block cover plates (1) unless function check of pedals indicates possible problem with pedal bearing blocks.

To remove cover plates (1) peel back carpeting and remove screws holding plates. Use an inspection light and mirror to inspect bearing blocks. Inspect for condition and looseness or play. Maximum allowable play is 0.080 inch axially and 0.030 inch radially. Inspect all weld areas in pedal controls. _____

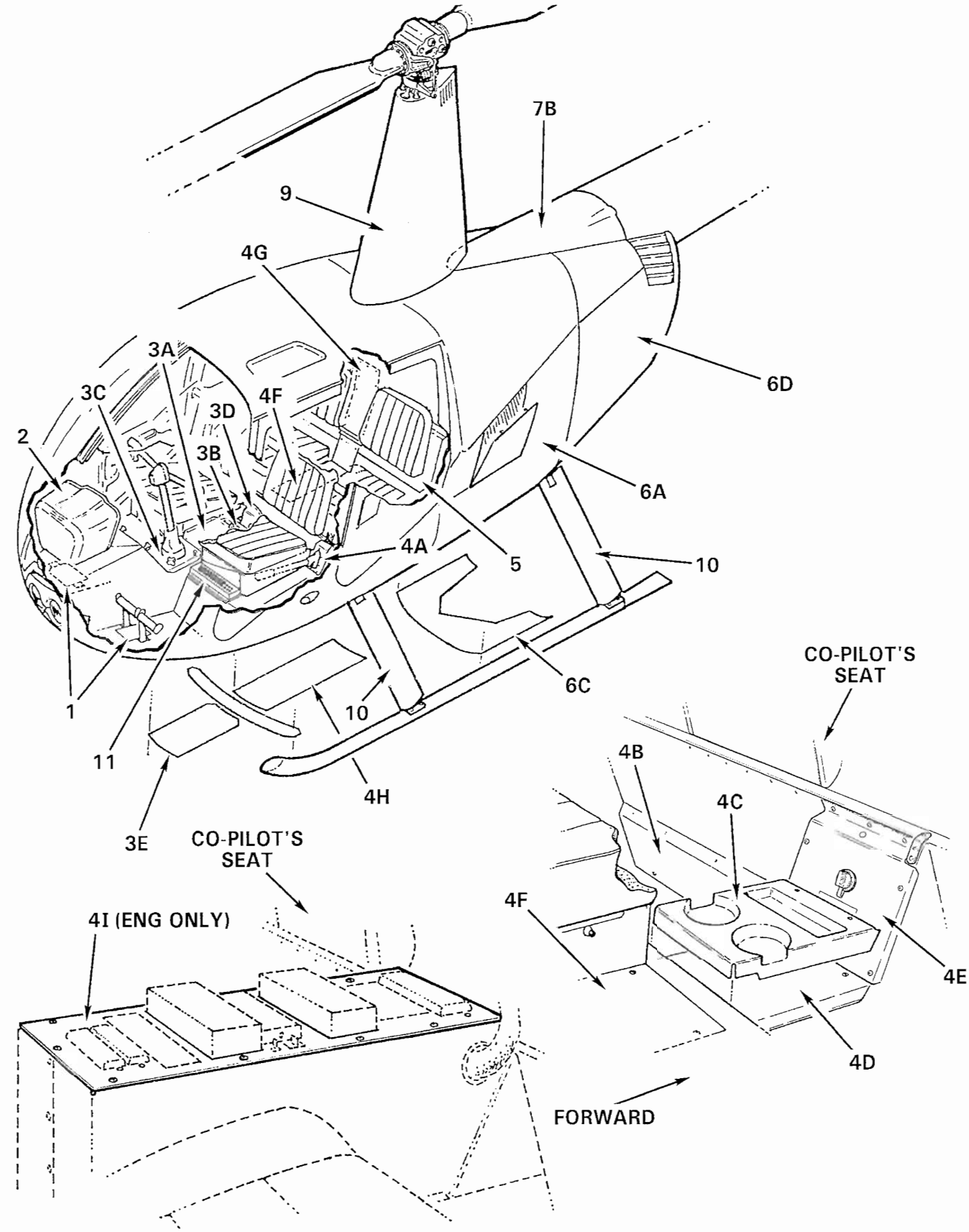


FIGURE 2-4 ACCESS AND INSPECTION PANELS

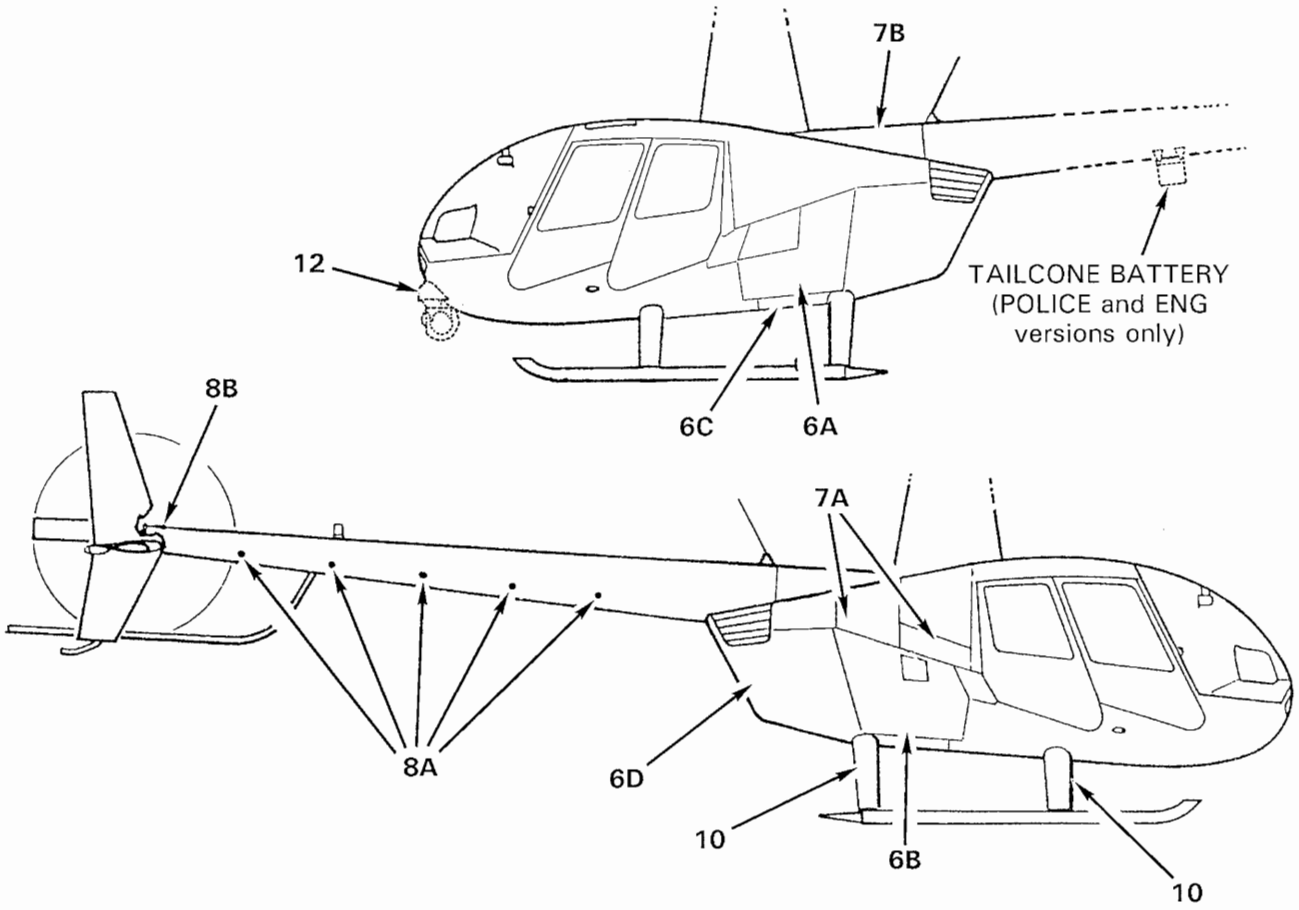


FIGURE 2-4A ACCESS AND INSPECTION PANELS

NUMBER	PART NUMBER	DESCRIPTION
1	B189-4	Deflector (LH)
	A412-2 and B189-2	Cover and Deflector (RH)
2	B050	Console Assy
3A	C445-1	Cover Assy
3B	C445-3	Cover
3C	C444-1	Cover
3D	C398-1	Cover Assy
3E	C794-1	Panel
4A	C680-1	Cover Assy
4B	C461-1	Cover
4C	C464-1	Tray
4D	C463-1	Cover
4E	C054-1	Cover Assy
4F	C474-2	Cover
4G	C474-1	Cover
4H	C794-2	Panel (without scoop)
	C794-3	Panel Assy (with scoop)
4H	C794-2	Panel (without scoop)
	C794-3	Panel Assy (with scoop)
4I	D383-1	Face (ENG only)
5	C003-10	Seat Back Assy (RH)
	C003-11	Seat Back Assy (LH)
6A	C337-1	Cowling Assy (LH)
6B	C378-1	Cowling Assy (RH)
6C	D041-1	Cowling Assy - Belly
6D	D040-1	Aft Cowling Assy
7A	D042-4	Door Assy
	D042-4	Door Assy
7B	C706-1	Tailcone Cowling Assy
8A	A231-1	Plug Assy
8B	A558-2	Cover
9	C261-1	Mast Fairing Assy
10	C082-2	Fairing Assy (FWD, RH)
	C082-3	Fairing Assy (FWD, LH)
	C082-4	Fairing Assy (AFT, RH)
	C082-5	Fairing Assy (AFT, RH)
11	C045	Circuit Breaker Panel
12 (Police ships)	D412-1 or D347-1	Fairing (Inframetrics Camera) / Fairing (FSI Camera)

2.410 Inspection Procedures and Checklist (cont'd)

2. Upper Console (2)

Console (2), is opened by removing one screw on each side. With console open, inspect the following:

Pitot-Static System: Check pitot and static lines for cracking, chafing, pinching or kinking. Check all connections for security. _____

Flight and Engine Gages: Check all gauges for security. Inspect wiring and connections on all gages. _____

Radio Tray(s): Check condition and security. _____

Tail Rotor Controls: Check accessible portions of TR pedal assemblies for defects. Verify operating clearance. _____

3. Remove Forward Tunnel Covers (3A & 3B), Cyclic Stop Cover (3C), Inboard Collective Cover (3D), and Forward Belly Panel (3E) _____

> NOTE
>
> If radio antennas are installed on removed panels, disconnect antenna lead and any ground wire. Pull respective radio circuit breaker and tag circuit breaker with "Antenna Removed".

Cyclic Box Assembly: Inspect cyclic box assembly for defects. Check cyclic stop sheet metal assembly for cracks and other defects (deterioration, distortion, loose rivets, corrosion). _____

Cyclic Stick Assembly: Inspect cyclic stick assembly for defects. Inspect welds for cracks. _____

> **CAUTION**
> **(manual controls)**
> Do not disturb clear silicone coating protecting strain gages, or attached wiring. Any damage to strain gages or wiring will disable trim system.

Cyclic Trim (manual controls): Turn master and cyclic trim switches on. Move cyclic laterally stop to stop and longitudinally stop to stop and check operation of trim motors. Check trim motors, springs and elastic cords for clearance from all wire bundles and fuselage structure during movement and at travel limits. _____

Cyclic Lateral Trim Actuator (manual controls): Turn master and cyclic trim switches on. Push and hold cyclic stick against right stop until motor stops then turn trim off. Move cyclic stick to left stop to compress spring. Inspect exposed portion of shaft for wear and galling. Do not grease rod on Rev H and subsequent C056-1 spring assemblies, bearing is self-lubricating. Inspect C130-13 urethane spacer (stop). Check security of attachment to cyclic pivot. _____

Cyclic Longitudinal Trim Actuator (manual controls): Inspect C130-13 urethane spacer (stop). Check security of attachment to cyclic stick. _____

2.410 Inspection Procedures and Checklist (continued)

3. Remove Forward Tunnel Covers (3A & 3B), Cyclic Stop Cover (3C), Inboard Collective Cover (3D) and Forward Belly Panel (3E) (continued)

Cyclic Friction: Check for excessive play or looseness in links and rod ends connected to cyclic stick. Verify no excessive flaring at either end of C130-2 spacer. _____

Cyclic Push-Pull Tube and Torque Tube: Inspect C319 torque tube paying special attention to area around blocks and end of torque tube for cracks. Inspect C121-1 push-pull tube rod end palnut and jam nut for tightness. Check witness holes on push-pull tubes. Check rod ends and bearings for excessive play and looseness. Check accessible portions of cyclic push-pull tube and torque tube for defects, including scratches. Pay particular attention to top of torque tube immediately below C348-1 anchor assembly. Inspect all nuts and bolts in cyclic controls for rotation and looseness. _____

Tail Rotor Push-Pull Tube: Inspect accessible portions of C121-9 tail rotor push-pull tube. Look for defects such as cracks, bends, scratches, or chafing. Check rod ends for excessive play and looseness. _____

Collective Friction and Stop: Inspect collective stop condition; no nicks, cuts or scratches are allowed. Check collective friction lever for security and operation. Move collective up and down and verify no bending or binding of stop. Verify collective boot's lace cannot entangle stop. _____

Throttle Overtravel Spring: Inspect operation of overtravel spring while operating throttle. It should move freely without any binding or jerkiness. Check play in upper and lower rod ends. Check rod ends for binding. _____

Wiring Harness: Inspect for chafing and clearance from controls. _____

Pitot and Static Lines: Inspect pitot and static lines for security and any evidence of cracking, chafing, pinching or kinking from sharp bends. Open drains and check for moisture; close drains. _____

Elastic Trim Cord(s): With cyclic forward-right, feel forward elastic trim cord(s) for voids which may indicate broken strands. _____

Heater Hose: Check heater hose for collapsed areas and chafing. _____

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

4. Remove Outboard Collective Cover (4A), Collective Torque Tube Cover (4B), Tray (4C), Mid Tunnel Covers (4D & 4E), Aft Tunnel Covers (4F & 4G), Aft Belly Cover Panel (4H), and Rear Console (4I, ENG ships only)

NOTE
If radio antenna is installed on removed panel, disconnect antenna lead and corresponding ground wire. Pull respective radio circuit breaker and tag circuit breaker with "antenna removed".

2.410 Inspection Procedures and Checklist (continued)

4. Remove Outboard Collective Cover (4A), Collective Torque Tube Cover (4B), Tray (4C), Mid Tunnel Covers (4D & 4E), Aft Tunnel Covers (4F & 4G), Aft Belly Cover Panel (4H), and Rear Console (4I, ENG ships only) (continued)

Collective Stick: Inspect condition of collective stick. Inspect all welds for cracks. Inspect C328-1 connecting rod assembly giving special attention to points of attachment. Inspect governor motor and governor motor arm for looseness or binding. Inspect collective-activated micro switch for cracks or loose wires. _____

Collective Stick Torque Tube: Verify no corrosion pitting. Apply a corrosion-preventative compound such as LPS 2, ACF-50, or Corrosion-X to any unpainted, phosphate-coated area while avoiding contaminating governor friction clutch (a foam-type applicator works well). Ensure interior of open-end "box" structures at inboard attach point and at A205 fork connection are also treated. _____

Aft End of Cyclic Torque Tube and Yoke Assembly: Inspect torque tube and yoke, paying special attention to area around blocks and end of torque tube for cracks. Check play in bellcrank bearings per Section 2.120. Inspect swaged bearing for movement in yoke. _____

Aft End of Cyclic Push-Pull Tube (C121-1) and Lower Ends of Vertical Push-Pull Tubes (C121-7): Inspect push-pull tubes for cracks. Check rod end jam nuts and palnuts for tightness and rod ends for play. Check rod end bearings for looseness. Inspect fork assembly areas. Check bearings for looseness. Check between bearings and swage for evidence of fretting. _____

Aft End of (C121-19) Tail Rotor Push-Pull Tube and Lower Bearing: Check witness hole. Check lower bellcrank bearing for play. Inspect all welds on support assembly for lower bellcrank and inspect surrounding sheet metal area for cracks. _____

Collective Push-Pull Tube (C121-19): Check for binding or nicks. Check witness holes. Check jam nuts and palnut for tightness and rod end for play. _____

Collective Friction Assembly: Check jam nuts and palnuts for tightness and rod ends for play. Inspect all welds on bellcrank support assembly and inspect surrounding sheet metal for cracks and corrosion. _____

Collective Spring Assembly (Manual Controls Only): Move collective up and down and verify no binding or cracking. Spring coils must not touch when collective is full down. Verify jam nut and palnut tightness. Verify rod ends play within limits. Verify guide rods are greased. If required by Section 1.101, service assembly per Section 8.221. _____

Throttle Control Linkage: Remove throttle control arm cover if cover is not transparent (under aft left seat [O-540], or inside tunnel [IO-540], at firewall). Inspect condition. Verify throttle control clearance to installed equipment and adjacent structure. Verify proper installation and security. Install cover. _____

Fuel Valve and Fuel Line: Inspect fuel line for damage and valve fittings for leakage (leakage is indicated by a blue or green residue, depending on fuel used, or odor of fuel). Verify no chafing of fuel lines. _____

Fuel Valve-to-Knob Torque Tube: Inspect condition. Verify attaching security. _____

2.410 Inspection Procedures and Checklist (continued)

5. Remove Aft Seat Back Assemblies (5)

Wiring: Check wiring for security and proper installation. _____

Pitot and Static Lines: Check for security, chafing, and kinks. _____

Air Conditioning Refrigerant Lines (if installed): Verify security & no damage. _____

Evaporator Drain Tubes and Valve (if installed): Verify tubes are unobstructed. Place a container under sediment-tube protruding from bottom of tee-fitting into right-aft baggage compartment. Remove plug from sediment tube and allow any accumulated moisture and debris to drain. Reinstall plug. Simultaneously squeeze drain tube and sediment tube near tee-fitting and verify check-valve ball moves up momentarily. _____

Strobe Power Supply & Alternator Control Unit: Inspect strobe power supply and alternator control unit wiring. Inspect mounting panels for cracks. _____

Blind Encoder & Governor Controller: Inspect blind encoder and governor controller wiring. Inspect mounting panels for cracks. _____

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

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

Vertical Firewall: Inspect vertical firewall condition, especially around structural attachment points, verify no cracks, buckling or wrinkles. _____

Fuse(s) and Fuse Holder(s) (if installed on vertical firewall): Verify security and no corrosion. Verify correct fuses: -66 wire requires AGC-3 fuse, -1601/-1602 wires require AGC-5 fuse. If installed, -1226 wire requires AGC-3 fuse. _____

Wiring: Verify security, proper installation, and no deterioration. _____

Electric Fuel Pump (IO-540 only): Verify security, proper installation, unobstructed drain tube, and no leakage. _____

Fuel Line & Hose(s): Inspect condition. Verify security, proper installation, no leakage, & (IO-540 only) good condition of spirap insulation on fuel line between firewall & gascolator. If deteriorated, replace MS3367-5-9 ty-raps securing fuel hoses to clamps (reference R44 SB-67). _____

Lower Steel Tube Frames: Thoroughly inspect lower steel tube structure for corrosion and inspect all welds for cracks. Ensure frames are not chafed by wires, hoses, clamps, etc. _____

Engine Cooling Panels: Inspect cooling panels for cracks and missing fasteners. _____

Oil Cooler(s): Inspect oil cooler(s) and fittings for damage, leaks, cleanliness, and security. Check oil cooler mounting area(s) for cracks. _____

2.410 Inspection Procedures and Checklist (continued)

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

Oil Lines: Inspect entire length of all oil lines and verify no cracks, abrasion, or broken clamps. Verify clearance; wires, ty-raps, and structure must not contact lines. _____

Gascolator: With fuel valve off, remove and clean gascolator bowl and filter screen. Verify no deterioration of gasket. If gascolator bowl is secured by threaded collar and ring, lightly lube threads and ring with A257-6 grease. Reassemble and turn fuel valve on. Safety wire after ensuring no leaks occur. Verify drain valve is secure and torque-striped. _____

Mixture Control: Verify mixture control moves mixture control arm stop to stop. Inspect condition and verify security of mixture control cable clamps on bracket; push and pull cable housing to ensure it does not slip in clamps. Inspect condition and verify security of mixture control cable inner wire attachment to mixture control arm. Ensure freedom of rotation between mixture control arm and inner wire retention fitting (bolt) when arm moves. Verify mixture control safety spring is properly installed (so spring force holds mixture control arm at full-rich position if inner wire breaks). _____

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

Full-Throttle Switch Rigging: Check per § 14.1020 and adjust as required. _____

Air Box & Alternate Air Door: Ensure carburetor heat slider valve (if applicable) moves fully from stop to stop. Replace air filter (lubricating IO-540 air filter rubber with A257-8 rubber lubricant will facilitate sealing). Check air box for condition and security. Verify spring-loaded alternate air door opens without binding and closes completely. _____

Engine Air Inlet Hose: Verify correct installation & security. Verify no rips, holes, or collapsed areas. Ensure hose is not chafing frame. _____

Carburetor Heat Scoop and Hose (O-540 engines only): Inspect for condition and security. _____

Heater Hose: Inspect for condition and security. _____

Battery and Battery Box (alternate locations under upper console or under left, front seat): Check cable terminals for cracks. Check each cell electrolyte for quantity and specific gravity if equipped with non-sealed battery. As required, perform capacity test per manufacturer's instructions or replace battery. Verify security and no obstructions in drain tube. _____

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. _____

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

2.410 Inspection Procedures and Checklist (cont'd)

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

Forward Flex Plate: Inspect condition, particularly edges. Verify security. Verify bonded washers are securely bonded to both sides of each flex plate arm. Verify operating clearance. _____

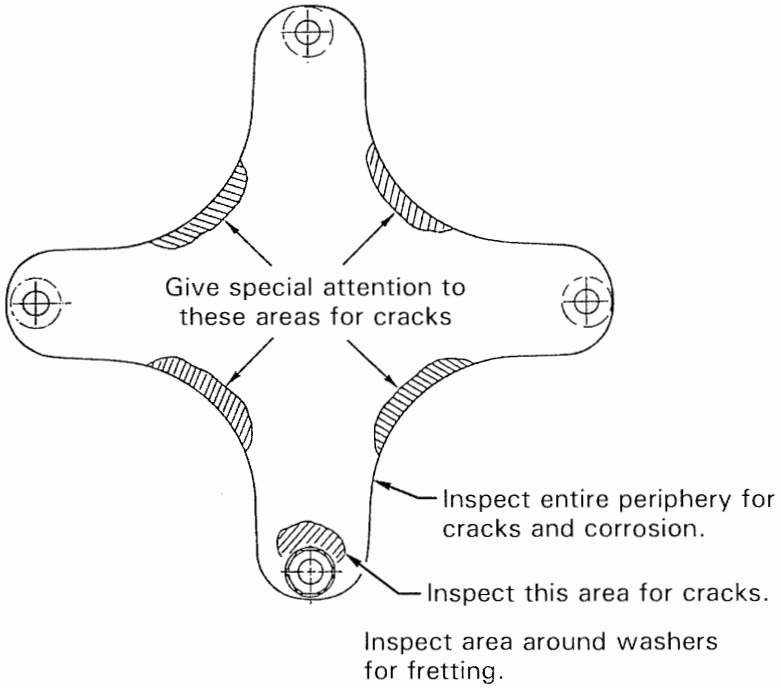


FIGURE 2-5 FLEX PLATE INSPECTION

Clutch Shaft Forward Yoke: Inspect condition. Verify no cracks, corrosion, or fretting. Verify security and operating clearance. _____

Rotor Brake: Inspect condition, including activating cable & pulleys and microswitch. Verify integrity of brake pads and 0.030 inch minimum pad thickness. Verify brake pad clearance to input yoke when brake is off. Verify security and operating clearance. _____

Jackshaft: Inspect entire welded assembly for cracks and corrosion. Inspect jackshaft supporting strut and tube weldments for security, cracks and corrosion. _____

Main Rotor Push-Pull Tubes: Inspect condition of viewable portions. Verify no cracks at ends. Inspect rod ends per Section 2.120. Verify no tears in sleeves (manual controls only). Verify security and operating clearances. _____

Main Rotor Push-Pull Tube Rollers & Bushings: (manual controls only): Inspect condition. Verify cleanliness, no wear into metal, and free movement of rollers. _____

2.410 Inspection Procedures and Checklist (cont'd)

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

Tail Rotor Push-Pull Tube and Upper Bellcrank: Inspect C121-15 push-pull tube, especially at ends, for cracks. Check jam nut for tightness and rod end for looseness. Inspect bellcrank and mounting for cracks or other defects. _____

Main Rotor Gearbox Cooling Hoses: Inspect both ends for security. Inspect for rips, holes, and chafing. _____

Main Rotor Gearbox: Inspect main rotor gearbox, especially around gearbox mounts, cap mounting lugs, and mast tube for cracks. Verify no contamination and no deterioration of rubber mounts. Verify security of Hall Effect senders. Check Telatemp for overtemp indications. _____

Main Rotor Gearbox Oil: With ship on level ground, verify correct oil level and cleanliness using sight gage. If required by Section 1.101, drain and flush gearbox per Section 1.120. _____

Main Rotor Gearbox Chip Detector: If required by Section 1.101, clean chip detector per Section 1.115. _____

Upper Steel Tube Frame: Use an inspection light and mirror to inspect each weld, verify no cracks or corrosion. _____

> **CAUTION**
>
> Upper steel tube frame is fatigue-loaded and therefore susceptible to fatigue cracks. Inspect thoroughly.

Horizontal Firewall: Inspect upper and lower surfaces of horizontal firewall, especially where bolted to steel structure, for cracks, buckling, or wrinkles. Inspect firewall under fuel tank for leakage (fuel residue). _____

Fuel Tanks: Inspect condition of visible portion. Verify no leaks. Verify security. _____

Auxiliary Fuel Tank Fuel Line: Inspect condition. Verify clearance to structure. Verify no leakage. Verify security. _____

Fuel Return Lines & Pressure Relief Valve (IO-540 only): Inspect condition. Verify no leakage. Verify security. _____

Fuel Gage Senders & Wiring: Inspect condition. Verify no leaks. _____

Fuel Tank Vents: Check vent tube connections for security. _____

Fuel Tank Sump Drains: Verify both drain valves open easily, drain fuel freely, spring closed, and seal completely. Verify D663-1 shut-off clamp on aux tank drain tube seals completely, and inspect clamp and tube for damage and deterioration. _____

Low Fuel Warning: Turn MASTER switch on. With a clean wooden dowel, gently depress low-fuel sender float in main fuel tank and verify LOW FUEL warning light illuminates. Turn MASTER switch off. _____

2.410 Inspection Procedures and Checklist (cont'd)

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

Fuel Caps: Inspect condition, to include gasket. Verify security when closed. Verify alignment marks on cap and tank align when cap is fully closed. _____

Nuts and Bolts: Inspect all nuts and bolts in this area for movement and looseness. _____

Cabin Bulkhead & Forward Hydraulic Servo Mounts: Inspect bulkhead and servo mounts (if installed) for corrosion, loose rivets, deformation and cracks. _____

Clutch Assembly: Inspect ends of drive shaft and seals on sheave for oil leakage. Inspect shaft for corrosion, especially at shaft-to-seal junctures. Remove any light surface corrosion at shaft-to-seal junctures, and apply a suitable corrosion-inhibitor. _____

Upper Sheave: Inspect sheave grooves. Replace any sheave showing corrosion pitting or flaking of metalized or anodized coatings, wear through anodized coatings, roughness, or sharp ridges. _____

Drive V-Belts (see Section 2.507): Inspect V-belts. Verify no breakage, deterioration of rubber, cuts, fraying, oil, grease, or foreign objects. _____

Actuator Fuses & Holders: Inspect condition. Verify no corrosion. Verify correct fuses (14-volt systems require AGC-3 fuses while 28-volt systems require AGC-1½ fuses). Verify twist-to-lock function and security. _____

Actuator Upper Bearing and Strut: Inspect seals on both sides of bearing for damage. Inspect strut, including both rod ends, and check witness holes. Check for fretting between bearing inner races and clutch shaft. Bearing inner races should be torque striped to clutch shaft. If stripes are broken or misaligned, shaft is unairworthy. Check bearing Telatemp. Perform bearing inspection per Section 2.503 if Telatemp indication has increased without corresponding increase in ambient temperature. _____

Actuator Lower Bearing: Inspect as much of bearing as can be seen. Inspect fiberglass scroll area at bearing attachment brackets for signs of cracking. Check bearing seals for evidence of deterioration. Inspect lower bearing brackets for looseness or wear. Inspect bearing per Section 2.502 if discrepancies are found _____

Intermediate Flex Plate and Forward End of Tail Rotor Drive Shaft (see Figure 2-5): Inspect flex plate for cracks and fretting. Inspect yoke-to-drive shaft weld for cracks (steel shafts). _____

Tailcone Attachment: Thoroughly inspect all welds in this area for cracks, corrosion, and security of attaching fasteners. Inspect tailcone mounting area for cracks. _____

2.410 Inspection Procedures and Checklist (cont'd)

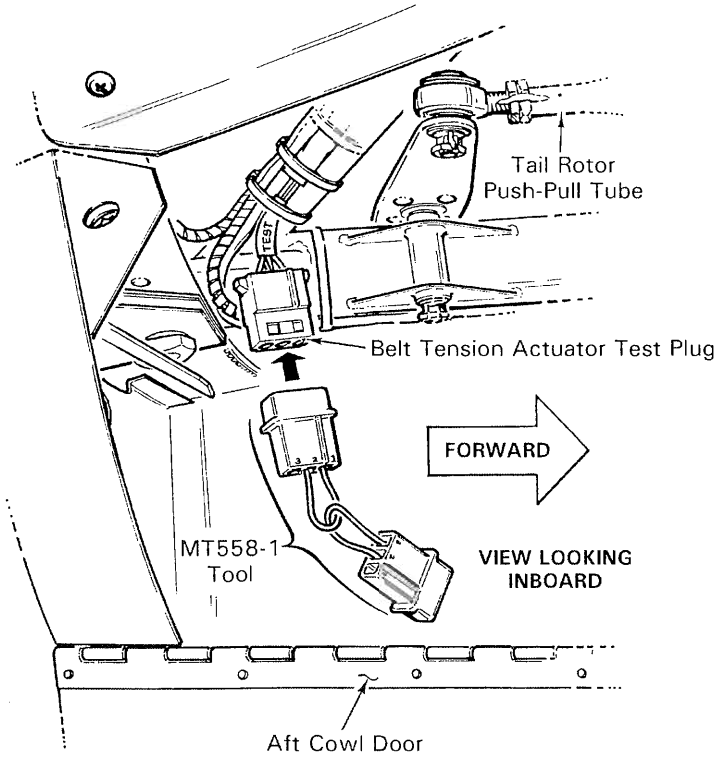
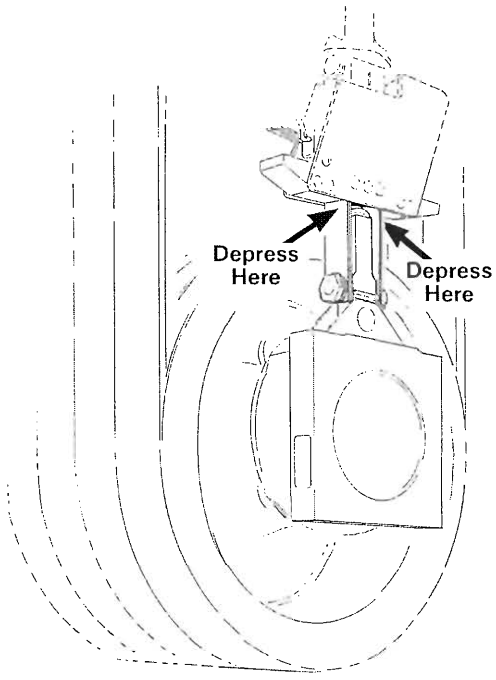


FIGURE 2-6 MT558-1 TOOL INSTALLATION



(Cooling fan and scroll not shown)

FIGURE 2-6A ACTUATOR SWITCH TEST

2.410 Inspection Procedures and Checklist (cont'd)

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

Actuator (C051): 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 (see 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 using either of the following two methods: _____

Method 1 - (actuator electrical harness must be equipped with "Test" plug per Figure 2-6)

a. With MASTER 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 MASTER 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 Section 7.551 before further flight. _____

Method 2 - (actuator electrical harness without "Test" plug)

a. Refer to Figure 2-6A. With MASTER switch on and actuator fully engaged, depress column springs on one side of actuator until springs snap inward (use large screwdriver or similar tool with several layers to tape over end to protect actuator). Hold springs inward for at least one second. Actuator motor should not run. If motor starts, allow motor to run approximately two seconds, then release pressure on column springs. Depress and hold column springs again. If motor starts again, opposite spring switch does not function properly. _____

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

c. Replace any non-functioning switch per Section 7.551 before further flight. _____

2.410 Inspection Procedures and Checklist (cont'd)

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

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 Section 7.230. Adjust as required. _____

Hydraulic Reservoir: Inspect condition. Verify security and no significant leakage. If required by Section 1.101, replace filter per Section 1.170. Drain and flush hydraulic system per Section 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. _____

Forward Hydraulic Servos: Inspect condition. Inspect rod ends per Section 2.120. Verify security and no significant leakage. Verify servo input rod end/clevis area is clean; cleanse area with no-residue, non-alcoholic solvent as required. Verify approximately 0.040 inch total freeplay at servo valve input. 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. _____

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

Aft Hydraulic Servo: Inspect condition. Inspect rod ends per Section 2.120. Verify security and no significant leakage.. Verify servo input rod end/clevis area is clean; cleanse area with no-residue, non-alcoholic solvent as required. Verify approximately 0.040 inch total freeplay at servo valve input. Verify valve clearance to surrounding structure while flight controls are moved through full range of travel. _____

Aft Hydraulic Servo: Inspect rod ends per Section 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 Criteria (cont'd)

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: Inspect condition of that section of shaft that can be seen through each hole, looking for obvious defects such as cracks, bends, bows in shaft or corrosion or contact with inside of tailcone. Check runout per Section 7.340. Inspect each end of drive shaft for cracks and corrosion. _____

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

Damper: Inspect tail rotor drive shaft damper (C041-1). Inspect bearing and housing for cracks, corrosion, wear (see Figure 2-8), and bearing seal deterioration. Inspect arms and bearings for cleanliness, cracks, bends and corrosion. Inspect bearing's inner race-to-drive shaft torque stripe. _____

Tailcone Exterior: Inspect tailcone exterior for nicks, scratches, corrosion, fretting between skin joints, loose rivets and dents. Inspect tailcone for cracks in vicinity of antenna mounts and battery (if installed on tailcone). _____

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 all antennas for condition and security. _____

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

Tailcone Interior: Inspect tailcone interior, especially around rivets, for cracks, fretting, and corrosion. _____

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

Empennage: Inspect entire empennage and attachment points for damage, cracks, and loose fasteners. Check tail skid for evidence of tail strike. If evidence of tail strike is found, refer to special inspection section. _____

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

Aft Flex Plate (See Figure 2-5): Inspect flex plate for cracks, fretting, and distortion. If fretting is detected, contact RHC Technical Support. Inspect security of flex plate fasteners. _____

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

Tail Rotor Guard: Inspect for security. Check forward mount for cracks around welded area. Inspect area around aft mount for cracking and fretting. _____

2.410 Inspection Criteria (cont'd)

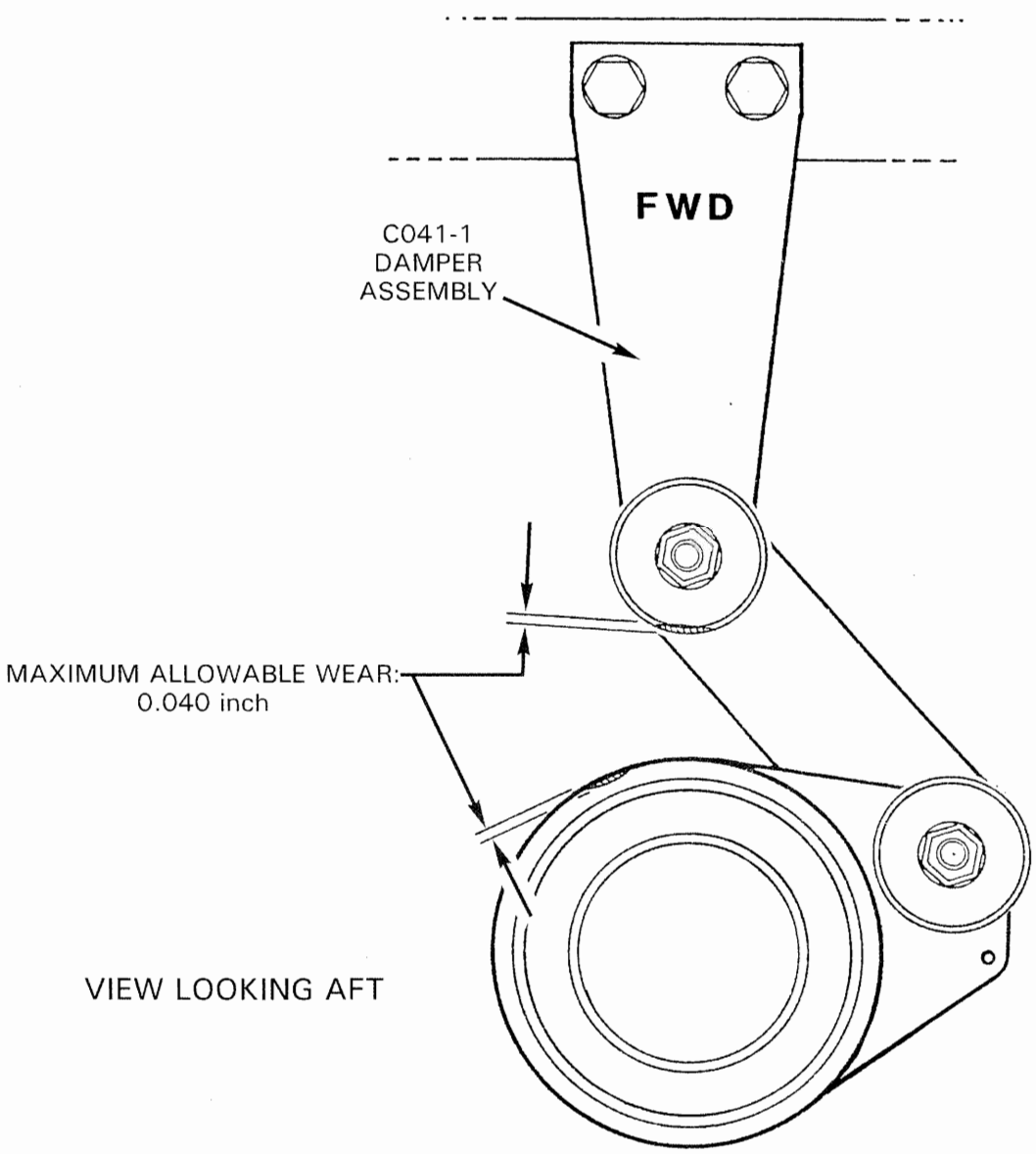


FIGURE 2-8 TAIL ROTOR DRIVE SHAFT DAMPER BEARING INSPECTION

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. _____

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 Section 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. _____

Tail Rotor Blades: Inspect blade surfaces for excessive erosion, nicks, scratches, cracks, and corrosion. Check tail rotor blade root fitting bearings for fretting and looseness. Loose bearing outer race in root fitting is unairworthy, requiring replacement of blade. C029-1 blades only: remove tip covers, inspect for debris and corrosion, & reinstall covers. C029-1 or C029-2 blades only: Inspect tail rotor blades for fatigue cracks per R44 SB-83. Refinish blades per Section 9.460 if excessive erosion is found. _____

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 Section 2.125. _____

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)

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 Section 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 Section 2.120. Verify security. _____

Swashplate Upper Scissors: Inspect condition. Inspect rod ends and spherical bearings per Section 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. _____

Swashplate Slider Tube: Inspect condition. Verify no cracks at rivet holes or corrosion on base. Verify no damage to, or wear through, anodized tube surface. _____

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

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

Swashplate Tilting Friction: Observe swashplate ball from below and have someone move collective stick slowly up & down. Verify swashplate ball immediately moves with swashplate when swashplate reverses direction. Movement of swashplate without attendant ball movement indicates axial play between ball and swashplate; adjust swashplate tilting friction per Section 8.413. _____

2.410 Inspection Procedures and Checklist (continued)

11. Rotor Hub Area (continued)

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

Hub: Inspect condition. Verify no nicks, scratches, gouges, or corrosion. If main rotor imbalance is suspected, check teeter and coning hinge friction per Section 9.124. Verify no brown or black residue (indicates bearing wear). _____

Hinge Bolts: Inspect condition. Verify cotter pins are in place and secure. Verify bolt heads and nuts are torque striped to thrust washers. _____

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

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

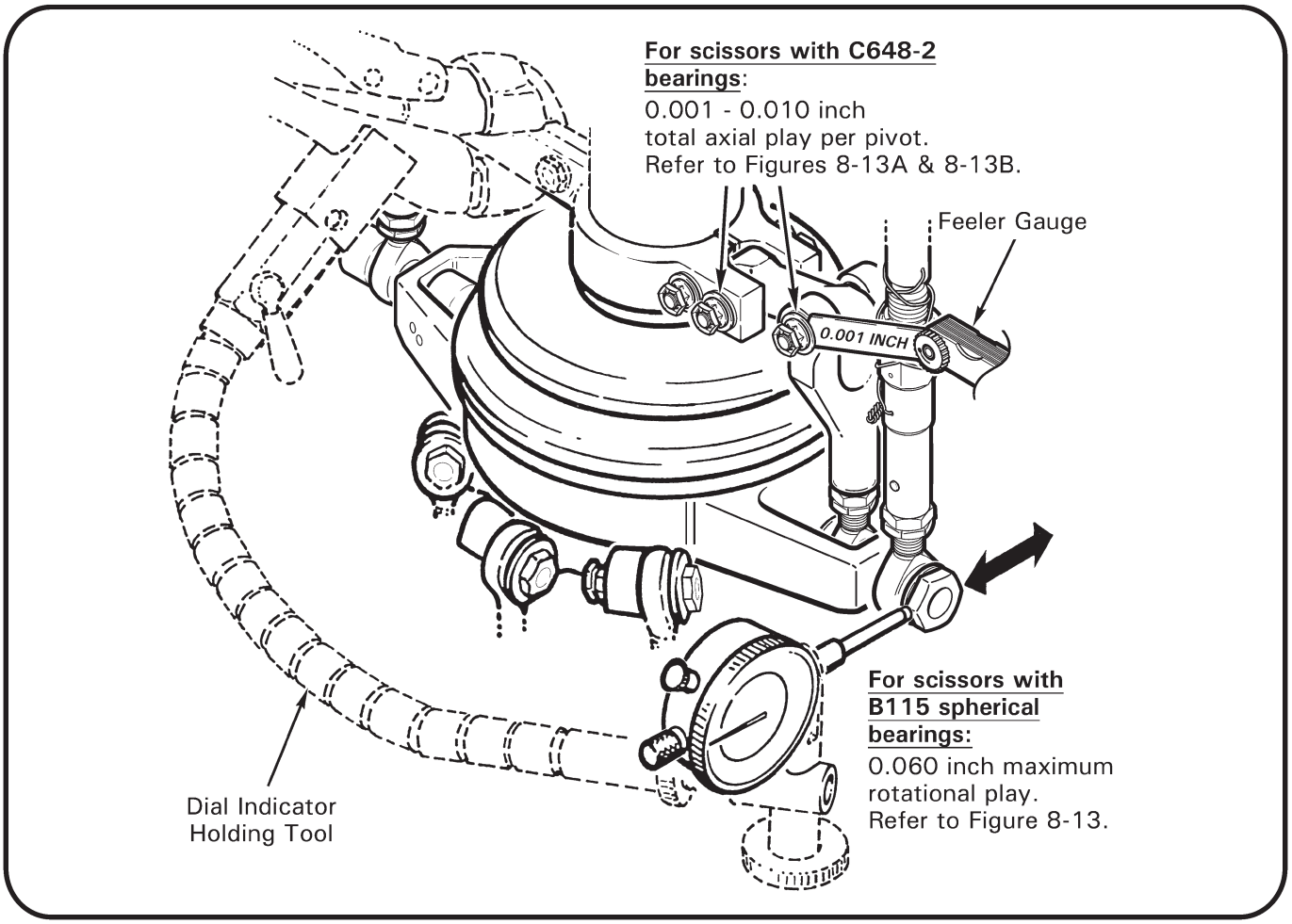


FIGURE 2-9 MEASURING UPPER SWASHPLATE ROTATIONAL PLAY
(Identify scissors bearing type and measure as shown)

2.410 Inspection Procedures and Checklist (continued)

12. Main Rotor Blades

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

Blade Spindles & Root Fittings: Inspect area for damage per § 9.133. Verify proper installation and security of visible fasteners. Renew deteriorated torque stripes per Figure 2-1. _____

C016-7 Main Rotor Blade Inspection: Remove tip covers. Remove corrosion and loose paint from tip covers, blade tips, and skin-to-spar bond lines. Epoxy prime, or prime and paint, any exposed bare metal on tip covers, blade tips, and skin-to-spar bond lines. Using an AN970-4 washer or 1965-or-later U.S. quarter-dollar coin, tap-test critical bond areas and verify no dull or hollow sounds. Visually inspect critical bond areas and verify no separation. Install tip covers, ensuring cover edges are flush with blade profile. _____

C016-2 or C016-5 Main Rotor Blade Bond Inspection: Perform R44 SB-72A or subsequent. _____

Main Rotor Blade Inspection: Inspect skins and doublers for scratches and corrosion per § 9.131. Inspect blades for dents and local deformations per § 9.132 and for voids per § 9.134. As required, wax blades with soft cleaning cloths using carnauba-type wax (such as SC Johnson® Paste Wax). Ensure tip cover and blade tip drain holes are unobstructed. _____

WARNING

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

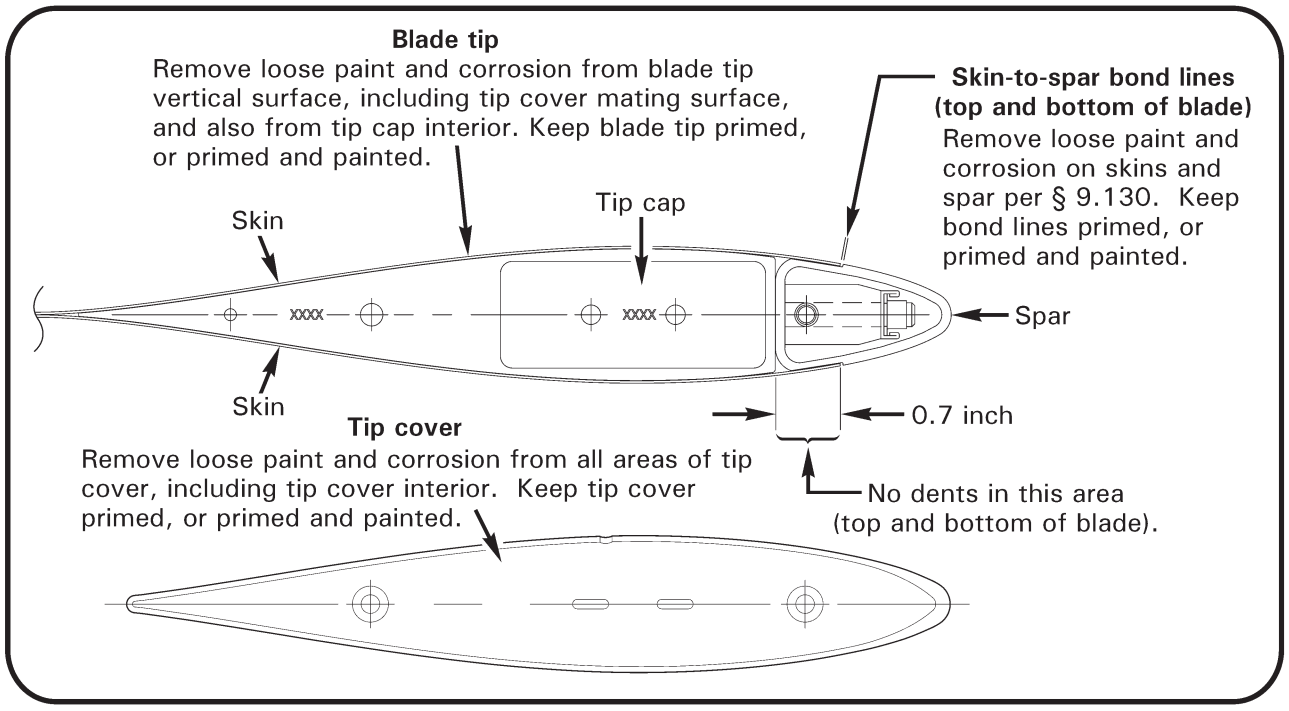


FIGURE 2-10 MAIN ROTOR BLADE TIP AND TIP COVER

2.410 Inspection Criteria (cont'd)

12. **Main Rotor Blades** (Refer to Section 9.130 for damage and repair limits) (cont'd)

Install tip covers: Verify security. _____

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

13. **Scroll Area**

Fanwheel Assembly: Clean and inspect fanwheel assembly for cracks and corrosion. Check leading edge of vanes for damage. Verify spring pin and fanwheel alignment marks are aligned (see Figure 2-11); remove fanwheel and inspect mating surfaces for damage if misalignment is evident. _____

Fiberglass Scroll: Inspect fiberglass scroll for cracks and contact marks from fanwheel. Inspect flexible seal around scroll inlet for any rips or damage. Inspect vane assembly in right upper scroll for damage. Verify drain hole is unobstructed. _____

Scroll Metal Inlet Lips &Gap: Verify 0.030 / 0.090 inch gap between lips and fanwheel inlet (elongate lip attach holes as required to adjust gap). _____

14. **Engine**

Refer to Section 1.101. Refer to Lycoming Operator's Manual (P/N 60297-10 sections 4 and 5), Lycoming SI 1080B, and applicable engine component manufacturer's maintenance publications for 100-hour or annual inspection and service procedure. _____

Engine Cooling Panels: Inspect condition. Pay particular attention to panel(s) mounting oil cooler(s) and panel attached to alternator cooling hose. Verify no cracks or missing or loose fasteners. Verify security. _____

Alternator & Pulley: Inspect condition. Verify steel pulley (use magnet); aluminum pulley is not approved. Verify security. Verify electrical wiring security. _____

Alternator Belt: Inspect condition. Replace belt if there are any cracks, missing teeth, or delamination. Check tension per Lycoming Service Instruction 1129 (latest revision). Verify proper belt alignment. _____

Emergency Spare Alternator Belt: Remove if installed. _____

Alternator Cooling Hose: Inspect condition. Verify no obstructions or holes. Verify security. _____

Air Conditioning Refrigerant Lines (if installed): Verify security, no damage, and clearance to adjacent structure. Verify dust caps installed on servicing fittings at vertical firewall. _____

Air Conditioning Compressor (if installed): Verify security. _____

Air Conditioning Compressor Drive Belt (if installed): Inspect condition. Verify 4.5/5.5 pounds force applied at mid-span of belt causes 0.11/0.17 inch belt deflection; adjust as required. _____

Muffler Elbow & Tailpipe Shields: Verify no cracks in shields and shield attaching brackets. Verify clamp security. _____

2.410 Inspection Criteria (cont'd)

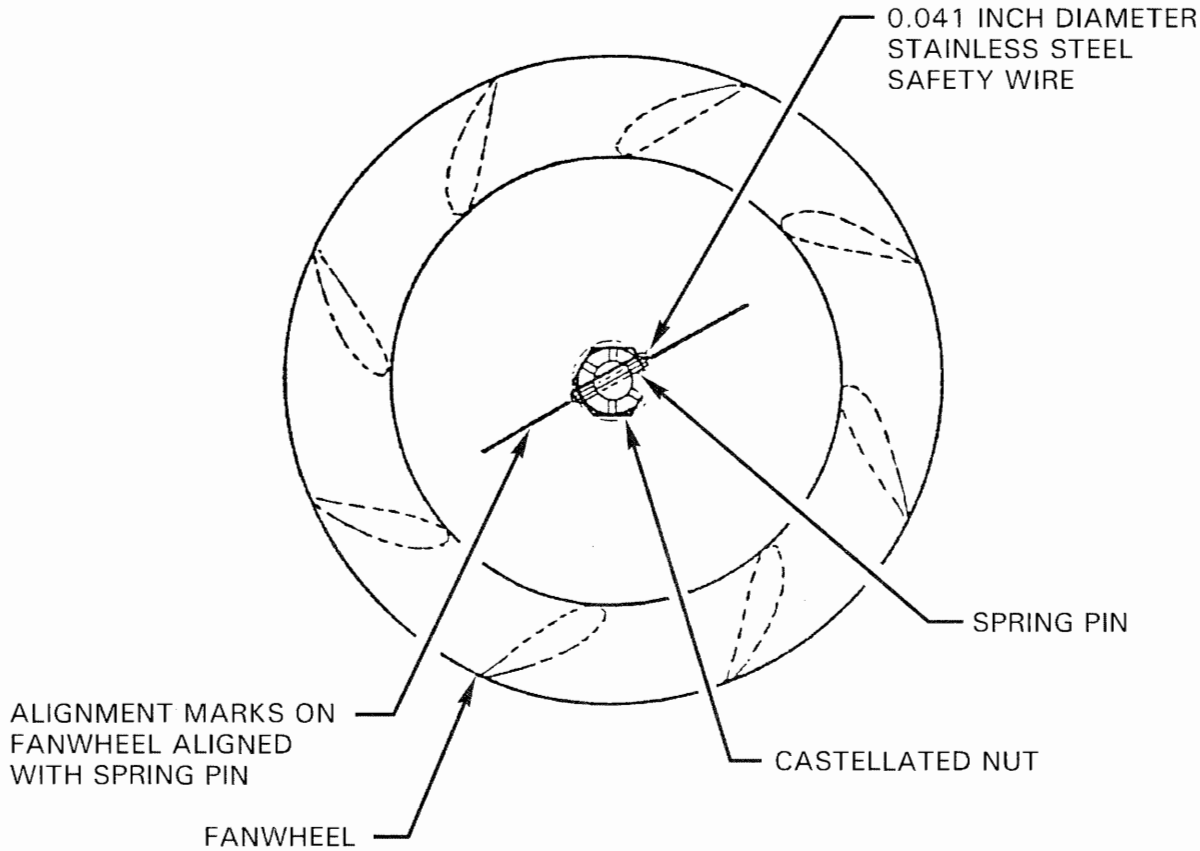


FIGURE 2-11 FANWHEEL ALIGNMENT MARKS

2.410 Inspection Procedures and Checklist (cont'd)

15. Exhaust System

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 Section 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 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 Section 1.470) to float cover snap mating surfaces. Annually perform Section 5.630 leak check. Every three years, perform Section 5.640 emergency inflation test.

2.410 Inspection Procedures and Checklist (cont'd)

17. Cabin

Verify no loose equipment that might foul controls. _____

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

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.

Trim Controller (Manual flight controls only) : Adjust trim controller per Section 14.710. _____

Windows: Minor damage that does not impair pilot's visibility or indicate impending structural failure is acceptable. For cracks and crazing adjacent to windshield retainer strips, refer to Section 2.580. _____

Acceptable damage includes:

a. One nick, not more than 0.010 inch deep and occupying an area not larger than 0.25 by 0.50 inch per square foot. _____

b. Scratches not more than 0.010 inch deep and 5 inches long. _____

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

d. Minor polarization faults in small areas of windshield near edges. _____

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

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. _____

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. _____

2.410 Inspection Procedures and Checklist (continued)

18. Special Equipment (if installed)

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). _____

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, Component Overhaul and Retirement, ADs, & SBs

Life-Limited Parts: Replace life-limited parts that have reached maximum service life per § 3.300. Verify components installed correspond with helicopter maintenance record and have sufficient time remaining for projected operations. _____

Component Overhaul: Replace components that have reached maximum service before overhaul per § 3.100. Verify components installed correspond with helicopter maintenance record and have sufficient time remaining for projected operations. _____

Component Retirement: Replace components that have reached maximum service life per § 3.100. Verify components installed correspond with helicopter maintenance record and 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. _____

2.410 Inspection Procedures and Checklist (continued)

19. Life-limited Parts, Component Overhaul and Retirement, ADs, & SBs (continued)

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 www.robinsonheli.com, under the Publications tab. _____

20. Required Documents and Placards

Documents: Check that required documents (Airworthiness Certificate, Registration, applicable Radio Station License, 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 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 Airbox Sealed: Ensure air box cover perimeter is sealed with aluminum tape (Clipper I models only). _____

22. Maintenance Records

Maintenance Records: Verify maintenance records are accurate, legible, and complete. Enter maintenance performed (such as part replacement, equipment adjustments, servicing, and lubrication) and inspection data. Data must include a description of (or reference to data acceptable to the Administrator) the work performed, date, helicopter total time in service, signature, certificate type and certificate number of person approving aircraft for return to service. _____

Inspection Procedures and Checklist completed:

Mechanic's signature: _____ Date: _____

2.500 SPECIAL INSPECTIONS

2.501 Upper and Lower Clutch Actuator Bearings Inspection

The actuator upper bearing is located on the clutch shaft, and the actuator lower bearing is located on the fanshaft. Failure of either actuator bearing in flight could cause loss of power to rotor system and result in a serious accident. Refer to Section 2.110 for general indications of bearing failure. In addition, just before failure of an actuator bearing, the clutch light may flicker (on and off in less than one second) constantly or illuminate for longer than normal in-flight retensioning time of up to 8 seconds, then off). Flight should not be resumed until cause of abnormal clutch light illumination has been determined.

Perform the following bearing inspections whenever an actuator bearing discrepancy is suspected or fanwheel is removed:

2.502 C181 Lower Bearing Inspection

1. Remove scroll and fanwheel per Section 6.210.

2. Support clutch drive shaft aft of sheave. Disconnect lower end of belt tension actuator from bearing housing.

3. Rotate bearing housing with finger tips. Verify no roughness, scraping or excessive looseness (0.010 inch maximum axial play). Verify no seal damage and no heat damage. Lubricate bearing per Section 1.140.

4. Carefully inspect inner race bearings on fanshaft. Forward bearing inner race is torque-striped to fanshaft two places 180 degrees apart; cracked or broken torque stripes indicate movement. No movement or fretting is allowed between inner race and fanshaft. Verify no distortion due to bearing outer races rotating in housing. Replace fanshaft & bearing assembly if indications of movement are noted.

5. Reinstall fanwheel per Section 6.220.

6. Check and adjust fanwheel dynamic balance per Section 6.240.

2.503 C184 Upper Bearing Inspection

1. Disconnect lateral centering strut from left side of bearing housing.

2. Disconnect bearing housing from actuator. Run actuator to its full disengage position by adjusting actuator down-limit screw upward. Refer to Figure 7-15. Do not allow upper and lower scissors' attaching screw heads to contact each other.

3. Rotate bearing housing and check for sound or feel of any roughness, scraping, or excessive looseness. Verify no seal damage, loss of lubricant or heat damage.

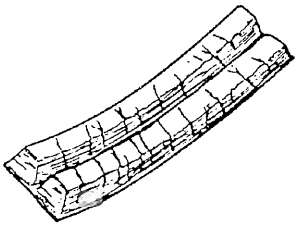
4. Carefully inspect inner races of bearings on clutch shaft. Aft bearing inner race is torque-striped to clutch shaft two places 180 degrees apart; cracked or broken torque stripes indicate movement. Verify no fretting between bearing inner races and shaft. Verify no distortion due to bearing outer race(s) rotating in bearing housing. Remove bearings and inspect bearing and shaft if indications of movement are noted.

5. Connect centering strut and actuator to bearing housing. Adjust actuator down-limit stop screw so there is a delay of less than 5 seconds between clutch engagement and rotor turning during start-up.

2.507 V-Belt Inspection

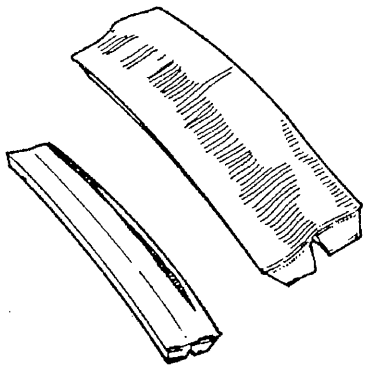
If any of the following conditions are observed, replace V-Belts in a matched set per Section 7.280.

1. Bottom of belts cracking.



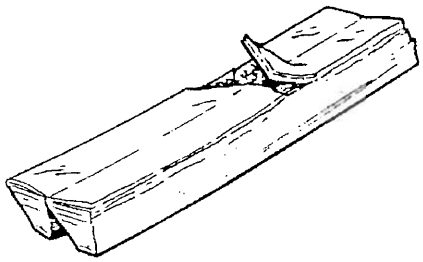
CAUSE	REMEDY
Belt slipping causing heat build-up and gradual hardening of undercord.	Return actuator to RHC for servicing.

2. Top of tie band frayed or damaged.



CAUSE	REMEDY
Surrounding structure interfering with normal operation of belt.	Reposition affected sheave for proper clearance and align sheaves per Section 7.230.
Foreign material contacting belt.	Remove foreign material

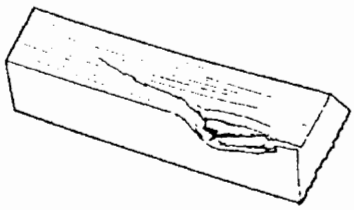
3. Top of tie band blistered or perforated.



CAUSE	REMEDY
Foreign material accumulating between belts.	Check for and remove foreign material.

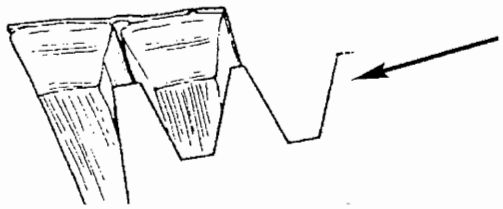
FIGURE 2-12 V-BELT DISCREPANCIES

2.507 V-Belt Inspection (cont'd)



4. BELT CUT ON BOTTOM

Cause	Remedy
Belt ran over sheave and came off, or belt forced over sheave flange during installation without proper slack.	Check belt tension per Section 7.283 and upper sheave alignment per Section 7.230.
Foreign material fell into belt drive making belt come off.	Remove foreign material if any. Install new belts properly per Section 7.280



5. BELT RIDING OUTSIDE SHEAVE GROOVE

V-belt has jumped one groove forcing belt out of sheave.

CAUTION

If belt condition shown is allowed to run in specified condition, failure would progress as shown below.

Cause	Remedy
One belt separated from tie band	Both belts separated from tie band



Cause	Remedy
Improper belt tension, misalignment of sheaves and/or foreign object struck belt forcing it from it normal path.	Replace V-belts per Section 7.280; align upper sheave per Section 7.230.



FIGURE 2-12A V-BELT DISCREPANCIES

2.508 Lower Sheave V-Belt Wear Pattern Inspection

Observe wear patterns in paint primer in all eight grooves of lower V-belt sheave. Wear patterns on both sides of all eight grooves should appear very similar. Wear patterns which vary in width less than a 3-to-1 ratio groove to groove are acceptable.

If wear pattern is noticeably different from groove to groove, inspect sheave grooves for roughness or excessive wear and replace V-belts per Section 7.280. If wear patterns are all similar and alignment and condition of belts and sheaves are satisfactory, no further action is required.

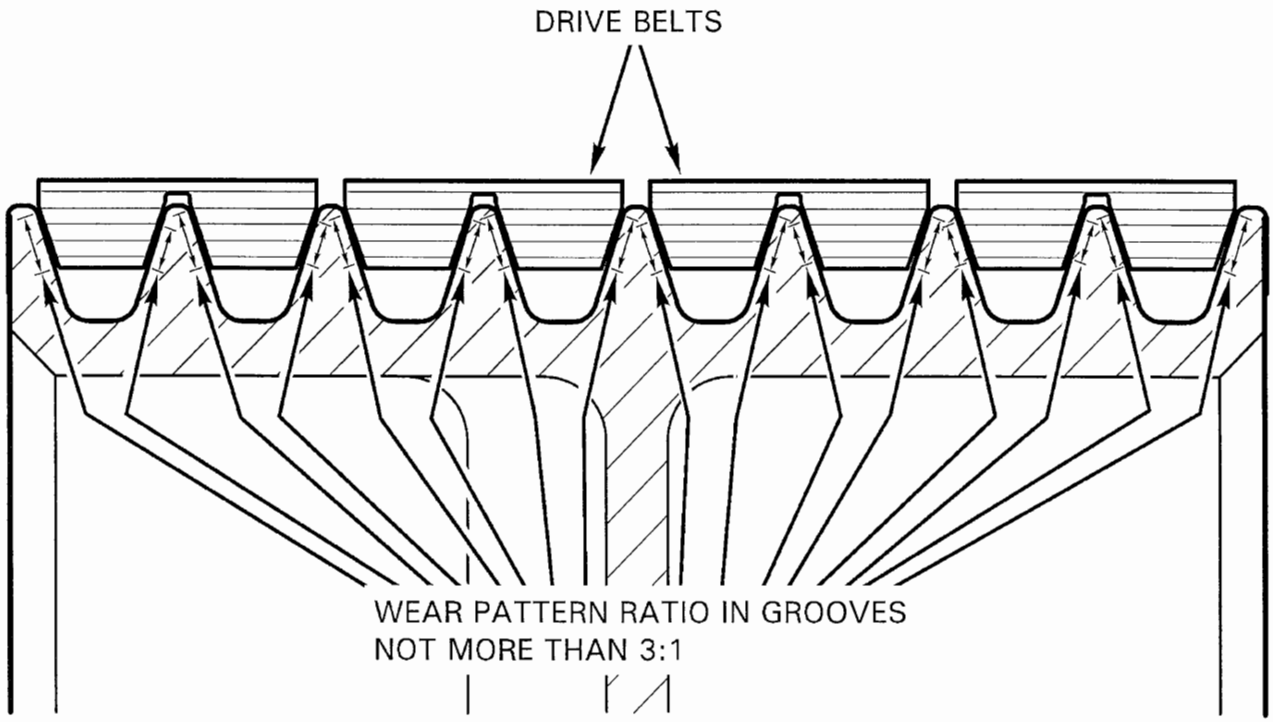


FIGURE 2-13 LOWER SHEAVE V-BELT WEAR PATTERN

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2.510 Tail Skid Strike

The tail skid strike inspection is listed in two parts, A and B. Part A concerns scuffing of tail skid. Part B is concerned with bending or breaking of tail skid and/or buckling of lower vertical stabilizer.

A. If evidence of scuffing is found on the tail skid, inspect the rotorcraft as follows:

1. Visually inspect tail rotor blades for evidence of solid object or ground contact. If tail rotor damage is found, inspect tail rotor per Section 2.520. _____
2. Visually inspect vertical stabilizer for evidence of buckling, cracks or loose rivets at tail skid and lower vertical to horizontal stabilizer attach points. _____
3. Visually inspect tail rotor guard for bending or cracking at attach mounts. _____
4. Visually inspect the horizontal stabilizer to tailcone attach points for evidence of buckling, loose rivets or cracking. _____
5. Visually inspect tailcone for damage and tailcone to upper steel tube structure attach points for buckling and loose attach bolts. _____

B. For skid bending or breakage, or buckling of lower vertical stabilizer, perform the following inspections in addition to those listed in Step A.

1. Inspect tail rotor drive shaft run-out per Section 7.340. _____
2. Remove tailcone and dye check C020 upper steel tube structure at tailcone attach points per Section 2.560. _____
3 Visually inspect tailcone attachment points for elongated holes (0.454 inch-diameter maximum.) _____
4. Remove the stabilizer assembly and dye penetrant inspect the tailcone casting. _____
   a) Remove paint from tailcone casting in areas shown in Figures 2-14 and 2-14A using a suitable paint remover per Section 1.410. _____
   b) Dye penetrant inspect using instructions provided by manufacturer of dye penetrant inspection kit. _____

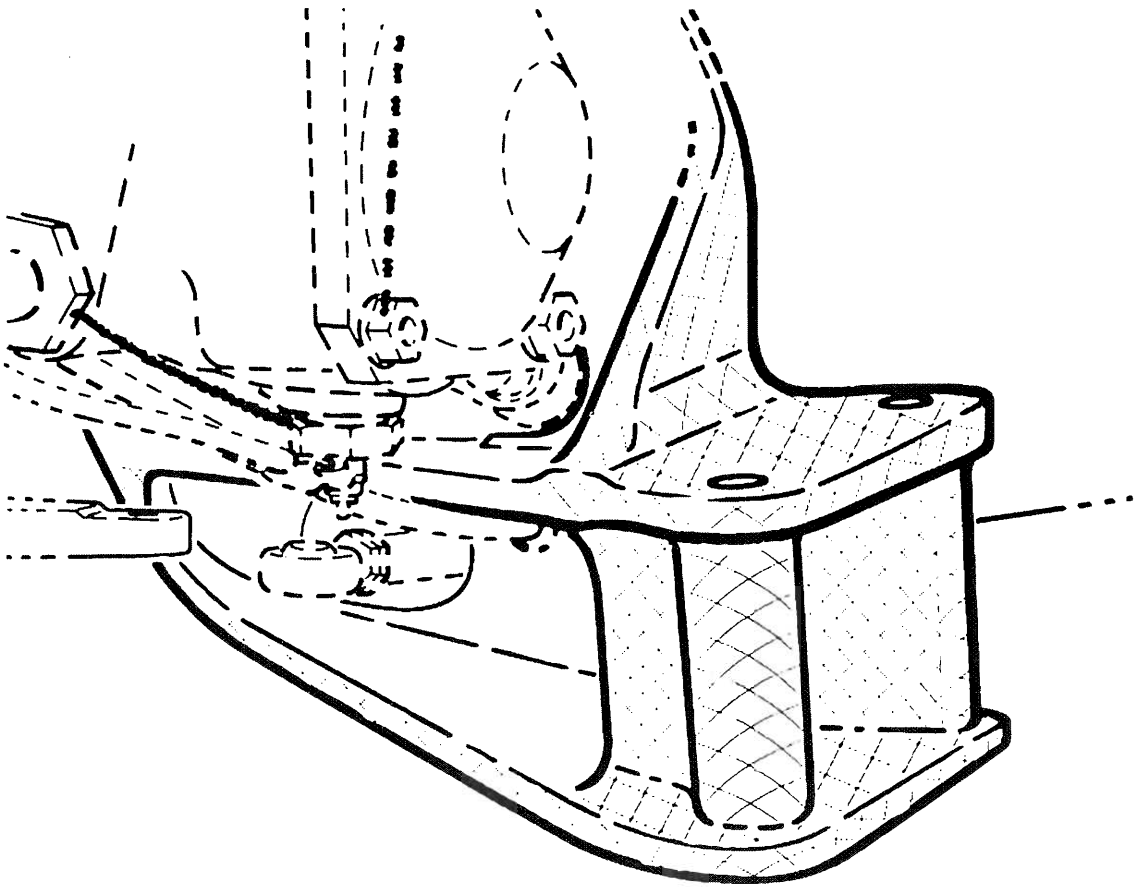


FIGURE 2-14 TAILCONE CASTING TOP AFT VIEW

DYE PENETRANT INSPECT DESIGNATED AREAS AFTER PAINT REMOVAL

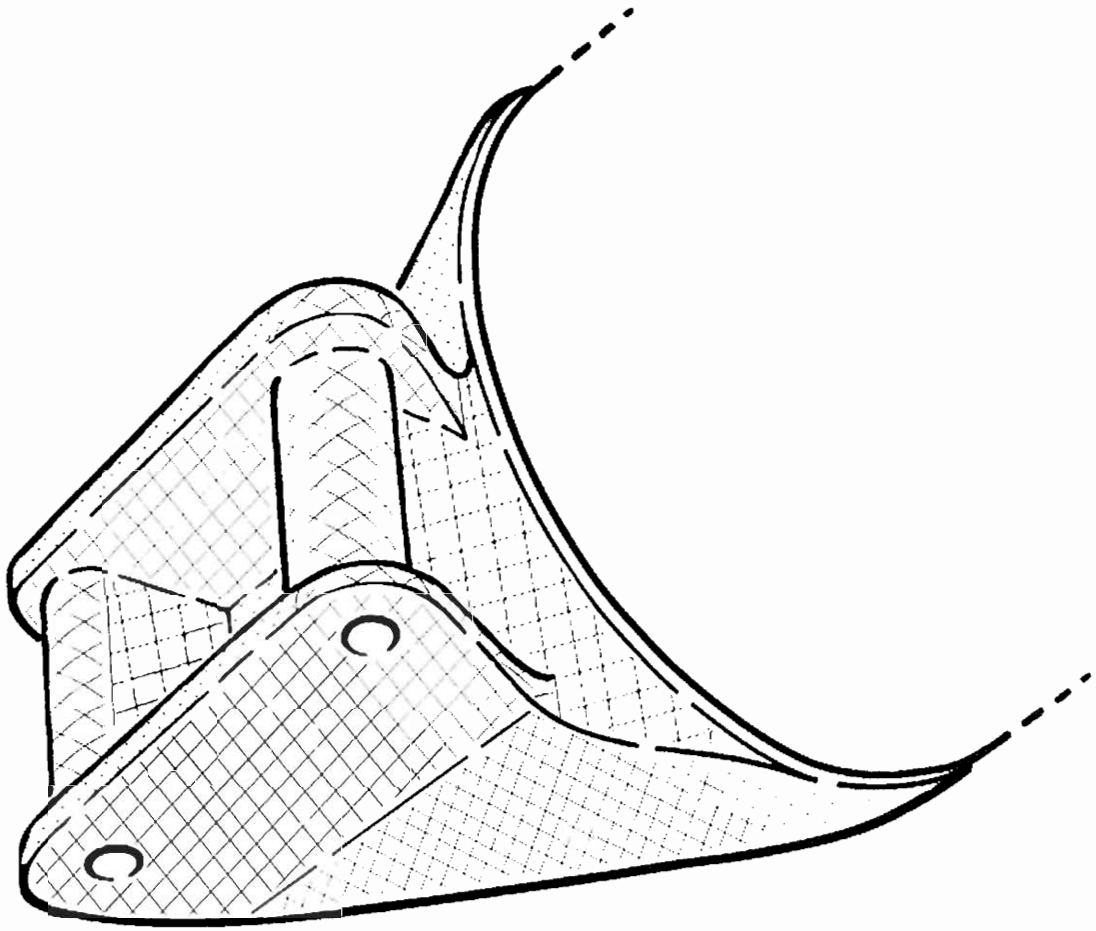


FIGURE 2-14A TAILCONE CASTING BOTTOM FWD VIEW

DYE PENETRANT INSPECT DESIGNATED AREAS AFTER PAINT REMOVAL

2.510 Tail Skid Strike (cont'd)

5. Inspect horizontal stabilizer as follows:
   a) Visually inspect horizontal stabilizer attach points for elongated holes (0.386-inch diameter maximum) loose rivets or buckling. _____
   b) Disassemble lower vertical stabilizer from horizontal and visually inspect attach points on vertical and horizontal stabilizers for elongated holes (0.266-inch diameter maximum), buckling, cracks or loose rivets. Buckling and cracks are cause for replacement of the unit. Loose rivets may be drilled out and replaced. _____
   c Remove tail rotor guard. Remove paint from forward and aft attachment points and dye penetrant inspect using instructions provided by manufacturer of dye penetrant inspection kit. Remove guard mount from tailcone by removing four 10-32 screws and dye penetrant inspect same as above step. _____

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 bending or shearing of a tail rotor blade or blades.

A. Inspect per Section 9.220 and complete part B item 1. _____

B. If one or both tail rotor blades contact ground or a solid object causing bending or shearing of blades a tail rotor sudden stoppage inspection must be performed. Inspect per following procedure:
   1) Check tail rotor drive shaft run-out per Section 7.340. If run-out exceeds 0.025 inch at any location the shaft must be replaced or repaired. Strip paint back at least 2 inches from welds at forward end of drive shaft and dye check per instructions supplied by manufacturer of dye check kit. If any evidence of cracks is found, drive shaft must be replaced. _____
   2) Visually inspect drive shaft for evidence of twisting, nicks, dents or scratches. Nicks and scratches may be polished out to a maximum of 0.003 inches deep. Evidence of twisting or dents is cause for replacement of the drive shaft. _____
   3) Remove yoke (C195-5) located at aft end of tail rotor drive shaft. Inspect holes for any elongation. Strip paint and dye check per instructions supplied by manufacturer of dye check kit. _____
   4) Remove tail rotor and tail rotor gearbox and return them to an RHC approved overhaul facility for overhaul and/or repair. _____
   5) Always replace aft and intermediate flex plates after tail strike. _____
   6) Visually inspect tailcone and empennage for evidence of a tail rotor blade strike. _____
   7) Visually inspect main rotor system. _____

2.530 Main Rotor Strike

The main rotor strike inspection is listed in two parts A and B. Part A concerns contact of main rotor blades with object in free air such as small stones, brush, small birds, etc. Part B is concerned with sudden stoppage of main rotor due to ground or solid object contact.

A. If main rotor blade has contacted a small object in free air such as small stones, brush, small birds, etc the main rotor blades should be inspected as follows:

1. Main rotor blades should be inspected for evidence of nicks, scratches, dents, etc. per Section 9.130. _____
2. Visually inspect trailing edge of blade for evidence of buckling or bending. This will be most evident near root of blade. _____

CAUTION

If evidence of buckling is found on a main rotor blade it will be considered to have sudden stoppage and sudden stoppage inspection must be used to inspect the entire rotorcraft

B. If main rotor blade or blades have contacted ground or a solid object, they must be inspected for sudden stoppage. Sudden stoppage is evident when buckling or bending of the main rotor blades has occurred. Use the following procedure for inspecting rotorcraft after main rotor sudden stoppage has occurred:

1. Check the tail rotor drive shaft run-out Section 7.340. _____
2. Remove the following components and return to a Robinson Helicopter Company approved overhaul facility for inspection and/or repair.

   C005 Main Rotor System _____

   C006 Main Rotor Gearbox _____

   C018 Clutch Assembly _____

   C947-1 Forward Flex Plate _____

   C907 and C908 Yokes _____
3. Inspect engine for sudden stoppage per engine manufacturer's instructions. _____
4. Dye penetrant inspect upper rotating swashplate for cracks and/or deformation. _____

2.540 Rotor/Engine Overspeed

Overspeed inspections are determined by severity of overspeed. Inspection is listed in three parts: A, B, and C. Part A concerns inspection of rotor system due to overspeed between 108% and 114%. Part B is concerned with inspection of rotor system due to overspeeds at or above 114%. Part C is concerned with engine overspeed inspections.

A. For rotor overspeeds between 108 and 114%:

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

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

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

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

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

3. Visually inspect main and tail rotor blades.

4. Check tail rotor drive shaft run-out per Section 7.340.

B. If an overspeed at or above 114% is reported or suspected or if balance changes or pitch bearing roughness is evident, perform following inspections in addition to Part A.

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

1. Perform inspection per Part A.

2. Check coning hinge bolts for evidence of bending. Replace any bent bolts.

3. Coning hinge bolts, washers, and journals must be magnetic particle inspected. Replace any cracked bolts, journals or washers.

2.540 Rotor/Engine Overspeed (cont'd)

4. Visually inspect hub and dye penetrant inspect any areas suspected of having cracks. Dye penetrant inspections are performed using instructions supplied by manufacturer of penetrant kit.

5. Reinstall blades and check balance. If a change in balance is evident, rotor system should be returned to an approved RHC overhaul facility for inspection and/or repair.

C. Determine percent engine overspeed from engine tachometer indication using following formula:

$$\text{Percent engine overspeed} = \frac{\text{Engine tachometer indication x 2665}}{2800} - 100$$

NOTE
102% engine tach indication equals 2718 actual engine RPM. The engine is rated at 2800 RPM.

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

2.550 Hard Landing

The hard landing inspection is listed in two parts: A and B. Part A concerns yielding (bending) of the cross tubes due to hard landing such as hovering autorotations or run-on landings that do not apply side loads to the landing gear. Part B is concerned with hard landings that, in addition to yielding of cross tubes, has yielding of steel tube frames or fuselage primary structure.

NOTE
Side loads show up in the airframe as buckles and bent steel tube structure.

2.550 Hard Landing (cont'd)

A. Yielding of cross tube due to hard landing with no side loads:

1. Check tail rotor drive shaft run-out per Section 7.340.

2. Visually inspect main rotor blades for oil canning of skins and buckling. See Section 9.130 for inspection and repair of main rotor blades.

3. Check landing gear cross tubes for yielding beyond serviceable limit. Place rotorcraft on level ground, and measure from tip of tail skid to ground. If less than 30 inches, one or both cross tubes must be replaced.

4. Check and adjust sheave alignment per Section 7.230

5. Inspect front seat structure for yielding.

6. Inspect aft seat structure for yielding. Open aft seat bottoms and verify no gap around foam spacer at aft end of seat bottom structure.

B. If yielding of steel tube frame(s) OR fuselage has occurred, inspect rotorcraft as follows:

1. Perform Part A inspections.

2. Visually inspect steel tube frames for yielding and cracks. Pay particular attention to aft vertical strut members of lower steel tube structure.

NOTE
No frame yielding is allowed.

3. Visually inspect fuselage, landing gear attach points, and firewalls for buckling or cracks.

NOTE
Vertical firewall attach points for engine mount struts are susceptible to cracks due to hard landings.

4. Dye check upper steel tube structure and all welded joints.

5. Visually inspect tailcone for buckling or loose rivets.

6. Visually inspect landing gear skid tube-to-strut attach points for bending and cracks.

7. Hard landings can be accompanied by tail skid strikes, tail rotor strikes, main rotor blade strikes, etc. To inspect for these conditions, refer to the appropriate portion of Section 2.500. Minor sheet metal repairs to cabin are permitted. Any cracks, yielding or buckling in steel tube structure or tailcone are cause for replacement. Major defects may be factory-repaired by replacement of parts and assemblies.

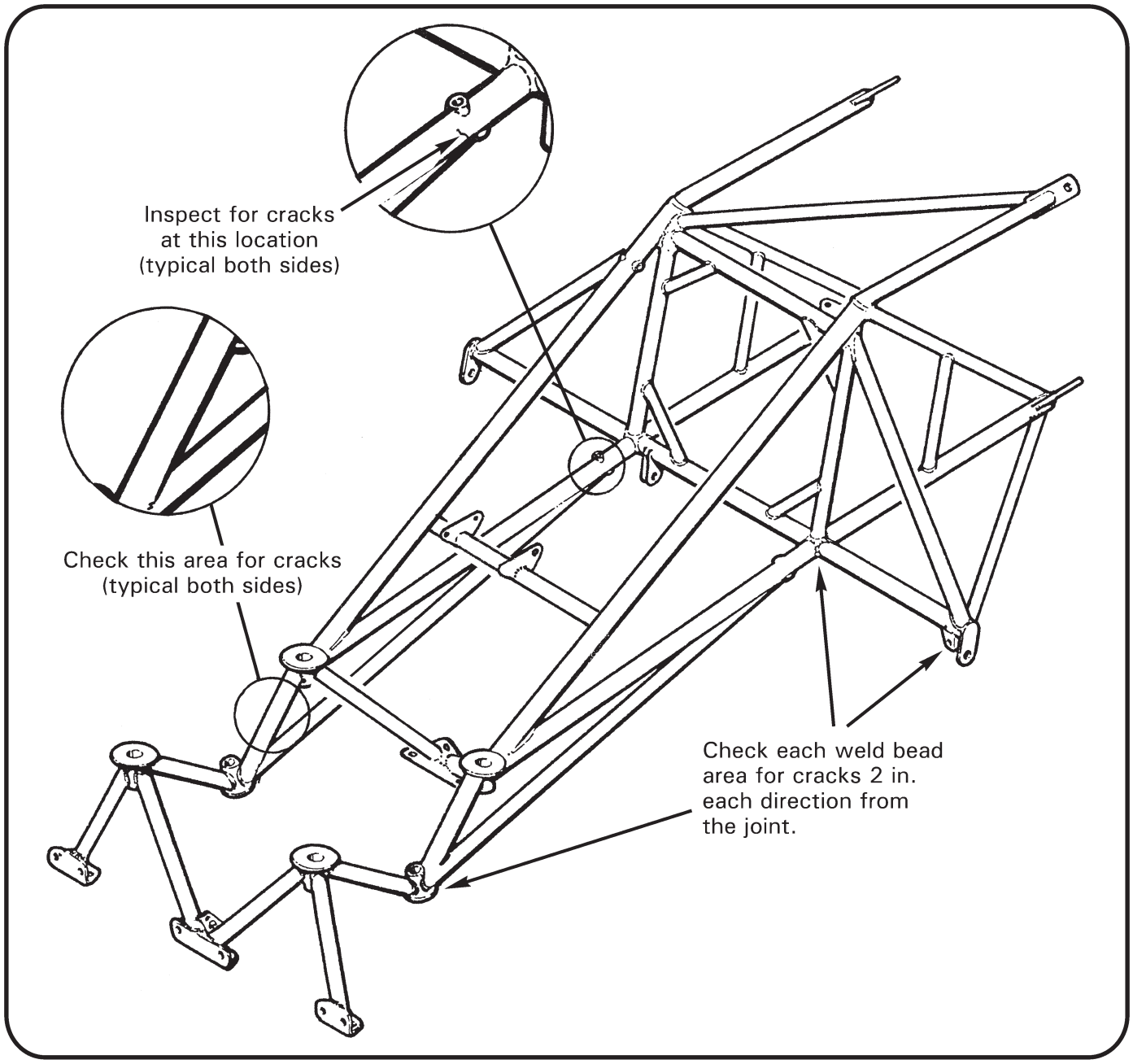


FIGURE 2-15 UPPER FRAME INSPECTION

2.560 Penetrant Inspection of C020 Upper Steel Tube Frame

1. Carefully clean all paint, primer, oil, grease, etc. from steel tube structure around and adjacent to four tailcone mounts (see Figure 2-15).

2. Apply epoxy paint remover and allow the softening action to complete (temperature affects time required).

3. Remove softened paint by hand using a wire brush. Be sure steel structure is perfectly clean before application of dye penetrant.

2.560 Penetrant Inspection of C020 Upper Steel Tube Frame (continued)

4. Carefully check for cracks in and around each weld bead and along each steel supporting tube for at least two inches away from weld beads. Replace any frame exhibiting crack indications.

5. If no cracks are found, clean all inspection materials from steel tubing.

6. Prime with good quality zinc chromate or epoxy primer and allow adequate drying time.

7. Refinish area with gray epoxy top coat or equivalent.

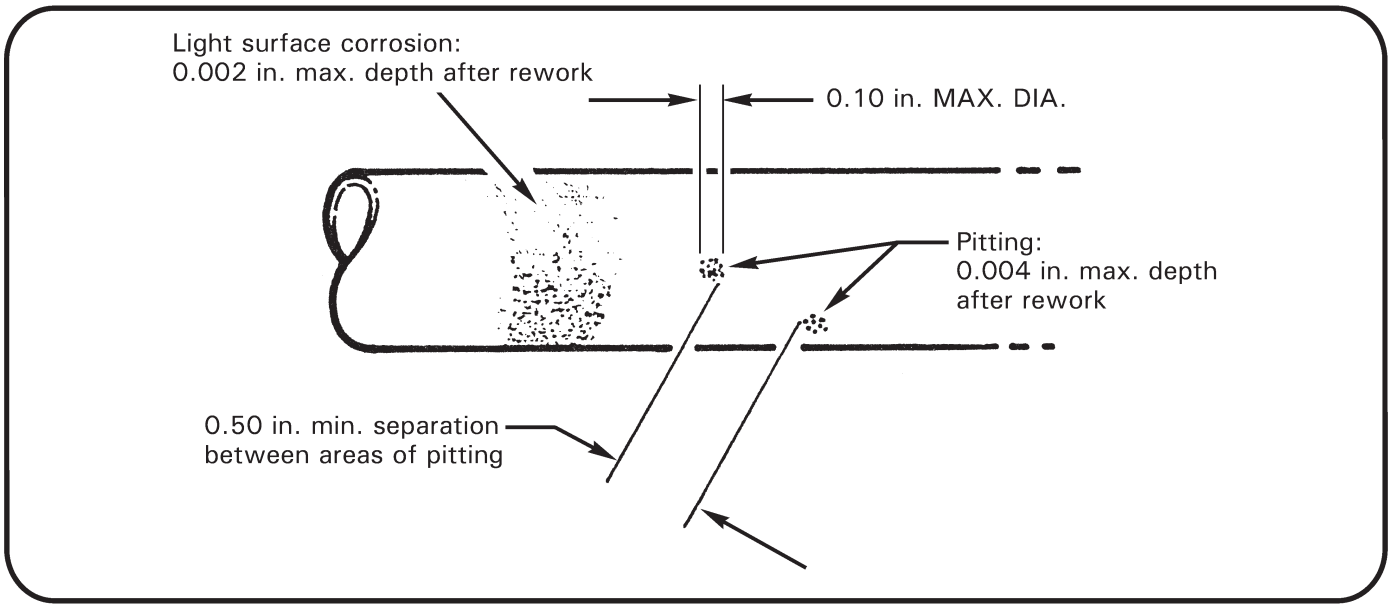


FIGURE 2-16 UPPER FRAME CORROSION REMOVAL LIMITATIONS

2.561 Corrosion on C020 Upper Steel Tube Frame

1. Polish out corrosion on steel frame tube members.

   a. Polish out light surface corrosion on frame members using Scotchbrite or 400 grit wet-or-dry sandpaper subject to dimensional limitations shown in Figure 2-16.

   b. Polish out corrosion pitting using 320-grit wet-or-dry sandpaper subject to dimensional limitations shown in Figure 2-16.

NOTE
For large areas of corrosion, it may be necessary to remove entire upper frame from aircraft and strip off paint to adequately determine extent of damage.

2. Prime bare metal with a good quality zinc chromate or epoxy primer.

3. Refinish area with gray epoxy top coat or equivalent.

2.570 Volcanic Ash Recommendations

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

1. Refer to Lycoming SI 1530. Wearing suitable protective equipment, use vacuum cleaner followed by compressed air to remove as much debris as possible. Do not use compressed air near main rotor blade drain holes.

2. Refer to R44 or R44 II Pilot's Operating Handbook (POH) Section 8. Thoroughly clean, wash, and rinse helicopter, including inner circumference of drive belts.

3. Remove main rotor blade tip covers and clean blade tips.

4. Using 10X magnification, visually inspect any exposed main rotor blade skin-to-spar bond line (adhesive) for gaps (empty space between skin and spar). Blade is unairworthy if any gap, including "pin hole(s)", is detected in the bond line. Refinish blade as required.

5. Inspect condition of drive belt sheaves. Replace any sheave having corrosion pitting, flaking, wear thru metalized or anodized coatings, roughness, or sharp ridges. Replace drive belts if either sheave has sharp ridge(s) on drive belt contact surface.

6. Disconnect alternator drive belt from alternator. Spin alternator pulley by hand and verify rotor bearings and brushes operate smoothly; repair alternator as required if roughness or unusual noise is encountered (volcanic ash can enter via unfiltered cooling air). Inspect alternator and ring gear support pulleys and verify no wear steps; replace alternator belt and pulley(s) if wear steps exist. Perform Lycoming SI 1129B alternator belt tension check and adjust as required.

7. Clean airbox interior and:
   a. Inspect air filter and replace as required.
   b. Inspect induction system downstream of air filter (a clean, white glove is beneficial). If volcanic ash is found then:
      i. Clean induction system, disassembling as required.
      ii. Disassemble carburetor or fuel injection servo, as applicable, inspect for internal contamination, and overhaul as required.
      iii. Perform Lycoming SI 1191A Cylinder Compression check.
      iv. Perform Lycoming SB 388C Procedure to Determine Exhaust Valve and Guide Condition.
      v. Inspect spark plug condition; service as required.
   c. On fuel injected engines, perform Lyciming SI 1275C Cleaning Fuel Injection Nozzles (volcanic ash can enter atomization screens).

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

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

2.580 Windshield Inspection

Inspect windshield for cracks and crazing adjacent to retainer strips using the following criteria. If cracks exceed these limits, replace windshields per Section 4.120.

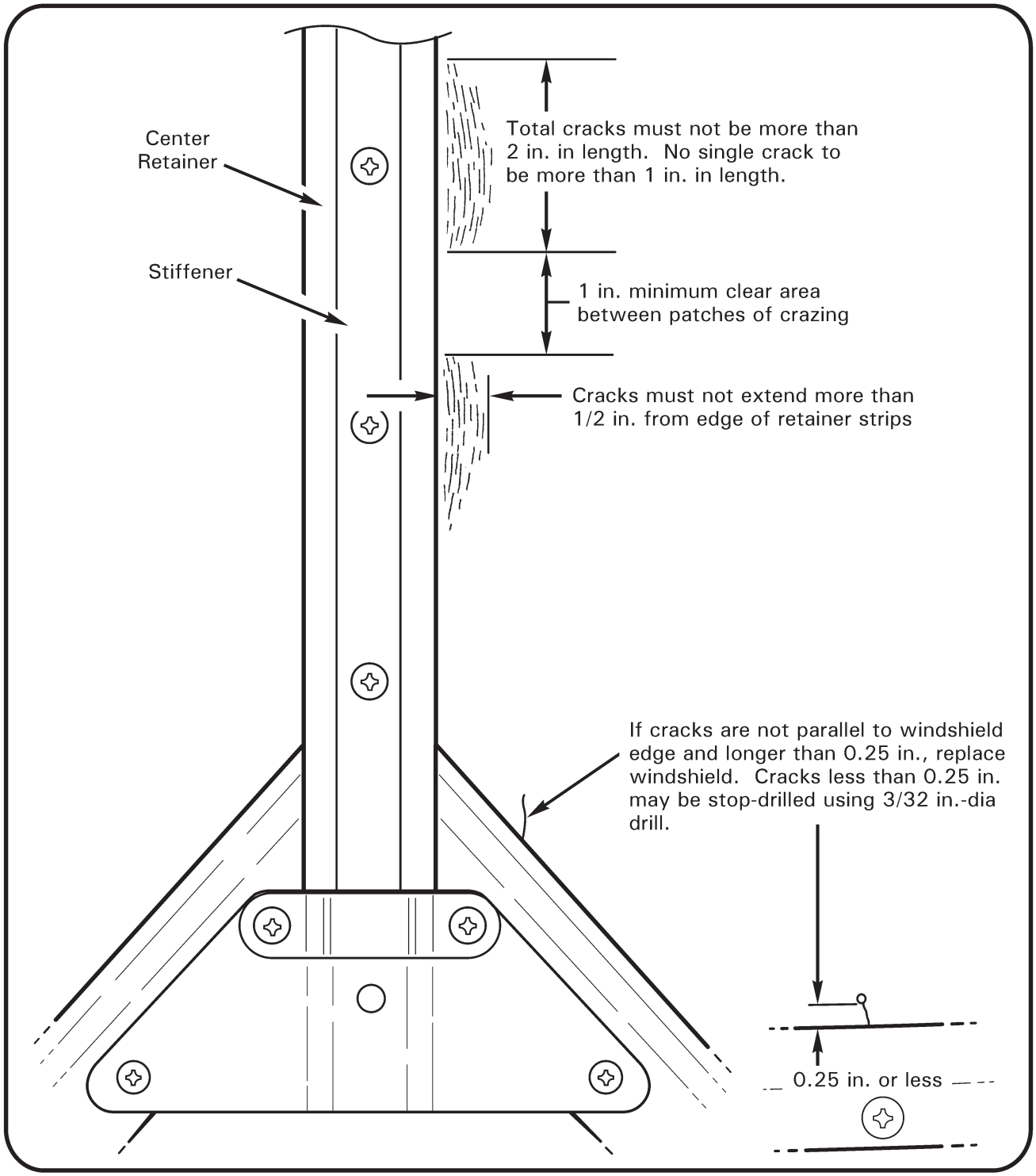


FIGURE 2-17 WINDSHIELD INSPECTION

2.590 Lightning Strike

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

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

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

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

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2.600 12-YEAR INSPECTION AND LIMITED OVERHAUL REQUIREMENTS

If less than 2200 hours time-in-service, but 12 years or more have elapsed since helicopter was new or last overhauled, proceed as follows:

> NOTE
>
> This Section does not supersede 2200-hour inspection and overhaul requirements contained in Section 3. Section 3 must be complied with based on component service lives regardless of when a 12-year inspection was completed.

2.610 Inspection Procedures

1. Ground check and run up aircraft per Sections 2.205 and 2.210.

2. Remove following components and return to an RHC-authorized component overhaul facility for disassembly & inspection per Section 2.630.

C005-x	Main rotor hub assembly
C005-x	Main rotor blade and spindle assembly
C006-x	Main rotor gearbox and mast assembly
C007-5	Fanshaft and bearing assembly
C008-x	Tail rotor assembly
C017-x	Swashplate assembly
C018-x	Clutch assembly
C021-1	Tail rotor gearbox assembly
C051-x	Belt tension actuator assembly
C792-x	Tachometer
D174-2	Fanwheel assembly
D211-1	Hydraulic Reservoir
D212-1	Hydraulic servo actuators
D278-x	Governor controller assembly

3. Replace following parts with new or overhaul exchange parts:

A120-3	Tail rotor bellcrank
A190-3	V-belts
A785-x	Hoses, air ducts (various dash numbers)
B173-x	Alternator belt
B283-x	Hose assemblies (various dash numbers)
C011-2	Arm assembly
C031-1	Tail rotor pitch control
C041-11	Bearing assembly
C480-1	Swashplate boot
C653-1	Mount
C653-2	Mount
C792-x	Dual Tachometer
D756-x	Bellcrank assembly

4. Remove engine and comply with current revision of Lycoming SI 1009. Flush and pressure test oil cooler. Overhaul or inspect, as required, magnetos, alternator, and carburetor or fuel injection components per appropriate manufacturers' maintenance publications and service bulletins.

2.610 Inspection Procedures (cont'd)

5. Remove horizontal and vertical stabilizers. Visually inspect. Verify no cracks, corrosion, loose rivets, dents, or deformation. Dye penetrant inspect suspect areas.

6. Remove landing gear assembly, disassemble (elbows to remain attached to struts), remove paint, and visually inspect. Verify no cracks, corrosion, or deformation. Magnetic particle and fluorescent penetrant inspect. Clean, prime, and paint using Section 1.400-approved materials.

7. Remove steel tube frames. Remove paint from frames not replaced, and visually inspect. Verify no cracks or corrosion. Magnetic particle inspect. Clean, prime, and paint using Section 1.400–approved materials.

8. Inspect airframe wiring condition. Verify no corrosion, insulation deterioration, or other damage.

9. Inspect and pressure test fuel tanks per Section 12.120.

10. Replace additional parts as required per Airworthiness Limitations.

11. Assemble aircraft. Rig flight controls and rotor systems per Section 10.100.

12. Weigh helicopter and calculate C.G. per Section 1.231. As required, revise Equipment List/Weight & Balance data in Section 6 of helicopter's Pilot's Operating Handbook.

13. Inspect aircraft per Section 2.400.

14. Ground check and run up aircraft per Sections 2.205 and 2.210.

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

15. Balance fanwheel per Section 6.240.

16. Balance tail rotor per Section 10.240.

17. Track and balance main rotor per Section 10.200.

18. Flight check aircraft per Section 2.220.

19. Drain, flush, and fill gearboxes per Sections 1.120 and 1.130.

20. Fill and bleed hydraulic system (if equipped) per Section 1.190.

2.620 (Reserved)

2.630 Component Inspection Procedures

An RHC-authorized component overhaul facility shall perform noted procedure.

PART NUMBER	DESCRIPTION	NOTES
C005-x	Main rotor hub assembly	Remove bearings. Visually inspect hub. Verify no fretting, corrosion, or obvious damage. Fluorescent penetrant inspect hub. Magnetic particle inspect journals and thrust washers.
C005-x	Main rotor blade & spindle assembly	Replace blades due to possibility of internal corrosion and adhesive deterioration. Replace pitch horn screws, boots, and O-rings. Pitch horn, spindles, and other hardware may be reused after inspection and verifying no damage.
C006-x	Main rotor gearbox and mast assembly	Replace pinion seal and all O-rings (mast tube base, input shaft, end cover, sump, chip detector, chip detector housing, and sight gage). Replace sealed ball bearing atop mast tube. Replace rubber mounts.
C007-5	Fanshaft and bearing assembly	Replace C181-3 bearing assembly with factory new or overhaul exchange part. Inspect fanshaft.
C008-x	Tail rotor assembly	Replace blades due to possibility of internal corrosion and adhesive deterioration. Remove teeter hinge bearings. Inspect hub and hub plates; verify no fretting or corrosion. Fluorescent penetrant inspect hub and hub plates. Replace teeter hinge bearings and blade attach bolts.
C017-x	Swashplate assembly	Clean, inspect, regrease, or replace (as required) swashplate duplex bearings.
C018-x	Clutch assembly	Disassemble, clean, and inspect. Replace all seals, O-rings, and lubricant. Replace C184-2 bearing assembly with factory new or overhaul exchange part.
C051-x	Belt tension actuator assembly	Return to factory for lubrication and calibration check.
D174-2	Fanwheel assembly	Disassemble, clean, inspect. Verify no cracks or corrosion.

2.700 2200-HOUR OVERHAUL REQUIREMENTS

When helicopter has accumulated 2200 hours time-in-service, proceed as follows:

> NOTE
>
> Kit R7543 contains the majority of parts required for a 2200-hour overhaul; check www.robinsonheli.com/public for current kit contents. Previously replaced airworthy components may remain in service until accumulating 2200 hours or 12 years time-in-service, whichever occurs first, since new or since last overhaul. Refer to Airworthiness Limitations section for additional parts requiring replacement.

2.710 Inspection Procedure

1. Ground check and run up aircraft per Sections 2.205 and 2.210.
2. Replace following parts with new or overhauled exchange parts:

C005-x	Main rotor blade and spindle assembly
C006-x	Main rotor gearboxes and mast assembly
C007-5	Fanshaft and bearing assembly
C008-x	Tail rotor assembly
C017-x	Swashplate assembly
C018-x	Clutch assembly
C021-1	Tail rotor gearbox assembly
C023-x	Tailcone (Rev M & prior)
C031-1	Tail rotor pitch control
C051-x	Actuator assembly
C056-1	Spring assembly
C627-x	4-Point Harness & Buckle assemblies
C628-x	Harness & Buckle assemblies
C792-2	Dual Tachometer
D174-2	Fanwheel assembly
D211-1	Hydraulic reservoir
D212-1	Hydraulic servo actuators
D268-x	Governor Controller

3. On all aircraft, replace following parts with new parts:

A120-3	Tail rotor bellcrank
A190-3	V-Belts
A723-x	Oil lines (various dash numbers)
A780-x	Battery cables
A785-x	Hoses, air ducts (various dash numbers)
A947-2	Flex plate assembly
B173-x	Alternator belt
B283-x	Hose assemblies (various dash numbers)
C121-17	Tail rotor push-pull tube assembly
C169-x	Muffler with risers
C258-1	Main rotor pitch link assemblies
C480-1	Swashplate boot
C918-7	Elastic trim cord (electric trim system only)
C947-1	Flex plate assembly
C947-3	Flex plate assembly
D079-1	Tail rotor guard
D224-1	Tail rotor driveshaft
Various	Engine cooling panels (consult IPC)

2.710 Inspection Procedure (cont'd)

4. Remove engine and overhaul or inspect as required by Lycoming. Flush and pressure test oil cooler. Overhaul or inspect, as required, magnetos, alternator, and carburetor or fuel injection components per appropriate manufacturers' maintenance publications and service bulletins.

5. Remove horizontal and vertical stabilizers. Visually inspect. Verify no cracks, corrosion, loose rivets, dents, or deformation. Dye penetrant inspect suspect areas.

6. Remove landing gear assembly, disassemble, remove paint, and visually inspect. Verify no cracks, corrosion, or deformation. Magnetic particle and fluorescent penetrant inspect. Clean, prime, and paint using Section 1.400 approved materials.

7. Remove steel tube frames. Remove paint from frames not replaced, and visually inspect. Verify no cracks or corrosion. Magnetic particle inspect. Clean, prime, and paint using Section 1.400–approved materials.

8. Inspect airframe wiring condition. Verify no corrosion, insulation deterioration, or other damage.

9. Inspect and pressure test fuel tanks per Section 12.120.

10. Replace additional parts as required per Airworthiness Limitations.

11. Assemble aircraft.

12. Rig flight controls and rotor systems per Section 10.100.

13. Inspect aircraft per Section 2.400.

14. Perform weight and balance per Section 1.230.

15. Ground check and run up aircraft per Sections 2.205 and 2.210.

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

16. Balance fanwheel per Section 6.240

17. Balance tail rotor per Section 10.240.

18. Track and balance main rotor per Section 10.200.

19. Flight check aircraft per Section 2.220.

20. Drain, flush, and fill gearboxes per Sections 1.120 and 1.130.

21. Fill and bleed hydraulic system (if equipped) per Section 1.190.

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CHAPTER 3

LIFE-LIMITED COMPONENTS

Section	*Title*	*Page*
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3.002	Time-In-Service Records	3.1
3.003	Fatigue Life-Limited Parts	3.1
3.100	Overhaul Requirements	3.2
3.110	Powerplant Overhaul Requirements	3.2
3.120	Aircraft Overhaul Requirements	3.2
3.200	Type Certificate Data Sheet (TCDS)	3.2
3.300	Airworthiness Limitations	3.9

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CHAPTER 3

LIFE-LIMITED COMPONENTS

3.000 Life-Limited Components

3.001 Introduction

This section lists fatigue life-limited parts and specified overhaul requirements for the R44 helicopter.

3.002 Time-In-Service Records

It is the operator's responsibility to maintain accurate time-in-service records for the airframe, engine, and life-limited components. An hourmeter activated by engine oil pressure is standard equipment on earlier R44 helicopters. Later helicopters are equipped with an hourmeter activated by a combination of oil pressure and up collective; the hourmeter will record time only when engine oil pressure exists and the collective is raised. Either hourmeter is an acceptable means of recording time in service (refer to Section 1.006).

Calendar time in service for the airframe and engine begins on the date of the original RHC-issued Export (or Standard) Certificate of Airworthiness for the helicopter. Calendar time in service for spares without a storage limit (refer to Section 1.490) begins on the date of the RHC-issued Airworthiness Approval Tag (Authorized Release Certificate) issued with the invoice.

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

WARNING

Components with mandatory overhaul or retirement intervals whose time-in-service is not reliably documented cannot be considered airworthy and must be removed from service.

3.003 Fatigue Life-Limited Parts

The Airworthiness Limitations Section lists the mandatory replacement schedule for fatigue life-limited parts.

If a part is fatigue life-limited or has a mandatory overhaul requirement and is interchanged between an R44 and an R66 helicopter, and if the part life-limit or overhaul requirement is different between an R44 and an R66 helicopter, the shorter life-limit or overhaul requirement must be used. If a part is fatigue life-limited or has a mandatory overhaul requirement, and the accumulated cycles and/or time-in-service are known but the helicopter type is unknown, the shorter life-limit or overhaul requirement must be used.

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

3.100 Overhaul Requirements

3.110 Powerplant Overhaul Requirements

The engine must be overhauled in accordance with the engine manufacturer's overhaul recommendations and procedures. Refer to latest revision of Textron Lycoming Service Instructions No. 1009.

3.120 Aircraft Overhaul Requirements

The complete airframe, including rotor systems, drive system, control system, and fuselage, must be overhauled as instructed by Robinson Helicopter Company when any of the following occur:

1. When the helicopter has been operated for 2200 hours since new or since last overhaul.

2. When an inspection of the helicopter indicates extensive subsurface corrosion in the primary structure, drive system or control system.

3. When the helicopter condition has deteriorated so the helicopter can no longer meet the performance, controllability or safety specifications given in the Pilot's Operating Handbook.

4. When the aircraft has been in service for twelve years since new or since last overhaul, regardless of the hours flown.

WARNING

Suspected damaged parts removed from damaged aircraft are not to be reinstalled in any aircraft unless part has been returned to RHC, together with its damage history, for inspection and is found by RHC to be airworthy.

3.200 Type Certificate Data Sheet (TCDS)

The Robinson R44 and R44 II Type Certficate Data Sheet (TCDS) reprinted on the following pages is subject to revision.

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

DEPAPTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

H11NM
Revision 8
Robinson
R44
R44 II
May 6, 2016

TYPE CERTIFICATE DATA SHEET NO. H11NM

This data sheet, which is a part of Type Certificate No. H11NM, prescribes conditions and limitations under which the product for which the type certificate was issued meets the airworthiness requirements of the Federal Aviation Regulations.

Type Certificate Holder: Robinson Helicopter Company
2901 Airport Drive
Torrance, California 90505

I. Model R44 (Normal Category Rotorcraft), Approved December 10, 1992

Model R44 helicopters with serial numbers below 10000 are configured with four seats. Model R44 helicopters with serial number 30001 and subsequent are configured with two seats. Some limitations are configuration-specific as indicated below. The Rotorcraft Flight Manual is also configuration-specific and has manufacturer's document number RTR 461 for the four seat configuration and RTR 463 for the two seat configuration.

Engine: One Lycoming O-540-F1B5, Type Certificate number E-295

Fuel:
91/96 grade aviation gasoline
100 LL grade aviation gasoline
100/130 grade aviation gasoline

Engine Limits:

S/Ns below 10000:

Maximum continuous: 205 hp at 2718 rpm (102%)
Takeoff (5 minute): 225 hp at 2718 rpm (102%)

S/N 30001 and subsequent:

Maximum continuous: 185 hp at 2718 rpm (102%)
Takeoff (5 minute): 210 hp at 2718 rpm (102%)

For all S/Ns:

See appropriate Rotorcraft Flight Manual for manifold pressure settings corresponding to horsepower limits.

Rotor Speed Limits (all S/Ns)

Power Off (Rotor Tach)	Power On (Rotor Tach)
Maximum: 432 rpm (108%)	Maximum: 408 rpm (102%)
Minimum: 360 rpm (90%)	Minimum: 404 rpm (101%) *

* Earlier R44s with tachometers showing an engine green arc range of 99% to 102% have a minimum power-on rotor speed of 396 rpm.

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I. Model R44 (Normal Category Rotorcraft), Approved December 10,1992, (cont'd)

Airspeed Limits

S/Ns below 10000:

V_{NE} (never exceed speed) at sea level is 130 KIAS (120 KIAS with fixed floats) for takeoff gross weights of 2200 lbs. or less. V_{NE} at sea level is 120 KIAS (110 KIAS with fixed floats) for takeoff gross weights over 2200 lbs.

S/N 30001 and subsequent:

V_{NE} (never exceed speed) at sea level is 120 KIAS for all takeoff weights with or without fixed floats.

For all S/Ns:

Power Off (Autorotation) V_{NE} at sea level is 100 KIAS.

For reduction of V_{NE} with altitude and temperature, see appropriate Rotorcraft Flight Manual.

Airspeed limit at power settings above Maximum Continuous Power is 100 KIAS.

Airspeed limit with inflated pop-out floats is 80 KIAS.

Airspeed limit for any combination of Doors Off is 100 KIAS.

Center of Gravity (C.G.) Range

S/Ns below 10000:

Longitudinal C.G. Range			Lateral C.G. Range		
Gross Weight (lbs.)	Forward (in.)	Aft (in.)	Long. C. G. (in.)	Left (in.)	Right (in.)
1550	92.0	102.5	92.0	-3.0	+3.0
2000	92.0	102.5	100.0	-3.0	+3.0
2200	92.0	100.25	102.5	-1.5	+1.5
2400	93.0	98.0			

Note: Straight line variation between points shown

S/N 30001 and subsequent:

Longitudinal C.G. Range			Lateral C.G. Range		
Gross Weight (lbs.)	Forward (in.)	Aft (in.)	Long. C. G. (in.)	Left (in.)	Right (in.)
1550	92.0	102.5	92.0	-3.0	+3.0
2000	92.0	102.5	100.0	-3.0	+3.0
2200	93.0	100.25	102.5	-1.5	+1.5

Note: Straight line variation between points shown

Empty Weight C.G. Limit

For all S/Ns, Empty weight C.G. must be such that calculated C.G. with 150 lb. pilot and full fuel is at STA 102.5 or forward.

Maximum Weight

S/Ns below 10000:
2400 lb.

S/N 30001 and subsequent:
2200 lb.

I. Model R44 (Normal Category Rotorcraft), Approved December 10,1992, (cont'd)

Minimum Crew

1 pilot at right side control station

Number of Seats

S/Ns below 10000:
4 (3 for Police and ENG Version)

Seat Locations: Pilot and Forward Passenger at STA 49.5
Aft Passengers at STA 79.5

S/N 30001 and subsequent:
2

Seat Locations: STA 49.5

Maximum Baggage

50 pounds of baggage and installed equipment in any baggage compartment. For any seat location, the maximum combined weight of the seat load, baggage, and installed equipment is 300 lbs.

For S/N 30001 and subsequent, maximum load on aft deck is 50 lbs each side, and maximum load in each compartment under aft deck is 50 lb.

Fuel Capacity

Tank	Tanks Without Bladders		Tanks With Bladders		Location (STA)
	Capacity (gal.)	Usable (gal.)	Capacity (gal.)	Usable (gal.)	
Main	31.6	30.6	30.5	29.5	106.0
Auxiliary	18.5	18.3	17.2	17.0	102.0

Oil Capacity

Component	Capacity (qt.)	Location (STA)
Engine	9	110.0
Main Rotor Transmission	2	100.0
Tail Rotor Transmission	0.11	327.0
Hydraulic Reservoir (if installed)	0.65	117.0

Maximum Operating Altitude

Density Altitude Limit 14,000 ft.
Maximum altitude above ground level is 9000 ft. to allow landing within 5 minutes in case of fire.

Manufacturer's Serial Numbers

0002, 0004 thru 9999 except 1140, 30001 and subsequent.

Certification Basis

14 CFR Part 27, dated February 1, 1965, including Amendments 27-1 through 27-24, Exemption No. 5473 dated July 2, 1992, to §27.955(a)(7) and 27.1305(q), and Exemption No. 6692 dated October 17, 1997 to §27.695.

14 CFR Part 36 Amendment 36-20.

Equivalent Safety Finding:
Number TD10352LA-R/S-1
14CFR Part 27.1401(d), Anticollision Light System

Special Condition:
No. 27-033-SC Robinson Model R44 and R44 II Helicopters, Installation of HeliSAS Autopilot and Stabilization Augmentation System (AP/SAS).

I. Model R44 (Normal Category Rotorcraft), Approved December 10,1992, (cont'd)

Equipment

The basic required equipment as prescribed in the applicable airworthiness regulations (see Certification Basis) must be installed in the aircraft for certification. In addition, the following FAA-approved Rotorcraft Flight Manual is required:

S/Ns below 10000:
R44 Rotorcraft Flight Manual (RTR 461) dated December 10, 1992, or later revision (See NOTES 4, 5, & 6).

S/N 30001 and above:
R44 Cadet Rotorcraft Flight Manual (RTR 463) dated April 29, 2016, or later revision.

II. Model R44 II (Normal Category Rotorcraft), Approved October 3, 2002

The R44 II helicopter includes a fuel injected engine with a 245 hp takeoff rating and a maxium weight of 2500 lb. The Rotorcraft Flight Manual has manufacturer's document number RTR 462.

Engine

One Lycoming IO-540-AE1A5, Type Certificate number 1E4

Fuel

100 LL grade aviation gasoline
100/130 grade aviation gasoline

Engine Limits

Maximum continuous: 205 hp at 2718 rpm (102%)
Takeoff (5 minute): 245 hp at 2718 rpm (102%)

See Rotorcraft Flight Manual for manifold pressure settings corresponding to horsepower limits.

Rotor Speed Limits

Power Off (Rotor Tach)	Power On (Rotor Tach)
Maximum: 432 rpm (108%)	Maximum: 408 rpm (102%)
Minimum: 360 rpm (90%)	Minimum: 404 rpm (101%)

Airspeed Limits

V_{NE} (never exceed speed) at sea level is 130 KIAS (120 KIAS with fixed floats) for takeoff gross weights of 2200 lbs. or less. V_{NE} at sea level is 120 KIAS (110 KIAS with fixed floats) for takeoff gross weights over 2200 lbs.

Power Off (Autorotation) V_{NE} at sea level is 100 KIAS.

For reduction of V_{NE} with altitude and temperature, see Rotorcraft Flight Manual.

Airspeed limit at power settings above Maximum Continuous Power is 100 KIAS.

Airspeed limit with inflated pop-out floats is 80 KIAS.

Airspeed limit for any combination of Doors Off is 100 KIAS.

II. Model R44 II (Normal Category Rotorcraft), Approved October 3,2002, (cont'd)

Center of Gravity (C.G.) Range

Longitudinal C.G. Range			Lateral C.G. Range		
Gross Weight (lbs.)	Forward (in.)	Aft (in.)	Long. C. G. (in.)	Left (in.)	Right (in.)
1600	92.0	102.5	92.0	-3.0	+3.0
2100	92.0	102.5	100.0	-3.0	+3.0
2300	92.0	100.25	102.5	-1.5	+1.5
2500	93.0	98.0			

Note: Straight line variation between points shown

Empty Weight C.G. Limit

Empty weight C.G. must be such that calculated C.G. with 150 lb. pilot and full fuel is at STA 102.5 or forward.

Maximum Weight

2500 lb.
2400 lb. for intentional water landings with fixed or pop-out floats.

Minimum Crew

1 pilot in forward right seat.

Number of Seats

4 (3 for Police and ENG Versions)
Seat Locations: Pilot and Forward Passenger at STA 49.5
Aft Passengers at STA 79.5

Maximum Baggage

50 pounds of baggage and installed equipment in any baggage compartment. For any seat location, the maximum combined weight of the seat load, baggage, and installed equipment is 300 lbs.

Fuel Capacity

Tank	Tanks Without Bladders		Tanks With Bladders		Location (STA)
	Capacity (gal.)	Usable (gal.)	Capacity (gal.)	Usable (gal.)	
Main	31.6	30.6	30.5	29.5	106.0
Auxiliary	18.5	18.3	17.2	17.0	102.0

Oil Capacity

Component	Capacity (qt.)	Location (STA)
Engine	9	110.0
Main Rotor Transmission	2	100.0
Tail Rotor Transmission	0.11	327.0
Hydraulic Reservoir	0.65	117.0

Maximum Operating Altitude

Density Altitude Limit - 14,000 ft.
Maximum altitude above ground level is 9000 ft. to allow landing within 5 minutes in case of fire.

Manufacturer's Serial Numbers

1140, 10001 thru 29999

Certification Basis

14 CFR Part 27, dated February 1, 1965, including Amendments 27-1 through 27-24, and Exemption No. 6692 dated October 17, 1997 to §27.695.

14 CFR Part 36 Amendment 36-24.

Equivalent Safety Finding:
Number TD10352LA-R/S-1
14CFR Part 27.1401(d), Anticollision Light System

Special Condition:
No. 27-033-SC Robinson Model R44 and R44 II Helicopters, Installation of HeliSAS Autopilot and Stabilization Augmentation System (AP/SAS).

II. Model R44 II (Normal Category Rotorcraft), Approved October 3, 2002, (cont'd)

Equipment

The basic required equipment as prescribed in the applicable airworthiness regulations (see Certification Basis) must be installed in the aircraft for certification. In addition, the following FAA-approved Rotorcraft Flight Manual is required:

R44 II Rotorcraft Flight Manual (RTR 462) dated October 3, 2002, or later revision (See NOTES 7 & 8).

DATA PERTINENT TO BOTH MODELS

Datum

100 in. forward of main rotor centerline.

Leveling Means

Refer to the R44 Maintenance Manual and Instructions for Continued Airworthiness (RTR 460).

Rotor Blade and Control Movements

Main Rotor blade angles at 75% radius:

Collective Pitch: 12.5° ±1.0° total travel

Note: Collective low pitch to be established in accordance with the Maintenance Manual and Instructions for Continued Airworthiness (RTR 460) procedures to obtain proper autorotation RPM.

Cyclic Pitch:	Forward	13.50° to 14.25°
	Aft	13.50° to 14.25°
	Left	7.5° to 8.5°
	Right	6.0° to 7.0°

Tail Rotor blade angles at 75% radius:

Collective Pitch:	Full right pedal	15.5° to 16.5°
	Full left pedal	18.5° to 19.0°

Production Basis

Production Certificate No. 424WE dated February 11, 1993.

GENERAL NOTES

NOTE 1. A current weight and balance report, including a list of equipment included in the certificated empty weight, and loading instructions when necessary, must be provided for each aircraft at the time of original airworthiness certification and at all times thereafter, except in the case of operators having an approved weight control system.

NOTE 2. The following placard must be installed in clear view of the pilot:
"THIS ROTORCRAFT APPROVED FOR DAY AND NIGHT VFR OPERATIONS"

For additional placards, see the Rotorcraft Flight Manual. All placards required in the Rotorcraft Flight Manual must be installed in the appropriate locations.

NOTE 3. Information essential to the proper maintenance of the helicopter, including retirement time of critical components, is contained in the Robinson R44 Maintenance Manual and Instructions For Continued Airworthiness (RTR 460). Retirement times are listed in the "AIRWORTHINESS LIMITATIONS" section.

NOTE 4. R44 Rotorcraft Flight Manual Supplement 5 dated July 17, 1996, or later revision is required when float landing gear is installed.

NOTE 5. R44 Rotorcraft Flight Manual Supplement 10 dated June 10, 1999, or later revision is required when emergency (pop-out) floats are installed.

NOTE 6. R44 Rotorcraft Flight Manual with revisions through November 5, 1999, or later revision is required when hydraulically-boosted main rotor flight controls are installed.

NOTE 7. Deleted as of April 29, 2016.

NOTE 8. Deleted as of April 29, 2016.

NOTE 9. Deleted as of February 13, 2015.

END

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3.300 Airworthiness Limitations

The Airworthiness Limitations section is FAA approved and specifies inspections and other maintenance required under 14 CFR §§ 43.16 and 91.403, unless an alternative program has been FAA approved.

There are two lists for fatigue life-limited parts. The first list (this page) is applicable to all R44 and R44 II helicopters. The second list (following page) provides increased service lives which may be used for the two-seat R44 Cadet configuration (R44 serial numbers 30001 through 39999).

R44 and R44 II Fatigue Life-Limited Parts

Part Number	Description	Maximum Service Life
C023-1	Tailcone Assembly, Rev M & Prior	2000 Hours
C016-2, -5, & -7	Main Rotor Blade	2200 Hours or 12 years[1]
C020-1 & -2	Upper Frame	2200 Hours
C029-1, -2, & -3	Tail Rotor Blade	2200 Hours or 12 years[1]
C030-1	Tail Rotor Hub	2200 Hours
C044-1	Horizontal Stabilizer, Rev L & Prior	2200 Hours[2]
C146-1 & -5	Gear Set, Main Gearbox	2200 Hours
C154-1	Main Rotor Hub	2200 Hours[2]
C158-1	Main Rotor Spindle	2200 Hours[2]
C196-1	Tail Rotor Drive Shaft	2200 Hours
C263-1 & -2	Sump, Main Gearbox	2200 Hours
C264-1 & -2	Housing, Main Gearbox	2200 Hours
C545-1	Gear Set, Tail Gearbox	2200 Hours[2]
C647-12	Bearing Set, C017-6 Swashplate	2200 Hours[2]
D062-2	Tail Rotor Hub	2200 Hours
D079-1	Tail Rotor Guard	2200 Hours[2]
G062-2	Tail Rotor Hub	2200 Hours[2]
A756-6	Cyclic Grip	4400 Hours
C023-1	Tailcone Assembly, Rev N & Subsequent	4400 Hours
C023-2, -3, -4, -14, & -15	Tailcone Assembly	4400 Hours
C044-1	Horizontal Stabilizer, Rev M & Subsequent	4400 Hours[2]
C198-1 & -2	Lower Swashplate	4400 Hours
C251-1	Main Rotor Shaft	4400 Hours
C319-3	Cyclic Torque Tube	4400 Hours
C320-1	Cyclic Stick	4400 Hours
C337-1	Jackshaft	4400 Hours
D196-1	Tail Rotor Drive Shaft	4400 Hours[2]

[1] Whichever limit occurs first. Calendar time starts on date of original RHC-issued Airworthiness Approval.

[2] Maximum service life is 2000 hours if part is, or ever has been, installed on an R66 helicopter.

3.300 Airworthiness Limitations (continued)

R44 Cadet Fatigue Life-Limited Parts

The following service lives may be used for parts installed on R44 helicopter serial numbers 30001 through 39999. The service lives from the first list (previous page) must be used if the part is, or ever has been, installed on any R44 helicopter other than serial numbers 30001 through 39999.

Part Number	Description	Maximum Service Life
C016-7	Main Rotor Blade, Rev AF & Subsequent	2400 Hours or 12 years[1]
C020-1 & -2	Upper Frame	2400 Hours
C029-3	Tail Rotor Blade	2400 Hours or 12 years[1]
C146-5	Gear Set, Main Gearbox	2400 Hours
C154-1	Main Rotor Hub	2400 Hours
C158-1	Main Rotor Spindle	2400 Hours
C263-2	Sump, Main Gearbox	2400 Hours
C264-2	Housing, Main Gearbox	2400 Hours
C545-1	Gear Set, Tail Gearbox	2400 Hours
C647-12	Bearing Set, C017-6 Swashplate	2400 Hours
D079-1	Tail Rotor Guard	2400 Hours
G062-2	Tail Rotor Hub	2400 Hours
C023-1, -14, & -15	Tailcone Assembly, Rev AQ & Subsequent	4800 Hours
C044-1	Horizontal Stabilizer, Rev P & Subsequent	4800 Hours
D196-1	Tail Rotor Drive Shaft	4800 Hours

[1] Whichever limit occurs first. Calendar time starts on date of original RHC-issued Airworthiness Approval.

Approved By: _____ Date: 5/5/2016

for Manager, Federal Aviation Administration
Los Angeles Aircraft Certification Office

FAA Approved: This and the previous page constitute the Airworthiness Limitations Section in its entirety, are considered segregated from the rest of the document, and set forth the FAA-approved mandatory replacement times for fatigue life-limited parts.

CHAPTER 4

AIRFRAME

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CHAPTER 4

AIRFRAME (Continued)

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CHAPTER 4

AIRFRAME

4.000 Airframe

4.001 Introduction

This section contains procedures for removal and installation of cabin components, steel tube structures, tailcone and empennage.

4.002 Description

The R44 is a four-place, 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 semi-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 Fuselage

4.110 Cabin Assembly

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

4.111 Cabin Assembly Repairs

1. Vertical firewall replacement must be performed at the factory in a jig. Firewall repairs may be accomplished in accordance with U.S. FAA Advisory Circular 43.13-1B. 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.

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4.120 Windshield Assembly

The C274 windshield is made of transparent acrylic set in a weather-tight silicone sealer and is screwed to cabin structure.

4.121 Windshield Removal

1. Remove forward door and hinges.

NOTE
To prevent scratching windshield, a protective cover should be taped to the inside and outside of the windshield prior to removal.

2. Remove screws and side retainer holding windshield.
3. Reinstall hinges and doors for cabin structure support with window removed.
4. Remove screws and retainers (upper, lower and middle) holding windshield.
5. Clean silicone sealant from retainers.
6. Clean silicone sealant from windshield for re-installation.

4.122 Windshield Replacement

1. Remove all old sealant on cabin and retainers if they are to be reused.
2. Cleco all window retaining strips in place, checking for proper alignment.
3. Install hinges and doors in door frames and secure. Remove bottom and center retaining strips, leaving side retaining strip to hold door and door frame in position.
4. Hold windshield in place by hand, and align it with frame according to contour of frame and windshield.
5. Mark windshield for trim using non-permanent marker, such as grease pencil or masking tape.
6. Trim to mark. A band saw is recommended. Band saw blade should contain at least 24 teeth per inch.

4.122 Windshield Replacement (cont'd)

NOTE
Tape cardboard to band saw table to prevent scratching of windshield. Saw carefully to prevent binding of saw blade and cracking windshield.

7. Hold windshield in place and check for fit. Re-trim as necessary.

8. After windshield is fitted, carefully sand or scrape edges smooth.

9. See Section 4.123 Windshield Installation.

4.123 Windshield Installation

a) Remove all old sealant from cabin, retainers and windshield.

b) Tape bottom and aft edges of windshield with A701-4 3/4-inch wide white polyvinyl chloride tape (3M #471).

c) Install windshield and cleco retainer strips.

d) Mask windshield along edge of retainer strips with 1/2" masking tape. This will catch silicone rubber squeeze-out on installation of retainer strips.

e) Remove retainer strips.

f) To ensure a proper seal, run a bead of B270-4 silicone rubber along entire edge of tape line.

g) While holding windshield in place, cleco retainer strips (center, upper and lower) into place.

h) With doors installed and closed, tighten center retainer strip first. Then tighten upper and lower retaining strips. A second person will be required to tighten nuts inside ship.

i) When center, upper and lower retaining strips are secure, remove door and hinges for side strip installation.

j) Install side retainer strip.

k) Reinstall hinges and door. Ensure all fasteners are tight.

l) Fill any gap between retainer and window with B270-4 sealant.

4.123 Windshield Installation (cont'd)

m) Remove masking tape next to retainers. Be careful not to smear wet sealant.

n) Clean any sealant off windshield after it has been allowed to dry.

4.130 Door Removal and Installation

4.131 Door Removal

1. Disconnect aft door(s) gas spring by holding door full open and lifting up firmly on gas spring's inner attach point.
2. Remove cotter pins and/or cotter rings from both hinge pins.
3. Remove door by opening latch and lifting door to disengage hinges.
4. If required, door hinges may be removed by removing mounting screws.

4.132 Door Installation

1. Install door hinges if removed.
2. Install door by aligning hinge pins and slide door down to engage hinges.
3. Install cotter pins or rings in both hinge pins of door.

WARNING

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

4. Reconnect aft door's gas spring.

4.140 Fairing, Cowling and Inspection Panels

MS27039C08 screws are used for fastening all removable cowlings and inspection panels.

4.141 Engine Cowling

Engine cowling includes left-hand and right-hand cowling assemblies, belly cowling assembly, and the aft cowling assembly.

The lower edge of both engine cowling assemblies are supported by removable channels. The air intake hose is attached to right engine side panel assembly, which may be removed or connected through door in panel. Lower left slat in aft cowling assembly may be removed for access to clean out anything that may have fallen through slats.

4.142 Mast Fairing

CAUTION

Mast fairing must be installed for flight.

The C261 mast fairing upper rib is mounted to main rotor gearbox at swashplate tube assembly. Lower rib is clamped to main rotor gearbox mast assembly.

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

The fuel tank vents are installed through grommets in lower rib and attach to middle rib of mast fairing. The C665-2 guide assembly for C121-5 push-pull tube is mounted to center rib. It should be adjusted to minimize preload on push-pull tube.

4.143 Upper Cowling

Cowling above horizontal firewall includes D042 doors behind and below auxiliary tank, C347 panels around mast tube, and C706-1 tailcone cowling.

CAUTION

All cowling must be installed for flight.

4.144 Cabin Inspection Panels

CAUTION

Inspection panels must be installed for flight. All panels may be left off for run-up. All must be installed for flight.

The cabin inspection panels include the following:

1. C794-1 forward belly panel and C794-3 aft belly panel assembly.
2. C465-1 and C465-2 aft seat back panels.
3. C474-1 panel between the aft seat backs and C474-2 panel between the aft seats.
4. C463-1 cover under the C464-1 tray.
5. C445-1 and C445-3 covers between the forward seats and C444-1 cyclic box cover.
6. C461-1 collective cross tube cover behind the left forward seat.

4.200 STEEL TUBE FRAME ASSEMBLIES

WARNING

All welded steel tube frames used in the R44 are stress relieved. No weld repairs are permissible outside Robinson Helicopter Company.

The following steel tube frames are required on the R44:

C020-1 Upper Frame Assembly

C046-1 Lower Frame Assembly, L.H.

C046-2 Lower Frame Assembly, R.H.

C046-3 Strut Assembly

C237-1 Frame Assembly

4.210 Lower Frame Assembly, L.H.

4.211 Frame Removal

a) Remove all cowling.

b) Remove main rotor gearbox, including both fuel tanks, per Section 7.110.

c) Remove powerplant, including tailcone and clutch assembly, per Section 6.110.

d) Remove battery and battery box.

e) Remove left aft seatback panel.

f) Disconnect the three forward mounting points (Figure 4-2A, Details D, E, and F) and the aft mounting point (Figure 4-2B, Detail H).

g) Disconnect the left aft NAS1307 landing gear mounting bolt.

h) Remove the NAS6604-2 bolt and the C722-2 cap screw connecting the upper frame to the lower left frame assembly (Figure 4-2, Details A & B).

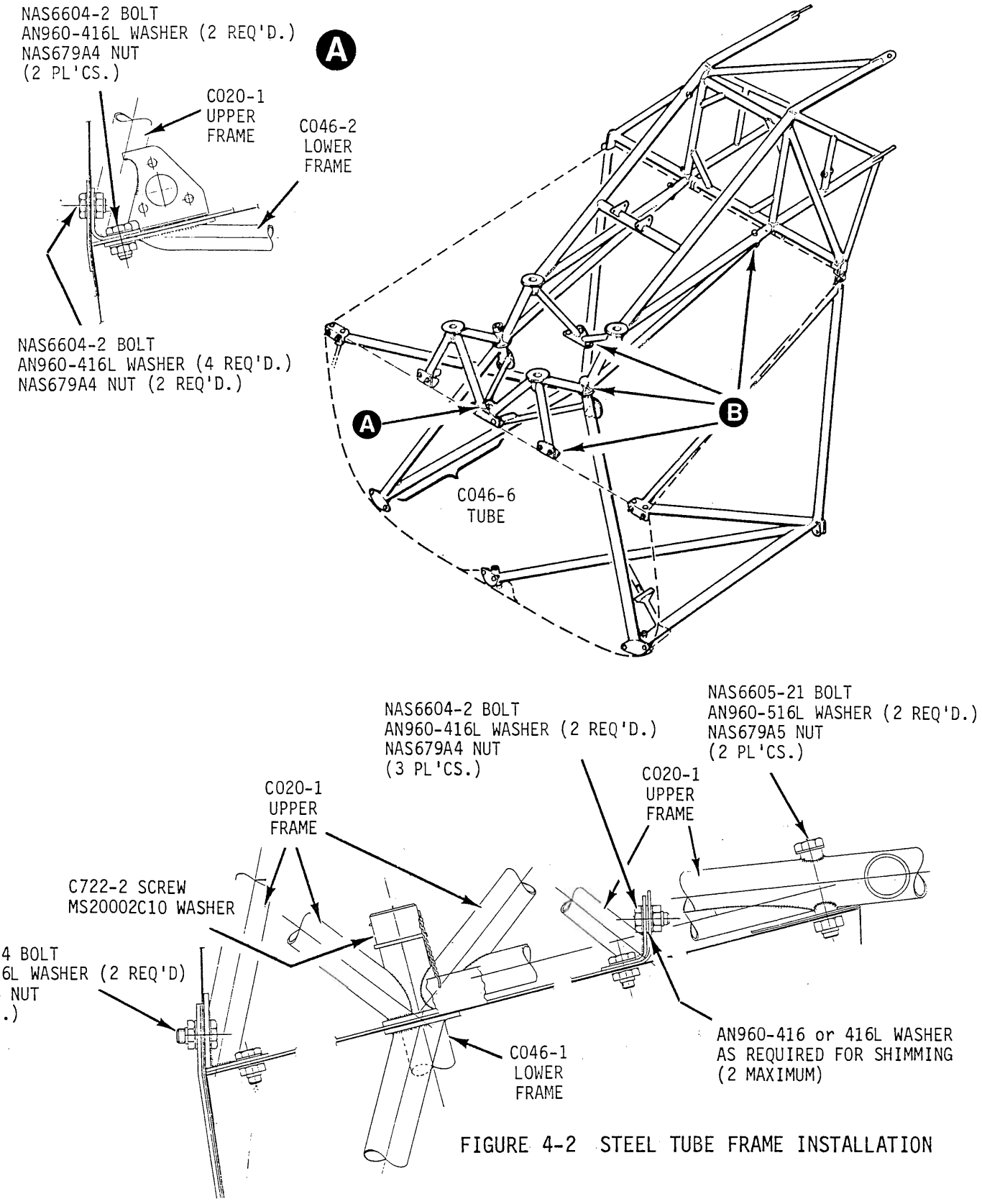


FIGURE 4-2 STEEL TUBE FRAME INSTALLATION

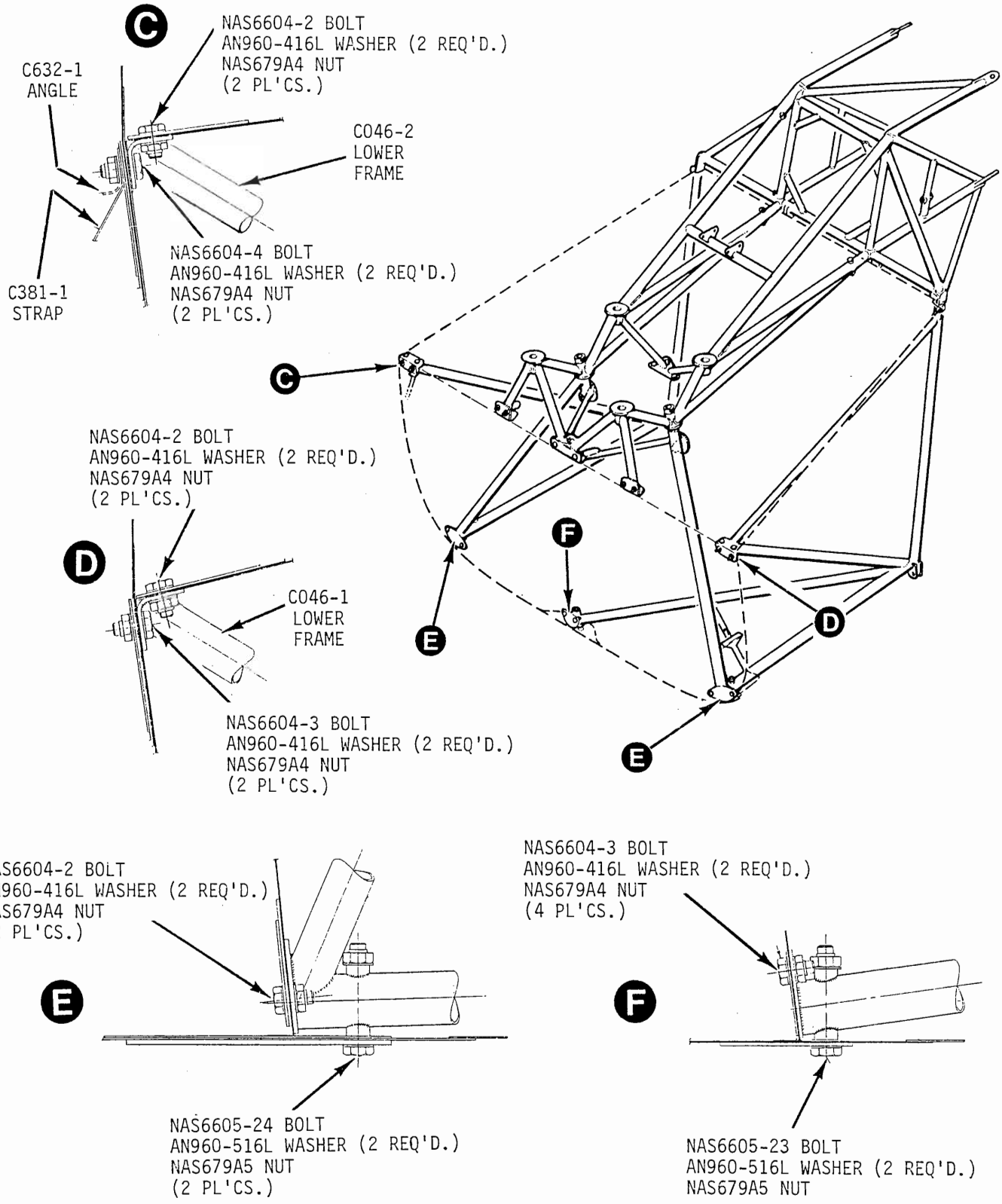


FIGURE 4-2A STEEL TUBE FRAME INSTALLATION

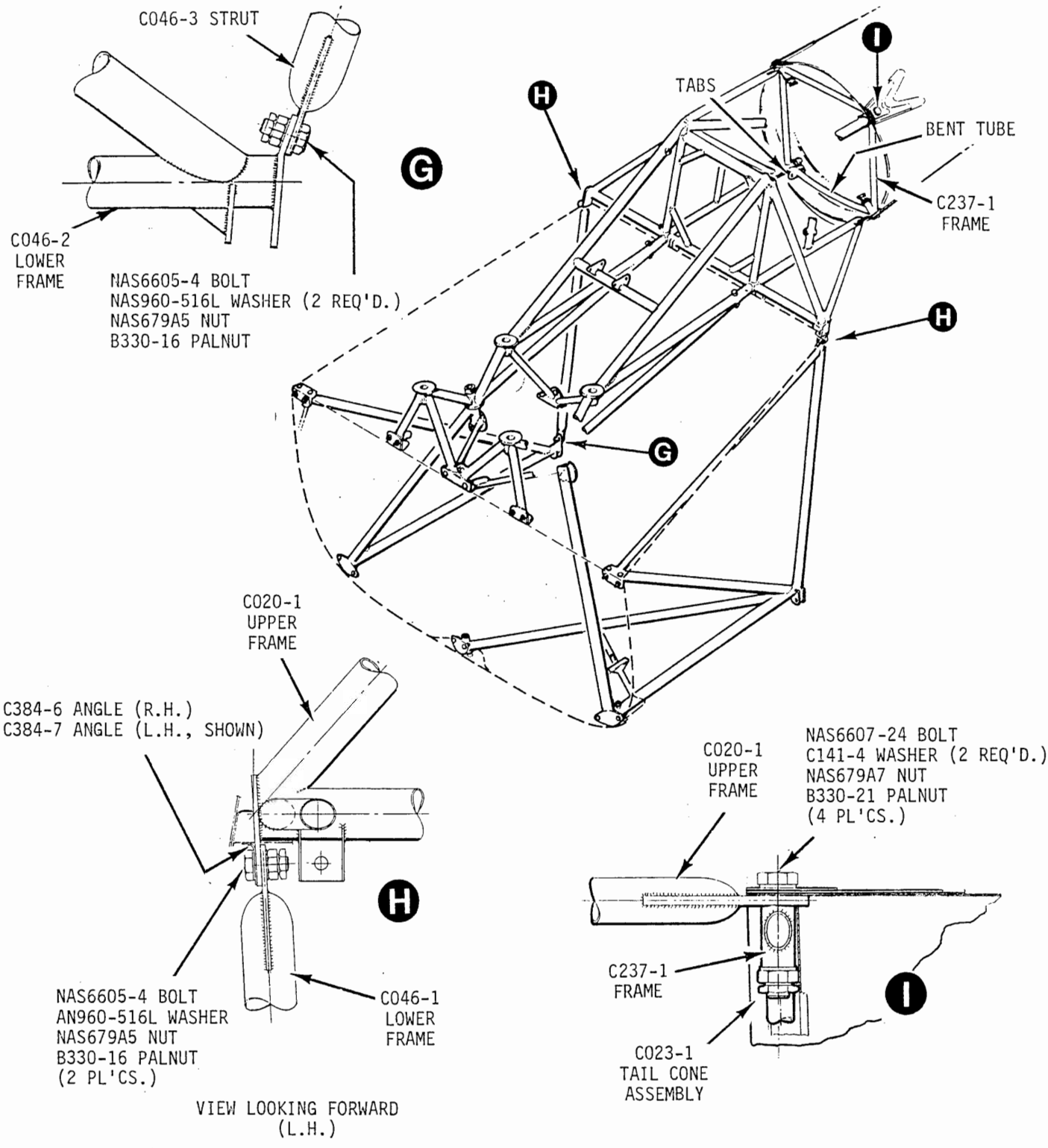


FIGURE 4-2B STEEL TUBE FRAME AND TAIL CONE INSTALLATION

4.211 Frame Removal (cont'd)

i) Remove the left frame assembly.

j) Remove the C014-7 landing gear support and D310-5 cowling bracket from the left frame assembly.

4.212 Frame Installation

a) Install the C014-7 landing gear support and D310-5 cowling bracket per Figure 5-1, Detail B. Torque per Section 1.320.

b) Position frame for installation. Install all hardware per Figure 4-2, Detail B, Figure 4-2A, Details D,E, and F, and Figure 4-2B, Detail H. Install all hardware before torquing.

c) Torque all NAS6600 bolts per Section 1.320. Torque the C722-2 Cap Screw per Section 1.330 and safety wire to the C385-1 firewall doubler with 0.041 inch diameter wire.

d) Install NAS6607 landing gear mounting bolt per Figure 5-1, Detail B, and torque per Section 1.320.

e) Install powerplant per Section 6.120.

f) Install tailcone per Section 4.312.

g) Install main rotor gearbox per Section 7.120.

h) Install clutch assembly per Section 7.220.

i) Install battery box and battery.

j) Verify all mounting hardware is torqued and install left aft seat back panel.

k) Install all cowling.

4.220 Lower Frame Assembly, RH

4.221 Frame Removal

1. Remove all cowling.
2. Remove main rotor gearbox, including both fuel tanks, per Section 7.110.
3. Remove powerplant, including tailcone, C046-3 strut, and clutch assembly, per Section 6.110.
4. Remove right rear seatback.
5. Disconnect the aft NAS6607 landing gear mounting bolt from the right landing gear support.
6. Disconnect the two forward mounting points (Figure 4-2A, Details C and E).
7. Remove the NAS6604-2 bolt and the C722-2 cap screw connecting the upper frame to the lower right frame assembly (Figure 4-2, Details A and B).
8. Remove the right frame assembly.
9. Remove the C014-7 landing gear support and the D310-6 bracket from the right frame assembly.

4.222 Frame Installation

1. Install the C014-7 landing gear support and D310-6 bracket per Figure 5-1. Torque per Section 1.320.
2. Position frame for installation. Install all hardware per Figure 4-2, Details A and B and Figure 4-2A, Details C and E. Install all hardware before torquing.
3. Torque all NAS6600 bolts per Section 1.320. Torque the C722-2 cap screw per Section 1.330 and safety wire to the C385-1 firewall doubler with 0.041 inch diameter safety wire.
4. Install NAS6607 landing gear mounting bolt per Figure 5-1 and torque per Section 1.320.
5. Install powerplant per Section 6.120.
6. Install tailcone per Section 4.300.
7. Install main rotor gearbox per Section 7.120.
8. Install clutch assembly per Section 7.200.
9. Verify all mounting hardware is torqued and install right aft seat back panel. Install all cowling.

4.230 Upper Frame Assembly

4.231 Frame Removal

Before the upper frame is disconnected and removed, the powerplant must be either removed or supported.

CAUTION

Extensive damage to the firewall and lower frame assemblies will occur if powerplant is not supported or if support is dislodged.

1. Remove all cowling.
2. Remove clutch assembly per Section 7.200.
3. Remove main rotor gearbox, including both fuel tanks, per Section 7.110.
4. Remove tailcone per Section 4.300.
5. Support powerplant or remove per Section 6.110.
6. Remove the right and left aft seat backs and panel between seatbacks.
7. Remove C316-1 upper bellcrank per Section 8.531 and remove the C121-15 push-pull tube.
8. Remove the C723 bulkhead assemblies at the aft end of the horizontal firewall.
9. Remove the NAS6605-4 bolts at the aft outboard corners of the horizontal firewall (Figure 4-2B, Detail H).
10. Remove all NAS6600 bolts and the C722-2 cap screws shown in Figure 4-2, Details A and B.
11. Remove upper frame.
12. Remove C329-1 bearing block assembly and A331-4 bellcrank assembly from upper frame.

4.232 Frame Installation

1. Clean upper frame and mounting points of all sealant, grease and oil. Install C329-1 bearing block assembly using AN509-8R11 screws, AN960-8L washers, and NAS1291-08 nuts, 3 places. Install A331-4 bellcrank assembly per Section 8.542.
2. Position upper frame for installation. Install all hardware per Figure 4-2, Details A and B and Figure 4-2B, Detail H. Install all hardware before torquing.
3. Torque all NAS6600 bolts per Section 1.320. Torque the C722-2 cap screws per Section 1.330 and safety wire to the C385-1 firewall doubler with 0.041 inch diameter wire.
4. Seal firewalls using B270-1 sealant to prevent fuel seepage.
5. Install the C723 bulkhead assemblies.
6. Install the C316-1 upper bellcrank per Section 8.532 and install the C121-15 push-pull tube.
7. Install powerplant, if removed, per Section 6.120.
8. Install tailcone per Section 4.300.
9. Install main rotor gearbox per Section 7.120.
10. Install clutch assembly per Section 7.200.
11. Verify all mounting hardware is torqued and install aft seat back and center panels.
12. Install all cowling.

4.240 Strut Assembly Removal and Installation

A. Removal

1. Remove right engine side panel and aft engine cowling.
2. Support engine from below to reduce the load on the lower frames.
3. Remove upper and lower mounting bolts and remove strut.

B. Installation

1. Install strut and hardware as shown in Figure 4-2B, Details G and H.
2. Torque bolts per Section 1.320.
3. Remove engine supports.
4. Install cowling.

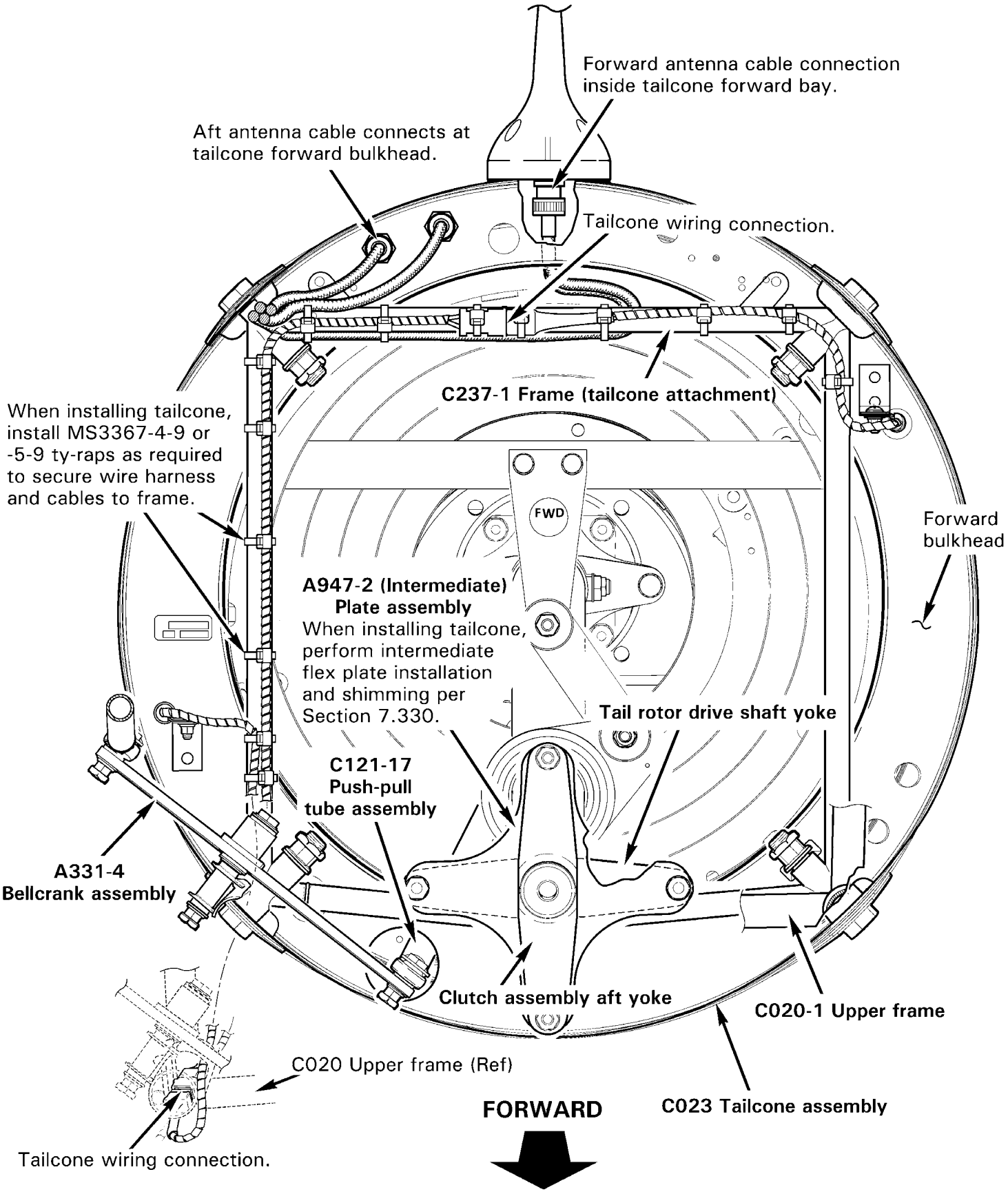


FIGURE 4-3 TAILCONE ASSEMBLY

4.300 Tailcone Assembly

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 Section 1.320, and torque stripe per Figure 2-1.

3. Install hardware securing C121-17 push-pull tube to A331-4 bellcrank assembly. Standard torque bolt per Section 1.320, and torque stripe per Figure 2-1.

4. Inspect flex plate per Section 2.140. Perform intermediate flex plate installation and shimming per Section 7.330.

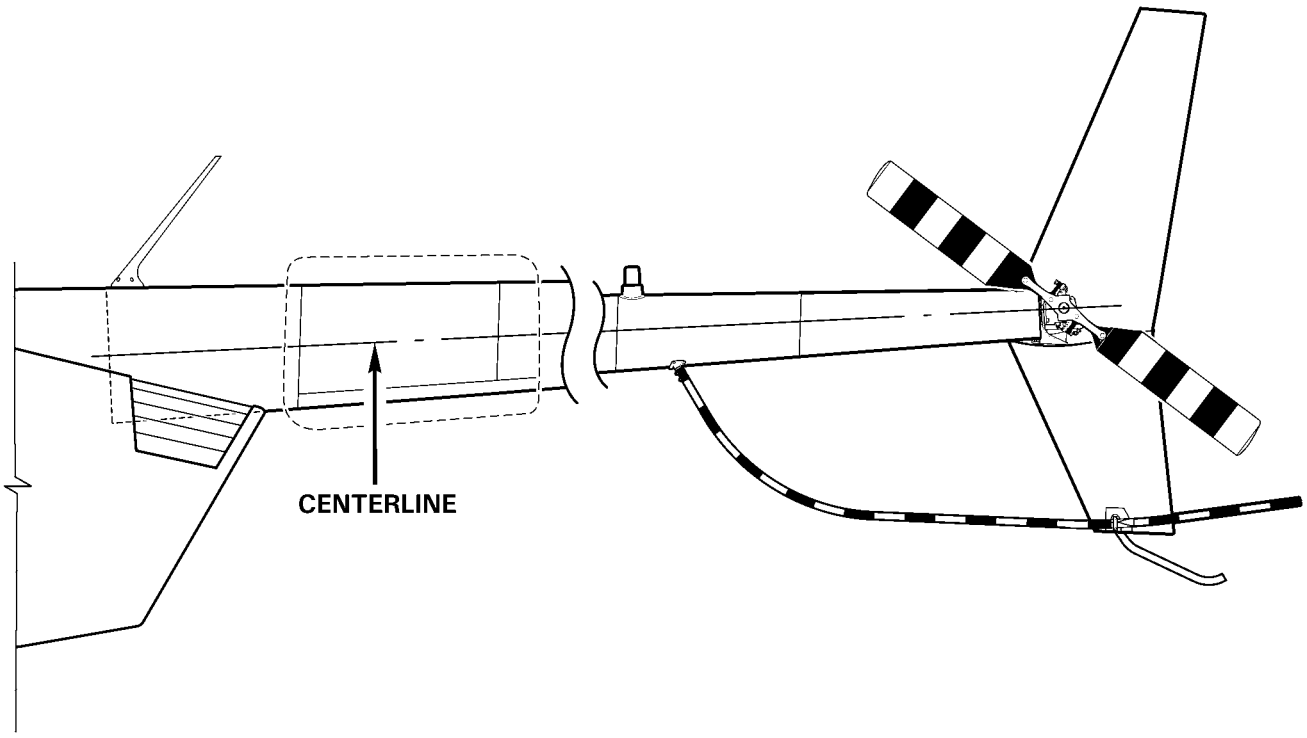
5. Perform tail rotor drive shaft runout per Section 7.340.

6. Connect tailcone wiring at connectors, connect two antenna cables inside tailcone forward bay, and connect antenna cables at forward bulkhead, as required. Individually test and verify correct function of tail position light, strobe, and TR chip light circuits.

7. Install MS3367-4-9 or -5-9 ty-raps as required to secure wire harness and cables to frame. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.

8. Install C706-1 tailcone fairing and D040-1 aft cowling assemblies.

9. Close associated circuit breakers, turn BATTERY switch ON, and verify proper function of lights and installed equipment with tailcone antennas. Turn BATTERY switch OFF.



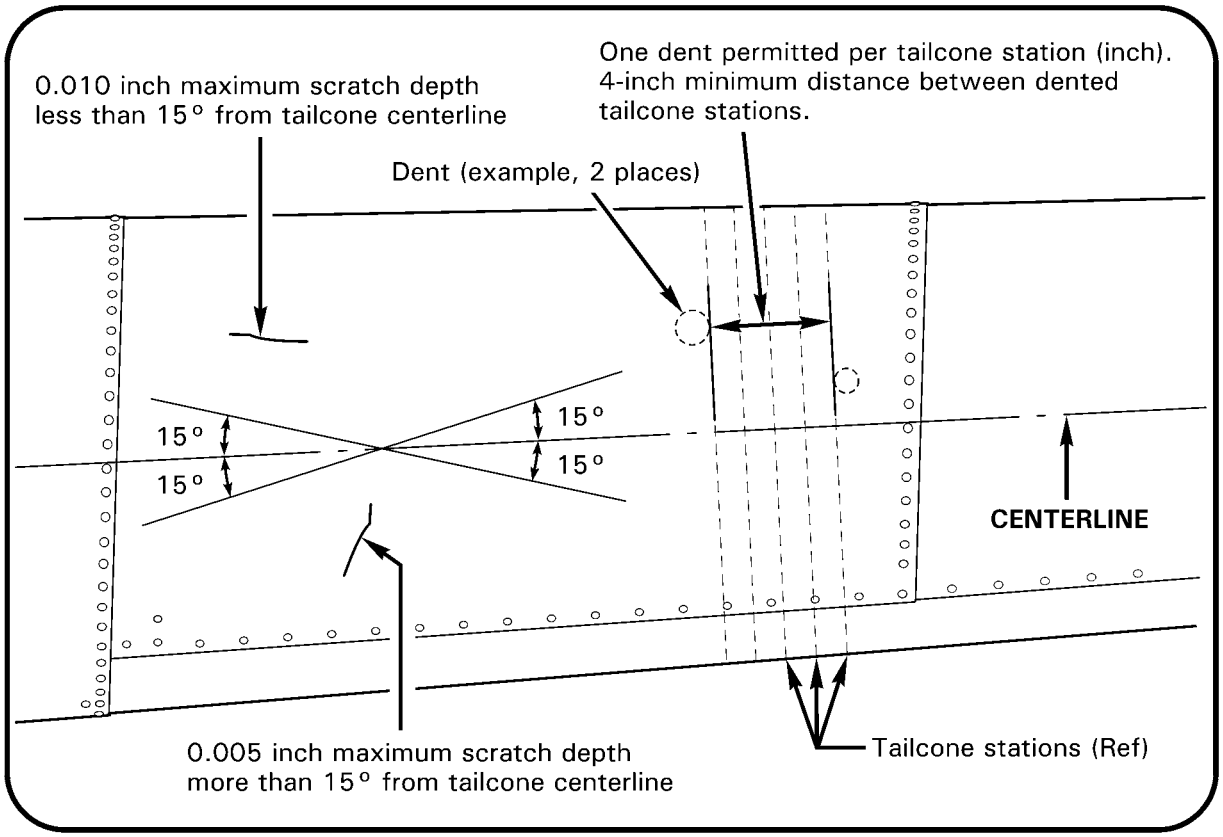


FIGURE 4-4 TAILCONE INSPECTION AND REPAIR

4.310 Inspection and Repair

This procedure outlines the inspection criteria and repair limits for the tailcone assembly. Repairs are limited to blending out scratches and refinishing skins.

A. Scratches

1. Refer to Figure 4-4. Verify damage does not exceed the following limits:

   a. 0.005 inch maximum scratch depth more than 15° from tailcone centerline.
   b. 0.010 inch maximum scratch depth less than 15° from tailcone centerline.

2. If damage exceeds limits, return tailcone assembly to RHC for repair. If damage is within limits, blend out scratches with a 0.10 inch minimum blend radius. Refinish skins using approved materials per Section 1.400.

B. Dents

1. Refer to Figure 4-4. Smooth, round bottom dents with 0.125 inch minimum radius without sharp nicks or cracks are acceptable when damage does not exceed the following limits:

   a. 0.030 inch maximum dent depth.
   b. 1.250 inches maximum dent diameter.
   c. One dent permitted per tailcone station (inch).
   d. 4.000 inches minimum distance between dented tailcone stations.

2. If damage exceeds limits, replace tailcone or return to RHC for repair.

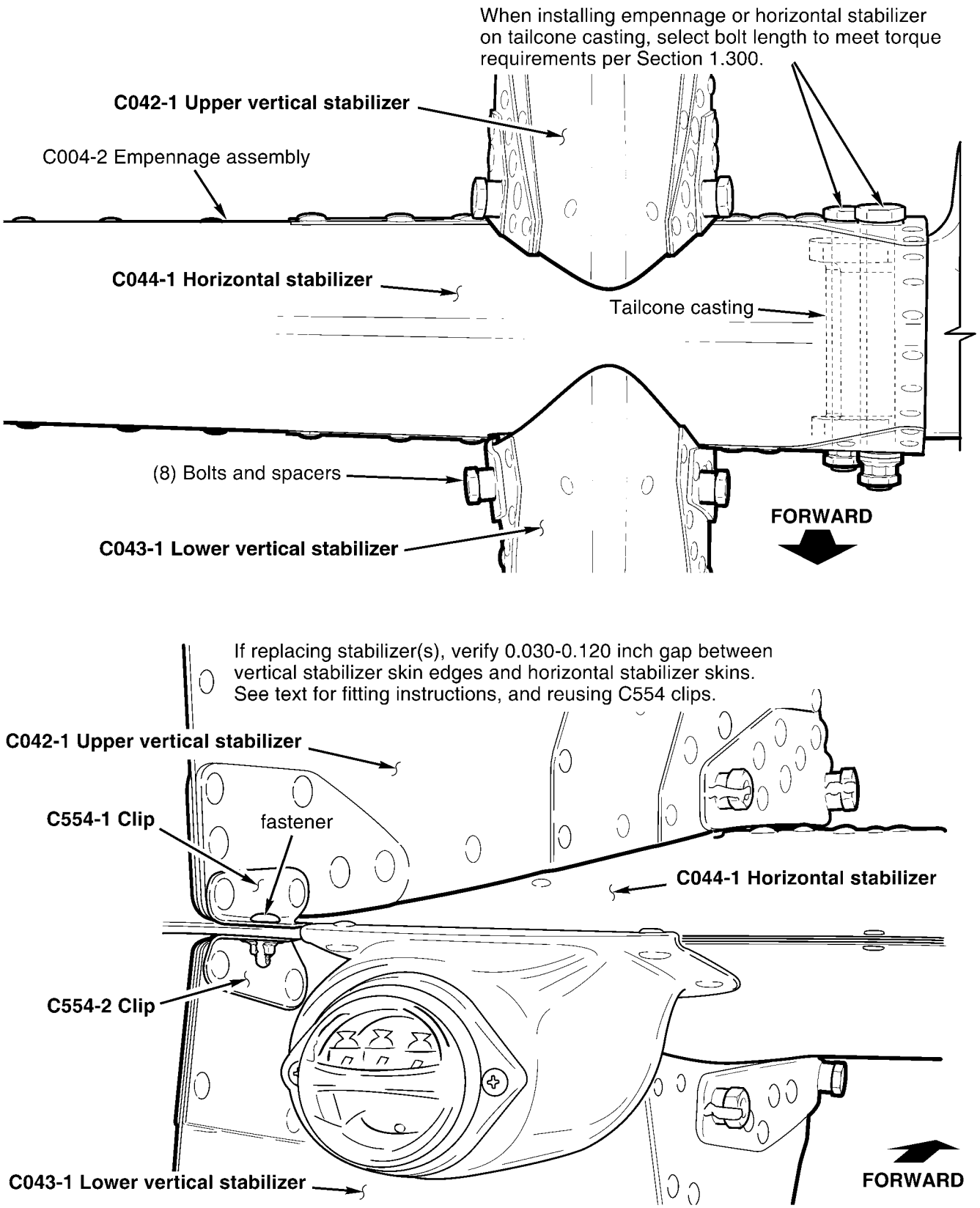


FIGURE 4-5 EMPENNAGE - TAILCONE CASTING

4.400 Empennage Assembly

A. Removal

1. Remove D079-1 guard assembly per Section 4.430.

2. Remove hardware securing forward MS21919WDG3 clamp to C044-1 horizontal stabilizer.

3. Cut and discard ty-raps as required, and disconnect position light wiring from airframe harness at connectors.

4. Refer to Figure 4-5. Support C004-2 empennage assembly, remove two bolts and associated hardware securing empennage to tailcone casting, and remove empennage.

B. Installation

1. Refer to Figure 4-5. Position C004-2 empennage assembly on tailcone casting. Install two bolts and associated hardware securing empennage to tailcone casting; select bolt length to meet torque requirements per Section 1.300. Standard torque hardware per Section 1.320, and torque stripe per Figure 2-1.

2. Connect position light wiring to airframe harness at connectors. Install hardware securing forward MS21919WDG3 clamp to C044-1 horizontal stabilizer. Install MS3367-4-9 or -5-9 ty-raps as required to secure wiring and connectors. 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 D079-1 guard assembly per Section 4.430.

4.410 Vertical Stabilizers

4.411 C042-1 Upper Vertical Stabilizer

A. Removal

1. Refer to Figure 4-5. Remove fastener securing C554 clips to C044-1 horizontal stabilizer trailing edge.

2. Remove four bolts and spacers securing C042-1 upper vertical stabilizer to horizontal stabilizer, and remove C042-1 stabilizer.

3. If replacing C042-1 stabilizer, C554-1 clip may be reused. Drill out two rivets securing clip to stabilizer.

4.411 C042-1 Upper Vertical Stabilizer (continued)

B. Installation

1. Refer to Figure 4-5. Position C042-1 upper vertical stabilizer on C044-1 horizontal stabilizer. Verify 0.030-0.120 inch gap between C042-1 stabilizer skin edges and horizontal stabilizer skins. File C042-1 stabilizer skin edge(s) as required.

2. Install four bolts and spacers securing C042-1 stabilizer to horizontal stabilizer. Special torque hardware per Section 1.330, and torque stripe per Figure 2-1.

3. Install fastener securing C554 clips to horizontal stabilizer trailing edge. (If reusing C554-1 clip, install clip and fastener, and match drill clip to C042-1 stabilizer with #30 drill. Deburr holes and install rivets.) Torque stripe fastener per Figure 2-1.

4.412 C043-1 Lower Vertical Stabilizer

A. Removal

1. Remove D079-1 guard assembly per Section 4.430.

2. Remove (R44 Clipper) C050-2 aux stabilizer per Section 4.422, as required. Remove tail skid per Section 4.440, as required.

3. Refer to Figure 4-5. Remove fastener securing C554 clips to C044-1 horizontal stabilizer trailing edge.

4. Support C043-1 lower vertical stabilizer. Remove four bolts and spacers securing C043-1 stabilizer to horizontal stabilizer, and remove C043-1 stabilizer.

5. If replacing stabilizer, C554-2 clip may be reused. Drill out two rivets securing clip to stabilizer.

B. Installation

1. Refer to Figure 4-5. Position C043-1 lower vertical stabilizer on C044-1 horizontal stabilizer. Verify 0.030-0.120 inch gap between C043-1 stabilizer skin edges and horizontal stabilizer skins. File C043-1 stabilizer skin edge(s) as required.

2. Install four bolts and spacers securing C043-1 stabilizer to horizontal stabilizer. Special torque hardware per Section 1.330, and torque stripe per Figure 2-1.

3. Install fastener securing C554 clips to horizontal stabilizer trailing edge. (If reusing C554-2 clip, install clip and fastener, and match drill clip to C043-1 stabilizer with #30 drill. Deburr holes and install rivets.) Torque stripe fastener per Figure 2-1.

4. Install (R44 Clipper) C050-2 aux stabilizer assembly per Section 4.420, as required. Install tail skid per Section 4.440, if removed.

5. Install D079-1 guard assembly per Section 4.430.

4.420 Horizontal Stabilizer(s)

4.421 C044-1 Horizontal Stabilizer

A. Removal

1. Remove C042-1 upper vertical stabilizer and C043-1 lower vertical stabilizer per Sections 4.411 and 4.412.

2. Remove hardware securing forward MS21919WDG3 clamp to C044-1 horizontal stabilizer.

3. Cut and discard ty-raps as required, and disconnect position light wiring from airframe harness at connectors.

4. Refer to Figure 4-5. Remove two bolts and associated hardware securing horizontal stabilizer to tailcone casting, and remove horizontal stabilizer.

B. Installation

1. Refer to Figure 4-5. Position C044-1 horizontal stabilizer on tailcone casting. Install two bolts and associated hardware securing horizontal stabilizer to tailcone casting; select bolt length to meet torque requirements per Section 1.300. Standard torque hardware per Section 1.320, and torque stripe per Figure 2-1.

2. Install C042-1 upper vertical stabilizer and C043-1 lower vertical stabilizer per Sections 4.411 and 4.412.

3. If horizontal stabilizer was replaced, match drill C554 clips 0.144-inch diameter hole through trailing edge of horizontal stabilizer. Deburr hole and install fastener.

4. Connect position light wiring to airframe harness at connectors. Install hardware securing forward MS21919WDG3 clamp to C044-1 horizontal stabilizer. Install MS3367-4-9 or -5-9 ty-raps as required to secure wiring and connectors. 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.

4.422 (R44 Clipper) C050-2 Aux Stabilizer

A. Removal

1. Remove tail skid per Section 4.440.

2. Using plastic scraper, remove sealant around edges where C971 brackets attach to C716 doublers. Remove C050-2 aux stabilizer.

B. Installation

1. Position C050-2 aux stabilizer on C043-1 lower vertical stabilizer. Install tail skid per Section 4.440.

2. Seal C971 bracket edges to C716 doublers using B270-4 sealant.

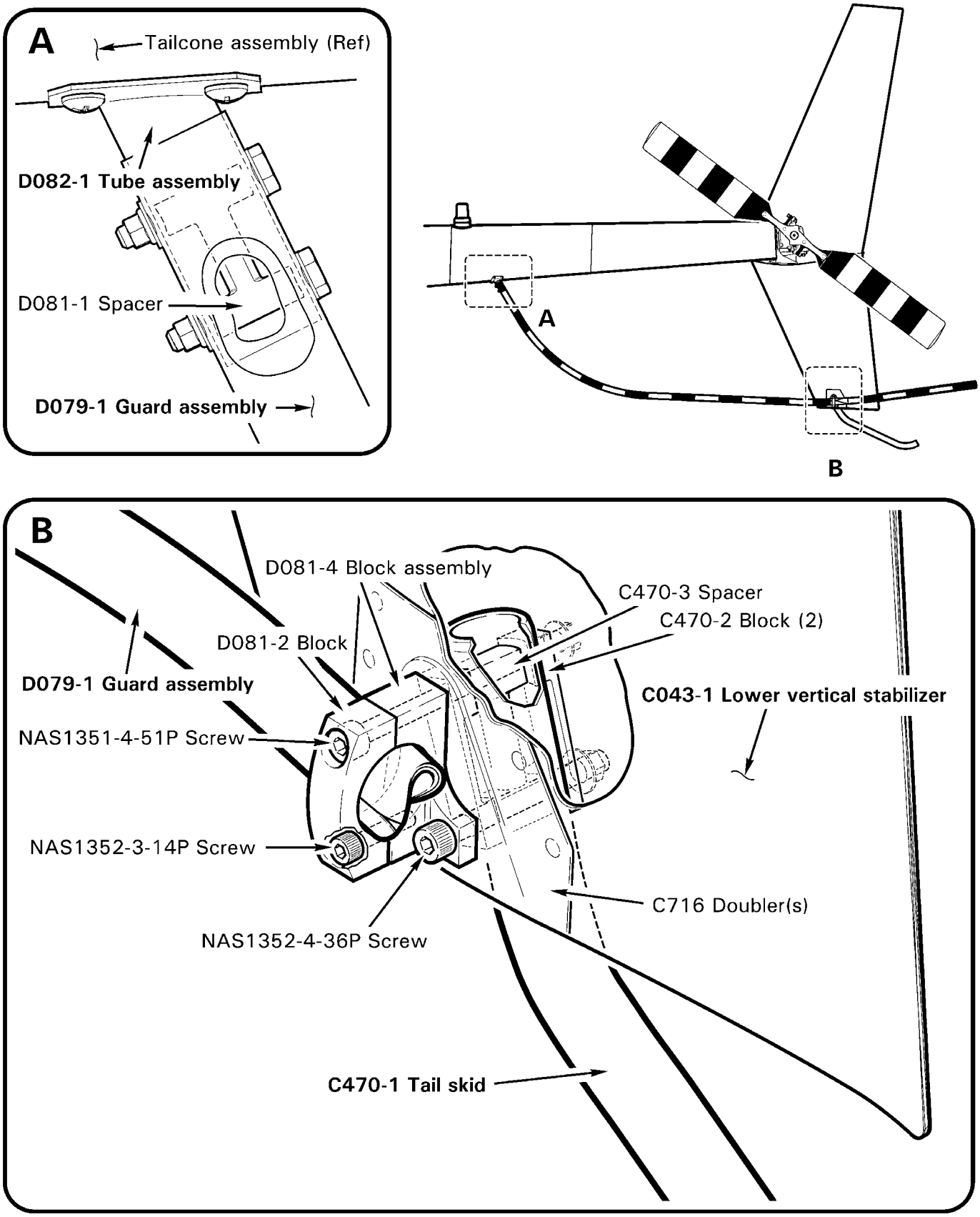


FIGURE 4-6 EMPENNAGE - TAIL ROTOR GUARD
(See R44 Illustrated Parts Catalog for R44 Clipper C050-2 aux stabilizer installation)

4.430 Tail Rotor Guard

A. Removal

1. Refer to Figure 4-6. Loosen two (forward) fasteners securing D081-2 block and D079-1 guard assembly to C043-1 lower vertical stabilizer.

2. Remove hardware securing guard to D082-1 tube assembly. Slide guard off of tube, then forward through blocks. Remove D081-1 spacer from tube.

B. Installation

1. Refer to Figure 4-6. Loosen two (forward) fasteners securing D081-2 block to C043-1 lower vertical stabilizer, if not previously accomplished. Insert D079-1 guard assembly aft through blocks.

2. Install D081-1 spacer inside D082-1 tube assembly.

3. Lightly coat mating surfaces of tube and D079-1 guard assembly, and retaining hardware bolt shanks, with approved primer per Section 1.400. While wet with primer, slide guard onto tube and install hardware. Standard torque bolts per Section 1.320, and torque stripe per Figure 2-1. Seal around end of guard with primer after assembly.

4. Verify D081 blocks clamp bonded sleeve on guard. For proper guard-to-stabilizer clamping, first standard torque (forward, top) NAS1351-4-51P or -53P screw and associated hardware per Section 1.320, then special torque (forward, bottom) NAS1352-3-14P screw and associated hardware per Section 1.330. Torque stripe fasteners per Figure 2-1.

4.440 Tail Skid

A. Removal

1. Refer to Figure 4-6. Support D079-1 guard assembly. Remove two (forward) fasteners securing D081-2 block and guard to C043-1 lower vertical stabilizer. Remove block.

2. Support C050-2 aux stabilizer assembly, if installed, and C470-1 tail skid. Remove hardware securing D081-4 block assembly to C043-1 stabilizer and remove block assembly.

3. Remove tail skid, two C470-2 blocks, and C470-3 spacer from tail skid. Support guard and aux stabilizer while hardware is removed.

B. Installation

1. Refer to Figure 4-6. Install C470-3 spacer inside C470-1 tail skid. Install tail skid and two C470-2 blocks inside C043-1 lower vertical stabilizer. Install D081-4 block assembly, and hardware securing block and tail skid assemblies to vertical stabilizer. Standard torque screw per Section 1.320, and torque stripe per Figure 2-1.

2. Install D081-2 block, and hardware securing block and tail skid to vertical stabilizer. Verify D081 blocks clamp bonded sleeve on guard. For proper guard-to-stabilizer clamping, first standard torque (forward, top) NAS1351-4-51P or -53P screw and associated hardware per Section 1.320, then special torque (forward, bottom) NAS1352-3-14P screw and associated hardware per Section 1.330. Torque stripe fasteners per Figure 2-1.

CHAPTER 5

LANDING GEAR

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CHAPTER 5

LANDING GEAR

5.000 Landing Gear

5.001 Introduction

This section covers the removal and installation of the landing gear assembly, cross tubes, skid tubes, skid shoes, ground handling wheel supports, and strut fairings.

5.002 Description

Standard landing gear consists of two aluminum skid tubes, four steel struts with forged aluminum elbows, and two aluminum cross tubes. The landing gear connects to the fuselage at each elbow. Aerodynamic fairings are clamped to each strut. The right forward connection is to a pivoting shackle which allows the forward cross tube to flex. The right, aft connection is to a flexible steel tube frame which allows the aft cross tube to flex. Skid shoes, constructed of 4130 steel with a hard wear surface, protect the underside of the skid tubes during landing.

R44 Clippers have permanently inflated utility floats or emergency pop-out floats mounted to skid tubes and incorporate extended steel struts and aft skid extensions to support the floats. Strut fairings are not installed with utility floats.

5.100 Landing Gear Assembly

5.110 Landing Gear Removal

1. Remove C388 channels and C475 cover at forward cross tube.

2. Remove D040 aft engine cowling and D041 engine belly cowling.

3. Disconnect A936 ground wire at aft, right elbow.

4. Hoist helicopter by main rotor hub per Section 1.220 until skids clear ground by approximately 4 inches.

5. Remove four NAS6607 landing gear mounting bolts. Remove forward, left mounting bolt first. Then rotate forward, right shackle to align mounting bolt with access hole in bulkhead before removing bolt. Forward bolts can be accessed from inside aft baggage compartments and through access holes under carpet at aft outboard corners of aft floor.

LANDING GEAR INSTALLATION

Item	*Part Number*	*Description*
1	A214-10	Washer
2	C014-10	Strut Assembly (fwd)
3	C105-1	Journal
4	LJS-1016	Bearing
5	C014-5	Shackle Assembly
6	C141-5	Washer
7	AN960-716L	Washer
8	D310-5	Aft Cowl Bracket, LH (shown)
	D310-6	Aft Cowl Bracket, RH (not shown)
9	B330-21	Palnut
10	NAS679A7	Nut
11	AN960-716	Washer
12	C278-1	Spacer
13	C241-1	Cross Tube (rear)
14	C014-9	Strut Assembly (rear)
15	C241-2	Cross Tube (fwd)
16	C141-6	Washer
17	C294-2	Bearing Assembly
18	C141-4	Washer
19	NAS6607-53	Bolt
20	A141-11	Washer
21	NAS6604-17	Bolt
22	C014-7	Support Assembly
23	C240-1	Elbow
24	NAS1291-4	Nut
25	C247-2	Rain Cap
26	NAS6604-41	Bolt
27	AN960-416L	Washer
28	A31007	Nut
29	S14119	Screw

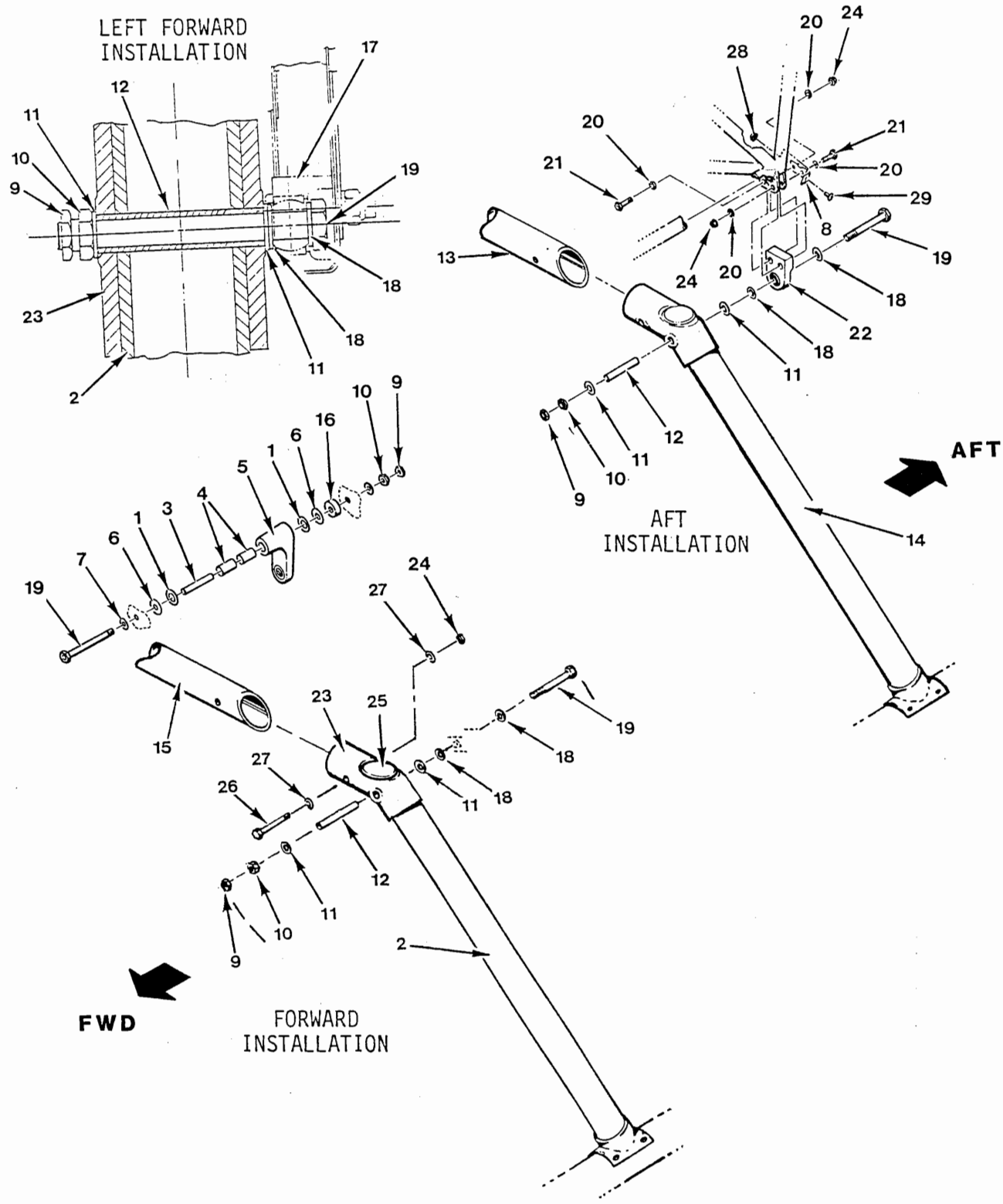


FIGURE 5-1 LANDING GEAR INSTALLATION

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5.120 Landing Gear Installation

a) Hoist the helicopter per Section 1.

b) Lift the right side of the landing gear and install both right side mounting bolts per Figure 5-1. Torque per Section 1.320, install palnuts, and torque stripe. Repeat on left side.

c) Connect ground wire at right aft elbow and attach battery drain tube to aft cross tube.

d) Install the C475-2 cover and the C388-1 channels at the forward cross tube.

e) Install all cowling.

5.200 CROSS TUBES

5.210 Cross Tube Removal

The aft cross tube must be replaced if it has yielded so that the tail skid is less than 30 inches from the ground.

NOTE

For hard landing inspection, see Section 2.550.

a) Remove landing gear per Section 5.110.

b) Disconnect one of the struts from the skid tube.

c) Remove the bolts in the elbows at each end of the cross tube and tap the elbows off of the cross tube.

5.220 Cross Tube Installation

a) Install cross tube into the elbows and install bolts per Figure 5-1. Torque bolts per Section 1.320.

b) Connect the unbolted strut to the skid tube and torque the NAS6606-4 bolts per Section 1.320.

c) Install landing gear per Section 5.120.

5.300 SKID TUBES

5.310 Skid Tube Removal

a) Raise one side of the helicopter by jacking under one end of the aft cross tube, one inch inboard of the elbow.

b) Remove the 4 bolts at each landing gear strut. Remove the skid tube.

c) Remove the C937 skid extension by removing the aft skid shoe. Remove the C719-1 wheel support.

5.320 Skid Tube Installation

a) Install the C937 skid extension and aft skid shoe onto the C014-11 or -12 skid tube assembly. Install the C719-1 wheel support and torque per Section 1.330; the reduced torque required by Section 1.330 is required to avoid damaging the skid tube.

b) Place the skid tube assembly under the fore and aft gear struts and install the attach bolts. Torque the NAS6606-4 attach bolts per Section 1.320.

c) Seal the slot in the side of the skid extension with B270-9 adhesive, if required.

5.330 Skid Shoe Replacement

The two A667-8 forward skid shoes and seven A667-7 skid shoes (four on the left skid and three on the right) are fastened with A142-1 screws. Use new screws when replacing shoes and torque to 27 in.-lb. Skid shoes must be replaced when the bottoms have worn to 0.050 inch thick at their thinnest point.

a) To inspect or replace the aft shoe on each skid, install ground handling wheels to lift the helicopter or jack up the helicopter at the aft landing gear cross tube per Figure 5-3B. Remove and discard worn skid shoes and screws and replace.

b) To inspect or replace all other skid shoes, install ground handling wheels, pull the tail down and place wood blocks under the skids to hold the skids up per Figure 5-3A. Replace any worn shoes.

5.340 Ground Handling Wheel Support Replacement

a) Remove the two mounting bolts and remove the C719-1 support.

b) Install the support using NAS6604-47 bolts and torque per Section 1.330. The reduced torque of Section 1.330 is required to avoid damaging the skid tube.

5.350 Skid Extension Replacement

a) Raise one side of the helicopter by jacking under one end of the aft cross tube, one inch inboard of the elbow.

b) Remove the aft skid shoe and remove the four bolts attaching the aft strut to the skid tube.

c) Remove the C937-1 or -2 skid tube extension and replace.

d) Attach the strut to the skid tube and torque the four NAS6606-4 bolts per Section 1.320. Install the skid shoe.

e) Seal the slot in the side of the skid extension with B270-9 adhesive.

5.400 STRUT FAIRINGS

5.410 Strut Fairing Removal

a) Loosen the clamps through the access hole on the inboard side of the fairing.

b) Remove all screws along the trailing edge.

c) Unscrew the clamps and slide the fairing off of the strut.

5.420 Strut Fairing Installation

a) Verify that a B162-3 clip nut is installed at each hole at the trailing edge of the fairing and that the strut clamps pass through both of the clips riveted to the fairing.

b) Slide the fairing onto the strut and loosely fasten the two clamps.

c) Install and tighten all screws along the trailing edge.

d) Position fairings by placing a long straight edge across both forward and aft fairings at the lower clamps (See below). The distance from the straight edge to the centerline of the trailing edge should measure 1.4 inches. Check for 0.10 inch clearance all around both ends of the fairing. Remove fairing to trim and reinstall, if required.

e) Apply B270-10 adhesive to both clamp threads and torque per Section 1.330. Verify 1.4 inch dimension with the straight edge.

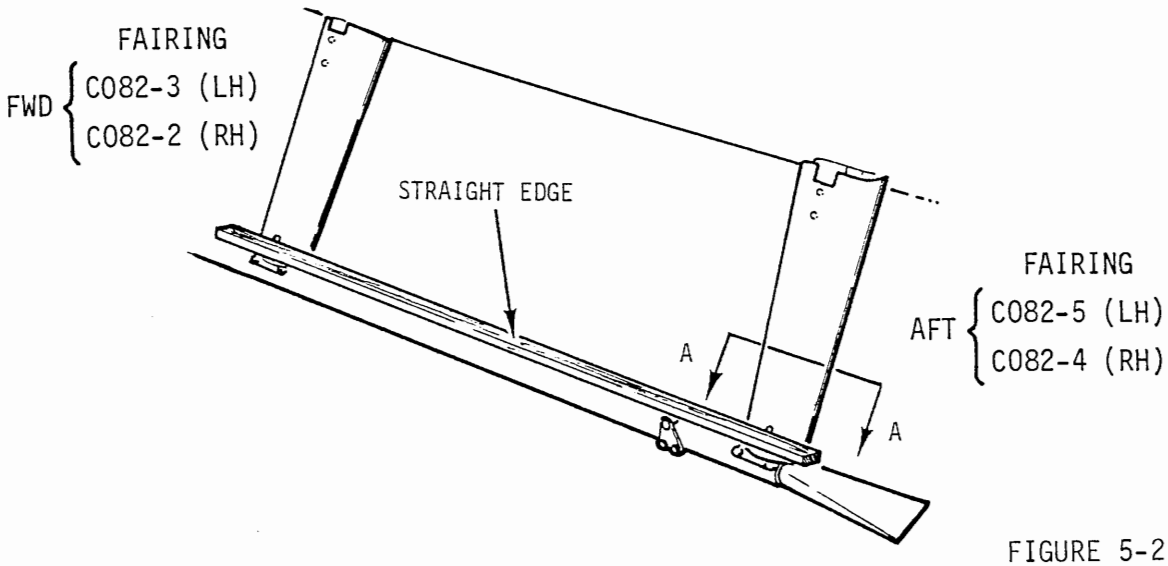
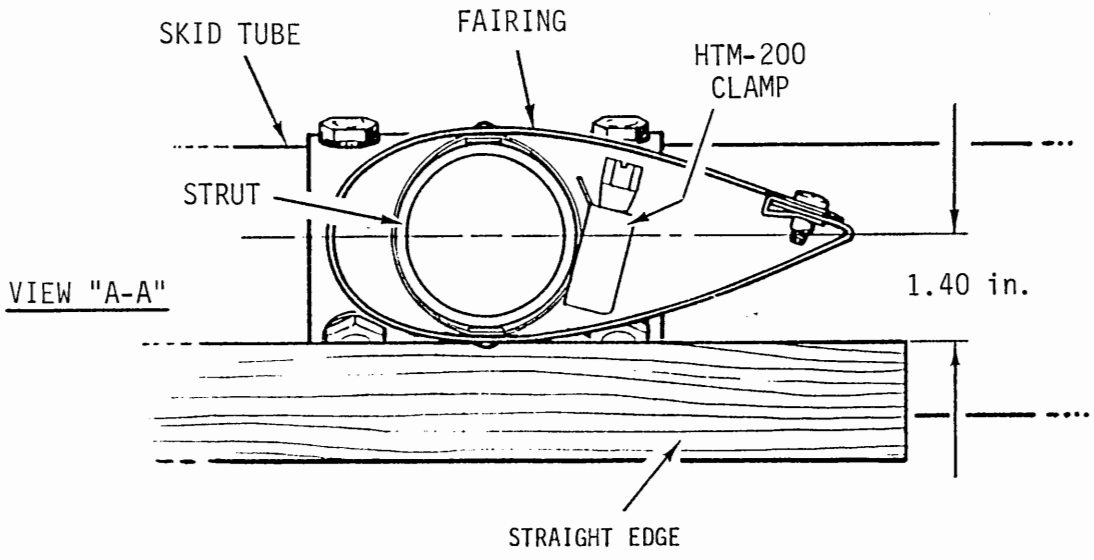


FIGURE 5-2



5.500 UTILITY FLOAT LANDING GEAR

The Robinson R44 Clipper helicopter may be flown with float landing gear or standard landing gear installed. When changing configurations, remove complete utility float landing gear and install complete standard landing gear. Do not remove float tubes from landing gear skid tubes unless necessary for repairs.

CAUTION

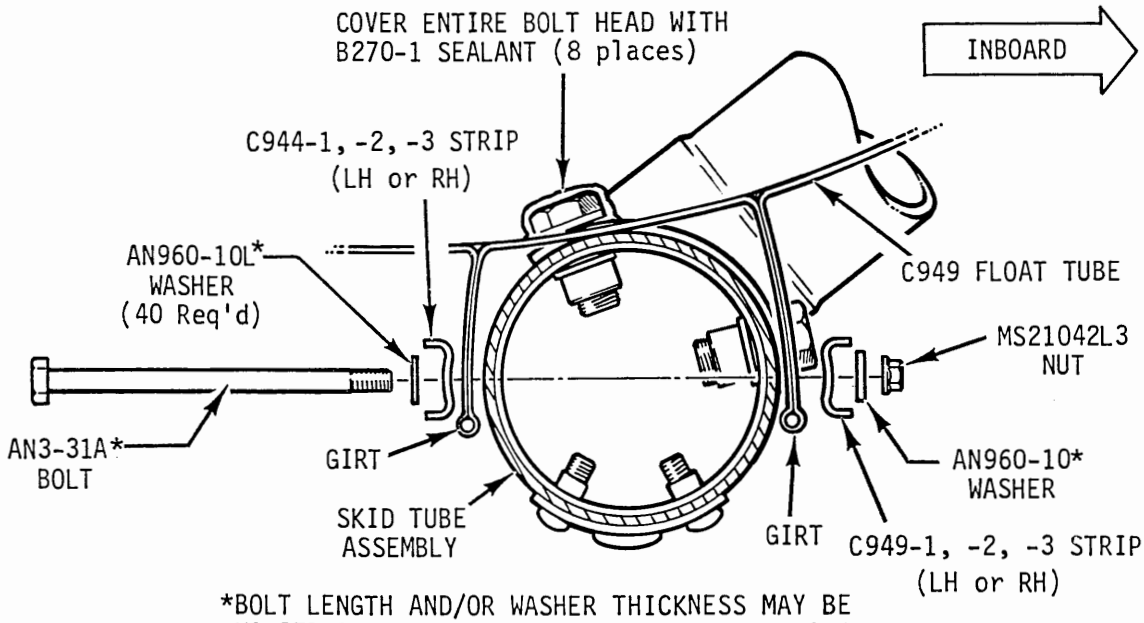
Float landing gear can only be installed on R44 Clipper helicopters.

5.510 Utility Float Landing Gear Removal

1. Remove float landing gear per Section 5.110.
2. Install standard landing gear per Section 5.120.
3. Remove C050 float stabilizer per Section 4.326.
4. Remove D372-2 air dams aft of static ports. Reinstall attaching screws.
5. Revise Equipment List/Weight and Balance data (located in helicopter Pilot's Operating Handbook, Section 6) using following information:

Part Number	Description	Weight (lb)	CG Arm (in.)	Moment (in.-lb)
C034-2	Utility Float Landing Gear	104.3	95.2	9929
C050-2	Utility Float Stabilizer	1.1	335.4	369
C014-8	Standard Landing Gear	60.9	86.3	5256

6. Perform flight check per Section 2.220.
7. Check and adjust autorotation RPM per Section 10.250 (usually requires lengthening pitch links approximately 1 full turn at upper rod end).



*BOLT LENGTH AND/OR WASHER THICKNESS MAY BE VARIED AS REQUIRED TO MAINTAIN 2-4 THREADS SHOWING BEYOND NUTS. SEAL UNDER HEAD AND NUT AND AROUND BOLT BETWEEN GIRTS AND SKID TUBE WITH B270-1 SEALANT.

FIGURE 5-3 UTILITY FLOAT ATTACHMENT
(LEFT SIDE SHOWN, VIEW LOOKING FORWARD)

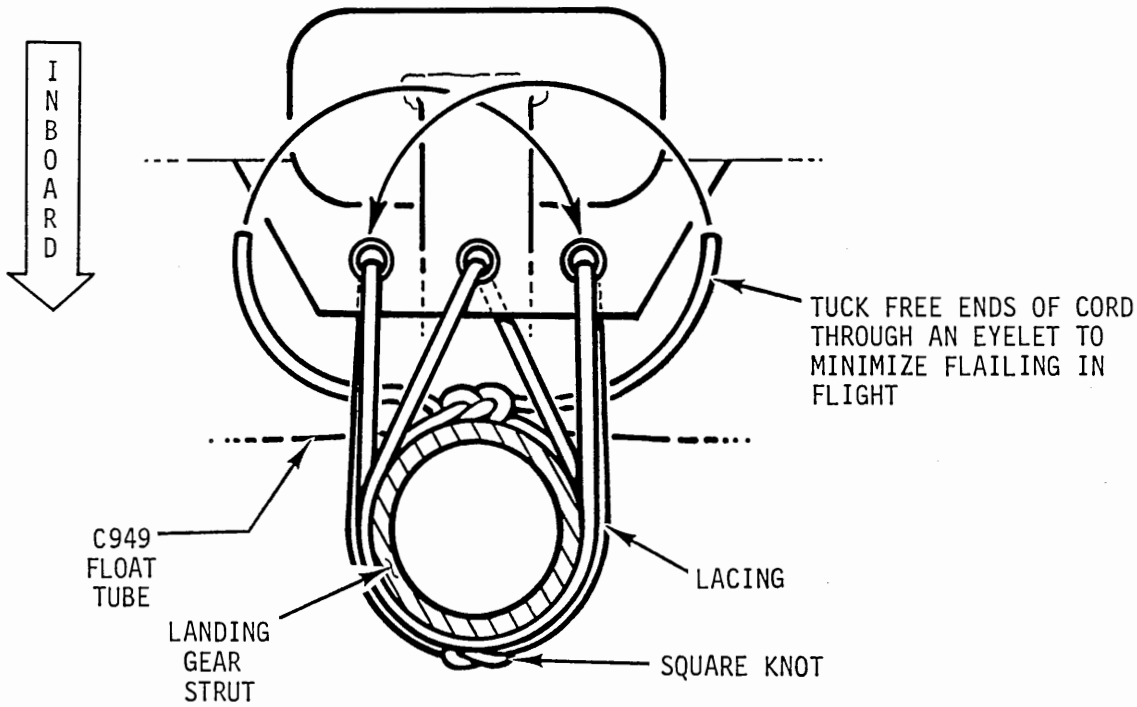


FIGURE 5-4 UTILITY FLOAT-TO-STRUT ATTACHMENT
(VIEW LOOKING DOWN)

5.520 Utility Float Landing Gear Installation

1. Remove standard landing gear per Section 5.110.
2. Install utility float landing gear per Section 5.120.
3. Install C050 float stabilizer per Section 4.327.
4. Adjust float pressure per helicopter's Pilot's Operating Handbook.
5. Install D372-2 air dams aft of static ports using existing screws.
6. Revise Equipment List/Weight and Balance data (located in helicopter's Pilot's Operating Handbook Section 6) using data provided in Section 5.510.
7. Shorten both main rotor pitch links by one full turn of upper rod end.
8. Perform flight check per Section 2.230.
9. Check and adjust autorotation RPM per Section 10.250.

5.530 Utility Float Tube Removal

1. Deflate float to loosen lacings.
2. Untie and remove lacings at each landing gear strut.
3. Remove hardware attaching float tube to skid tube and skid extension.
4. Remove retainer strips from girts. Carefully separate girt from skid tube and skid extension.

NOTE
Sealant between girt and skid tube at each bolt hole also acts as an adhesive. Use caution to avoid girt damage during removal.

5.540 Utility Float Tube Installation

NOTE
Before installation, remove old sealant from skid, float, girts, and hardware. A soft plastic scraper may be used.

1. See Figure 5-3. Ensure bolt heads directly beneath float are covered with a protective layer of B270-1 sealant (see Section 1.480). Apply additional sealant as required.
2. See Figure 5-3. Position uninflated float tube over landing gear skid tube and extension. Align holes in C944 retainer strips, float tube girts, and skid tube.
3. Install AN3 attach bolts per Figure 5-3. Seal under bolt head and nut with B270-1 sealant (ref Section 1.480). Torque bolts per Section 1.320.

5.540 Utility Float Tube Installation (cont'd)

4. Inflate float with filtered, oil-free, dry air to pressure specified in Pilot's Operating Handbook.

5. Install and tighten lacing at each landing gear strut per Figure 5-4.

5.600 EMERGENCY POP-OUT FLOAT LANDING GEAR

Emergency pop-out floats are an option for R44 Clippers and replace permanently inflated utility floats. Included are extended struts, skid extensions, uninflated floats stowed in protective covers along skid tubes, a lightweight composite pressure cylinder located in the compartment under the left-front seat, an inflation manifold, an inflation lever located on the pilot's collective, and an additional horizontal stabilizer at base of lower vertical stabilizer. A valve atop the pressure cylinder incorporates a pressure gage, a thermal relief valve which releases pressure if exposed to excessive heat (281 degrees F), a metal sealing disk, and a spring-loaded pin. To inflate the floats, the red inflation lever on pilot's collective stick must first have its spring-loaded safety in the READY position and then the lever must be squeezed forcefully enough to shear an aluminum rivet. Squeezing the lever causes a spring-loaded pin to puncture the metal sealing disk and allows the 4945 psig (nominal, at 20°C) helium charge to inflate both floats via the manifold. The manifold consists of hoses with metal fittings incorporating a check valve at each float chamber. There are six chambers per float (earlier versions have five chambers). Each float chamber also has a topping valve for manual inflation and a pressure relief valve which vents excessive internal pressure. When inflated, pop-out floats are identical to utility floats in size, shape, and internal chamber arrangement.

If installing utility float or standard landing gear in place of pop-out floats, removal of pressure cylinder, inflation lever (including brackets and cable), and exterior hoses (cap pressure cylinder hose and T-fitting in forward cross tube tunnel) is required. Additionally, check autorotation RPM per Section 10.250 and update empty weight and balance.

WARNING

Cylinder contents are under extreme pressure. 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.

5.610 Pop-out Float Removal

NOTE

To help prevent float damage, avoid removing floats from skid tubes unless necessary for repairs.

1. Remove heat-shrink and disconnect flexible line exiting forward strut fairing from T-fitting on float. Cap line and T-fitting to prevent contamination.

5.610 Pop-out Float Removal (cont'd)

2. Unfasten hook-and-loop fasteners along inboard sections of float cover to expose lacing. Loosen, but do not remove, lacing.

3. See Figure 5-5. Remove AN3 bolts attaching float to skid tube and skid extension.

4. See Figure 5-5. Remove C944 retainer strips from girts. Carefully separate girts from skid tube and skid extension.

NOTE

Sealant installed between girts and skid tube at each bolt hole also acts as an adhesive. Use caution to avoid girt damage during removal.

5.620 Pop-out Float Installation

NOTE

Before installation, remove old sealant from skids, floats, and hardware. A soft plastic scraper may be used.

WARNING

Cylinder contents are under extreme pressure. 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 pop-out floats or inflation hoses. **Remove locking pin when work is completed.**

1. See Figure 5-5. Ensure strut bolt heads directly beneath float are covered with a protective layer of B270-1 sealant (see Section 1.480). Apply additional sealant as required.

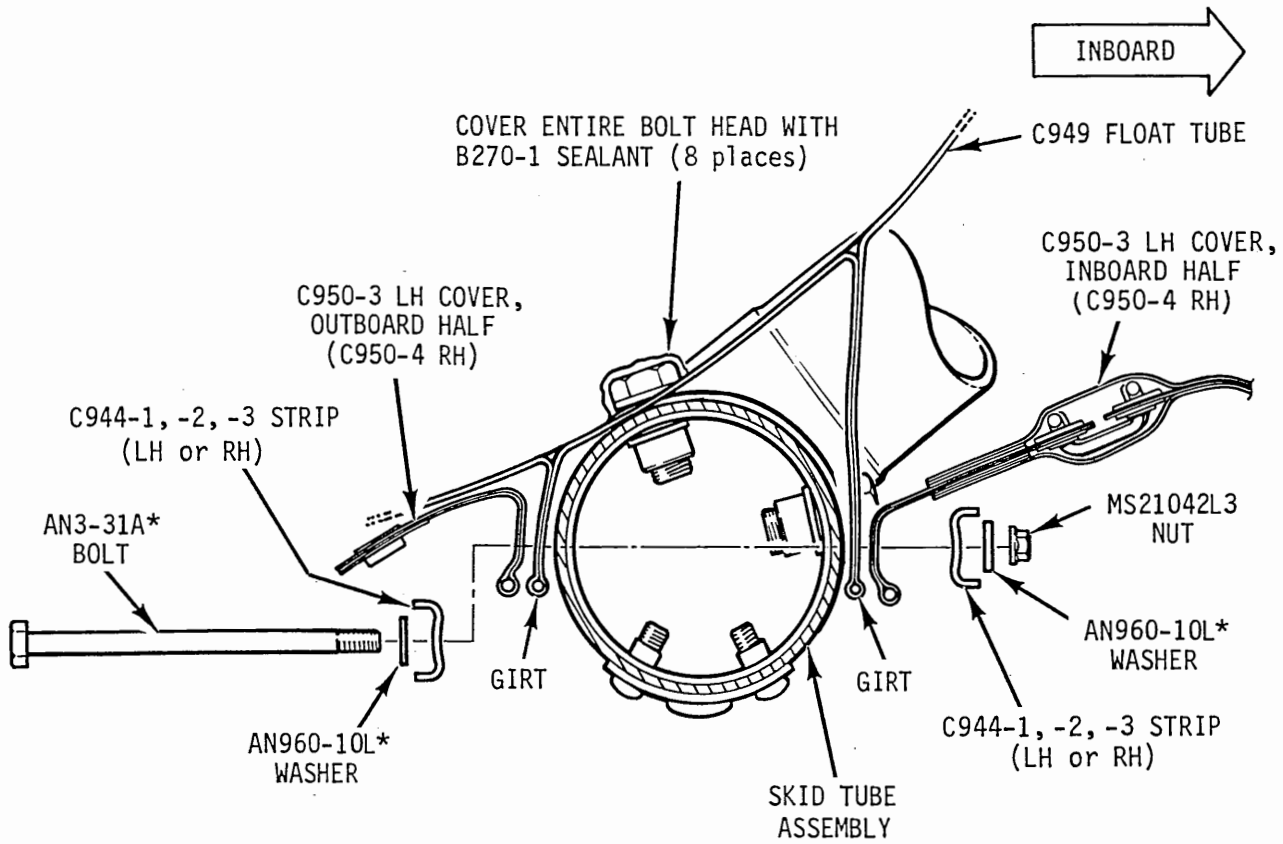
2. See Figure 5-5. Position uninflated float over landing gear skid tube and skid extension. Align holes in C944 retainer strips, float cover, float girts, and skid.

3. Install AN3 attach bolts per Figure 5-5. Seal under bolt head, nut, and around bolt between girts and skid tube with B270-1 sealant (see Section 1.480). Torque bolts per Section 1.320.

4. Inflate float with filtered, oil-free, dry air to 3.0 psig via topping valves.

5. Slide heat-shrink over flexible line exiting forward strut fairing. Ensure heat-shrink is of sufficient length to cover all sharp edges and seal out water after activation. Remove protective caps and connect flexible line to float T-fitting. Orient connection as required to minimize preload. Torque fitting per Section 1.330. Position heat-shrink over fittings and shrink with heat gun, using a shield to protect float from heat.

6. Pack floats per Section 5.650.



*BOLT LENGTH AND/OR WASHER THICKNESS MAY BE VARIED AS REQUIRED TO MAINTAIN 2-4 THREADS SHOWING BEYOND NUTS. SEAL UNDER HEAD AND NUT AND AROUND BOLT BETWEEN GIRTS AND SKID TUBE WITH B270-1 SEALANT.

FIGURE 5-5 POP-OUT FLOAT ATTACHMENT
(LEFT SIDE SHOWN, VIEW LOOKING FORWARD)

5.630 Leak Check

WARNING

Cylinder contents are under extreme pressure. 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 pop-out floats or inflation hoses. **Remove locking pin when work is completed.**

1. Disconnect D674-1 line assembly from pressure cylinder valve. Install protective cap on cylinder valve fitting. Cover D674-1 line fitting to prevent contamination, but do not install an air-tight seal (D674-1 line must be allowed to leak to verify check valve function at each float chamber).

2. Unfasten hook-and-loop fasteners along inboard sections of float cover to expose lacing. Loosen, but do not remove, lacing.

3. Unfasten outboard sections of float cover and unroll float to expose valves.

4. Inflate floats with filtered, oil-free, dry air to 2.0 psig via topping valves.

5. Allow float air temperature to stabilize for 5 minutes minimum then record OAT and pressure in each float chamber.

6. One to two hours after initial pressure check, again record OAT and pressure in each float chamber. Allowable chamber pressure drop from initial measurement is 0.2 psig adjusted for any temperature change. Pressure will change by 0.06 psig per degree C temperature change. For example, float chamber pressure will decrease 0.6 psig if temperature drops 10 degrees C.

7. If leaks are detected, repair float with supplied repair kit and repeat steps 4, 5, & 6.

8. Connect D674-1 line assembly to cylinder valve and torque per Section 1.330.

9. Pack floats per Section 5.650.

NOTE

Annually apply A257-7 dry-film lubricant (see Section 1.470) to float cover snap mating surfaces.

5.640 Emergency Inflation Test

WARNING

Cylinder contents are under extreme pressure. 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 pop-out floats or inflation hoses. **Remove locking pin when work is completed.**

1. Unsnap outboard edge of both float covers. Hook-and-loop fasteners (inboard) may remain secured.

2. Remove locking pin from valve, move inflation lever safety to READY position, and verify area around floats is clear.

3. Squeeze inflation lever to inflate floats. Approximately 20 pounds force will be required due to the shear-rivet. Time for floats to attain full shape without wrinkles should be three seconds or less.

CAUTION

Floats inflate rapidly and with a loud noise. Keep area clear during inflation and inform all nearby personnel. Remove or close all doors prior to inflation. Open doors interfere with float inflation and may be damaged.

4. Allow float temperatures to stabilize for at least five minutes then record OAT and pressure in each float chamber. Minimum allowable pressures are:

O.A.T (degrees C)	Minimum Pressure (psig) in Forward Two Chambers	Minimum Pressure (psig) in Middle Chamber	Minimum Pressure (psig) in Aft Two Chambers
5-9	1.30	1.00	0.60
10-14	1.60	1.30	0.90
15-19	1.90	1.60	1.20
20-24	2.20	1.90	1.50
25-29	2.50	2.20	1.80
30-34	2.80	2.50	2.10
35-39	3.10	2.80	2.40

5.640 Emergency Inflation Test (cont'd)

5. Disconnect D674-1 hose assembly from pressure cylinder valve immediately after initial pressure check. Install protective cap on cylinder valve fitting. Cover D674-1 hose fitting to prevent contamination, but do not install an air tight seal (D674-1 hose must be allowed to leak to verify check valve function at each float chamber).

6. Verify no rips or chafing on floats or covers.

7. One to two hours after initial pressure check, again record OAT and pressure in each float chamber. Allowable chamber pressure drop from initial measurement is 0.20 psi adjusted for any temperature change. Pressure will change by 0.06 psi per degree C temperature change. For example, float chamber pressure will decrease 0.6 psig if temperature drops 10 degrees C.

8. If leaks are detected, repair float with supplied repair kit then perform leak check per Section 5.630 on repaired float chamber.

9. Connect D674-1 hose assembly to valve fitting. Orient line as required to maintain minimum 0.25 inch clearance to cylinder and C390-5 panel. Torque B-nut per Section 1.330 and torque stripe.

10. Pack floats per Section 5.650.

NOTE

Annually apply A257-7 dry-film lubricant (see Section 1.470) to float cover snap mating surfaces.

11. Remove D679 pressure cylinder assembly per Section 5.660 and return to RHC for servicing.

12. Install serviceable pressure cylinder per Section 5.670.

13. Rig inflation lever per Section 5.690.

14. Replace inflation lever shear rivet per Section 5.680.

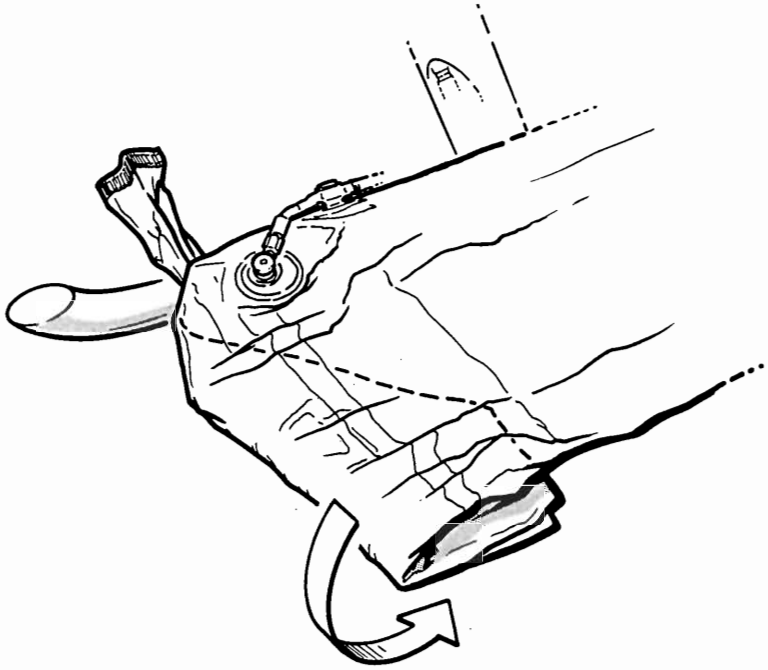
5.650 Pop-out Float Packing Procedure

1. Deflate float. Verify float is properly secured to skid and all hoses are properly connected and covered with heat shrink.

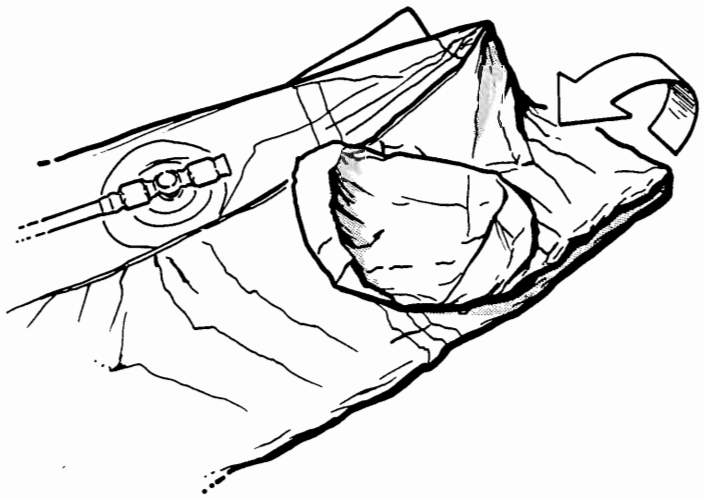
2. Spread deflated float to outboard side of skid tube. Using a vacuum, evacuate each float chamber through topping valve to remove as much air as possible.

3. Using a cloth covered with talcum powder, lightly coat entire float, including inside of covers.

4. Fold front end of float under and back until fold line reaches girt:

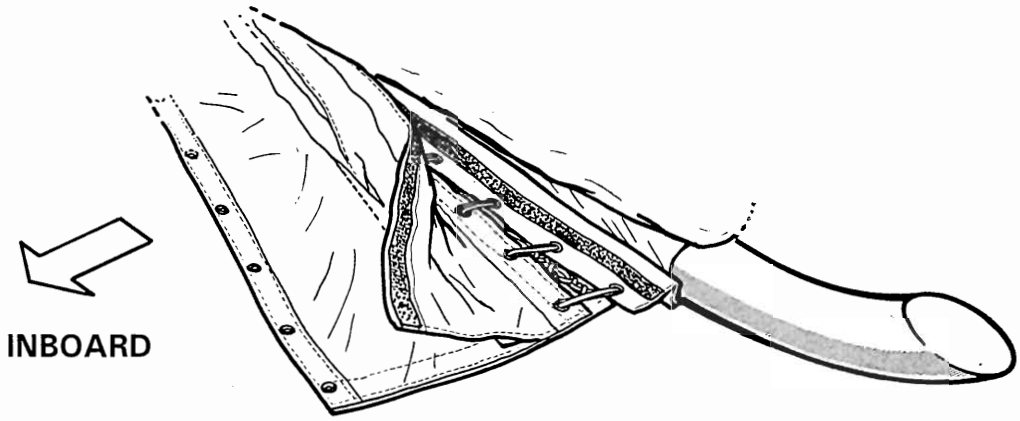


5. Fold aft end of float over and forward until fold line reaches girt:

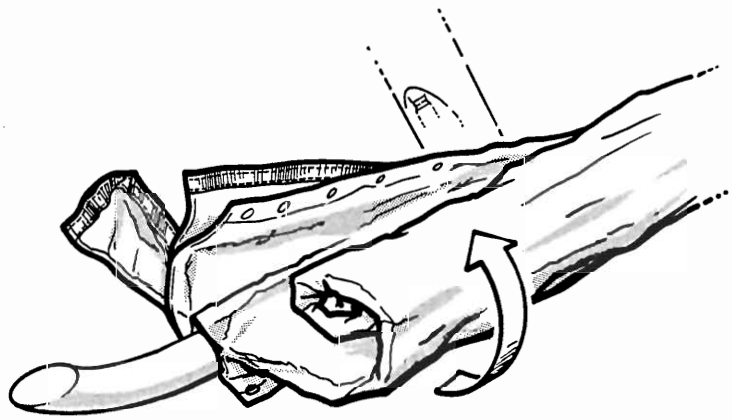


5.650 Pop-out Float Packing Procedure (cont'd)

6. Secure hook-and-loop fasteners at inside of inboard girt along length of cover:



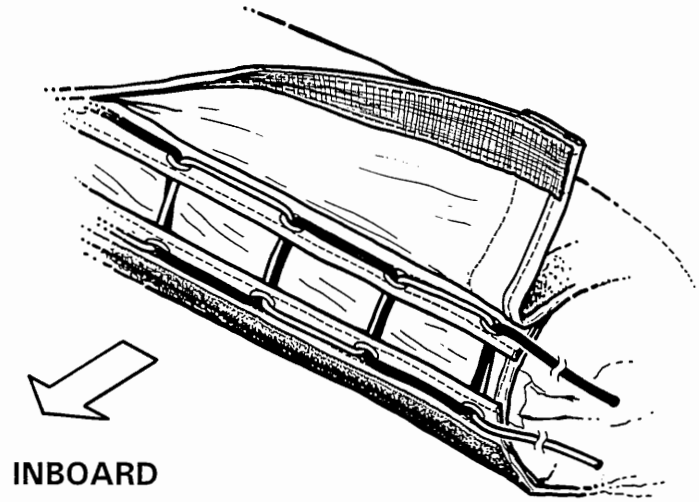
7. Align hoses and valve cover flaps and roll float from outer edge toward skid as tightly as possible:



5.650 Pop-out Float Packing Procedure (cont'd)

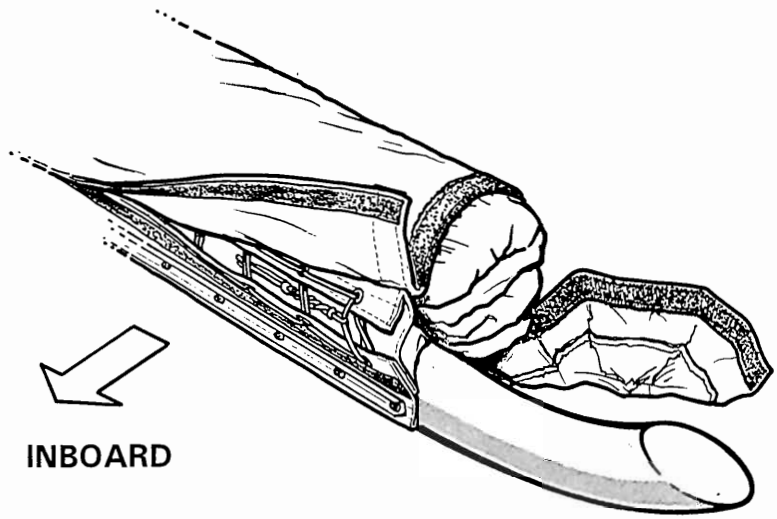
8. Hold float on top of skid tube and install cover around float. Using a swab or small brush, apply A257-7 lubricant to mating surfaces of snaps. Secure hook-and-loop and snap fasteners along outboard girt (see Figure 5-5).

9. There are two lacing cords per float. One cord secures the float cover on the skid aft extension. The remaining cord secures the float cover to the skid. Verify lacing cord installed through grommets in cover using crossover ("ladder" lacing) method shown below:



10. Pull lacing at each segment until tight or until material edges join; do not overtighten. Tie lacing ends in double square knots (4 alternating overhand knots) to secure.

11. Tuck in loose ends of lacing cord as shown and secure hook-and-loop fasteners along length of cover. Secure hook-and-loop fasteners at end caps:



12. Verify all fasteners are properly secured and floats are rolled tightly with no lumps or loose areas.

5.660 Pressure Cylinder Removal (see Figure 5-6A)

WARNING

Cylinder contents are under extreme pressure. Install locking pin in pressure cylinder valve (see Figure 5-6A) when working in forward left baggage compartment, during cylinder removal or installation, and when working on pop-out floats or inflation hoses.

1. Install locking pin in valve.
2. Disconnect D674-1 line assembly at valve fitting. Install protective caps on valve and line fittings.
3. Remove D675-9 cover.
4. On B125-2 connector, cut & remove ty-rap closest to valve. Disconnect connector from valve cable.
5. Disconnect D675-10 support from valve. Do not kink cable.
6. Remove D669-3 strap.
7. Carefully remove pressure cylinder.
8. If cylinder has been discharged, order KI-167 Cylinder Valve Service and Fill kit.

NOTE

If cylinder requires depressurization for transportation, use KI-151 Pop-Out Float Cylinder Bleed-Off Kit.

5.665 Filling Pressure Cylinder (See Figure 5-6)

WARNING

ONLY cylinders labeled "DOT-E 10915-4945" may be refilled. Cylinders labeled "DOT-E 10915-4500" must be returned to RHC for exchange/upgrade.

Maximum cylinder life is 15 years from date of manufacture and maximum hydro-test interval is 5 years. Also, maximum interval in aircraft between inspections is 3 years. Therefore returning to service cylinders older than 12 years or having hydro-tests older than 2 years is not recommended unless alternate arrangements are made to ensure life/hydro-test limits are not exceeded.

All fill equipment (pumps, hoses, fittings, etc.) must be rated for 6000 psi minimum working pressure and be in good condition.

Cylinder temperature and pressure must be kept within safe limits. Monitor pressure gauge and use thermocouple or other appropriate temperature probe to monitor temperature on face of thermal relief fitting during fill. Do not allow temperature to exceed 50°C (122°F) or pressure to exceed 5500 psig. If limits are approached, stop fill and allow cylinder to cool and pressure to drop before continuing. Placing cylinder in a water bath and using slow to moderate fill rates is recommended. If using water bath, keep water level below valve assembly to avoid water contamination of valve.

1. Remove fill-port cap.
2. Install MT546-2 Adapter Assembly per Figure 3 (Torque 40 in-lb).
3. Attach fill hose to MT546-2 Adapter Assembly.
4. Fill with 99.98% minimum purity (industrial grade) helium per chart below:

Ambient Temp (°C)	Pressure (psig)
-20	4268
-10	4437
0	4606
10	4776
20	4945
30	5114
40	5283

5. Allow cylinder and valve to cool to ambient temperature. Top off with helium to compensate for any pressure loss due to cooling.
6. Remove fill hose and re-install fill-port cap (Torque 40 in-lb).

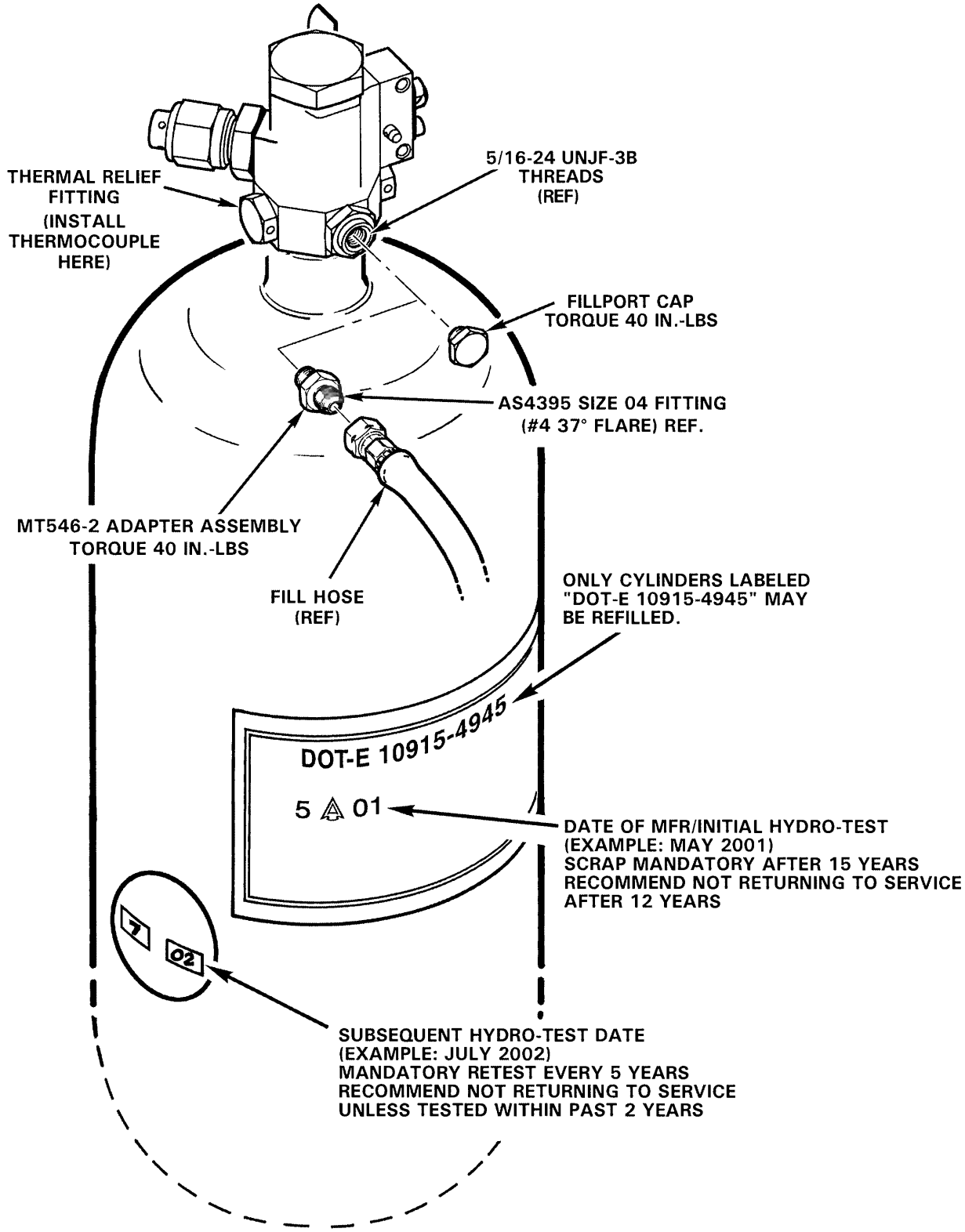


FIGURE 5-6 FILLING PRESSURE CYLINDER

5.670 Pressure Cylinder Installation (see Figure 5-6A)

WARNING

Cylinder contents are under extreme pressure. Install locking pin in pressure cylinder valve (see Figure 5-6A) when working in forward left baggage compartment, during cylinder removal or installation, and when working on pop-out floats or inflation hoses. **Remove locking pin when work is completed.**

1. Install locking pin in valve.
2. Ensure cylinder's three forward contact areas are covered with anti-chafe tape.
3. Carefully position cylinder into D669 strap and D669 cradle per Figure 5-6A.
4. Install D675-10 support on valve.
5. See Figure 5-6B. Connect valve cable to B125-2 connector and secure with ty-rap. Verify dimension shown.
6. Install D675-9 cover on valve.
7. Rotate cylinder as required to minimize cable bending and ensure clearance with surrounding structure. Install D669-3 strap.
8. Connect D674-1 hose assembly to valve fitting. Orient line as required to maintain minimum 0.25 inch clearance to cylinder and C390-5 panel. Torque B-nut per Section 1.330 and torque stripe.
9. Rig inflation lever per Section 5.680.
10. Replace inflation lever shear rivet per Section 5.690.
11. Remove locking pin from valve.

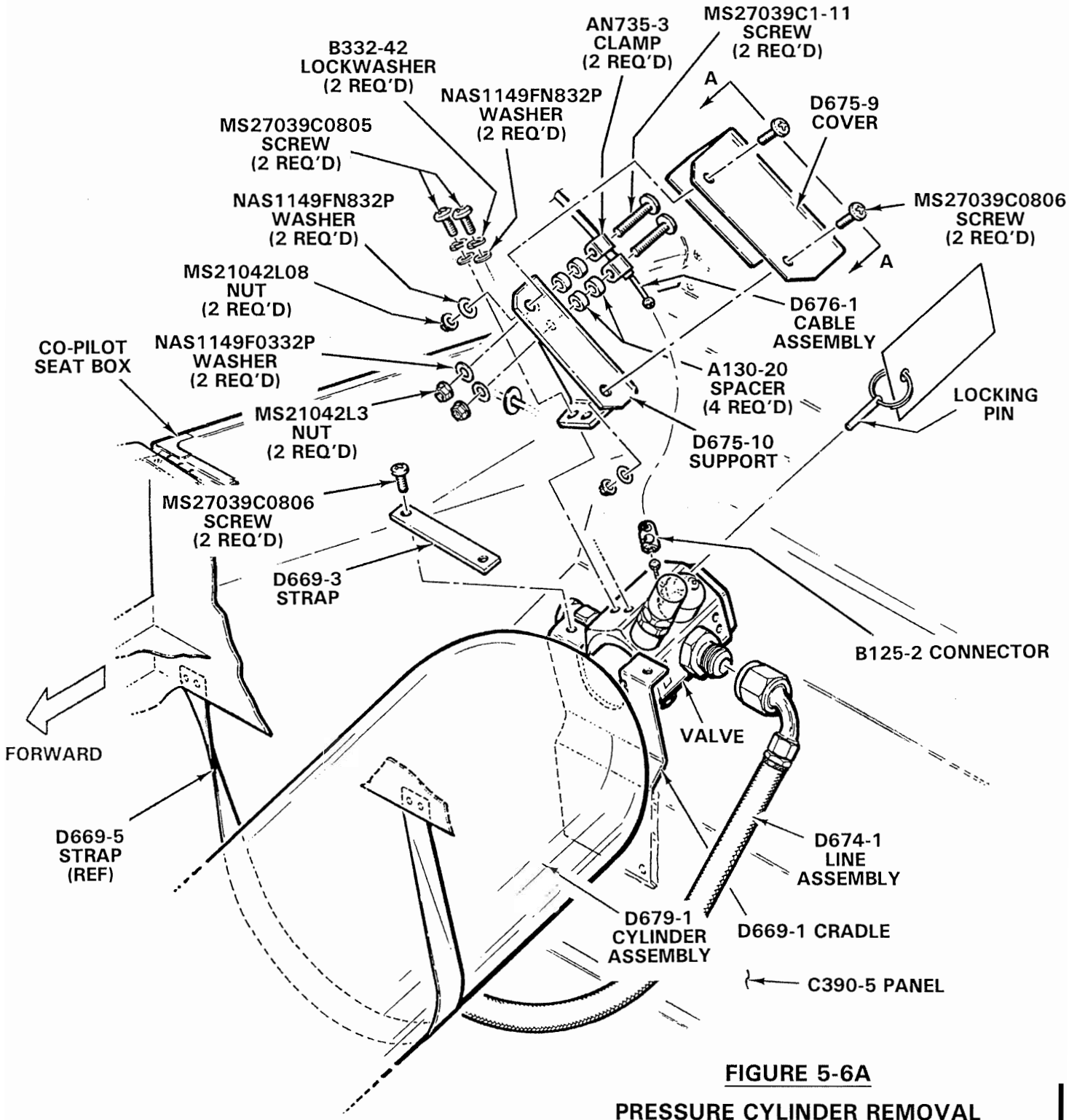
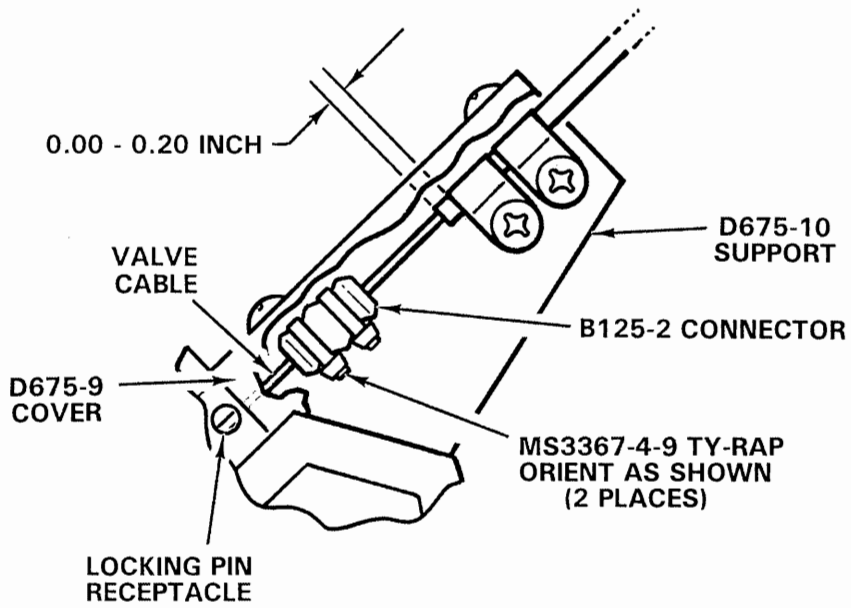


FIGURE 5-6A

PRESSURE CYLINDER REMOVAL AND INSTALLATION



VIEW A-A FROM FIGURE 5-6

(VIEW LOOKING FORWARD)

FIGURE 5-6B

5.680 Inflation Lever Rigging

WARNING

Cylinder contents are under extreme pressure. Install locking pin in pressure cylinder valve (see Figure 5-6A) when working in forward left baggage compartment, during cylinder removal or installation, and when working on pop-out floats or inflation hoses.

1. Install locking pin in valve.
2. See Figure 5-7. With inflation lever safety in READY position, collective full up, and no shear-rivet installed, verify 1.30/1.25 inch dimension shown when inflation lever is squeezed to eliminate slack. If required, reposition cable housing in clamps at inflation lever to obtain 1.30/1.25 inch dimension.
3. Place inflation lever safety in LOCKED position. Verify no preload in cable thru full travel of collective with inflation lever squeezed against safety.
4. Replace inflation lever shear rivet per Section 5.690.

5.690 Inflation Lever Shear-Rivet Replacement

1. Before installing rivet, verify inflation lever rigging per Section 5.680.

WARNING

Cylinder contents are under extreme pressure. 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 pop-out floats or inflation hoses. Remove locking pin when work is completed.

2. Install locking pin in valve.
3. See Figure 5-7. Place inflation lever safety in LOCKED position.
4. Insert MS20470A2-6-5 (or MS20470A2-6.5) rivet per Figure 5-7.

WARNING

Use only MS20470A2 series annealed rivet in inflation lever assembly; other hardware may prevent float inflation.

5. Using locking pliers or similar, flatten shop-head end of rivet per Figure 5-8.
6. Remove locking pin from valve.

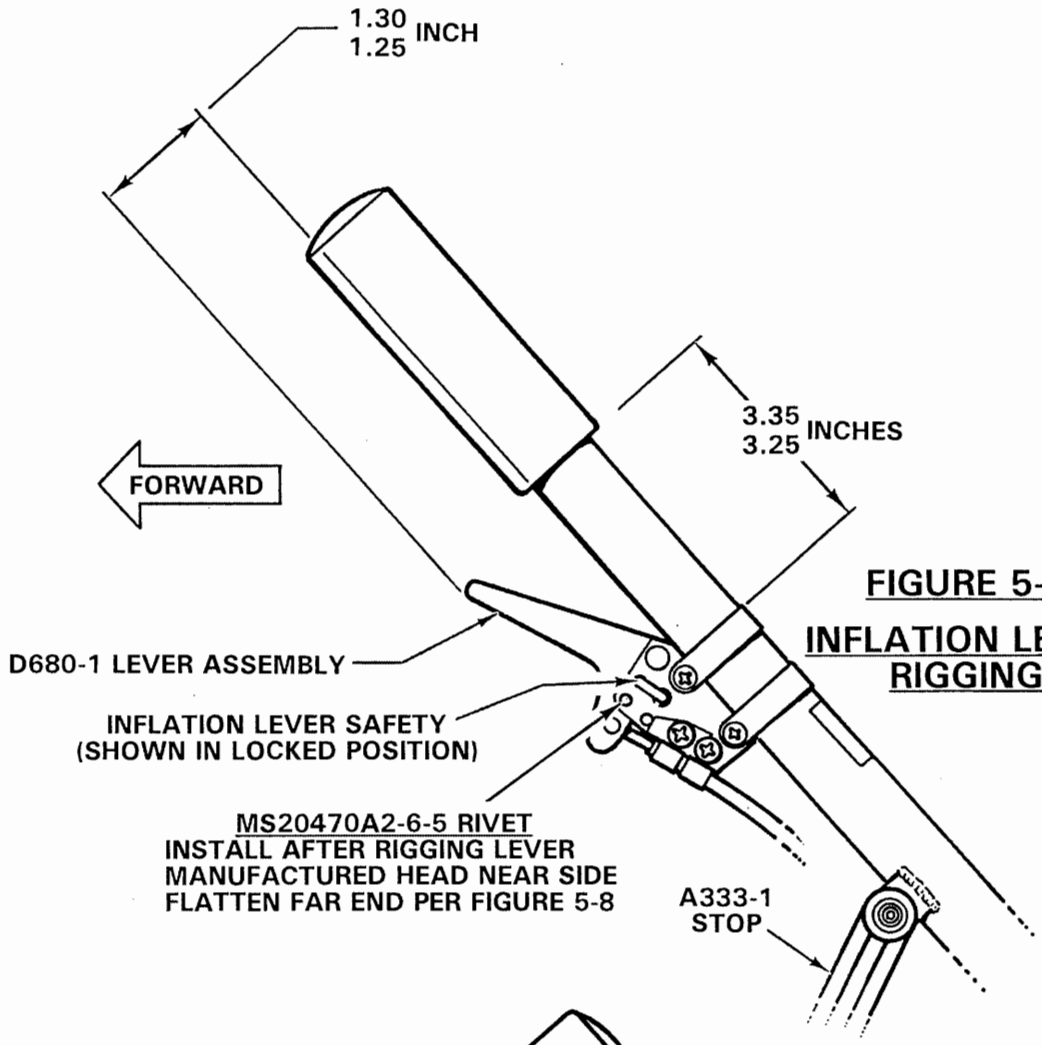


FIGURE 5-7

INFLATION LEVER RIGGING

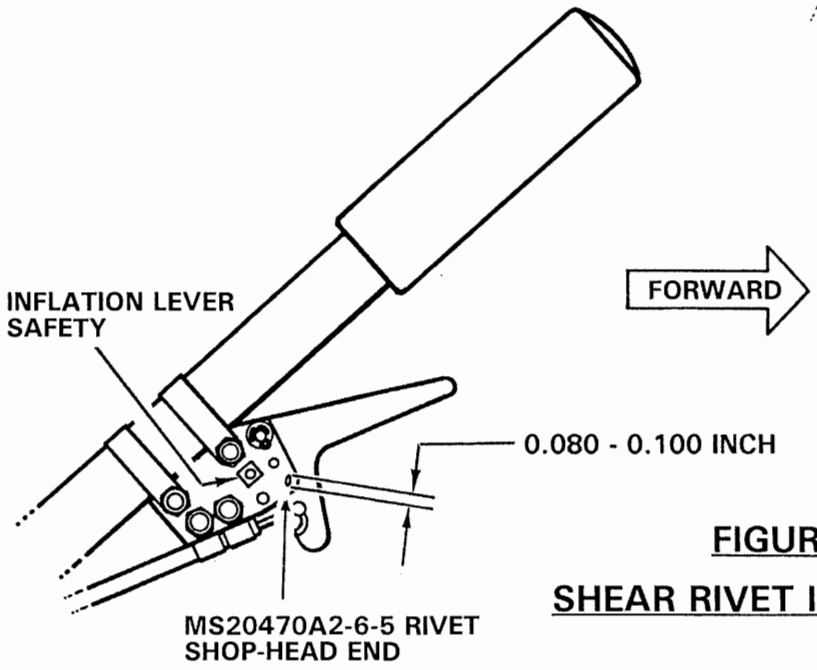


FIGURE 5-8

SHEAR RIVET INSTALLATION

5.700 MAINTENANCE

1. Ensure drain holes in bottoms of skid tubes are not plugged (two per skid, standard and pop-out gear only), located between the two forward skid shoes and just aft of the skid shoe at the forward strut.

2. Touch up skid tubes, cross tubes and struts to prevent corrosion. See Section 1.400 for approved materials.

3. Inspect skid shoes frequently, especially following touch-down autorotations or running take-offs or landings.

4. Install lost or loose raincaps with B270-1 or B270-9 adhesive (see Section 1.480). Mix adhesive per manufacturer's instructions.

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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 via flexible ducts to the muffler, the main rotor gearbox, the hydraulic reservoir (if installed), the drive belts, 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 (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.

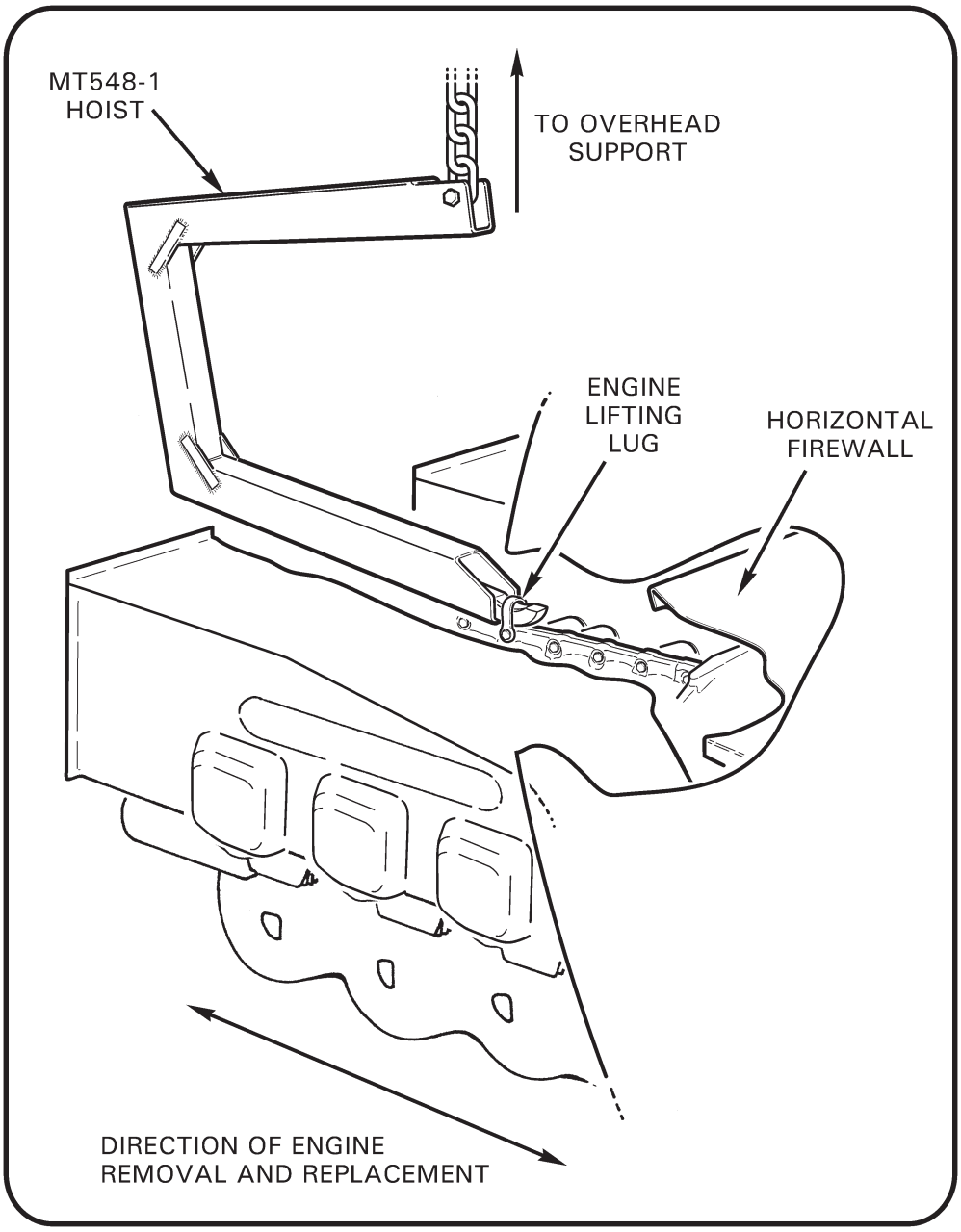


FIGURE 6-1 ENGINE HOISTING

6.100 Powerplant

NOTE

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

6.110 Engine Removal

1. Remove tailcone cowling and all engine cowling.
2. Remove tailcone per § 4.300.

6.110 Engine Removal

3. Remove fanwheel and scroll assembly per § 6.210.
4. Remove clutch assembly, belt tension actuator, and V-belts per §§ 7.200, 7.510, & 7.281.
5. Disconnect engine breather tube at engine by removing one clamp from the rubber coupling. Cap exposed connections.
6. Turn fuel on-off valve to off position. Remove air box assembly and carburetor (if equipped) per § 6.410 or 6.460, as applicable.
7. Disconnect manifold pressure line from the forward left cylinder (O-540) or intake manifold (IO-540) and cap exposed connections.
8. Disconnect oil pressure hose and cap exposed connections.
9. **O-540:** If installed, disconnect primer line at T-fitting on engine and cap exposed connections.

   IO-540: Disconnect fuel hose from engine-driven fuel pump inlet and disconnect fuel return hose from fuel control inlet T-fitting. Cap exposed connections.
10. Disconnect airframe and battery ground straps from engine oil sump bolts.
11. Tag for identification and disconnect alternator wiring, starter wiring, magneto-to-airframe wiring, cylinder head temperature sender wire and oil temperature sender wire.
12. Disconnect cabin heater duct from muffler shroud.
13. Support engine at bottom of lower sheave. Use a wood block to prevent damage to sheave.
14. Remove aft engine support assembly by disconnecting all four bolts.

NOTE

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

15. Refer to Figure 6-1. Support engine at lifting lug using MT548-1 or -8 tool with a hoist.
16. Disconnect and remove two forward engine-mounting bolts.
17. Remove right, aft vertical strut weldment connecting lower right frame to upper frame.
18. On R44 IIs and later R44s, remove left, aft vertical strut weldment connecting lower left frame to upper frame.
19. Remove engine.

CAUTION

To prevent damage while removing the engine, someone should assist on each side of engine.

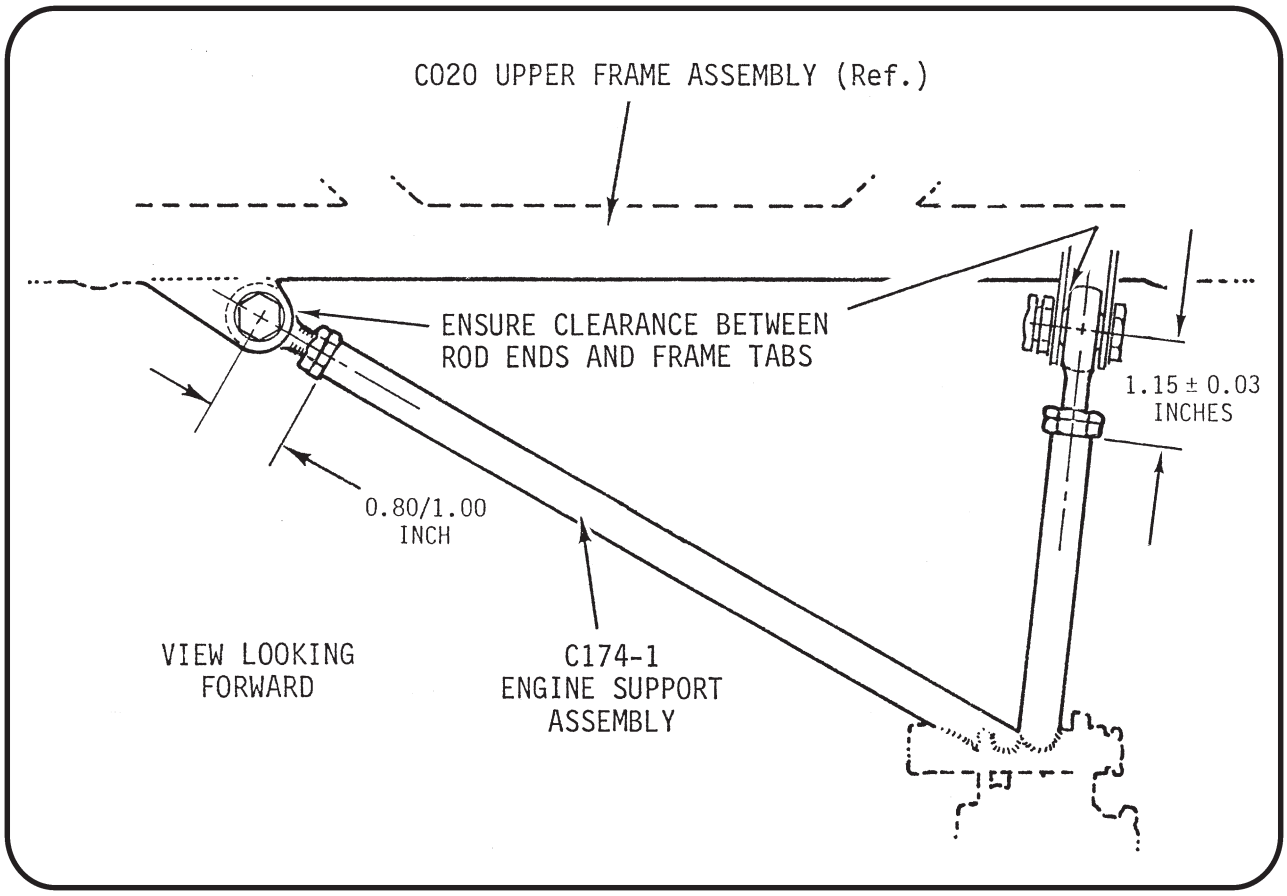


FIGURE 6-2 ENGINE AFT SUPPORT ASSEMBLY

6.120 Engine Installation

1. Refer to Figure 6-1. Connect MT548-1 or -8 tool to engine lifting lug. Carefully hoist engine and position it into alignment with engine mounting pads.

2. If applicable, install left, aft vertical strut weldment connecting lower left frame to upper frame. Standard torque hardware per § 1.320 and torque stripe per Figure 2-1.

3. Install right, aft vertical strut weldment connecting lower right frame to upper frame.

4. Install two forward engine mounting bolts. Standard torque hardware per § 1.320 and torque stripe per Figure 2-1.

5. Support weight of engine at bottom of lower sheave. Use a wood block to prevent damage to sheave. Remove hoist.

6. Connect aft engine support assembly. Standard torque hardware per § 1.320 and torque stripe per Figure 2-1.

7. Remove support from lower sheave.

6.120 Engine Installation (continued)

8. **O-540:** Install carburetor per § 6.440.

   IO-540: Connect throttle linkage. Connect mixture control cable per Figure 6-7. Adjust | cable so there is 0.03-0.10 inch clearance under mixture control knob (springback) when fully depressed and mixture arm is in full rich position.

9. Adjust throttle correlation rigging per § 10.150.

10. Connect cabin heater duct to muffler shroud.

11. Connect airframe and battery grounding straps to engine oil sump bolts and torque per § 1.330.

12. Connect alternator wiring, starter wiring, both magneto-to-airframe wiring, cylinder head temperature sender wire and oil temperature sender wire. Ty-rap as required.

13. Connect engine breather tube.

14. **O-540:** If installed, connect primer line to T-fitting on engine.

    IO-540: Connect fuel hose to engine-driven fuel pump inlet and connect fuel return hose to fuel control inlet T-fitting. Torque per § 1.330.

15. Connect oil pressure hose.

16. Connect manifold pressure line.

17. Install fuel injection air box per § 6.480, if applicable.

18. Install V-belts, belt tension actuator, and clutch assembly per §§ 7.282, 7.520, and 7.220.

19. Install fanwheel per § 6.220.

20. Install tailcone per § 4.312.

21. Install all engine cowling and tailcone cowling.

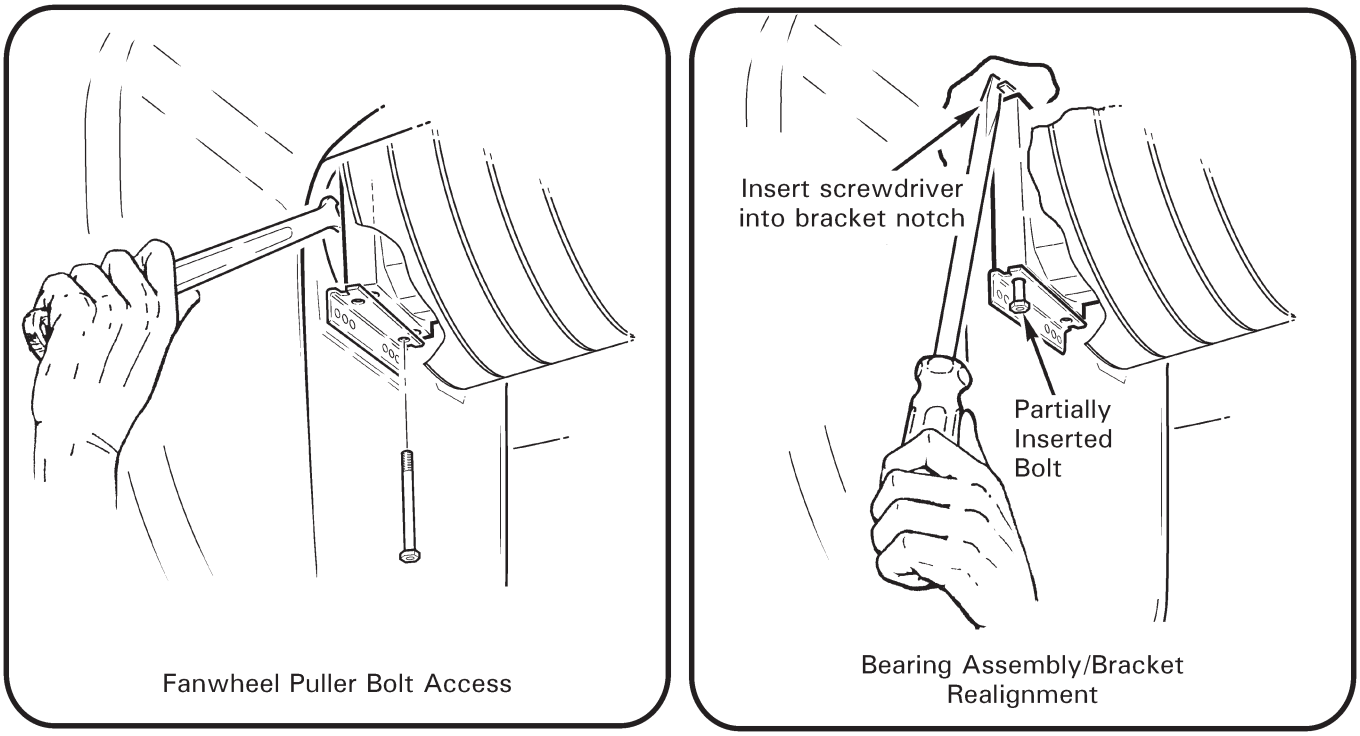


FIGURE 6-3 FANWHEEL HUB BOLT ACCESS

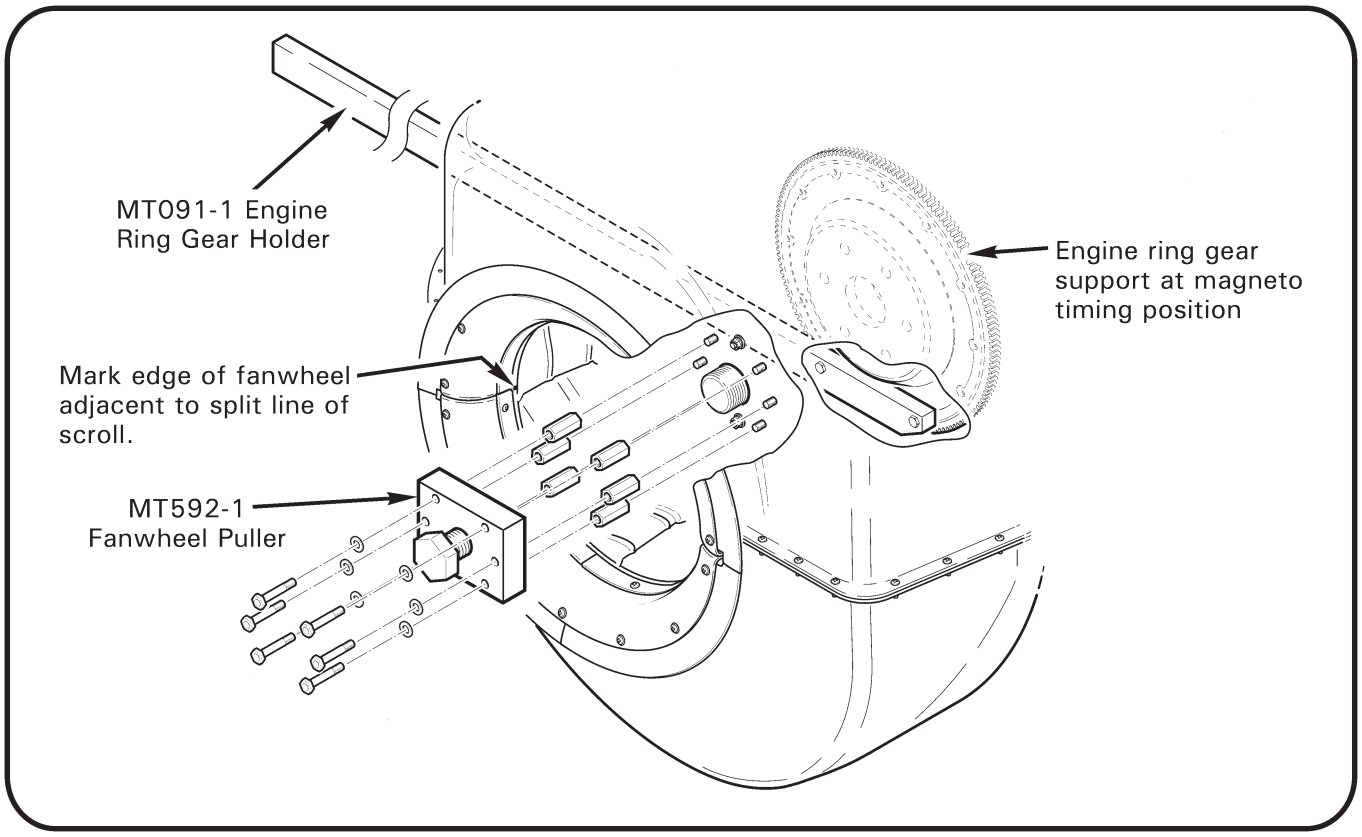


FIGURE 6-4 FANWHEEL PULLER INSTALLATION

6.200 Cooling System

6.210 Fanwheel and Scroll Removal

NOTE

If same fanwheel will be reinstalled then orient starter ring gear support to magneto timing position and mark fanwheel at split line of scroll; this will minimize need for new balance weights. See Figure 6-4.

1. Remove engine aft cowling.
2. Remove cooling hoses from lower and upper halves of scroll.
3. Disconnect tail pipe straps from lower scroll. Note shim stack on mounting screws.
4. If installed, disconnect air conditioning condenser from lower scroll and temporarily secure it to a frame.
5. Remove scroll perimeter screws. Remove two bolts that attach scroll to lower actuator bearing block and remove scroll lower half.
6. Cut safety wire and remove roll pin which secures fanwheel retaining nut. Remove retaining nut.
7. Use a half-inch open-end wrench to hold fanwheel hub bolt heads and remove 6 of 8 nuts and washers (see Figure 6-3). Replace nuts with MT092-3 spacers.
8. Back out MT592-1 fanwheel puller's center bolt and attach puller to the MT092-3 spacers (see Figure 6-4).

CAUTION

Verify fan retaining nut has been removed. Have someone support fan to prevent dropping it. Fanwheel may come off tapered shaft with a loud pop.

9. Securely attach MT091-1 starter ring gear holding tool and have someone hold ring gear stationary (see Figure 6-4).
10. Tighten fanwheel puller's large center bolt against fanshaft until fanwheel is unseated.
11. Remove fanwheel puller and reinstall nuts and washers on fan hub bolts. Special torque nuts per Section 1.330.

6.220 Fanwheel and Scroll Installation

1. Evaluate drive belts, alternator belt, and C181 bearing condition; replace as required. Clean tapered shaft and fanwheel hub mating surfaces with solvent and dry. Inspect shaft and hub for damage; replace as required.

2. Place scroll upper half on fanwheel and install fanwheel on tapered shaft. Secure scroll upper half to engine cooling panels.

3. Using A257-9 anti-seize, coat threaded portion only of C007 shaft and clamping surfaces of MS20002-24 washer, NAS1149F2432P washers (use as many as will fit), and castellated nut. Install hardware with MS20002-24 washer against hub.

> NOTE
>
> If installing original fanwheel, ensure starter ring gear support is at magneto timing position and align marks on fanwheel with scroll split line.

4. Secure MT091-1 ring gear holding tool to engine ring gear support and hold stationary. Special torque C182-1 nut per Section 1.330 until slot in castellated nut aligns with hole in fanshaft, but do not install spring pin.

> NOTE
>
> If slot in castellated nut does not align with hole in fanshaft throughout torque range, remove or add NAS1149F2432P washers under nut.

5. Position lower scroll and insert two AN3-41A bolts through bearing mounting bracket, actuator bearing block, and bearing mounting bracket nut plates on upper scroll. If required, align upper mount bracket nutplate by inserting a screwdriver into notch in bracket. Standard torque bolts per Section 1.320 and torque stripe.

6. Install screws, washers, and nuts around scroll perimeter.

7. Verify D229 lip-to-fanwheel inlet clearance is 0.010-0.090 inch. If necessary, adjust lip clearance by elongating lip mounting holes.

8. Connect tail pipe to C173 straps. See Section 6.520 for shimming requirements.

9. Connect muffler and MRGB cooling hoses to scroll. Ensure MRGB cooling hoses cross and clear tail rotor push-pull tube thru full range of travel.

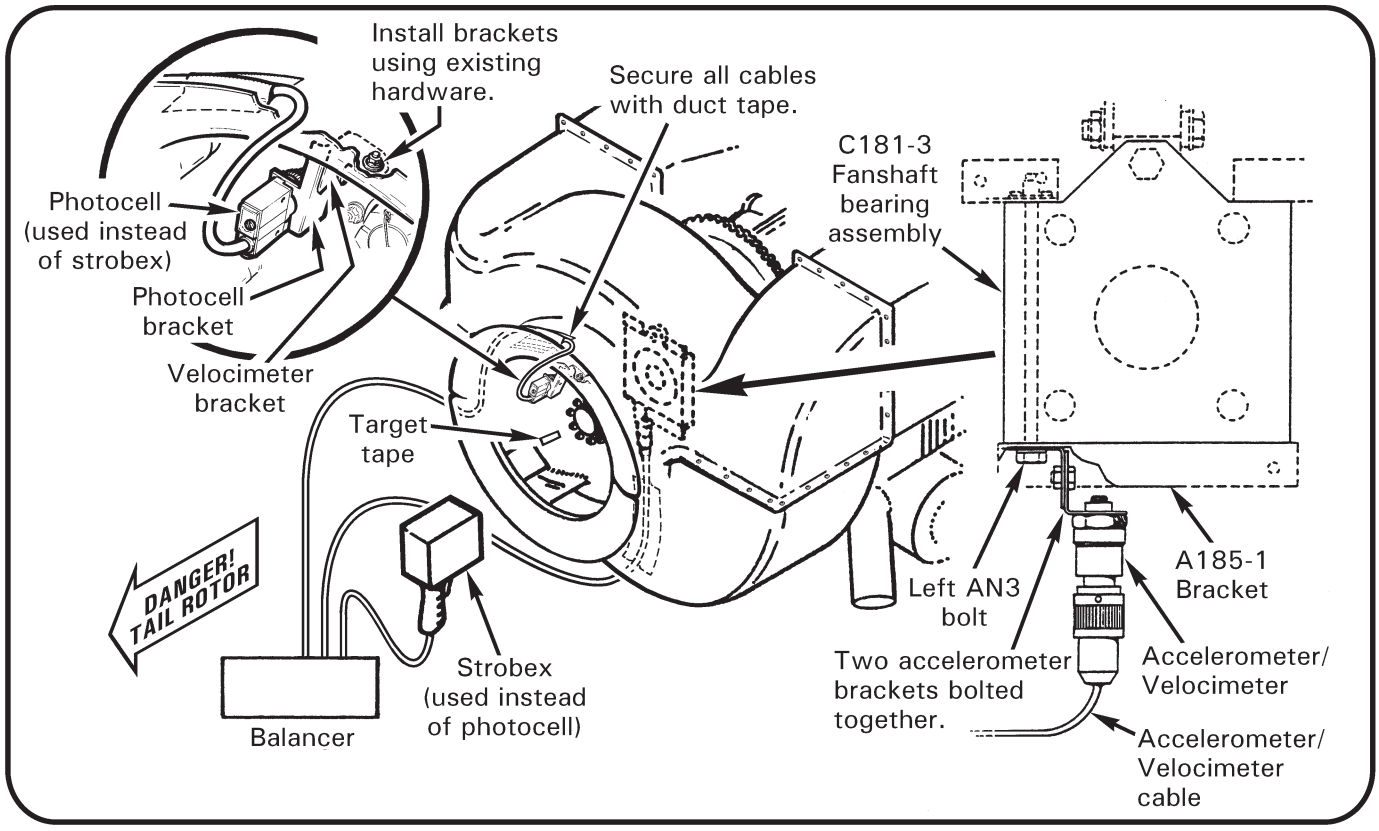
10. If applicable, install air conditioning condenser and condenser heat shield on lower scroll.

11. Balance fanwheel per Section 6.240.

> **CAUTION**
>
> Fanwheel balance must be checked upon installation; fanwheel imbalance can cause damage.

6.230 (Reserved)

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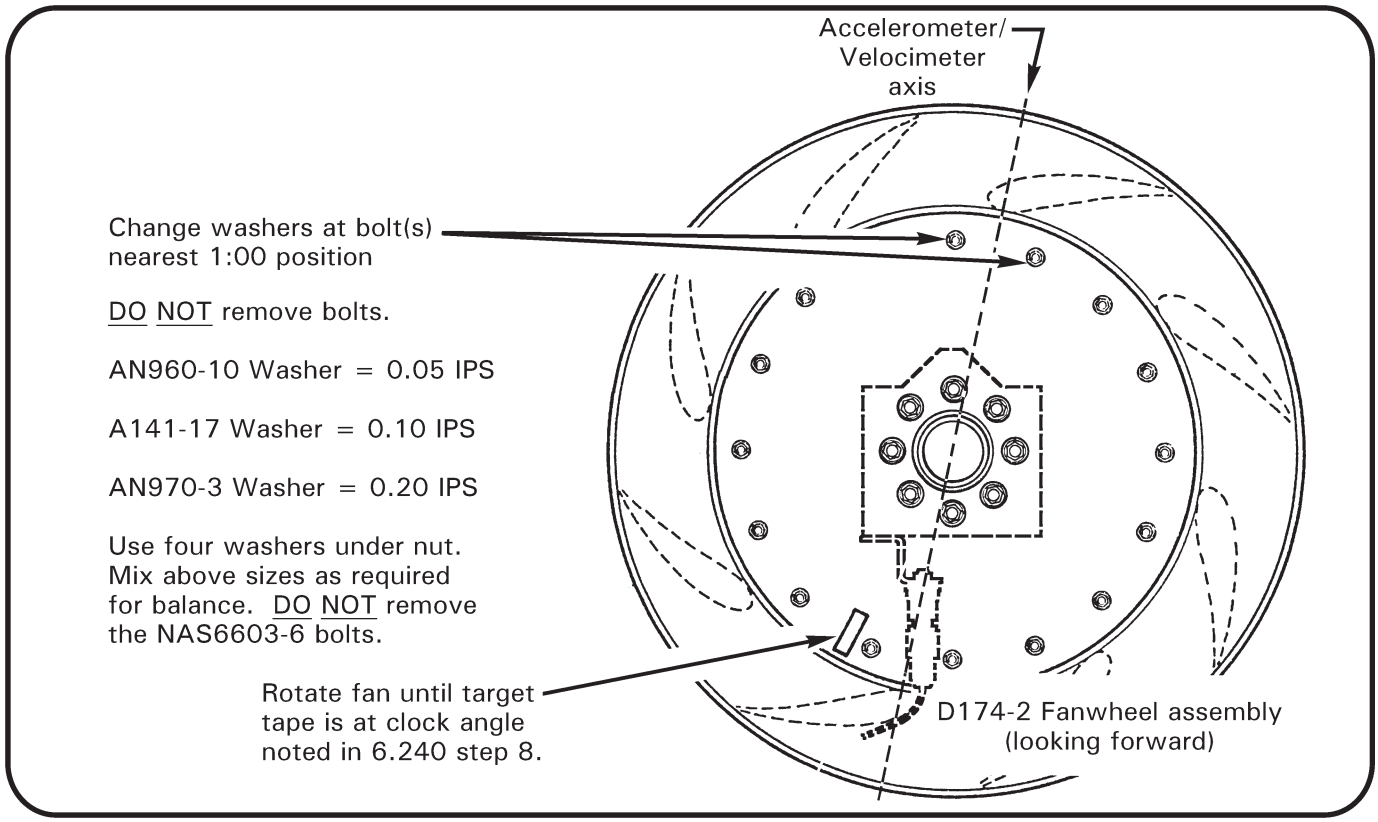


FIGURE 6-5 FAN BALANCING

6.240 Fan Dynamic Balance

NOTE

When using Micro Vib, Chadwick-Helmuth Model 192- or 8500-series, or equivalent equipment consult the equipment's specific operating instructions. The following instructions pertain to Chadwick-Helmuth Model 8350 and 177-series (Vibrex) equipment.

1. Remove engine aft cowling.
2. Install accelerometer wire on fanshaft bearing per Figure 6-5. Accelerometer should be pointed down. A suitable bracket may be assembled from two accelerometer brackets or may be fabricated.
3. Place a target tape at edge of one fan vane (see Figure 6-5).
4. Set Strobex mode to position B. Set Balance Box RPM range to X10 scale. Set Balance Box RPM dial to 270.
5. Start engine and run helicopter at 102% RPM with rotor system engaged and governor on.

WARNING

Use extreme care near tail rotor.

6. Point Strobex at fanshaft nut and pull trigger. Note clock angle of target tape.
7. Push Tune button on Balance Box. Note change (if any) in clock angle of target tape. While pushing Tune button, adjust RPM dial to bring the target tape back to the clock angle viewed in Step 6. Balance Box is tuned to fan RPM if there is no change in target tape clock angle when Tune button pushed and released.
8. Note clock angle of target tape when Balance Box is tuned.
9. Note vibration reading on IPS meter.
10. Shut engine down.

CAUTION

Ensure ignition switch is off and keys are out of switch whenever fanwheel is moved by hand.

11. After first run-up, secure MT091-1 ring gear holding tool to engine ring gear support and hold stationary. Special torque C182-1 nut per Section 1.330 until spring pin can be installed in shaft. Install spring pin and safety with 0.041-inch diameter stainless steel wire.

NOTE

If spring pin cannot be installed within C182-1 nut's torque range, remove or add NAS1149F2432P washers under nut. Large pliers may be used to squeeze spring pin into position.

6.240 Fan Dynamic Balance (continued)

12. If balance reading is over 0.2 IPS, washers must be exchanged to balance cooling fan. Rotate fanwheel until target tape is in position noted in Step 8. Change AN960-10, A141-17, or AN970-3 washers under nut nearest to the 1:00 position or split required weight change under two nearest nuts (see Figure 6-5). One AN960-10 washer will change balance reading approximately 0.05 IPS. One A141-17 washer equals two AN960-10 washers. One AN970-3 washer equals four AN960-10 washers. Four washers are required under each nut. To access bolt head, remove D229-4 cover on forward side of lower scroll and rotate fan as required. Do not remove the NAS6603-6 bolts or the NAS1149F0316P washers may be dislodged (see Figure 6-5). Torque NAS6603-6 bolt and MS21042L3 nut per Section 1.330. Install D229-4 cover on lower scroll.

13. After washers have been installed, check fan balance reading. Exchange washers until a reading of less than 0.2 IPS is obtained.

14. Remove accelerometer and attaching brackets.

15. Refer to Figure 2-11. Mark fanwheel with torque stripe directly opposite, and aligned with, each end of roll pin.

16. Install engine aft cowling.

6.300 Lubrication System

NOTE

See Section 1 for grade and quantity of oil required. Refer to Lycoming Operator's Manual for adjustment and maintenance of lubrication system.

6.310 Oil Cooler Removal

1. Remove right engine side panel and aft engine cowling.

2. Disconnect the oil lines at the cooler.

3. Remove two screws and nuts holding C636-1 support to cooling shroud.

4. Disconnect mounting bolts and remove oil cooler and support.

6.320 Oil Cooler Installation

1. Install MS20822-8 elbows, if required, using B270-6 sealant and torque to 110 in.-lb plus torque required to align elbows.

2. Install oil cooler and C636-1 Support to engine cooling shroud using four mounting bolts. Torque bolts per Section 1.320.

3. Install two screws and nuts that fasten support to cooling shroud. Torque nuts to 15 in.-lb plus nut drag.

4. Reconnect oil lines and torque tubing nuts per Section 1.330.

5. Install cowling.

6.400 Induction System

6.410 Carburetor Removal

1. Remove right engine side panel.
2. Turn off fuel valve and disconnect fuel line at carburetor. Cap fuel line and carburetor inlet port.
3. Disconnect air intake and carburetor heat ducts from air box.
4. Disconnect throttle linkage from throttle arm, mixture control cable from carburetor and carburetor heat control cable from air box and slider valve.
5. Disconnect carburetor air temperature probe at quick-disconnect plug located approximately four inches from probe.
6. Remove palnuts and nuts securing carburetor to oil sump and remove carburetor and air box assembly.

6.420 Carburetor Air Box Removal

1. Remove four long bolts securing air filter cover. Open cover and remove air filter.
2. Clip safety wire securing four air box-to-carburetor attach bolts and remove bolts, air box and gasket.

6.430 Carburetor Air Box Installation

1. Install air box and gasket to carburetor with four attach bolts.
2. Torque four attach bolts per Section 1.330 and safety with 0.032 inch safety wire.
3. Reinstall air filter, close cover and secure with four long bolts.

NOTE

Tighten nuts on long attach bolts until 2-4 threads protrude through nut and cover is uniformly sealed. Overtightening of nuts can cause distortion of cover and leakage of air box seal.

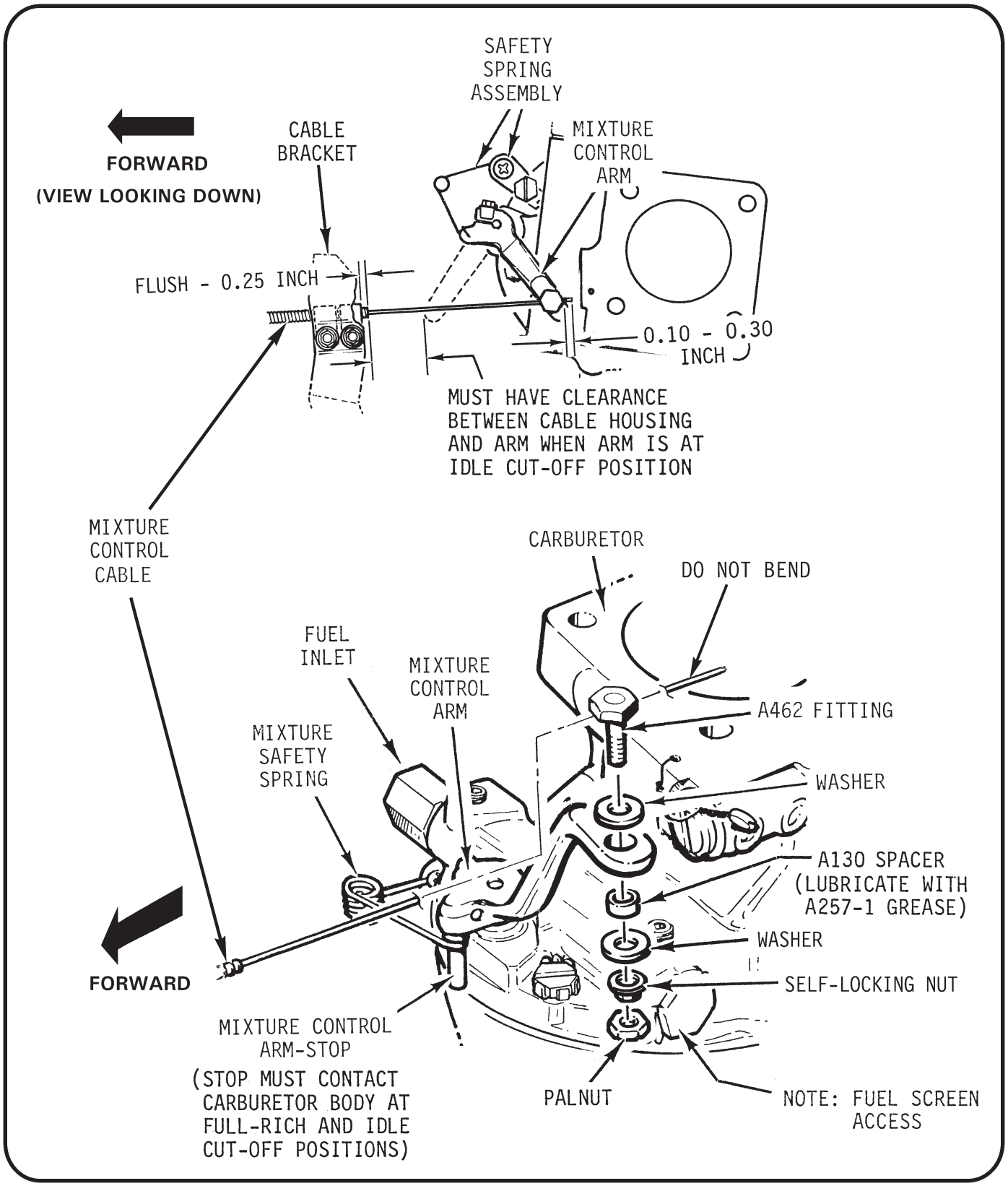


FIGURE 6-6 O-540 MIXTURE CONTROL INSTALLATION

6.440 Carburetor Installation

1. Install air box per Section 6.430.
2. Using new gasket, install carburetor on oil sump mounting studs with throttle arm to ship's left. Torque mounting nuts per Section 1.330 and install palnuts.
3. Connect throttle linkage to throttle arm. Adjust throttle correlation rigging per Section 10.150 and torque per Section 1.320.
4. Connect mixture control cable to carburetor (see Figure 6-6) and carb heat control to air box slider valve. Rig each control for 0.03-0.10 inch clearance under knobs when fully depressed. Verify full travel of mixture arm and carburetor heat slider valve.
5. Connect carburetor air temperature probe and secure connector to carburetor with ty-rap.
6. Connect fuel hose to carburetor and torque per Section 1.330.
7. Connect air intake and carburetor heat hoses to air box.
8. Install engine cowling(s).
9. Comply with Section 2.210, steps 15 & 16.

6.450 Carburetor Heat Scoop Removal

1. Remove engine right cowling.
2. Disconnect hose from air box to carb heat scoop.
3. Loosen clamps and remove scoop.

6.460 Carburetor Heat Scoop Installation

1. Position scoop on exhaust manifold and tighten mounting clamps.
2. Connect hose from air box to scoop.
3. Inspect scoop for 0.1-inch minimum clearance in all directions; adjust as required. Torque mounting clamp screws per Section 1.320.
4. Install engine cowling.

6.470 Fuel Injection Air Box Removal

1. Remove engine right cowling.
2. Remove air intake hose.
3. Cover fuel control air intake.
4. Remove four screws and large area washers atop of, and securing air box to, horizontal firewall.
5. Remove air box.

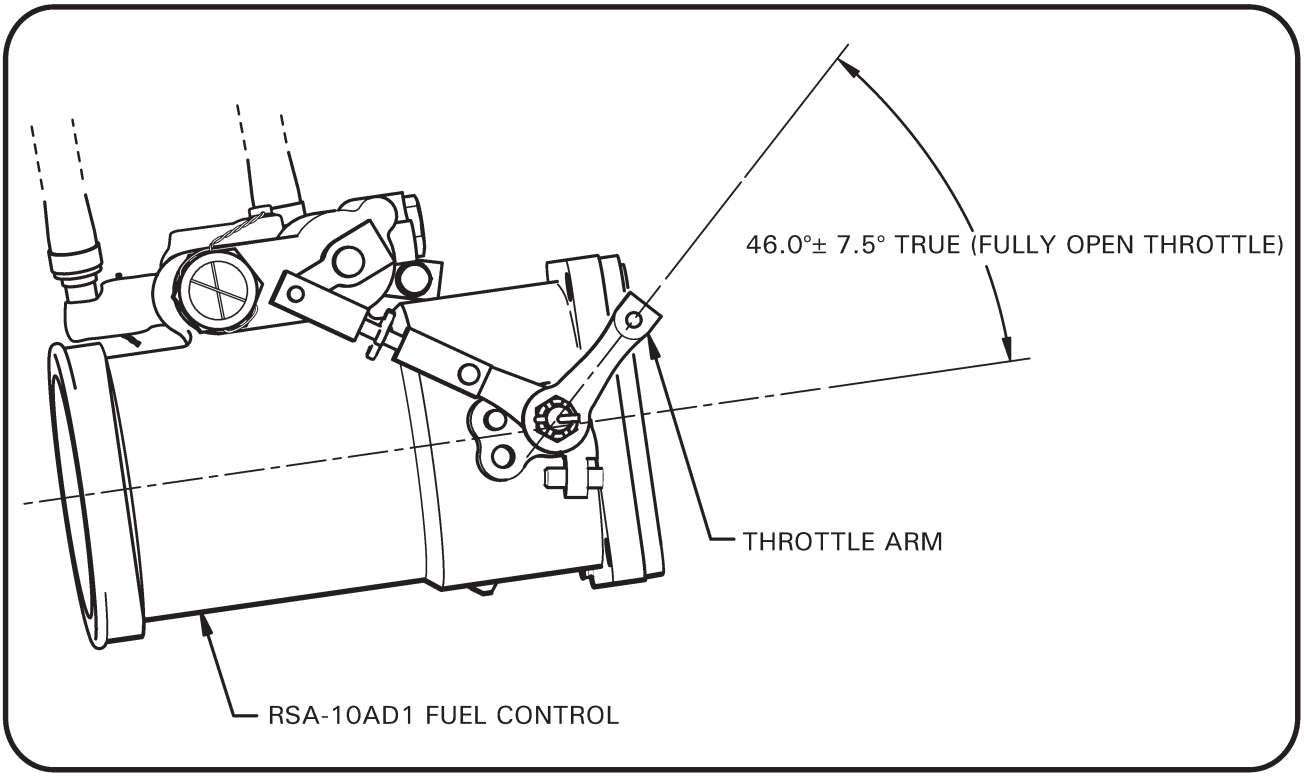


FIGURE 6-7 IO-540 THROTTLE ARM ADJUSTMENT

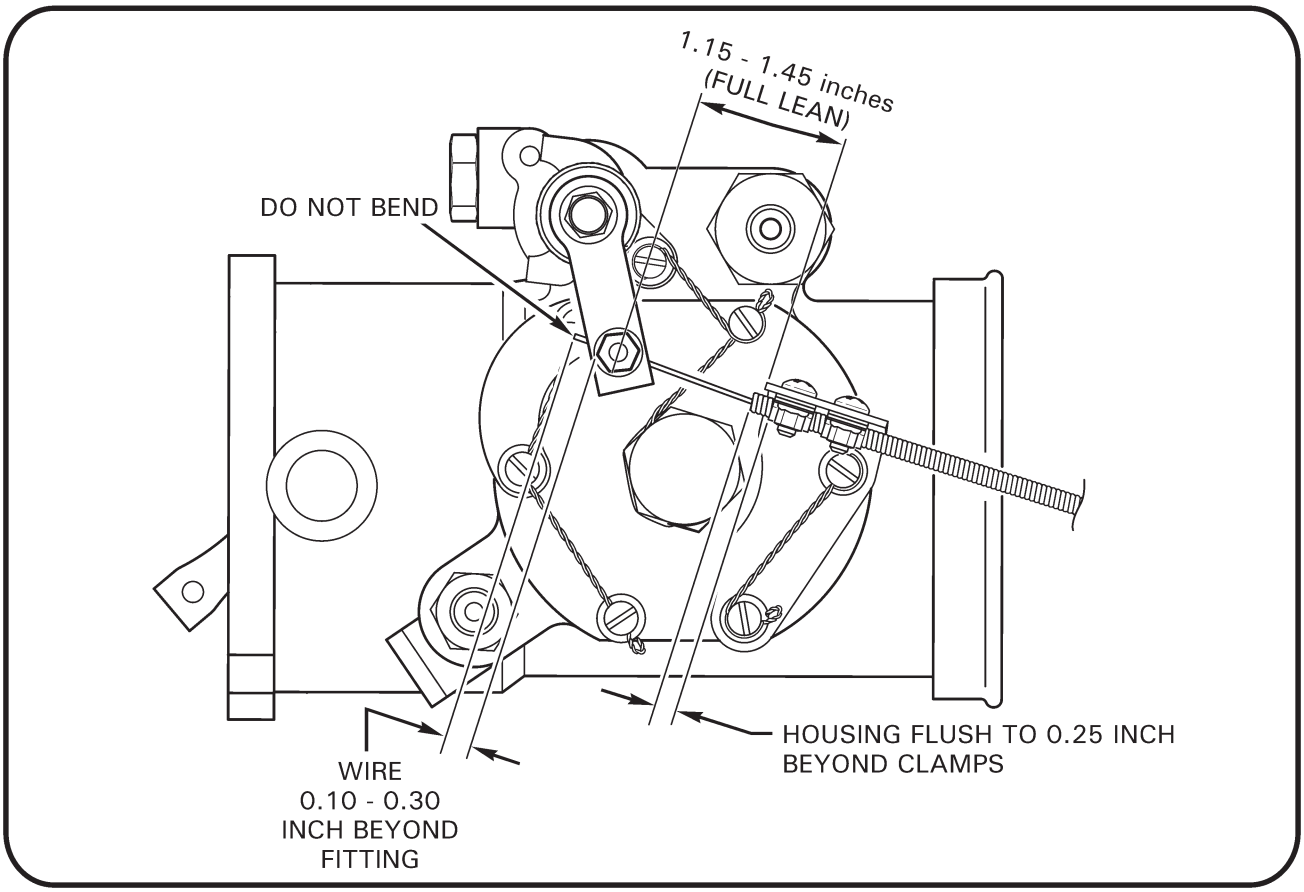


FIGURE 6-8 IO-540 MIXTURE CABLE INSTALLATION

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 air intake hose.

4. Disconnect fuel control inlet tee from fuel control inlet reducer. Install protective caps on all open fuel passages.

5. Disconnect and cap fuel hose from fuel control outlet.

6. Disconnect push-pull tube from bellcrank attached to fuel control mounting flange.

7. Disconnect mixture control cable from fuel control.

8. Loosen lower, aft bolt securing fuel control to intake manifold. Remove three remaining bolts and remove fuel control with attached link and bellcrank.

9. Remove old gasket from intake manifold inlet. Cover inlet if not immediately replacing fuel control.

10. Compare fittings on removed fuel control with replacement fuel control. Transfer fittings as required and torque per Section 1.330.

6.495 Fuel Control Installation

1. Compare fittings on removed fuel control with replacement fuel control. Transfer fittings as required and torque per Section 1.330.

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.

4. Remove protective caps from fuel inlet and outlet. Drain all fluid.

5. Using new gasket and with fuel inlet pointing up, install fuel control on intake manifold flange with longer bolt thru bellcrank in forward, upper hole.

6.495 Fuel Control Installation (continued)

6. Connect fuel inlet tee to fuel control inlet reducer. Torque per Section 1.330 and torque stripe.

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. Connect mixture control cable inner wire to mixture control arm. Ensure A130 spacer lubricated with A257-1 grease. 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 and control wire. 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. Torque per Section 1.330 and torque stripe.

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.

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).

6.495 Fuel Control Installation (continued)

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 Section 10.150.

25. Install right cowling.

6.500 Exhaust System

6.510 Exhaust System Removal

1. Remove engine side panels and aft cowling.
2. Disconnect C173 straps from tail pipe.
3. Disconnect hoses at muffler shroud.
4. If installed, remove carburetor heat scoop per Section 6.450.
5. Disconnect exhaust risers at each engine cylinder, and remove exhaust system.

6.520 Exhaust System Installation

1. Install exhaust risers with new exhaust gaskets. Joints under bead clamps may be wrapped with A701-10 stainless-steel tape. Special torque riser nuts per Section 1.330.
2. Slide muffler section onto exhaust risers and attach with bead clamps. Standard torque bead clamp bolts per Section 1.320.

CAUTION

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

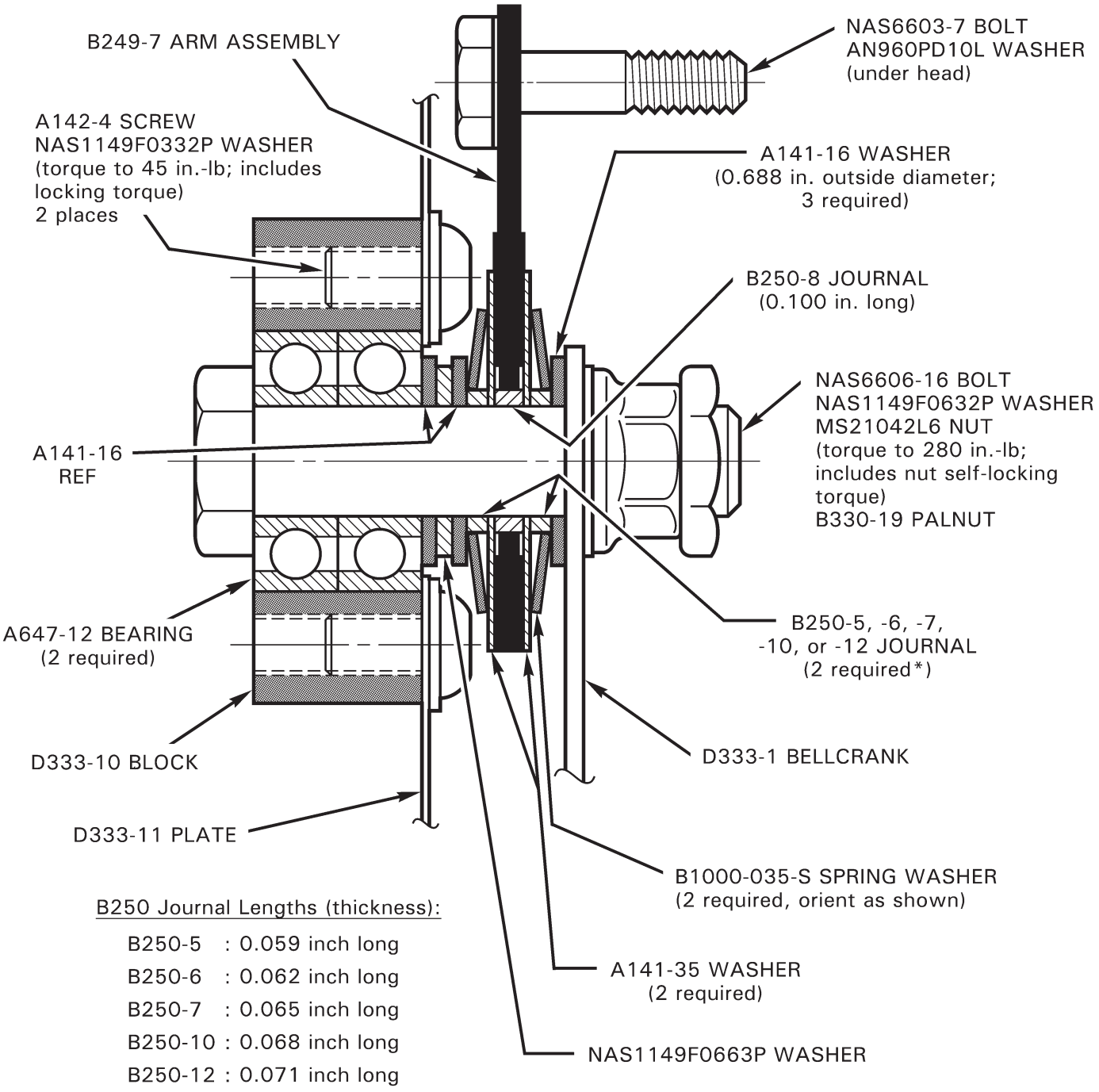
3. Install carburetor heat scoop (O-540 engine) per Section 6.460.
4. Connect muffler cooling and heater hoses to muffler shroud.
5. Connect tail pipe to C173 straps. To accommodate thermal growth, install shim washer(s) between tailpipe ears and straps as required to create a 0.02/0.08 inch forward preload on straps at tailpipe attachment.
6. Install heat shields.
7. Install cowling.

6.600 Troubleshooting

6.610 Low-Power Checklist

When low engine power output is suspected, use the following checklist to verify:

1. Aircraft gross weight is not exceeded. Weigh aircraft if it was not weighed at last overhaul.
2. Engine oil pressure, oil temperature, and CHT are within limits.
3. MAP gage indicates ambient pressure (engine off).
4. Proper grade of fuel per Pilot's Operating Handbook.
5. Main rotor blades are clean and smooth (no rough paint).
6. Exhaust is unobstructed.
7. Main rotor blade trim tabs are not excessively bent.
8. If equipped, verify carburetor heat valve closes fully in off position.
9. Induction system is unobstructed. Air filter and both inlet hoses (ambient and carburetor heat) are clean, undamaged, unobstructed, and do not collapse in flight. Carburetor-to-engine gasket is correct size.
10. Fuel injector nozzles are unobstructed (IO-540 only). Clean nozzles per Lycoming Service Instruction 1275C.
11. Engine tachometer indication is correct. Verify with digital tachometer (such as found in newer dynamic balancing equipment) or similar equipment.
12. Oil screens or filter do not exhibit metallic debris consistent with internal engine damage.
13. Proper cylinder compression (both leakage and direct) per Lycoming recommendations.
14. Mixture neither excessively lean nor rich. Compare fuel flow. Verify fuel filter cleanliness, check spark plug indications, check carburetor throttle body-to-float bowl screw security per Lycoming SB 366.
15. Proper spark plug type and condition.
16. Proper magneto-to-engine timing. Verify engine-left (helicopter-right) magneto is not operating in retard mode when ignition switch is in BOTH position (disconnect retard terminal after starting engine and compare hover MAP indications; lesser hover MAP with retard terminal disconnected indicates magneto was operating retarded).
17. Proper fuel flow and unobstructed carburetor/fuel control inlet screen. Perform fuel-flow check per Section 12.
18. If primer-equipped carbureted engine, verify fuel is not leaking past primer pump (ensure primer pump is locked) and air is not leaking past fittings in cylinder head.



*Install B250-5, -6, -7, -10, or -12 journals as required to produce a rotational friction of 10-12 inch-pounds. Journal dash numbers may be mixed. After adjustment, clamp long side of D333-11 plate in padded vise with B249-7 arm assembly contacting vise jaws while providing rotational clearance for D333-1 bellcrank; measure rotational friction by rotating bolt head with dial-indicating torque wrench.

FIGURE 6-9 D334 BELLCRANK - CARB HEAT ASSIST FRICTION ADJUSTMENT

6.610 Low-Power Checklist (continued)

19. Carburetor or fuel control throttle lever contacts full-throttle stop (collective must be raised slightly).

20. Carburetor or fuel control mixture arm contacts stop when mixture control is in full-rich position and mixture arm does not exhibit springback at extremes of travel when disconnected from control cable/safety spring (due to internal binding).

21. No induction/MAP system leaks. To check MAP system, disconnect MAP line at cylinder head fitting and apply suction with syringe until MAP gage indicates 10 inches Hg. Monitor gage for one minute; indication should rise no more than 1 inch Hg. Verify carburetor throttle shaft bushings are not worn; check both axial and radial clearances. Intake leaks can also occur due to loose intake pipe connections in oil sump and/or cracked sump runner tubes. On fuel-injected engines, verify intake manifold drain ("sniffle") valve does not leak ambient air into intake manifold.

22. Proper exhaust valve guide clearance per Lycoming SB388 (latest revision).

23. Proper dry-tappet clearance per Lycoming Overhaul Manual.

24. With lifters pumped up (valve lash removed), each intake valve should exhibit equal travel during opening when measured with a dial indicator. Similarly, each exhaust valve should exhibit equal travel during opening. Unequal travel indicates damaged cam lobe(s).

25. Proper magneto internal timing.

26. Carburetor float bowl fuel level correct.

27. Cylinder head intake port has radiused edge where inlet airflow turns 90 degrees toward valve. If no radius exists, contact Lycoming Technical Support.

28. Proper crankshaft-to-camshaft timing: As #1 piston passes TDC on compression stroke, the #2 intake valve should open while the #2 exhaust valve closes (valve overlap position).

29. If engine exhibits low-power immediately after overhaul, verify correct 8.5:1 compression ratio piston P/N 75089 has been installed (instead of 7.0:1 low compression piston P/N 75413).

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CHAPTER 7

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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. The other shafts throughout the drive system are made of alloy steel.

7.100 Main Rotor Gearbox

7.110 Main Rotor Gearbox Removal

a) Remove the C706-1 tailcone cowling, both engine side panels, and the aft engine cowling.

b) Remove the mast fairing per Section 4.142. Remove the middle and lower mast fairing ribs from the mast tube.

c) Remove the main rotor per Section 9.111.

d) Disconnect the rotor brake cable pulleys on the arm and aux tank. Remove the cable housing clamp on the aux tank channel.

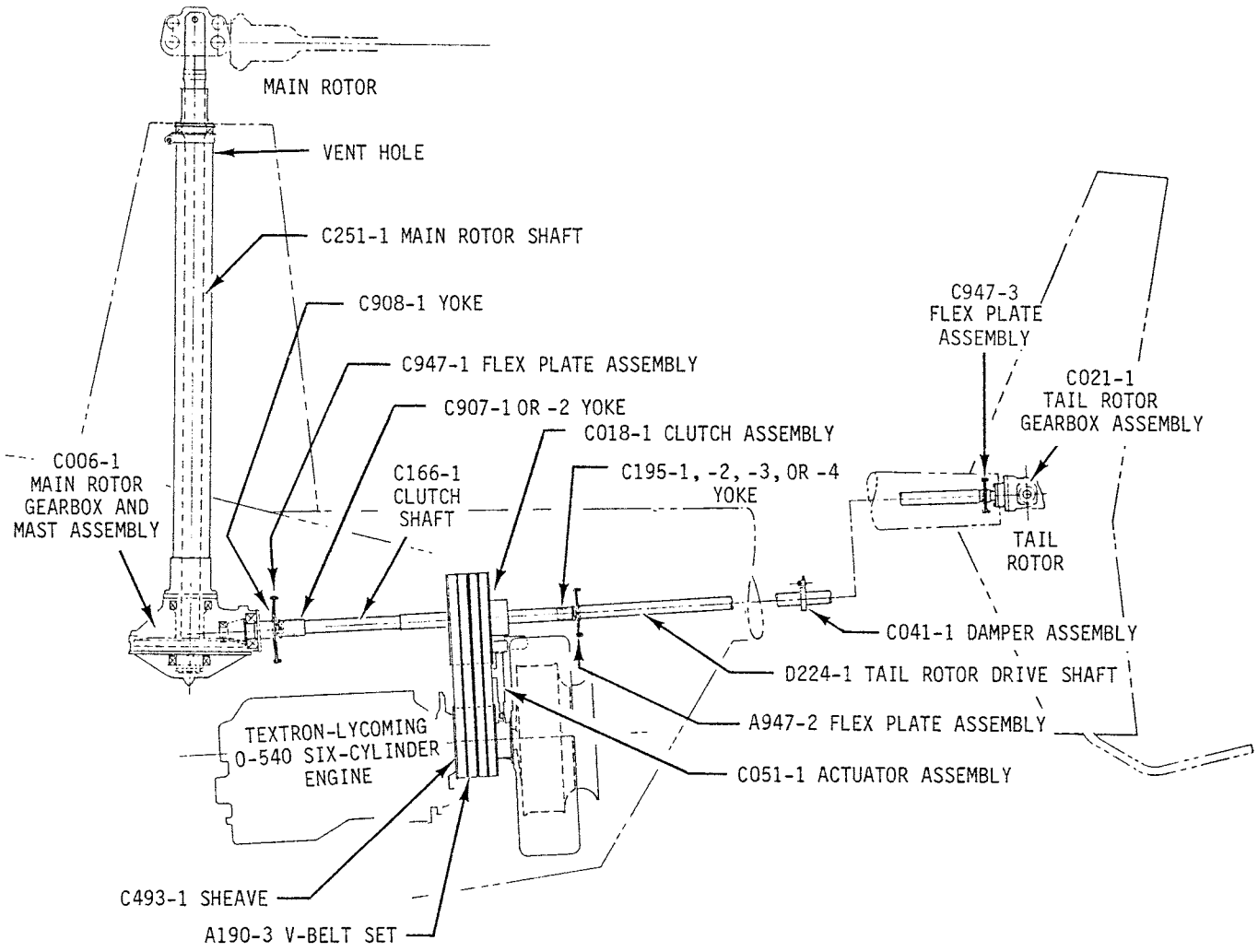


FIGURE 7-1 DRIVE SYSTEM

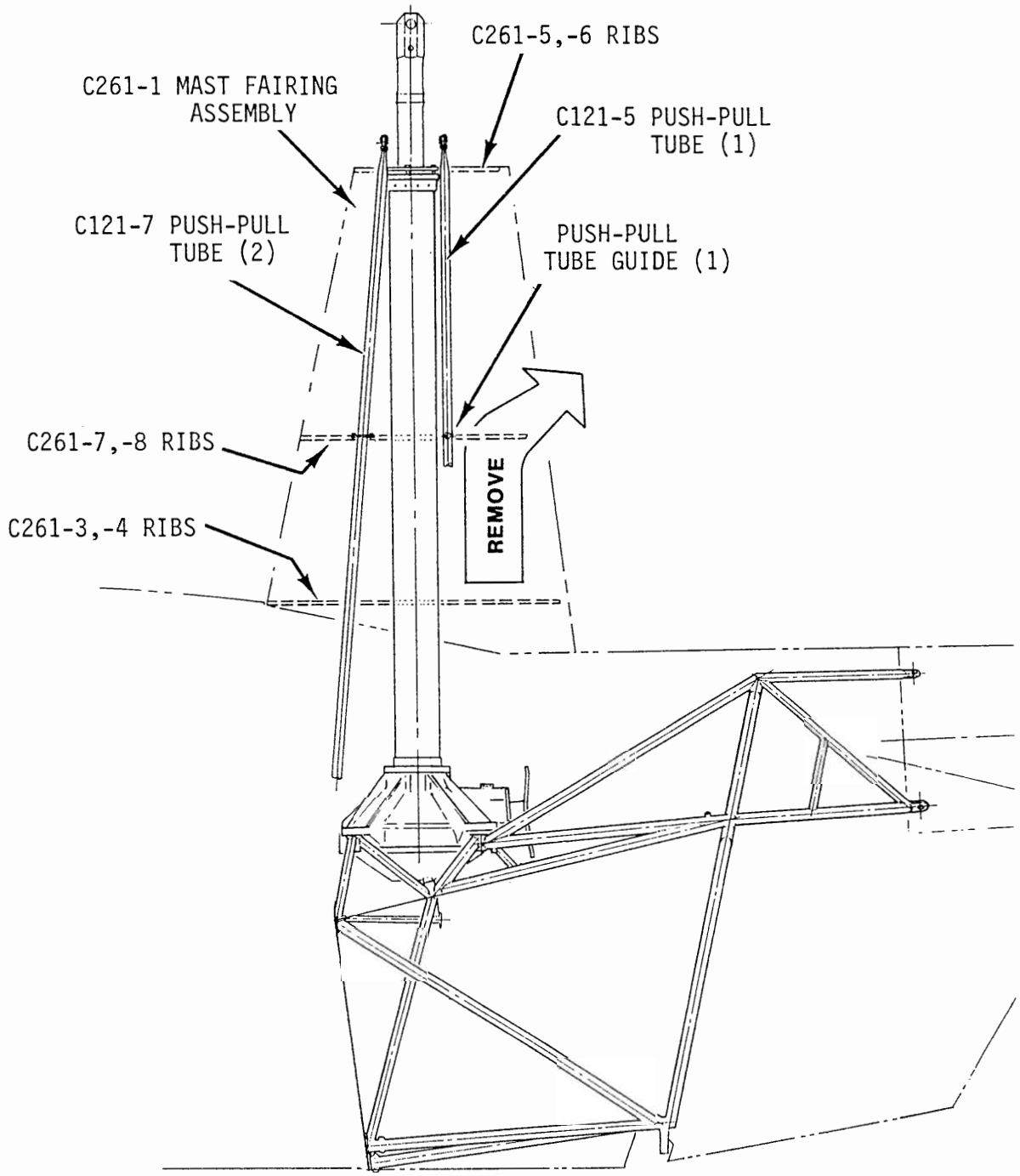


FIGURE 7-2 MAIN ROTOR GEARBOX REMOVAL

7.110 Main Rotor Gearbox Removal (cont'd)

e) Remove the main and auxiliary fuel tanks per Section 12.110. Mark all electrical connections for reinstallation.

f) Disconnect the jackshaft (C337-1) from the forward and aft push-pull tubes and the support struts.

g) Remove the jackshaft support struts (see Section 8.300).

h) Disconnect forward flex plate from gearbox yoke and note the washer stack up on each bolt.

i) Disconnect the chip detector, Hall Effect sender, overtemp sender leads, and ground wire. Tag wires for reassembly.

j) Remove the gearbox left and right cooling hoses and nozzle.

k) Remove the four main rotor gearbox mounting bolts. Carefully lift the gearbox up to clear the forward push-pull tubes and remove (see Figure 7-2).

1) It is recommended that the transmission be hoisted using the MT527-1 helicopter lifting fixture.

CAUTION

Leveling shims may be installed between the gearbox mounts and the frame mounting pads. These should remain attached or mark mounting pads with shim thickness for reinstallation.

l) Remove the droop stops and disconnect the lower scissors at the mast. Slide the swashplate assembly off the slider tube.

7.120 Main Rotor Gearbox Installation

CAUTION

Prior to operation of a new, overhauled or repaired gearbox, 6 ounces of A257-2 gear oil must be injected into the vent hole (see Figure 7-1) on the top aft side of the mast tube. Fill gearbox with oil to the level indicated on the sight glass decal. The gearbox must remain vertical during and after filling.

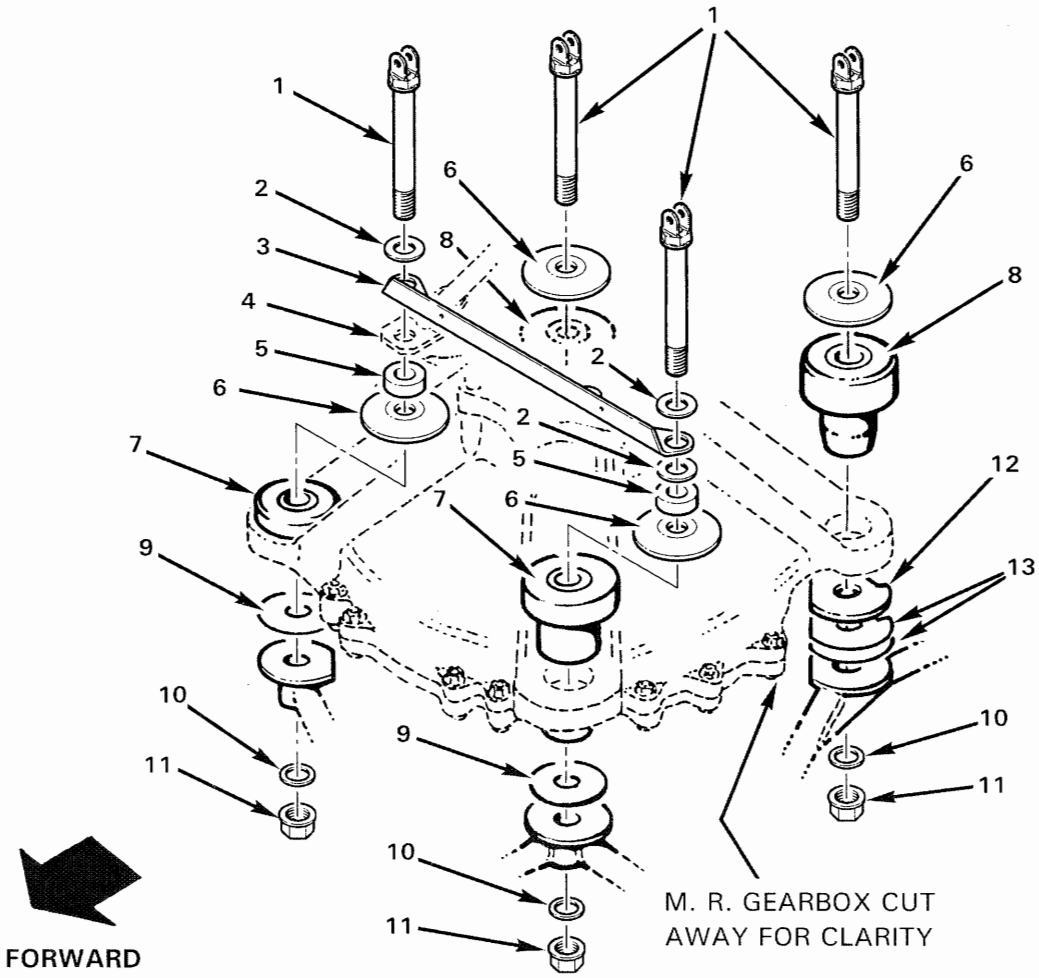


FIGURE 7-2A MAIN ROTOR GEARBOX INSTALLATION

NUMBER	DESCRIPTION	NUMBER	DESCRIPTION
1	Fitting	8	Mount
2	Washer	9	Shim (3 max per pad)
3	Brace (hydraulic controls)	10	Washer
4	Strut Weldment	11	Nut
5	Spacer	12	Spacer
6	Washer	13	Shim (3 max per pad)
7	Mount		

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7.120 Main Rotor Gearbox Installation (cont'd)

1. Level MRGB mounting pads by installing original shims. If original shim thickness is unknown, level mounting pads per Section 7.130.

2. Verify two C796-3 spacers are the same thickness and install one C796-3 spacer on each aft mounting pad atop any shim(s).

3. Remove foreign objects and prepare area for gearbox installation. Assistance is desirable to help position gearbox. Position MRGB on mounting pads.

4. Install MRGB mounting hardware per Figure 7-2A. Orient A650 fitting tabs laterally per Figure 8-9, special torque per Section 1.330, and torque stripe per Figure 2-1.

5. Connect forward flex plate, using previously recorded shim washer positions. Standard torque fasteners per Section 1.320.

6. Install jackshaft support struts and jackshaft (see Section 8.300).

7. Connect main rotor gearbox cooling hoses and nozzle.

8. Install fuel tanks per Sections 12.130 and 12.140.

9. Connect electrical leads to fuel tanks and main rotor gearbox. Reinstall rotor brake upper pulley and cable and connect pulley to arm. Install rotor brake cable clamp to auxiliary tank channel. Position cable end fitting on outboard side of pulley on aux tank.

10. Install main rotor per Section 9.000.

11. Install mast fairing and connect pitot tube.

12. Check clutch sheave alignment per Section 7.230.

13. Check intermediate flex plate shimming per Section 7.330.

14. Install all cowling.

7.130 Leveling Main Rotor Gearbox

Level main rotor gearbox mounting pads laterally to landing gear aft cross tube and longitudinally at 3.8° ± 0.2° angle to C046-6 tube (ref Figure 4-2). Use A796-1 shims on forward pads and C796-2 shims on aft pads, maximum 3 shims per pad (shims are 0.020 inch thick).

7.140 C908-1 Yoke Replacement

Yoke Removal

1. Remove clutch per section 7.210 or remove forward flex plate and let forward end of clutch shaft rest on firewall per Figure 7-8. Place a wood block between horizontal firewall and yoke flange to prevent yoke from rotating, or engage rotor brake.

2. Remove cotter pin, nut, and C141-10 washer from main rotor gearbox pinion shaft.

3. Slide yoke off gearbox pinion shaft.

Yoke Installation

1. Ensure yoke and gearbox splines are clean and undamaged. Install C908-1 yoke on main rotor gearbox pinion shaft. Install C141-10 washer and AN320-8 castellated nut.

2. Support yoke for torquing by placing a wood block between yoke flange and horizontal firewall. Special torque AN320-8 nut per Section 1.330 and install cotter pin. Remove block.

CAUTION

Check Hall Effect sender-to-yoke magnet gap per Section 7.141 before run-up or turning blades.

3. Install clutch assembly and/or forward flex plate per Section 7.220.

7.141 Setting Hall Effect Sender Gap

If Hall Effect Sender gap is not 0.030 ± 0.010 inch, loosen jam nuts on sender and adjust gap. Check gaps between both yoke magnets at both senders.

7.150 Replacement of Main Rotor Gearbox Pinion Seal (see Figure 7-2B)

a. Disconnect A947-2 intermediate flex plate at tail rotor drive shaft. Mark flex plate and fasteners with a grease pencil for reinstallation.

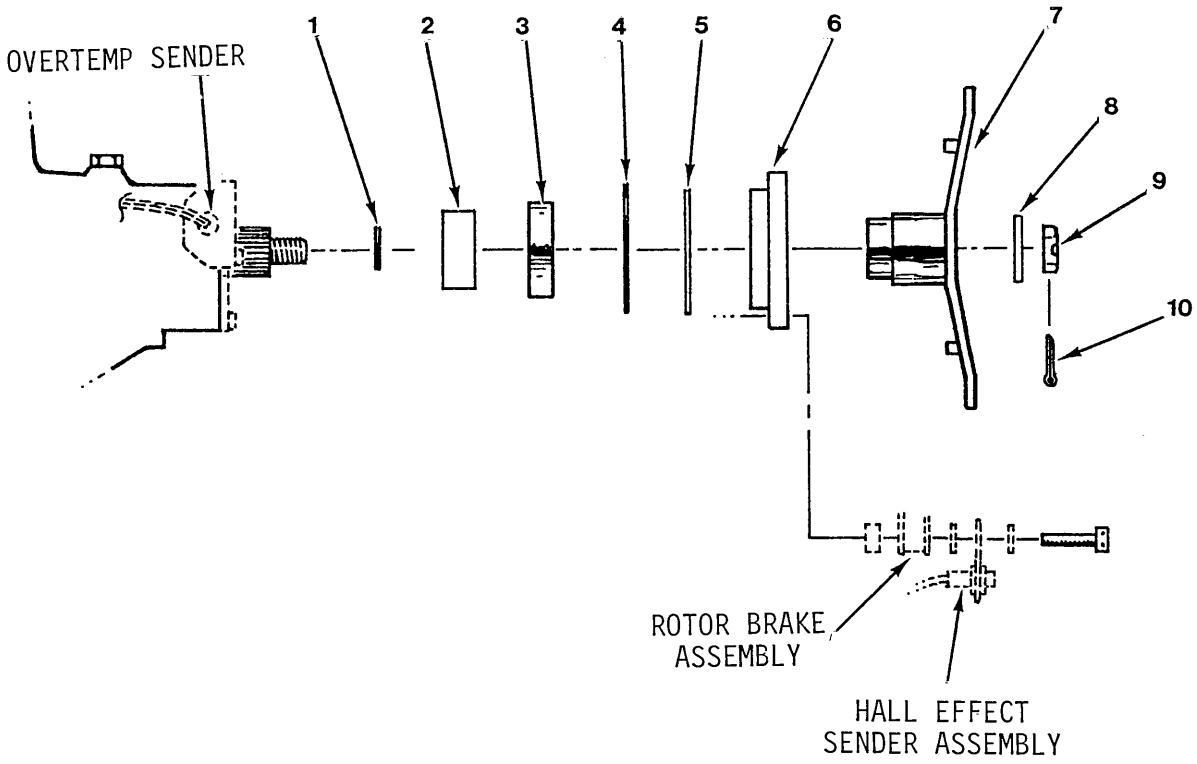
b. Disconnect C947-1 forward flex plate.

c. Rest forward end of clutch on firewall. Remove the C908-1 yoke from pinion shaft per Section 7.140.

d. Cut safety wire and remove rotor brake assembly per Section 7.610.

e. Remove Hall Effect sender bracket and gearbox overtemp sender bracket.

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



NUMBER	PART NO.	DESCRIPTION
1	C215-029	"O"-RING
2	C266-1	SPACER
3	C966-3	SEAL
4	C215-156	"O"-RING
5	C117	SHIM
6	C270-1	END COVER
7	C908-1	YOKE ASSEMBLY
8	C141-10	WASHER
9	AN320-8	NUT
10	MS25665-210	COTTER PIN

FIGURE 7-2B MAIN ROTOR GEARBOX PINION SEAL REPLACEMENT

7.150 Replacement of Main Rotor Gearbox Pinion Seal (cont'd)

CAUTION

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

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

NOTE

Open face of seal must point toward gearbox.

h. Install bearing end cover over pinion shaft. Place Hall Effect sender bracket and overtemp sender bracket on cover and install rotor brake assembly per Section 7.620.

i. Torque screws per Section 1.330 and safety with 0.032 inch diameter safety wire.

j. Check Hall Effect sender gap per Section 7.141.

7.155 MRGB Sump O-Ring Replacement Procedure

a. Remove MRGB per Section 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 stack-up at all C263-1 sump-to-C264-1 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 and o-ring.

e. Prelubricate new C215-279 o-ring with A257-2 oil and install on sump. Ensure o-ring is not twisted in sump groove.

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. Prior to torquing fasteners, position those shims used on NAS1352 series (internal-wrenching) screws against C264-1 housing to prevent shims from interfering with bolt threads and deforming.

h. Torque bolts per Section 1.320. Torque NAS1352 screws per Section 1.330 and safety wire per MS33540.

7.155 MRGB Sump O-Ring Replacement Procedure (continued)

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

j) Install MRGB per Section 7.120.

7.160 Main Rotor Gearbox Overtemp Inspection

1. Perform the following if MR TEMP warning light illuminates, and gearbox Telatemp indicates abnormally high operating temperature:

   a. Inspect gearbox cooling duct for obstructions and conditions. Clear obstructions or replace duct as required.

   b. Remove chip detector and inspect for chips. Return gearbox to RHC if chips are found.

   c. Drain gearbox oil and remove sight gage and filler plug. Observe gear tooth surfaces thru filler plug and sight gage holes while rotating gearbox pinion and inspect for damage. Return gearbox to RHC if damage is detected or if gearbox does not rotate smoothly. If no damage is noted, refill gearbox.

   d. Replace Telatemp. Ensure old Telatemp adhesive is removed and new Telatemp makes good contact with gearbox.

   e. If gearbox overtemp indications continue, return gearbox to RHC.

2. If MR TEMP warning light illuminates but Telatemp indicates normal operating temperature, replace gearbox overtemp sender and perform steps 1a, 1b, and 1e.

3. If Telatemp indicates 240°F/116°C but MR TEMP warning light does not illuminate, test MR TEMP warning circuit and perform steps 1a, 1b, 1d, and 1e.

NOTE
Light illuminates at 240 ± 5°F.

7.170 Main Rotor Gearbox Chip Light Indicator

If MR CHIP light illuminates:

1. Drain and flush gearbox per Section 1.120 except strain oil (a paint filter works well) while draining and examine any particles found in oil or on chip detector.

2. Particles larger than 0.12 inch long or 0.02 inch wide are cause for concern and should be identified as ferrous or non-ferrous with a magnet. If particles are ferrous return main rotor gearbox to RHC for repair along with particles. If particles are non-ferrous, drain and flush gearbox per Section 1.120.

3. If MR CHIP illuminates again within next 100 hours time-in-service a gearbox failure may be imminent. Return gearbox to RHC for repair.

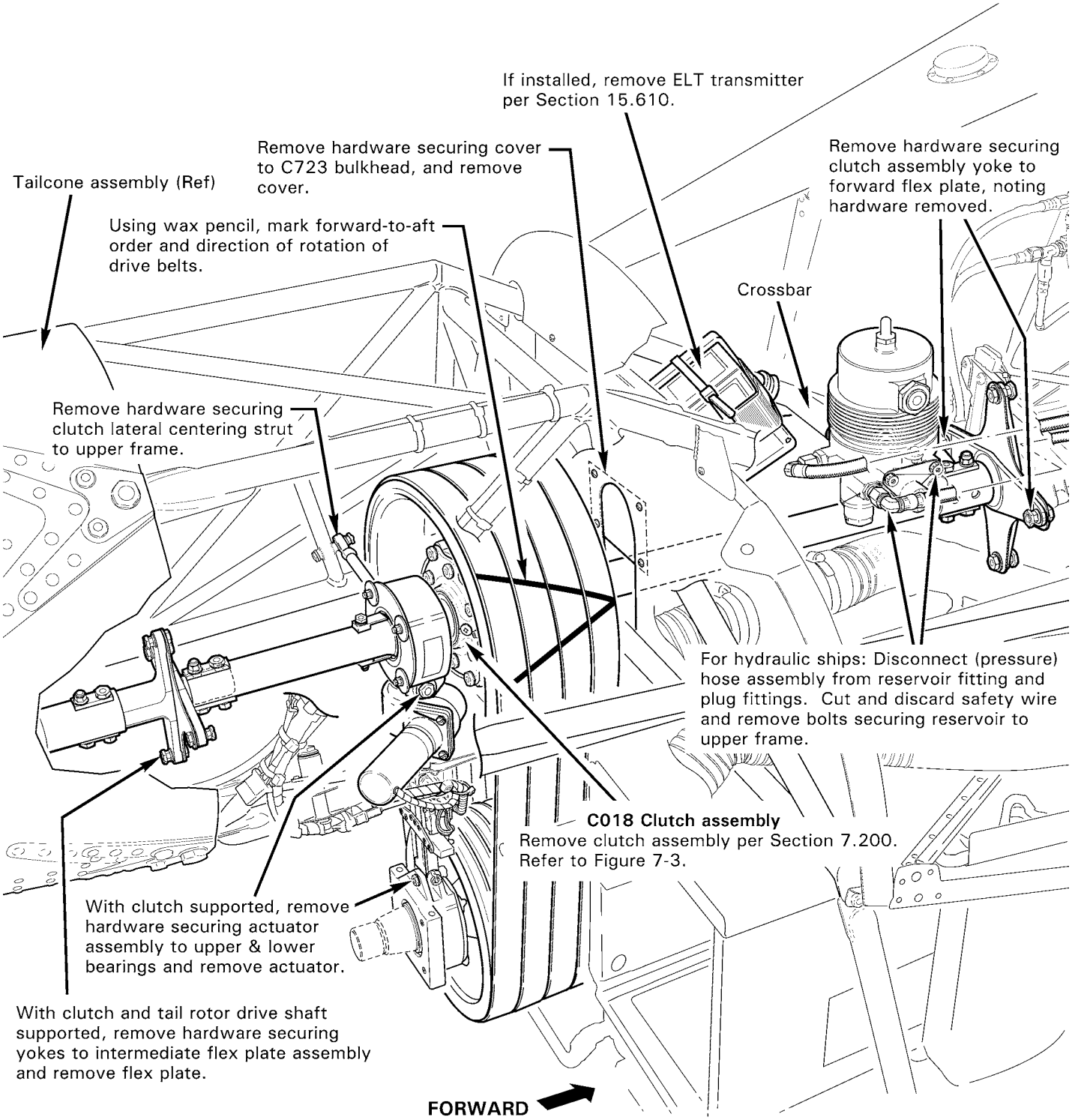


FIGURE 7-2C CLUTCH ASSEMBLY REMOVAL
(Shown with fanwheel and scroll removed)

7.200 Clutch Assembly

A. Removal

1. Turn BATTERY switch ON and verify actuator is fully disengaged. Turn BATTERY switch OFF.
2. Remove C706-1 tailcone fairing assembly.
3. Remove fanwheel and scroll per Section 6.210.
4. Refer to Figure 7-2C. Remove hardware securing C018 clutch assembly and D224 tail rotor drive shaft assembly yokes to A947-2 (intermediate) flex plate assembly, noting locations of hardware removed. Remove plate assembly. Support drive shaft using a foam block, or equivalent, while drive shaft is disconnected from drive train.
5. Remove hardware securing clutch assembly yoke to C947-1 (forward) flex plate assembly, noting locations of hardware removed. Protect forward flex plate from damage. Support clutch assembly by installing ty-raps around forward and aft yokes, and securing ty-raps to upper frame.
6. For hydraulic ships: Disconnect D205-1 or -11 (pressure) hose assembly from hydraulic reservoir elbow or union, and plug fittings. Cut and discard safety wire, and remove bolts securing reservoir to upper frame. Support reservoir.
7. If installed, remove ELT transmitter per Section 15.610.
8. Remove hardware securing C723-6 cover to C723 bulkhead, and remove cover.
9. Remove hardware securing clutch lateral centering strut to upper frame.
10. Cut and discard ty-raps as required and disconnect actuator wiring from airframe harness at connectors. Remove hardware securing actuator to upper & lower bearings and remove actuator.
11. Remove and discard palnuts securing C907 (forward) yoke and C195 (aft) yoke to clutch shaft. (Palnuts in these locations are no longer required.) Tape clutch shaft, yokes, and yoke hardware as required to protect component from damage during removal.
12. Using wax pencil, mark forward-to-aft order and direction of rotation of drive belts. Support clutch assembly, cut and discard ty-raps securing clutch to upper frame, and remove drive belts.
13. Refer to Figure 7-3. Have a second person support the forward end of the clutch shaft, and the hydraulic reservoir, if installed. Move clutch aft, until forward yoke is aft of upper frame crossbar, then move clutch forward (at an angle) over top of crossbar. Move clutch aft (at an angle), until sheave is clear of the tailcone. Carefully maneuver forward yoke aft through C723 bulkhead.
14. If sending clutch assembly to RHC for repair, remove clutch lateral centering strut, and clutch forward and aft yokes per Sections 7.260 and 7.270.

B. Installation

1. On C018 clutch assembly, install clutch lateral centering strut, and C907 (forward) yoke and C195 (aft) yoke per Sections 7.260 and 7.270, if removed. (Palnuts securing yokes to clutch shaft are no longer required.)

7.200 Clutch Assembly (continued)

B. Installation (continued)

2. Tape clutch shaft, yokes, and yoke hardware as required to protect component from damage during installation. If not previously accomplished, protect forward flex plate from damage.
3. Refer to Figures 7-2C and 7-3. Have a second person support the hydraulic reservoir, if installed, and prepared to support the forward end of the clutch shaft. Carefully maneuver clutch forward yoke forward through C723 bulkhead. Move clutch forward (at an angle), over top of upper frame crossbar, until sheave and aft yoke are clear of the tailcone. Move sheave and aft yoke up then aft, until forward yoke is aft of crossbar. Move clutch forward into mounting position.
4. Refer to Figure 7-2C. Observe markings and install drive belts in proper forward-to-aft order and direction of rotation (as removed). Support clutch assembly by installing ty-raps around forward and aft yokes, and securing ty-raps to upper frame.
5. Install actuator per Section 7.520, steps a thru d.
6. Install hardware securing clutch assembly yoke to C947-1 (forward) flex plate assembly, using hardware removed. Standard torque nuts and palnuts per Section 1.320, and torque stripe per Figure 2-1.
7. Install hardware securing clutch lateral centering strut to upper frame. Standard torque nut and palnut per Section 1.320, and torque stripe per Figure 2-1. Cut and discard ty-raps securing clutch to upper frame.
8. Install C723-6 cover on C723 bulkhead. Verify security.
9. If removed, install ELT transmitter per Section 15.610.
10. For hydraulic ships: Install bolts securing hydraulic reservoir to upper frame and special torque bolts per Section 1.330. Install 0.032-inch diameter lockwire and safety bolts together in pairs.
11. For hydraulic ships: Torque check hydraulic reservoir union, or elbow jam nut and palnut, per Section 1.330. Remove plugs and connect D205-1 or -11 (pressure) hose assembly to reservoir elbow or union. Special torque hose B-nut per Section 1.330 and torque stripe per Figure 2-1.
12. Perform fanwheel and scroll installation per Section 6.220, steps 1 thru 11.
13. Connect actuator wiring to airframe harness at connectors. Install ty-raps as required to secure wire harness to frame. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
14. Perform clutch sheave alignment per Section 7.230.
15. Inspect A947-2 (intermediate) flex plate assembly per Section 2.410. Perform intermediate flex plate installation and shimming per Section 7.330.
16. Install C706-1 tailcone fairing assembly.

NOTE

During initial fanwheel balance, perform "Starting Engine and Run-up" per Pilot's Operating Handbook Section 4, with hydraulics off and cyclic neutralized, to purge air from system.

17. Balance fanwheel per Section 6.240.

7.210 Clutch Assembly Lubricant Inspection and Servicing

NOTE

To retrofit older clutch assemblies with C168-5 retainers, order KI-202 kit. Each C168-5 retainer has a B289-3 screw; screws must be installed on opposite sides of the clutch shaft (when one screw is on top, opposite screw must be on bottom). With C168-5 retainers installed, clutch lubricant inspection and servicing may be performed without clutch removal.

NOTE

Sprag clutch housing capacity is approximately 4 fl oz (118 ml).

A. Clutch Assemblies with C168-5 Retainers

WARNING

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

1. Remove C706-1 tailcone fairing assembly. Remove hardware securing C723-6 cover to C723 bulkhead and remove cover.

2. Rotate clutch shaft until bolts securing yokes to shaft are vertical. Engage rotor brake.

3. Rotate sheave until forward retainer B289-3 screw is on top. Remove screw and install clean MT147-2 fitting. Attach drain hose.

4. Rotate sheave until fitting and attached drain hose are on bottom. Route drain hose into a suitable, clean container. Remove aft retainer B289-3 screw and allow lubricant to drain into container.

5. Install second clean MT147-2 fitting in aft retainer and connect a clean supply of A257-4 lubricant to fitting. Flush sprag clutch housing until exiting lubricant is obviously red. Disconnect lubricant supply and allow lubricant to drain completely into container.

6. Strain all lubricant from container through a 180-200 micron paint filter/strainer. Fluid may be dark, and may sparkle with very fine metallic debris; this is normal. If metallic debris is trapped in the filter/strainer, remove clutch assembly and return it to RHC, or an R44 Service Center authorized to overhaul clutch assemblies, for disassembly and inspection.

7. If metallic debris is not found in the filter, attach drain hose to (top) aft retainer fitting. Route drain hose into a suitable container. Connect a clean supply of A257-4 lubricant to (bottom) forward retainer fitting. Fill sprag clutch housing thru bottom fitting until no air bubbles are visible in drain hose. Shut-off fluid flow.

7.210 Clutch Assembly Lubricant Inspection and Servicing (continued)

A. Clutch Assemblies with C168-5 Retainers (continued)

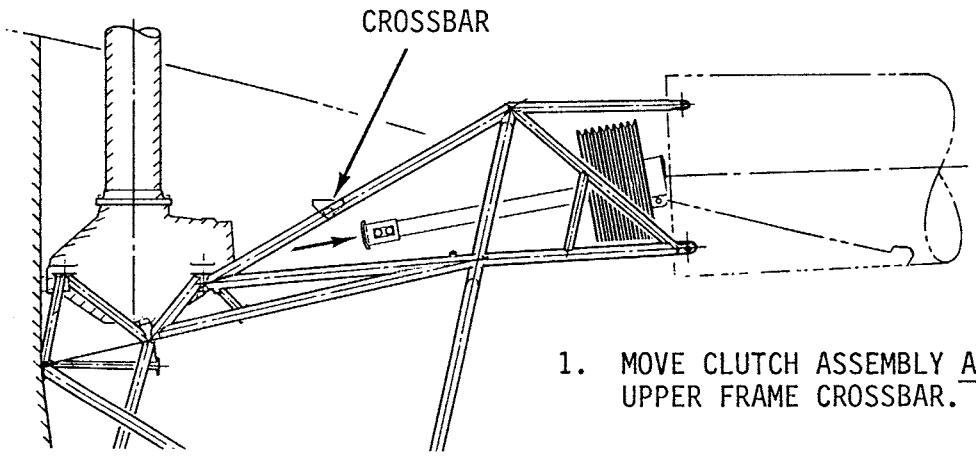
8. Remove (top) aft retainer fitting and install screw. Rotate sheave until forward retainer fitting is on top. Remove fitting and verify lubricant level contacts threads; add lubricant as required. Install forward screw.

9. Install C723-6 cover on C723 bulkhead. Install C706-1 tailcone fairing assembly.

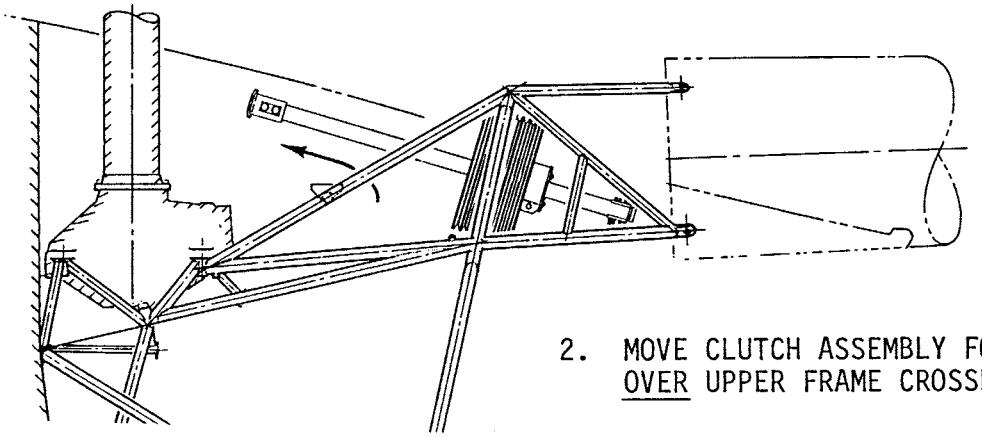
B. Clutch Assemblies with Retainers without B289-3 Screws

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

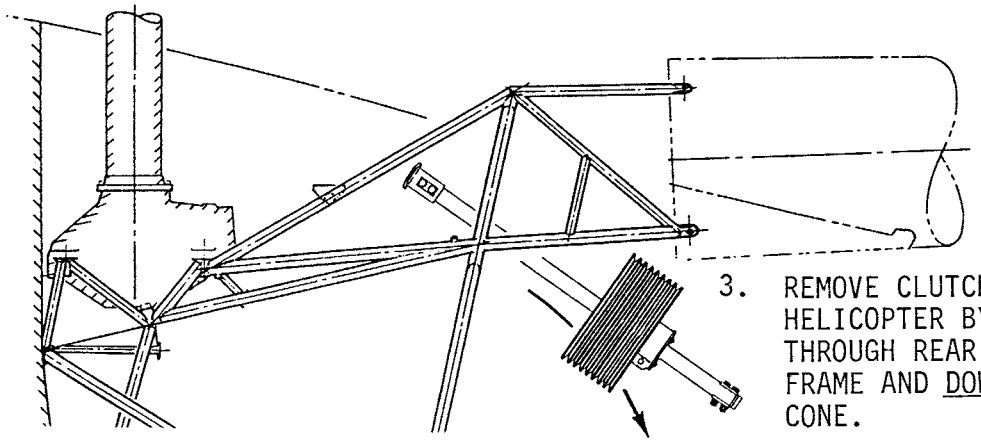
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1. MOVE CLUTCH ASSEMBLY AFT AND UNDER UPPER FRAME CROSSBAR.



2. MOVE CLUTCH ASSEMBLY FORWARD UP AND OVER UPPER FRAME CROSSBAR.



3. REMOVE CLUTCH ASSEMBLY FROM HELICOPTER BY LOWERING AFT THROUGH REAR SECTION OF UPPER FRAME AND DOWN BELOW TAIL CONE.

FIGURE 7-3 CLUTCH REMOVAL

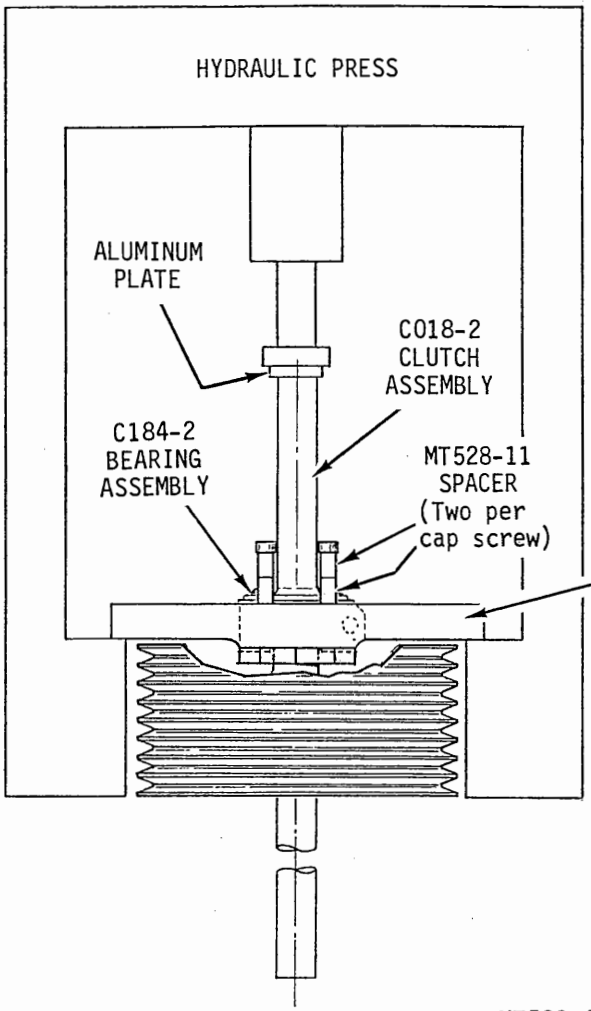


FIGURE 7-3A

REMOVAL OF C184-2 BEARING ASSEMBLY USING HYDRAULIC PRESS AND MT528-1 REMOVAL TOOLS.

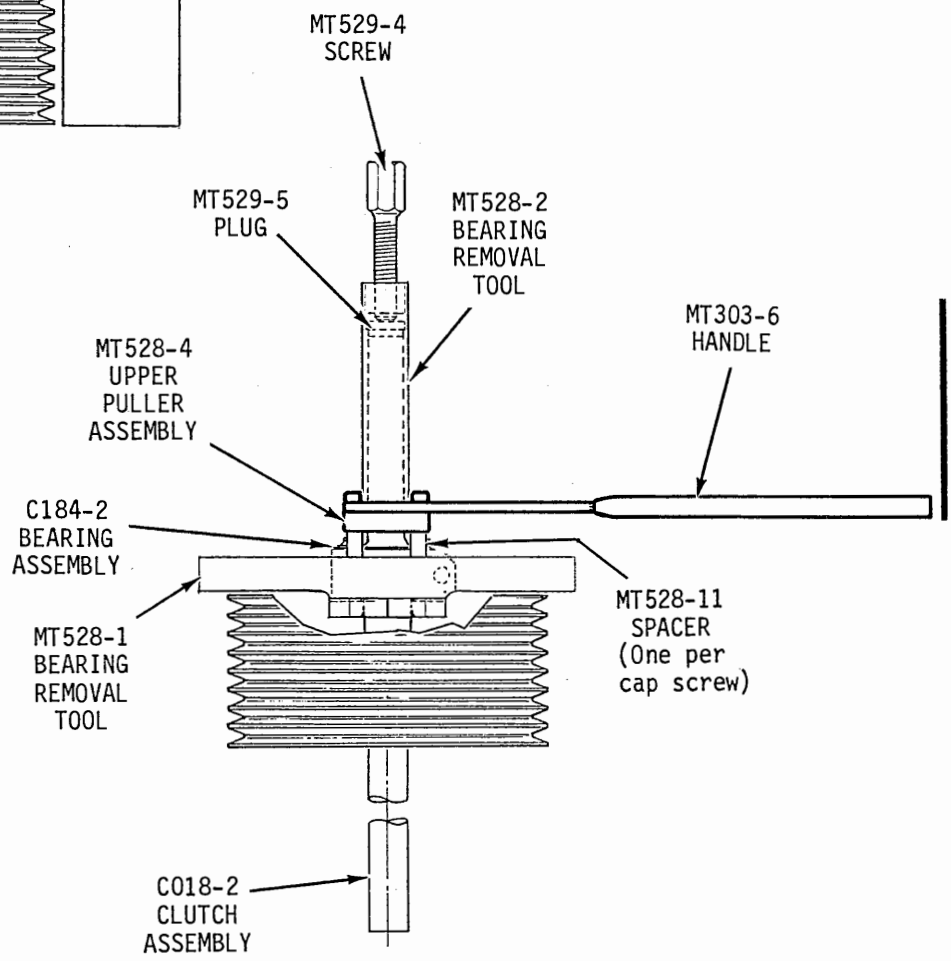


FIGURE 7-3B

REMOVAL OF C184-2 BEARING ASSEMBLY WHEN HYDRAULIC PRESS IS NOT AVAILABLE; USE MT528-1 AND MT528-2 REMOVAL TOOLS.

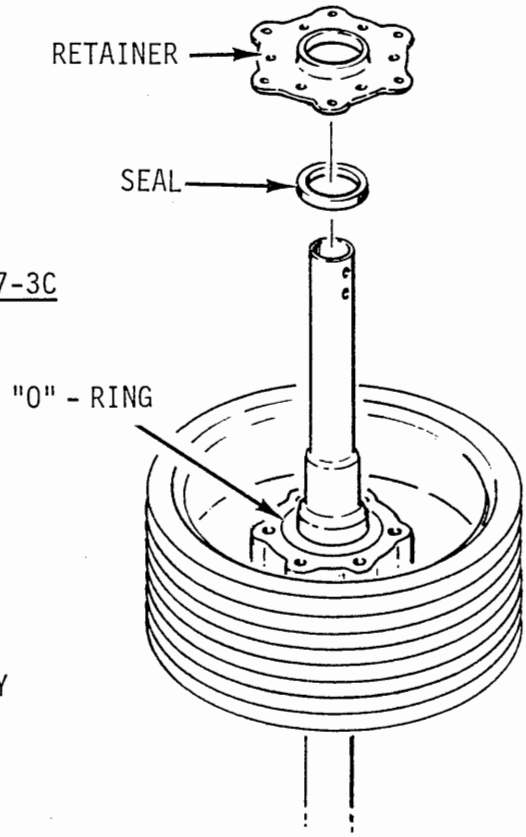


FIGURE 7-3C

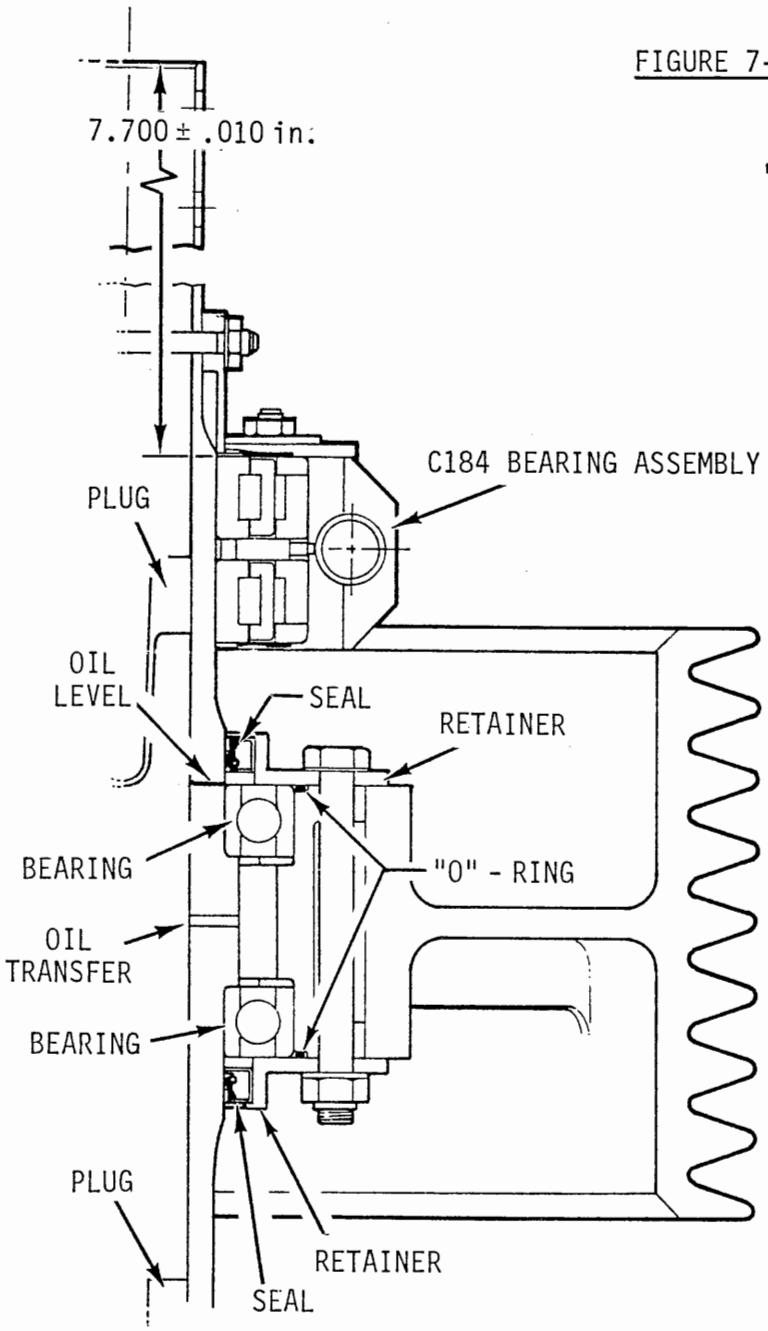


FIGURE 7-3D

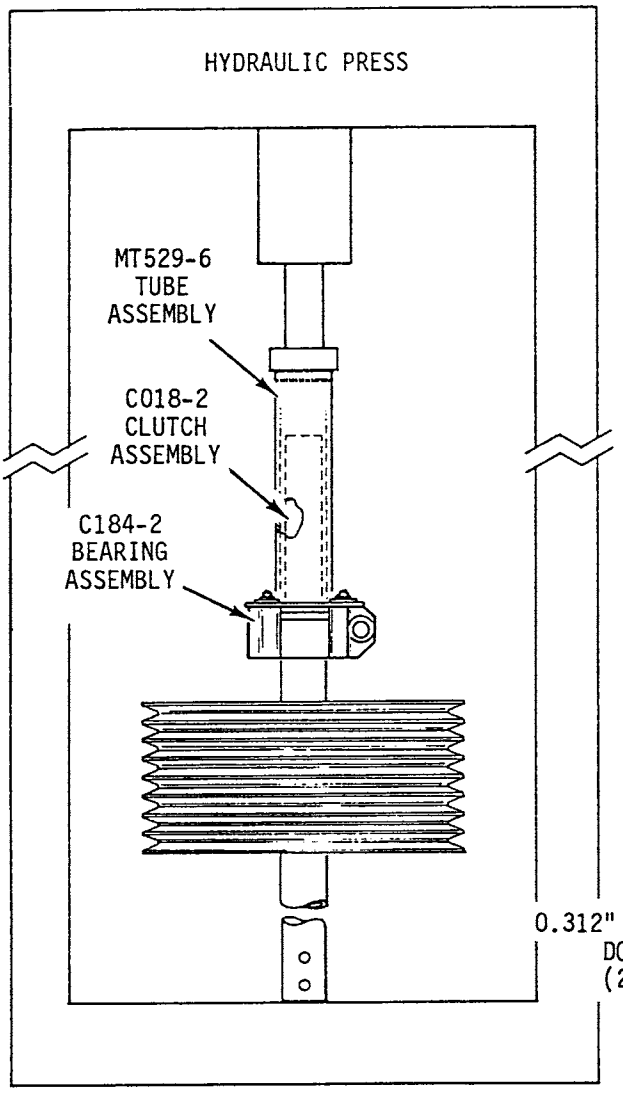


FIGURE 7-3E

INSTALLATION OF C184-2 BEARING USING HYDRAULIC PRESS AND MT528-1 INSTALLATION TOOLS.

WARNING

DO NOT PRESS ACROSS SHEAVE OR BEARINGS WILL BE DAMAGED.

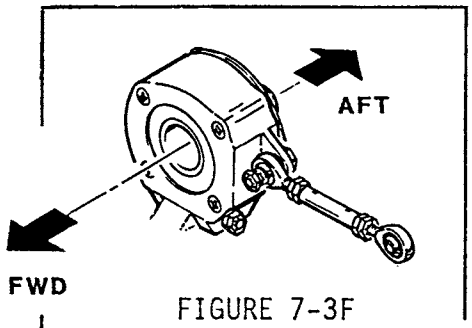


FIGURE 7-3F

INSTALL C184-2 BEARING ASSEMBLY ONTO SHAFT WITH NUTS FACING AWAY FROM CLUTCH.

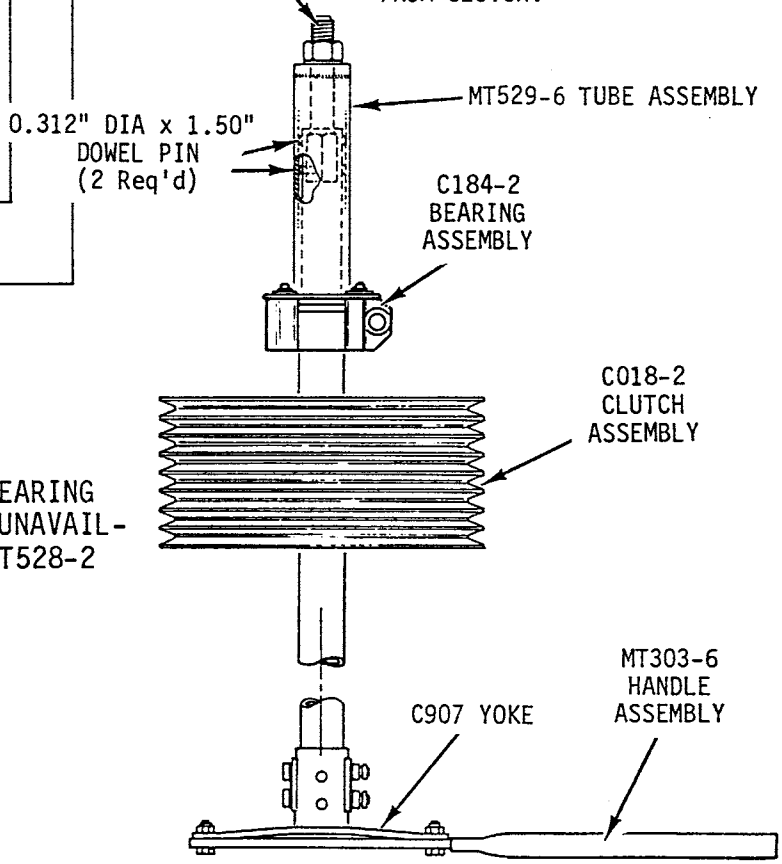


FIGURE 7-3G

INSTALLATION OF C184-2 BEARING WHEN HYDRAULIC PRESS IS UNAVAILABLE; USE MT528-1 AND MT528-2 INSTALLATION TOOLS.

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7.211 C184 Bearing Assembly Removal

a. Remove clutch assembly per Section 7.210.

b. Remove C195 yoke per Section 7.270.

c. Remove C191-5 stops.

d. Remove bearing assembly as follows:

Using a hydraulic press:

1. Install MT528-1 bearing removal tool per Figure 7-3A.
2. Support MT528-1 bearing removal tool on hydraulic press per Figure 7-3A.
3. Install aluminum plate between clutch shaft and press ram per Figure 7-3A to protect end of shaft.
4. Press until C184-2 bearing is removed from the shaft.

CAUTION

Hold clutch assembly to prevent clutch from falling to the floor.

Without a hydraulic press:

1. Install MT528-1 and MT528-2 bearing removal tools per Figure 7-3B. Use only one MT528-11 spacer at each cap screw. Ensure MT529-4 screw threads are coated with anti-seize.
2. Remove bearing assembly by holding handle and tightening screw.

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7.212 C184 Bearing Assembly Installation

1. Remove loose paint and clean mating area on clutch shaft. If reusing a bearing assembly, inspect condition of seals and inner races.

2. Heat C184 bearing assembly to 200º F maximum (approximately 5 minutes in 200ºF oven). Monitor bearing temperature with a pyrometer or a telatemp.

3. Coat bearing shoulder on clutch shaft with zinc-chromate or epoxy primer. While primer is still wet, install bearing assembly on clutch shaft:

NOTE
Do NOT install bearing with B270-10 adhesive.

NOTE
Be sure to put side of C184 bearing assembly with nuts facing away from clutch (see Figure 7-3F).

   a. Using a hydraulic press: Support clutch assembly at forward end of clutch shaft. Place MT529-6 tube assembly on clutch shaft per Figure 7-3E. Center tube assembly over inner race of bearing assembly. Press bearing assembly until MT529-6 tube assembly bottoms on end of clutch shaft (bearing assembly should be at dimension shown in Figure 7-3D).

CAUTION
Do NOT support clutch assembly at sheave or internal bearings will be damaged.

   b. Without hydraulic press: Use MT529-6 tube assembly (included in MT528-1 tool set) and MT528-2 tool set as shown in Figure 7-3G. Center tube assembly over inner race of C184 bearing assembly. Tighten nut onto MT529-4 screw (coat nut face and screw with anti-seize) until MT529-6 tube assembly bottoms on end of clutch shaft (bearing assembly should be at dimension shown in Figure 7-3D).

4. Remove bearing press tooling.

5. Check bearing for smooth rotation.

6. Seal bearing inner race-to-shaft juncture with primer to minimize corrosion.

7. Torque stripe inner race of bearing to clutch shaft two places, 180º apart.

8. Install C191-5 stops. Torque bolts per Section 1.130 and torque stripe.

9. Install new telatemp on C184 bearing housing if original was altered by heating.

10. Install clutch assembly C195 aft yoke per Section 7.270.

7.213 Clutch Assembly Seals Replacement

NOTE

To retrofit older clutch assemblies with C168-5 retainers, order KI-202 kit.

1. Remove clutch assembly per Section 7.200.
2. a. If replacing aft seal, remove C184 bearing per Section 7.211.

   b. If replacing forward seal, remove C907 yoke per Section 7.260. If C168 retainers lack B289-3 screws, also remove C184 bearing per Section 7.211 due to lubricant filling requirements.
3. Remove loose paint from clutch shaft, then thoroughly clean entire clutch assembly.

NOTE

Sprag clutch housing capacity is approximately 4 fl oz (118 ml). Retain drained lubricant in a suitable, clean container.

CAUTION

Some clutch assemblies have roller bearings and require two bearing-preload shims under each retainer; do NOT lose shims when removing retainer(s).

4. Position clutch assembly horizontally with upper sheave resting in a clean, non-marking container. Remove bolts and associated hardware and both NAS1352 screws securing affected seal retainer. Remove retainer and keep both shims (used with roller bearings only) in place. Discard o-ring. Rotate clutch shaft until yoke attachment holes are vertical and allow lubricant to drain into container (shaft oil transfer holes are parallel with yoke attachment holes).
5. Flush cavity containing bearings and sprag clutch with clean A257-4 lubricant until lubricant draining into container is obviously red.
6. Strain all lubricant from container through a 180-200 micron paint filter/strainer. Lubricant may be dark, and may sparkle with very fine metallic debris; this is normal. However, if metallic debris is trapped in the filter, submit clutch assembly to RHC, or an R44 Service Center authorized to overhaul clutch assemblies, for repair.
7. Press old seal out of retainer and discard seal. Clean and dry retainer bore.
8. Press new seal, with flat face outboard, into retainer until it seats against retainer lip.

NOTE

If C168-5 retainers are installed, B289-3 screws must be on opposite sides of the clutch shaft (when one screw is on top, opposite screw must be on bottom).

7.213 Clutch Assembly Seals Replacement (cont'd)

9. If replacing forward seal, position clutch assembly vertically with long end of shaft pointing up. Lightly lubricate new o-ring and seal inner lip with A257-4 lubricant, install o-ring in clutch housing forward groove, and slide retainer over clutch shaft forward end. If installed, ensure both shims are properly positioned against roller bearing outer race. Align retainer and housing screw holes and install NAS1352 screws.

10. Position clutch assembly vertically with short end of shaft pointing up.

11. a. If retainers lack B289-3 screws, remove aft retainer and keep both shims (used with roller bearings only) in place. Discard o-ring. Lightly lubricate new o-ring with A257-4 lubricant and install in clutch housing aft groove.

    b. If retainers have B289-3 screws and aft retainer has not been removed, remove B289-3 screw from aft retainer.

12. With clutch assembly remaining vertical, fill housing with A257-4 lubricant until lubricant level is flush with top of bearing races per Figure 7-3D.

13. a. If retainers lack B289-3 screws, lightly lubricate aft retainer seal inner lip with A257-4 lubricant and slide retainer over clutch shaft aft end. If installed, ensure both shims are properly positioned against roller bearing outer race. Align retainer and housing screw holes and install NAS1352 screws.

    b. If retainers have B289-3 screws, install B289-3 screw in aft retainer.

14. Position clutch assembly horizontally and rotate clutch shaft until yoke attachment holes are vertical. Allow lubricant to transfer internally for two minutes.

15. Repeat steps 10 thru 14 until no more lubricant can be added.

16. Install bolts and associated hardware securing C168 retainers to sheave. Using a criss-cross pattern, standard torque bolts per Section 1.320 and torque stripe per Figure 2-1.

17. Tighten four cap screws securing retainers to sheave and torque stripe per Figure 2-1.

18. Install C184 bearing assembly per Section 7.212, as required. Install C907 yoke per Section 7.260, as required.

19. Install clutch assembly per Section 7.200, as required.

7.220 (Reserved)

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FORWARD AND INTERMEDIATE FLEX PLATE INSTALLATION

NUMBER	PART NUMBER	DESCRIPTION
1	B330-19	Palnut
2	MS21042L6	Nut
3	AN960-616L	Washer
4	C908-1	Yoke
5	NAS6604-4 or -5 (as required for thread engagement)	Bolt
6	C947-1	Flex Plate
7	NAS6606-5 or -6 (as required for thread engagement)	Bolt
8	NAS6606-31	Bolt
9	C191-1	Block
10	C907-1 or -2	Yoke
11	C018-2	Clutch Assembly
12	C553-1	Block
13	D224-1	Tail Rotor Drive Shaft
14	B330-16	Palnut
15	AN960-416	Washer
16	C184-2	Bearing Assembly
17	B330-13	Palnut
18	MS21042L4	Nut
19	AN960-416L	Washer
20	C195-1,-2,-3 or -4	Yoke
21	A947-2	Flex Plate
22	NAS6605-24	Bolt
23	AN960-516L	Washer
24	C191-6	Block
25	MS21042L5	Nut
26	None or AN960-616L maximum	Washer (see Section 7.230)
27	AN960-416L minimum or AN960-416 maximum	Washer (see Section 7.330)
28	None or AN960-416L or AN960-416 maximum	Washer (see Section 7.330)

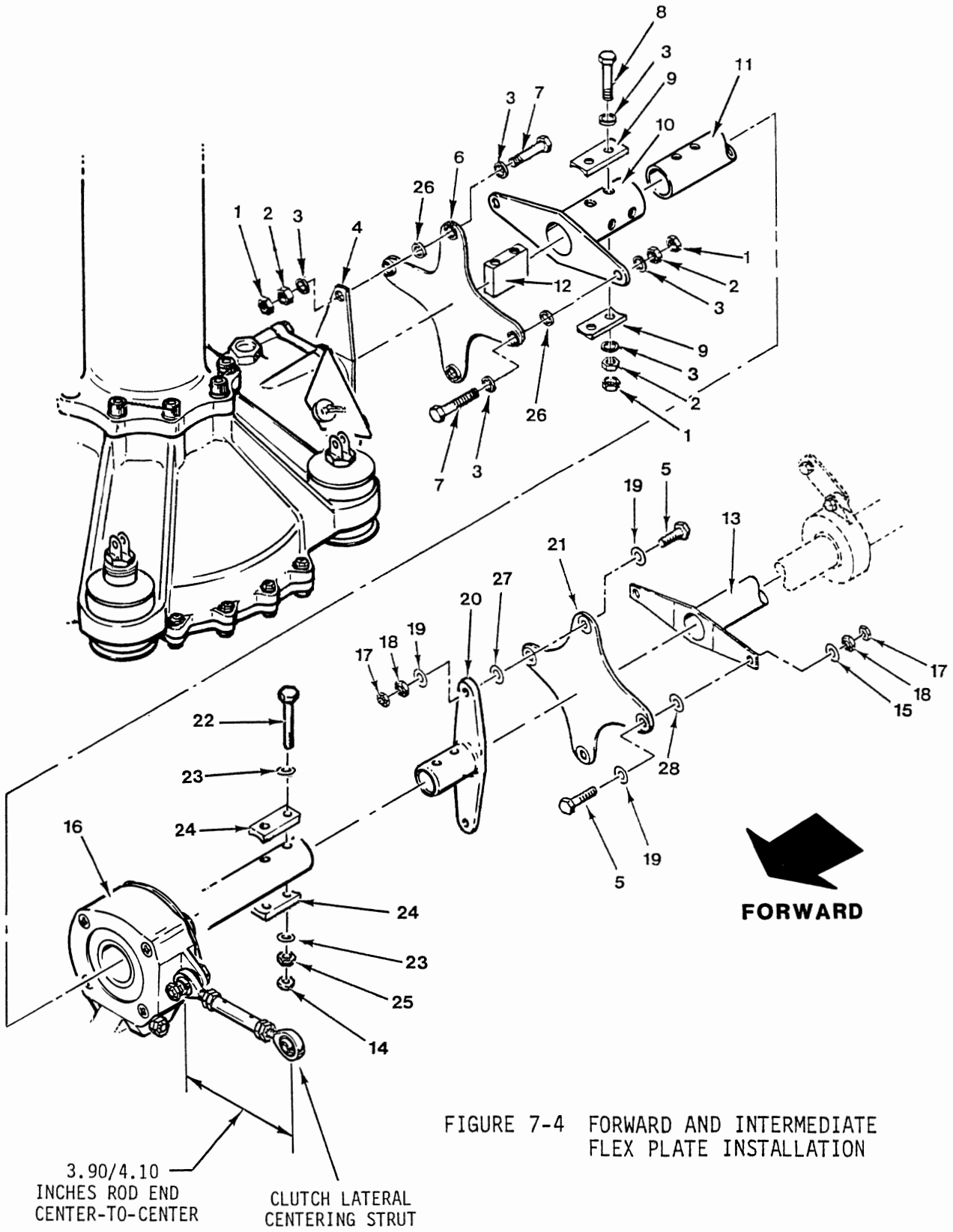


FIGURE 7-4 FORWARD AND INTERMEDIATE FLEX PLATE INSTALLATION

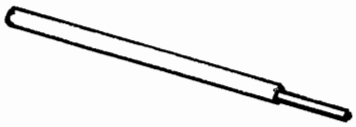


FIGURE 7-5 MT331-4 SHEAVE ALIGNMENT BAR

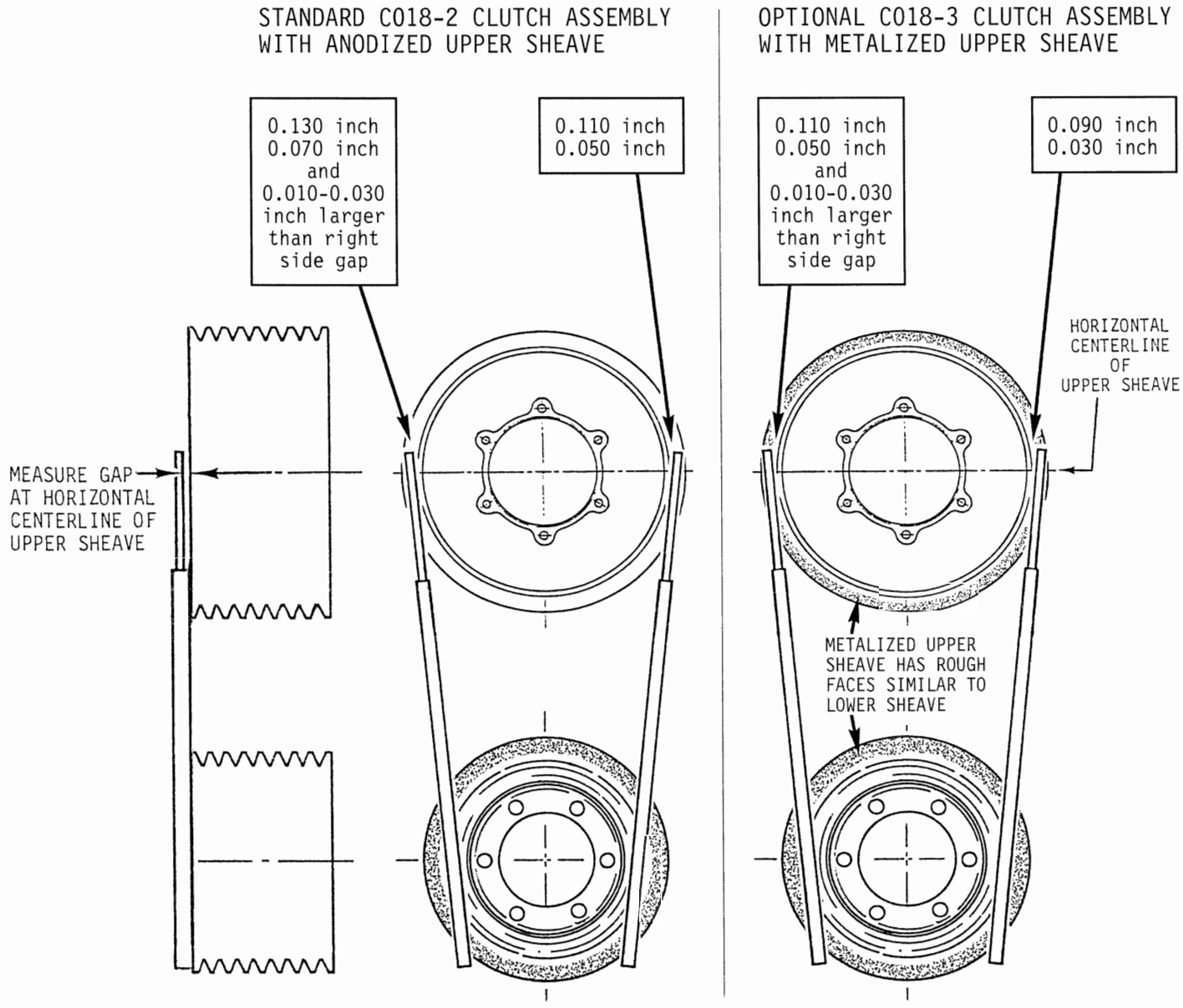


FIGURE 7-6 SHEAVE ALIGNMENT DIMENSIONS

7.230 Clutch Sheave Alignment

Checking sheave alignment:

1. Engage clutch.

2. Hold MT331-4 Sheave Alignment Bar against aft face of lower sheave extending bar upward to horizontal center line of upper sheave.

3. Measure left and right gaps per Figure 7-6. Both gaps must be within noted limits and left gap must be 0.010/0.030 inch larger than right gap. Adjust lateral clutch centering per Section 7.250 if left gap is not 0.010/0.030 inch larger than right gap.

   If either gap exceeds maximum limit then upper sheave is too far forward and must be moved aft by shimming forward flex plate and/or adjusting C907 yoke length. Shimming is accomplished by installing a maximum of one NAS1149F0632P washer between C947-1 flex plate and both arms of C907 and/or C908 yoke; NAS1149F0632P washers installed on either yoke will decrease right and left gap an amount equal to washer thickness. Each C907 yoke has two sets of mounting holes which change the effective yoke length by 0.120 inch. The C907-2 yoke is either 0.120 inch or 0.240 inch longer than the long position of the C907-1 yoke. Right and left gaps will both decrease by 0.120 inch with each 0.120 inch increase in C907 yoke length.

   If either gap is smaller than minimum limit then upper sheave is too far aft and must be moved forward by removing shims (if installed) at forward flex plate and/or adjusting C907 yoke length. Removing NAS1149F0632P washers from between C947-1 flex plate and both arms of C907 and/or C908 yoke will increase both gaps an amount equal to washer thickness. Each C907 yoke has two sets of mounting holes which change the effective yoke length by 0.120 inch. The C907-1 yoke is either 0.120 inch or 0.240 inch shorter than the short position of the C907-2 yoke. Right and left gaps will both increase by 0.120 inch with each 0.120 inch decrease in C907 yoke length.

4. Check intermediate flex plate shimming per Section 7.330 if shims were added or removed at C947-1 flex plate or if C907 yoke length was altered.

7.240 Clutch Shaft Angle

No check of the clutch shaft angle is required.

7.250 Lateral Clutch Centering

1. Clutch actuator must be fully engaged.

2. Check sheave alignment on left and right side per Figure 7-6.

7.250 Lateral Clutch Centering (cont'd)

3. Left side gap must be 0.010 inch to 0.030 inch larger than right side gap.

4. Clutch lateral centering strut (see Figure 7-4) may be adjusted within limits to improve centering measurement. Lengthen the strut to decrease the left gap and increase the right gap; shorten strut to increase left gap and decrease right gap. Strut limits are 4.10/3.90 inches rod end center-to-center. Check both rod end witness holes after any strut adjustment.

5. If alignment cannot be adjusted within required measurements, contact Robinson Helicopter Company Technical Support Department.

6. Standard torque attach bolts and jam nuts per Section 1.320. Install palnuts, standard torque per Section 1.320, and torque stripe per Figure 2-1.

7.260 C907 Yoke Removal and Installation

To remove yoke:

a. Remove the clutch assembly per Section 7.210.

b. Remove bolts and clamping blocks securing C907 yoke to clutch shaft. Mark which set of yoke attachment holes are used.

c. Remove C907 yoke:

1. (Preferred method). If press is available, position clutch assembly in press per Figure 7-7. Ensure brass or aluminum drift fits against outer rim of clutch shaft and not against inner spacer. Press clutch shaft out of yoke.

CAUTION

Ensure clutch assembly does not fall when yoke is removed.

2. If a press is not available, tightly secure C907 yoke arms to MT303-6 handle using NAS6606 bolts. Refer to Figure 7-7A. Clamp handle in a vise and twist clutch shaft out of yoke by turning upper sheave. Apply penetrating oil to yoke-shaft juncture as required. If difficulty is encountered, remove handle and arrange to use a press as described in preceding step.

CAUTION

Avoid bending loads on clutch shaft when handle is clamped in vise as C907 yoke can be damaged.

To install yoke:

a. Remove loose paint and clean mating area on shaft.

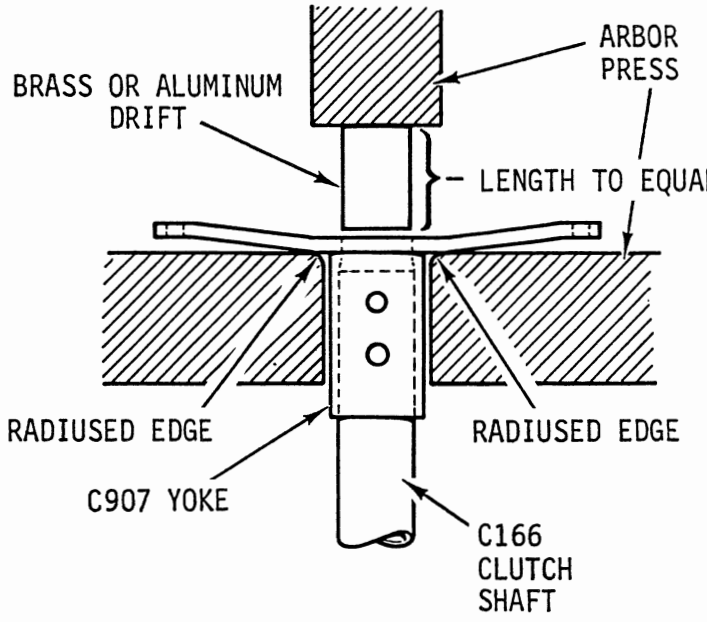


FIGURE 7-7
C907 YOKE REMOVAL

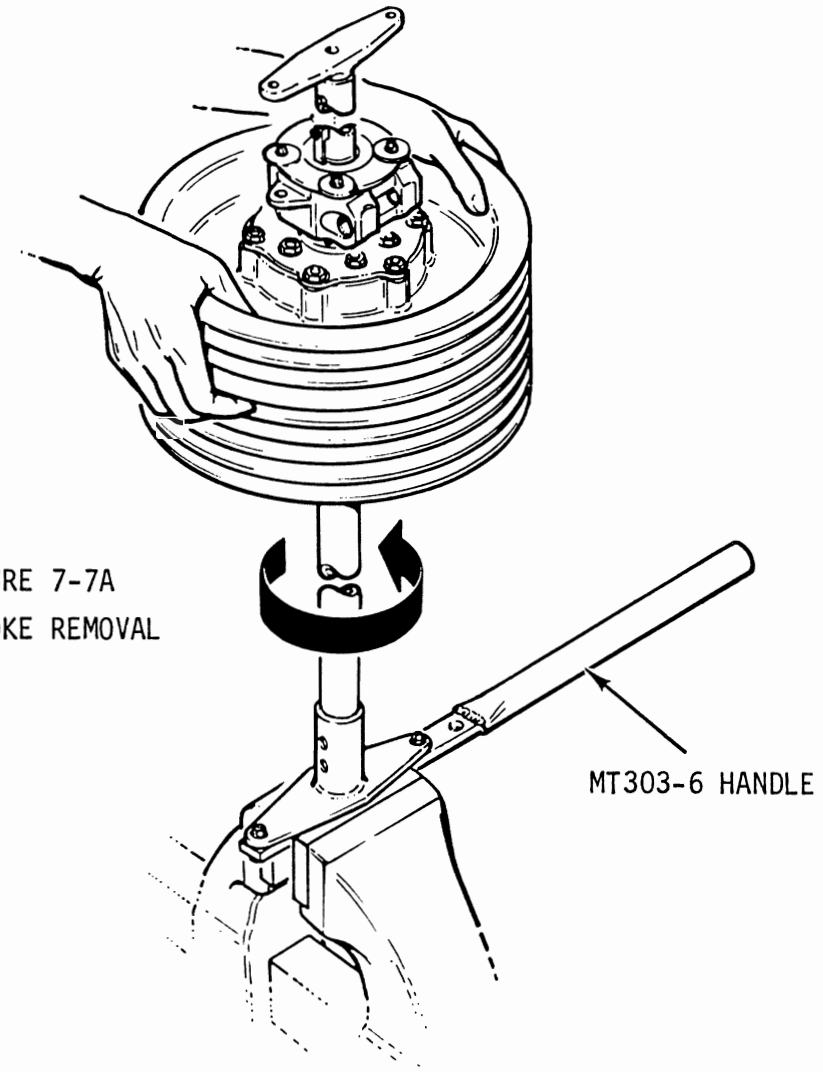


FIGURE 7-7A
C907 YOKE REMOVAL

7.260 C907 Yoke Removal and Installation (cont'd)

b. Coat inside of C907 yoke and mating portion of clutch shaft with zinc-chromate or epoxy primer. While primer is still wet, install yoke on clutch shaft and align marked holes on yoke (if applicable) with clutch shaft holes.

c. Secure yoke to shaft with clamping blocks and bolts. Torque bolts per Section 1.320. Install palnuts, torque per Section 1.330, and torque stripe.

7.270 C195 Yoke Removal and Installation

To remove yoke:

NOTE

Yoke may be removed without clutch removal.

a. Remove intermediate flexplate.

b. Remove bolts and clamping blocks securing C195 yoke to clutch shaft.

c. Twist yoke out of clutch shaft.

To install yoke:

a. Remove loose paint and clean mating area inside shaft.

b. Coat inside of clutch shaft and shank of C195 yoke with Zinc-chromate or epoxy primer. While primer is still wet, slide yoke into clutch shaft and align holes.

c. Install clamping blocks and bolts. Torque bolts per Section 1.320. Install palnuts, torque per Section 1.330, and torque stripe.

d. Install intermediate flexplate per Section 7.330.

CAUTION

There must be one AN960-416L or one AN960-416 washer between each arm of C195 yoke and A947-2 flex plate. See Section 7.330.

7.280 V-Belts

7.281 V-Belt Removal

a) Remove tailcone cowling.

b) Lower clutch actuator to its fully disengaged position.

c) Mark the back of each belt with a felt pen. Use numbers or a v-mark to indicate direction and order so they will be in the same positions if they are to be reinstalled. Mark the direction of rotation on each belt so that they cannot be reversed.

d) Mark and disconnect the intermediate flex plate from clutch. Disconnect the centering strut from clutch to upper frame at frame end.

e) Remove fan and scroll per Section 6.200.

f) Remove actuator assembly per Section 7.510.

g) Remove belts from sheave.

CAUTION

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

7.282 V-Belt Installation

WARNING

Install V-belts only in matched sets. Do Not install used V-belts from another helicopter.

a) Before installation of new belts, inspect the sheave grooves. Replace any sheave showing corrosion, pitting or flaking of the metalized or anodized coatings, wear through the anodized coating, roughness, or sharp ridges.

CAUTION

Rough or corroded grooves in the upper or lower sheave can cause V-belts to roll, break, or come off. Refer also to Section 2.160.

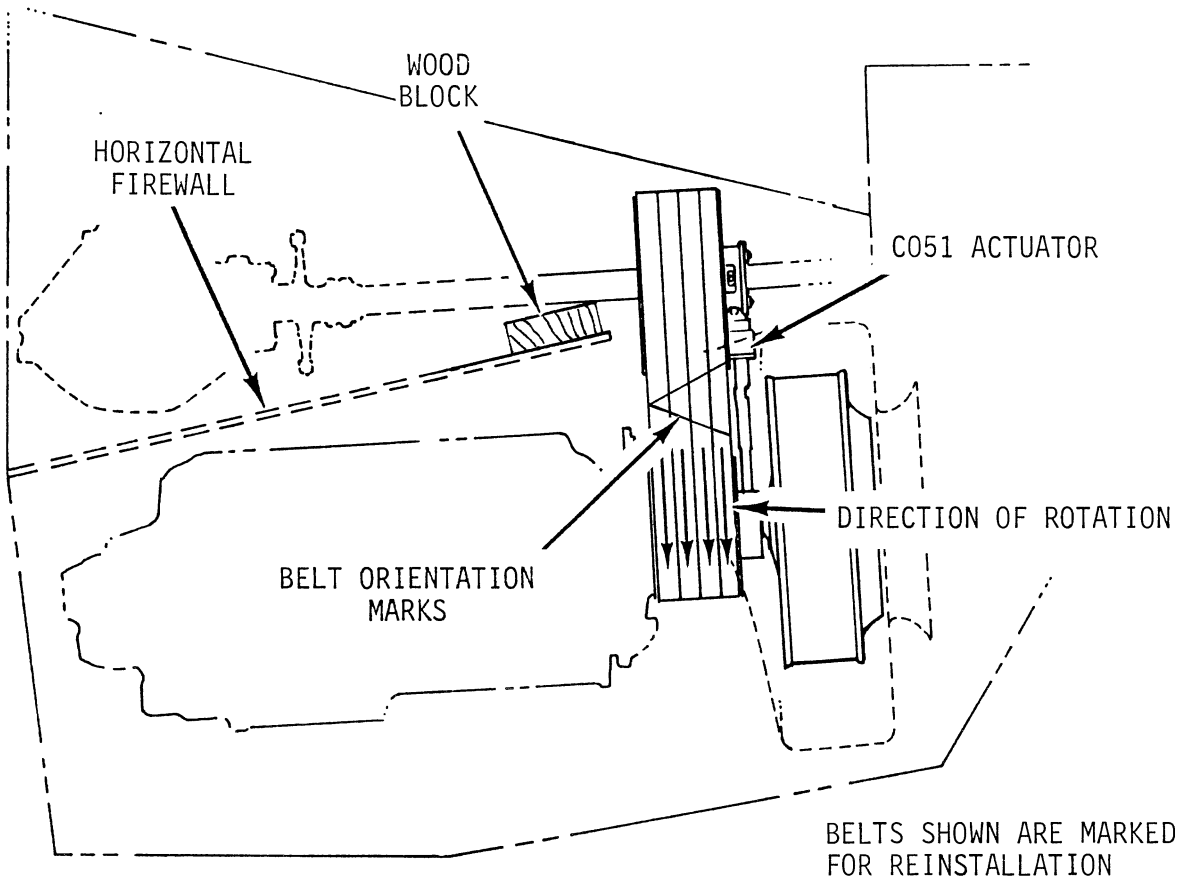


FIGURE 7-8 V-BELT AND ACTUATOR REMOVAL

7.282 V-Belt Installation (cont'd)

b) Paint the grooves in the lower sheave with a thin coating of zinc chromate or epoxy primer per Section 1.400.

c) Install belts on sheaves. If used belts are reinstalled, inspect them for damage per Section 2.150. Make sure they are in their proper order with respect to fore/aft position and proper direction of rotation.

d) Install the actuator assembly per Section 7.520.

e) Connect the intermediate flex plate to the clutch.

f) Install fan and scroll per Section 6.200.

g) Check clutch sheave alignment per Section 7.230.

h) Shim and connect intermediate flex plate per Section 7.330.

i) Adjust the actuator's down-limit stop screw so when the actuator is engaged at start up there is a delay of less than 5 seconds before rotor starts turning.

NOTE

First adjustments of the actuator down limit screw, to regulate new belt disengage slack, occur relatively soon with longer periods between later adjustments. Recheck.

A delay between clutch switch engagement and the rotor starting to turn of more than 5 seconds indicates excessive slack. If rotor rotates when cranking engine with starter motor, belts may not have enough slack.

CAUTION

During start up and engagement, belts too tight can damage flex plates and belts too loose can jump out of grooves.

j) Ground run or hover the helicopter for at least 20 minutes.

k) At the end of the ground run, inspect the sheave grooves for the contact pattern in the primer. A similar contact pattern in all eight grooves indicates the belt/sheave combination is compatible. A noticeably different contact pattern from groove to groove indicates the combination is not compatible.

l) If the belt/sheave combination is not compatible, re-check sheave alignment, replace belts, and repeat installation procedure. If belt/sheave combination is still not compatible, it may be necessary to replace the lower sheave. The wear pattern in all eight grooves must be similar before the aircraft is released for flight.

7.283 Belt Tension

No procedure for checking belt tension on the helicopter is required.

7.290 C007 Fanshaft and Bearing Assembly, Starter Ring Gear Support, Lower Sheave and Alternator Belt Replacement.

7.291 Removal

a) Remove V-belts per Section 7.281.

b) Cut the safety wire and remove the six NAS6608 bolts holding the fanshaft.

c) Remove the C007 fanshaft and bearing assembly. Temporarily secure the lower sheave with one of the removed bolts if it is not to be removed.

d) To remove the lower sheave, the use of a soft mallet may be required to tap the sheave while pulling it off.

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

1) Loosen the alternator belt tension.
2) Note the zero mark on the starter ring gear support at one propeller flange bushing. Mark this bushing to ease reinstallation.
3) Remove the starter ring gear support.

7.292 Installation

a) Install a new alternator belt at this time if required. Reinstall the starter ring gear support. Align the zero mark on the ring gear support with the marked bushing. The bushing and matching hole are slightly larger than the five other holes. This makes the incorrect installation of the starter ring gear support difficult but not impossible.

b) Install the lower sheave and fanshaft assembly. Check that two AN960-816 washers are installed under each NAS6608-42H bolt. Lightly snug the bolts. Check for clearance between the lower sheave and starter ring gear support's conical surface. Insert a 0.005 inch feeler gauge at 6 places between the attachment bolts. Lack of clearance indicates the wrong starter ring gear support is installed or that the ring gear support is improperly installed. Torque the bolts per Section 1.330 in a star pattern followed by a circular pattern. Safety wire the bolts in pairs with 0.041 inch diameter stainless steel safety wire.

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

CAUTION

Reinstalling the bolts with less than two AN960-816 washers may cause the bolt shank to bottom on the engine propeller flange bushing. This condition would not clamp the lower sheave and fanshaft assembly securely to the engine flange.

c) Tension the alternator belt at the pulley nut at this time. The slip torque at the pulley nut for a new belt is 11-13 ft-lb; for a used belt, the slip torque is 7-9 ft-lb.

d) Reinstall V-belts per Section 7.282.

7.300 TAIL ROTOR DRIVE SHAFT

7.310 Tail Rotor Drive Shaft Removal

a) Remove the tailcone per Section 4.311.

b) Use a 3-foot socket extension with a 3/8-inch socket to disconnect the two NAS6603 bolts which hold the drive shaft damper arm to its mounting bracket.

c) Using the upper aft tailcone inspection hole, disconnect the C947-3 aft flex plate from tail rotor gearbox input shaft flange. Support the aft end of the drive shaft so it cannot fall and damage the drive shaft or tailcone.

d) The drive shaft can now be pulled out of the forward end of the tailcone

7.320 Tail Rotor Drive Shaft Installation

a) Insert tail rotor drive shaft into tailcone.

NOTE

If aft flex plate was disconnected from tail rotor gearbox and removed, first connect flex plate to the drive shaft and then insert the drive shaft into tailcone. Torque the NAS6604 bolts per Section 1.320.

b) Support drive shaft through upper aft tailcone inspection hole to prevent damage and for alignment purposes.

c) Using the upper aft tailcone inspection hole, connect the C947-3 aft flex plate to gearbox with the bolt heads against the flex plate. Use one AN960-416L washer under the bolt head. Torque to per Section 1.320.

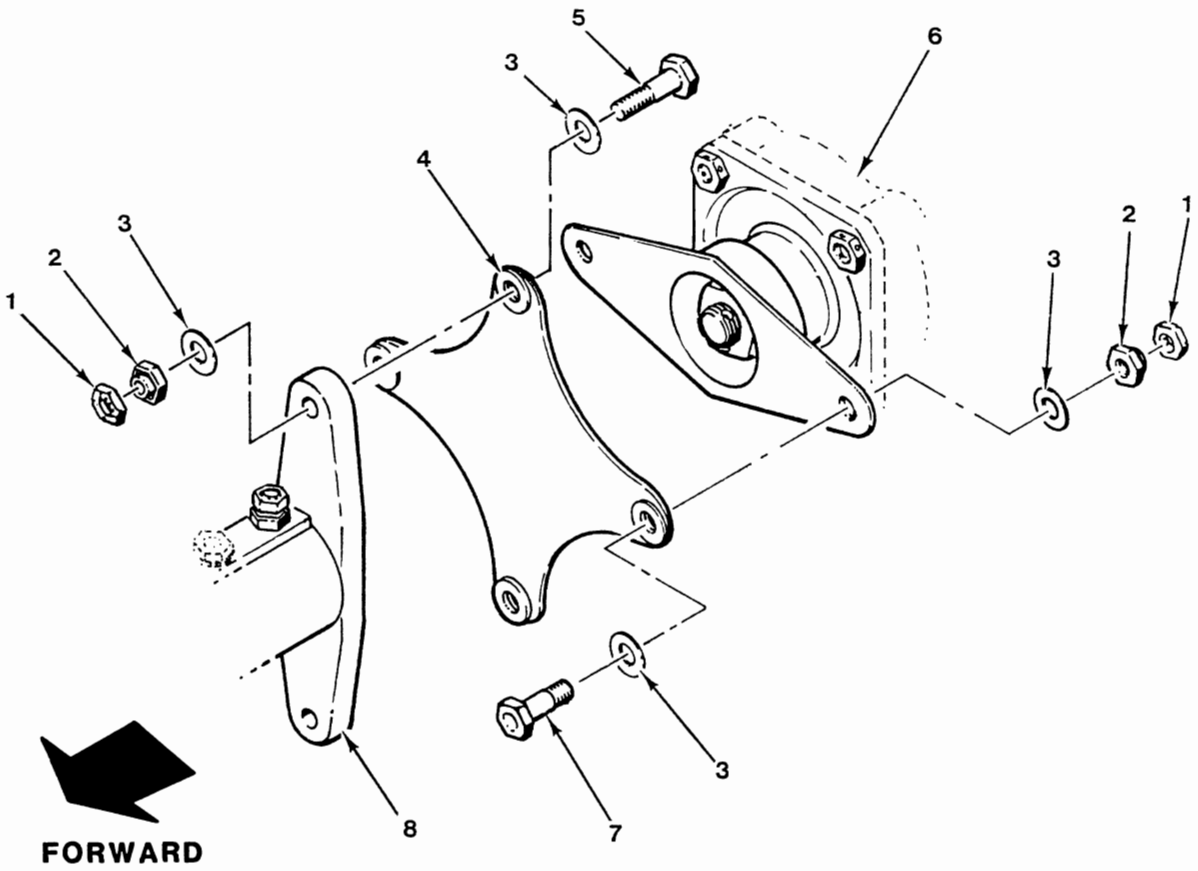


FIGURE 7-9 AFT FLEX PLATE INSTALLATION

NUMBER	PART NO.	DESCRIPTION
1	B330-13	PALNUT
2	NAS679A4	NUT
3	AN960-416L	WASHER
4	C947-3	FLEX PLATE (AFT)
5	NAS6604-7	BOLT
6	C021-1	TAIL ROTOR GEARBOX
7	NAS6604-4	BOLT
8	D224-1	TAIL ROTOR DRIVE SHAFT ASSEMBLY

7.320 Tail Rotor Drive Shaft Installation (cont'd)

CAUTION

Improper installation of flex plate can damage tail rotor drive shaft and gearbox.

d) Through inspection holes on side of tailcone, determine longitudinal alignment of damper arm with tailcone attachment bracket. If clearance or interference between arm and bracket is greater than 0.12 inches, contact Robinson Helicopter Technical Support Department. If clearance or interference is less than 0.12 inch, connect damper assembly to tailcone cross member. Torque bolts per Section 1.320.

e) Install tailcone per Section 4.312.

f) Install and shim intermediate flex plate per Section 7.330.

g) Perform tail rotor drive shaft run-out check per Section 7.340.

7.321 Adjustment of Damper Friction

a) Remove tail rotor drive shaft from tailcone per Section 7.310.

b) Disassemble damper per Figure 7-10.

c) Inspect C041-5 DU washers for worn Teflon® coating (dark gray face) and replace as required.

d) Inspect A141-37 washers and C041-3 arm for indications of wear or grooving. Replace as required.

e) Reassemble damper per Figure 7-10. Torque pivot bolts per Section 1.320.

CAUTION

Teflon® (dark gray) face of C041-5 DU washer must be placed against A141-36 washer or C041-3 link. Remove plastic or tape coating if installed.

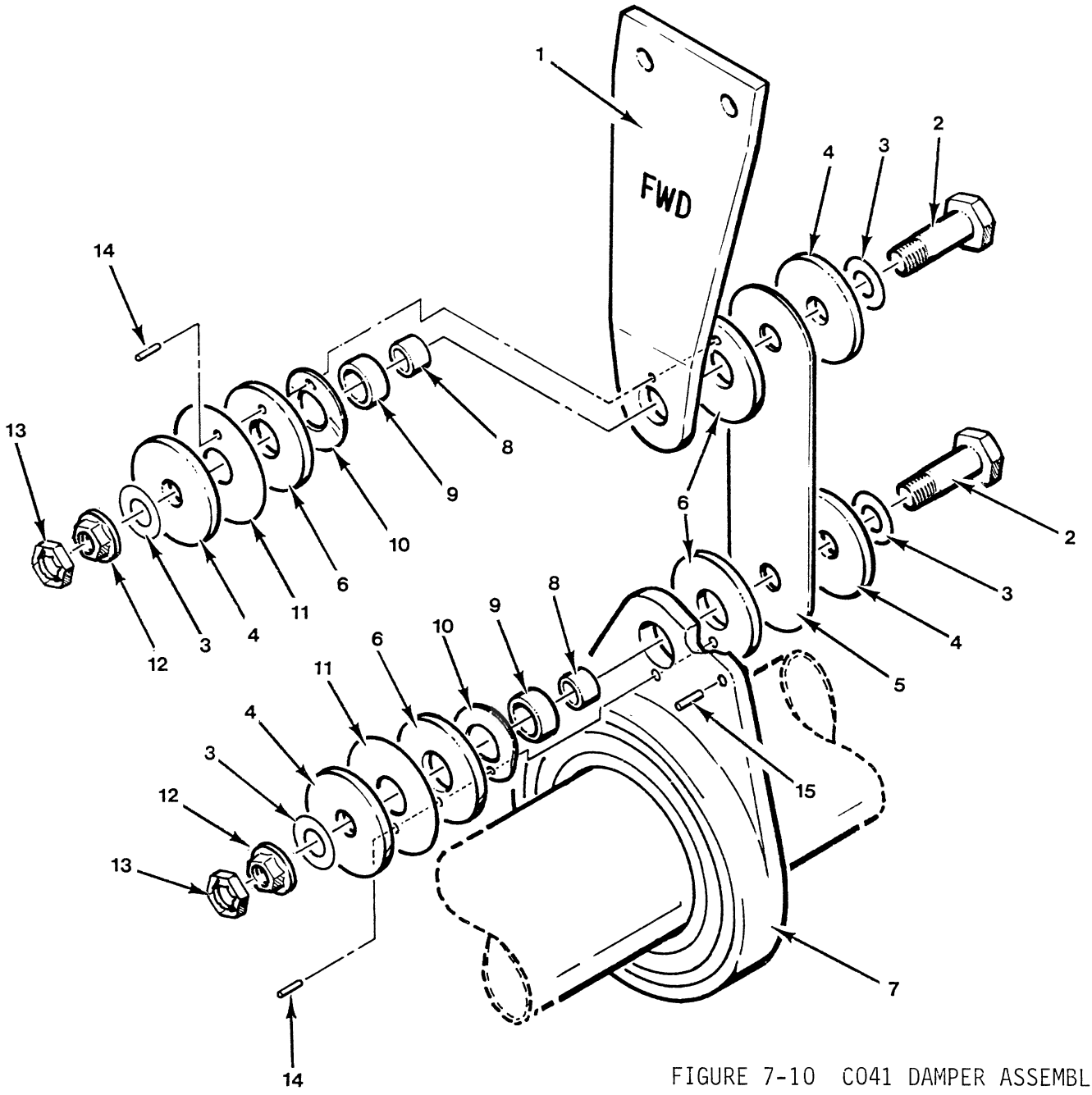
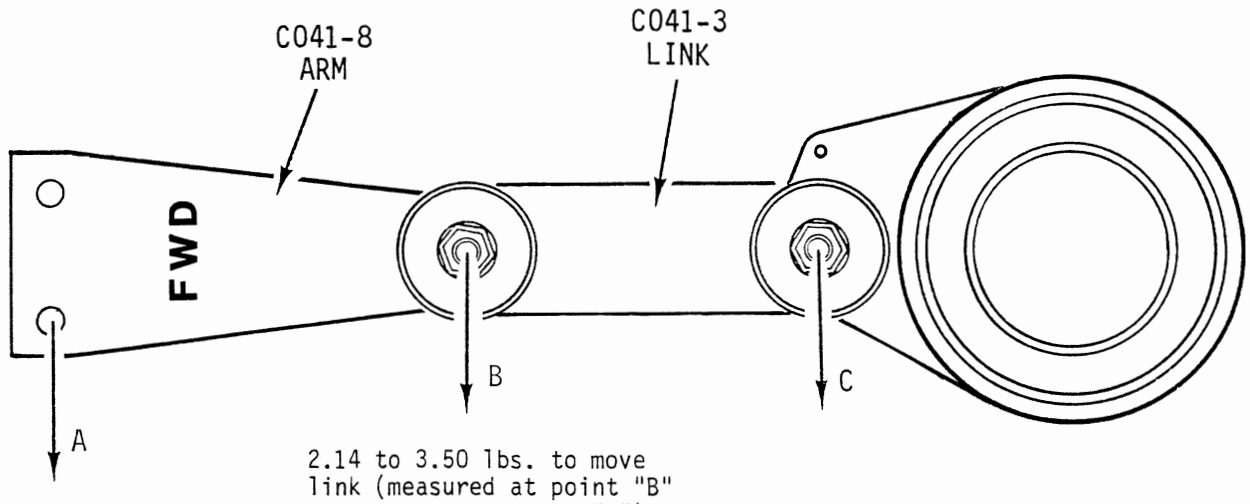


FIGURE 7-10 C041 DAMPER ASSEMBLY

NUMBER	PART NUMBER	DESCRIPTION	NUMBER	PART NUMBER	DESCRIPTION
1	C041-8	Arm	9	05DU04	Bushing
2	NAS6604-6	Bolt	10	C041-6	Spring Washer
3	AN960PD416L	Washer	11	A141-36	Washer
4	A141-37	Washer	12	NAS679A4	Nut
5	C041-3	Link	13	B330-13	Palnut
6	C041-5	Washer	14	A041-10	Dowel Pin
7	C041-11	Bearing Assembly	15	MS16562-11	Roll Pin
8	A105-12	Journal			



2.50 to 4.25 lbs. to move arm (Measured at point "A" rotating about point "B").

2.14 to 3.50 lbs. to move link (measured at point "B" rotating about point "C").

FIGURE 7-11A C041 DAMPER ASSEMBLY ADJUSTMENT

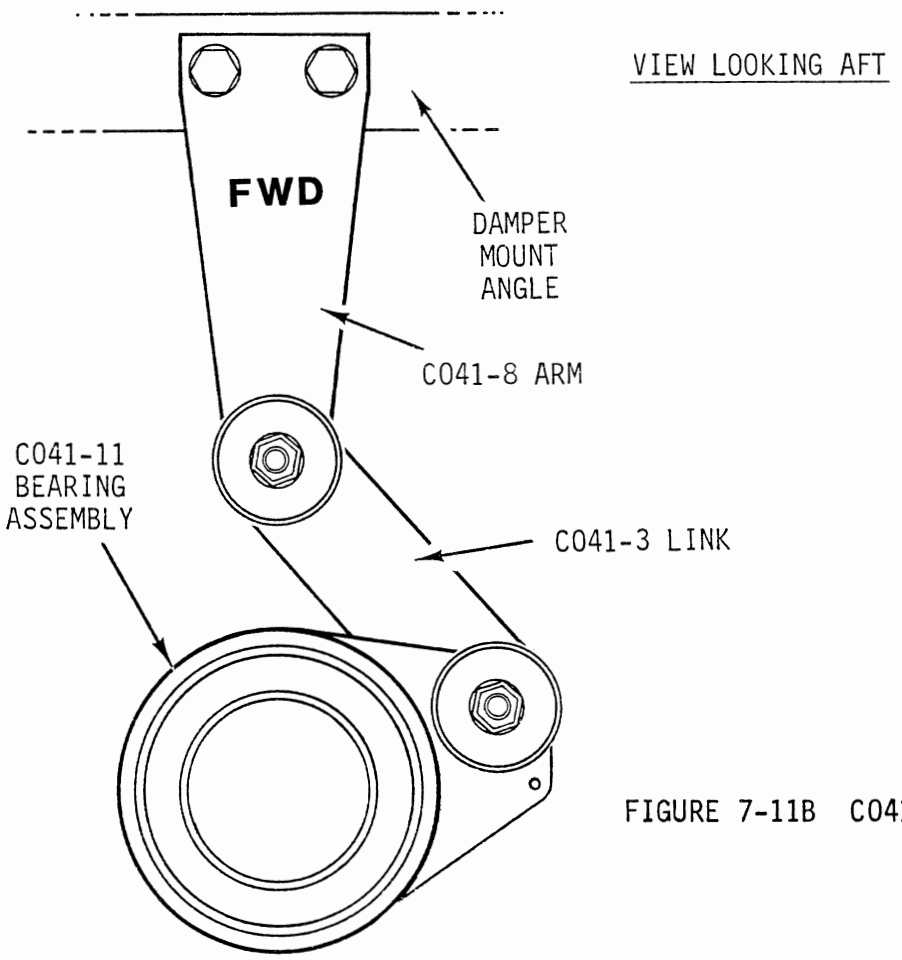


FIGURE 7-11B C041 DAMPER ORIENTATION

7.321 Adjustment of Damper Friction (cont'd)

f) Refer to Figure 7-11A. Hold C041-3 link and attach a spring scale or dead weight to one bolt hole in C041-8 arm. It should take 2.50 to 4.25 lb to move arm. Check bearing housing pivot friction with spring scale or dead weight at link bolt. It should take 2.14 to 3.50 lb to move link.

If drag is less than specified, check C041-6 spring washer and bend washer until it has a total height of 0.065 - 0.078 inch. If spring washer is correct height, but drag is still too low, lap end of A105-12 journal. If drag is greater than specified, flatten spring washer slightly.

CAUTION

DO NOT ADJUST DAMPER DRAG BY CHANGING BOLT TORQUE.

g) Torque MS21042L4 nut per Section 1.320 and recheck damper frictions per Step f). Install B330-13 palnuts and torque stripe.

h) Install tail rotor drive shaft per Section 7.320.

7.330 Intermediate Flex Plate Installation and Shimming

Measurements taken with intermediate flex plate removed.

a) Engage clutch actuator.

b) Rotate drive flanges of tail rotor shaft and C195 yoke horizontal.

c) Insert NAS1304 bolt through tail rotor shaft and C195 aft clutch yoke at 9 o'clock position. Measure and record gap between flanges at 3 o'clock position. Remove bolt.

d) Insert bolt at 3 o'clock position. Measure and record gap at 9 o'clock position. Measurements in sequence C and D are Measurement 1.

e) Remove bolt and rotate tail rotor shaft 180 degrees. Repeat steps C & D. This will be Measurement 2.

NOTE

Measurement 1 and 2 should be similar. If measurements are not similar, one or both yokes are bent.

f) Determine difference between 3 o'clock and 9 o'clock gap in Measurement 1. Determine difference between 3 o'clock and 9 o'clock gap in Measurement 2.

7.330 Intermediate Flex Plate Installation and Shimming (cont'd)

g) Use following formula to obtain the calculated dimensions for proper shimming required at the intermediate flex plate.

NOTE

Use the measurement with the smaller difference between 3 and 9 o'clock readings.

9 o'clock reading + 3 o'clock reading	=	_____
Divide above sum by 2	=	_____
Subtract *		_____ *
Calculated Dimension	=	_____

*Average thickness of the A947-2 flex plate measured at the bonded washers.

Shim as required per Table 7-1.

h) Reinstall the flex plate using the shims determined above. Torque the attach bolts per Section 1.320. Install palnut and torque stripe. Refer to Figure 7-4.

7.340 Checking Tail Rotor Drive Shaft Runout

The runout check described below is to prevent excessive runout on the tail rotor drive shaft which can cause a failure in the intermediate flex coupling or damper assembly.

a) Remove all the tailcone inspection covers on the tailcone right side. Engage the clutch.

b) Assemble the Robinson Tool Number MT260-6 tool and a suitable dial indicator.

NOTE

The dial indicator included in the Robinson MT122 bolt stretch gauge is recommended for this tool.

7.340 Checking Tail Rotor Drive Shaft Runout (cont'd)

c) Insert the dial indicator through the inspection hole farthest aft on the right side of the tailcone. Press the dial indicator firmly against the tailcone when the extension is riding on the drive shaft.

d) Have someone rotate the drive shaft at the C166 clutch shaft at least three full revolutions. The indicator may vary somewhat with each revolution so it will be necessary to take an average.

e) Repeat procedure in steps C & D at the next inspection hole forward.

f) Remove the extension from the MT260 tool and, using the longer extensions, check the drive shaft at each of the other two inspection holes.

g) The maximum amount of runout at any of the locations must not exceed 0.025 inch. If the runout is excessive, the drive shaft must be repaired or replaced.

7.350 Two-Piece Tail Rotor Drive Shaft

a) The two-piece tail rotor drive shaft consists of one C196-1 shaft, one C195-5 yoke, one C041-1 damper assembly, two C191-2 clamping blocks and associated hardware. See Figure 7-12A .

b) The C041-1 damper bearing assembly is field replaceable; refer to Figures 7-12A and 7-12B for appropriate dimensional criteria.

c) The D224-1 drive shaft is produced in one length only.

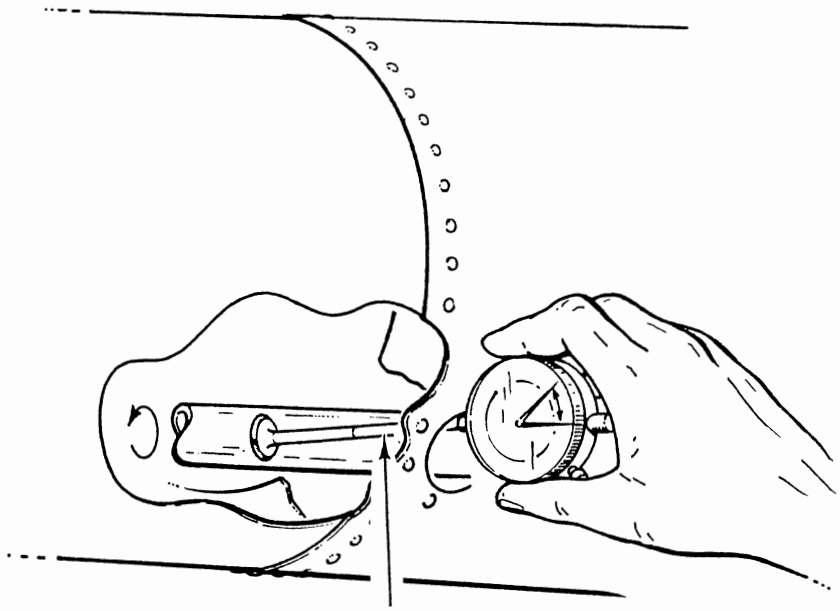


FIGURE 7-12 TAIL ROTOR DRIVE SHAFT RUNOUT CHECK

TABLE 7-1

A947-2 INTERMEDIATE FLEX PLATE SHIM TABLE

Calculated dimension in inches from Section 7.330(g)	Total shims required between the flex plate and the clutch shaft's C195 yoke (required 2 places).	Total shims required between the flex plate and the TR drive shaft's D224 yoke (required 2 places).
(0.137 or more calculated)	The measurement is over the limit and a longer C195 yoke is required.	
(0.136) (0.107)	1 each AN960-416 washer substituted for AN960-416L	1 each AN960-416 washer
(0.106) (0.077)	1 each AN960-416L washer	1 each AN960-416 washer
(0.076) (0.047)	1 each AN960-416L washer	1 each AN960-416L washer
(0.046) (0.017)	1 each AN960-416L washer	No washers for shimming
(0.016) or less calculated number	Shorter C195 yoke is required	

CAUTION: There must be an AN960-416L or AN960-416 washer between each arm of C195 yoke and A947-2 flex plate.

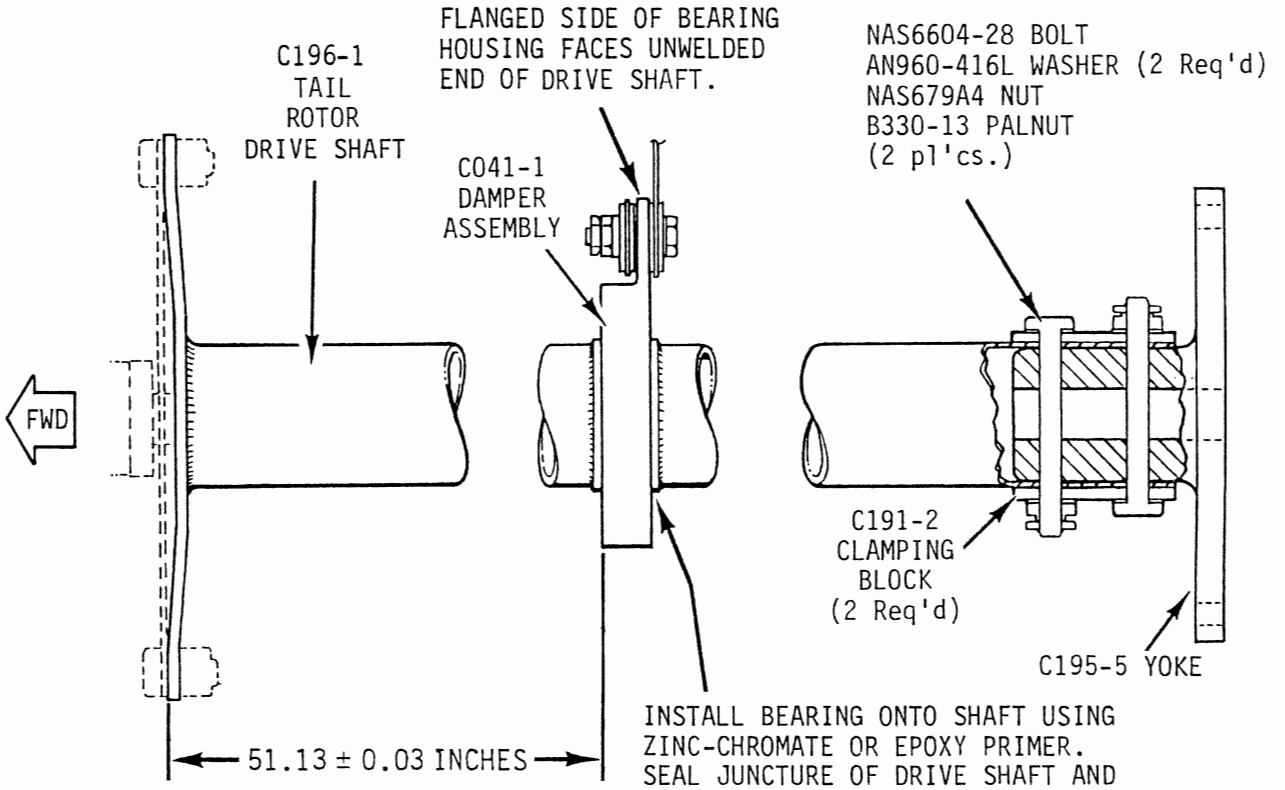


FIGURE 7-12A TAIL ROTOR DRIVE SHAFT

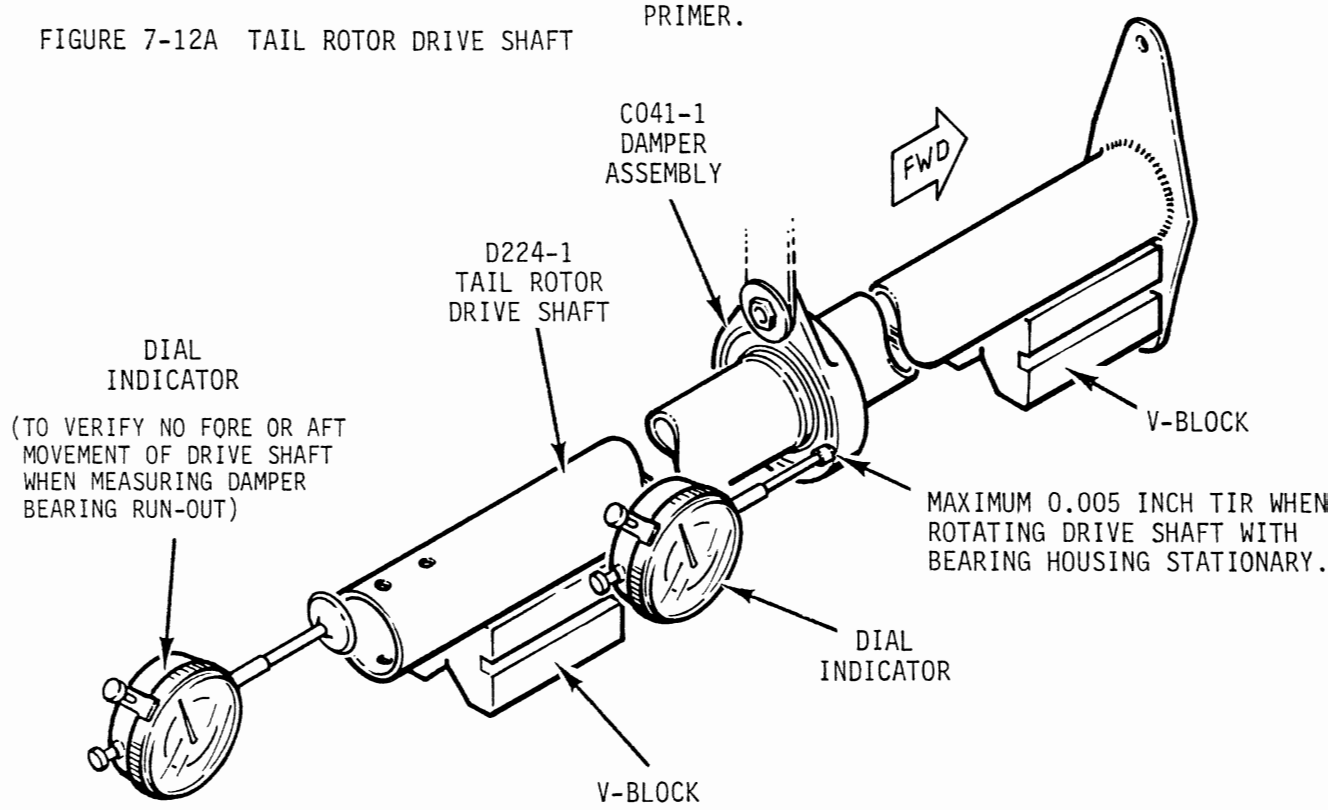


FIGURE 7-12B DAMPER BEARING RUN-OUT INSPECTION

7.400 TAIL ROTOR GEARBOX

7.410 Tail Rotor Gearbox Removal

a) Mark the tail rotor hub and blades and tail rotor pitch links to their respective pitch control arms before disassembly. This will facilitate reinstallation and eliminate re-rigging the tail rotor if push-pull tube lengths are not altered.

b) Remove the tail rotor hub and blades. Leave the pitch control links attached to the tail rotor blades.

c) Disconnect the A120 bellcrank from the push-pull tube.

d) Remove A120-3 bellcrank and pitch control from tail rotor gearbox. Disconnect A120-3 bellcrank attach bolt from the gearbox output cartridge and slide pitch control, with the bellcrank attached, off the gearbox output shaft. Reassemble bellcrank hardware to bellcrank.

e) Working through upper aft inspection hole of tailcone, disconnect the aft flex coupling from gearbox input shaft flange.

CAUTION

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

f) Disconnect chip detector wire at bottom of gearbox.

g) Cut the safety wire and remove four bolts holding the tail rotor gearbox to the tailcone. Careful handling of gearbox on removal is required to prevent damage to input shaft or the threads on the output shaft.

7.420 Tail Rotor Gearbox Installation

a) Install the tail rotor gearbox to the tailcone and torque four cap screws per Section 1.330. Safety wire screws in pairs with 0.032 inch diameter safety wire.

b) Connect the chip detector wire at the tail rotor gearbox.

c) Connect flex plate to tail rotor gearbox. Torque bolts to per Section 1.320.

d) Tail rotor drive shaft support can now be removed.

7.420 Tail Rotor Gearbox Installation (cont'd)

e) Check intermediate flex plate shimming per Section 7.330.

f) Install the tail rotor pitch control and bellcrank. Re-shim per Section 8.560 if original stack lost or binding occurs when assembly is moved.

g) Reconnect C121-17 push-pull tube to aft bellcrank.

h) Install tail rotor hub and blades.

i) Connect pitch links to the pitch control arms.

j) Ensure all bolts are torqued per Section 1.300.

7.430 Tail Rotor Gearbox Chip Indicator

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

a) Use a clean container to catch tail rotor gearbox oil.

b) Cut safety wire on chip detector and disconnect the electrical wires. Remove chip detector and drain oil.

c) Strain the oil and inspect any particles found in the oil or on the chip detector. Examine the 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 non-ferrous by using a magnet. If numerous particles are found and the next running of the gearbox produces more particles, a tail rotor gearbox failure may be impending and a tail rotor gearbox overhaul is required.

d) See Section 1.130 for flushing and refilling of the gearbox.

7.440 Tail Rotor Gearbox Output Shaft Seal Replacement (ref Figure 7-13)

a) Remove tail rotor and pitch control bearing per Section 7.410.

NOTE

Mark all attachments for proper re-assembly.

b) Cut the safety wire and remove four MS20074-04-06 bolts securing the C112-2 cap.

c) Slide C112-2 cap over the output shaft and remove the seal and 'O'-ring.

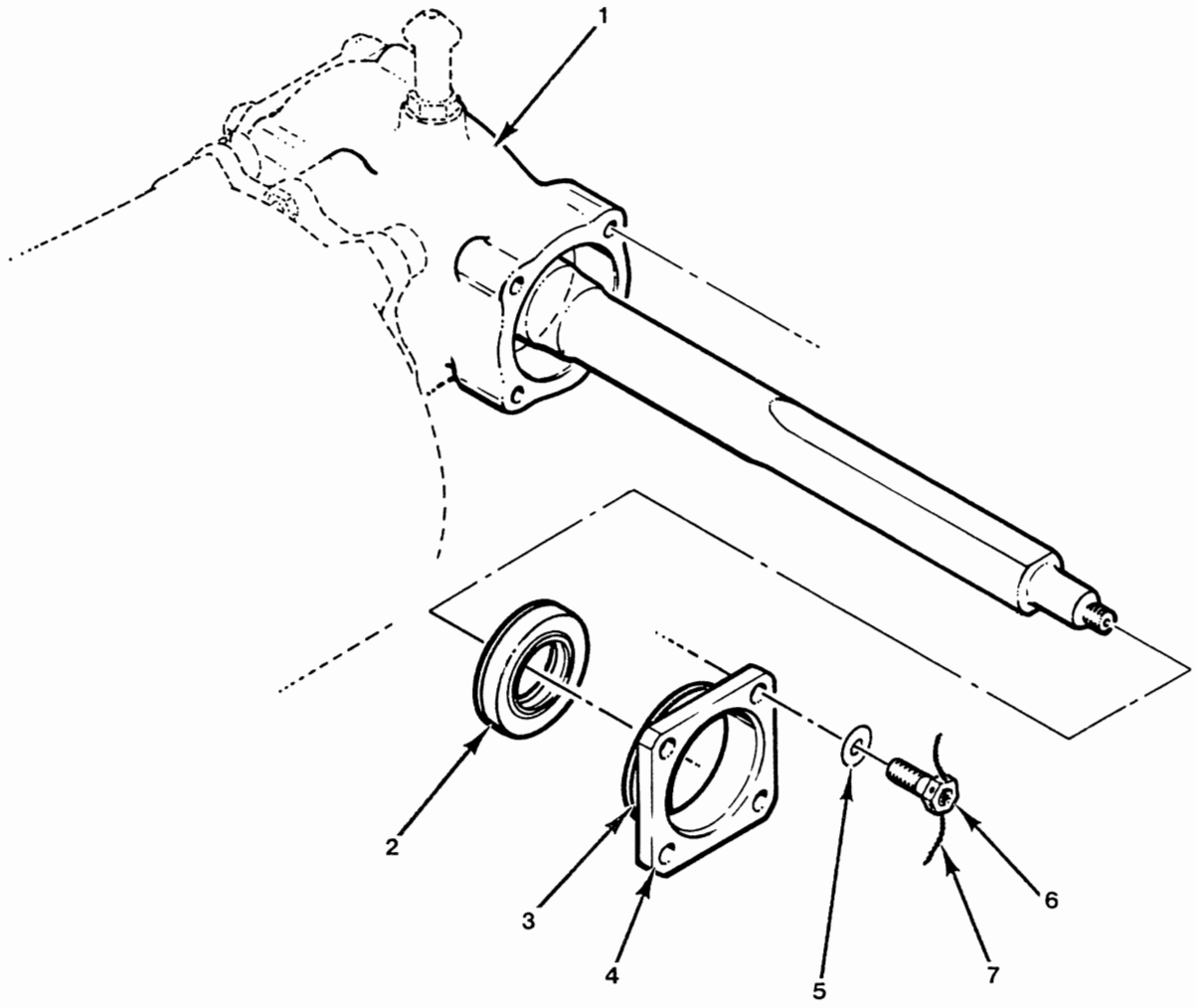


FIGURE 7-13 TAIL ROTOR GEARBOX OUTPUT SHAFT SEAL REPLACEMENT

NUMBER	PART NUMBER	DESCRIPTION
1	C109-1	Housing
2	C966-2	Seal
3	C215-133	O-Ring
4	C112-2	Cap
5	AN960-416L	Washer
6	MS20074-04-06	Bolt
7	-	0.032 in. dia Safety Wire

7.440 Tail Rotor Gearbox Output Shaft Seal Replacement (cont'd)

CAUTION

Be careful not to lose or change shim stack-up between the cap and the gearbox. Any change to the shim stack-up will change factory-set preload drag.

d) Carefully clean seal seating surface and O-ring groove and dry.

e) Press a new C966-2 seal into the cap bore 0.160 inches below the external surface with seal lip toward the gearbox. Lubricate a new C215-133 O-ring with A257-2 gear oil and install in groove in cap.

f) Lubricate the seal seating area of the output shaft with A257-2 gear oil.

g) Slide the cap over the output shaft and reinstall on the gearbox. Torque the four bolts to 60 in.-lb and safety wire in pairs with 0.032 inch diameter safety wire.

h) Reassemble pitch control bearing and tail rotor per Section 8.562.

7.450 Tail Rotor Gearbox Input Shaft Seal Replacement (Ref Figure 7-13A)

NOTE

It is not necessary to remove pitch control assembly and tail rotor for this procedure.

a) Remove gearbox from tailcone per Section 7.410.

b) Remove MS24665-210 cotter pin from the nut at the center of C116-1 input yoke.

c) Place the gearbox assembly on a bench and put a 2-inch thick wood block between one arm of the C116-1 yoke and the gearbox housing.

d) Remove the AN320-8 castellated nut and remove the yoke.

e) Cut the safety wire on and remove four MS20074-04-06 bolts.

f) Remove C112-1 cap. Be sure not to lose the C141-2 washer that is located between cap and bearing. Remove the O-ring.

g) Press out old seal and clean the seal seating surface and O-ring groove.

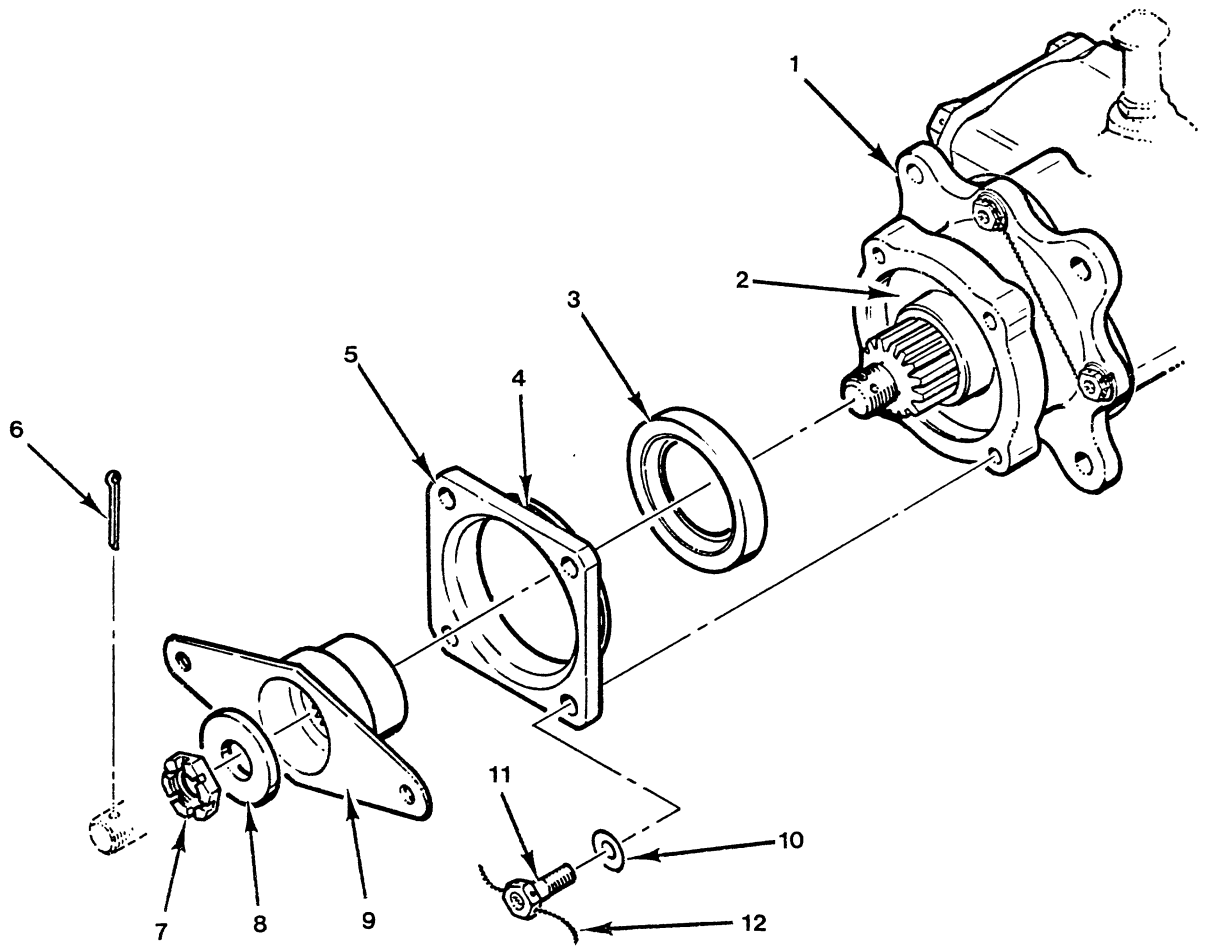


FIGURE 7-13A TAIL ROTOR GEARBOX INPUT SHAFT SEAL REPLACEMENT

NUMBER	PART NUMBER	DESCRIPTION
1	C110-1	Input Cartridge
2	C141-2	Washer (between cap & input cartridge)
3	A966-3	Seal
4	C215-140	O-Ring
5	C112-1	Cap
6	MS24665-210	Cotter Pin
7	AN320-8	Nut
8	A141-10	Washer
9	C116-1	Yoke
10	AN960-416L	Washer
11	MS20074-04-06	Bolt
12	-	0.032 in. dia Safety Wire

7.450 Tail Rotor Gearbox Input Shaft Seal Replacement (cont'd)

h) Press a new A966-3 seal into cap 0.250-inch from external surface with seal lip toward gearbox. Lubricate a new C215-140 O-ring with A257-2 gear oil and install in groove in cap.

i) Install C141-2 washer and cap into C110-1 cartridge. Install four MS20074-04-06 bolts with AN960-416L washers under head. Torque to 60 in.-lb and safety wire in pairs with 0.032-inch diameter safety wire.

j) Install C116-1 yoke, A141-10 washer, and AN320-8 nut onto gear shaft.

k) Hold the gearbox and support yoke flange with a 2-inch wooden block.

l) Torque the nut to 290-410 in.-lb and secure with a new MS24665-210 cotter pin.

m) Install gearbox per Section 7.420.

7.500 ACTUATOR ASSEMBLY

7.510 Actuator Removal

a) Remove aft cowling assembly.

b) Disengage clutch to its fullest disengaged position.

c) Remove cooling fan and scroll per Section 6.200.

d) Put a six-inch wooden block under the clutch shaft just forward of the upper sheave on the horizontal firewall. This keeps the sheave from drooping and prevents damage to the forward flex plate (see Figure 7-8).

e) Disconnect two wiring connections to actuator.

f) Disconnect the clutch lateral centering strut from the upper frame.

g) Remove the upper NAS6605 and lower NAS6604 bolts and remove actuator.

7.520 Actuator Installation

a) Inspect upper and lower clutch actuator bearings per Section 2.140.B.

b) Position actuator for installation.

c) Install lower attach bolt with head facing aft. Use one AN960-416L washer under bolt head and one AN960-416 washer under nut. Torque per Section 1.320, install palnut and torque stripe.

7.520 Actuator Installation

d) Connect actuator gearmotor housing to C184 bearing per Figure 7-14. Standard torque bolt per Section 1.320, install & torque palnut, and torque stripe per Figure 2-1.

e) If installed, remove block(s) supporting clutch assembly.

f) Connect clutch lateral centering strut, standard torque bolt per Section 1.320, install palnut, and torque stripe per Figure 2-1.

g) Install fanwheel and scroll per Section 6.220.

h) Connect gearmotor and switch harness electrical leads and ty-rap as required.

i) Balance fanwheel per Section 6.240.

j) Install aft cowling.

CAUTION

Do not engage actuator without scroll installed.

7.530 Actuator Gearmotor Replacement

Actuator gearmotor can be replaced with actuator on helicopter.

1. Disconnect gearmotor electrical leads.
2. Cut safety wire from four gearmotor attach screws.
3. Remove screws, using care not to drop them in V-belt drive.
4. Slowly slide gearmotor assembly from housing. An unscrewing motion may be necessary.
5. Lightly lubricate worm gear on new gearmotor assembly with A257-1 grease before installing. Install O-ring onto gearmotor nose.
6. Install new gearmotor into housing with wire leads pointing outboard. Verify no gap exists between housing and motor mounting flange.
7. Install and tighten (4) mounting screws into housing and safety in pairs with 0.032 inch diameter safety wire.
8. Connect gearmotor electrical leads. Engage clutch, listen for binding, and verify actuator shuts off after column springs yield (indicated by "popping" sound).

CAUTION

If gearmotor electrical pins are reversed in connector, gearmotor will operate backward and down-limit switch and spring switches **WILL NOT** shut off power; damage to actuator and drive belts can occur.

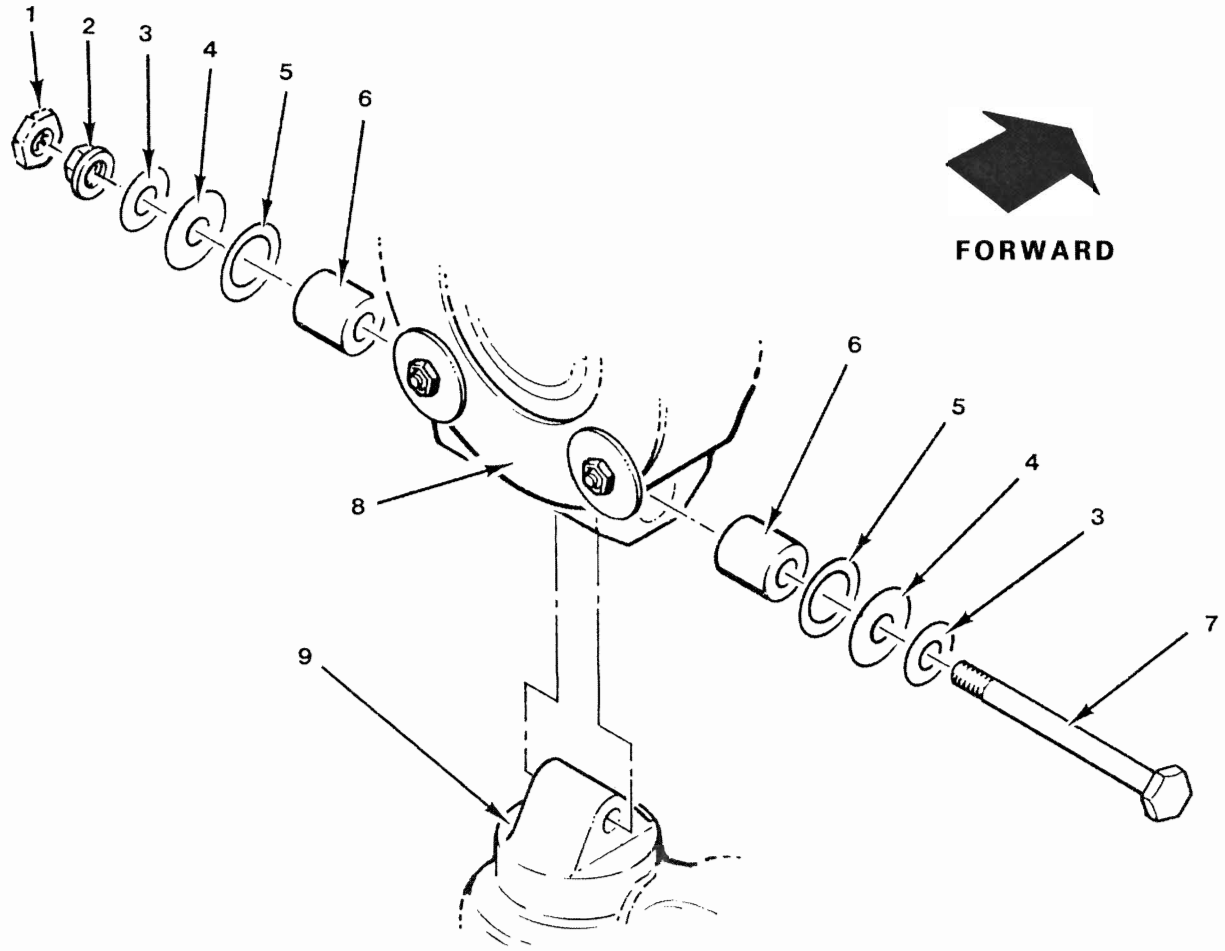


FIGURE 7-14 ACTUATOR ASSEMBLY INSTALLATION

NUMBER	PART NUMBER	DESCRIPTION
1	B330-16	PALNUT
2	MS21042L5	NUT
3	C141-1	WASHER
4	AN960-516L	WASHER
5	CA214-8	THRUST WASHER
6	C105-2	JOURNAL
7	NAS6605-38	BOLT
8	C184-2	UPPER BEARING ASSEMBLY
9	C051-1	ACTUATOR ASSEMBLY

7.540 Actuator Adjustment

1. Engaged Limit

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

2. Disengaged (Down-Limit) Adjustment

   The down-limit switch is activated by the down-limit stop screw, which can be adjusted using long 3/8-inch open-end (MT357-6) and ¼-inch box-end (MT357-7) wrenches. Adjust down-limit stop screw to maintain proper belt deflection per Section 7.282 with actuator fully disengaged. Minimum clearance between screw heads at scissors is 0.015 inch per Figure 7-15.

3. Maximum Extension

   Maximum engaged extension is 1.60 inches, measured as shown in Figure 7-15. 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

7.551 Switch Replacement

1. Remove actuator per Section 7.510.

NOTE
Switches may be replaced as a complete switches & harness assembly, or replaced individually by installing heat shrink and soldering wire connections.

2. Remove desired switch by removing attaching screw, nut, washer, and spacing washers between switch and plate.

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

3. Replace complete switches and wire harness assembly or, if installing a single switch, cut wires from faulty switch as close to switches as possible.

4. Slide new heat shrink over each cut wire. Solder wires to switch and install heat shrink over solder connection.

5. Reassemble switch(es) to plate. Two spacing washers are installed between switch and plate at each attach screw and one under nut. Do not over tighten screws or plastic switch housing may crack.

6. Reinstall actuator per Section 7.520.

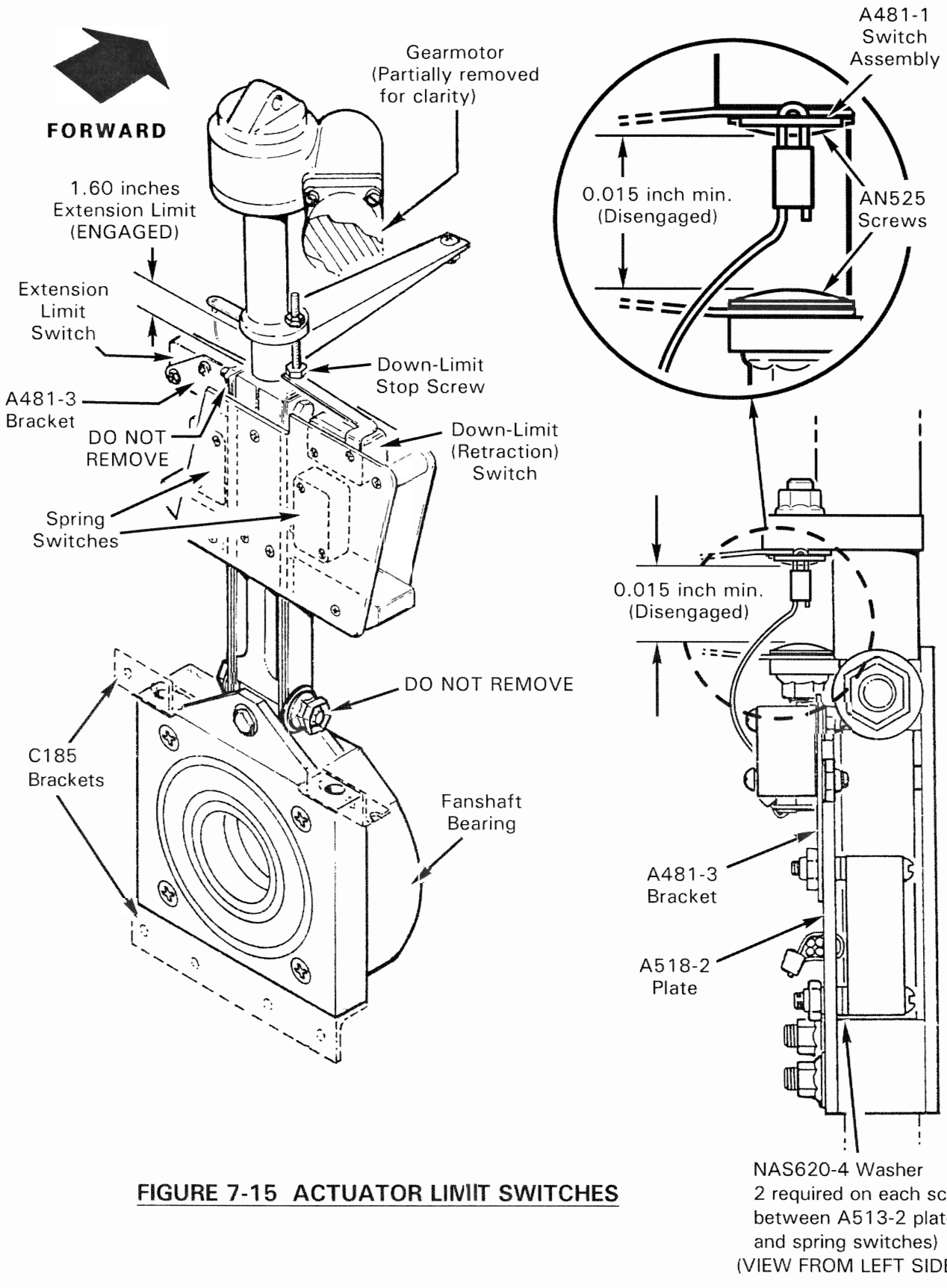


FIGURE 7-15 ACTUATOR LIMIT SWITCHES

7.551 Switch Replacement (cont'd)

d) Slide heat shrink over each cut wire. Solder wires to switch and install heat shrink over solder connection.

e) Reassemble switch(es) to plate. Two spacing washers are installed between switch and plate at each attach screw and one under nut. Do not overtighten screws or plastic switch housing may crack.

f) Reinstall actuator on helicopter per Section 7.520.

7.552 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 the wire bundle above the horizontal firewall in the 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

a) Remove tailcone cowling. Remove the forward flex plate. Mark and record any shim washers installed between the flex plate and the input yoke to the main rotor gearbox or the yoke on the clutch shaft.

b) Remove the cotter pin and the nut securing the input yoke on the main rotor gearbox. Remove the yoke. Disconnect the spring from the firewall angle.

c) Remove the cable pulley from the lever. Disconnect the wiring to the micro switch at the three-pin connector.

d) Cut and remove the safety wire, then remove the three bolts securing the rotor brake. Record the position of the two small and one long spacers for reinstallation. Remove the rotor brake assembly.

7.620 Rotor Brake Installation

a) Place the rotor brake assembly over the splined input pinion shaft of the main rotor gearbox.

b) Place one each of the two small (C130-3) spacers in place between the rotor brake assembly and the pinion end cover. Install one each AN960-416L washer on the three NAS1352-4H30P bolts. Insert the first bolt through the rotor brake assembly and the A130-41 spacer. Insert the second bolt through the Hall Effect sender plate, rotor brake assembly and the A130-41 spacer. Place one AN960-416 washer between the Hall Effect sender plate and the rotor brake bracket.

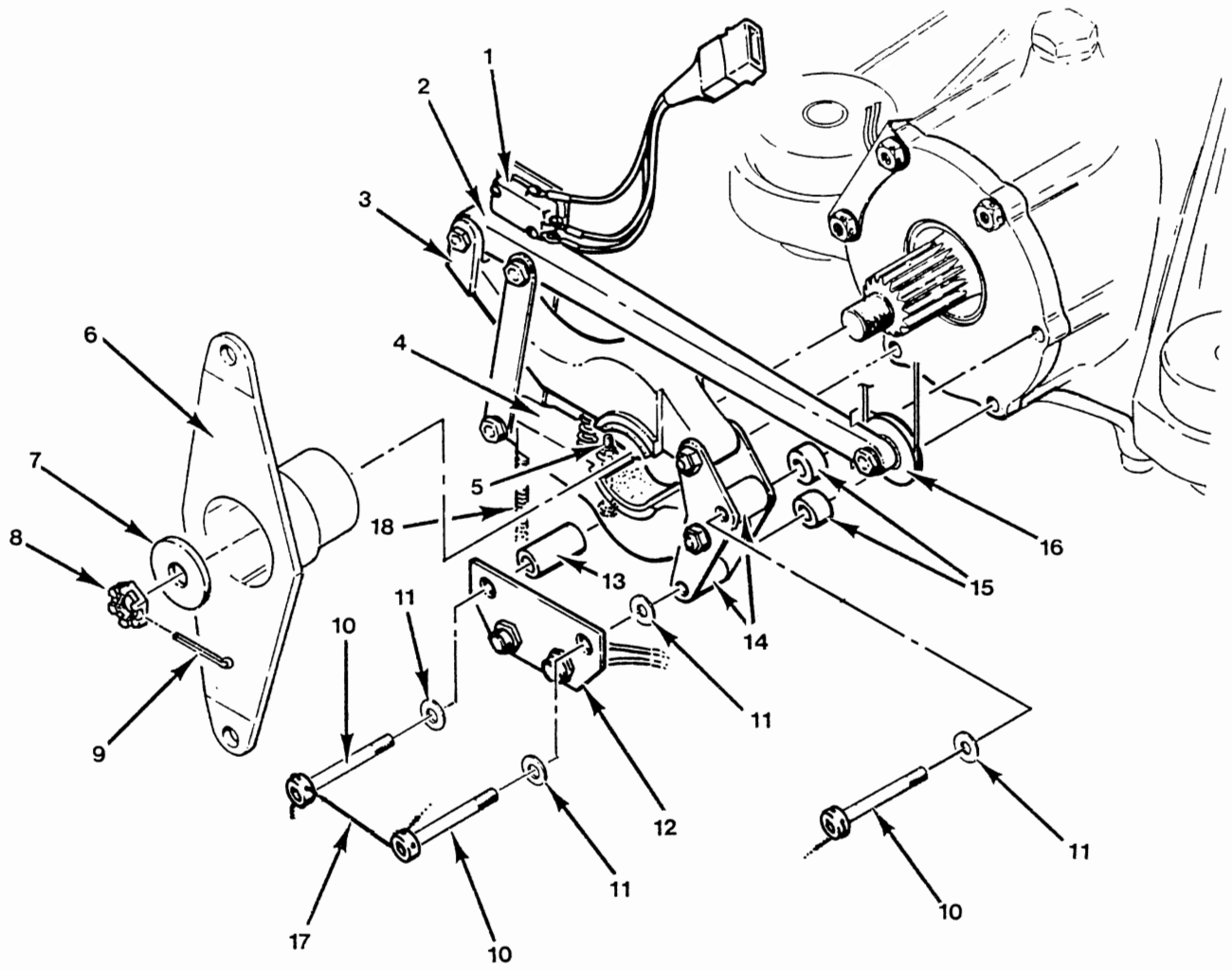


FIGURE 7-16 ROTOR BRAKE INSTALLATION

NUMBER	PART NUMBER	DESCRIPTION	NUMBER	PART NUMBER	DESCRIPTION
1	-	Micro Switch	12	D114-1	Bracket
2	D112-1	Lever	13	C130-4	Spacer
3	D110-1	Arm Assembly	14	A130-41	Spacer
4	D123-1	Arm Assembly	15	C130-3	Spacer
5	NAS428-3-14	Bolt	16	AN210-1A	Pulley
	NAS1291-3	Nut	17	-	0.032 in. dia Safety Wire
6	C908-1	Yoke Assembly	18	E0240-037-3500S	Spring
7	C141-10	Washer			
8	AN320-8	Nut			
9	MS24665-210	Cotter Pin			
10	NAS1352-4H30P	Screw			
11	AN960-416	Washer			

7.620 Rotor Brake Installation (cont'd)

c) Insert the third bolt through the Hall Effect sender plate and the long C130-4 spacer. Finger tighten the three bolts into the gearbox, then torque the bolts to 120 in.-lb and safety with 0.032 inch diameter safety wire. Attach the spring to the firewall angle.

d) Place the C908-1 yoke on the pinion shaft. Install one each C141-10 washer and AN320-8 nut on the pinion shaft. Torque the nut to a minimum of 290 in.-lbs. Align the castellations on the nut with the hole through the pinion shaft. Do not exceed 410 in.-lbs. Install one MS24665-210 cotter pin.

e) Set the Hall Effect sender-to-magnet gap per Section 7.141.

f) Attach the cable pulley to the lever. Reconnect the wiring to the micro switch at the three-pin connector.

g) With the brake engaged, adjust the gap between the NAS428-3-14 bolthead on the D123-1 arm and the C130-4 spacer to 0.030-0.035 inch. Lock the adjustment by tightening the MS21042L3 nut (see Figure 7-16A).

h) With the brake in the released position, measure the gap between the D112-1 lever and the D110-1 arm assembly. The gap measurement should be 0.030 - 0.170 inch. Adjust the length of the bead chain as required to obtain proper gap.

i) Adjust the micro switch to open and close at a gap of 0.20 - 0.30 inch between the D112-1 lever and the D110-1 arm.

j) Install the forward flex plate. Check the clutch sheave alignment per Section 7.230. Check the intermediate flex plate installation and shimming per Section 7.330.

7.630 Rotor Brake Pad Replacement

a) Minimum pad thickness is 0.030 inch.

b) Brake pad replacement is accomplished by replacing the D110-1 and D123-1 arm assemblies.

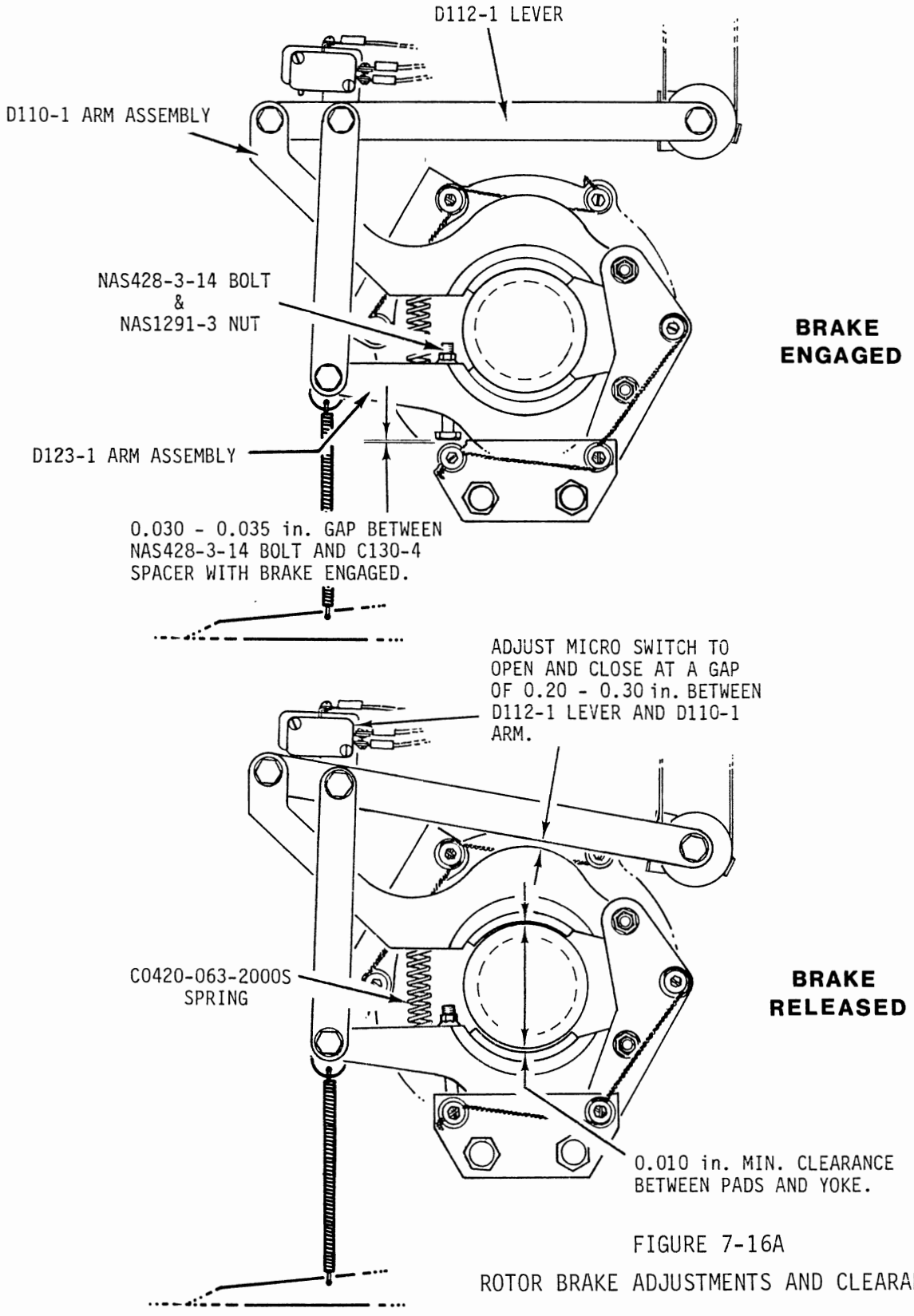


FIGURE 7-16A

ROTOR BRAKE ADJUSTMENTS AND CLEARANCES

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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

The optional 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 Section 1.470). 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.

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.

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 during 100-hour inspections. 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.

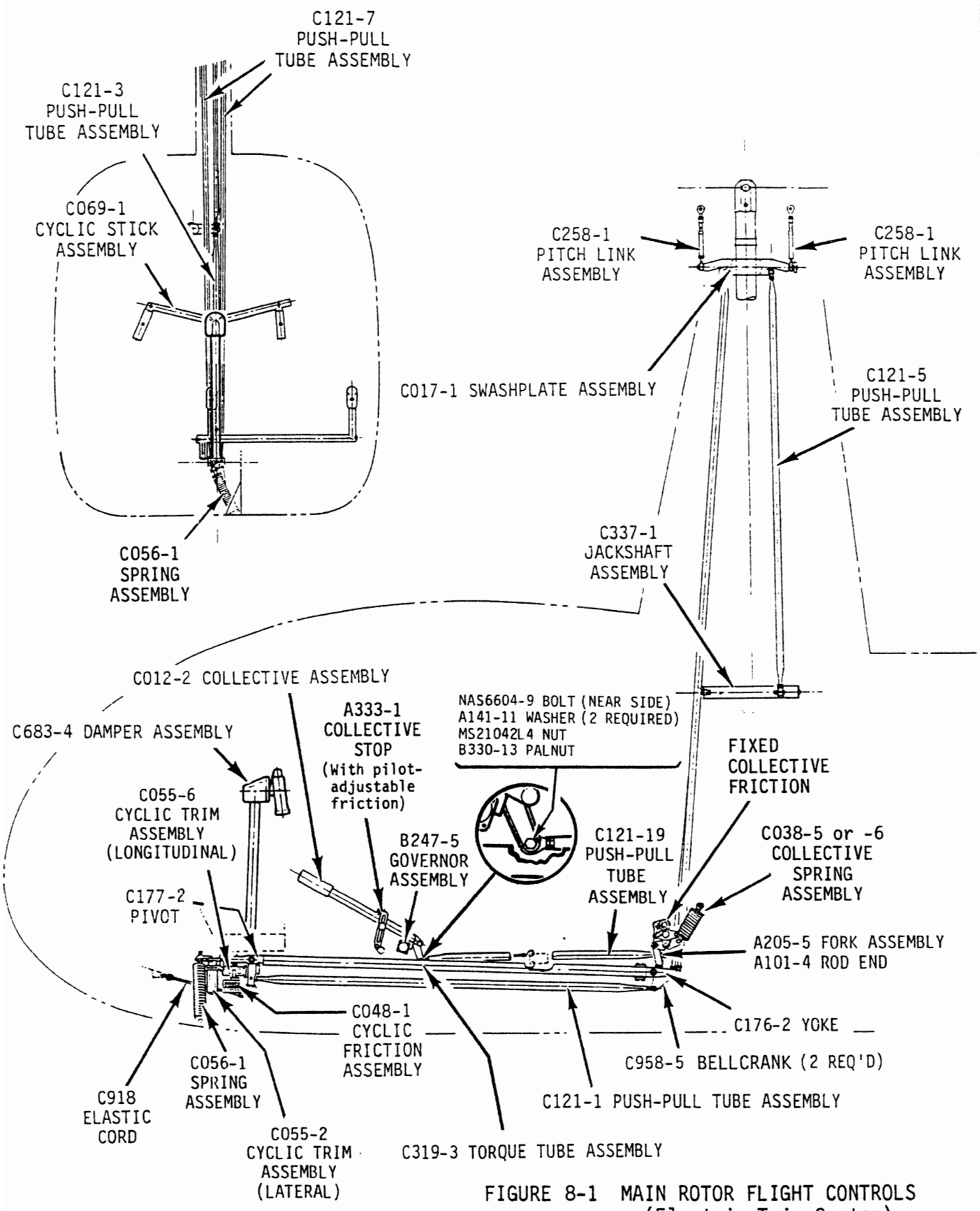


FIGURE 8-1 MAIN ROTOR FLIGHT CONTROLS
(Electric Trim System)

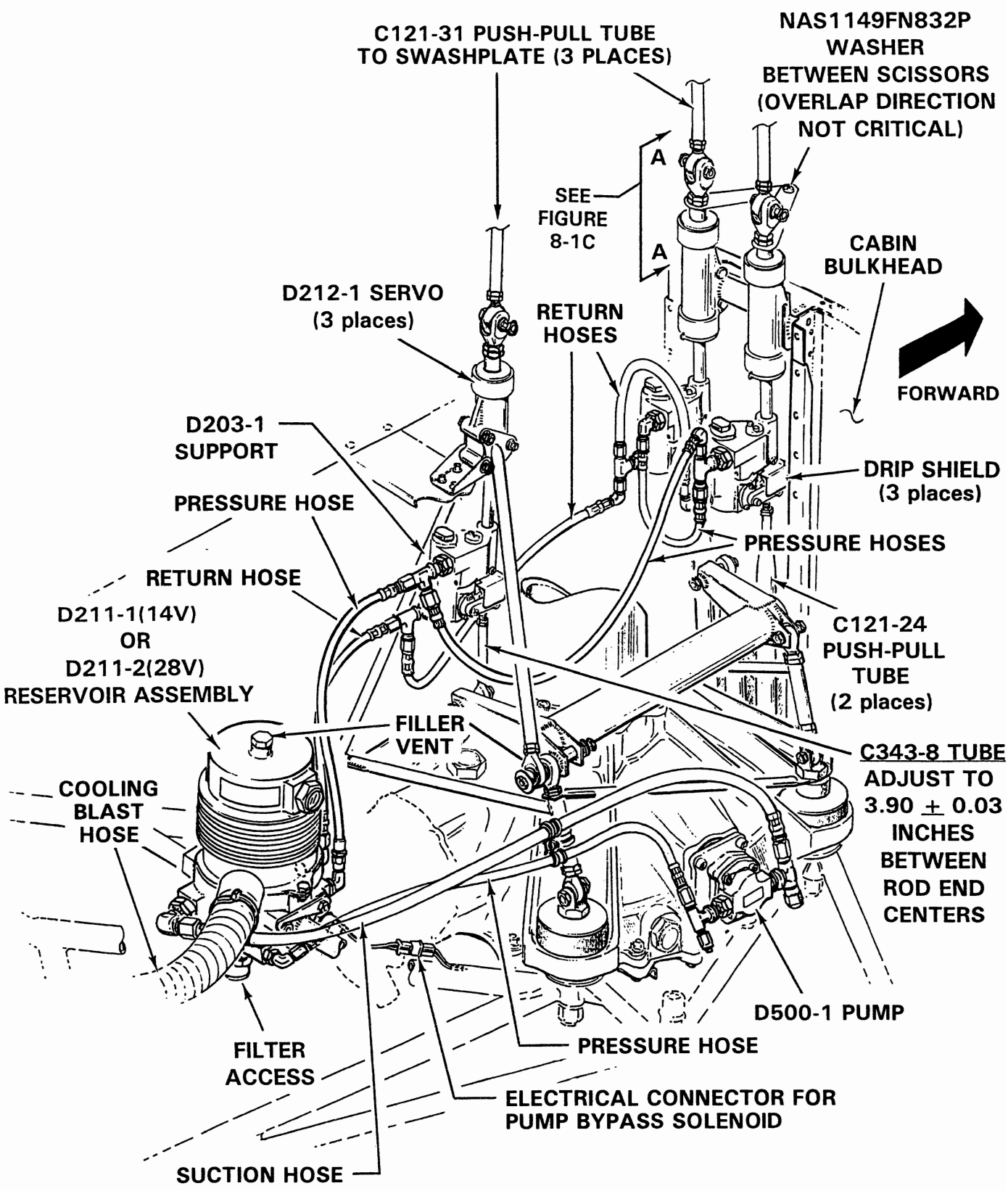


FIGURE 8-1A

HYDRAULIC FLIGHT CONTROL SYSTEM

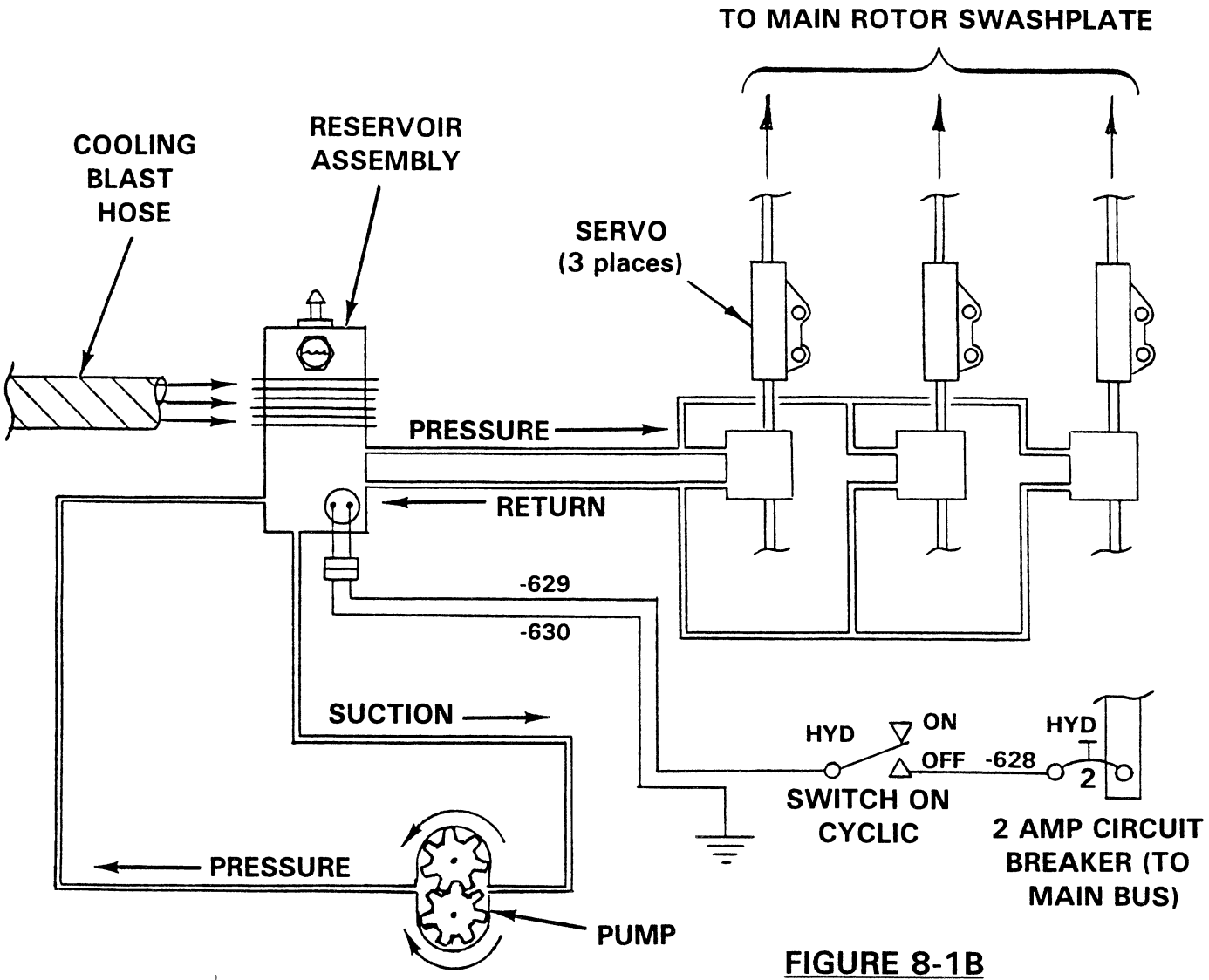
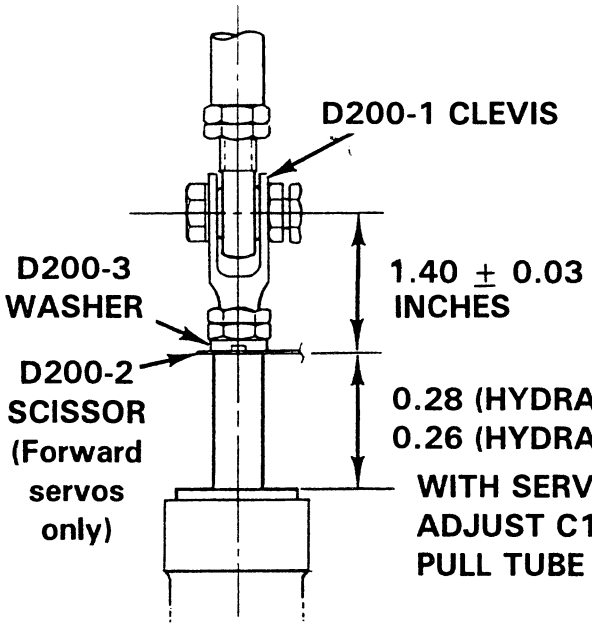


FIGURE 8-1B

HYDRAULIC SYSTEM SCHEMATIC



(View A-A from Figure 8-1A)

FIGURE 8-1C

SERVO RIGGING

(Typical three places)

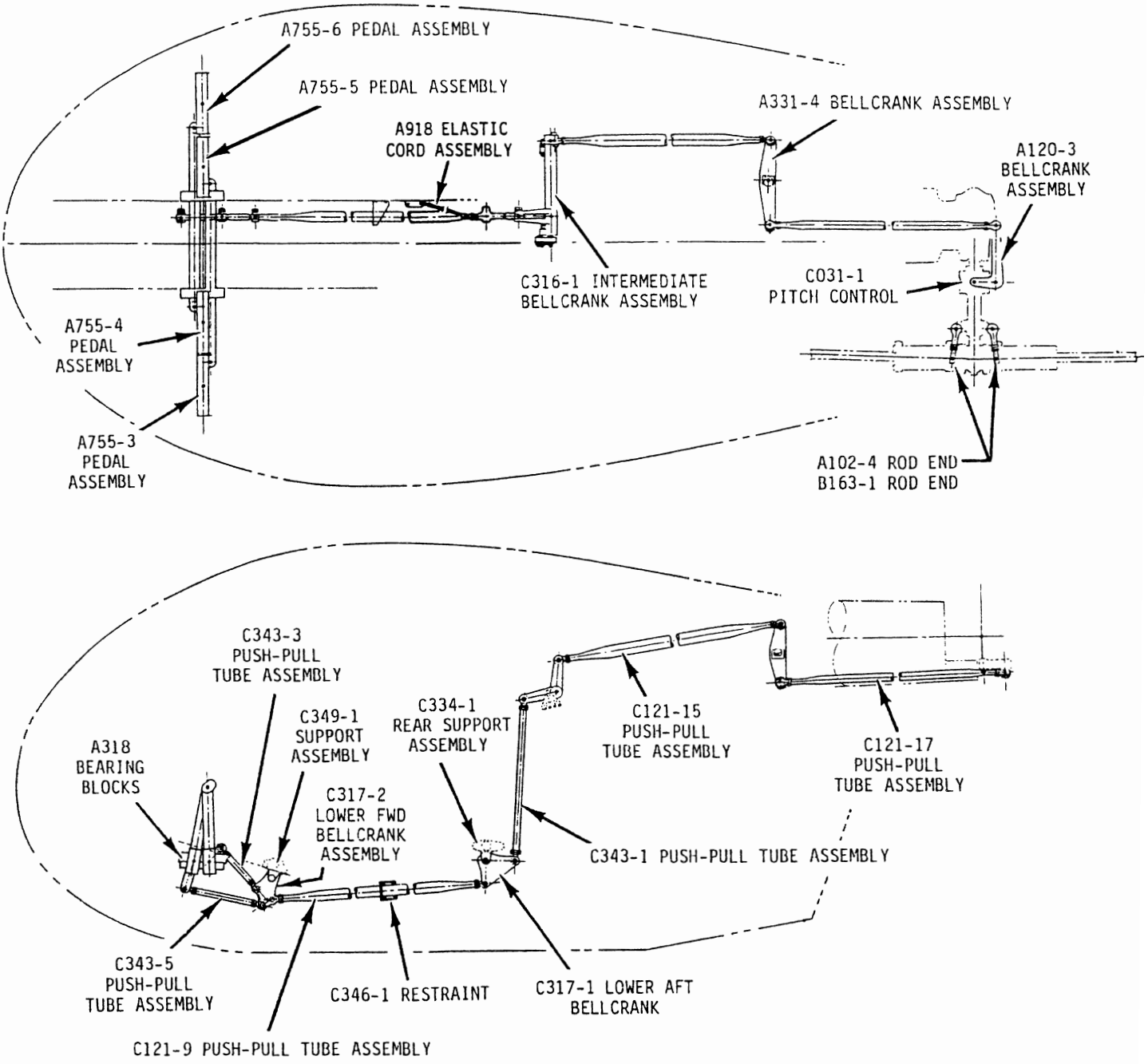


FIGURE 8-2 TAIL ROTOR FLIGHT CONTROLS

8.100 CYCLIC CONTROLS

WARNING

Manual control (electric-trim) R44s require 0.065 inch wall thickness C319-3 torque tube assemblies with C177-2 pivot (C177-4 pivot assembly) and C176-3 yoke. R44s with hydraulic flight controls require 0.049 inch wall thickness C319-5 torque tube assemblies with C177-3 pivot and D696 yoke.

8.110 Cyclic Assembly

8.111 Cyclic Assembly Removal

a) Remove belly panels and control tunnel covers.

b) Remove roll pin from cyclic friction knob and remove knob. Install a pin on shaft to retain spacers. Remove carburetor heat control knob on ships equipped with carb heat assist.

c) Remove C683-4 damper atop cyclic stick (not applicable to hydraulic flight controls).

d) Remove all screws securing C444-1 cover. Disconnect post light wire and secure cover at highest point of cyclic stick.

e) Open upper console and disconnect outside air temperature gauge and intercom system controller wiring. Remove radio face plate.

f) Remove forward and aft longitudinal cyclic trim elastic cords per Section 8.131.

8.111 Cyclic Assembly Removal (cont'd)

g) Install MT544-2 lateral trim spring assembly retainer onto lateral trim spring per Section 8.141. Remove B330-13 palnut and AN316-4R nut atop lateral trim spring shaft. It is not necessary to remove motor assembly from cyclic assembly.

h) Disconnect electrical connections at bottom of cyclic stick.

i) Remove NAS6604-8 bolt from forward end of C121-1 push-pull tube. Move push-pull tube aft and/or move cyclic grip aft to disconnect push-pull tube from cyclic stick.

j) Remove two bolts connecting forward end of C319-3 torque tube assembly to C177-2 pivot and move torque tube assembly aft to disconnect it from pivot.

CAUTION

Protect C319-3 torque tube from scratches.

k) Disconnect, but do not remove, two bolts holding cyclic friction assembly to cabin. Apply friction to help keep assembly together.

l) Remove screws securing cyclic box to cabin. Lift cyclic assembly up and disconnect strain gage plug on left side of cyclic box, slide lateral trim assembly arm off spring assembly shaft, and remove cyclic stick assembly. Install nuts onto two friction assembly bolts, hand tight, to retain bolts and spacers.

CAUTION

Before removing cyclic, protect silicone-covered strain gages on cyclic stick with soft cloth or foam. Damaged strain gages or wiring will disable electronic trim system.

m) Remove A231-9 hole plugs in keel panel in right aft baggage compartment. Remove NAS6605-46 bolt, C130-7 spacer and hardware connecting C121-7 push-pull tube lower rod ends to C176-2 yoke.

n) Remove NAS6605-16 bolt and hardware connecting C121-3 push-pull tube lower rod end to C958-5 bellcrank.

o) Disconnect A205-5 fork assembly from C326-7 bellcrank by removing NAS6604-38 bolt, C130-12 spacer, and related hardware.

p) Remove C319-3 torque tube assembly and attached parts by moving assembly down and aft through belly.

8.112 Cyclic Assembly Installation

a) Install C319-3 torque tube assembly (with attached C121-1 push-pull tube assembly, C176-2 yoke, C958-5 bellcranks, and A205-5 fork assembly) through aft belly of helicopter. Before installation, verify center-to-center distance between B115-1 bearings and A101-4 rod end in A205-5 fork is 3.80 ± 0.03 inches and jam nut and palnut are torqued per Section 1.320.

b) Connect A205-5 fork assembly to C326-7 bellcrank per Figure 8-3 and torque.

c) Connect lower end of C121-3 push-pull tube to C958-5 bellcranks and torque.

d) Connect C121-7 push-pull tubes to C176-2 yoke using a NAS6605-46 bolt and C130-7 spacer and torque. Install two A231-9 hole plugs in keel panel.

e) Position cyclic stick between keel panels. Connect strain gage wire plug to cyclic box, carefully slide lateral trim assembly arm onto spring assembly shaft, and guide carb heat assist rod (if installed) thru box. Install all screws fastening cyclic box to cabin.

CAUTION

Exercise care when installing lateral trim assembly arm onto spring shaft to avoid damaging teflon liner in bearing bore.

f) Connect C319-3 torque tube assembly to C177-2 pivot and torque.

CAUTION

Protect C319-3 torque tube from scratches.

g) Fasten cyclic friction assembly to cabin.

h) Connect forward end of C121-1 push-pull tube to cyclic stick and torque.

i) Connect all electrical plugs at bottom of cyclic stick. Position protective sleeving to cover maximum amount of wiring possible and secure sleeving ends with lacing tape.

j) Finger tighten AN316-4R nut on lateral trim spring shaft then install and torque B330-13 palnut. Remove MT544-2 retainer.

k) Install longitudinal cyclic trim elastic cords per Section 8.132.

l) Move cyclic control through all positions and verify that there are clearances and no binding. Turn master battery and trim switches on and check clearances with trim motor arms in different positions. Use circuit breakers to control position at which arms stop.

8.112 Cyclic Assembly Installation (cont'd)

m) Install radio face plate, connect OAT gage and intercom system wires and ty-rap as required. Close and secure upper console.

n) Connect cyclic box cover post light wire, guide carb heat assist actuating rod (if installed) thru hole in cover, and secure cover. Install cyclic friction knob, and roll pin. Install carburetor heat control knob on ships with carb heat assist.

o) Install C683-4 damper assembly atop cyclic stick and torque per Section 1.330 (not applicable to hydraulic flight controls).

p) Install all panels.

q) Rig main rotor flight controls per Section 10.121 if any push-pull tube length was changed.

r) Adjust trim controller per Section 14.710.

8.120 Cyclic Grip Assembly

8.121 Cyclic Grip Assembly Removal

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

a) If installed, remove C683-4 damper and disconnect D140-1 trim controller from airframe wiring.

b) Remove forward belly panel.

c) Remove lacing tape from both ends of protective sleeving covering wires exiting base of stick assembly. Using pin extractor, remove from housing those pins connected to wires 234, 235, 236, 277, 280, 281, 611, 612, 613, 614, 615, and 939 (if installed). Attach a 3 foot length of safety wire or wire lacing tape to one removed pin.

d) Remove cotter pin, castellated nut, and A141-14 washer where grip assembly attaches to stick assembly.

e) Remove grommet atop cyclic stick at grip assembly wiring entrance. With a soft-faced hammer, gently tap cyclic grip assembly pivot and remove grip assembly and attached wiring from stick assembly. Ensure safety wire or lacing installed in step c) protrudes from top and bottom of stick assembly. Also, ensure pivot bearings remain with stick assembly.

NOTE

Do not damage bearings while removing.

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C334 AFT SUPPORT ASSEMBLY

NUMBER	PART NUMBER	DESCRIPTION
1.	MS21042L3	Nut
2.	AN960-10L	Washer
3.	D336-1	Plate
4.	C130-24	Spacer
5.	A130-21	Spacer
6.	C130-25	Spacer
7.	B1000-050-S	Spring Washer
8.	NAS6603-11	Bolt
9.	B249-6	Arm Assembly
10.	C315-7	Aft Support Assy Weldment
11.	NAS6604-2	Bolt
12.	MS21042L4	Nut
13.	AN960-416	Washer
14.	AN960-416L	Washer
15.	B330-19	Palnut
16.	MS21042L6	Nut
17.	AN960-616	Washer
18.	B250-11	Journal
19.	NAS6606-17	Bolt
20.	B330-13	Palnut
21.	C038-5 or -6	Collective Spring Assy (Ref)
22.	C311-1	Bolt
23.	A141-11	Washer
24.	NAS6604-11	Bolt
25.	C343-1	Push-Pull Tube Assy (Ref)
26.	B316-4	Rod End
27.	AN316-4R	Nut
28.	A127-4	Rod End
29.	NAS6604-8	Bolt
30.	A141-3	Washer
31.	A105-3	Journal
32.	C317-1	Bellcrank Assy
33.	C121-9	Push-Pull Tube Assy (Ref)
34.	NAS6604-7	Bolt
35.	A205-5	Fork Assembly
36.	C130-12	Spacer
37.	AN316-6R	Nut
38.	D173-1	Rod End
39.	C121-19	Push-Pull Tube Assy (Ref)
40.	A130-47	Spacer
41.	NAS6604-38	Bolt
42.	C326-7	Bellcrank
43.	B303-1	Bearing
44.	C130-32	Spacer
45.	C958-5	Bellcrank
46.	AN316-5R	Nut
47.	B330-16	Palnut
48.	A101-4	Rod End

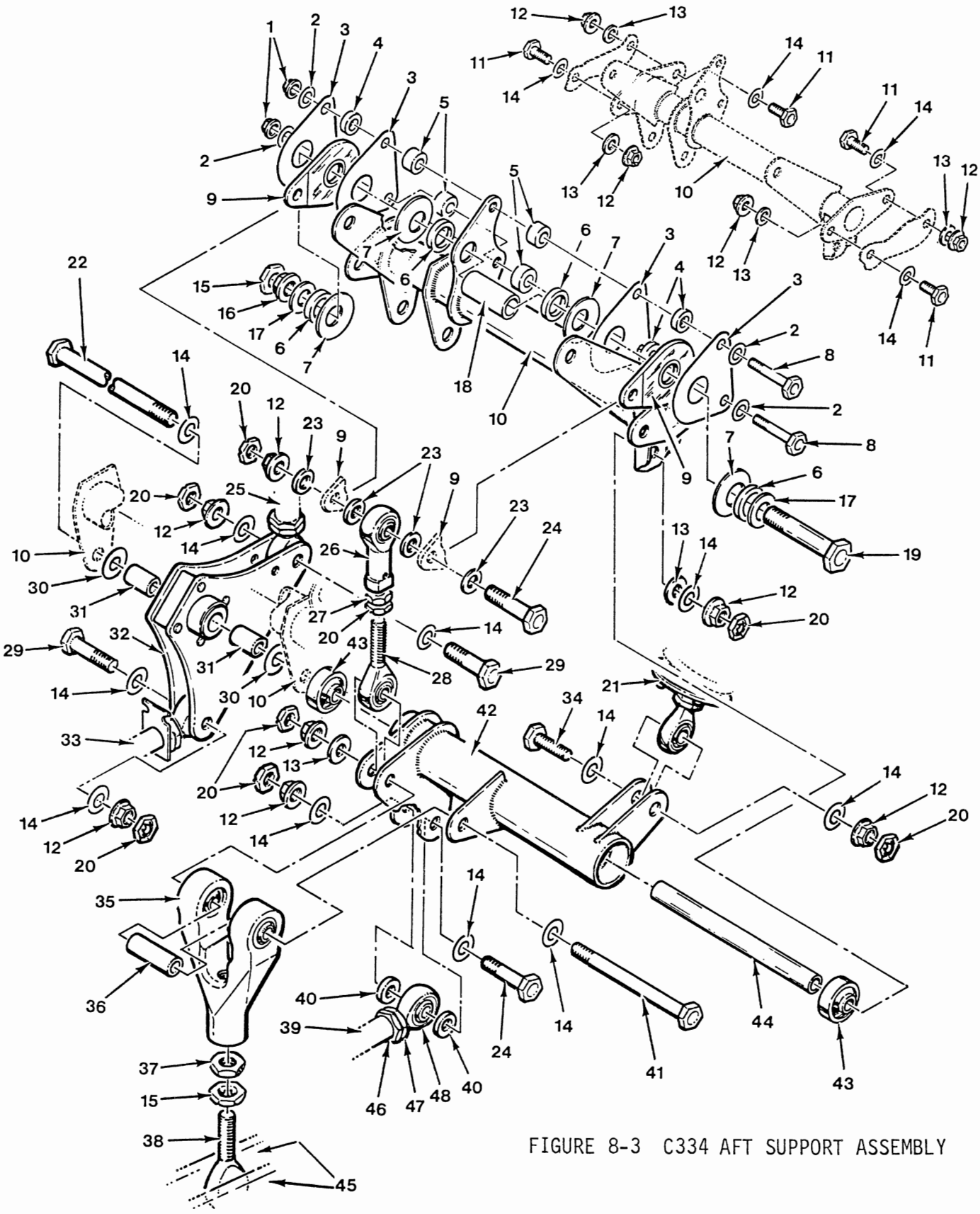


FIGURE 8-3 C334 AFT SUPPORT ASSEMBLY

8.122 Cyclic Grip Assembly Installation

a) Ensure rollpin is installed in grip assembly with protruding end down. Protective sleeving covers wires exiting grip assembly with one grommet in grip and one on wire bundle.

b) Slide grip assembly into bearings in stick assembly. Install A141-14 washer, castellated nut and cotter pin.

CAUTION

Tighten castellated nut only until there is no axial movement of bearings and cyclic grip assembly. Overtightening nut will damage bearings.

c) Temporarily attach grip assembly wiring to safety wire (or lacing) exiting atop cyclic stick. Carefully pull wires thru cyclic stick. Install grommet, included with grip assembly wiring, into cyclic stick wiring entrance hole. Route grip assembly wires thru existing sleeving protecting wires exiting cyclic stick bottom. Remove safety wire (or lacing).

d) Install pins on each wire into proper position in housings. Refer to Figures 14-2 and 14-4 for pin position.

e) Position protective sleeving on wiring exiting cyclic stick bottom to cover maximum amount of wiring possible. Secure sleeving ends with lacing tape.

f) Connect cyclic and airframe wiring and ty-rap. Move cyclic control through all positions and verify clearance and no binding. Turn master battery and trim switches on and check clearances with trim motor arms in different positions. Use circuit breakers to stop arms in different positions.

g) Install end cap (hydraulic flight control) or C683-4 damper assembly (manual flight control) atop cyclic stick. Torque damper assembly attaching screws per Section 6.330.

h) Install forward belly panel.

i) Adjust trim controller per Section 14.710 (not applicable to hydraulic flight controls).

8.130 Longitudinal Cyclic Trim Elastic Cords

Elastic cords are used to zero longitudinal cyclic stick forces during hovering and cruise flight. Refer to Figures 8-4 and 8-4A.

One or two cyclic trim elastic cords are installed in the R44. One aft (cruise) cord, which imparts a forward cyclic force, is connected to the longitudinal trim motor cable. One optional forward (hover) elastic cord, which imparts an aft cyclic force, may be connected to the bottom of the cyclic stick assembly. Before replacing any elastic cord, ensure longitudinal trim motor arm is traveling thru its full operating range when cyclic stick is placed in full forward and then full aft position.

If cyclic grip moves forward in hover, a stronger forward elastic cord is required. If cyclic grip moves aft in cruise flight, a stronger aft elastic cord is required. Decreasing forward (hover) elastic cord strength by 5 pounds has the same effect as increasing aft (cruise) elastic cord strength by 10 pounds.

a) Remove elastic cord per Section 8.131 and determine part number from identification tag.

NOTE

The R44 IPC lists elastic trim cords by part number and installed load (force).

b) Using above information, and amount of force required to counter cyclic force, select an appropriate elastic trim cord from the IPC. If cord is old, try replacing it with same part number new cord first.

c) Install per Section 8.132.

d) Test fly helicopter to determine if proper cord was selected. The cyclic trim must zero (neutralize) cyclic forces during a 100 KIAS autorotation at C.G. station 99+.

e) Repeat steps a) thru d) as required to balance longitudinal cyclic forces.

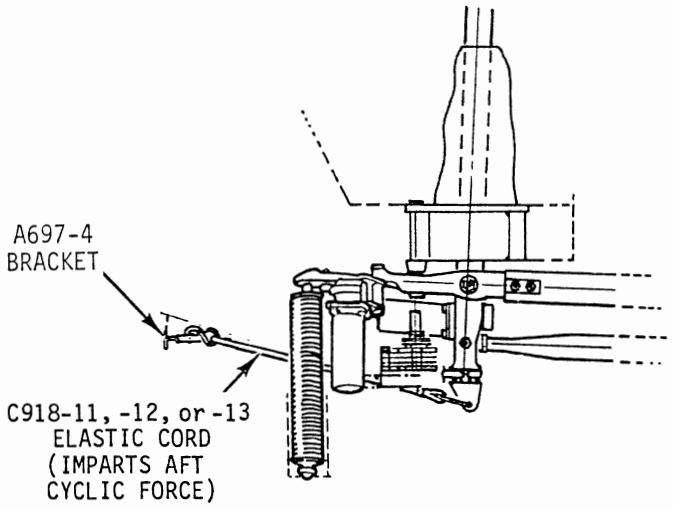


FIGURE 8-4
FORWARD (HOVER)
ELASTIC TRIM CORD

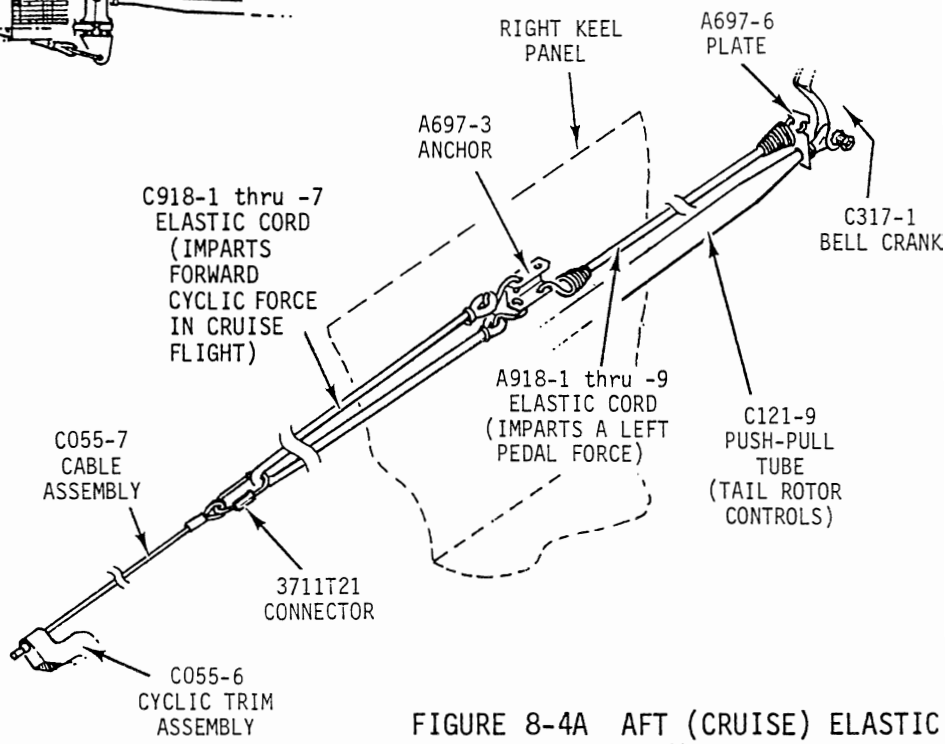


FIGURE 8-4A AFT (CRUISE) ELASTIC TRIM CORDS

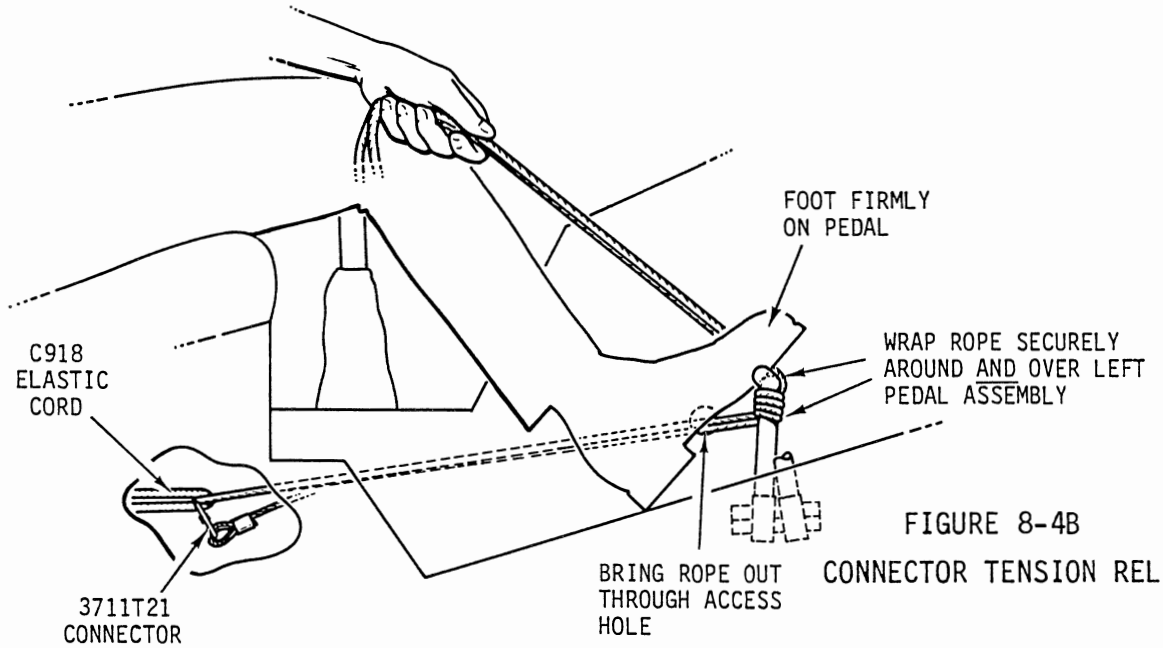


FIGURE 8-4B
CONNECTOR TENSION RELIEF

8.131 Elastic Cord Removal

NOTE

See Section 2 for elastic cord inspection criteria.

1. Aft elastic cord (C918-1 through -9):

   a) Remove control tunnel covers (reference Figure 2-2, item 3A & 4F).

   b) Turn master battery and trim switches on. Hold cyclic stick firmly against aft stop to allow longitudinal trim motor arm to go to upper stop. Turn master battery and trim switches off.

   c) Move cyclic stick full forward. Remove black plastic hole plug from right keel panel just aft of right side tail rotor pedals.

   d) Refer to Figure 8-4B. Apply full right pedal. Route one end of an 8 foot length of 1/4 inch diameter nylon rope through right keel panel hole just aft of right side tail rotor pedals, through C918 elastic cord next to 3711T21 connector and back through keel panel hole. Wrap both ends of rope around left pedal and hold securely. Slowly apply left pedal to take up slack on rope and relieve tension on 3711T21 connector. Unhook connector from C918 elastic cord. Let left pedal return slowly full aft.

CAUTION

Always remove tension on 3711T21 connector before unscrewing it. DO NOT allow C918 elastic cord to put tension on an unsecured 3711T21 connector.

   e) Very slowly, ease off tension on rope until there is no more tension on elastic cord.

   f) Unhook both ends of elastic cord from A697-3 anchor riveted to right keel panel. Remove elastic cord.

2. Forward elastic cord (C918-11, -12, -13):

   a) Remove forward belly panel.

   b) Move the cyclic to full aft position.

   c) Unhook the forward trim cord from the A697-5 clip located at the bottom of the cyclic stick.

   d) Remove the trim cord hook from the forward bracket.

8.132 Elastic Cord Installation

1. Aft elastic cord installation

CAUTION

C918-8 and -9 elastic cords may only be used with C055-10 cyclic trim assembly.

a) Hook both ends of trim cord to A697-3 anchor on right keel panel.

b) Move cyclic to full forward position with longitudinal trim motor arm in up position.

c) Refer to Figure 8-4B. Apply full right pedal. Route one end of an 8 foot length of 1/4 inch diameter nylon rope through right keel panel hole just aft of right seat tail rotor pedals, through C918 elastic cord next to 3711T21 connector, and back through keel panel hole. Wrap both ends of rope around left pedal and hold them securely.

d) Reference Figure 8-4A.Slowly apply left pedal to stretch C918 elastic cord. Install and secure the 3711T21 connector between the C918 elastic cord and C055-7 cable assembly. Reference Figure 8-4A. Slowly release tension on rope. Remove rope.

CAUTION

DO NOT allow the C918 elastic cord to apply tension to an unsecured 3711T21 connector.

WARNING

Turn on trim system and ensure clearance is maintained between the elastic cord hooks, push-pull tubes and wiring throughout entire cyclic control and trim system travel.

e) Reinstall all panels and the hole plug.

f) Evaluate trim cord per Section 8.130(d).

8.132 Elastic Cord Installation (cont'd)

2. Forward elastic cord installation

a) Hook forward end of elastic cord to bracket under radio rack.

b) Pull cyclic to full aft position and hook aft end of trim cord to A697-5 clip located at bottom of cyclic stick.

WARNING

Turn on trim system and ensure clearance is maintained between elastic cord hooks, push-pull tubes, and wiring throughout entire cyclic control and trim system travel.

c) Install belly panel.

8.140 Lateral & Longitudinal Cyclic Trim Assemblies

8.141 Lateral Cyclic Trim Assembly Removal (C055-2 or C055-9)

a) Remove forward belly panel and panel between forward seats.

b) Remove roll pin from cyclic friction knob and remove knob. Install pin on shaft to retain spacers. Remove carburetor heat control knob on ships equipped with carburetor heat assist.

c) Remove all screws securing C444-1 cover. Disconnect post light wire and secure cover at highest point of cyclic stick.

d) Open upper console and disconnect the OAT gage and intercom system wiring. Remove radio face plate.

e) Turn master battery and trim switches on. Move and hold cyclic against right stop until lateral trim arm moves fully left. Then turn trim and master battery switches off and move cyclic stick to full left position to compress trim spring.

f) Install MT544-2 lateral spring assembly retainer and secure with heavy-duty ty-raps at two places to spring assembly. Remove palnut and AN316-4R nut atop spring shaft.

g) Disconnect lateral trim motor wiring.

h) Remove two NAS6603-26 bolts which connect trim assembly to C177-2 pivot.

i) Remove gearmotor assembly.

j) If necessary, remove spring assembly by disconnecting C591-2 block from cabin assembly.

8.142 Lateral Cyclic Trim Assembly Installation (C055-2 or C055-9)

CAUTION

There are two trim controller part numbers: D140-1 and D140-2. D140-1 trim controller must be used ONLY with C055-2, -6 and -8 cyclic trim assemblies. D140-2 trim controller must be used ONLY with C055-9, -10 and -11 cyclic trim assemblies. Incompatible controller and trim assembly(s) will result in trim system failure.

a) If C056-1 spring assembly was removed, install C591-2 block (permanently attached to spring assembly bottom) in cabin. Orient attaching screw heads forward. Install trim assembly's two NAS6603-26 bolts downward thru C177-2 pivot. Carefully slide trim assembly arm onto spring shaft. Position trim assembly below, and attach it to, C177-2 pivot with NAS6603-26 bolts, two AN960-10L washers and two MS21042L08 nuts. Torque bolts per Section 1.320.

b) Install AN316-4R nut finger tight on spring shaft, then install B330-13 palnut and torque palnut per Section 1.320. Move cyclic to left and remove MT544-2 lateral spring assembly retainer.

c) Route trim motor wiring around front of and outboard of cyclic friction assembly. Connect trim motor wiring. Ty-rap wiring as required to prevent interference with flight controls.

d) Turn master battery and trim switches on.

e) Move cyclic to left stop and right stop and observe movement of trim motor arm throughout full range of travel. It must be free with no binding or interference. Turn master battery and trim switches off.

f) Install radio face plate, connect OAT and intercom system wires, and ty-rap as required. Close and secure upper console.

g) Connect cyclic box cover post light wire, guide carb heat assist actuating rod (if installed) thru hole in cover, and secure cover. Install cyclic friction knob and roll pin. Install carburetor heat control knob on ships with carb heat assist.

h) Install all panels.

i) Adjust trim controller per Section 14.710.

8.143 Longitudinal Cyclic Trim Assembly Removal (C055-6 or C055-10)

a) Remove cyclic stick assembly per Section 8.111, steps a) thru k). Alternatively, perform steps a) thru e) and g) of Section 8.111 and leave cyclic stick assembly installed.

b) Remove two NAS1352-08 screws connecting longitudinal cyclic trim assembly to cyclic stick. Remove trim assembly.

8.144 Longitudinal Cyclic Trim Assembly Installation (C055-6 or C055-10)

CAUTION

There are two trim controller part numbers: D140-1 and D140-2. D140-1 trim controller must be used ONLY with C055-2, -6 and -8 cyclic trim assemblies. D140-2 trim controller must be used ONLY with C055-9, -10 and -11 cyclic trim assemblies. Incompatible controller and trim assembly(s) will result in trim system failure.

a) Refer to Figure 8-4C. Install trim motor assembly on cyclic stick with NAS1352-08-12P screw NAS620-8L washer and MS21042L08 nut in lower position and lightly tighten. Pivot motor upward and install NAS1352-08-32P screw, C130-11 spacer (may be secured to motor with ty-rap to ease installation), C130-20 spacer (chamfer pointing aft), NAS620-8L washer, and MS21042L08 nut in upper position. Remove ty-rap used to position C130-11 spacer, if installed. Torque nuts to 20-25 in.-lbs (includes nut self-locking torque).

b) If removed, install cyclic stick assembly per Section 8.112 steps e) thru q). If cyclic was not removed, connect trim motor wiring and perform steps k) thru q) of Section 8.112.

c) Adjust trim controller per Section 14.710.

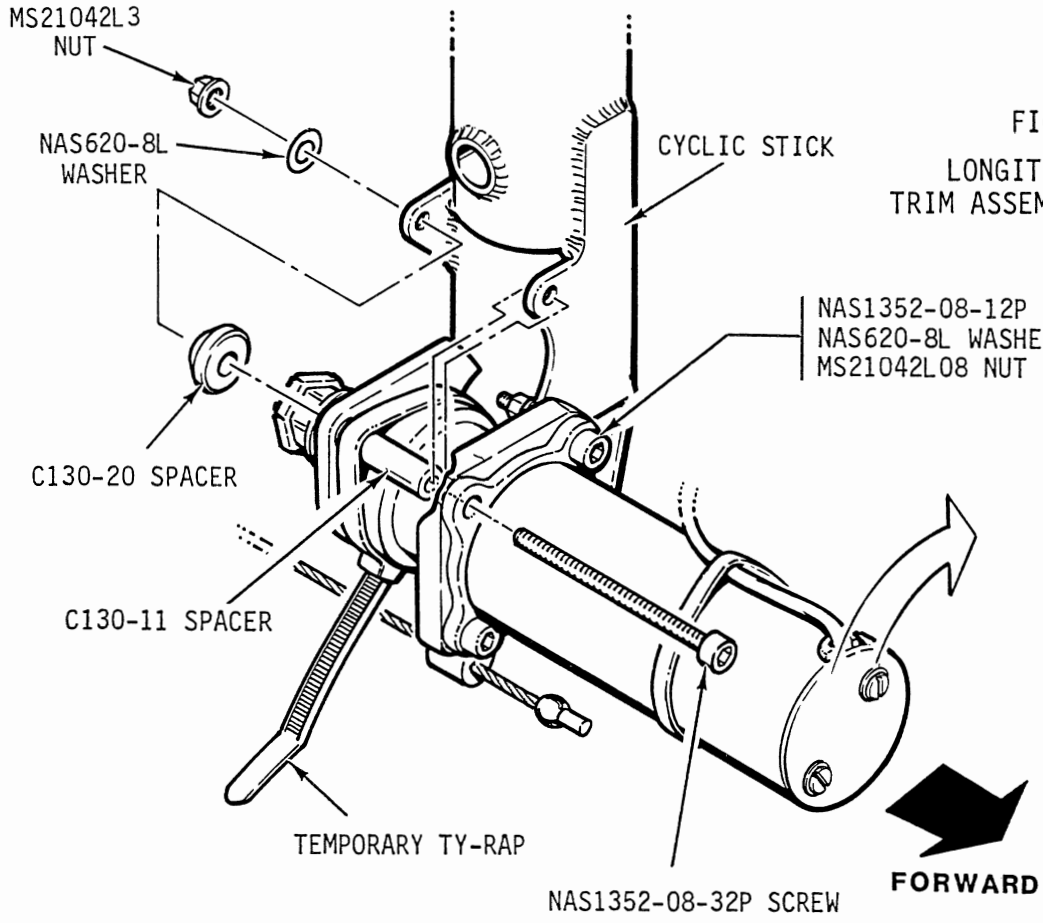


FIGURE 8-4C
LONGITUDINAL CYCLIC
TRIM ASSEMBLY INSTALLATION

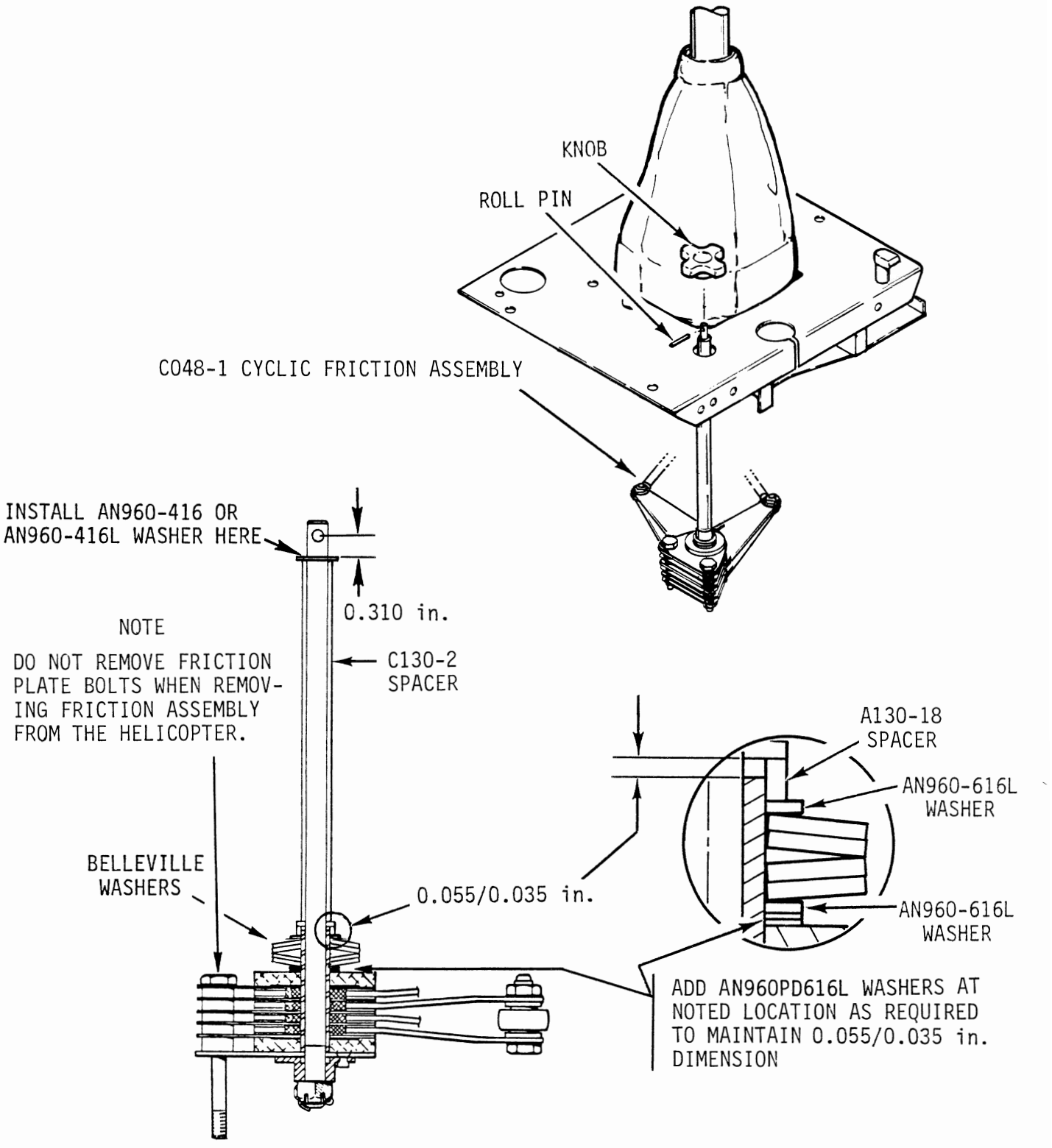


FIGURE 8-4D CYCLIC FRICTION ASSEMBLY AND ADJUSTMENT

8.150 Cyclic Friction Assembly

The cyclic friction assembly is located below the forward left corner of the cyclic box. Turning friction knob clockwise applies friction to both longitudinal and lateral cyclic axes. Adjustment is required if friction cannot be applied.

8.151 Cyclic Friction Adjustment

a) Turn friction knob counter-clockwise until it stops.

b) Remove roll pin connecting knob to shaft.

c) Lift knob off shaft.

d) Install AN960-416 or -416L washer, as required, per Figure 8-4D so knob rotates 1/8 to 1 turn before adding friction. With friction on, force required to move cyclic in a lateral direction should be 7-13 lb (measured at grip) with trim motors in neutral position.

e) Replace knob and install roll pin.

f) Move flight controls throughout complete travel. Verify no binding or clearance problems exist.

8.160 C121-7 Push-Pull Tube

8.161 C121-7 Push-Pull Tube Removal

a) Remove aft belly panel.

b) Remove mast fairing.

c) Remove two plugs located in aft right baggage compartment.

d) Remove NAS6605-46 bolt attaching C121-7 push-pull tube rod ends to C176-2 yoke.

e) Disconnect bolts fastening C121-7 push-pull tubes to swashplate.

f) Tape sheet metal edges to prevent push-pull tube damage.

g) Position swashplate and rotor to slide C121-7 push-pull tube up and clear. Mark right and left tubes for reinstallation.

h) Inspect push-pull tubes and sleeves for damage per Section 8.162.

i) Inspect push-pull tube guide rollers for wear. Replace guide rollers if worn.

NOTE

If push-pull tube is replaced, adjust rod ends to obtain same center-to-center length or main rotor flight controls will require rigging per Section 10.

8.162 C121-7 Push-Pull Tube Inspection/Repair

a) Nicks, cuts or scratches in tube which are longitudinal and no more than 0.010 inch deep, or across tube and no more than 0.005 inch deep, may be polished out.

b) Tubes dented or flattened more than five percent of diameter must be replaced.

c) Maximum tube wear at guide is 0.015 inch per wall after polishing wear ridges. Epoxy prime repair surfaces before sleeve installation. Any tube wear requires new sleeve installation.

d) Replace tube worn in excess of 0.015 inch after polishing.

8.163 C121-7 Push-Pull Tube Sleeve Installation

NOTE

Repair any wear damage on C121-7 push-pull tube per Section 8.162 prior to the push-pull tube sleeve installation.

a) Clean push-pull tube with MEK or acetone.

b) Apply tape to restrict adhesive to a six-inch long area beginning 30.5 inches from lower end of push-pull tube (not end of rod end).

c) Test paint for paint bubbling; apply 1-inch band of B270-3 adhesive to one end of six inch area. If paint bubbles, remove paint and apply epoxy primer to area before applying adhesive.

WARNING

Adhesive to be applied to complete area under push-pull tube sleeve.

d) Apply adhesive supplied in kit to entire six-inch long area. (Adhesive will quickly set and become stringy. Brush on thin coat of adhesive without large lumps as rapidly as possible).

NOTE

Sleeve must be installed within two minutes after adhesive is applied.

e) Slide sleeves onto tube and center on adhesive.

f) Rotate tube and apply heat using up to 1200-watt heat gun to evenly shrink sleeve and produce a smooth surface.

CAUTION

DO NOT apply heat continuously to same area.

8.163 C121-7 Push-Pull Tube Sleeve Installation (cont'd)

g) Allow to cool and apply adhesive to seal end of sleeve. Do not allow adhesive at sleeve ends above surface of sleeve or sleeve will be damaged or will not enter guide during installation.

8.164 C121-7 Push-Pull Tube Sleeve Inspection

Visually inspect sleeve for wrinkles, pin holes, bubbles, gouges, torn areas, etc. Replace sleeve if any damaged or suspect areas are found.

8.165 C121-7 Push-Pull Tube Installation

CAUTION

Exercise extreme care when installing C121-7 push-pull tube into guide to prevent damage to push-pull tube sleeve.

a) Install C121-7 push-pull tube and hardware per Figure 8.4F.

b) Attach C121-7 push-pull tubes to swashplate.

c) Reinstall mast fairing. See Figure 8-4E.

NOTE

Locate and tighten clamp holding lower fairing rib to mast tube assembly prior to closing.

d) Remove protective tape from sheet metal edges used to protect push-pull tubes during installation and close mast fairing.

e) Check full travel clearances of flight controls.

f) Verify fasteners are torqued.

g) Install panels and baggage compartment plugs.

h) If push-pull tube rod end center-to-center dimension was changed, check main rotor rigging per Section 10.

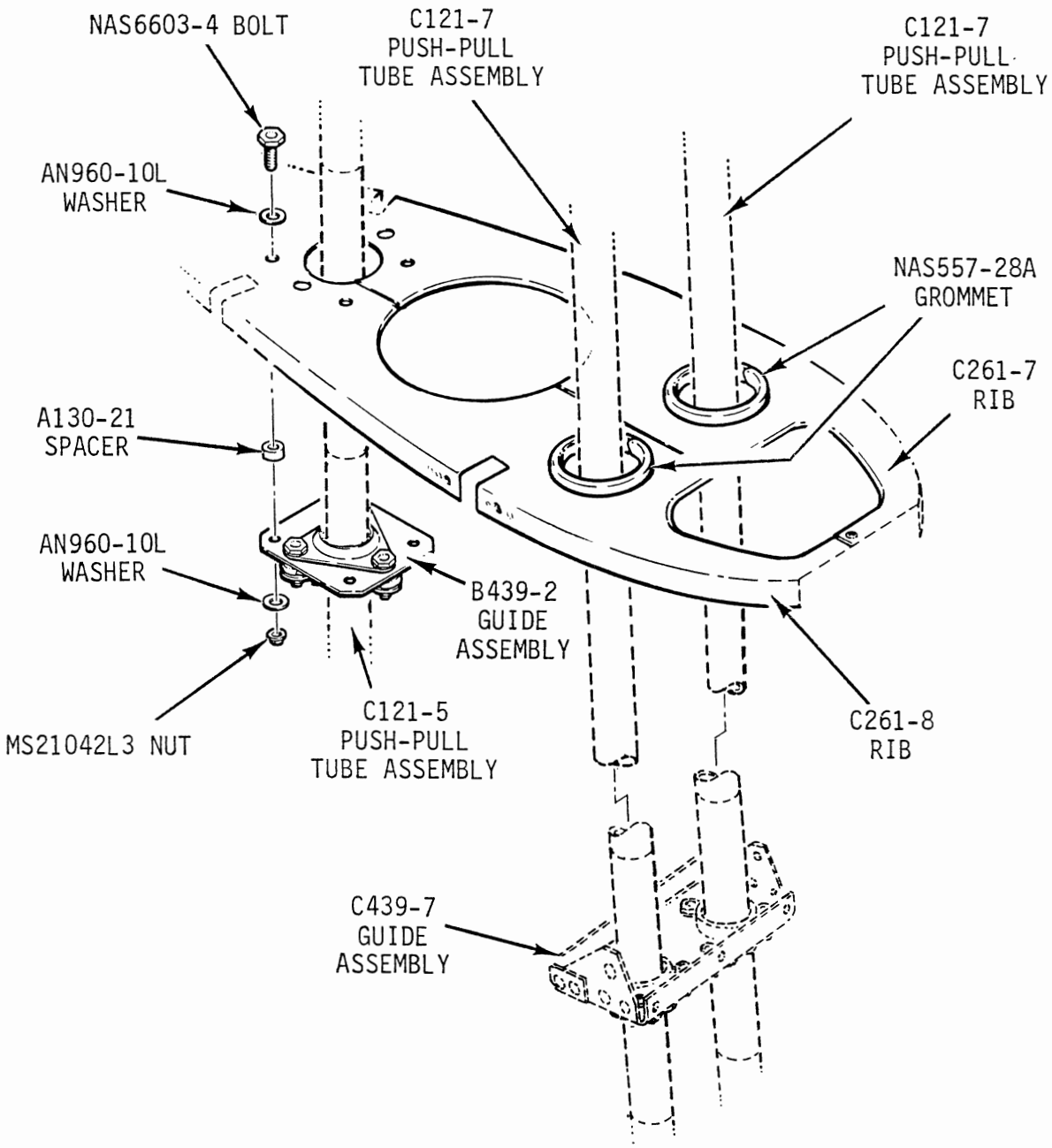


FIGURE 8-4E PUSH-PULL TUBES AND GUIDES
(Electric Trim System only)

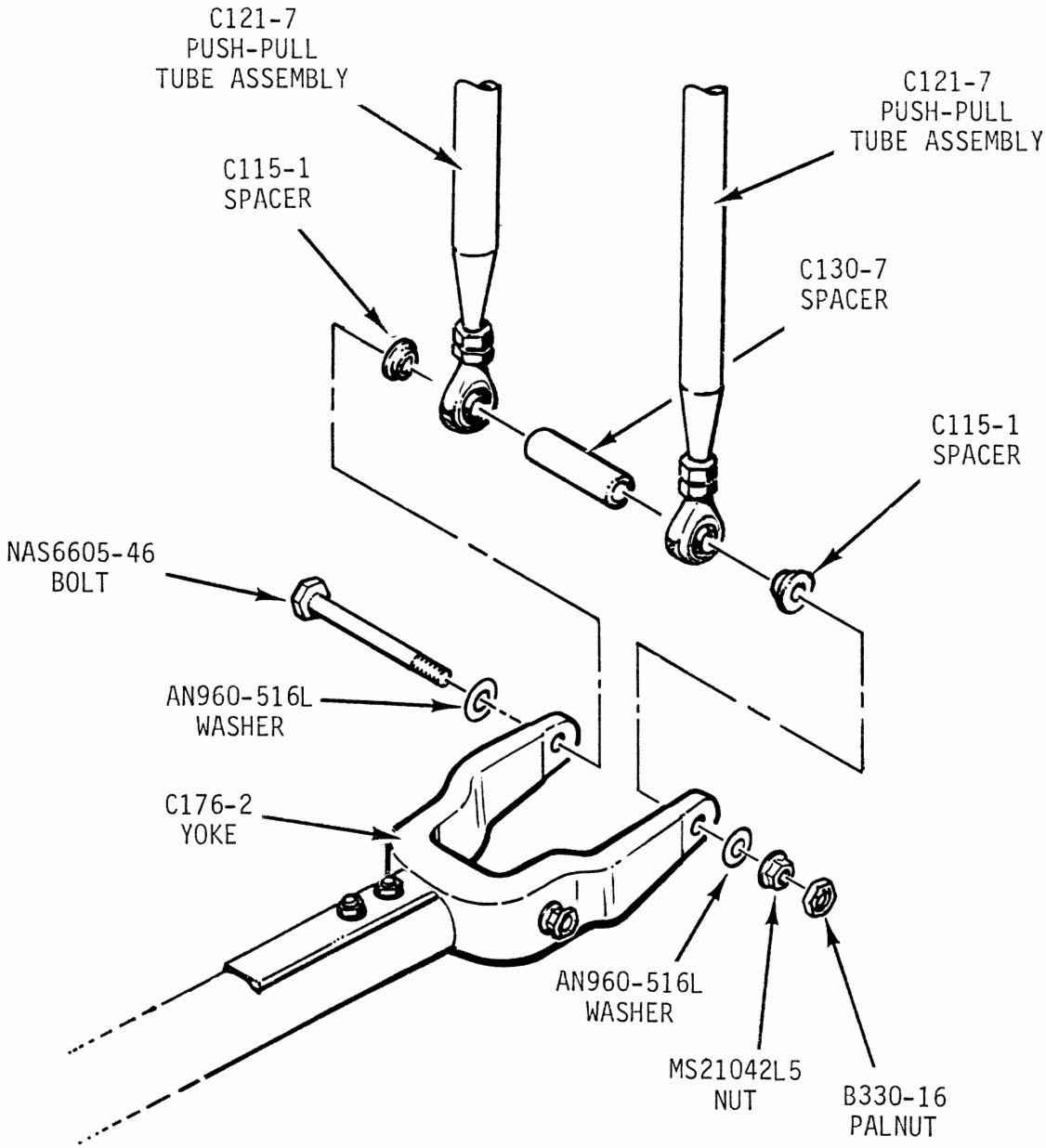


FIGURE 8-4E C121-7 PUSH-PULL TUBE ASSEMBLY INSTALLATION

8.200 COLLECTIVE CONTROL

8.210 Collective Stick Assembly

8.211 Collective Stick Removal

a) Remove forward horizontal panel, aft vertical panel, both collective boot covers, and the collective cover located behind forward left seat back.

b) Install the MT544-1 spring retainer on the collective spring located at the vertical tunnel while collective is in full down position.

c) Disconnect forward end of C121-19 Push-Pull tube from the collective by removing NAS6604-9 bolt.

d) Unplug the governor motor wiring located near left side of collective stick.

e) Disconnect collective stop from the anchor by removing the NAS6603-5 bolt and disconnecting the overtravel spring from the collective.

f) Remove one NAS6604-17 bolt which connects the collective assembly to the fuselage located behind the pilot's seat on the right keel panel.

g) Remove the three screws holding the C303-1 support at the left end of the collective. The support is to be removed with the collective assembly.

h) Remove collective.

8.212 Collective Stick Installation

a) Assemble A332-1 friction lever per Figure 8-5. The spring washers, item 14, should be assembled with their concave sides together. The two washers, item 13, are installed with the grey Teflon® coated surface against the A333-1 stop (item 12). The A332-1 lever is threaded onto the NAS1352-4-24P screw as the screw starts to protrude from the attachment fitting.

NOTE

See collective friction adjustment for finalizing friction assembly after completion of collective installation. Refer to Section 8.224.

b) Connect C303-1 support to collective stick, if required. Install NAS6604-11 bolt and attaching hardware. Torque per Section 1.320.

c) Install collective stick into rotorcraft.

d) Connect collective inboard attach bolts. Torque to per Section 1.320.

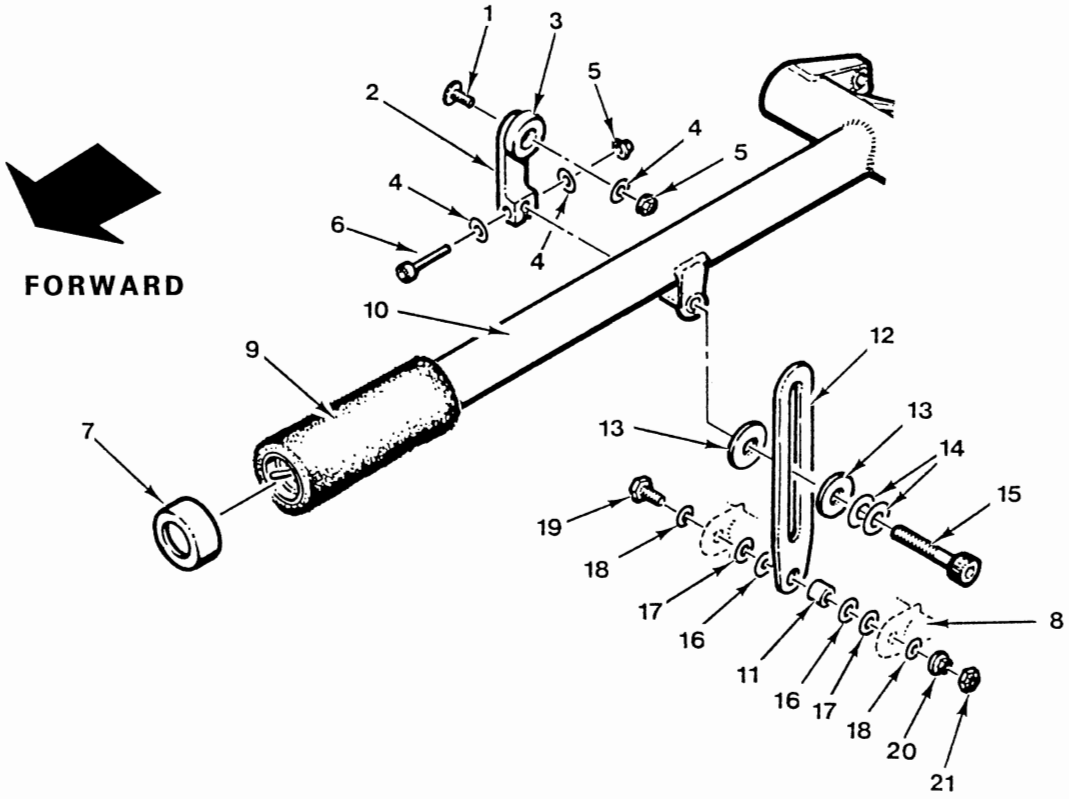


FIGURE 8-5 COLLECTIVE FRICTION ASSEMBLY

NUMBER	PART NUMBER	DESCRIPTION	NUMBER	PART NUMBER	DESCRIPTION
1	MS27039C0806	Screw	13	A141-20	Washer
2	A332-1	Lever	14	B0500-022-S	Belleville Washer
3	A431-1	Knob	15	NAS1352-4-24P	Screw
4	AN960-8L	Washer	16	AN960-416	Washer (A/R)
5	MS21042L08	Nut	17	AN960-416L	Washer (A/R)
6	NAS1352-08-12P	Screw	18	AN960-10L	Washer
7	A959-2	End Cap	19	NAS6603-5	Bolt
8	C348-1	Anchor	20	MS21042L3	Nut
9	A601-1	Grip	21	B330-7	Palnut
10	C758	Collective Assy			
11	A130-4	Spacer			
12	A333-1	Stop			

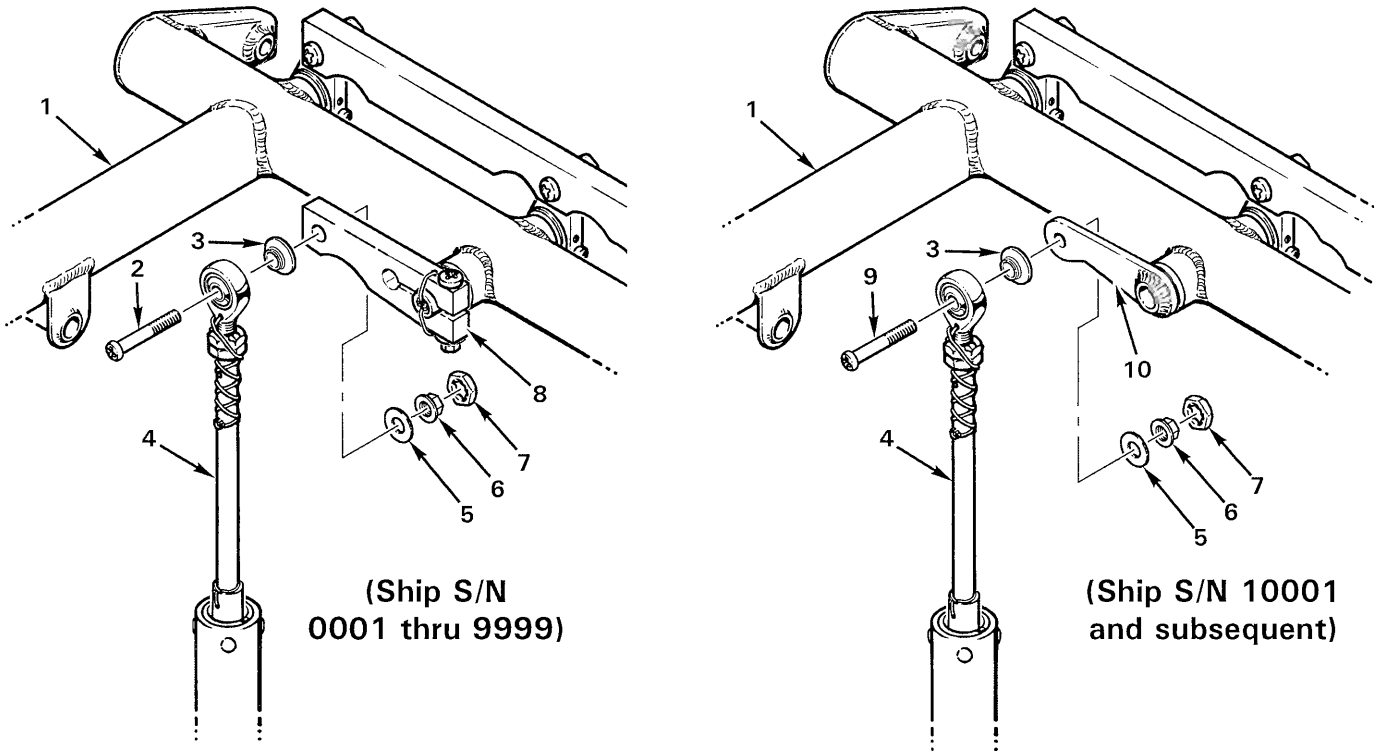


FIGURE 8-6 UPPER OVERTRAVEL SPRING INSTALLATION

NUMBER	PART NUMBER	DESCRIPTION
1	C758	Collective Assembly
2	A486-1	Screw
3	A341-1	Spacer
4	A327-1	Overtravel Spring Assembly
5	NAS1149F0332P	Washer
6	MS21042L3	Nut
7	B330-7	Palnut
8	C342-1	Arm Assembly
9	A486-4	Screw
10	C341-1	Arm Weldment

8.212 Collective Stick Installation (cont'd)

e) Connect left support held in place by one upper MS37039C1-08 screw, AN960-10L washer and MS21042L3 nut. Install two lower MS27039C0806 screws, AN960-8L washers and MS21042L08 nuts.

f) Install lower end of A333-1 stop to the C348-1 anchor. When installing A333-1 stop onto the A130-4 spacer, add AN960-416 and 416L washers on either side of stop as required to align stop with collective and to obtain 0.001 to 0.035 inch axial play. Torque nut per Section 1.320. Install palnut and check for binding and axial play.

g) Connect C121-19 Push-Pull tube to collective. Torque NAS6604-9 bolt per Section 1.320.

CAUTION

The NAS6604-9 bolt at the forward end of the C121-19 push-pull tube must be installed so the bolt head is toward the left side of the helicopter. Refer to Figure 8-1.

h) Connect governor motor plug to the connector.

i) Remove the MT544-1 spring retainer from the collective spring assembly.

j) Install the A327-1 overtravel spring to the collective arm (see Figure 8-6).

NOTE

Use special A486 screw and A341-1 spacer. With screw head against rod end ball, install spacer with large diameter against collective arm. Torque to 28 in.-lb plus nut drag and install palnut.

WARNING

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

k) For rigging of throttle correlation, see Section 10.150.

l) Verify all bolts and fasteners torqued.

m) Install all panels.

8.213 Pilot-Adjustable Collective Friction (see Figure 8-5)

1. Loosen screw (6) on friction lever.

2. a. Manual controls - Hold friction lever knob 0.3-0.6 inch aft of full-forward position. Adjust screw (15) until washers (13) cannot be rotated with fingers then tighten friction lever screw (6).

   b. Hydraulic flight controls - Hold friction lever knob fully aft against collective stick. Adjust screw (15) to produce a force of 18-22 pounds at collective grip, then tighten friction lever screw (6).

8.214 Fixed Collective Friction Adjustment (manual controls only, see Figure 8-3)

1. Remove vertical center panel between aft seatbacks.

2. a. Manual controls - see Figure 8-3. Tighten bolt (19) as required to eliminate feedback load through collective without being excessive.

   b. Hydraulic flight controls - With carburetor heat LOCKED and pilot-adjustable collective friction fully off (zero friction), adjust NAS6606 bolt as required to produce 4-5 pounds (average of both directions) force at collective grip within servo deadbands.

3. Adjust pilot-adjustable collective friction per Section 8.213.

8.220 Collective Spring Assembly (manual controls only, see Figure 8-8)

The collective spring assembly is installed to balance the collective control forces produced in flight by the main rotor. The spring in the C038-5 or C038-6 spring assembly may be changed or adjusted to balance the collective control after main rotor blade change.

WARNING

When collective spring is compressed and retaining rings are installed, extreme care must be taken not to remove retaining rings unless suitable safety device is used to slowly relieve tension (see Figure 8-8).

8.221 Collective Spring Removal & Servicing

1. Remove aft vertical center panel between aft seat backs.

2. Place the collective in the full down position. Install 3 MS16633-2018 retaining rings in grooves on guide rods. If necessary, loosen locking nuts and rotate spring until grooves in guide rods are exposed. Carefully raise collective until retaining rings contact cap.

WARNING

Spring is under compression.

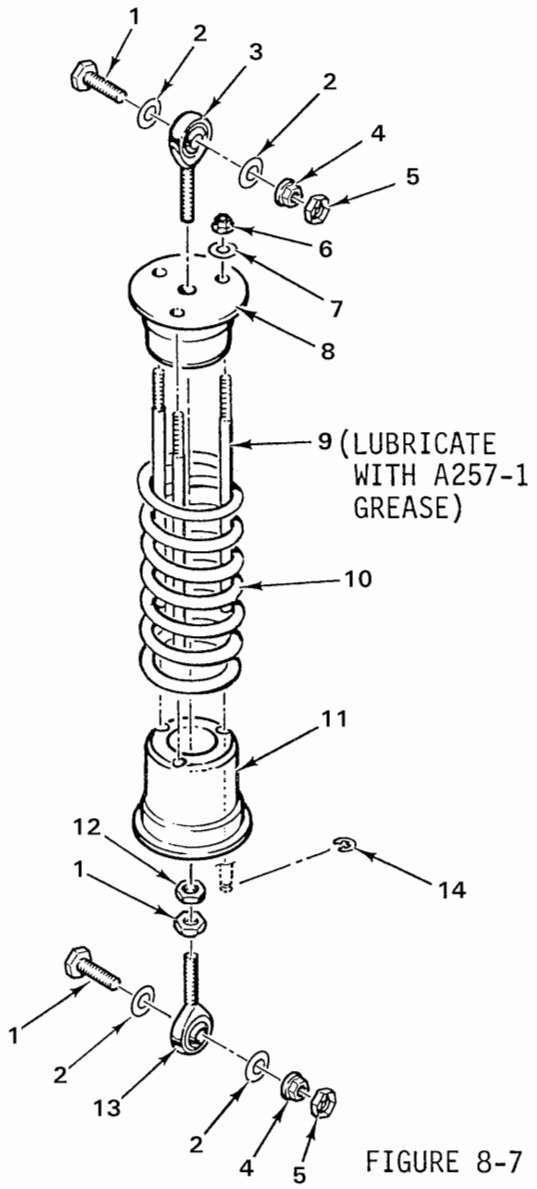


FIGURE 8-7 C038-5 AND -6 COLLECTIVE SPRING ASSEMBLY

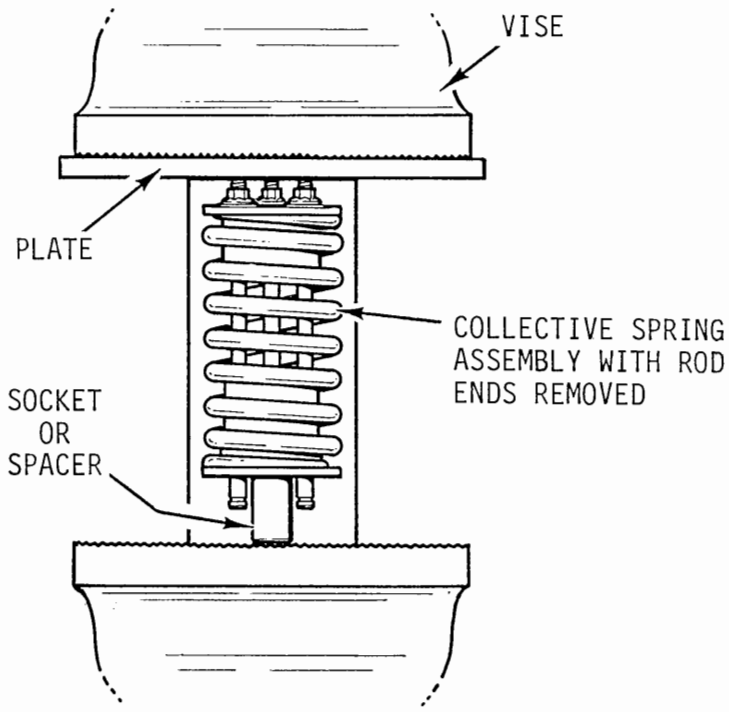


FIGURE 8-8

SUGGESTED METHOD FOR RELIEVING SPRING COMPRESSION

NUMBER	PART NUMBER	DESCRIPTION	NUMBER	PART NUMBER	DESCRIPTION
1	NAS6604-7	Bolt	10	A429-11	Spring (Strong; for C038-5 Assy)
2	AN960-416L	Washer		A429-12	Spring (Medium; for C038-6 Assy)
3	B292-4	Rod End (left-hand thread)		A429-13	Spring (Weak; for C038-7 Assy)
4	MS21042L4	Nut	11	C426-2	Cap
5	B330-13	Palnut	12	AN316-4R	Nut
6	MS21042L3	Nut	13	A127-4	Rod End
7	AN960-PD10L	Washer	14	MS16633-3018 (or -2018 or -1018)	Retaining Ring(used for removal and installation only)
8	C426-1	Cap			
9	C428-2	Rod			

8.221 Collective Spring Removal & Servicing (cont'd)

3. Remove bottom spring attach bolt.

4. Disconnect spring assembly upper attach bolt and remove spring assembly.

5. Remove rod ends from spring assembly and inspect. Verify threaded shanks are straight and play is with Section 2.120 limits.

6. Install spring assembly in vise per Figure 8-8. Remove retaining rings and decompress spring.

7. Clean C426-2 lower cap and inspect 0.194 inch diameter guide rod holes. Replace cap if holes are elongated, tapered, or greater than 0.204 inch diameter (a suitable size drill bit shank may be used as a go/no-go gauge).

8. Clean guide rods and inspect visible portions. Guide rods must be straight, cylindrical, and smooth. Replace guide rods if bent, tapered, worn or rough.

9. Lubricate guide rods with A257-1 grease (ref. Section 1.470) and reassemble spring assembly in reverse order.

8.222 Collective Spring Installation

WARNING

Install with nut end of guide rods pointing up (see Figure 8-7).

WARNING

When installing the C038 spring assembly, both rod ends must extend an equal number of turns (B292-4 rod end has left-hand thread). Failure to ensure both rod ends protrude equally can cause either one to run out of threads during adjustments and can cause bodily harm.

1. Connect B292-4 upper rod end to C427 support assembly and torque NAS6604 bolt per Section 1.320.

2. Move collective to align rod end into C326 bellcrank. Install bolt and torque per Section 1.320.

3. After installation of spring assembly, remove all three retaining rings from guide rods.

8.222 Collective Spring Installation (cont'd)

4. Verify coils are not binding with collective stick full down. Adjust spring assembly as required per Section 8.223.

WARNING
Failure to remove retaining rings or allowing spring coils to bind can limit control travel.

5. Operate collective through its full range of travel and check for any interference or binding.

6. Install removed panels.

8.223 Collective Spring Adjustment

Small force adjustments may be made by extending or contracting overall length.

1. Secure collective fully down.

2. Remove panel between aft seatbacks.

3. Loosen palnut and jam nut on A127-4 rod end at bottom of spring assembly.

4. Rotate spring assembly to increase or decrease collective-up force (lower rod end is right-hand thread and upper rod end is left-hand thread). Extending rod ends increases collective-up force; screwing rod ends in decreases collective-up force.

5. Tighten jam nut per Section 1.320.

WARNING
Ensure spring coils do not touch with collective full down after making adjustment. Spring coils that touch can limit flight control travel.

6. While observing collective spring, move collective fully up and down and verify no interference.

7. Install removed panels.

8.230 RPM Governor System

The governor system senses engine RPM and applies corrective input forces to the throttle; when RPM is low, governor increases throttle and vice versa. Throttle inputs are through a friction clutch, which can be easily overridden by the pilot. The governor is active from 79% - 111% engine RPM and can be switched on or off by the pilot using the toggle switch on the end of the right seat collective control.

The governor system is designed to assist the pilot in controlling the RPM in the normal operating range. It may not prevent over- or under-speed conditions generated by aggressive flight maneuvers. Within the active range there is a 1%-wide deadband from 101% - 102% where the governor will not take action provided the rpm is steady.

The governor system consists of the following major components:

1. The D278 governor controller, a solid-state analog-circuit control unit mounted behind the left aft seat backrest. The controller senses engine RPM via tachometer points in the engine right magneto (helicopter left side) and provides a corrective signal to the governor assembly. All governor controllers operate on 14 volts; 28-volt ships utilize a 28- to 14-volt converter to power the controller.

2. The 14-volt B247-5 governor assembly, attached to the collective stick assembly behind the left front seat. When activated by the governor controller, the governor gearmotor and attached worm gear drives a friction clutch connected to the throttle.

3. Signal and power wiring.

8.231 Governor Controller Removal

1. Remove left, aft backrest to gain access to controller.

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

2. Disconnect electrical connector.

3. Remove four screws securing governor controller to shelf.

8.232 Governor Controller Installation

> **CAUTION**
>
> R44 helicopters require the D278-1 controller. R44 II helicopters require the D278-2 controller.

1. Secure governor controller to shelf.

2. Connect electrical connector.

3. Install backrest.

8.233 Governor Assembly Removal

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

WARNING

No adjustment of the friction clutch is permitted. No replacement of the gear motor is permitted. If the friction setting is incorrect, or the gear motor operates incorrectly, remove the complete assembly and return to RHC.

a) Remove collective stick assembly per Section 8.211.

b) Remove the NAS6603-6 bolt from the connecting rod.

c) Remove one NAS1351-4-28P screw and NAS1291-4 nut.

d) Cut safety wire and remove two AN503-8-4 screws.

e) Remove B247-5 governor assembly.

8.234 Governor Assembly Installation

a) Connect the connecting arm to the governor assembly.

NOTE

DO NOT change the length on the connecting rod. The rod ends center-to-center distance should be 2.90 inches - 2.93 inches.

b) Install two AN960-10L washers, one between rod end and governor motor arm and one under the nut. Torque nut and palnut per Section 1.320.

c) Install the NAS1351-4-28P screw and torque per Section 1.320.

d) Install the two AN503-8-4 screws and torque to 27 in.-lb and safety wire with 0.020 inch diameter safety wire.

e) Install collective stick per Section 8.212.

8.239 Governor Troubleshooting

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

When switched on, the governor is active from 80% to 112% engine rpm. Below 80% and above 112% engine rpm the governor will take no action.

When operating in the active range, the governor will attempt to maintain engine rpm at approximately 102% ± 0.5% (D278-1 controller) or ± 0.75% (D278-2 controller). The edges of this governed rpm window - called a "deadband" - may be detected when the helicopter is in stable (no gusts), straight and level flight as follows:

1. Gently hold throttle and very slowly increase rpm (do not exceed 104%). Note and record engine rpm indication when governor input (subtle throttle resistance) is encountered.

2. Gently hold throttle and very slowly decrease rpm (do not go below 99%). Note and record engine rpm indication when governor input (subtle throttle resistance) is encountered.

3. Subtract second reading from first reading. Result should be approximately 1% (D278-1) or 1½% (D278-2).

A deadband not centered on 102% is indicative of a governor controller problem.

A wider-than-normal deadband, but still centered on 102%, is usually indicative of excessive throttle linkage friction and/or insufficient governor friction.

Check throttle friction by disconnecting overtravel spring assembly upper rod end from C341/C342 arm and attaching a spring scale to the rod end. With throttle arm in idle position, slowly pull up overtravel spring assy with spring scale and note maximum 4 pounds moving friction prior to full open throttle. Excessive throttle linkage friction can be caused by binding rod ends, control interference, carburetor throttle shaft bushing elongation, or binding carburetor accelerator pump (typically binds in one direction only).

Check governor friction with collective down, collective friction on, overtravel spring assy upper rod end disconnected from C341/C342 arm, and arm positioned horizontally. Attach a spring scale to hole in the arm and, with scale held tangential to arm, slowly pull on scale and note both the breakaway and the moving frictions. Breakaway friction is typically 0-0.5 pound greater than moving friction. Breakaway friction 1 pound or greater than moving friction may indicate damaged or contaminated governor friction clutch. Moving friction must be minimum 8 pounds until arm stops moving. Insufficient moving friction can be caused by wear, contamination, or loss of spring rate.

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

8.239 Governor Troubleshooting (cont'd)

Erratic operation is usually indicative of wiring damage or tachometer point problems. Wiring damage may be evidenced by crushing, pinching, or abrasion, all of which can result in grounding of one or both center wire conductor(s) to the shielding or to structure. Tachometer point problems may be caused by contamination (due to over-lubrication of magneto cam follower felt), oxidation (such as from an obstructed vent plug or leaking magneto drive seal), or loose contact(s), in addition to installation or assembly errors.

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

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

8.300 JACKSHAFT AND SUPPORT STRUTS

8.310 Jackshaft (See Figure 8-9)

8.311 Jackshaft Removal

NOTE

Rigging check is not necessary if jackshaft support strut rod ends and push-pull tube rod ends are not moved.

a) Disconnect the push-pull tubes from the jackshaft.

b) Disconnect the two jackshaft support bolts at the upper support rod ends.

c) Remove jackshaft.

8.312 Jackshaft Installation

a) Install jackshaft to strut rod ends. Aft support rod end requires a C141-1 safety washer between the rod end ball and bolthead.

b) Torque nuts per Section 1.320 and install palnut.

c) Connect the C121-3 and -5 push-pull tubes to jackshaft. Both push-pull tube attach boltheads point forward. The forward C121-3 push-pull tube rod end requires a C141-1 safety washer and C115-1 spacer between the rod end and bolthead. The aft C121-5 push pull-tube rod end requires a C141-1 safety washer between the rod end and bolthead.

d) Torque nuts per Section 1.320 and install palnut.

e) Verify no binding or interference with control system exists throughout flight control travel.

8.320 Strut Assembly (Jackshaft Support)

8.321 Jackshaft Strut Removal

a) Remove jackshaft per Section 8.311.

b) Remove the support struts from the main rotor gearbox fittings. Disconnect the aft vertical strut upper rod end to release the aft strut from the C345-1 strut weldment.

8.322 Jackshaft Strut Installation (see Figure 8-9)

a) Install lower rod ends to the main rotor gearbox fittings as shown in Figure 8-9.

b) Reinstall the aft vertical strut upper rod end as shown in Figure 8-9. The rod end extension must be set to 0.93 ± 0.03 inch from the end of the strut to the center line of the rod end ball. (The dimension is the same for all six support rod ends.)

c) Install jackshaft and push-pull tubes per Section 8.312.

d) Verify that all bolts and jam nuts are torqued per Section 1.320.

JACKSHAFT INSTALLATION

NUMBER	DESCRIPTION
1	Jackshaft Assembly
2	Rod End
3	Washer
4	Nut
5	Palnut
6	Washer
7	Washer
8	Bolt
9	Palnut
10	Nut
11	Bolt
12	Bolt
13	Spacer
14	Washer
15	Tube Weldment
16	Nut
17	Rod End
18	Bolt
19	Washer
20	Nut
21	Palnut
22	Fitting
23	Washer
24	Strut Weldment
25	Spacer
26	Washer (Ref)
27	Push-Pull Tube Assembly (Ref)
28	Push-Pull Tube Assembly (Ref)

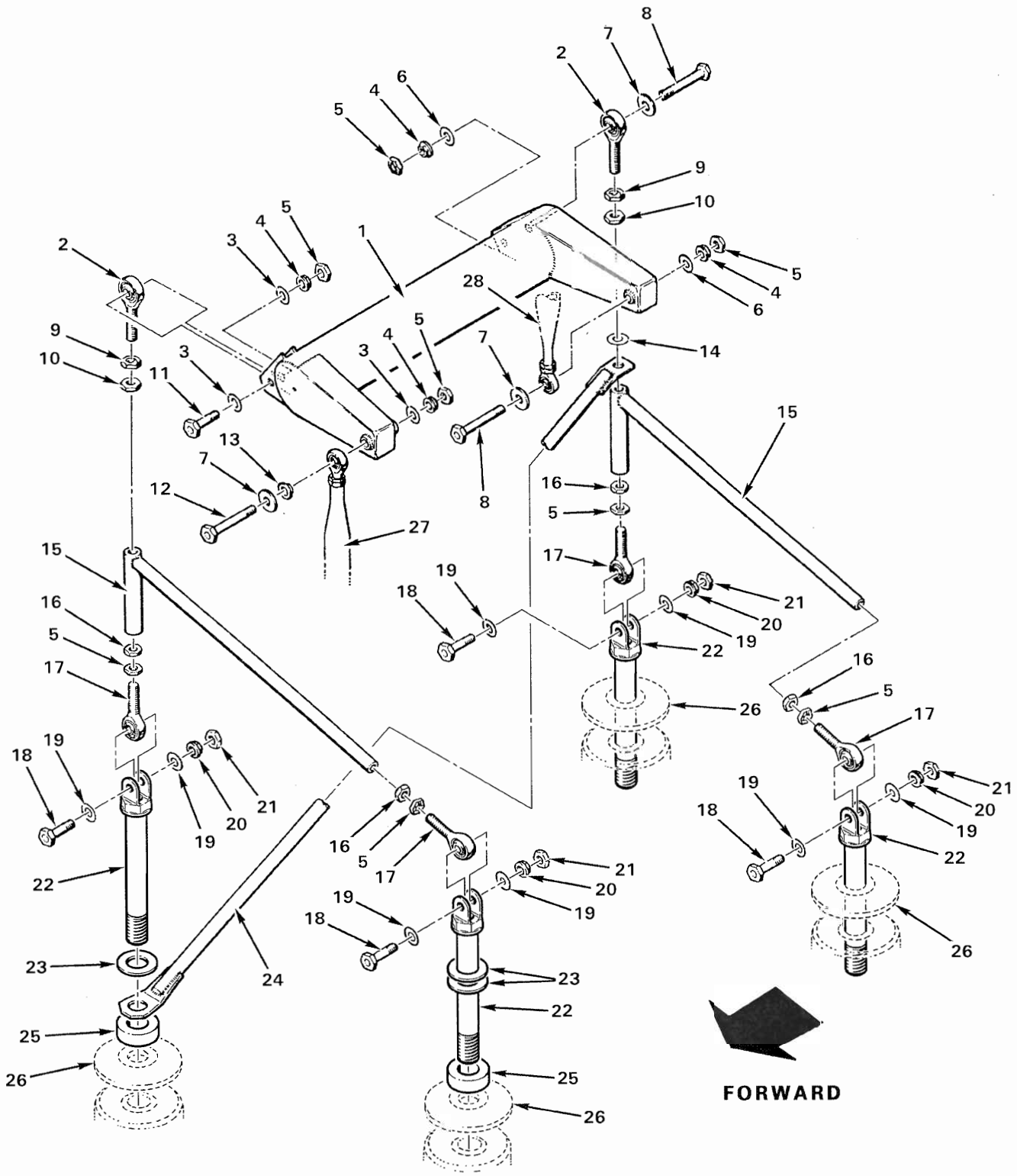


FIGURE 8-9 JACKSHAFT INSTALLATION

8.400 SWASHPLATE AND MAIN ROTOR PITCH LINKS

8.410 Swashplate

8.411 Swashplate Removal

NOTE
Rigging check is not required if push-pull tube rod end center-to-center dimension does not change.

1. Remove main rotor blades and hub per Sections 9.111 and 9.121.
2. Remove droop stops and teeter stops.
3. Disconnect upper C204 arm at C203 yoke.
4. Disconnect and remove C203 yokes and A210 key.
5. Remove swashplate boot by cutting plastic ty-raps.
6. Disconnect three push-pull tubes and rod end of lower forward A205 fork assembly from lower (non-rotating) swashplate.
7. Lift swashplate with attached fork and pitch links off slider tube.

8.412 Swashplate Installation (see Figure 8-10)

WARNING
R44 II (fuel injected) helicopters require two A205-7 forks, A600-6 manifold pressure gage, two C005-8 main rotor blade & spindle assemblies (two C016-5 main rotor blades & two C157-2 pitch horns), C006-5 main rotor gearbox, C008-4 tail rotor assembly (two C029-2 tail rotor blades), two C016-5 main rotor blades, C017-4 swashplate, three C121-31 push-pull tubes, two C203-5 yokes, C204-2 arm (stainless steel, lower), C204-3 arm (stainless steel, upper), C792-4 dual tachometer, D201-5 support weldment (forward hydraulic servos), and D204-8 support weldment (aft hydraulic servo).

1. Install swashplate onto slider tube assembly. Connect lower scissors' fork to left side of middle of three lugs on lower, non-rotating swashplate. Connect aft push-pull tube to right side of aft, single lug on lower swashplate. Torque per Section 1.320 and install palnuts.
2. Verify swashplate tilting friction per Section 8.413; adjust as required.
3. Slide swashplate boot over main rotor drive shaft and set in place.
4. Refer to Figures 8-13, 8-13A and 8-13B. Install C203 yokes on main rotor drive shaft upper flange using A210 key to index yokes to shaft. Finger tighten clamping hardware.

8.412 Swashplate Installation (cont'd)

NOTE
Round edge of A210 key to fit into slot in flange on C251 drive shaft.

5. Torque yoke clamping bolt securing A210 key first per Section 1.320 and install palnut.

6. If yoke clamping bolt opposite A210 key is an NAS6605 bolt, special torque per Section 1.330 and install palnut. If bolt is an NAS6604 bolt, torque per Section 1.320 (standard torque) and install palnut. A slight gap between yokes opposite A210 key is normal.

7. Install chord arm weights, if any. Torque per Section 1.320 and install palnut.

8. If required, fill remainder of rod end threaded hole in upper A205 fork with B270-4 or B270-13 sealant (see Section 1.480).

9. Refer to Figures 8-13 & 8-13A. Install upper A205 fork and C204 arm on C203 yoke and torque per Section 1.320. Verify pivot frictions on upper scissors are less than 5 inch-pounds with hydraulic controls, or less than 2.5 inch-pounds with manual controls; as required, replace bearings per Section 8.600 or change shim thickness. Verify bolt, arm, and clamped hardware in upper scissor's pivots rotate together. Install palnuts.

10. Verify bolt, arm, and clamped hardware in lower scissor's pivots rotate together. Connect forward push-pull tube rod ends to remaining lower lugs on swashplate. Torque per Section 1.320 and install palnuts.

11. Connect upper A205 fork rod end and lower rod end of C258 pitch link to interrupter-side swashplate ear. Torque per Section 1.320 and install palnut.

12. Position swashplate boot on rotating swashplate with inner lip contacting C203 yoke. Secure with ty-raps.

13. Attach two A255-3 counterweights and lower rod end of C258 pitch link to swashplate ear opposite interrupter. Torque per Section 1.320 and install palnut.

14. Install main rotor hub and blades per Sections 9.122 and 9.112.

15. Verify safety washers and C115 spacers installed on all rod ends per Figure 2-1. Torque stripe fasteners per Figure 2-1.

16. Verify no interference with control movement throughout flight control travel and swashplate movement corresponds with cyclic and collective movement.

17. Track and balance main rotor per Section 10.230.

SWASHPLATE ASSEMBLY

NUMBER	DESCRIPTION	NUMBER	DESCRIPTION
1	Bolt	22	Washer
2	Washer	23	Rod End
3	Counterweight (1.10 inch O.D.)	24	Boot
	Counterweight (1.90 inch O.D.)	25	Pitch Link (incl items 23, 32-34, 36 & 37)
4	Nut	26	Bolt
5	Palnut	27	Ty-rap
6	Bolt	28	Bolt
7	Washer	29	Ty-rap
8	Nut	30	Swashplate Assembly
9	Palnut	31	Bolt
10	Yoke Assembly (2 Req'd)	32	Palnut
11	Washer	33	Nut
12	Washer	34	Fitting
13	Bolt	35	Bolt
14	Washer	36	Link Assembly
15	Key	37	Nut
16	Bearing	38	Interrupter
17	Spacer or Journal	39	Rivet
18	Arm	40	Arm
19	Bolt	41	Counter Weight (0.70 inch O.D.)
20	Fork Assembly	42	Rivet (one per C258-4 Link Assembly)
21	Spacer	43	Link

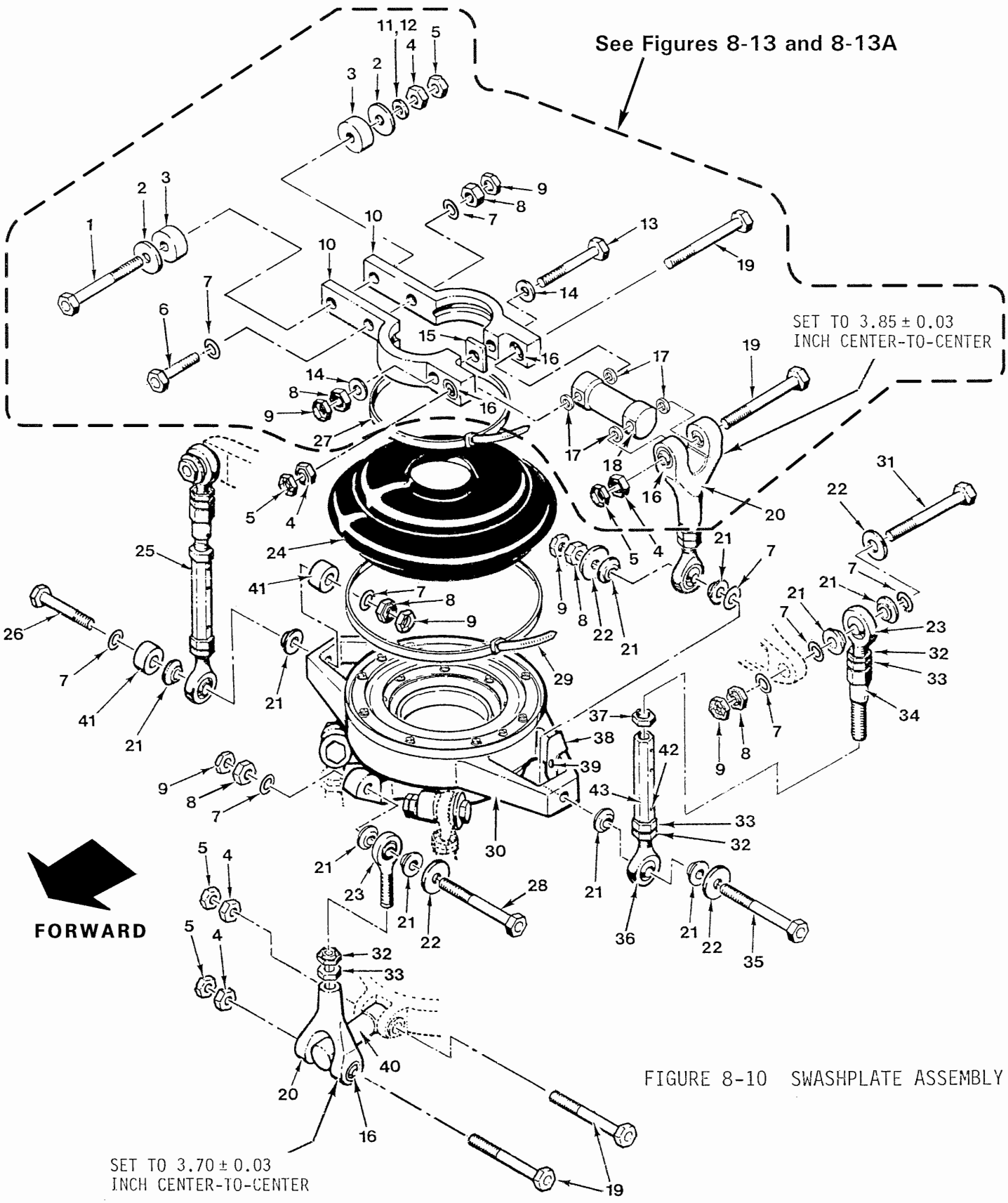


FIGURE 8-10 SWASHPLATE ASSEMBLY

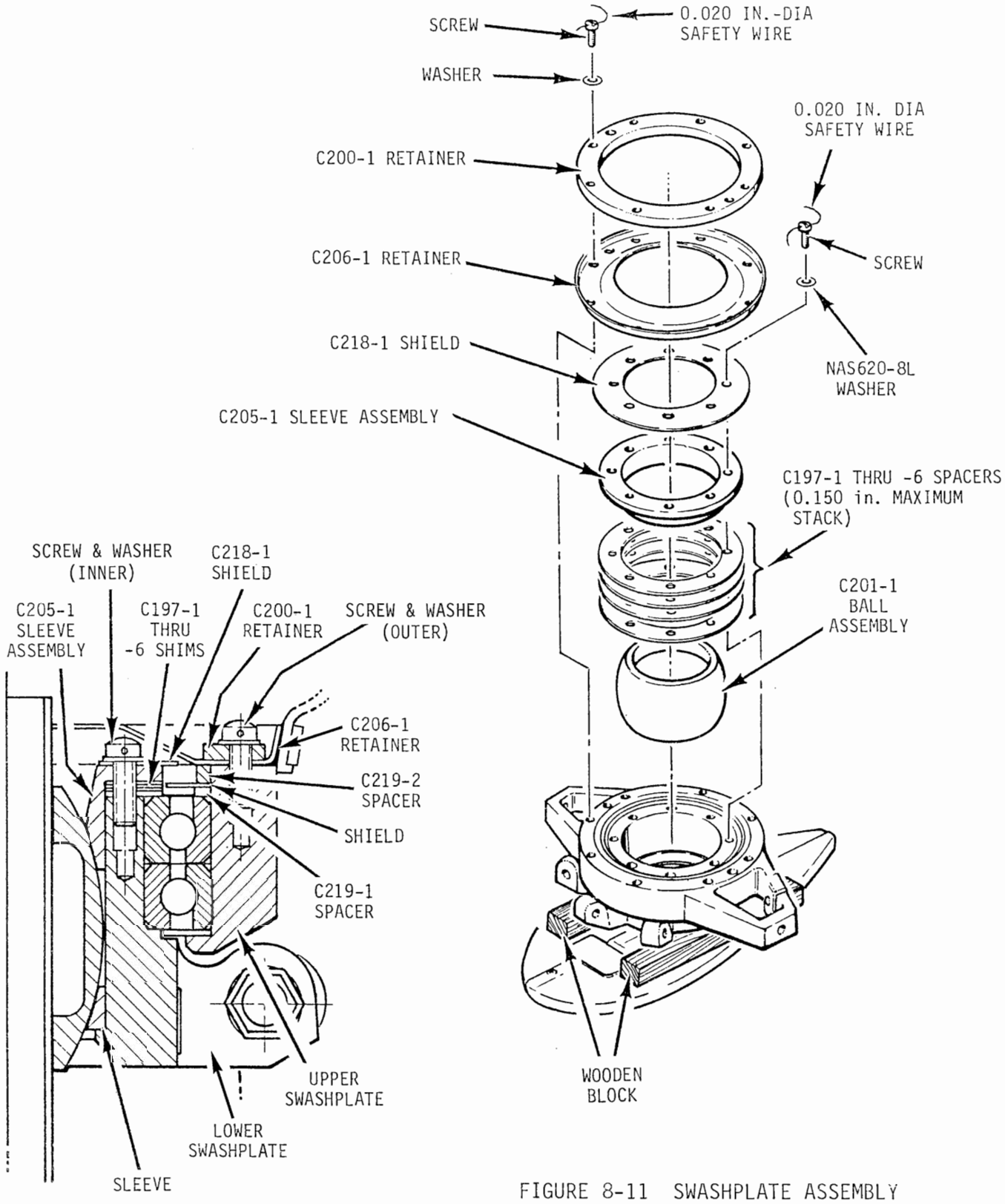


FIGURE 8-11 SWASHPLATE ASSEMBLY

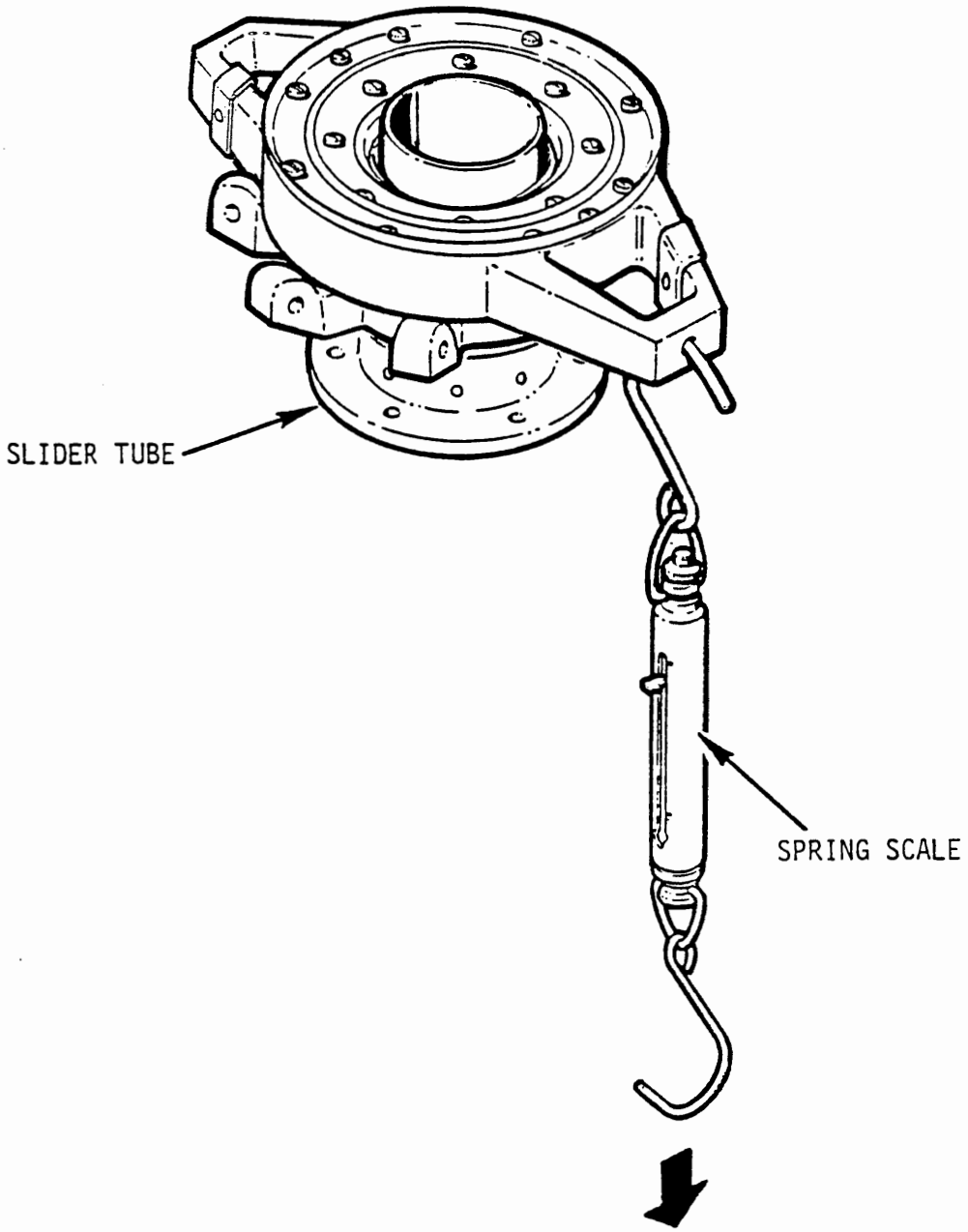


FIGURE 8-12 MEASURING SWASHPLATE TILTING FORCE

8.413 Swashplate Tilting Friction Adjustment

Swashplate tilting friction is established by C197-1 through C197-6 spacers controlling clamping force of Teflon-lined sleeves on the ball assembly.

1. Mark for reassembly and disconnect boot, pitch links and drive linkage (scissors) from upper swashplate and both forward push-pull tubes from lower swashplate

2. Align upper swashplate arms with lateral axis of helicopter and center cyclic stick. Using MT359-1 spring scale (or equivalent) connected to upper swashplate arm bolt hole per Figure 8-12, pull down and note scale reading while swashplate is moving; do not use breakaway reading. Force required to tilt swashplate must be free-without-looseness minimum to 5 pounds maximum.

3. To adjust friction, remove outer screws from upper swashplate and raise and secure retainers to allow access to inner screws. Remove inner screws securing sleeve to lower swashplate.

4. Raise sleeve and measure thickness of C197 spacer stack. Adjust spacer stack thickness as required, but not exceeding 0.150 inch, to achieve proper tilting friction. Decreasing spacer stack thickness increases tilting friction while increasing spacer stack thickness decreases tilting friction. All inner screws must be installed and torqued per Section 1.330 prior to measuring friction.

5. Safety wire inner screws with 0.020 inch diameter safety wire. Secure retainers to upper swashplate with outer screws, torque per Section 1.330, and safety wire.

6. Connect both forward push-pull tubes to lower swashplate, torque per Section 1.320, and torque stripe.

7. Connect both pitch links and drive linkage to upper swashplate (interrupter on same side as drive linkage), torque per Section 1.320, and torque stripe.

8.500 TAIL ROTOR CONTROLS

8.510 Tail Rotor Pedals

8.511 Tail Rotor Pedal Removal

1. Soak both front floor carpets with Prep-sol for 15-20 minutes, then lift carpet carefully from the floor on both sides and remove from the cabin. Caution: This is a flammable material. Follow manufacturer's safety precautions to prevent injury.

2. Remove the screws between the pedals holding the access plates to the floor and remove the plates.

3. Lift the console and disconnect the intercom system controller and the outside air temperature gauge wiring.

4. Remove radios, radio face plate and the radio rack by removing the screws which secure it to the sides of the console.

8.511 Tail Rotor Pedal Removal (cont'd)

5. Disconnect both pedal assemblies from the C343-3 and C343-5 push-pull tubes by removing two NAS6604-9 bolts.

> ***CAUTION***
>
> DO NOT remove the rod ends or change the length of the push-pull tubes.

6. Remove six NAS6603-20 bolts (three per side) which hold the A318-1 and -2 bearing block halves together.

7. Remove the lower bearing block halves.

8. Remove the tail rotor pedals one at a time by lifting one end and allowing the other to drop into the chin. They can be removed from either the right or the left side.

> NOTE
>
> On reassembly, the right pedal assembly is mounted forward in the bearing blocks and the left is mounted aft.

> NOTE
>
> Pedal blocks (upper and lower) are a machined matched set as indicated by matching letter or number on the upper and lower portion of blocks. DO NOT mix them or alignment problems may develop on installation.

8.512 Tail Rotor Pedal Installation

1. Fill the grooves in the pedal bearing blocks with A257-1 grease.

2. Install the pedal assemblies into the bearing blocks and torque the bearing block attach bolts per Section 1.320.

> NOTE
>
> If a force greater than 5 lbs is required to move pedals, check the bearing blocks to ensure they are matched correctly.

3. Connect both pedal assemblies to the push-pull tubes and torque the NAS6604-9 bolts to per Section 1.320 and install palnuts.

4. Install radio racks, radios and radio panel face plate.

5. Move the pedals through the full range of travel to ensure there is no interference or binding.

6. Secure console. Install the pedal cover plates and carpeting. Use B270-7 or -8 adhesive to attach carpeting.

8.520 C317 Lower Bell Crank

8.521 C317-2 Lower Forward Bell Crank Removal

a) Remove two screws securing the upper console. Lift up the console and disconnect intercom system controller and outside air temperature gauge wiring.

b) Remove radios, radio panel face plate and the radio rack which is secured with screws to the side panels.

c) Disconnect forward C343-3 and C343-5 push-pull tubes and aft C121-9 push-pull tube from the bell crank by removing all three NAS6604-9 bolts.

d) Remove four MS27039C0807 screws which secure the C349-1 support assembly to the forward keel panel.

e) Remove support and bell crank assembly from the ship.

f) Remove NAS6604-19 bolt which connects the bell crank to the support. Remove bell crank.

8.522 C317-2 Lower Forward Bell Crank Installation

This procedure also covers rigging of the lower push-pull tubes and pedal assemblies. If re-checking of rigging is not required, disregard rigging portions and follow installation sequences.

a) Install two A105-3 journals inside C317-2 bell crank. Place one A141-3 washer against the outside ends of the A105-3 journals upon assembly to the support.

Tighten pivot nut and check for smooth and free operation. Maximum spring scale drag of 2 lbs is acceptable to move the bell crank. Torque per Section 1.320.

If a force in excess of 2 lb is required to move the bell crank measure the distance between the A141-3 washers with the washers held tightly against the journals. Using a one inch diameter spotface tool with a 0.250 inch pilot in one A105-3 journal, lightly shave the outside face of each bearing 0.002 inch - 0.003 inch at a time. Assembly the bell crank on the support assembly. If a force in excess of 2 lb is required to move the bell crank, repeat above step.

b) Install the support assembly in the ship and secure it to the keel panels with four MS27039C0807 screws. Adjust the length of C343-3 push-pull tube rod ends center-to-center to 4.42 inch and adjust C343-5 rod ends center-to-center to 6.45 inch. Verify that the rod ends are engaged sufficiently by checking the witness holes with a piece of 0.020 inch safety wire.

8.522 C317-2 Lower Forward Bell Crank Installation (cont'd)

Connect all three push-pull tubes to C317-2 bell crank. Do not torque the NAS6604-9 bolts yet. The length of C121-9 push-pull tube must be set to 66.0 inch. Ensure the 121-9 push-pull tube is installed through the center of the C346-1 restraint at the mid span position.

The vertical C343-1 push-pull tube which connects C317-1 aft bell crank to C316-1 upper bell crank must measure 13.40 in. rod end center-to-center.

Connect fwd end of C121-9 push-pull tube to the C317-2 fwd bell crank and the aft end to C317-1 bell crank. Tighten the bolts but do not torque them yet. Connect one end of C343-1 push-pull tube to the C317-1 aft bell crank and the other end to C316-1 upper bell crank. Tighten the bolts but do not torque them yet.

Install a 3/16 inch diameter pin through the rigging hole located in the right aft passenger cargo compartment and push it through C317-1 bell crank's rigging hole. With rigging pin installed, adjust lengths of C121-9 and C343-3 push-pull tubes to obtain 2.90 in. between right pedal and right-hand stop.

After adjusting pedal travel, remove the rigging pin and apply full left pedal. With left pedal at stop, adjust length of C343-1 to obtain 0.10 - 0.20in. from C121-15 forward rod end to bulkhead. With left pedal at stop, adjust length of C121-17 push-pull tube to obtain 0.35 ± 0.03 inch between C031-1 pitch control assembly and face of the tail rotor gearbox end cap. Check all push-pull tube rod ends witness holes for engagement.

NOTE

It is permissible for the bell crank arm to touch and deflect acoustical foam, as long as it does not interfere with free movement and full travel of the controls.

c) Torque all attaching bolts per Section 1.320. Install palnuts and torque stripe fasteners.

8.522 C317-2 Lower Forward Bell Crank Installation (cont'd)

d) Check for smoothness and ease of operation. Move pedals full travel. Check for any interference between tubes, wires and structure.

e) If required, check complete tail rotor rigging if changes to C343-1, C343-3, C343-5, C121-9, C121-15 or C121-17 push-pull tube lengths have been made.

f) Verify all attach bolts and jam nuts torqued per Section 1.300.

g) Install radio rack, radio face plate, radios and all the panels which were removed.

8.523 C317-1 Lower Aft Bell Crank Removal

a) Install collective spring retainer or safety wire the collective spring per Section 8.221.

b) Remove collective spring per Section 8.221.

c) Disconnect C121-9 and C343-1 push-pull tubes by removing respective NAS6604 bolts from the C317-1 bell crank.

d) Disconnect A205-3 fork assembly from the C326-1 bell crank assembly by removing NAS6604-38 bolt. Leave friction assembly connected to C315-1 upper support.

e) Remove NAS6604-9 bolt and disconnect C121-19 collective push-pull tube from the C326-1 bell crank.

f) Remove four NAS6604-2 bolts which are securing C315-1 rear support assembly to the left and right panels. Remove C334 assembly.

g) C317-1 aft bell crank is connected to rear support assembly by C311-1 bolt which is common to C317-1 to C326-1 bell cranks. Remove the bolt and remove C317-1 aft bell crank.

8.524 C317-1 Lower Aft Bellcrank Installation

a) Install C317-1 aft bellcrank on C315-1 or C315-7 rear support assembly with NAS6604-105 bolt, one NAS1149F0432P washer under head and two NAS1149F0463P washers under nut. Standard torque bolt per Section 1.320, install & torque palnut, and torque stripe per Figure 2-1.

b) Install C334 rear support assembly in ship and secure it to side panels with four NAS6604-2 bolts. Standard torque bolts per Section 1.320, and torque stripe per Figure 2-1.

c) Connect C343-1 and C121-9 push-pull tubes to the C317-1 tail rotor control aft bellcrank. Connect the C121-19 push-pull tube to C326-7, C326-8, or C334-4 bellcrank. Verify A697-6 tab oriented 0° to 20° outboard from vertical. Standard torque bolt per Section 1.320, install & torque palnut, and torque stripe per Figure 2-1.

d) Set upper A205-3 fork assembly center-to-center distance to 3.80 inch ± 0.03 inch. Reconnect A205-3 fork assembly to C326-7, C326-8, or C334-4 bellcrank.

e) If applicable, set collective-friction rod end link assembly center-to-center to 2.300 inches ± 0.010 inch (C327-1 collective-friction link assembly is not adjustable). Install bolts and standard torque per Section 1.320. Install & torque palnuts, and torque stripe per Figure 2-1.

f) If applicable, connect bottom rod end of collective spring assembly to C326-7, or C326-8 support assembly per Section 8.222. Standard torque bolt per Section 1.320, install & torque palnuts, and torque stripe per Figure 2-1. Remove retainer from spring.

g) Move pedals and check for smoothness and ease of operation. Move pedals, collective, and cyclic full travel, and verify no interference between tubes, bellcranks, wires and structure.

8.530 C316-1 Upper Bellcrank

8.531 Bellcrank Removal

a) Remove aft vertical panel between seat backs and right rear seatback.

b) Disconnect C343-1 push-pull tube from the bellcrank assembly by removing the NAS6604-8 bolt.

c) Disconnect C121-15 push-pull tube from C316-1 bellcrank by removing NAS6604-8 bolt.

d) Disconnect C316-1 bellcrank from aircraft by removing NAS1304-17 bolt from inboard support and NAS6604-11 bolt from outboard support.

8.532 Bellcrank Installation

a) Install bellcrank with NAS1304-17 bolt through bearing block and then through bellcrank and NAS6604-11 bolt connecting bellcrank to outboard support. Torque bolts per Section 1.320. Install palnuts, torque per Section 1.320 and torque stripe per Figure 2-1.

b) Reconnect forward end of C121-15 push-pull tube and upper rod end of C343-1 push-pull tube to C316-1 bellcrank. Torque bolts per Section 1.320. Install palnuts, torque per Section 1.320 and torque stripe per Figure 2-1.

NOTE
If rod ends, of C121-15 and C343-1 push-pull tubes, were removed or length of push-pull tubes were altered re-rig tail rotor blades per Section 10.140.

8.540 A331-4 Intermediate Bellcrank (See Figure 8-14)

8.541 Bellcrank Removal

a) Disconnect C121-15 and -17 push-pull tubes from A331-4 bellcrank.

b) Disconnect NAS6604-35 attach bolt and remove bellcrank.

8.542 Bellcrank Installation

a) Install two A105-3 journals into bellcrank bearings. One A141-3 washer is required on each side of bellcrank against A105-3 journals (If required, ream A139-1 bearing with 0.375/0.376 in. dead-sharp reamer for journal's smooth installation).

b) Install bolt and torque per Section 1.320. Install palnut, torque per Section 1.320 and torque stripe per Figure 2-1.

c) Check for smoothness and ease of operation.

d) Connect A121-15 and -17 push-pull tubes. A214-3 safety washer is required under the bolt head which connects C121-15 push-pull A331-4 tube to the bellcrank and one MS20002-4 washer is required between the rod end ball and the bellcrank.

e) A214-3 safety washer is required between bolt head and forward rod end of C121-17 push-pull tube.

f) Re-rig tail rotor per Section 10.140 if push-pull tube lengths were altered.

8.542 Bell Crank Installation (cont'd)

e) Move pedals full travel, check for any interference between tubes, wire, components or structure.

8.550 A120-3 Aft Bell Crank

8.551 Bell crank Removal

a) Disconnect C121-17 push-pull tube from A120-3 aft bell crank.

b) Disconnect bell crank pivot from attach bolt connected to tail rotor gearbox.

c) Remove nut holding bell crank to the pitch control. Remove bell crank and reinstall nut and shims found between bell crank and pitch control for bell crank installation.

8.552 Bell Crank Installation

See C031-1 Pitch Control Installation (see Section 8.562).

8.560 C031-1 Pitch Control

8.561 Pitch Control Removal

a) Remove tail rotor hub and blade assembly. Mark corresponding tail rotor blade grips, tail rotor pitch change to each of the pitch control ears, for later reinstallation so re-rigging is not required.

b) Disconnect and remove A120-3 aft bell crank per Section 8.551.

c) Remove C031-1 pitch control from tail rotor output shaft.

8.562 Pitch Control Installation

a) Slide C031-1 pitch control assembly onto output shaft.

b) Position A120-3 bell crank assembly on the tail rotor gearbox and install NAS6604-25 bolt, one AN960-416L washer under bolt head, two MS20002-4 washers, one on each side of the bearing and MS21042-4 nut. Tighten but don't torque at this time.

c) Measure the gap existing between the A120-3 bell crank ear and the flats on the C125-1 pitch control stud. Install sufficient C117-34, -35 and -36 washers between bell crank and stud to completely fill the gap but not apply any axial preload on the spherical bearing after all the nuts are tightened. The clearance tolerance is ± 0.003". Install one AN960-516L washer and MS21042-5 nut on protruding end of stud. Torque nut to 200 in.-lb plus nut drag while holding stud from rotating, and install palnut.

8.562 Pitch Control Installation (cont'd)

d) Torque nut on A120-3 bellcrank pivot per Section 1.320 and install palnut.

e) Attach aft end of C121-17 push-pull tube to the A120-3 bellcrank with NAS6604-10 bolt, AN960-416L under head, and A214-3 safety washer under nut next to rod end. Torque nut per Section 1.320 and install palnut.

f) Install pitch control links per Section 8.572.

g) Install tail rotor hub and blade assembly (see Section 9.212).

h) Ensure all bolts, jam nut and palnuts are torqued per Section 1.300.

8.570 Tail Rotor Pitch Links

8.571 Tail Rotor Pitch Link Removal

NOTE

To ensure proper rigging upon reinstallation of pitch links, mark pitch links to corresponding blade grip and pitch control ear.

a) Disconnect the two attach bolts on both rod ends of the pitch link.

b) Remove pitch link.

8.572 Tail Rotor Pitch Link Installation

WARNING

A214-3 safety washers are to be installed next to each rod end.

CAUTION

One-piece tail rotor pitch links must be used in sets. DO NOT use one-piece pitch links with adjustable pitch links.

NOTE

If installing same pitch links, match pitch link to proper blade grip and pitch control ear. If installing new, adjustable pitch links, measure overall length of old pitch link with micrometer or caliper. Adjust the new pitch link to the measurement obtained within 1/2 turn of the rod end.

8.572 Tail Rotor Pitch Link Installation (cont'd)

WARNING

Both pitch links must be same part number (same type and material). Mixing one-piece with adjustable-length pitch links is prohibited. Mixing steel one-piece with aluminum one-piece pitch links is prohibited.

Refer to Figure 9-11.

A. If installing one-piece pitch link(s):

1. Connect pitch link to pitch control arm and blade pitch horn.

2. Torque attach bolts per Section 1.320. Install palnuts, torque per Section1.320, and torque stripe per Figure 2-1. Repeat for opposite blade.

B. If installing new, adjustable-length pitch link(s) based on old pitch link length:

1. Match pitch link to proper blade pitch horn and pitch control arm and connect pitch link. Torque attach bolts per Section 1.320. Install palnuts, torque per Section 1.320, and torque stripe per Figure 2-1. Repeat for opposite blade.

2. Torque attach bolts per Section 1.320. Verify proper rod end centering and adjust as required. Install palnut, torque per Section 1.320, and torque stripe per Figure 2-1. Repeat for opposite blade.

3. Check tail rotor control rigging per Section 10.140.

C. If installing new, adjustable-length pitch links (nominal length setting):

1. Assemble male rod end, with jam nut and palnut installed, into female rod end. Adjust rod ends until a dimension of 2.620 ± 0.010 inches, measured between rod end bearing centers.

2. Attach pitch link female rod end to outboard side of pitch control arm. Torque bolt per Section 1.320. Install palnut, torque per Section 1.320, and torque stripe per Figure 2-1.

3. Connect pitch link male rod end to blade pitch horn. NAS1149F0432P, NAS1149F0463P, A214-3 or A141-14 washers may be under nut for chordwise balance. Torque bolt per Section 1.320. Install palnut, torque per Section 1.320, and torque stripe per Figure 2-1.

4. Torque pitch link jam nut and palnut per Section 1.320 and torque stripe per Figure 2-1. Repeat steps 1 thru 4 for opposite blade.

5. Check tail rotor control rigging per Section 10.140.

8.600 C203 YOKE AND A205 FORK ASSEMBLY

8.610 Bearing Removal

B115-1 Spherical bearings and C648-2 journal bearings may be removed with a press. Press from inner side of bearings while supporting outboard side of yoke or fork. Use a socket or other suitable pressing tool to apply the force.

8.615 C648-2 Bearing Installation (0.5625/0.5630 inch diameter bearing bores)

1. Clean mating surfaces of A205 fork or C203 yoke where C648 bearing is installed. Deburr any sharp edges that may damage bearings during installation.

2. Coat yoke or fork bearing bores with zinc chromate or epoxy primer. While primer is still wet, press in C648 bearing while supporting backside of fork or yoke.

8.620 B115-1 Bearing Installation

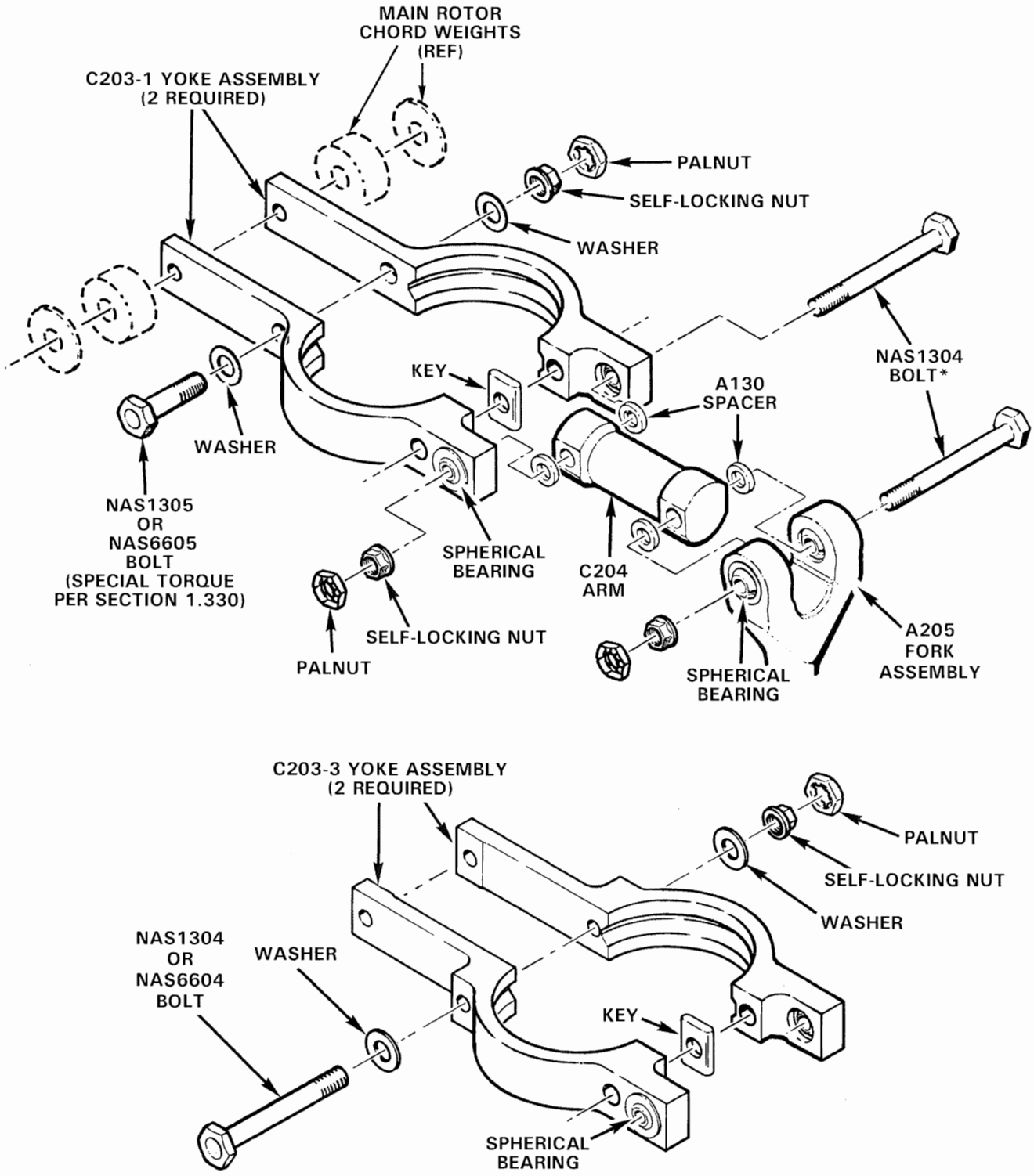
1. Press out old bearings.

2. Clean yoke or fork assembly bearing bores of old adhesive.

3. Measure bearing bores; maximum allowable diameter is 0.6260 inches.

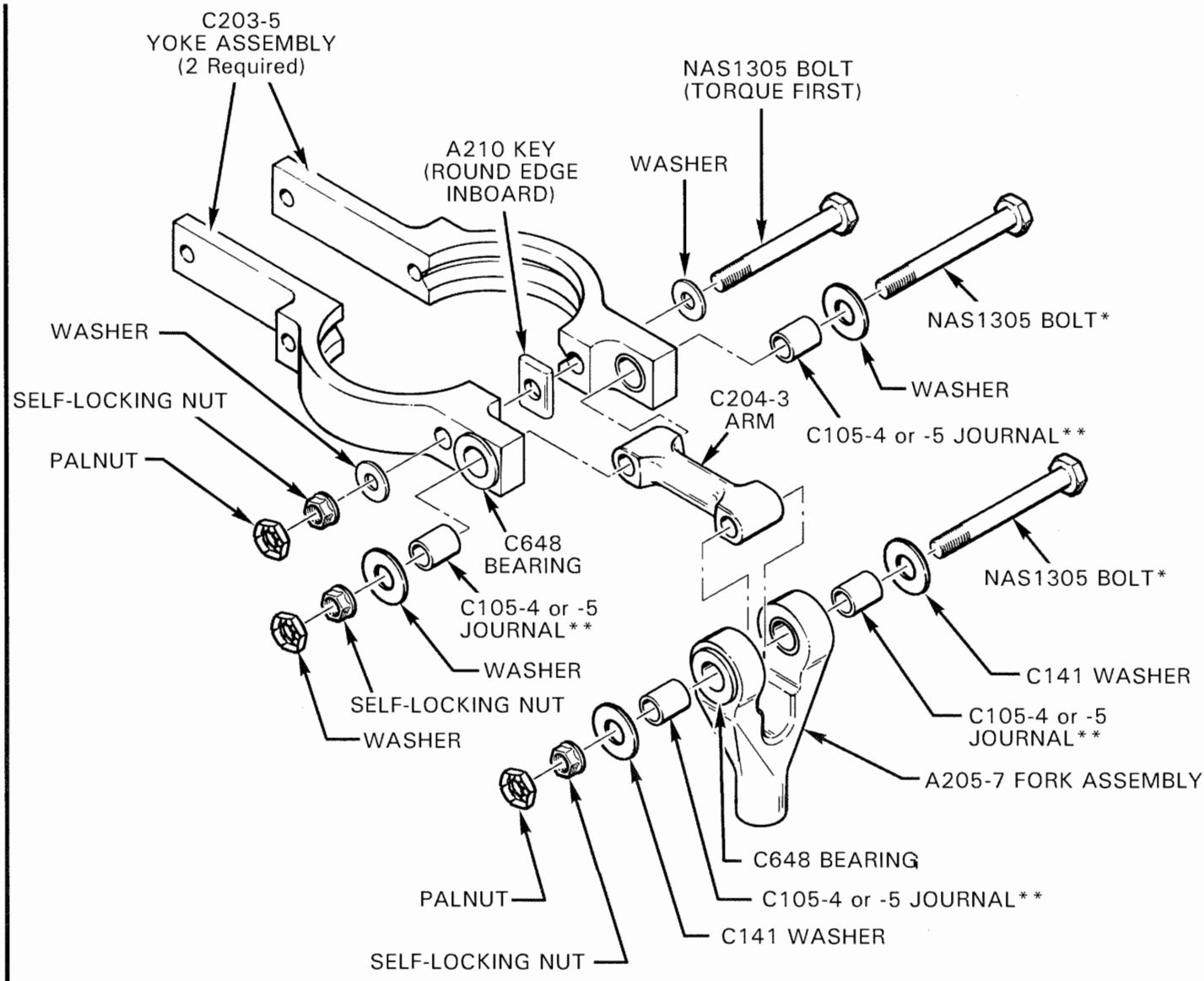
4. Lightly coat B115-1 bearing outer races with B270-10 adhesive and install B115-1 bearings into bearing bores. Wipe off excess adhesive. Do not allow adhesive to enter B115-1 bearing itself.

5. While adhesive is still wet, assemble yoke or fork assembly per Section 8.412. Wait until adhesive has been allowed to cure per manufacturer's instructions prior to checking bearing pivot force.



*SMALLER DIAMETER BOLTS THAN LATER REVISION INSTALLATION

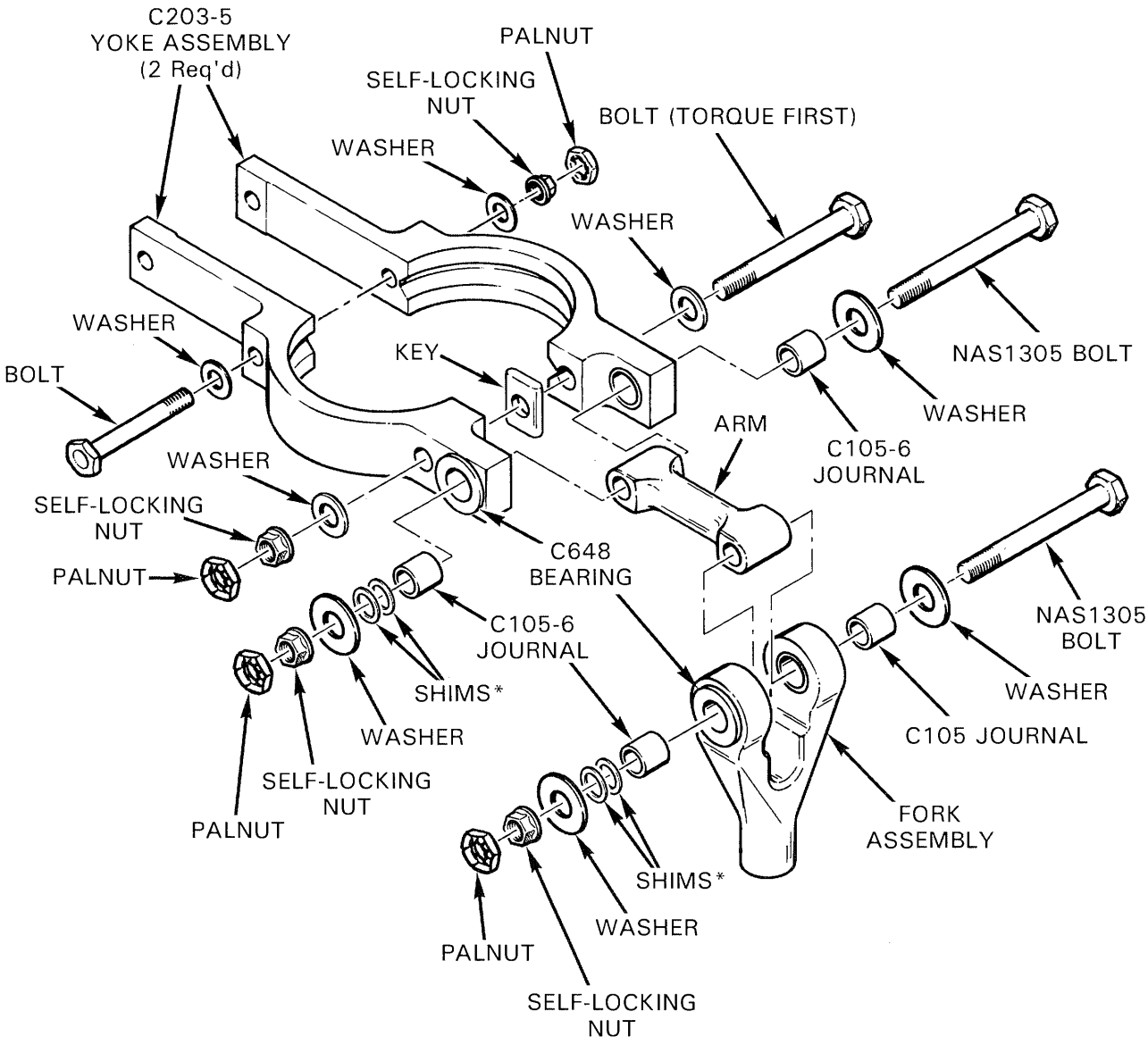
FIGURE 8-13 R44 EARLY REVISION CHORD ARM YOKE INSTALLATIONS
(DO NOT USE ON FUEL-INJECTED R44 II)



***Note larger diameter bolts than on earlier revision installations.**

****Select a combination of C105-4 or -5 journals to provide 0.001 - 0.010 inch axial play in joint. Refer to Figure 2-9.**

FIGURE 8-13A R44 II & R44 CHORD ARM YOKE INSTALLATIONS



***Select a combination of C117-67, -68, and/or -69 shims to provide 0.001-0.010 inch axial play in joint. Refer to Figure 2-9.**

FIGURE 8-13B R44 II & R44 LATE REVISION CHORD ARM YOKE INSTALLATIONS

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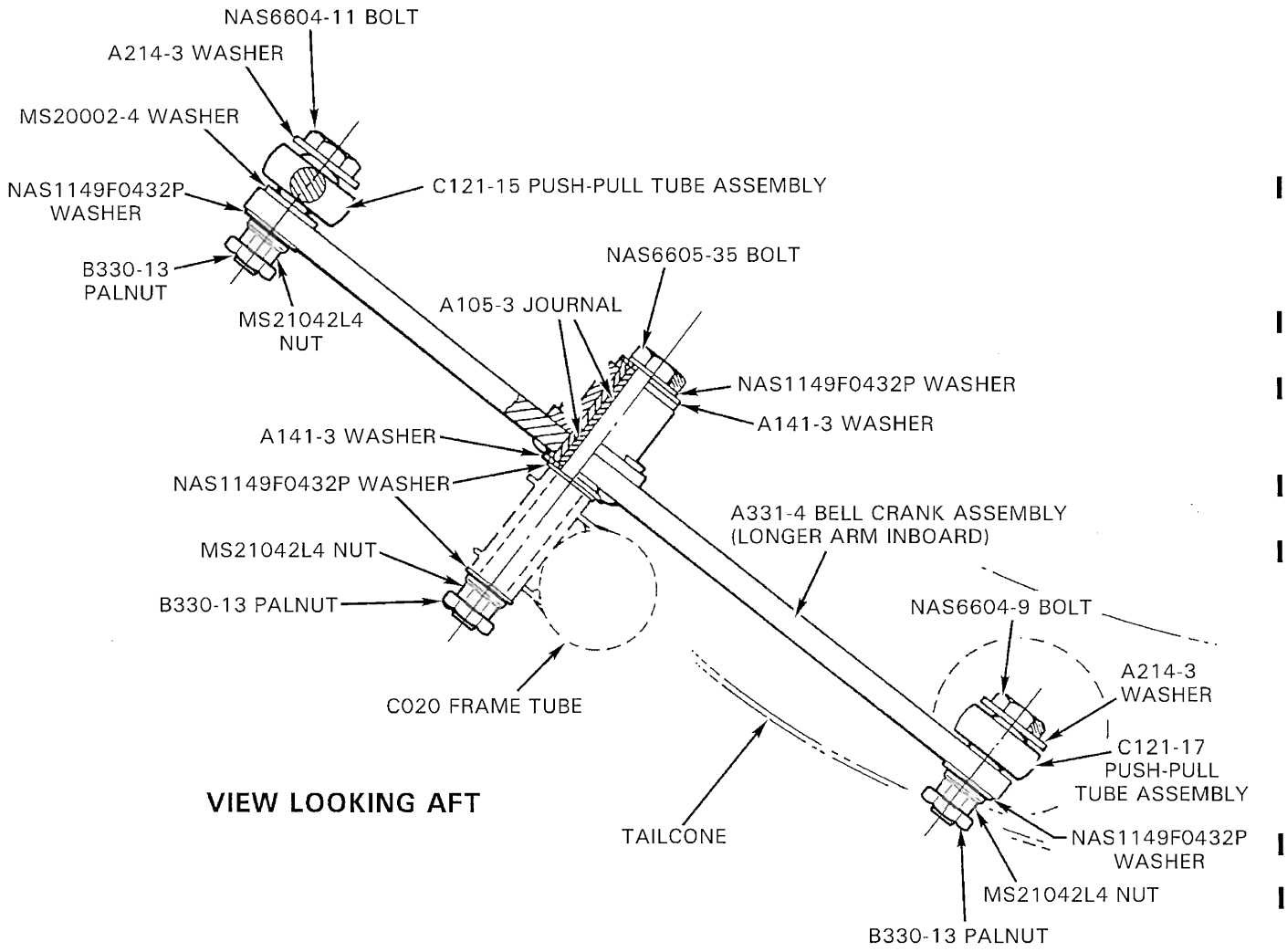


FIGURE 8-14 A331-4 BELLCRANK INSTALLATION

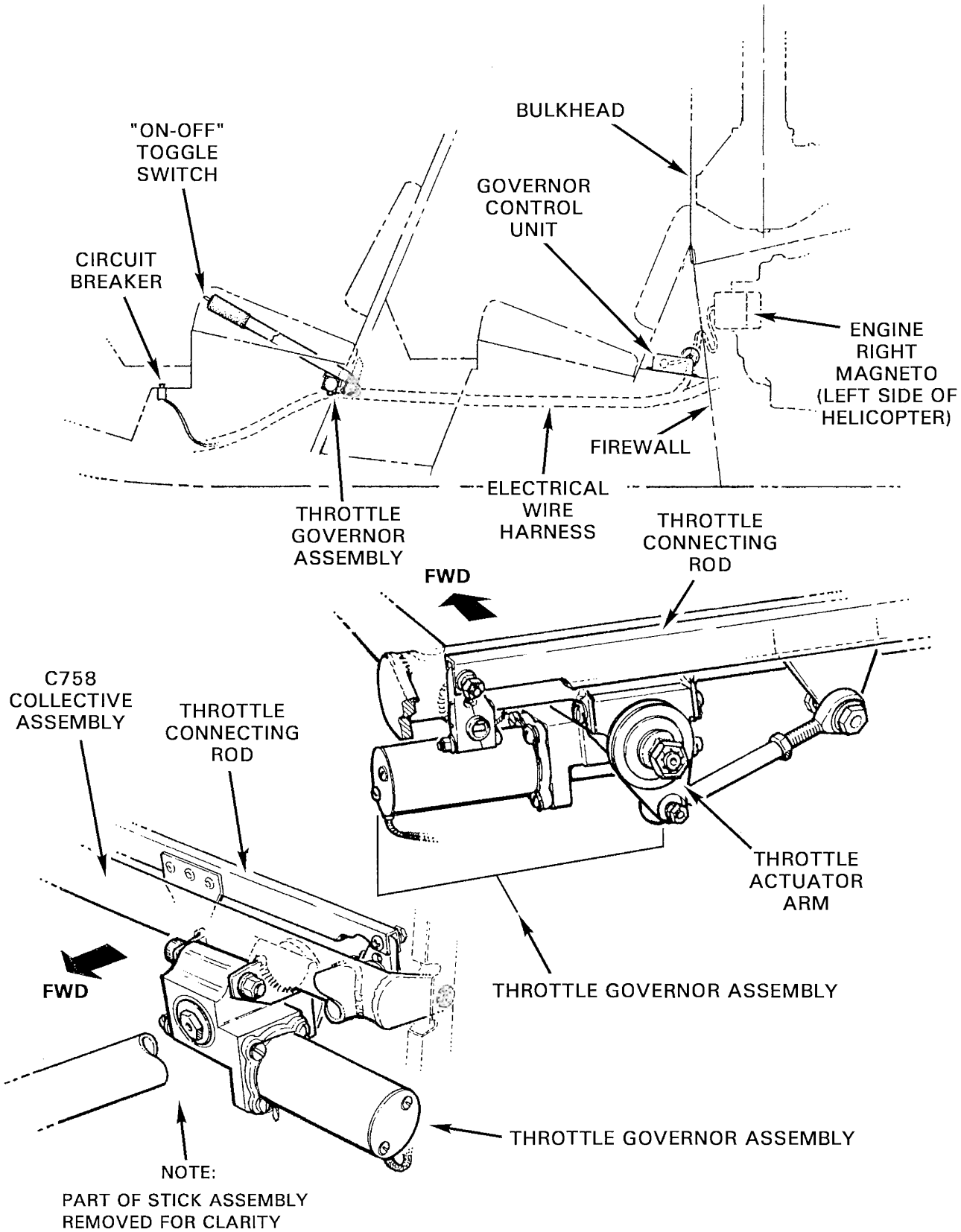


FIGURE 8-15 THROTTLE GOVERNOR INSTALLATION

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CORRECT ALIGNMENT

INCORRECT ALIGNMENT



MS28773 Retainers
(Diagonal split)

MS28773 Retainers, installed on hydraulic system fittings, are superseded by D454 Retainers. Verify correct alignment of diagonal split if installing new MS28773 Retainers. MS28773 Retainers ARE NOT reusable.



D454 Retainers
(Straight split)

D454 Retainers, installed on hydraulic system fittings, supersede MS28773 Retainers. D454 Retainers have a straight split to eliminate installation error, and are more rigid for better sealing. D454 Retainers ARE reusable.

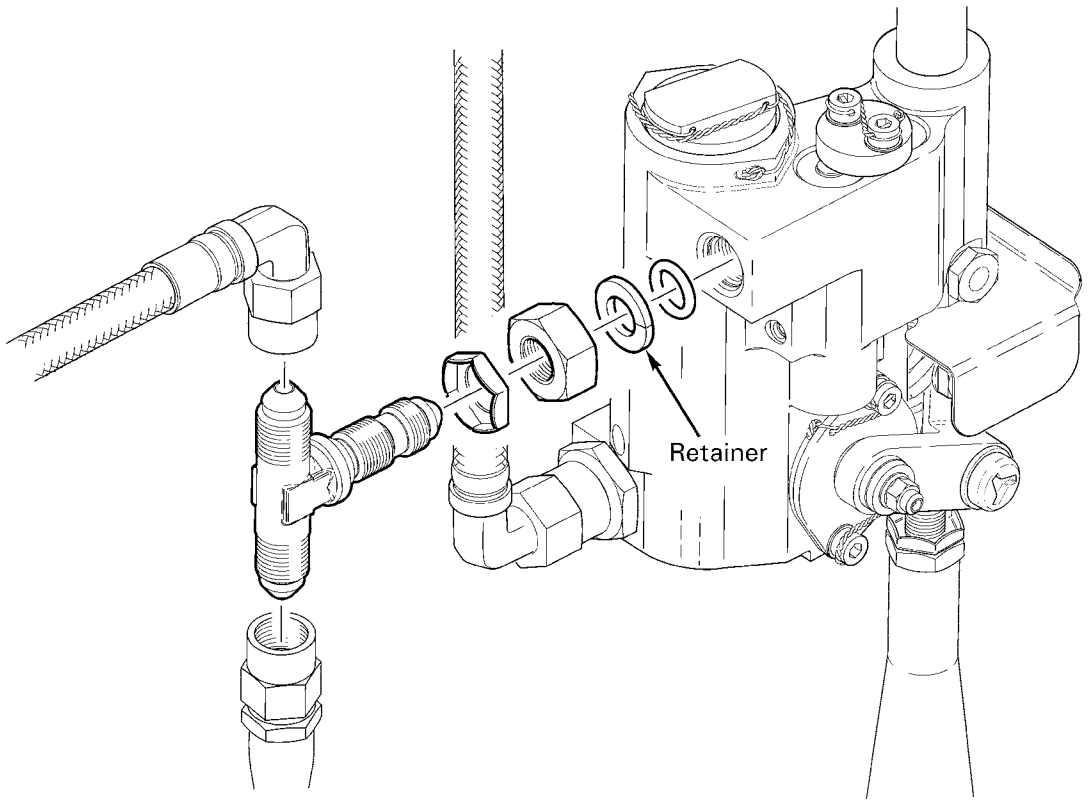


FIGURE 8-16 HYDRAULIC FITTING O-RING RETAINERS

8.700 Hydraulic Flight Controls

8.710 Hydraulic Reservoir Removal

CAUTION

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

1. Refer to Figure 8-1A. Remove C706-1 tailcone cowling.
2. Place a one-liter container beneath suction line fitting on reservoir. Disconnect and cap suction line at reservoir aft elbow and allow reservoir fluid to drain into container.
3. Disconnect and cap one return and two pressure lines from reservoir elbows.
4. Disconnect pump bypass solenoid electrical connector.
5. Cut safety wire from and remove four drilled-head bolts securing reservoir to upper frame. Remove reservoir.

8.720 Hydraulic Reservoir Installation

CAUTION

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

1. Refer to Figures 8-1A and 8-16. Install elbows into reservoir with palnuts, jam nuts, retainers, and O-rings.
2. Point forward elbows up. Torque jam nuts and palnuts per Section 1.330. Forward elbows are different sizes and nuts require different torques.
3. Position reservoir on upper frame and install four drilled-head bolts. Torque bolts per Section 1.330 and safety wire.
4. Connect servo pressure and return lines to forward elbows and torque per Section 1.330. Torque stripe jam nuts, palnuts, and B-nuts.
5. Connect pump bypass solenoid electrical connector and ty-rap wires as required.
6. Connect pump suction line to aft (suction) elbow. Position elbow to minimize preload on suction line. Torque jam nut, palnut, and B-nut per Section 1.330 and torque stripe.
7. Connect pump pressure line to remaining elbow. Position elbow to minimize preload on pressure line. Torque jam nut, palnut, and B-nut per Section 1.330 and torque stripe.
8. Verify line and servo clearance to surrounding structure while flight controls are moved through full range of travel.
9. Verify reservoir cooling hose is secure and directed at center of reservoir cooling fins. Adjust as required.

8.720 Hydraulic Reservoir Installation (continued)

10. Fill reservoir with A257-15 (see Section 1.470) fluid.

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.

11. Secure C706-1 tailcone cowling and connect any attached antenna.

12. Bleed hydraulic system per Section 1.190.

8.730 Hydraulic Pump Removal

CAUTION

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

1. Remove auxiliary fuel tank per Section 12.121.
2. Refer to Figure 8-1A. Remove reservoir filler-vent.
3. Cover reservoir filler-vent hole with finger to prevent fluid loss. Disconnect and cap suction line at hydraulic pump forward T-fitting.
4. Disconnect and cap pressure line at hydraulic pump aft T-fitting.
5. Remove four self-locking nuts and washers securing pump to gearbox.
6. Remove pump, phenolic insulator if installed, and o-ring. Discard o-ring. Do not remove metal cartridge.

8.740 Hydraulic Pump Installation

CAUTION

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

1. Refer to Figures 8-1A and 8-16. Install palnuts, jam nuts, retainers, and new o-rings on T-fittings and install T-fittings in pump. Ensure lower arm of both T-fittings is capped.

CAUTION

Verify retainers have been installed per Figure 8-16. Improper installation will result in loss of hydraulic fluid.

2. Lubricate new o-ring with A257-2 gearbox oil and install on pump mounting flange. If C267 cartridge in MRGB has 0.125 inch thick flange then also install phenolic insulator on pump mounting flange. Install pump on gearbox studs so larger T-fitting is forward. Install washers and self-locking nuts on studs and special torque per Section 1.330.

3. Position pump T-fittings so that outlets are approximately 45° from vertical with top pointing inboard. Special torque jam nuts and palnuts per Section 1.330. Nuts are different sizes and require different torques.

4. Connect reservoir pressure hose to pump pressure (aft) T-fitting. Special torque B-nut per Section 1.330.

5. Cover reservoir filler-vent hole with finger to prevent fluid loss. Remove plug from suction hose and connect hose to pump suction (forward) T-fitting. Special torque B-nut per Section 1.330.

6. Install auxiliary fuel tank per Section 12.122 and verify minimum 0.25 inch clearance with hydraulic hoses and fittings. Reposition hoses and fittings as required.

7. Torque stripe jam nuts and B-nuts per Figure 2-1.

8. Bleed hydraulic system per Section 1.190.

9. Install a 110-4 Telatemp on easily visible surface of pump.

8.750 Hydraulic Servo Removal

CAUTION

Do not pressurize hydraulic system while any hydraulic system component is disconnected or removed.

1. Remove mast fairing and C706-1 tailcone fairing assembly. Remove aft belly panel.
2. Refer to Figures 8-1A and 8-1C. Perform the following measurements on all D212-1 hydraulic servo assemblies to be removed:
   a. Measure & record dimension between D200-1 clevis hole center & top of servo piston shaft.
   b. Apply cyclic and collective frictions. With collective full down and hydraulics unpressurized, manipulate cyclic stick so piston in servo to be removed is in its lowest position. Measure & record dimension between top of servo piston shaft and top of cylinder assembly.

CAUTION

Dimension between clevis hole center and top of servo piston shaft must be 1.40 ± 0.03 inches; dimension between top of servo piston shaft and top of cylinder assembly must be 0.28 ± 0.03 inch. If dimensions are not within required range, perform main rotor rigging per Section 10.120 after servo installation.

3. a. Forward Right Servo: Remove aux fuel tank per Section 12.121.
   b. Forward Left Servo: Remove main fuel tank per Section 12.111.
4. Remove hardware securing servo clevis to C121-25 or -31 push-pull tube's lower rod end.
5. a. Forward Servo: Mark (right or left) position of C121-24 or -28 push-pull tube's. Loosen jam nut and palnut securing tube to servo's lower rod end, and remove hardware securing tube's lower rod end to C175-4 cyclic pivot assembly. Count and record number of turns required to unscrew tube from servo's lower rod end.
   b. Aft Servo: Remove hardware securing C343-8 tube's lower rod end to C339-1 or -10 jackshaft weldment.

CAUTION

Do not remove tri-wing fastener; servo's lower rod end must remain attached to servo.

6. Disconnect D205 hose assemblies from servo unions (or elbows) and tees. Cap and plug fittings.
7. a. Forward Servo: Remove hardware joining D200-2 scissors. Remove hardware securing servo to D201-1 or -5 support and remove servo. Remove associated C121-24 or -28 push-pull tube.
   b. Aft Servo: Remove hardware securing servo to C345-5 weldment.

8.750 Hydraulic Servo Removal (continued)

8. Aft Servo: Measure & record center-to-center dimension between servo's lower rod end and C343-8 tube's lower rod end. Loosen palnut and nut securing tube to servo's lower rod end and remove tube.

CAUTION

Dimension between C343-8 tube's rod ends must be 3.90 ± 0.03 inches. If dimension is not within required range, perform main rotor rigging per Section 10.120 after servo installation.

9. Remove clevis, scissor, D200-3 washer, elbows, unions, and tee fittings from servo, as applicable.

10. Actuate servo piston shaft by hand and drain as much hydraulic fluid from servo as possible. Plug servo ports.

8.760 Hydraulic Servo Installation

CAUTION

Do not pressurize hydraulic system while any hydraulic system component is disconnected or removed.

CAUTION

Refer to Section 8.750. Dimension between clevis hole center and top of servo piston shaft must be 1.40 ± 0.03 inches; dimension between top of servo piston shaft and top of cylinder assembly must be 0.28 ± 0.03 inch; dimension between C343-8 tube's rod ends must be 3.90 ± 0.03 inches. If dimension(s) recorded during servo removal were not within required range, or if dimension(s) are unknown, adjust to correct dimensions in Section 8.760 steps 1 and 2, proceed with servo installation thru step 11, then perform main rotor rigging per Section 10.120.

1. Refer to Figures 8-1A and 8-1C. Lightly coat D200-1 clevis threads with B270-21 protectant. Assemble clevis, palnut, jam nut, D200-3 washer (forward servo), and D200-2 scissor (forward servo), and install assembly in D212-1 hydraulic servo assembly piston shaft. Point scissor forward and inboard. Adjust dimension between clevis hole center & top of servo piston shaft to dimension recorded during servo removal. Verify slots in scissor and washer engage piston shaft tangs, then tighten jam nut and palnut finger tight.

2. Aft Servo: Lightly coat servo's lower rod end threads with B270-21 protectant and install C343-8 tube. Adjust tube on servo's rod end, and tube's rod end, to the center-to-center dimension (between rod ends) recorded during servo removal, and with rod ends 90° to each other. Tighten jam nuts and palnuts finger tight.

CAUTION

Do not remove tri-wing fastener; servo's lower rod end must remain attached to servo.

8.760 Hydraulic Servo Installation (continued)

3. a. Forward Servo: Position associated C121-24 or -28 push-pull tube in helicopter. Install hardware securing servo to D201-1 or -5 support. Standard torque fasteners per Section 1.320 and torque stripe per Figure 2-1.

   b. Aft Servo: Install hardware securing servo to C345-5 weldment. Standard torque fasteners per Section 1.320 and torque stripe per Figure 2-1.

4. Forward Servos: Install hardware joining scissors (scissor overlap direction not critical); special torque nut to 25 in.-lb, special torque palnut to 5-10 in.-lb, and torque stripe per Figure 2-1.

5. Using backup wrench, align clevis minimum amount necessary to be parallel with helicopter's longitudinal axis. Standard torque jam nut and palnut per Section 1.320, and torque stripe per Figure 2-1.

6. Install hardware securing servo clevis to C121-25 or -31 push-pull tube's lower rod end. Standard torque fastener per Section 1.320 and torque stripe per Figure 2-1.

7. a. Forward Servo: Lightly coat servo's lower rod end threads with B270-21 protectant. Counting number of turns recorded during servo removal, install C121-24 or -28 push-pull tube on servo's lower rod end. Install hardware securing tube's lower rod end to C175-4 cyclic pivot assembly, standard torque fastener per Section 1.320, and torque stripe per Figure 2-1. Using backup wrench, standard torque tube's jam nuts and palnuts, and torque stripe per Figure 2-1.

   b. Aft Servo: Install hardware securing C343-8 tube's lower rod end to C339-1 or -10 jackshaft weldment. Standard torque fastener per Section 1.320 and torque stripe per Figure 2-1. Using backup wrench, standard torque jam nuts and palnuts, and torque stripe per Figure 2-1.

8. Refer to Figure 2-1A. Verify proper rod end centering on all push-pull tubes attached to servos.

CAUTION

Refer to Figure 8-16. Improper retainer installation can result in loss of hydraulic fluid and vibrations in the flight controls.

9. Remove caps and plugs. Lubricate new packings using A257-15 hydraulic fluid and install packings on servo unions (or elbows) and tees. Install fittings with associated hardware in servo ports and connect D205 hose assemblies to fittings. Align fittings to minimize hose preload and ensure hose clearance with surrounding structure; special torque fittings per Section 1.330 and torque stripe per Figure 2-1. Special torque hose B-nuts per Section 1.330 and torque stripe per Figure 2-1.

10. a. Forward Right Servo: Install aux fuel tank per Section12.122.

    b. Forward Left Servo: Install main fuel tank per Section 12.112.

11. Bleed hydraulic system per Section 1.190.

8.760 Hydraulic Servo Installation (continued)

12. Perform the following measurements on all servos just installed:

    a. Measure & record dimension between clevis hole center & top of servo piston shaft. Verify dimension is same as recorded during removal; adjust as required.

    b. Apply cyclic and collective frictions. With collective full down and hydraulics unpressurized, manipulate cyclic stick so piston in servo just installed is in its lowest position. Measure & record dimension between top of servo piston shaft and top of cylinder assembly. Verify dimension between top of piston shaft and top of cylinder is same as recorded during removal. As required, lengthen or shorten associated C121-3, -24, -28, or -30 push-pull tube to obtain correct dimension and repeat this step.

NOTE

Cyclic must be manipulated after each push-pull tube adjustment and prior to measuring in order to accommodate freeplay at unpressurized input.

CAUTION

Dimension between clevis hole center and top of servo piston shaft must be 1.40 ± 0.03 inches; dimension between top of servo piston shaft and top of cylinder assembly must be 0.28 ± 0.03 inch; dimension between C343-8 tube's rod ends must be 3.90 ± 0.03 inches. If dimension(s) recorded are not within required range, adjust to correct dimensions in Part 8.760 steps 1 and 2, proceed with servo installation thru step 11, then perform main rotor rigging per Section 10.120.

13. Install aft belly panel. Install C706-1 tailcone fairing assembly and mast fairing.

14. Perform pitot line leak check per Section 13.211.

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CHAPTER 9

ROTOR SYSTEMS

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CHAPTER 9

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CHAPTER 9

ROTOR SYSTEMS

9.000 Rotor Systems

The main rotor has two all-metal blades mounted to the hub by coning hinges. The hub is mounted to the shaft by a teeter hinge. The coning and teeter hinges use self-lubricated bearings. Droop stops for the main rotor blades provide a teeter hinge friction restraint which normally prevents the rotor from teetering while starting or stopping. Pitch change bearings for each blade are enclosed in a housing at the blade root. The housing is filled with oil and sealed with an elastomeric boot. Each blade has a thick stainless steel spar at the leading edge which is resistant to corrosion and erosion. The skins are bonded to the spar approximately one inch aft of the leading edge. Blades must be refinished if the paint erodes to bare metal at the skin-to-spar bond line. Bond may be damaged if bond line is exposed.

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 are elastomeric. The tail rotor blades are constructed with aluminum skins and forged aluminum root fittings.

9.100 Main Rotor

Refer to R44 Illustrated Parts Catalog (IPC) Chapter 62.

9.110 Main Rotor Blades

WARNING

Due to potentially destructive results, use of blade tape (anti-erosion tape) is prohibited.

9.111 Main Rotor Blade Removal

Refer to Figure 9-1. Four people will be required to remove the blades. One person must support the blade approximately 2/3 its length from the root while another supports the root and removes or installs the attachment bolt.

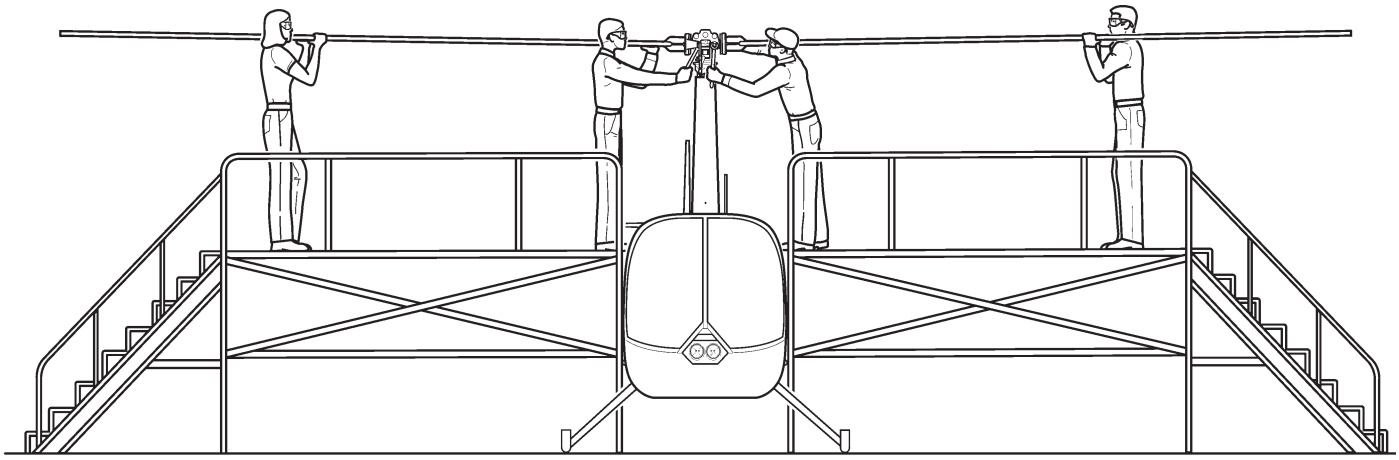


FIGURE 9-1 SUPPORTING MAIN ROTOR BLADES DURING BLADE REMOVAL OR INSTALLATION

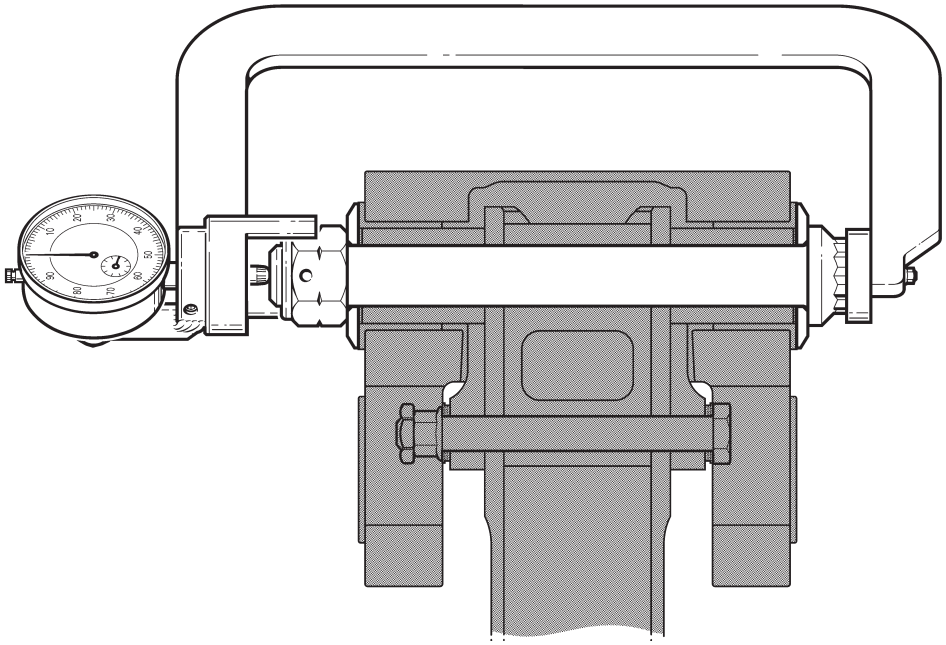


FIGURE 9-2 MEASURING BOLT STRETCH (SHOWN ON TEETER BOLT, BLADES REMOVED)

9.111 Main Rotor Blade Removal (continued)

1. Mark one main rotor blade and its corresponding hub location, pitch link, and retaining nut & bolt with "X" using a marker or grease pencil. Mark opposite blade and its hub location, pitch link, and retaining nut & bolt with "O".
2. Measure and record coning hinge axial gaps per Figure 9-7.
3. Remove hardware securing main rotor pitch links to blade pitch horns.
4. Remove cotter pins and loosen blade coning hinge retaining nuts until finger tight.

CAUTION

After removing one blade, support installed blade in a level position until it is removed.

5. Remove nut, thrust washer, and trailing-edge shims (if used) from one blade. Cone blade as required to position spindle tusk off of droop stop. Supporting blade at root, rotate pitch horn down, and remove hinge bolt and thrust washer.

CAUTION

Do not drop journals (inside hub bearings) which can slide out when removing blade bolt.

NOTE

Blade installation hardware is specific to each blade, each blade's leading and trailing edge, and each blade's location in hub. It is good practice after blade removal to install hardware in hub finger tight exactly as removed.

6. Place blade on a cushioned surface to prevent damage to skins.
7. Remove opposite blade per steps 5 and 6.

9.112 Main Rotor Blade Installation

1. Check teeter hinge friction and adjust as required per § 9.124.
2. If coning hinge axial gap recorded during blade removal was beyond tolerance, or if corresponding hub bearing(s) or spindle was replaced, perform coning hinge journal and shim calculation per § 9.123.
3. Level hub and insert journals in hub bearings. Install thrust washer on blade bolt.
4. Insert main rotor blade spindle in hub and align spindle and journal bores. Cone blade as required to position tusk off of droop stop. Rotate pitch horn down and install hinge bolt at leading-edge side.

NOTE

A bolt may be inserted from trailing-edge side to align spindle and journal bores (it is pushed out as coning hinge bolt is installed).

5. Install trailing-edge shims (if used) and thrust washer. Apply light coat A257-9 anti-seize to bolt threads and nut face. Install nut finger tight.

NOTE

Do not allow anti-seize to contact journals, shims, or hub bearing areas. These areas must be clean and dry.

CAUTION

After installing one blade, support blade in a level position until opposite blade is installed.

6. Install opposite blade per steps 3 thru 5.
7. Tighten nut on coning hinge bolt until journals and thrust washer are firmly seated. Loosen nut until both thrust washers can be freely rotated.
8. Refer to Figure 9-2. Install MT122-6 main rotor bolt stretch tool on hinge bolt. Zero dial indicator by rotating dial face and lock dial. Remove tool.
9. Using wrenches with at least 600 ft-lb torque capacity, tighten nut until drilled holes in nut and bolt align. Install MT122-6 tool and measure bolt stretch:

   a. If bolt stretch is between 0.020–0.022 inch, remove tool and install a new cotter pin wet with epoxy primer.

   b. If bolt stretch is not between 0.020–0.022 inch, remove old nut and old bolt and install a new bolt and a new nut. Stretch new bolt per § 1.330, and drill new nut and bolt per § 9.116. Install a new cotter pin wet with epoxy primer.

WARNING

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

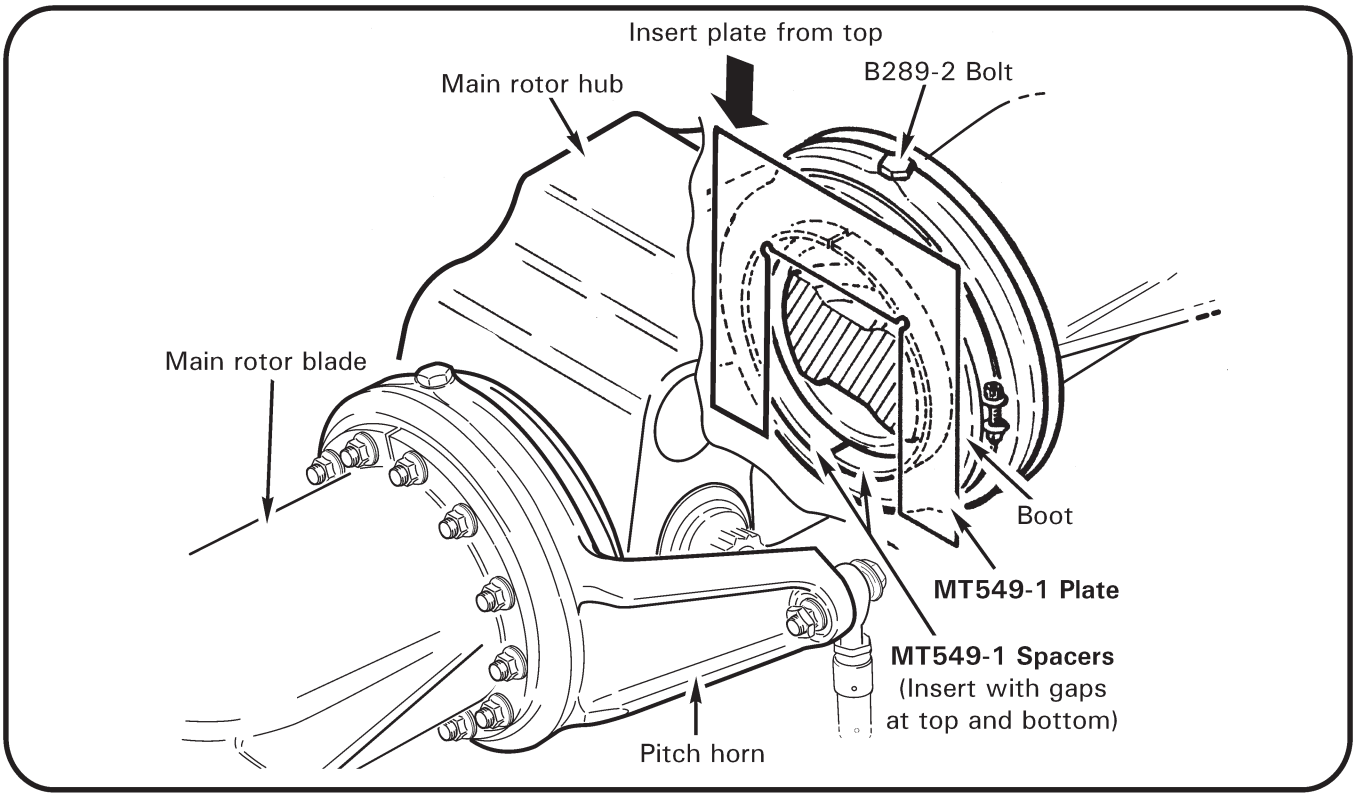


FIGURE 9-3 ADJUSTING BOOT CLEARANCE

9.112 Main Rotor Blade Installation (continued)

10. Install hardware securing main rotor pitch link to pitch horn. Standard torque hardware per § 1.320 and torque stripe per Figure 2-1.

11. Perform steps 7 thru 10 on opposite blade. If different blades are being installed or if blade pitch bearing housing has recently been serviced perform steps 12 thru 16.

12. Position cyclic and collective controls mid-travel and apply frictions.

13. Refer to Figure 9-3. Insert two MT549-1 spacers between hub and blade boot with gaps at top and bottom. Spacers should fit in recess of boot. Hold spacers in place against boot and insert MT549-2 plate from top between hub and spacers. Push plate down until it contacts spindle.

14. Remove bottom B289-2 bolt from pitch horn and allow oil to flow. Place a finger over hole as soon as oil flow decreases to a drip to prevent air from being sucked inside pitch bearing housing.

15. Remove finger from hole and quickly install bolt. Special torque bolt per § 1.330 and torque stripe per Figure 2-1.

16. Remove plate and spacers. Repeat on opposite blade.

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

9.113 Boot Removal

1. Remove main rotor blades per § 9.111.

2. Place a suitable drain container below pitch horn. Remove two B289-2 bolts and drain fluid.

3. Remove outer boot clamp and hold boot back to expose inner boot clamp. Remove inner clamp and peel boot from spindle. Boot inner portion may be sealed to spindle with B270-1 sealant.

4. As required, use a plastic scraper and vacuum cleaner to remove old B270-1 sealant from spindle area to be covered by boot inner lip. Avoid contaminating spindle bearings with old sealant.

WARNING

Use only plastic scrapers to remove old sealant; chemical removal is prohibited.

9.114 Boot Installation

1. Visually inspect and verify boot is undamaged. Carefully stretch new boot over spindle.

2. Solvent-clean surfaces clamped by boot inner lip. Properly position boot inner lip; install C165-1 (inner) clamp assembly and tighten clamp to 2.850 ± 0.005 inch outside diameter. Rotate spindle and verify adequate clearance between clamp assembly and pitch horn. Wipe off excess sealant and allow to cure in accordance with sealant manufacturer's recommendations.

NOTE

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

3. Stretch boot outer lip over pitch horn flange. Rotate spindle and align pitch horn bolt hole with spindle bolt hole per Figure 9-4. Install C165-2 (outer) clamp assembly and tighten clamp. Verify security.

4. Fill pitch bearing housing per § 9.115.

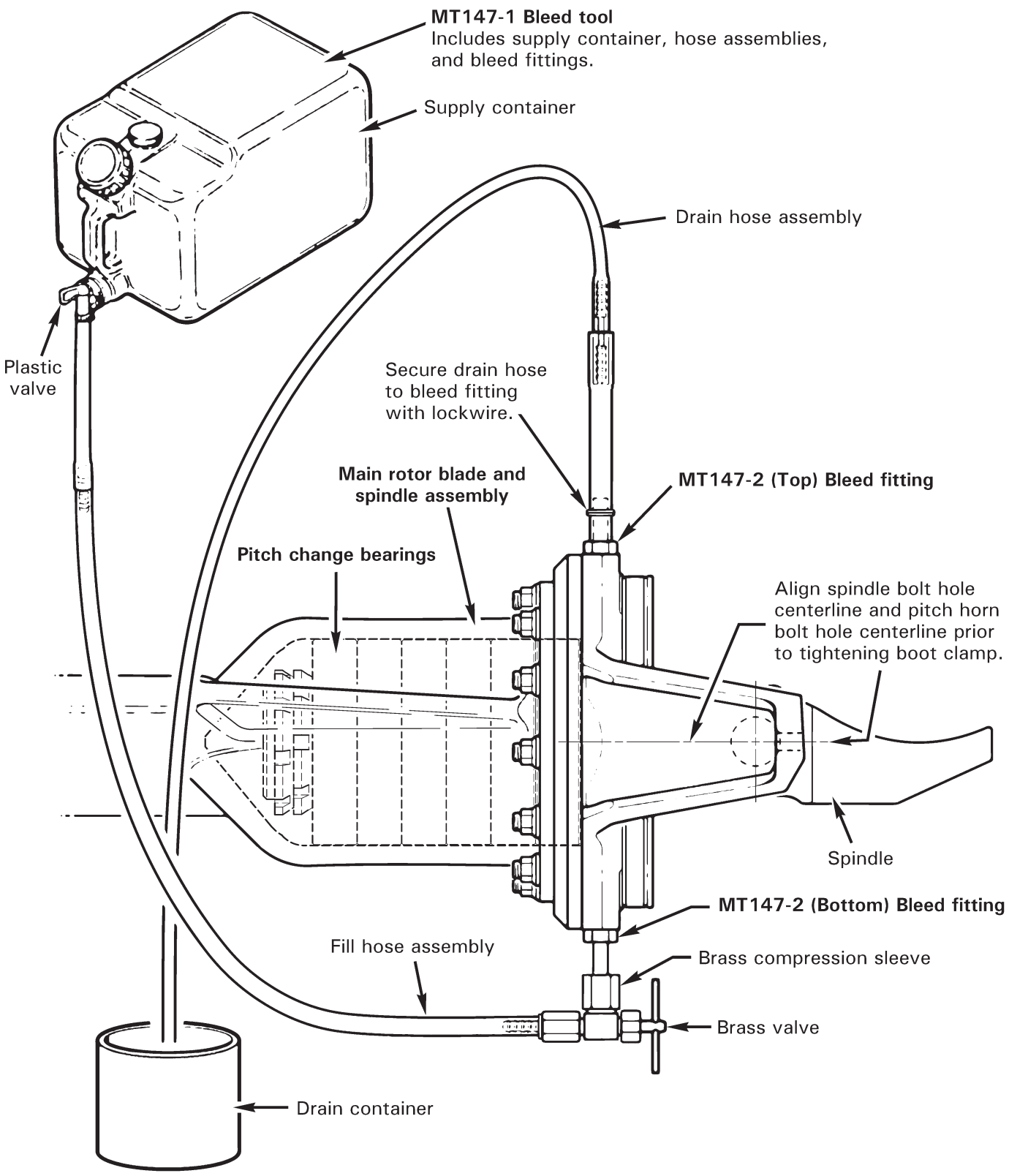


FIGURE 9-4 FILLING PITCH BEARING HOUSING

9.115 Filling Pitch Bearing Housing

NOTE

MT147-1 Main rotor blade spindle air bleed tool includes supply container, hose assemblies, and bleed fittings.

WARNING

Refer to appropriate Material Safety Data Sheet (MSDS) and take necessary safety precautions when working in proximity to hazardous materials.

1. Remove main rotor blades per § 9.111.
2. Refer to Figure 9-4. Place a suitable drain container below main rotor pitch horn. Remove two B289-2 bolts from pitch horn and drain fluid.
3. Install MT147-2 bleed fittings into pitch horn openings. Attach drain hose assembly to (top) bleed fitting, secure with two wraps of lockwire. Position drain hose into drain container.
4. Place supply container with sufficient A257-4 fluid approximately 3 feet above spindle. Route fill hose assembly into drain container and open brass valve. Open supply container plastic valve and purge air from fill hose. Close valves.
5. Connect brass valve to (bottom) bleed fitting by tightening brass compression sleeve.
6. Open valves and fill spindle housing until no air bubbles are visible in drain hose assembly. Massage spindle boot, oscillate spindle, and raise blade tip up & down to remove trapped air.
7. Remove drain hose assembly and (top) bleed fitting, and install B289-2 bolt. Roll the blade over. After five minutes, inspect the boot for leaks. If no leaks are found, close valves, remove fill hose assembly brass valve and (bottom) bleed fitting, and install other bolt.
8. Torque B289-2 bolts per § 1.330 and torque stripe per Figure 2-1.
9. Repeat steps for opposite blade.

9.116 Drilling Main Rotor Hub Bolts

NOTE

Protect hub from damage due to chuck contact by wrapping chuck and/or covering hub edge with several layers of tape.

New bolts and nuts must be installed and bolts stretched per § 1.330 prior to drilling.

Using a six-inch long 0.156-inch diameter Cobalt twist-drill and cutting oil, drill a hole through nut and bolt using an accessible pre-drilled hole in nut. The MT569-2 drill guide assembly will facilitate drilling a perpendicular hole. If a pre-drilled hole is inaccessible, completely loosen nut, slightly rotate bolt to favorable position, then special torque per § 1.330. Protect adjacent area from drilling debris.

9.120 Main Rotor Hub

9.121 Main Rotor Hub Removal

1. Remove main rotor blades per § 9.111.

2. Refer to Figure 9-5. Mark rotor hub using a grease pencil, tape, or soft marker as follows:

   a. Indicate nut side of teeter bolt.
   b. Indicate chord arm side of drive shaft.

3. If same hub will be installed, measure teeter hinge friction per Figure 9-8 and record value.

4. Remove cotter pin, nut, C152 thrust washers, C117 shims, C106 journals, and bolt. Rotate hub as required and remove hub. Do not drop thrust washers or journals.

5. Reinstall bolt, thrust washers, shims, journals, and nut in rotor hub exactly as removed.

CAUTION

Main rotor chordwise balance is adjusted using C106 journals and C117 shims. If assembly stack-up is altered, an out-of-balance condition can occur.

9.122 Main Rotor Hub Installation

1. Clean and dry teeter hinge hardware using approved solvent per § 1.400. Inspect journals and thrust washers for chipping of chrome plating, corrosion, and/or wear grooves extending through chrome plating (0.0006 inch maximum wear). Replace journal or thrust washer if any of these conditions exist.

2. If teeter hinge friction recorded during hub removal was less than 5 ft-lb or more than 20 ft-lb, if teeter hinge hub bearing(s) was replaced, or if previous installation information is unavailable, perform teeter hinge journal and shim calculation per § 9.123 Part A.

3. Refer to Figure 9-5. Line up mark on hub with chord arm on drive shaft. Install teeter hinge bolt, thrust washers, shims, and journals (if previous installation information is available, install parts exactly as removed).

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

WARNING

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

5. Refer to Figure 9-2. Install MT122-6 main rotor bolt stretch tool on teeter bolt. Zero dial indicator by rotating dial face and lock dial. Remove tool.

9.122 Main Rotor Hub Installation (continued)

6. Using wrenches with at least 600 ft-lb torque capacity, tighten nut until drilled holes in nut and bolt align. Install MT122-6 tool and measure bolt stretch:

   a. If bolt stretch is between 0.020–0.022 inch, remove tool and verify correct teeter hinge friction per § 9.124 Part A. Adjust teeter hinge friction as required.

   b. If bolt stretch is not between 0.020–0.022 inch, remove old nut and old bolt and install a new bolt and a new nut. Stretch new bolt per § 1.330 and verify correct teeter hinge friction per § 9.124 Part A. Adjust teeter hinge friction as required. Drill new nut and bolt per § 9.116.

WARNING

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

7. Install a new cotter pin wet with epoxy primer.

C106 Journal Lengths		
Part No.	Length	Location
C106-1	1.300 in.	Coning hinge, no shims
C106-2	1.305 in.	Coning hinge, no shims
C106-3	1.310 in.	Coning hinge, no shims
C106-4	1.315 in.	Coning hinge, no shims
C106-5	1.775 in.	Teeter hinge (two, or one + C106-6 per hinge), shims
C106-6	1.815 in.	Teeter hinge (none, or one + C106-5 per hinge), shims
C106-7	1.284 in.	Coning hinge (two per hinge), shims

C117 Shim Sizes		
Part No.	Thickness	Location (Between thrust washer and journal)
C117-8	0.012 in.	Teeter hinge; Coning hinge trailing-edge side
C117-9	0.015 in.	Teeter hinge; Coning hinge trailing-edge side
C117-10	0.020 in.	Teeter hinge; Coning hinge trailing-edge side
C117-11	0.025 in.	Teeter hinge; Coning hinge trailing-edge side

TABLE 9-1 C106 JOURNAL LENGTHS AND C117 SHIM SIZES

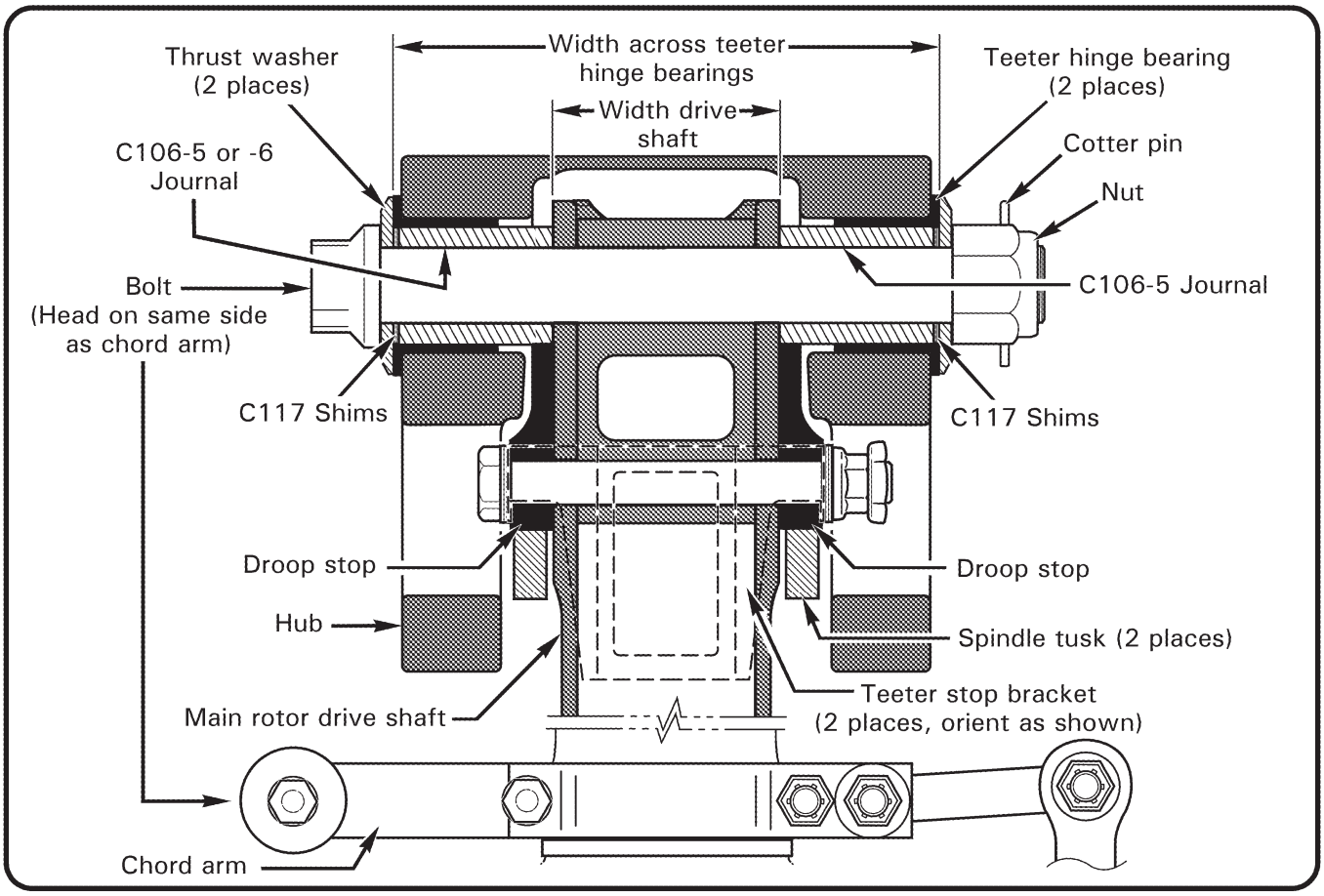


FIGURE 9-5 TEETER HINGE (HUB INSTALLATION)

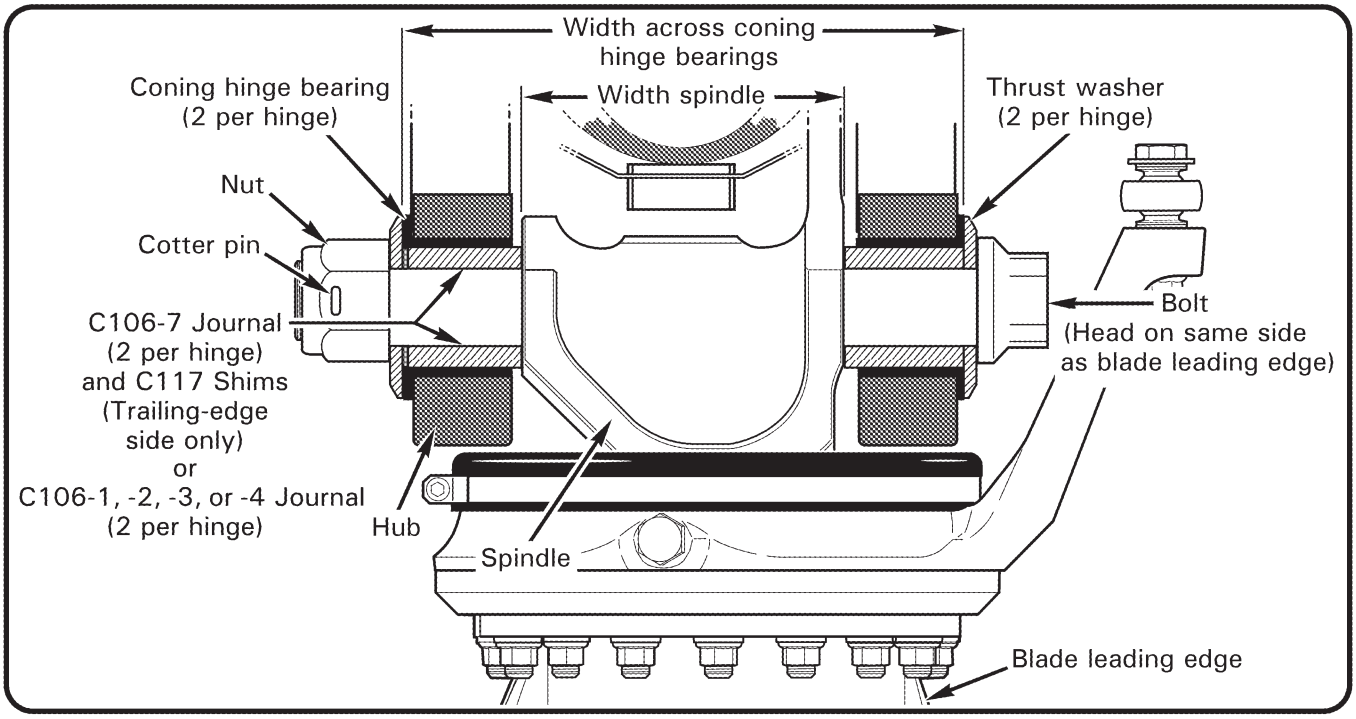


FIGURE 9-6 CONING HINGE (BLADE INSTALLATION; VIEW LOOKING DOWN)

9.123 Main Rotor Hub Journal and Shim Calculations

Refer to Table 9-1 and Figures 9-5 and 9-6.

A. Teeter Hinge Calculation

1. Measure main rotor hub width across the teeter hinge bearing faces: _____ in.
2. Subtract measured width of C251 driveshaft at teeter hinge bolt hole: – _____ in.

   Calculated empty space: = _____ in.
3. Use one C106-5 or C106-6 journal and a selection of C117 shims to create a combined length of approximately 1.835 inches. Use as many different size shims as possible. Place thrust washer, shims, and journal under teeter bolt head; shims must be placed between thrust washer and journal.

   Subtract combined measured thickness of selected journal and shims: – _____ in.

   Difference: = _____ in.
4. Subtract measured length of C106-5 journal to be used on nut-side: – _____ in.

   Difference: = _____ in.

CAUTION

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

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

   Initial C117 shim stack between nut-side journal & thrust washer: = _____ / _____ in.
6. Adjust shim stack as required to meet teeter hinge friction requirements (5-20 ft-lb; 8-12 ft-lb is ideal). Use as many different size shims as possible to facilitate head shifting during balancing.

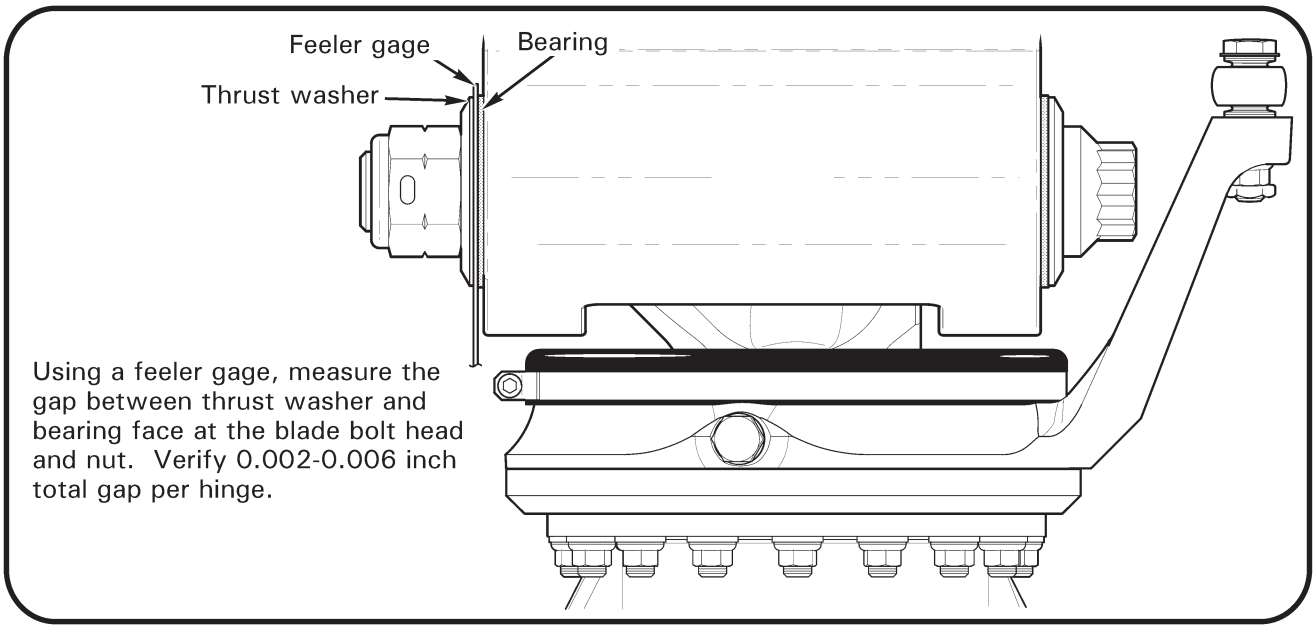


FIGURE 9-7 MEASURING CONING HINGE AXIAL GAP

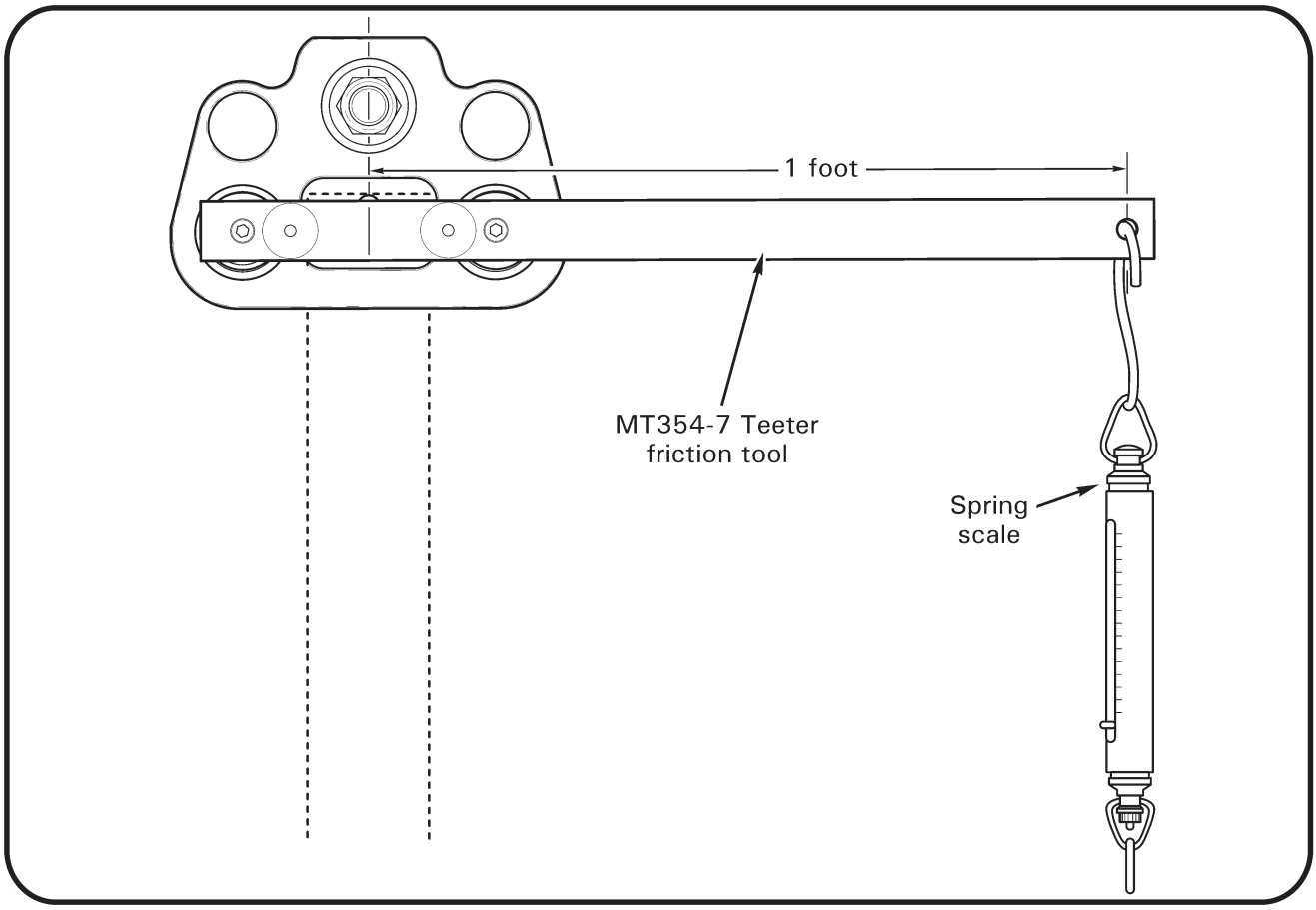


FIGURE 9-8 MEASURING TEETER HINGE FRICTION

9.123 Main Rotor Hub Journal and Shim Calculations (continued)

B. Coning Hinge Calculation

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

Calculated empty space: = _____ in.

CAUTION

Initial coning hinge hardware stack-up must be adjusted to 0.012/0.016 inch greater than calculated empty space. A smaller initial stack-up could damage thrust washers and hub bearings during installation.

3. To accommodate dimensional change due to clamping force, add: + 0.012/0.016 in.

Sum: = _____ in.

4. Perform step a or step b:
   a. Subtract combined measured length of (2) C106-7 journals from Sum: – _____ in.

      Initial C117 shim stack between trailing-edge journal & thrust washer: = _____ in.

   b. Select a combination of C106-1, -2, -3, or -4 journals whose combined measured lengths equal Sum. The same journal dash number must be used under the head of both coning hinge bolts to maintain symmetry.
5. Adjust journal combination or shim stack as required to meet coning hinge axial gap requirement per Figure 9-7 and to maintain teeter friction requirement as follows: It must be possible to manually cone each blade without teetering the hub when blades are held up off the droop stops and lifted at tip.

9.124 Adjusting Hinge Friction

A. Teeter Hinge Friction Adjustment

1. Remove main rotor blades per § 9.111.
2. Refer to Figure 9-5 and Table 9-1. Remove cotter pin, nut, thrust washer, and nut-side C117 shims. Adjust teeter hinge friction by changing nut-side shim stack thickness in small increments; reducing shim stack thickness increases friction, increasing shim stack thickness reduces friction. Install shims, thrust washer, and nut.

9.124 Adjusting Hinge Friction (continued)

A. Teeter Hinge Friction Adjustment (continued)

3. Refer to Figure 9-8. While torquing teeter hinge bolt per § 1.330, check teeter hinge friction frequently. To check friction, install MT354 teeter friction tool into coning hinge bearings on one side of main rotor hub and measure moving force (not breakaway force) required to teeter main rotor hub with a spring scale.

NOTE
Do not exceed 20 ft-lb teeter friction. If bolt cannot be torqued per § 1.330 without exceeding friction limit, increase shim stack thickness per step 2.

4. Install a new bolt and nut per § 9.122.

B. Coning Hinge Friction Adjustment

1. Refer to Figure 9-6 and Table 9-1. Remove cotter pin, nut, thrust washer, and nut-side C117 shims (or journal). Adjust coning hinge friction by changing nut-side shim stack thickness (or journal length) in small increments; reducing shim stack thickness (or using a shorter journal) increases friction, increasing shim stack thickness (or using a longer journal) reduces friction. Coning hinge friction is zero when there is a measurable axial gap per Figure 9-7. Install shims (or journal), thrust washer, and nut.

2. Install a new bolt and nut per § 9.122, steps 7 thru 9. Repeat steps for opposite blade.

3. Check coning hinge friction by lifting blades until spindle tusks clear droop stops. Hold one blade level and cone opposite blade. Rotor hub may not teeter as blade is coned. Repeat check on opposite blade.

4. Using a feeler gage, measure gap between thrust washers and bearing faces at coning hinge bolt head and nut. Verify 0.002-0.006 inch total gap per hinge.

5. Drill nut and bolt per § 9.116. Install a new cotter pin wet with epoxy primer.

9.125 Shifting the Main Rotor Hub

1. Remove cotter pin, nut, thrust washer, and nut-side C117 shims.

2. Have two people cone the main rotor blades. Push out teeter hinge bolt with another bolt.

3. Move or exchange existing shims from one side of hub to the other as indicated by main rotor balance chart (refer to § 10.230).

4. Install teeter hinge bolt per § 9.122

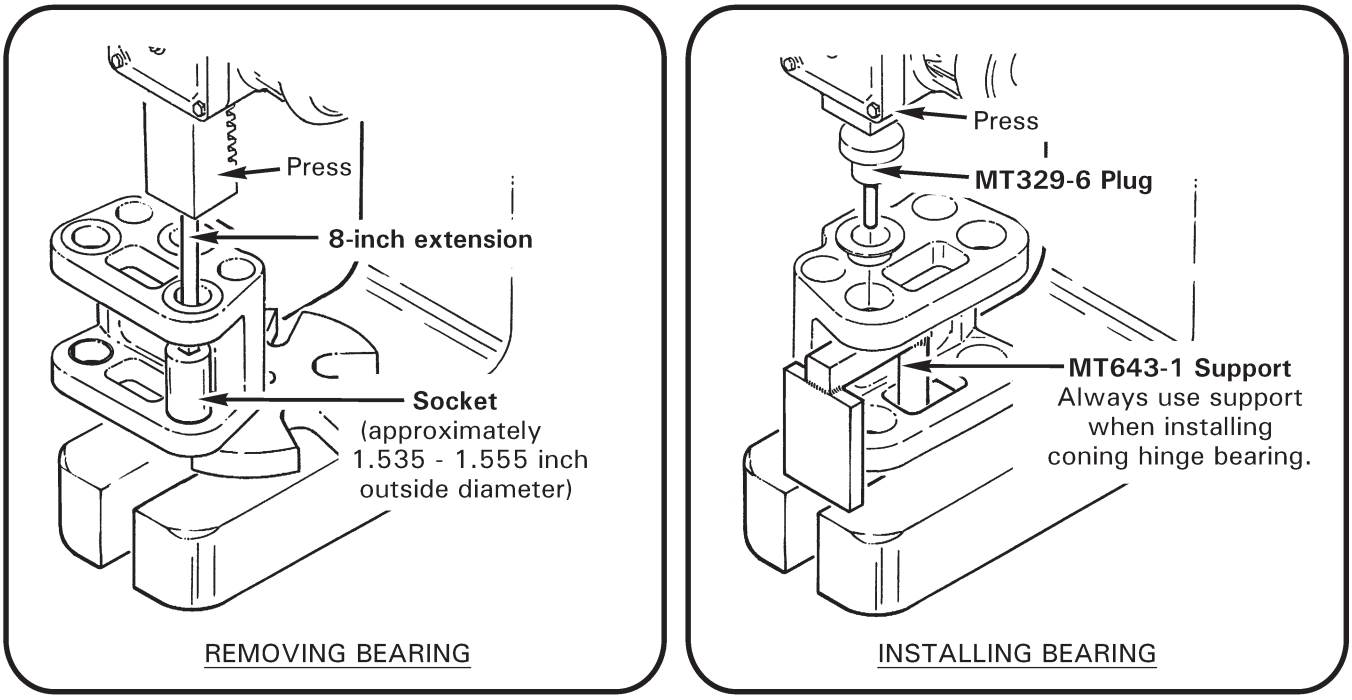


FIGURE 9-9 MAIN ROTOR HUB BEARING REPLACEMENT

9.126 Main Rotor Hub Bearing Replacement

1. Refer to Figure 9-9. Verify tooling surfaces are smooth to avoid damaging hub and bearings. Press bearing(s) from hub using a socket (approximately 1.535-1.555 inch outside diameter) and an 8-inch extension.

2. Visually inspect hub bearing bore and verify no scoring or scratches. Polish out fretting or corrosion to 0.001 inch maximum depth (0.005 inch on radius at edge of bore) and 0.25 inch minimum blend radius using 320-grit or finer wet-or-dry sandpaper. Fretting or corrosion that extends beyond repair limit requires hub replacement.

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

3. Verify bearing mating surfaces are smooth and clean and apply light coat of epoxy primer (refer to § 1.400). If visible, orient coning hinge bearing's Teflon liner seam toward top of hub. While primer is wet, press in new bearing using MT329-6 plug (and MT643-1 support if replacing coning hinge bearing) until bearing flange is completely seated against hub.

4. Using a syringe, seal between bearing's outboard flange and hub and bearing's inboard edge and hub with small fillet of epoxy primer.

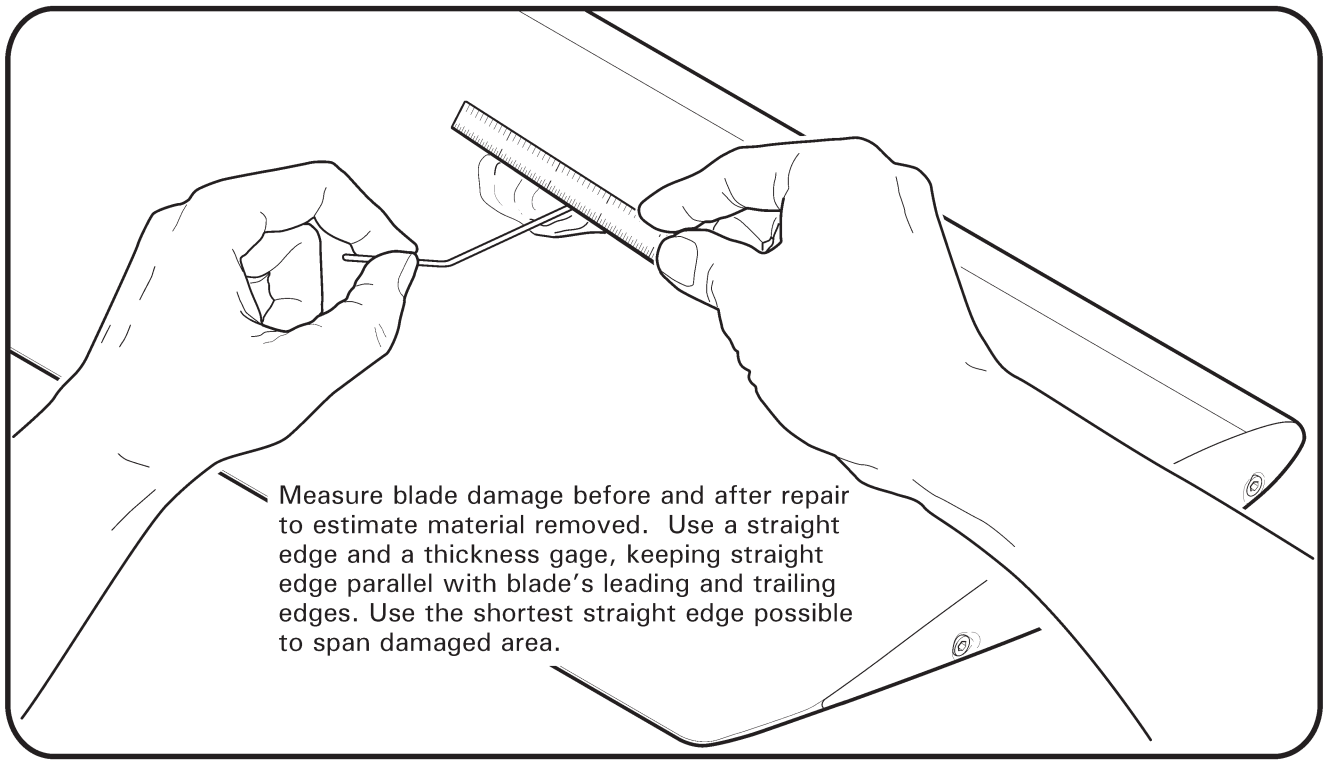


FIGURE 9-10 MEASURING MAIN ROTOR BLADE DAMAGE

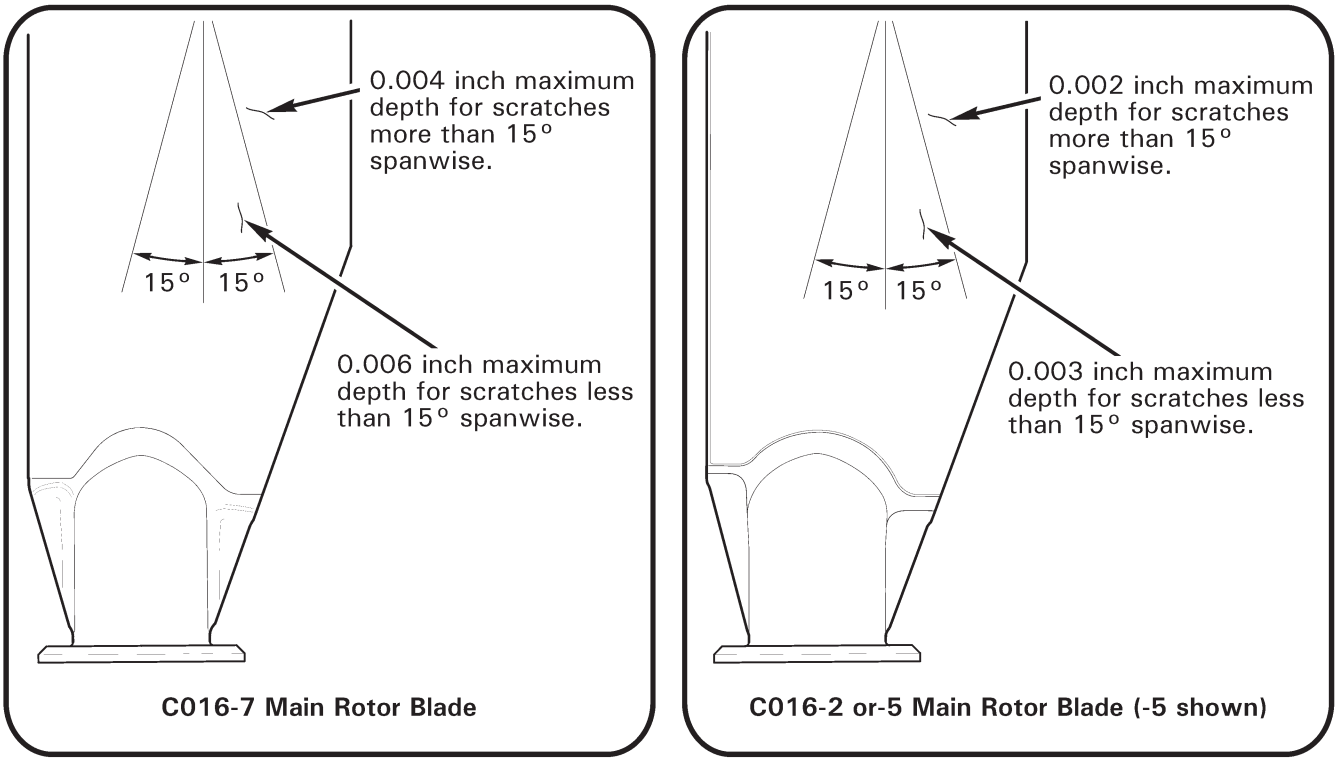


FIGURE 9-11 SCRATCH LIMITS

9.130 Inspection of Main Rotor Blades

NOTE

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

NOTE

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

CAUTION

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

A. Measuring Damage

1. Refer to Figure 9-10. Measure blade damage using a straight edge and a thickness gage. Keep straight edge parallel with the leading and trailing edges.
2. If blades are installed on the helicopter, measure damage using the shortest straight edge possible to span damaged area. Using a straight edge of excessive length will cause a false reading due to natural droop of the blade.

B. Measuring Material Removed After Repair

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

9.131 Scratches and Corrosion on Blade Skins and Doublers

1. Refer to Figure 9-11. Damage may not exceed the following limits after rework:

   C016-7 Blades:

   a. 0.004 inch maximum depth for scratches more than 15° from spanwise axis.
   b. 0.006 inch maximum depth for scratches less than 15° from spanwise axis.
   c. 0.012 inch maximum corrosion between RS 174.0 and RS 198.0.
   d. 0.008 inch maximum corrosion between RS 124.0 and RS 174.0.
   e. 0.006 inch maximum corrosion between RS 58.0 and RS 124.0.
   f. 0.010 inch maximum corrosion between RS 18.7 and RS 58.0.

   C016-2 or -5 Blades:

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

2. Refer to § 9.140 for repair procedures for damage within limits. Polish out damage by hand with 0.10 inch blend radius.

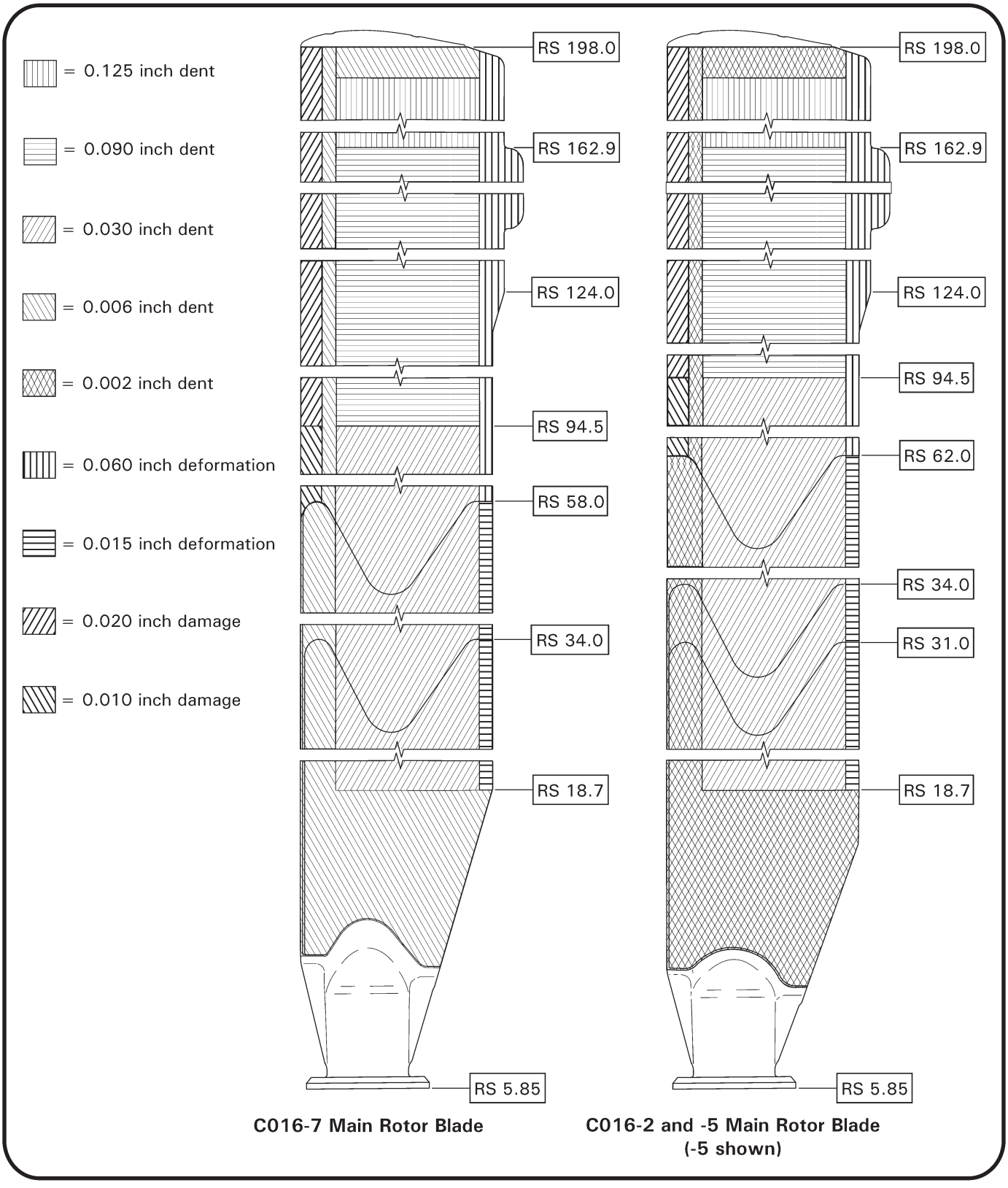


FIGURE 9-12 DENTS AND LOCAL DEFORMATIONS

9.132 Dents and Local Deformations

CAUTION

Tap-test dented areas in honeycomb using an AN970-4 washer or 1965-or-later U.S. quarter dollar coin in good condition. If any voids are found associated with dents, contact RHC Technical Support.

CAUTION

Do not repair any dent that has a sharp cut or break in the skin; dent must have 0.060 inch minimum radius. If necessary, locally penetrant inspect, keeping penetrant materials away from bond joints.

1. Refer to Figure 9-12. Damage may not exceed the following limits:

   a. Honeycomb:

      i. 0.020 inch maximum bulge on opposite side of blade, opposite dent.
      ii. 0.125 inch maximum depth dent between RS 162.90 and RS 198.0.
      iii. 0.090 inch maximum depth dent between RS 94.5 and RS 162.9.
      iv. 0.030 inch maximum depth dent between RS 18.7 and RS 94.5.

   b. Leading edge of doublers: 0.010 inch maximum depth dent.

   c. Supported bond joints:

      C016-7 Blades: 0.006 inch maximum depth dent.

      C016-2 or -5 Blades: 0.002 inch maximum depth dent.

   d. Local deformations:

      C016-7 Blades: Within 0.75 inch forward of trailing edge:

      i. 0.060 inch deformation between RS 58.0 and RS 198.0.
      ii. 0.015 inch deformation between RS 18.7 and RS 58.0.

      C016-2 or -5 Blades: Within 1.0 inch forward of trailing edge:

      i. 0.060 inch deformation between RS 62.0 and RS 198.0.
      ii. 0.015 inch deformation between RS 18.7 and RS 62.0.

   e. Spar: Refer to step 2. Blend damaged areas by hand with a minimum 1.0 inch blend radius. Blending is not allowed within 0.010 inch of spar groove leading edge.

      C016-7 Blades:

      i. 0.020 inch maximum depth damage between RS 94.5 and RS 198.0.
      ii. 0.010 inch maximum depth damage between RS 58.0 and RS 94.5.

      C016-2 and -5 Blades:

      i. 0.020 inch maximum depth damage between RS 94.5 and RS 198.0.
      ii. 0.010 inch maximum depth damage between RS 62.0 and RS 94.5.

2. Refer to § 9.140 for repair procedures for damage within limits. Smooth, round bottom dents with 0.060 inch minimum radius may be filled and faired to an aerodynamic shape.

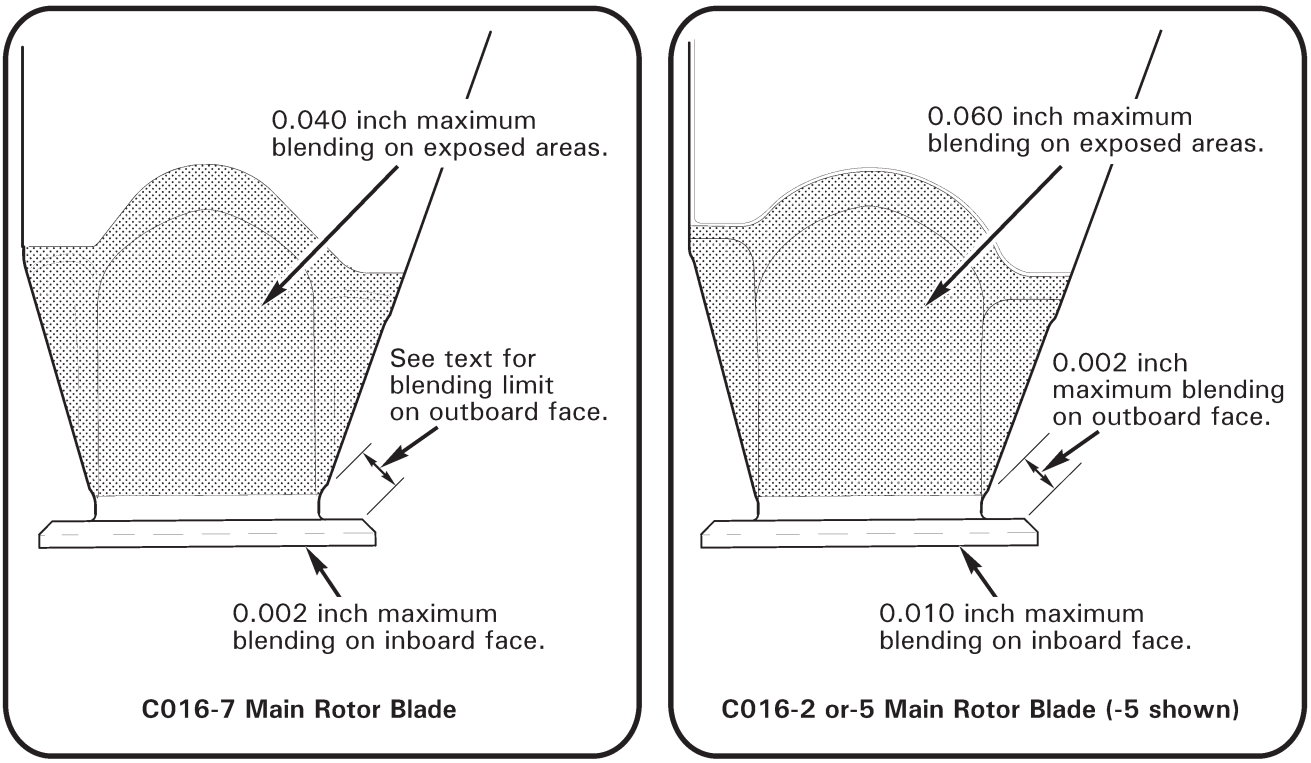


FIGURE 9-13 ROOT FITTING BLEND LIMITS

9.133 Root Fitting Damage

1. Refer to Figure 9-13. Damage may not exceed the following limits:

   C016-7 Blades:

   Refer to step 2. Blend damaged areas by hand with a minimum 0.030 inch blend radius.

   a. 0.002 inch maximum depth blending on flange inboard face.
   b. 0.005 inch maximum depth, 0.250 inch maximum diameter blending on flange outboard machined face (3 blends maximum). 0.10 inch minimum distance from hole edges.
   c. 0.040 inch maximum depth blending on exposed areas of root fitting.

   C016-2 and -5 Blades:

   Refer to step 2. Blend damaged areas by hand with a minimum 0.10 inch blend radius.

   i. 0.010 inch maximum depth blending on flange inboard face.
   ii. 0.002 inch maximum depth blending on flange outboard machined face.
   iii. 0.060 inch maximum depth blending on exposed areas of root fitting.

2. Refer to § 9.140 for repair procedures for damage within limits.

9.134 Voids

CAUTION

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

CAUTION

Voids or debonds in doublers are not field repairable. If voids or debonds are detected in doublers which exceed limits, contact RHC Technical Support.

A. Critical Bond Areas

Refer to Figure 9-14. Critical bond areas are areas less than 0.50 inch spanwise and less than 0.30 inch chordwise from the edge of any structural bond joint.

Bond areas not defined as semi-critical or non-critical are considered critical.

Voids separated by less than 0.25 inch are considered continuous.

1. Damage may not exceed the following limits:

   a. 0.10 square inch maximum void.
   b. Area must be at least 90% bonded.

B. Semi-Critical Bond Areas

C016-7 Blades:

C016-7 Blades do not have semi-critical bond areas.

C016-2 and -5 Blades:

Refer to Figure 9-14. Semi-critical bond areas are areas more than 0.50 inch spanwise or more than 0.30 inch chordwise from the edge of the trim tab.

Voids separated by less than 0.25 inch are considered continuous.

1. Damage may not exceed the following limits:

   a. 0.80 inch diameter circle maximum void.
   b. 1.5 square inches maximum void.
   c. 0.10 square inch maximum of a void extending into a critical bond area.
   d. Area must be at least 80% bonded.

C. Non-Critical Bond Areas

Refer to Figure 9-14. Non-critical bond areas are areas more than 0.50 inch spanwise or more than 0.30 inch chordwise from doubler edges and bonded areas between skin and honeycomb.

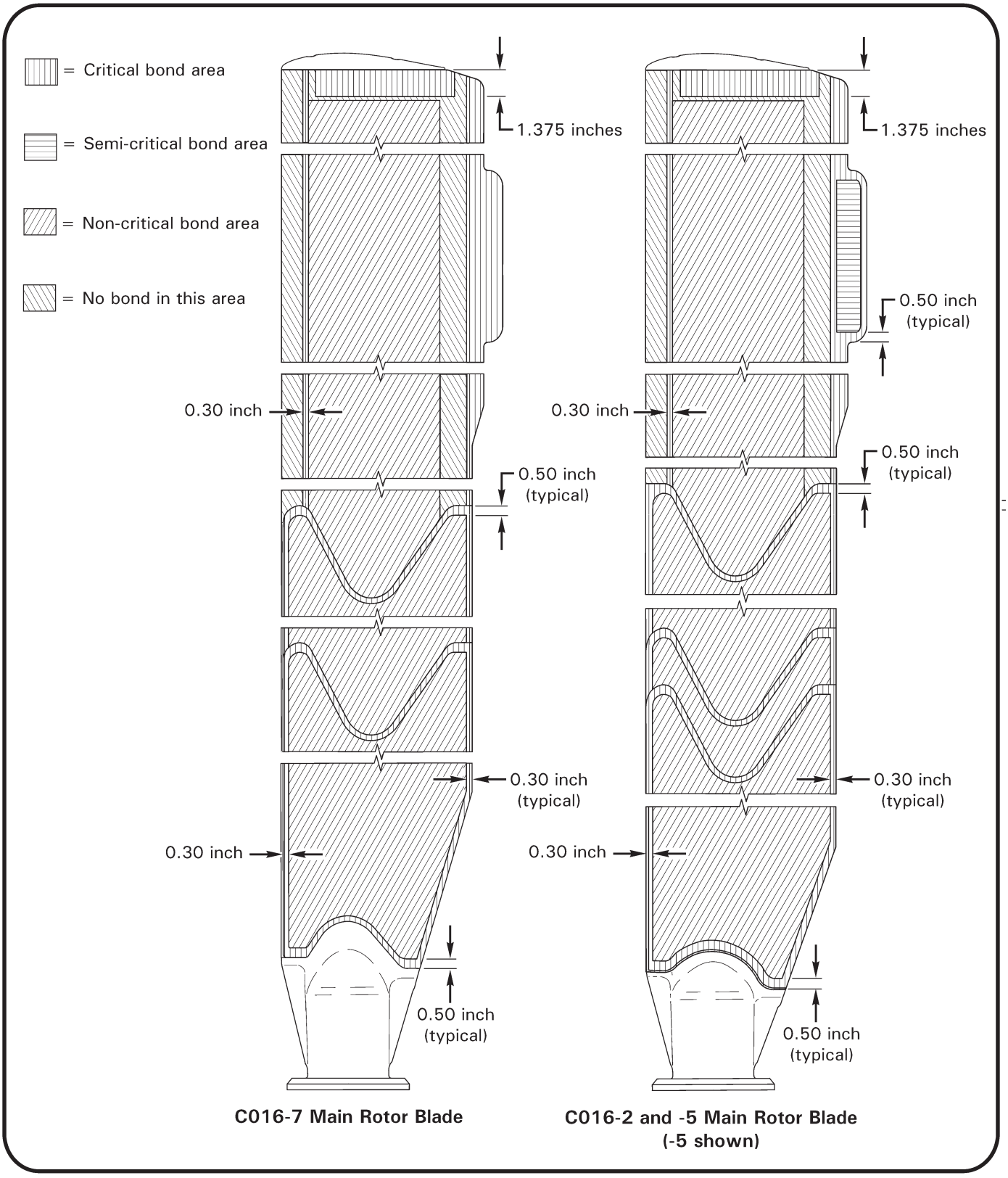


FIGURE 9-14 BOND AREAS

9.134 Voids (continued)

C. Non-Critical Bond Areas (continued)

C016-7 Blades:

1. Voids in doubler bond joints separated by less than 0.25 inch are considered continuous. Damage in doubler bond joints may not exceed the following limits:

   a. Area must be at least 80% bonded.
   b. 6.0 square inches, 2.0 inches chordwise, & 7.0 inches spanwise maximum void.
   c. 0.10 square inch maximum of a void extending into a critical bond area.
   d. Voids are permissible within 0.30 inch of doubler leading edge where it wraps around spar and root fitting.

2. Voids in honeycomb bond joints separated by less than 0.50 inch spanwise or 1.0 inch chordwise are considered continuous. Damage in honeycomb bond joints may not exceed the following limits:

   a. Area must be at least 80% bonded.
   b. 15.0 square inches, 1.5 inches chordwise, & 20.0 inches spanwise maximum void inboard of RS 121.0.
   c. 15.0 square inches, 2.5 inches chordwise, & 20.0 inches spanwise maximum void outboard of RS 121.0.

C016-2 and -5 Blades:

1. Voids in C934 doubler bond joints may not exceed the following limits:

   a. 6.0 square inches, 2.0 inches chordwise & 7.0 spanwise maximum void.
   b. 0.10 square inch maximum void extending into a critical bond area.
   c. 2.0 inches maximum void from outboard tips (refer to R44 SL-31).

2. Voids in C162 doubler bond joints may not exceed the following limits:

   a. 6.0 square inches, 2.0 inches chordwise, & 7.0 inches spanwise maximum void.
   b. 0.10 square inch maximum void extending into a critical bond area.
   c. 4.0 square inches, 0.50 inch chordwise, & 12.0 inch spanwise maximum void between doubler and spar.
   d. 0.20 inch chordwise maximum void along doubler leading edge where it wraps around spar and root fitting.

3. Voids in honeycomb bond joints inboard of RS 121.0 may not exceed 10.0 square inches, 1.50 inches chordwise, & 20.00 inches spanwise maximum.

4. Voids in honeycomb bond joints outboard of RS 121.0 may not exceed 15.0 square inches, 2.50 inches chordwise, & 20.00 inches spanwise maximum.

5. Voids in honeycomb bond joints between RS 150.0 and RS 166.0 must be at least 1.0 inch forward of honeycomb trailing edge and the skin over void may not move when trim tabs are flexed.

6. Voids in doubler bond joints separated by less than 0.25 inch, less than 0.50 inch spanwise, or less than 1.0 inch chordwise are considered continuous. Area must be at least 80% bonded.

Intentionally Blank

9.140 Repair of Main Rotor Blades

Refer to § 1.400 for approved materials.

CAUTION

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

1. Measure damage per § 9.130.

2. Remove damage at trailing edges, trim tab edges, tip cap, and/or tip corner by trimming per § 9.141 as required.

3. Polish out damage using 220 grit or finer wet-or-dry aluminum-oxide or silicon-carbide abrasive paper, and finish with 320 grit or finer wet-or-dry abrasive paper. A fine-toothed file may be used along the spar and trailing edge, provided the area is finished with 320 grit or finer wet-or-dry abrasive paper. Sand or file in spanwise direction. Remove only the material necessary to remove the damage and blend to the radius or dimension specified. Visually inspect and verify damage is removed.

4. Measure material removed per § 9.130. Verify repair does not exceed limit specified.

5. Seal or fill as required per the following:

   a. Clean area to be sealed or filled using approved solvent (refer to § 1.400).

   b. Apply epoxy primer to bond joints with pin holes or other openings. Mix primer per manufacturer's instructions. Allow a minimum of 24 hours cure time.

   c. Using 220-grit or finer wet-or-dry aluminum-oxide or silicon-carbide abrasive paper, hand-sand cured adhesive in spanwise direction to a smooth, aerodynamic finish, congruent with the blade airfoil. Do not remove metal.

   d. Hand-sand surrounding painted surface until 25% primer remains. Keep bare metal to a minimum.

6. Paint per § 9.142 as required.

7. Track and balance main rotor per § 10.230 as required.

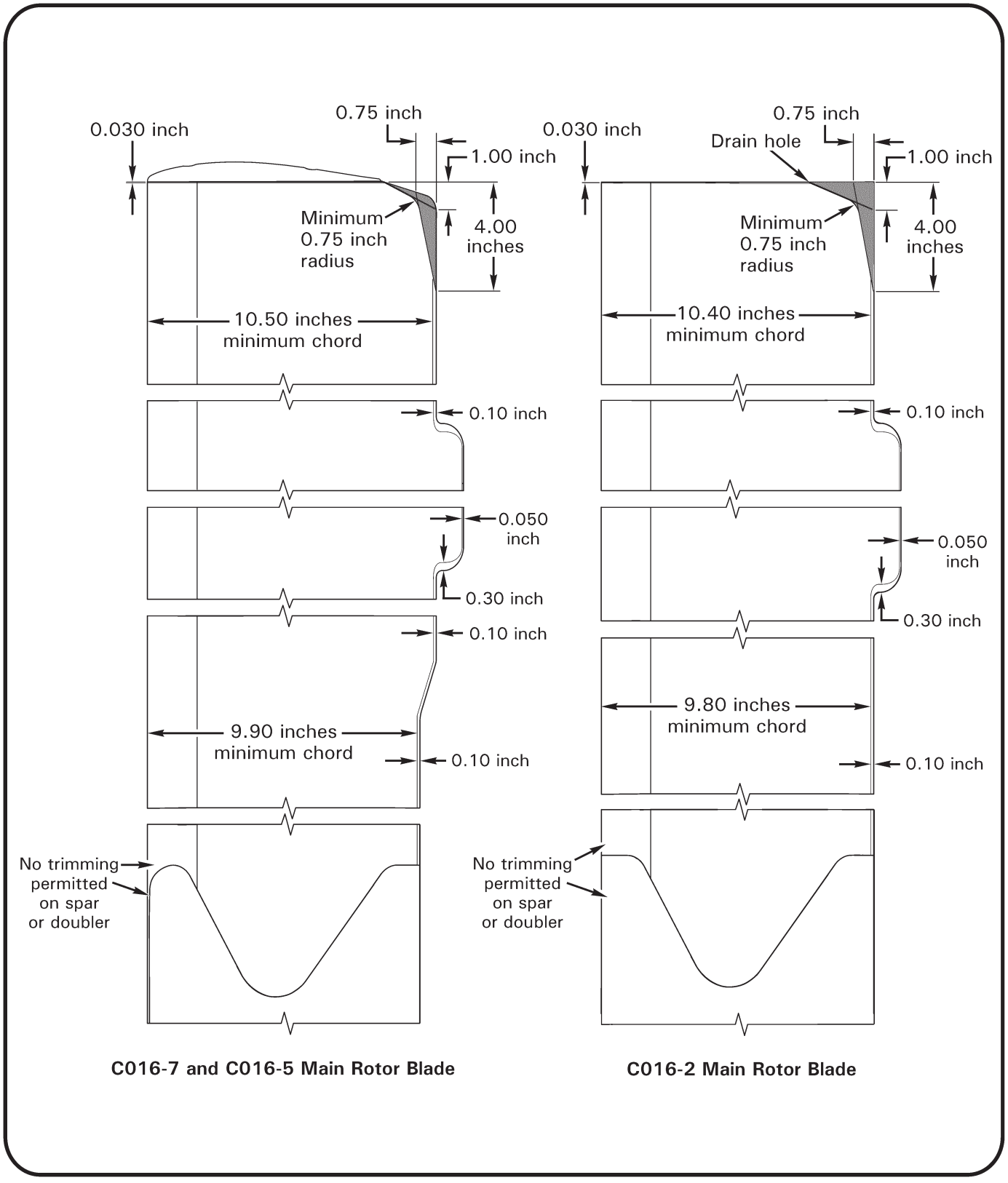


FIGURE 9-15 TRIM LIMITS

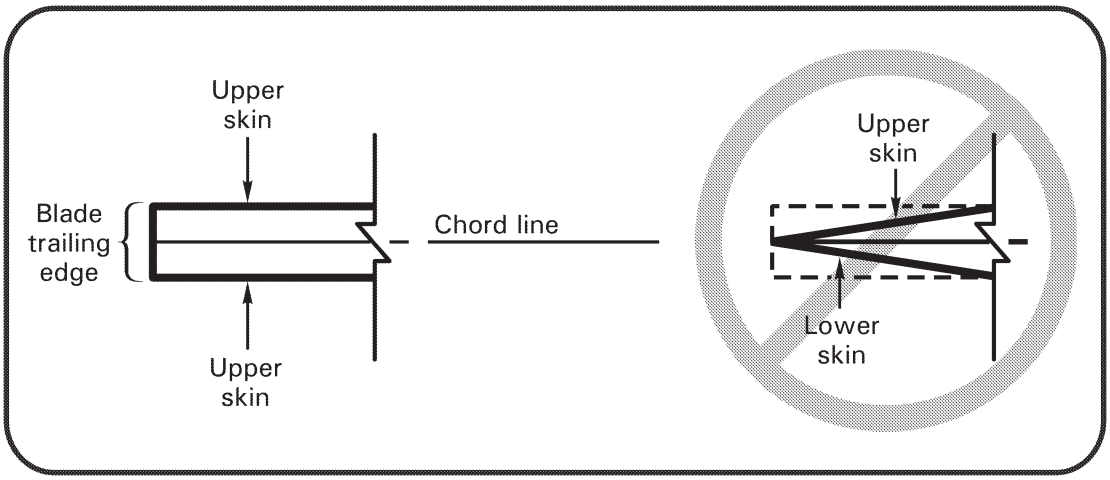


FIGURE 9-16 FILING EDGES SQUARE WITH SKINS

9.141 Trimming

Refer to Figures 9-15 & 9-16. Trimming may be performed on the trailing edge of main rotor blade skins and trim tab edges within limits shown. (Alternately, a trailing edge nick or notch may be blended out 1.0 inch minimum spanwise, each side of nick or notch within limits shown.) Trimming is not permitted on spar or doublers.

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

Finish repair per § 9.140 steps 2 thru 7. File trailing edge or trim tab edges square with skins (do not file into a point). Verify minimum chord dimension.

9.142 Painting

Refer to § 1.400 for approved materials. Refer to paint manufacturer's recommendations.

CAUTION

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

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

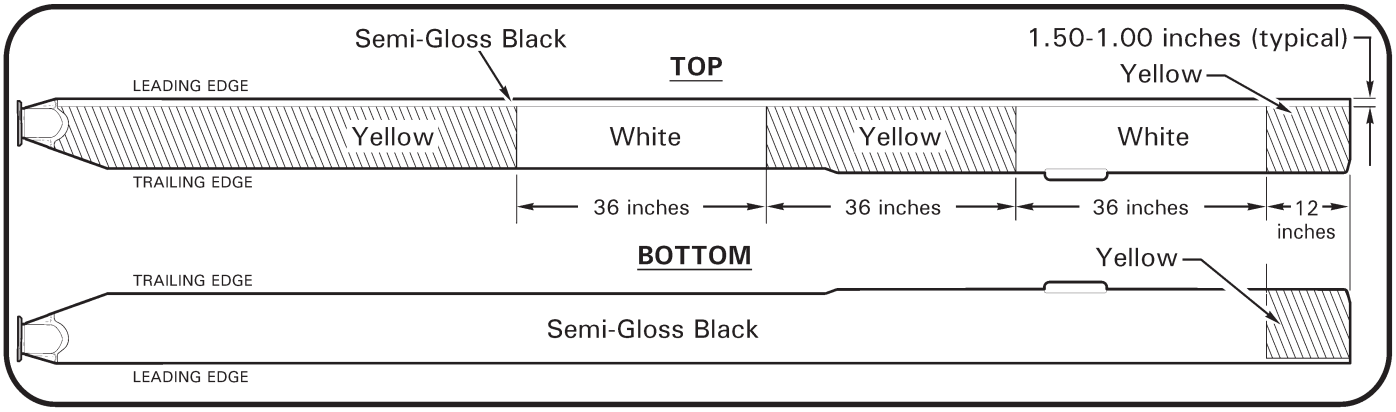


FIGURE 9-17 C016-7 AND C016-5 MAIN ROTOR BLADE PAINT SCHEME

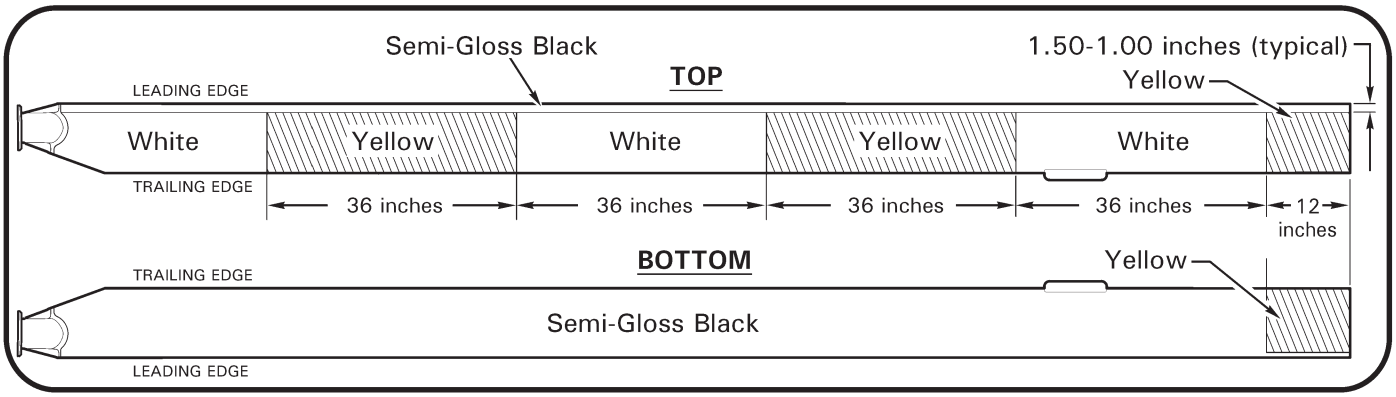


FIGURE 9-18 C016-2 (STRAIGHT CHORD) MAIN ROTOR BLADE PAINT SCHEME

9.142 Painting (continued)

6. Refer to Figures 9-17 & 9-18. 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. Install blade tip cover(s) if removed.

8. Remove masking materials.

9.200 Tail Rotor Assembly

9.210 Tail Rotor Assembly Removal

1. Refer to Figure 9-11 or Figure 9-12. 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.

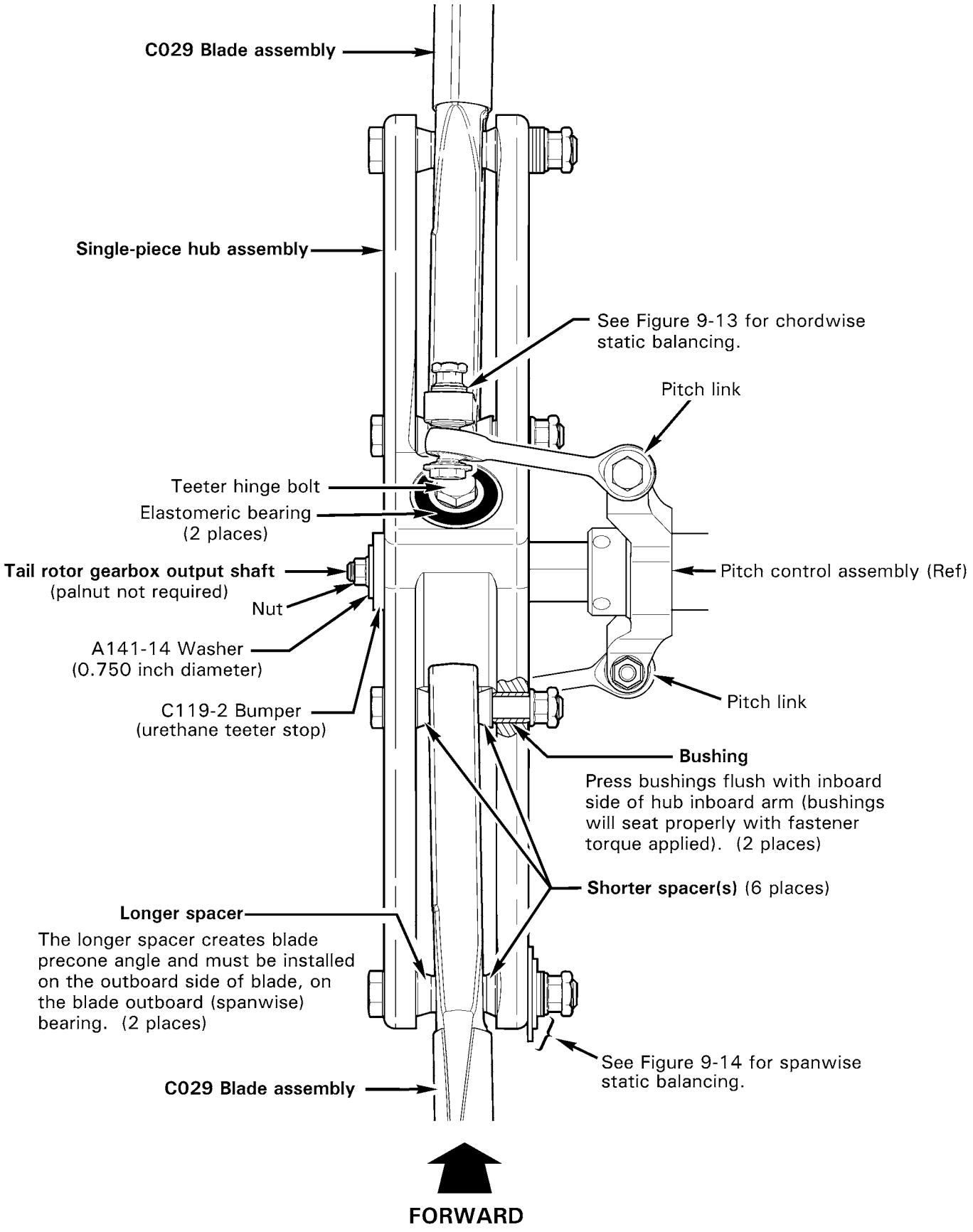


FIGURE 9-11 SINGLE-PIECE HUB TAIL ROTOR ASSEMBLY INSTALLATION

9.220 Tail Rotor Assembly Installation

A. Single-Piece Hub (Elastomeric Bearing) Tail Rotor Assembly

1. Refer to Figure 9-11. 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.

2. Install teeter hinge bolt and tighten nut until elastomeric bearing metal spacers contact output shaft, but do not torque. Verify blades cone toward tail rotor gearbox.

CAUTION

If balancing hardware information is unknown, perform static balance per Section 9.230.

3. Remove tags. Install hardware securing tail rotor blades to pitch links as removed, or as determined by static balancing. Standard torque nuts & palnuts per Section 1.320, and torque stripe per Figure 2-1.

4. Fabricate a tracking aid using 1x12-inch aluminum sheet; make a 90º bend 2 inches from one end. With tail rotor horizontal, tape tracking aid to tailcone near blade tip.

5. Rotate tail rotor drive shaft and mark tracking aid where each blade tip drain hole passes. Adjust (teeter) tail rotor until both blade tips pass the same point within 0.125 inch. Special torque teeter hinge bolt per Section 1.330. Recheck track. Repeat step until blades are tracked.

6. Install palnut on teeter hinge bolt, standard torque per Section 1.320, and torque stripe per Figure 2-1. Remove tracking aid.

7. Teeter tail rotor hub back and forth. Verify teeter hinge bolt, bearing metal spacers, washers, and nuts remain stationary when tail rotor is teetered.

8. Install C119-2 bumper, A141-14 washer, and nut. Standard torque nut per Section 1.320 and torque stripe per Figure 2-1.

9. Dynamically balance tail rotor per Section 10.240.

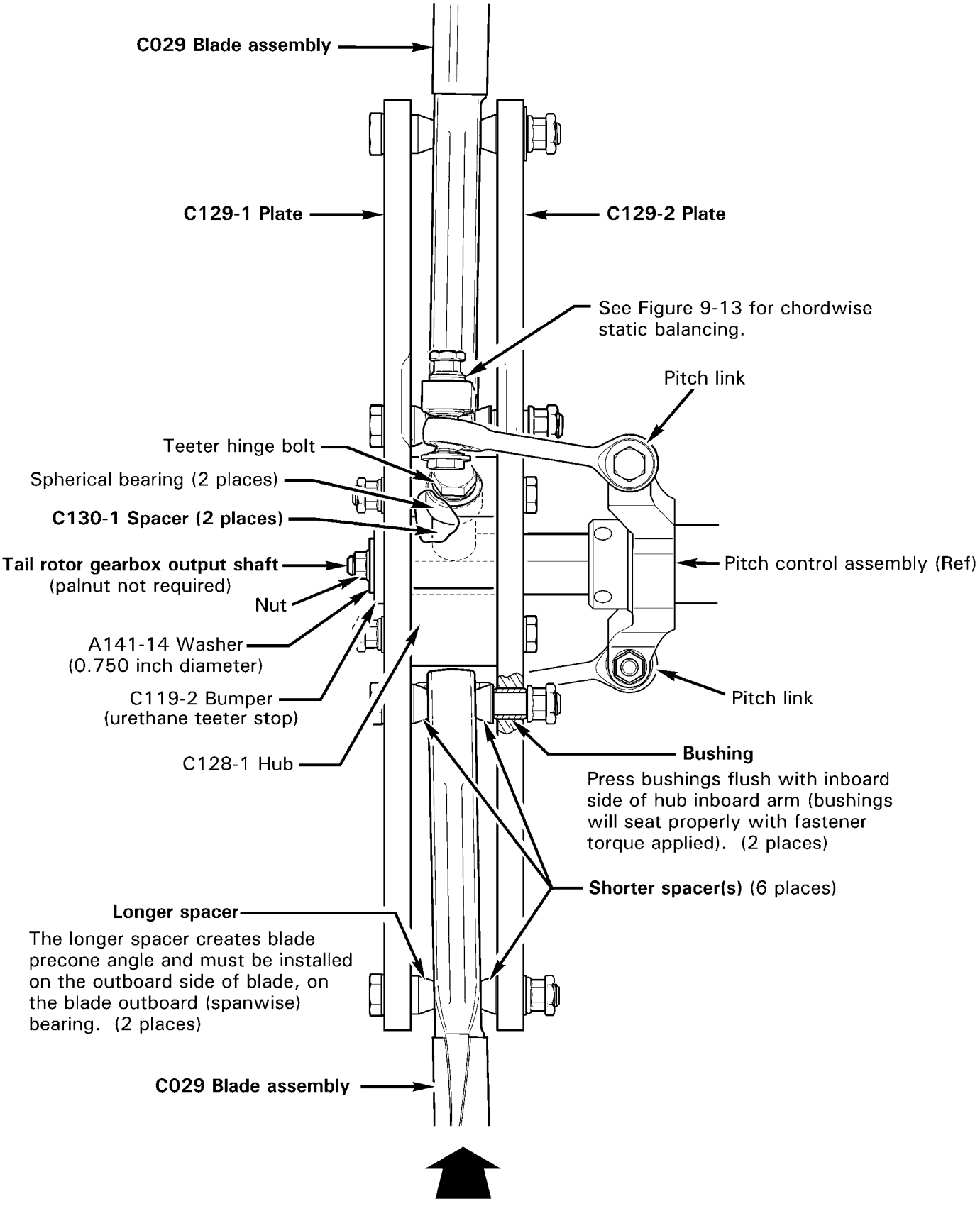


FIGURE 9-12 THREE-PIECE HUB TAIL ROTOR ASSEMBLY INSTALLATION

9.220 Tail Rotor Assembly Installation (continued)

B. Three-Piece Hub (Spherical Bearing) Tail 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. Refer to Figure 9-12. 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.

3. Install teeter hinge bolt, standard torque nut & palnut per Section 1.320, 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.

4. 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.

5. Install hardware securing tail rotor blades to pitch links as removed, or as determined by static balancing. Standard torque nuts & palnuts per Section 1.320, and torque stripe per Figure 2-1.

6. Install C119-2 bumper, A141-14 washer, and nut. Standard torque nut per Section 1.320 and torque stripe per Figure 2-1.

7. Dynamically balance tail rotor per Section 10.240.

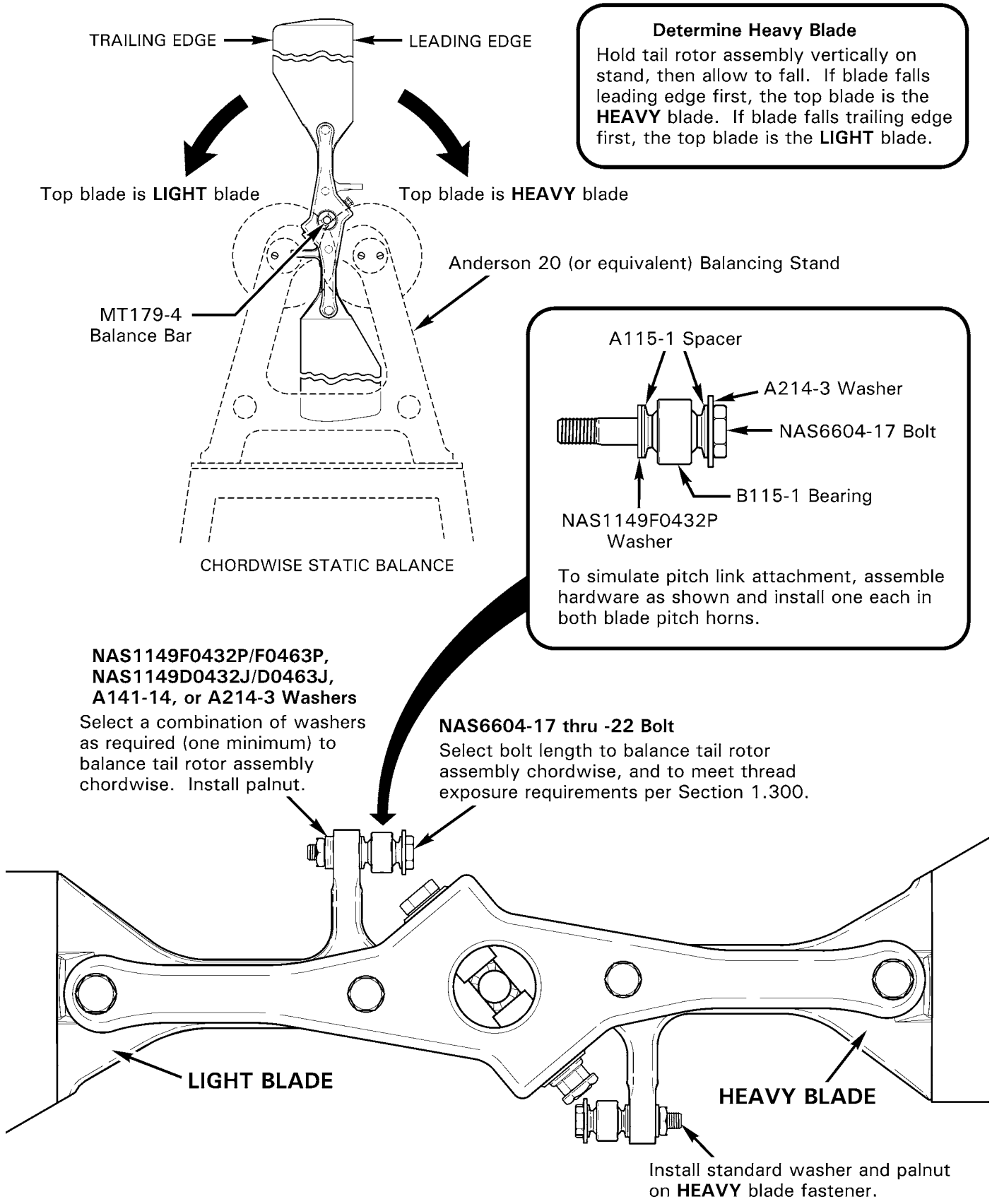


FIGURE 9-13 CHORDWISE STATIC BALANCE
(C008-9 Tail Rotor Assembly Shown)

9.230 Static Balance

A. Chordwise Static Balance

1. Refer to Figure 9-13. Install MT179-4 balance bar into tail rotor assembly. Install teeter hinge bolt, tighten until bearing spacers firmly clamp bar, and install palnut finger-tight. Using a carpenter's square, adjust balance bar until approximately perpendicular to hub.

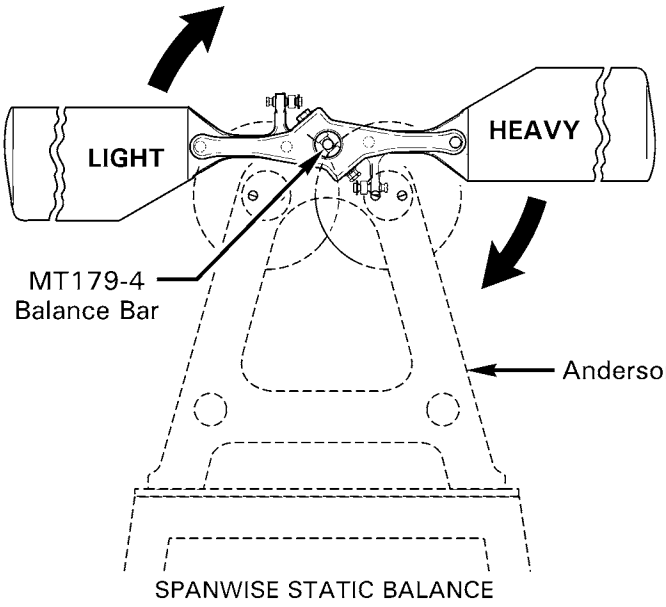
2. Place tail rotor assembly with balance bar on Anderson 20 or equivalent balancing stand. Adjust pitch of both blades so they are similar. Hold tail rotor assembly vertically, then allow to fall. If the blade falls leading edge first, the top blade is the heavy blade. If the blade falls trailing edge first, the top blade is the light blade.

3. To simulate pitch link attachment, assemble hardware as shown and install in blade pitch horns. Install standard washer and palnut on heavy blade fastener.

4. Chordwise balancing is achieved by varying NAS6604 bolt length and nut-side washers on light blade fastener. Select bolt length and washers for balancing, and to meet thread exposure requirements per Section 1.300. Repeat step 2.

5. Blades are balanced chordwise when blade does not fall when positioned vertically on balancing stand. Repeat step 4, adjusting bolts and washers until blades are balanced within one thin washer.

6. Perform spanwise static balance per Section 9.230 Part B.



Determine Heavy Blade

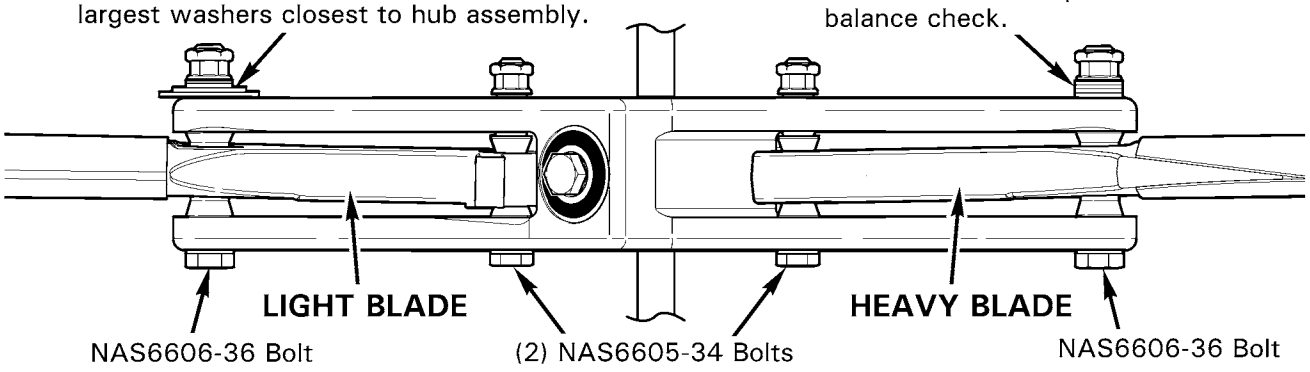
Hold tail rotor assembly horizontally on stand, then allow to fall. The falling blade is the **HEAVY** blade; the rising blade is the **LIGHT** blade.

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.

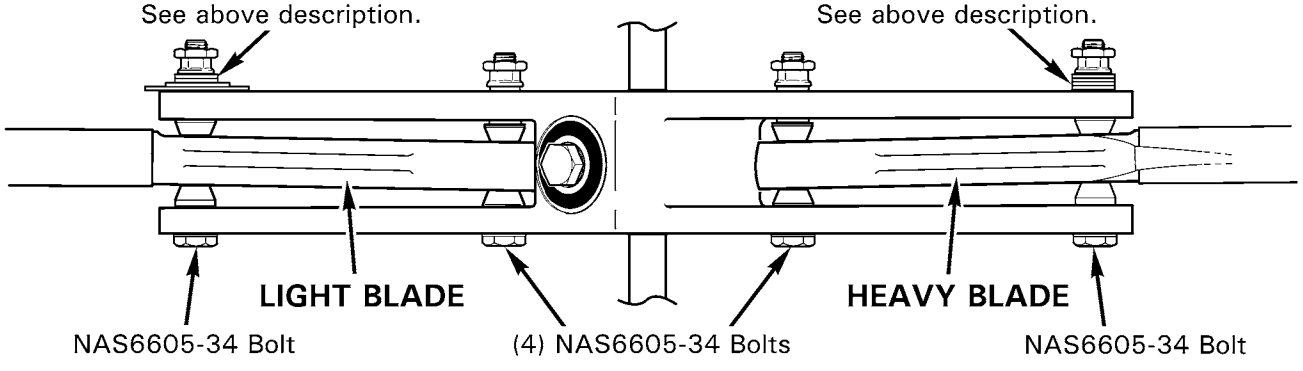


FIGURE 9-14 SPANWISE STATIC BALANCE

9.230 Static Balance (continued)

B. Spanwise Static Balance

CAUTION

Verify four washers installed under nut of outboard (spanwise) blade fastener prior to tail rotor assembly installation or dynamic balance.

1. Refer to Figure 9-14. Install standard hardware for initial spanwise static balance check. Standard torque fasteners per Section 1.320.

2. Install MT179-4 balance bar into tail rotor assembly. Install teeter hinge bolt, tighten until bearing spacers firmly clamp bar, and install palnut finger tight. Using a carpenter's square, adjust balance bar until approximately perpendicular to hub.

3. Place tail rotor assembly with balance bar on Anderson 20 or equivalent balancing stand. Hold tail rotor assembly horizontally, then allow to fall. The falling blade is the heavy blade; the rising blade is the light blade.

4. Spanwise balancing is achieved by varying nut-side washer size on light blade outboard fastener. Four washers are required under outboard fastener nuts; place largest washers closest to hub assembly. Select washers for balancing, standard torque hardware per Section 1.320, and repeat step 3.

5. Blades are balanced spanwise when blade does not fall when positioned horizontally on balancing stand. Repeat step 4, adjusting outboard fastener washers until blades are balanced.

6. Recheck chordwise and spanwise balance. Tail rotor assembly must be statically balanced within one thin washer. Remove MT179-4 balance bar.

7. Touch-up bolt heads using approved paint (see Section 1.400).

9.300 Tail Rotor Blades

NOTE

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

9.310 Tail Rotor Blade Removal

1. Remove tail rotor assembly per Section 9.210.
2. Refer to Figure 9-11 or Figure 9-12. 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.

9.320 Tail Rotor Blade 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 Section 9.530, as required.
2. Refer to Figure 9-11 or Figure 9-12. If removed, apply light coat of approved primer (see Section 1.400) 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 Section 1.320, and torque stripe inboard bolts per Figure 2-1.
4. Perform tail rotor assembly static balance per Section 9.230.

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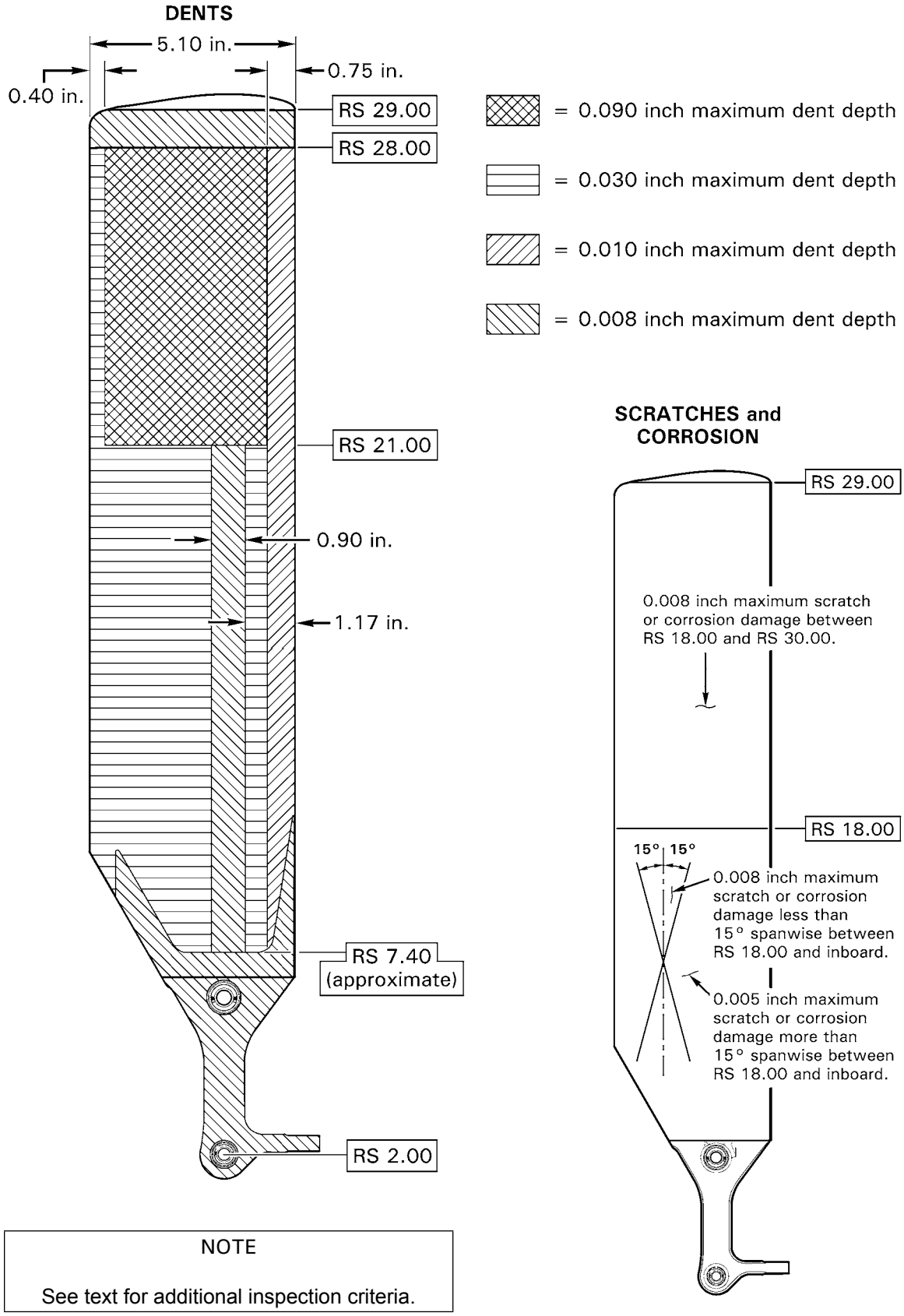


FIGURE 9-15 TAIL ROTOR BLADE INSPECTION CRITERIA

9.400 Tail Rotor Blade Inspection and Repair

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

CAUTION

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

Refer to Section 9.130 for measuring blade damage.

9.410 Scratches and Corrosion

1. Refer to Figure 9-15. Verify damage does not exceed the following limits:
   a. 0.008 inch maximum damage between RS 18.00 and RS 29.00.
   b. 0.005 inch maximum damage more than 15° spanwise between RS 18.00 and inboard.
   c. 0.008 inch maximum damage less than 15° spanwise between RS 18.00 and inboard.
2. Refer to Section 9.130 (main rotor) for repair procedures for damage within limits. Blend out scratches or corrosion on skins with a minimum 0.10 inch blend radius.

9.420 Dents

CAUTION

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

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

CAUTION

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

CAUTION

Do not repair any dent that has a sharp cut or break in the skin. If necessary, locally penetrant inspect, keeping penetrant materials away from bond joints.

WARNING

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

9.420 Dents (continued)

A. Skins

1. Refer to Figure 9-15. Smooth, round bottom dents with 0.060 inch minimum radius may be repaired when damage does not exceed the following limits:

   a. 0.010 inch maximum depth between leading edge and 0.75 inch aft (chordwise).
   b. 0.75 inch aft (chordwise) of leading edge:
      i. 0.090 inch maximum dent depth between RS 21.00 and RS 29.00.
      ii. 0.030 inch maximum dent depth between RS 21.00 and inboard.
   c. 0.030 inch maximum depth between trailing edge and 0.40 inch forward (chordwise).
   d. 0.008 inch maximum depth between RS 28.00 and RS 29.00.
   e. 0.008 inch maximum depth over the skin-to-root fitting bond joint and inboard honeycomb.

2. Refer to Section 9.130 (main rotor) for repair procedures for damage within limits.

9.430 Erosion

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

9.440 Root Fitting Damage

1. Verify damage does not exceed the following limits:

   a. No repairs permitted within 1.5-inch diameter circle from center of spherical bearing.
   b. 0.040 inch maximum depth on other root fitting exposed areas.

2. Refer to Section 9.130 (main rotor) for repair procedures for damage within limits. Blend out root fitting damage with a minimum 1.0 inch blend radius.

9.450 Nicks and Notches

A. Trailing Edge

1. Verify damage does not exceed the following limits:

   a. 0.050 inch maximum in the extreme trailing edge.

2. Refer to Section 9.130 (main rotor) for repair procedures for damage within limits. Blend out nicks and notches in blade trailing edge for 1.0 inch minimum each side of nick or notch.

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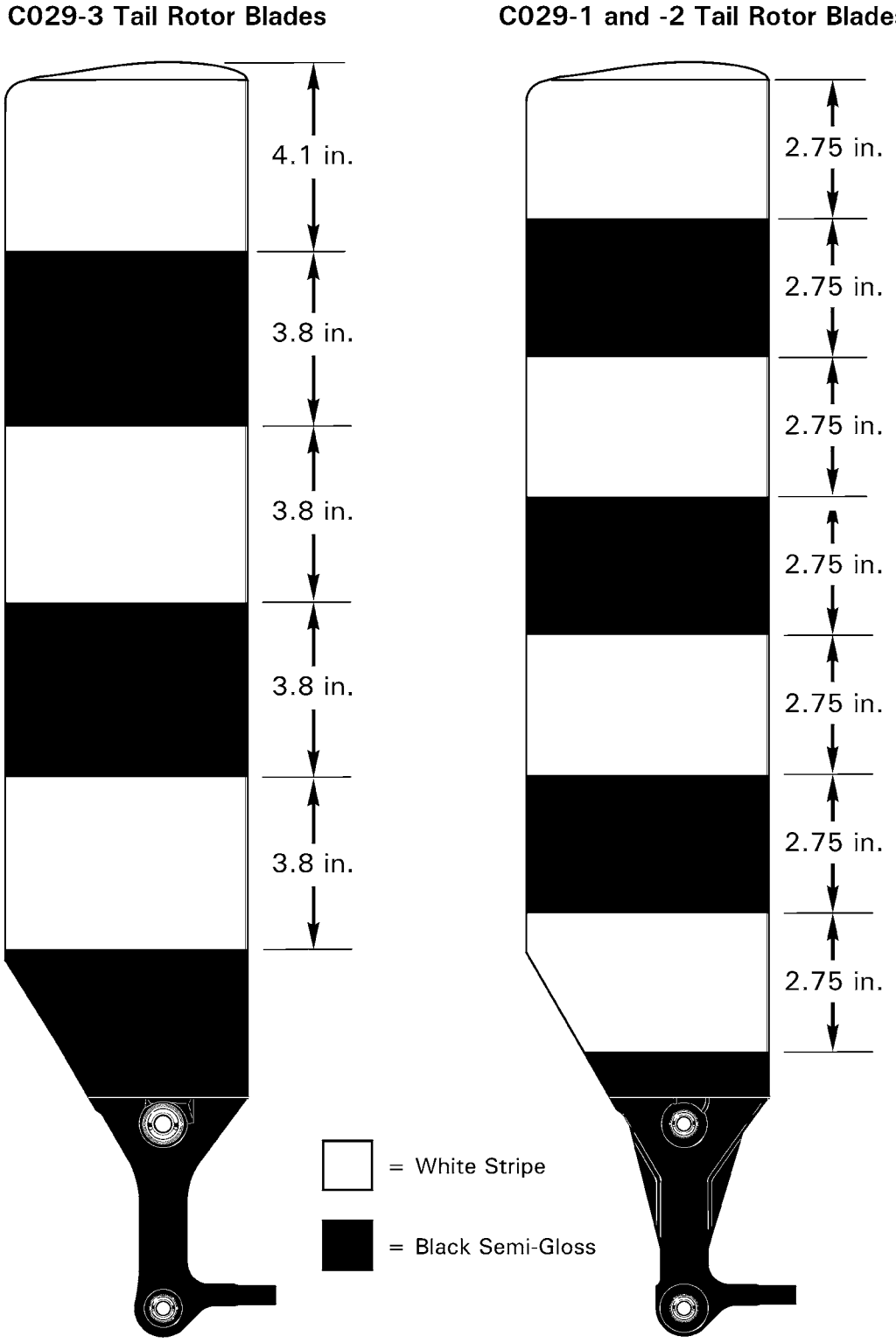


FIGURE 9-16 TAIL ROTOR BLADE PAINT SCHEME

9.460 Painting

1. Clean with QSOL 220 and wipe lint-free with a tack rag.

2. Apply a 2 to 3-inch wide strip of epoxy primer along all exposed bond joints.

3. Apply two full coats of epoxy primer to all exterior surfaces. Time limits are 10 minutes minimum, 8 hours maximum between coats. If 8 hours is exceeded, scuff with 600 grit wet-or-dry aluminum oxide or silicon carbide abrasive paper in a spanwise direction, QSOL 220 wipe and mist primer before applying next coat.

4. Spray white all over and allow to dry before masking for trim stripes. See Figure 9-16.

5. Spray finish coat semi-gloss black stripes and root fitting.

6. Remove all masking materials.

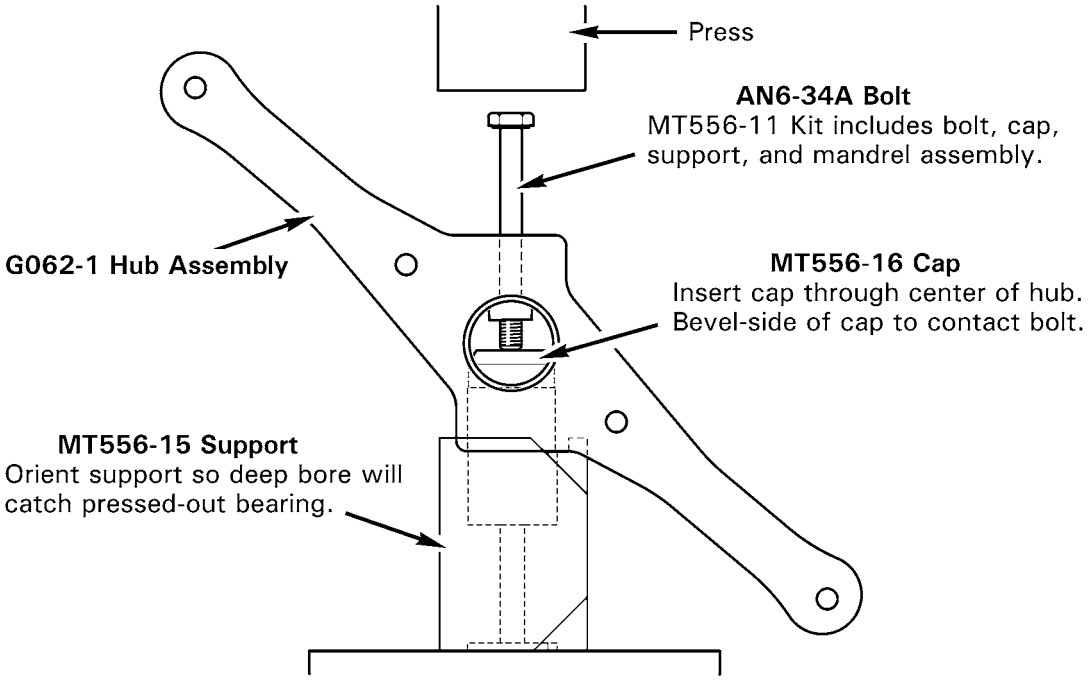


FIGURE 9-17 ELASTOMERIC BEARING REMOVAL

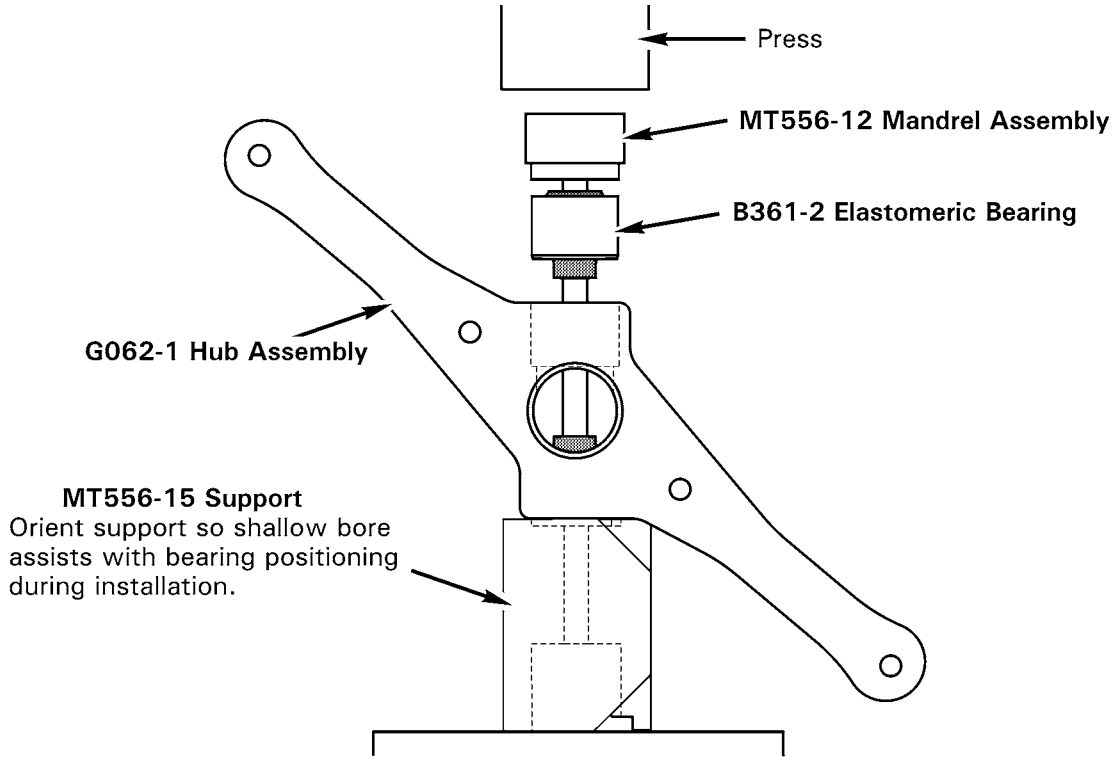


FIGURE 9-18 ELASTOMERIC BEARING INSTALLATION

9.500 Tail Rotor Hub

9.510 Tail Rotor Hub Elastomeric Bearing Replacement

A. Removal

1. Remove tail rotor assembly per Section 9.210.
2. Remove tail rotor blades per Section 9.310.
3. Refer to Figure 9-17. Press bearing(s) from hub using MT556-11 bearing removal (and installation) tools.

B. Installation

1. Inspect tail rotor hub per Section 9.530.

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

2. Refer to Figure 9-18. Using Q-tip, apply light coat of approved primer (see Section 1.400) to bottom of hub bearing bore. Apply a thin line of primer to center of bearing outside diameter. While primer is wet, press bearing into hub using MT556-11 bearing removal and installation tools. Wipe away excess primer.
3. Repeat steps for second bearing, as required.

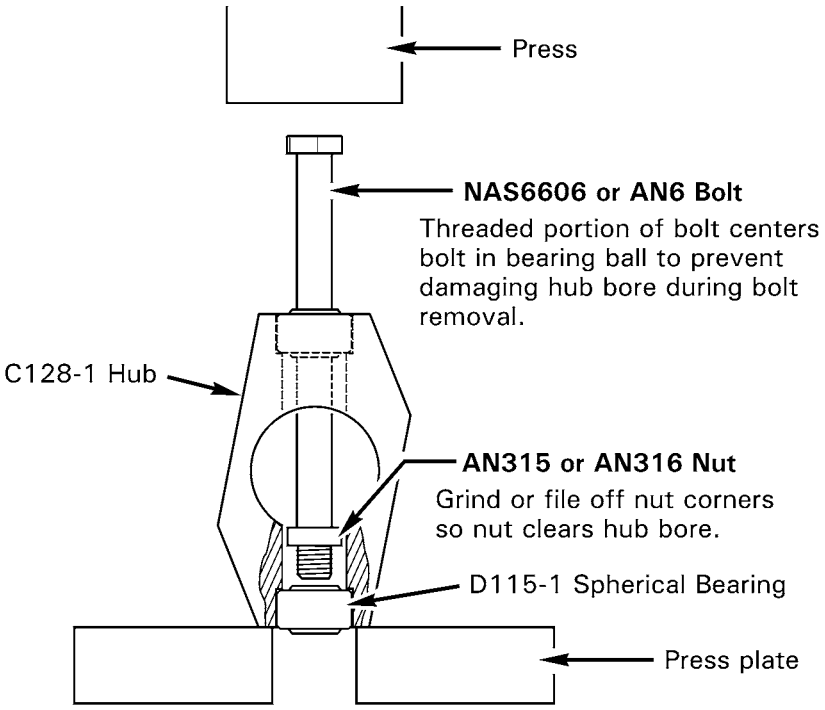


FIGURE 9-19 SPHERICAL BEARING REMOVAL

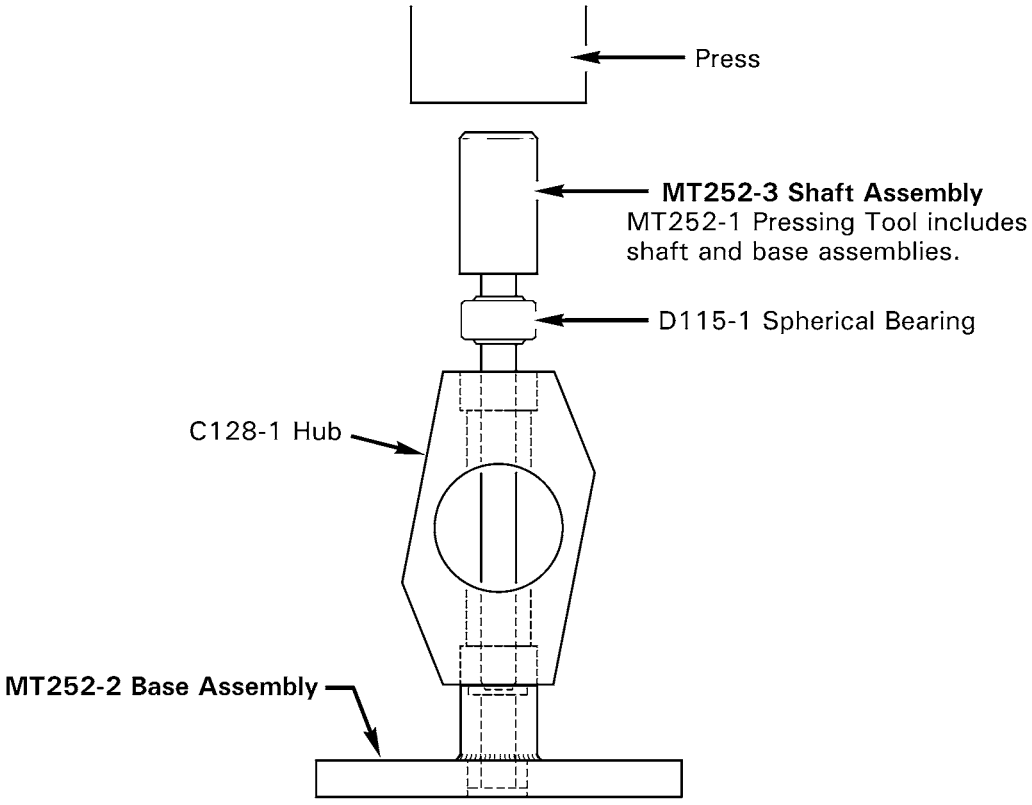


FIGURE 9-20 SPHERICAL BEARING INSTALLATION

9.520 Tail Rotor Hub Spherical Bearing Replacement

A. Removal

1. Remove tail rotor assembly per Section 9.210.
2. Remove tail rotor blades per Section 9.310.
3. Refer to Figure 9-19. Press bearing(s) from hub as shown.

B. Installation

1. Inspect tail rotor hub per Section 9.530.

CAUTION

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

NOTE

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

NOTE

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

NOTE

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

2. Refer to Figure 9-20. Using Q-tip, apply light coat of approved primer (see Section 1.400) to bottom of hub bearing bore. Apply a thin line of primer to center of bearing outside diameter. While primer is wet, press bearing flush with top of hub using MT252-1 bearing installation tools. Wipe away excess primer.
3. Repeat steps for second bearing, as required.
4. Align marked line and install hub between hub plates as removed. Install hardware, standard torque nuts & palnuts per Section 1.320, and torque stripe per Figure 2-1.
5. Install tail rotor blades per Section 9.320.

9.530 Tail Rotor Hub Inspection

1. Remove tail rotor blades per Section 9.310, if not previously accomplished. Inspect blades per Section 9.400.

2. Remove teeter bearings per Section 9.510.

3. Clean tail rotor hub using approved solvent (see Section 1.400). Remove old primer and/or metal shavings from hub which might prevent new bearings from seating properly.

4. Visually inspect for indications of damage, wear, nicks, dings, and corrosion. Verify arm straightness, no elongation of bolt holes, and no fretting or galling of bearing bores. Corrosion is not permitted.

5. Touch-up bare metal using approved materials (see Section 1.400).

6. Install new teeter bearings per Section 9.510.

7. Install tail rotor blades per Section 9.320.

CHAPTER 10

RIGGING, TRACK AND BALANCE

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10.133	A120-3 Bell Crank	10.12
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CHAPTER 10

RIGGING, TRACK AND BALANCE (Continued)

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CHAPTER 10

RIGGING, TRACK AND BALANCE

10.000 Rigging, Track and Balance

10.001 Introduction

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

WARNING

A rotor which is smooth after balancing but then goes out of balance again within a few flights is suspect and must be examined by a RHC-authorized component overhaul facility before further flight.

10.002 Rod End Adjustment Procedures

The following procedure is standard for adjustment of rod ends:

1. Loosen palnut and jam nut on rod end shank.

2. Screw rod end in or out of push-pull tube or pitch link as required to obtain proper rigging adjustment.

3. After any rod end adjustment, verify rod end threaded shank blocks passage of 0.020 inch diameter wire thru the witness hole in the push-pull tube or pitch link as shown in Figure 2-1. When no witness hole is provided, refer to Figure 2-1 for maximum rod end extension.

4. Position rod ends to allow as much push-pull tube or pitch link rotation as possible without binding. Refer to Figure 2-1A.

5. C258-1 main rotor pitch links may require adjustment during rigging or tracking. For collective adjustments, both pitch links must be adjusted exactly the same.

   Each main rotor pitch link has coarse, medium, and fine length adjustments:

   a. Coarse length adjustments are made by rotating coarse-threaded section of pitch link. Disconnect upper rod end from blade and loosen jam nut in middle of pitch link only. Increase blade angle by unscrewing C258-2 fitting from lower pitch link. Decrease angle by screwing fitting into lower pitch link. One full turn changes blade angle by approximately 0.88º.

   b. Medium length adjustments are made by rotating upper rod end only. Disconnect rod ends from blade and loosen rod end jam nuts. Increase blade angle by unscrewing rod end from pitch link. Decrease angle by screwing rod end into pitch link. One full rod end turn changes blade angle by approximately 0.48º.

10.002 Rod End Adjustment Procedures (cont'd)

c. Fine length adjustments are made by rotating only the C258-2 fitting. Upper and lower rod ends remain connected. Loosen jam nuts at upper rod end and in the middle of pitch link. Increase blade angle by screwing fitting out of lower pitch link. Decrease blade angle by screwing fitting into lower pitch link. One full turn of fitting changes blade angle approximately 0.40°.

6. Torque jam nuts and palnuts per Section 1.320 and torque stripe per Figure 2-1.

10.100 Rigging

10.110 Main Rotor Flight Controls

10.111 Cyclic Controls

The cyclic control travel is non-adjustable and is controlled by the A211-3 stop plate attached to cyclic box assembly.

NOTE

The following push-pull tube assemblies and fork assembly between the keel panels are to be adjusted to the noted center-to-center dimensions:

C121-1	=	51.03 ± 0.03 inches
C121-3	=	32.54 ± 0.03 inches
C121-19	=	31.38 ± 0.03 inches
A205-3, -5	=	03.80 ± 0.03 inches

a) Refer to Figure 10-1. Place cyclic control in neutral position. Cyclic neutral position is 7.0 inches to the right of full-left travel and at mid-point of total fore and aft travel or use MT559-1 rigging blocks. Place collective control full down.

b) Apply full cyclic and collective friction.

NOTE

Care must be taken not to move cyclic control from neutral position.

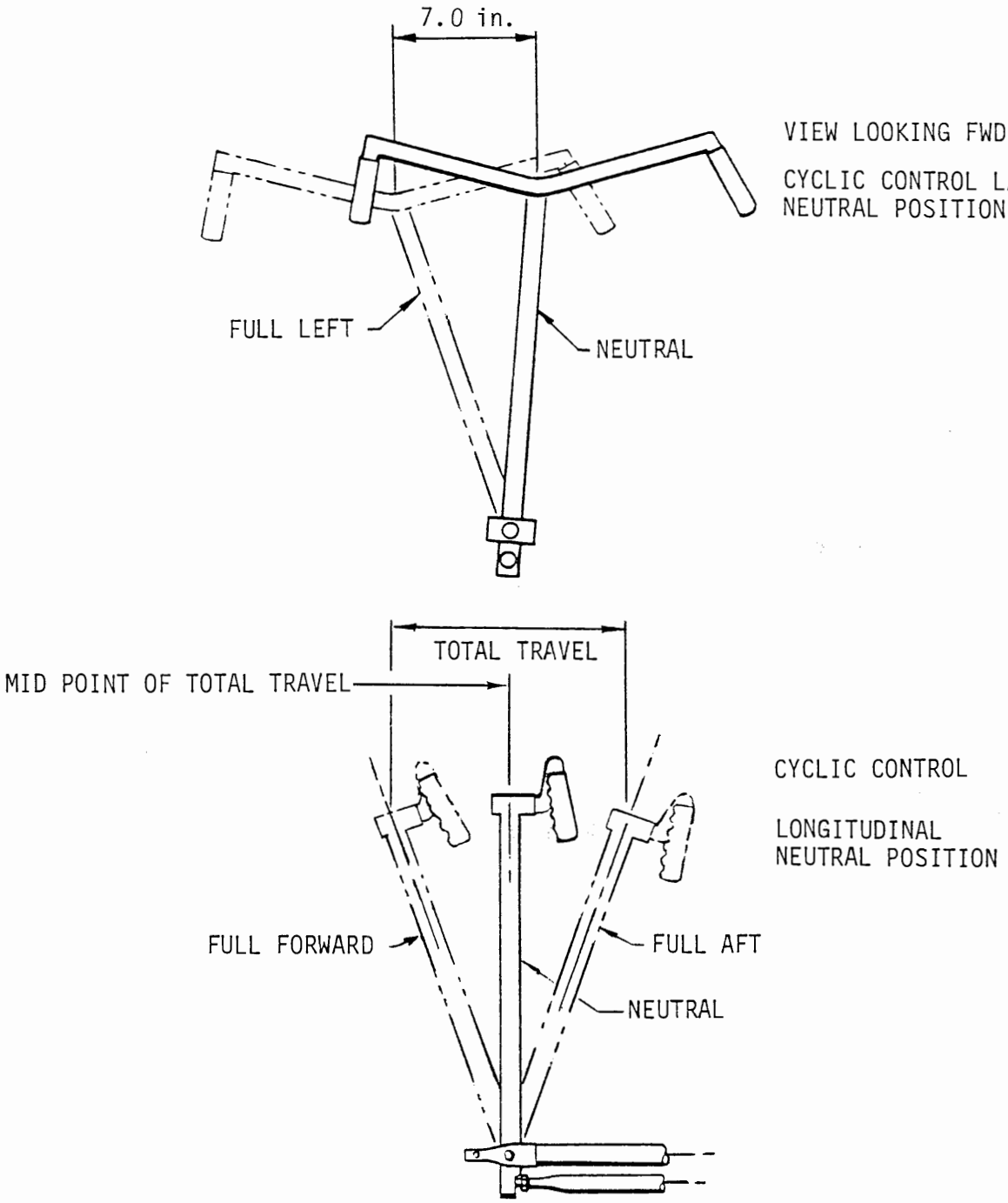


FIGURE 10-1 CYCLIC CONTROL STICK NEUTRAL POSITION

10.112 Swashplate

With the cyclic and collective controls locked in position per Section 10.111, adjust the C121-7 and C121-5 push-pull tubes to obtain a constant clearance from the flange of the C281-1 fitting of 1.069 (see Figure 10-2). MT146-2 swashplate rigging blocks may be used as a spacer to set the 1.069 inch dimension.

10.113 Collective Control

Since the collective slider stop is non-adjustable, this check is to ensure full control travel is obtained and does not interfere with the swashplate travel.

a) Lift the swashplate boot so the uniball and slider tube may be observed.

b) Pull the collective control full up. The uniball must be flush with the top of the slider tube within 0.03 inches. If this does not occur, turn the upper rod ends of the C121-5 and C121-7 push-pull tubes in or out equally to raise or lower the swashplate.

10.120 Main Rotor

The main rotor is rigged by determining the average blade angle. Blade angle measurements are taken at the 0.75 radius of the main rotor (or 49.5 inches in from the blade tip).

The main rotor blade angles are measured using the MT525-1 rigging fixture and a Kell-Strom KS113 propeller protractor or a comparable protractor (see Figure 10-4). Use the following procedure to set up for rigging:

a) Verify that the A205-5 forks at the swashplate are set to the proper length (see Figure 10-3). Measuring to bolt center lines, the lower fork assembly should be 3.70 ± 0.03 inches and the upper fork assembly should be 3.85 ± 0.03 inches.

b) Level the rotorcraft per Section 1.220 (Method 2, Main Rotor Hub).

c) Place a tracking stick at the end of one rotor blade and mark the height of the blade tip. Rotate the rotor 180° and mark the height of the opposite blade tip. Teeter the main rotor as necessary to obtain a main rotor track of ± 1 inch.

d) Zero the propeller protractor to the main rotor hub at the location marked "Level Here". The protractor must be placed parallel to the teeter hinge bolt.

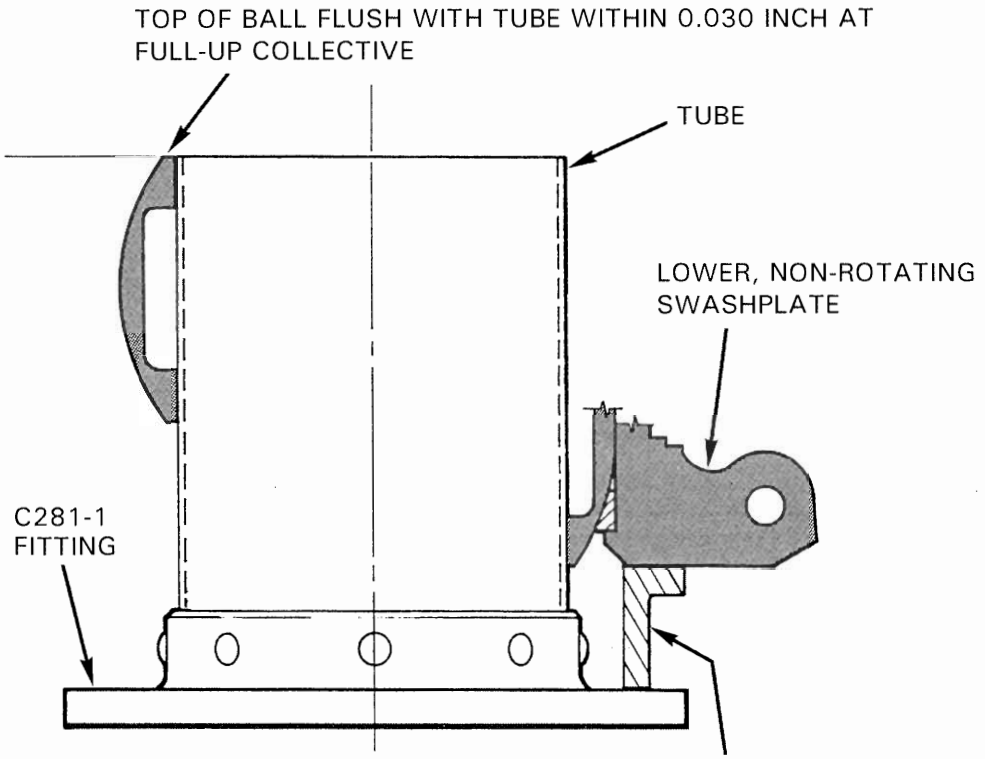


FIGURE 10-2 LOWER SWASHPLATE CLEARANCE

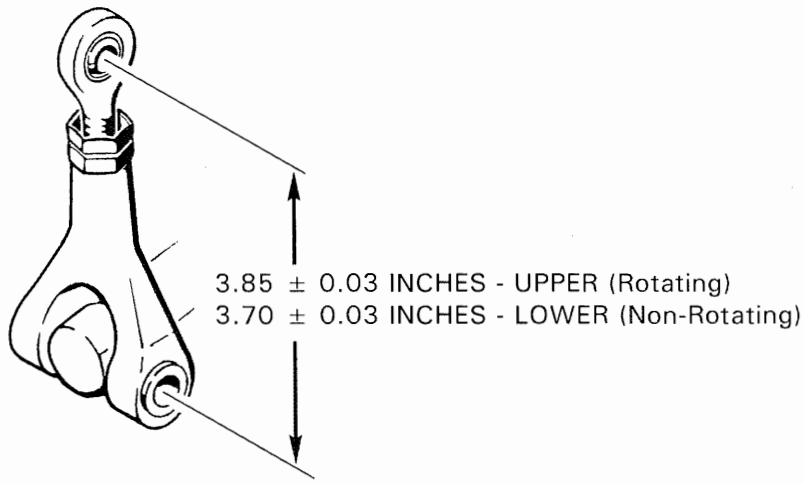


FIGURE 10-3 A205-5 FORK DIMENSIONS FOR SWASHPLATE SCISSORS

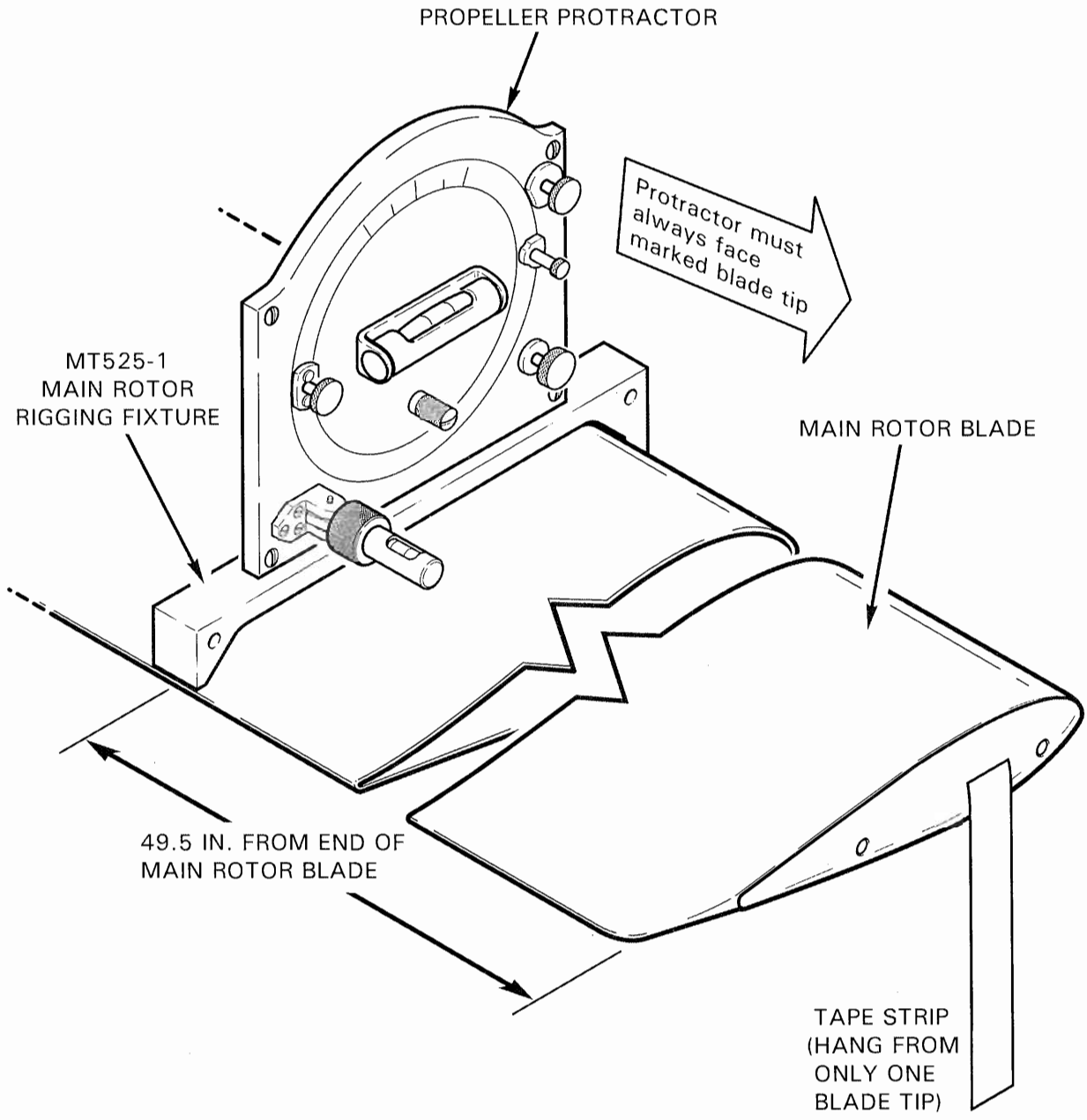


FIGURE 10-4 PLACEMENT OF PROTRACTOR

10.120 Main Rotor (cont'd)

NOTE

When zeroing the protractor, the face or dial should remain facing one of the rotor blades. Mark this blade with a piece of tape. When making blade angle readings, the face or dial of the protractor must always face the marked blade.

e) Measure in from the tip of each main rotor blade 49.5 inches and place a piece of 1-inch masking tape chordwise across each blade with the center of the tape over the mark.

WARNING

Do not mark the rotor blades with a ball point pen or other sharp instrument. Use a grease pencil or soft marker. Sharp instruments can scratch the blades skins, causing cracks and fatigue failure of the blade.

f) Mark each rotor blade with a different color designation such as red or blue. This will be used in recording blade angles.

10.121 Cyclic Travel Rigging

NOTE

Adjust collective travel rigging before cyclic travel rigging. Hydraulic flight controls must be pressurized prior to measuring blade angles.

a) Place the collective control full down. Place the cyclic control in the neutral position laterally (7.0 inches to the right of full left travel) and hold against the forward stop.

NOTE

Sand bags may be used to secure cyclic stick against stops to ensure it will not move.

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

10.121 Cyclic Travel Rigging (cont'd)

c) Forward longitudinal cyclic:

1) Measure the blade angles and record below. Rotate the rotor 180° and record the blade angles below.

Blue Blade Position		Cyclic Full Forward
Pitch horn aft		_____° nose up
Pitch horn forward	+	_____° nose down
		_____° ÷2 = _____°
		(14.25/13.50 degrees required)

Red Blade Position		Cyclic Full Forward
Pitch horn aft		_____° nose up
Pitch horn forward	+	_____° nose down
		_____° ÷2 = _____°
		(14.25/13.50 degrees required)

2) Adjust the aft swashplate push-pull tube as required (one full turn = 0.44°) to obtain blade angle averages between 13.50° and 14.25°. Additional coarse adjustment is available by simultaneously adjusting the two forward push-pull tubes but they both must be adjusted exactly the same amount.

d) Aft longitudinal cyclic:

1) Place the cyclic control in the neutral position laterally and hold against the aft stop.

2) Measure the blade angles and record below. Rotate the rotor 180° and record the blade angles below.

Blue Blade Position		Cyclic Full Aft
Pitch horn aft		_____° nose down
Pitch horn forward	+	_____° nose up
		_____° ÷2 = _____°
		(14.25/13.50 degrees required)

Red Blade Position		Cyclic Full Aft
Pitch horn aft		_____° nose down
Pitch horn forward	+	_____° nose up
		_____° ÷2 = _____°
		(14.25/13.50 degrees required)

10.121 Cyclic Travel Rigging (cont'd)

3) Adjust the aft swashplate push-pull tube as required (one full turn = 0.44°) to obtain blade angle averages between 13.50° and 14.25°. Additional coarse adjustment is available by simultaneously adjusting the two forward push-pull tubes, but they both must be adjusted exactly the same amount.

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

e) Left Lateral Cyclic:

1) Place the cyclic control in the neutral position longitudinally (mid travel) and hold the cyclic against the left stop.

2) Rotate the rotor until the pitch links are aligned with the lateral axis of the helicopter. Place the tracking stick at the end of one blade for reference.

3) Measure the blade angles and record below. Rotate the rotor 180° and record the blade angles below:

Blue Blade Position	Cyclic Full Left	
Pitch horn right	_____	nose up
Pitch horn left	+ _____	nose down
	= _____ ÷ 2 = _____	° Average
		(8.5/7.5 degrees required)

Red Blade Position	Cyclic Full Left	
Pitch horn right	_____	nose up
Pitch horn left	+ _____	nose down
	= _____ ÷ 2 = _____	° Average
		(8.5/7.5 degrees required)

4) Adjust either of the two forward push-pull tubes as required (one full turn = 0.6 degree) to obtain blade angle averages between 7.5° and 8.5°.

f) Right lateral cyclic:

1) Place the cyclic control in the neutral position longitudinally (mid travel) and hold the cyclic against the right stop.

10.121 Cyclic Travel Rigging (cont'd)

2) Measure the blade angles and record below. Rotate the rotor 180° and record the blade angles below:

Blue Blade Position	Cyclic Full Right	
Pitch horn right	_____	nose down
Pitch horn left	+ _____	nose up
	= _____ ÷ 2 = _____	° Average
		(7.0/6.0 degrees required)

Red Blade Position	Cyclic Full Right	
Pitch horn right	_____	nose down
Pitch horn left	+ _____	nose up
	= _____ ÷ 2 = _____	° Average
		(7.0/6.0 degrees required)

3) Adjust either of the two forward push-pull tubes as required (one full turn = 0.6 degree) to obtain blade angle averages between 6.0° and 7.0°.

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

10.122 Collective Travel Rigging

a) Place the cyclic control in the neutral position (see Figure 10-1). Place the collective control full down. Apply full cyclic and collective friction.

b) Rotate the main rotor to align pitch links with the longitudinal axis of the helicopter. Place the tracking stick at the end of one blade for reference.

c) Measure the blade angles using the MT525-1 rigging fixture and propeller protractor.

10.122 Collective Travel Rigging (cont'd)

> NOTE
>
> The MT525-1 fixture is placed on top of the blade at 49.5 inches from blade tip. The fixture must be held tightly against the leading edge to ensure accurate readings. All measurements must be taken with protractor facing marked blade.

Record blade angles, then rotate rotor 180° and again record angles. Adjust the pitch link of each blade until the two blade angles are within 0.2 degrees of each other when the blade pitch horn is in the forward position. Check the blade angles with each blade pitch horn aft. Average of these angles must be within 0.2 degrees also.

COLLECTIVE FULL DOWN

	Blue Blade	Red Blade
Pitch horn forward	_____° nose up	_____° nose up
Pitch horn aft	+ _____° nose up	+ _____° nose up
	_____° ÷2 = _____°	_____° ÷2 = _____°

(1.0/2.0 degrees required)

d) Raise collective control to the full up position. Apply full collective friction. Measure the blade angles per Step c) above and record averages below.

	Blue Blade	Red Blade
Pitch horn forward	_____° nose up	_____° nose up
Pitch horn aft	+ _____° nose up	+ _____° nose up
	_____° ÷2 = _____°	_____° ÷2 = _____°

(Average 12.5°/13.5° degrees above collective-down required for rigging; autorotation rpm adjustment will determine final angle)

e) Track and balance main rotor per Section 10.200.

10.130 Tail Rotor Flight Controls

10.131 Pedals (See Figure 10-5)

Pedal rigging is accomplished as follows:

a) Insert a 3/16-inch diameter rigging pin through the hole in the right-hand keel panel and the rigging pin holes in the C317-1 bellcrank.

b) Adjust the C121-9 push-pull tubes as required to obtain a dimension of 2.90 ± 0.03 inches from the pedal to the right hand stop located on the side of the forward console (does not apply to helicopters without stop on lower console).

10.132 C316 Bellcrank (See Figure 10-5)

Remove rigging pin and place left pedal against its stop. Adjust C343-1 push-pull tube to obtain 0.10 - 0.20 inches between C316-1 rod end and bulkhead (0.3 - 0.5 for helicopters without pedal stop on lower console).

10.133 A120-3 Bellcrank

With left pedal at stop, adjust the C121-17 push-pull tube length as required to obtain 0.35 ± 0.03 inch between two faces of pitch control assembly and the housing. (See Figure 10-7).

10.134 Tail Rotor Pitch Links

Adjust the pitch links to a dimension of 2.620 ± 0.010 inches between rod end centers (see Section 8.570).

10.140 Tail Rotor Rigging

1) Set up:

a) Level the rotorcraft per Section 1.220 (Method 2, Main Rotor Hub).

b) Rotate the tail rotor until the blades are parallel to the tailcone.

c) Tape a tracking stick to the tailcone at the tip of the fwd blade.

NOTE
A tracking stick can be made using a 1" x 12" strip of aluminum with a 90° bend 2 inches from one end.

d) Visually align the tail rotor to a zero teeter position and mark the tracking stick where the tip of the tail rotor blade passes.

e) Rotate the tail rotor 180°, using the forward flex coupling so teeter angle is not disturbed, until the opposite blade tip is aligned with tracking stick. Mark the stick.

f) Teeter the tail rotor to position the blade tip to the mid point between the marks. Rotate the tail rotor and check that the blades track. Repeat the above procedure as necessary to track the tail rotor.

g) Place the left pedal against its stop. Mark the tracking stick where the blade tip passes the stick. Place the right pedal against its stop and mark the tracking stick.

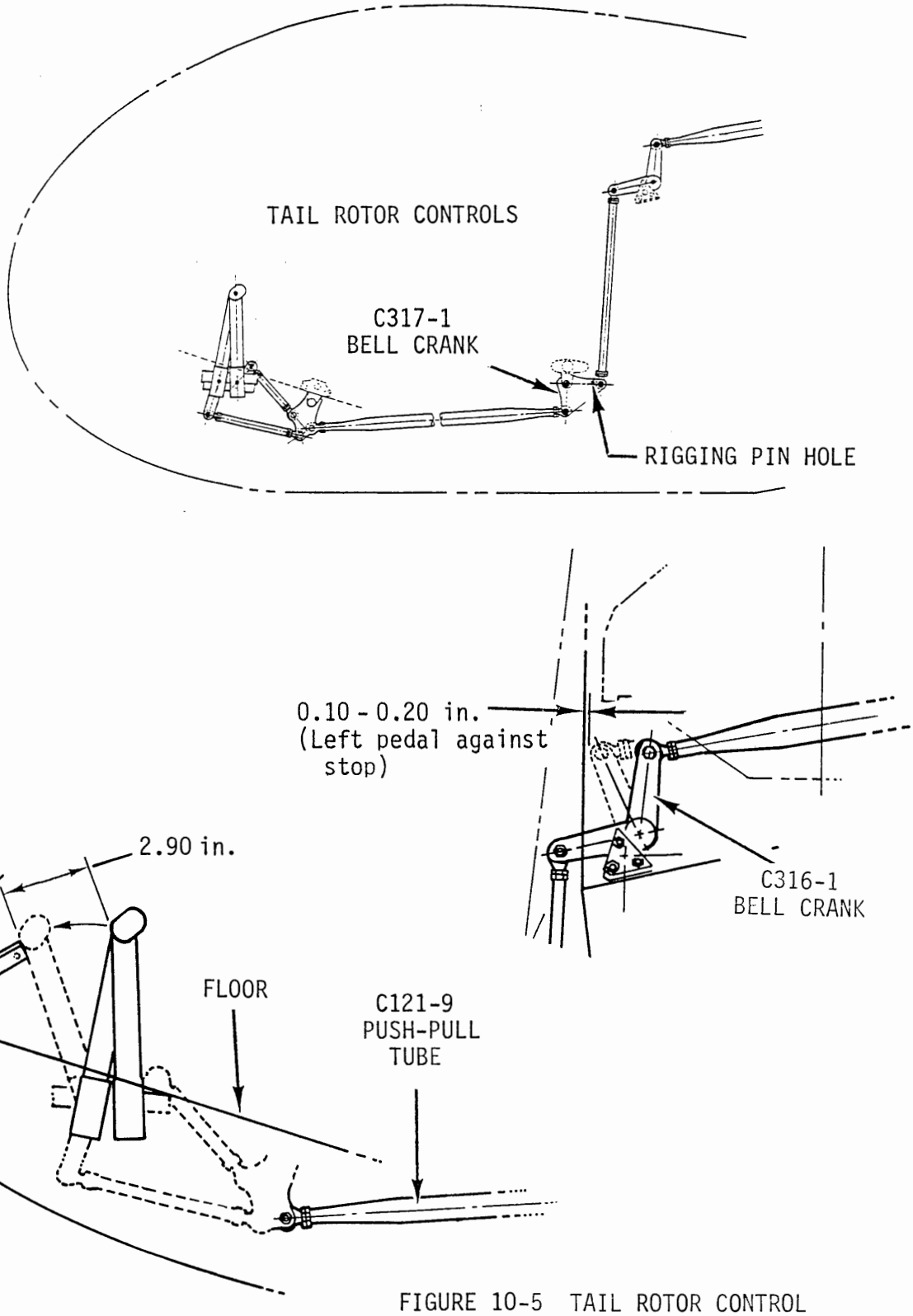


FIGURE 10-5 TAIL ROTOR CONTROL PEDAL RIGGING

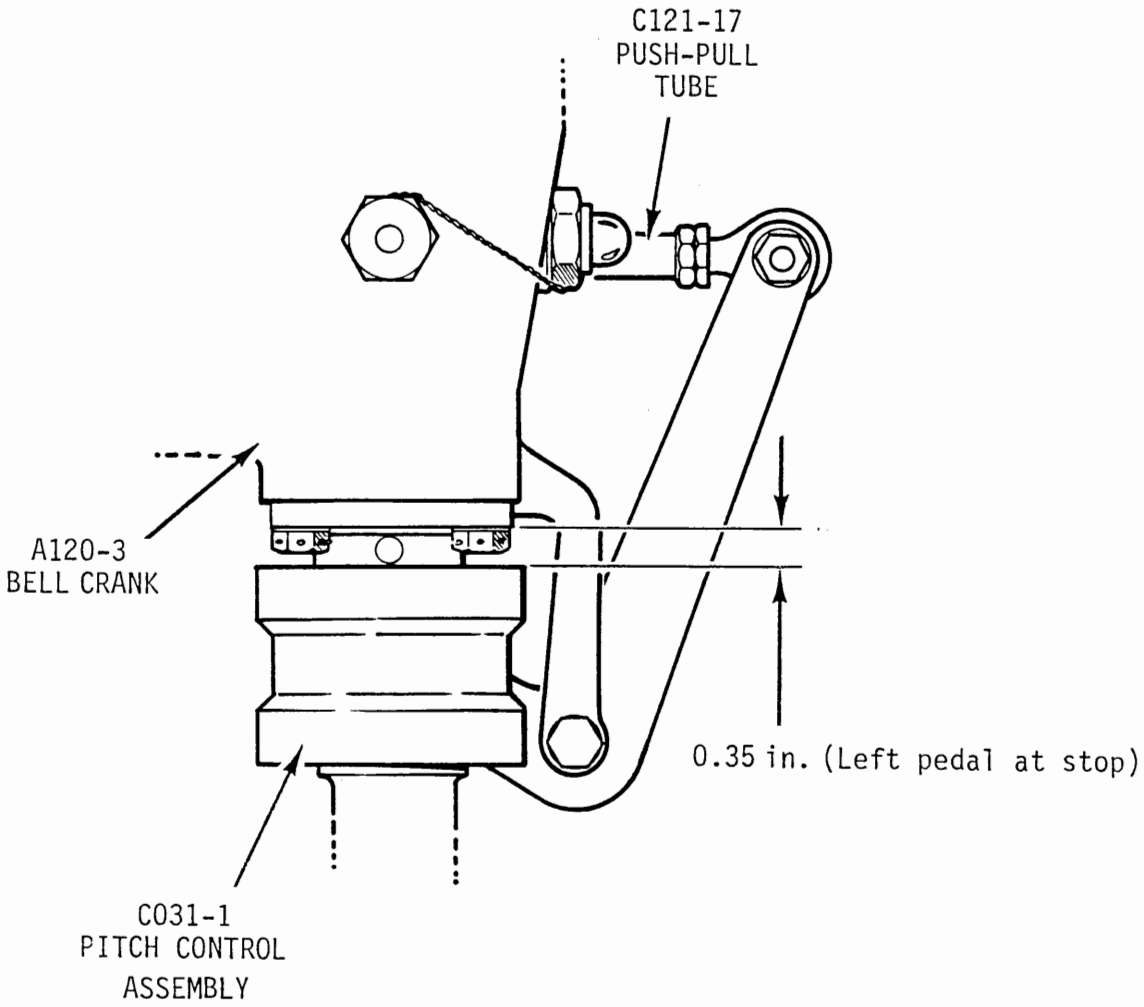


FIGURE 10-6 A120-3 BELL CRANK RIGGING

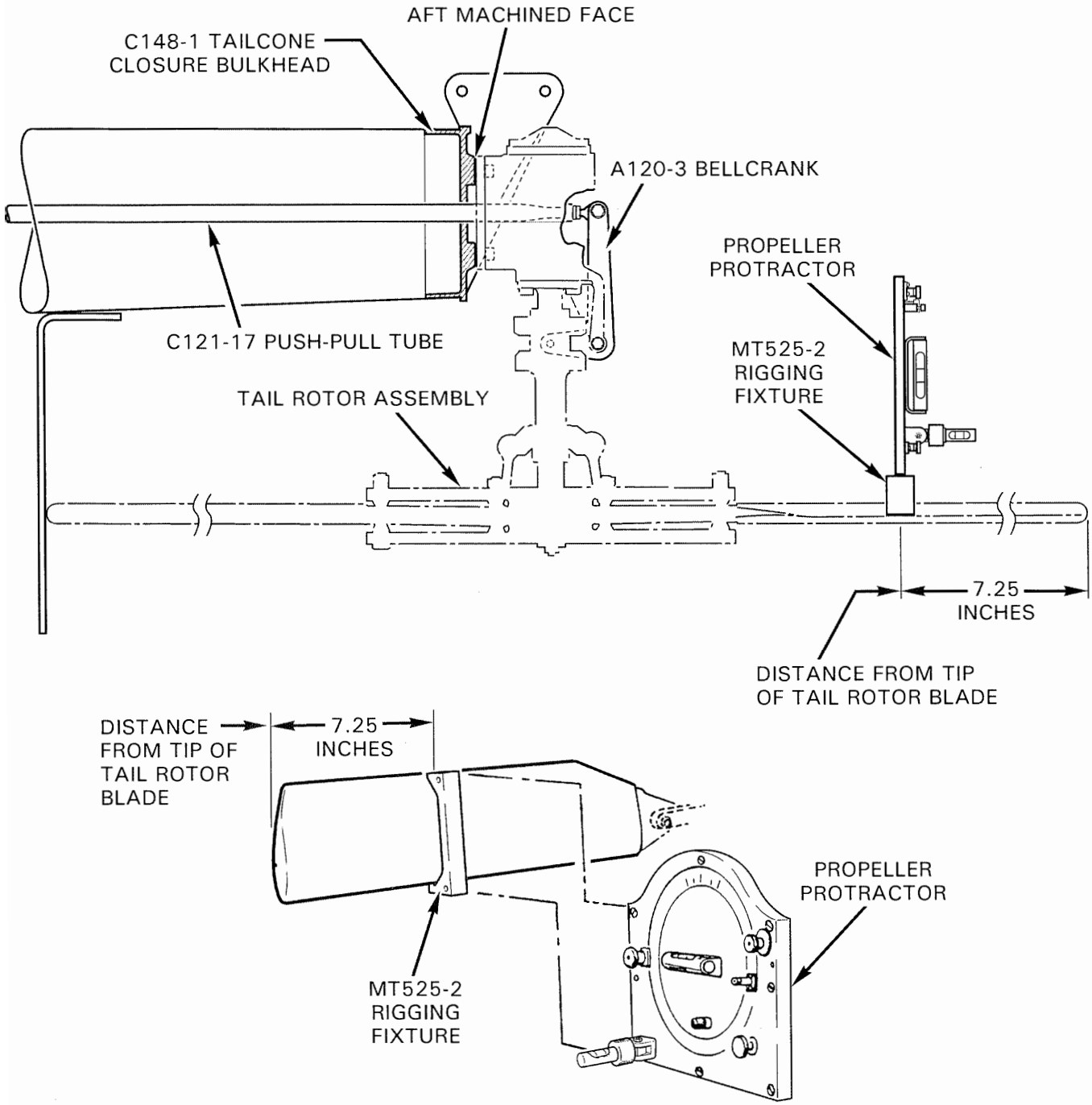


FIGURE 10-7 TAIL ROTOR RIGGING

10.140 Tail Rotor Rigging (cont'd)

2) Measure the tail rotor blade angles as follows:

a) Using a soft marker or grease pencil mark each blade as red or blue.

b) Measure in from each blade tip 7.25 inches and place 3/4 inch masking tape chordwise on each blade at this point.

c) Have someone hold one blade tip at left pedal track mark with left pedal against its stop.

d) Place MT525-2 rigging fixture on aft blade inboard side.

NOTE
MT525-2 fixture must straddle masking tape.

e) Using a propeller protractor measure blade angle and record below. Rotate tail rotor 180 degrees and record opposite blade angle.

Pedals Full Left

Blue Blade _____ ° nose right

Red Blade + _____ ° nose right

_____ ° ÷ 2 = _____

(18.5/19.0 degrees required)

CAUTION
For acceptable track, differences between Blue and Red blade angles must not exceed 0.4 degree. If blade angles cannot be adjusted to within 0.4 degree of each other using adjustable pitch links then remove tail rotor assembly and rotate it one-half revolution, reinstall and repeat above procedure. If blade angles still cannot be adjusted to within 0.4 degree of each other then replace blade(s). Contact factory for blade matching assistance.

NOTE
Adjustable pitch link jam nuts must be tight to ensure accurate blade angle measurements.

10.140 Tail Rotor Rigging (cont'd)

WARNING

Both pitch links must be same part number (same type and material). Mixing one-piece with adjustable-length pitch links is prohibited. Mixing steel one-piece with aluminum one-piece pitch links is prohibited.

f. Adjustment of blade angles is made using rod ends of C121-17 push-pull tube. One full turn of rod end will change blade angles 0.33 degrees. Adjust rod end as necessary to obtain 18.5 to 19.0 degrees.

g. Place right pedal against its stop. Measure blade angles and record below using right pedal track mark.

Pedals Full Right

Blue Blade _____° nose left

Red Blade + _____° nose left

_____° ÷ 2 = _____
(15.5/16.5 degrees required)

h. Adjust C121-17 push-pull tube as necessary to obtain blade angles of 15.5 to 16.5 degrees.

NOTE

If adjustment is required to obtain right pedal blade angles, left pedal angles must be rechecked.

i. If blade angle range, for left and right pedal settings, cannot be obtained using above procedure, this indicates pedal travel is either too great or too small. Use following procedure to check and adjust pedal travel:

1) Add right and left pedal angles together. If total is less than 34.0° pedal total travel is too small. If total is greater than 35.5° total travel is too great.

2) If total travel is too small, first increase right pedal travel by increasing length of C121-9 push-pull tube. To increase left pedal travel, decrease length of C343-3 push-pull tube.

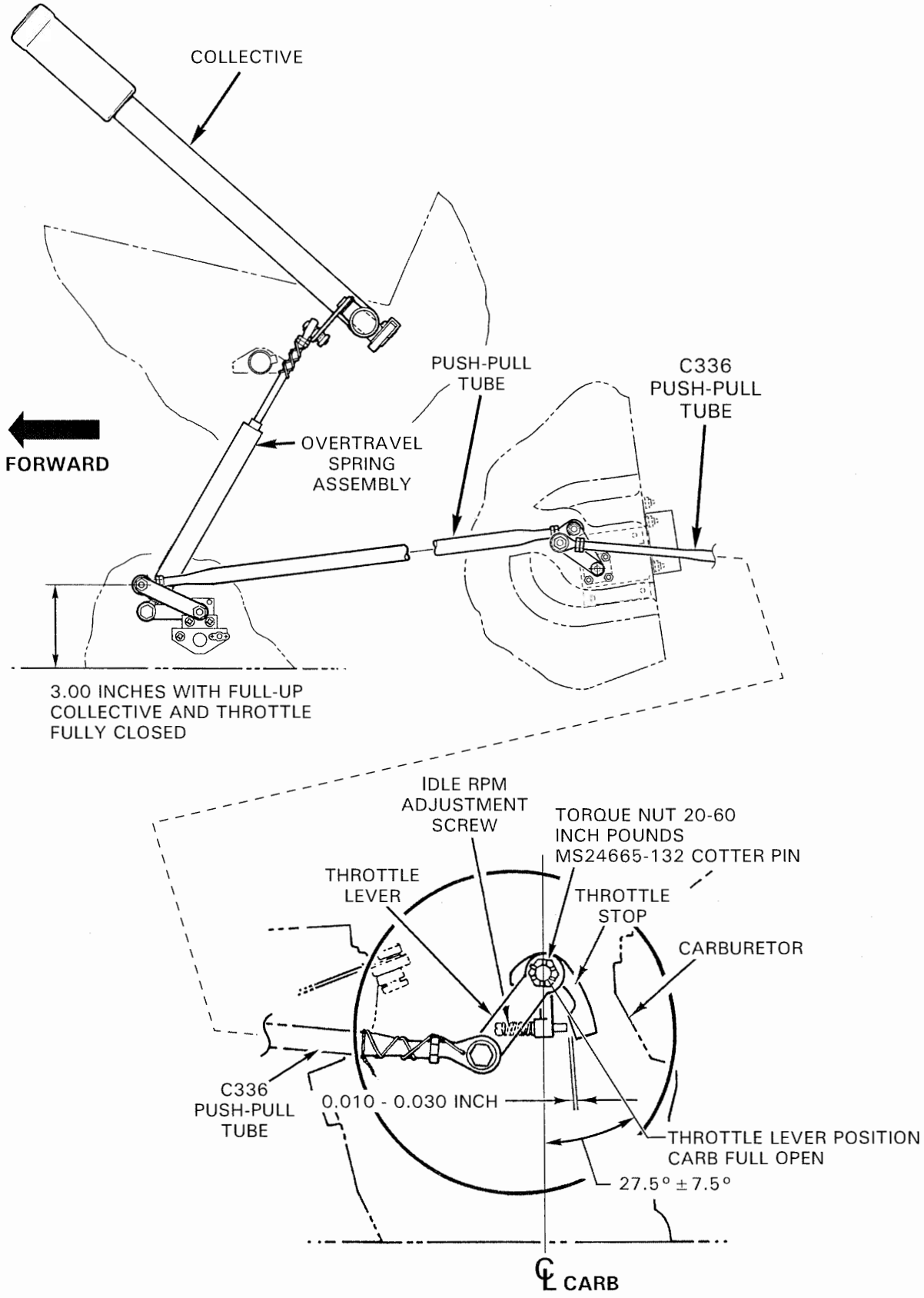


FIGURE 10-8 THROTTLE CORRELATION RIGGING (CARBURETED SHIPS)

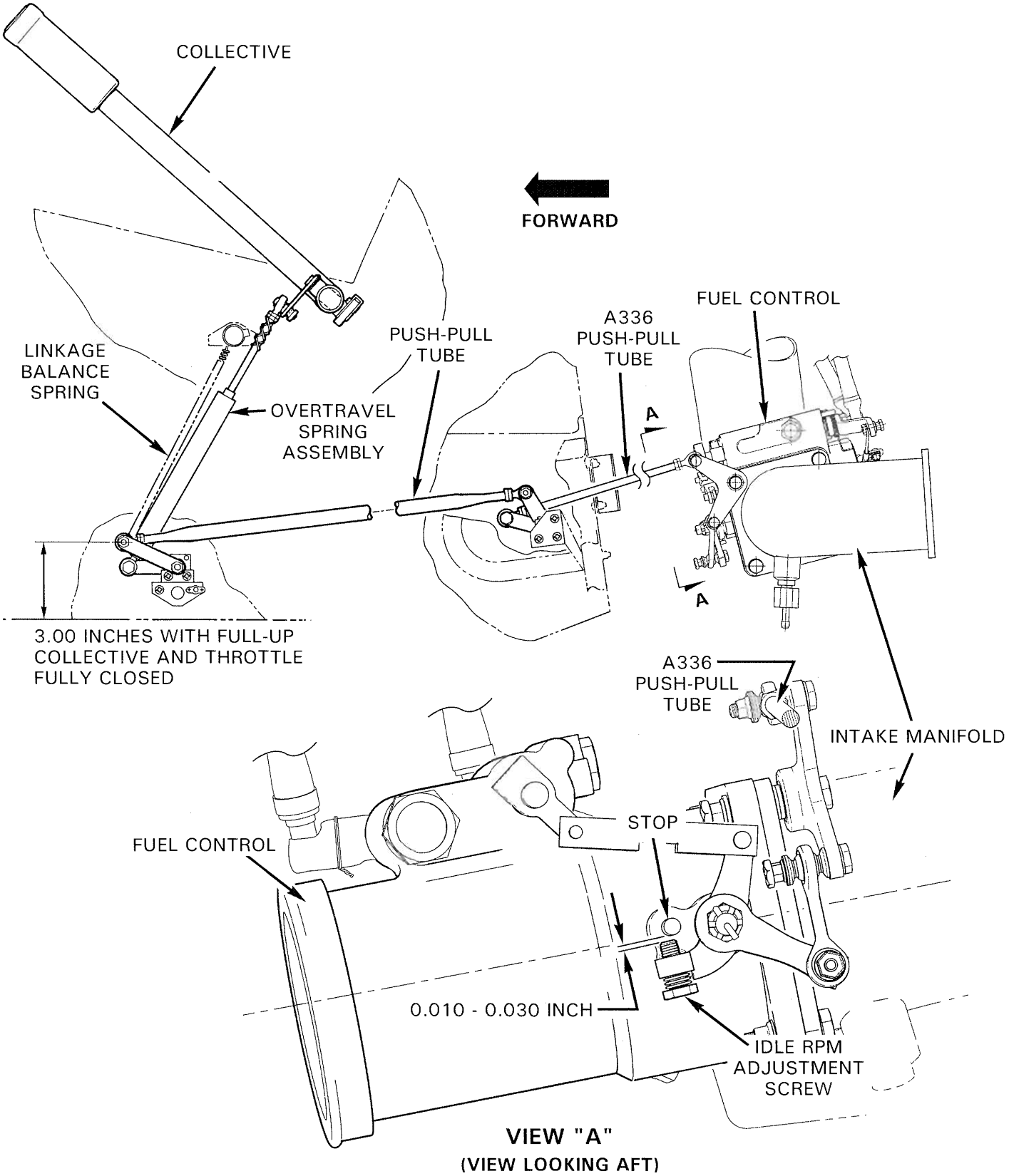


FIGURE 10-8A THROTTLE CORRELATION RIGGING (FUEL INJECTED SHIPS)

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10.140 Tail Rotor Rigging (cont'd)

3) To decrease the total travel, shorten the C121-9 push-pull tube for right pedal travel and increase the length of C343-3 or C343-9 push-pull tube for left pedal travel.

4) Recheck the tail rotor blade angles per steps e) through h) above.

j) Ensure all rod ends are installed properly by checking the push-pull tube witness holes. Tighten all rod end palnuts and jam nuts. Torque stripe all nuts.

k) Balance tail rotor per Section 10.240.

10.150 Throttle Correlation Rigging (see Figure 10-8)

For in-service check and adjustment:

1. Verify idle rpm is correct with engine warm, clutch fully engaged, and throttle closed. Adjust O-540 idle to 53-57% and IO-540 idle to 58-62%.

2. Shut down helicopter.

3. Rotate twist-grip throttle fully closed through overtravel spring pressure to positive stop. Holding throttle tight against stop, raise collective full up while observing throttle arm on carburetor or fuel control, as applicable. Throttle arm should move 0.010-0.030 inch off of idle stop screw when collective up-stop is reached.

4. If necessary, adjust length of throttle push-pull tube at carburetor or fuel control, as applicable.

5. Standard torque jam nut(s) per Section 1.320, check witness holes, and torque stripe per Figure 2-1.

10.160 Actuator Rigging

No field adjustment of actuator-engaged belt tension is permitted. Adjust actuator's down-limit stop screw so there is a delay of less than 5 seconds before rotor starts turning when actuator is engaged at start up.

10.200 TRACK AND BALANCE

The Chadwick-Helmuth Vibrex system, the TEC ACES system, the Dynamic Solutions Systems' MicroVib system, or equivalent equipment is required to perform dynamic rotor balancing and in-flight tracking checks.

10.210 Equipment Requirements

The following list of equipment may be used on the R44 for track and balance:

a) Balancers

Chadwick-Helmuth Model Number	177M05 177M-6 177M-6A 177M-7 177M-7A 8350 series M192 series or equivalent equipment

b) Strobex

Chadwick-Helmuth Model Number	135M-10* 135M-10A*, B* and C* 135M-11 or equivalent equipment

* When tracking the main rotor using the 135M-10 series Strobex a double interrupter must be used.

c) Cables, accelerometers/velocimeters, pickups, and targets**

Chadwick-Helmuth Model Number	3140	D.C. Adapter Cable
	3030	Magnetic pickup
	3319-1 or 10808-25	Magnetic pickup cable
	4177	Accelerometer
	4296-1 and -2	Accelerometer Cable
	3300	Target Patches
	4270	Target Patches
	7310	Velocimeter
	11210-20/-50	Velocimeter Cable

d) Brackets**

Robinson MT121-1 Magnetic Pickup Bracket

e) Charts**

Robinson	Main Rotor Chart Tail Rotor Chart

** As required by the balancing equipment being used.

10.220 Equipment Installation

10.221 Main Rotor Equipment Installation (see Figure 10-9A)

Refer to specific manufacturer's installation instructions when using balancing equipment other than Chadwick-Helmuth. Install Chadwick-Helmuth equipment as follows:

a) Install the accelerometer/velocimeter under the upper console left-side attachment screw with cable connector pointing outboard.

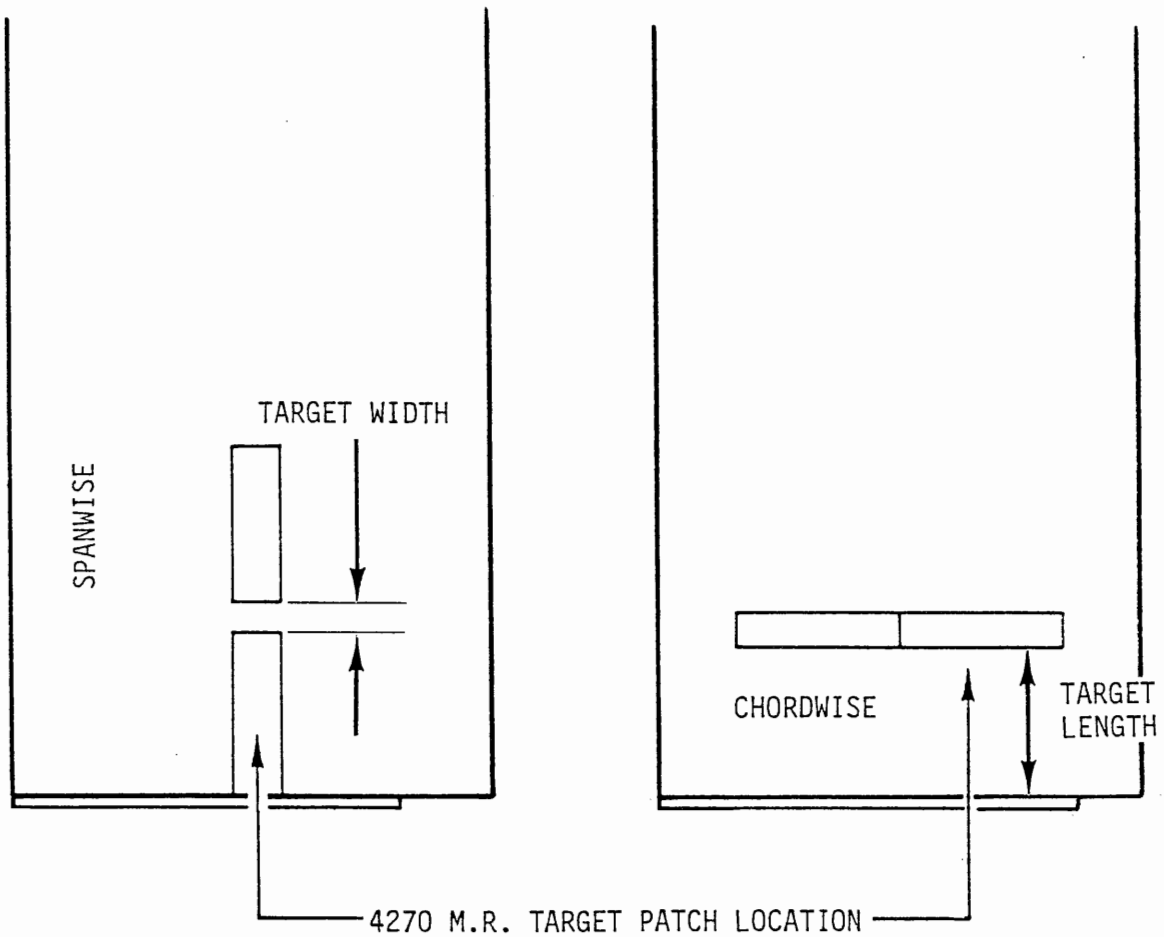


FIGURE 10-9 MAIN ROTOR TARGET PATCH LOCATION

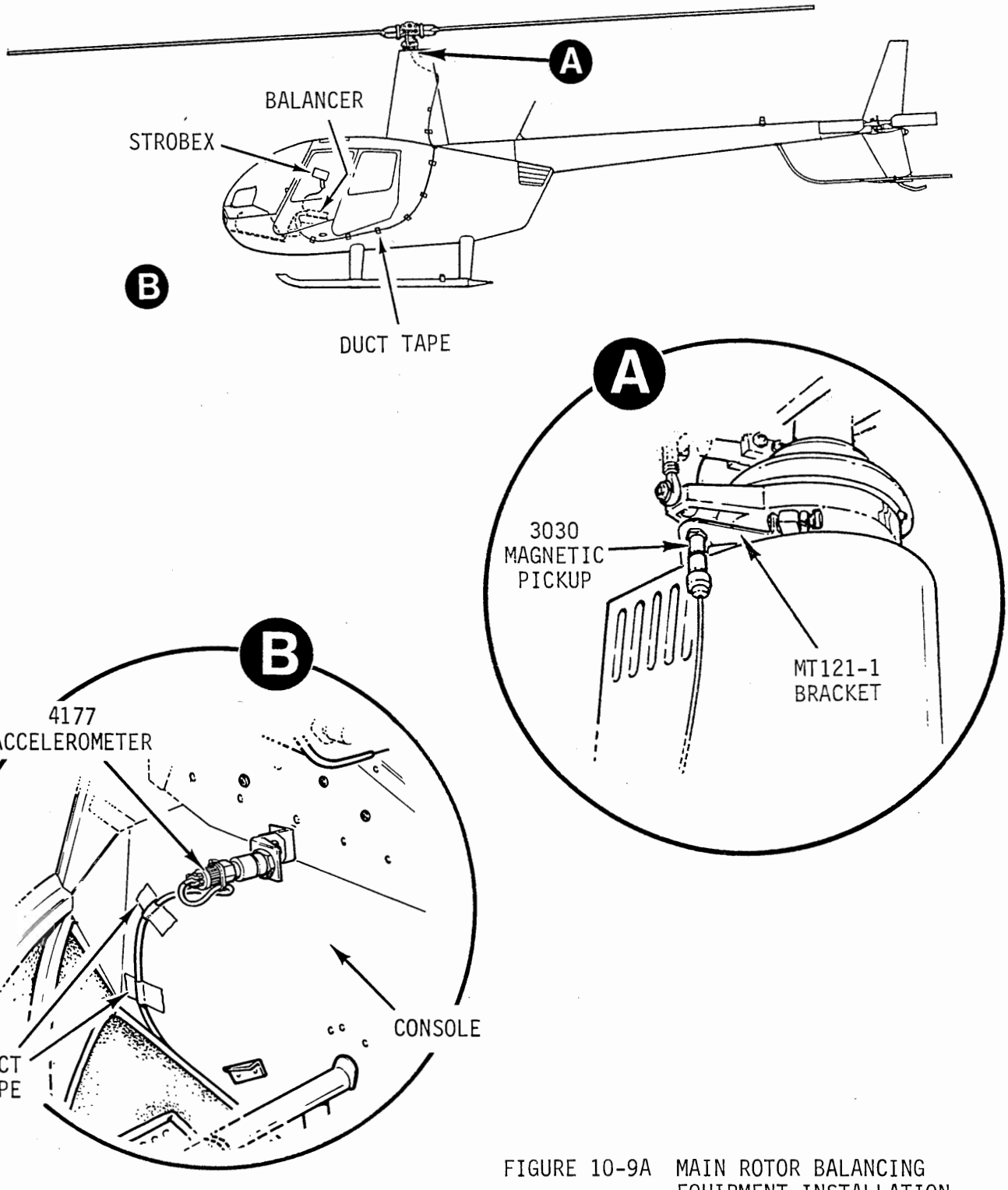


FIGURE 10-9A MAIN ROTOR BALANCING EQUIPMENT INSTALLATION

10.221 Main Rotor Equipment Installation (cont'd)

b) Install MT121-1 Bracket onto the lower right-hand side of the swashplate.

WARNING

Ensure attachment bolts are torqued to 200 in.-lb plus nut drag. The MT121-1 Bracket will remain installed for in-flight track and balance.

c) Install the 3030 magnetic pickup onto the MT121-1 Bracket. Set the interrupter pickup gap to 0.030" ± 0.010".

d) Attach the cable to the magnetic pickup. Pull collective stick full up and cyclic stick full left. Secure the cable to the mast fairing with duct tape. Route the cable to the lower front of the left door frame. Secure the cable every 12 inches with duct tape.

CAUTION

Security of the cable is essential as the helicopter will be flown at Vne.

e) Attach the cable to the accelerometer/velocimeter mounted on the left forward hold down screw of the console. Secure with duct tape.

CAUTION

Ensure the cable cannot become entangled with tail rotor pedals.

f) Attach the cables to the balancer and secure excess cable to the bracket in front of the left seat.

g) Apply the 4270 target tapes to the main rotor blades per Figure 10-9.

10.222 Tail Rotor Equipment Installation (see Figures 10-9C and 10-9D)

NOTE
Prior to installing balancing equipment, verify blades are clean and smooth, no debris under tip covers (square tip blades), rod end and spherical bearing play are within limits, and elastomeric bearings (if applicable) are satisfactory.

1. Install accelerometer/velocimeter bracket under upper forward tail rotor gearbox output seal housing attachment bolt. Connector end of accelerometer/velocimeter must point up.

2. If using a Vibrex 2000-series balancer with photocell, install photocell bracket between velocimeter and velocimeter bracket as shown in Figure 10-9C.

3. If using Strobex to obtain clock angle, install a target tape spanwise facing outboard on one arm of tail rotor hub. If using photocell to obtain clock angle, install a target tape spanwise facing inboard on one arm of tail rotor hub.

4. Connect cable(s) to accelerometer/velocimeter and photocell (if used). Route cable(s) forward and wrap around tailcone several times. Secure with duct tape.

WARNING
Ensure cable(s) cannot entangle tail rotor.

5. If using Strobex to obtain clock angle, route cable to a position located approximately 20 feet to left of tail rotor. Place sandbags (or similar) on cable to prevent cable movement. If using photocell to obtain clock angle, cables may be routed into cabin and secured with duct tape to prevent cable movement.

6. Connect cable(s) to balancer.

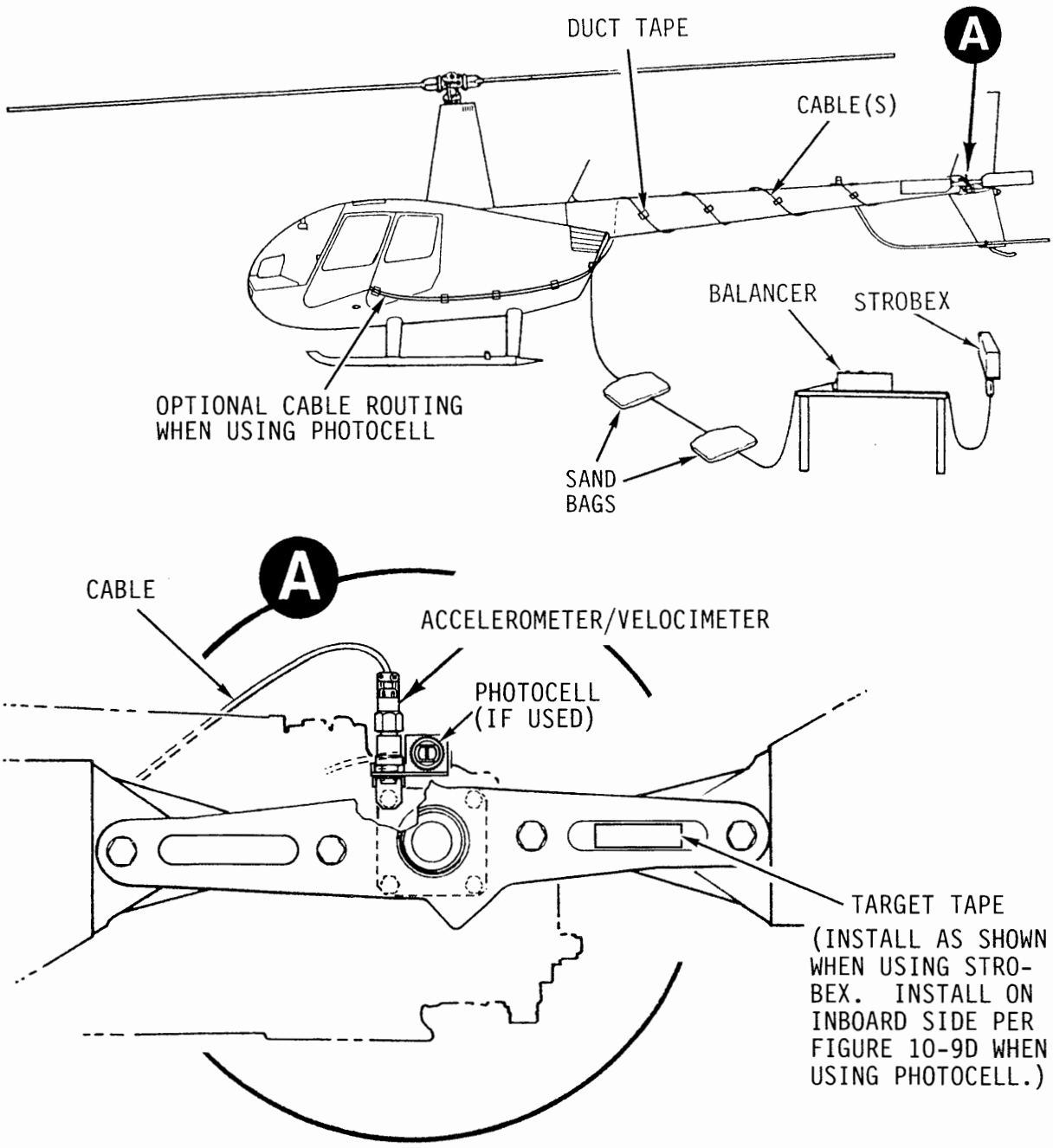
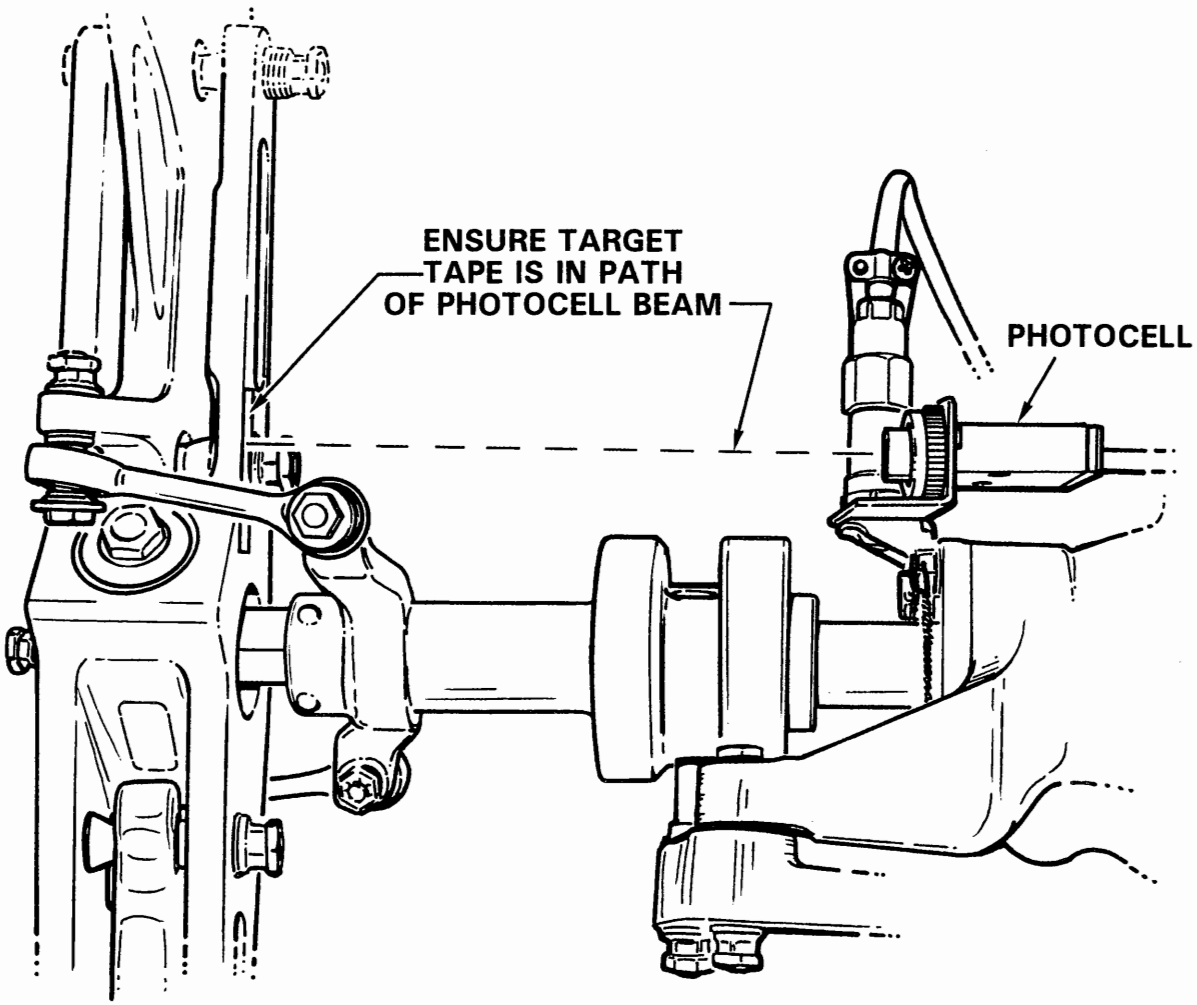


FIGURE 10-9C

TAIL ROTOR BALANCING EQUIPMENT INSTALLATION



(VIEW LOOKING FORWARD)

FIGURE 10-9D

TAIL ROTOR PHOTOCELL INSTALLATION

10.230 Main Rotor Track and Balance Procedure

> NOTE
>
> Prior to installing balancing equipment, verify blades are clean and smooth, rod ends and spherical bearings play are within limits, correct swashplate tilting friction, and correct teeter and coning hinge frictions.

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

1. Check main rotor track in a hover. When using Vibrex 177- or 8350-series equipment, place Function knob in track position, RPM (flash rate) on Strobex to 326. Adjust track by shortening high blade pitch link per Section 10.232 to bring track within 0.25 inch.

2. Check main rotor balance in a hover. For Vibrex 177- or 8350-series equipment, place Function knob in "A" position, RPM on Phazor to 408. Adjust balance as indicated by main rotor balance chart (maximum 0.2 IPS).

3. Fly the helicopter at 50, 60, 70, 80, 90, 100, 110, 120, and 130 knots. Check track at each airspeed and record.

> **WARNING**
>
> **Do not exceed Vne of helicopter when checking track.**

4. Make slight tab adjustment to correct for a climbing blade by bending trim tab down per Section 10.233.

> **WARNING**
>
> **Blades with two trim tabs are obsolete and must be removed from service.**

5. Repeat Steps 3 & 4 as required until track will remain on at all airspeeds within 3/8 inch.

6. Readjust main rotor balance in a hover (maximum 0.2 IPS).

7. Check autorotational RPM per Section 10.250. Adjust as required.

8. Evaluate collective trim and adjust as required (non-hydraulic aircraft only).

9. Check main rotor balance in a hover. Adjust as required.

10.230 Main Rotor Track and Balance Procedure (cont'd)

10.231 Main Rotor Balance Adjustments

Spanwise balance adjustments are made by adding or subtracting weight as indicated by the balance chart. Weight is changed by removing the blade tip cover and changing C298 tip weights. Fine adjustments may be made with AN960-10 or -10L washers and also by trimming washers.

Coarse adjustment of chordwise balance is accomplished by shifting rotor hub (see Section 9.124) as indicated on balance chart. Fine adjustment of chordwise balance is accomplished by adding or subtracting A255-1 or -2 chord weights or AN970-4 washers as indicated by balance chart. A maximum of four A255-2 weights (four A255-2 weights equal twelve A255-1 weights) may be installed.

Three A255-1 Weights = One A255-2 Weight

Eight AN970-4 Washers = A255-1 Weight

10.232 Main Rotor Pitch Link Adjustment

Two length adjustments can be made on the main rotor pitch link. Coarse adjustment is made by loosening upper rod end jam nut, disconnecting rod end from blade pitch horn and turning rod end up or down (one-half turn of rod end changes track approximately 0.25 inch).

Fine adjustment is made by leaving rod end connected to pitch horn and loosening rod end jam nut, loosening barrel jam nut, and then screwing barrel up or down. One barrel revolution is equivalent to one-half turn of rod end. Partial turns of barrel can be made by counting number of hex flats rotated (see Figure 10-11).

CAUTION

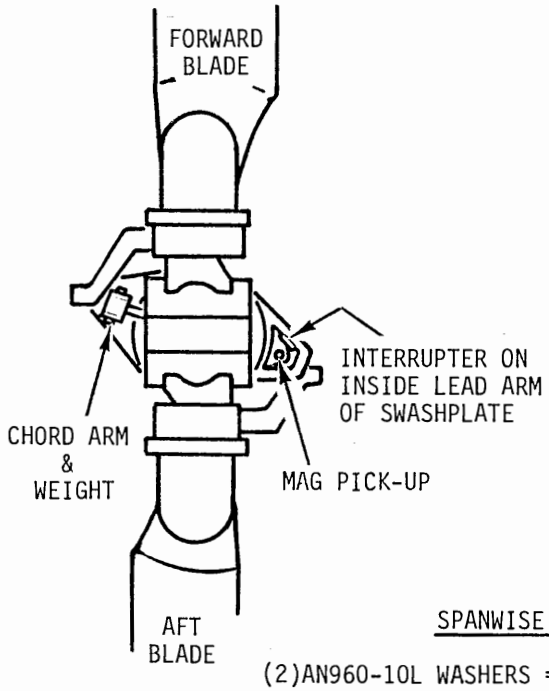
After adjusting pitch link, verify 0.020 inch diameter safety wire cannot pass through witness holes.

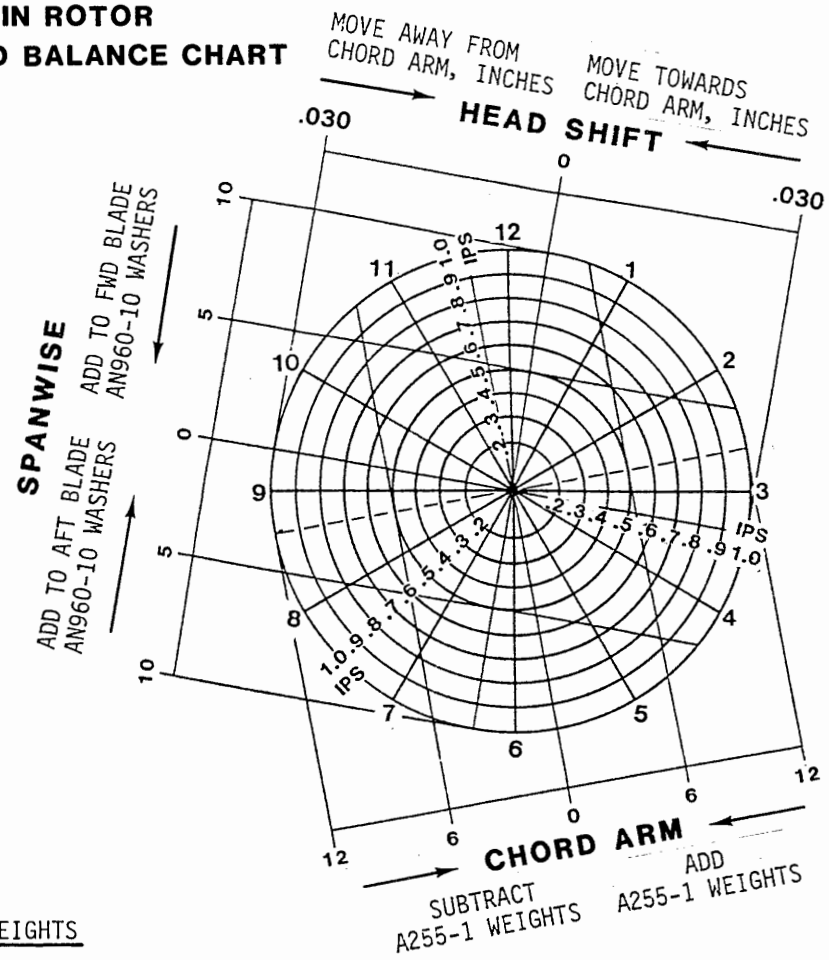
SHIP S/N _____

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MAIN ROTOR TRACK AND BALANCE CHART

MOUNT ACCELEROMETER ON LEFT SIDE OF CONSOLE POINTED LEFT





SPANWISE WEIGHTS

(2)AN960-10L WASHERS = (1)AN960-10 WASHER

(5)AN960-10 WASHERS = (1)C298-2 WEIGHT

(11)AN960-10 WASHERS = (1)C298-3 WEIGHT

(4)C298-3 WEIGHTS = (1)C298-4 WEIGHT

CHORD ARM WEIGHTS

(8)AN970-4 WASHERS = (1)A255-1 WEIGHT

(3)A255-1 WEIGHTS = (1)A255-2 WEIGHT

BALANCE		TRACK (KNOTS)										
CLOCK	IPS	HOVER	CLIMB	50	60	70	80	90	100	110	120	130

CHANGE MADE: _____

CHANGE MADE: _____

CHANGE MADE: _____

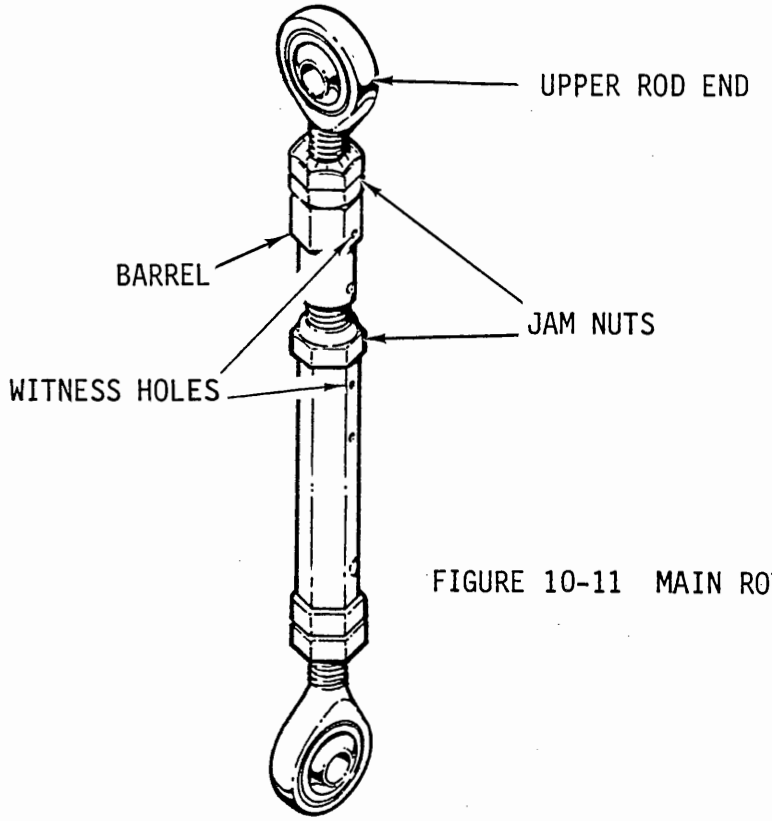


FIGURE 10-11 MAIN ROTOR PITCH LINK

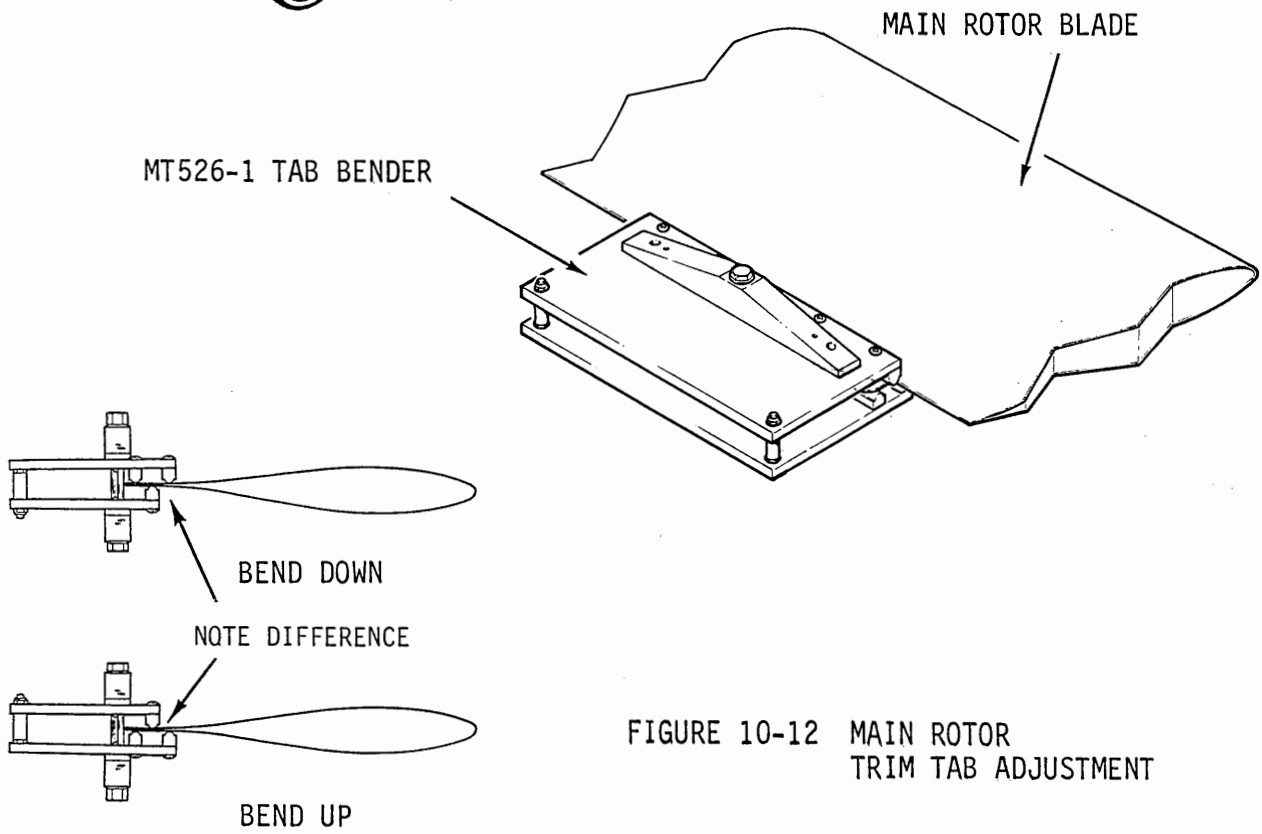


FIGURE 10-12 MAIN ROTOR TRIM TAB ADJUSTMENT

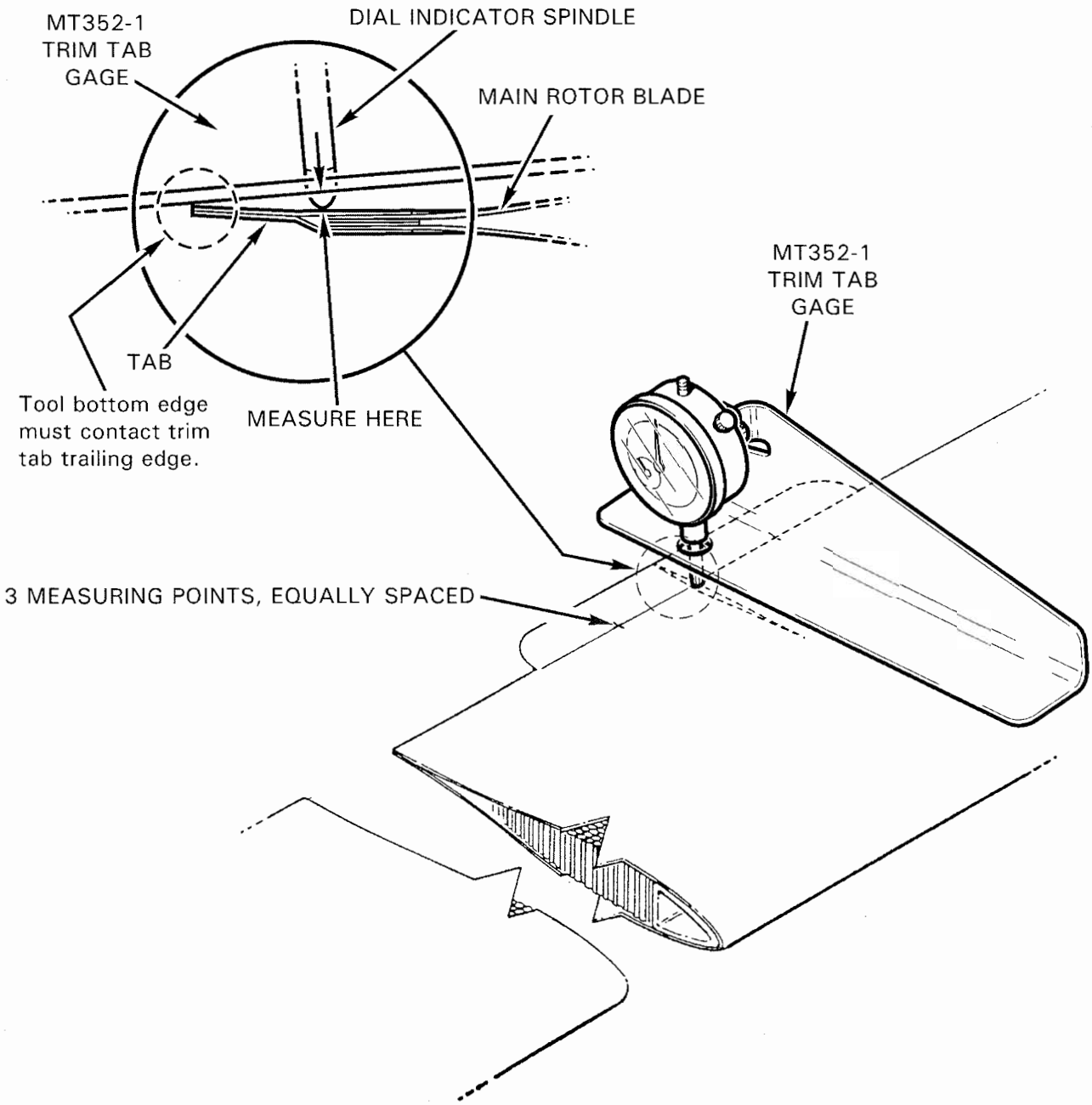


FIGURE 10-13 MAIN ROTOR TRIM TAB MEASUREMENT

10.233 Main Rotor Blade Trim Tab Adjustment

Main rotor blade trim tab adjustments are made using the MT526-1 tab bender and the MT352-1 trim tab gage. Refer to Figure 10-13. Using a felt marker, draw a line across top of trim tab aligned with blade trailing edge. Mark line with three equally spaced measuring points. Place trim tab gage chordwise across upper surface of blade and trim tab trailing edge with dial indicator stylus resting on a marked measuring point. Set dial indicator scale to zero. Similarly measure both remaining measuring points and verify they are within 0.005 inch of first.

CAUTION

MT352-1 gage must contact trim tab trailing edge. Space between edge of gage and trailing edge of trim tab indicates trim tab bent beyond limit.

To bend trim tab, loosen bolt on MT526-1 tab bender and slide tab bender over trim tab trailing edge as far toward leading edge as possible. Ensure single-rib side of tool contacts blade bottom surface to bend tab down and vice-versa. Tighten bolt to bend tab. Clamping action of tool is sufficient to bend tab; do not use tool like a lever. Refer to Figure 10-12. Make very slight bends downward on trim tab. Do not bend trim tab upward unless absolutely necessary; bending trim tab upward can increase cyclic stick shake. A trim tab bend of approximately 0.015 inch will move tip of main rotor blade approximately 0.2 inch. Remeasure trim tab with MT352-1 gage. Adjust bend in trim tab as required to keep three measuring points within 0.005 inch.

CAUTION

Do not use main rotor blade trim tab bending tools manufactured by other helicopter manufacturers. Use of these tools will damage main rotor blade.

10.234 Main Rotor Track and Balance Troubleshooting

	Symptom	Probable Cause	Correction
1.	Excessive Cyclic or Stick Shake	Rough or binding A205-5 fork assembly (upper swashplate).	Replace or refer to Section 8.6.
		Brinelled spindle bearing (rough movement).	Send blade(s) to RHC or Service Center for spindle bearing replacement.
		Rough blade surface (chipped paint).	Repair blades per Section 9.130.
		Rough or binding pitch links.	Replace pitch link rod ends
		MR blade boot misaligned.	Realign or replace boot per Sections 9.113 & 9.114.
		MR teeter or coning hinge binding.	Replace bearings per Section 9.126.
		MR blade trim tabs bent upward.	Bend trim tabs evenly down per Section 10.233.
		Blade mismatch.	Send blade(s) to RHC for replacement.
2.	Excessive Ship Vibration	MR out of track and balance.	Track and balance per Section 10.230.
		MR teeter or coning hinge friction.	Adjust hinge friction per Section 9.124.
		MR teeter or coning hinge binding.	Replace bearings per Section 9.126.
		Brinelled spindle bearing (rough movement).	Send blade(s) to RHC or Service Center for spindle bearing replacement.
		MR teeter hinge bearings worn.	Replace bearings per Section 9.126.
3.	Excessive Cyclic Stick Forces	Brinelled spindle bearing (rough movement).	Send blade(s) to RHC or Service Center for spindle bearing replacement.
4.	Intermittent Blade Track Picture	MR teeter or coning hinge friction	Adjust hinge friction per Section 9.124.
		MR coning hinge binding.	Replace bearings per Section 9.126.
		MR teeter hinge not "broken-in."	Track and balance per Section 10.230. Adjust track to minimize error.
		Brinelled spindle bearing (rough movement).	Send blade(s) to RHC or Service Center for spindle bearing replacement.
5.	Radical Changes to Cyclic Trim	MR teeter hinge bearings worn.	Replace bearings per Section 9.126.
		Brinelled spindle bearing (rough movement).	Send blade(s) to RHC for spindle bearing replacement.
6.	Lateral Intermittent Ship Vibration	Engine misfiring due to malfunction in spark plugs, ignition leads, magneto, or engine not “broken-in.”	Refer to Textron-Lycoming Maintenance Instructions.
7.	4 per second Fore/Aft Oscillation	Aircraft CG out of limits.	Operate aircraft within CG envelope.
		Deteriorated / contaminated main gearbox rubber mount(s).	Replace main gearbox mounts.

10.240 Tail Rotor Balance Procedure

Refer to specific manufacturer's installation instructions when using balancing equipment other than Chadwick-Helmuth Vibrex system.

Install Chadwick-Helmuth equipment per Section 10.222. Set Function Knob on Balancer to appropriate channel. Set balancer RPM Range knob to X10 and set RPM to 231. With helicopter running with governor ON, view tail rotor assembly with Strobex. Tune Balancer while viewing target tape and adjusting RPM dial on Balancer. Record clock angle and IPS on tail rotor balance chart. Adjust as required until balance is less than 0.2 IPS.

Spanwise balance adjustments for C029-1 square-tip blades are made by adding, subtracting, or exchanging weights under the removable tip cover. Use C134-1 or -2 tip weights or AN960-8 or -8L washers. -8L washers may be trimmed as a very fine adjustment.

Spanwise balance adjustments for C029-2 and C029-3 round-tip blades are made by exchanging different diameter washers under nut securing blade's outboard retaining bolt. The bolt has sufficient length to allow necessary spanwise weight changes; verify 2-4 threads protruding past nut after torquing per Section 1.320.

Chordwise balance is adjusted by adding, subtracting, or exchanging A141-14, A214-3, NAS1149F0463P/F0432P, or NAS1149D0463J/D0432J washers under nut securing blade's pitch link attaching bolt. Change pitch link attaching bolt length as required for proper thread engagement (see Section 1.310, refer to IPC for allowable lengths).

DATE _____ SERIAL NO. _____

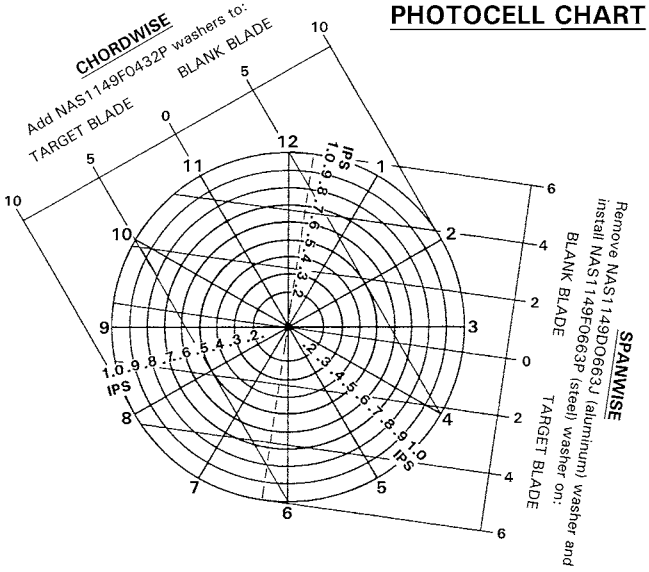
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C008-9 TAIL ROTOR ASSEMBLY

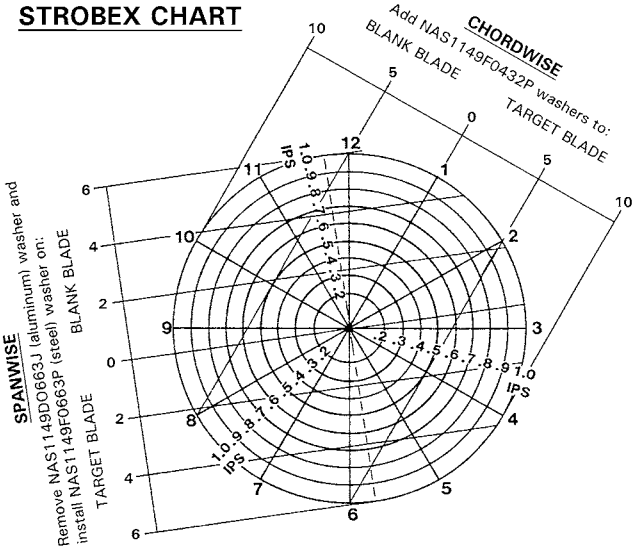
CHORDWISE WEIGHTS			
(1) NAS1149F0463P Washer	=	(2)	NAS1149F0432P Washers
(1) A214-3 Washer	=	(3.5)	NAS1149F0432P Washers
(1) A141-14 Washer	=	(5)	NAS1149F0432P Washers

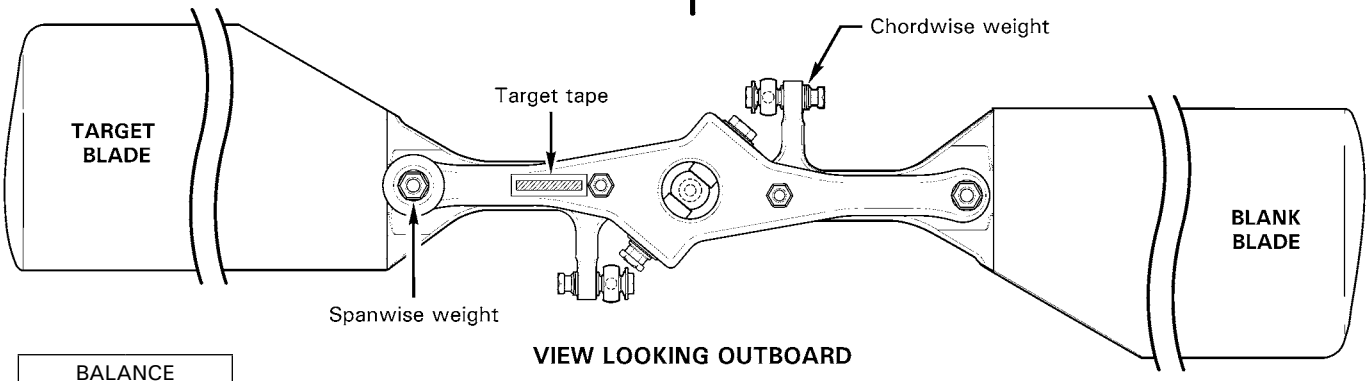
SPANWISE WEIGHTS			
(1) C141-23 Washer	=	(3.5)	NAS1149F0663P Washers
(1) C141-24 Washer	=	(7)	NAS1149F0663P Washers
(2) NAS1149F0632P		(1)	NAS1149F0663P Washer

PHOTOCELL CHART



STROBEX CHART





VIEW LOOKING OUTBOARD

BALANCE	
CLOCK	IPS

ADJUSTMENT: _____

CLOCK	IPS

ADJUSTMENT: _____

CLOCK	IPS

ADJUSTMENT: _____

CLOCK	IPS

ADJUSTMENT: _____

FIGURE 10-14 C008-9 TAIL ROTOR ASSEMBLY DYNAMIC BALANCE CHART

DATE _____ SERIAL NO. _____

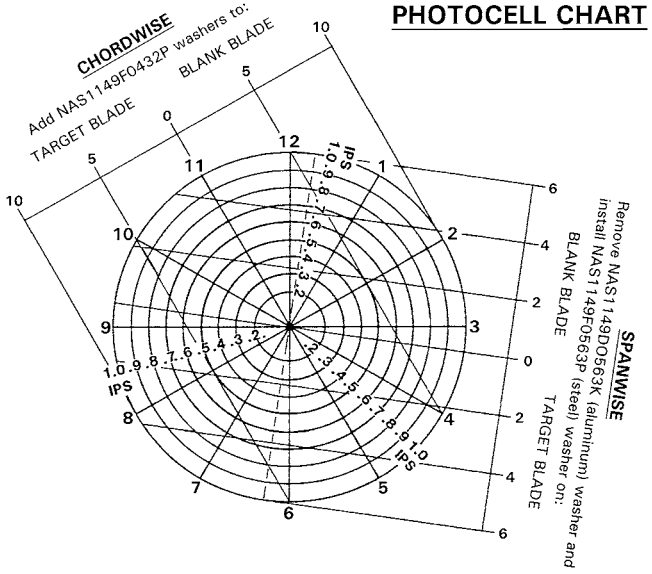
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C008-4 TAIL ROTOR ASSEMBLY

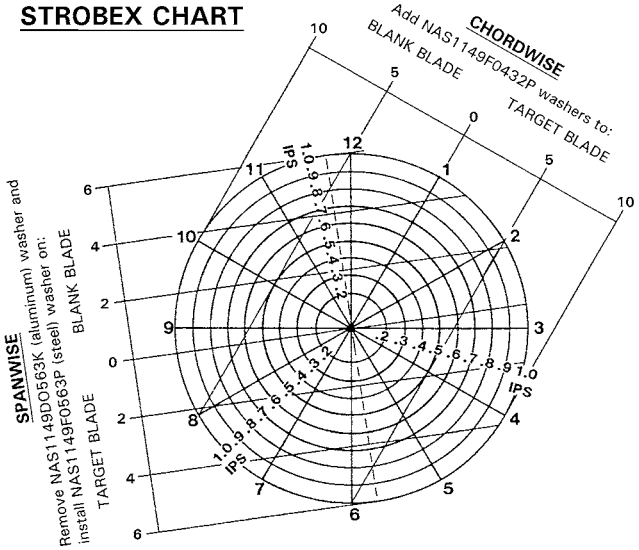
CHORDWISE WEIGHTS			
(1) NAS1149F0463P Washer	=	(2)	NAS1149F0432P Washers
(1) A214-3 Washer	=	(3.5)	NAS1149F0432P Washers
(1) A141-14 Washer	=	(5)	NAS1149F0432P Washers

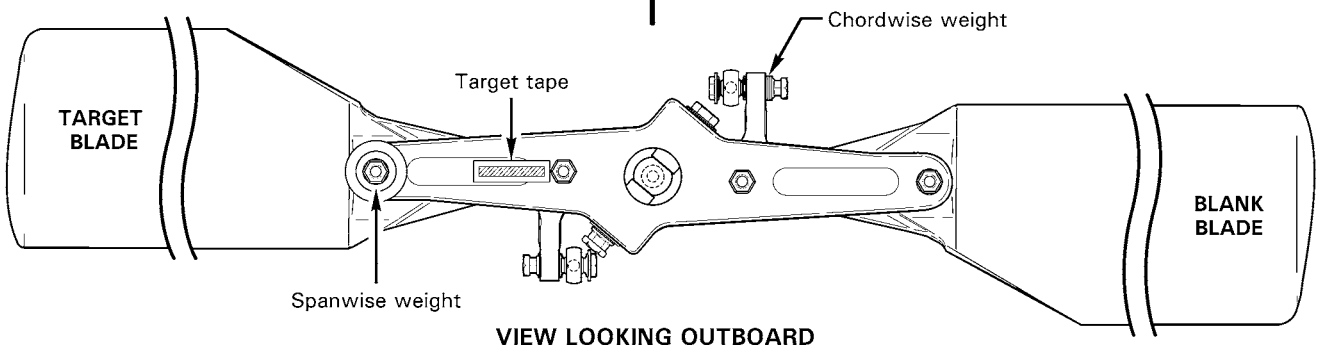
SPANWISE WEIGHTS			
(1) C141-20 Washer	=	(5)	NAS1149F0563P Washers
(1) AN970-5 Washer	=	(13)	NAS1149F0563P Washers

PHOTOCELL CHART



STROBEX CHART





VIEW LOOKING OUTBOARD

BALANCE	
CLOCK	IPS

ADJUSTMENT: _____

CLOCK	IPS

ADJUSTMENT: _____

CLOCK	IPS

ADJUSTMENT: _____

CLOCK	IPS

ADJUSTMENT: _____

FIGURE 10-15 C008-4 TAIL ROTOR ASSEMBLY DYNAMIC BALANCE CHART

DATE _____ SERIAL NO. _____

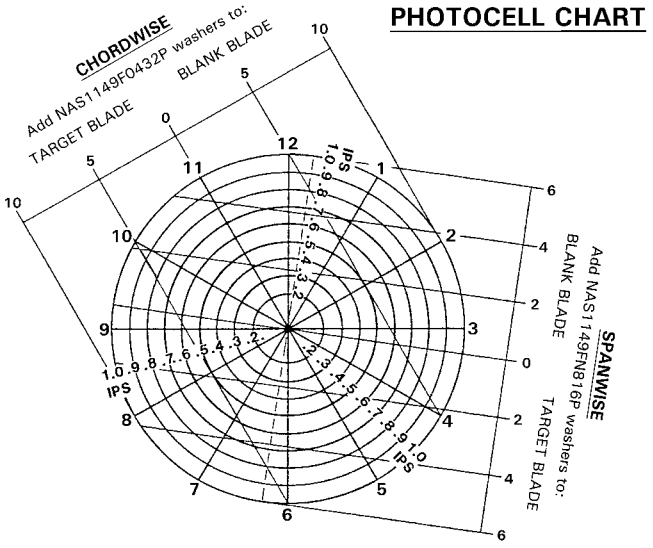
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C008-2 TAIL ROTOR ASSEMBLY

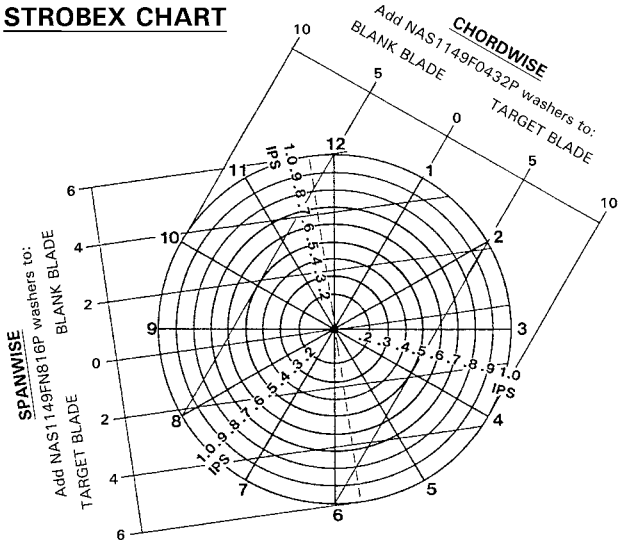
CHORDWISE WEIGHTS			
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(1) A141-14 Washer	=	(5)	NAS1149F0432P Washers

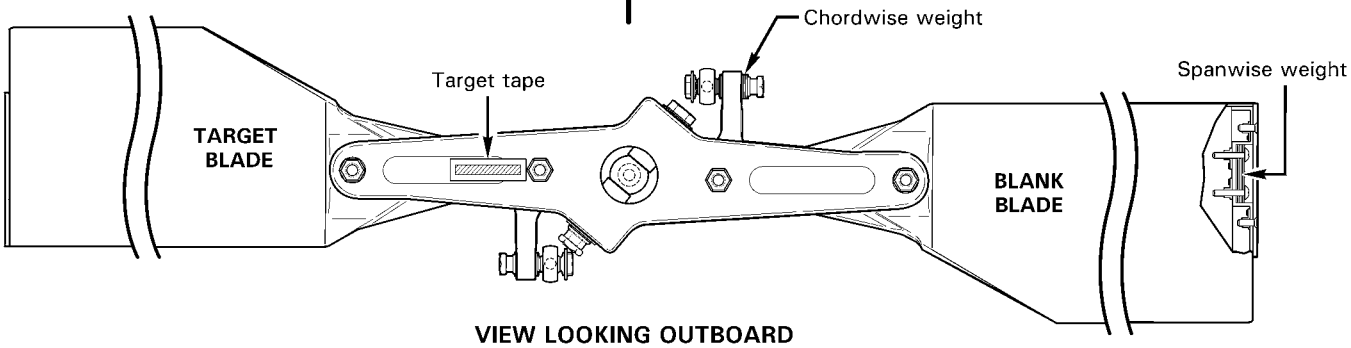
SPANWISE WEIGHTS			
(1) NAS1149FN832P	=	(2)	NAS1149FN816P Washers
(1) C134-1 Weight	=	(14)	NAS1149FN816P Washers

PHOTOCELL CHART



STROBEX CHART





VIEW LOOKING OUTBOARD

BALANCE	
CLOCK	IPS

ADJUSTMENT: _____

CLOCK	IPS

ADJUSTMENT: _____

CLOCK	IPS

ADJUSTMENT: _____

CLOCK	IPS

ADJUSTMENT: _____

FIGURE 10-16 C008-2 TAIL ROTOR ASSEMBLY DYNAMIC BALANCE CHART

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10.250 Autorotational RPM Adjustment

Use the following procedure for checking and adjusting autorotational RPM:

WARNING

Failure to properly adjust autorotational RPM (RPM too low) may prevent the rotorcraft from achieving proper RPM at low gross weights.

a) Perform autorotation RPM check at less than 1900 lb gross weight. Calculate the takeoff gross weight of the helicopter. Record the time on the hour meter.

Take-Off gross weight _____

Take-Off hourmeter reading _____

b) Set the altimeter to 29.92" Hg (1013.2 millibars) prior to performing the autorotation. Autorotate with the collective control firmly held against the down stop with an airspeed of 50 KIAS.

WARNING

Do not allow the rotor to overspeed when performing autorotation checks. Progressively lengthen both main rotor pitch link rod ends until full down collective can be obtained without overspeeding the rotor.

Take at least 3 RPM readings at 500 to 1000 foot altitude intervals.

Record the following in-flight data:

Test #	Hourmeter Reading	OAT	Pressure Altitude	Test %RPM
1	_____	_____	_____	_____
2	_____	_____	_____	_____
3	_____	_____	_____	_____
4	_____	_____	_____	_____
5	_____	_____	_____	_____

10.250 Autorotational RPM Adjustment (cont'd)

c) After test flight, refer to Figure 10-15 chart and determine following:

Test #	Elapsed Time (in-flight hourmeter reading minus take-off hour-meter reading)	lbs of Fuel Consumed (elapsed time x 93 lb/hr)	Test Gross Weight (take-off gross weight minus fuel consumed)	Test Longitudinal Center of Gravity	Chart % RPM *	Test % RPM (from in-flight data)	RPM Correction (chart % RPM minus Test % RPM)
1							
2							
3							
4							
5							

* Chart Instructions:

1. Start at outside air temperature, and draw a vertical line up to pressure altitude.
2. Draw a horizontal line from pressure altitude to rotorcraft gross weight at time of autorotation.
3. Draw a vertical line down from autorotation gross weight to required auto RPM.

   Notes:

   i. Increase rotor RPM 0.75% for every inch that CG is forward of FS 100.0.

   ii. Decrease rotor RPM 2% for model R44 II.

d) Adjust pitch links based on average RPM correction required. Lengthen both pitch links to decrease RPM if test RPM is greater than chart RPM; shorten both pitch links to increase RPM. One full rod end turn will change RPM 3½%. Adjust both pitch links exactly the same so track will not be affected.

e) Repeat steps (a) through (d) as required until the RPM correction is ± 1% of chart RPM.

AUTOROTATION RPM

COLLECTIVE FULL DOWN
50 KIAS
(One full turn of rod ends = approximately $3\frac{1}{2}$% RPM change)
(One full turn of rod end = $1\frac{1}{6}$ turns of barrel)

NOTES:

1. Increase Rotor RPM 0.75% for every inch that CG is forward of FS 100.0.
2. Decrease Rotor RPM 2% for Model R44 II.

Example: R44 II, OAT = 25°C, Hp = 2000 ft, GW = 1900 lb, CG = FS 98.0
Design RPM = 104% – 2% + (2 x 0.75%) = 103.5%

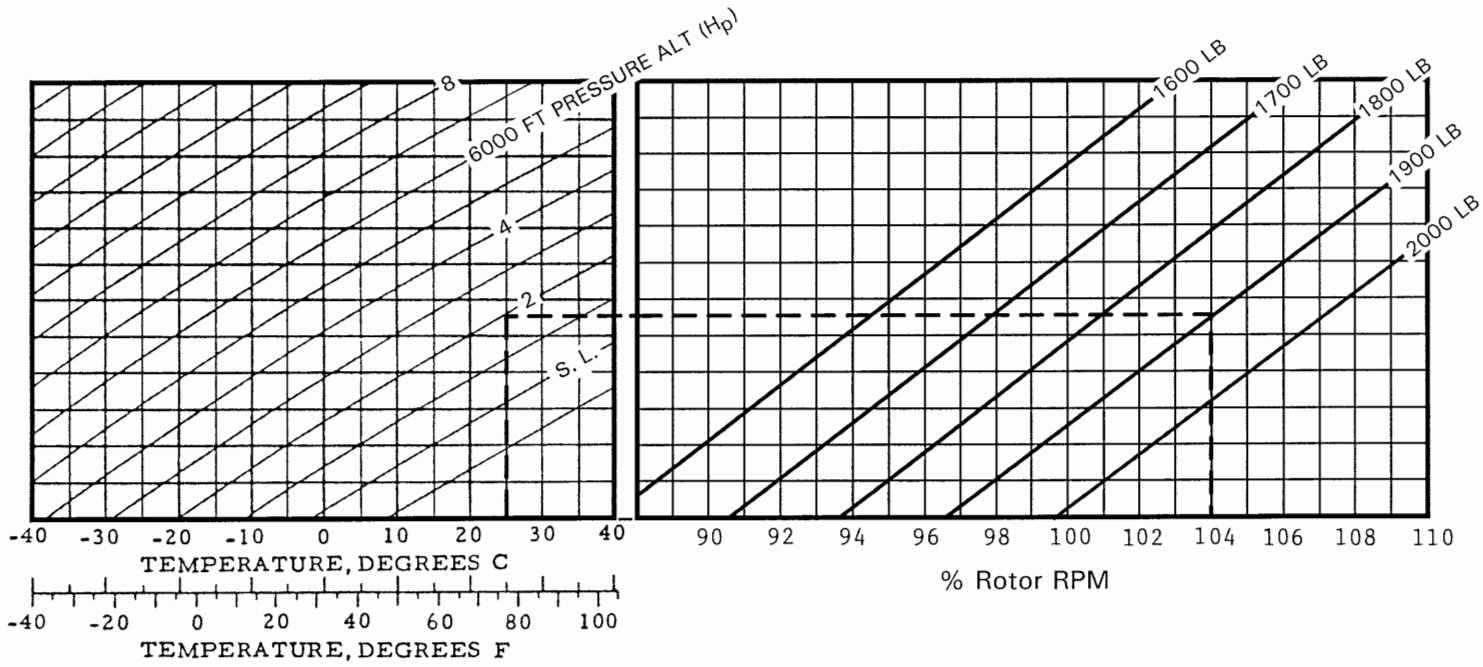


FIGURE 10-15

CHAPTER 11

HEATING, VENTILATION AND AIR CONDITIONING

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11.002	Description	11.1
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11.220	Cabin Air Vent Cable Installation	11.5
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11.322	Refrigerant Charge	11.11
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11.343	Evaporator Drain System	11.18
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CHAPTER 11

HEATING , VENTILATION AND AIR CONDITIONING

11.000 Heating and Ventilation

11.001 Introduction

This section contains the procedures necessary for replacement of the heater and ventilation systems components.

11.002 Description

The cabin heater system consists of a heat shroud over the muffler, a control valve on the forward side of the firewall, an outlet grill forward of the pilot's tail rotor pedals, and the interconnecting ducts between components. Air is supplied by the engine cooling fan. The push-pull heat control is located on the face of the lower console. The heat control actuates the control valve which directs the air either into the cabin or out an overboard discharge on the underside of the cabin.

Fresh air vents are located in each door and in the nose of the helicopter. A push-pull control for the nose vent is located on the face of the lower console.

11.100 Cabin Heater

Refer to Figure 11-1.

NOTE
The cabin heater is required to be installed in the R44 helicopter. Air flow through the muffler shroud cools the muffler and engine compartment.

11.110 Control Cable and Valve Replacement

1. Remove the aft tunnel belly panel and engine belly cowling.
2. Remove the three screws holding the C753-1 cover and remove the cover and insulation.
3. Remove four screws holding the C625-1 box and remove the box.
4. Remove the control wire by straightening the end (if applicable) and loosening the A462-1 fitting clamping the wire.
5. To remove the A019-3 valve assembly and A623-1 inlet, remove the two hoses and the remaining four screws through the firewall.
6. To remove the control cable casing, open upper console. Remove the cable jam nut behind the lower console face and the AN742-3 clamp holding the casing to the chin. Inside the right forward baggage compartment, remove the clamp. Outboard of the right aft floor, remove the outboard carpet from the top to access the cable casing. Remove the two clamps under the panel outboard of the right aft seat. Remove the clamp holding the casing to the vertical firewall and pull the casing out through the lower console face.

11.110 Control Cable and Valve Replacement (continued)

7. To install the control cable casing, verify that an MS35489-4 or AN931-3-5 grommet is installed in the tunnel wall next to the valve and an NAS557-3A grommet is installed 6 places in holes through which the casing passes (each place except one place through a vertical firewall stiffener and through the bulkhead at the front of the right forward baggage compartment). Install the casing through the lower console face and cable jam nut, through the stiffener on the side of the console, through the right forward baggage compartment, outboard of the right aft floor, through the right aft baggage compartment, through two stiffeners on the vertical firewall, and into the tunnel. Set end of casing approximately 0.8 inches into the tunnel. Fasten casing with AN742-3 clamps five places.

8. To install the valve and inlet, clean off the old sealant and reseal with B270-4 sealant. Install valve and inlet and fasten with screws in four places.

9. Install control cable wire through the A462-1 fitting and adjust to give approximately 0.060 springback at the knob when the valve is fully closed. Verify control operates freely. Cut excess wire approximately 0.01 inch or less from the fitting.

10. Install the C625-1 box and seal with B270-1 sealant. Verify the valve and box are sealed by taping the belly hole closed and applying low air pressure to the inlet. Check for leaks inside the tunnel by using a piece of yarn at the end of a stick.

11. Install one inch thick Microlite AA insulation over the C625-1 box and install the C753-1 cover.

12. Install heater hoses. Install belly cowling, belly cover, and close upper console.

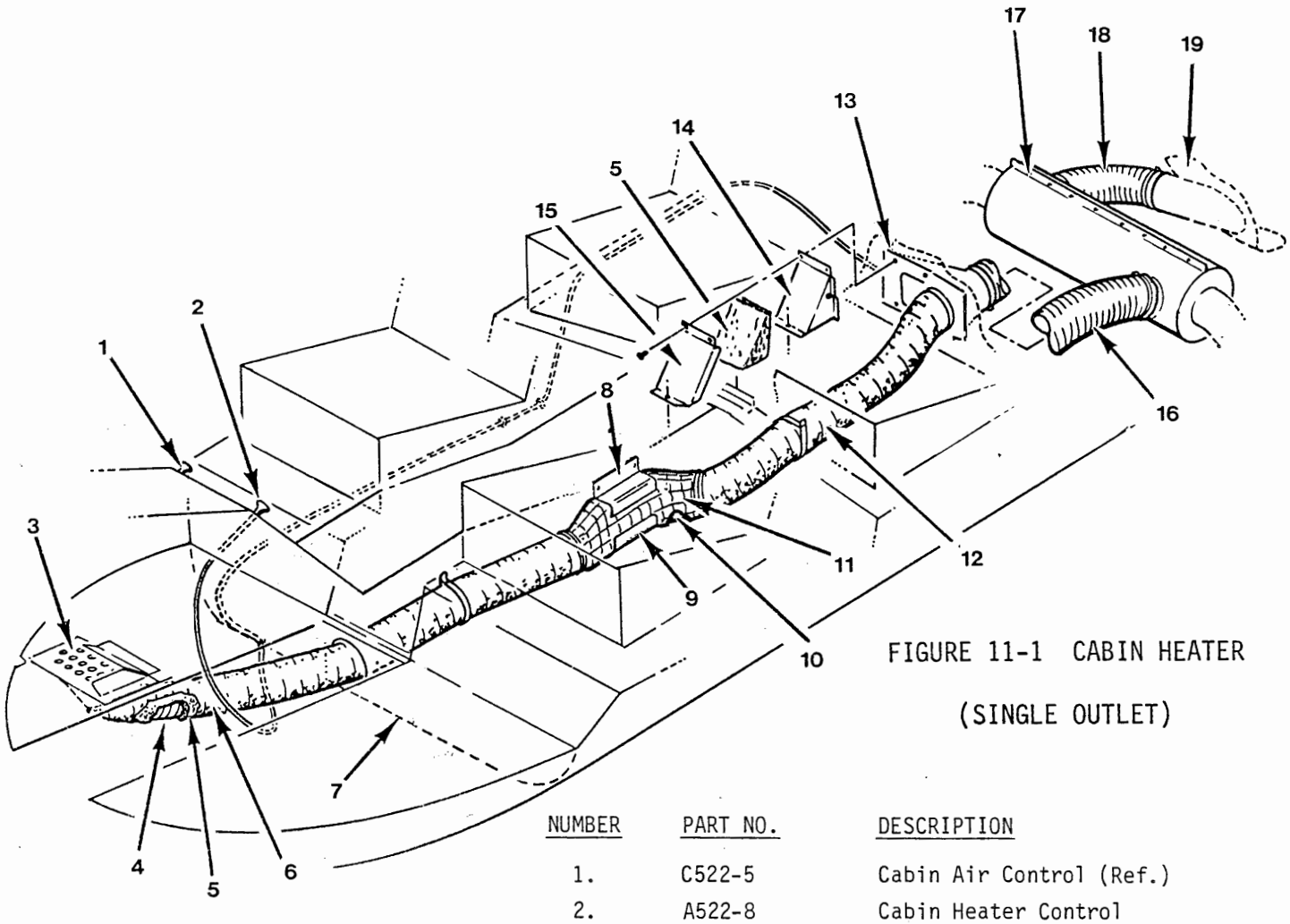


FIGURE 11-1 CABIN HEATER

(SINGLE OUTLET)

NUMBER	PART NO.	DESCRIPTION
1.	C522-5	Cabin Air Control (Ref.)
2.	A522-8	Cabin Heater Control
3.	B164-1	Heater Outlet
4.	A785-15	Hose
5.	R111	Insulation
6.	A701-1	Foil Tape (Forward of item 7)
	A701-2	Foil Tape (Aft of item 7)
7.	D230-1	Bulkhead (Ref.)
8.	C631-2	Clip
9.	C631-1	Clip
10.	D164-1	Duct
11	C630-1	Insulation
12	A785-14	Hose
13	A019-3	Valve Assembly
14	C625-1	Box
15	A753-1	Cover
16	A758-13	Hose
17	C169-2	Shroud Assembly
18	A785-12	Hose
19	C236	Cooling Scroll (Ref.)

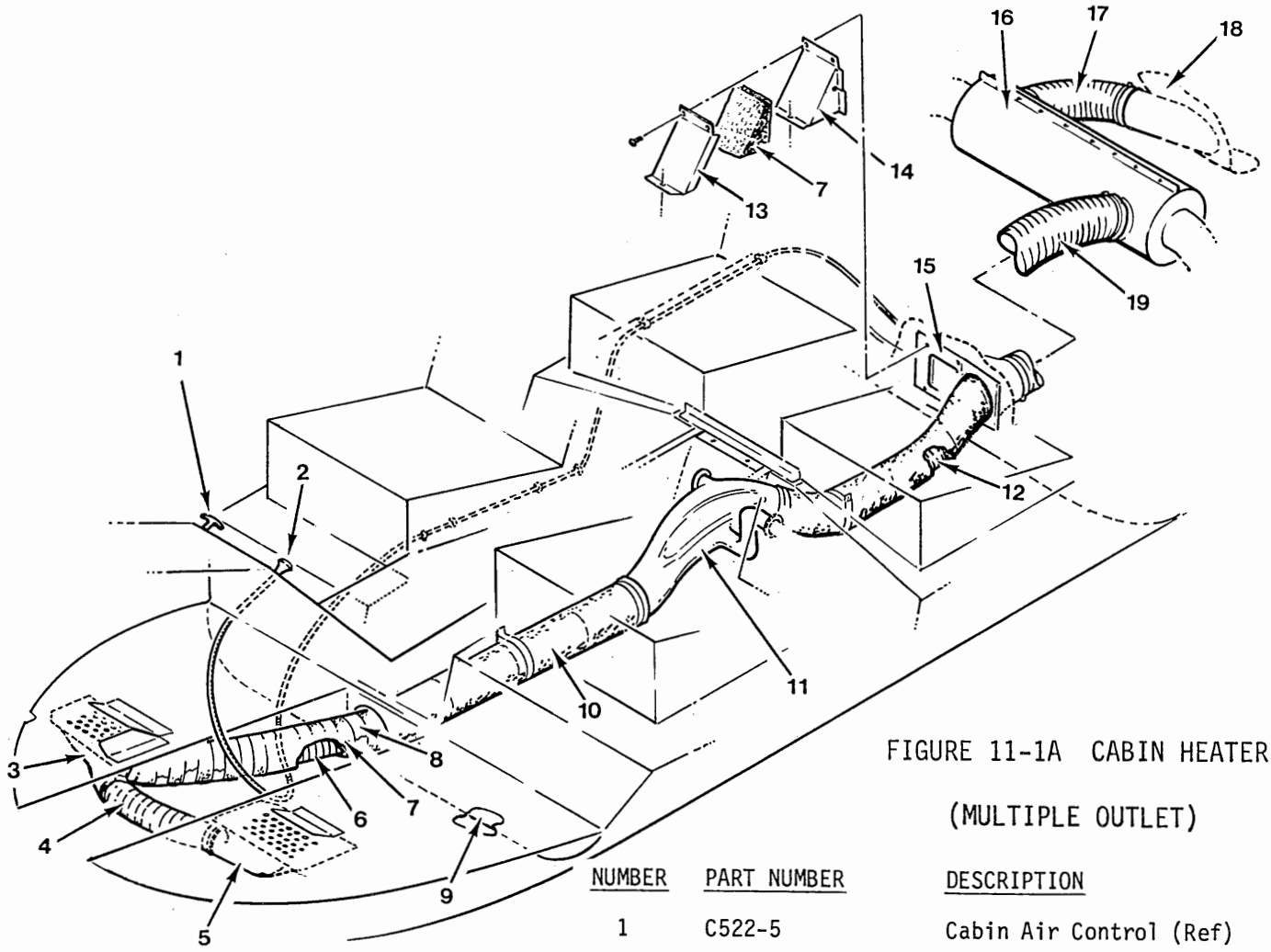


FIGURE 11-1A CABIN HEATER

(MULTIPLE OUTLET)

NUMBER	PART NUMBER	DESCRIPTION
1	C522-5	Cabin Air Control (Ref)
2	A522-8	Cabin Heater Control
3	D164-1	Heater Outlet
4	A785-24	Hose
5	D166-1	Outlet (LH)
6	A785-23	Hose
7	R111	Insulation
8	A701-1	Foil Tape (Forward of item 9)
9	D230-1	Bulkhead (Ref)
10	A701-2	Foil Tape (Aft of item 9)
11	D164-2	Duct
12	A785-14	Hose
13	C753-1	Cover
14	C625-1	Box
15	A019-1	Valve Assembly
16	C169-2	Shroud Assembly
17	A785-12	Hose
18	C236	Cooling Scroll
19	A785-13	Hose

11.120 Muffler Shroud Replacement

a) Remove the D040-1 aft engine cowling.

b) Remove the tail pipe from the exhaust hanger at the engine cooling scroll.

c) Disconnect the two heater hoses from the shroud.

d) Remove the screws at the top of the shroud and remove the shroud over the tail pipe.

e) To install the shroud, reverse steps a through d.

11.200 VENTILATION

11.210 Cabin Air Vent Cable Removal (See Figure 11-2)

a) Open upper console.

b) Remove cotter pin and clevis pin at the forward cabin vent.

c) Remove attaching clamps.

d) Remove cable jam nut at lower console face and remove cable.

11.220 Cabin Air Vent Cable Installation (See Figure 11-2)

a) Install or replace the MS3548-4 grommet in the vent box, if required.

b) Insert the A5225-5 cable through the hole in the lower console and tighten the jam nut.

c) Secure the control wire to the vent door using one MS20392-2C13 clevis pin and one MS24665-73 cotter pin.

d) Install the cable clamps. Adjust cable casing for proper operation of vent. Then tighten clamps securely to insure casing does not slide when operating the vent control knob.

e) Close and secure upper console.

11.230 Door Vent (See Figure 11-3)

The door vent hinge is riveted in place and can be replaced, if damaged, by drilling out the rivets and replacing the vent door and/or hinge as required.

The A226-3 seal around the vent door can be replaced if damaged using B270-4 or B270-13 adhesive.

The friction can be adjusted on the door vent by tightening the NAS1291-08 nut holding the knob on the center pivot of the double arm linkage.

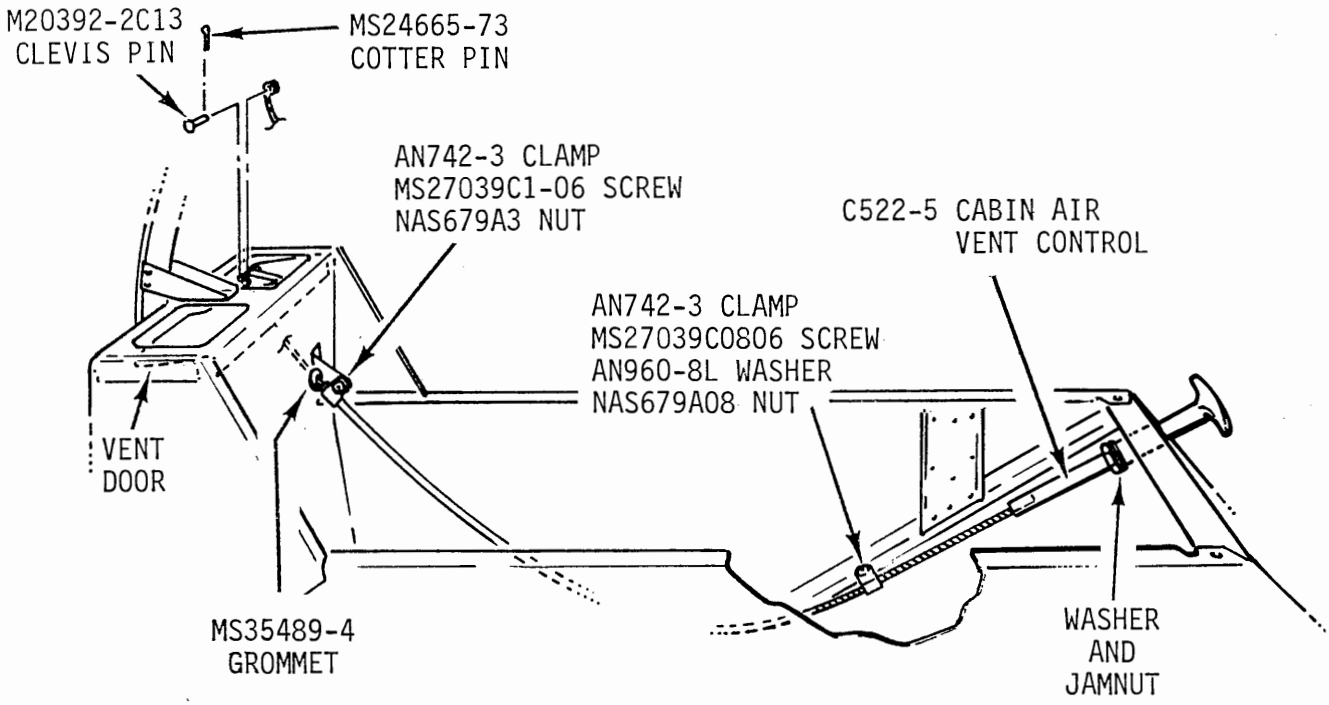


FIGURE 11-2 CABIN AIR VENT INSTALLATION

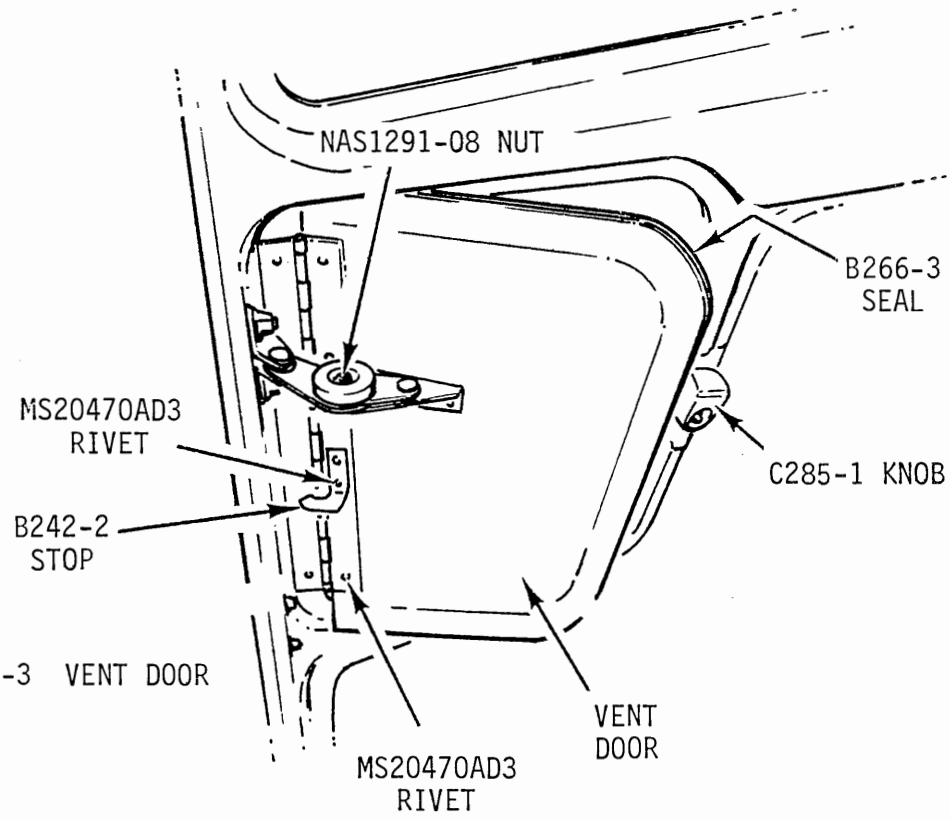


FIGURE 11-3 VENT DOOR

11.300 AIR CONDITIONING

11.301 Introduction

This section covers maintenance and troubleshooting procedures for the optional cabin air conditioning system.

> NOTE
>
> Air conditioning service procedures and required equipment are generally similar to those for standard R134a automotive systems. In the United States, only personnel with EPA certification under Section 609 of the Clean Air Act may charge the system with refrigerant or work on the refrigerant system once it has been charged. Different requirements may apply in countries other than the United States.

11.302 Description

The optional cabin air conditioning system is shown schematically in Figure 11-4. The system is similar to conventional automotive and light aircraft systems and consists of a compressor accessible through the left engine cowl door, a condenser mounted on the left side of the engine cooling fan scroll, an evaporator and fan assembly mounted to the aft cabin wall, an overhead outlet duct, and interconnecting lines and hoses. The system uses R134a refrigerant.

The compressor is belt-driven from an engine accessory drive cartridge and equipped with an electromagnetic clutch. When the system is off, the compressor clutch is disengaged, allowing the compressor pulley to freewheel.

The evaporator fan draws warm cabin air though the evaporator inlet grill and evaporator where it is cooled. Cooled air is drawn through the fan and blown through the overhead duct.

The system is controlled by a toggle switch on the overhead duct which allows selection of off, low, and high fan settings. The compressor is automatically engaged by switching the fan on. A temperature (freeze) switch disengages the compressor when evaporator temperature drops below freezing. Safety (pressure) switches disengage the compressor if excessive refrigerant leakage occurs or if refrigerant pressure is excessive. A full-throttle switch disengages the compressor when the engine is near full throttle to ensure that aircraft performance is not affected. The compressor clutch and fan circuits are protected by the A/C circuit breaker.

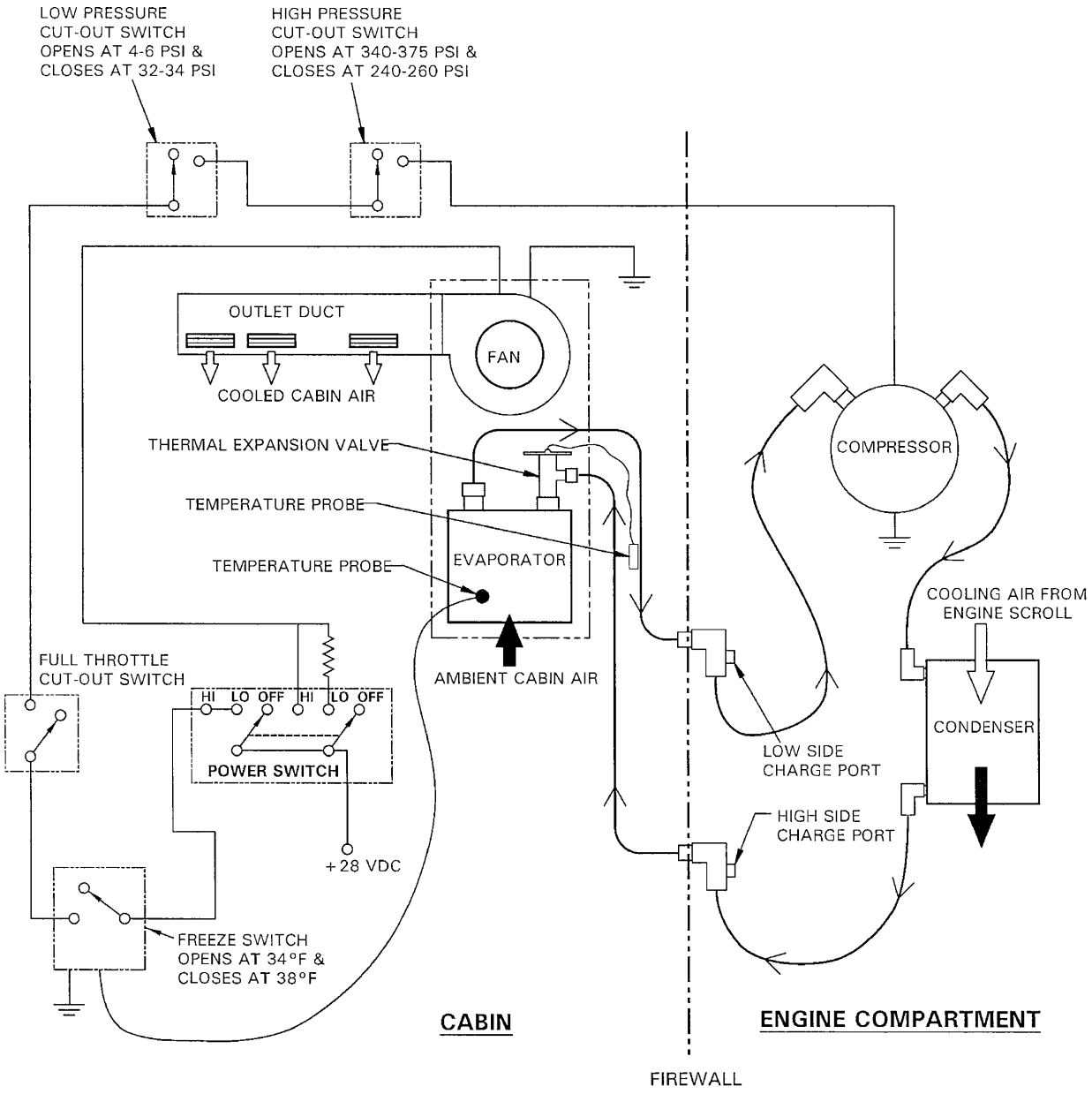


FIGURE 11-4 AIR CONDITIONING SYSTEM SCHEMATIC

11.310 System Troubleshooting

Two likely system difficulties are:

1. Failure to cool the air flowing through the evaporator and overhead duct.

2. Excessive condensate (water) in the evaporator box area when the system is operating.

Failure to cool is most likely caused by either refrigerant loss or interruption of the compressor clutch power supply (by one of the in-line switches or a wiring fault, see Figure 11-4 schematic). Excessive condensate is most often caused by an improperly assembled or blocked evaporator drain system. Both difficulties can usually be corrected with minimum effort and expense if careful troubleshooting is done prior to major component maintenance. A troubleshooting chart follows.

11.310 System Troubleshooting (cont'd)

PROBLEM	POSSIBLE CAUSE	TROUBLESHOOT/CORRECTIVE ACTION
Air is not cold	Low Refrigerant Charge/ Refrigerant Leak	Recover refrigerant per Section 11.321. System should operate normally on approximately 0.75 to 1.25 lb refrigerant. If less than 0.75 lb refrigerant is recovered, leak test per Section 11.323, repair leaks if any, and recharge per Section 11.322.
	Switch or Wiring Problem Interrupting Compressor Clutch Power	With aircraft not running, turn on Master switch and A/C switch on overhead duct (low or high setting ok). Have observer listen to and observe compressor clutch through left cowl door. Clutch should engage (click and snap against pulley) whenever A/C is switched on. Check wiring at freeze switch (behind D798-1 evaporator assembly), high and low pressure switches (behind left rear seatback), and full-throttle cutout switch (in control tunnel). Repair any damaged wiring or connectors. Verify correct rigging per Section 11.350. Check continuity through each switch. All switches should be closed with a properly charged system and aircraft at rest on ground. Replace any defective switch.
	Failed Compressor Belt	Inspect belt. Replace belt per Section 11.331 as required.
	Insufficient Condenser Airflow	Inspect condenser installation (left side of fan scroll). Verify no blockage and all seals in place. Remove blockage and/or repair seals to ensure airflow through core.
	Extreme Environmental Conditions	Extreme temperature and humidity may result in cooling effect less than a typical automobile. No corrective action available.
Excessive condensate around evaporator assembly and overhead duct	Blocked or Kinked Evaporator Drain Line	Verify system is draining normally. After several minutes ground run in humid conditions with A/C on, water should be seen draining from the drain tube. If water drainage is not observed, inspect drain line (see Section 11.343). Correct any damaged or kinked lines. Clean sediment trap as required. Verify proper function of check ball.
	Damaged Insulation	Verify evaporator assembly and duct insulation are installed correctly and undamaged (see R44 Parts Catalog). Correct any insulation deficiencies.
	Extreme Humidity	Some condensation is unavoidable in extreme humidity. Ensure all fresh air vents closed. Limit opening and closing cabin doors as much as practical to limit humidity entering cabin.

11.320 REFRIGERANT

11.321 Refrigerant Recovery

If a leak or other service problem is encountered after system is charged with refrigerant, refrigerant must be recovered before work on system can proceed.

Automotive-style air conditioning service equipment is required to recover refrigerant. This equipment is available from many manufacturers in varying levels of automation and complexity. Minimum components include a vacuum pump, storage container, pressure/vacuum gauge, and appropriate lines and fittings. Ensure equipment is compatible with R134a refrigerant and technician is appropriately qualified before attempting refrigerant recovery.

Automotive-style high and low side system service ports are located on the vertical firewall inside the left-hand engine cowl door.

Connect service equipment to system service ports and recover refrigerant per equipment manufacturer's instructions.

11.322 Refrigerant Charge

Automotive-style air conditioning service equipment is required to charge system with refrigerant. This equipment is available from many manufacturers in varying levels of automation and complexity. Minimum components include a vacuum pump, pressure pump, refrigerant supply, scale to measure refrigerant charge, pressure/vacuum gauge, and appropriate lines and fittings. Service system only with R134a refrigerant, and ensure technician is appropriately qualified before attempting refrigerant charge.

CAUTION

Proper lubrication is required to minimize compressor wear. Verify compressor oil level per Section 11.333.5 before beginning charge procedure.

The R44 air conditioning system is not equipped with a traditional receiver-dryer. Ensure system is under full vacuum to eliminate all moisture before charging.

Automotive-style high and low side system service ports are located on the vertical firewall inside the left-hand engine cowl door.

Connect service equipment to system service ports, vacuum system, and charge with R134a refrigerant per equipment manufacturer's instructions. Correct charge is 1.25 lb (1 lb 4 oz, or 0.567 kg) refrigerant.

CAUTION

Do not overcharge system. If a slow leak is suspected, find and correct per Section 11.323 first, then use correct charge.

11.323 Leak Detection

Leaks may be detected using several techniques, depending on equipment available. Leak detection should not be attempted with the aircraft/system running. In addition to safety hazards, leaks are more difficult to detect with the varying pressures and temperatures of an operating system.

An empty system should hold full vacuum (27 to 29 in Hg vacuum at sea level) with no assistance from the vacuum pump for 20 minutes or more. If a vacuumed system creeps up in pressure, a leak may be present. Technician should be thoroughly familiar with vacuum equipment to ensure leak is in aircraft system and not in vacuum equipment or connections.

Leaks in a charged system may be detected using a mild soap and water solution applied to lines and fittings in suspected leak areas (bubbles indicate leaks) or using commercially available electronic refrigerant detectors. Follow detector manufacturer's instructions. Large leaks may be detected audibly if area is quiet or by formation of frost in area of leak.

NOTE

Frost does not necessarily indicate a leak. Normal system operation and/or charging procedures can cause frost to accumulate on some components.

NOTE

System pressure is not a reliable indicator of charge state or the presence of leaks. Because R134a is a liquid/vapor mixture with the system at rest, pressure will remain constant as more liquid vaporizes until majority of charge is lost.

Very small leaks can be detected by charging the system with helium gas. Helium molecules are smaller than R134a molecules and will leak more quickly. Charge system to 200 psi maximum. Use commercially available electronic helium detector or soap and water solution to locate leaks.

Leaks are most likely to occur at fittings and crimped transitions between hard line and flexible hose. Concentrate initial leak detection efforts in these areas.

11.330 COMPRESSOR

11.331 Compressor Belt Replacement

Compressor belt replacement is based on belt condition. Replace any belt exhibiting frayed edges, excessive cracking, heat damage, or rubber deterioration.

To replace belt, loosen NAS6604 bolt through D782-3 adjusting arm slot, and loosen all three NAS6606 bolts through compressor lugs. Rotate compressor up and inboard as required to disengage belt from either compressor or drive pulley, and remove belt.

> CAUTION
>
> Do not rotate compressor further than necessary to avoid damage to refrigerant lines and fittings. Do not use refrigerant lines or fittings for leverage; handle compressor body or lugs.

Slip new belt over both pulleys, and rotate compressor down and outboard to tension belt. Tension belt such that a 4.5 to 5.5 lb force applied mid-span produces 0.14 inch belt deflection. Tighten compressor mount and adjustment hardware.

11.332 Compressor Removal

1. Remove engine left cowling.
2. Disconnect and remove battery as required for compressor access.
3. Recover refrigerant per Section 11.321.
4. Disconnect compressor clutch wiring from airframe harness.
5. Disconnect refrigerant lines from compressor. Protect all open lines and fittings from contamination.
6. Remove belt from compressor drive pulley per Section 11.331.
7. Remove three compressor lug bolts loosened in step 6, and remove compressor.

11.333 Compressor Installation

1. Install compressor using three NAS6606 bolts at mount lugs and NAS6604 bolt at D782-3 adjusting arm slot. Refer to R44 Illustrated Parts Catalog for hardware stack up. Leave all hardware loose enough to rotate compressor.

2. Install compressor drive belt, tension per Section 11.331, and tighten mount and adjusting hardware.

3. Connect refrigerant lines to compressor. Torque low-pressure (large) fitting to 300 in.-lb. Torque high-pressure (small) fitting to 210 in.-lb.

4. Connect compressor clutch wiring to airframe harness.

5. Check and adjust compressor oil quantity as follows:

CAUTION
Recover refrigerant prior to checking oil level.

   a. Remove compressor oil fill cap (black hex-head cap on upper outboard surface of compressor body behind clutch and pulley).

   b. Turn compressor shaft clockwise until clutch plate counterweight is positioned per Figure 11-5.

   c. Insert Airpro P/N 90-3028 or equivalent dipstick per Figure 11-5, and take oil level reading.

   d. Add A257-20 oil as required to bring dipstick reading to 8 to 10 notches. Approximately 2 to 3 ounces total oil is required for completely empty compressors. Compressors are typically shipped at least partially filled with oil.

   e. Reinstall fill cap. Torque to 156 in.-lb.

6. Perform vacuum or helium leak check per Section 11.323.

7. Charge system with refrigerant per Section 11.322.

8. Install and connect battery (if removed).

9. Install engine left cowling.

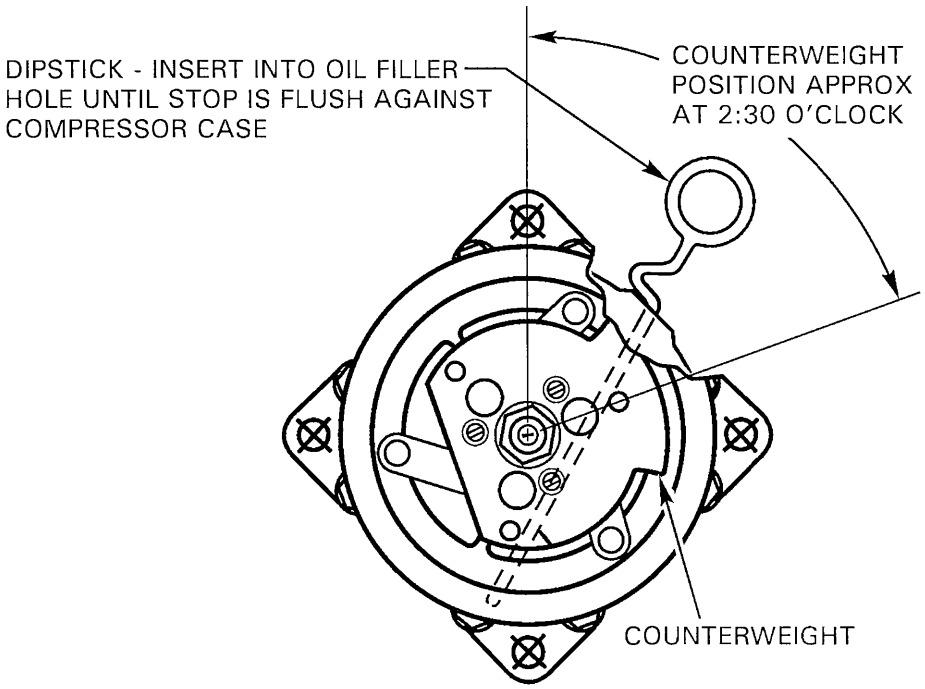


FIGURE 11-5 COMPRESSOR OIL FILL

11.340 EVAPORATOR ASSEMBLY

11.341 Evaporator Assembly Removal

1. Recover refrigerant per Section 11.321.

2. Remove overhead duct as follows:

   a. Remove screw aft of rotor brake knob.

   b. Slide duct forward and down to disengage tabs from evaporator box and windshield frame.

   c. Push rotor brake knob through slot in duct.

   d. Disconnect electrical connector.

   e. Remove duct.

3. Remove screws (4 each side) securing headset jack boxes to evaporator assembly.

NOTE
Two different length screws and two different length spacers are used to mate headset jack boxes to evaporator. Use caution to retain spacers during disassembly and note hardware arrangement for re-assembly.

NOTE
The entire decorative (headliner) cover is secured to the evaporator box via hook and loop fastening material and may be removed if desired. It is necessary to remove the headset hangers in order to remove the cover. Refer to R44 Illustrated Parts Catalog for details.

4. Remove trim securing headliner between seats, and remove left rear seat back.

5. Remove and discard safety wire, and remove drain tube from drain fitting at base of evaporator box (right side).

6. Disconnect refrigerant lines at vertical connection nuts near upper inboard seat back corner.

7. Push back headliner as required, and remove 6 screws securing evaporator box flanges to aft cabin bulkhead. Tilt top of evaporator box forward and lift up and out.

11.342 Evaporator Assembly Installation

1. Secure evaporator box to aft cabin bulkhead using 6 screws through box flanges.

2. Verify O-rings are clean and undamaged, and connect refrigerant line connection nuts. Torque insulated line to 210 in.-lb and uninsulated line to 150 in.-lb.

3. Connect drain tube to evaporator box drain fitting and secure using 0.032 in diameter safety wire.

4 Secure headset jack boxes to evaporator assembly. Use screw and spacer arrangement retained from Section 11.341 or refer to R44 Illustrated Parts Catalog for hardware details.

5. Install overhead duct as follows:

a. Position duct approximately, feed rotor brake knob through slot in duct, and connect electrical connector.

b. Slide duct up and aft such that tabs engage evaporator box fan opening and windshield frame.

c. Install screw aft of rotor brake knob.

6. Verify no leaks (refer to Section 11.323 as required). Charge system per Section 11.322.

7. Install left rear seat back, and secure headliner between seat backs using trim.

11.343 Evaporator Drain System

The evaporator drain system, shown schematically in Figure 11-6, is designed to prevent condensate from backing up in the evaporator box and leaking into the passenger compartment. All components are necessary for proper drainage. Blockage or kinking of a drain line may result in water damage to the cabin interior near the evaporator box.

The flexible tube drains condensate to the tee located behind the right rear seat back. At tee, a sediment-tube extends several inches down to a plug. The sediment-tube is designed to allow contamination to settle out without clogging the main drain system. Inspect tube periodically. Remove plug and clean out tube if sediment build-up nears tee fitting.

Just above tee fitting is a ball retained in upper flex tube. Normally a small amount of water is retained in the loop formed by drain tube and tee fitting. If the system is dry, the ball seats against the tee and prevents the evaporator fan from drawing air up through the drain system until water fills this area.

The hard drain tube runs along the aft, inboard corner of right-rear baggage compartment and out the belly. Normal system operation in humid conditions should result in condensation dripping from the tube. In extremely dry conditions there may be little or no condensation. Periodically inspect evaporator drain assembly to verify it has not been damaged or dislodged.

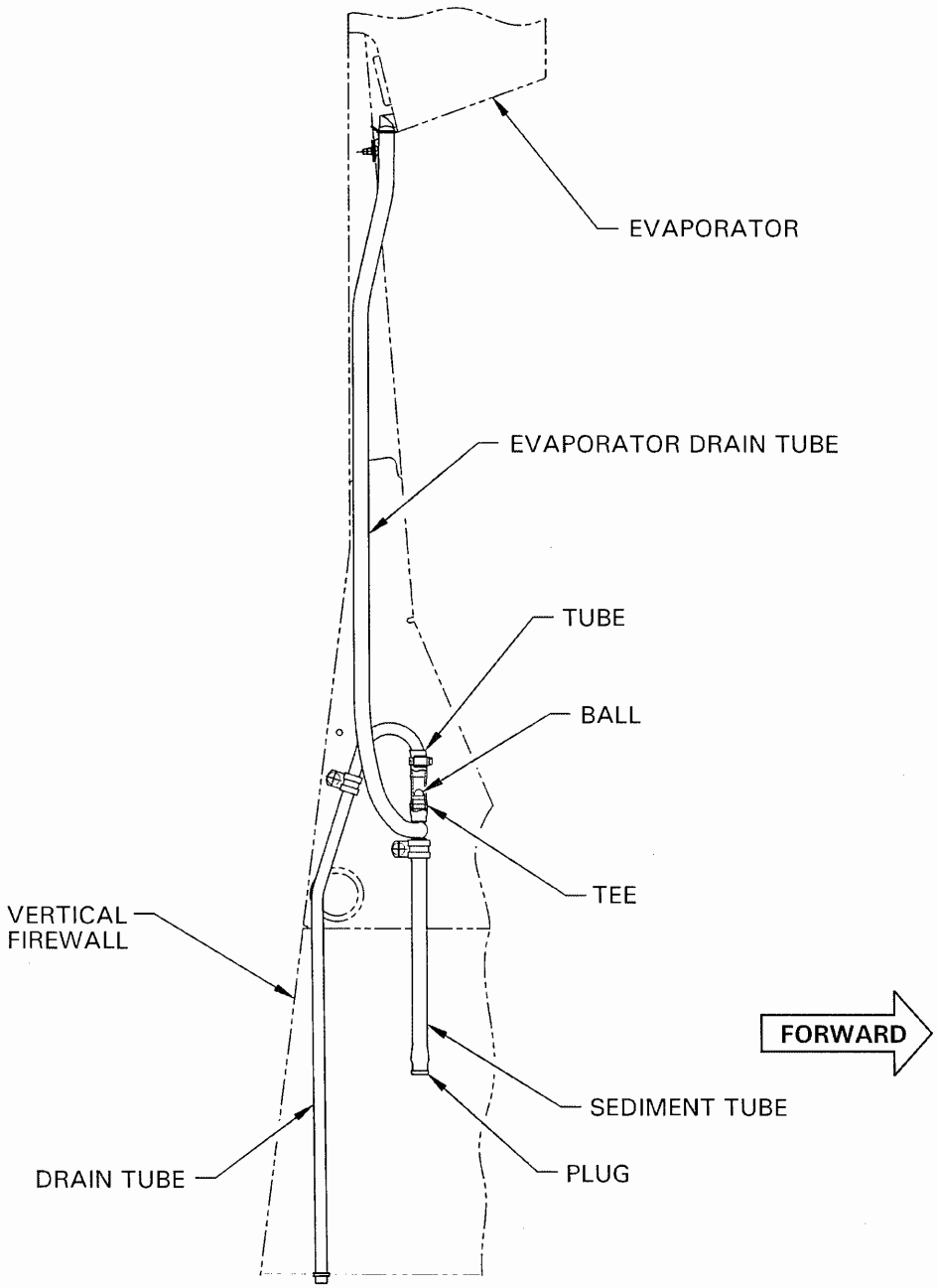
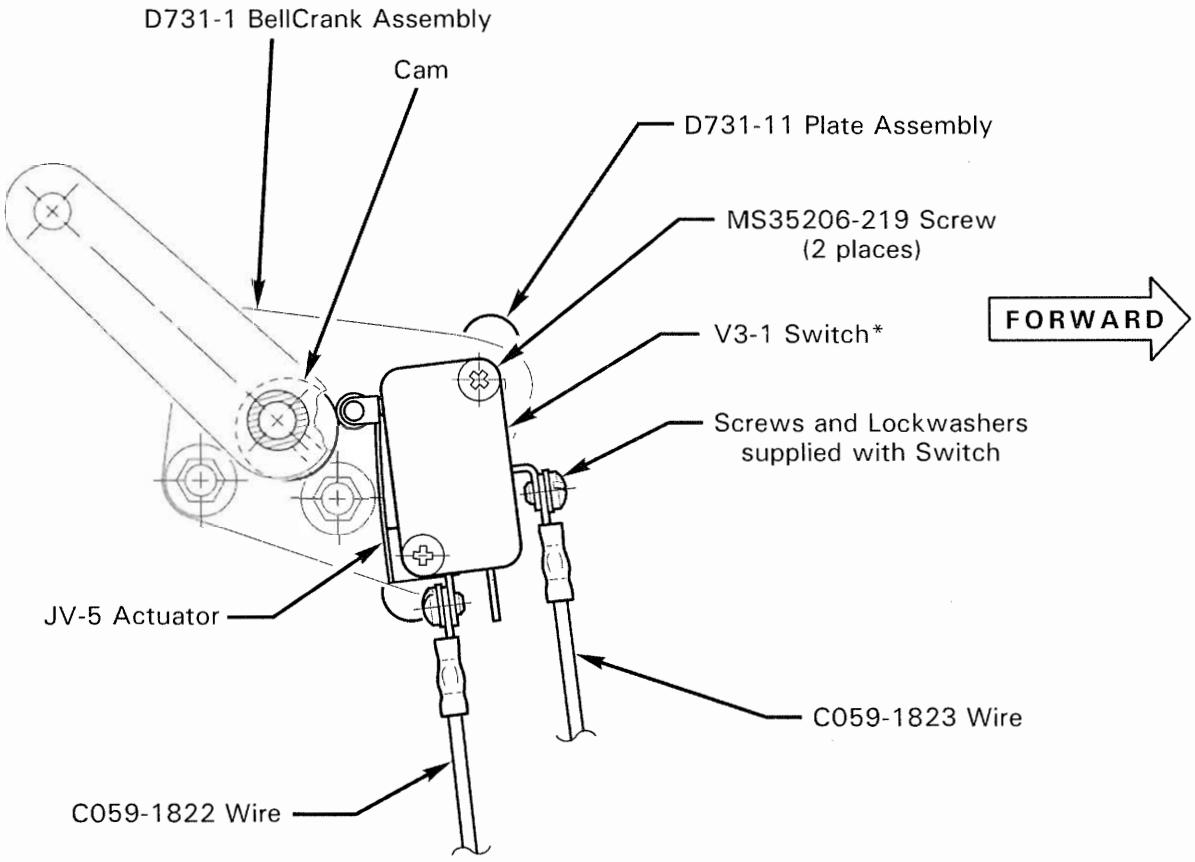


FIGURE 11-6 EVAPORATOR DRAIN SYSTEM

11.350 Full Throttle Cut-Out Switch Rigging

A full-throttle cut-out switch is designed to disengage the compressor clutch approximately 1 inch MAP below full throttle. This guarantees that air conditioning operation does not affect aircraft performance at altitude. Full throttle cut-out is controlled via a microswitch located near the bellcrank assembly at the aft end of the throttle push-pull tube in the main control tunnel. The switch is normally closed (allows current flow to the compressor) when its button is not depressed. A cam on the bellcrank assembly depresses the button and opens the switch near full throttle.

Adjust switch so button is depressed by cam when throttle arm at fuel control is 0.15 to 0.20 inch away from full-open throttle stop.



*Adjust position of V3-1 switch so that switch opens when fuel control throttle arm is 0.15 - 0.20 off full throttle stop.

FIGURE 11-7 AIR CONDITIONING CUTOFF SWITCH
(View looking outboard from centerline)

11.400 DRIVE CARTRIDGE

11.410 Drive Cartridge Seal Removal

1. Remove engine left cowling.
2. Disconnect and remove battery as required for access.
3. Loosen belt tension and remove belt from pulley.
4. Refer to Figure 11-7. Remove B330-19 palnut and MS21042L6 nut.
5. Remove pulley from shaft to expose A966-5 seal and woodruff key.
6. Remove seal using appropriate tool being careful not to damage housing. Do not remove shims under seal.

11.420 Drive Cartridge Seal Installation

1. Ensure seal recess area is clean and free of debris.
2. Ensure shims are in place, and install A966-5 seal flush with the housing.
3. Install woodruff key and pulley on shaft.
4. Install MS21042L6 nut and special torque per Section 1.330. Install B330-19 palnut and standard torque per Section 1.320. Apply B270-22 protectorant to exposed surfaces of shaft.
5. Install compressor drive belt, tension per Section 11.331, and adjusting hardware.

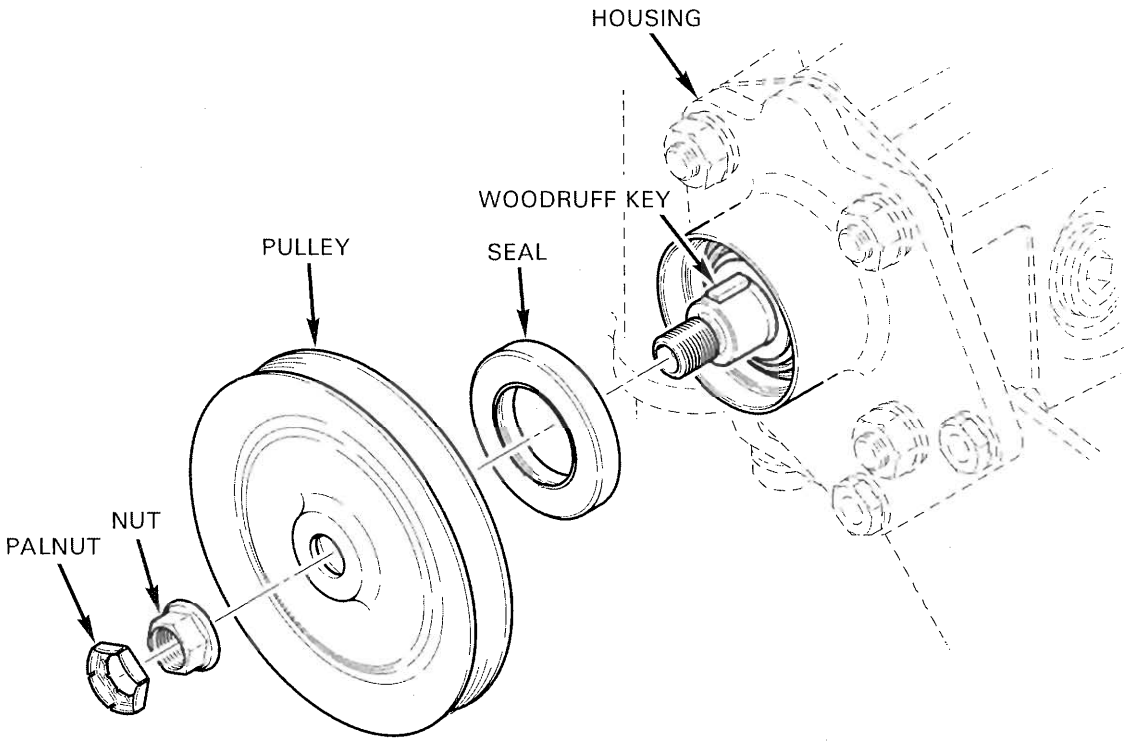


FIGURE 11-7 CARTRIDGE ASSEMBLY - COMPRESSOR DRIVE

CHAPTER 12

FUEL SYSTEM

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CHAPTER 12

FUEL SYSTEM

12.000 Description

NOTE
Per R44 Service Bulletin SB-78B, fuel tanks without bladders should no longer be in service.

This section includes procedures for maintaining R44 (Lycoming O-540 engine, carbureted) and R44 II (Lycoming IO-540 engine, fuel injected) fuel systems. Refer to carburetor, fuel control, or fuel system accessory manufacturer's instructions for continued airworthiness. Refer to Figures 12-1 and 12-2 for R44 and R44 II fuel system overviews.

The fuel system includes main and auxiliary tanks, a shutoff valve control located between the front seats, and a strainer (gascolator). The fuel tanks have flexible bladders in aluminum enclosures. Fuel tank air vents are located inside the mast fairing.

The R44 fuel system is a gravity-flow (no fuel pumps) system; the R44 II fuel system is a pressurized fuel system that includes an engine-driven pump, an auxiliary (electric) fuel pump, and a fuel return line which allows pump supply in excess of engine demand to return to the fuel tanks.

The R44 II auxiliary pump primes the engine for starting and runs in flight to provide fuel pump redundancy. The engine will function normally with either the engine-driven or auxiliary (electric) pump operating. The ignition switch prime (momentary) position operates the auxiliary fuel pump for priming prior to engine start. After start, the pump runs continuously as long as the engine has oil pressure and the clutch switch is in the engage position.

The R44 II has a pressure switch on the gascolator which illuminates the fuel filter caution light if the strainer becomes contaminated. Continued operation with an illuminated filter caution light may result in fuel starvation. A pressure switch downstream of the auxiliary fuel pump illuminates the aux fuel pump caution light if auxiliary pump output pressure is low. When the clutch switch is disengaged, the auxiliary pump is off and the aux fuel pump caution light should be illuminated. Proper mechanical fuel pump function is indicated by normal engine operation after engine start prior to clutch switch engagement and before shutdown while clutch switch is disengaged.

The R44 and R44 II have plunger-style drain valves at the gascolator and at each fuel tank sump. The gascolator is located on the lower right side of the firewall and is drained by pushing up on the plastic tube which extends below the belly. Valves for both tanks are located inside the right cowl door below the auxiliary tank. Fuel samples are taken by extending the plastic tubes clear of the aircraft and pushing on the plungers. Fuel should be sampled from all three locations prior to the first flight of the day and after refueling to verify no contamination and correct grade.

The fuel gages are electrically operated by float-type transmitters in the tanks. When the gages read E the tanks are empty except for a small quantity of unusable fuel. The low fuel caution light is actuated by a separate electric sender located on the bottom of the main tank.

The auxiliary tank is interconnected with the main tank and is located somewhat higher so it will become empty first while fuel still remains in the main tank. The fuel shutoff valve controls flow from both tanks to the engine.

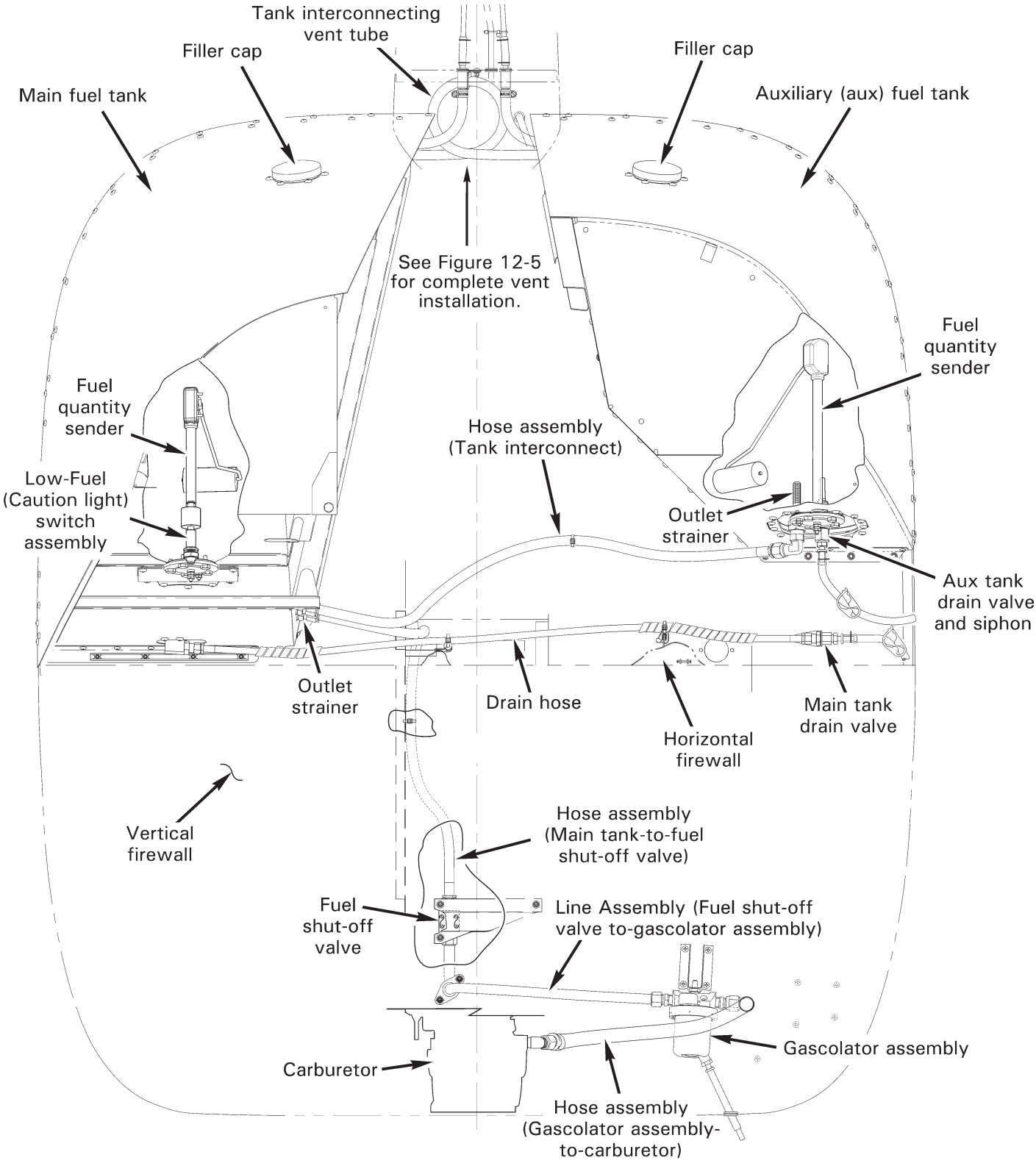


FIGURE 12-1 R44 FUEL SYSTEM (LYCOMING O-540 ENGINE; CARBURETED)

12.100 Fuel Tanks

12.110 Main Tank

CAUTION

Flexible hoses kink easily; handle with care.

CAUTION

Temporarily cap fuel fittings when opened.

WARNING

Fuel vapors are explosive. Do not use electric tools in vicinity of an opened fuel system.

12.111 Main Tank Removal

1. Defuel helicopter per Section 1.150.
2. Remove mast fairing. Open access doors, disconnect ELT antenna & ground wire at connectors if ELT is installed, and remove tailcone fairing. Remove C347 channel assembly, angles, and panel.
3. Remove aft left backrest assembly. Remove left cowling assembly.
4. Loosen clamps securing vent tubes to C010-6 main tank assembly and pull tubes off tank.
5. Cut & discard ty-raps as required and disconnect fuel quantity sender and low-fuel switch assembly wiring from airframe harness at connectors. Remove nuts securing wiring to fuel quantity sender if connectors are not installed.
6. Disconnect D205-28 (tank-to-shut-off valve) and D205-29 (tank interconnect) hose assemblies from tank.
7. Cut & discard ty-raps attaching D205-30 (drain) hose assembly to horizontal firewall clamp and doubler, then disconnect hose from drain valve connector. Cap fittings.
8. Above aft left seat, gently lift foam from cabin bulkhead and remove four screws securing tank to bulkhead.
9. At tank aft panel, remove three screws securing tank to the intermediate bulkhead, and two bolts securing tank aft panel between horizontal firewall and upper frame.
10. Remove perimeter screws securing tank to cabin bulkhead and horizontal firewall. Remove tank, with attached D205-30 hose assembly. Cap fittings.

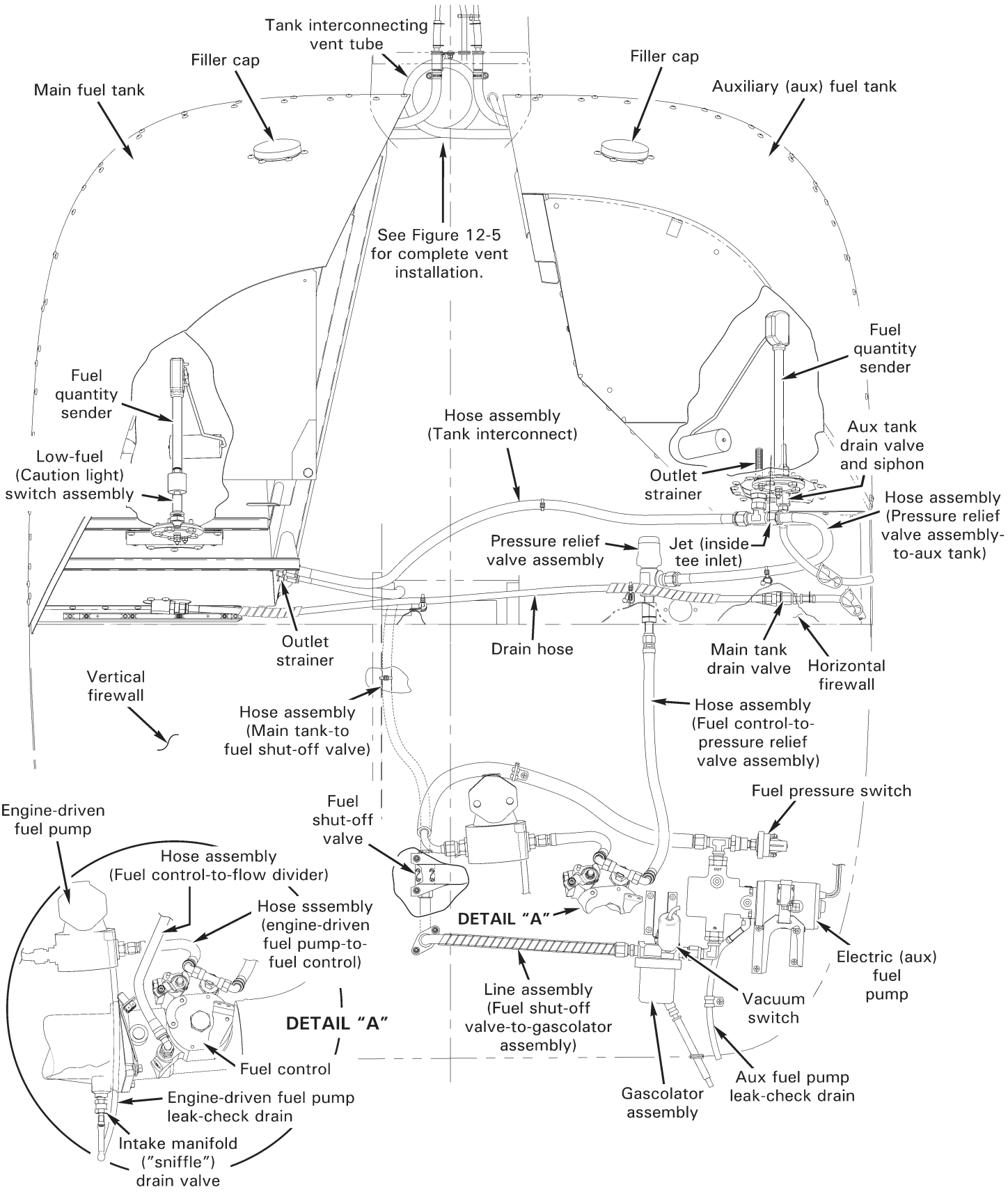


FIGURE 12-2 R44 II FUEL SYSTEM (LYCOMING IO-540 ENGINE; FUEL INJECTED)

12.112 Main Tank Installation

1. Connect D205-30 (drain) hose assembly to main tank drain union; special torque hose nut to 100 in.-lb and torque stripe per Figure 2-1. Position C010-6 main tank assembly in helicopter, routing D205-30 (drain) hose assembly thru "cut-away" in horizontal firewall doubler; verify hose is not pinched. Install perimeter screws securing tank to cabin bulkhead and horizontal firewall.

2. At tank aft panel, install two bolts securing tank aft panel between horizontal firewall and upper frame. Standard torque bolts per Section 1.320 and torque stripe per Figure 2-1.

3. Install three screws securing tank aft panel to the intermediate bulkhead.

4. Above aft left seat, gently lift foam from cabin bulkhead and install four screws securing tank to bulkhead.

5. Remove caps. Connect D205-28 (tank-to-shut-off valve) hose assembly to tank forward fitting. Connect D205-29 (tank interconnect) hose assembly to tank aft fitting. Special torque hose nuts to 120 in.-lb and torque stripe per Figure 2-1.

6. Install ty-rap around D205-30 hose assembly through horizontal firewall clamp; install ty-rap around trim through horizontal firewall doubler flange and install ty-rap around hose assembly through doubler ty-rap. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.

7. Connect fuel quantity sender and low-fuel switch assembly wiring at connectors. Install nuts securing wiring to fuel quantity sender if connectors are not installed. Install ty-raps as required.

8. Connect vent tubes to tank and tighten clamps until snug. Verify security.

9. Perform fuel quantity indication check per Section 12.412. Verify no leaks.

10. Install aft left backrest assembly and left cowling assembly.

11. Install C347 channel assembly, angles, and panel. Install tailcone fairing, connect ELT antenna & ground wire at connectors if ELT is installed, and close access doors. Install mast fairing.

12. Perform pitot-static leak check per Section 13.211 as required.

12.113 Main Tank - Bladder Replacement

NOTE

During disassembly, progressively tape bladder openings to protect interior from foreign object contamination. During assembly, progressively remove protective tape.

CAUTION

D028-1 bladder assembly temperature should be above 65°F before removing, installing, or flexing bladder.

1. Remove main fuel tank per Section 12.111.
2. Remove hardware securing D247-1 bulkhead assembly and three angles to tank and remove angles. Detach hook-and-loop tape and remove bulkhead.
3. Remove fuel quantity sender per Section 12.410.
4. Remove screws securing D250-1 cover assembly to D028-1 bladder assembly and tank; carefully remove cover, with low-fuel switch assembly attached. Remove and discard o-ring.
5. Disconnect D205-30 (drain) hose assembly from AN815-3D union and cap hose fitting. Remove union and discard o-ring. Remove two screws securing bladder to tank.
6. Remove B254-3 strainer assembly and AN815-6D union and discard o-rings. Remove two screws securing bladder to tank.
7. At vents, remove screw securing bladder to tank.
8. Remove fuel cap. Remove screws securing bladder to tank.
9. Detach hook and loop tape and carefully remove bladder.
10. Carefully insert new D028-1 bladder assembly inside main tank assembly. Align bladder and tank fastener holes and press hook-and-loop tape together.
11. Install screws securing bladder to tank near fuel cap. Install fuel cap.
12. At vents, apply A257-9 anti-seize to threads and install screw securing bladder to tank.
13. Apply A257-9 anti-seize to threads and install two screws securing bladder to tank near tank interconnect and tank-to-shut-off valve hose connections. Lubricate new o-rings with A257-6 grease and install o-rings on B254-3 strainer assembly and on AN815-6D union. Install strainer assembly into forward fitting, special torque to 150 in.-lb, and torque stripe per Figure 2-1. Install union into aft fitting, special torque to 200 in.-lb, and torque stripe per Figure 2-1.
14. Apply A257-9 anti-seize to threads and install two screws securing bladder to tank near drain hose connection. Lubricate new o-ring with A257-6 grease and install o-ring on AN815-3D union. Install union, special torque to 100 in.-lb, and torque stripe per Figure 2-1. Remove cap and connect drain hose to union. Special torque hose nut to 100 in.-lb and torque stripe per Figure 2-1.

12.113 Main Tank - Bladder Replacement (continued)

15. Lubricate new o-ring with A257-6 grease and install o-ring in bladder groove in opening at bottom of tank. Carefully insert cover into bladder, with attached low-fuel switch assembly aft. Apply A257-9 anti-seize to threads and install screws securing cover to bladder and tank.

16. Install fuel quantity sender per Section 12.410.

17. Align bulkhead and tank fastener holes. Install hardware securing bulkhead and angles to tank.

18. Pressure check assembled fuel tank by plugging vents and fittings and pressurizing bladder to no more than 1 psi. Check for leaks with a mild soap and water solution applied to all seams.

19. Install main fuel tank per Section 12.112.

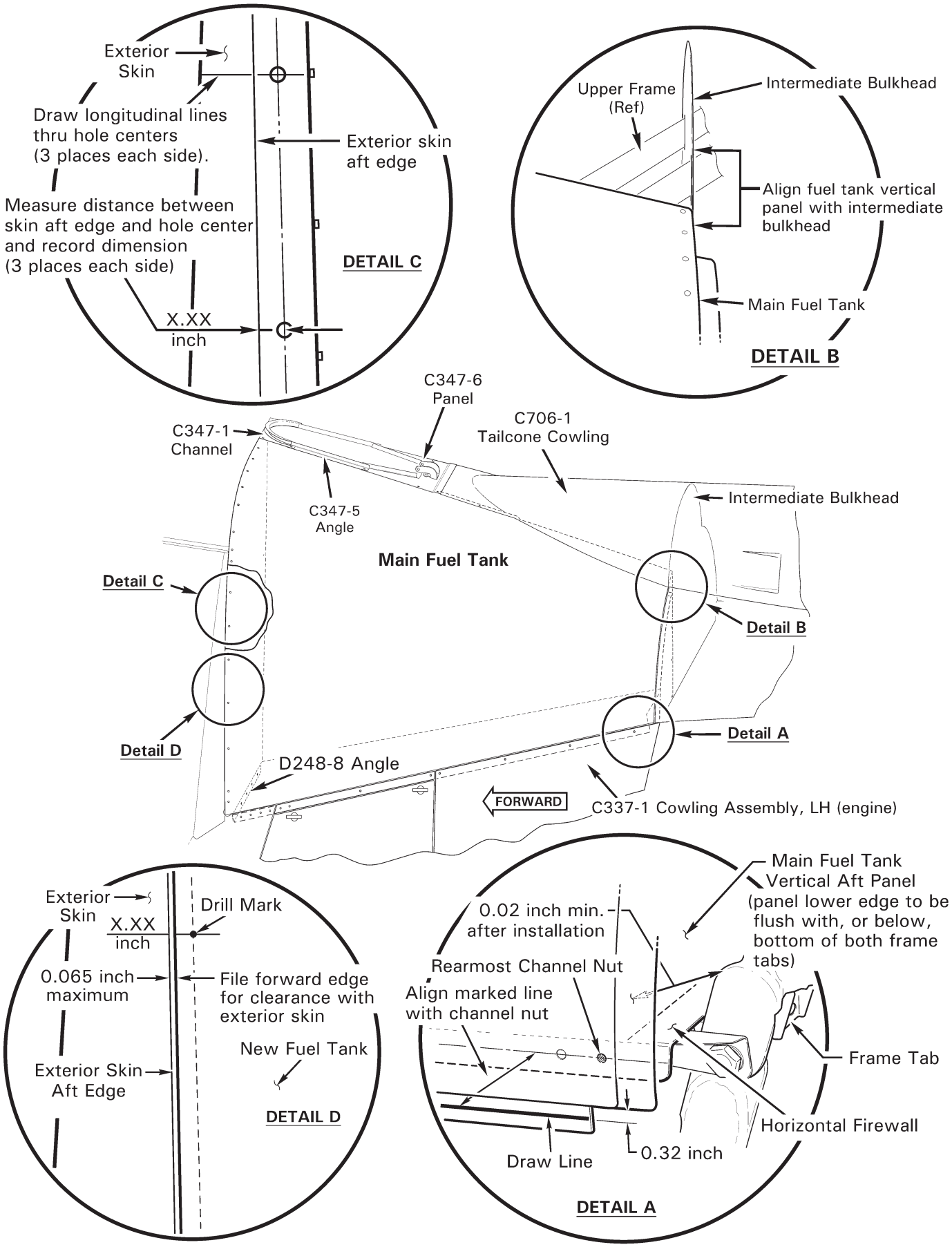


FIGURE 12-3 MAIN TANK REPLACEMENT

12.114 Main Tank Replacement

1. Remove main fuel tank per Section 12.111.
2. Refer to Figure 12-3, Detail C. Draw longitudinal lines from center of three bulkhead channel nut holes onto exterior skins. Measure and record distances as shown.
3. On new C010-6 main tank assembly, loosen screws securing D248-8 angle to tank and slide angle to forward-most position. Tighten screws.
4. Refer to Figure 12-3, Detail A. Mark tank bottom flange with a line 0.32 inch below and parallel to tank skin.
5. Position tank in helicopter. Verify forward portion of tank flange is between exterior skin and horizontal firewall flange. Verify tank vertical panel is between upper frame tabs and firewall flange; panel edge must be flush or below frame tab bottom edge.
6. Align marked line with rearmost channel nut on horizontal firewall flange per Figure 12-3, Detail A. Align tank vertical panel with intermediate bulkhead per Detail C. Secure tank position by clamping panel to frame tabs.
7. Install aft cowling assembly. Install left cowling assembly, but do not install top row of screws. Adjust tank position as required for approximately 0.020 inch gap between tank skin and left cowling.
8. Refer to Figure 12-3, Detail D. Estimate material to be removed for fitting tank forward edge with cabin exterior skin aft edge; file or cut tank to create a gap of no more than 0.065 inch between tank and skin. Deburr trimmed edge with 220-grit or finer wet-or-dry aluminum oxide abrasive paper.
9. Solvent-clean tank deburred edge and apply Alodine 1122 or Alodine 1201 in accordance with manufacturer's instructions. Apply epoxy primer to dry edge.
10. From inside cabin, begin at the lowest nutplate and drill a #30 pilot hole through tank skin (using existing nutplate as drill guide), and install cleco. Moving upward, repeat step for remaining nutplates.
11. Transfer longitudinal lines and recorded distances from exterior skin to tank, and lay out three drill marks. Using a drill stop, enlarge pilot holes to 0.170-inch diameter.
12. From inside cabin, gently lift foam and match-drill 0.170-inch holes in D248-8 angle through holes in C259-1 bulkhead.

CAUTION

Protect drive belts from drilling debris.

13. Match-drill 0.170-inch holes in tank vertical panel through holes in intermediate bulkhead. Match-drill 0.250-inch holes in panel through upper frame tab holes; temporarily install bolts.
14. Using a drill stop, progressively match-drill and cleco 0.170-inch holes in tank flange, on marked line, through left cowling holes.
15. Cleco C347-1 channel to cabin. Match-drill 0.170-inch holes in tank inboard flanges through remaining holes in channel.
16. Clean up debris. Install main fuel tank per Section 12.112.

12.120 Aux Tank

CAUTION

Flexible hoses kink easily; handle with care.

CAUTION

Temporarily cap fuel fittings when opened.

WARNING

Fuel vapors are explosive. Do not use electric tools in vicinity of an opened fuel system.

12.121 Aux Tank Removal

1. Defuel helicopter per Section 1.150.
2. Open right side of mast fairing. Open access doors, disconnect ELT antenna & ground wire at connectors if ELT is installed, and remove tailcone fairing. Remove C347 channel assembly, angles, and panel. Remove D042-5 door assembly.
3. Remove aft-right backrest assembly.
4. Loosen clamps securing vent tubes to D043-5 aux tank assembly and pull tubes off tank.
5. Cut & discard ty-raps as required and disconnect fuel quantity sender wiring from airframe harness at connectors. Remove nuts securing wiring to sender if connectors are not installed.
6. Remove hardware securing rotor brake cable clamp to tank channel. Remove screws securing B157-1 mount to channel if screws have nutplates, or remove hardware securing MS24566-1B pulley to B157-1 mount.
7. a. R44: Disconnect hose assembly from tank elbow. Cap fittings.

   b. R44 II: Disconnect hose assemblies from tank tee. Remove D453-2 jet from tee if desired. Cap fittings.
8. Above aft right seat, gently lift foam from bulkhead and remove fasteners securing tank to bulkhead.
9. Remove aft bolt securing tank channel to upper frame.
10. Remove perimeter screws securing tank to bulkhead. Remove tank.

12.122 Aux Tank Installation

1. Position D043-5 aux tank assembly in helicopter. Install aft bolt securing tank channel to upper frame. Standard torque bolt per Section 1.320 and torque stripe per Figure 2-1.

2. Install perimeter screws securing tank to bulkhead.

3. Above aft right seat, gently lift foam from bulkhead and install fasteners securing tank to bulkhead.

4. a. R44: Remove caps. Connect hose assembly to tank elbow. Special torque hose nuts to 120 in.-lb and torque stripe per Figure 2-1.

   b. R44 II: Remove caps. Verify tank tee is aligned with D321-1 valve assembly within 5°. Install if removed, or verify the proper installation of, D453-2 jet in tee inlet (outboard). Connect hose assemblies to tee. Verify D205-31 hose assembly elbow is horizontal within 5°. Special torque hose nuts to 120 in.-lb and torque stripe per Figure 2-1.

5. Install screws securing B157-1 mount to channel if screws have nutplates, or install hardware securing MS24566-1B pulley to B157-1 mount. Install hardware securing rotor brake cable clamp to tank channel. Verify security.

6. Connect fuel quantity sender wiring at connectors. Install nuts securing wiring to fuel quantity sender if connectors are not installed. Install ty-raps as required.

7. Connect vent tubes to tank and tighten clamps until snug. Verify security.

8. Perform fuel quantity indication check per Section 12.412. Verify no leaks.

9. Install aft-right backrest assembly.

10. Install D042-5 door assembly. Install C347 channel assembly, angles, and panel. Install tailcone fairing, connect ELT antenna ground wire at connector if ELT is installed, and close access doors. Close right side of mast fairing.

12.123 Aux Tank - Bladder Replacement

NOTE

During disassembly, progressively tape bladder openings to protect interior from foreign object contamination. During assembly, progressively remove protective tape.

CAUTION

D028-2 bladder assembly temperature should be above 65°F before removing, installing, or flexing bladder.

1. Remove aux fuel tank per Section 12.121.
2. Remove hardware securing D247-2 bulkhead assembly and D253-3 angle to tank and remove angle. Detach hook and look tape and remove bulkhead.
3. Remove fuel quantity sender per Section 12.410.
4. Remove screws securing D250-2 cover assembly to D028-2 bladder assembly and tank; carefully remove cover, with drain valve assembly attached. Remove and discard o-ring.
5. At vents, remove screw securing bladder to tank.
6. Remove fuel cap. Remove screws securing bladder to tank.
7. Detach hook and look tape and carefully remove bladder.
8. Carefully insert new D028-2 bladder assembly inside aux tank assembly. Align bladder and tank fastener holes and press hook and loop tape together.
9. Install screws securing bladder to tank near fuel cap. Install fuel cap.
10. At vents, apply A257-9 anti-seize to threads and install screw securing bladder to tank.
11. Lubricate new o-ring with A257-6 grease and install o-ring in bladder groove at bottom of tank. Carefully insert cover into bladder, with drain valve assembly attached. Apply A257-9 anti-seize to threads and install screws securing cover to bladder and tank.
12. Install fuel quantity sender per Section 12.410.
13. Align bulkhead and tank fastener holes. Install hardware securing bulkhead and angle to tank.
14. Pressure check assembled fuel tank by plugging vents and fittings and pressurizing bladder to no more than 1 psi. Check for leaks with a mild soap and water solution applied to all seams.
15. Install aux fuel tank per Section 12.122.

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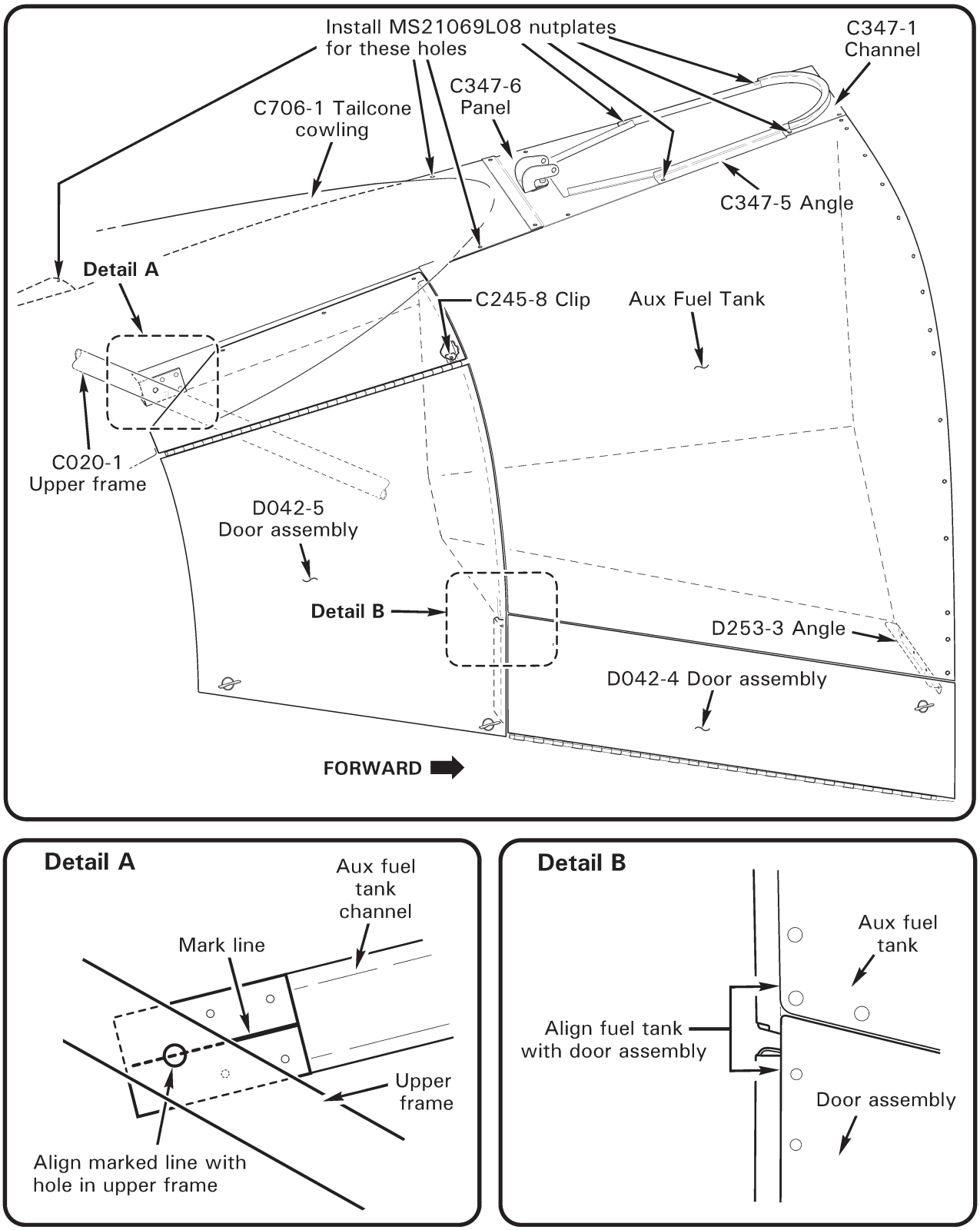


FIGURE 12-4 AUX TANK REPLACEMENT

12.124 Aux Tank Replacement

1. Remove aux fuel tank per Section 12.121.

2. Refer to Figure 12-3, Detail C. Draw longitudinal lines from center of three bulkhead channel nut holes onto exterior skins. Measure and record distances as shown.

3. Refer to Figure 12-4, Detail A. Mark horizontal centerline of new D043-1 aux fuel tank channel doubler.

4. Position tank in helicopter. Align marked line with center of upper frame attachment hole per Figure 12-4, Detail A. Align tank exterior skin with aft edge of latched D042-4 door assembly per Detail B. Secure tank position by clamping channel to frame at attachment hole.

5. Refer to Figure 12-3, Detail D. Estimate material to be removed for fitting tank forward edge with cabin exterior skin aft edge; file or cut tank to create a gap of no more than 0.065 inch between tank and skin. Deburr trimmed edge with 220-grit or finer wet-or-dry aluminum oxide abrasive paper.

6. Solvent-clean tank deburred edge and apply Alodine 1122 or Alodine 1201 in accordance with manufacturer's instructions. Apply epoxy primer to dry edge.

7. From inside cabin, begin at the lowest nutplate and drill a #30 pilot hole through tank skin (using existing nutplate as drill guide), and install cleco. Moving upward, repeat step for remaining nutplates.

8. Transfer longitudinal lines and recorded distances from exterior skin to tank, and lay out three drill marks. Using a drill stop, enlarge pilot holes to 0.170-inch diameter.

9. Match-drill 0.250/0.256-inch hole in fuel tank channel through upper frame attachment hole; temporarily install bolt.

10. Refer to Figure 12-4. Open D042-4 door. Using a drill stop, match-drill 0.170-inch holes in C259-2 bulkhead through holes in D253-3 angle. Close and latch door.

11. Install D042-5 door assembly; latch door. Adjust door position for no more than 0.050-inch gap between door forward edge and tank skin edge, but maintain door-to-tank contour. Lay out hole location on C245-8 clip; verify drill hole on clip will have minimum 0.12-inch edge distance. Match-drill 0.170-inch hole in clip through door; install and secure screw.

12. Match-drill 0.170-inch holes in tank channel through holes in D042-5 door assembly.

13. Cleco C347-1 channel to cabin. Match-drill 0.170-inch holes in tank inboard flanges through remaining holes in channel.

14. Clean up debris. Install aux fuel tank per Section 12.122.

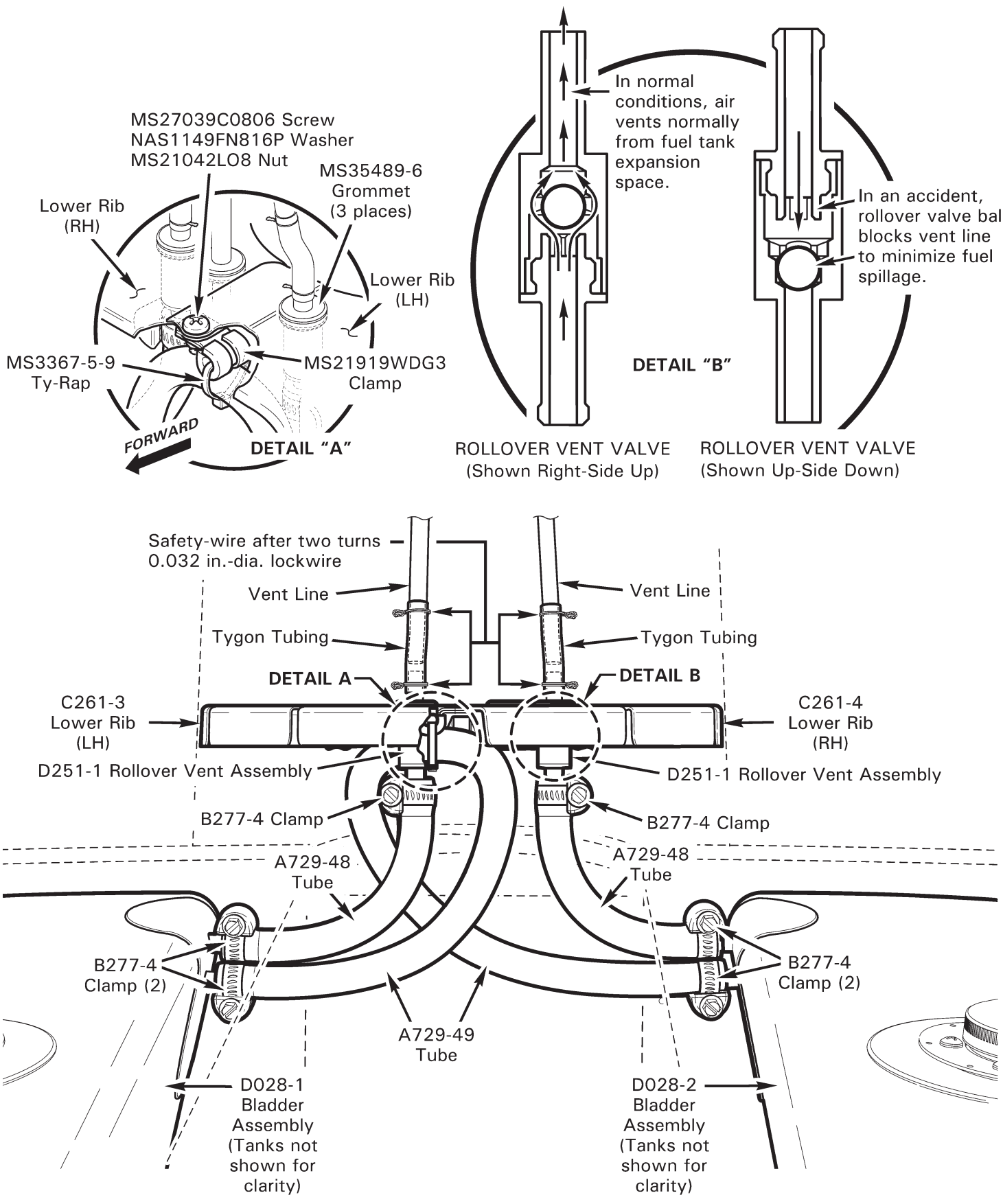


FIGURE 12-5 FUEL VENTS

12.200 Fuel Vents

12.210 Roll-Over Vent Valves

R44 roll-over vent valves contain one brass ball. In normal conditions, air flows around the vent ball from the bladder expansion spaces. In the event of inadvertent over-filling or in-flight fuel sloshing, the ball will float and seal the vent. If the aircraft is inverted, the ball seals the vent to minimize fuel spillage. There are no internal packings.

A. Removal

1. Open mast fairing.
2. Cut and discard safety wire securing A729-47 tube to D251-1 roll-over vent assembly and pull tube off vent. Pull vent through rib grommet.
3. Loosen clamp securing A729-48 tube to vent and pull tube off vent.

B. Installation

1. Observe orientation markings and install D251-1 roll-over vent valve assembly to A729-48 tube and tighten clamp. Insert valve through rib grommet.
2. Connect A729-47 tube to valve, wrap two turns 0.032-inch diameter lockwire and safety tube tight to valve.
3. Perform vent system check per Part C.

C. Vent System Check

1. Open mast fairing. Verify fuel caps are installed.
2. Attach temporary hose to one C731-2 (vent) line.
3. Blow into the hose; do not use compressed air. Verify air blows out the other vent opening. If air does not blow out the other vent, remove obstruction(s) in vent line(s) or in bladder and repeat check.
4. Close mast fairing.

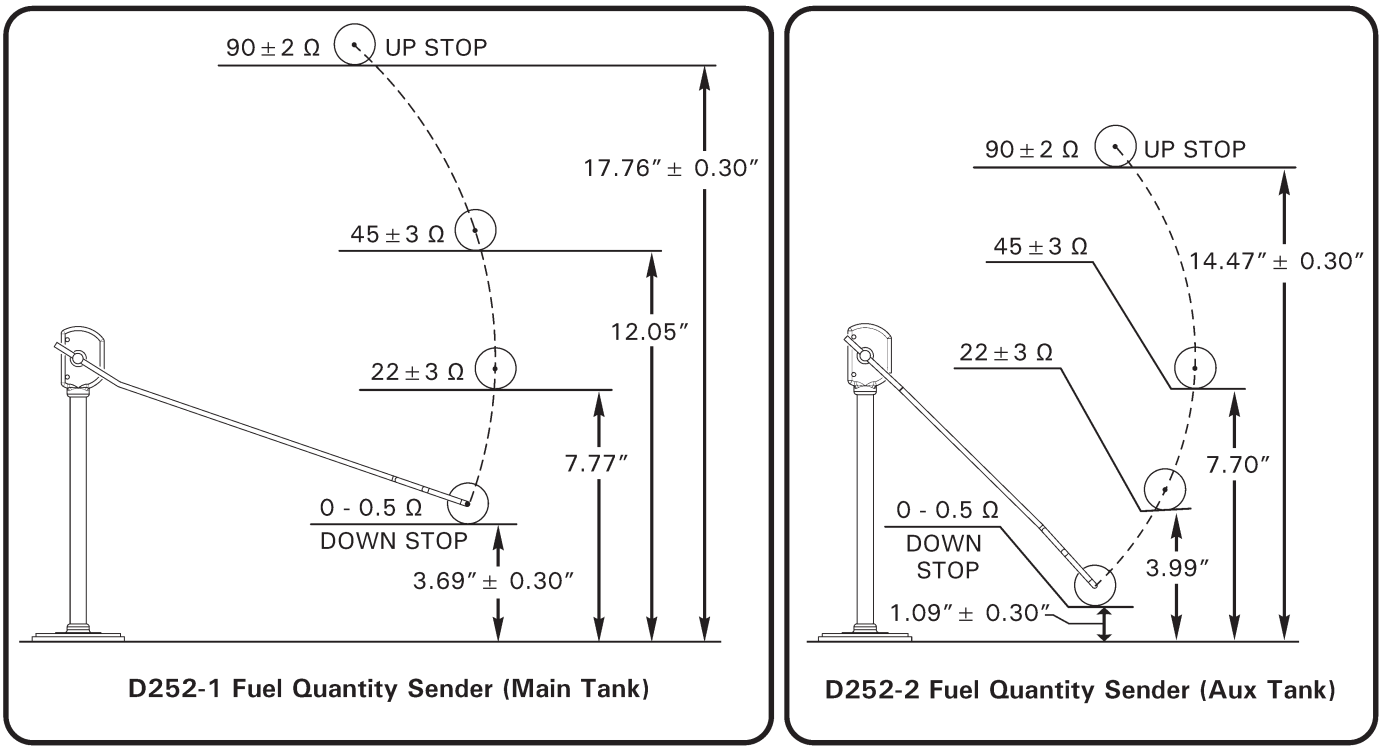


FIGURE 12-6 FUEL QUANTITY SENDER CHECK

12.300 Drain Valves

A. Removal

1. Defuel helicopter per Section 1.150. Remove engine right cowling, as required.
2. Except for all-aluminum main tank, cut and discard safety wire securing A729 tube to A761-1 drain valve and remove tube.
3. Remove valve from connector, tank, or gascolator assembly. Tape fuel system opening.
4. Actuate valve to expose stem, then remove and discard o-ring.

B. Installation

1. Actuate A761-1 drain valve to expose stem, then install new o-ring in stem seat.
2. Lightly coat valve threads using B270-6 sealant. Remove tape and install valve in connector, tank, or gascolator assembly. Standard torque valve per Section 1.320 (if valve is installed in B416-3 [aluminum] gascolator bowl, special torque valve to 120 in.-lb) and torque stripe per Figure 5-1.
3. Except for all-aluminum main tank, fit A729 tube onto valve, wrap tube with two turns 0.032-inch diameter lockwire, and safety tube to valve.
4. Fuel helicopter per R44 or R44 II Pilot's Operating Handbook Section 2 and inspect fuel system for leaks. Install engine right cowling, if removed.

12.400 Fuel Quantity

12.410 Fuel Quantity Senders

A. Removal

1. a. D252-1 (main tank) fuel quantity sender: Remove main tank per Section 12.111. Remove screws securing A374-5 angle to bladder assembly.

   b. D252-2 (aux tank) fuel quantity sender: Defuel helicopter per Section 1.150. Disconnect D205-29 hose assembly, and D205-31 hose assembly (R44 II) if applicable, from elbow (R44) or tee (R44 II).

2. D252-2 (aux tank) fuel quantity sender: Cut & discard ty-raps as required and disconnect fuel quantity sender wiring from airframe harness at connectors. Remove screws securing D250-2 cover assembly to bladder ring and tank and remove cover, with fuel quantity sender attached.

3. Remove bolts securing fuel quantity sender to cover assembly. Carefully pull sender lever through opening, then tape opening.

4. Remove palnuts securing C049-11 connector assembly to fuel quantity sender, using backup wrench on center stud nut.

B. Installation

1. Perform fuel quantity sender check per Section 12.411.

2. Install new palnuts securing C049-11 connector assembly to D252 fuel quantity sender; special torque palnut on center stud to 11 in.-lb using backup wrench on nut.

3. Remove tape, then carefully insert fuel quantity sender lever through opening in D250 cover assembly. Install hardware, special torque bolts in criss-cross pattern per Section 1.330, and torque stripe per Figure 2-1.

4. a. D252-1 (main tank) fuel quantity sender: Apply A257-9 anti-seize to screw threads and install screws securing A374-5 angle to bladder ring. Install main tank per Section 12.112.

   b. D252-2 (aux tank) fuel quantity sender: Install D250-2 cover assembly with fuel quantity sender attached, carefully inserting lever in bladder. Apply A257-9 anti-seize to screw threads and install screws securing cover to bladder ring and tank. Connect sender wiring to airframe harness at connectors. Install ty-raps as required.

5. Perform fuel quantity indication check per Section 12.412. Verify no leaks.

12.411 Fuel Quantity Sender Check

1. Remove fuel quantity sender per Section 12.410.

2. Simulate mounting position of appropriate sender per Figure 12-6. Position float arm as shown and measure the resistance with a multimeter. Verify resistance is within tolerance at four noted heights.

3. If resistance is out of tolerance at any height, bend the float arm up for a sender with excessive resistance, or bend the float arm down for a sender with too little resistance. Repeat steps until sender resistance is within tolerance.

4. Install fuel quantity sender per Section 12.410.

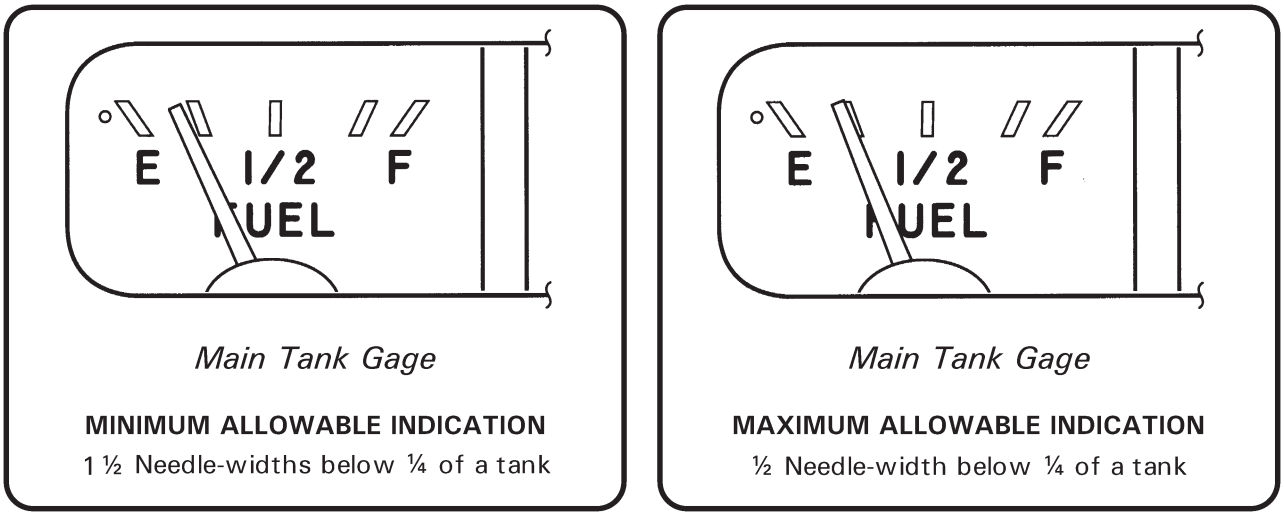


FIGURE 12-7 FUEL QUANTITY INDICATION CHECK

12.412 Fuel Quantity Indication Check

1. Defuel helicopter per Section 1.150.

2. Fuel main tank with 9.25 gallons per Pilot's Operating Handbook Section 2. Wait five minutes for fuel levels to equalize. Inspect for leaks.

3. Turn battery switch on and read fuel quantity gage. Verify fuel gage indicates one half to one and one half needle-widths below a quarter of a tank, as shown in Figure 12-7.

4. If indication is beyond allowable limit, perform fuel quantity sender check per Section 12.411. If sender resistance is within tolerance, adjust fuel gage per Section 14.440, or replace fuel gage and repeat check.

12.420 Low-Fuel Switch Assembly

CAUTION

Avoid contaminating fuel bladder or tank interior. Cover arms with sleeves and use lint-free gloves when working inside interior.

A. Removal

1. Remove main fuel tank per Section 12.111.

2. Remove A521-1 low-fuel switch assembly wiring pins from connector housing.

3. Remove fuel cap. Carefully capture switch assembly body with clean mechanical fingers (avoid capturing movable float). Remove AN924-5D nut securing switch assembly to tank.

4. Carefully pull switch assembly through fuel cap opening (avoid fuel quantity sender). Install fuel cap, and tape fuel bladder or tank opening.

12.420 Low-Fuel Switch Assembly (continued)

B. Installation

1. Lubricate new o-ring with A257-6 grease, and install o-ring over A521-1 low-fuel switch assembly threads.
2. Tape switch assembly wiring to 30-inch length of lockwire.
3. Remove fuel cap and tape. Position tank upside down. Thread lockwire through fuel cap opening and switch assembly mounting hole. Pull switch assembly wires and threads through mounting plate and retaining nut.
4. Apply light coat B270-1 sealant to AN924-5D nut mating surface and install nut securing switch assembly to tank. Special torque nut to 150 in.-lb, and torque stripe per Figure 2-1.
5. Install main fuel tank per Section 12.112.
6. Perform operation check per Part C.

C. Operation Check

1. Turn battery switch on. Fuel helicopter per R44 or R44 II Pilot's Operating Handbook Section 2 as required and inspect fuel system for leaks.
2. With a clean wooden dowel, gently depress low-fuel switch assembly float and verify LOW FUEL warning light illuminates after approximately 1 second delay.
3. If warning light does not illuminate when float is depressed, but does illuminate when activating push-to-test switch, replace switch assembly.

12.500 Gascolator Assembly and Aux Fuel Pump Installation

A. Cleaning Sediment Bowl

1. Turn battery switch off. Turn fuel shut-off valve off. Remove right cowling assembly. Drain fuel using A666-1 gascolator assembly drain valve.
2. Clean exterior of gascolator, D743 electric (aux) fuel pump (R44 II), attached fittings, C741-1 line assembly, and B283-3 hose assembly.
3. Cut and discard safety wire securing gascolator collar to outlet fitting. Unscrew collar, and remove collar, ring (if installed), and sediment bowl.
4. Remove gasket & screen from gascolator top. Inspect, then clean, sediment bowl & screen.
5. Install screen and gasket in gascolator top. Apply light coat A257-6 grease to collar threads and collar inner flange. Verify large diameter of ring (if installed) contacts collar inner flange. Slide ring (if installed) and collar over bottom of sediment bowl so small diameter of ring engages groove in bowl flange. Position sediment bowl drain valve thru hole in belly panel, and hand-tighten collar, ring (if installed), and bowl onto gascolator top until snug. Verify no threads exposed in gascolator top. Safety collar to outlet adapter using 0.032-inch diameter lockwire.
6. Turn fuel shut-off valve on. Perform ground check and run up per Sections 2.205 & 2.210. Verify no leaks; repair as required.
7. Install right cowling assembly.

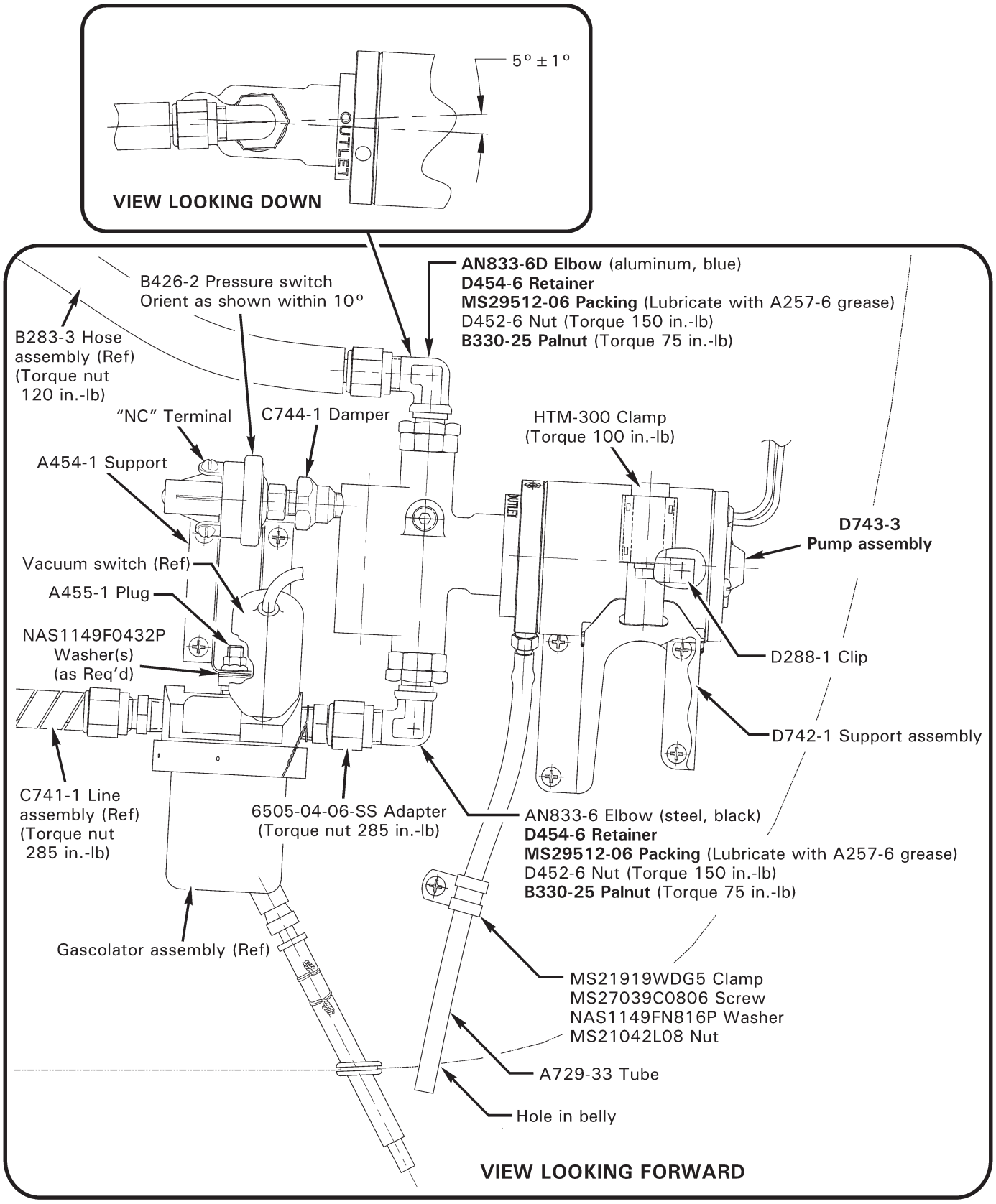


FIGURE 12-8 GASCOLATOR ASSEMBLY AND AUX FUEL PUMP INSTALLATION

12.500 Gascolator Assembly and Aux Fuel Pump Installation (continued)

CAUTION

Temporarily cap fuel fittings when opened.

B. Removal

1. Turn battery switch off. Turn fuel shut-off valve off. Remove right cowling assembly. Drain fuel using A666-1 gascolator assembly drain valve.

2. Refer to Figure 12-8. Clean exterior of gascolator, D743 electric (aux) fuel pump (R44 II), attached fittings, C741-1 line assembly, and B283-3 hose assembly.

3. Cut and discard safety wire securing gascolator collar to outlet fitting. Disconnect C741-1 line assembly from gascolator inlet nipple.

4. a. R44: Disconnect B283-3 hose assembly from gascolator outlet nipple. If installed, disconnect primer line from AN894D4-2 bushing on gascolator outlet tee.

   b. R44 II: Disconnect B283-3 hose assembly from aux pump tee or elbow, as applicable.

5. R44 II: Cut and discard ty-raps as required and disconnect D745-1 vacuum switch and aux pump wiring from airframe harness at connectors. Mark and disconnect wires from B426-2 fuel pressure switch.

6. R44 II: Remove hardware securing aux pump drain tube clamp to vertical firewall. Open HTM-300 clamp securing aux pump to D742-1 support and clip on firewall.

7. Remove nut and washer securing gascolator to A454-1 support and remove gascolator, or aux pump with attached gascolator, as applicable.

8. R44 II: Separate gascolator from pump by disconnecting adapter from elbow. As required, transfer fittings and pressure switch to replacement pump using new packings.

C. Installation

1. Refer to Figure 12-8. Install AN833-6 steel elbow in inlet, and new AN833-6D aluminum elbow in outlet of new D743-3 or D743-4 aux fuel pump assembly per the following:

   a. Install new B330-25 palnut followed by D452-6 nut (counterbore facing outboard) on inboard threads of elbow. Install new D454-6 retainer on smooth area between threads and press retainer completely into counterbore of nut. Lubricate new MS29512-06 packing with A257-6 grease and install between threads adjacent to retainer.

   b. Rotate combined nut & retainer until packing is pushed against outboard threads. Screw elbow into pump until packing contacts pump, indicated by a sudden increase in torque. Hold nut with wrench and tighten elbow no more than one full turn until elbow points away from motor. Position the steel AN833-6 lower elbow parallel to the long axis of the pump. Per Figure 12-8, Detail A, position the aluminum AN833-6D upper elbow approximately 5° counterclockwise from parallel to long axis of pump (looking down). Hold elbow and special torque D452-6 nut to 150 in.-lb, special torque palnut to 75 in.-lb, and torque stripe per Figure 2-1.

12.500 Gascolator Assembly and Aux Fuel Pump Installation (continued)

C. Installation (continued)

2. Apply light coat B270-6 sealant to C744-1 damper threads (do not apply sealant to first thread), install damper in D743-3 aux fuel pump assembly, and standard torque C744-1 damper to 60 in.-lb. Apply light coat B270-6 sealant to B426-2 switch (do not apply sealant to first thread), install switch on C744-1 damper, and standard torque switch to 60 in.-lb. Tighten switch (only) to orient NC terminal within 10°, as shown.

3. Connect gascolator 6505-04-06-SS adapter to the pump's steel AN833-6 lower elbow. Align gascolator A455-1 plug to point up and parallel with pump inlet, special torque adapter nut to 285 in.-lb, and torque stripe per Figure 2-1.

4. Remove caps. Position A666-1 gascolator assembly drain valve thru hole in belly panel. Insert A455-1 plug in A454-1 support, then connect C741-1 line assembly to inlet nipple (marked "IN"), finger-tight.

5. R44 II: With aux fuel pump motor resting firmly on D742-1 support, note any gap between bottom of A454-1 support and shoulder of A455-1 plug, and fill gap as required by installing NAS1149F0432P washers on plug.

6. Install washer and nut on A455-1 plug, special torque nut to 70 in.-lb, and torque stripe per Figure 2-1.

7. R44 II: Insert HTM-300 clamp around aux pump motor, through clip on vertical firewall and slot in D742-1 support. Special torque clamp to 100 in.-lb and torque stripe per Figure 2-1. Install hardware securing aux pump drain tube clamp to vertical firewall.

8. Special torque C741-1 line assembly nut to 285 in.-lb, & torque stripe per Figure 2-1.

9. a. R44: If installed, connect primer line to bushing on gascolator outlet tee, special torque nut to 25 in.-lb, and torque stripe per Figure 2-1. Connect B283-3 hose assembly to gascolator outlet nipple, special torque nut to 120 in.-lb, and torque stripe per Figure 2-1.

   b. R44 II: Verify two layers of 10.0/10.5-inch length, B161-8 spirap insulation covering C741-1 line assembly between firewall and nut. Install new spirap as required. Connect B283-3 hose assembly to aux pump tee, special torque nut to 120 in.-lb, and torque stripe per Figure 2-1.

10. Safety gascolator collar to outlet fitting using 0.032-inch diameter lockwire.

11. R44 II: Connect D745-1 vacuum switch and aux pump wiring to airframe harness at connectors. Connect wires as marked to B426-2 fuel pressure switch. Install ty-raps as required.

12. Perform minimum fuel flow check per Section 12.600.

13. Perform ground check and run up per Section 2.205 & 2.210. Verify no leaks.

14. Install right cowling assembly.

12.600 Minimum Fuel Flow Check

1. Fuel main tank with approximately 5 gallons (30 lb) fuel per R44 or R44 II Pilot's Operating Handbook Section 2, as required. Remove right cowling assembly.

2. Electrically ground helicopter, and turn fuel shut-off valve off.

3. a. R44: Disconnect B283-3 hose assembly from carburetor, turn battery switch and fuel shut-off valve on, and defuel helicopter into an approved, electrically grounded container until LOW FUEL light illuminates. Turn battery switch and fuel shut-off valve off.

   b. R44 II: Cut and discard safety wire securing gascolator collar to outlet fitting. Unscrew collar, and remove collar, ring, and sediment bowl; remove gasket and screen from gascolator top. Turn battery switch and fuel shut-off valve on, and defuel helicopter into an approved, electrically grounded container until LOW FUEL light illuminates. Turn battery switch and fuel shut-off valve off.

4. Place electrically-grounded, calibrated container beneath hose or gascolator, turn fuel shut-off valve on, and record time required to fill container. Verify filling time does not exceed maximum time listed below:

ALLOWABLE FUEL FLOW RATE	
QUANTITY	*MAXIMUM TIME*
1 U.S. Gallon	90 seconds
4 Liters	95 seconds
1 Imperial Gallon	108 seconds

5. If filling time is exceeded, perform vent system check per Section 12.210 Part C. Inspect fuel tank outlet strainer, line assembly, and hose assemblies for obstructions. Remove obstructions and repeat check.

6. a. R44: Connect B283-3 hose assembly to carburetor, special torque nut to 120 in.-lb, and torque stripe per Figure 2-1.

   b. R44 II: Inspect, clean, and install screen and gasket in gascolator top. Apply light coat A257-6 grease to collar threads and collar inner flange. Verify large diameter of ring contacts collar inner flange. Slide ring and collar over bottom of sediment bowl so small diameter of ring engages groove in bowl flange. Position sediment bowl drain valve thru hole in belly panel, and hand-tighten collar, ring, and bowl onto gascolator top until snug. Verify no threads exposed in gascolator top. Safety collar to outlet nipple using 0.032-inch diameter lockwire.

7. Perform ground check and run up per Section 2.205 & 2.210. Verify no leaks.

8. Install right cowling assembly.

12.700 R44 II Troubleshooting

PROBLEM	POSSIBLE CAUSE	CORRECTION
FUEL FILTER warning light illuminates during flight	Fuel system contaminated	Inspect gascolator and fuel control inlet screens for contamination. Inspect fuel system for obstructions or debris and correct cause.
	Fuel tank vents obstructed	Inspect vents for contamination. Correct cause.
	Vacuum switch contaminated	Replace vacuum switch.
AUX FUEL PUMP warning light illuminates during flight	Insufficient fuel quantity	Add fuel.
	Aux fuel pump output insufficient	Replace aux fuel pump per Section 12.500.
	Failed pressure relief valve assembly	Perform pressure relief valve leakage check per Section 12.730.
Fuel draining from intake manifold “sniffle” drain valve	Engine-driven fuel pump diaphragm failure	Replace engine-driven fuel pump.
	Flow divider piston stuck open	Perform flow divider check per Section 12.710.
Fuel draining from electric (auxiliary) fuel pump drain	Failed seal in aux fuel pump	Replace aux fuel pump, or return aux fuel pump to http://weldonpumps.com for repair.
Oil draining from engine-driven fuel pump drain	Leaking diaphragm	Replace engine-driven fuel pump.

12.710 Flow Divider Internal Leakage Check

NOTE

Refer to Lycoming Service Instruction No. 1518 for information on stuck-closed flow divider.

1. Fully fuel helicopter. Turn battery switch off. Electrically ground helicopter.
2. Place electrically-grounded, suitable container beneath the intake manifold “sniffle” drain valve.
3. Turn fuel shut-off valve on. Push mixture control into FULL RICH position. Wait 15 minutes, then inspect container for evidence of fuel leaking from drain valve.
4. Replace or repair flow divider if fuel is found in container.

12.720 Injection Nozzle Comparative Flow Check

NOTE

Refer to Precision Airmotive Form 15-810B "Troubleshooting Techniques," Lycoming SSP-1776 "Service Table of Limits," and Lycoming SB 342 (current revision; ref AD 2011-26-04).

1. Turn battery switch off. Electrically ground helicopter. Remove engine left & right cowlings and upper spark plug access panels.

2. Remove injection nozzles from cylinders and reinstall nozzles on delivery lines. Place a calibrated container beneath each nozzle.

3. Turn fuel shut-off valve on. Rotate twist grip OPEN. Activate aux fuel pump by turning key to PRIME position.

4. Push mixture control into FULL RICH position for 15 to 30 seconds then pull mixture to off; verify volume collected is similar between all injection nozzles. If volume is not similar, isolate cause (nozzle, delivery line, flow divider fitting, flow divider) and repair.

5. Install nozzles and delivery lines and torque per Lycoming SSP-1776.

6. Install upper spark plug access panels and engine left & right cowlings.

12.730 Pressure Relief Valve Leakage Check

1. Verify sufficient fuel in aux tank. Disconnect fuel control-to-pressure relief valve hose assembly from fuel control inlet tee and drain residual fuel into an electrically-grounded, suitable container. If fuel drains continuously from hose assembly, replace pressure relief valve assembly.

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CHAPTER 13

INSTRUMENTS

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CHAPTER 13

INSTRUMENTS

13.000 Instruments

13.001 Introduction

This section contains a basic description of instrumentation installed in R44 Helicopters, general maintenance procedures and trouble-shooting procedures.

13.002 Description

Standard flight instruments include an airspeed indicator, dual (engine and rotor) tachometer, sensitive altimeter, manifold pressure gage, vertical speed indicator and magnetic compass. Engine cluster gages include an ammeter, oil pressure, oil temperature, cylinder head temperature and fuel quantities. Also provided are a carburetor air temperature gage (for carbureted engines), a clock, and a digital outside air temperature gage. An hourmeter actuated by engine oil pressure and collective switch is located to the right of the pilot's seat.

13.100 Pitot-Static System

The pitot-static system supplies air pressure to operate the airspeed indicator, altimeter, and vertical speed indicator. The pitot tube is located on the front of the mast fairing; a heated pitot tube is optional. Dual static ports are located aft of rear passenger doors; one on each side of cabin. Water can be drained from pitot and static lines by removing plastic drain plugs which are accessible by removing the belly aft panel; draining these lines should only be required if operation of airspeed or altimeter systems appear erratic. Openings of both pitot and static sources should be inspected frequently for bugs or other obstructions.

13.200 Flight Instruments

Refer to Section 2 of R44 Pilot's Operating Handbook for specific instrument markings.

13.210 Airspeed Indicator

The airspeed indicator displays airspeed in knots and miles per hour. The airspeed indicator operates correctly in forward flight only; backward or lateral flight will not indicate correct airspeed. The airspeed indicator will indicate forward airspeeds up to a maximum of 130 knots (Red Line).

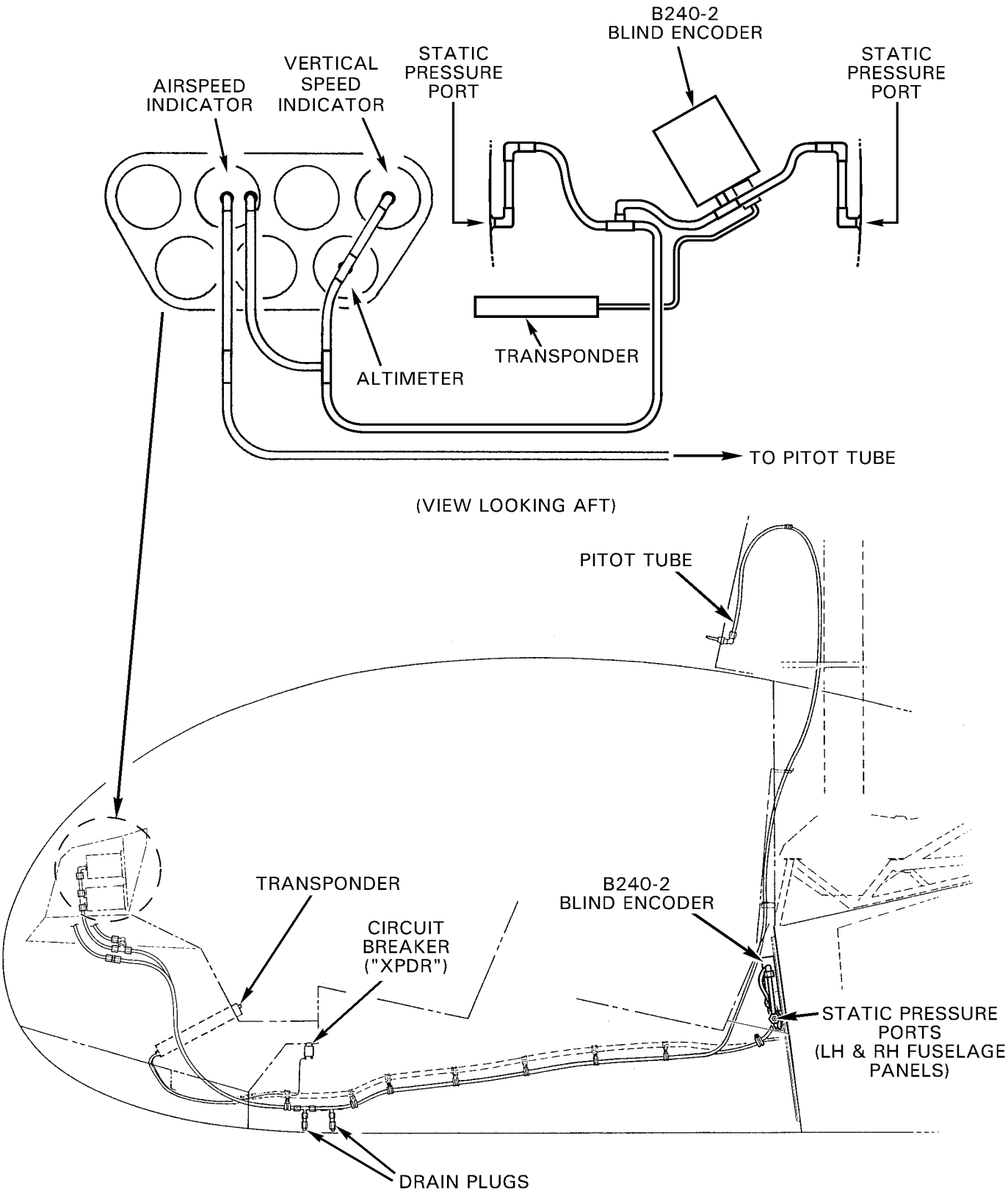


FIGURE 13-1 PITOT AND STATIC SYSTEM INSTALLATION

13.211 Pitot line leak test

CAUTION

Do not apply suction to pitot system or pressure to static system

1. **Method 1**: Using hand pump

   a. Seal pitot tube drain hole with pressure sensitive tape. Attach flexible tubing and hand pump unit (60 ml syringe) to pitot tube with pump plunger at top of cylinder.

   b. SLOWLY apply pressure to pitot line by depressing pump plunger until airspeed indicator reads 80 mph (70 knots). Pump plunger will remain in place without need to pinch off flexible tubing.

   c. Gently tap airspeed indicator glass to remove friction effects.

   d. If indicator pointer drops more than 10 mph (8-9 knots) in one minute, an unacceptable leak is indicated. After leak has been repaired, retest per sections (a) thru (d).

   e. Remove tape from pitot tube drain hole and verify airspeed indicator goes to zero.

   f. Remove test apparatus from pitot tube after acceptable test results are obtained.

2. **Method 2** : Using flexible tubing

   a. Seal pitot tube drain hole with pressure sensitive tape. Attach flexible tubing to pitot tube.

   b. SLOWLY apply pressure to pitot line by rolling flexible tubing around roller until airspeed indicator reads 80 mph (70 knots). Pinch off pressure supply at flexible tube.

   c. Gently tap airspeed indicator glass to remove friction effects.

   d. If indicator pointer drops more than 10 mph (8-9 knots) in one minute, an unacceptable leak is indicated. After the leak has been repaired, retest per sections (a) thru (d).

   e. Remove tape from pitot tube drain hole and verify airspeed indicator goes to zero.

   f. Remove test apparatus from pitot tube after acceptable test results are obtained.

13.220 Altimeter

The altimeter provides altitude information relative to sea level when barometric pressure correction scale is properly set. Check altimeter calibration by setting correction scale to present altimeter setting and checking altimeter reading against field elevation. They must agree within 70 feet.

13.221 Static line leak test

CAUTION

When applying suction to static line, airspeed, altimeter and vertical speed indicators may be damaged if suction is applied or removed rapidly.

1. **Method 1**: Using hand pump

   a. Set altimeter to field elevation.

   b. Seal static opening with pressure sensitive tape. Attach flexible tubing and hand pump unit to static line at drain with pump plunger depressed.

   c. SLOWLY apply suction to static line with hand pump until altimeter reaches 500 ft. greater than field elevation. Pump plunger will remain in that position.

   d. Gently tap glass on altimeter until rate-of-climb indicator has stabilized. After stabilization, altimeter should be adjusted to the next higher 100 foot mark and then timed for one minute. Change of less than 100 feet in elevation in one minute is acceptable.

   e. SLOWLY remove suction from static line.

   f. After leak has been repaired, retest per sections a thru e.

   g. Remove test equipment.

2. **Method 2:** Using flexible tubing

   a. Set altimeter to field elevation.

   b. Seal static opening with pressure sensitive tape. Preroll flexible tubing around roller so that suction may be produced by unrolling. Attach flexible tubing to static line at drain.

   c. SLOWLY apply suction to static line with hand pump until altimeter reaches 500 ft. greater than field elevation. Pump plunger will remain in that position.

   d. Gently tap glass on altimeter until rate-of-climb indicator has stabilized. After stabilization, altimeter should be adjusted to next higher 100 foot mark and then timed for one minute. Change of less than 100 feet in elevation in one minute is acceptable.

   e. SLOWLY remove suction from static line

   f. After leak has been repaired, retest per sections a thru e.

   g. Remove test equipment.

13.230 Vertical Speed Indicator

The vertical speed indicator provides rate of ascent or descent. Check vertical speed indicator for a zero rate needle indication when rotorcraft is stationary.

13.240 Outside Air Temperature (OAT)

The outside air temperature indicator has a stainless steel probe protruding from chin of rotorcraft and is connected to gauge by a calibrated length of cable.

> NOTE
>
> No cutting or splicing of OAT probe wires is permitted.

13.300 DRIVE TRAIN AND POWERPLANT INSTRUMENTS

13.310 Engine - Rotor Tachometer

The R44 is equipped with one electronic dual (engine and rotor) tachometer. The sensor for engine tachometer is breaker points in engine right magneto. Sensor for rotor tachometer is an electronic Hall Effect device which senses passage of two magnets attached to main rotor gearbox input yoke assembly. Each tachometer circuit has a separate circuit breaker and is completely independent from the other. They can be powered by either alternator or battery even if "MASTER BAT" switch is turned off. With alternator, battery and electrical circuits functioning normally tachometer power will be interrupted only if "MASTER BAT" and "ALT" switches are turned off and "CLUTCH ENGAGE" switch is disengaged.

> **CAUTION**
>
> Installation of electrical devices can affect accuracy and reliability of electronic tachometers. Therefore, no electrical equipment may be installed in the R44 helicopter unless installation is specifically approved by RHC. At 100% RPM of engine, engine and rotor tachometer needles must indicate 100% ± 1%. For adjustment of rotor tachometer, see Section 14.100 Dual Tachometer Adjustment.

13.320 Manifold Pressure Gauge

The manifold pressure gauge provides an indication of absolute air pressure in engine intake manifold. Red line on gauge indicates maximum manifold pressure for which rotorcraft is type certificated at 104% rotor RPM. Manifold pressure gauge should indicate within 0.3 inches Hg of ambient barometric pressure when engine is not running.

13.330 Carburetor Air Temperature

A carburetor air temperature gauge on panel is used to determine when carburetor heat is required during possible carburetor icing conditions, such as high humidity. Apply heat as required to keep needle out of yellow band. Carburetor air temperature gauge should read approximately the same as OAT gauge when engine is cold.

13.340 Engine Instrument Cluster

13.341 Oil Pressure Gauge

The oil pressure gauge indicates engine oil pressure and receives its signal from a variable-resistor-type sender located in left-hand forward corner of engine compartment next to hourmeter pressure switch.

13.342 Oil Temperature Gauge

The oil temperature gauge indicates engine oil temperature and receives its electrical signal from a probe mounted in engine oil pressure screen housing or oil filter adapter.

13.343 Cylinder Head Temperature Gauge

The cylinder head temperature gauge indicates temperature of cylinder #2 (O-540), cylinder #1 or #5 (IO-540) and receives its signal from a probe installed in bottom of cylinder head.

13.344 Fuel Quantity Gauge

The fuel quantity gauge indicates fuel level and receives its signal from a variable-resistor-type float indicator (see Section 12.000 for adjustment).

13.345 Ammeter

The ammeter indicates loads in electrical system. The system loads are measured at shunt located on lower right-hand side of vertical firewall in the engine compartment.

13.400 Troubleshooting Guide

INSTRUMENT	PROBLEM	PROBABLE CAUSE
Airspeed Indicator	No Indication	1. Blockage of pitot tube. 2. Disconnected pitot tube. 3. Kinks (bends) in pitot line under upper console. 4. Defective indicator.
	Erratic Indication	1. Loose pitot or static line connection. 2. Broken pitot line. 3. Water in pitot-static system. 4. Defective instrument.
Altimeter	No Indication	1. Blockage in static line. 2. Defective instrument.
	Erratic Indication	1. Water in static line.
Vertical Speed Indicator	Climb indication with no return to zero in level flight.	1. Blockage in the static line.
	Erratic Indication	1. Water in static system. 2. Defective indicator.
	No Indication	1. Defective indicator.

NOTE

For troubleshooting procedures for electrical-powered instruments, see Section 14.000.

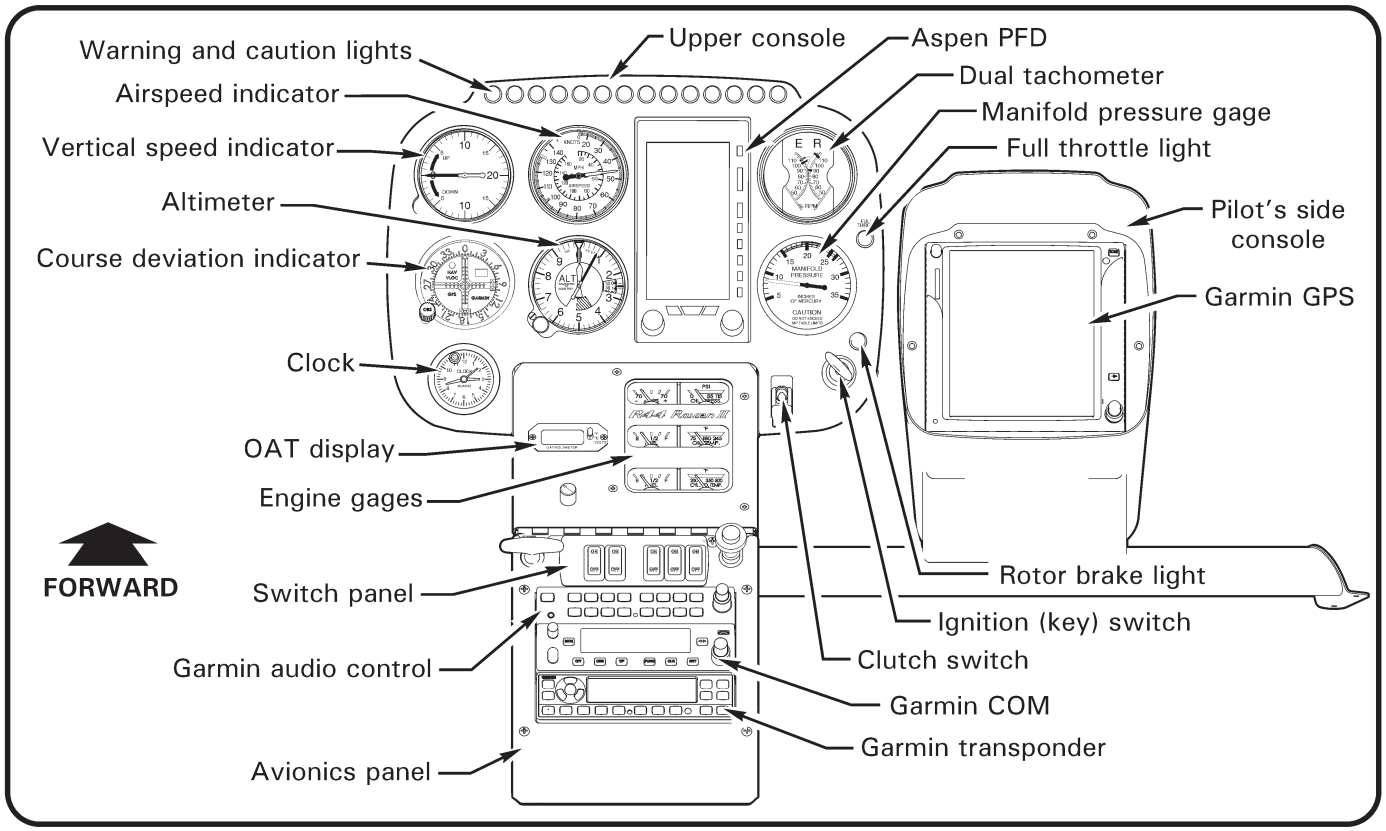


FIGURE 13-2 EIGHT-INSTRUMENT CONSOLE WITH ASPEN PFD - TYPICAL (R44 II SHOWN)

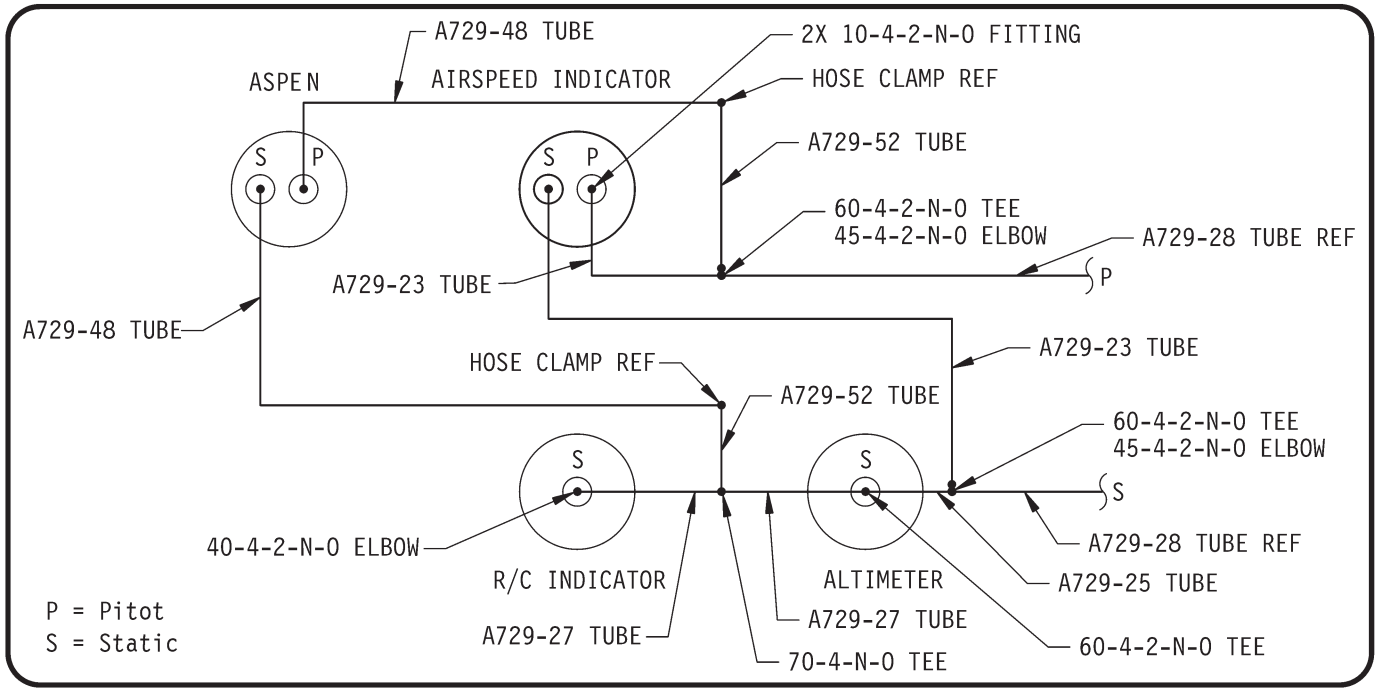


FIGURE 13-3 ASPEN PFD PITOT-STATIC SCHEMATIC

13.500 Optional Equipment

13.510 Aspen PFD and MFD Installations

Refer to R44 Illustrated Parts Catalog Figures 95-63 thru 95-71.

A. Description

R44 options include a single screen Aspen PFD or a dual screen Aspen PFD and MFD.

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

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

The Aspen MFD (Multifunction Display) is an LCD unit with displays for moving map navigation data, terrain, and traffic. Terrain and traffic may also be overlaid on moving map.

GPS position data is received from Garmin GTN series GPS for moving map and terrain displays. Aspen MFD also includes an internal terrain database.

TIS-A traffic data may be received from Garmin GTX330 transponder for moving map display; TIS-A traffic data is received from GTN series GPS for traffic display.

Heading and outside air temperature data is received from Aspen PFD. GPS position data may be received from Aspen PFD which includes a remote sensor module for backup GPS position data if primary GPS fails.

B. Schematics

Refer to Figure 14-23 for C800-1 Aspen PFD electrical schematic, and Figure 14-24 for C800-3 Aspen PFD and MFD electrical schematic.

Refer to Figures 13-1 and 13-3 for Aspen PFD pitot-static schematic, and Figures 13-1 and 13-5 for Aspen PFD and MFD pitot-static schematic.

C. Removal

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.

2. Gently depress blue tab(s) at top of Aspen PFD/MFD to release display(s) from mounting bracket(s).

3. PFD only: Disconnect pitot and static lines from display using quick-disconnect couplers. Temporarily cap pitot and static line fittings at display and in aircraft to prevent contamination.

4. Loosen screws securing airframe wiring harness connector(s) to display(s), unplug connector(s), and remove display(s).

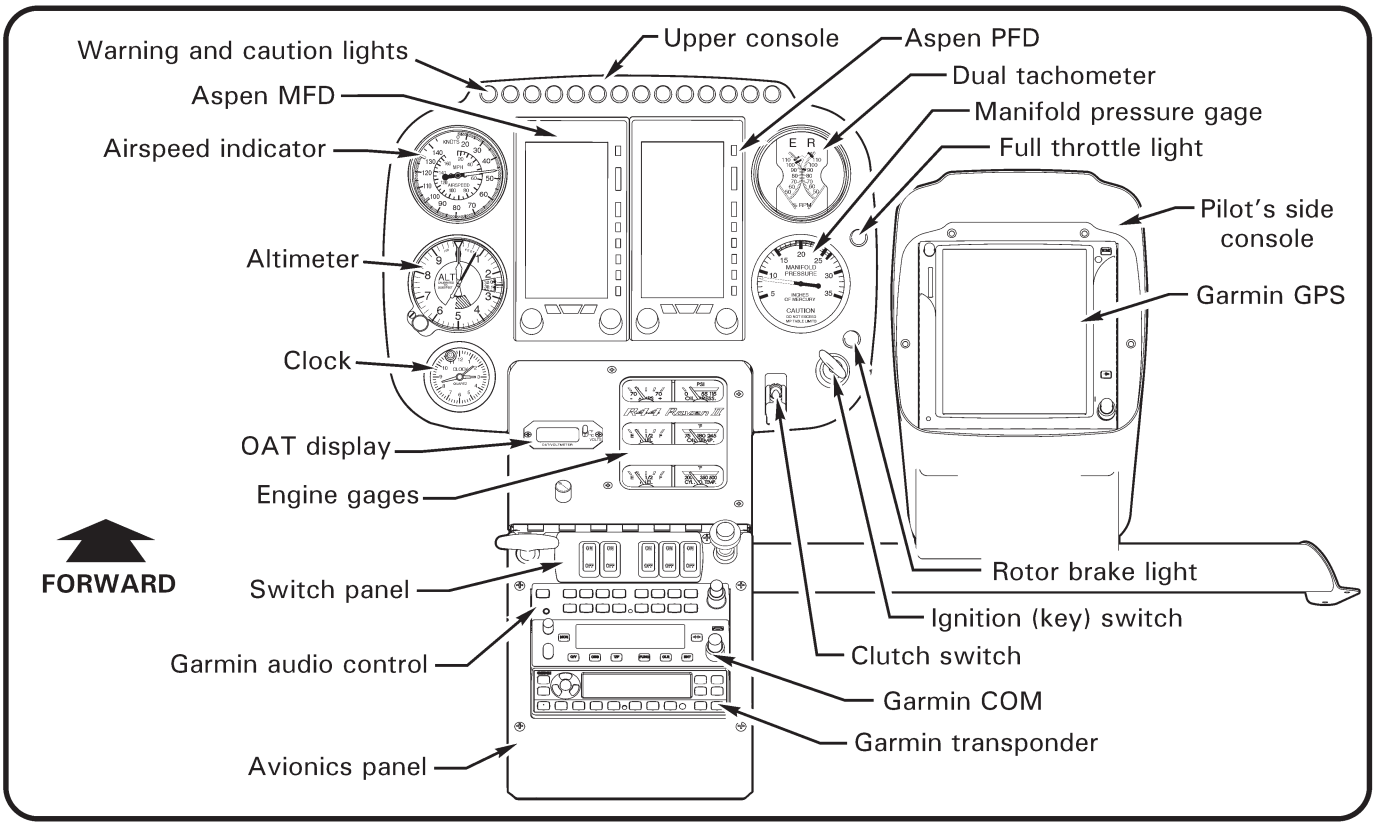


FIGURE 13-4 EIGHT-INSTRUMENT CONSOLE WITH ASPEN PFD AND MFD - TYPICAL (R44 II SHOWN)

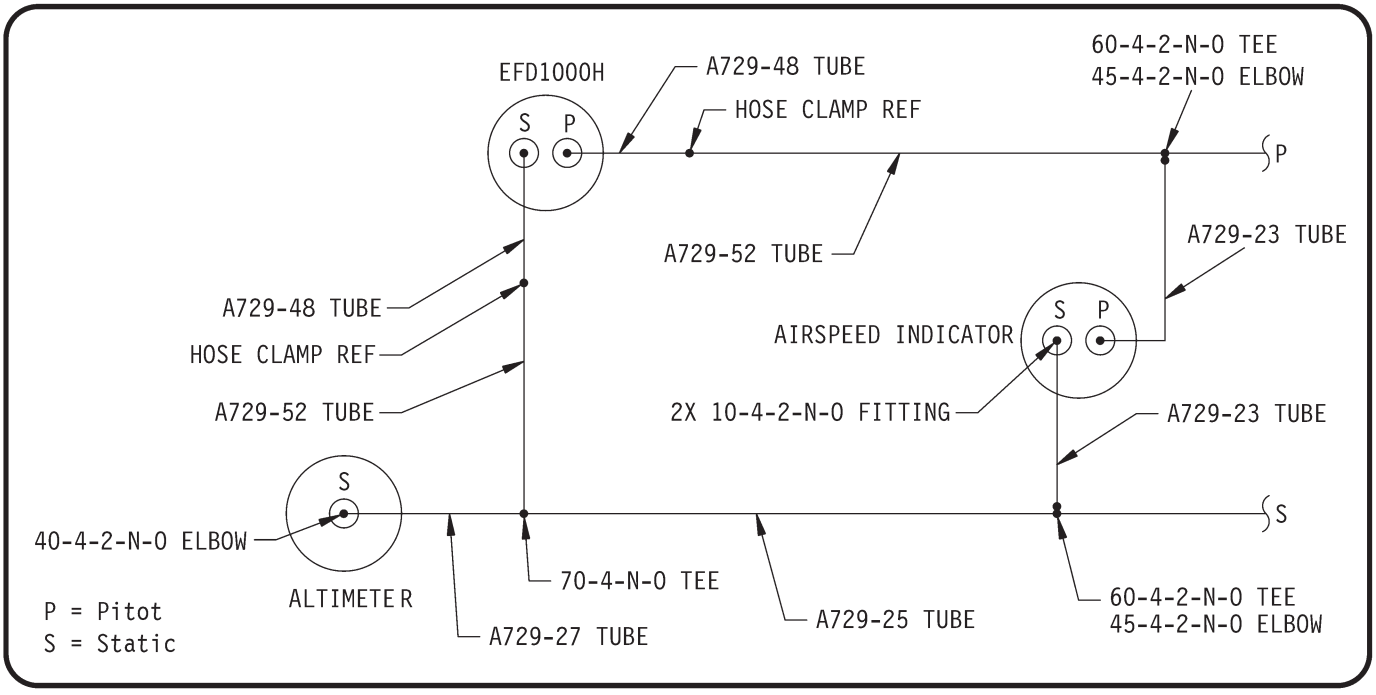


FIGURE 13-5 ASPEN PFD AND MFD PITOT-STATIC SCHEMATIC

13.510 Aspen PFD and MFD Installations (continued)

D. Installation

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.
2. Plug airframe wiring harness connector(s) into Aspen PFD/MFD display(s) and tighten screws. Verify security.
3. PFD only: Remove temporary fitting caps and connect pitot and static lines to display using quick-disconnect couplers.
4. Insert display(s) into mounting bracket(s) until blue tab(s) snap(s) into place. Verify security.
5. Push-in EFIS circuit breaker (7.5 amp) at panel. Turn battery & avionics switches on.
6. Perform appropriate functional checks per Aspen EFD1000H PFD / EFD500H MFD Pilot's Guide. Turn battery and avionics switches off.
7. Perform pitot-static leak check.

E. Antenna

Refer to Section 14.800 for antenna locations and R44 Illustrated Parts Catalog (IPC) Chapter 6.

NOTE

Do not use magnetized tools.

Removal

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.
2. Using plastic scraper, remove B270-1 sealant from around EFIS antenna at corners where it attaches to tailcone.
3. Disconnect antenna cable from antenna. Remove screws securing antenna and antenna ground wire to tailcone and remove antenna.

Installation

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

13.510 Aspen PFD and MFD Installations (continued)

F. Scheduled Maintenance and Inspections

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

G. Special Maintenance and Inspections

1. Turn battery and avionics switches off. Open circuit breaker panel and upper console.

2. Inspect condition of and verify no obvious damage to Aspen displays, pitot-static lines, metal braiding, copper bus bars, circuit breaker, and wiring. Verify no loose, chafed, or broken wires or terminals. Verify no evidence of arcing. Verify equipment security.

3. Secure circuit breaker panel and upper console. Perform ground checks per Part D steps 5 and 6.

CHAPTER 14

ELECTRICAL AND AVIONICS SYSTEMS

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CHAPTER 14

ELECTRICAL AND AVIONICS SYSTEMS

14.000 Electrical and Avionics Systems

14.001 Introduction

This section contains information for correcting difficulties that may arise in the electrical system. It includes a general description and some test and adjustment procedures.

14.002 Description

14-volt electrical systems include a 14-volt, 70-ampere capacity alternator (limited to 50 amps continuous), battery relay, alternator control unit and 12-volt battery.

28-volt electrical systems include a 28-volt, 70-ampere capacity (limited to 64 amps continuous) alternator, battery relay, alternator control unit, and 24-volt battery. A 130-amp capacity alternator, limited to 85 amps continuous, is standard on the Police version.

The battery is in a fiberglass container located on the lower left steel tube frame, in the nose under the upper console, or in the left-front baggage compartment. Police and E.N.G. versions have the battery suspended from the tailcone.

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

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

The alternator control unit (ACU) senses system voltage at the ammeter shunt via a remote sense wire. The 14-volt ACU has three functions: it regulates alternator output voltage to maintain a battery voltage of 13.7-13.9 volts, it warns of low-voltage by illuminating the ALT warning light if voltage decreases to 12.55-12.95 volts, and it protects against over-voltage by shutting off alternator field if voltage increases to 15.75-16.25 volts. The 28-volt ACU also has three functions: it warns of low-voltage by illuminating the ALT warning light if voltage decreases to 24.00-26.00 volts, it protects against over-voltage by shutting off alternator field if voltage increases to 32.00-33.40 volts, and it regulates alternator output voltage by modulating field current within a 0.25-1.00 volt window centered at 28.25-28.75 volts. This allows alternator output to more closely follow electrical load demands and reduces voltage fluctuations.

In addition to a circuit breaker, the clutch actuator circuit incorporates a low-amperage fuse to prevent a motor overload from tripping the circuit breaker and turning off the CLUTCH light prematurely, and to prevent motor burnout due to prolonged motor overload. This also results in drive belt overtensioning protection. A time delay is also included in the circuit to prolong actuator spring switch life, and to prevent overtensioning due to spring switch flutter resulting from excessive vibration. The time delay affects gearmotor operation only during Engage cycle; the time delay does not affect CLUTCH light operation and does not function during Disengage cycle. The time delay allows gearmotor operation 0.25 seconds after circuit completion (indicated by CLUTCH light illumination). Any circuit interruption (indicated by CLUTCH light extinguishing) instantly resets the time delay.

14.002 Description (continued)

The lighting system includes the anti-collision light, navigation lights, two landing lights, post and internal lights for instruments and an overhead map light. Landing lights are wired through the clutch switch, turning the lights off when disengaged. Post and internal instrument light brightness is adjustable via a wire-wound rheostat on early 14-volt ships, or via an electronic dimmer on later 14-volt and all 28-volt ships. The electronic dimmer will shut down if encountering a short-to-ground circuit; dimmer will reset when short is cleared.

Warning lights on the instrument panel include clutch, low oil pressure, low fuel, main rotor and tail rotor gearbox chip lights, main rotor gearbox over-temp, engine fire (sensor activates at 275 ± 10 °F), low rotor RPM light, low voltage (ALT), rotor brake, and starter engaged. R44 IIs additionally include fuel filter, aux fuel pump, and carbon monoxide warning lights.

The gage cluster includes an ammeter, oil pressure, oil temperature, cylinder head temperature and main and auxiliary fuel quantities. Also provided on this circuit are the carburetor air temperature (O-540 only) and outside air temperature. The map light is on the same breaker as a back-up in the event of a short and failure of the lighting system circuit.

The tachometer is an electronic engine and rotor dual tachometer. The sensor for the engine tach is a contact assembly (breaker points) in the engine-right magneto (helicopter left side). A Hall Effect sensor for, and receiving power from, the rotor tachometer senses passage of two magnets on the main rotor gearbox input yoke. Signals from these sensors are conditioned by solid state circuits inside the dual tachometer. Each tachometer circuit has a separate circuit breaker and is completely independent of the other. They can be powered by either the alternator or the battery and receive current from two redundant sources. Power to the tachometer is interrupted only when the master battery and alternator switches are off and the clutch switch is disengaged. All tachometers operate on 14 volts; 28-volt ships utilize two voltage regulators to change 28 volts to the 14 volts required by both tachometers.

CAUTION

The installation of electrical devices can affect the accuracy and reliability of the electronic tachometer; therefore, no electrical equipment may be installed in the R44 helicopter unless that particular installation is specifically approved by the factory.

CAUTION

When installing upper console, ensure multi-pin connectors are matched correctly. Both halves of number 1 connector have a white stripe. Crossing connections will result in damage to electrical system.

E.N.G. and Police versions each have an additional, right-side circuit breaker panel on the ledge just forward of the pilot's seat containing all circuit breakers for the optional E.N.G. or police equipment. The forward row of circuit breakers is connected to a 28-volt bus. The aft row of circuit breakers is connected to a 14-volt bus on E.N.G. versions while on police versions the outboard section of the aft row of circuit breakers is connected to a 14-volt bus. The 14-volt bus is powered by a 28- to 14-volt converter. A separate Master switch on the left side of the circuit breaker panel controls power to all E.N.G. or police equipment.

14.100 Dual Tachometer Adjustment

The C792 Dual Tachometer is pre-set at the factory. Slight variations between rotorcraft may require readjustment of the rotor side of the tachometer. To adjust:

1. Remove screws securing instrument face to upper console and carefully pull face aft.

2. Ground run the helicopter at 102% engine tachometer indication. Adjust screw on back of tachometer so rotor tachometer indicates 102%. Turn adjustment screw clockwise to increase and counter-clockwise to decrease rotor tachometer indication (0.4 turn equals approximately 1% change).

3. Install face.

4. If tachometer cannot be adjusted, replace or return to RHC for repair.

14.200 Low Rotor RPM Warning Unit Adjustment

When the collective is raised 0.2 to 0.4 inches (measured at grip) above fully down, the low-rotor RPM warning unit must activate the low-rpm warning horn and low-rpm light at 97% to 96% rotor RPM; horn and light must turn off above 96% to 97% rotor RPM.

The low rotor RPM warning unit is inside the upper console mounted on the left vertical panel. Adjustments are made by turning an exposed screw on warning unit, accessible by removing a black-plastic plug from a 3/8-inch diameter hole on the left vertical panel. The A569 warning unit's adjustment screw sensitivity is approximately 2 turns per 1% change. If warning unit cannot be adjusted to range stated above, it must be replaced.

14.300 Police and Electronic News Gathering (E.N.G.) Version Equipment

14.310 (Nucomm) HD Microwave System

Refer to R44 Illustrated Parts Catalog (IPC) Figures 90-21 and 90-27. Refer to MM Figures 14-3H, 14-3I, 14-3J, and 14-3K for microwave system installation wiring schematic.

14.311 (Nucomm) HD Microwave System - Controller

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Remove screws and washers securing ARC-CM-TX-RX-CR-01 controller to aft console. Carefully lift controller from console.
3. Loosen screws securing D-sub connector to controller receptacle and disconnect connector from controller. Remove controller.

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Position ARC-CM-TX-RX-CR-01 controller above aft console support and connect D-sub connector to controller receptacle. Tighten connector screws and verify security.
3. Position controller in support and install mounting washers and screws. Verify security.
4. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.312 (Nucomm) HD Microwave System - Transmitter

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Disconnect cable plugs from CMTX7-LITE transmitter.
3. Remove screws securing D429-12 angles and cable clamps to seat support and transmitter. Remove transmitter.

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Install screws securing D429-12 angles and cable clamps to seat support and CMTX7-LITE transmitter. Verify transmitter security.
3. Connect cable plugs to transmitter.
4. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.313 (Nucomm) HD Microwave System - Pod Antenna

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Disconnect cable plugs from PA8- or PA16- pod antenna and D618-1 amp assembly.
3. Have a second person support pod antenna. Remove screws and washers securing pod antenna to D586 brackets, and remove pod antenna.
4. Remove power amp per Section 14.314.

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Have a second person support PA8- or PA16- pod antenna. Install screws and washers securing pod antenna to D586 brackets. Verify pod antenna security.
3. Connect cable plugs to pod antenna.
4. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.314 (Nucomm) HD Microwave System - Power Amp

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Remove pod antenna per Section 14.313, as required, or disconnect cable plugs from amp assembly.
3. Remove screws securing amp assembly to PA8- or PA16- pod antenna, and remove amp and thermal pads.

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Align thermal pads, amp assembly, and PA8- or PA16- pod antenna fastener holes and install screws. Verify amp security.
3. Install pod antenna per Section 14.313, as required, or connect cable plugs to amp assembly.
4. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.320 (Vislink) HD Microwave System

Refer to R44 Illustrated Parts Catalog (IPC) Figures 90-23 and 90-27. Refer to MM Figures 14-3H, 14-3I, 14-3J, and 14-3K for microwave system installation wiring schematic.

14.321 (Vislink) HD Microwave System - Control Panel

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Remove screws and washers securing L1260 control panel to aft console. Carefully lift control panel from console.
3. Loosen screws securing D-sub connector to control panel receptacle and disconnect connector from control panel. Remove controller.

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Position L1260 control panel above aft console support and connect D-sub connector to control panel receptacle. Tighten connector screws and verify security.
3. Position control panel in support and install mounting washers and screws. Verify security.
4. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.322 (Vislink) HD Microwave System - L1600 Encoder Transmitter

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Disconnect cable plugs from L1600 encoder transmitter.
3. Remove screws securing transmitter to seat support, and remove transmitter.

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Install screws securing L1600 encoder transmitter to seat support. Verify transmitter security.
3. Connect cable plugs to transmitter.
4. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.322 (Vislink) HD Microwave System - HDT-1000 Encoder Transmitter

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Disconnect cable plugs from HDT-1000 encoder transmitter.
3. Remove hardware securing transmitter to D429-13 plate, and remove transmitter.

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Install hardware securing HDT-1000 transmitter to D429-13 plate. Verify transmitter security.
3. Connect cable plugs to transmitter.
4. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.323 (Vislink) HD Microwave System - Pod Antenna

Perform pod antenna removal and installation per Section 14.313.

14.324 (Vislink) HD Microwave System - Power Amp

Perform power amp removal and installation per Section 14.314.

14.330 Geneva Audio System

Refer to MM Figures 14-3L and 13-3M for geneva audio system installation wiring schematic.

14.331 Geneva Audio - Pilot Audio Panel

Refer to R44 Illustrated Parts Catalog (IPC) Figure 92-21.

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Remove screws securing D579-8 audio panel to radio tray, and remove audio panel.

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Position D579-8 audio panel in appropriate radio tray support and install two mounting screws. Verify security.
3. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.332 Geneva Audio System - Co-pilot Audio Panel

Refer to R44 Illustrated Parts Catalog (IPC) Figure 92-23.

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Remove screws securing D557-2 cover to D592-1 mount and D579-7 audio panel. Remove cover.
3. Remove screws securing mount to FM transceiver and cabin structure.
4. Loosen screws securing D-sub connector to audio panel receptacle and disconnect connector from audio panel.
5. Remove audio panel. Remove screws securing mount to audio panel and remove mount.

14.332 Geneva Audio System - Co-pilot Audio Panel (continued)

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Position D592-1 mount on D579-7 audio panel and install screws. Verify mount security.
3. Position audio panel in helicopter and connect D-sub connector to audio panel receptacle. Tighten connector screws and verify security.
4. Install screws securing mount to FM transceiver and cabin structure. Verify audio panel security.
5. Install screws securing D557-2 cover on audio panel. Verify cover security.
6. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.333 Geneva Audio System - Aft Audio Panels

Refer to R44 Illustrated Parts Catalog (IPC) Figure 92-25.

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Remove screws securing D579-7 or D579-9 audio panel to aft console. Carefully lift audio panel from console.
3. Loosen screws securing D-sub connector to audio panel receptacle and disconnect connector from audio panel. Remove audio panel.
4. Remove screws securing molding to audio panel and remove molding.

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Position molding on D579-7 or D579-9 audio panel and install screws. Verify molding security.
3. Position audio panel above appropriate aft console support and connect D-sub connector to audio panel receptacle. Tighten connector screws and verify security.
4. Position audio panel in support and install two mounting screws. Verify security.
5. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.334 Geneva Audio System - Router

Refer to R44 Illustrated Parts Catalog (IPC) Figure 92-27 and 92-31.

A. G13000 Digital Router Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Hinge forward left seat forward.
3. Loosen screws securing D-sub connectors and ground wires to G13000 digital router receptacles and disconnect connectors from router. Remove audio panel.
4. Remove screws, washers, and spacers securing router to cabin floor. Remove router.

B. G13000 Digital Router Removal Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Hinge forward left seat forward.
3. Position G13000 digital router on cabin floor and install spacers, washers, and screws. Verify router security.
4. Connect appropriate D-sub connectors and ground wires to router receptacles. Tighten connector screws and verify security.
5. Position audio panel in support and install two mounting screws. Verify security.
6. Hinge forward left seat aft. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

C. D579-2 Backplane Router Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Hinge forward left seat forward. Cut and discard ty-raps as required to disconnect C060-5 transmit switch wiring from harness at connectors.
3. Loosen screws securing exterior D-sub connectors and ground wires to D579-2 backplane router and disconnect connectors from router.
4. Remove screw securing #1140 wire to router case. Remove screws securing three covers to router case, to access interior wire connectors.
5. Loosen screws securing interior D-sub connectors to router and disconnect connectors from router. Move harness to the side.
6. From helicopter belly, remove screws and washers securing router to floor. Lift router up and out of seat compartment.

14.334 Geneva Audio System - Router (continued)

D. D579-2 Backplane Router Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Hinge forward left seat forward.
3. Position D579-2 backplane router in seat compartment. From helicopter belly, install screws and washers securing router to floor. Verify security.
4. If not previously accomplished, remove screws securing three covers to router case, to access interior wire connectors.
5. Connect appropriate D-sub connectors to router interior receptacles. Tighten connector screws and verify security.
6. Install screws securing three covers to router case. Install screw securing #1140 wire to router case.
7. Connect appropriate D-sub connectors to router exterior receptacles. Tighten connector screws and verify security.
8. Connect C060-5 transmit switch wiring to harness at connectors and install ty-raps as required. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads.
9. Hinge forward left seat forward. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.335 Geneva Audio - Transmit Switch

Refer to R44 Illustrated Parts Catalog (IPC) Figure 92-29.

A. Removal

1. Turn battery switch off & pull-out associated circuit breaker.
2. Unplug B121-1 transmit switch assembly from seat support. Hinge forward left seat forward.
3. Cut and discard ty-raps as required to disconnect transmit switch wiring from harness at connectors.
4. Remove hardware securing C060-5 transmit switch assembly to seat support, and remove switch assembly.

B. Installation

1. Turn battery switch off & pull-out associated circuit breaker.
2. Hinge forward left seat forward.
3. Position C060-5 transmit switch assembly against seat support and install hardware. Verify switch security.
4. Connect switch assembly wiring to harness at connectors and install ty-raps as required. Cinch ty-raps until snug without over-tigthening, and trim tips flush with heads.
5. Hinge forward left seat forward. Plug B121-1 transmit switch assembly in seat support receptacle.
6. Push-in associated circuit breaker & turn battery switch on. Perform appropriate post-installation function checks. Turn battery switch off.

14.400 Troubleshooting

Following are some troubles and corrections. When investigating trouble, eliminate causes one by one, beginning with the most probable.

14.405 A569 Low Rotor RPM Warning Unit

Perform following tests prior to replacing A569 low rotor-rpm warning unit:

1. Verify:
   a. Low RPM light bulb is functional.
   b. Battery switch off.
   c. Full-down collective.
   d. Horn circuit breaker in.
2. Access and disconnect both horn and A569 low rotor-rpm warning unit from airframe electrical wiring.
3. Turn battery switch on and verify Horn Start circuit breaker remains in. If Horn Start circuit breaker pops then -70 wire is shorted to ground; repair as required. Turn battery switch off.
4. On the warning unit's airframe electrical connector, install a jumper between wires -70 & -75.
5. Turn battery switch on and verify Horn Start circuit breaker remains in. If Horn Start circuit breaker pops then a short-to-ground exists in -75 wire and/or collective-activated V3-1 switch; repair as required.
6. Fully raise collective and verify Horn Start circuit breaker remains in and Low RPM light illuminates. If Horn Start circuit breaker pops then a short-to-ground exists in -76 wire and/or -78 wire and/or collective-activated V3-1 switch; repair as required. If Low RPM light does not illuminate then collective-activated V3-1 switch is faulty or misadjusted and/or an open exists in -70, -75, or -76 wires.
7. Slowly raise and lower collective fully several times while simultaneously manipulating throttle. Verify Horn Start circuit breaker remains in and Low RPM light remains illuminated whenever collective is raised. If Horn Start circuit breaker pops then a short-to-ground condition is occurring in -70, -75, or -76 wires and/or collective-activated V3-1 switch due to collective movement. Check for pinched/rubbing wiring and repair as required.
8. Turn battery switch off. Connect horn to airframe wiring.
9. Turn battery switch on. Raise collective and verify horn activates and has consistent tone. If Horn Start circuit breaker pops then horn is faulty and/or -78 wire is shorted to ground; repair as required. If horn fails to activate then -79 wire is open or horn is faulty; repair as required. If tone is inconsistent then horn is faulty and/or poor connections exist; repair as required.

14.405 A569 Low Rotor RPM Warning Unit (continued)

10. Check A999 master radio relay current draw:

    a. Battery switch off and belt tension actuator fully disengaged.

    b. Disconnect A569 low-rpm warning unit's connector and place an ammeter in series (positive lead on pin 1 0) between pins 1 0 and 11 on airframe side of connector.

    c. Battery switch on, Horn Start and Clutch Start circuit breakers in, avionics off, rotor brake released, mixture at idle cut-off.

    d. Select key switch to Start (Both on Raven lis) position and crank engine. Note and record current draw at ammeter while cranking engine. Select key switch to Off position.

    e. Disconnect 582 wire at tab on starter solenoid and isolate connector (do not let it ground). Select key switch to Start position. Note and record current draw at ammeter; for 14-volt systems current should be 94-1 56 milliamps and a buzzing sound should be heard from the starter vibrator (for 28-volt systems current should be 40-70 milliamps and starter vibrator should make no noise). Select key switch to Off position.

11. Check starter circuit:

    a. Battery switch off and belt tension actuator fully disengaged.

    b. Disconnect A569 low-rpm warning unit's connector and jump pins 10 and 11 on airframe side of connector.

    c. Battery switch on, Horn Start and Clutch Start circuit breakers 1n, rotor brake released, mixture at idle cut-off.

    d. Select key switch to Start position and crank engine. If engine does not crank there is a problem in the starter circuit. If engine cranks then there is a problem in either the A569 unit or the sense circuit.

12. Check A569 sense circuit:

    a. Battery switch on.

    b. Momentarily engage clutch and verify Clutch light illuminates then disengage clutch completely (switch to remain disengaged throughout this sequence).

    c. Battery switch off.

    d. Disconnect D602 time delay connector. Ground airframe-side plug's pin 1 thru a suitable voltage (post-light type) lamp.

CAUTION

Failure to ground pin 1 thru a suitable voltage lamp (such as direct grounding) may result in wiring damage.

14.405 A569 Low Rotor RPM Warning Unit (continued)

12. e. Verify less than 200 ohms (20 ohm nominal for 14-volt system; 70 ohm nominal for 28-volt system) to ground at pin 4 and at pin 5 on ship side of A569 connector.

    f. Battery switch on.

    g. With A569-5 unit connected to airframe harness, verify voltage does not exceed 0. 5V from pin 4 to ground and from pin 5 to ground.

    h. Battery switch on, Horn Start and Clutch Start circuit breakers 1n, rotor brake released, mixture at idle cut-off.

    i. Select key switch to Start position and crank engine. Failure of engine to crank indicates problem in A569 unit.

13. Upon completion of preceding tests, a faulty A569 low rotor-rpm warning unit may be replaced and adjusted per Section 14.200.

14.410 Electrical Trouble-Shooting

TROUBLE	PROBABLE CAUSE	CORRECTION
No electrical power	Battery terminals corroded	Clean terminals
	Bad or no ground	Clean ground path
	Tripped circuit breaker	Check circuit, if circuit checks ok, reset circuit breaker
	Low battery voltage	Check battery. Recharge if necessary.
	Low or no alternator output	Check alternator belt tension, wiring, and alternator control unit
	Bad wire or terminal	Replace
Engine cranks slowly, but will not start	Low battery voltage	Service or replace battery
	Insufficient drive belt deflection	Adjust actuator down-limit screw
	Corroded or dirty battery or starter terminals	Clean terminals
	Bad starter relay, wires or terminals	Replace defective parts
Engine cranks, but will not start	Key switch in off position (IO-540)	Place switch in BOTH position
	Bad ignition switch	Replace switch
	Bad starting vibrator	Repair or replace vibrator
	Incorrect retard timing	Adjust retard magneto internal timing
Starter fails to operate	Rotor brake engaged	Release rotor brake
	Low battery charge	Check and recharge if necessary
	Circuit breakers tripped	Reset both HORN START and CLUTCH START circuit breakers
	Actuator not fully disengaged	Engage actuator momentarily, then fully disengage
	Loose connections	Check all wiring (refer to wiring diagram)
	Defective wiring	Check all wiring (refer to wiring diagram
	Starter motor - burned winding or bad brushes	Repair or replace starter
	Faulty A569 low-RPM warning unit	Check unit per Section 14.405

14.410 Electrical Trouble-Shooting (cont'd

	TROUBLE	PROBABLE CAUSE	CORRECTION
5)	Discharged	Battery worn out	Replace battery
		Charging rate not set correctly	Check alternator control unit output. Replace if below 13.4 volts
		Standing too long	Remove and recharge battery if left in unused helicopter for four or more weeks.
6)	Starter - low cranking speed	Same electrical causes as listed under "starter fails to operate"	Same remedies listed for those troubles.
7)	Battery life is short	Impurities in electrolyte	Replace battery.
		Low charging rate	Check ACU output. If below 13.4 volts replace the unit.
8)	Electrolyte runs out of battery	Too much water added to battery.	Drain and keep battery at proper fluid level and specific gravity.
	Charging rate too high.	Check the ACU output voltage. Replace if necessary.	
9)	Excessive electrolyte inside container	Spillage from overfilling	Use care in adding water.
		Vent lines leaking or clogged	Repair or clean.
		Charging rate too high	Check ACU output voltage. Replace if necessary.

14.410 Electrical Trouble-Shooting (cont'd

	TROUBLE	PROBABLE CAUSE	CORRECTION
10)	Battery consumes excessive water	Charging rate too high (if in all cells)	Check ACU output voltage. Replace if necessary.
11)	Alternator fails to supply charging current with engine operating.	ACU failure Open field circuit wiring	Check ACU output voltage. Replace if necessary. Repair or replace wiring to field circuit.
12)	Starter kicks back while cranking (may cause broken starter or starter ring gear)	Retard breaker contact in the engine left magneto pushed out or no connection between the lead and the magneto contact	Measure the retard breaker lead connection. Connector lead must be 0.609 in. ± 0.10. There must be a small amount of springback when the connector is placed into the magneto.
		Incorrect ignition vibrator wiring	Trace ignition vibrator wiring from ignition switch to magneto. Correct as required.
		Bad ignition switch	Replace ignition switch.
		Bad ignition vibrator	Replace vibrator
		Incorrect internal magneto retard breaker timing. Engine left magneto	Correct as required Consult TCM Aircraft Products literature.
		Open circuit in ignition vibrator wiring circuit	Repair or replace wiring for ignition vibrator

14.430 Clutch Actuator Electrical Trouble-Shooting (cont'd)

TROUBLE		PROBABLE CAUSE
Actuator disengaged will not engage WARNING (yellow)		
Light on	Light off	
X		1) Motor seized.
X		2) Motor fuse blown (3-amp).
X		3) Open circuit in motor wiring.
X		4) Overtravel switch assy tripped.
	X	5) No voltage at circuit breaker.
	X	6) Circuit breaker tripped.
	X	7) Up limit switch stuck (Normally closed).
	X	8) -88 wire not grounded.

14.430 Clutch Actuator Electrical Trouble-Shooting (cont'd)

TROUBLE		PROBABLE CAUSE
Actuator disengaged will not engage WARNING (yellow)		
Light on	Light off	
X		1) Motor assembly seized.
X		2) Motor fuse blown (3-amp).
X		3) Open circuit in motor wiring.
X		4) Overtravel switch assy tripped.
	X	5) No voltage at circuit breaker.
	X	6) Circuit breaker tripped.
	X	7) Down limit switch stuck (Normally closed).
	X	8) -88 wire not grounded.

14.420 Instrument Trouble-Shooting

	TROUBLE	PROBABLE CAUSE	CORRECTION
1)	Engine gauge(s) not reading	Tripped circuit breaker	Check circuit. If circuit checks ok, reset circuit breaker.
		No power or ground	Check power and ground wires.
		Bad sender or wire	Check with new one, replace sender or wire if necessary.
		Bad gauge	Check with new gauge. Replace if necessary.
2)	Erratic or intermittent reading	Loose power, ground or sender wire. Loose battery connection	Check all three. Tachometer will be erratic when alternator switch turned off if there is a bad battery connection.
3)	Excessively high or low gauge readings	Bad gauge	Check with new gauge.
		Crossed or shorted wire	Check circuit

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14.430 Clutch Actuator Electrical Trouble-Shooting (cont'd)

TROUBLE	PROBABLE CAUSE
In flight Actuator engaged warning (yellow)	
Flickers	1) Actuator leaf spring improperly adjusted. 2) C190 drive belts not matched properly. 3) Open circuit in motor wiring 4) C184-1 or C007-3 bearing running rough.
Comes on for 1-6 seconds	Normal operation of actuator as it re-tensions drive belts.
Comes on for over 6 seconds	1) Drive belts stretched beyond limit of actuator overtravel switch. Belts must be replaced. 2) Actuator overtravel switch activated by outside force.
Comes on for over 10 seconds	1) Check sheaves and belts for excessive wear. 2) Check column springs for operation. 3) Verify fanwheel balance. 4) Check or change out time delay. 5) Remove actuator and send to RHC for evaluation.

14.440 Electrically Powered Instruments Accuracy Check

Using Vibrex 2000 balancing equipment (or similar) capable of displaying ±1 rpm resolution and calibrated within one year, verify tachometer accuracy per following tables. Connect equipment in accordance with R22 Maintenance Manual (MM) sections 10.221 and 6.240 (use photocell instead of Strobex per Figure 6-4A). Operate aircraft at noted tachometer indications and verify engine and rotor rpms as specified. Tachometer needles are 1% wide.

C792-x Dual Tachometer

Tachometer indication	Engine RPM	Rotor RPM
96%	2556-2561	383-384
100%	2662-2667	399-400
102%	2715-2721	529-530

The rotor tachometer may be adjusted per MM section 14.100. No other adjustments are permitted. If tachometer does not meet accuracy tolerance then it must be replaced or returned to RHC for repair.

A058-10 Carb. Air Temp. Probe

0 degrees	=	89.68/91.08 ohms
15 degrees	=	95.67/98.07 ohms
16 degrees	=	96.10/98.50 ohms
17 degrees	=	96.54/98.94 ohms
18 degrees	=	96.97/99.37 ohms
19 degrees	=	97.40/99.80 ohms
20 degrees	=	97.83/100.23 ohms
21 degrees	=	98.27/100.67 ohms
22 degrees	=	98.70/101.10 ohms
23 degrees	=	99.13/101.53 ohms
24 degrees	=	99.56/101.96 ohms
25 degrees	=	100.00/102.40 ohms

R44 C604-2 Carb. Air Temp. Gage at 13.7 Vdc;
R44 C604-8 Carb. Air Temp. Gage at 28.2 Vdc

77.40 ohms	=	-30 ± 2	degrees C
81.73 ohms	=	-20 ± 1.75	degrees C
86.05 ohms	=	-10 ± 1.5	degrees C
90.38 ohms	=	0 ± 1	degrees C
94.71 ohms	=	10 ± 1.5	degrees C
99.03 ohms	=	20 ± 1.75	degrees C
103.36 ohms	=	30 ± 2	degrees C

Example: Replacing the carburetor air temperature probe with a ¼ to 1-watt 100-ohm resistor should result in a indication of approximately 21 degrees C (measure exact resistor value & refer to above). A probe dipped in a Styrofoam cup full of crushed ice and water should indicate 90.38 ohms resistance per above table. Probe installation torque is 3 to 4 inch-pounds; over-torquing probe will result in damage.

14.440 Electrically Powered Instruments Accuracy Check (cont'd)

Following instrument cluster gages are calibrated at 20 to 25 degree angle from horizontal.

Fuel level senders should have 90 ± 2 ohms resistance when fully up (full fuel) and 0 to 0.5 ohm when fully down (no fuel). Perform fuel sender calibration per MM section 12.230 whenever sender is replaced, or if factory-set fuel gage potentiometers have been disturbed. On backside of each fuel gage are "Null" and "Gain" potentiometer screws, covered with aluminum tape pressed against the screw heads to prevent rotation. "Null" potentiometer is adjusted so gage indicates empty at 0.7 ohm sender circuit resistance; "Gain" is adjusted so gage indicates half at 42 ohms sender circuit resistance. Calibration values are:

Fuel Quantity Gages
6246-00473 (14V) & 6246-00716 (28V)

0.70 ohm =	E (empty) -1, +0	pointer width
21.20 ohms =	1/4 full ± 1	pointer width
42.00 ohms =	1/2 full ± 1	pointer width
67.50 ohms =	3/4 full ± 1	pointer width
90.00 ohms =	F (full) ± 1	pointer width

Ammeter
6246-00468 (14V & 28V)

-104 mV =	-70 amps ± 1	pointer width
-52 mV =	-35 amps ± 1	pointer width
0 mV =	0 amps ± ¼	pointer width
+52 mV =	+35 amps ± 1	pointer width
+104 mV =	+70 amps ± 1	pointer width

CHT Probe
3080-38 (14V & 28V)

200 degrees F =	745 ohms
475 degrees F =	38 ohms
500 degrees F =	32 ohms

CHT Gages
6246-00088 (14V) & 6246-00718 (28V)

745 ohms =	200 degrees F ± 1 pointer width
110 ohms =	350 degrees F ± 1 pointer width
34 ohms =	500 degrees F ± ½ pointer width

Oil Pressure Sending Unit
B308-1 (14V & 28V)

0 psi =	5-13 ohms
29 psi =	48-57 ohms
58 psi =	84-94 ohms
87 psi =	119 131 ohms
115 psi =	145-161 ohms

115-psi redline Oil Pressure Gages
6246-00647 (14V) & 6246-00715 (28V)

9 ohms =	0 psi ± 1 pointer width
46 ohms =	25 psi ± 1 pointer width
84 ohms =	55 psi ± 1 pointer width
131 ohms =	95 psi ± 1 pointer width
152 ohms =	115 psi ± 1 pointer width

14.440 Electrically Powered Instruments Accuracy Check (cont'd

Oil Temperature Sender A760-1 (14V)	Oil Temperature Gage 6246-00090 (14V) 6246-00717 (28V)
100 degrees F = 497 ohms	903.5 ohms = 75 degrees F ± 1 pointer width
150 degrees F = 179 ohms	100 ohms = 180 degrees F ± 1 pointer width
200 degrees F = 72 ohms	36 ohms = 245 degrees F ± 1 pointer width
250 degrees F = 34 ohms	

14.500 Electrical Load Analysis

To calculate the total electrical load for a specific helicopter, identify all items of equipment installed on the helicopter from the table below and sum the corresponding continuous and intermittent loads.

Maximum continuous alternator load is given in the table below:

System Voltage	Alternator Rating	Maximum Continuous Load
14V	70 amp	50 amps
28V	70 amp	64 amps
28V	130 amp	85 amps

Intermittent loads are provided for reference.

Alternately, the electrical load may be measured directly at the battery output terminal with the alternator switched off and all other equipment turned on. The measured load may be scaled by the ratio of battery voltage to nominal system voltage to obtain a value that is compared with the alternator load limit.

WARNING

Field (non-factory) installation of electronic equipment can be hazardous. Due to the compactness of the console and tunnel containing the controls and wire bundles, installation of any additional wires can interfere with flight controls. Electronic tachometers, warning systems, and navigation equipment essential to flight are sensitive to interference from other electrical devices. The reliability and accuracy of the tachometers is essential for safe operation of the helicopter, and installation of an electrical device not tested and approved by RHC may result in a hazardous condition.

A. 14-Volt System

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
MAIN BUS					
ESSEX BATTERY RELAY	1	0.75	0.75	0.75	0.75
KISSLING BATTERY RELAY	1	0.35	0.35	0.35	0.35
ALTERNATOR FIELD	1	2.40	2.40	2.40	2.40
AVIONICS RELAY	1	0.13	0.13	0.13	0.13
ENGINE GAGE CLUSTER	1	0.60	0.60	0.60	0.60
HOURMETER	1	0.03	0.03	0.03	0.03
CARB AIR TEMP	1	0.13	0.13	0.13	0.13
AMMETER	1	0.50	0.50	0.50	0.50
DIGITAL OAT GAGE	1	0.15	0.15	0.15	0.15
MAP LIGHT	1	0.58	0.58	0.58	0.58

14.500 Electrical Load Analysis (continued)

A. 14-Volt System (continued)

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
MAIN BUS (continued)					
WARNING LIGHTS	10	0.00	0.08	0.00	0.80
FULL THROTTLE CAUTION LIGHT	1	0.00	0.08	0.00	0.08
LOW RPM HORN	1	0.00	0.25	0.00	0.25
RPM GOVERNOR MOTOR	1	0.00	1.50	0.00	1.50
BELT TENSION ACTUATOR	1	0.00	3.50	0.00	3.50
TRIM MOTORS	2	0.00	1.15	0.00	2.30
HYDRAULIC SHUTOFF SOLENOID	1	0.00	1.54	0.00	1.54
AUX POWER PLUGS (MAX)	1	10.00	10.00	10.00	10.00
HEATED PITOT	1	8.00	8.00	8.00	8.00

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
TACH BUS					
DUAL TACHOMETER (E)	1	0.10	0.10	0.10	0.10
DUAL TACHOMETER (R)	1	0.10	0.10	0.10	0.10

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
LIGHTS BUS					
POSITION LIGHTS (L, R, & AFT, INCANDESCENT)	3	2.20	2.20	6.60	6.60
POSITION LIGHTS (L & R, LED)	2	0.25	0.25	0.50	0.50
POSITION LIGHT (AFT, LED)	1	0.30	0.30	0.30	0.30
MAST MOUNTED POS LIGHT RELAY	1	0.20	0.20	0.20	0.20
MAST MOUNTED POSITION LIGHTS	2	2.20	2.20	4.40	4.40
MAST MOUNTED POSITION LIGHTS (LED)	2	0.25	0.25	0.50	0.50
OVERHEAD PANEL LIGHT	1	1.00	1.00	1.00	1.00
POST LIGHTS	7	0.08	0.08	0.56	0.56
INSTRUMENT LIGHTS	4	0.20	0.20	0.80	0.80
LANDING LIGHT RELAY	1	0.20	0.20	0.20	0.20
LANDING LIGHTS (INCANDESCENT)	2	7.70	7.70	15.40	15.40
LANDING LIGHTS (HID)	2	2.90	9.52	5.80	19.04
ANTI-COLLISION LIGHT & POWER SUPPLY	1	3.20	3.20	3.20	3.20
ANTI-COLLISION LIGHT (FORWARD)	1	3.40	3.40	3.40	3.40

14.500 Electrical Load Analysis (continued)

A. 14-Volt System (continued)

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
LIGHTS BUS (continued)					
ANTI-COLLISION LIGHT (LED)	1	0.90	4.00	0.90	4.00
ANTI-COLLISION LIGHT (LED, FORWARD)	1	0.90	4.00	0.90	4.00

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
AVIONICS					
KY197A COM	1	0.80	6.00	0.80	6.00
GTR225B COM	1	0.59	5.90	0.59	5.90
KX155 NAV/COM	1	0.40	6.00	0.40	6.00
KX165 NAV/COM	1	0.70	8.50	0.70	8.50
GNC420 COM/GPS	1	2.44	8.40	2.44	8.40
GNS430 COM/NAV/GPS	1	2.44	8.40	2.44	8.40
GNS530 COM/NAV/GPS	1	2.84	8.80	2.84	8.80
GTN625/635/650 COM/NAV/GPS	1	2.65	6.97	2.65	6.97
GTN725/750 COM/NAV/GPS	1	3.45	10.22	3.45	10.22
KR87 ADF	1	1.24	1.24	1.24	1.24
KN63 DME	1	1.21	1.21	1.21	1.21
GARMIN RADIO NAVIGATION INDICATOR	1	0.41	0.41	0.41	0.41
KING RADIO NAVIGATION INDICATOR	1	0.08	0.08	0.08	0.08
MARKER BEACON	1	0.50	0.50	0.50	0.50
GARMIN TRANSPONDER	1	1.10	3.10	1.10	3.10
GDL88 ADS-B IN	1	1.28	1.28	1.28	1.28
KCS55A HSI	1	3.23	3.23	3.23	3.23
RADAR ALTIMETER	1	1.45	1.45	1.45	1.45
AA12S AUDIO CONTROL (SINGLE, STEREO)	1	1.00	1.00	1.00	1.00
AMS42 DUAL AUDIO CONTROL	1	0.57	0.57	0.57	0.57
AIR COMM SINGLE AUDIO CONTROL	1	1.00	1.00	1.00	1.00
AIR COMM DUAL AUDIO CONTROL	1	3.00	3.00	3.00	3.00
GMA 350H AUDIO CONTROL	1	0.80	1.50	0.80	1.50
ASPEN EFD 500H EFD	1	1.60	1.60	1.60	1.60
ASPEN EFD 1000H PFD	1	4.80	4.80	4.80	4.80
ATTITUDE HORIZON (MECHANICAL)	1	0.54	1.40	0.54	1.40
ATTITUDE HORIZON (LCD)	1	0.20	0.20	0.20	0.20

14.500 Electrical Load Analysis (continued)

A. 14-Volt System (continued)

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
AVIONICS (continued)					
DIRECTIONAL GYRO	1	0.44	1.40	0.44	1.40
TURN COORDINATOR	1	0.70	0.70	0.70	0.70
KG102A GYRO	1	3.00	3.00	3.00	3.00
HELISAS	1	4.29	4.29	4.29	4.29
COOLING BLOWER	1	0.30	0.30	0.30	0.30

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
MARINE AVIONICS					
ICOM IC-M412 MARINE TRANSCIEVER	1	1.50	5.50	1.50	5.50
VERTEX VX-2200 FM TRANSCIEVER	1	2.50	11.00	2.50	11.00
KENWOOD TK-7160 OR TK8160 FM TRANSCIEVER	1	1.00	8.00	1.00	8.00
KENWOOD TK-7180 OR TK8180 FM TRANSCIEVER	1	1.00	9.00	1.00	9.00
YAESU FT-8800R FM TRANSCIEVER	1	0.50	8.00	0.50	8.00
GPSMAP 169 MARINE GPS	1	0.29	0.29	0.29	0.29

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
OTHER EQUIPMENT					
STARTER RELAY	1	0.00	15.00	0.00	15.00
STARTING VIBRATOR	1	0.00	2.50	0.00	2.50
STARTER MOTOR	1	0.00	200.00	0.00	200.00
CLOCK, STANDARD	1	0.02	0.02	0.02	0.02
CLOCK, DIGITAL	1	0.00	0.00	0.00	0.00

14.500 Electrical Load Analysis (continued)

B. 28-Volt System

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
MAIN BUS					
ALTERNATOR FIELD (70 AMP)	1	2.40	2.40	2.40	2.40
ALTERNATOR FIELD (130 AMP)	1	4.00	4.00	4.00	4.00
AMMETER	1	0.50	0.50	0.50	0.50
EATON BATTERY RELAY	1	0.50	0.50	0.50	0.50
KISSLING BATTERY RELAY	1	0.25	0.25	0.25	0.25
AVIONICS RELAY	1	0.10	0.10	0.10	0.10
CARB AIR TEMP	1	0.07	0.07	0.07	0.07
MAP LIGHT	1	0.30	0.30	0.30	0.30
MAP LIGHT (LED)	1	0.02	0.02	0.02	0.02
DIGITAL OAT GAGE	1	0.15	0.15	0.15	0.15
ENGINE GAGE CLUSTER	1	0.29	0.29	0.29	0.29
HOURMETER	1	0.02	0.02	0.02	0.02
HYDRAULIC SHUTOFF SOLENOID	1	0.80	0.80	0.80	0.80
LOW RPM HORN	1	0.00	0.25	0.00	0.25
LOW RPM WRG. UNIT	1	0.00	0.16	0.00	0.16
WARNING LIGHTS	12	0.00	0.04	0.00	0.48
RPM GOVERNOR MOTOR & CONVERTER	1	0.60	0.60	0.60	0.60
BELT TENSION ACTUATOR	1	0.00	1.40	0.00	1.40
TRIM MOTORS & CONVERTER	2	0.55	1.00	1.10	2.00
ELECTRIC FUEL PUMP	1	0.00	3.00	0.00	3.00
FUEL PRESS WARNING LIGHT	1	0.00	0.04	0.00	0.04
FUEL PUMP RELAY	1	0.00	0.09	0.00	0.09
FULL THROTTLE CAUTION LIGHT	1	0.00	0.04	0.00	0.04
AUX POWER PLUGS (MAX)	1	10.00	10.00	10.00	10.00
HEATED PITOT	1	4.00	4.00	4.00	4.00

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
TACH BUS					
DUAL TACHOMETER (E)	1	0.03	0.03	0.03	0.03
DUAL TACHOMETER (R)	1	0.04	0.04	0.04	0.04

14.500 Electrical Load Analysis (continued)

B. 28-Volt System (continued)

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
LIGHTS BUS					
INSTRUMENT LIGHTS	8	0.10	0.10	0.80	0.80
LANDING LIGHT RELAY	1	0.08	0.08	0.08	0.08
LANDING LIGHTS (INCANDESCENT)	2	3.57	3.57	7.14	7.14
LANDING LIGHTS (HID)	2	1.60	5.25	3.20	10.50
MAST MOUNTED POS LIGHT RELAY	1	0.20	0.20	0.20	0.20
OVERHEAD PANEL LIGHT	1	0.50	0.50	0.50	0.50
POSITION LIGHTS (INCANDESCENT)	3	1.10	1.10	3.30	3.30
POSITION LIGHTS (L & R, LED)	2	0.25	0.25	0.50	0.50
POSITION LIGHT (AFT, LED)	1	0.30	0.30	0.30	0.30
POSITION LIGHTS (MAST MOUNTED, INCANDESCENT)	2	2.20	2.20	4.40	4.40
POSITION LIGHT (MAST MOUNTED, LED)	2	0.25	0.25	0.50	0.50
POST LIGHTS	7	0.04	0.04	0.28	0.28
ANTI-COLLISION LIGHT & POWER SUPPLY	1	1.70	1.70	1.70	1.70
ANTI-COLLISION LIGHT (FORWARD)	1	1.80	1.80	1.80	1.80
ANTI-COLLISION LIGHT (LED)	1	0.67	3.00	0.67	3.00
ANTI-COLLISION LIGHT (LED, FORWARD)	1	0.67	3.00	0.67	3.00

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
AVIONICS					
KY196A COM	1	1.00	5.00	1.00	5.00
GTR225B COM	1	0.28	2.60	0.28	2.60
GNC420 COM/GPS	1	1.22	4.20	1.22	4.20
GNS430 COM/NAV/GPS	1	1.22	4.20	1.22	4.20
GNS530 COM/NAV/GPS	1	1.42	4.40	1.42	4.40
GTN625/635/650 COM/NAV/GPS	1	1.31	4.41	1.31	4.41
GTN725/750 COM/NAV/GPS	1	1.71	4.71	1.71	4.71
KTR909 UHF TRANSCIEVER	1	0.60	8.00	0.60	8.00
KX155 NAV/COM	1	0.40	6.00	0.40	6.00
KX165 NAV/COM	1	0.70	8.50	0.70	8.50
KR87 ADF	1	0.62	0.62	0.62	0.62
KN63 DME	1	0.61	0.61	0.61	0.61
GARMIN RADIO NAVIGATION INDICATOR	1	0.10	0.10	0.10	0.10

14.500 Electrical Load Analysis (continued)

B. 28-Volt System (continued)

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
AVIONICS (continued)					
KING RADIO NAVIGATION INDICATOR	1	0.06	0.06	0.06	0.06
MARKER BEACON	1	0.50	0.50	0.50	0.50
GARMIN TRANSPONDER	1	0.85	1.60	0.85	1.60
GDL88 ADS-B IN	1	0.64	0.64	0.64	0.64
KCS55A HSI	1	1.73	1.73	1.73	1.73
RADAR ALTIMETER	1	0.73	0.73	0.73	0.73
GMA 350H AUDIO CONTROL	1	0.40	1.00	0.40	1.00
AMS42 DUAL AUDIO CONTROL	1	0.41	0.41	0.41	0.41
AA12S AUDIO CONTROL (SINGLE, STEREO)	1	0.80	0.80	0.80	0.80
AIR COMM SINGLE AUDIO CONTROL	1	0.50	0.50	0.50	0.50
AIR COMM DUAL AUDIO CONTROL	1	1.50	1.50	1.50	1.50
ASPEN 500H EFD	1	0.80	0.80	0.80	0.80
ASPEN 1000H PFD	1	2.40	2.40	2.40	2.40
ATTITUDE HORIZON W/INCL (MECHANICAL)	1	0.27	0.70	0.27	0.70
ATTITUDE HORIZON (LCD)	1	0.18	0.18	0.18	0.18
BLIND ENCODER	1	0.15	0.15	0.15	0.15
DIRECTIONAL GYRO	1	0.25	0.60	0.25	0.60
TURN COORDINATOR	1	0.35	0.35	0.35	0.35
HORIZON REF IND.	1	1.80	1.80	1.80	1.80
HELISAS	1	2.14	2.14	2.14	2.14
COOLING BLOWER	1	0.20	0.20	0.20	0.20

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
AIR CONDITIONING					
COMPRESSOR	1	1.22	1.22	1.22	1.22
DOME LIGHT LED	1	0.02	0.02	0.02	0.02
EVAPORATOR BLOWER	1	8.25	8.25	8.25	8.25

14.500 Electrical Load Analysis (continued)

B. 28-Volt System (continued)

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
MARINE AVIONICS					
GPSMAP 162 MARINE GPS	1	0.14	0.14	0.14	0.14
ICOM IC-M412 MARINE TRANSCIEVER	1	1.50	5.50	1.50	5.50
VERTEX VX-2200 FM TRANSCIEVER	1	0.70	7.00	0.70	7.00
KENWOOD TK-7160 OR TK8160 FM TRANSCIEVER	1	1.00	8.00	1.00	8.00
KENWOOD TK-7180 OR TK8180 FM TRANSCIEVER	1	1.00	9.00	1.00	9.00
YAESU FT-8800R FM TRANSCIEVER	1	0.50	8.00	0.50	8.00
ROSS VHF FM TRANSCIEVER	1	0.60	6.00	0.60	6.00

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
OTHER EQUIPMENT					
STARTER MOTOR	1	0.00	200.00	0.00	200.00
STARTER ON LIGHT	1	0.00	0.04	0.00	0.04
STARTER RELAY	1	0.00	7.00	0.00	7.00
TCM STARTING VIBRATOR	1	0.00	2.50	0.00	2.50
UNISON STARTING VIBRATOR	1	0.00	5.00	0.00	5.00
CLOCK, STANDARD	1	0.02	0.02	0.02	0.02
CLOCK, DIGITAL	1	0.00	0.00	0.00	0.00

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
POLICE EQUIPMENT (28V BUS)					
POLICE EQUIPMENT RELAY	1	0.43	0.43	0.43	0.43
DIGITAL VCR	1	0.28	0.28	0.28	0.28
ETS	1	0.53	1.50	0.53	1.50
NAT FM CONTROL HEAD	1	1.00	1.00	1.00	1.00
NAT NTX138-000 FM RADIO	1	0.70	2.00	0.70	2.00
TECHNISONIC TFM-500 FM TRANSCIEVER	1	1.00	3.20	1.00	3.20
INFRARED CAMERA SYSTEM	1	7.00	12.00	7.00	12.00
INTERIOR LIGHT	1	0.22	0.22	0.22	0.22

14.500 Electrical Load Analysis (continued)

B. 28-Volt System (continued)

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
POLICE EQUIPMENT (28V BUS; continued)					
MICROWAVE SYSTEM	1	3.10	3.10	3.10	3.10
MONITOR	1	0.43	0.43	0.43	0.43
PA/SIREN	1	4.00	4.00	4.00	4.00
SEARCHLIGHT	1	27.00	27.00	27.00	27.00
SLAVE SYSTEM	1	0.15	0.49	0.15	0.49

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
POLICE EQUIPMENT (14V BUS)					
ROSEN FLAT SCREEN MONITOR @ 13.75V	1	3.70	4.20		
ROSEN FLAT SCREEN MONITOR	1	2.31	2.63	2.31	2.63
BENDIX/KING FM RADIO @ 13.75V	1	1.00	1.50		
BENDIX/KING FM RADIO	1	0.63	0.94	0.63	0.94
LOJACK @ 13.75V	1	0.75	0.75		
LOJACK	1	0.47	0.47	0.47	0.47
PANASONIC VHS RECORDER @ 13.75V	1	1.20	1.20		
PANASONIC VHS RECORDER	1	0.75	0.75	0.75	0.75

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
ENG EQUIPMENT (28V BUS)					
5" TRANSVIDEO MONITOR	3	0.28	0.59	0.84	1.77
6" SONY LCD MONITOR	1	0.43	0.43	0.43	0.43
AUDIO COOLING FAN	1	0.22	0.22	0.22	0.22
GENEVA AUDIO SYSTEM	1	1.92	1.92	1.92	1.92
AUDIO SYSTEM COOLING FAN	1	0.18	0.18	0.18	0.18
FLIR CAMERA SYSTEM	1	6.00	8.00	6.00	8.00
AFT COMPARTMENT COOLING FAN	1	0.20	0.20	0.20	0.20
DIRECTIONAL M/WAVE ANTENNA	1	0.70	0.70	0.70	0.70
DIRECTIONAL MICROWAVE SYSTEM	1	0.50	1.50	0.50	1.50
HD CAMERA SYSTEM	1	3.00	3.80	3.00	3.80

14.500 Electrical Load Analysis (continued)

B. 28-Volt System (continued)

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
ENG EQUIPMENT (28V BUS; continued)					
HD MICRO CAMERA SYSTEM	2	0.86	0.86	1.72	1.72
MICROWAVE POWER AMP	1	8.60	8.60	8.60	8.60
MICROWAVE RECEIVER	1	0.70	0.70	0.70	0.70
MICROWAVE TRANSMITTER	1	1.35	1.35	1.35	1.35
MICROWAVE ANTENNA ACTUATOR MOTOR	1	0.00	0.75	0.00	0.75
MICROWAVE TRANSMITTER	1	3.10	3.10	3.10	3.10
NEWS EQUIP RELAY	1	0.43	0.43	0.43	0.43
OMNI MICROWAVE ANTENNA MOTOR	1	0.00	0.75	0.00	0.75
POST LIGHT	3	0.04	0.04	0.12	0.12
INTERIOR LIGHT (FORWARD)	1	0.22	0.22	0.22	0.22
INTERIOR LIGHT (REAR)	1	0.22	0.22	0.22	0.22
RADIO DESIGN LABS VIDEO SWITCH	1	0.00	0.03	0.00	0.03
VIDEO TITLER	1	0.07	0.07	0.07	0.07

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
ENG EQUIPMENT (14V BUS)					
4" TELE LCD MONITOR @ 13.75V	3	0.50	0.50		
4" TELE LCD MONITOR	3	0.31	0.31	0.94	0.94
6" TRANSVIDEO REAR SEAT MONITOR @ 13.75V	1	1.50	1.50		
6" TRANSVIDEO REAR SEAT MONITOR	1	0.94	0.94	0.94	0.94
6.5" TRANSVIDEO MONITOR	3	0.30	0.30	0.90	0.90
9" ASTRO MONITOR @ 13.75V	1	1.67	1.67		
9" ASTRO MONITOR	1	1.04	1.04	1.04	1.04
AFT TALENT LIGHT @ 13.75V	1	1.00	1.00		
AFT TALENT LIGHT	1	0.63	0.63	0.63	0.63
AVIONICS INNOVATIONS AM/FM RECEIVER/CD @ 13.75V	2	0.38	0.70		
AVIONICS INNOVATIONS AM/FM RECEIVER/CD	2	0.23	0.44	0.47	0.88
AVIONICS INNOVATIONS AM/FM RECEIVERS @ 13.75V	2	0.65	0.65		

14.500 Electrical Load Analysis (continued)

B. 28-Volt System (continued)

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
ENG EQUIPMENT (14V BUS; continued)					
AVIONICS INNOVATIONS AM/FM RECEIVERS	2	0.41	0.41	0.81	0.81
DOWN CONVERTER @ 13.75V	1	0.54	0.54		
DOWN CONVERTER	1	0.34	0.34	0.34	0.34
KENWOOD FM RADIO & GENEVA INTERFACE @ 13.75V	2	1.16	8.16		
KENWOOD FM RADIO & GENEVA INTERFACE	2	0.73	5.10	1.45	10.20
KENWOOD FM TRANSCIEVER @ 13.75V	2	0.40	9.00		
KENWOOD FM TRANSCIEVER	2	0.25	5.63	0.50	11.25
FWD TALENT LIGHT @ 13.75V	1	1.00	1.00		
FWD TALENT LIGHT	1	0.63	0.63	0.63	0.63
LED VU METER @ 13.75V	1	0.20	0.20		
LED VU METER	1	0.13	0.13	0.13	0.13
SD MICRO CAMERAS @ 13.75V	3	0.41	0.41		
SD MICRO CAMERAS	3	0.26	0.26	0.77	0.77
UNIDEN SCANNER @ 13.75V	1	0.38	0.70		
UNIDEN SCANNER	1	0.23	0.44	0.23	0.44
SD MICRO CAMERA @ 13.75V	2	0.41	10.22		
SD MICRO CAMERA	2	0.26	6.39	0.51	12.78
SVHS VIDEO TAPE RECORDER @ 13.75V	1	1.50	1.50		
SVHS VIDEO TAPE RECORDER	1	0.94	0.94	0.94	0.94
SYNC AND OUTPUT AMPS @ 13.75V	2	0.10	0.10		
SYNC AND OUTPUT AMPS	2	0.06	0.06	0.13	0.13
SYNC GENERATOR @ 13.75V	1	0.25	0.25		
SYNC GENERATOR	1	0.16	0.16	0.16	0.16
TALENT LIGHT (W/SD) @ 13.75V	1	1.43	1.43		
TALENT LIGHT (W/SD)	1	0.89	0.89	0.89	0.89
TALENT LIGHT (W/HD) @ 13.75V	2	0.11	0.11		
TALENT LIGHT (W/HD)	2	0.07	0.07	0.14	0.14
TUNER DISTRIBUTION AMP @ 13.75V	1	0.02	0.02		
TUNER DISTRIBUTION AMP	1	0.02	0.02	0.02	0.02
TV TUNER @ 13.75V	1	0.83	0.83		
TV TUNER	1	0.52	0.52	0.52	0.52

14.500 Electrical Load Analysis (continued)

B. 28V System Voltage (continued)

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
ENG EQUIPMENT (14V BUS; continued)					
TV TUNER DISTRIBUTION AMP @ 13.75V	1	0.02	0.02		
TV TUNER DISTRIBUTION AMP	1	0.01	0.01	0.01	0.01
KRAMER VIDEO SWITCHER @ 13.75V	1	0.25	0.25		
KRAMER VIDEO SWITCHER	1	0.16	0.16	0.16	0.16
BURST ELECTRONICS VIDEO SWITCHER @ 13.75V	1	0.63	0.63		
BURST ELECTRONICS VIDEO SWITCHER	1	0.39	0.39	0.39	0.39
SONY VIDEO TAPE RECORDER @ 13.75V	1	2.16	2.16		
SONY VIDEO TAPE RECORDER	1	1.35	1.35	1.35	1.35
PANASONIC VIDEO TAPE RECORDER @ 13.75V	1	5.33	5.33		
PANASONIC VIDEO TAPE RECORDER	1	3.33	3.33	3.33	3.33

EQUIPMENT	QTY	CONTINUOUS AMPS EACH	INTERMITTENT AMPS EACH	CONTINUOUS TOTAL	INTERMITTENT TOTAL
ENG EQUIPMENT (5V BUS)					
VIDEO DISTRIBUTION AMPLIFIER @ 5V	1	0.50	0.50		
VIDEO DISTRIBUTION AMPLIFIER	1	0.11	0.11	0.11	0.11
SD MICRO CAM, RATIO CONV. @ 5V	2	0.66	0.66		
SD MICRO CAM, RATIO CONV.	2	0.15	0.15	0.29	0.29
SD MICRO CAM. UPCONVERTER @ 5V	2	0.70	0.70		
SD MICRO CAM. UPCONVERTER	2	0.16	0.16	0.31	0.31

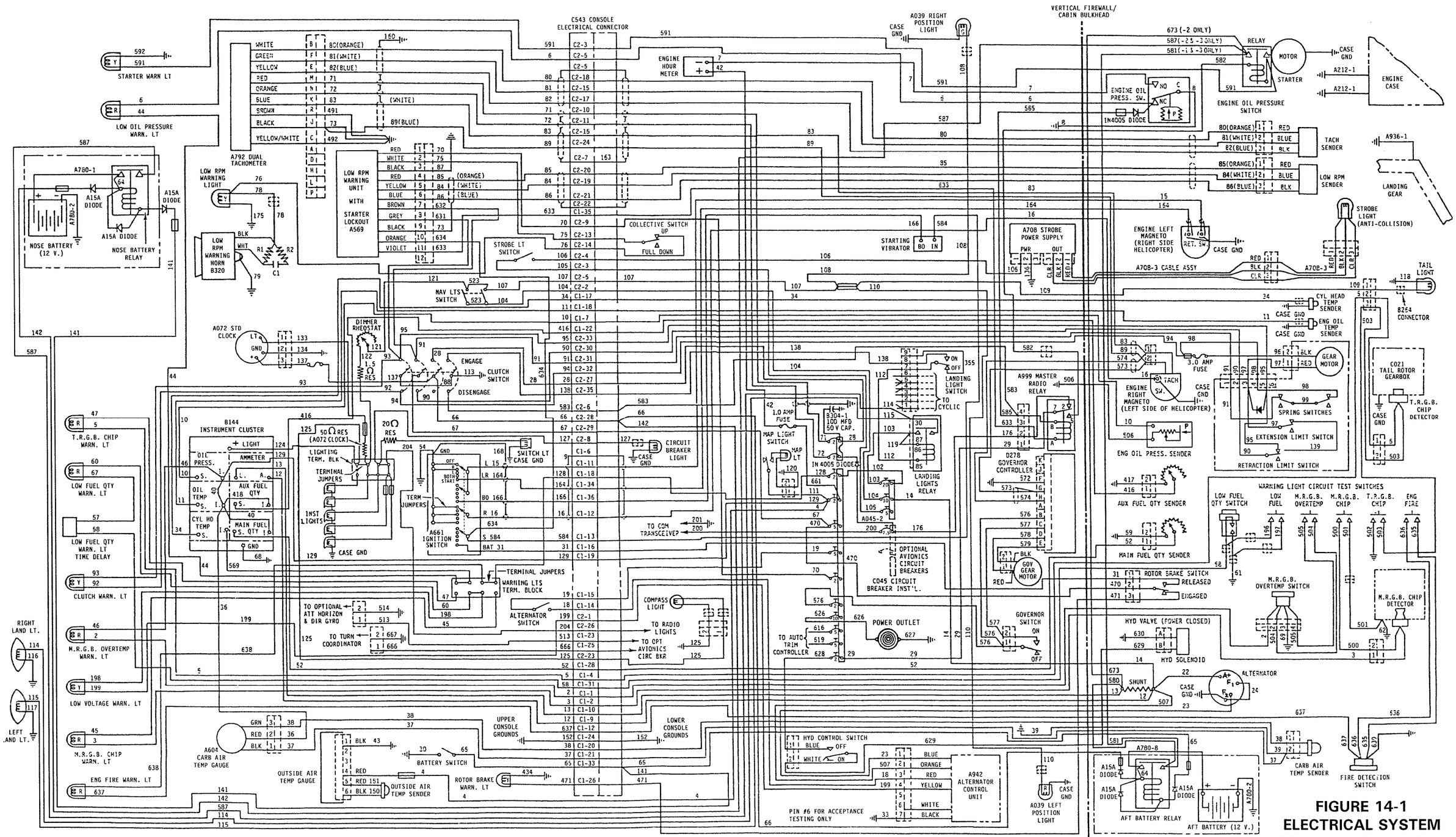
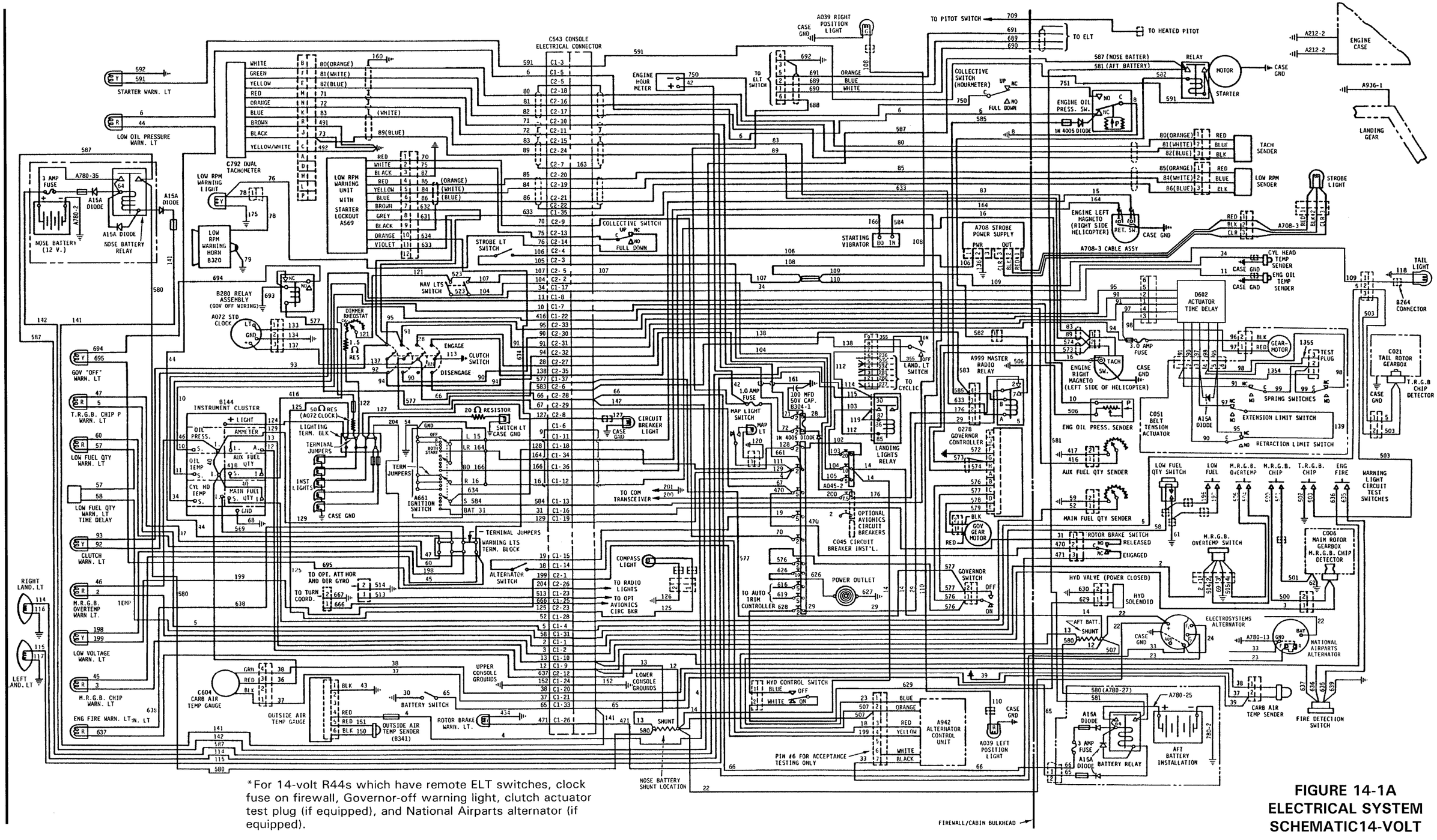


FIGURE 14-1
ELECTRICAL SYSTEM SCHEMATIC (14-VOLT)



*For 14-volt R44s which have remote ELT switches, clock fuse on firewall, Governor-off warning light, clutch actuator test plug (if equipped), and National Airparts alternator (if equipped).

FIGURE 14-1A
ELECTRICAL SYSTEM SCHEMATIC14-VOLT

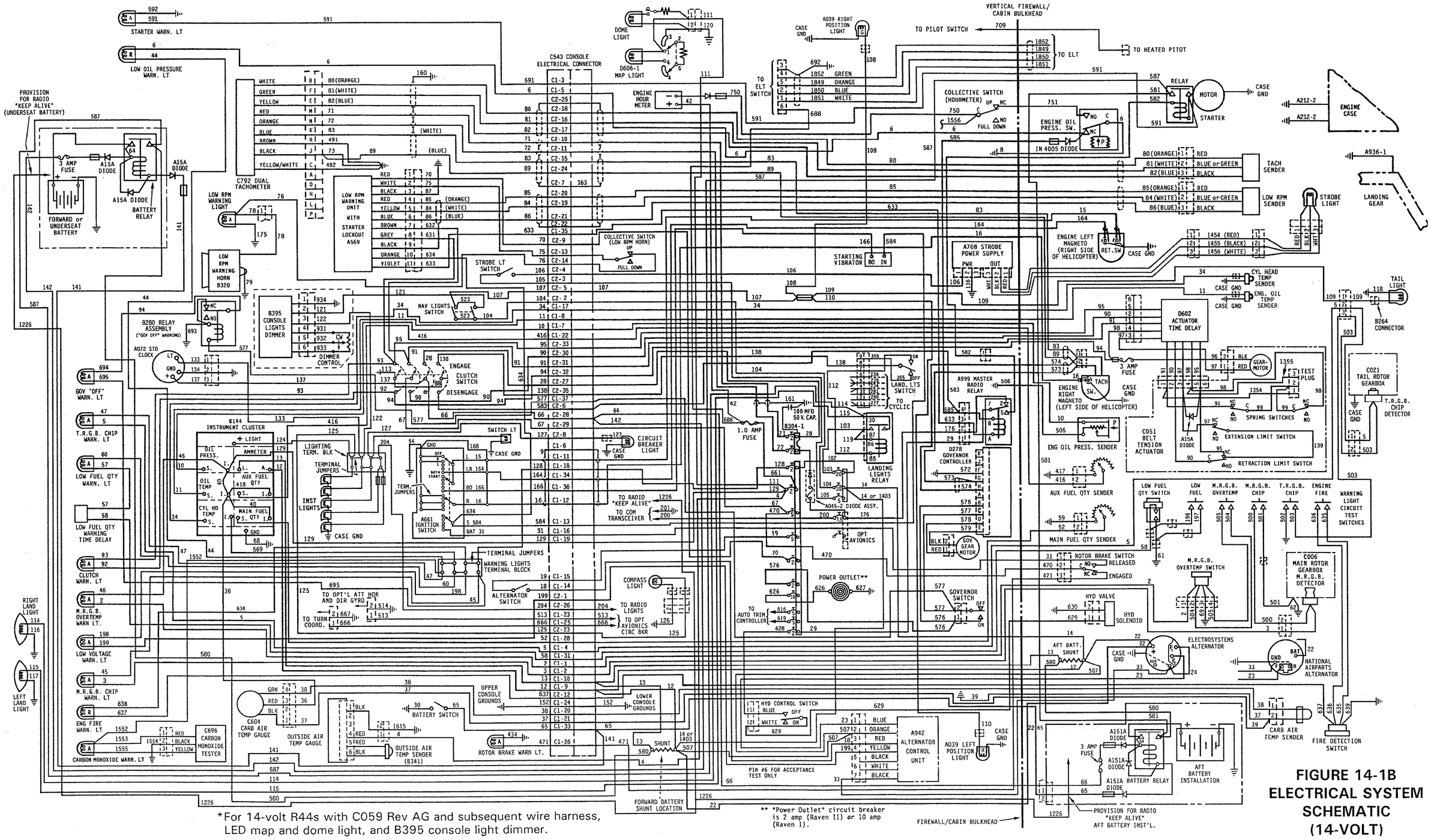


FIGURE 14-1B ELECTRICAL SYSTEM SCHEMATIC (14-VOLT)

*For 14-volt R44s with C059 Rev AG and subsequent wire harness, LED map and dome light, and B395 console light dimmer.

** "Power Outlet" circuit breaker is 2 amp (Raven II) *or* 10 amp (Raven I).

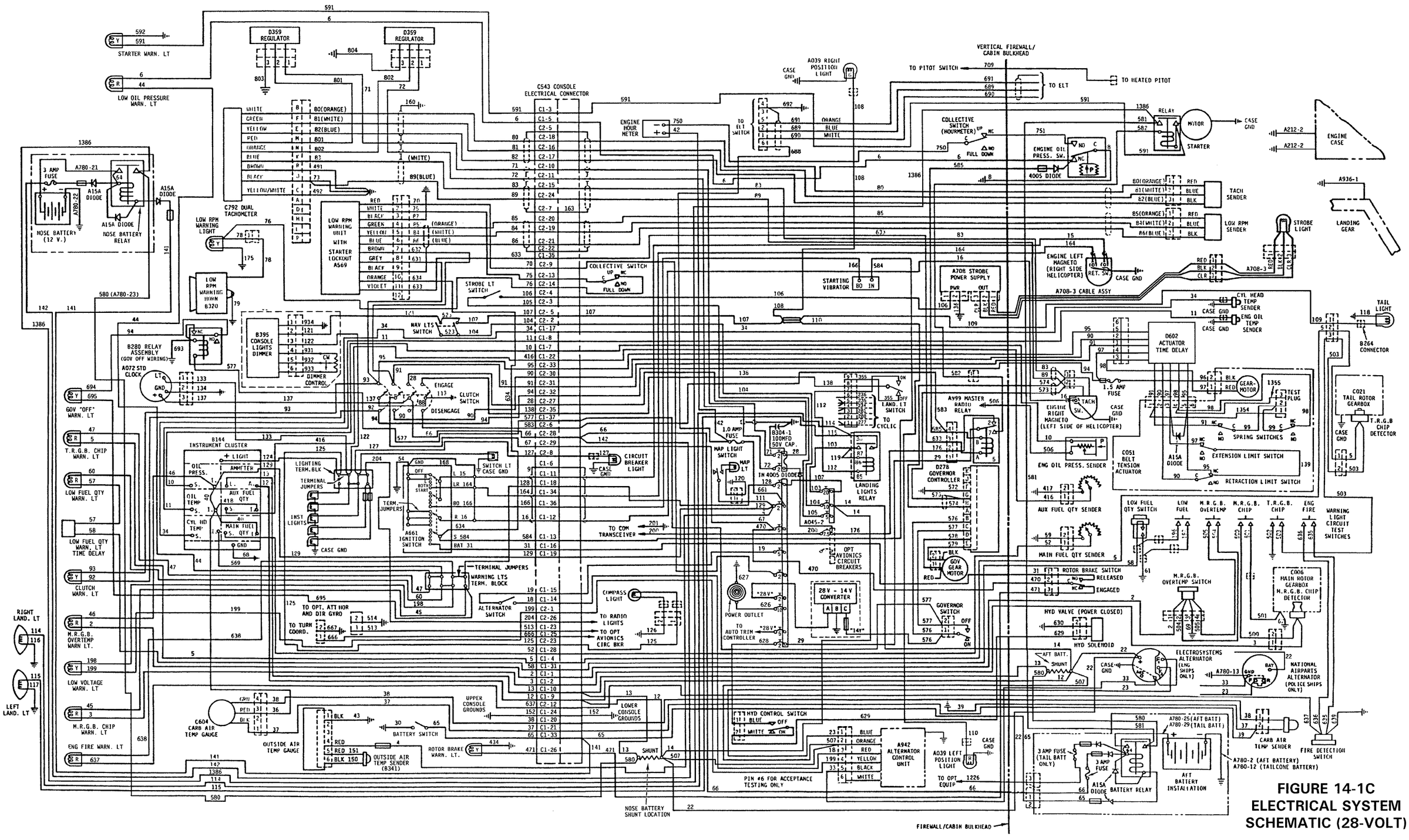
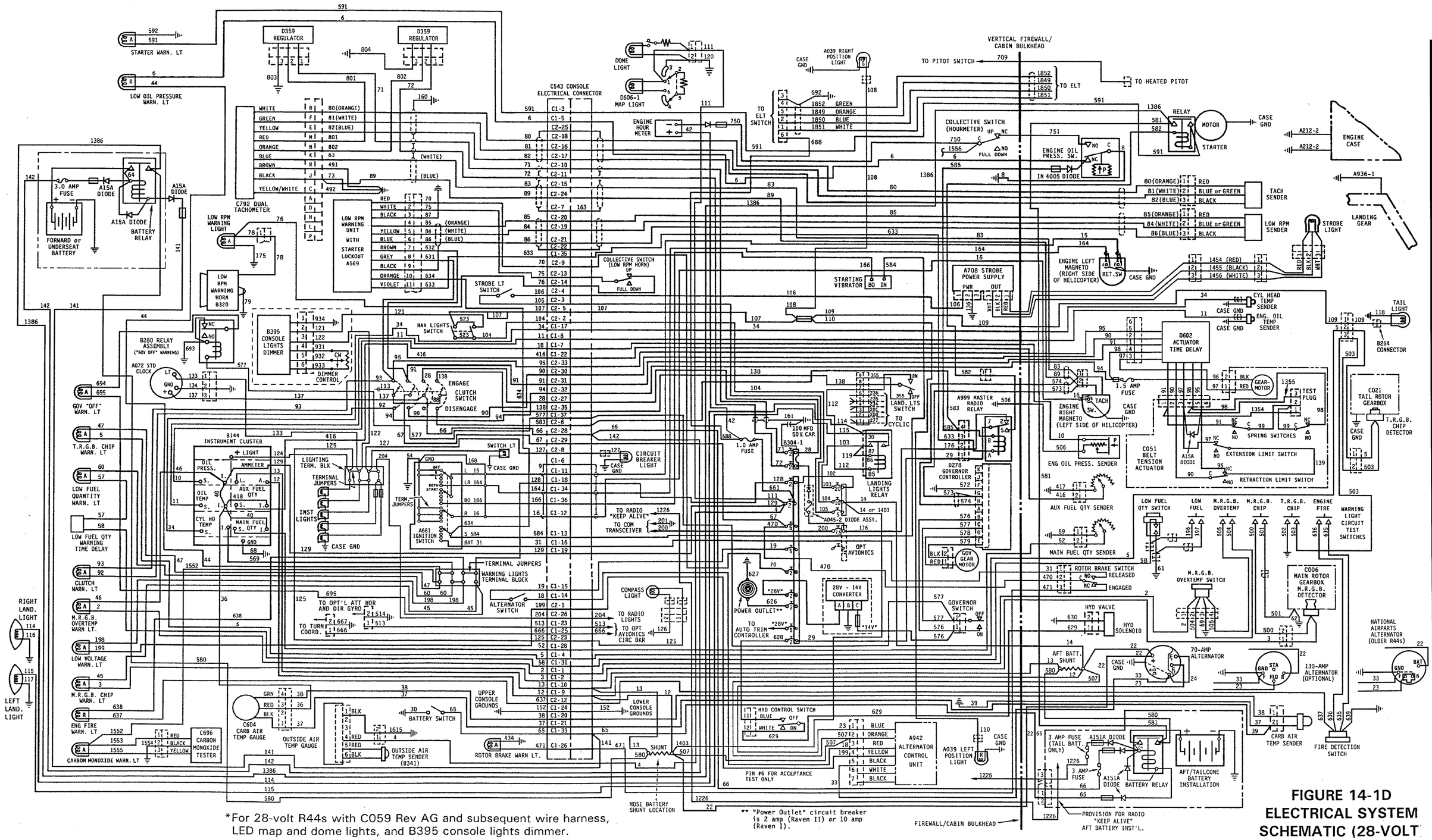


FIGURE 14-1C ELECTRICAL SYSTEM SCHEMATIC (28-VOLT)



*For 28-volt R44s with C059 Rev AG and subsequent wire harness, LED map and dome lights, and B395 console lights dimmer.

** "Power Outlet" circuit breaker is 2 amp (Raven II) *or* 10 amp (Raven I).

FIGURE 14-1D
ELECTRICAL SYSTEM SCHEMATIC (28-VOLT

Intentionally blank

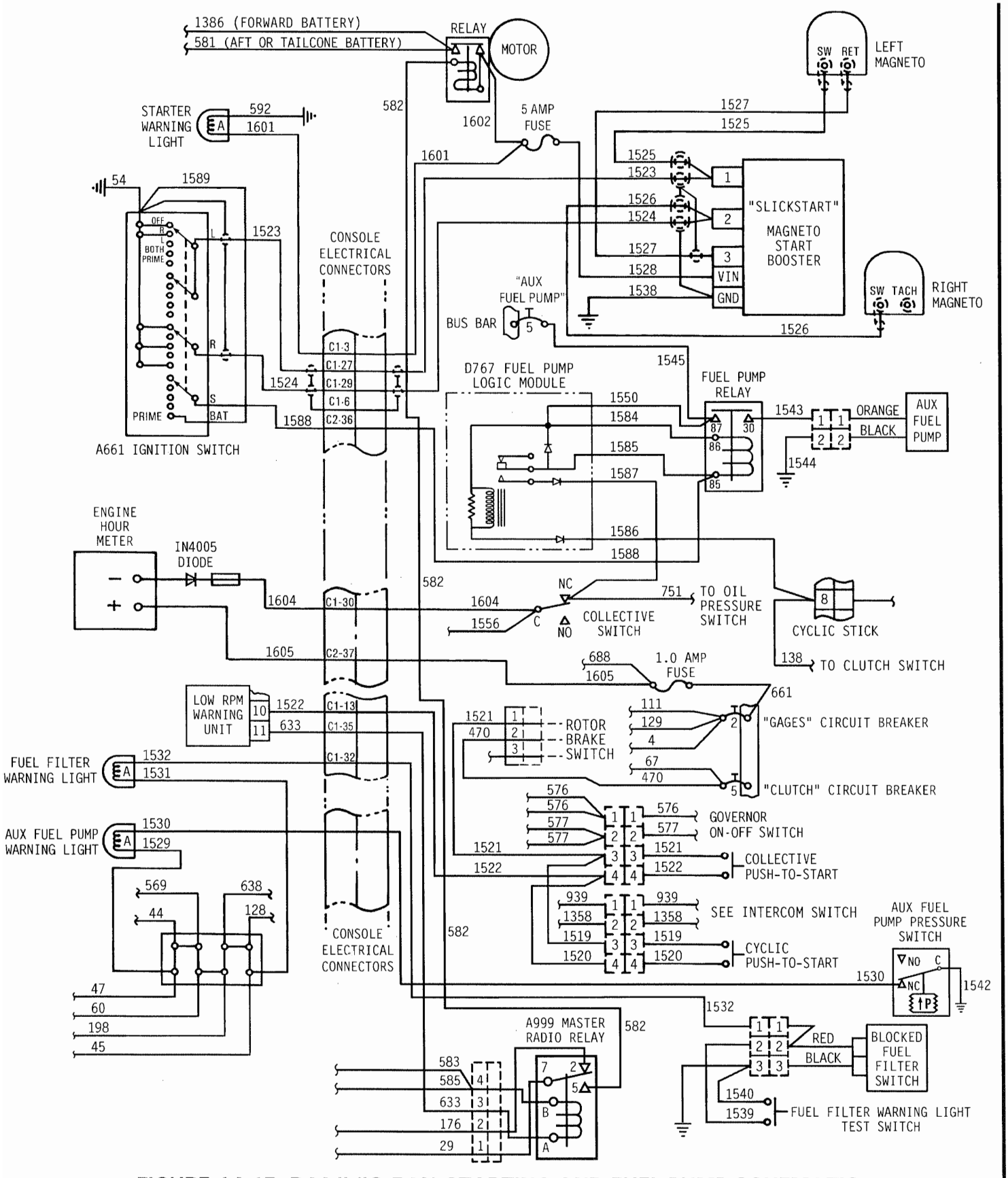


FIGURE 14-1E R44 II (IO-540) STARTING AND FUEL PUMP SCHEMATIC

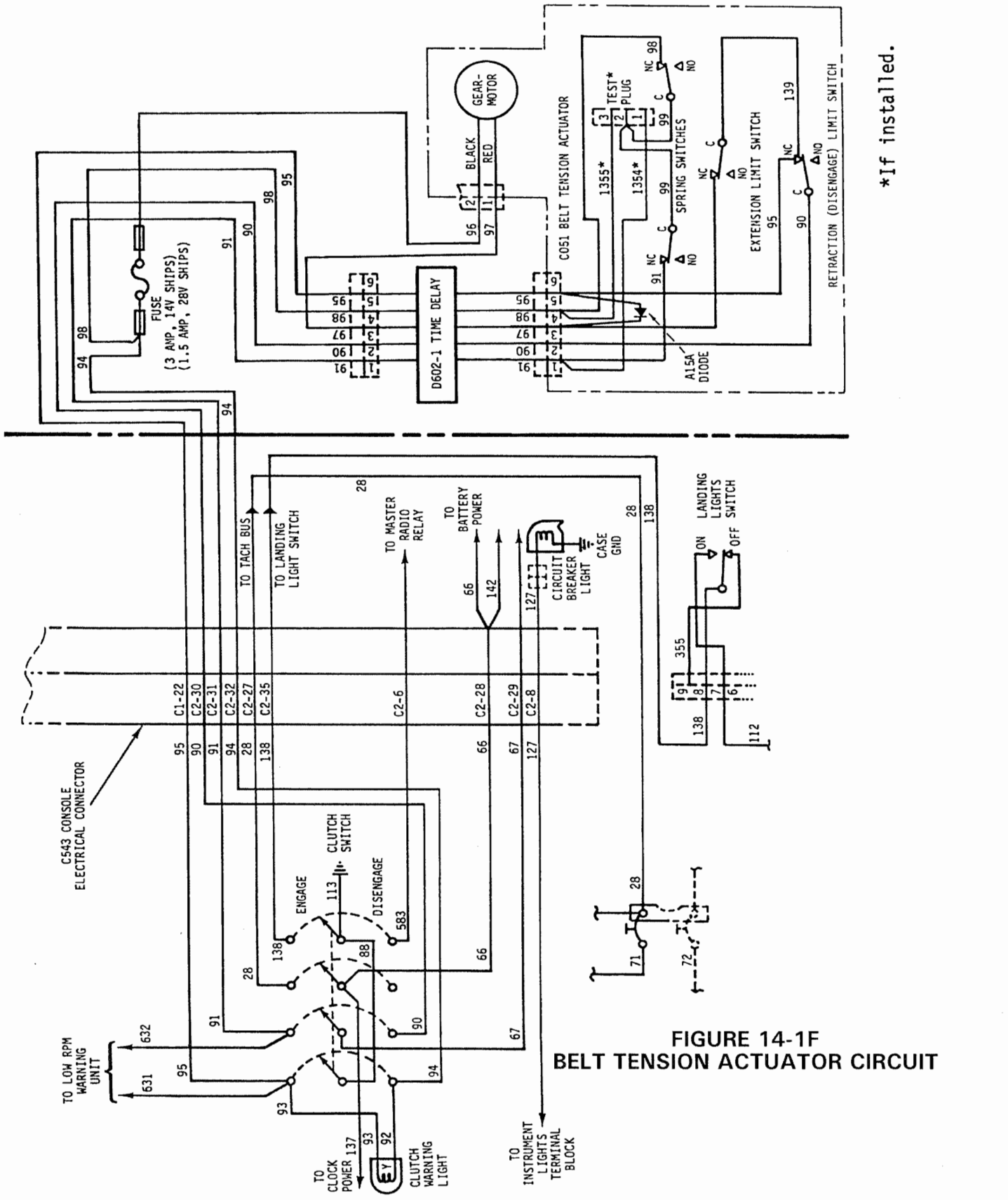


FIGURE 14-1F
BELT TENSION ACTUATOR CIRCUIT

14.600 ELECTRICAL SYSTEMS SCHEMATICS (Cont'd)

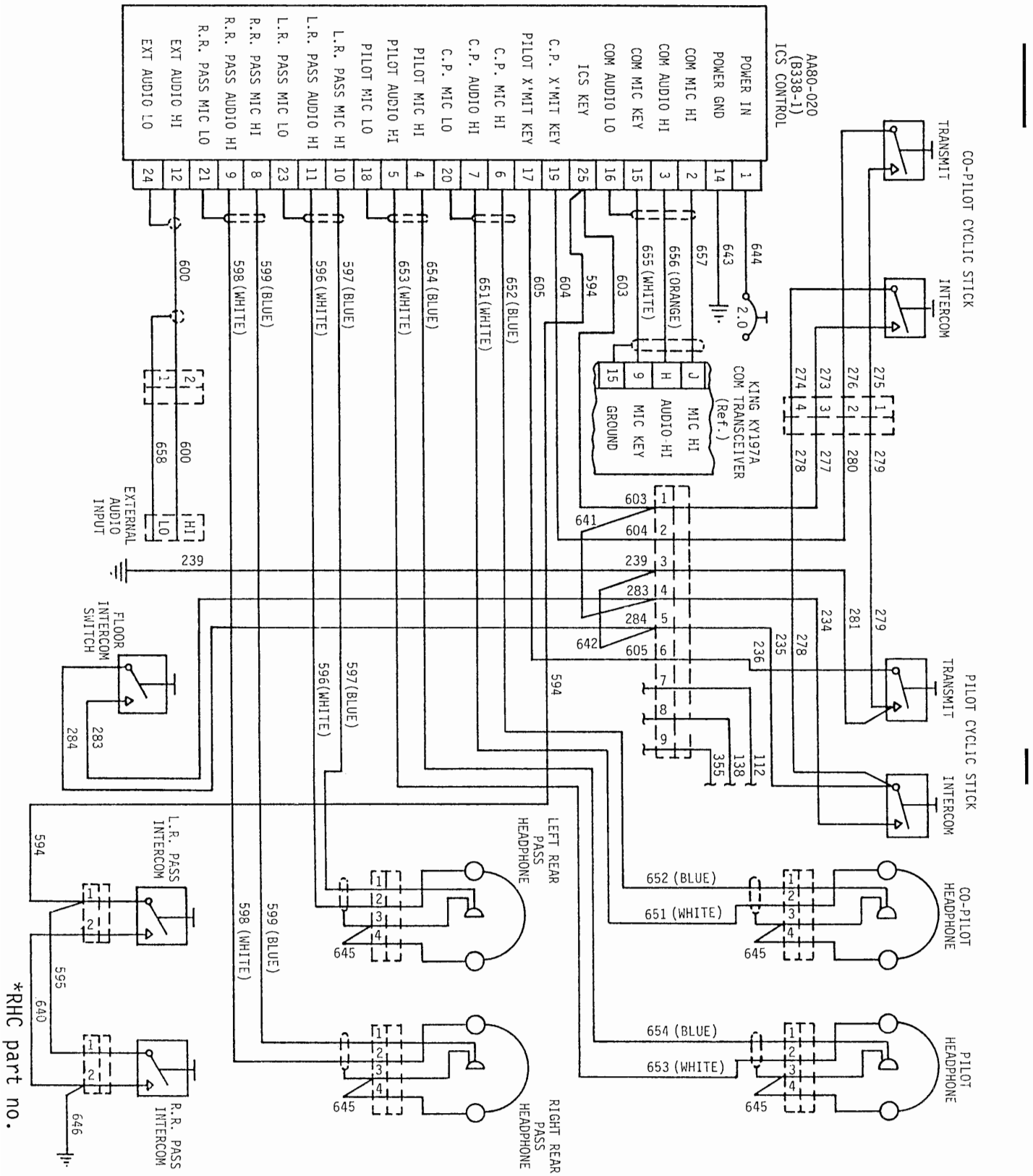


FIGURE 14-2 INTERCOM SCHEMATIC WITH NAT AA80-020 (B338-1*) ICS CONTROL (SHIP S/N 10410 and PRIOR, SHIP S/N 1417 thru PRIOR)

14.600 ELECTRICAL SYSTEMS SCHEMATICS (Cont'd)

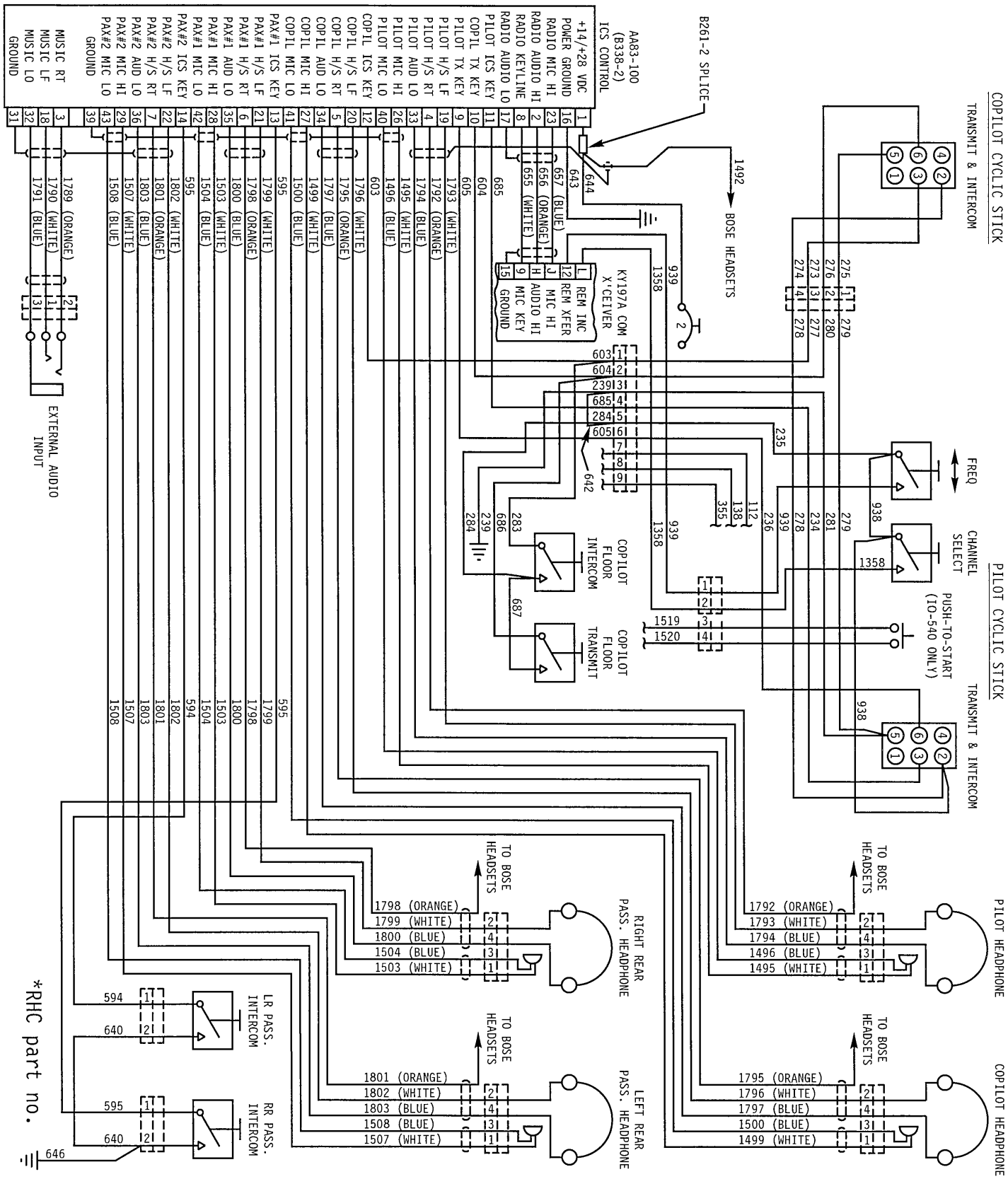


FIGURE 14-2A INTERCOM SCHEMATIC WITH NAT AA83-100 (B338-2*) ICS CONTROL (SHIP S/N 10410 and SUBSEQUENT, SHIP S/N 1418 thru 9999)

14.600 ELECTRICAL SYSTEMS SCHEMATICS (Cont'd)

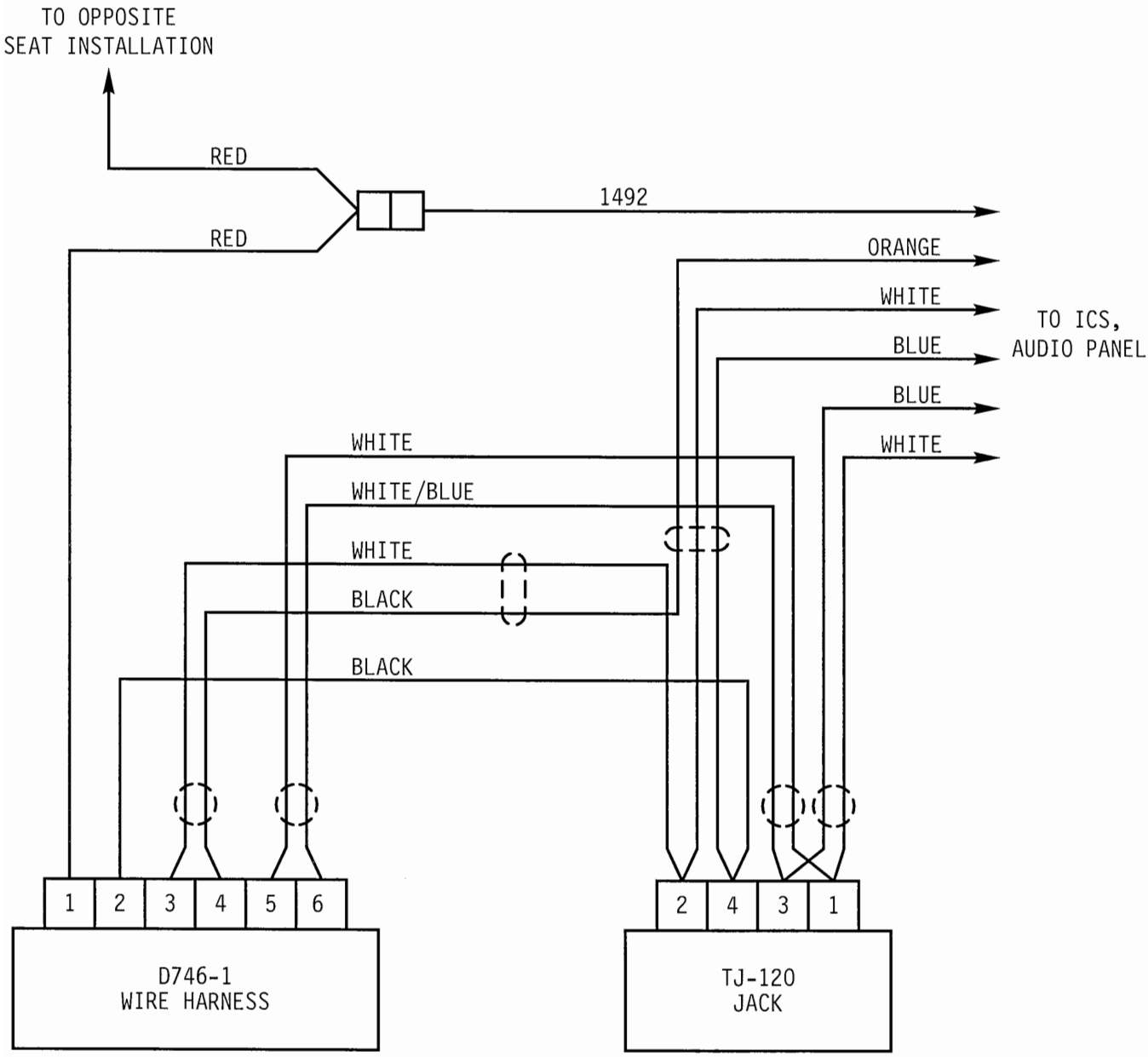


FIGURE 14-2B WIRING SCHEMATIC - BOSE HEADSET

14.600 ELECTRICAL SYSTEM SCHEMATICS (Cont'd)

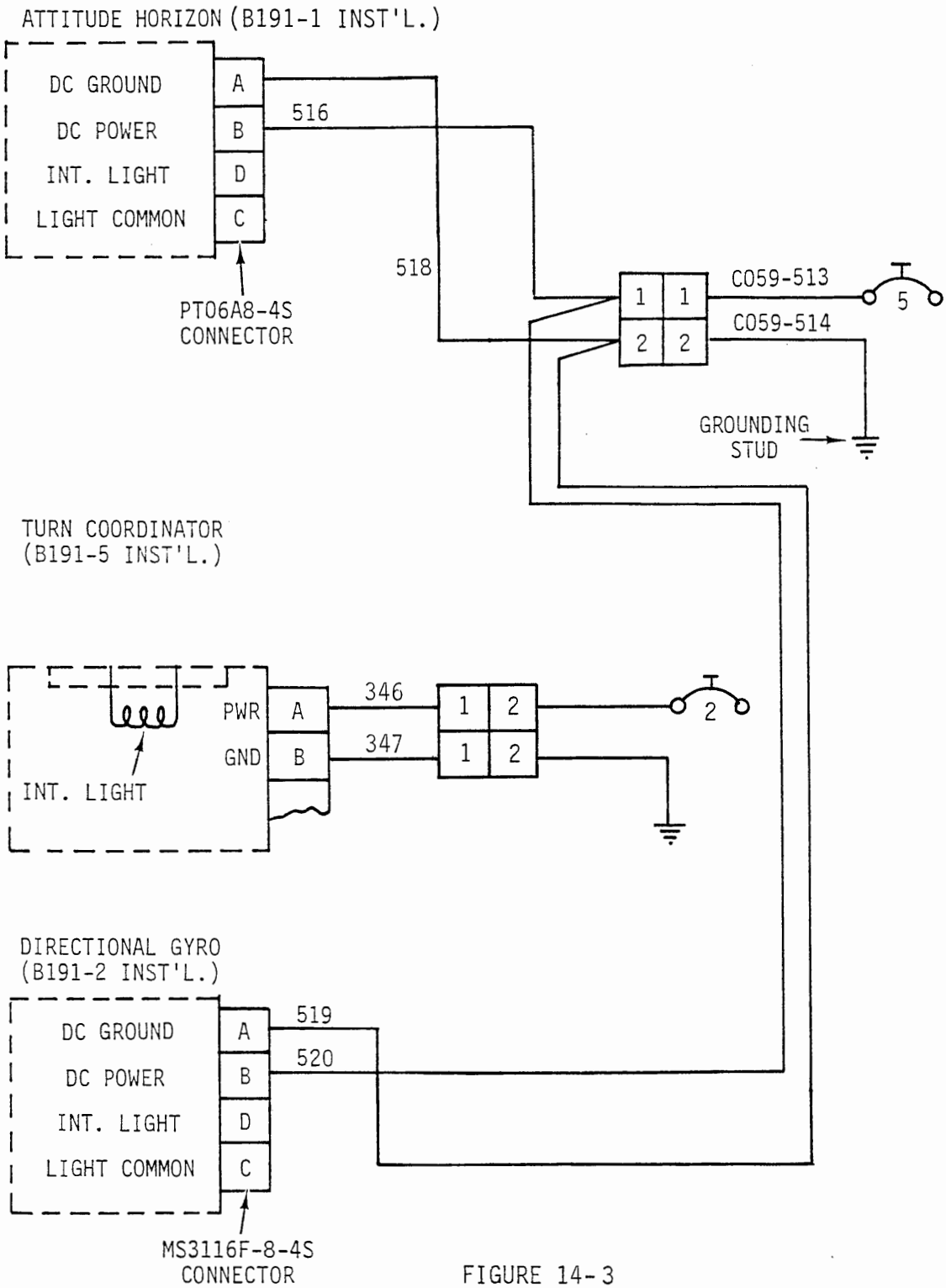
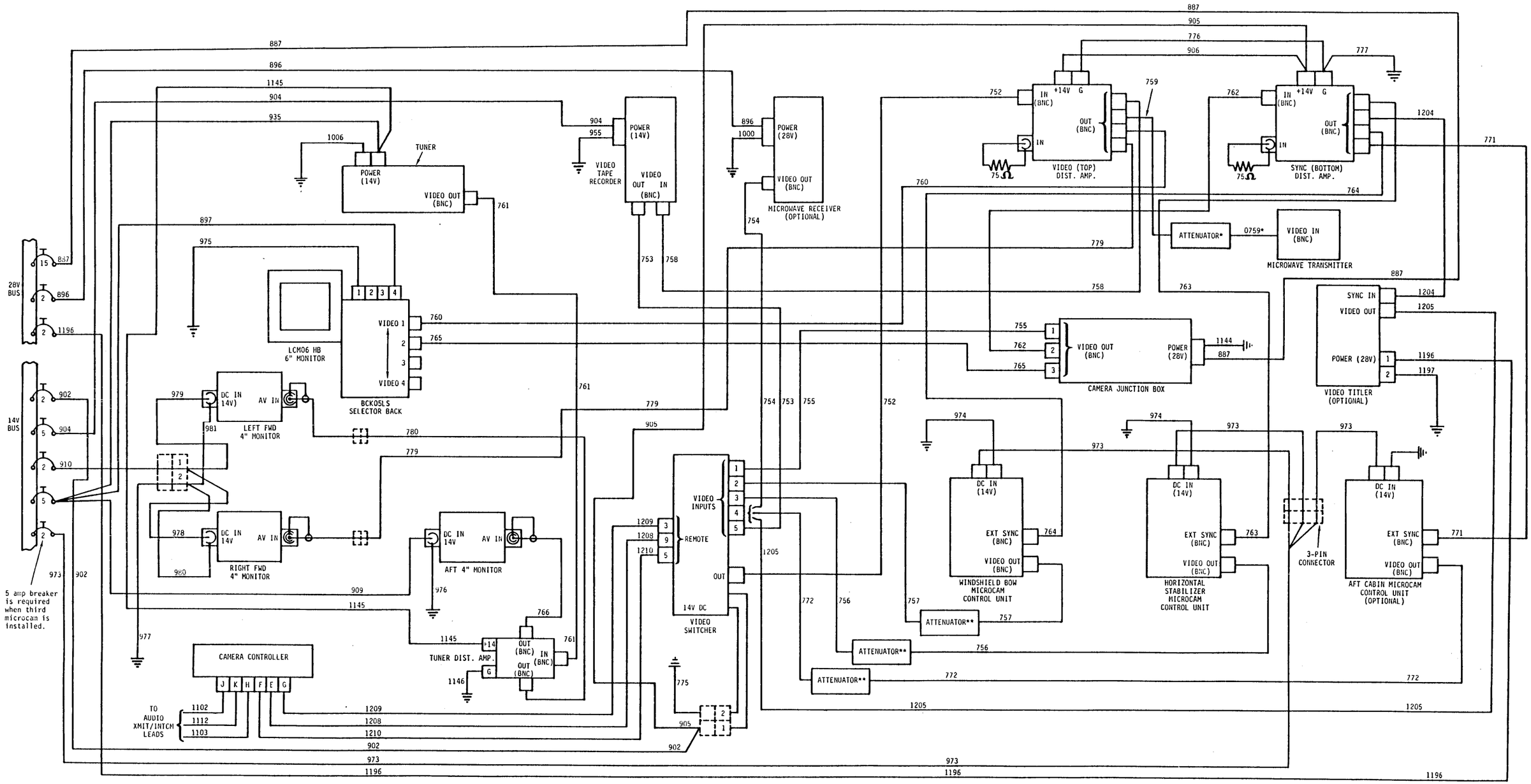


FIGURE 14-3

B191-3 ATTITUDE HORIZON (J.E.T. ELECTRONICS)
B191-4 DIRECTIONAL GYRO (J.E.T. ELECTRONICS)
B329-1 TURN COORDINATOR (ELEC. GYRO CORP.)

14.600 ELECTRICAL SYSTEM SCHEMATICS (Cont'd)



*Installed only if reduced bandwidth is required.

**31-70019 Coupler may be installed at this location instead.

FIGURE 14-3A

VIDEO SIGNAL WIRING SCHEMATIC (ENG helicopters only)

14.600 ELECTRICAL SYSTEM SCHEMATICS (Cont'd)

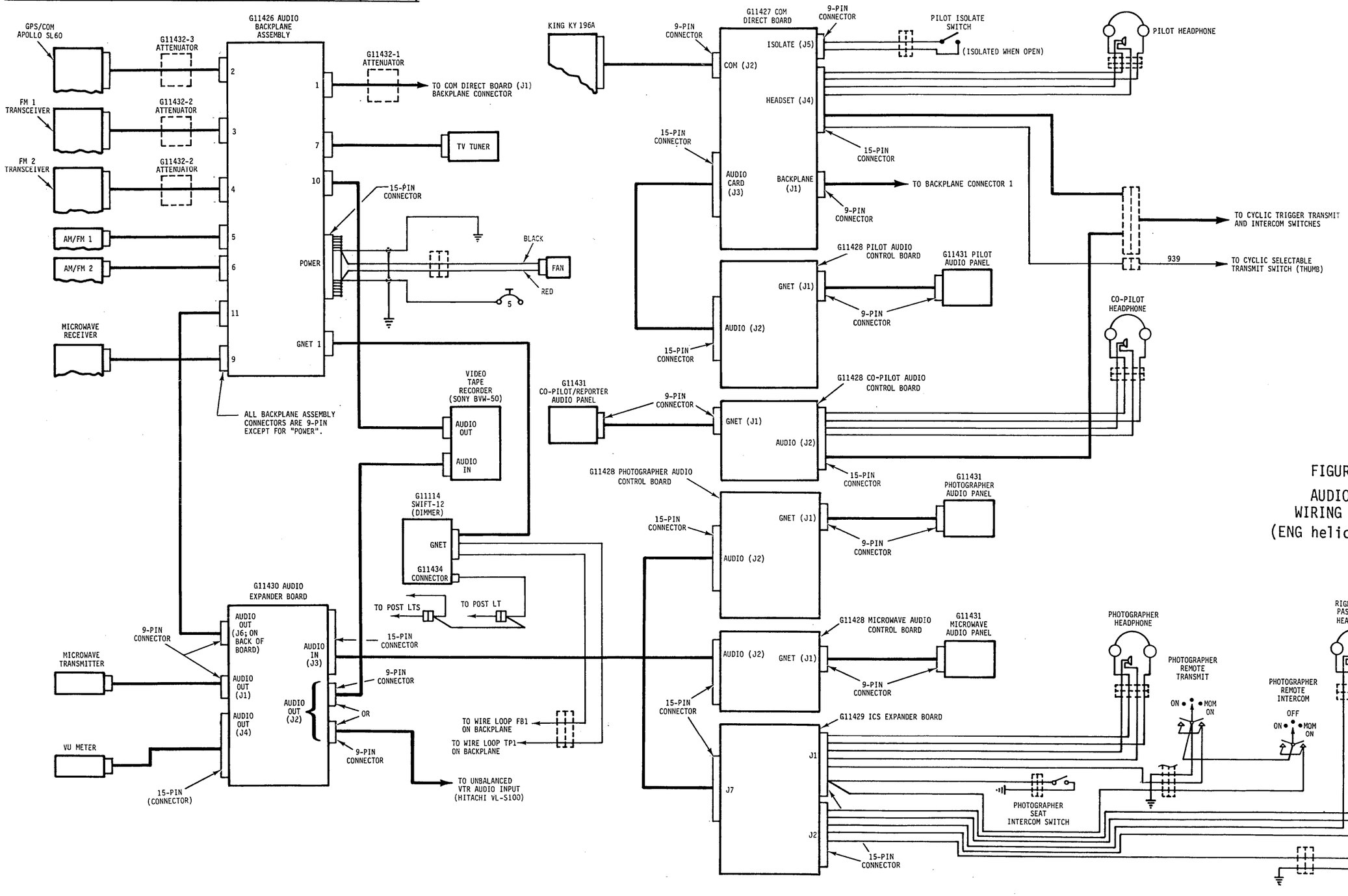


FIGURE 14-3B
AUDIO SIGNAL
WIRING SCHEMATIC
(ENG helicopters only)

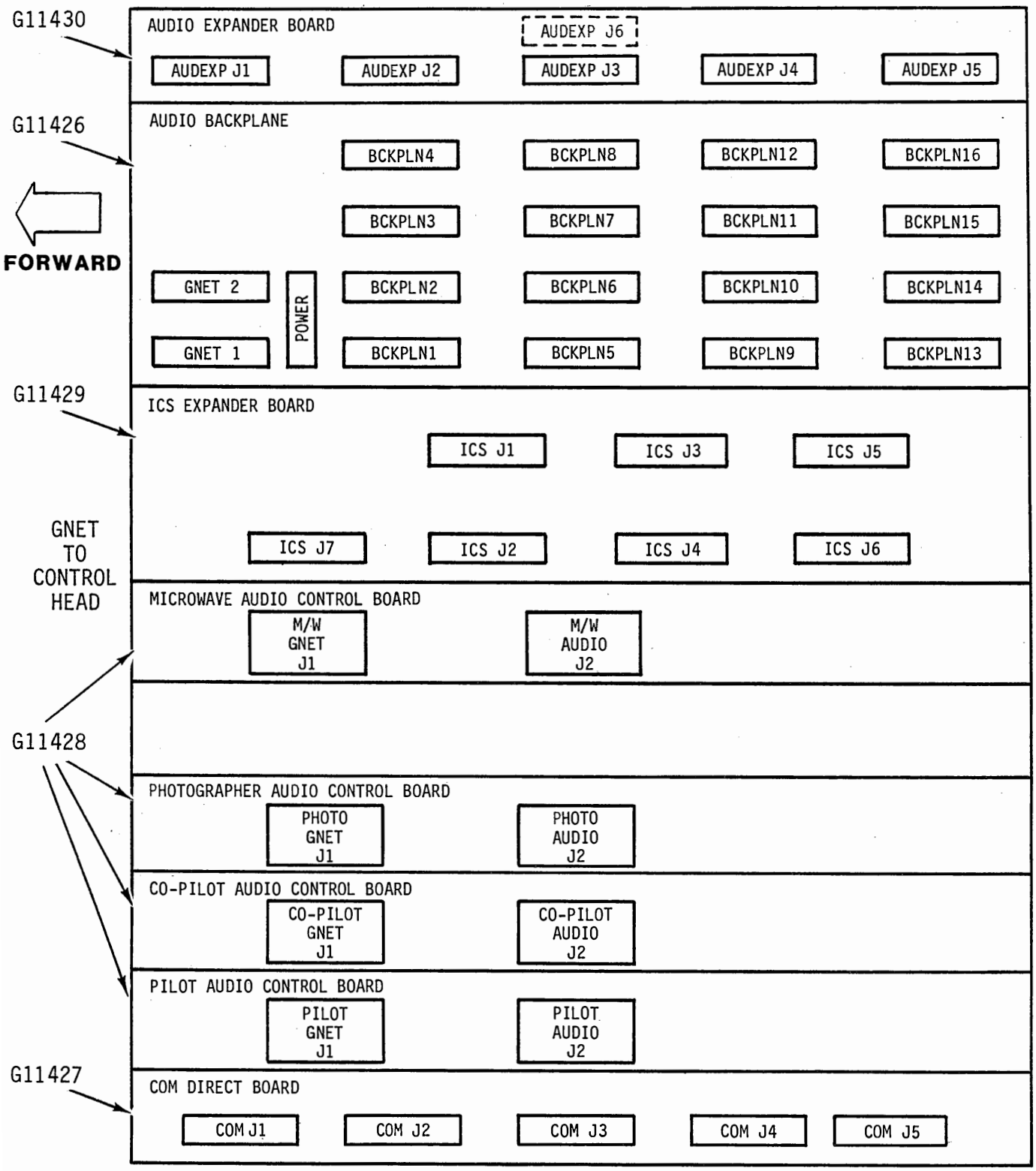


FIGURE 14-3C

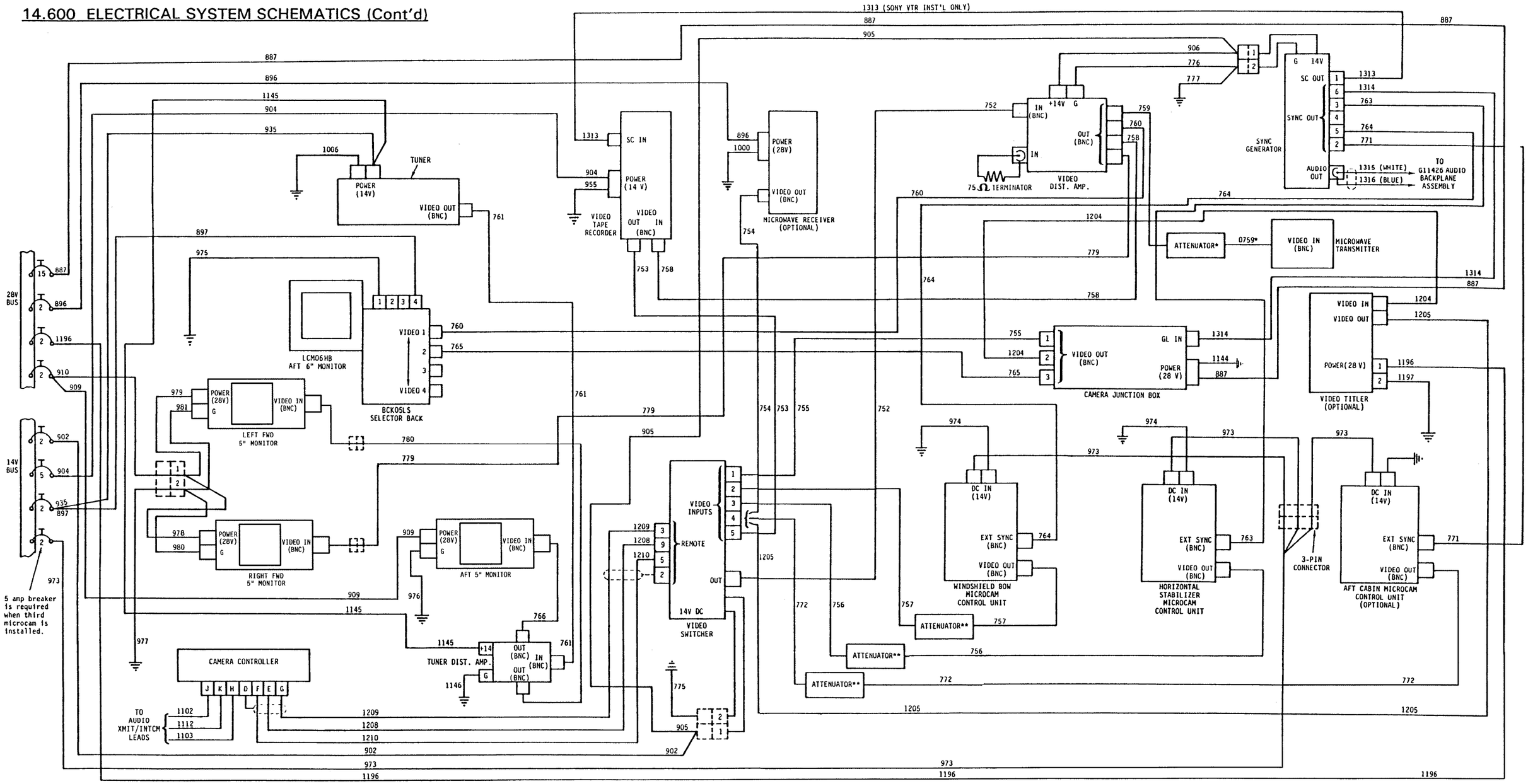
GENEVA BOX AUDIO SIGNAL WIRING
CONNECTOR DIAGRAM

(Located beneath forward LH seat, view looking down)

(ENG helicopters only)

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14.600 ELECTRICAL SYSTEM SCHEMATICS (Cont'd)



*Installed only if reduced bandwidth is required.

**31-70019 Coupler may be installed at this location instead.

FIGURE 14-3D VIDEO SIGNAL WIRING SCHEMATIC

(ENG helicopters only, ship S/N 469 and on with five-inch monitors. S/N 475 and on have Sync Generator instead of two Video Distribution Amps.)

14.600 ELECTRICAL SYSTEM SCHEMATICS (Cont'd)

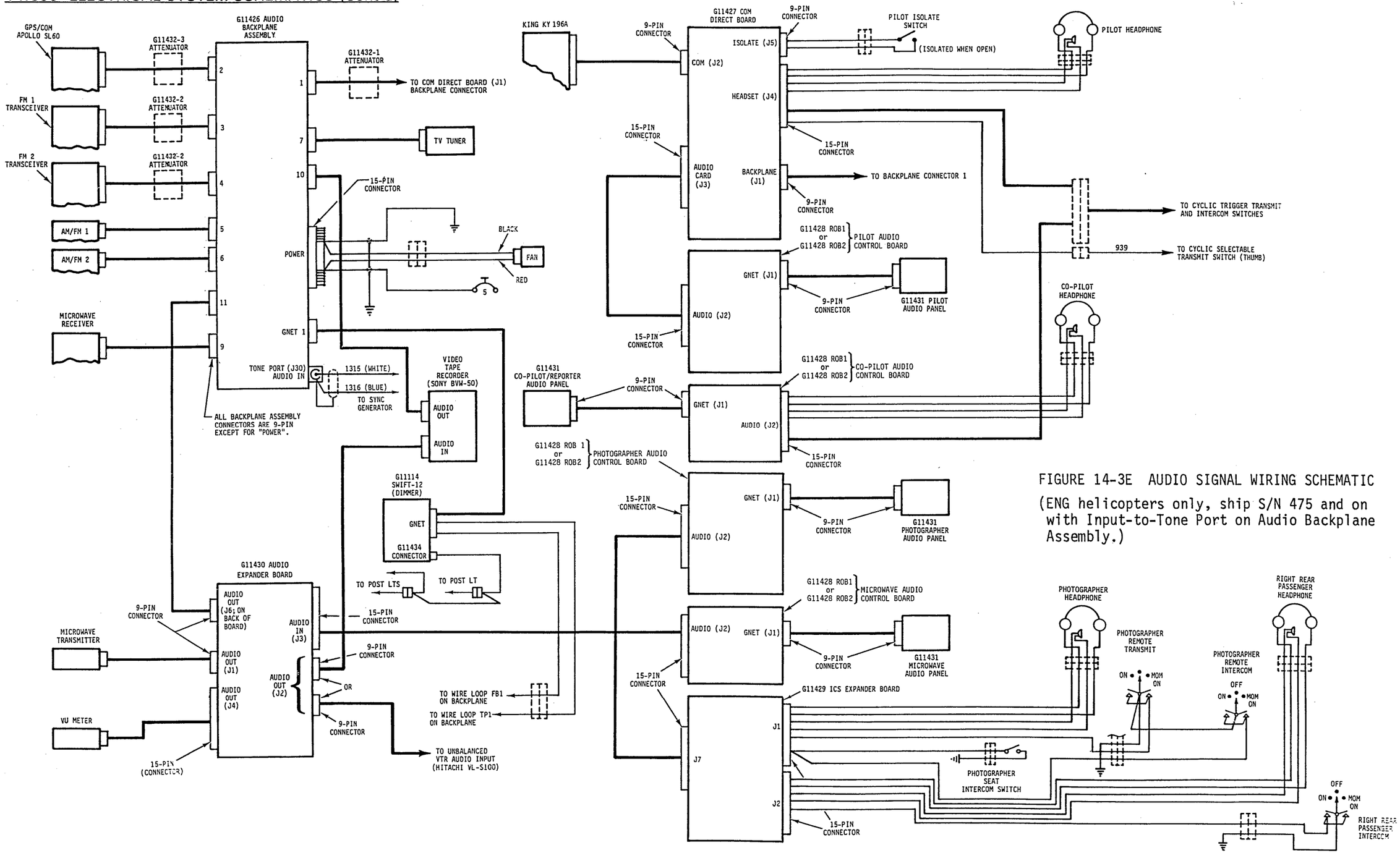
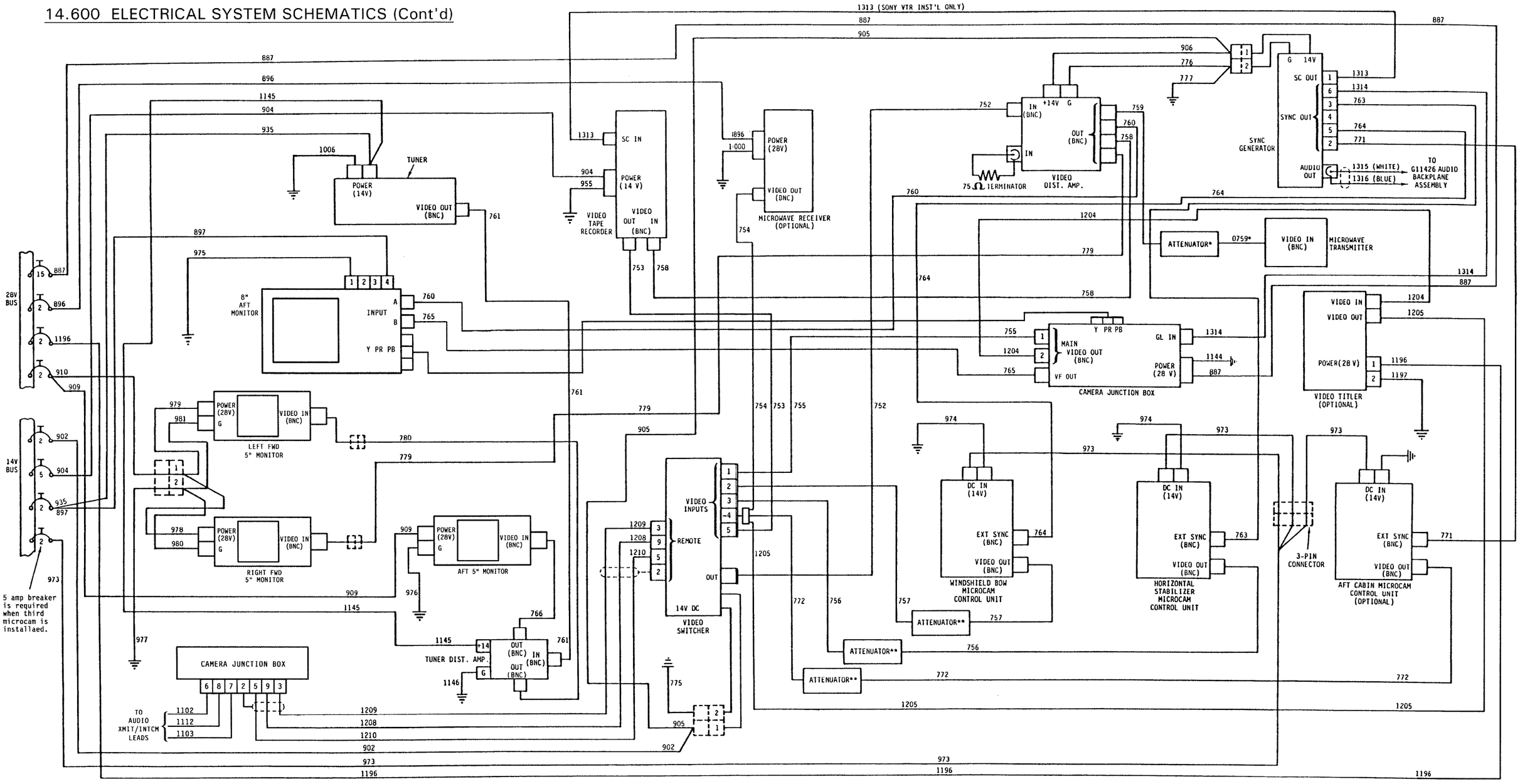


FIGURE 14-3E AUDIO SIGNAL WIRING SCHEMATIC

(ENG helicopters only, ship S/N 475 and on with Input-to-Tone Port on Audio Backplane Assembly.)

14.600 ELECTRICAL SYSTEM SCHEMATICS (Cont'd)



*Installed only if reduced bandwidth is required.

**31-70019 Coupler may be installed at this location instead.

FIGURE 14-3D VIDEO SIGNAL WIRING SCHEMATIC
(ENG helicopters only, ship S/N 10016 and on)

14.600 ELECTRICAL SYSTEM SCHEMATICS (Cont'd)

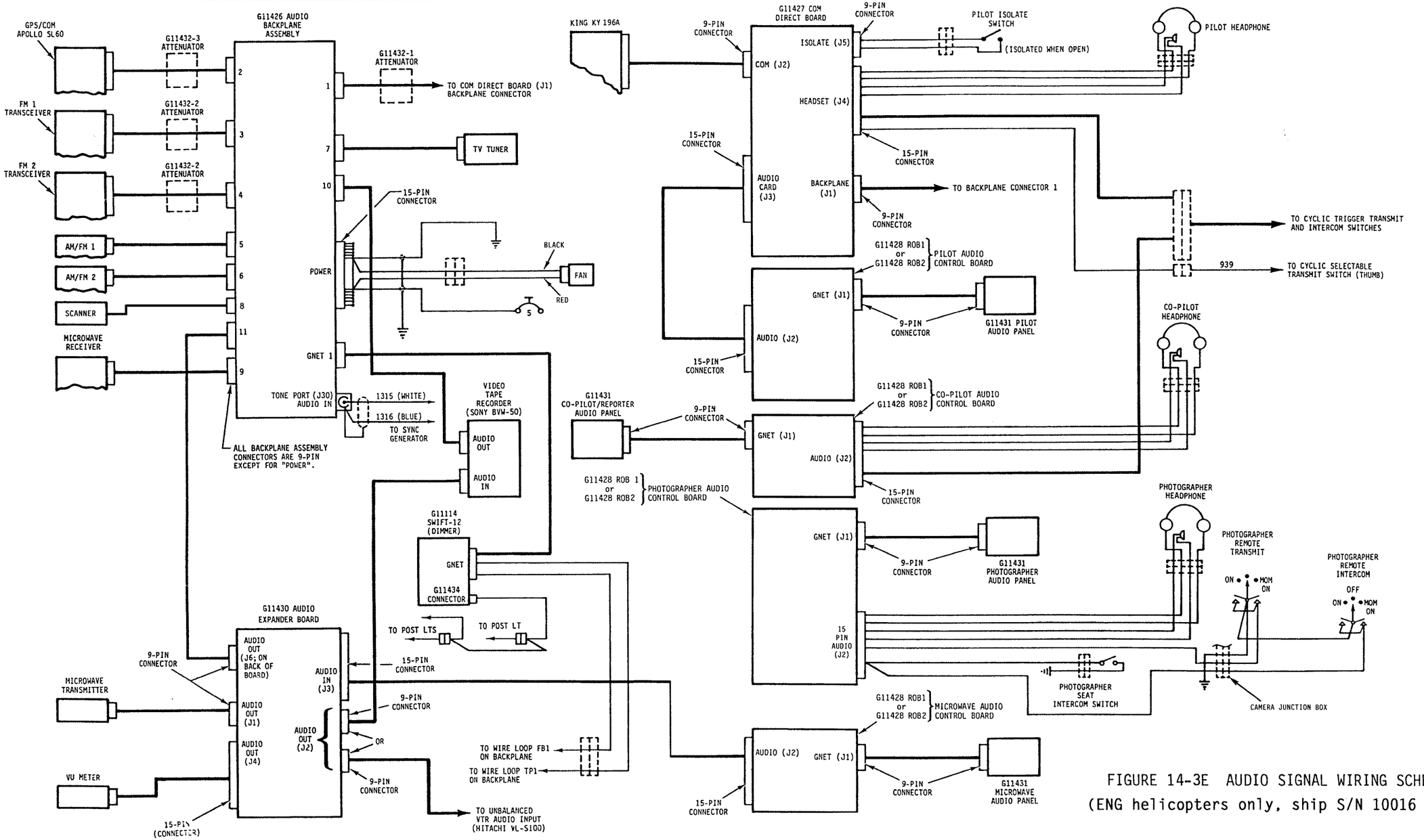


FIGURE 14-3E AUDIO SIGNAL WIRING SCHEMATIC
(ENG helicopters only, ship S/N 10016 and on)

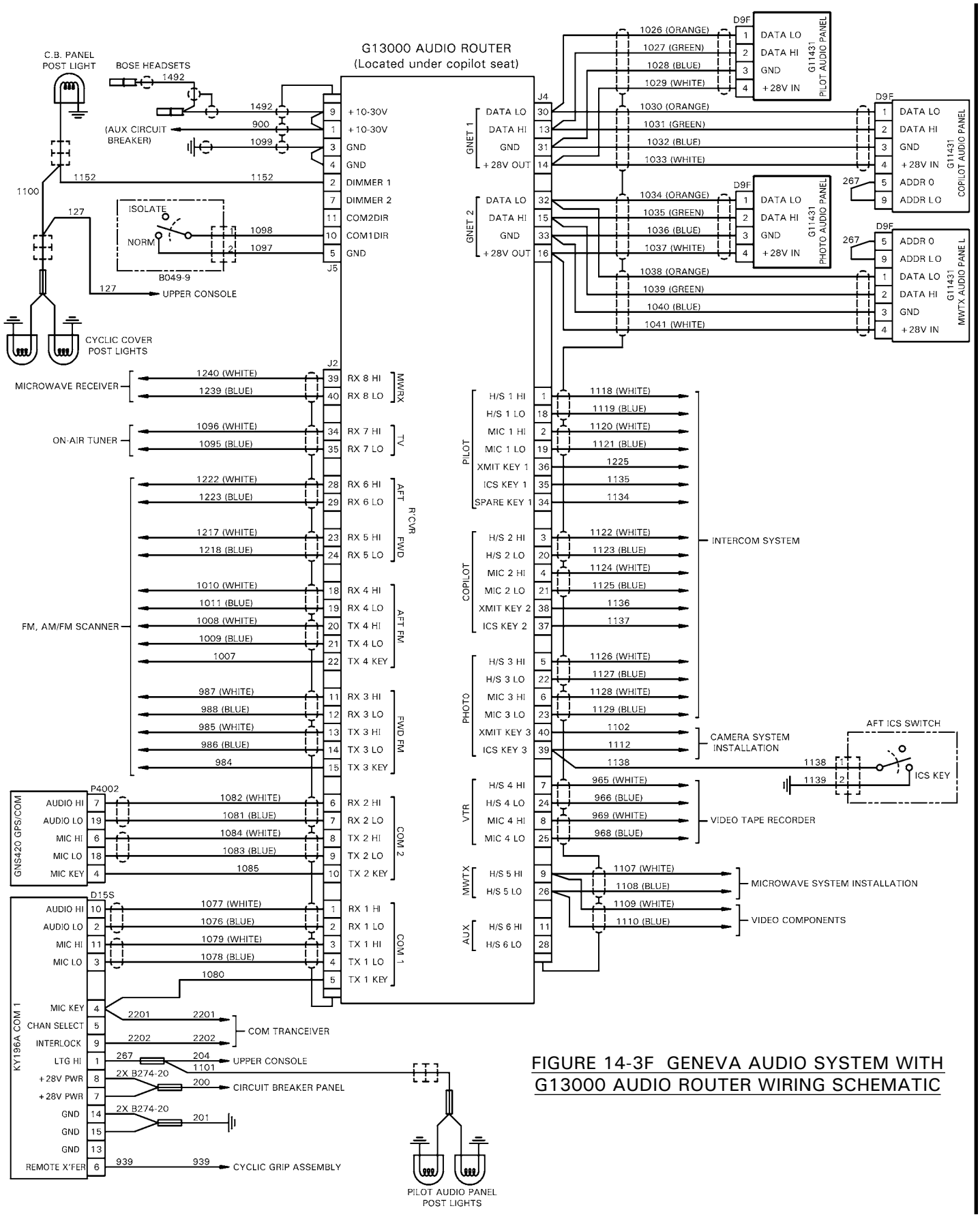


FIGURE 14-3F GENEVA AUDIO SYSTEM WITH G13000 AUDIO ROUTER WIRING SCHEMATIC

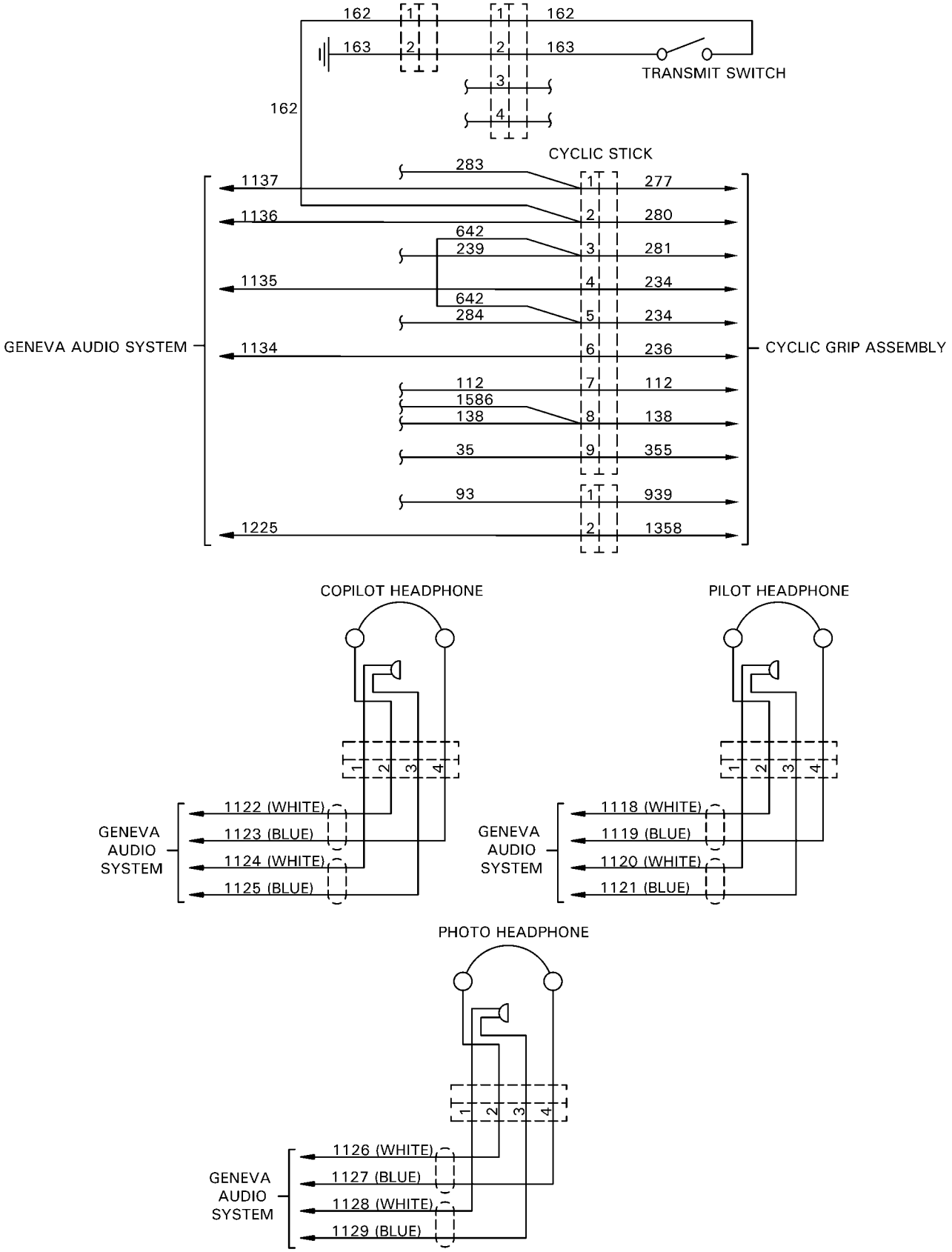


FIGURE 14-3G INTERCOM SYSTEM WIRING SCHEMATIC FOR E.N.G. HELICOPTERS WITH G13000 AUDIO ROUTER GENEVA AUDIO SYSTEM

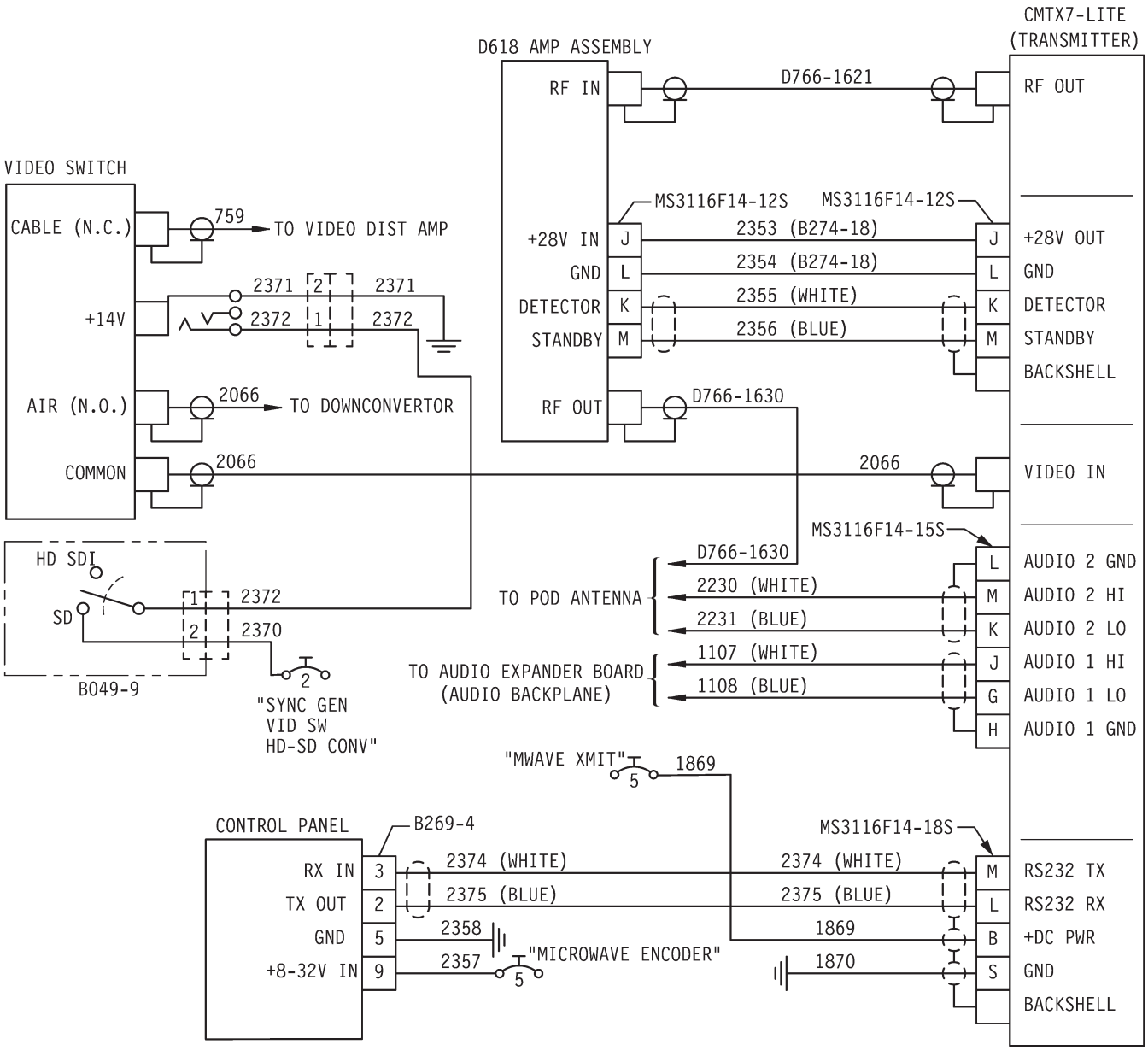


FIGURE 14-3H D056-1 MICROWAVE SYSTEM INSTALLATION

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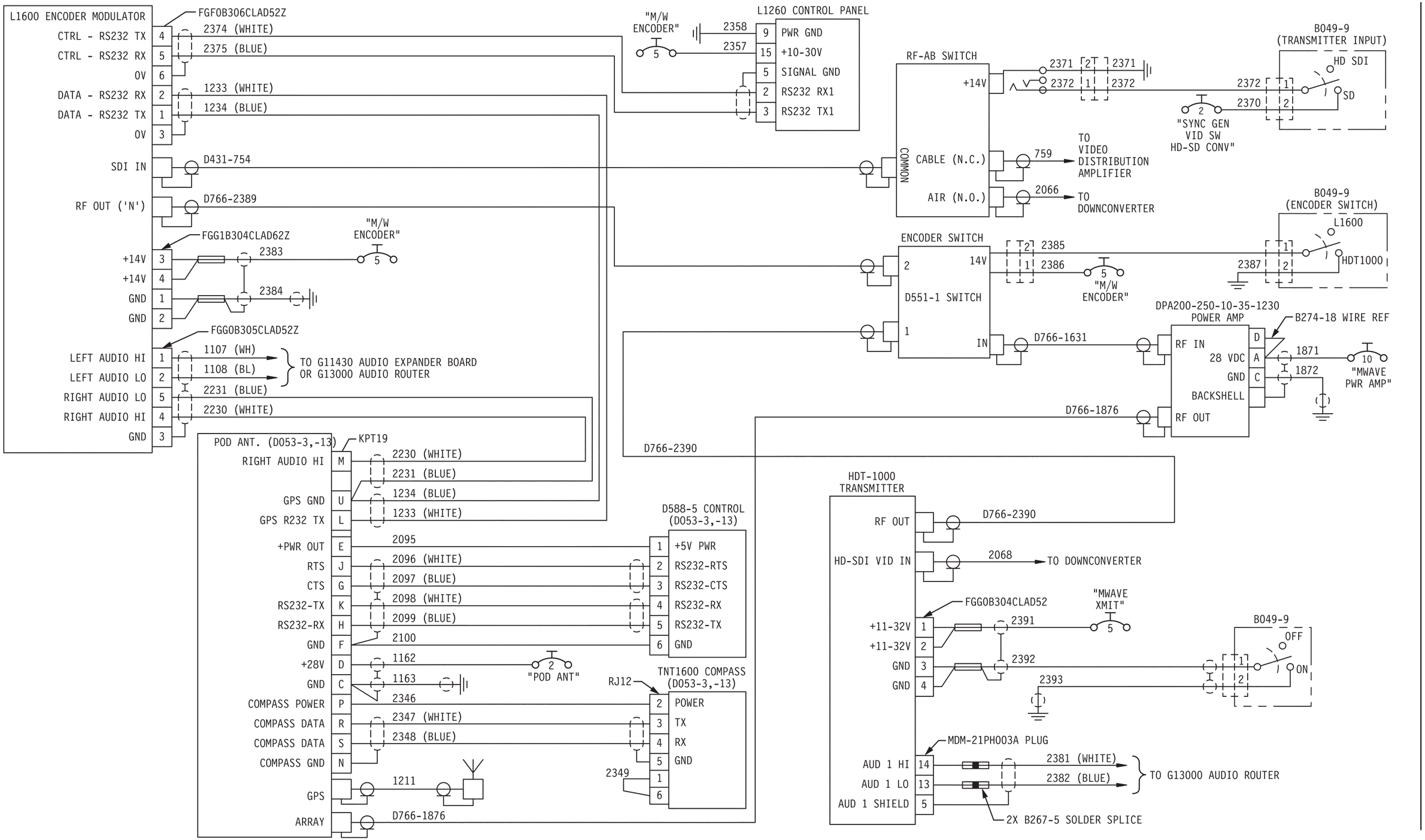


FIGURE 14-3I D056-2 MICROWAVE SYSTEM INSTALLATION

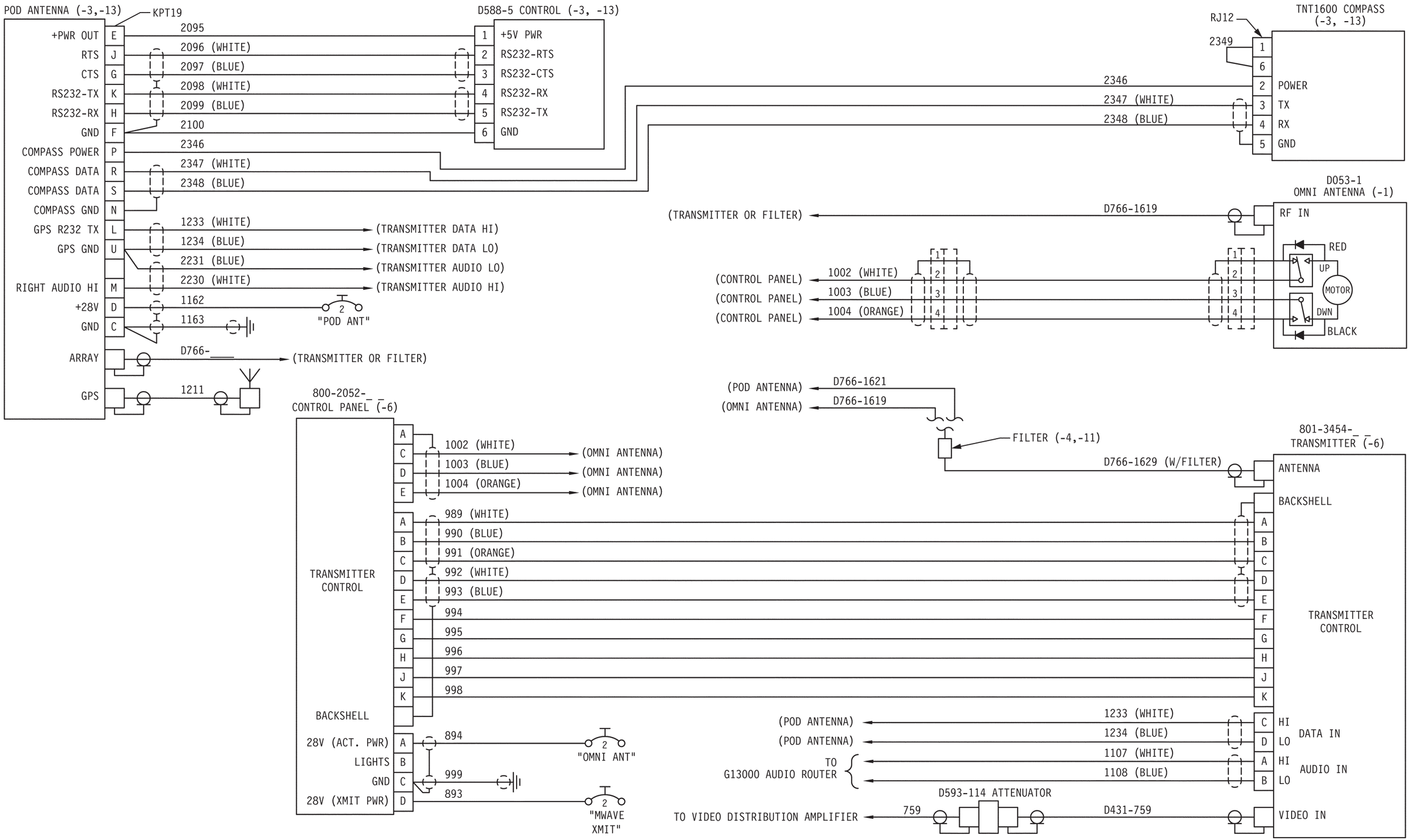


FIGURE 14-3J D053-1, -3, -4, -5, -6, & -11 MICROWAVE SYSTEM INSTALLATION

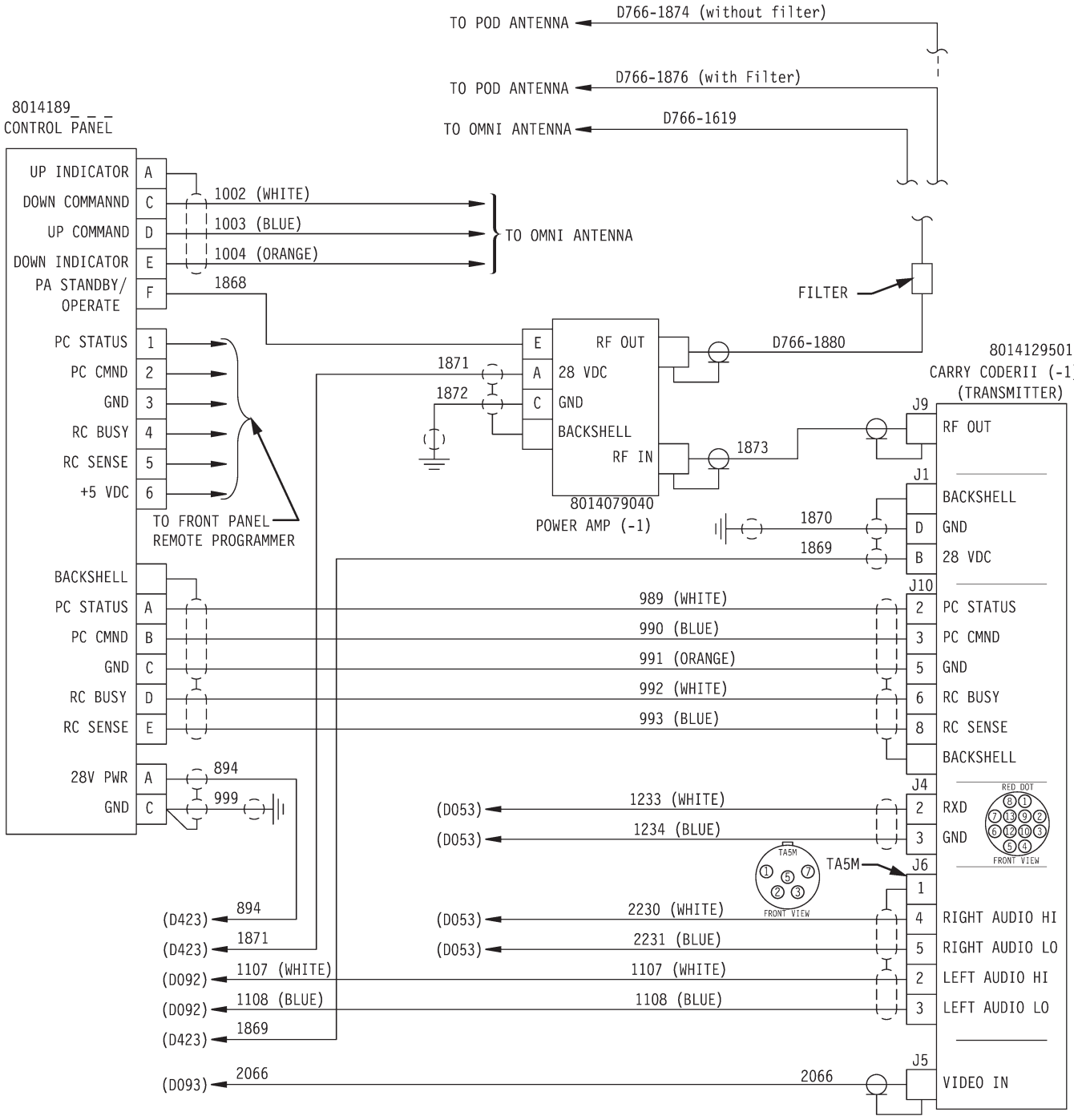


FIGURE 14-3K D055 DIGITAL MICROWAVE SYSTEM INSTALLATION

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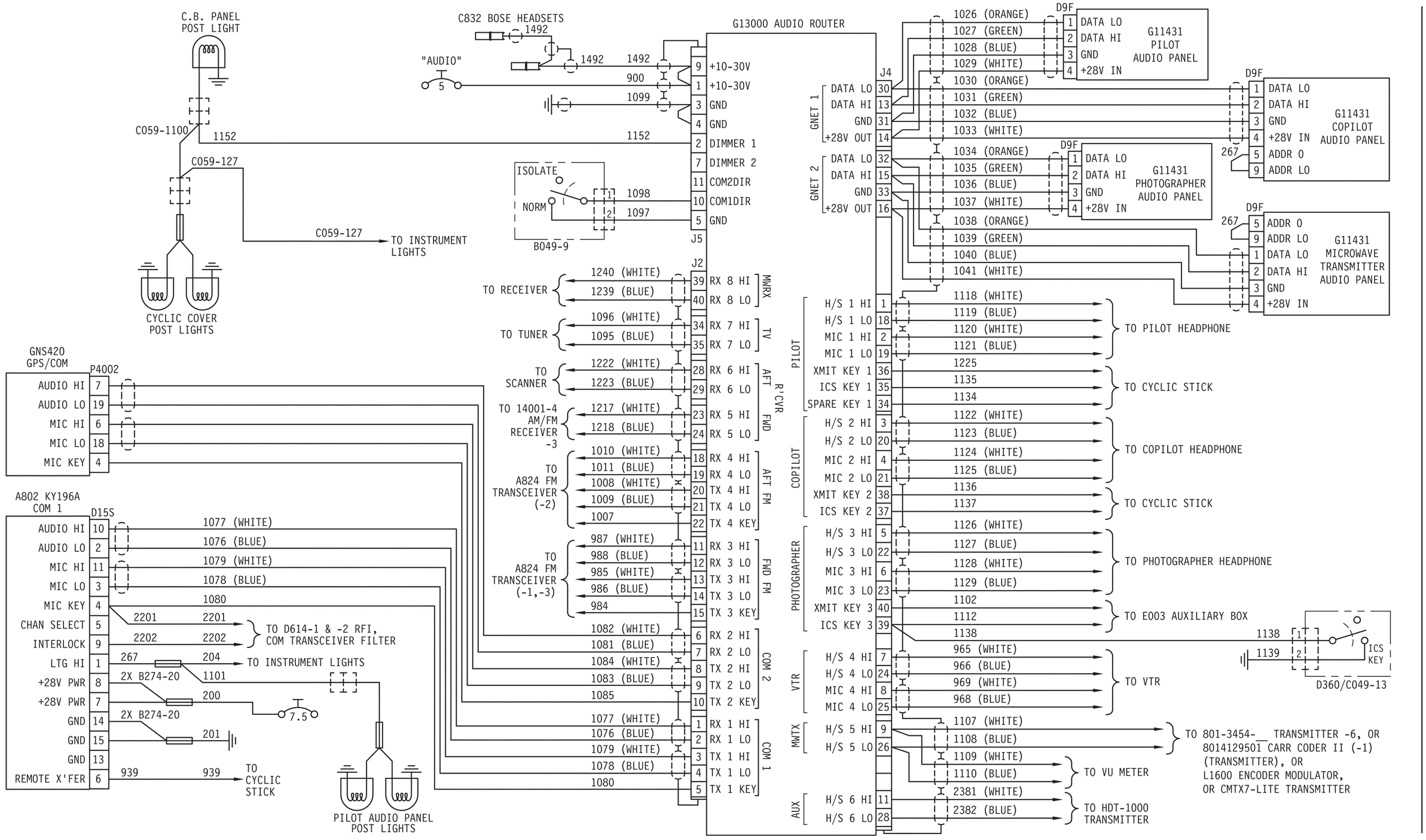


FIGURE 14-3L D092-6 GENEVA AUDIO SYSTEM INSTALLATION

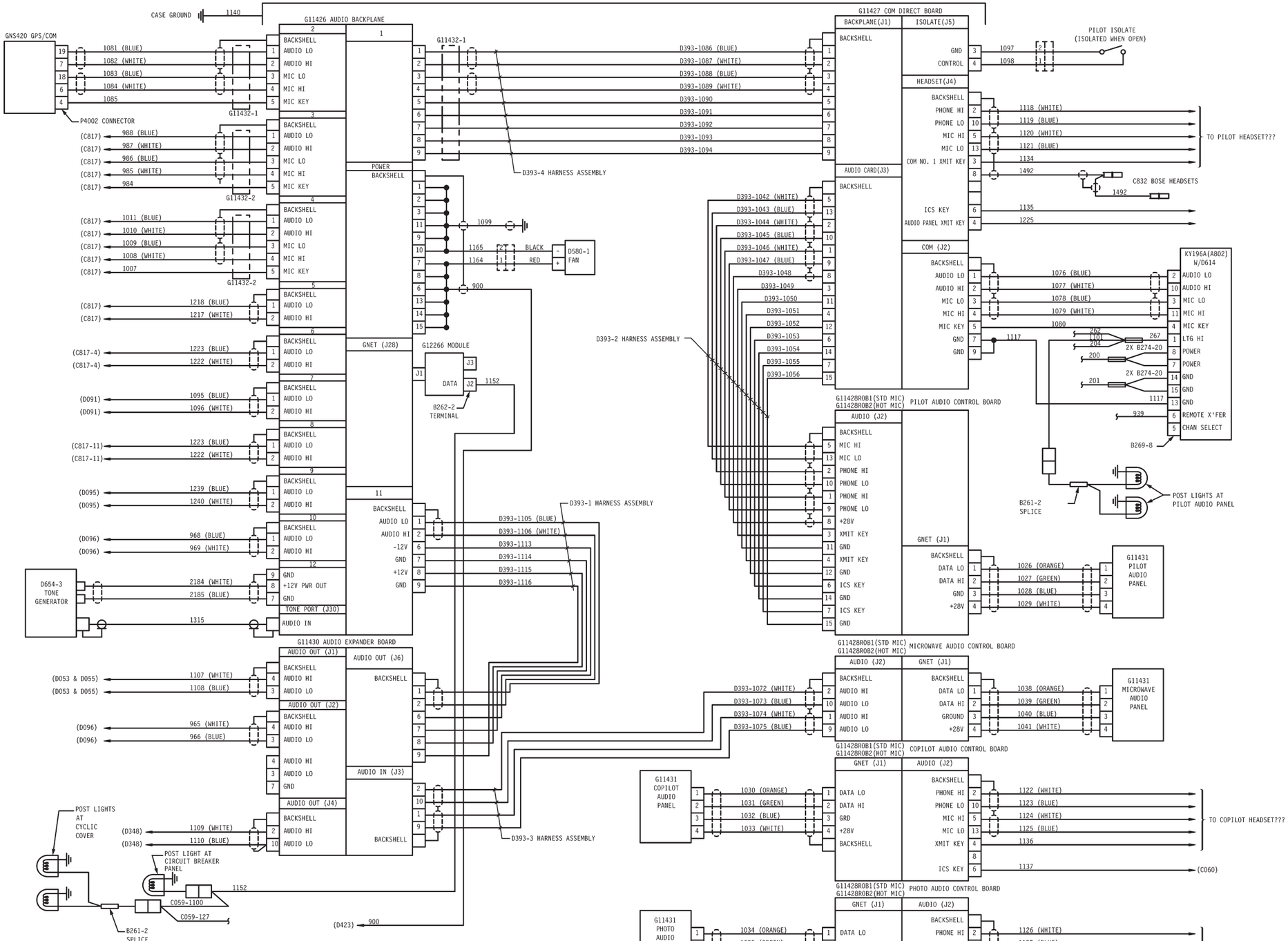


FIGURE 14-3M D092-5 GENEVA AUDIO SYSTEM INSTALLATION

14.700 ELECTRIC TRIM SYSTEM

The R44 is equipped with an automatic electric trim system. The system includes cyclic stick-mounted strain gages, a trim controller in the left front baggage compartment and lateral and longitudinal electric trim actuators at the base of the cyclic stick. The strain gages sense cyclic stick forces applied by the pilot. The trim controller processes the strain gage signals and sends compensating trim force commands to the trim actuators. A thumb-activated trim control switch on the right hand cyclic grip allows fine adjustment of the trim controller.

The automatic trim controller consists of two independent motor controllers housed in the same box. Each section has inputs for power, strain gage signal, and offset control as well as outputs for motor and regulated strain gages power. A single on-off switch on the cyclic center stick deactivates the trim actuator outputs while signal processing circuits remain on and stabilized.

If a problem is evident, then check and adjust trim controller per Section 14.710. Refer to Section 14.720 if problems are encountered when adjusting trim controller. Contact RHC Technical Support if trim controller adjustment and trouble shooting do not correct or identify problem.

14.710 Trim Controller Adjustment

CAUTION

There are two trim controller part numbers: D140-1 and D140-2. D140-1 trim controller must be used ONLY with the C055-2, -6 and -8 cyclic trim assemblies. D140-2 trim controller must be used ONLY with the C055-9, -10 and -11 cyclic trim assemblies. Incompatible controller and trim assembly(s) will result in trim system failure.

1) Prepare helicopter:

   a) Ship on level ground.

   b) Cyclic stick must have C683-4 damper firmly attached.

   c) Removable co-pilot grip or C683-6 damper installed.

   d) Cyclic boot installed and secured.

   e) Cyclic stick vertical.

   f) Cyclic friction fully on.

   g) Trim switch "OFF".

   h) Trim box connected to airframe harness (but not mounted).

   i) Attach test cord from MT547-1 set-up box to trim controller. Remove cover nuts from longitudinal and lateral balance potentiometers.

14.710 Trim Controller Adjustment (cont'd)

j. Pull all circuit breakers except warning lights, trim (28V aircraft only) longitudinal trim (14V aircraft only), and lateral trim (14V aircraft only).

k. Turn on master battery switch.

Note: System must be on (circuit breakers in) for 10 minutes to stabilize before final adjustments are made (coarse adjustments and checkout can be done during warm up).

2. Connect MT547-1 set-up box test leads to the VDC jacks (red to (+), black to (-)) of a sensitive scale high impedance digital multimeter (such as Fluke 75, Fluke 8010A, Fluke 8050A, etc).

3. Switch on set-up box to LONG TP1 and adjust longitudinal balance potentiometer for a reading of 0.0 mV ± 5.0 mV. Use small blade screwdriver to adjust potentiometer; do not loosen jam nut.

4. Switch set-up box to LONG TP2. Reading should be 0.0 mV ± 0.2 mV.
Record reading: _____ mV

5. Press and hold trim control thumb switch in forward direction. Meter reading should go in positive direction to a maximum of approximately either +325 mV (for D140-1 trim controller) or +92 mV (for D140-2 trim controller).
Record reading: _____ mV

6. Press and hold trim control thumb switch in aft direction. Meter reading should go in negative direction to a maximum of approximately -72 mV (D140-1) or -92 mV (D140-2). Record reading: _____ mV

7. The time required to travel from full (+) to full (-) (or vice versa) is approximately either 6 seconds (D140-1) or 4 seconds (D140-2).

Note: Some meters may take up to 1 second to stabilize at the new reading, therefore a 1 second longer reading could be acceptable.

8. For 14V aircraft, momentarily turn master "OFF" then back "ON". For 28V aircraft, momentarily disconnect then reconnect 10-pin power connector (containing wires 616 and 619) at trim controller. Meter reading should return to 0.0 mV ± 0.2 mV.
Record reading: _____ mV

9. Switch set-up box to LONG TP3. After 10 minutes warm up, adjust longitudinal balance for a reading of 0.0 mV ± 5.0 mV. Tap box with knuckles to relieve O-ring (which seals the potentiometer shaft) tension. Readjust as required until reading stays within limits. Then reinstall longitudinal balance potentiometer cover nut. Record reading: _____ mV

10. An approximately 2 1/2 lb forward force applied to middle of stick should result in a reading of -100 mV to -150 mV. An approximately 2 1/2 lb aft force applied to middle of stick should result in a similar but positive reading of +100 mV to +150 mV.

Note: Do not actually move stick.

14.710 Trim Controller Adjustment (cont'd)

11. No force on stick should result in same reading as in step 9, ± 2.5 mV.
Record reading: _____ mV

12. Switch set-up box to LAT TP1 and adjust lateral balance for a reading of 0.0 mV ± 5.0 mv.

13. Switch set-up box to LAT TP2. Reading should be either 0.0 mV ± 0.2 mV (D140-1) or +20.0 mV ± 0.2 mV (D140-2).
Record reading: _____ mV

14. Press and hold trim control thumb switch in left direction. Meter reading should go in positive direction to a maximum of approximately +92 mV (D140-1) or +75mV (D140-2). Record reading: _____ mV

15. Press and hold trim control thumb switch in right direction. Meter reading should go in the negative direction to maximum of approximately -92 mV (D140-1) or -35 mV (D140-2). Record reading: _____ mV

16. The time required to travel from full (+) to (-) (or vice versa) is approximately 7 seconds (D140-1) or 6 seconds (D140-2).

    Note: Some meters may take up to 1 second to stabilize at the new reading, therefore a 1 second longer reading could be acceptable.

17. For 14V aircraft, momentarily turn master "OFF" then back "ON". For 28V aircraft, momentarily disconnect then reconnect 10-pin power connector (containing wires 616 and 619) at trim controller. Meter reading should return to 0.0 mV ± 0.2 mV (D140-1) or 20.0 mV ± 0.2 mV (D140-2).
Record reading: _____ mV

    a. For systems with D140-2 trim controller ONLY: Momentarily press trim control switch until a stable reading of 0.0 mV ± 0.2 mV is obtained.

    Note: Voltage at LAT TP2 must remain at 0.0 mV ± 0.2 mV thru step 20. The voltage will be correct provided trim controller power is not interrupted and the trim control switch is not moved.

18. Switch set-up box to LAT TP3. After 10 minute warm up adjust lateral balance for a reading of 0.0 mV ± 5.0 mV. Tap box with knuckles to relieve O-ring tension, readjust as required until reading stays within limits. Reinstall lateral balance potentiometer cover nut.
Record reading: _____ mV

19. An approximately 2 1/2 lb left force applied to middle of stick should result in a reading of -100 mV to -150 mV. An approximately 2 1/2 lb right force applied to middle of stick should result in a similar but positive reading of +100 mV to +150 mV. **Note**: Do not actually move stick.

20. No force on the stick should result in the same readings in step 18, ±2.5 mV.
Record reading: _____ mV

14.710 Trim Controller Adjustment (cont'd)

21. With thumb switch, adjust LAT TP3 to +100mV. Turn trim switch ON and observe trim actuator response; it should run smoothly to the stop. Turn trim switch OFF. With thumb switch, adjust LAT TP3 to -100mV. Turn trim switch ON and observe trim actuator response; it should run smoothly to the stop. Turn trim switch OFF. With thumb switch, again adjust LAT TP3 to +100 mV. Turn trim switch ON and observe trim actuator response; it should run smoothly to the stop. Replace actuator if it does not run smoothly. Turn trim switch and master switch OFF.

22. Turn master switch ON. Switch set-up box to LONG TP3. With thumb switch, adjust LONG TP3 to -100mV. Turn trim switch ON and observe trim actuator response; it should run smoothly to stop. Turn trim switch OFF. With thumb switch, adjust LONG TP3 to +100 mV. Turn trim switch ON and observe trim actuator response; it should run smoothly to the stop. Replace actuator if it does not run smoothly. Turn trim switch OFF.

23. Switch set-up box to LONG TP2 and adjust thumb switch for 0.0 mV ± 0.2 mV. Switch set-up box to LAT TP2 and adjust thumb switch for 0.0 mV ± 0.2 mV.

24. Disconnect meter and test cable and install receptacle cap (make sure it locks in position). Turn trim system switch "ON". Motors should not be running.

25. A light finger push to stick in forward or aft direction should cause longitudinal motor to run down or up, respectively. Motor should stop when push stops. Motor should run smoothly from stop to stop.
    Note: Motor runs faster with stronger push.

26. A light finger push to stick in the left or right direction should cause lateral motor to run left or right. Motor should stop when push stops. Motor should run smoothly from stop to stop.
    Note: Motor runs faster with stronger push.

27. Lateral push should not cause longitudinal motor to run and vice versa.

28. Pull LONG TRIM circuit breaker and verify only lateral trim actuator functions when lateral and longitudinal forces are applied to cyclic stick. Reset LONG TRIM circuit breaker. (Not applicable to 28 volt aircraft.)

29. Pull LAT TRIM circuit breaker and verify only longitudinal trim actuator functions when lateral and longitudinal forces are applied to cyclic stick. Reset LAT TRIM circuit breaker. (Not applicable to 28 volt aircraft.)

30. Partially release cyclic friction. Hold cyclic grip and move it in all directions. Motors should move with motion. If motor pushes back and resists motion (or moves sideways to force), there is a wiring error.

    Verify adequate clearance for all combinations of stick and motor arm positions. Verify adequate clearance for motor wires and cyclic stick wires.

31. Center motors and turn trim system and master switches "OFF". Reset all circuit breakers.

32. Install and secure trim controller, and route D161-1 trim controller harness out of baggage compartment and away from any sharp edges (sheet metal, screws, etc).

14.720 Trim System Electrical Troubleshooting

Perform Trim Controller Adjustment per section 14.710 whenever a problem is suspected in trim system.

If LONG or LAT TP1 is in excess of ±2.00 volts and will not adjust, there may be a broken strain gage signal wire. Refer to Figure 14-4 Automatic Trim Control Schematic. Lateral circuit signal is pin S & pin R. Longitudinal circuit signal is pin T & pin U.

If LONG TP1 & TP3 (or LAT TP1 & TP3) adjust satisfactorily (balance) but it is not possible to obtain ±100-150mV reading when pushing cyclic stick (ref Section 14.710 steps 10 & 19), there may be a broken strain gage power wire. Lateral circuit power is pin A & pin P. Longitudinal circuit power is pin V & pin N.

Check following if strain gage wiring faults are suspected.

1. Strain Gage Bridge Resistance Readings: Disconnect 19-pin signal connector at trim controller and measure resistance between following harness connector pins. If infinite resistance is found between any 3 combinations in one circuit then an open circuit exists. A damaged strain gage is indicated if resistance readings do not follow chart.

Lateral Circuit

Pin	to	Pin	=	Resistance
A		P		350±3 ohms
S		R		350±3 ohms
A		S		262±3 ohms
A		R		262±3 ohms
P		S		262±3 ohms
P		R		262±3 ohms

Longitudinal Circuit

Pin	to	Pin	=	Resistance
V		N		350±3 ohms
T		U		350±3 ohms
V		T		262±3 ohms
V		U		262±3 ohms
N		T		262±3 ohms
N		U		262±3 ohms

2. Strain Gage Bridge Insulation Resistance: Disconnect 19-pin signal connector at trim controller and measure at harness connector; resistance must be in excess of 20 megohms for each of the following:

Lateral Gages
Pin A to ship ground

Longitudinal Gages
Pin V to ship ground

Lateral Gages-to-Longitudinal Gages
Pin A to Pin V

Lateral Gages-to-Shield
Pin A to Pin G

Longitudinal Gages-to-Shield
Pin V to Pin G

Shield
Pin G to Ship Ground

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14.700 ELECTRIC TRIM SYSTEM (CONT'D)

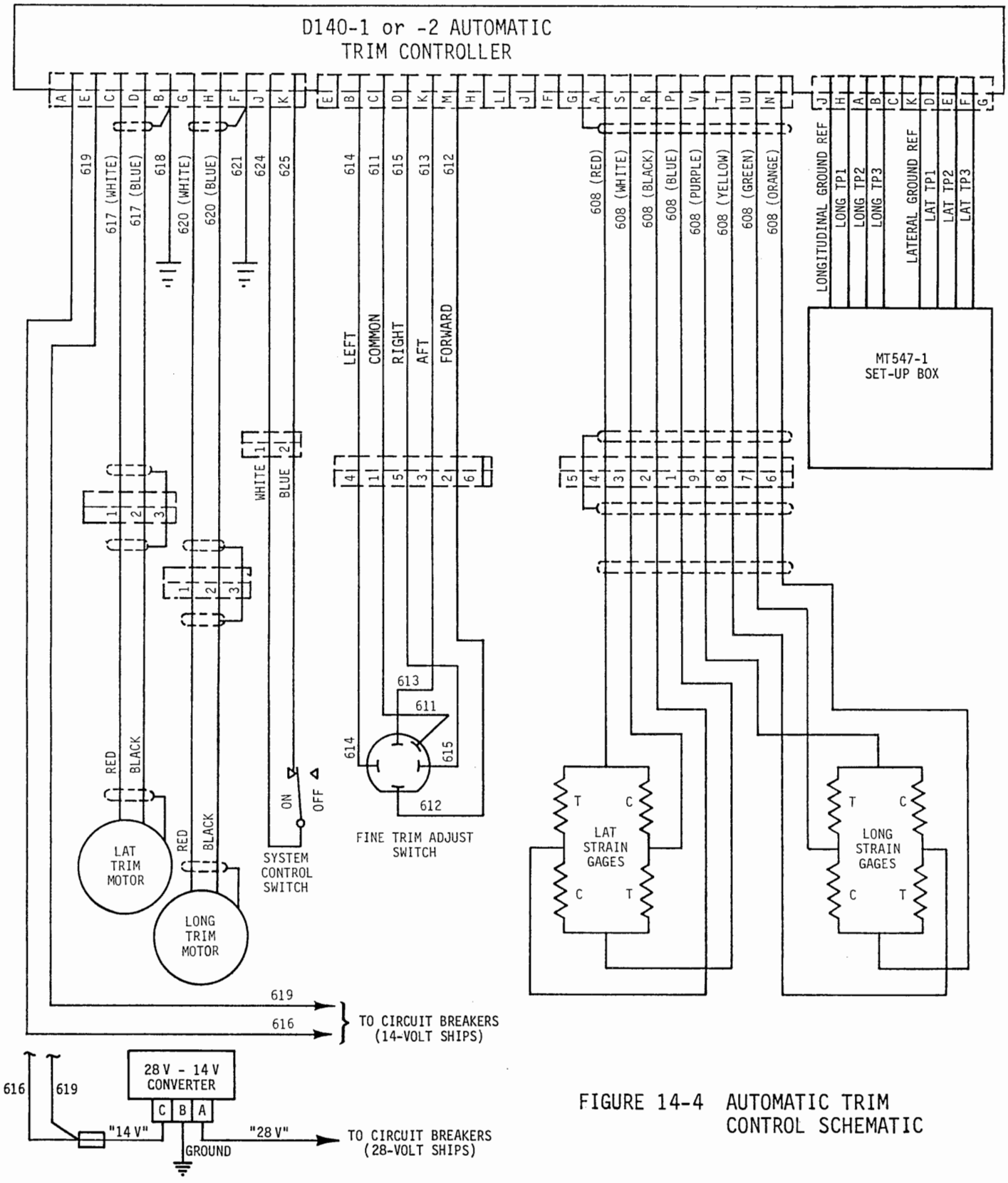


FIGURE 14-4 AUTOMATIC TRIM CONTROL SCHEMATIC

14.700 ELECTRIC TRIM SYSTEM (CONT'D)

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14.800 Antenna Locations

NO.	ANTENNA	MHz	PART NO.
1	ADF	—	KA44B
2	Marker Beacon	—	CI 102
3	Transponder	—	CI 105-16, KA60
4	RH Belly UHF	400-960	CI 285
5	DME	—	CI 105-16, KA60
6	Transponder	—	CI 105-16, KA60
7	LH/RH Belly (Ref)	—	See no.s 8 and 9
8	RH Belly FM	138-174	CI 292-3
	RH Belly FM	450-470	CI 177-20
	RH Belly AM/FM	—	CI 222
	RH Belly FM	403-512	CI 273, CI 272-1, CI 271
9	LH Belly FM	138-174	CI 292-3
	LH Belly FM	450-470	CI 177-20
	LH Belly FM	220-225	D721-1
	LH Belly FM	403-512	CI 273, CI 272-1, CI 271
	LH Belly COM	118-136	CI 122
10	ELT	—	AV-300
11	Cowling GPS	—	GA 30
12	RMS/GPS		Also, see no. 13.
13	Upper Fwd COM	—	CI 121, CI 248-5
	Upper Fwd FM	—	CI 177
	Upper Fwd FM	403-512	CI 273, CI 272-1, CI 271
	Upper Fwd FM	800-870	CI 306
	Upper Fwd COM/GPS	—	CI 2580-200
14	Upper Aft COM	—	CI 121, CI 248-5
	Upper Aft FM	—	CI 177
	Upper Aft COM/GPS	—	CI 2580-200
	Upper Aft FM	403-512	CI 273, CI 272-1, CI 271
15	Lower Fwd FM	—	CI 177
	Lower Fwd FM	403-512	CI 273, CI 272-1, CI 271
	Lower Fwd FM	800-870	CI 306
16	Lower Aft FM	—	CI 177
	Lower Aft VHF	118-136	CI 122
	Lower Aft FM	403-512	CI 273, CI 272-1, CI 271
	Lower Aft FM	800-870	CI 306
17 & 18	NAV	108-118 & 329-335	D20543 (VOR & LOCALIZER)
	NAV	108-118 & 329-335	D20543 (VOR & LOCALIZER W/DIPLEXER)

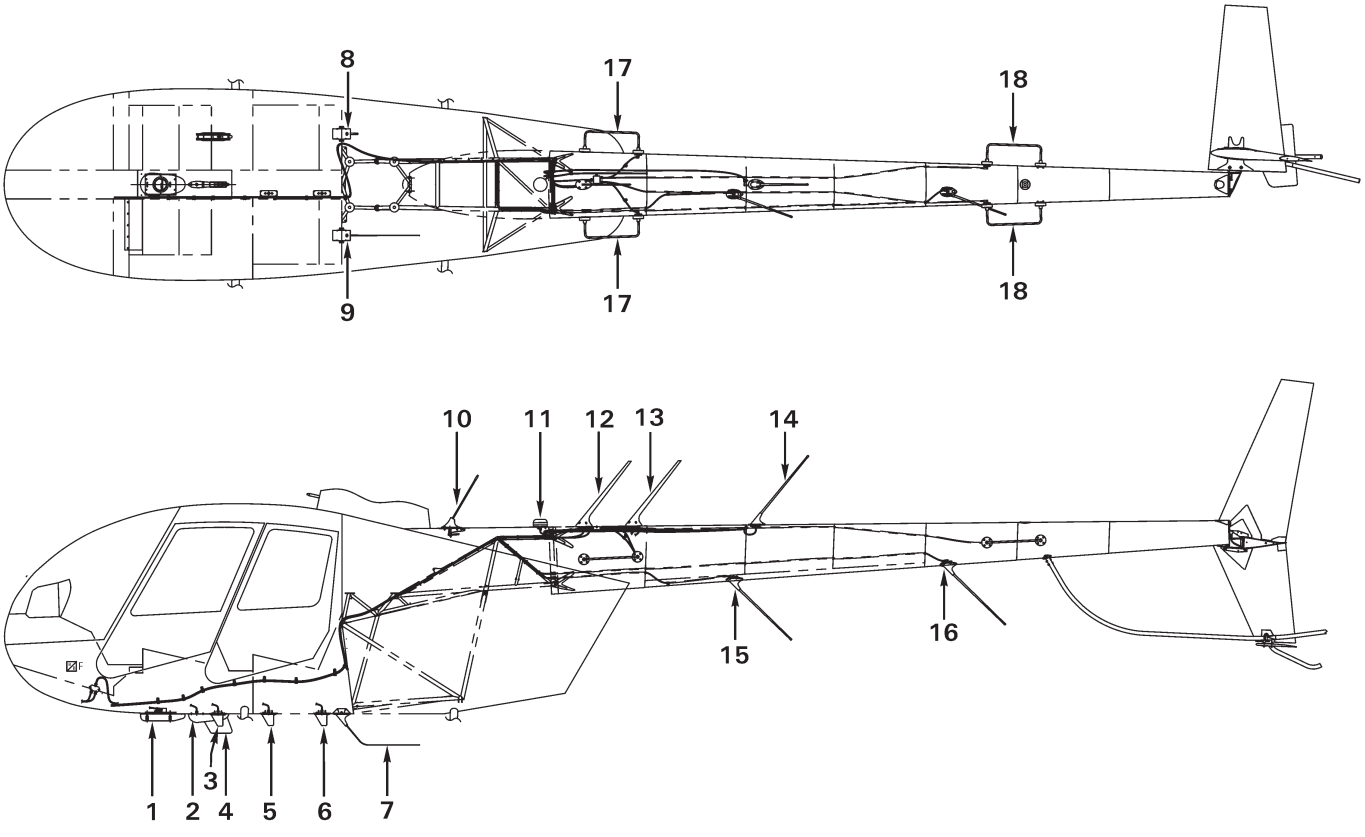


FIGURE 14-5 ANTENNA LOCATIONS

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14.900 AVIONICS SCHEMATICS

The basic communications wiring common to all the Com. radio configurations include a N.A.T. Intercom System that provides a voice-activated intercom and Pilot and Co-Pilot cyclic stick switches. In addition, an intercom switch at each of the 2 rear seats can also activate the intercom.

The pilot's and co-pilots individual headphone jacks are mounted to the ceiling and a little behind their respective heads. The rear passenger headphone jacks are contained in a com box centered at the rear most portion of the cabin ceiling. The pilot can use the Pilot "Isolate" switch which will remove him from the Intercom bus; he can then communicate over the com radio without disturbances.

14.900 AVIONICS SCHEMATICS (Cont'd)

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14.900 AVIONICS SCHEMATICS (Cont'd)

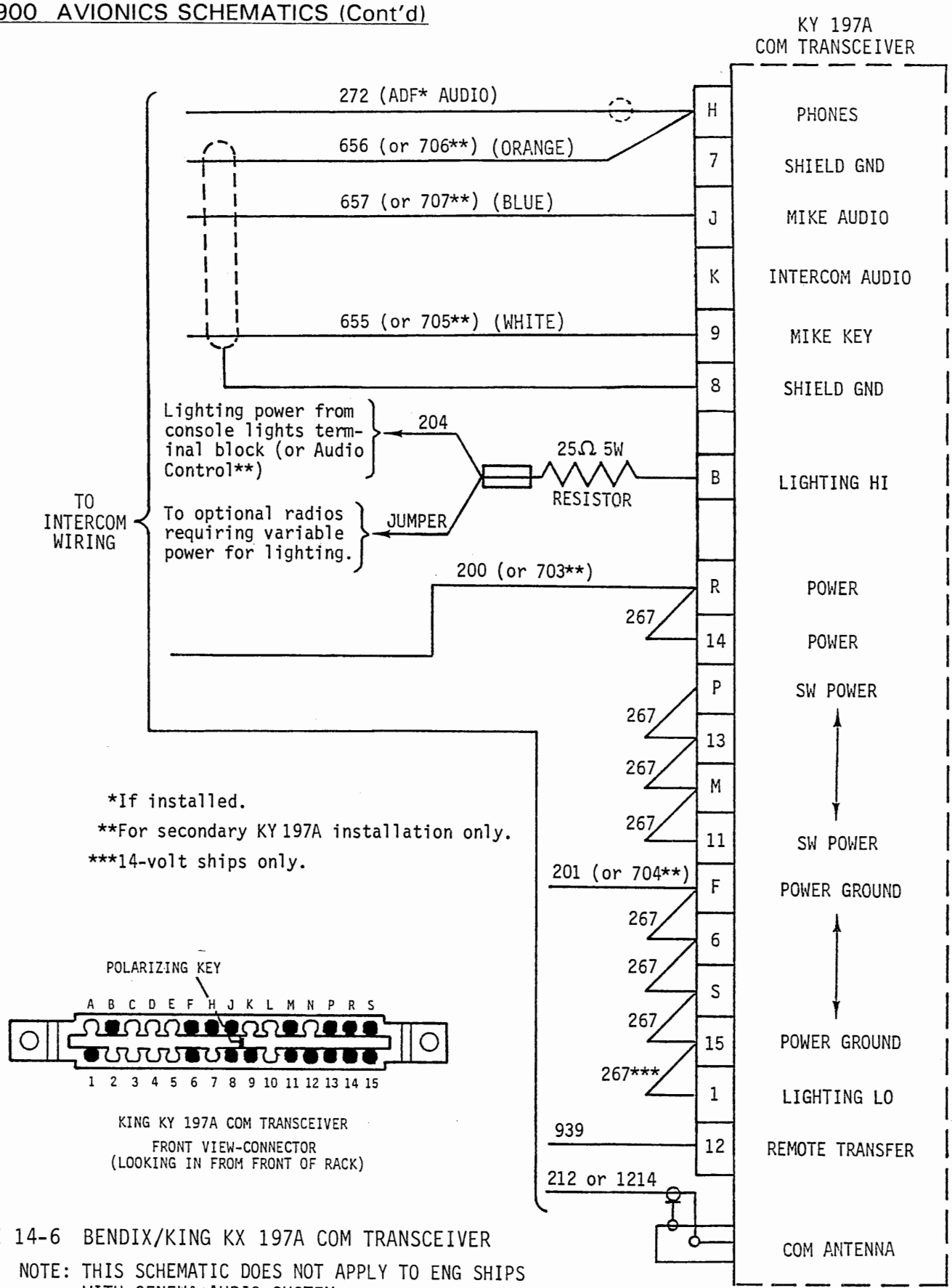


FIGURE 14-6 BENDIX/KING KX 197A COM TRANSCEIVER

NOTE: THIS SCHEMATIC DOES NOT APPLY TO ENG SHIPS WITH GENEVA AUDIO SYSTEM.

14.900 AVIONICS SCHEMATICS (Cont'd)

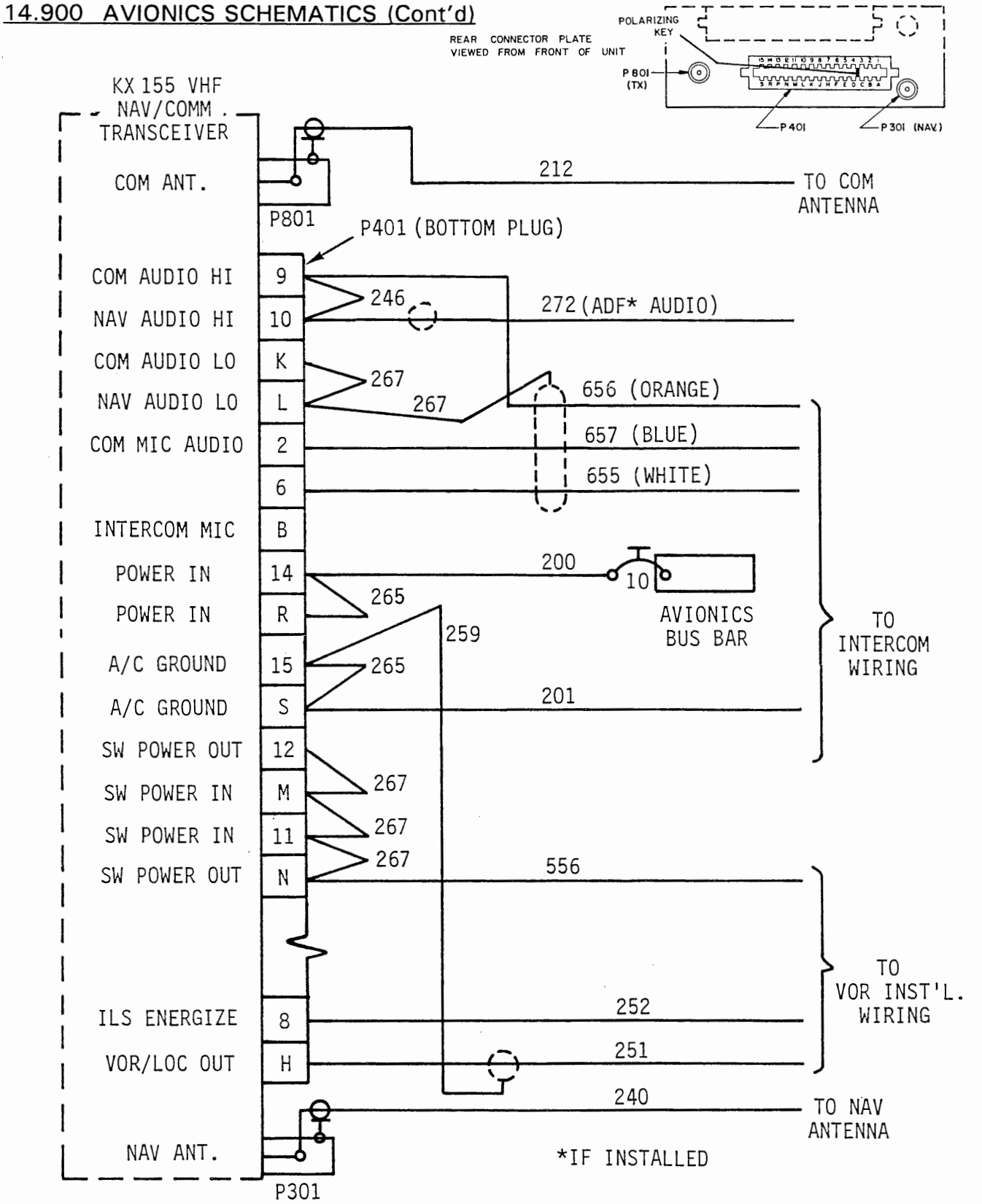


FIGURE 14-7 BENDIX/KING KX 155 VHF NAV/COMM TRANSCEIVER

14.900 AVIONICS SCHEMATICS (Cont'd)

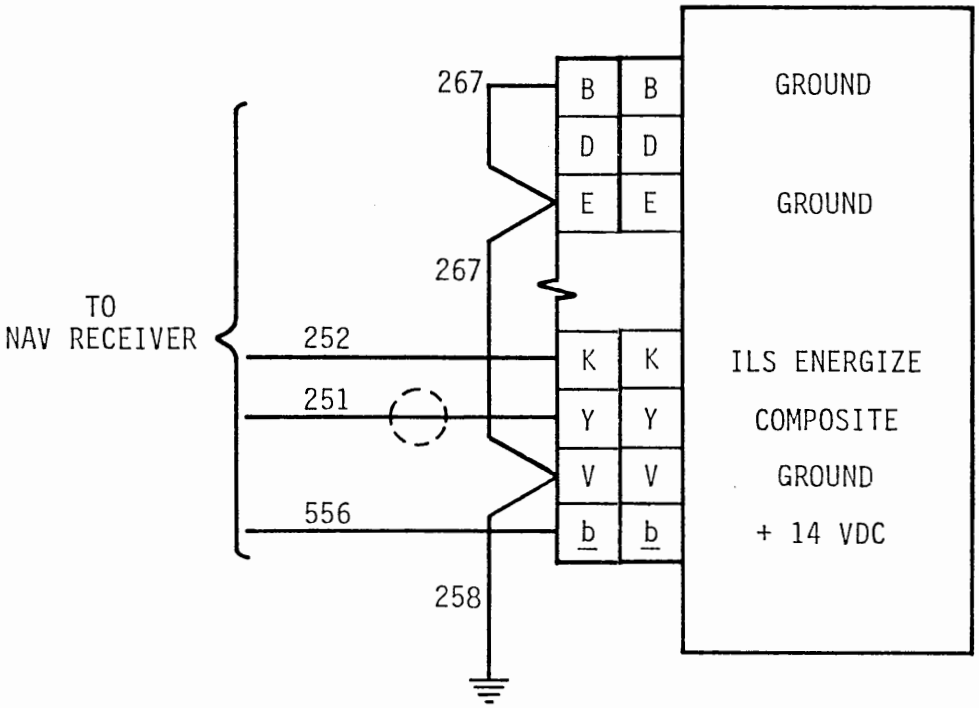


FIGURE 14-8 BENDIX/KING KI 203 VOR INDICATOR

14.900 AVIONICS SCHEMATICS (Cont'd)

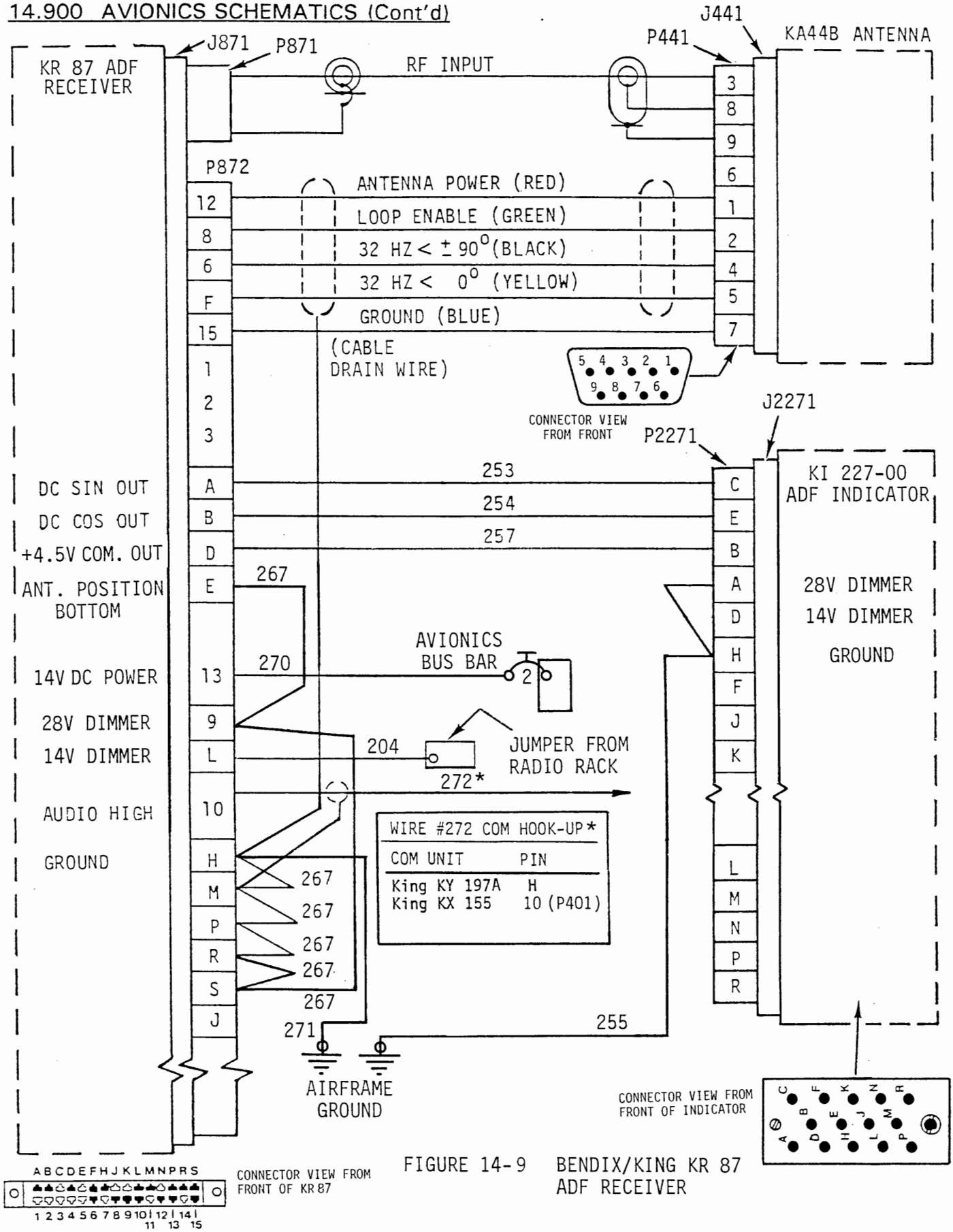


FIGURE 14-9 BENDIX/KING KR 87 ADF RECEIVER

14.900 AVIONICS SCHEMATICS (Cont'd)

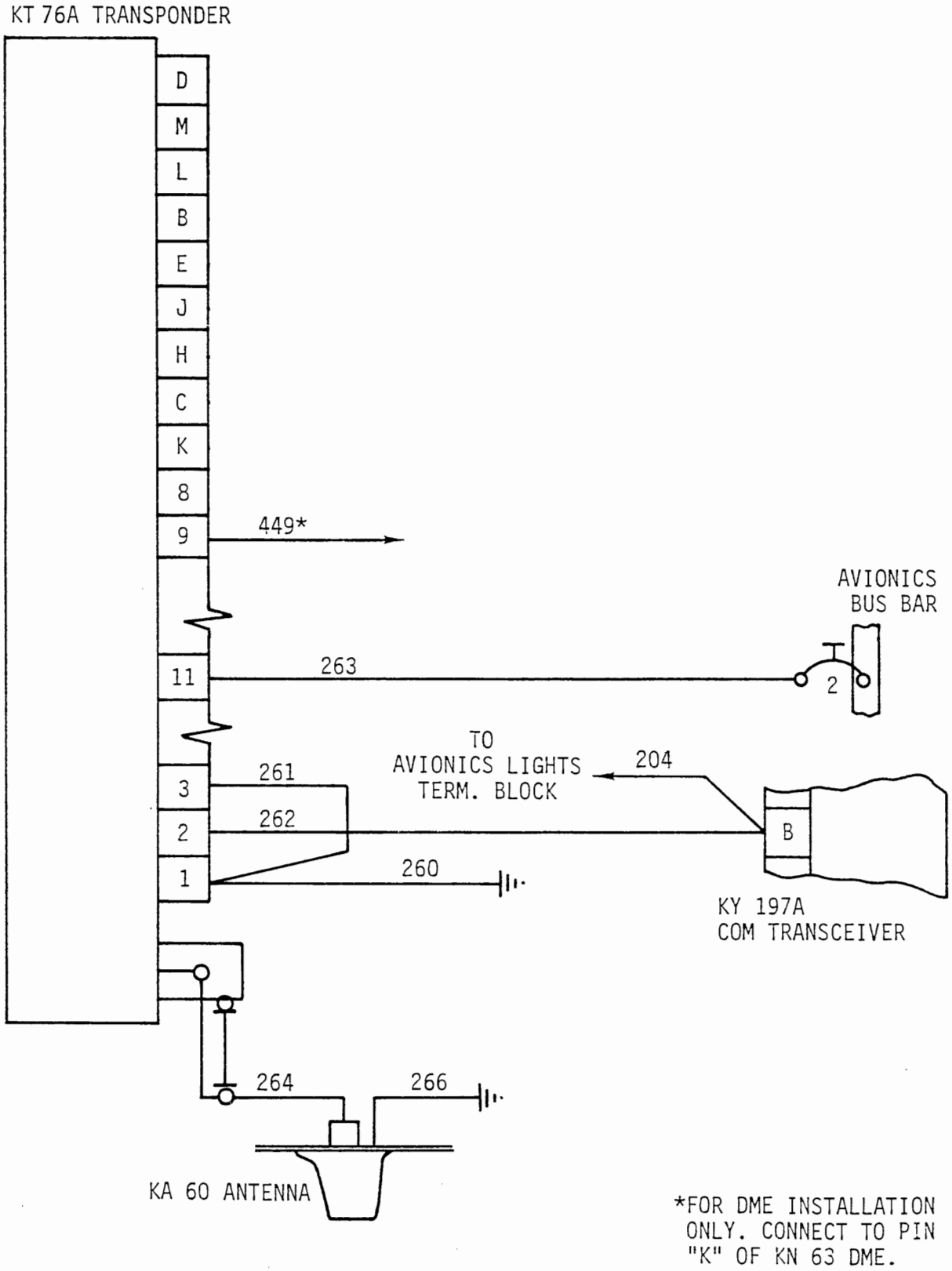


FIGURE 14-10 BENDIX/KING KT 76A TRANSPONDER

14.900 AVIONICS SCHEMATICS (Cont'd)

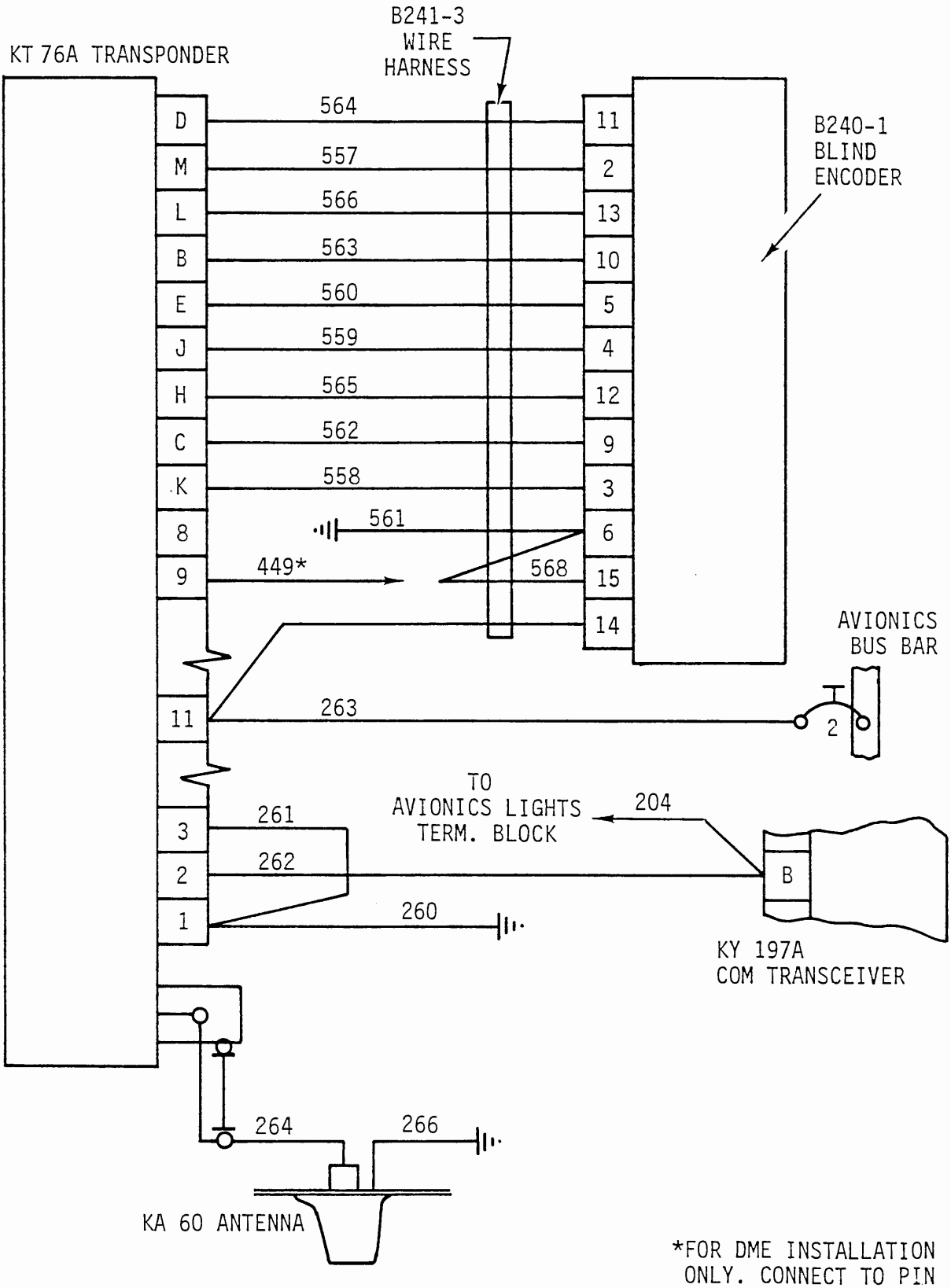


FIGURE 14-11 BENDIX/KING KT 76A TRANSPONDER WITH BLIND ENCODER

14.900 AVIONICS SCHEMATICS (Cont'd)

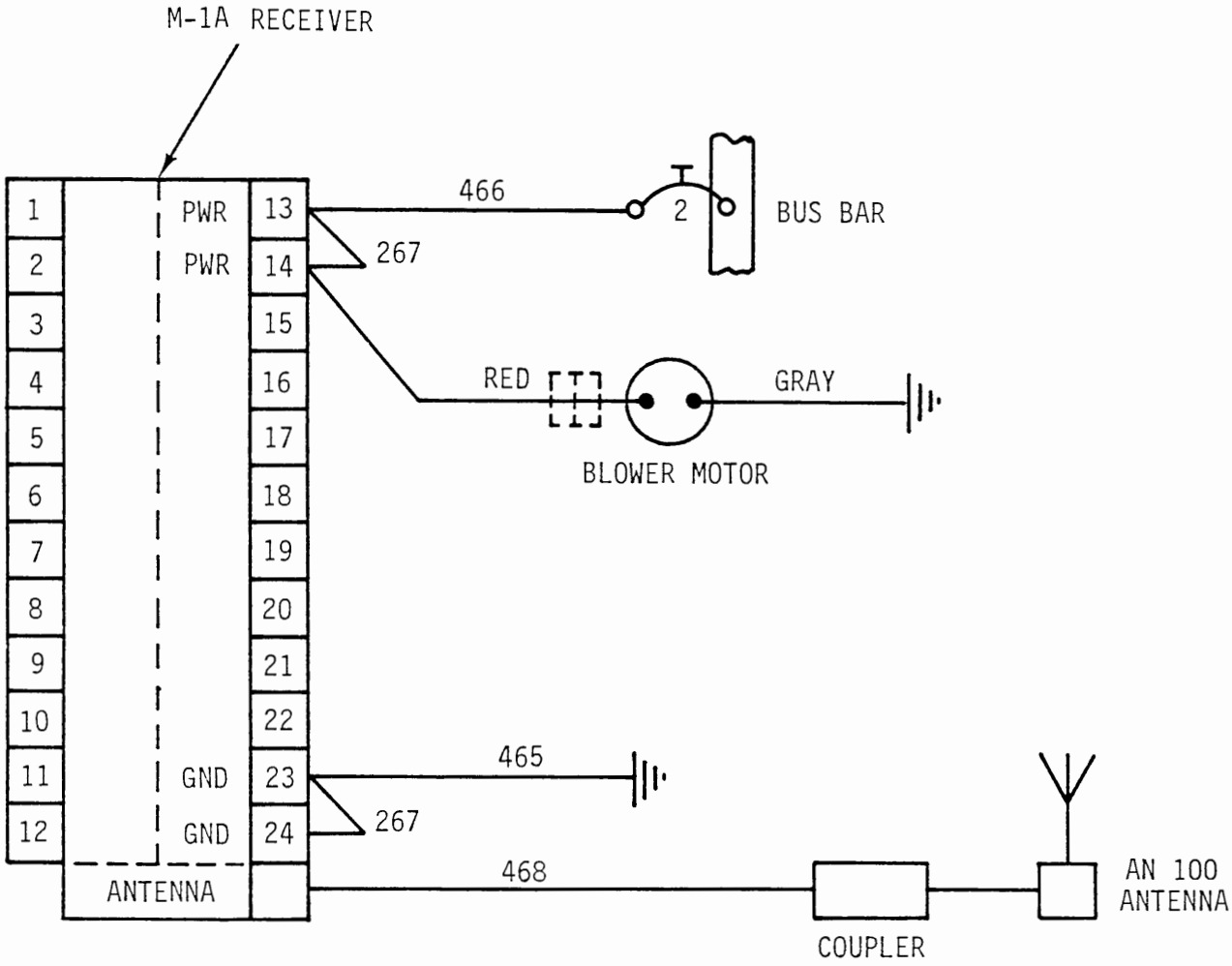


FIGURE 14-12 NORTHSTAR M-1A LORAN C RECEIVER

14.900 AVIONICS SCHEMATICS (Cont'd)

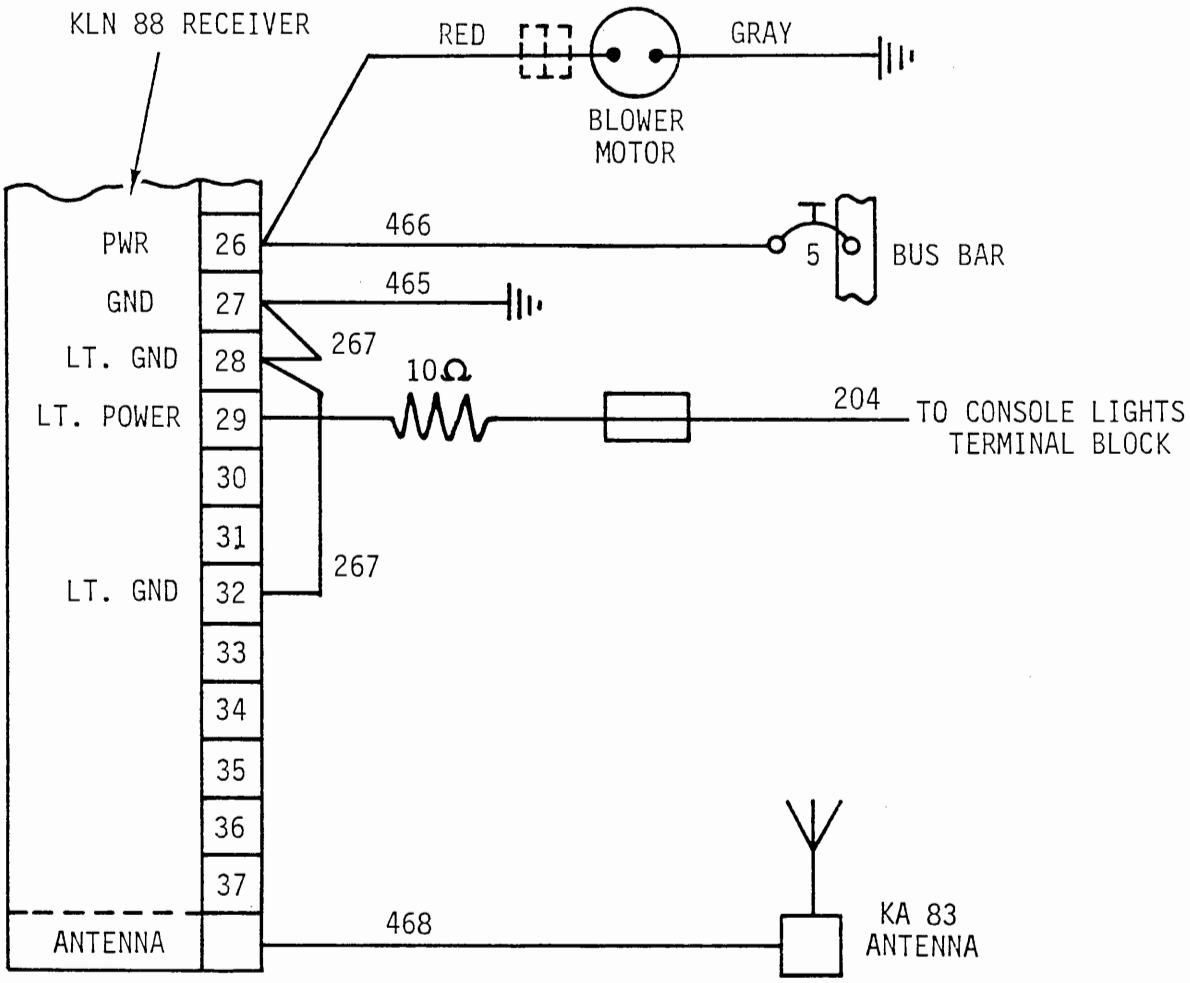


FIGURE 14-13 BENDIX/KING KLN 88 LORAN C RECEIVER

14.900 AVIONICS SCHEMATICS (Cont'd)

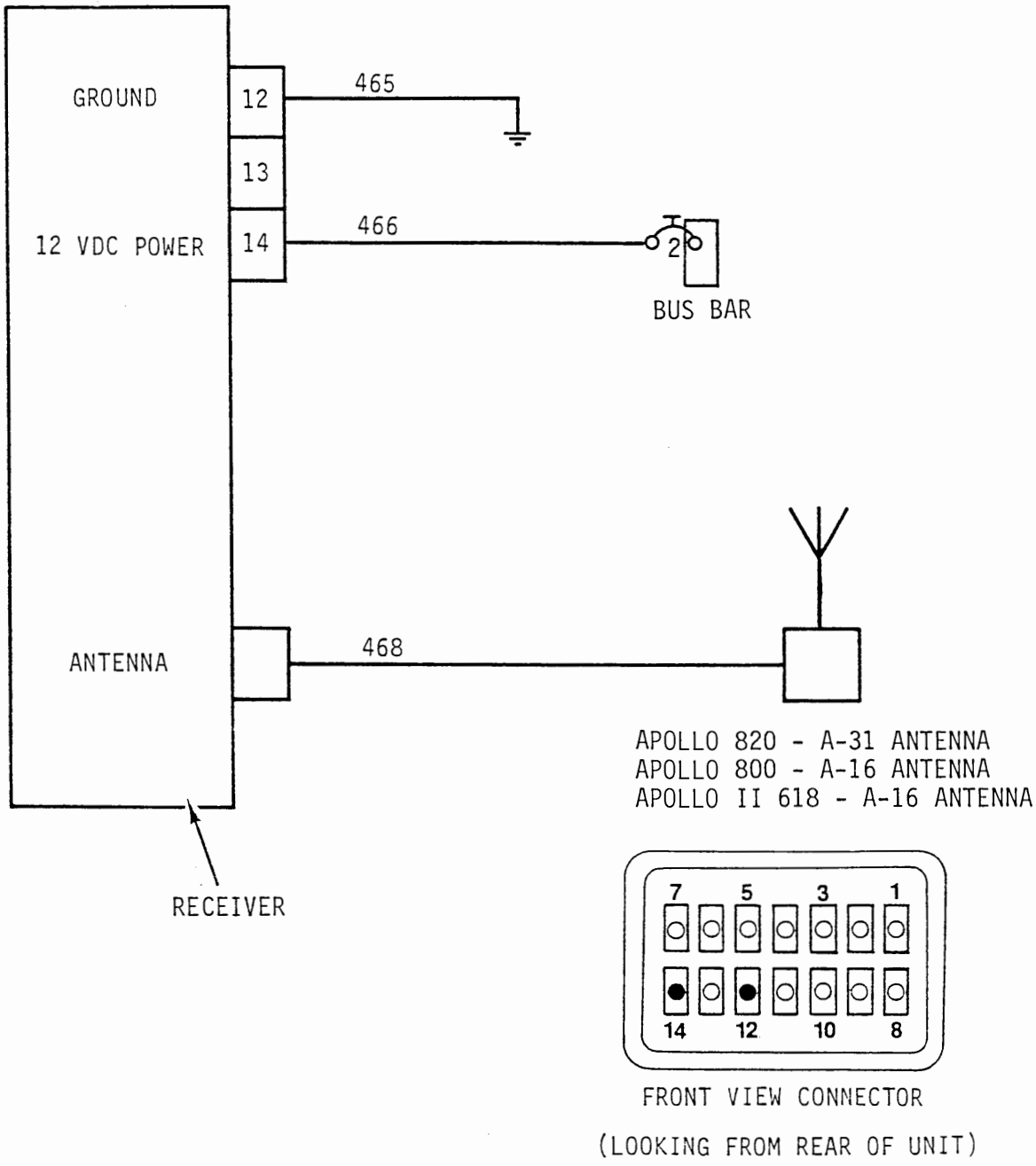


FIGURE 14-14

APOLLO 820 FLYBUDDY GPS RECEIVER
APOLLO 800 FLYBUDDY PLUS LORAN C RECEIVER
APOLLO 618 TCA LORAN C RECEIVER

14.900 AVIONICS SCHEMATICS (Cont'd)

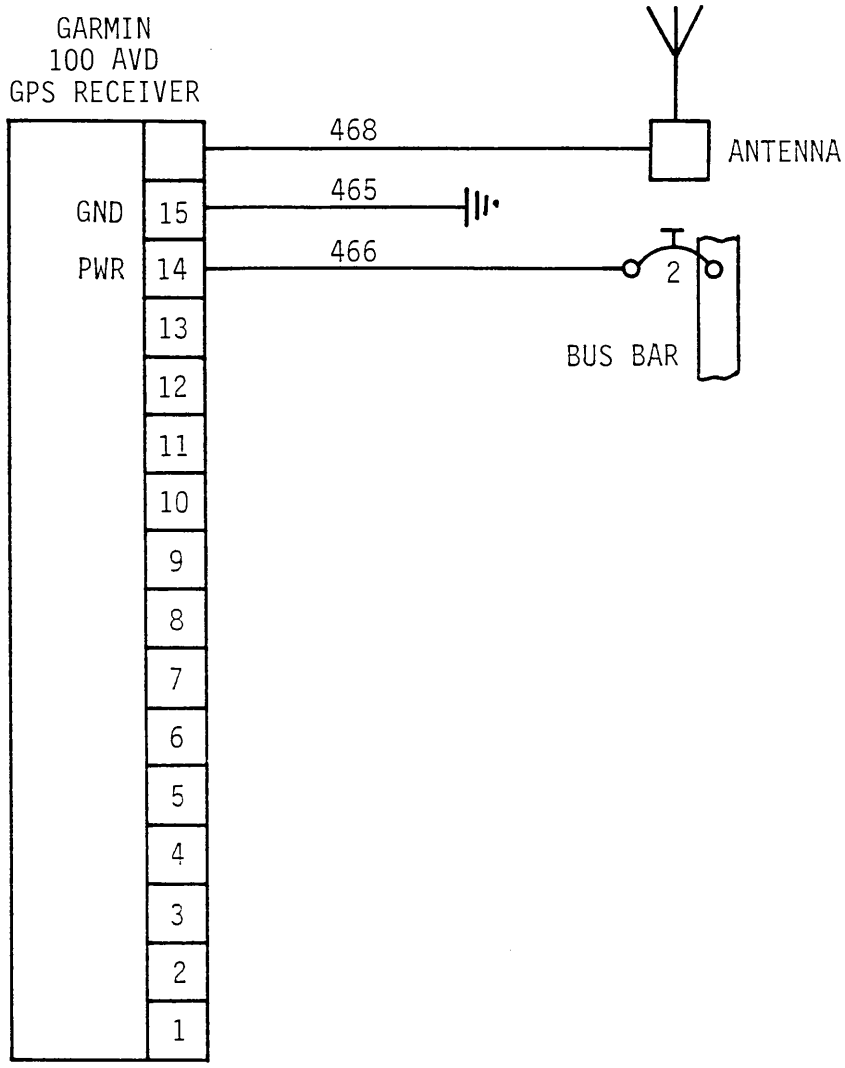


FIGURE 14-15 GARMIN 100 AVD GPS RECEIVER

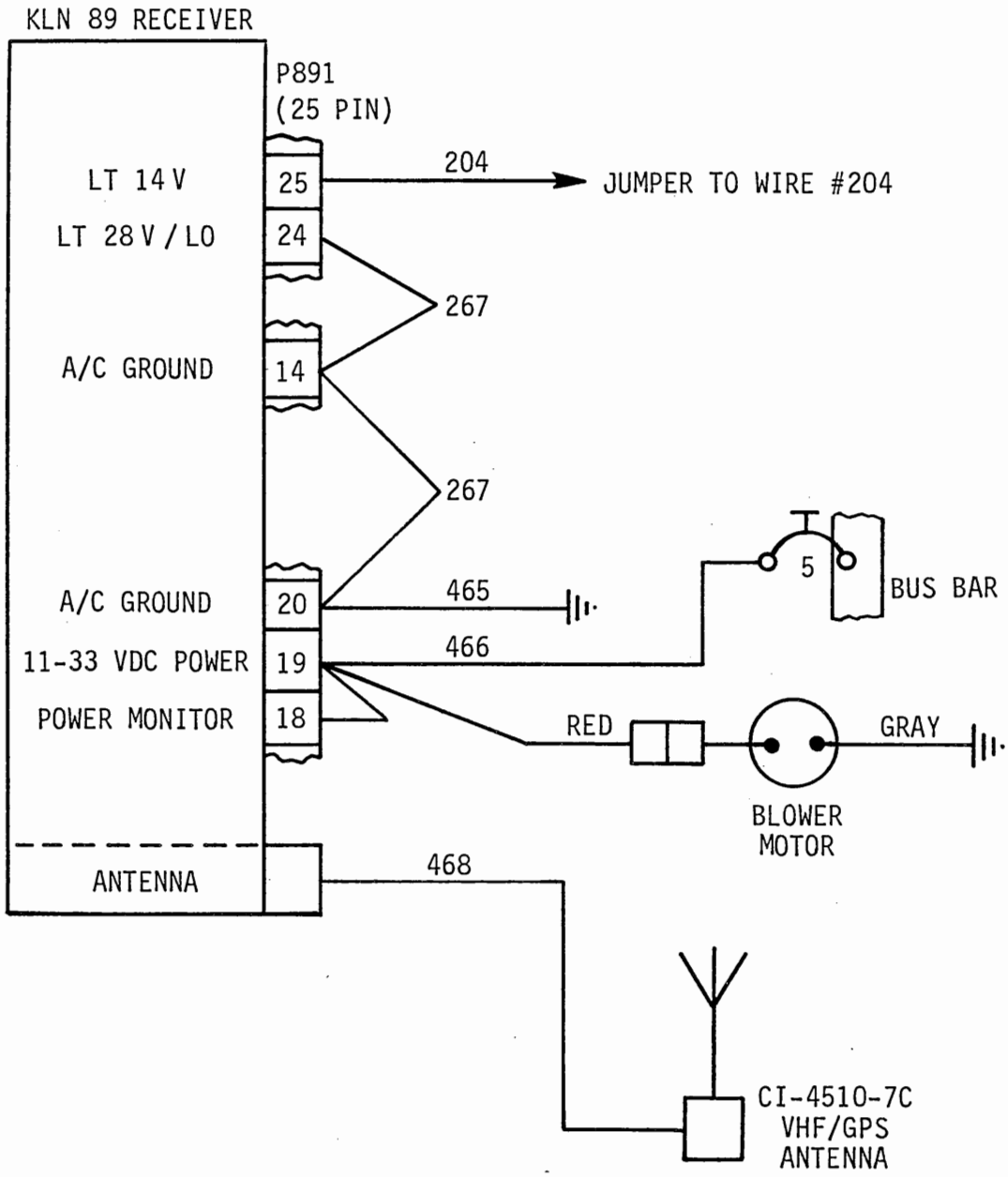


FIGURE 14-16 BENDIX/KING KLN 89 GPS RECEIVER

14.900 AVIONICS SCHEMATICS (Cont'd)

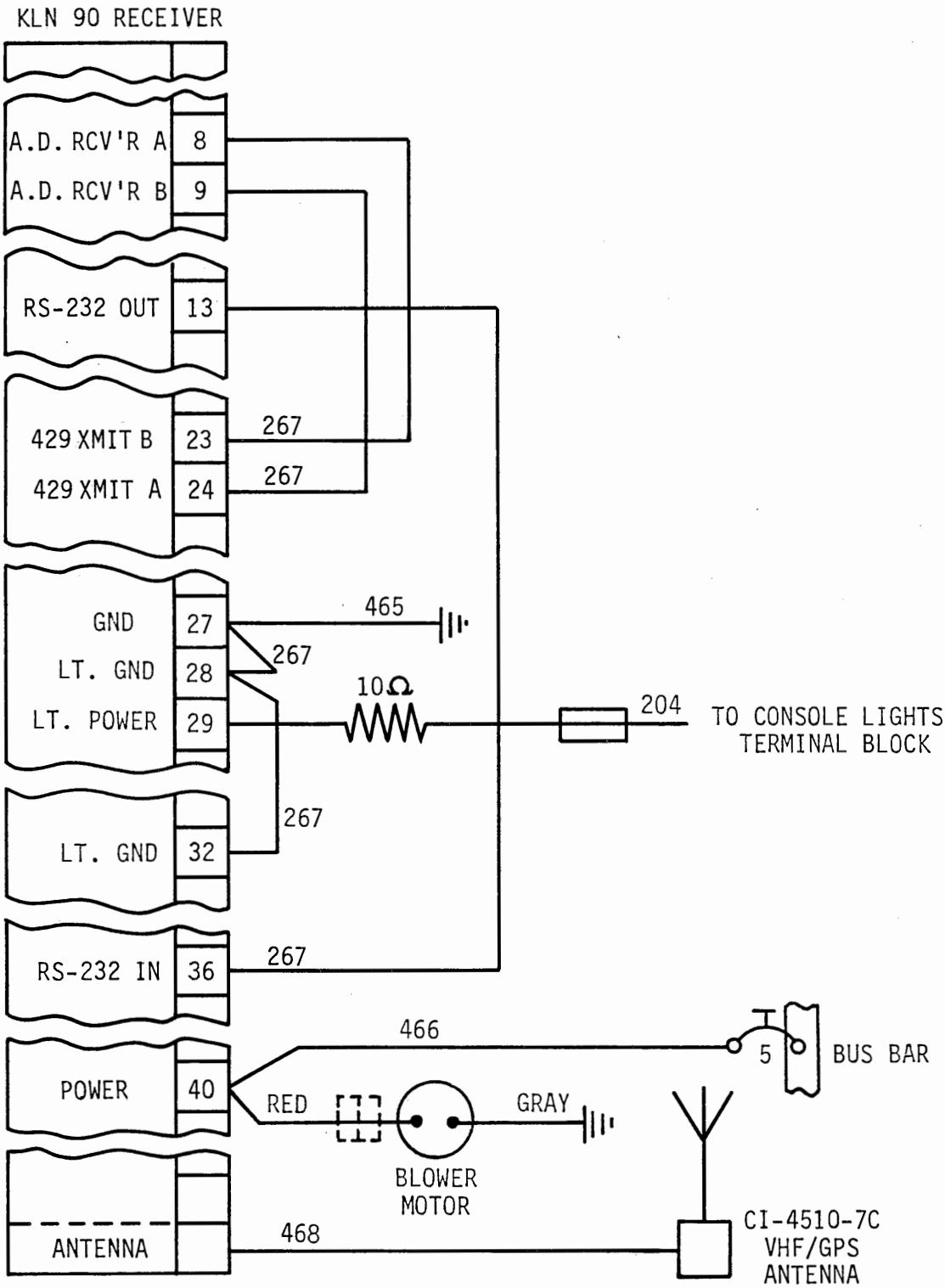


FIGURE 14-17 BENDIX/KING KLN 90 GPS RECEIVER

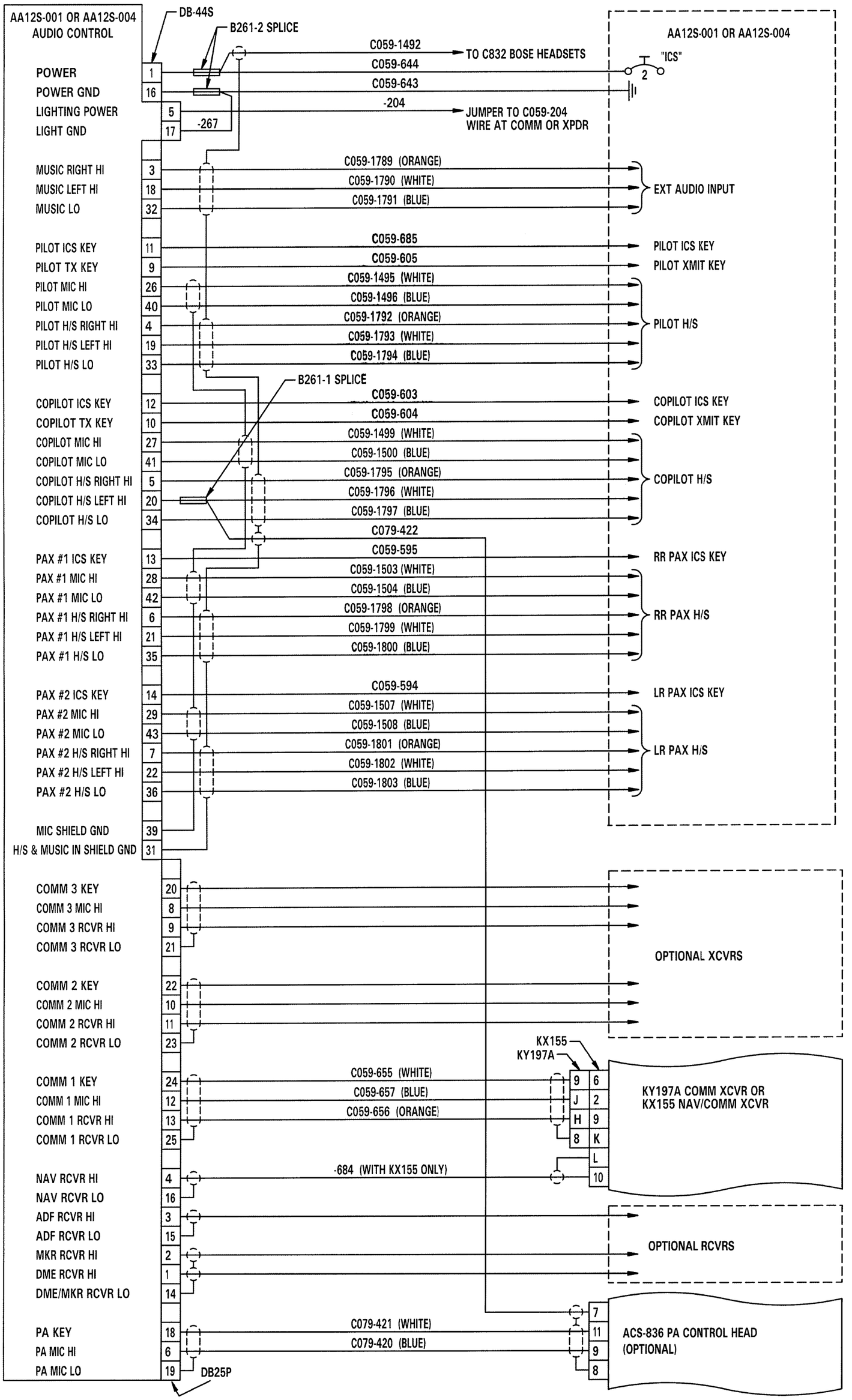


FIGURE 14-19 AA12S-002 or AA12S-005 AUDIO CONTROLLER

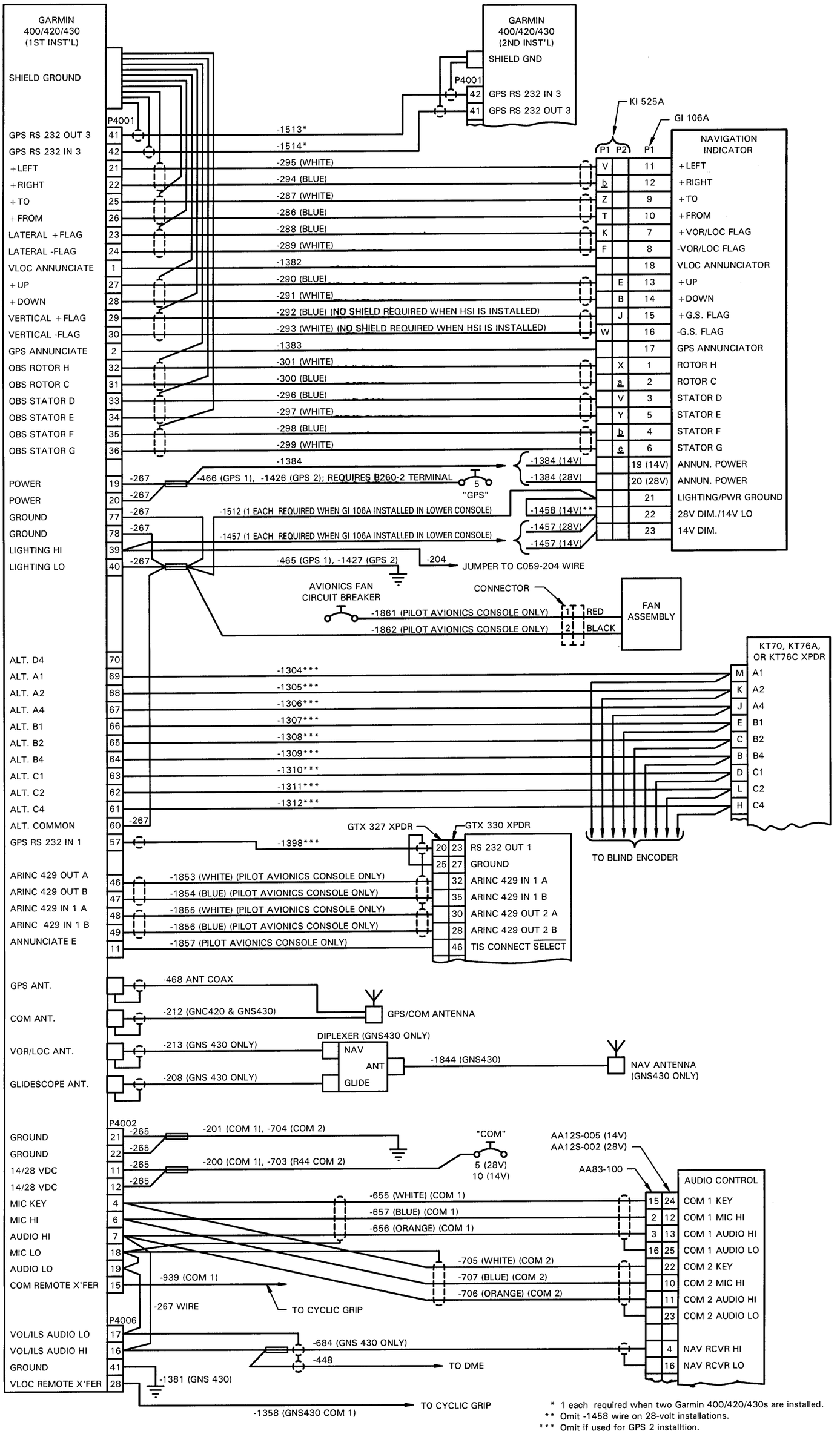


FIGURE 14-20 GARMIN 400/420/430 GPS

14.1000 Avionics for R44 Helicopter S/N 2363 & Subsequent and R44 II Helicopter S/N 13697, 13698, 13702, 13705 & Subsequent

14.1010 C024 Electrical System Installation

A. Description

The main switch panel has rocker-style switches and is located above the radios on the avionics panel. An avionics master switch, located in the main switch panel near the alternator and battery switches, controls a relay which interrupts power to the avionics bus (system is fail-safe ON). The clutch actuator switch, the ignition switch, and also the clock are located on the upper console near the primary instruments. The outside air temperature/voltmeter is located on the upper console lower panel.

B. Schematic

Refer to Figure 14-21 for C024 electrical system schematic.

14.1020 C036 Electrical Components Installation

A. Description

1. Instrument Lighting

A light at the top of the windshield illuminates the instruments. Instrument lighting is active when the nav lights switch is on; a dimmer knob above the switch adjusts brightness.

a. LED-lamp replacement

i. Remove hardware securing G196-6 light assembly to windshield stiffener. Remove two cap screws securing cover and LED-lamp assembly to housing. Disconnect lamp wires from airframe harness and remove lamp.

ii. Connect C238-2289 (white) airframe harness wire to LED-lamp assembly red wire, and C238-2290 airframe harness wire to lamp black wire. Install cover (chamfer facing away from housing) and install two cap screws. Install hardware securing G196-6 light assembly bracket on windshield stiffener with bracket tilted up. Verify security.

iii. Turn battery switch and NAV LIGHTS switch on and verify proper operation with dimmer knob. Turn battery switch and NAV LIGHTS switch off.

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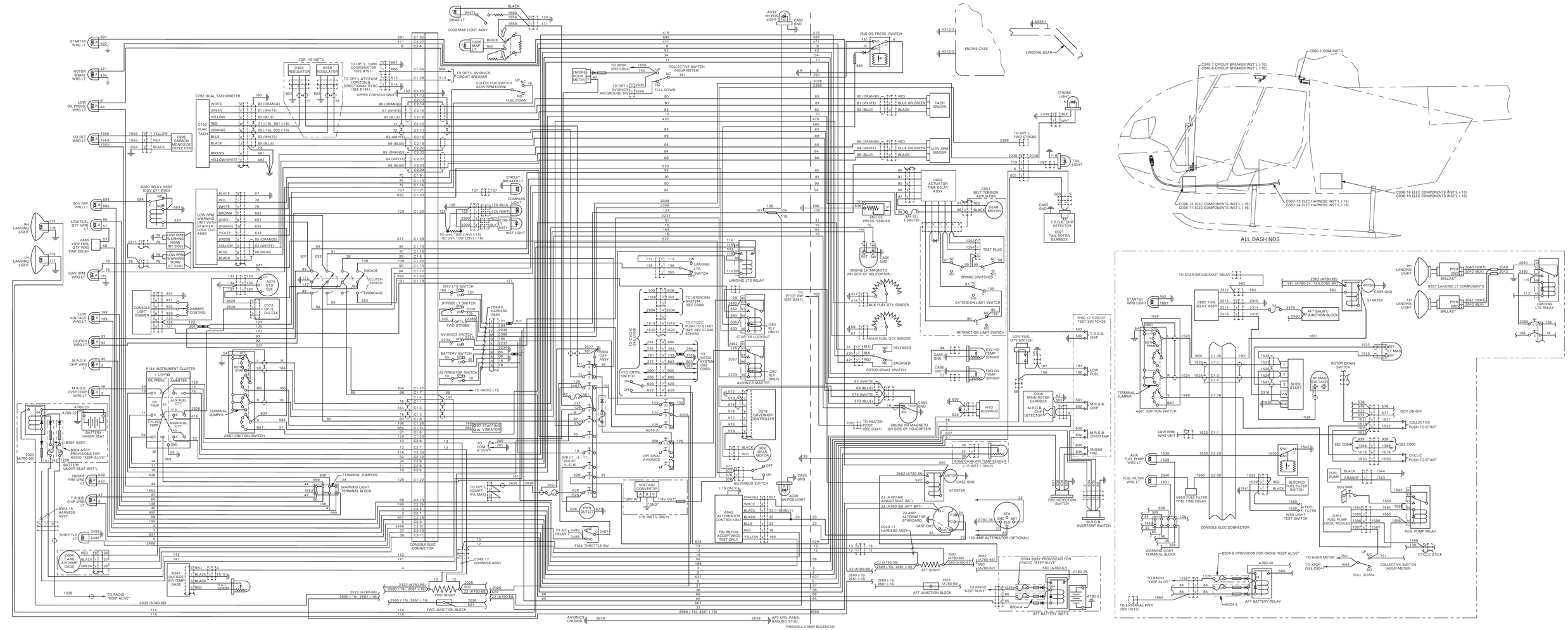


FIGURE 14-21 R44 ELECTRICAL SYSTEM INSTALLATION

(C024 Revision AG shown; R44 Helicopter S/N 2363 & Subsequent and R44 II Helicopter S/N 13697, 13698, 13702, 13705 & Subsequent)

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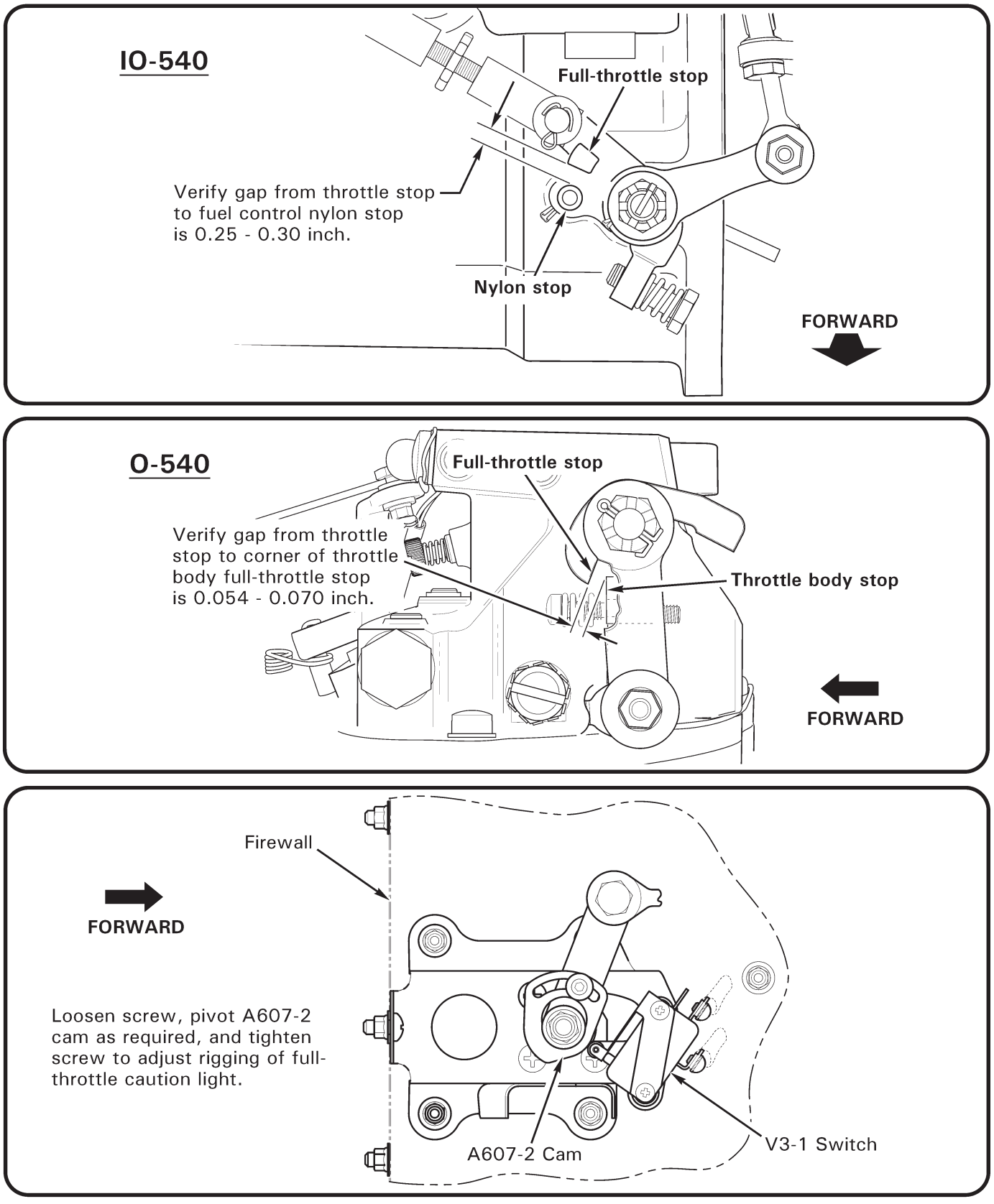


FIGURE 14-22 FULL THROTTLE CAUTION LIGHT RIGGING CHECK

14.1020 C036 Electrical Components Installation (continued)

A. Description (continued)

2. Full Throttle Caution (Amber) Light

The full throttle caution light, located near the manifold pressure gage, is activated by a switch in the throttle linkage and indicates that the engine is near full throttle. The low RPM warning system indicates when RPM is below normal values; the full throttle light alerts the pilot to reduce power demand before a low RPM situation is encountered.

a. Rigging Check

i. Turn fuel shut-off valve off.

ii. Turn battery switch on. Raise collective full up and slowly rotate twist grip open until FULL THROTTLE caution light just illuminates.

iii. A. **IO-540:** Refer to Figure 14-22. Verify gap from throttle stop to fuel control nylon stop is 0.25–0.30 inch. Adjust as required per step 2b.

B. **O-540:** Refer to Figure 14-22. Verify gap from throttle stop to corner of throttle body full-throttle stop is 0.054–0.070 inch. Adjust as required per step 2b.

iv. Lower collective & turn battery switch off. Turn fuel shut-off valve on.

b. Switch Adjustment

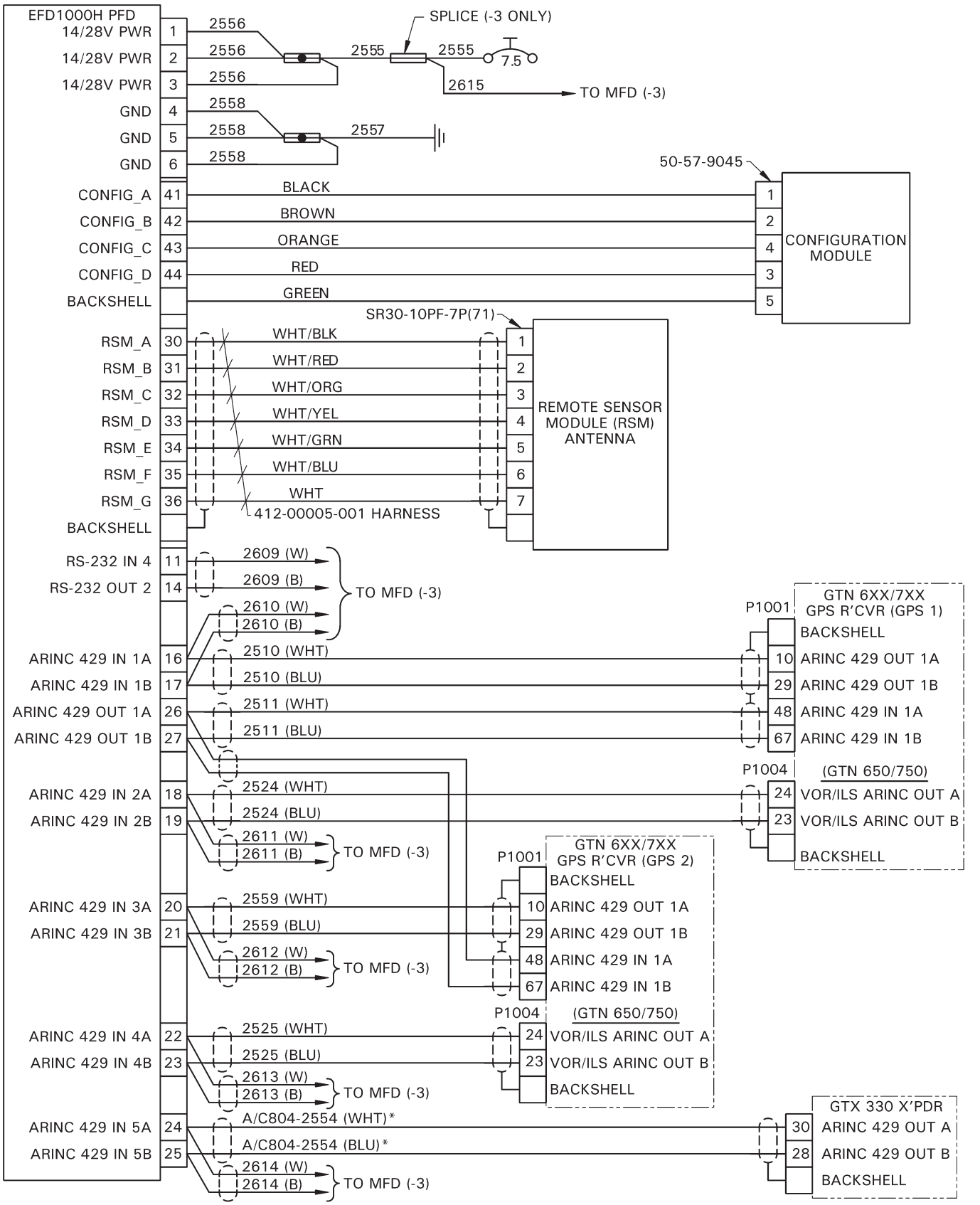
i. A. **IO-540:** Refer to Figure 14-22. Raise collective full up, rotate (throttle) twist grip as required, loosen screw, and pivot A607-2 slotted cam (in throttle linkage, forward of vertical firewall) so V3-1 switch activates when throttle stop is approximately 0.027 inch from fuel control nylon stop. Tighten screw.

B. **O-540:** Refer to Figure 14-22. Raise collective full up, rotate (throttle) twist grip as required, loosen screw, and pivot A607-2 slotted cam (in throttle linkage, forward of vertical firewall) so V3-1 switch activates when throttle stop is approximately 0.062 inch from corner of throttle body full-throttle stop. Tighten screw.

ii. Perform rigging check per step 2a.

B. Schematic

Refer to Figure 14-21 for C024 electrical system schematic.



* Connect to GTX 330 Traffic (TIS-A) only if no other traffic system installed (i.e. GDL 88 [TIS-B]).

FIGURE 14-23 C800-1 ASPEN PFD ELECTRICAL SCHEMATIC

14.1030 C058 Cyclic Grip Assembly

Refer to R44 Illustrated Parts Catalog (IPC) Figures 67-11 and 67-15B.

A. Description

The angle of the pilot's cyclic grip can be adjusted fore and aft relative to the cross tube. The most forward position provides the most control clearance at aft cyclic.

B. Grip Angle Adjustment

1. Loosen cap screws securing pilot's cyclic grip, block assembly, and bar to grip weldment.

2. Rotate grip about weldment to desired angle. Special torque cap screws to 40 in.-lb.

C. Removal and Installation

Refer to Sections 8.121 and 8.122 for cyclic grip assembly removal and installation procedures.

D. Schematic

Refer to Figure 14-21 for C024 electrical system schematic.

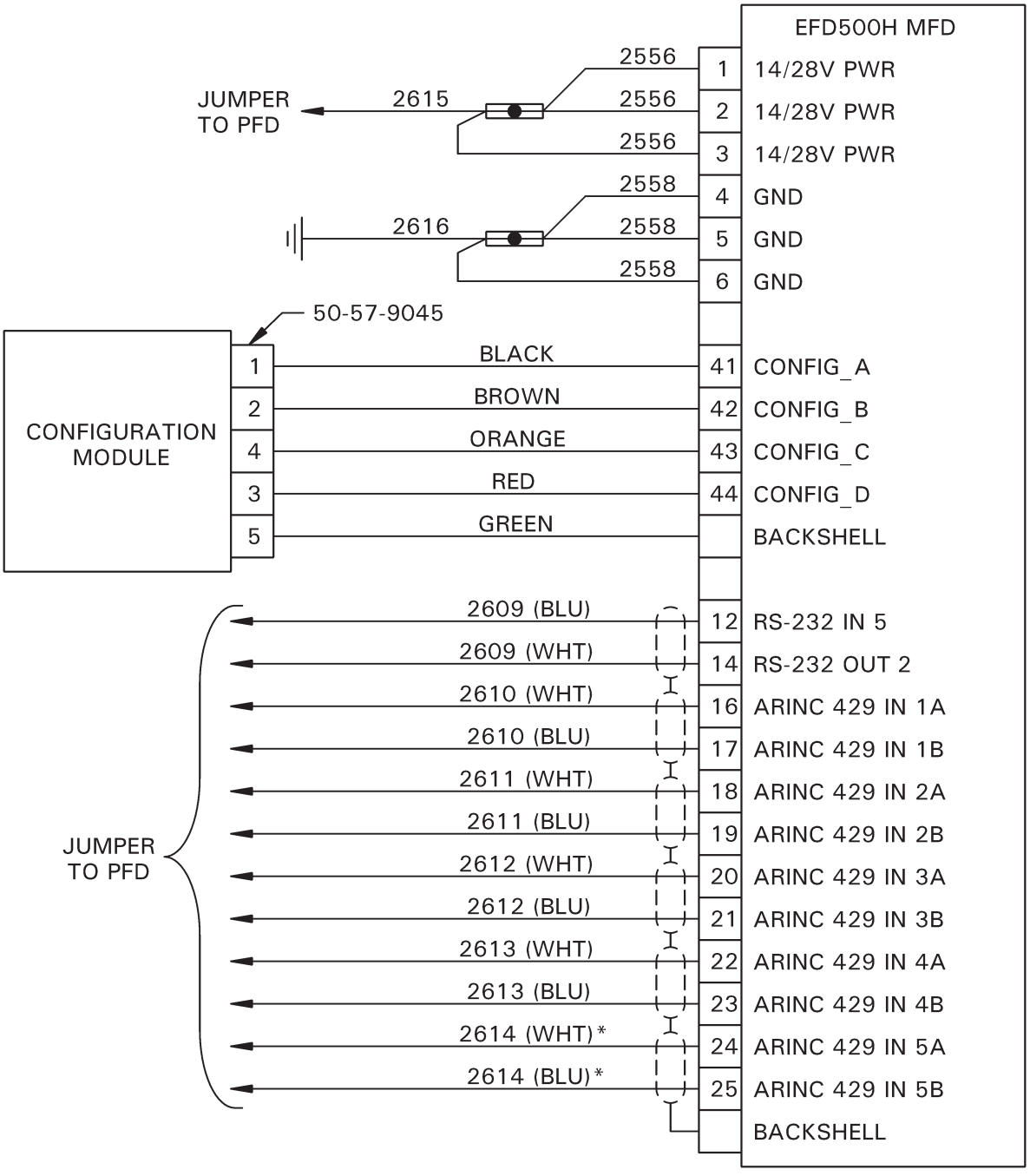
14.1040 C800 Aspen PFD and MFD Installations

Refer to Section 13.510 for Aspen PFD and MFD Installations.

A. Schematic

Refer to Figure 14-23 for C800-1 Aspen PFD Installation electrical schematic.

Refer to Figure 14-24 for C800-3 Aspen MFD Installation electrical schematic.



* Connect to GTX 330 Traffic (TIS-A) only if no other traffic system installed (i.e. GDL 88 [TIS-B]).

FIGURE 14-24 C800-3 ASPEN MFD ELECTRICAL SCHEMATIC

14.1050 C802-2 COM Radio (Garmin GTR 225B) Installation

Refer to R44 Illustrated Parts Catalog (IPC) Figure 97-31.

> NOTE
>
> Refer to Garmin GTR 225B Maintenance Manual and Instructions for Continued Airworthiness.

A. Description

The C802-2 COM radio (Garmin GTR 225B) has an airport frequency database, can monitor standby frequencies, and stores most-used frequencies. The C802-2 COM radio is a dual voltage unit, suitable for 14V and 28V systems.

B. Schematic

Refer to Figure 14-25 for C802-2 COM Radio Installation electrical schematic.

C. Removal

1. Turn battery switch off and pull-out COM radio circuit breaker (5 amp for 28 volt or 10 amp for 14 volt) at panel.
2. Loosen radio key securing C802-2 COM radio to avionics tray.
3. Carefully unplug/remove radio from tray.

D. Installation

1. Turn battery switch off and pull-out COM radio circuit breaker (5 amp for 28 volt or 10 amp for 14 volt) at panel.
2. Carefully plug-in/install C802-2 COM radio in appropriate location in avionics tray.
3. Tighten radio key securing radio to tray. Verify equipment security.
4. Push-in COM radio circuit breaker (5 amp for 28 volt or 10 amp for 14 volt) at panel. Turn battery and avionics switches on.
5. Perform appropriate functional checks per Garmin GTR 225B Pilot's Guide. Turn battery and avionics switches off.

E. Antenna

Refer to Section 14.800 for antenna locations and R44 Illustrated Parts Catalog (IPC) Chapter 6.

> NOTE
>
> Antenna installation depends on number of COM installations and additional equipment installed.

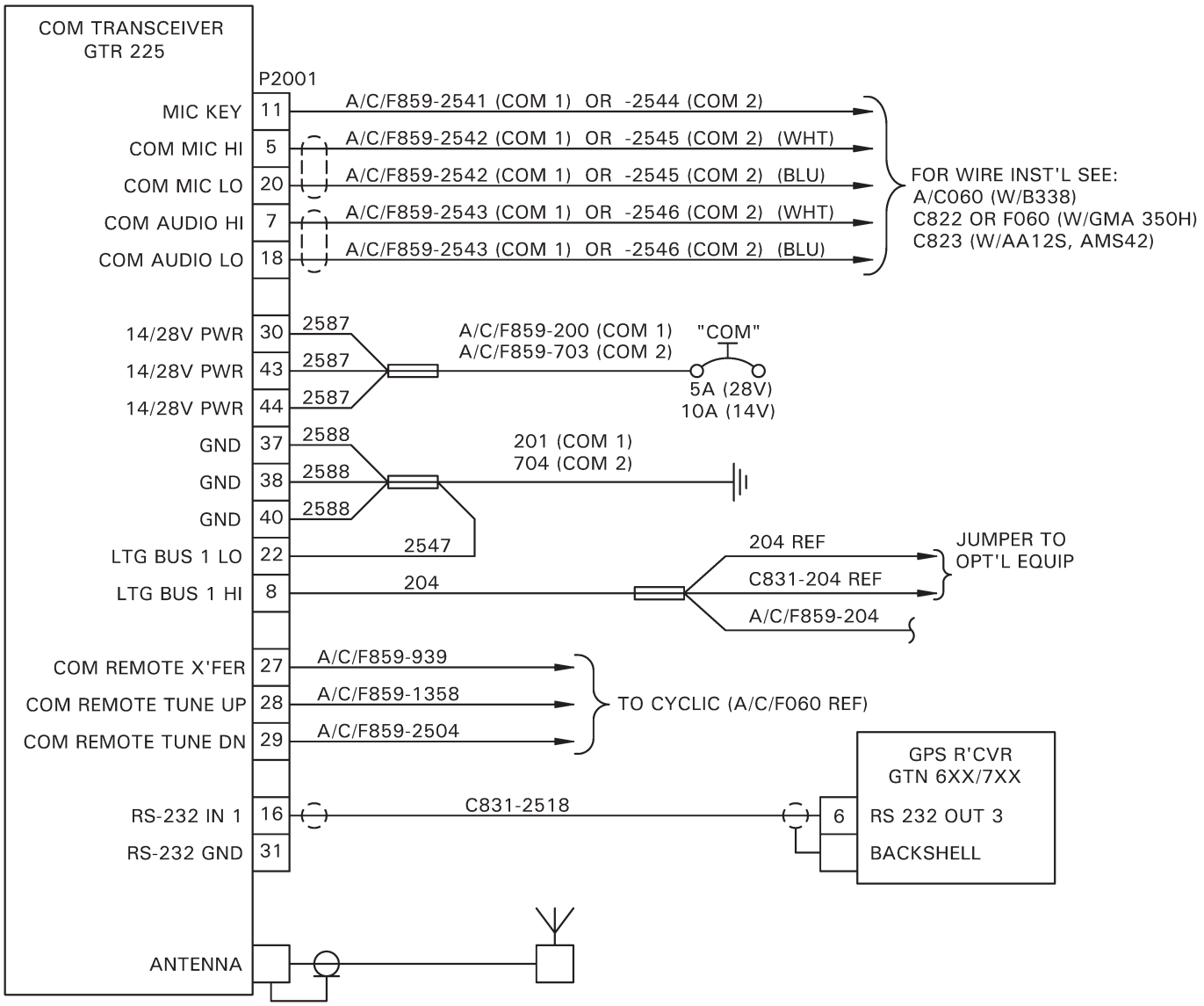


FIGURE 14-25 C802-2 COM RADIO SCHEMATIC (GARMIN GTR 225B)

14.1050 C802-2 COM Radio (Garmin GTR 225B) Installation (continued)

E. Antenna (continued)

Removal

1. Turn battery switch off and pull out COM radio circuit breaker (5 amp for 28 volt or 10 amp for 14 volt) at panel.

2. Using plastic scraper, remove B270-1 sealant from around COM antenna at corners where it attaches to tailcone.

3. Disconnect antenna cable from antenna. As required, remove B270-13 sealant from fastener holes. Remove screws securing antenna to tailcone and remove antenna.

Installation

1. Turn battery switch off and pull out COM radio circuit breaker (5 amp for 28 volt or 10 amp for 14 volt) at panel.

2. Remove paint & primer from antenna mating surfaces to ensure electrical ground.

3. As required, apply light coat B270-13 sealant to screw threads and install screws securing antenna to tailcone. As required, seal around screw heads and fill fastener holes using B270-13 sealant and allow to dry. Verify security.

4. Apply small bead B270-1 sealant (0.1 inch max in height) around antenna at corners where it attaches to tailcone and allow to dry.

5. Connect antenna cable to antenna. Verify security.

6. Perform ground checks per Part D steps 4 and 5.

F. Scheduled Maintenance and Inspections

Every 100 hour or annual inspection, determine software and database versions and update per Garmin GTR 225B Pilot's Guide as required.

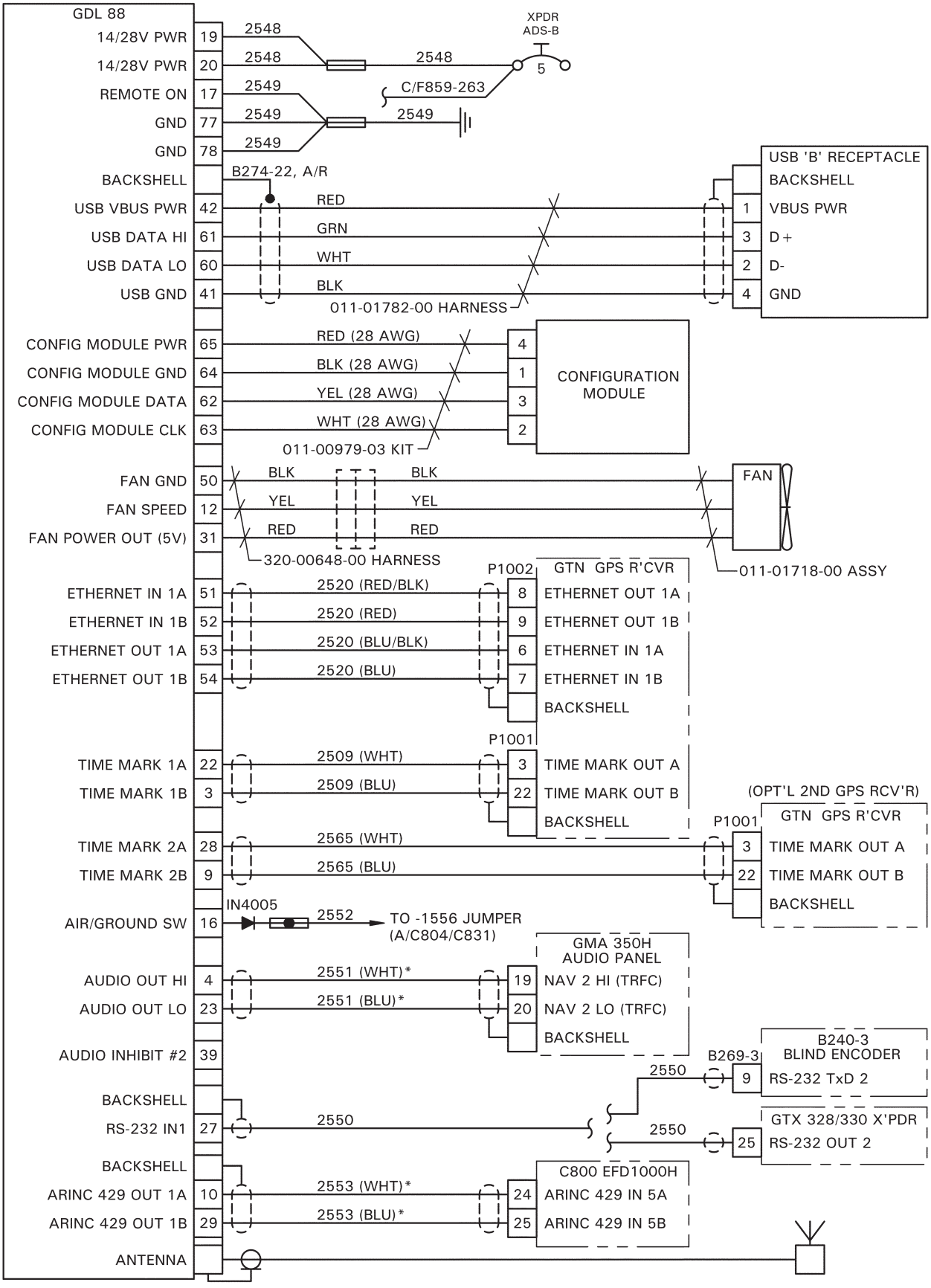
NOTE
Garmin requires database information be updated regularly to ensure information is current.

G. Special Maintenance and Inspections

1. Turn battery and avionics switches off. Open circuit breaker panel and upper console.

2. Inspect condition of and verify no obvious damage to COM radio, radio tray, copper bus bars, circuit breaker, and wiring. Verify no loose, chafed, or broken wires or terminals. Verify no evidence of arcing. Verify equipment security.

3. Secure circuit breaker panel and upper console. Perform ground checks per Part D steps 4 and 5.



* GDL 88 Traffic wiring is in lieu of GTX 330 traffic wiring.

FIGURE 14-26 C803-1 ADS-B SCHEMATIC (GARMIN GDL 88)

14.1060 C803-1 ADS-B In Receiver (Garmin GDL 88) Installation

Refer to R44 Illustrated Parts Catalog (IPC) Figure 97-33.

> NOTE
>
> Refer to Garmin GDL 88 Maintenance Manual and Instructions for Continued Airworthiness.

A. Description

Refer to Section 14.1070 for ADS-B system descriptions.

B. Schematic

Refer to Figure 14-26 for C803-1 ADS-B Installation electrical schematic.

C. Removal

1. Turn battery switch off and pull out XPDR circuit breaker (5 amp) at panel.
2. Under the left front seat, disconnect airframe harness from GDL 88 receiver at connectors.
3. Remove screws securing GDL 88 receiver to C904-1 mount assembly, and remove GDL 88 receiver.

D. Installation

1. Turn battery switch off and pull out XPDR circuit breaker (5 amp) at panel.
2. Under the left front seat, position GDL 88 receiver on C904-1 mount assembly and install screws. Verify security.
3. Connect airframe harness to GDL 88 receiver at connectors.
4. Push in XPDR circuit breaker (5 amp) at panel. Turn battery and avionics switches on.
5. Perform appropriate functional checks per Garmin GDL 88 Pilot's Guide. Turn battery and avionics switches off.

E. Antenna

Refer to Section 14.800 for antenna locations and R44 Illustrated Parts Catalog (IPC) Chapter 6.

NOTE
Antenna installation depends on number of COM installations and additional equipment installed.

Removal

1. Turn battery switch off and pull out XPDR circuit breaker (5 amp) at panel.
2. Using plastic scraper, remove B270-1 sealant from around GDL 88 antenna at corners where it attaches to belly.
3. Disconnect antenna cable from antenna. Remove hardware securing antenna to belly and remove antenna.

Installation

1. Turn battery switch off and pull out XPDR circuit breaker (5 amp) at panel.
2. Remove paint & primer from antenna mating surfaces to ensure electrical ground.
3. Install hardware securing antenna to belly. Apply small bead B270-1 sealant around antenna at corners where it attaches to belly and allow to dry.
4. Connect antenna cable to antenna. Verify security.
5. Perform ground checks per Part D steps 4 and 5.

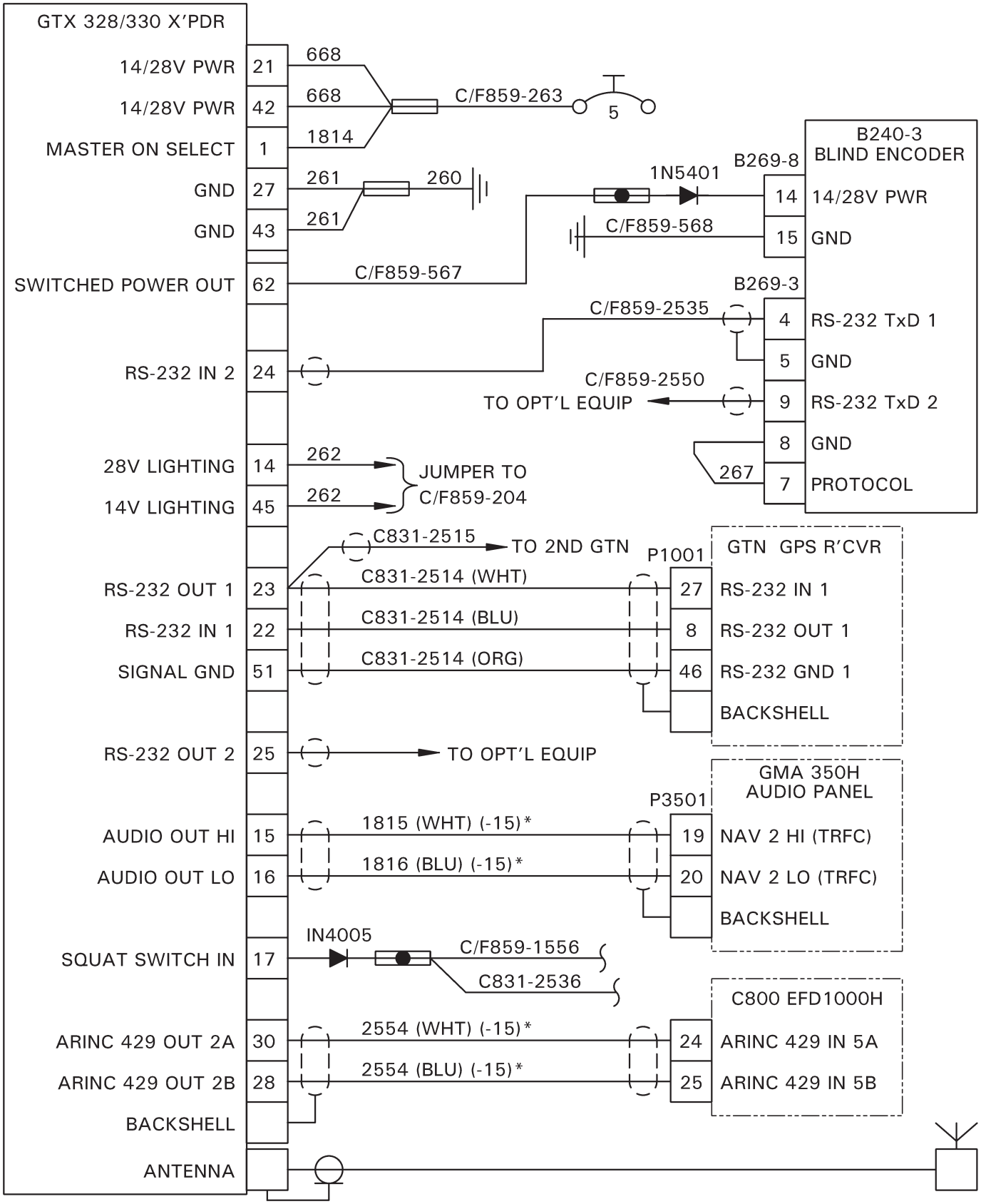
F. Scheduled Maintenance and Inspections

NOTE
Refer to Garmin GDL 88 Maintenance Manual and Instructions for Continued Airworthiness.

G. Special Maintenance and Inspections

1. Turn battery and avionics switches off. Open circuit breaker panel and access left front seat.
2. Inspect condition of and verify no obvious damage to GDL 88, circuit breaker, and wiring. Verify no loose, chafed, or broken wires or terminals. Verify no evidence of arcing. Verify equipment security.
3. Secure circuit breaker panel and left front seat. Perform ground checks per Part D steps 4 and 5.

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* One required on ships with Traffic Information System (TIS-A).

FIGURE 14-27 C804-15 TRANSPONDER SCHEMATIC (GARMIN GTX 330 ES)

14.1070 C804-15 Transponder (Garmin GTX 330 ES) Installation

Refer to R44 Illustrated Parts Catalog (IPC) Figure 97-35.

> NOTE
>
> Refer to Garmin GTX 330 ES Maintenance Manual and Instructions for Continued Airworthiness.

A. Description

GPS-based Automatic Dependent Surveillance-Broadcast (ADS-B) Out equipment transmits information to air traffic control and ADS-B In equipment receives information from air traffic control or from other aircraft. The R44 may be equipped with ADS-B Out or with ADS-B Out and ADS-B In systems.

Both ADS-B systems operate mostly automatically. ADS-B equipment is programmed with aircraft specific-data at installation. ADS-B systems use the primary GPS for position information. Additional flight-specific data is entered by the pilot using transponder controls. ADS-B data is transmitted via the transponder's Extended Squitter (ES) on frequency 1090 MHz.

The ADS-B In system receives data via a receiver on frequencies 978 MHz and 1090 MHz. Received data (traffic and weather) is displayed on the primary GPS screen.

ADS-B Out equipment (transponder and primary GPS) or ADS-B Out and ADS-B In equipment (transponder, primary GPS, and receiver) must be powered and in normal operating modes for proper system function. ADS-B Out system faults are annunciated on the transponder and primary GPS screens. ADS-B In system faults are annunciated on the primary GPS screen.

Change of aircraft registration may require ADS-B equipment programming by qualified maintenance personnel.

Refer to R44 Pilot's Operating Handbook Section 9 for additional information.

B. Schematic

Refer to Figure 14-27 for C804-15 transponder & blind encoder electrical schematic.

C. Removal

1. Turn battery switch off and pull out XPDR circuit breaker (5 amp) at panel.
2. Loosen radio key securing C804-15 transponder to avionics tray.
3. Carefully unplug/remove transponder from tray.

14.1070 C804-15 Transponder (Garmin GTX 330 ES) Installation (continued)

D. Installation

1. Turn battery switch off and pull out XPDR circuit breaker (5 amp) at panel.
2. Carefully plug-in/install C804-15 transponder in appropriate location in avionics tray.
3. Tighten radio key securing transponder to tray. Verify equipment security.
4. Push in XPDR circuit breaker (5 amp) at panel. Turn battery & avionics switches on.
5. Perform appropriate functional checks per Garmin GTX 330 ES Pilot's Guide. Turn battery and avionics switches off.

E. Antenna

Refer to Section 14.800 for antenna locations and R44 Illustrated Parts Catalog (IPC) Chapter 6.

NOTE

Antenna installation depends on optional equipment installed.

Removal

1. Turn battery switch off and pull out XPDR circuit breaker (5 amp) at panel.
2. Using plastic scraper, remove B270-1 sealant from around transponder antenna at corners where it attaches to B322-12 doubler.
3. Remove screws securing mounting plate to cabin skin and disconnect antenna cable from antenna. Remove hardware securing mounting plate to antenna and remove antenna.

Installation

1. Turn battery switch off and pull out XPDR circuit breaker (5 amp) at panel.
2. Remove paint & primer from between cabin skin and B322-12 doubler to ensure electrical ground.
3. Install hardware securing transponder antenna to mounting plate. Verify security. Apply small bead B270-1 sealant (0.1 inch max in height) around antenna at corners where it attaches to mounting plate and allow to dry.
4. Connect antenna cable to antenna and install screws securing mounting plate to cabin skin. Verify security.
5. Perform ground checks per Part D steps 4 and 5.

14.1070 C804-15 Transponder (Garmin GTX 330 ES) Installation (continued)

F. Scheduled Maintenance and Inspections

Every 100 hour or annual inspection, determine software and database versions and update per Garmin GTX 330 ES Pilot's Guide as required.

NOTE

Garmin requires database information be updated regularly to ensure information is current.

G. Special Maintenance and Inspections

1. Turn battery and avionics switches off. Open circuit breaker panel and upper console.

2. Inspect condition of and verify no obvious damage to transponder, radio tray, copper bus bars, circuit breaker, and wiring. Verify no loose, chafed, or broken wires or terminals. Verify no evidence of arcing. Verify equipment security.

3. Secure circuit breaker panel and upper console. Perform ground checks per Part D steps 4 and 5.

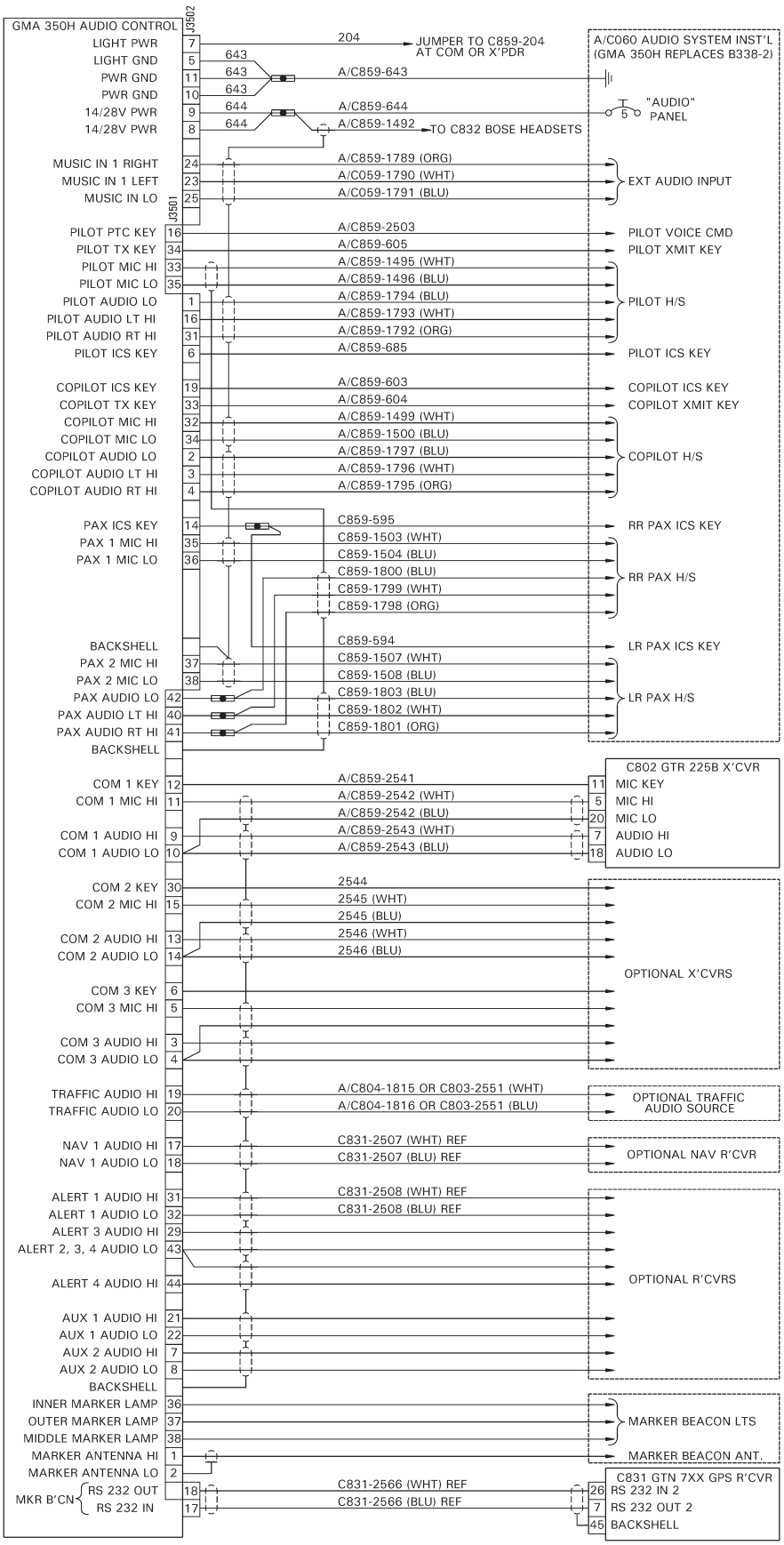


FIGURE 14-28 C822-2 AUDIO CONTROL SCHEMATIC (GARMIN GMA 350H)

14.1080 C822-2 Audio Control (Garmin GMA 350H) Installation

NOTE

Refer to Garmin GMA 350H series Maintenance Manual and Instructions for Continued Airworthiness.

A. Description

The C822-2 audio control (Garmin GMA 350H) includes improved background noise suppression, 3D audio (if stereo headsets are used), and a manual ICS squelch mode to adjust audio thresholds for each occupant.

B. Schematic

Refer to Figure 14-28 for C822-2 audio control (Garmin GMA 350H) electrical schematic.

C. Removal

1. Turn battery switch off and pull out AUDIO PANEL circuit breaker (5 amp) at panel.
2. Loosen radio key securing Garmin GMA 350H audio control to avionics tray.
3. Carefully unplug/remove audio control from tray.

D. Installation

1. Turn battery switch off and pull out AUDIO PANEL circuit breaker (5 amp) at panel.
2. Carefully plug-in/install Garmin GMA 350H audio control in appropriate location in avionics tray.
3. Tighten radio key securing audio control to tray. Verify equipment security.
4. Push in AUDIO PANEL circuit breaker (5 amp) at panel. Turn battery & avionics switches on.
5. Perform appropriate functional checks per Garmin GMA 350H series Pilot's Guide. Turn battery & avionics switches off.

14.1080 C822-2 Audio Control (Garmin GMA 350H) Installation (continued)

E. Antenna

Refer to Section 14.800 for marker beacon antenna location and R44 Illustrated Parts Catalog (IPC) Chapter 6.

Removal

1. Turn battery switch off and pull out AUDIO PANEL circuit breaker (5 amp) at panel.
2. Using plastic scraper, remove B270-1 sealant from around CI 102 marker beacon antenna at corners where it attaches to belly panel.
3. Remove hardware securing C794 forward belly panel to belly and disconnect C850-210 antenna cable from antenna. Remove screws securing antenna to panel and remove antenna.

Installation

1. Turn battery switch off and pull out AUDIO PANEL circuit breaker (5 amp) at panel.
2. Remove paint and primer from antenna mating surfaces to ensure electrical ground.
3. Apply light coat B270-11 adhesive to screw threads and install screws securing CI 102 marker beacon antenna to C794 forward belly panel. Verify security.
4. Connect C850-210 antenna cable to antenna. Install screws securing forward belly panel to belly. Verify security.
5. Apply small bead B270-1 sealant (0.1 inch max in height) around antenna at corners where it attaches to belly panel and allow to dry.
6. Perform ground checks per Part D steps 4 and 5.

F. Scheduled Maintenance and Inspections

On condition.

G. Special Maintenance and Inspections

1. Turn battery and avionics switches off. Open circuit breaker panel and upper console.
2. Inspect condition of and verify no obvious damage to audio control, radio tray, copper bus bars, circuit breaker, and wiring. Verify no loose, chafed, or broken wires or terminals. Verify no evidence of arcing. Verify equipment security.
3. Secure circuit breaker panel and upper console. Perform ground checks per Part D steps 4 and 5.

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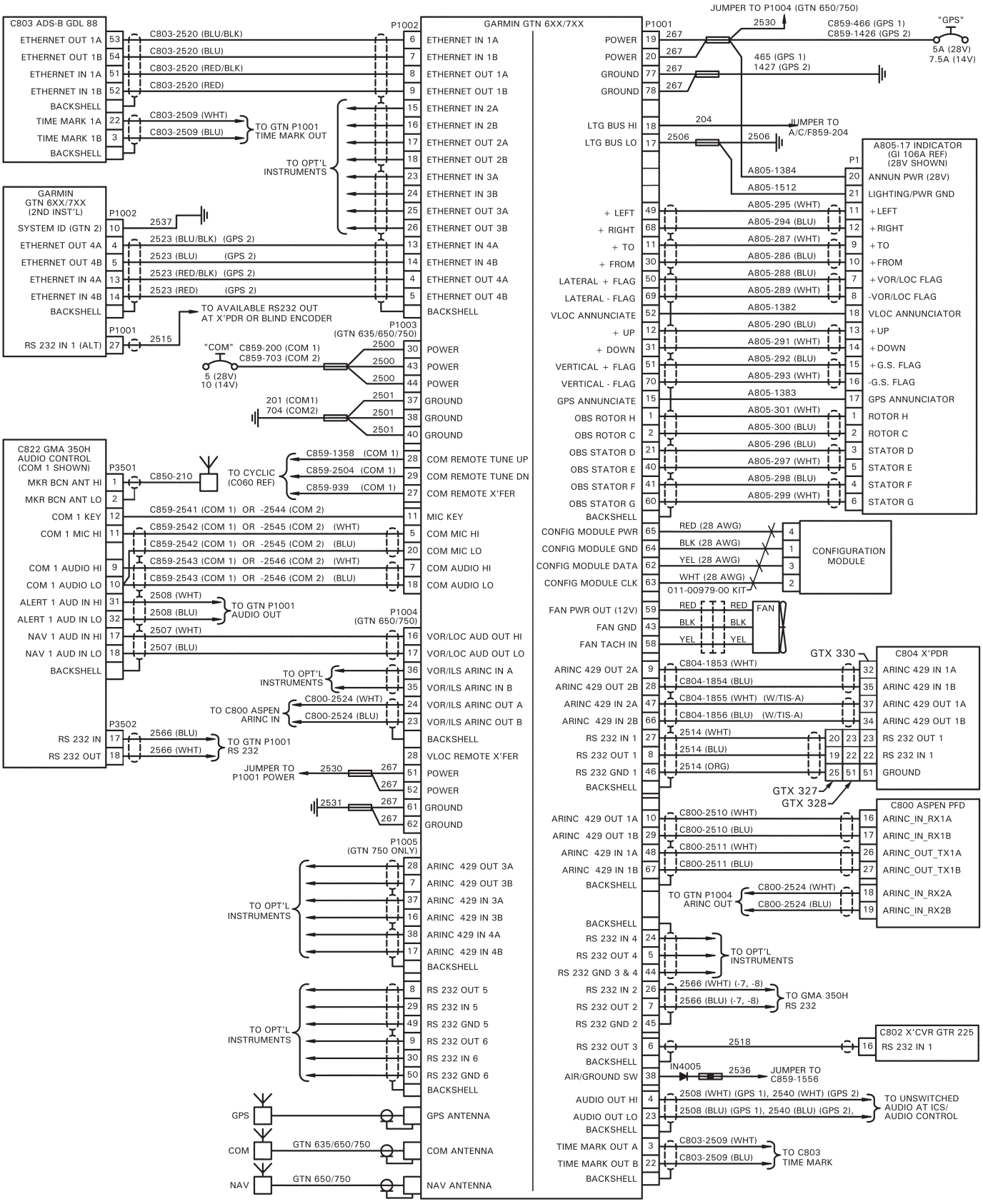


FIGURE 14-29 C831 GPS SCHEMATIC (GARMIN GTN 600/700 SERIES)

14.1090 C831 GPS (Garmin GTN 600/700 series) Installation

Refer to R44 Illustrated Parts Catalog (IPC) Figures 97-37 thru 97-45.

> NOTE
>
> Refer to Garmin GTN 600/700 series Maintenance Manual and Instructions for Continued Airworthiness.

A. Description

The C831 GPS (Garmin GTN 600/700 series) interface is a combination of touch screen technology with traditional buttons and knobs. GTN 600/700 series GPS(s) may be installed in the pilot-side console location only. Note: R44 ADS-B Out system requires Garmin GTN 600/700 series GPS (refer to Section 14.1070).

B. Schematic

Refer to Figure 14-29 for C831 GPS (Garmin GTN 600/700 series) installation electrical schematic.

C. Removal

1. Turn battery switch off and pull out all COM circuit breakers (5 amp for 28 volt or 10 amp for 14 volt) and all GPS circuit breakers (5 amp for 28 volt or 7.5 amp for 14 volt) as required at panel.

2. Loosen radio key securing C831 GPS(s) to tray in pilot's side console.

3. Carefully unplug/remove GPS(s) from tray.

D. Installation

1. Turn battery switch off and pull out all COM circuit breakers (5 amp for 28 volt or 10 amp for 14 volt) and all GPS circuit breakers (5 amp for 28 volt or 7.5 amp for 14 volt) as required at panel.

2. Carefully plug-in/install C831 GPS(s) in appropriate location in tray in pilot's side console.

3. Tighten radio key securing GPS(s) to tray. Verify equipment security.

4. Push in all COM circuit breakers (5 amp for 28 volt or 10 amp for 14 volt) and all GPS circuit breakers (5 amp for 28 volt or 7.5 amp for 14 volt) as required at panel. Turn battery and avionics switches on.

5. Perform appropriate functional checks per Garmin GTN 600/700 series Pilot's Guide. Turn battery and avionics switches off.

14.1090 C831 GPS (Garmin GTN 600/700 series) Installation (continued)

E. Antenna

Refer to Section 14.800 for antenna locations and R44 Illustrated Parts Catalog (IPC) Chapter 6.

> NOTE
>
> Antenna installation depends on number COM installations and additional equipment installed.

Removal

1. Turn battery switch off and pull out all COM circuit breakers (5 amp for 28 volt or 10 amp for 14 volt) and all GPS circuit breakers (5 amp for 28 volt or 7.5 amp for 14 volt) as required at panel.

2. Using plastic scraper, remove B270-1 sealant from around GPS antenna at corners where it attaches to tailcone.

3. Disconnect antenna cable from antenna. As required, remove B270-13 sealant from fastener holes. Remove screws securing antenna to tailcone and remove antenna.

Installation

1. Turn battery switch off and pull out all COM circuit breakers (5 amp for 28 volt or 10 amp for 14 volt) and all GPS circuit breakers (5 amp for 28 volt or 7.5 amp for 14 volt) as required at panel.

2. Remove paint & primer from antenna mating surfaces to ensure electrical ground.

3. As required, apply light coat B270-13 sealant to screw threads and install screws securing antenna to tailcone. As required, seal around screw heads and fill fastener holes using B270-13 sealant and allow to dry. Verify security.

4. Apply small bead B270-1 sealant (0.1 inch max in height) around antenna at corners where it attaches to tailcone and allow to dry.

5. Connect antenna cable to antenna. Verify security.

6. Perform ground checks per Part D steps 4 and 5.

F. Scheduled Maintenance and Inspections

Every 100 hour or annual inspection, determine software and database versions and update per Garmin GTN 600/700 series Pilot's Guide as required.

> NOTE
>
> Garmin requires database information be updated regularly to ensure information is current.

14.1090 C831 GPS (Garmin GTN 600/700 series) Installation (continued)

G. Special Maintenance and Inspections

1. Turn battery and avionics switches off. Open circuit breaker panel. Remove hardware securing pilot's side console shell assembly to tray and carefully pivot shell assembly upward (GPS[s] and faceplate may be also be removed).

2. Inspect condition of and verify no obvious damage to GPS(s), tray, copper bus bars, circuit breaker, and wiring. Verify no loose, chafed, or broken wires or terminals. Verify no evidence of arcing. Verify equipment security.

3. Secure circuit breaker panel and pilot's side console. Perform ground checks per Part D steps 4 and 5.

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CHAPTER 15

FURNISHINGS

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CHAPTER 15

FURNISHINGS

15.000 Description

The seats are not adjustable but later pilot-side pedals are adjustable. Each helicopter is supplied with a cushion which can be placed behind the pilot to position him forward. This allows shorter pilots to reach the pedals, the cyclic stick in its most forward position, and the controls on the center console.

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

Four-point harnesses are optional for the front seats. Later four-point harnesses are equipped with webbing stops located above the inertia reels. The stops limit retraction of the harnesses and should be adjusted such that the harnesses are comfortable without excessive slack.

A baggage compartment is located under each seat. Seat cushions hinge forward for access to these compartments. Loading instructions are located on a placard inside each baggage compartment and in the Pilot's Operating Handbook.

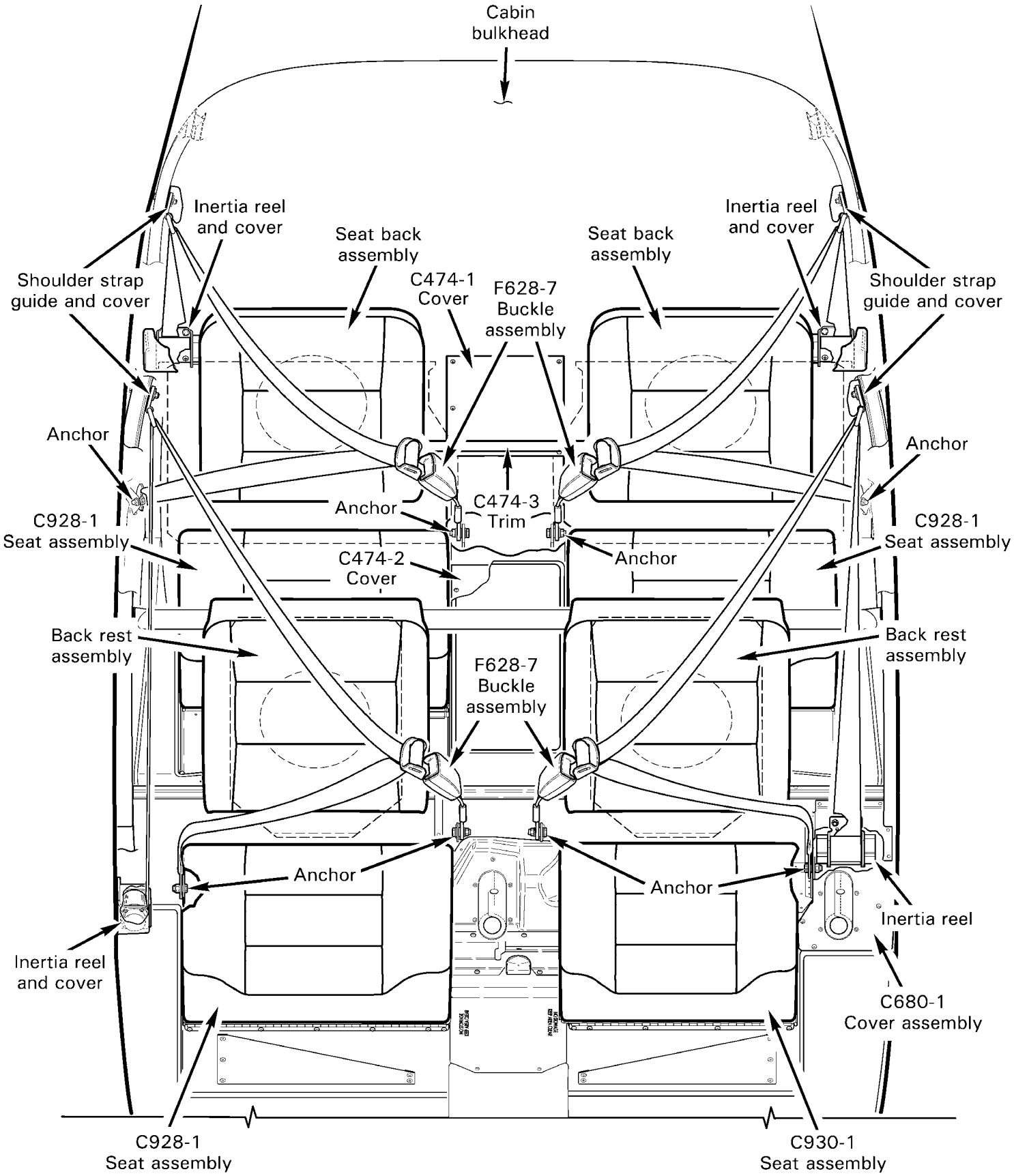


FIGURE 15-1 SEAT HARNESSES, SEAT ASSEMBLIES, AND BACK RESTS

15.100 Seat Harnesses

A. Seat Harness Removal

1. Refer to Figure 15-1. As required, remove C680-1 (removable collective) cover assembly. Hinge seat assemblies forward.

2. Remove hardware securing F628-7 buckle assemblies to inboard anchors, and hardware securing lap belts to outboard anchors.

3. Remove shoulder strap guide covers, then remove hardware securing guides to door frames.

4. Remove inertia reel covers, then remove hardware securing reels to cabin. Remove seat harnesses.

B. Seat Harness Installation

1. Refer to Figure 15-1. Install hardware securing inertia reels to cabin. Install reel covers.

2. Install hardware securing shoulder strap guides to door frames. Orient bolt head flats parallel to door post within 5°. Standard torque fasteners per Section 1.320. Install guide covers.

3. a. Rotate F628-7 buckle assemblies 35°-40° forward and install hardware securing buckle assemblies to inboard anchors. Standard torque fasteners per Section 1.320.

   b. Install hardware securing C628-4 buckle assemblies to inboard anchors. Standard torque fasteners per Section 1.320. Using a calibrated spring scale, measure force required to rotate buckle assembly at buckle slot about its fastener. Force required to rotate buckle is 1.5 - 2.5 lb. If force is less than 1.5 lb., disassemble buckle fastener, replace A041-6 spring washer or lap (shorten) A130-52 spacer as required, and repeat step.

CAUTION

Verify no sharp edges or burrs on buckle assembly locking bar or latch plate.

4. Ensure belts are not twisted; install hardware securing lap belts to outboard anchors. Standard torque fasteners per Section 1.320.

5. If removed, install C680-1 (removable collective) cover assembly. Hinge seat assemblies aft.

15.110 Four-Point Harness Assembly

NOTE

Four-point harness installation for front seats is optional equipment.

A. Removal

1. As required, remove C680-1 (removable collective) cover assembly. Hinge seat assemblies forward.
2. Remove hardware securing four-point harness assembly lap belts to inboard and outboard anchors.
3. Remove hole plugs secured to forward side of back rest panels.
4. Remove inertia reel covers, then remove hardware securing reels to cabin. Pull connector and buckle assemblies through support tube padding cover strap and remove harnesses.

B. Installation

1. Install hardware securing four-point harness assembly inertia reels to cabin. Install reel covers, and hole plugs in forward side of back rest panels. Verify security.
2. Pull connector and buckle assemblies through support tube padding cover strap.
3. Ensure belts are not twisted; install hardware securing lap belts to outboard anchors. Standard torque fasteners per Section 1.320. Verify security.
4. If removed, install C680-1 (removable collective) cover assembly. Hinge seat assemblies aft.

15.200 Seat and (Aft) Seat Back Assemblies

A. Seat Assembly Removal and Installation

1. Refer to Figure 15-1. Remove hardware securing seat assembly forward hinge to seat box. Remove seat assembly.

2. Install seat assembly, and install hardware securing seat assembly forward hinge to seat box. Verify security.

B. (Aft) Seat Back Assembly Removal and Installation

1. Refer to Figure 15-1. Remove hardware securing C474-1 cover, C474-3 trim, and C474-2 cover to cabin. Remove covers and trim.

2. Remove hardware securing (aft) seat back assembly to cabin bulkhead. Remove seat back assembly.

3. Install (aft) seat back assembly, and install hardware securing seat back assembly to cabin bulkhead. Verify security.

4. Install C474-1 cover, C474-3 trim, and C474-2 cover, and install hardware securing covers and trim to cabin. Verify security.

15.210 Back Rest Assembly Replacement

1. Aft Back Rest: Remove seat back assembly per Section 15.200.

2. Refer to Figure 15-1. Drill out rivets securing back rest assembly cushion to back rest panel and remove cushion. Deburr holes.

3. Remove old adhesive residue from cabin support tube with plastic wedge. Wipe surface with a clean cloth, wet with acetone.

4. Center and straighten new cushion on back rest panel. Match drill cushion panel through back rest panel #30 holes and deburr holes. Clean up debris.

5. Attach cushion to back rest panel with rivets. Verify security.

6. a. Forward Back Rest: Apply B270-18 adhesive to underside of cushion flap and to mating portion of support tube. Pull flap around tube, smooth wrinkles, and trim excess flap. Remove excess adhesive prior to curing.

   b. Aft Back Rest: Install back rest assembly per Section 15.200.

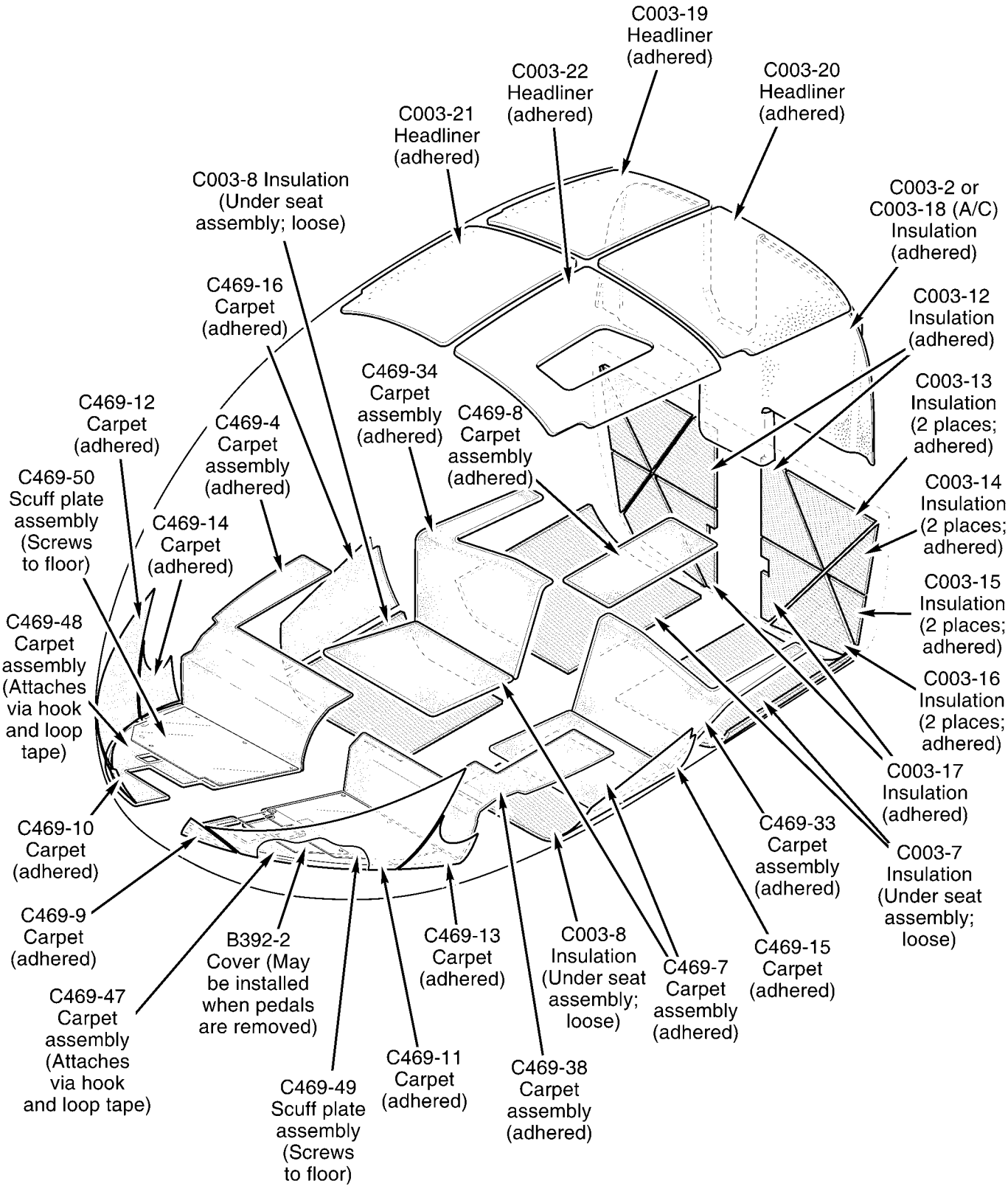


FIGURE 15-2 CARPET AND INSULATION

15.300 Carpet

15.310 Forward Cabin Floor Carpet

A. Removal and Installation

1. Refer to Figure 15-2. Remove adjustable and/or removable pedals, as required. If installed, remove hardware securing B392-3 cover to cabin floor and remove cover.
2. Remove hardware securing scuff plates to floor and remove scuff plates. Detach carpet assembly from floor via hook and loop tape (Velcro).
3. Install carpet assembly, and attach carpet to floor via hook and loop tape.
4. Install scuff plates, and install hardware securing scuff plates to floor.
5. Install adjustable and/or removable pedals, as required. As required, install B392-3 cover, and install hardware securing cover to floor.

15.320 Adhered Carpet

A. Removal and Installation

WARNING

Ensure adequate ventilation when using solvents and adhesives.

CAUTION

Use caution when removing adhered carpet if carpet is intended for reuse.

1. Refer to Figure 15-2. Starting at corners, gently peel back carpet by hand, or with a plastic wedge or putty knife. Dampen old adhesive with Dupont Prep-Sol (or equivalent) to facilitate removal.
2. Verify proper carpet fit and trim as required (do not trim carpet welt). Apply B270-8 adhesive to bonding surface and carpet backing. Press carpet to surface, smooth wrinkles, and remove excess adhesive prior to curing.

15.400 Insulation and Headliner Replacement

WARNING

Ensure adequate ventilation when using solvents and adhesives.

NOTE

Use caution not to damage surface underneath insulation when removing insulation with tools. Insulation is installed with adhesive, except under seat assemblies. Order new insulation as required; reuse of removed insulation is not recommended.

1. Refer to Figure 15-2. Peel off insulation by hand. Using a plastic wedge or putty knife, carefully remove residual insulation and old adhesive. Wipe surface with a clean cloth, wet with acetone.
2. Verify proper insulation fit and trim as required. Apply B270-8 adhesive to bonding surface and insulation backing. Press insulation to surface, smooth wrinkles, and remove excess adhesive prior to curing.

15.500 Miscellaneous Furnishings

15.510 Pilot's Operating Handbook (POH) Strap Replacement

1. Remove Pilot's Operating Handbook (POH). Drill out rivets securing POH retaining strap to cabin and remove strap. Deburr holes and clean up debris.

2. Cleco new retaining strap to cabin. Progressively remove clecos and install rivets. Verify security. Install POH.

15.520 License Holder Replacement

1. Remove aircraft documents from license holder. Drill out rivets securing license holder to cabin and remove license holder. Deburr holes and clean up debris.

2. Cleco new license holder to cabin. Progressively remove clecos and install rivets. Verify security. Insert aircraft documents into license holder, and tuck flap under windshield frame.

15.530 Map Pocket Replacement

1. As required, remove seat assembly per Section 15.200.

2. Drill out rivets securing map pocket to seat box and remove pocket, washers, and retaining strips. Deburr holes and clean up debris.

3. Fold outboard pocket edge around A913-1 strip, align holes, and cleco to seat box. Fold inboard pocket edge around A913-2 strip, align holes, and cleco to seat box. Trim excess material.

4. Progressively remove clecos and install washers and rivets. Verify security.

5. If removed, install seat assembly per Section 15.200.

15.600 Emergency Equipment

15.610 Emergency Locator Transmitter (ELT)

NOTE
ELT installation is optional equipment.

The Emergency Locator Transmitter (ELT) installation consists of a transmitter with internal battery pack, an external antenna, and a remote switch/annunciator. The transmitter is mounted to the upper steel tube frame and is accessible through the center right-side cowl door. The remote switch/annunciator is located left of the cyclic stick.

The ELT is operated by a switch on the transmitter and by the remote switch. The transmitter switch has been set in the ARM position at installation and should always be in this position for flight. The remote switch/annunciator is a three position switch with indicator light. This switch should be in the ARMED position for flight. With both switches set to armed, the ELT will begin transmitting when subjected to a high "G" load. When the unit is transmitting, the red indicator light illuminates.

15.600 Emergency Equipment

15.610 Emergency Locator Transmitter (ELT; continued)

Moving the remote switch to ON activates the transmitter. Use the ON position if an emergency landing is imminent and time permits.

If the ELT is inadvertently activated, use the momentary RESET & TEST position of the remote switch to stop transmission and reset the unit. The red indicator will extinguish when unit is reset.

Register an ELT when first purchased, when contact information changes, or when aircraft ownership, or registration changes. For registration information, visit the COSPAS-SARSAT website at: http://cospas-sarsat.org.

Kannad 406 AF-Compact ELTs are interchangeable between aircraft. A dongle contains a memory chip that must be programmed with aircraft-specific information prior to installation for the ELT to function. The dongle may be removed and shipped to RHC or a Kannad service center for reprogramming.

Refer to ELT Kannad 406 AF-Compact/406 AF-Compact (ER) Installation and Operation Manual for maintenance requirements and procedures. Additional ELT information is available on the RHC website at: http://www.robinsonhelicopter.com/supportelt.htm.

NOTE
Do not cut B359-2 releasable, reusable ty-rap.

A. ELT Removal and Installation

1. Turn BATTERY switch OFF. Open aft right access door.

2. Disconnect dongle, or wire harness lead, and antenna lead from ELT transmitter.

3. Pull red tab to remove B359-2 ty-rap. Detach hook and loop tape, or unlatch strap, securing transmitter to bracket and remove transmitter.

4. Install ELT transmitter, and attach hook and loop tape, or latch strap, securing transmitter to bracket. Install B359-2 ty-rap and cinch ty-rap until snug without over-tightening. Verify security.

5. Connect dongle, or wire harness lead, and antenna lead to transmitter. Verify security.

B. KANNAD ELT Dongle Removal and Installation

1. Turn BATTERY switch OFF. Open aft right access door.

2. Cut and discard ty-raps as required, disconnect A837-10 (dongle) harness assembly from airframe harness at connectors, and from ELT transmitter, and remove A837-10 harness assembly.

3. Connect programmed A837-10 (dongle) harness assembly to airframe harness at connectors, and to ELT transmitter, and install ty-raps as required. Cinch ty-raps until snug without over-tightening, and trim tips flush with heads. Verify security.

15.620 Fire Extinguisher

NOTE
Fire extinguisher installation is optional equipment.

Inspect fire extinguisher monthly according to manufacturer's instructions. Maintenance instructions are located on extinguisher bottle. Record inspection and maintenance dates and findings as required.

A. Strap and Pocket Assembly Replacement

1. Detach strap assembly from pocket assembly, and detach pocket assembly straps via hook and loop tape. Remove fire extinguisher.

2. As required, open upper console. If installed, remove hardware securing HID landing light left ballast to left console and secure ballast away from workspace.

3. Drill out rivets securing strap assembly and pocket assembly to cabin or console and remove strap and pocket. Deburr holes and clean up debris.

4. Cleco new strap assembly and pocket assembly to cabin or console. Progressively remove clecos and install washers and rivets. Verify security.

5. If removed, install hardware securing HID landing light left ballast to left console. Verify security. If opened, close upper console.

6. Install fire extinguisher and attach pocket assembly straps around extinguisher via hook and loop tape. Route strap assembly through extinguisher head and attach to pocket assembly via hook and loop tape. Verify security.

CHAPTER 16

SPECIAL TOOLS

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16.000	Special Tools	16.1

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SECTION 16

SPECIAL TOOLS

16.000 SPECIAL TOOLS

16.001 Introduction

The following section contains a list of special tools available from Robinson Helicopter for use with the procedures in this manual to properly maintain the R44 helicopter.

16.100 TOOL LIST

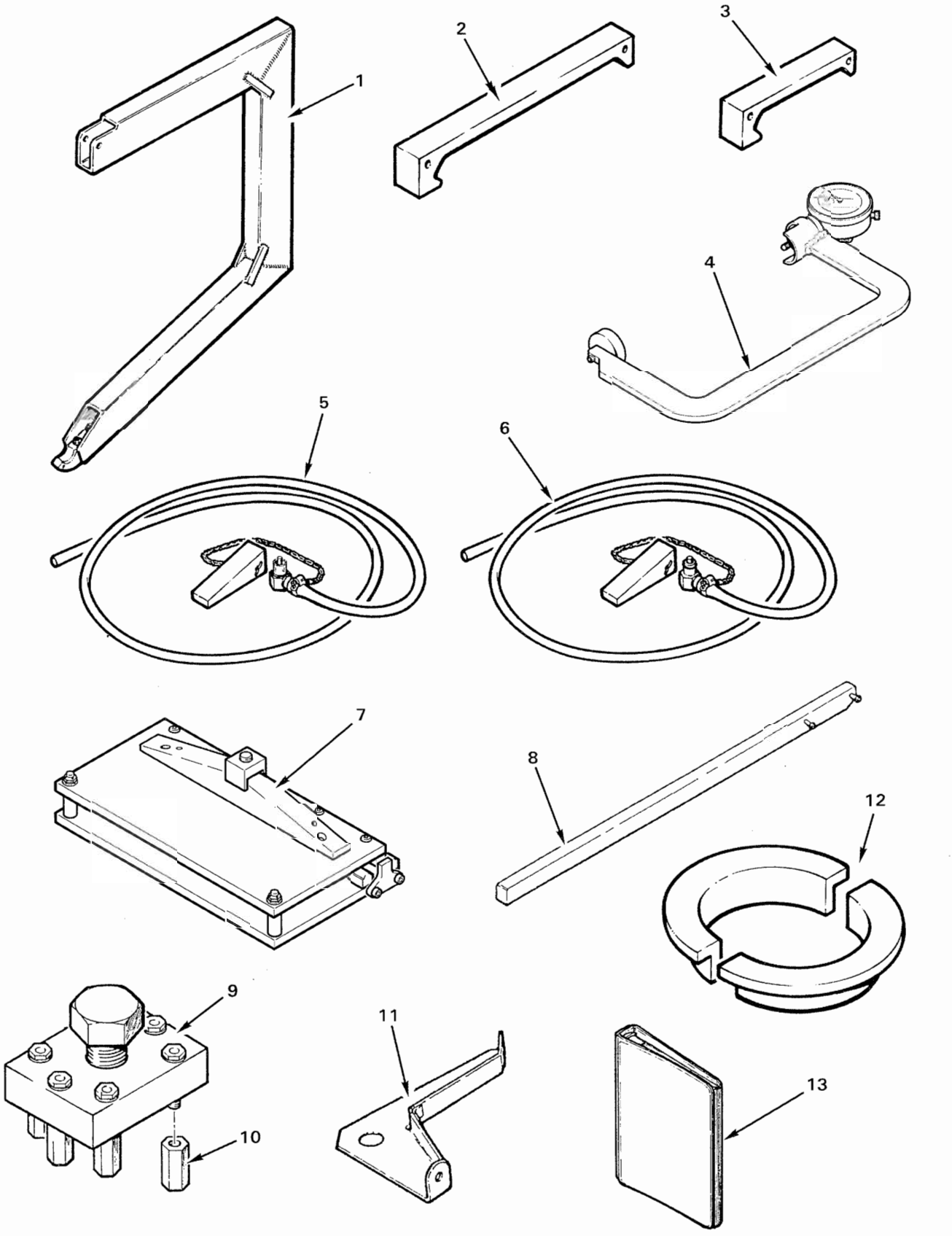
1)	MT548-1	Engine Hoist
2)	MT525-1	Main Rotor Rigging Fixture
3)	MT525-2	Tail Rotor Rigging Fixture
4)	MT122-6	Main Rotor Hub Bolt Stretch Measuring Tool
5)	MT053-1	Main Rotor Gearbox Drain Valve Tool (for old-style A7260 chip detector)
6)	MT054-1	Main Rotor Gearbox Drain Valve Tool (for B7260 "quick release" chip detector)
7)	MT526-1	Main Rotor Blade Trim Tab Bender
8)	MT091-1	Engine Ring Gear Holder
9)	MT592-1	Fan Puller (incl item 10)
10)	MT092-3	Spacer
11)	MT121-1	Bracket - Magnetic Pickup
12)	MT146-2	Blocks - Swashplate Rigging (set of 2 blocks; use with C198-1 swashplate, use MT146-3 with C198-2 swashplate)
13)	60297-10	Engine Operator's Manual (Lycoming part no.)
14)	MT173-5	Torque Wrench Extension Tool Set - Fan Nut (R22 and R44; includes items 15 thru 19)
15)	MT173-6	Torque Wrench Welded Assembly
16)	9HT4441*	Extension Bar (3/4" drive, 8-in. length)
17)	MT173-7	Socket (3/4" drive, 1-1/2" 12 pt. 9-47782*)
18)	MT173-4	Socket (3/4" drive, 1-11/16" 12 pt. 9-47784*)
19)	MT173-8	Socket (3/4" drive, 2" 12 pt. 9-47788*)
20)	MT147-1	Air Bleed Tools - Main Rotor Spindle
21)	MT252-1	Bearing Pressing Tool - Tail Rotor Hub
22)	MT549-2	Flat Plate
23)	MT549-1	Spacer - Spindle Boot Adjustment
24)	MT527-1	Helicopter Lifting Fixture
25)	MT527-5	Bushing

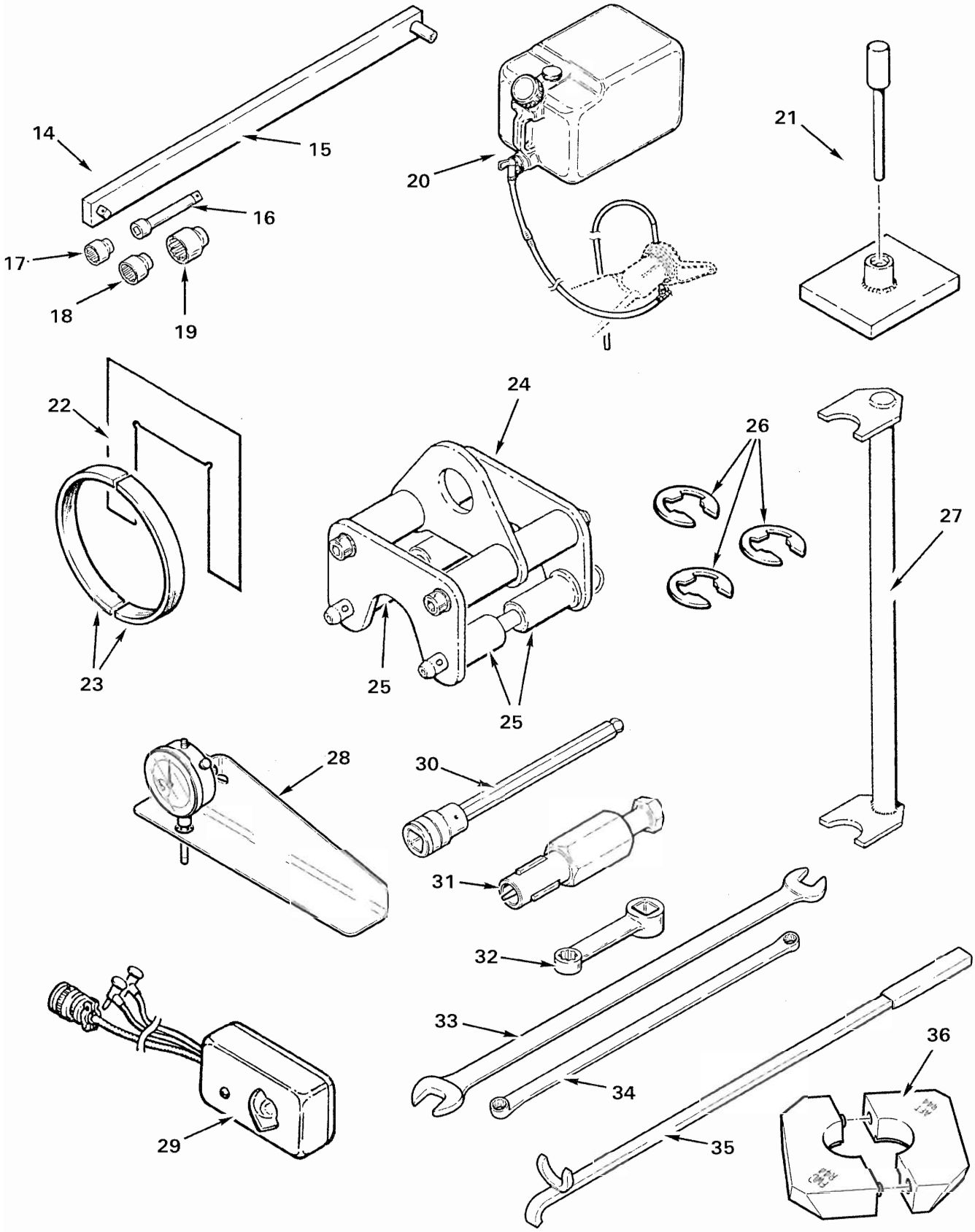
*Sears/Craftsman part no.

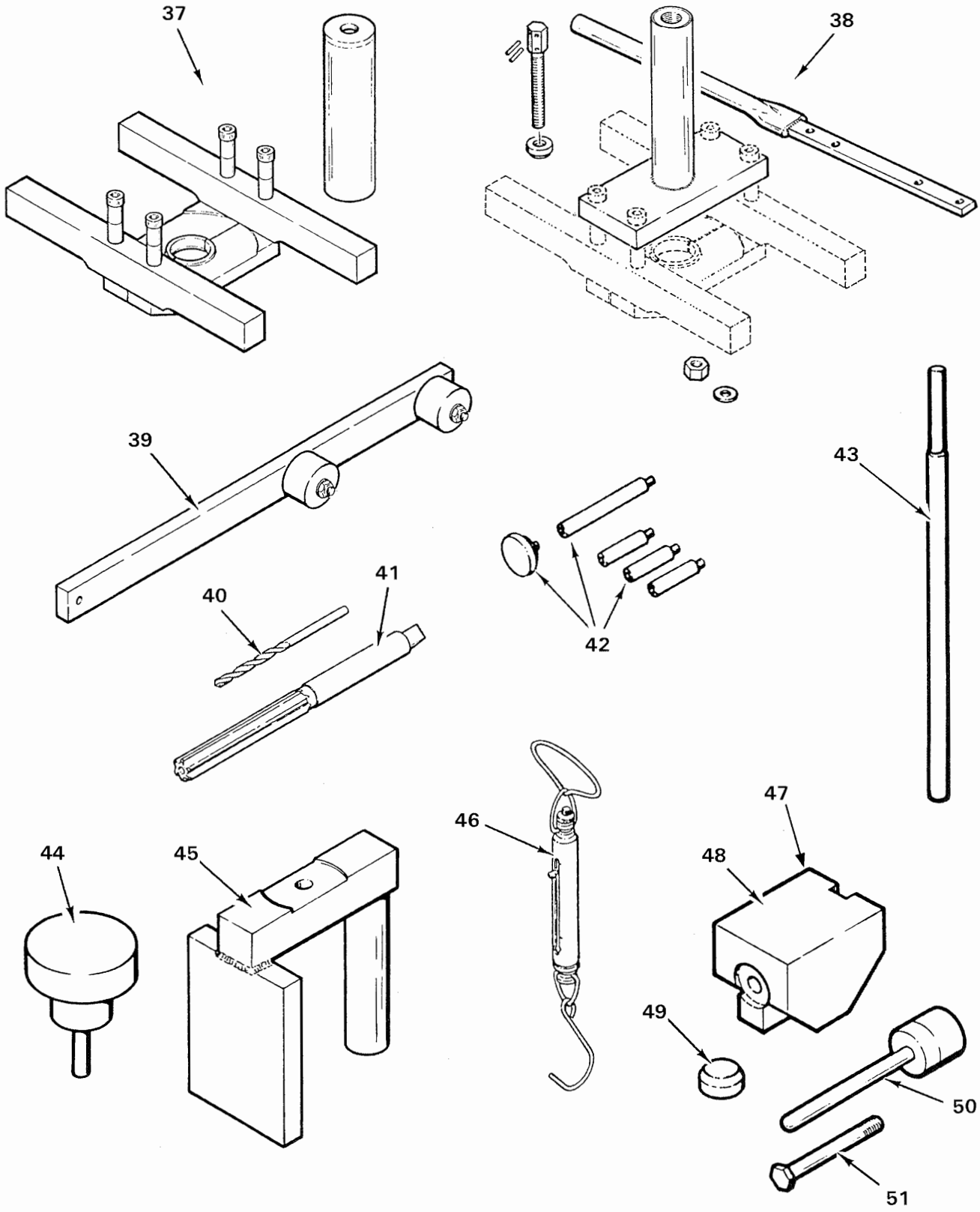
26)	MS16633-2018	Retaining Ring (3 required for removal or installation of C038 collective spring assembly)
27)	MT544-2	Spring Retainer - Trim
28)	MT352-1	Main Rotor Blade Trim Tab Gage
29)	MT547-1	Cyclic Trim Set-up Box
30)	MT357-4	Hex Driver (Snap-on part no. FABL8)
31)	MT357-8	Nipple Chuck
32)	MT357-5	Torque Adapter (Snap-on part no. FRDH101)
33)	MT357-6	Wrench - Open End (3/8" & 7/16"; 44475*)
34)	MT357-7	Wrench - Box End (7/32" & 1/4"; XDH78A**)
35)	MT516-1	Valve Spring Compressor Tool
36)	MT559-1	Blocks - Main Rotor Rigging (set of 2 blocks; holds cyclic stick in neutral position)
37)	MT528-1	Clutch Bearing (C184) Removal/Installation Tool (For use with hydraulic press)
38)	MT528-2	Clutch Bearing (C184) Removal/Installation Tool (For use when hydraulic press is not available)
39)	MT354-4	Teeter Moment Tool
40)	MT357-3	0.156 in. dia. Cobalt Steel Drill Bit
41)	MT357-2	0.375 in. dia. Reamer
42)	MT260-6	Tail Rotor Drive Shaft Runout Indicator Kit
43)	MT331-4	Sheave Alignment Bar
44)	MT329-6	Plug (hub bearing installation)
45)	MT643-1	Support (hub bearing installation)
46)	MT359-1	Spring Scale
47)	MT556-11	Support Tail Rotor Elastomeric Bearing Removal/Installation Tool (includes items 46 thru 49)
48)	MT556-15	Support
49)	MT556-16	Cap
50)	MT556-12	Mandrel Assembly
51)	AN6-34A	Bolt
52)	MT133-1	Parallel Valve Tool Assembly (O-320, O-360, & O-540 engines; not shown)
53)	MT133-5	Angle Valve Tool Assembly (IO-540 engines; not shown)
54)	MT133-9	Adapter (for measuring valve wiggle; not shown)
55)	MT384-1	Hydraulic Pump Assembly (115V, 60Hz for USA, Canada and Mexico; not shown)
56)	MT348-2	Hydraulic Pump Assembly (220V, 50Hz for outside North America; not shown)

*Sears/Craftsman part no.

**Snap-on part no.


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CHAPTER 17

REVISION LOG

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REVISION LOG

MAY 2016

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 www.robinsonheli.com to verify the issue or revision date is current. A subscription service form is included in the front of this manual.

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1.28	JUN 2014
1.29	JUN 2014
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8.iv	DEC 2011

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Page	Date
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