

CHAPTER 4

AIRFRAME

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CHAPTER 4

AIRFRAME

4.000 Description

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

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

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

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

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

4.100 Cabin Assembly

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

4.110 Repair

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

4.120 Windshield Assembly

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

4.130 Door Removal and Installation

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4.140 Fairing, Cowling, 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

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| <p>CAUTION</p> |
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|---|
| <p>Mast fairing must be installed for flight.</p> |
|---|

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.

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| <p>CAUTION</p> |
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|---|
| <p>All cowlings must be installed for flight.</p> |
|---|

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

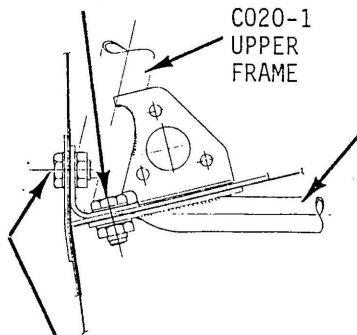
4.210 Lower Frame Assembly, L.H.

4.211 Frame Removal

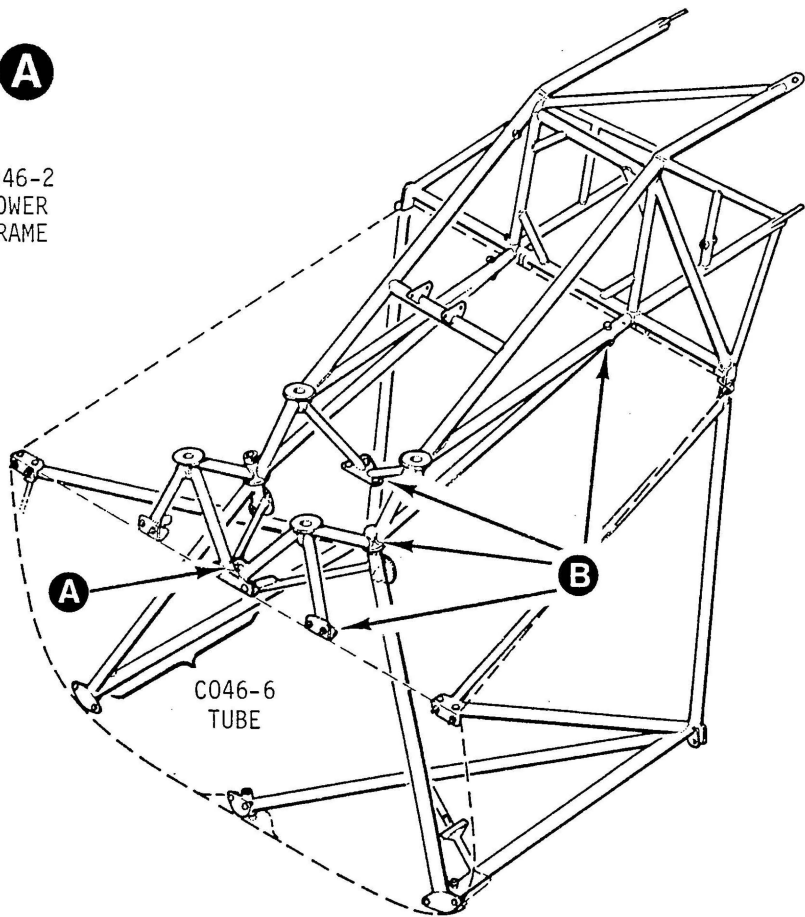
- a) Remove all cowling.
- b) Remove main rotor gearbox, including both fuel tanks, per Section 7.110.
- c) Remove powerplant, including tailcone and clutch assembly, per Section 6.110.
- d) Remove battery and battery box.
- e) Remove left aft seatback panel.
- f) Disconnect the three forward mounting 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).

NAS6604-2 BOLT
AN960-416L WASHER (2 REQ'D.)
NAS679A4 NUT
(2 PL'CS.)

A



NAS6604-2 BOLT
AN960-416L WASHER (4 REQ'D.)
NAS679A4 NUT (2 REQ'D.)



NAS6604-2 BOLT
AN960-416L WASHER (2 REQ'D.)
NAS679A4 NUT
(3 PL'CS.)

NAS6605-21 BOLT
AN960-516L WASHER (2 REQ'D.)
NAS679A5 NUT
(2 PL'CS.)

C020-1
UPPER
FRAME

C722-2 SCREW
MS20002C10 WASHER

NAS6605-4 BOLT
AN960-516L WASHER (2 REQ'D.)
NAS679A5 NUT
(4 PL'CS.)

C046-1
LOWER
FRAME

AN960-416 or 416L WASHER
AS REQUIRED FOR SHIMMING
(2 MAXIMUM)

FIGURE 4-2 STEEL TUBE FRAME INSTALLATION

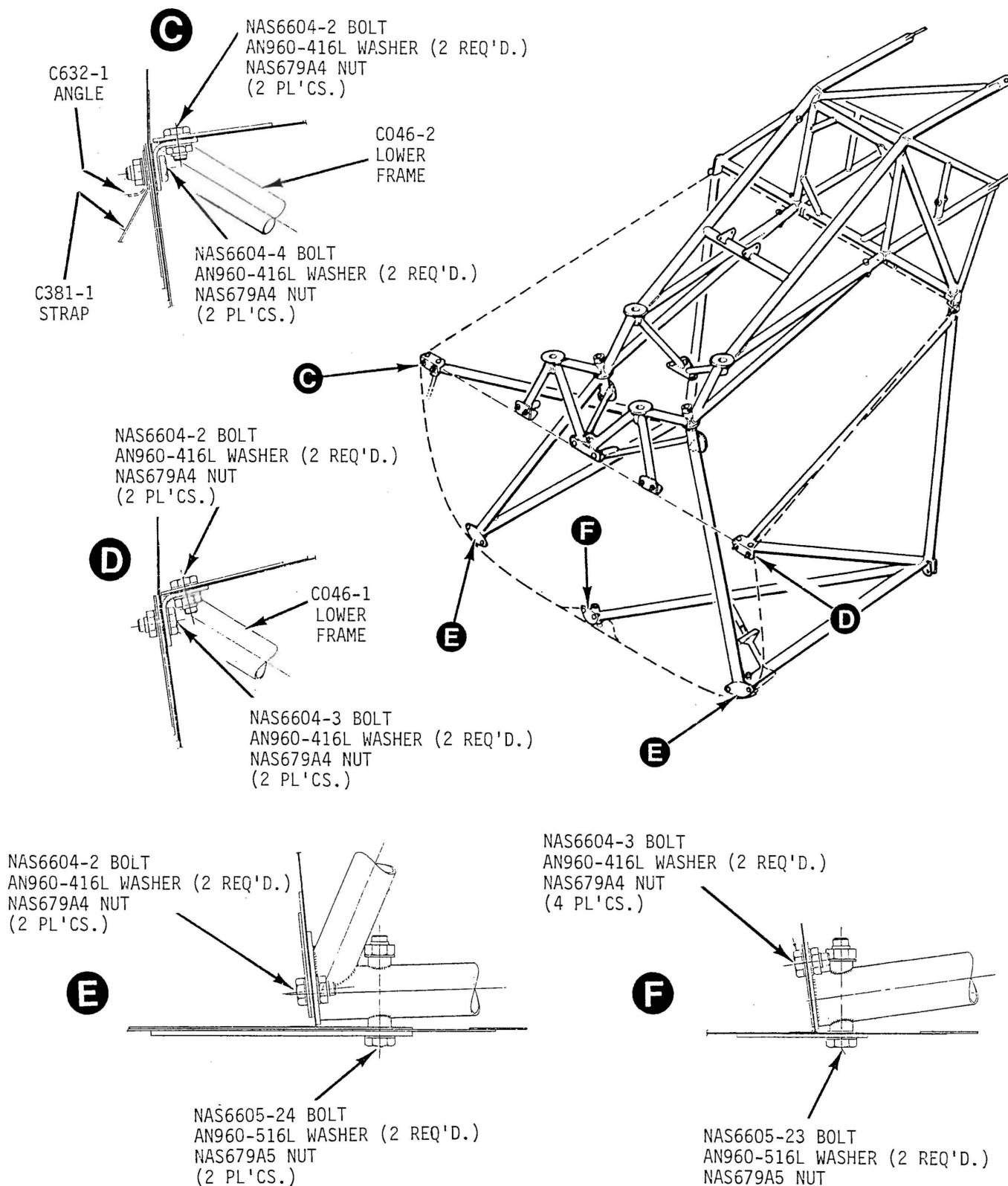


FIGURE 4-2A STEEL TUBE FRAME INSTALLATION

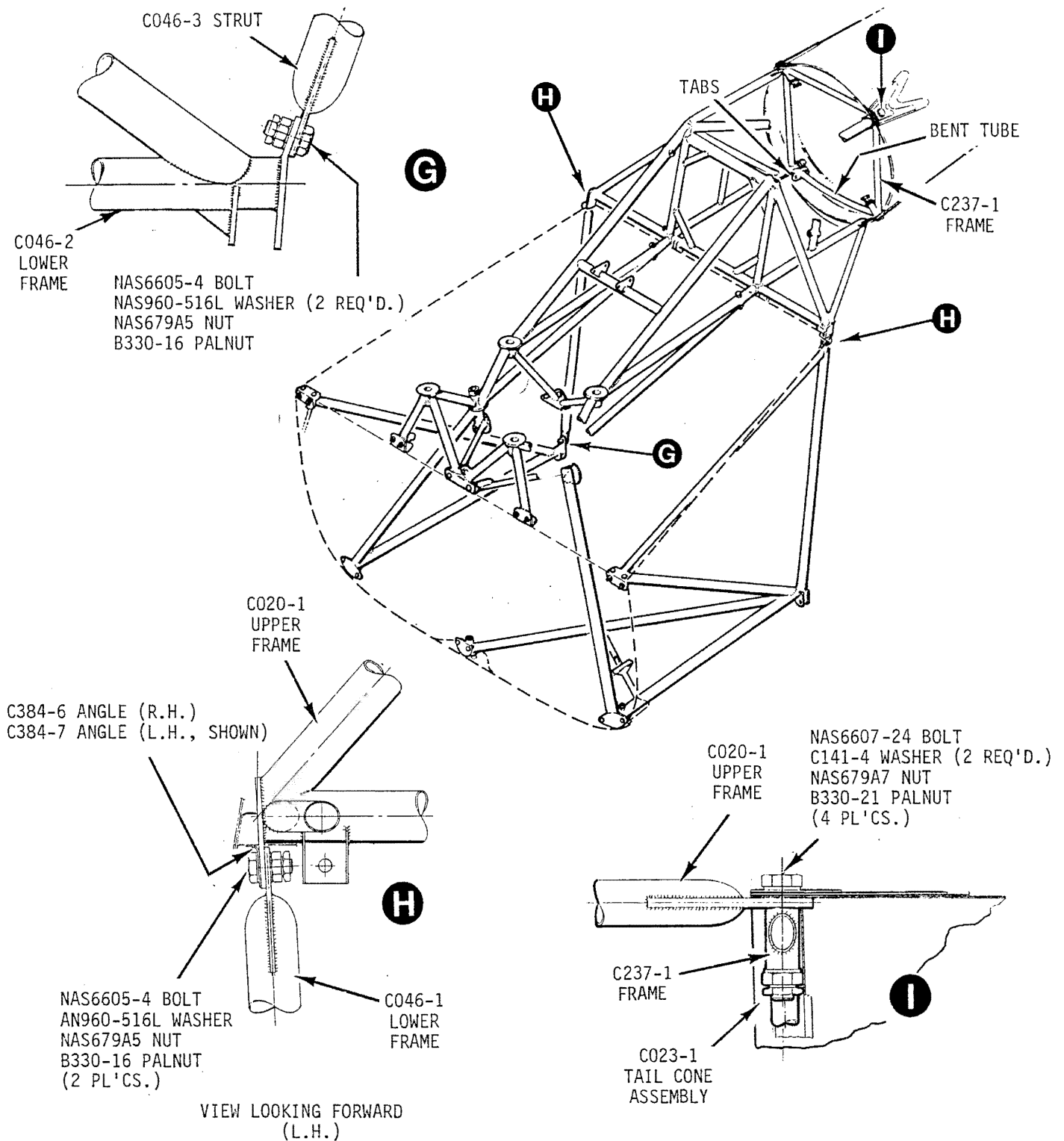


FIGURE 4-2B STEEL TUBE FRAME AND TAIL CONE INSTALLATION

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.

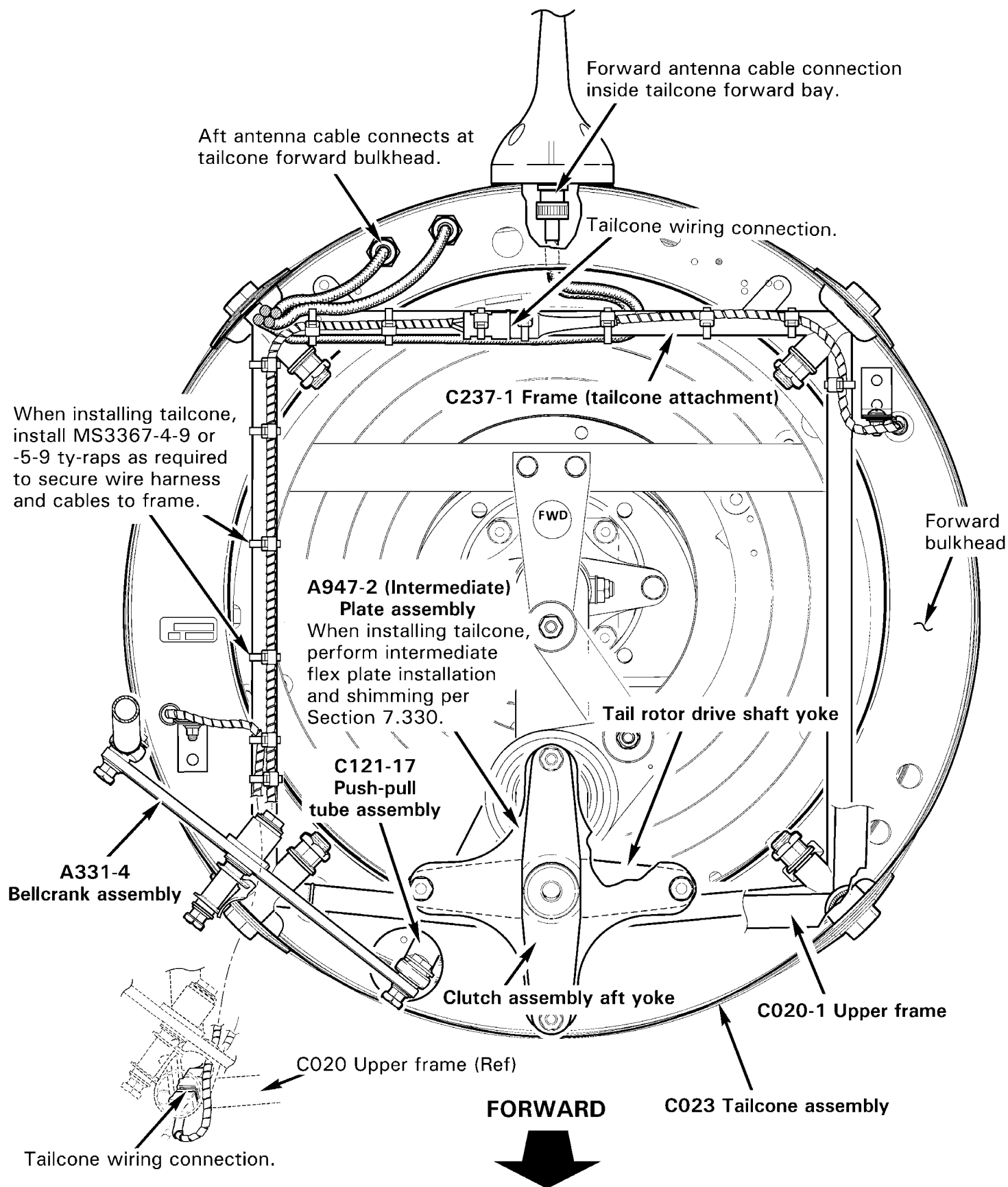


FIGURE 4-3 TAILCONE ASSEMBLY

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.

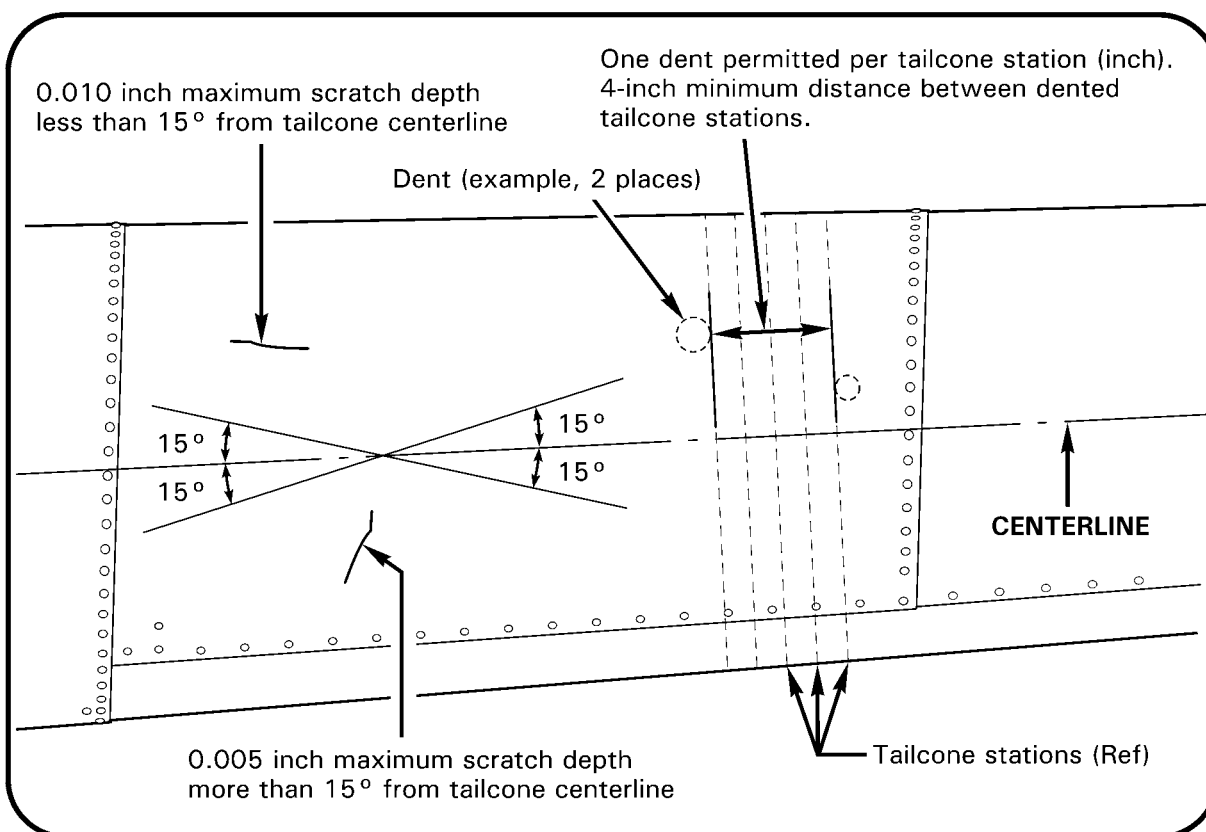
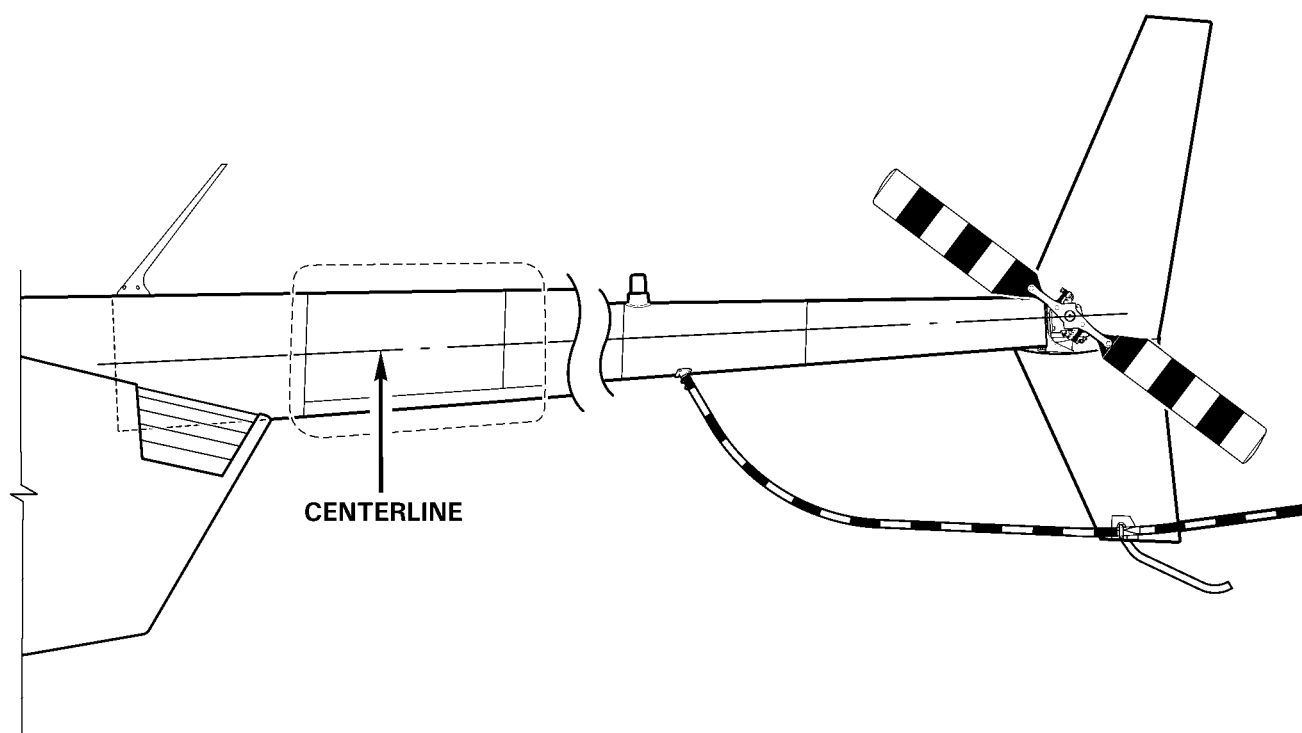


FIGURE 4-4 TAILCONE INSPECTION AND REPAIR

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.

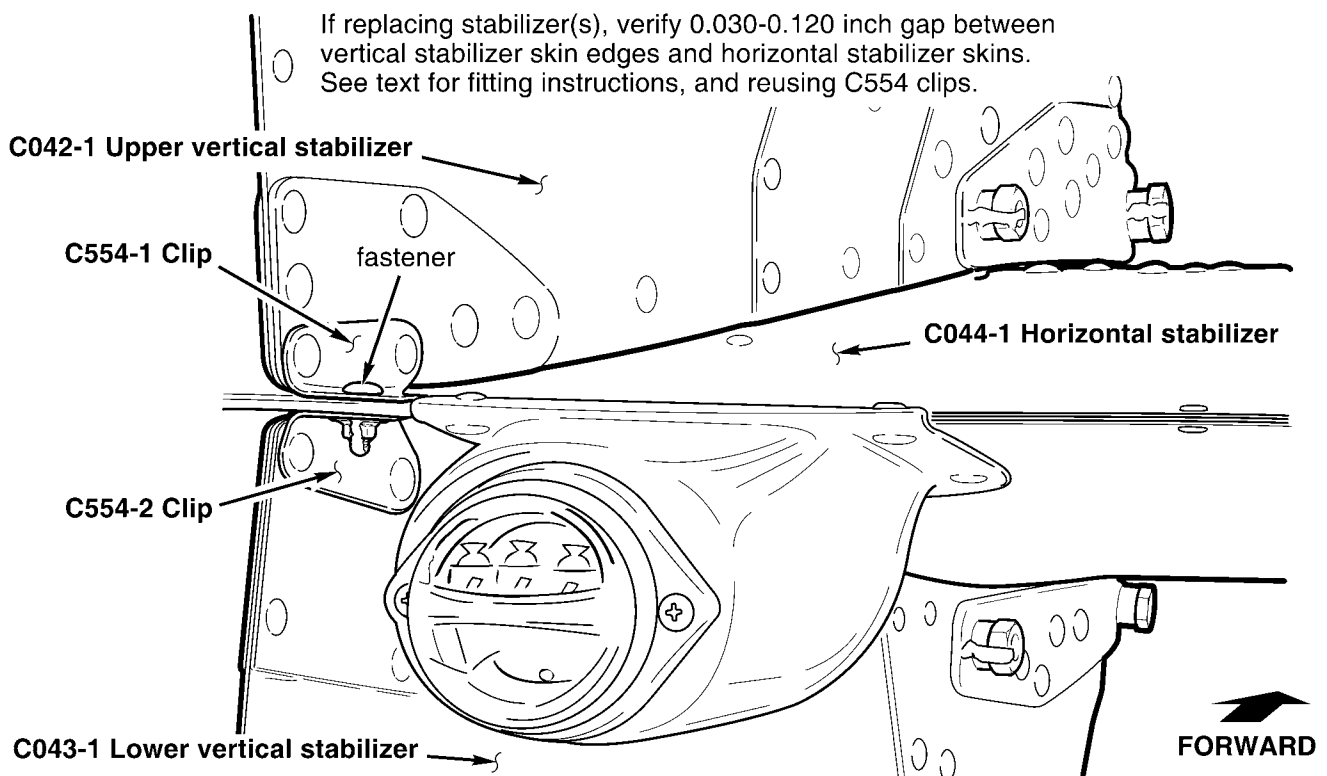
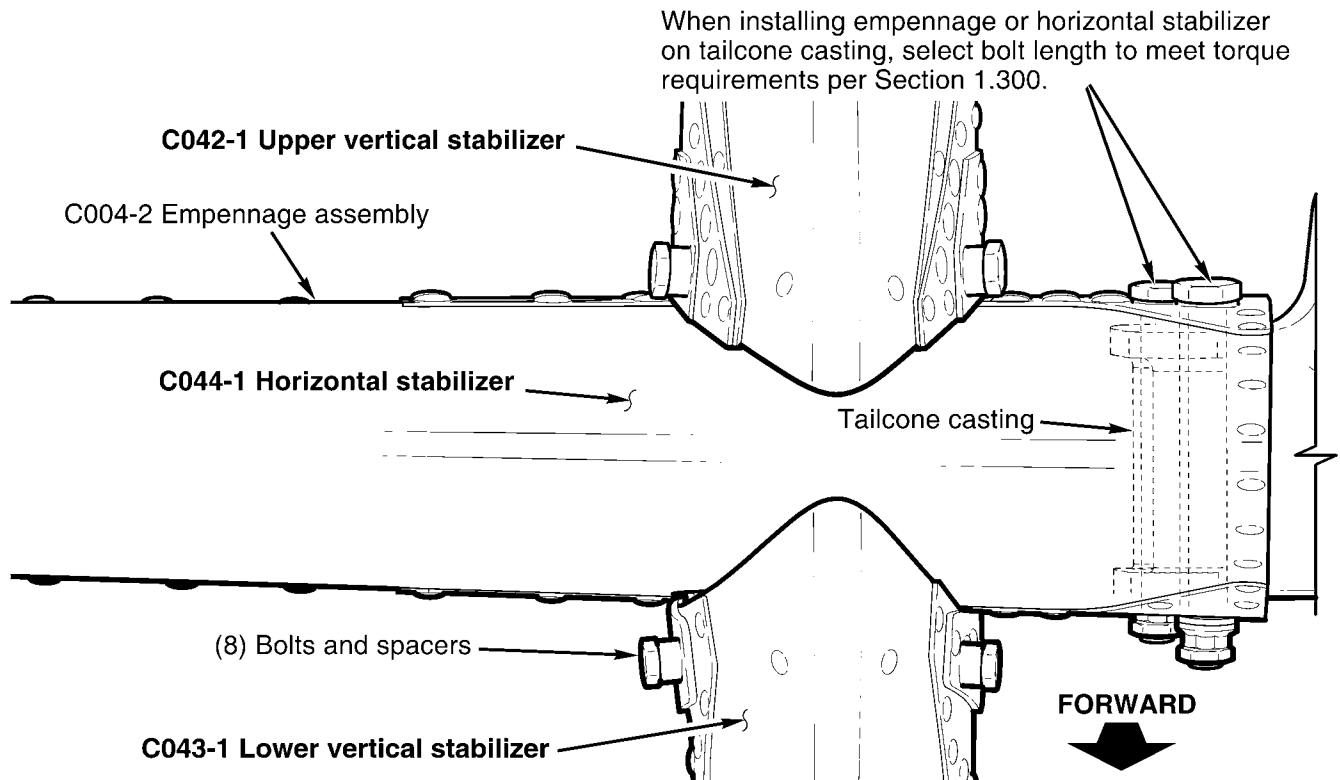


FIGURE 4-5 EMPENNAGE - TAILCONE CASTING

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.

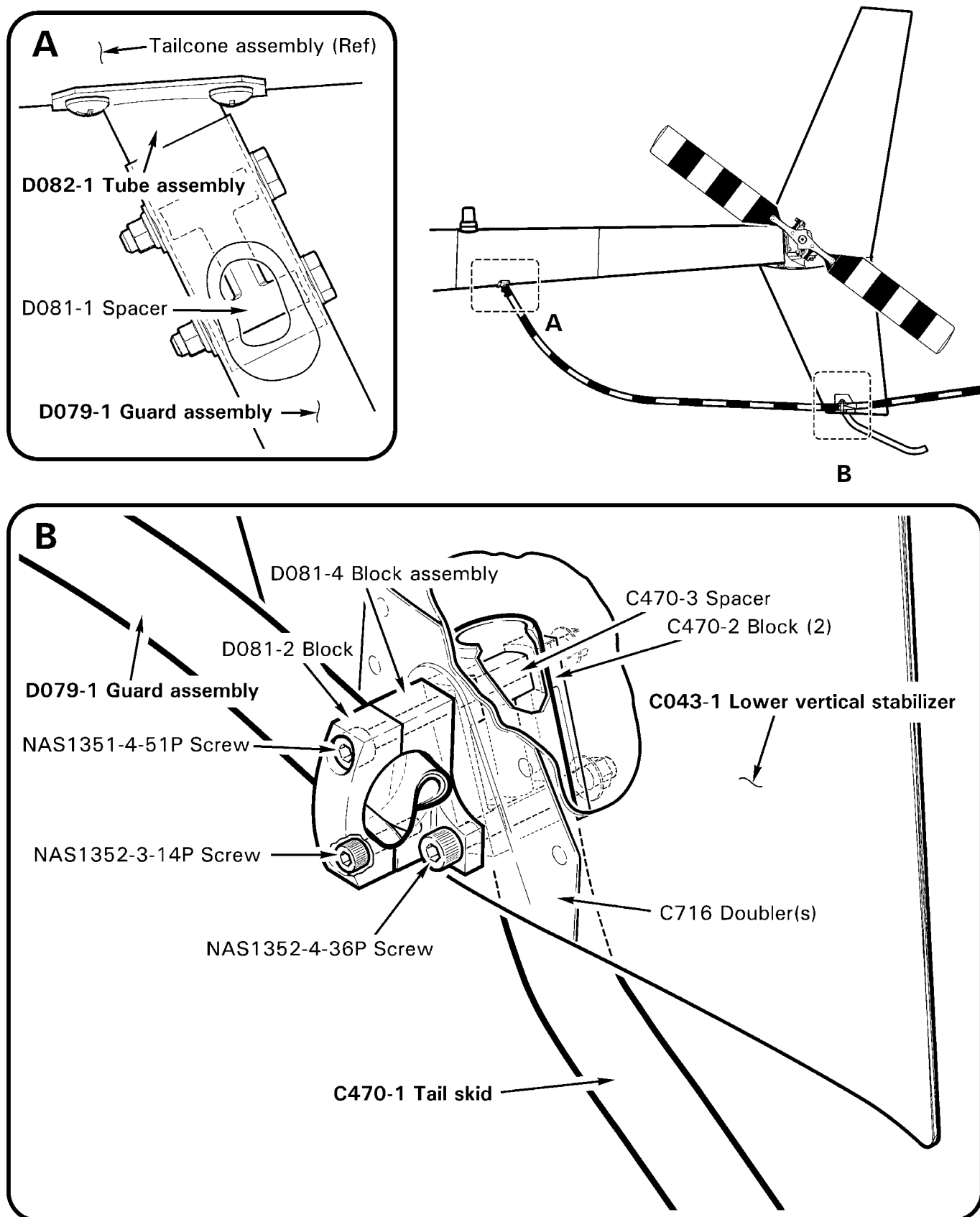


FIGURE 4-6 EMPENNAGE - TAIL ROTOR GUARD

(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.