ENSTROM HELICOPTER CORPORATION

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ENSTROM F-28F/280F SERIES MAINTENANCE MANUAL

Revision 14, dated Jul 30/2024, applies to the Enstrom F-28F/280F Series Maintenance Manual, 1985 Edition/1990 2nd Edition. Place this cover sheet behind the "Record of Revisions" card after removing and inserting the pages listed below.

Remove Pages	Insert Pages
v through x	v through x
xiii through xiv	xiii through xiv
MM-8-1 through MM-8-62	MM-8-1 through MM-8-76
MM-9-1 through MM-9-76	MM-9-1 through MM-9-82
MM-12-1 through MM-12-80	MM-12-1 through MM-12-86

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Section 7 – Instruments

Section 8 – Structures

Section 9 – Main Rotor

MAINTENANCE MANUAL SUPPLEMENT 280FX & 1986 F-28F – SECTIONS 15 THROUGH 25

Section 21 – Electrical Systems and Components

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Section 23 – [Reserved]

Section 24 – Instruments

Section 25 – [Reserved]

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REV. NO	REV DATE	DESCRIPTION	DATE	FAA APPROVED
10	Feb 7/19	Cover ix, xiii, xiv MM-4-40, MM-4-42 MM-8-0 through MM-8-0.2 MM-8-12 through MM-8-16.2 MM-12-18 through MM-12-22 MM-21-1 through MM-21-4 MM-21-6 through MM-21-8, MM-21-14 MM-21-33 through MM-21-58 MM-24-7 through MM-24-8	N/A	N/A
11	Oct 25/19	Cover iv through vii, ix, xiii MM-1-3 MM-2-11, MM-2-12 MM-2-14 through MM-2-20 MM-4-3, MM-4-9, MM-4-11 MM-4-22, MM-4-32 MM-4-47, MM-4-51 through MM-4-56 MM-4-65, MM-4-66, MM-4-77, MM-4-78 MM-6-0.1, MM-6-0.2 MM-6-1 through MM-6-8 MM-8-36 MM-9-1 through MM-9-48 MM-10-1 through MM-10-68 MM-12-1 through MM-12-80 MM-13-0.1, MM-13-0.2, MM-13-31 MM-13-35, MM-13-37, MM-13-49 MM-13-67 through MM-13-71 MM-13-93 through MM-13-100 MM-21-15, MM-21-16 MM-24-0.1, MM-24-0.2 MM-24-8 through MM-24-10	N/A	N/A
12	Jul 16/2020	Cover vi, xiii, MM-1-1, MM-1-4, MM-1-5 MM-2-1, MM-2-12, MM-2-21, MM-2-22 MM-8-0, MM-8-0.2, MM-8-17, MM-8-18 MM-8-19, MM-8-20, MM-8-61, MM-8-62 MM-21-2 MM-23-1, MM-23-2	N/A	N/A
13	Jan 5/24	Cover i, vii, viii, ix, xiii MM-10-1 through MM-10-74 MM-11-1 through MM-11-84 MM-20-1 through MM-20-2 MM-25-1 through MM-25-2	N/A	N/A
14	Jul 30/24	vi through ix, xiii MM-8-1 through MM-8-76 MM-9-1 through MM-9-78 MM-12-1 through MM-12-86	N/A	N/A

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STRUCTURE

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SECTION 8

STRUCTURE

NOTE

Section 22 content – supplemental maintenance procedures for models F-28F Post-1986 (S/N 744 and subsequent) and 280FX, has been incorporated into Section 8. Model or S/N effectivity is noted where applicable.

8-1 CABIN

The cabin assembly is constructed of an aluminum sheet metal seat structure which supports an outer cabin shell of reinforced fiberglass. The entire cabin section can be removed from the pylon as a unit.

A. Cabin Removal

(1) Remove cabin doors and fiberglass seat deck.

(2) Remove cowling and disconnect and remove engine compartment door hinge bracket from cabin.

(3) Disconnect and remove air filter housing.

(4) Disconnect collective push rod from collective walking beam at the cabin firewall.

(5) Disconnect lateral and longitudinal cyclic push-pull rods at bellcranks on each side of the cabin wall.

(6) Disconnect main battery cable inside engine compartment.

(7) Drain fuel from both fuel tanks and remove tanks.

NOTE: Install plugs in fuel line fittings.

(8) Disconnect tail rotor control cables at turnbuckle in engine compartment or under baggage box, as applicable. See Paragraph 10-8.

(9) Disconnect all oil lines, fuel lines, and airspeed static tube at the firewall.

(10) Disconnect electrical wiring:

(a) Engine system components

(b) Flight system components

(c) Avionic connections (i.e., antenna leads)

(11) Disconnect clutch control cable at turnbuckle in seat structure and at forward clutch cable mount on side of firewall. See Paragraph 11-2.

(12) Disconnect engine and rotor tachometer cables.

(13) Disconnect throttle control cable from injector and pylon mount.

(14) Disconnect mixture control cable from injector and pylon mount.

(15) Remove screws connecting fire curtain to firewall.

NOTE: Sealastic bead will peel from firewall to remove.

(16) Disconnect fuel shut-off control.

(17) Disconnect shoulder harness cables on aft side of cabin back wall. Disconnect the seat belt cables from the keel attachment locations.

(18) Disconnect flex hose and control cable from cabin heat duct on aft side of firewall.

(19) Support cabin and remove six cabin attachment bolts (1, 2). See Figure 8-1 for bolt locations. Lift cabin free of aircraft.

B. Cabin Inspection

(1) Inspect cabin shell for obvious damage, cracks, and condition and security of hardware securing cabin shell to the cockpit bulkhead and cockpit floor.

(2) Inspect cockpit bulkhead and cockpit floor for obvious damage, loose inserts, and condition and security of hardware securing bulkhead to the pylon and cockpit floor to the keel structure.

C. Cabin Repair

(1) Replace damaged or missing hardware.

(2) Repair damage to cabin shell, cockpit bulkhead, or cockpit floor I/A/W AC 43.13-1B. Contact Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

D. Cabin Installation

(1) Lift cabin and align with pylon mounts. Install six attachment bolts. Torque 1/4” bolts (1) to 40-50 in-lb/4.5-5.7 Nm. Torque 5/16” bolts (2) to 80-90 in-lb/9-10.2 Nm. See Figure 8-1.

NOTE: Throttle, mixture, and clutch cables must be lined up and guided through the firewall.

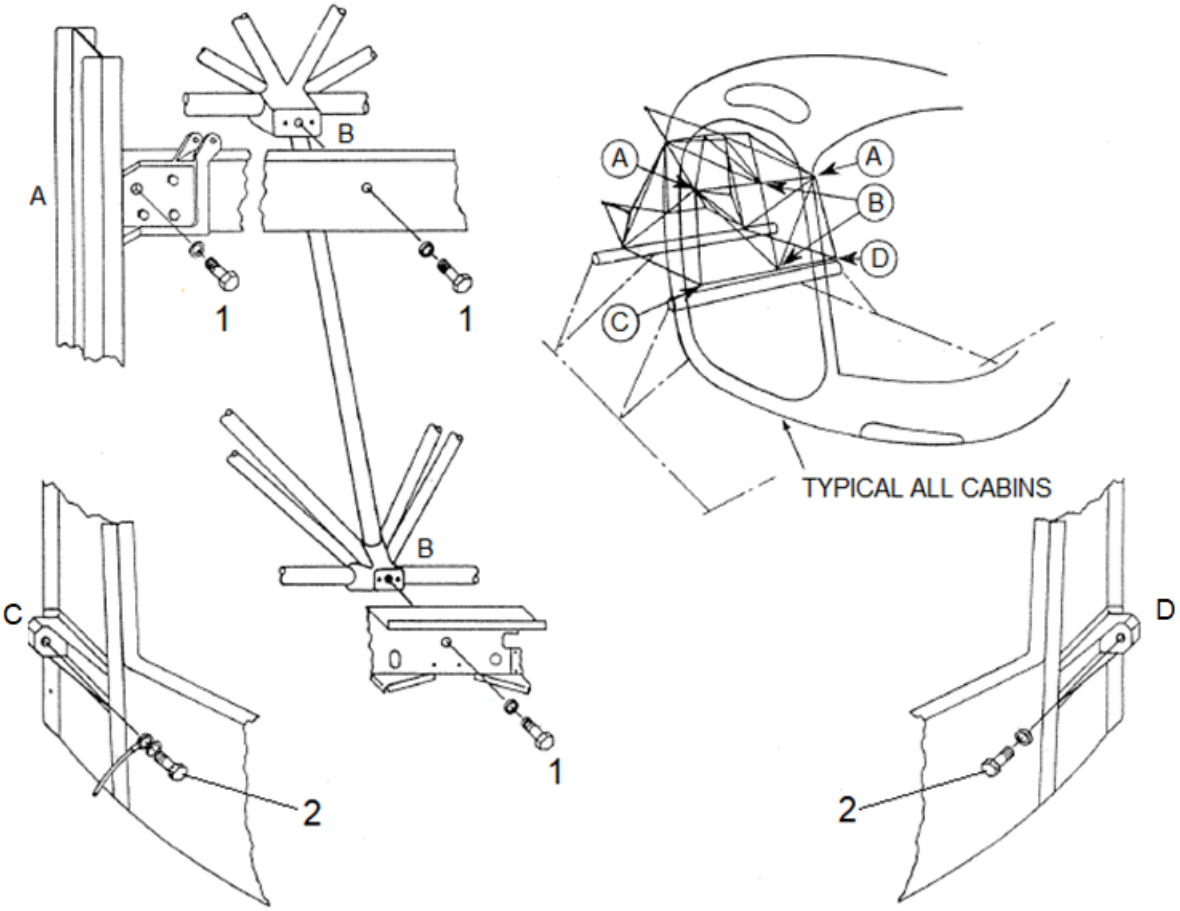
NOTE: Safety wire the two outboard lower cabin mounts after torque.

(2) Connect flex hose and cabin heat control cable to duct on the aft side of firewall.

(3) Connect shoulder harness cables on aft side of the cabin.

(4) Connect fuel shut-off control cable.

(5) Secure fire curtain to firewall using screws and fire barrier sealant CP 25WB+ (3M) or equivalent.



NOTE: Some installations may be shimmed at point (B) bottom.

1. Bolt (1/4 in)
2. Bolt (5/16 in)

Figure 8-1. Cabin Assembly Installation

(6) Connect mixture control cable and throttle control cable to pylon mounts and injector. See Paragraph 13-12 for proper rigging of the injector and correlator.

(7) Connect clutch cable at forward pylon mount and at turnbuckle in seat structure. Do a complete clutch cable rigging procedure. See Paragraph 11-1.

(8) Connect all electrical wiring in engine compartment.

(9) Connect all oil lines, fuel lines, and air speed static tube at firewall.

(10) Connect engine and rotor tachometer cables.

(11) Connect tail rotor cables at turnbuckle in engine compartment. Adjust cable tension per Paragraph 10-7, A. Check tail rotor rigging per Paragraph 10-8, B.

(12) Install engine compartment door hinge bracket between cabin and bulkhead.

(13) Install fuel tanks and connect all fuel lines. Check for leaks after fuel servicing.

(14) Connect the main battery cable inside engine compartment.

(15) Connect the lateral and longitudinal cyclic push-pull rods to bellcranks on each side of cabin wall.

(16) Connect collective push rod to collective walking beam at cabin backwall.

(17) Install air filter housing and connections.

(18) Check all flight controls for proper operation. Check all items on the Daily Check List and complete a Preflight Inspection. See Paragraph 4-48.

(19) Install cowling and engine compartment doors.

(20) Install fiberglass seat deck and cabin doors.

8-2 WINDSHIELDS AND WINDOWS

A. Windshield and Window Inspection

(1) Inspect windshields and windows for cracks, crazing, pits, and scratches.

B. Windshield and Window Repair

(1) Damage to the windshields and windows which does not interfere with pilot's line of sight during normal flight and landing attitudes or damage that does not impair structural integrity may be repaired by stop drilling or patching I/A/W AC 43.13-1B; however, the windshield or window should be replaced at the earliest opportunity.

C. Windshield Removal (F-28F) (See Figure 8-2)

(1) Remove doors.

(2) Remove door hinges to provide clearance for windshield installation.

NOTE: Hinge locations must be marked on hinges for proper reinstallation. Hinges will not align for proper fit if positions are altered.

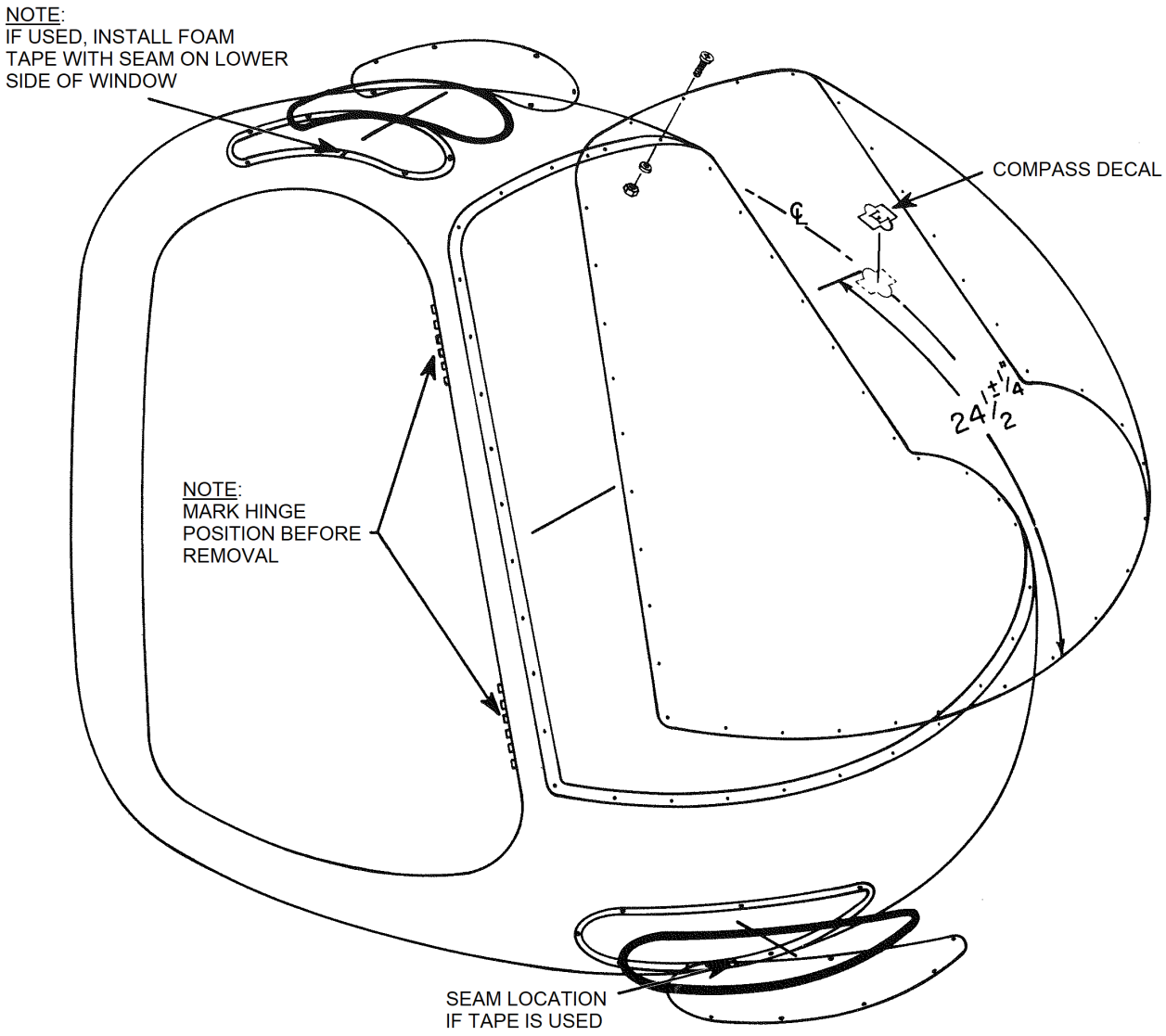


Figure 8-2. F-28F Windshield and Window Installation

(3) Remove attachment screws around outer edge of windshield.

(4) Remove compass from windshield.

(5) Cut out and remove center portion of windshield.

NOTE: When cutting center portion, stay approximately 2-3 inches away from cabin frame. Apply two layers of masking tape to cabin adjacent to windshield edge to protect paint.

(6) Heat remaining edge of glass and bonding adhesive using a portable heat gun and peel glass from cabin frame.

NOTE: When bonding adhesive is warm, it can be scraped from the edge of the cabin using a suitable size putty knife.

(7) Sand windshield mount area clean and free of old bonding adhesive with fine sandpaper.

D. Windshield Installation (F-28F) (See Figure 8-2)

(1) Clean recessed windshield area of cabin frame with acetone or equivalent.

NOTE: Be sure this area has been sanded smooth and free of old bonding adhesive before wiping with acetone.

(2) Position new windshield over cabin and apply tape to temporarily hold windshield in place.

(3) Apply 1/4 inch wide masking tape following contour of windshield and recessed area of cabin to mark windshield size for cutting.

(4) Remove windshield and cut around the tape line using an oscillating saw or a die grinder with a 1/16 inch cut-off wheel. Leave approximately an extra inch on the outside of the perimeter.

CAUTION: SUPPORT THE TAIL OF THE ACRYLIC WHILE CUTTING TO PREVENT THE TAIL FROM BREAKING OFF AND CRACKING THE ACRYLIC.

(5) Place the window back over the opening and secure with tape. Mark the edge of the finished window perimeter with tape or a fine marker.

NOTE: Ensure approximately a 1/8 inch gap between the edge of the window and the edge of the cabin contour.

(6) Carefully cut the window to size, using the cut-off tools, bench belt sander, or sandpaper on a block. Sand and round the edges to a smooth finish.

NOTE: Check fit to cabin and re-sand as required.

(7) Install windshield and tape it in place. Use a small pilot drill bit to mark the position of the holes in the cabin structure. Do not drill the holes all the way through the acrylic at this time.

(8) Remove the window from the cabin and place it on a padded table or similar work surface.

(9) Drill the holes for the fasteners. Use a drill bit size that will be approximately 1/8 inch larger than the diameter of the attaching screw or rivet.

CAUTION: DRILLING ACRYLICS IS BEST ACCOMPLISHED USING A DRILL MANUFACTURED OR MODIFIED FOR DRILLING ACRYLICS. USE CARE WHEN DRILLING TO PREVENT CRACKING GLASS.

NOTE: Most cracks caused by drilling occur when the drill bit breaks through the backside of the acrylic. Use a small block of wood to support the back side of the window when drilling the holes through the acrylic. If the block is held tight to the window, the acrylic will not crack.

(10) Use a 9/32 inch (7.14 mm) drill bit to open the hole to finished dimensions.

(11) Smooth (chamfer) the top and bottom edges of the holes with a rotary grindstone.

(12) Drill approximately six or eight holes on upper and lower edge of windshield with a #41 drill for mechanical fasteners (Clecos).

(13) Remove windshield. Clean fiberglass recess of cabin with acetone. Lightly sand bonding edge of windshield and clean with acetone.

(14) Apply bonding sealant PR-1425 B-2 (or equivalent) to recess in cabin frame using a putty knife. Spread adhesive approximately 1/8 inch to 3/16 inch thick.

NOTE: Follow the exact mixing requirements of two-part adhesives and sealants.

(15) Install windshield in position and press firmly against adhesive.

(16) Temporarily install mechanical fasteners (Clecos) to hold windshield in position until PR1425 B-2 (or equivalent) adhesive is set up.

CAUTION: ALLOW ADHESIVE TO DRY APPROXIMATELY 24 HOURS BEFORE INSTALLING ATTACHMENT SCREWS TO PREVENT CRACKING THE GLASS.

(17) Run a #19 drill through screw holes to remove bonding adhesive and install screws into holes. Secure with washers and nuts.

CAUTION: DO NOT OVERTORQUE ATTACHMENT SCREWS ON INSTALLATION.

(18) Remove mechanical fasteners.

(19) Install door hinges in position as previously marked in removal procedure.

(20) Install compass to windshield as follows: (see Figure 8-2)

(a) Install compass to windshield from middle rib of lower door hinges and mark centerline of windshield with a grease pencil.

NOTE: Use cloth type measurement tape, if possible, to prevent scratching plexiglass.

(b) Measure up 24-1/2 inch ± 1/4 inch from the bottom edge of windshield and mark a line.

(c) Clean contact surface of windshield with acetone.

(d) Apply double back tape (Scotch Brand 4262 Neoprene, or equivalent) to contact area of compass.

NOTE: Tape is not to extend beyond contact surfaces.

(e) Align top edge of compass to line marked on windshield and press firmly into position. While holding compass on inside, have another person rub windshield from the outside to remove air bubbles.

(f) Apply compass decal over contact surface on outside of windshield.

(21) Prepare windshield edges for paint. Repaint outer mount edge.

(22) Install doors (Para. 8-4).

E. Windshield Removal (280F Series) (See Figure 8-3)

NOTE: The 280F windshield consists of two pieces of plexiglass. Windshield halves can be replaced individually.

(1) Drill out rivets holding center strip in position and remove strip.

(2) Drill out remaining rivets around outer edge of windshield.

(3) Cut out and remove center portion of windshield.

NOTE: When cutting center portion, stay approximately 2-3 inches away from cabin frame.

(4) Heat the remaining edge of glass and bonding adhesive using a portable heat gun and peel glass from cabin frame.

NOTE: When bonding adhesive is warm it can be scraped from edge of cabin using a suitable size putty knife.

(5) Sand windshield mount area clean and free of old bonding adhesive with fine sandpaper.

(6) Remove foam tape from center support brace.

F. Windshield Installation (280F Series) (See Figure 8-3)

(1) Clean recessed windshield area of cabin frame with acetone or equivalent.

(2) Position new windshield over cabin and apply tape to temporarily hold windshield in place.

NOTE: Use care in aligning windshield to recess in cabin as the plexiglass is formed with a slight indentation along outer edge that must be matched to cabin frame.

(3) Apply 1/4 inch wide masking tape following contour of windshield and recessed area of cabin to mark windshield size for cutting.

(4) Remove windshield and cut around the tape line using an oscillating saw or a die grinder with a 1/16 inch cut-off wheel.

CAUTION: SUPPORT THE TAIL OF THE ACRYLIC WHILE CUTTING TO PREVENT THE TAIL FROM BREAKING OFF AND CRACKING THE ACRYLIC.

(5) Place the window back over the opening and secure with tape. Mark the edge of the finished window perimeter with tape or a fine marker.

NOTE: Ensure approximately a 1/8 inch gap between the edge of the window and the edge of the cabin contour.

(6) Carefully cut the window to size, using the cut-off tools, bench belt sander, or sandpaper on a block. Sand and round the edges to a smooth finish.

NOTE: Check fit to cabin and re-sand as required.

(7) Install windshield and tape in place. Match drill to old rivet holes in cabin using a #30 drill or drill new holes through windshield and cabin at midpoints between old holes.

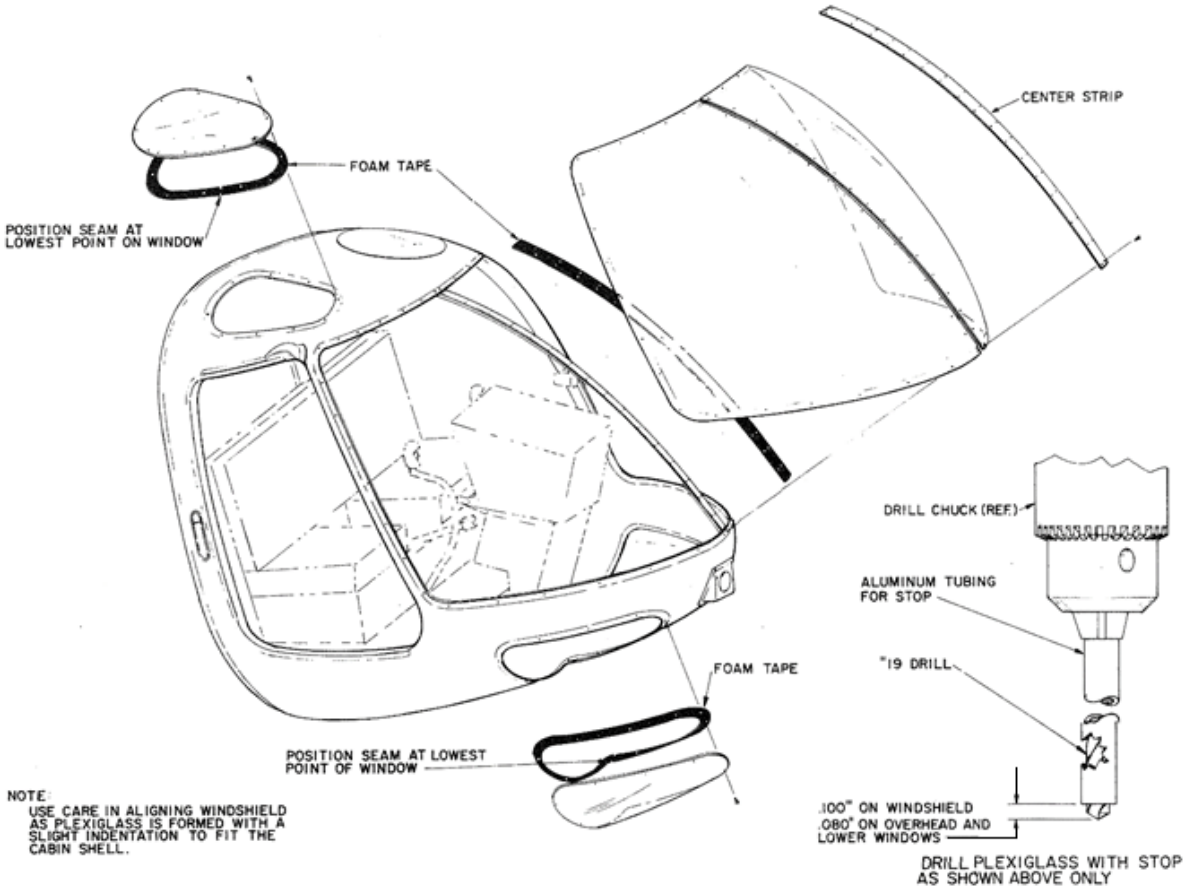


Figure 8-3. 280F Series Windshield

CAUTION: DRILL BITS CAN BE GROUND TO A VERY SHARP POINT TO AID IN DRILLING PLEXIGLASS. USE CARE IN DRILLING TO PREVENT CRACKING GLASS. DO NOT DRILL THROUGH INNER FIBERGLASS INTERIOR TRIM WHEN DRILLING SIDE AND BOTTOM OF WINDSHIELD.

(8) Drill approximately six to eight holes through windshield on top and bottom for mechanical fasteners (Clecos) using a #41 drill bit.

(9) Remove windshield. Clean fiberglass recess of cabin with acetone. Lightly sand bonding edge of windshield and clean with acetone.

(10) Apply foam tape to center strip bar of cabin. Use 3M Brand tape #4016 (or equivalent), 1 inch wide by 1/16 inch thick.

(11) Apply bonding sealant PR1425 B-2 (or equivalent) to recess in cabin frame using a putty knife. Spread adhesive approximately 1/8 inch to 3/16 inch thick.

NOTE: Follow the exact mixing requirements of two-part adhesives or sealants.

NOTE: Do not apply PR1425 B-2 (or equivalent) to the center strip area.

(12) Install windshield in position and press firmly against adhesive.

(13) Temporarily install mechanical fasteners (Clecos) to hold windshield in position until PR-1425 B-2 (or equivalent) is set up.

CAUTION: ALLOW ADHESIVE TO DRY APPROXIMATELY 24 HOURS BEFORE INSTALLING RIVETS TO PREVENT CRACKING GLASS.

(14) Run a #30 drill through rivet holes to remove bonding adhesive.

(15) Drill through all existing rivet holes in plexiglass with a modified #19 drill. See Figure 8-3 for drill modification.

CAUTION: DRILL THROUGH PLEXIGLASS ONLY WITH #19 DRILL. DO NOT DRILL THROUGH FIBERGLASS CABIN FRAME.

(16) Apply a small bead of Phenoseal 102 (or equivalent) on each side of windshield center seam and install center strip in position. Secure with rivets.

(17) Install and secure rivets in remaining holes.

(18) Remove mechanical fasteners (Clecos).

(19) Prepare windshield edges for paint. Repaint outer mount edge.

G. Overhead and Lower Window Removal (All F/FX)

(1) Drill out existing rivets.

(2) Remove plexiglass from double backing tape.

(3) Remove tape from cabin recessed area.

H. Overhead and Lower Window Installation (All F/FX)

NOTE: The overhead and lower window installations may be installed using either double backing foam tape or bonding sealant.

(1) Clean recess in cabin with acetone or equivalent.

(2) If using bonding sealant, proceed to step (3). Install double backing foam tape in position. Use 3M Brand tape #4016 (or equivalent), 3/4 inch wide x 1/16 inch thick

NOTE: Install tape with ends meeting at bottom side of window to prevent possible leakage through seam. Do not remove paper backing from outboard side of tape until window has been marked for cutting.

(3) Position new plexiglass window over recessed area of cabin and apply masking tape to temporarily hold window in place.

(4) Apply 1/4 inch wide masking tape following contour of window and recessed area of cabin to mark window size for cutting.

(5) Remove window and cut around the tape line using an oscillating saw or a die grinder with a 1/16 inch cut-off wheel. Leave approximately an extra inch on the outside of the perimeter.

CAUTION: SUPPORT THE TAIL OF THE ACRYLIC WHILE CUTTING TO PREVENT THE TAIL FROM BREAKING OFF AND CRACKING THE ACRYLIC.

(6) Place the window back over the opening and secure with tape. Mark the edge of the finished window perimeter with tape or a fine marker.

NOTE: Ensure approximately a 1/8 inch gap between the edge of the window and the edge of the cabin contour.

(7) Carefully cut the window to size, using the cut-off tools, bench belt sander, or sandpaper on a block. Sand and round the edges to a smooth finish.

NOTE: Check fit to cabin and re-sand as required.

(8) Clean outer edge of window with acetone.

(9) If using bonding sealant, proceed to step (10). If installing tape, remove paper backing from foam tape and install window in position. Press firmly against tape. Proceed to step (11).

(10) Apply bonding sealant PR1425B1/2 (or equivalent) to recess in cabin frame using a putty knife. Spread adhesive approximately 1/8 inch to 3/16 inch thick.

NOTE: Follow the exact mixing requirements of two-part adhesives or sealants.

CAUTION: ALLOW ADHESIVE TO DRY APPROXIMATELY 24 HOURS BEFORE INSTALLING RIVETS TO PREVENT CRACKING GLASS.

(11) Match drill to old rivet holes in cabin using a #30 drill or drill new holes through window and cabin at midpoints between old holes.

NOTE: Drill bits can be ground to a very sharp point to aid in drilling plexiglass. Use care in drilling to prevent cracking glass.

(12) Drill through all rivet holes in plexiglass with a modified #19 drill. See Figure 8-3 for drill modifications.

(13) Secure window in place with rivets.

(14) Prepare window edges for paint. Repaint outer mount edge.

8-4 CABIN DOORS

A. Door Removal (F-28F) (See Figure 8-4)

CAUTION: SUPPORT CABIN DOOR WHEN REMOVING THE HINGE PINS TO PREVENT DAMAGE TO THE DOORS.

CAUTION: TAKE CARE NOT TO DAMAGE THE WINDSHIELD DURING CABIN DOOR REMOVAL AND INSTALLATION.

NOTE: Removal procedures are the same for removing either cabin door.

NOTE: Cabin door installation may be configured with a bungee.

(1) Disconnect lower bungee (1) by removing screw (8) at the forward corner of the door frame.

(a) If equipped with a gas spring (9), remove safety clips (10) and pull gas spring off the ball joints (11) at both ends.

(2) Pull hinge pins (2) from upper and lower hinges (5) and carefully remove door.

B. Door Inspection (F-28F)

(1) Inspect cabin doors and hinges for condition, damage, and security.

(2) Inspect door latching assembly for condition, damage, and proper operation.

(3) Inspect window and pop-out vent for condition, damage, and security.

C. Door Repair (F-28F)

(1) Repair door I/A/W AC 43.13-1B. Contact Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

(2) Replace seal strips around door if deteriorated or damaged. Attach new seal using trim adhesive 8031 (3M) or equivalent.

(3) Replace components of door latching assembly that are unserviceable.

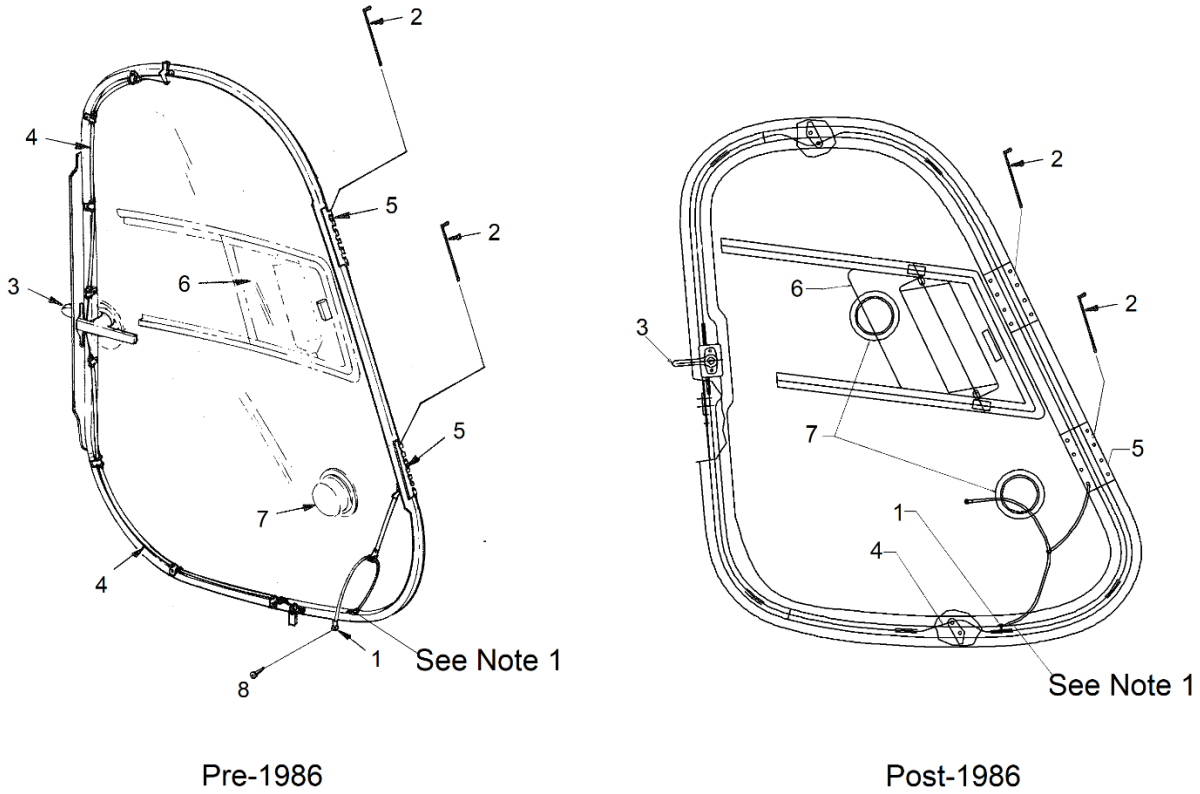
D. Door Installation (F-28F) (See Figure 8-4)

(1) Align door to hinges (5) and install hinge pins (2).

(2) Attach lower bungee (1), if equipped, with screw (8) at the forward corner of the door frame.

(3) Install gas spring (9), if equipped, by reversing the procedure in Para. 8-4, A, 1.

(4) Check operation of the door latch and upper and lower retaining lugs.



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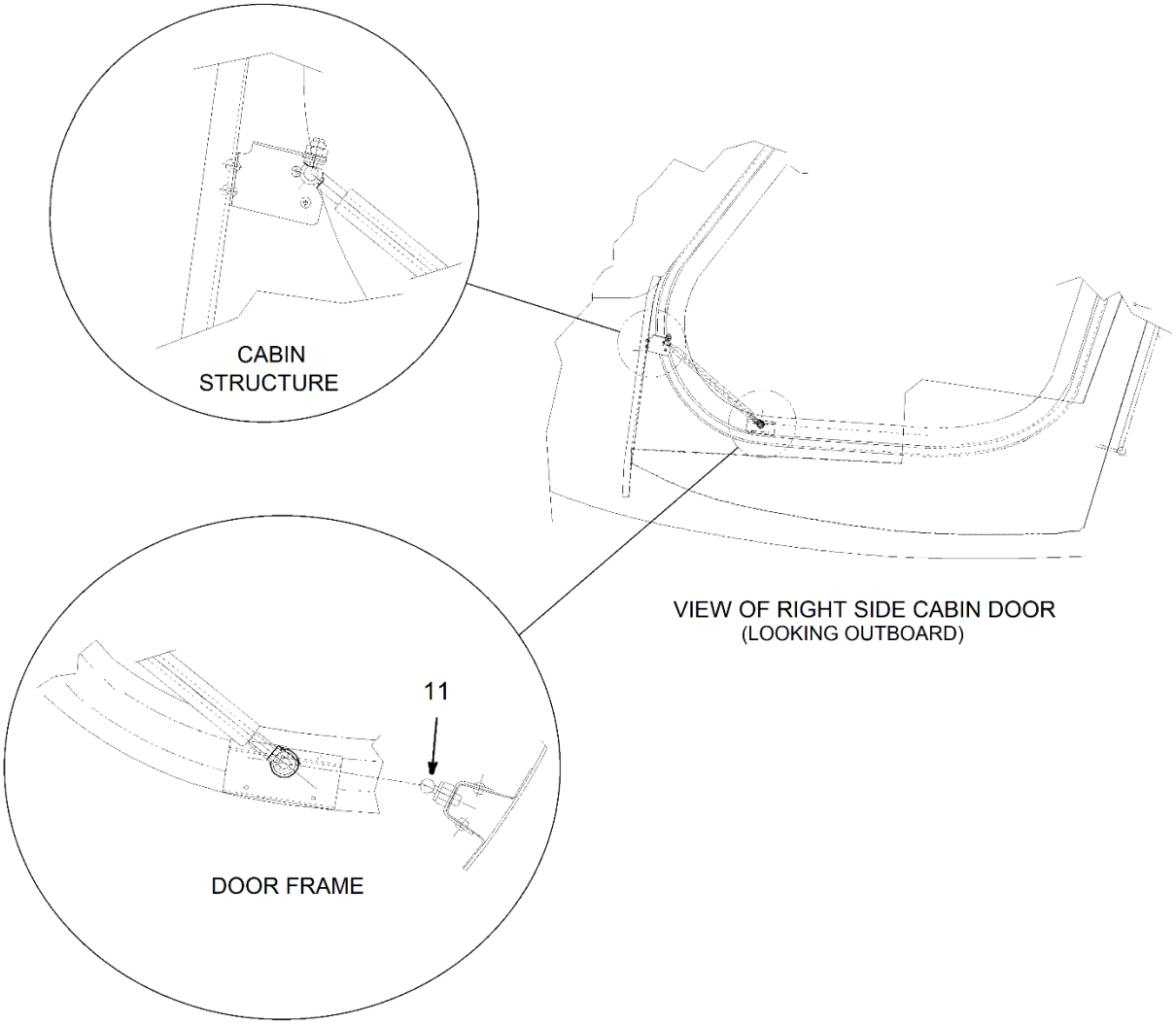
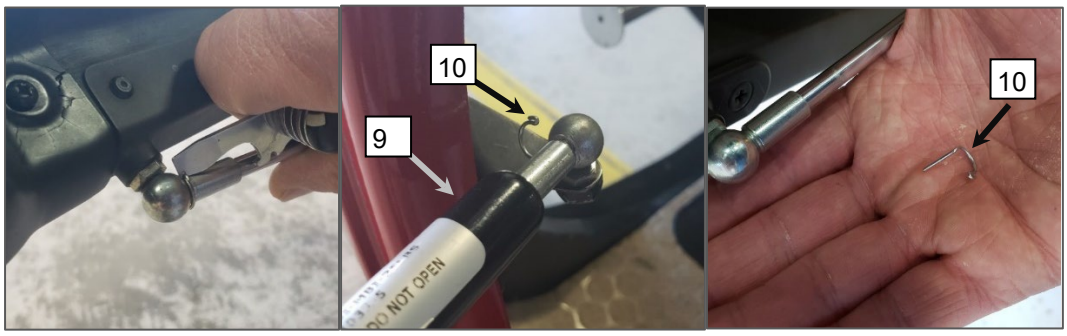
1. Bungee (See Note 1)
2. Hinge Pin
3. Door Handle
4. Cable
5. Hinge
6. Sliding Vent Window
7. Snap Vent
8. Screw

Note
1. Bungee and/or gas spring may be present. See Sheet 2 for gas spring attachment.

Figure 8-4. F-28F Cabin Door Installation





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9. Gas Spring
10. Safety Clip
11. Ball Joint

Figure 8-4. F-28F Cabin Door Installation

E. Door Glass Removal (F-28F) (See Figure 8-4)

NOTE: For installation of door glass on later F-28F model doors (S/N 744 and subsequent), refer to the Enstrom Helicopter Corporation website, 280FX Technical Tips for replacing the door glass. Otherwise, the door should be returned to Enstrom Helicopter Service for glass replacement.

(1) Disconnect cables and remove door handle (3).

NOTE: Remove the roll pin from the inboard door handle and separate and remove external door handle.

(2) Remove cables (4) and lower bungee (1) from door frame.

(3) Mark door hinges (5) as to their position on door frame and remove hinges.

NOTE: Hinges cannot be alternated for upper and lower positions.

(4) Remove sliding vent window (6) and snap vents (7).

(5) Remove foam strip from outer edge of door frame.

(6) Remove screws securing T-molding and remove molding.

(7) Remove screws from door glass. Heat bonded area of plexiglass with a portable heat gun and remove glass from door frame.

NOTE: Use care in glass removal to prevent distortion of tubular door frame.

(8) Remove excess bonding adhesive from door frame with a putty knife. Sand frame clean.

NOTE: When ordering a replacement door glass, be sure to specify if a sliding vent window and/or snap vents are required so they can be installed at the factory.

F. Door Glass Installation (F-28F) (See Figure 8-4)

NOTE: Check fit of door frame to cabin before locating glass on frame.

(1) Position new glass on door frame and match drill to screw holes using a #41 drill. Countersink holes using an 82° countersink.

NOTE: Replacement door glass has been rough cut to size. Final sanding of plexiglass to door frame is completed after bonding procedure is done.

(2) Remove door glass from frame and clean bonding surfaces of both items using acetone or equivalent.

(3) Apply bonding adhesive PR-1425 B-2 (or equivalent) to bonding surface of door frame. Spread adhesive approximately 1/8 inch to 3/16 inch thick.

(4) Carefully install door glass on door frame.

NOTE: Install enough screws in door glass and frame to hold glass in position. DO NOT tighten screws until bonding adhesive is set up (approximately 24 hours).

(5) Install screws to secure door glass to frame.

(6) Final fit plexiglass to door frame by sanding on belt sander.

(7) Install T-molding to door frame and secure with screws.

(8) Install foam strip on outer edge of door frame.

(9) Install and secure hinges (5) to their previously marked position on door frame.

(10) Prepare and repaint door frame.

(11) Install and secure door handles (3), cables (4), and latches.

(12) Install lower bungee (1) or gas spring (9) at forward corner of door frame, as applicable.

(13) Install door on aircraft with hinges (5) and check operation of door handle and latch.

G. Door Removal (280F Series) (S/N 2166 and Prior) (See Figure 8-5)

CAUTION: SUPPORT CABIN DOOR WHEN REMOVING THE HINGE PINS TO PREVENT DAMAGE TO THE DOORS.

CAUTION: TAKE CARE NOT TO DAMAGE THE WINDSHIELD DURING CABIN DOOR REMOVAL AND INSTALLATION.

NOTE: Removal procedures are the same for removing either cabin door.

NOTE: Cabin door installation may be configured with a retaining strap.

NOTE: Keep the upper door shims with the door as they are individually fitted.

(1) Remove screw from door strap (1) on the lower corner of the door.

(a) If equipped with a gas spring (5), remove safety clip (6) and pull gas spring off ball joint (7). (Refer to Figure 8-5.2.)

(2) Remove bolt (2) and spacer (3) from hinge pivot point at the top of the door.

(3) Carefully lift door from cabin frame.

G.1 Door Removal (S/N 2167 and Subsequent) (See Figure 8-5.1)

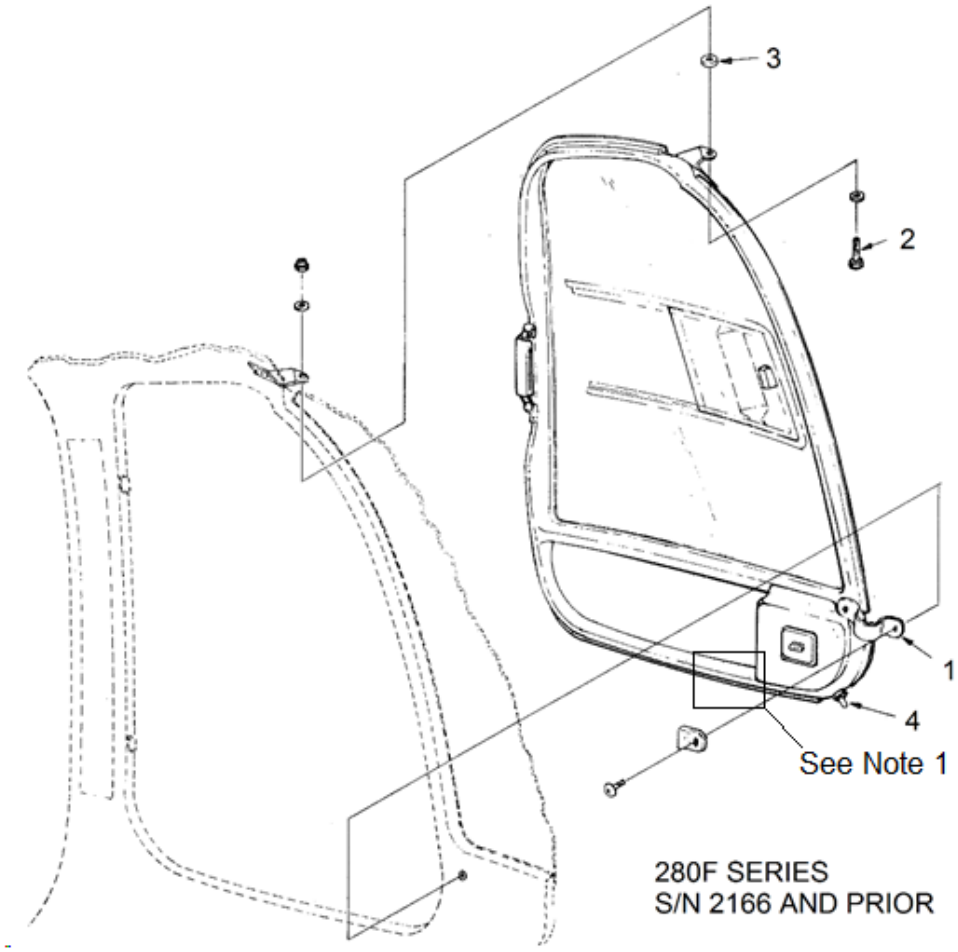
NOTE: Removal procedures are the same for removing either cabin door.

CAUTION: SUPPORT CABIN DOOR WHEN REMOVING CLEVIS PINS TO PREVENT DAMAGE TO THE DOORS.

(1) Open door and hold it in the open position.

(2) Remove safety pin (6) from gas spring (5) and pull gas spring (5) off ball joint (7). (Refer to Figure 8-5.2)

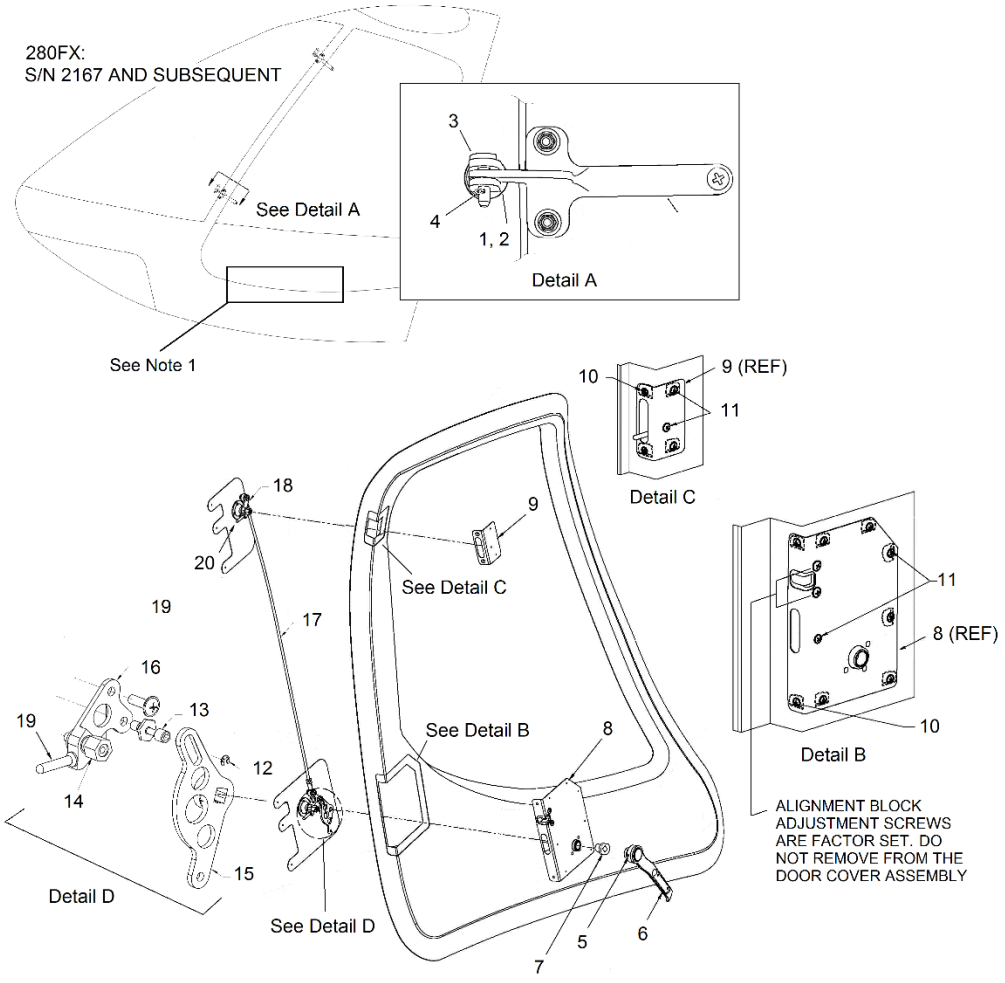
(3) Remove upper and lower door hinge quick disconnect pins or cotter pins (4) and clevis pins (3), as applicable, and remove door.



1. Door Strap
2. Bolt
3. Spacer
4. Pivot Peg

Note 1: See Figure 8-5.2 for gas spring attachment.

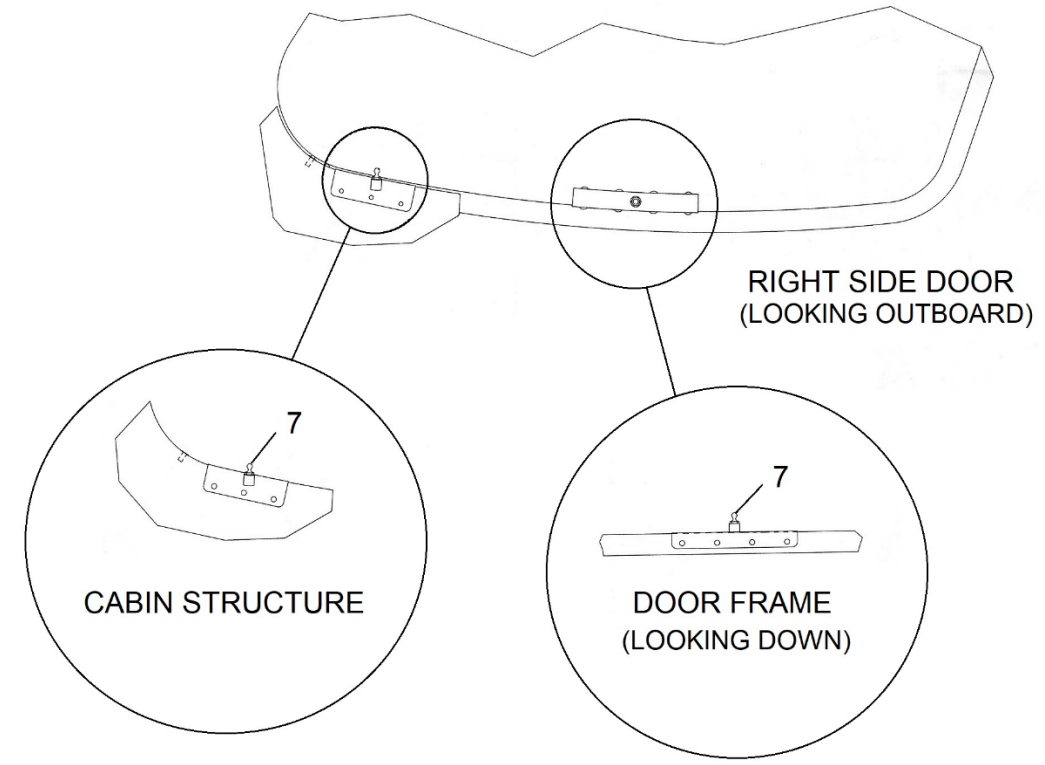
Figure 8-5. 280F Series Cabin Door

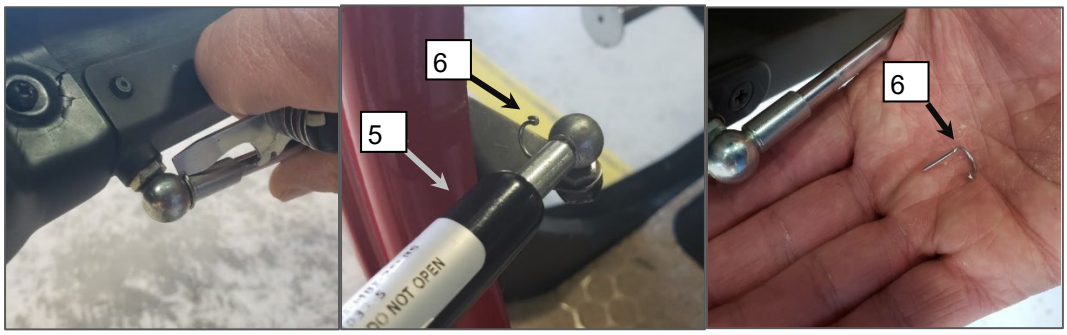


1.	Hinge Post	11.	Screw
2.	Hinge Bushing (hidden)	12.	Retaining Ring
3.	Clevis Pin	13.	Cam Roller
4.	Cotter Pin	14.	Shoulder Screw
5.	Set Screw	15.	Cam Lever Arm
6.	Door Handle (Interior)	16.	Lower Bellcrank Assembly
7.	Bushing	17.	Push-Pull Rod Weldment
8.	Lower Door Cover Assembly	18.	Upper Bellcrank Assembly
9.	Upper Door Cover	19.	Lower Dog Pin
10.	Screw	20.	Upper Dog Pin

Note 1: See Figure 8-5.2 for gas spring attachment.

Figure 8-5.1. 280FX Cabin Door





5. Gas Spring
6. Safety Clip
7. Ball Joint

Figure 8-5.2. Gas Spring Installation (280F Series)

G.2 Door Disassembly – Access to the Latch Mechanism (280FX S/N 2167 and Subsequent)

(1) Remove door (Para. G.1).

(2) Loosen set screw (5) to remove inside door handle (6).

(3) Pull off bushing (7).

(4) Remove screws (10) and (11) and remove lower door cover assembly (8). **DO NOT** remove the two alignment block adjustment screws.

(5) Remove screws (10) and (11) and remove upper door cover (9).

G.3 Door Assembly (280FX S/N 2167 and Subsequent)

(1) Install screws (10) and (11) to install the upper door cover. Ensure screw (11) engages the shoulder screw (14).

(2) Install screws (10) and (11) to install the lower door cover assembly. Ensure screw (11) engages the shoulder screw (14).

(3) Push on the bushing (7).

(4) Install the inside door handle (6) and tighten the set screw (5).

H. Door Inspection (280F Series)

(1) Inspect cabin doors, hinges, bronze bushings (Figure 8-5.1, Item 2), and pins for condition, damage, and security.

(2) Inspect door latching assembly for condition, damage, and proper operation.

(a) (S/N 2167 and subsequent): For faulty door operation, remove the door bellcrank covers (Para. G.2):

1 Inspect the door cam mechanism for missing retaining ring (12), condition of cam roller (13), and condition and security of cam lever arm (15), bellcranks (16) and (18), and push-pull rod (17) attachment fasteners.

(b) Inspect the two bellcrank assembly dog pins (19) and (20) for parallel condition.

1 If a parallel condition does not exist between the two dog pins (19) and (20), loosen the jam nut(s) on either end of the push-pull rod (17) and turn the rod to align the dog pins (19) and (20). Re-tighten the jam nut(s).

(3) Inspect window and pop-out vent for condition, damage, and security.

I. Door Repair (280F Series)

(1) Repair door I/A/W AC 43.13-1B. Contact Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

(2) Replace seal strips around door if deteriorated or damaged. Attach new seal using trim adhesive 8031 (3M) or equivalent.

(3) Replace components of the door latching assembly that are unserviceable.

J. Door Installation (280F Series) (S/N 2166 and Prior) (See Figure 8-5)

(1) Align bottom pivot peg (4) on lower corner of door with hole in cabin door frame and install door into position.

(2) Install spacer (3) and mount hardware in upper hinge. See Figure 8-5 for proper hardware installation.

(3) Secure door strap (1) on lower corner of door with screw or install gas spring, as applicable.

(4) Check door and door latch for proper operation.

J.1 Door Installation (S/N 2167 and Subsequent) (See Figure 8-5.1)

(1) Position door on hinges installed on cabin shell and install clevis pins (3) and cotter pins (4).

(2) Install gas spring (5) and safety clip (6).

(3) Check door and door latch for proper operation.

K. Door Glass Installation (280F Series)

NOTE: Refer to the Enstrom Helicopter Corporation website, 280FX Technical Tips for installing windows. Otherwise, the door should be returned to Enstrom Helicopter Service for glass replacement.

8-7 SEAT BELTS – SHOULDER AND LAP TYPE

A. Lap Belt Removal (Figure 8-6)

(1) Remove seat cushions.

(2) Disconnect attachment end of lap belts by applying pressure to the spring-loaded latch and opening it sufficiently to clear the structural attach point as it is lifted.

B. Shoulder Harness Removal (Figure 8-6)

(1) Remove fuel cells (Para. 13-10, B, (1)).

(2) Remove screws, washers, and nuts (4 places) that attach each shoulder harness to the cabin backwall.

B.1. Lap Belt Inspection

NOTE: Any time the seat deck has been removed, perform the following inspection.

(1) Inspect the orientation of the belt fitting and locking spring latch.

NOTE: The belt fitting should be installed with the clasp facing down and the spring latch closed (see Figure 8-6).

(2) Inspect the general condition of the lap belt and buckle.

(3) Inspect the retaining bolt for proper operation and wear.

NOTE: Replace any defective lap belt assembly fittings or attachments.

C. Lap Belt Installation

NOTE: a. Lap belts must be connected to the specified structural attach points to ensure belt security.

b. There are four structural attach points to accommodate two- and three-passenger configurations; (1) left rear cabin wall, (2) right of left center seat beam, (3) right of right center seat beam, and (4) right rear cabin wall.

c. Secure the lap belts to the airframe by applying downward pressure on the structural attach point with the latch portion of the belt attachment mechanism until it locks in place.

(1) Left seat position - install as follows:

(a) Attach seat belt half with release mechanism to left rear cabin wall structural attach point. See Figure 8-6, Point "A".

(b) Attach seat belt half with flat tab to structural attach point right of left center seat beam. See Figure 8-6, Point "B".

(2) Center seat position (if required) - attach as follows:

(a) Attach seat belt half with release mechanism to the structural attach point right of left center seat beam. See Figure 8-6, Point "B".

NOTE: Install on right side of left seat position belt.

(b) Attach seat belt half with flat tab to structural attach point right of right center seat beam. See Figure 8-6, Point "C".

(3) Right seat position - attach as follows:

(a) Attach seat belt half with release mechanism to the structural attach point right of right center seat beam. See Figure 8-6, Point "C".

NOTE: Install on right side of center seat position belt (if installed).

(b) Attach seat belt half with flat tab to right rear cabin wall structural attach point. See Figure 8-6, Point "D".

D. Shoulder Harness Installation

(1) Attach shoulder harness to cabin backwall with screws, washers, and nuts (4 places per attachment) (shown in Figure 8-6, Detail C, Detail D, and Detail E).

(2) Install fuel cells (Para. 13-10, B, (2)).

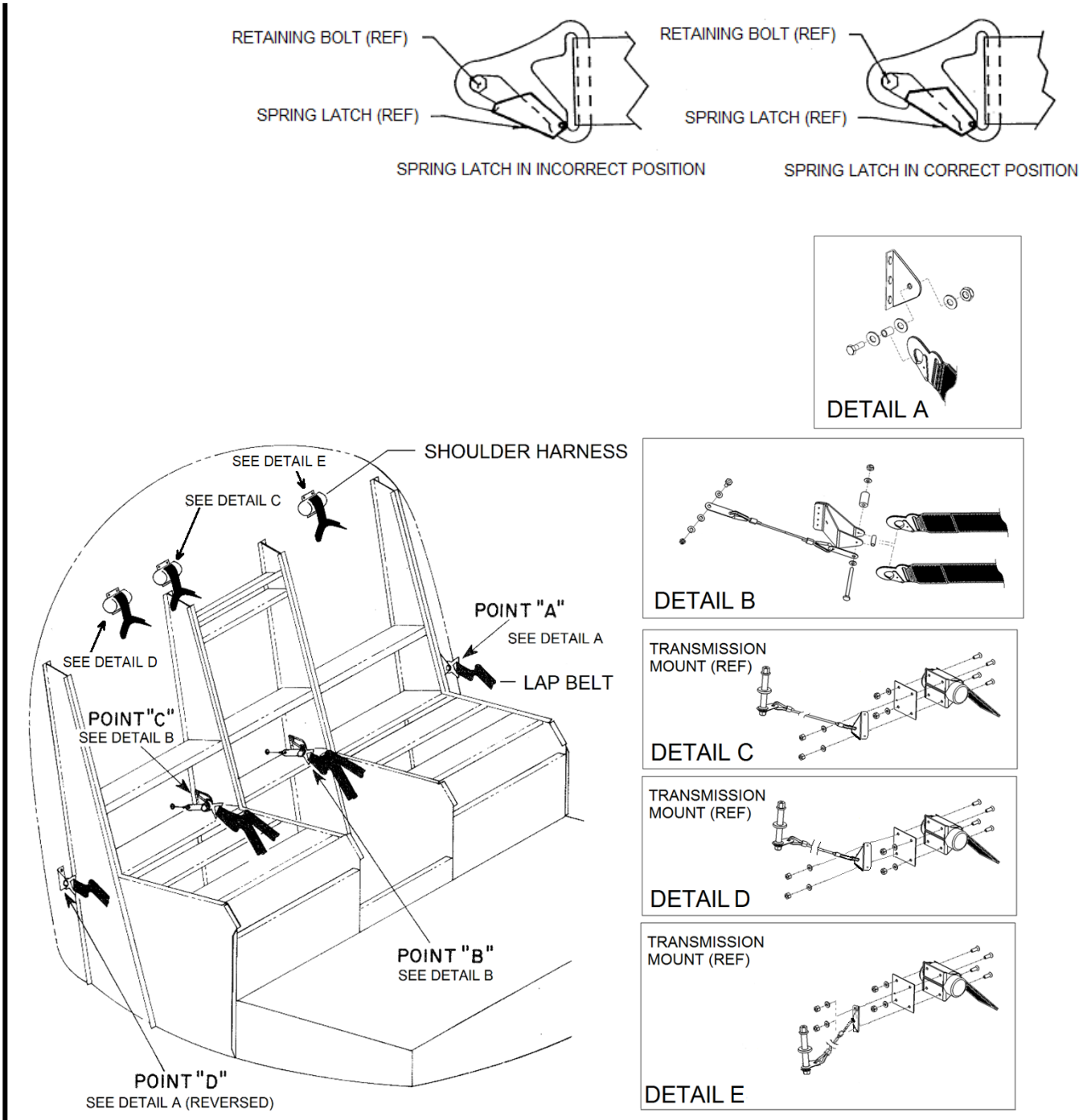


Figure 8-6. Seat Belt Attachment

8-8 SEAT DECK ASSEMBLY

A. Seat Deck Removal

(1) Remove seat cushions and seat belts.

(2) Disconnect cyclic stick canon plugs and remove cyclic boots.

(3) Remove the two aft screws that secure the fiberglass cover over the pilot's collective stick, loosen the forward screw, and rotate the cover out of the way.

(4) Remove screws securing fiberglass cover over collective push-pull rod at top of seat deck and remove cover.

(5) Remove handles from clutch engagement lever.

NOTE: Handles are screwed together.

(6) Release and remove retention pin and remove co-pilot's collective stick.

(7) Remove screws from the battery access (or ELT access, if equipped) cover, if installed.

(8) Remove screws securing fiberglass seat deck in place and carefully lift seat deck from seat structure.

B. Seat Structure Assembly Inspection

(1) Inspect structure for corrosion, cracks, deformation, evidence of working rivets, and damaged or loose/missing hardware.

(2) Inspect pylon attachments for corrosion, damage, proper security of and damage to the attachment hardware.

(3) Inspect cyclic bellcrank brackets (upper cabin mount) at the top backwall structure for corrosion, cracks, deformation, and security. (Refer also to SDB 0126.)

C. Seat Structure Repair

(1) Replace damaged or missing hardware.

(2) Repair damage to the structure I/A/W AC 43.13-1B. Contact Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

D. Seat Deck Installation

(1) Install fiberglass seat deck over clutch engagement lever and into position. Secure in place with attachment screws.

(2) Install co-pilot's collective stick into bellcrank.

(a) Insert the retention pin with lever aligned with the collective and fold the lever down.

NOTE: The pin lever is correctly installed when the cam locking feature is engaged. If the lever folds down with no resistance felt, insert the pin 180° the other way, and fold down. A resistance should be felt as the cam engages.

WARNING: The pin must engage the hole in the collective stick. After installing the pin, verify the security of the collective stick by trying to pull the collective stick out of the stick fitting.

1 To ensure the pin is fully engaged in the hole in the collective stick, try to pull the collective stick out of the stick fitting. If the collective stick does not pull out of the stick fitting, it is properly secured.

2 Twist the throttle full travel and verify the pilot's and copilot's throttles move together.

3 Move the collective full travel and move throttle full travel with the collective fully up and full down. Verify there is not binding or interference in the throttle or collective.

(3) Install handles in clutch engagement lever and screw together to secure.

(4) Install fiberglass cover over collective push-pull rod at top of seat deck and secure with screws.

(5) Install fiberglass cover over pilot's collective stick and secure with screws.

(6) Install battery (12V installation only) or ELT (if equipped) access panel and secure with screws, if installed.

(7) Install cyclic stick boots and secure the cyclic canon plugs into their receptacles.

(8) Install seat belts and seat cushions.

8-9 LANDING GEAR

A. Landing Gear Assembly

(1) Landing Gear Removal

(a) Install sling T-0011 on main rotor hub and hoist helicopter to remove weight from landing gear. See Figure 4-3.

(b) Remove left and right engine doors and bottom cowling.

(c) To remove the landing gear assembly as a unit from the pylon, proceed as follows: (See Figure 8-7)

1 Disconnect engine controls, EGT/EDM, heater control and quarter panels.

2 Remove top bolt from pylon mount clamps on cross tubes (4 places).

3 Lower and remove landing gear assembly.

(d) Remove individual landing gear items as follows: (See Figure 8-8)

NOTE: See Paragraphs 8-9, B, C, and D for removal or replacement of skid shoes, ground handling wheels, or oleo struts.

1 Skid tube (1): Remove six attachment bolts from landing gear legs (2). Remove skid tube assembly.

2 Landing gear leg (2): Remove oleo. Disconnect drag strut (3) from landing gear leg (2). Remove upper pivot bolt from clamp (8) on cross tube and remove the three lower bolts securing landing leg to skid tube. Remove landing gear leg.

3 Cross tube (6): Disconnect drag strut (3) and landing gear leg (2) from cross tube clamp (8). Remove cross tube assembly.

(2) Landing Gear Inspection

(a) Cross Tubes:

NOTE: Cross tubes with bows up to 0.5 inches/12.7 mm are serviceable and may be flipped over and reinstalled.

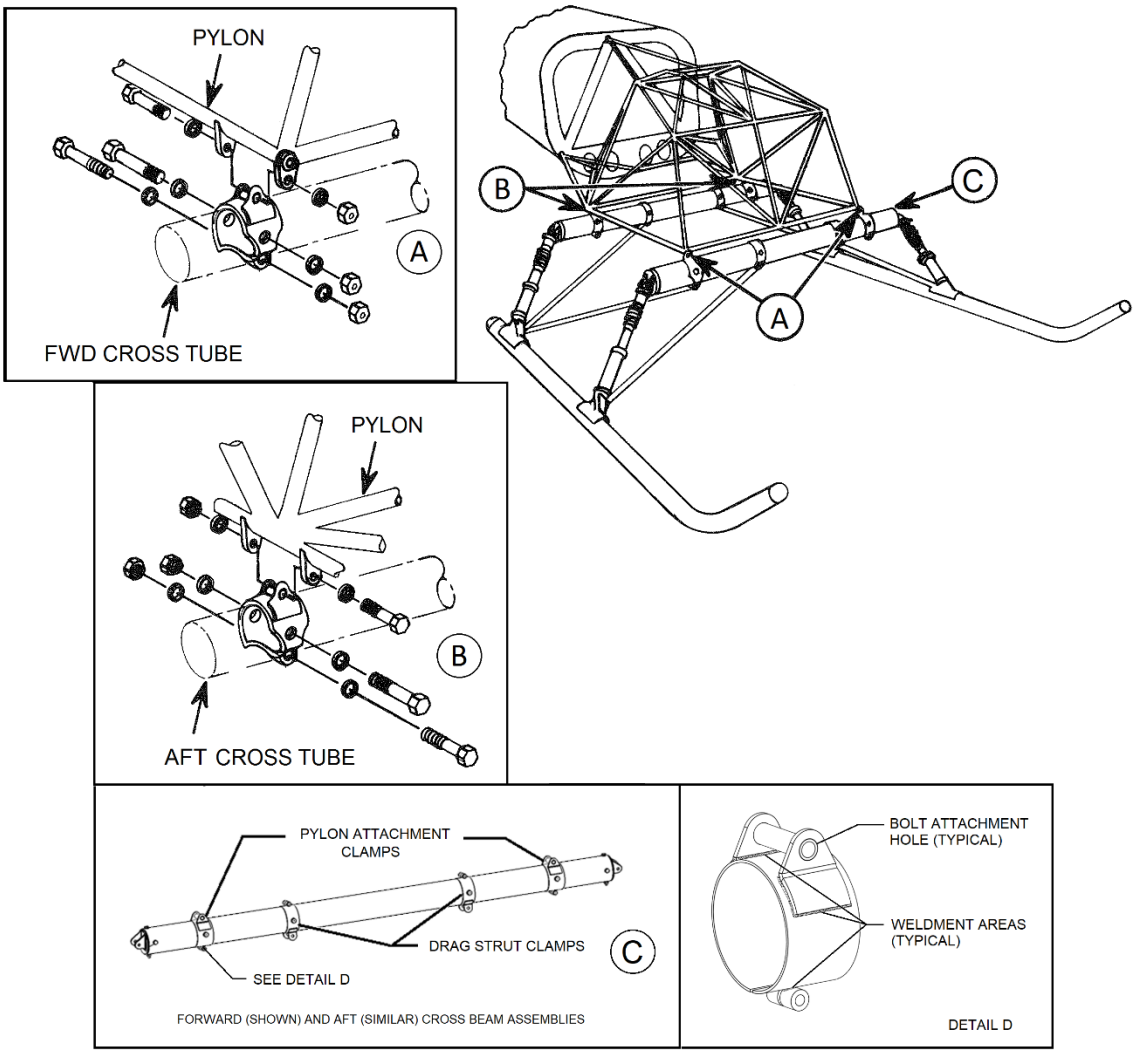


Figure 8-7. Landing Gear to Pylon Attachment and Cross Tube Clamp Detail

1 Cross tubes with bows up to 0.5 inches/12.7mm are serviceable. Replace cross tubes with a bow greater than 0.5 inches/12.7 mm, bends, cracks, or elongated bolt holes

2 Replace end caps that are cracked or the bolt holes are elongated.

(b) Landing Gear Legs and Drag Struts:

1 Landing gear legs and drag struts that are bent, bowed, or cracked may be repaired I/A/W AC 43.13-1B. Contact Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

a Visually inspect each landing gear leg in the area noted in Figure 8-7.1 for cracks. Utilize a tapping procedure in any area that may exhibit surface blisters or roughness.

2 Replace landing gear legs and drag struts with elongated bolt holes.

(c) Skid Tubes:

1 Skid tubes that are bent, bowed, dented, or have holes in them are repairable I/A/W AC 43.13-1B. Contact Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

2 Replace skid tubes with elongated bolt holes.

(d) Drag Strut and Pylon Attachment Clamps:

1 Visually inspect attachment clamps for elongated bolt holes, cracked weldments, corrosion, and security of hardware. Refer to Figure 8-8.1 for an example of weldment cracks.

a Replace clamps that exhibit cracks or cracked weldments, elongated bolt holes, and corrosion greater than .010 inch/0.25 mm deep. Corrosion equal to or less than .010 inch/0.25 mm deep may be blended and polished smooth.

b Secure loose attachment hardware (standard torque).

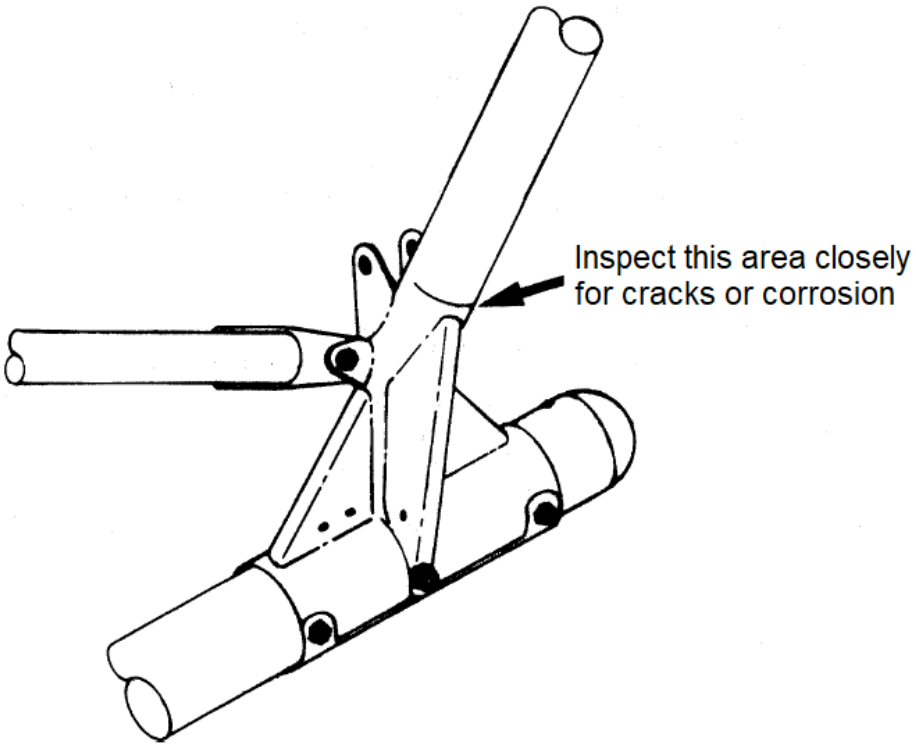


Figure 8-7.1. Landing Gear Leg Inspection

(3) Landing Gear Installation

(a) Install individual landing gear items as follows: (See Figure 8-8)

1 Skid tube (1): Install in reverse order of step (1), (d), 1.

2 Landing Leg (2): Install in reverse order of step (1), (d), 2.

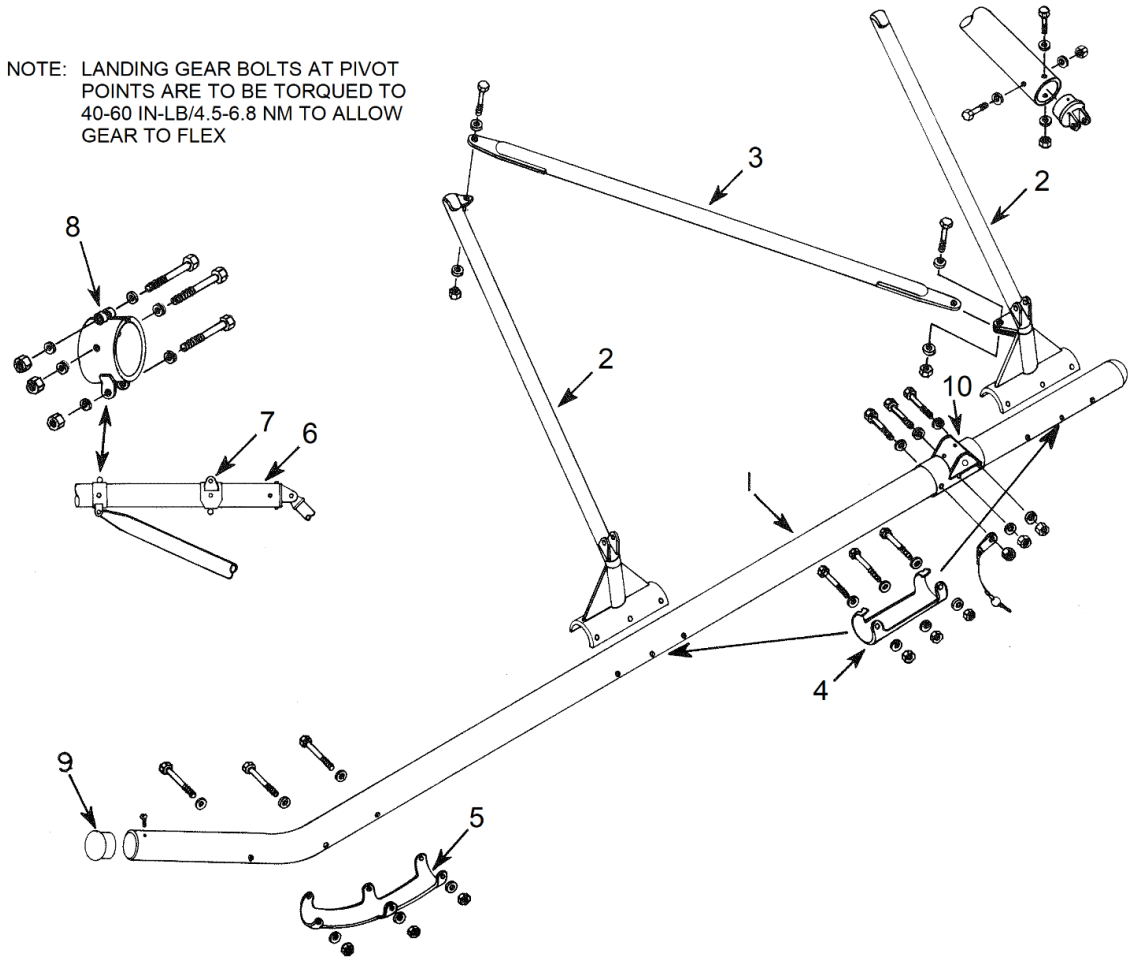
3 Cross tube (6): Install in reverse order of step (1), (d), 3.

a Strut (3) attachment torque: 60 in-lb/6.8 Nm.

b Landing gear leg attachment torque at pivot points: 40-60 in-lb/4.5-6.8 Nm.

c Refer to Para. 8-9, D, 5 for oleo installation.

(b) Install the landing gear assembly in reverse order of steps (1), (a) through (c). Refer to Figure 8-7 for proper bolt orientation.



1. Skid Tube
2. Landing Leg
3. Drag Strut
4. Wear Plate
5. Forward Wear Plate
6. Cross Tube Assembly
7. Skid Clamp
8. Clamp
9. End Cap
10. Bracket Wheel Assy

Figure 8-8. Landing Gear Assembly Breakdown

B. Skid Shoes

(1) Inspection

(a) Inspect the skid shoes for cracked or torn mounting straps and for excessive wear.

(2) Skid Shoes Replacement (See Figure 8-8)

(a) Skid shoes may be replaced by one of the following methods:

1 Jack up landing gear.

2 Install sling T-0011 on main rotor hub and hoist helicopter.

3 With ground handling wheels down, pull down on aft of tailcone.

4 Replace skid shoes (4) or (5) by removal and replacement of the attachment bolts (three forward, two aft) securing them to skid tubes.

C. Ground Handling Wheels

(1) Operational Description

Each landing gear skid tube has provisions for easily installed landing gear wheel assemblies. Each assembly has a manually operated over-centering device to lift the skids for installation of the wheels or retract them for flight. The ground handling wheels should be retracted and the helicopter allowed to rest on the skids when the engine run-up is being performed or when helicopter is parked. To raise or lower ground handling wheels, proceed as follows: (See Figure 8-9)

WARNING: APPROXIMATELY 135 LB OF FORCE IS EXERTED THROUGH THE WHEEL BAR WHEN RAISING OR LOWERING WHEELS. IT IS IMPORTANT THAT THE WHEEL BAR DOES NOT SLIP OFF THE END OF THE AXLE OR THE OPERATOR DOES NOT LOSE HIS GRIP ON THE HANDLE, PARTICULARLY WHEN REMOVING OR REPLACING THE LOCK PIN, OR POSSIBLE INJURY COULD RESULT.

(a) To lower the wheels, the slot in the end of wheel bar should be inserted on the axle with the handle facing forward. Then, keeping the handle aligned on the flats of the axle, apply a constant pressure to the handle and release the retaining pin. An upward and aft lifting motion is applied to the handle until the retaining pin holes line up for pin insertion. Insert pin and remove wheel bar. Keep feet from under skid tubes, stay outside of the skid, and do not straddle during procedure.

(b) To raise the wheels the same procedure is used with the exception that the wheel bar is installed with the handle facing aft, and the operator must restrain the wheel bar from rotating downward after the retaining pin is removed.

(2) Ground Handling Wheels Removal (See Figure 8-10)

(a) Place wheel assembly in retracted position.

(b) Rotate retaining pin ring up from the axle assembly. Remove snap ring (7) and washer (6) from outboard end of axle (4). Pull pin (5) and slide wheel and axle assembly from mount bracket.

(c) Remove nut (1) and washer (2) from axle and slide wheel assembly from axle.

(3) Ground Handling Wheels Installation (See Figure 8-10)

NOTE: Tires must be at least 6 ply. It is recommended that replacement tires are ordered directly from Enstrom.

(a) Install wheel assembly (3) on axle (4) and secure with washer (2) and nut (1).

(b) Inflate tire to 75 psi.

CAUTION: WHEEL ASSEMBLY MUST BE SECURED ON AXLE BEFORE INFLATING TIRE TO PREVENT POSSIBLE SEPARATION OF THE RIM.

(c) Apply Lubriplate 630-AA (MIL-PRF-81322) to axle and slide axle in mount bracket on skid tube with wheel in raised position.

(d) Install retaining pin (5) and secure with washer (6) and snap ring (7). Rotate retaining pin ring down and around the axle assembly to secure.

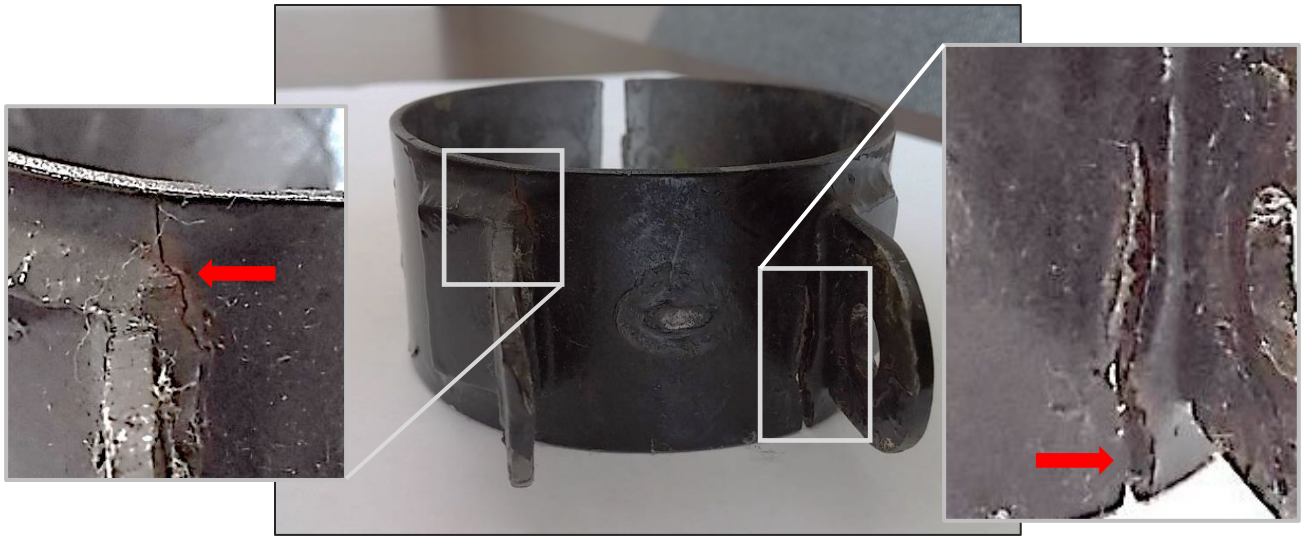
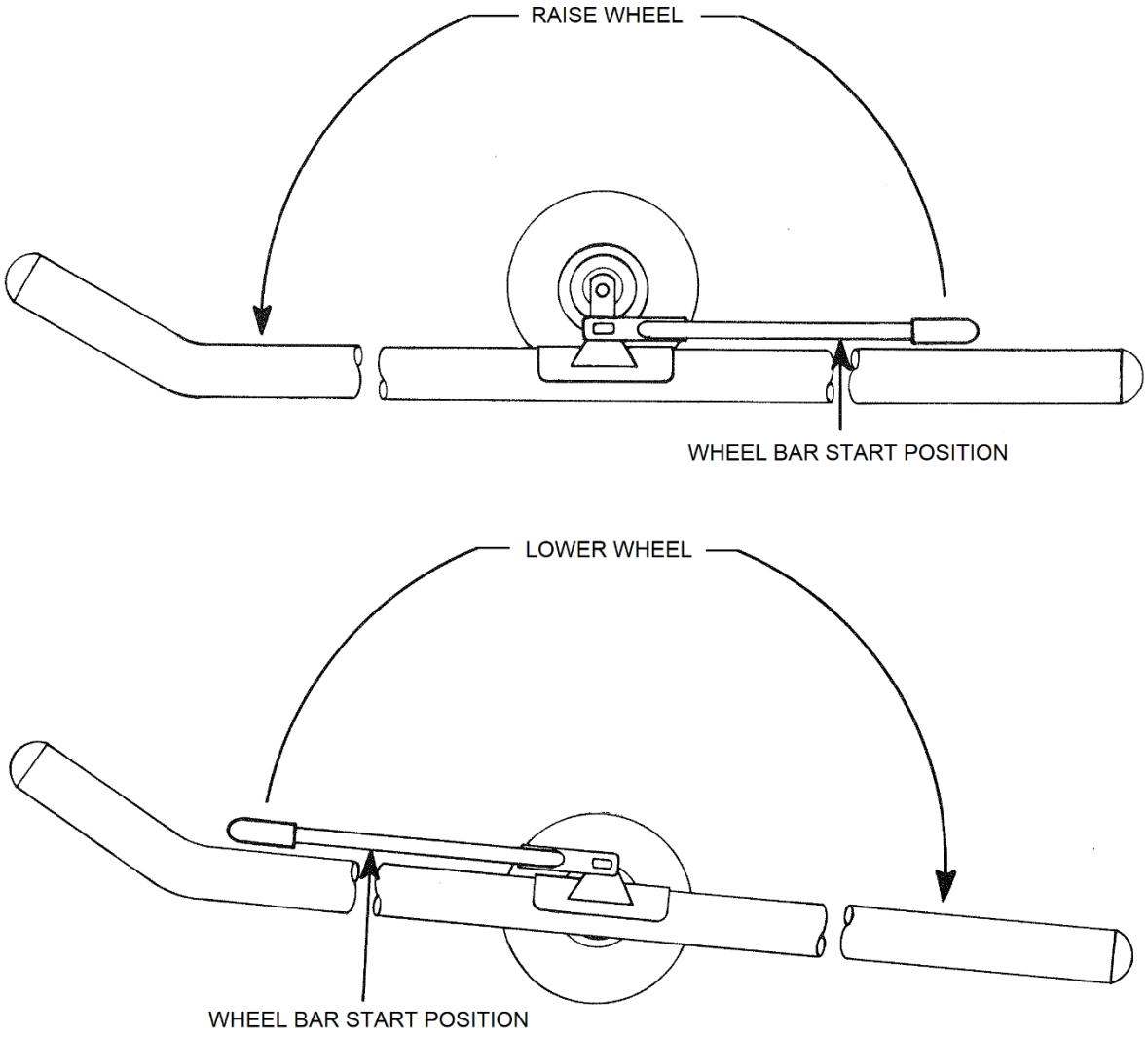
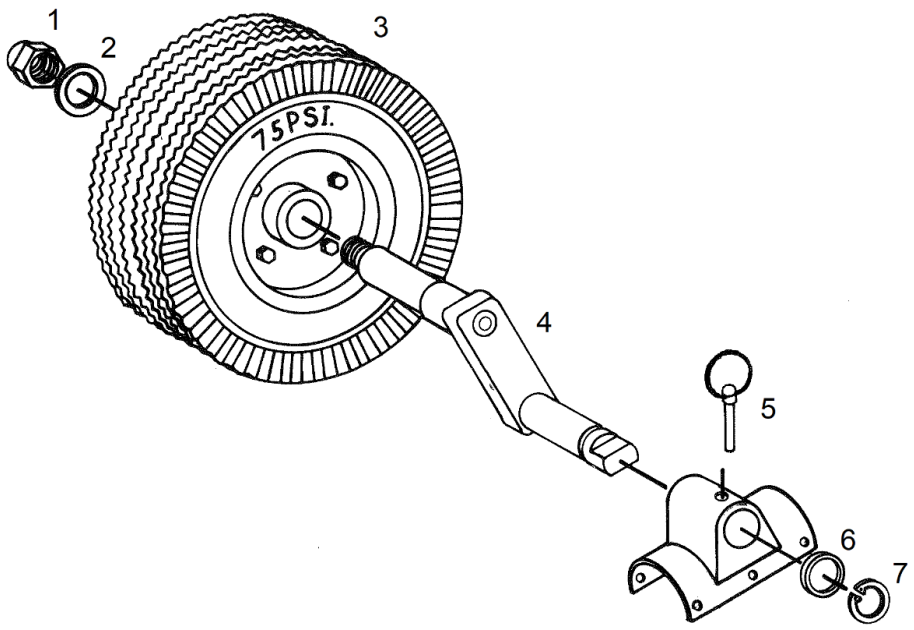


Figure 8-8.1 Cross Tube Weldment Clamp Cracks



WARNING - USE CAUTION WHEN RAISING OR LOWERING WHEELS WITH HANDLE, CARE SHOULD BE TAKEN TO KEEP HANDLE ALIGNED WITH AXLE AND FIRMLY HELD WHILE ENGAGED FOR ROTATION

Figure 8-9. Ground Handling Wheel Operation



CAUTION: WHEEL ASSEMBLY MUT BE SECURED ON AXLE BEFORE INFLATING TIRE TO PREVENT POSSIBLE SEPARATION OF RIM.

1. Nut
2. Washer
3. Wheel Assembly
4. Axle
5. Pin
6. Washer
7. Snap Ring

Figure 8-10. Ground Handling Wheel Removal and Installation

D. Oleo Struts

(1) Oleo Strut Removal (See Figure 8-11)

NOTE: The weight of the aircraft must be removed from oleo struts before strut removal can be accomplished. Install sling T-0011 on main rotor hub and hoist entire helicopter.

(a) Remove upper and lower attachment hardware from oleo strut at cross tube and landing gear leg.

(b) Remove oleo assembly.

(c) Remove bolts securing universal links (1) to oleo strut and remove links.

(2) Oleo Strut Disassembly (See Figure 8-12)

(a) Remove cap from valve (1) and slowly open valve to relieve pressure from oleo strut.

(b) Remove valve (1) and pour hydraulic fluid from oleo into a pan.

(c) Use a razor blade or knife to cut the paint line between the seal housing assembly (6) and the cylinder assembly (14) (Figure 8-12).

CAUTION: DO NOT CLAMP THE CYLINDER IN A VISE BY THE EARS AT THE BOTTOM OF THE CYLINDER. USE TOOL T-0169-1.

(d) Install tool T-0035 on the seal housing assembly (6) and T-0169-1 between the ears to unscrew the seal housing from the cylinder.

(e) Slowly pull piston assembly out of cylinder assembly.

(f) Lay piston shaft assembly with edge of piston (13) on a block of wood, and using a flat punch remove dowel pin (12).

CAUTION: USE CARE IN REMOVING DOWEL PIN TO PREVENT DAMAGE TO PISTON (13).

(f) Remove valve assembly (13) from piston shaft (2).

(g) Remove rebound rings (11) and spacer (10).

(h) Slide guide shaft assembly (6) and boot (3) from piston shaft.

(i) Disassemble guide shaft assembly (6) as follows:

1 Remove O-ring (7) from O.D. of threaded area.

2 Remove O-ring (9) and back-up ring (8) from I.D. of guide shaft assembly.

3 Remove wiper (4) from brass guide (5).

4 If brass guide is worn or damaged, it can be removed by tapping out with a nylon drift.

(j) Disassemble valve assembly (13), if required, as follows: (Figure 8-12, View B)

NOTE: Do not disassemble this unit unless damage or wear has occurred to valve (19).

1 Remove nuts (15) and washers (16).

2 Remove valve pistons (17) and valve springs (18) from shaft (20).

3 Carefully press shafts (20) from piston (19).

(3) Oleo Strut Inspection

(a) Inspect the oleos for damage, leakage, proper extension, and freedom of movement.

(b) When the strut is disassembled inspect in accordance with Table 8-1.

(4) Oleo Strut Assembly (See Figure 8-12)

(a) Assemble piston assembly (13), if required, as follows: (See Figure 8-12, View B)

1 Carefully press shafts (20) into the piston (19).

CAUTION: IF EXCESSIVE PRESSURE IS USED TO PRESS SHAFTS INTO THE PISTON, DAMAGE TO THE VALVE AREA OF THE PISTON CAN RESULT.

2 Install valve pistons (17) and springs (18) on the shafts.

3 Install washers (16) and nuts (15).

4 Adjust the valve and spring length to 1.60 inch ± .010 inch. Measurement is taken from the inner base of the piston (19) to the outboard edge of the valve piston (17). See Figure 8-12, Valve Setting Dimension.

(b) Assemble the guide shaft assembly (6) as follows:

1 Press brass guide (5) into position if previously removed

2 Install wiper (4) into the brass guide (5).

3 Install O-ring (7) on the O.D. of the guide shaft (threaded end).

4 Install back-up ring (8), then O-ring (9) into the groove in the I.D. of the guide shaft (threaded end).

CAUTION: THE CONVEX SIDE OF THE BACK-UP RING (8) MUST FACE TOWARD THE O-RING (9).

(c) Install oleo boot (3) on the piston shaft (2), if required.

(d) Lubricate both ends of the guide shaft assembly in a pan of hydraulic fluid (MIL-PRF-5606) to provide lubrication for assembly and install the assembly on the piston shaft (2).

(e) Install spacer (10) on the piston shaft (2).

CAUTION: THE FLANGED END OF SPACER FACES TOWARD THREADS OF GUIDE SHAFT ASSEMBLY (6).

(f) Install rebound rings (11) - (5 each) on the piston shaft (2).

CAUTION: NOTCHES IN THE REBOUND RINGS MUST BE STAGGERED.

(g) Align the flow passage port on the inner edge of the piston assembly (13) to the flow passage hole in the piston shaft (2) and install the piston assembly.

(h) Secure valve to the piston shaft with dowel pin (12).

CAUTION: THE ENDS OF THE DOWEL PIN MUST BE SEATED BELOW THE O.D. SURFACE OF THE PISTON TO PREVENT POSSIBLE BINDING ON INSTALLATION IN THE CYLINDER ASSEMBLY.

(i) Slide the guide shaft assembly (6) and the rebound rings (11) up against the piston (13). Keep the rebound rings staggered.

(j) Clamp the cylinder assembly (14) in a vise using tool T-0169-1 in an upright position. Fill the cylinder to the base of the threads with hydraulic fluid (MIL-PRF-5606).

CAUTION: DO NOT CLAMP THE CYLINDER IN THE VISE BY THE EARS AT THE BOTTOM OF THE CYLINDER. USE TOOL T-0169-1.

CAUTION: NOTCHES IN THE REBOUND RINGS MUST BE STAGGERED.

NOTE: The piston must be inserted into the cylinder assembly slowly to allow the hydraulic fluid to work through the staggered notches of the rebound rings and the flow passage in the piston assembly.

(k) Install the piston and guide shaft assembly into the cylinder assembly. Slowly push the piston to the base of cylinder assembly (collapsed position).

NOTE: The guide shaft assembly will be torqued in a later step.

(l) Hand-tighten the guide shaft assembly (6) to the cylinder assembly (14). Make an index mark from the guide shaft assembly to the cylinder assembly.

(m) Install and secure oleo valve (1). Safety wire (MS20995C32) valve to mount flange of piston shaft.

(n) Loosen the air valve.

(o) Attach one end of a clear plastic hose to the oleo valve and the other end in a container of MIL-PRF-5606.

(p) Open the air valve. Slowly pump the strut in and out until the hose is free of air bubbles when compressing the oleo assembly.

(q) Fully collapse the strut, tighten the air valve, and remove the hose.

(r) Torque the guide assembly using T-0169-1. Using the index mark, torque the guide assembly to the cylinder assembly by turning the index mark on the cylinder assembly approximately 1/4 inch past the index mark on the guide assembly.

NOTE: The oleo may be pressurized before or after installation in the helicopter. (If the oleo is not installed, pressurize to 200 psi (1,379 kPa) and check for leaks.)

(s) Connect the nitrogen pressure line to the oleo valve. Set the nitrogen pressure regulator to 400 psi (2,758 kPa). Remove the oleo from the vise and remove tools T-0035 and T-0169-1.

WARNING: THE PISTON SHAFT WILL EXTEND WHEN THE OLEO VALVE IS OPENED.

(t) Slowly open the oleo valve and allow the oleo to fill until the piston shaft is fully extended and the oleo pressure has equalized to the regulator pressure. Close the oleo valve.

(u) Close the nitrogen tank valve, set the regulator pressure back to zero, and disconnect the nitrogen pressure line from the oleo valve.

(v) Install the valve cap.

(w) Inspect the oleo for leaks.

(5) Oleo Strut – Installation (see Figure 8-11)

NOTE: Helicopter must be jacked or hoisted with a sling for oleo strut installation.

(a) Lubricate the attach bolt hardware with LPS 2, ACF 50, or MIL-PRF-81322 grease and install while wet.

(b) Place a light washer (2) on each side of universal link (1) and install between mount ears on oleo strut (2 places). Secure in place using bolt (5), light washers (3) and nut (4) (Figure 8-11). Note there is no washer under the head of the top inboard attachment bolt (P/N 28-17135-11).

(c) Place a light washer (2) on each side of universal link (1) and install the oleo assembly between mount ears on cross tube. Secure in place using bolt (5), heavy washers (3) and nut (4). Torque as follows:

NOTE: Install oleo struts with valves facing aft. See the following exception: Agriculture and float ships require rear oleo valves to face forward.

1 Connect a spring scale to the bottom hole in the bottom universal link and torque the top attachment hardware until it requires 2 lb force to swing the oleo strut assembly in and out and fore and aft.

2 Use a beam type in/lb torque wrench to record the torque on the nut that is installed on the bolt facing aft.

3 Place a light washer on each side of the universal link and connect the bottom universal block to the landing gear leg.

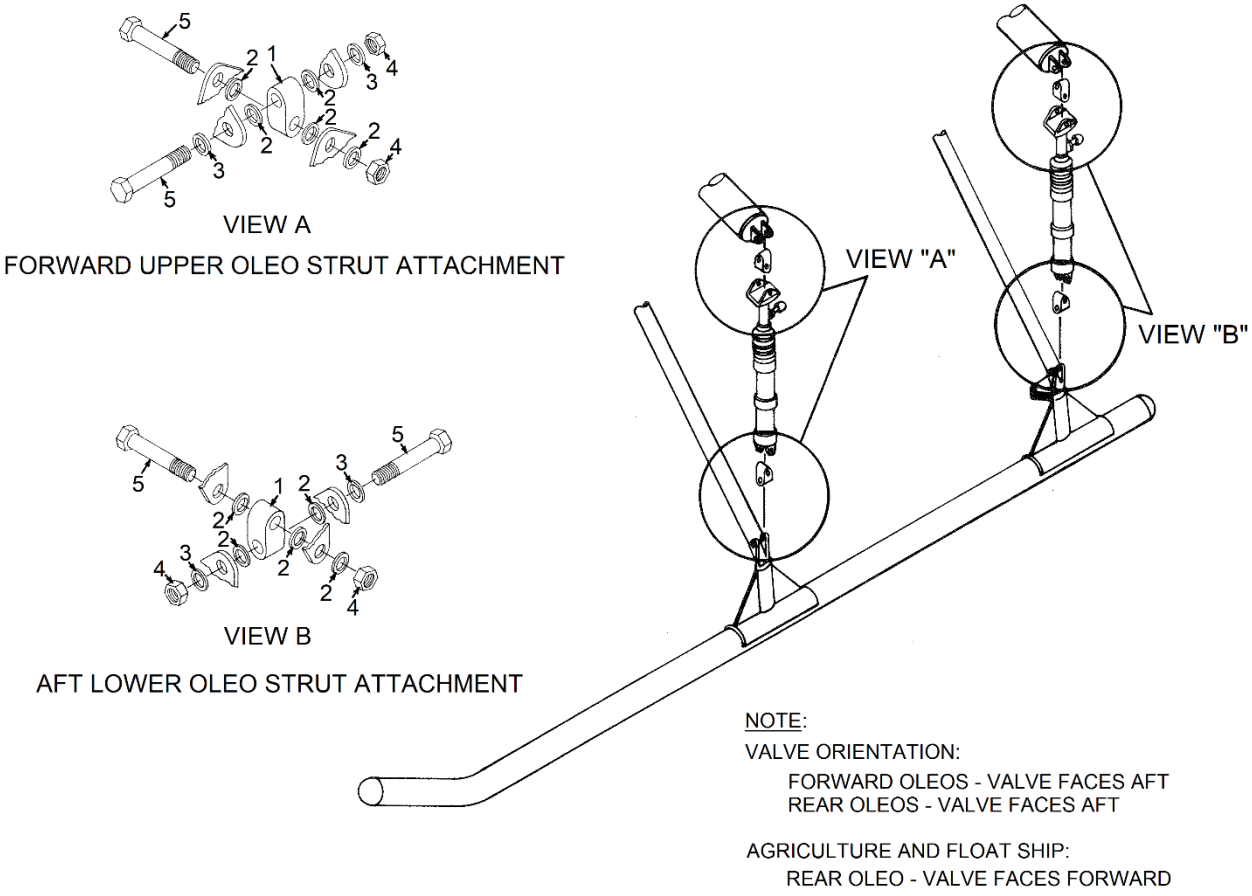
4 Remove the hardware connecting the top of the oleo to the cross tube. Set the hardware aside in the same position and order for reinstallation.

5 Connect the spring scale to the top hole in the top universal link and torque the attachment hardware at the bottom universal block connections with a required 2 lb drag as in step 1 above.

6 Reinstall the top universal link to the cross tube. Ensure the hardware is installed in the position and order as previously installed.

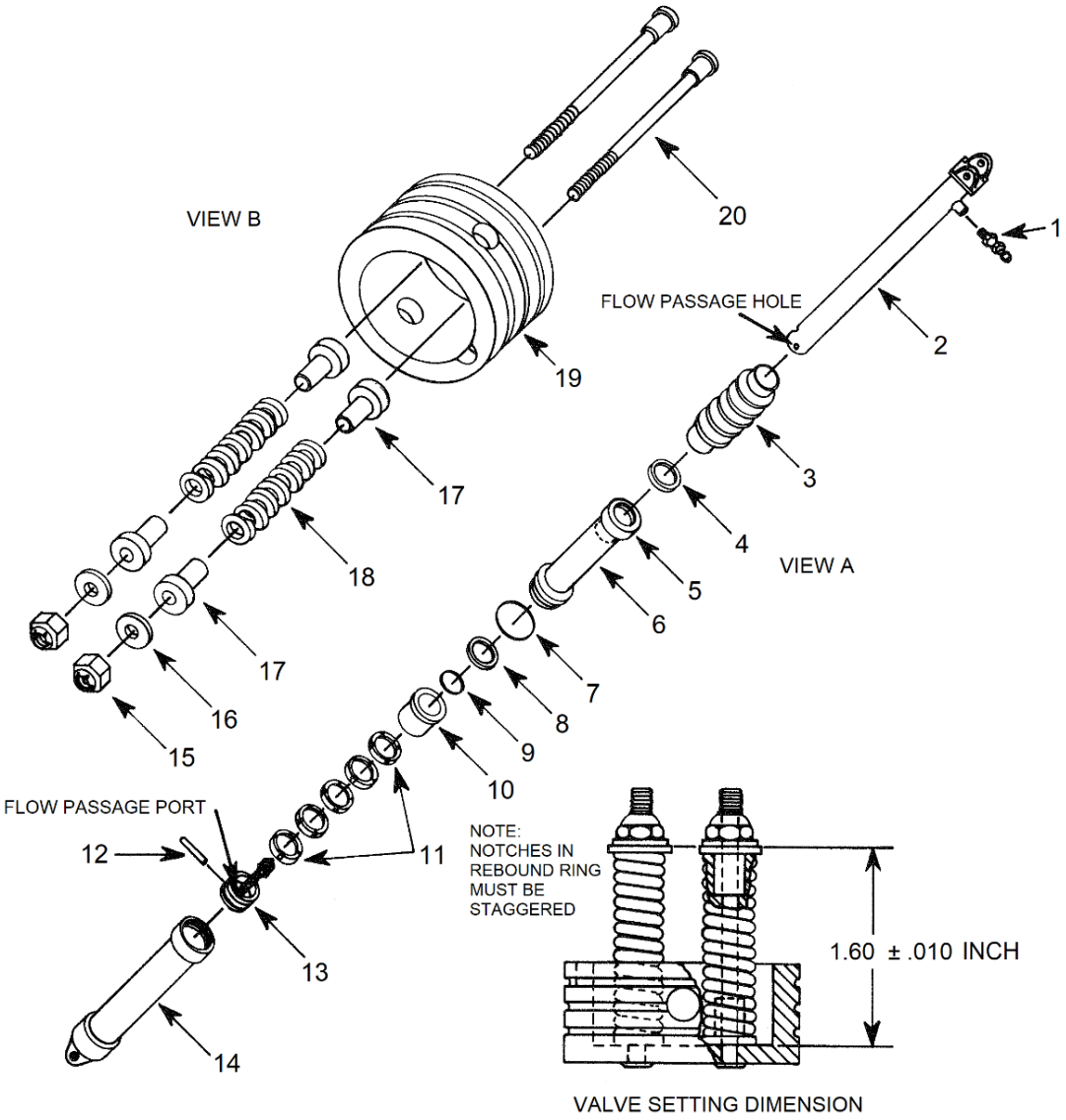
7 Tighten the nut to the torque setting recorded in step 2.

(6) Service the oleos in accordance with Paragraph 4-20.



1. Universal Links
2. Light Washer
3. Light Washer
4. Nut
5. Bolt

Figure 8-11. Oleo Strut Installation



1. Valve
2. Piston Shaft
3. Boot
4. Wiper
5. Brass Guide
6. Shaft Assembly
7. O-ring
8. Back-up Ring
9. O-ring
10. Spacer
11. Rebound Rings
12. Dowel Pin
13. Valve Assembly
14. Cylinder Assembly
15. Nut
16. Washer
17. Valve Piston
18. Valve Spring
19. Piston
20. Shaft

Figure 8-12. Oleo Strut Assembly

Table 8-1. Oleo Strut – Inspection

Part No.	Figure & Item No.	Part Name	Inspect	Serviceable Limits	Repair Limits	Repair or Action
AN6287-1 MS28889-2	Fig 8-12 Item 1	Valve	Check valve O-rings for cracks or tears	None allowed	Not repairable	Replace O-rings
28-17146-1 28-17146-7	Fig 8-12 Item 2	Piston Shaft	Shaft dia. 1.2495 to 1.2515	-.0005	-.0001	Return to factory for re-chrome and grind
			Check for nicks	None allowed	Not repairable	Replace piston shaft
			Dowel pin hole dia. .2490 to .2495	+.0005	Not repairable	Replace piston shaft
			Threaded boss – no crossed or missing threads	None allowed	Not repairable	Replace piston shaft
28-17158-1	Fig 8-12 Item 3	Oleo Boot	Check for cracks or tears	None allowed	Not repairable	Replace boot
28-17144-1 28-17144-5	Fig 8-12 Item 6	Guide Shaft Assembly	Threads – no crossed or missing threads	None allowed	Not repairable	Replace guide shaft
			Brass guide bore dia. 1.406 to 1.408	+.002	Not repairable	Replace brass guide (Part Number 28-17153)

Table 8-1. Oleo Strut – Inspection

Part No.	Figure & Item No.	Part Name	Inspect	Serviceable Limits	Repair Limits	Repair or Action
28-17149-1	Fig. 8-12 Item 10	Spacer	Check for nicks and scratches	None allowed	.010 deep	Polish and blend
28-17151-1	Fig. 8-12 Item 11	Rebound Rings	Check for cracks or tears	None allowed	Not repairable	Replace rings
28-17147-3	Fig. 8-12 Item 12	Dowel Pin	O.D. dia. -.2505 to .2495	-.0002	Not repairable	Replace pin
28-17140-1	Fig. 8-12 Item 14	Cylinder Assembly	Bore dia. -1.7655 to 1.7645	+.001	Not repairable	Replace cylinder
			Threads – no crossed or missing threads	None allowed	Not repairable	Replace cylinder
			Mount holes in ears .312 diameter	+.001	Not repairable	Replace cylinder
28-17145-1	Fig. 8-12 Item 19	Piston	O.D. dia. -1.763 to 1.762	-.001	Not repairable	Replace piston
			Pin hole .2495 to .2490	+.002	Not repairable	Replace piston
			Check for scratches in O.D.	None allowed	.002 deep	Polish to remove with very fine sandpaper or emery cloth

NOTE: All O-rings should be replaced when rebuilding oleo strut assembly.

* All dimensions are in inches.

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E. Landing Gear Fairings (280FX)

280FX models are equipped with landing gear fairings on the oleo struts and landing gear legs (Figure 8-12.1). These fairings are made of aluminum and fiberglass and are clamped onto the landing gear assembly. To check for proper strut extension, the helicopter should be sitting on level ground. The struts should then be leveled by rocking the helicopter by pushing up and down slightly on the tail cone. For the checking method, see Paragraph 4-20; for proper inflation, see Paragraph 4-20, A.

NOTE: For a float installation, the complete fairing assemblies must be removed. Prior to mount clamp removal, their position should be marked for ease of reinstallation.

(1) Removal – Access to Service Oleo Strut

(a) Remove 3 screws (9) from upper flex boot (6) lower end.

(b) Lift flex boot (6) upward to expose oleo valve for required servicing see Paragraph 4-20 Item 1.

(2) Removal – Access for Oleo Strut Removal

(a) Proceed with paragraph 1, steps (a) and (b).

(b) Remove 2 screws (10) front and back, top and bottom of oleo fairing (2).

(c) Slip rubber boot (4) at bottom of fairing (2) downward to clear attaching screws.

(d) Remove screws (5) from trailing edge of fairing (2).

(e) Spread fairing (2) carefully to clear oleo and remove from forward side.

(f) Remove 4 screws (7) and bolt (8) from lower fairing (1) or (3).

(g) To remove forward fairing (1) carefully spread to clear gear and oleo remove from forward side.

(h) To remove aft lower fairing (3) carefully spread to clear gear and oleo and slip forward on drag strut.

(i) Remove oleo as described in Paragraph 8-9, D.

(3) Inspection

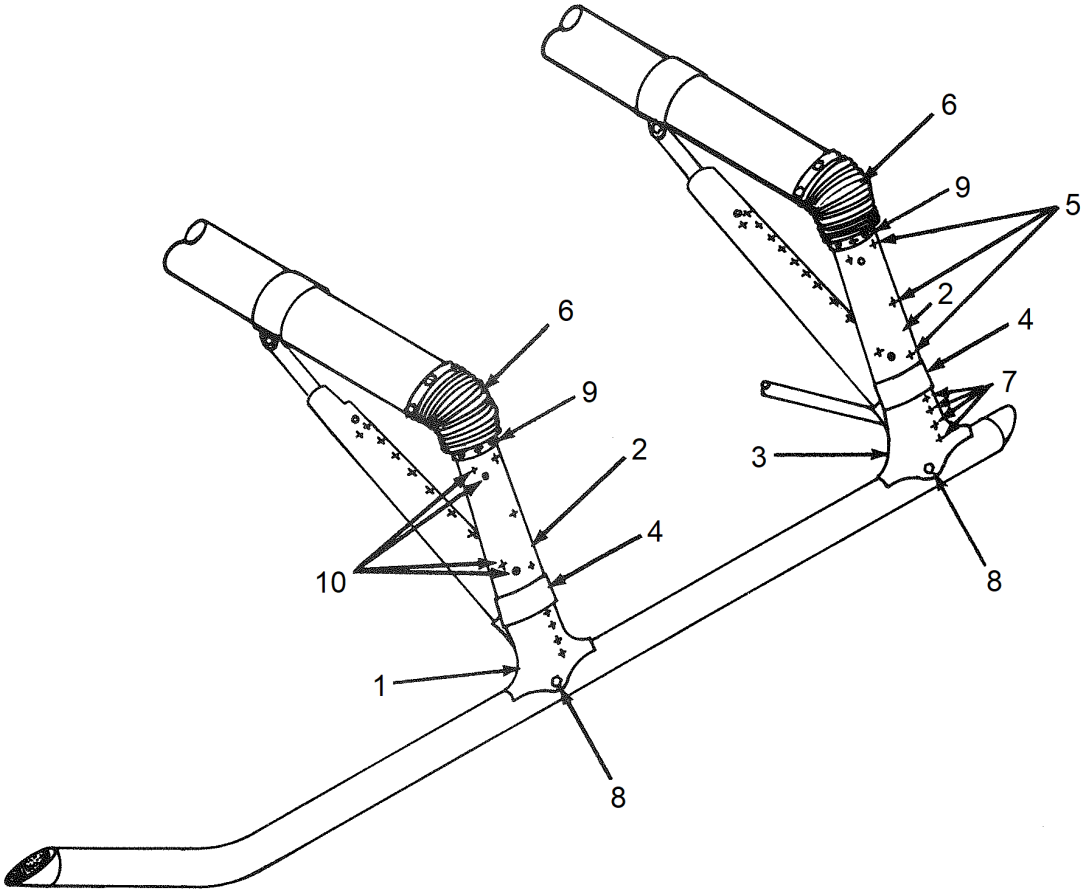
(a) Check for cracked or damaged components and replace as required.

(b) Check for missing nut plates and screws replace as required.

(4) Assembly – After Oleo Replacement

(a) Reverse procedures in step (2) and step (1).

(b) Check for proper security.



+ DESIGNATES INBOARD SCREWS

1. Forward Lower Fairing
2. Oleo Fairing
3. Aft Lower Fairing
4. Rubber Boot
5. Screw Attachment (Inboard)
6. Upper Flex Boot
7. Screw Attachment (Inboard)
8. Bolt Attachment
9. Screw Attachment
10. Screw Attachment (2 Inboard, 2 Outboard)

Figure 8-12.1. Landing Gear Fairings (280FX)

8-10 PYLON

A. Pylon Removal and Installation

The pylon assembly supports all major structural and drive train components of the helicopter. The removal and installation of the pylon is accomplished by completing the removal and installation procedures for the following items:

(1)	Cabin Assembly	See Paragraph 8-1
(2)	Tailcone Assembly	See Paragraph 8-12
(3)	Main Rotor Transmission	See Paragraph 11-6
(4)	Powerplant	See Paragraph 13-2
(5)	Landing Gear	See Paragraph 8-9

B. Pylon Inspection

Inspection is limited to a field survey of the pylon condition. Visually inspect all members of the pylon for the following:

(1) Cracks and dents
(2) Integrity of finish
(3) Evidence of corrosion
(4) Security of welded joints
(5) Scuffing and abrasion

C. Pylon Repair

Damage to the pylon section tubes can be repaired in accordance with FAR 43. Special care must be taken during such repairs as not to distort the structure. Remove minor surface corrosion and paint the area using MIL-PRF-23377 primer or equivalent. Repair limit ≤ 10% wall thickness (e.g., .0035 inch for a .035 inch thick wall).

8-11 BAGGAGE COMPARTMENT

A. Baggage Compartment Removal (See Figure 8-13)

(1) Remove baggage compartment door as follows: (See Figure 8-13, View A)

(a) Remove panel (1) from kick-in steps.

(b) Release fastener screws (2) on upper cowling.

(c) Remove the two screws (3), washers, and nuts from upper hinge pin post at top right corner of baggage compartment.

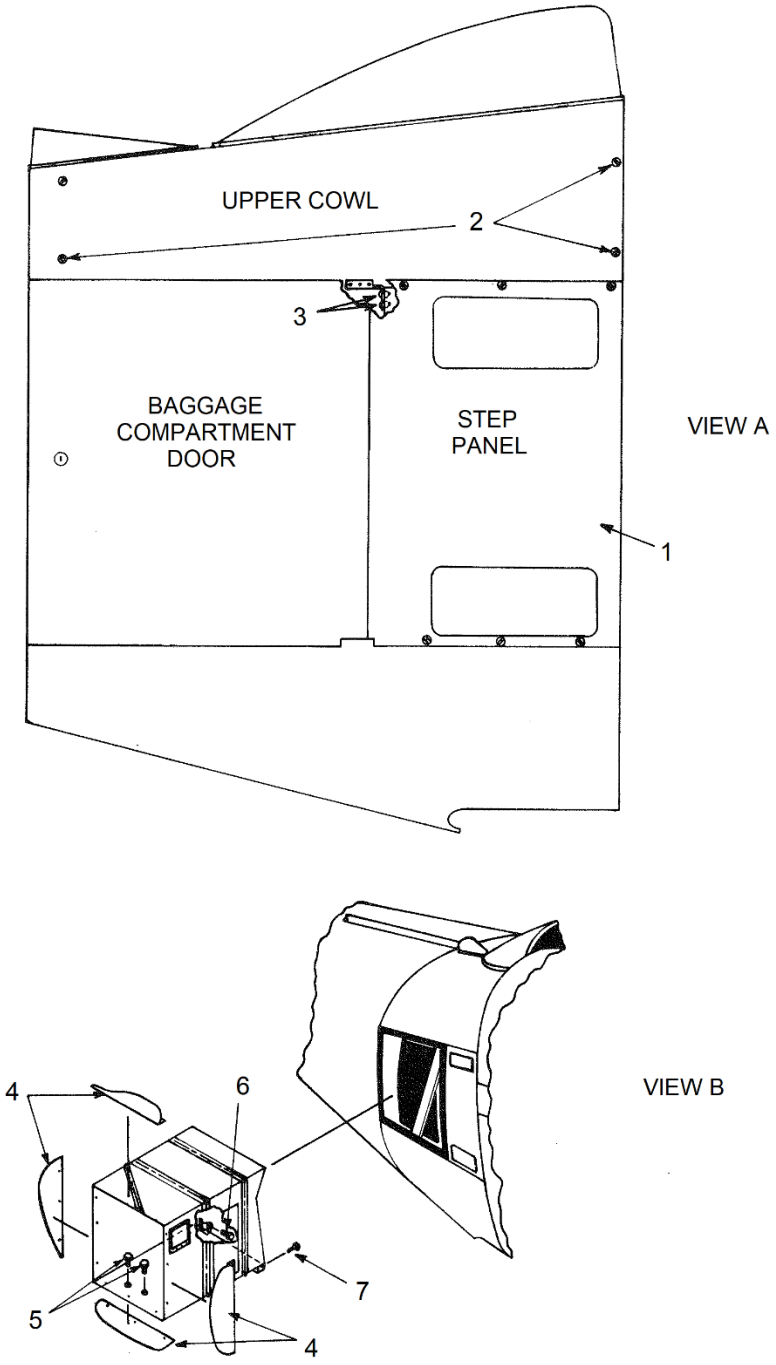
CAUTION: SUPPORT THE DOOR WHILE ATTACHMENT HARDWARE IS REMOVED.

(d) Turn key latch and open door.

(e) Lift upper cowling to slide it from pivot pins on door and remove door assembly.

(2) Remove upper and side cowling.

(3) Remove sheet metal flanges (4) from the right side, outboard edges of the baggage compartment.



1. Panel
2. Screw
3. Screw
4. Flange
5. Screw
6. Bolt
7. Bolt

Figure 8-13. Baggage Compartment Installation

(4) Remove the two attachment screws (5) securing baggage compartment to pylon.

(5) Remove attachment bolt (6) from lower left aft corner of baggage compartment.

(6) Remove bolt (7) from mount strap on lower left forward corner of baggage compartment.

(7) Carefully slide baggage compartment out of pylon structure.

B. Baggage Compartment Inspection

(1) Inspect the baggage compartment shelf and bulkheads for obvious damage, loose inserts, and the condition and security of the hardware.

(2) Inspect the mounting brackets for damage and security.

C. Baggage Compartment Repair

(1) Replace damaged or missing hardware.

(2) Repair damage to the baggage compartment shelf, bulkheads, or the mounting brackets I/A/W AC 43.13-1B. Contact Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

D. Baggage Compartment Installation (See Figure 8-13)

(1) Slide baggage compartment into pylon structure.

(2) Install bolt (6) in lower left aft corner of baggage compartment. Torque bolt and safety (MS20995C32).

(3) Install bolt (7) through mount strap and baggage compartment at lower left forward corner. Torque bolt.

(4) Install screws (5) securing front of baggage compartment to pylon.

(5) Install the sheet metal flanges (4) to front edges of baggage compartment and secure with screws.

(6) Install upper and side cowling.

NOTE: Do not secure the fasteners (2) on right side of upper cowling until baggage compartment door has been installed.

7 Lift upper cowling slightly and install baggage compartment door into position. Secure fastener screws (2) in upper cowling.

8 Install kick-in steps panel (1).

9 Close baggage compartment door and check key latch operation.

8-12 TAILCONE ASSEMBLY

A. Tailcone Removal (See Figure 8-14)

(1) Remove wrap-around cowling.

(2) Disconnect flex coupling at forward end of tail rotor drive shaft. See Paragraph 10-6.

(3) Remove tach drive cover and O-rings.

(4) Disconnect static line from bulkhead fitting (1) on lower right side of tailcone.

(5) Disconnect strobe wires (2) at forward end of tailcone.

(6) Remove quick disconnect at antenna and rotating beacon, if so equipped.

(7) Remove inspection panel for access and remove cotter keys from pulleys. For older aircraft, disconnect the tail rotor cables (3) at control brackets on tail rotor transmission. Attach a string to each individual cable and pull cables through fair leads to forward portion of tail cone assembly.

NOTE: Disconnect strings from cables and allow them to remain routed through tailcone to facilitate installation upon assembly of tailcone assembly to pylon.

(8) Place two supporting fixtures (4) under fuselage of tailcone to support it during removal. Remove the three attachment bolts (5) and washers (6) securing tailcone to pylon and remove tailcone.

NOTE: If any shims are found they must be used at same points with new tailcone. If the tailcone was replaced, the tailcone alignment must be checked and shimmed accordingly.

NOTE: Use care in removal procedure to prevent possible damage to tail rotor assembly and/or transmission.

B. Tailcone Inspection

(1) Inspect the tailcone for buckling, corrosion, cracks, dents, and working rivets.

C. Tailcone Repair

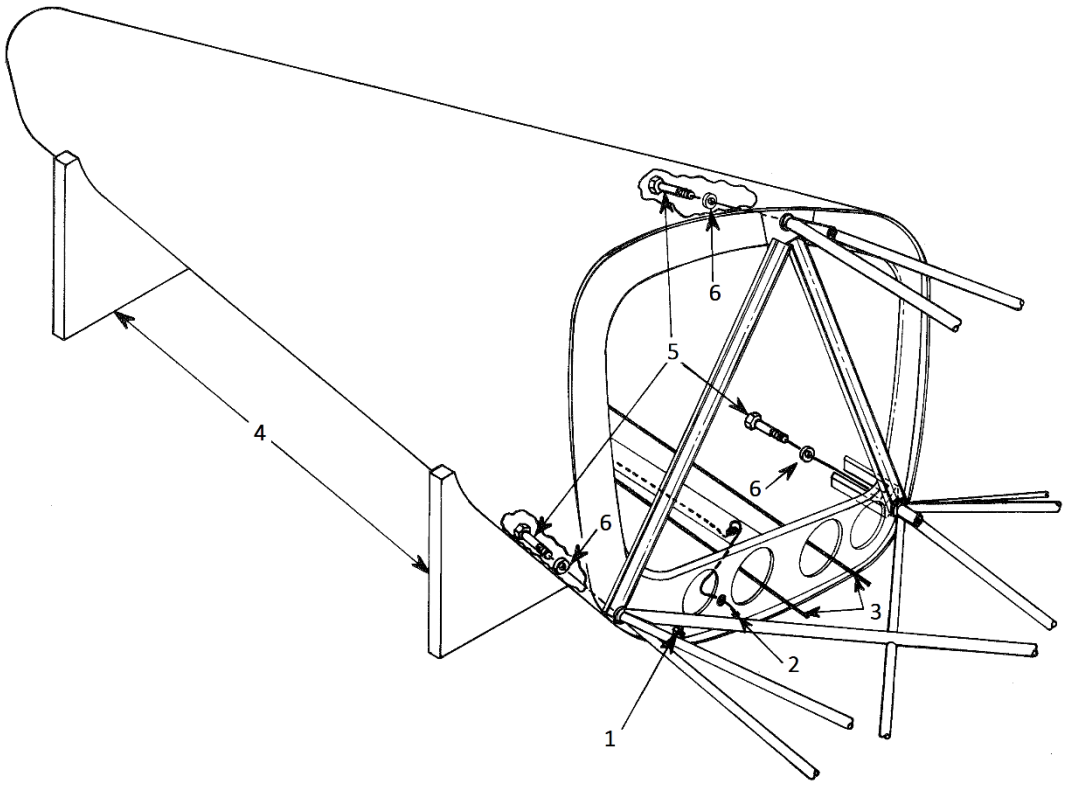
(1) Repair damage to the tailcone I/A/W AC 43.13-1B. Contact Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

D. Tailcone Installation (See Figure 8-14)

NOTE: Realignment is required for a new tailcone installation. Refer to the Technical Tips Work Aid Document (WAD) link at Tailcone Alignment Work Aid.

(1) Align tailcone to pylon mount and install bolts (5), washers (6), and shims if used (3 places). Torque bolts to 240 in-lb and safety (MS20995C25).

CAUTION: DO NOT INSTALL THE NAS146DH-24 BOLT INTO EITHER OF THE BOTTOM TAILCONE ATTACHMENT HOLES. DAMAGE WILL RESULT.



NOTE: There are two different sizes of bolts for mounting the tailcone to the pylon: 2 NAS146DH-22 bolts for the bottom, and 1 NAS146DH-24 bolt for the top. Each bolt gets 1 MS20002C6 washer with the chamfer towards the bolt head.

1. Bulkhead Fitting
2. Strobe Wire
3. Tail Rotor Cable
4. Support Fixture
5. Bolt
6. Washer

Figure 8-14. Tailcone Installation

NOTE: Tailcone installation requires a person at the aft end to support the tailcone and two people on the forward end to lift and align the tailcone to the pylon.

(2) Connect previously routed strings to tail rotor cables (3) and pull cables back through fair leads to aft end of tailcone. Connect cables to tail rotor control brackets on transmission.

NOTE: Check cable tension and adjust if required. See Paragraph 10-7, Tail Rotor Cables.

(3) Install quick disconnects at antenna and rotating beacon if so equipped.

(4) Connect strobe wires (2) at forward end of tailcone.

(5) Connect static line to bulkhead fitting (1) on forward end of tailcone.

(6) Install O-rings on tach drive assembly and install tach drive cover.

(7) Connect flex coupling at forward end of tail rotor drive shaft. See Paragraph 10-6.

(8) Inspect all wires, cables, and attachment points for security.

(9) Install wrap-around cowling.

NOTE: If any area of the tail rotor assembly, tail rotor drive shaft, or tail rotor transmission was worked on, see Section 10 for correct installation procedures.

8-12.1 TUBULAR TAIL ROTOR GUARD (F-28F, 280FX)

A. Tail Rotor Guard Removal (See Figure 8-12.2)

(1) Remove bolt (13) and associated hardware (14 and 15), remove clamp (12).

(2) Remove bolts (16) and (23) with associated hardware (17 and 18).

(3) Remove the tail rotor guard assembly (11).

B. Tail Rotor Guard Inspection

(1) Inspect tail rotor guard for cracks or other damage.

(2) Inspect end fittings for loose or sheared rivets.

(3) Inspect end fittings for elongated holes or other damage.

(4) Check retention bolts for excessive wear and or thread damage.

(5) Inspect security of chafe pads (24 and 25) for tail guard protection.

NOTE: Some isolated cases of water have been found inside of the tail rotor guard assembly, if this condition is present, a 1/8 inch diameter hole may be drilled in the lowest point of tube for drainage.

C. Tail Rotor Guard Installation

(1) Position tail rotor guard in forward upper fitting and install bolt (23) and hardware.

(2) Install clamp (12) and bolt (13) with associated hardware.

(3) Position aft tail rotor guard fitting into tail rotor gear box and install bolt (16) with required hardware, torque all three bolts (13), (16) and (23).

8-12.2 TAIL ROTOR DRIVESHAFT COVER (280FX)

The tail rotor driveshaft cover consists of four pieces of formed aluminum which are attached to the tailcone. This cover helps protect the driveshaft and the bearings from the weather, and also helps streamline the tailcone. The aftmost section of the cover is held in place with two screws and two quarter-turn fasteners. The three forward sections are held in place by hinges on the right side and quarter-turn fasteners on the left side. This provides easy, fast removal of the driveshaft cover for inspection and servicing the driveshaft and bearings. (See Figure 8-14.1.)

A. Cover – Opening for access to the tail rotor drive shaft

(1) Unfasten the ¼ turn fasteners (1) thru (4).

(2) Lift section (7) up from left side and over.

(3) Repeat same procedure for section (8) and (9).

NOTE: This will allow the required access to lubricate the tail drive bearing pillow blocks; the aft two pillow blocks are accessible without removing section (10).

(4) Removal of the aft section (10) for complete tail rotor drive shaft exposure can be accomplished by unfastening item (5) both sides and by removing screw (6) both sides.

NOTE: With covers in the condition noted in (1) through (4) allows for complete tail rotor drive removal, if required.

B. Inspection – Cover assembly only

(1) Check for cracks and missing or damaged fasteners, repair and or replace as required.

C. Cover – Closing

(1) Reverse procedures as noted items (4) through (1), paragraph A.

(2) Check final security after closing.

8-13 EXTENSION TUBE

A. Extension Tube Removal (See Figure 8-15)

(1) Disconnect the tail rotor cables and remove the tail rotor assembly and gearbox. See Paragraph 10-5, Tail Rotor Gearbox Removal

NOTE: The tail rotor assembly and gearbox can be removed as a unit.

(2) Remove the tail rotor guard (1) to provide clearance for extension tube removal.

NOTE: The tail rotor guard on the 280F series helicopter can remain attached as it does not obstruct extension tube removal.

(3) Remove the left horizontal stabilizer to provide access to the inspection plate. See Paragraphs 8-14 through 8-16, Stabilizer Removal, as applicable.

NOTE: The stabilizer on the F-28F, post 1986, and 280F series helicopter is mounted forward of the inspection panel and does not require removal.

(4) Remove the attachment bolts from aft pillow block (2).

(5) Remove the inspection panel (3).

(6) Remove the three attachment bolts (4) from forward end of the extension tube inside tailcone. Access is gained through the inspection panel.

NOTE: Mark the orientation of the extension tube before removal.

(7) Remove the bolts from extension tube clamp (5) (4 places). Remove the extension tube (6) by pulling aft with a slight rotating action.

B. Extension Tube Inspection

(1) Inspect the extension tube for corrosion, cracks, dents, nicks, scratches, elongated bolt holes, condition and security of the nutplates installed in the end of the tube, and security of the installation.

(2) Inspect the extension tube mounting clamp for condition, damage, and security.

NOTE: Smoking around the rivets that are used to secure the extension tube to the bulkhead attachment clamp usually indicates looseness of the bracket.

(a) With a finger placed across the mounting clamp, manually push the extension tube up and down to determine if the attachment to the bulkhead is loose. If loose, replace defective rivets with screws. (Refer to step C, (2) below

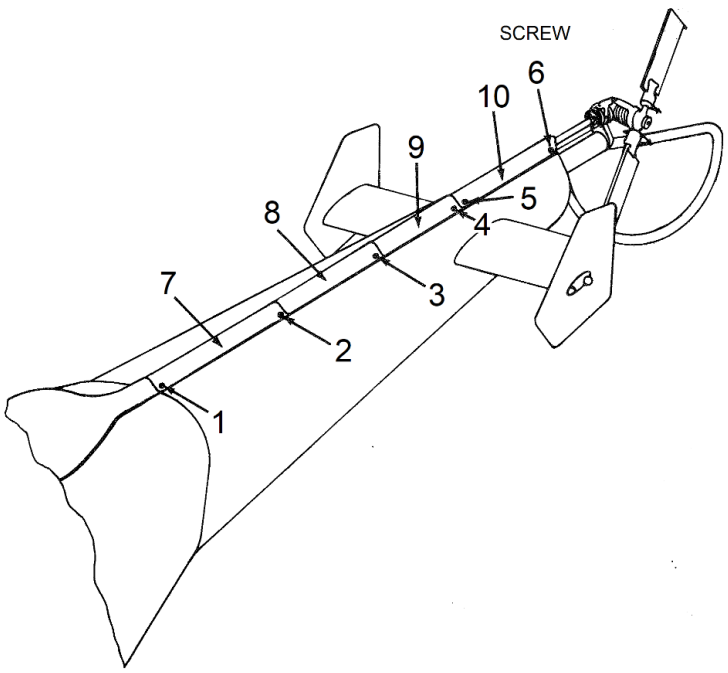
C. Extension Tube Repair

(1) Corrosion, nicks, and scratches not exceeding 0.008 inch/.2 mm may be polished out. Replace damaged nut plates. Replace the extension tube if cracked, damage exceeds 0.008 inch/.2 mm, or the tail rotor transmission screw holes are elongated.

(2) Replace the mounting clamp if cracks or damage makes it unserviceable.

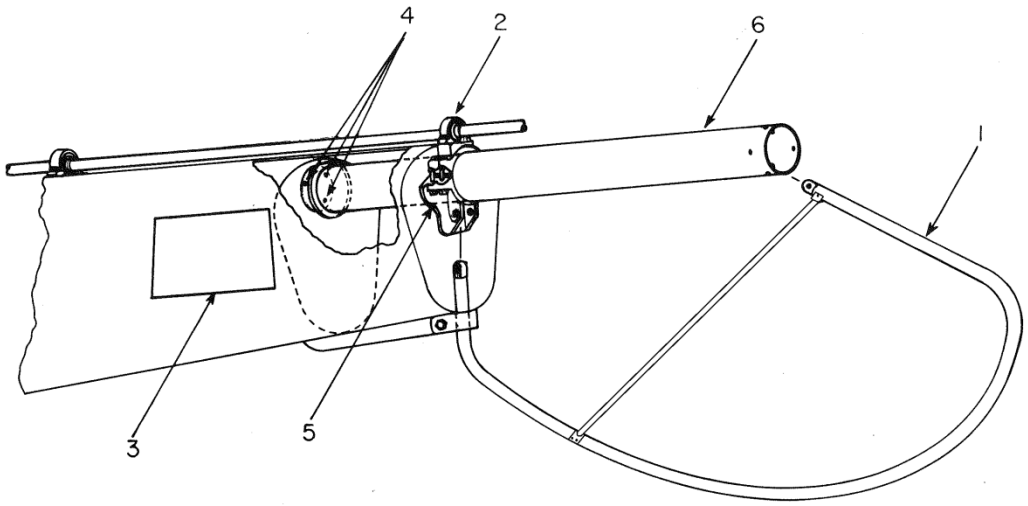
(3) If necessary, defective rivets may be replaced by AN525-8-10 or MS27039-( ) equivalent structural screws and heavy washers.

Note: Ensure grip length extends through the clamp mount and bulkhead.



1.	1/4 Turn Fastener	6.	Screw
2.	1/4 Turn Fastener	7.	Cover Section
3.	1/4 Turn Fastener	8.	Cover Section
4.	1/4 Turn Fastener	9.	Cover Section
5.	1/4 Turn Fastener	10.	Cover Section

Figure 8-14.1 Tail Rotor Driveshaft Cover (280 FX)



1.	Tail Rotor Guard	4.	Bolt
2.	Aft Pillow Block	5.	Mounting Clamp
3.	Inspection Panel	6.	Extension Tube

Figure 8-15. Extension Tube

D. Extension Tube Installation

(1) Apply Lubriplate 630-AA (MIL-PRF-81322) to the forward end of extension tube (6) and slide tube into tailcone mount. Install bolts (4) through the mount and into extension tube. Tighten bolts.

(2) Install the four attachment bolts into extension tube clamp (5) and torque bolts (50-70 in-lb/5.6-7.9 Nm).

CAUTION: EXCESSIVE TORQUE ON THE EXTENSION TUBE CLAMP BOLTS CAN DEFORM THE EXTENSION TUBE.

(3) Install the attachment bolts in the aft pillow block (2). Tighten bolts and safety wire (MS20995C32).

(4) Install the tail rotor gearbox and the tail rotor assembly as a unit. See Paragraph 10-5 for Gearbox Installation.

(5) Install and secure inspection panel (3).

(6) Connect and secure the tail rotor cables to the control bracket. See Paragraph 10-7, Tail Rotor Cables.

NOTE: Check that the cable tension is 35-40 lb.

(7) Install the left horizontal stabilizer on F-28F model helicopters. See Paragraph 8-14 or 8-16, Stabilizer Installation, as applicable.

(8) Install and secure the tail rotor guard (1) on F-28F and 280FX model helicopters.

(9) Check tail rotor rigging. See Paragraph 10-7, Tail Rotor Assembly.

(10) Inspect all connections for security.

8-14 HORIZONTAL STABILIZERS (F-28F PRE-1986)

A. Stabilizer Removal (See Figure 8-16)

(1) Remove screw and washers from tab (1) in the aft end of the left-hand stabilizer (4).

(2) Remove bolts (2) from the left-hand stabilizer (5) and spar (3).

(3) Slide stabilizer from the spar.

(4) Repeat steps 1 through 3 to remove the right-hand stabilizer (6).

(5) Remove access panel (7) on the left side of tailcone.

(6) Remove bolt (4) which secures the spar (3) to the left side spar fitting and slide the spar from the tailcone. spar should be marked to indicate relative location for correct reinstallation and matching to stabilizer mount holes.

B. Stabilizer Inspection (F-28F Pre-1986)

(1) Inspect the spar and horizontal stabilizer assembly as follows and in accordance with Table 8-2.

NOTE: If either stabilizer requires replacement, it shall be necessary to install a new spar, as stabilizers are match-drilled to spar on installation.

NOTE: Aspects of the following procedure are discussed in AD 88-11-06.

(a) Remove the left and right stabilizer assemblies (P/N 28-20100) from the spar (P/N 28-11222-1).

NOTE: Mark spar position left, right, top, etc. prior to removal so that on reinstallation it will be reposition correctly. Remove the inspection panel on the left side of the tailcone. Remove the bolt securing the spar to the tailcone and remove the tubular spar from the tailcone.

1 Confirm that the tubular spar wall thickness is .049. Replace any tubular spars with a wall thickness of .035 inch with an airworthy .049 inch wall spar.

(b) Visually inspect the attachment fittings for imbedded burrs, fretting and cracks. Pay particular attention to the spar attachment area around all drilled holes. Cracked fittings must be replaced. Cracked sheet metal may be repaired per standard practice.

(c) Inspect the spar by using magnetic particle process, dye penetrant process, or a 10-power or higher magnifying glass to confirm that no cracks exist. Pay particular attention to the spar area around **all** drilled holes. Any cracks found are cause for rejection – replace with an airworthy part. Refer to Figure 8-15.1 for the location of all holes to be inspected.

(d) Conduct a dye penetrant inspection or a close visual inspection by a 10-power or higher magnifying glass of the stabilizer spar trailing edge attachment clips (P/N 28-20106). Any cracks are cause for rejection – replace with an airworthy part.

(e) Corrosion of the tubular spar (particularly in areas of dissimilar metal contact) to depths greater than .005 inch is cause for rejection. Surface corrosion may be cleaned up with 320 grit emery paper. Surface protection of bare areas must be provided by a coat of primer (MIL-PRF-23377).

(f) Reinstall spar in the same relative position to tail cone. If spar is replaced it must be match drilled to tail cone and stabilizers. Remove, deburr all holes, and prep all surfaces with epoxy primer prior to final assembly.

(g) Reinstall the horizontal stabilizer using new airworthy parts, as required.

NOTE: A light coat of LPS 500 or the equivalent on the O.D. of the spar and the I.D. of fittings will aid in reassembly.

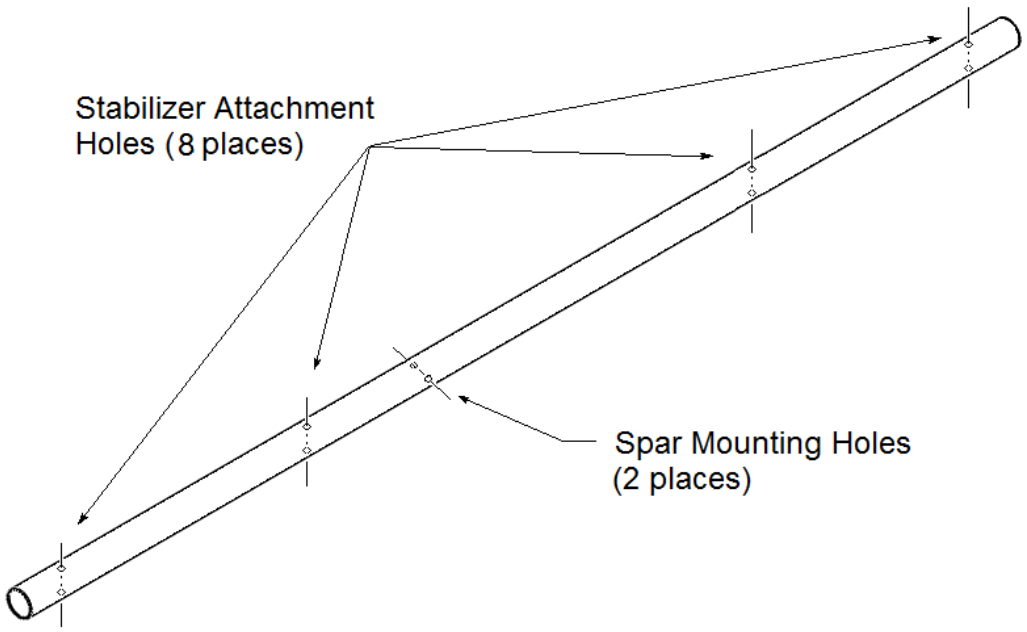


Figure 8-15.1. Stabilizer Spar Inspection – Stabilizer and Mounting Hole Attachment Points

C. Stabilizer Installation (F-28F) (See Figure 8-16)

(1) Apply Lubriplate 630-AA (MIL-PRF-81322) or equivalent to the spar (3) and slide the spar into the tailcone spar mounts.

NOTE: Install the spar with mount hole for the bolt (4) to the left side of the tailcone.

(2) Align bolt hole in the spar with hole in the spar mount located inside the tailcone inspection panel and install bolt (4). Torque bolt.

(3) Install and secure access panel (7) on the left side of the tailcone.

(4) Apply Lubriplate 630-AA (MIL-PRF-81322) or equivalent to the O.D. of the spar extending from each side of the tailcone.

(5) Slide stabilizers (4) and (5) onto the spar (3).

(6) Align bolt holes in the stabilizer to the holes in the spar and install bolts (2) in each stabilizer. Torque bolts.

NOTE: When installing a new stabilizer and spar, proceed as follows:

(a) Lubricate and install spar in the tailcone. Secure with bolt (4).

(b) Lubricate O.D. of the spar and slide the stabilizer in position.

(c) Align pre-drilled pilot holes (#41 drill size) in the stabilizer to pilot holes in the spar.

(d) Drill through stabilizer and spar in the pilot hole positions with a #12 drill (.189 inch diameter).

(e) Install bolts (2) and torque.

(7) Shim between the aft tab (1) and the tailcone with washers and secure with screw.

NOTE: Shim thickness (washers) to equal gap between the inboard end of the stabilizer and tailcone. This dimension may vary from side to side.

8-15 HORIZONTAL STABILIZERS – 280F

A. Stabilizer Removal (280F) (See Figure 8-17)

(1) Remove screw and washers from tab (1) in aft end of stabilizer.

(2) Remove bolts (2) securing stabilizer to spar.

(3) Slide stabilizer off of spar to remove.

(4) Separate strobe wires at quick disconnect points to allow complete removal.

B. Stabilizer Inspection (280F)

(1) Inspect in accordance with Table 8-3.

C. Stabilizer Installation (280F)

(1) Apply Lubriplate 630-AA (MIL-PRF-81322) or equivalent to spar on each side of tailcone.

(2) Attach strobe wires at quick disconnect points and slide stabilizer onto spar.

(3) Align bolt holes in stabilizer to holes in spar and install bolts (2). Torque bolts.

(4) Shim between the aft tab (1) and the tailcone with washers and secure with screw.

NOTE: Shim thickness (washers) to equal gap between inboard end of stabilizer and tailcone. This dimension may vary from side to side.

8-16 HORIZONTAL AND VERTICAL STABILIZERS (F-28F POST-1986; 280FX)

The horizontal stabilizers are aluminum semi-monocoque construction. The vertical endplates are constructed from fiberglass over foam cores, with the anticollision and navigation lights mounted on the outboard side of each end plate. Refer to Figure 8-18.

A. Stabilizer Removal

(1) Remove trailing edge tab screw (6) and washer (7).

(2) Remove one through bolt (8) at the outermost end of the spar (3) and washer (9) and nut (10).

(3) Loosen the two internal wrenching bolts (20) located under the inboard removable skin plugs (21) on the underside of the stabilizer.

(4) Slide stabilizer (4) or (5) about 3 to 4 inches for clearance to disconnect strobe (19) and navigation light wiring.

(5) Remove stabilizer.

(6) Repeat steps (1) through (4) for removal of opposite assembly.

(7) Spar removal (3) open access panel on right side of tail cone aft of spar.

(8) Loosen spar clamp bolts (1) at 2 locations.

(9) Slide spar (3) outward to remove, note spar should be marked to indicate relative location for correct reinstallation and matching to stabilizer mount holes. Mark with ink brush pen only - do not scribe.

B. Stabilizer Inspection

NOTE: If either stabilizer requires replacement, it shall be necessary to install a new spar, as the stabilizers are match-drilled to the spar on installation.

(1) Inspect in accordance with Table 8-4.

C. Stabilizer Installation

(1) Apply Lubriplate 630-AA (MIL-PRF-81322) to the spar (3) and slide the spar into the tail cone spar mounts.

(2) Install the right-hand stabilizer (5) by sliding it on the spar (3) close to the tail cone.

(3) Connect the wiring for the navigation lights and slide the stabilizer completely onto the spar.

(4) Slide the stabilizer on completely aligning the spar and stabilizer holes for the through bolt (8). Install the bolt (8) through the stabilizer and spar and tighten.

(5) Position the spar and the stabilizer until the trailing edge tab fitting is in alignment with the retainer nut plate in the tail cone and the aft tab screw can be installed.

(6) Install screw (6) and washer (7).

(7) Install the spar clamp mount bolts (1) at two places, torque (50-70 in-lb/5.6-7.9 Nm), and safety wire.

(8) Install the screws (20) and washers (26) on underside and tighten.

NOTE: In some cases an additional washer (7) shim may be required under fitting to reduce bending.

(9) Install access panel on tail cone.

(10) Install left hand stabilizer assembly by repeating steps 2, 3, 4, 5, 6, and 8.

(11) Check bolts and screws for proper torque and security. Unless specified otherwise, use standard torque.

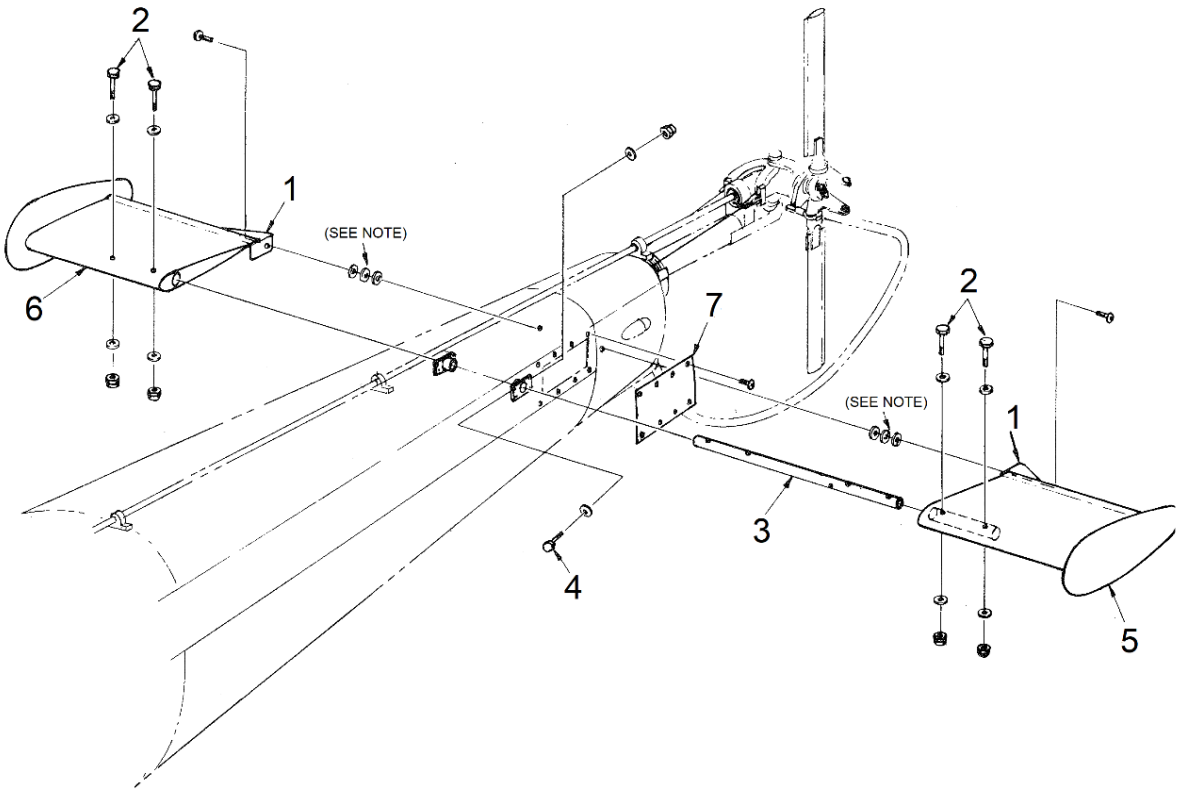
D. Endplate Assembly

NOTE: If endplate is damaged and removal is required it can be accomplished as follows:

(1) Remove strobe light assembly, disconnect wiring.

(2) Remove (10) number 10 screws and remove endplate assembly.

(3) Reinstall by reversing steps (2) and (1).



NOTE: Shim with washers to equal gap between stabilizer and tailcone.

1. Tab
2. Bolts
3. Spar
4. Bolt
5. Left Hand Stabilizer
6. Right Hand Stabilizer
7. Access Panel

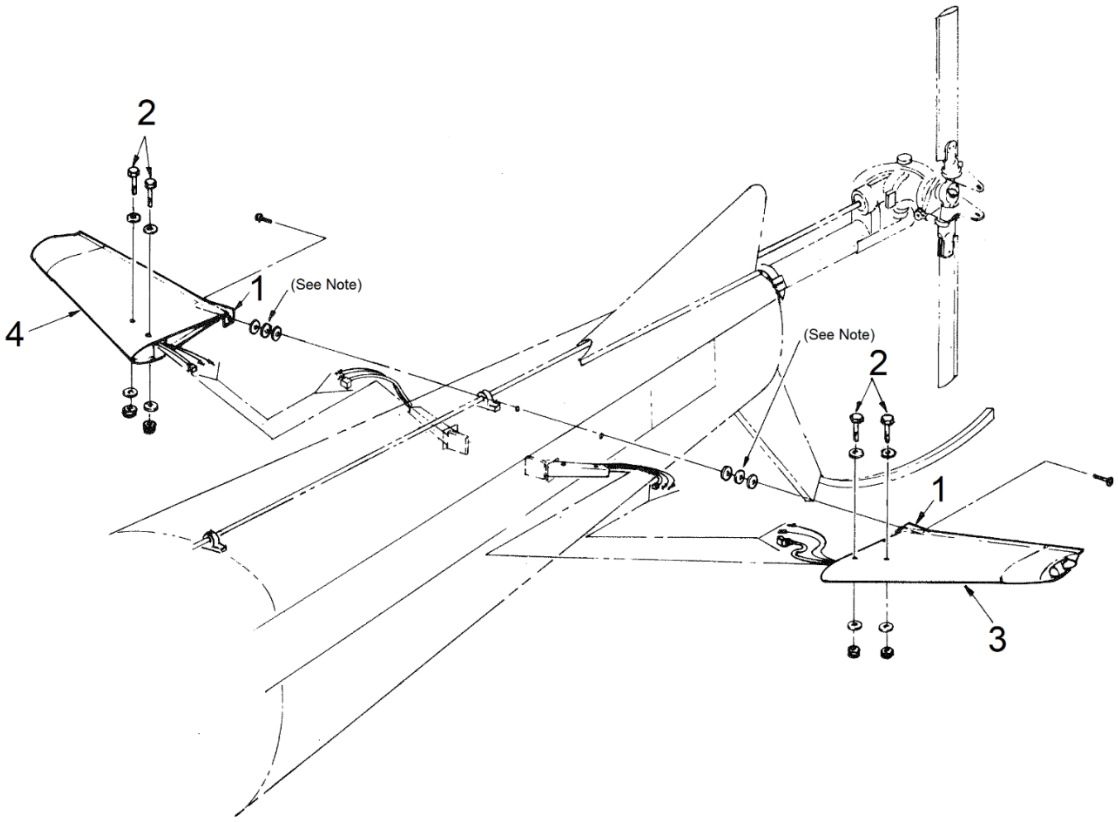
Figure 8-16. Horizontal Stabilizer Installation (F-28F Pre-1986)

Table 8-2. Horizontal Stabilizer (F-28F Pre 1986, S/N 743 and Prior) – Inspection

P/N	Figure & Item No.	Part Name	Inspection*	Serviceable Limits*	Repair Limits	Repair or Action
28-20100-1 28-20100-2	Fig. 8-16 5 & 6	Horizontal Stabilizer	Stabilizer Bushings 1.130 dia. ± .001	+.001	Not Repairable	Replace bushing
			Bolt holes – .189 dia. ± .005	+.002	Not Repairable	Replace stabilizer
			Stabilizer skin – check for cracks	(See Note)	(See Note)	(See Note)
			Sheet metal (See Note)			
28-11222-15	3	Center Spar	O.D. .1.120-1.130 dia.	-.0005	Not Repairable	Replace spar
			Bolt holes - .191 dia. ± .005	+.002	Not Repairable	Replace spar
			Spar surface – check for nicks, scratches, cracks	None allowed	Not Repairable	Replace spar
			Corrosion Pits	-.005 in depth		Blend out and protect

NOTE: Structural repairs to be made in accordance with AC 43.13-1B. Contact the Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

* All dimensions are in inches.



NOTE: Shim with washers to equal gap between stabilizer and tailcone.

1. Tab
2. Bolt
3. Left Hand Stabilizer
4. Right Hand Stabilizer

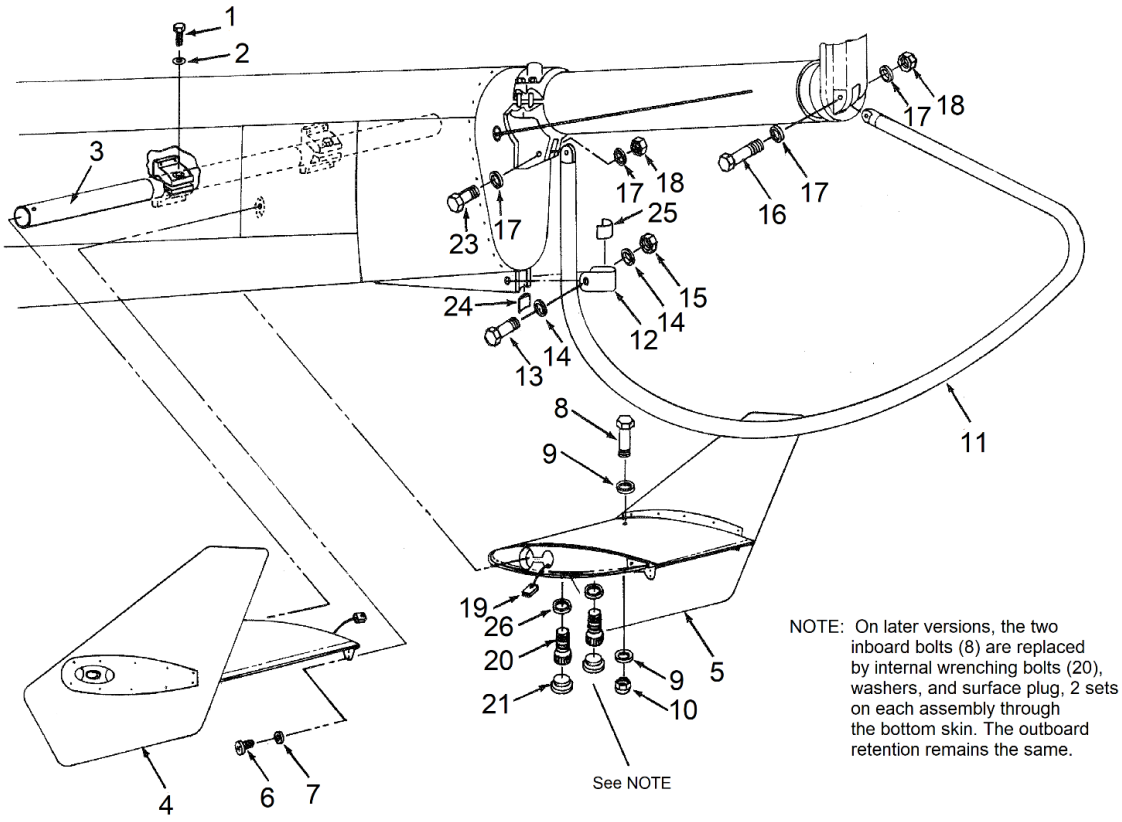
Figure 8-17. Horizontal Stabilizer Installation (280F)

Table 8-3. Horizontal Stabilizer (280F) – Inspection

P/N	Figure & Item No.	Part Name	Inspection*	Serviceable Limits*	Repair Limits	Repair or Action
280-200003-1 280-200003-2	Fig. 8-17 3 & 4	Horizontal Stabilizer	Bolt holes – .189 dia. ± .005	+.002	Not Repairable	Replace stabilizer
			Stabilizer skin – check for cracks	(See Note)	(See Note)	(See Note)
			Strobe lights – check for cracks in lens cover	None allowed	Not Repairable (See Note)	Replace lens cover
			Sheet metal (See Note)			
280-200000-13 280-200000-14	Not Illustrated	Spar	Bolt holes - .189 dia. ± .005	+.002	Not Repairable	Replace spar
			Spar surface – check for nicks, scratches, cracks	None allowed	Not Repairable	Replace spar

NOTE: Structural repairs to be made in accordance with AC 43.13-1B. Contact the Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

* All dimensions are in inches.



1.	Spar Clamp Bolt	14.	Washer
2.	Washer	15.	Nut
3.	Spar	16.	Bolt
4.	Stabilizer	17.	Washer
5.	Stabilizer	18.	Nut
6.	Trailing Edge Tab Screw	19.	Strobe
7.	Washer	20.	Internal Wrenching Bolt
8.	Bolt	21.	Inboard Removable Skin Plugs
9.	Washer	22.	(Not Used)
10.	Nut	23.	Bolt
11.	Tail Rotor Guard	24.	Pad
12.	Clamp	25.	Pad
13.	Bolt	26.	Washer

Figure 8-18. Tubular Tail Rotor Guard and Vertical Stabilizers (F-28F Post-1986; and 280FX)

Table 8-4. Horizontal Stabilizer (F-28F Post-1986 and 280FX) – Inspection

P/N	Figure & Item No.	Part Name	Inspection*	Serviceable Limits*	Repair Limits	Repair or Action
28-20119-1/-2	Figure 8-18 Item 3	Horizontal Stabilizer (Bolt Mounts)	Stabilizer Bushings 1.130 diam. ± .001	+.001	Not Repairable	Replace bushing
			Bolt holes – .189 dia. ± .005	+.002	Not Repairable	Replace stabilizer
28-20119-3/-4	Figure 8-18	(Bolt Mount and Clamps)	Stabilizer skin – check for cracks	None allowed	Repairable (Note)	Replace stabilizer
			Fitting cracks – (sheet metal)	(See Note)	(See Note)	(See Note) As required, replace fittings
			End Plate Damage	None allowed	Not repairable	Replace Endplate
28-11222-15	Figure 8-18 Item 3	Center Spar	O.D. -1.120/1.130 diam.	-.0005	Not Repairable	Replace spar
			Bolt holes – .191 dia. ± .005	+.002	Not Repairable	Replace spar
			Spar surface – check for nicks, scratches, cracks	None allowed	Not Repairable	Replace spar
			Corrosion Pits	-.005 in depth		Blend out and protect

NOTE: Structural repairs to be made in accordance with AC 43.13-1B. Contact the Enstrom Helicopter Corporation Customer Service for detailed damage and repair limitations.

* All dimensions are in inches.

8-17 AIRSCOOP (280FX)

The airscoop comprises three separate pieces which are fiberglass construction. These include a nose piece which is attached to the cabin roof, a center duct which is mounted to the top of the fuel tanks, and a large airscoop which is mounted on the wraparound cowl behind the trans-mission. This airscoop funnels the cooling air around the transmission and into the cooling fan. The large airscoop blends into the tail rotor driveshaft cover. (Ref. Figure 22-1)

A. Removal – For Access to the Upper Drive System or for Main Rotor Gearbox Removal

(1) Remove side cowl (9) and opposite side panel (10) then remove 5 each screws (4) on the forward section of airscoop (6) and lift airscoop off.

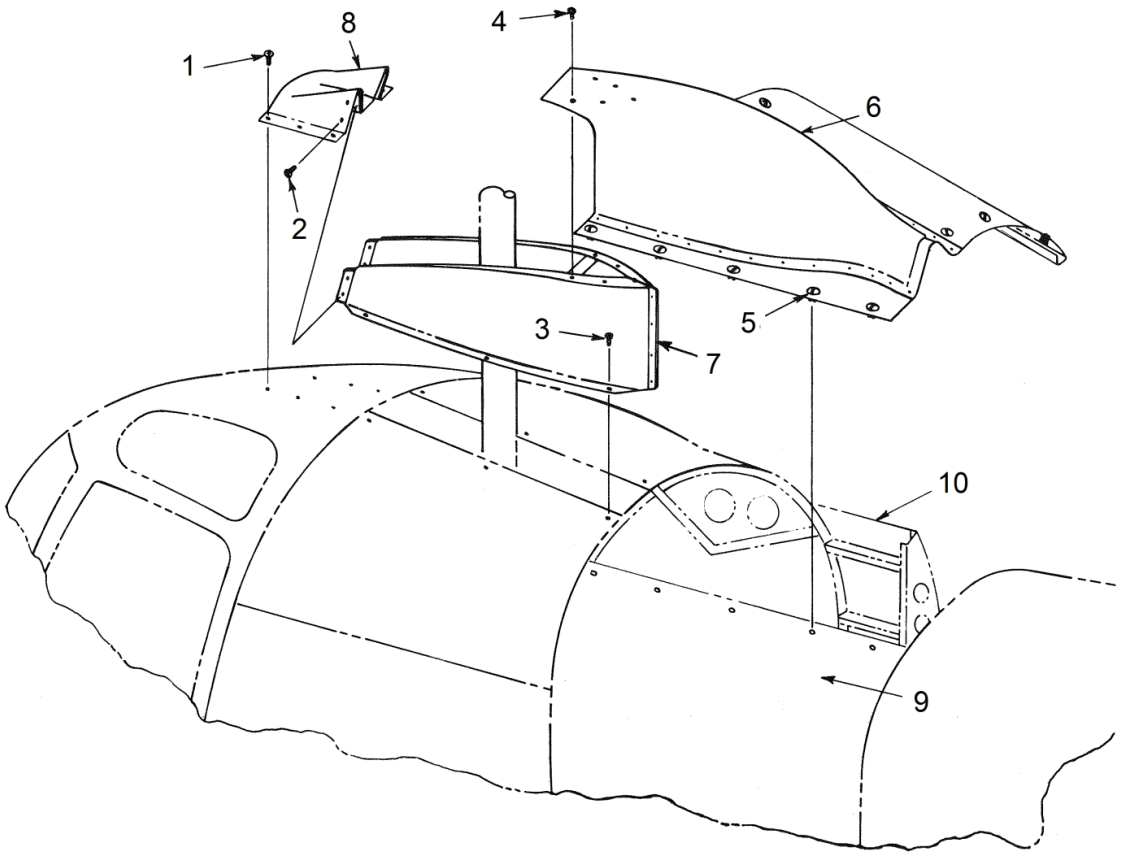
(2) Remove screws (2) 4 places from center duct (7) and nose piece (8).

(3) Remove screws (3) from either side of the center duct and remove.

NOTE: The nose piece (8) need not be removed, the assembly should be inspected for damage and/or missing fasteners.

B. Installation

(1) Install in reverse order of steps (1) through (3).



1.	Screw	6.	Airscoop
2.	Screw	7.	Center Duct
3.	Screw	8.	Nose Piece
4.	Screw	9.	Side Cowl
5.	Fastener Stud	10.	Side Panel

Figure 8-19. Three-Piece Airscoop (280FX)

8-18 CABIN CLOSEOUT PANELS (280FX)

Effective S/N 2168 and subsequent, the cabin closeout installation consists of two removable exterior closeout panels mounted to the bottom of the cabin. The panels provide easier access to portions of the cyclic trim system, which avoids having to access the system from above and the need to remove interior components. The left side closeout panel also includes a housing assembly to accommodate the aft landing light. Refer to Figure 8-20.

A. Removal – Left Side Closeout Panel

NOTE: It is not required to remove the LED light assembly when removing the left side closeout panel. Likewise, it is not required to remove the closeout panel if removing the LED light assembly only. If removing the landing light only, accomplish steps A.1 and A.2. If it is not required to remove the landing light, step A.2 may be omitted. Support the panel during removal to prevent damage to the LED light assembly.

(1) Pull the aft landing light circuit breaker (**AFT LDG LTS**, CB46).

(2) If required, remove LED light assembly (8):

(a) Remove four screws (10) and lens clamp (9) from landing light housing (7).

(b) Remove two terminal post screws to disconnect the ground and power wires from the back of the LED light assembly.

(3) Remove twelve screws (2) that attach closeout panel (1) to the cabin shell.

(4) Disconnect wire harness connector P339 (3) from J339.

(5) Remove closeout panel (1).

B. Installation – Left Side Closeout Panel

(1) Connect wire harness P339 (3) to J339.

(2) Install closeout panel (1) to the cabin shell with screws (2).

(3) If required, install LED light assembly (8):

NOTE: Ensure correct wire polarity when connecting the wires.

(a) Secure the ground and power wires to the back of the LED light assembly (8).

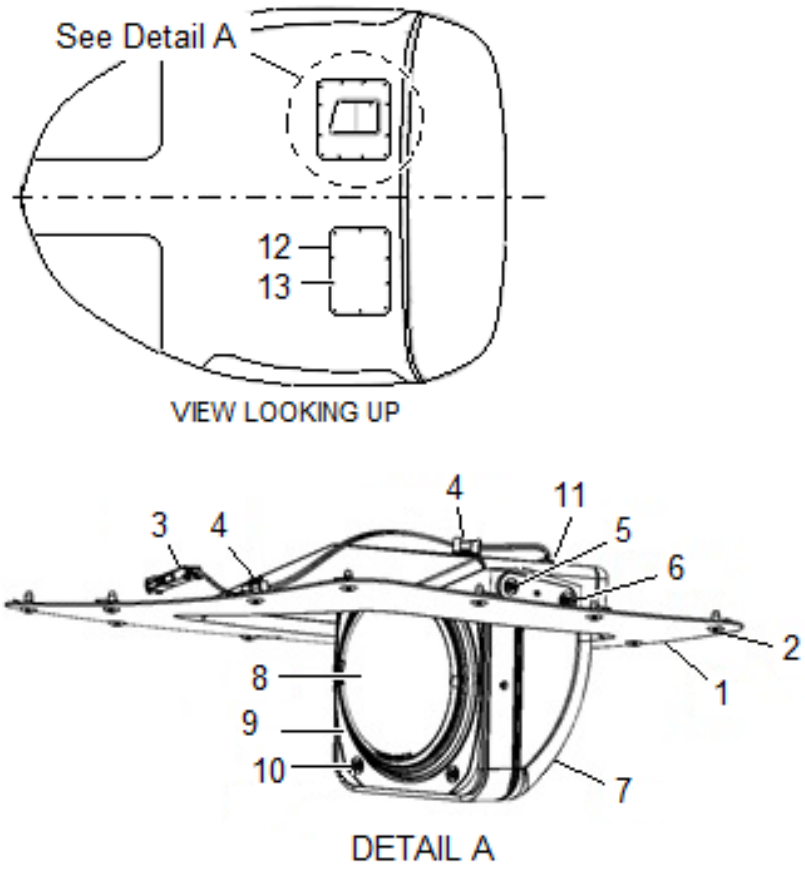
(b) Install LED light assembly (8) in landing light housing (7). Ensure the alignment key of the LED light assembly fits the notch in the landing light housing.

(c) Install lens clamp (9) and secure with screws (10).

(4) Push in the aft landing light circuit breaker (**AFT LDG LTS**, CB46).

C. Removal and Installation – Right Side Closeout Panel

(1) Removal and installation of right side closeout panel (12) is accomplished via ten attachment screws (13).



1. Closeout Panel (Left)
2. Screw
3. Connector (P339)
4. Clamp
5. Screw
6. Screw
7. Landing Light Housing
8. LED Landing Light
9. Lens Clamp
10. Screw
11. Grommet
12. Closeout Panel (Right)
13. Screw

Figure 8-20. Cabin Closeout Panels and Landing Light Housing (280FX)

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SECTION 9

MAIN ROTOR

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9-1 MAIN ROTOR SYSTEM

A. General – Main Rotor System

The main rotor system is a three bladed, high inertia, fully articulated rotor system. The main rotor hub assembly is comprised of two opposing forged aluminum hub plates separated by an aluminum cylindrical spacer. Through bolts hold these items together along with steel spline adapters. Three steel universal blocks are mounted in needle roller bearing units that permit flapping and lead-lag motions. Laminated phenolic pads are used to limit blade travel in both the lead-lag and flapping axes. A thrust nut on the bottom of each universal block transfers vertical blade forces to both hub plates through the universal block. The rotor blades are secured to each universal block on the hub through a forged aluminum grip which is in turn secured to a steel spindle assembly through a retention nut and supporting bearings. Blade feathering loads and centrifugal blade loads are carried by Lamiflex elastomeric bearing assemblies or Tension-Torsion (TT) Straps. Closed circuit hydraulic dampers are incorporated between each flapping pin and the rotor hub to limit the lead-lag velocity of the blades.

NOTE: Lamiflex bearings are discontinued. If the lamiflex bearings must be replaced, the aircraft must be converted to a TT strap retention assembly. Refer to Table 2-2 *Vendor Contact Information* to obtain the TT strap retention assembly installation (STC SR03465CH). Installation instructions and instructions for continued airworthiness publications are provided with the STC. (F-28F S/N 832 and subsequent and 280FX S/N 2147 and subsequent are equipped from the factory with the TT strap retention assembly installation, STC SR03465CH.)

9-2 MAIN ROTOR HUB

A. Removal – Main Rotor Hub

WARNING: USE EXTREME CAUTION WHEN REMOVING THE BLADE AND GRIP ASSEMBLIES TO PREVENT INJURING PERSONNEL.

(1) Remove the main rotor blades (Para. 9-8).

CAUTION: FOREIGN OBJECTS DROPPED DOWN THE MAST MUST BE IMMEDIATELY REMOVED TO PREVENT DAMAGING THE FLIGHT CONTROLS.

(2) Remove bolt (3) securing the pitch change bellcrank to the push-pull rod (6) in the mast (3 places) (Figure 9-1).

NOTE: Install a tie wrap to hold the spacer (7) in the push-pull rod (3 places).

(3) Remove center pivot bolt (4) from the pitch change bellcrank. Pivot the bellcrank from the mounting bracket and allow to hang free on the pitch change link (2) (3 places) (Figure 9-1).

NOTE: Install a tie wrap to hold the spacer (8) in the bellcrank (3 places).

(4) Remove the safeties from the mast nut (27) (Figure 9-2).

WARNING: THE TORQUE OF THE MAST NUT CAN BE DIFFICULT TO BREAK. USE EXTREME CAUTION WHEN REMOVING THE MAST NUT.

(5) Remove mast nut (27) and spacer (26) from the mast using tool T-0197-7 or digital torque multiplier (ATP761). If this is not available, install T-0048 tool and use a 3/4" drive electric impact wrench. If a 3/4" drive electric impact wrench is not available, install one main rotor blade and pull the breaker bar against the blade while using a large (2 kg) hammer to shock the tool (T-0048).

(6) Disconnect the tail rotor drive shaft flex plate at pinion to prevent damage.

(7) Install the hoist sling (T-0011) so the arms are between the pitch arm and the blade retention assembly, over the lead/lag retaining nut, and outboard of the main rotor damper rod-end. The sling arms are long enough to be double wrapped, if preferred (Figure 4-3).

(8) Attach the sling to a lifting device and slowly lift the hub assembly from the mast. The hub must be lifted exactly parallel to the mast. If there are any side loads, the hub will stick on the splines and will not come off. If the hub has been installed for a long period of time, the hub puller (T-0174-1) must be used and the control rods must be removed from inside the mast.

NOTE: It may be helpful to put the left-side wheel down to align the mast vertically prior to lifting the hub assembly from the mast.

(9) Install the hub assembly onto a hub stand.

B. Disassembly – Main Rotor Hub

NOTE: Mark all parts for reassembly in the same respective positions.

(1) Remove bolt (13) to disconnect the pitch link (2) from the pitch arm (1) (3 places) (Figure 9-1).

(2) Remove pitch arm (1) from the blade grip (3 places).

(3) Remove the dampers (Para. 9-5, C).

NOTE: To facilitate tracking, mark the hub adapter locations relative to the grip assemblies such that all blade grips and pitch change links are installed in the same location upon reassembly of the main rotor hub. A reused main rotor shaft may have previous markings.

(4) Remove the retention assemblies (Para. 9-3, A).

(5) Remove bolts (1) and (2) from the bellcrank brackets (3) and remove the brackets (Figure 9-2).

(6) Remove dust cover (4).

(7) Bend locking tabs (6) out of the recesses in the retaining nuts (5). Install tool (T-0051-1 or T-0051-3) on the nuts and remove the nuts and the washers.

(8) Turn the hub assembly over and remove locking keys (10) from the retaining nuts (9).

(9) Using tool T-0003, remove the nuts, shims (8), and DU washers (7).

(10) Turn the hub assembly over and remove the hardware (11) from the center hub adapter.

(11) Remove upper and lower spline adapters (12) and (18) by tapping them from the hub plates with a nylon drift.

(12) Remove dowel pins (13) from the hub plates (14) and (17) and the center spacer (16) by tapping them through with an aluminum drift.

(13) Remove grease fittings (19) from the hub plates (6 places).

WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

NOTE: Heating the assembly can be facilitated by using an oven.

(14) Heat the upper hub plate to approximately 250°F/121°C and lift the hub plate from the universal blocks (U-block) (15). Tap with a plastic mallet if necessary.

(15) Heat the lower hub plate to approximately 250°F/121°C and tap the universal blocks from the hub plate.

C. Inspection – Main Rotor Hub

(1) Refer to Table 9-1 for detailed inspection requirements.

D. Assembly – Main Rotor Hub (Figure 9-2)

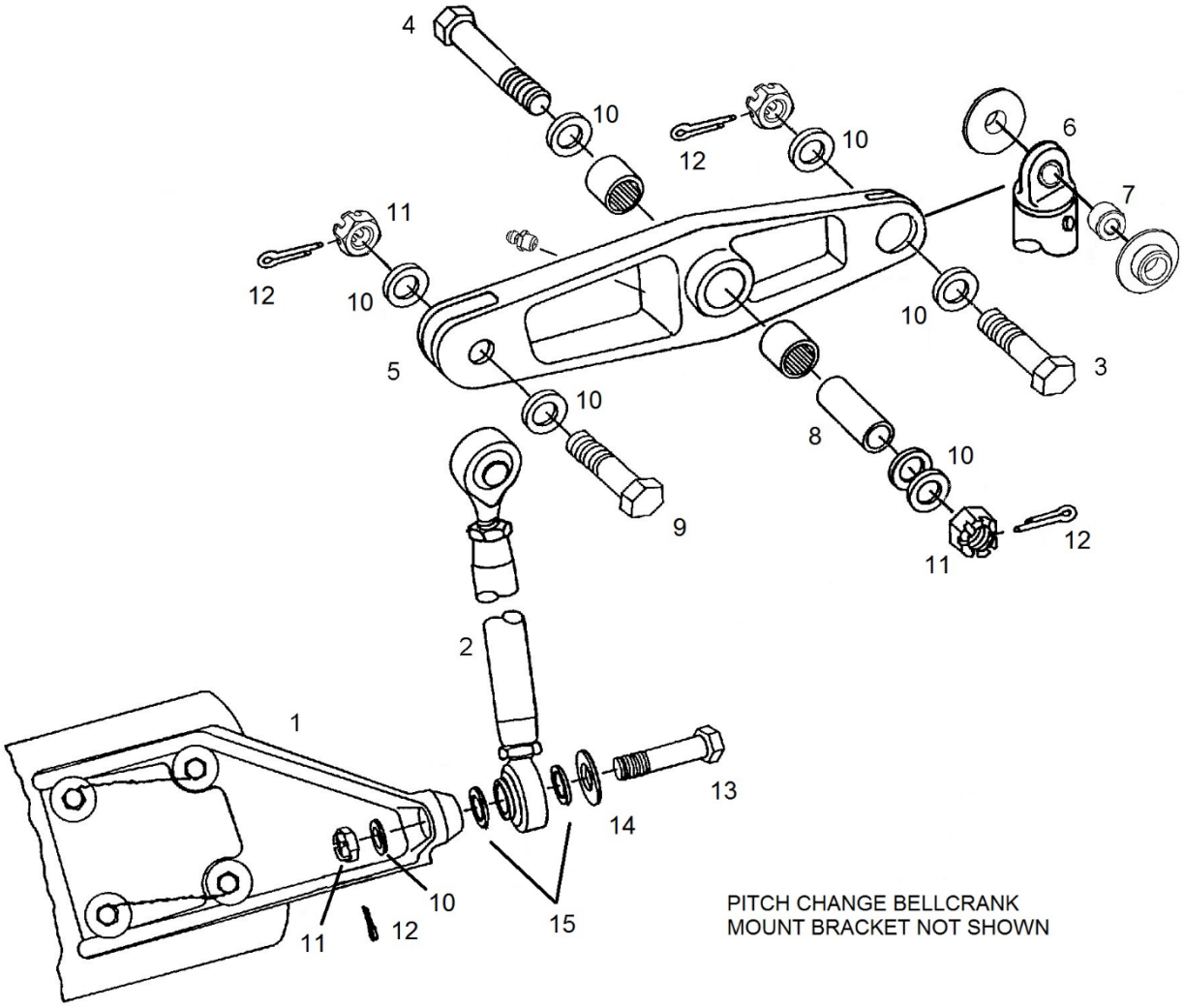
WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

NOTE: The upper hub plate has helicoil inserts in the outer bosses for the bellcrank mount brackets. The lower hub plate bosses are solid.

(1) Heat upper hub plate (14) and the lower hub plate (17) to approximately 250°F/121°C.

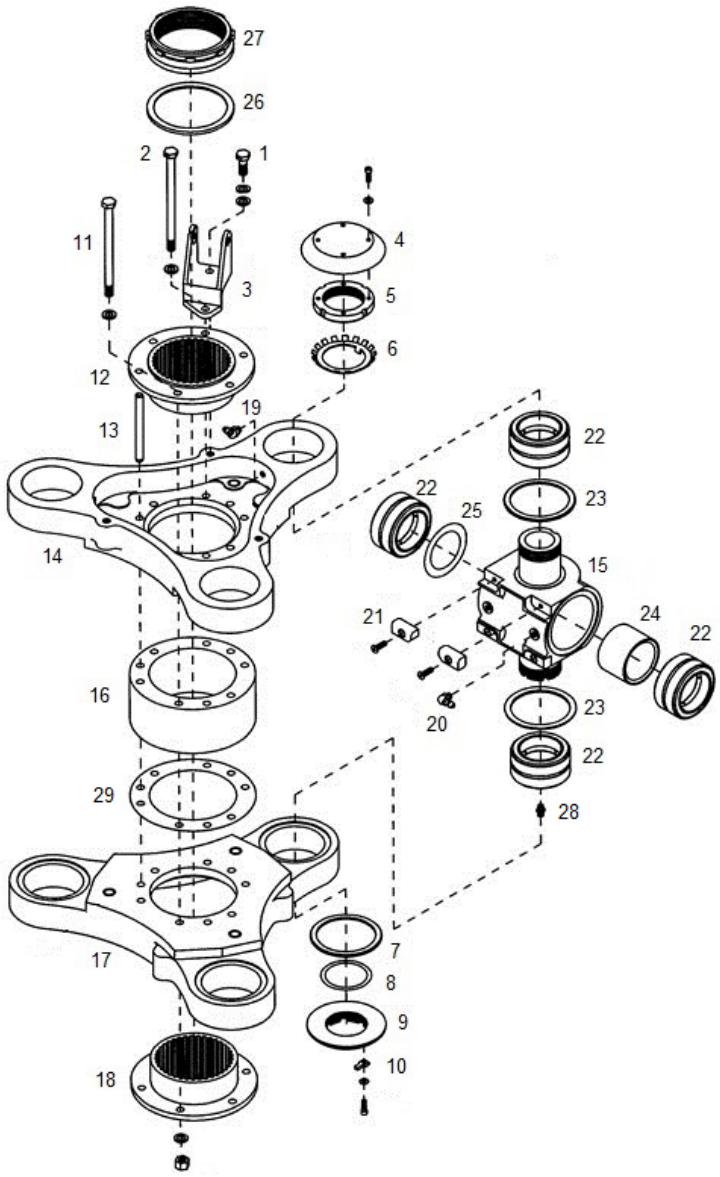
(2) Place the lower hub plate on 2" X 4" wood blocks. Lubricate the bearing bores with MIL-G-25537.

NOTE: Ensure the DU washers have been installed on the U-blocks with the chamfered side facing the hub plates. The DU washers must be seated in the recessed area of the hub plate. Lubricate (MIL-G-25537) the DU washers before installation in the hub plates.



1. Pitch Arm
2. Pitch Change Link
3. Bolt
4. Bolt
5. Pitch Change Bellcrank
6. Push-Pull Rod Assembly
7. Spacer
8. Spacer
9. Bolt
10. Washer
11. Nut
12. Cotter Pin
13. Bolt
14. Washer (P/N ECD050-19)
15. Spacer

Figure 9-1. Pitch Change Bellcrank and Pitch Link Installation



1.	Bolt	11.	Bolt	21.	Stop Pad
2.	Bolt	12.	Upper Spline Adapter	22.	Bearing
3.	Bracket	13.	Dowel Pin	23.	DU Washer
4.	Dust Cover	14.	Upper Hub Plate	24.	Spacer
5.	Retaining Nut	15.	Universal Block	25.	Shim
6.	Lock Washer	16.	Center Spacer	26.	Hub Spacer
7.	DU Washer	17.	Lower Hub Plate	27.	Retaining Nut
8.	Shim	18.	Lower Spline Adapter	28.	Grease Fitting
9.	Retaining Nut	19.	Grease Fitting	29.	Shim
10.	Lock Key	20.	Grease Fitting		

Figure 9-2. Main Rotor Hub Assembly

(3) If required, assemble the U-block assembly (Para. 9-4, C).

(4) Install U-block assemblies (15) into the bearing bore of the hub plate with the threaded notched end of the U-blocks down (3 places).

(5) Place spacer (16) on the lower hub plate (17) and align the bolt holes.

(6) Lubricate (MIL-G-25537) the bearing bores of the upper hub plate (14) and install the upper hub plate onto the U-blocks.

NOTE: The dowel pins must be installed until slightly recessed from face of hub plate surface.

(7) Lubricate (MIL-G-25537) dowel pins (13) and tap pins into the center hole of the 3-hole bolt pattern (3 places).

NOTE: The upper spline adapter has the wider flat surface on the top side of the splines while the lower adapter has a rib extending from the lower end of the splines.

CAUTION: WHEN INSTALLING SPLINE ADAPTERS, THE PHASING MARKS ON TOP OF THE SPLINES MUST ALIGN WITH ONE OF THE BELLCRANK MOUNT BRACKETS (3). USING A FELT MARKER, MARK A LINE ON OUTBOARD EDGE OF HUB PLATE IN LINE WITH SPLINE PHASING MARKS TO AID IN THE ALIGNMENT WHEN INSTALLING LOWER SPLINE ADAPTER.

(8) Insert bolts in upper spline adapter (12) as guides and install spline adapter into upper hub plate (14).

NOTE: To distinguish between spline adapters, the upper spline adapter (12) has the wider flat surface on top side of splines while the lower spline adapter has a rib extending from lower end of spline.

(9) Carefully turn the hub assembly over and position on wood blocks.

(10) Install lower spline adapter (18) (aligning the phasing mark with the upper adapter phasing mark) into lower hub plate (17).

(11) Install center hub bolts (11) in the holes adjacent to the bellcrank bracket mount holes and install washers and nuts. Torque bolts.

(12) Install bellcrank brackets (3) and secure with bolts (1) and (2). Torque bolts (1) and safety with 0.032 safety wire. Torque bolts (2).

(13) To set rotational drag of U-blocks (15), proceed as follows:

(a) Place the hub assembly on a stand with lower end of U-blocks up.

(b) Lubricate (MIL-G-25537) DU washer (7) and install into recess of hub plate with chamfer in board toward hub plate.

(c) Install shims (8) (approximately 0.025 inch/0.6 mm thick) and lower U-block nut (9). Using tool T-0003, torque nut to 50 ft-lb/67.8 Nm.

(d) Rotate the U-block to one of the stops and install a hinge pin partially into bearing until it extends 4.75 in/12.1 cm.

(e) Attach a spring scale to the head of hinge pin and pull to check the drag of the U-block.

NOTE: Drag tolerance with nut torqued is 4 to 10 lb/1.8 to 4.5 kg.

(f) Add or subtract shims (8) until the proper drag torque is obtained.

NOTE: Nut (9) must be torqued before checking drag.

(g) Place locking key (10) into the slot of nut (9) aligned with the notch in the U-block and secure the key with screw.

(h) Adjust the drag of all three U-blocks following steps (b) through (g).

(14) Turn the hub assembly over on the stand.

(15) Install upper U-block nuts (5) as follows:

(a) Install lockwasher (6) and nut (5) on U-block.

(b) Torque nut (5) to 20 ft-lb/27.1 Nm using tool T-0051-3.

(c) Using a plastic mallet, tap down on top of nut and re-torque to seat the upper bearing.

NOTE: Repeat step (c) until nut (5) will not move when being torqued to 20 ft-lb/27.1 Nm.

(d) Bend tab from lock washer (6) into the slot in nut (5) to secure the nut after torque is completed.

(e) Install dust cover (4) on the nut and secure with screws and washers.

(f) Repeat steps (a) through (e) on each U-block.

(16) Install grease fittings (19) into upper and lower hub plates (6 places).

(17) Install the retention assemblies (Para. 9-3, E).

(18) Install the damper assemblies (Para. 9-5, H).

(19) Install the pitch arms to the blade grips.

(20) Install the pitch link (2) to the pitch arm (1) with bolt (13) and hardware (3 places) (Figure 9-1). Torque and cotter pin.

E. Installation – Main Rotor Hub (Figure 9-1, Figure 9-2)

WARNING: USE EXTREME CAUTION WHEN INSTALLING THE BLADE AND GRIP ASSEMBLIES TO PREVENT FROM INJURING PERSONNEL.

(1) Locate the spline with phasing mark at top of main rotor shaft and mark it with a black felt marker for alignment ease. Apply a lubricant (MIL-PRF-81322) to the rest of the rotor shaft splines.

(2) Using sling T-0011 on main rotor hub assembly, carefully lower hub onto main rotor shaft while aligning the phasing marks on lower spline adaptor to phasing mark of rotor shaft spline. Remove sling.

CAUTION: WHEN HUB INSTALLED, THE ROTOR SHAFT SPLINE PHASING MARK MUST BE LOCATED BETWEEN UPPER SPLINE ADAPTER PHASING MARKS. CHECK THIS BEFORE INSTALLING MAST NUT AND WASHER.

(3) Install mast spacer (26) with chamfered side down toward splines.

(4) Install mast nut (27) and torque to 400 ft-lb/542.3 Nm using Digital Mast Torque Multiplier P/N ATP761 or tool T-0048. Lockwire (.041) the mast nut (three places).

(5) Remove the tie wrap from the spacer (7) in the control rod (6) and connect the control rod (6) and spacer (7) with the bolt (3), nut, and washers.

(a) Torque the nut. Ensure that the bellcrank will pivot on the control rod without resistance.

NOTE: Resistance may be a result of protruding bronze bushings that cause drag when the hardware is torqued. File the bushings until the applied torque does not cause drag when the walking beam is pivoted at the control rod attachment point.

(6) Remove the tie wrap from the spacer (8) in the bellcrank (5) and connect the spacer (8) with the bolt (4), nut, and washers.

(a) Torque the nut. Ensure that the bellcrank will pivot on the control rod without resistance.

(7) Install the main rotor blade (Para. 9-13).

(8) Inspect all connections for security and proceed to the Preflight Control System check (Para. 9-2, F).

F. Preflight Control System Check

NOTE: Whenever a helicopter has had work performed to the flight controls, it is recommended that a flight test be conducted before returning the helicopter to service.

(1) Check the blade track (Para. 12-2).

(2) Perform a complete Flight Test Procedure (Para. 12-13).

Table 9-1. Inspection Requirements – Main Rotor Hub Assembly

Part No.	Figure 9-2 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits	Repair or Action
28-14202-1	3	Bellcrank bracket	Deformed or cracked ears	None Allowed	Not Repairable	Replace Bracket
			Security of bushings in bracket – press fit	No Play Allowed	Not Repairable	Replace Bracket
			Nicks, scratches, or corrosion	None Allowed	≤ .010 Deep	Blend and Polish Smooth
28-14227-1	5	Nut	Threads (rolled or missing)	None Allowed	Not Repairable	Replace Nut
W-09-1	6	Lockwasher	Tangs (deformed or cracked)	None Allowed	Not Repairable	Replace Lockwasher
28-14236-1	7	DU washer	Flatness	.005	Not Repairable	Replace Washer
			Thickness .090 to .093	-.003	Not Repairable	Replace Washer
28-14256-1	9	Nut	Threads (rolled or missing)	None Allowed	Not Repairable	Replace Nut
28-14224-1	12 (& 18)	Spline Adaptors	Inboard face of adapter perpendicular to O.D.	+.0025 FIM	Not Repairable	Replace Adapter
			O.D. 3.6235 to 3.6245	-.0005	Not Repairable	Replace Adapter
			Spline pitting	.003 Deep	Not Repairable	Replace Adapter
			Spline corrosion	None Allowed	Surface Corrosion	Wire Brush to Remove
			Spline wear	.0015 on Side	Not Repairable	Replace Adapter

Table 9-1. Inspection Requirements – Main Rotor Hub Assembly

Part No.	Figure 9-2 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits	Repair or Action
28-14224-1	12	Spline Adaptor (continued)	Nicks, scratches, or corrosion	.010 Deep	≤ .010 Deep	Blend and Polish Smooth
			Cracks	None Allowed	Not Repairable	Replace Adapter
28-14280-5	14	Upper Hub	Spline Adapter Bore 3.624 to 3.625 diameter	+.0005	Not Repairable	Replace Upper Hub
			U Block Bearing Bore 2.4986 to 2.4994	+.0008	Not Repairable	Replace Upper Hub
			Recesses for the DU washers parallel to the upper surface within .001	+.0005	Not Repairable	Replace Upper Hub
			Damper bolt bushings diameter .4995 to .5000	+.0005	Not Repairable	Replace Bushing
			Threads for bellcrank brackets (crossed or missing).	None Allowed	Not Repairable	Replace Helicoil
			Nicks, scratches, or corrosion	None Allowed	≤ .010 Deep	Blend and Polish Out Smooth
			Cracks	None Allowed	Not Repairable	Replace Upper Hub

Table 9-1. Inspection Requirements – Main Rotor Hub Assembly

Part No.	Figure 9-2 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits	Repair or Action
28-14117-11	15	U-Block	Bore Dia. 2.4996 to 2.4998	+.0002	Not Repairable	Replace U-Block
			Bearing Surface O.D. 1.7492 to 1.7498	-.0002	Not Repairable	Replace U-Block
			Bearing Surfaces concentric	.001 FIM	Not Repairable	Replace U-Block
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace U-Block
			Nicks, scratches, or corrosion	None allowed at the radius of the bearing spindle	≤ .030 deep	Blend and polish out smooth
			Cracks	None Allowed	Not Repairable	Replace U-Block
28-14223-1	16	Spacer	Dowel Hole Dia. .3125	+.0005	Not Repairable	Replace Spacer
			Bolt Hole Dia. .313 to .318	+.002	Not Repairable	Replace Spacer
			Nicks, scratches, or corrosion	.030 Deep	≤ .010 Deep	Replace Spacer
			Cracks	None Allowed	Not Repairable	Replace Spacer
28-14281-5	17	Lower Hub	Spline Adapter Bore 3.624 to 3.625	+.0005	Not Repairable	Replace Lower Hub
			U Block Bearing Bores 2.4986 to 2.4994	+.0008	Not Repairable	Replace Lower Hub

Table 9-1. Inspection Requirements – Main Rotor Hub Assembly

Part No.	Figure 9-2 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits	Repair or Action
28-14281-5	17	Lower Hub (continued)	Recesses for the DU washers parallel to the lower surface within .001	+.0005	Not Repairable	Replace Lower Hub
			Damper Bolt Bushing Dia. .4995 to .5000	+.0005	Not Repairable	Replace Bushing
			Nicks, scratches, or corrosion	None Allowed	≤ 0.10 Deep	Blend and Polish Out Smooth
			Cracks	None Allowed	Not Repairable	Replace Lower Hub
28-14224-3	18	Spline Adaptor	Inboard face of adapter perpendicular to O.D.	+.0025 FIM	Not Repairable	Replace Adapter
			O.D. 3.6235 to 3.6245	-.0005	Not Repairable	Replace Adapter
			Spline pitting	.003 Deep	Not Repairable	Replace Adapter
			Spline corrosion	None Allowed	Surface Corrosion	Wire Brush to Remove
			Spline wear	.0015 on Side	Not Repairable	Replace Adapter
			Nicks, scratches, or corrosion	.010 Deep	≤ .010 Deep	Blend and Polish Smooth
			Cracks	None Allowed	Not Repairable	Replace Adapter
28-14251-1, -2	21	Stop Pad	Visual damage (cracks, chips, etc.)	None Allowed	Not Repairable	Replace Stop

Table 9-1. Inspection Requirements – Main Rotor Hub Assembly

Part No.	Figure 9-2 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits	Repair or Action
ECD092-1	22	Bearing	O.D. 2.4994 to 2.5000	No Tolerance Allowed	Not Repairable	Replace Bearing
			I.D. 1.7493 to 1.7500	No Tolerance Allowed	Not Repairable	Replace Bearing
			Ratcheting or roughness	None Allowed	Not Repairable	Replace Bearing
28-13236-1	23	DU Washer	Flatness	.005	Not Repairable	Replace Washer
			Thickness .090 to.093	-.003	Not Repairable	Replace Washer
28-14235-1	24	Spacer	Ends parallel	.0015 FIM	Not repairable	Replace Spacer
P/N	**Figure 9-3 Item #**	**Part Name**	**Inspection***	**Serviceable Limits***	**Repair Limits**	**Repair or Action**
28-14233-2	3	Flapping Pin	Threads (crossed or missing)	None Allowed	Not Repairable	Replace Pin
			Damper bolt hole Dia. .5005 to .5015	+.0015	Not Repairable	Replace Pin
			O.D. 1.7486 to 1.7492	-.0005	Not Repairable	Replace Pin
			Longitudinal scores or scratches	.011 deep	≤ .011 deep	Blend and polish out smooth
			Radial Scores	None Allowed	Not Repairable	Replace Pin
28-14233-3	3	Flapping Pin	O.D. 1.7483 to 1.7493	-.0005	Not Repairable	Replace Pin
			Inspect the remainder of the flapping pin following the inspection criteria listed for the -2 flapping pin.			

* All dimensions are in inches.

9-3 RETENTION ASSEMBLY

NOTE: Lamiflex bearings are discontinued. If the Lamiflex bearings must be replaced, the aircraft must be converted to a TT strap retention assembly. Refer to Table 2-2 *Vendor Contact Information* to obtain the TT strap retention assembly installation (STC SR03465CH). Installation instructions and instructions for continued airworthiness publications are provided with the STC. (F-28F S/N 832 and subsequent and 280FX S/N 2147 and subsequent are equipped from the factory with the TT strap retention assembly installation, STC SR03465CH.)

A. Removal – Retention Assembly (Figure 9-3)

(1) Remove the main rotor blade (Para. 9-8) from the retention assembly if the hub assembly is installed on the aircraft.

(2) Remove the main rotor dampers (Para. 9-5, C).

(3) Disconnect pitch change link (2) from the pitch change bellcrank (5) (Figure 9-1).

(4) Bend the lockwasher tab (4) away from the hinge pin retaining nut (5). Remove the nut using tool (T-0051-1 or T-0051-3).

(5) Lift the retention assembly off of the down stop and rotate the grip slightly so that the hinge pin (3) will clear the pitch arm. Slide or tap the hinge pin (3) from the retention assembly and remove the retention assembly from the hub.

(6) Remove DU washers (1) and shims (2), if any are installed, from both recesses in the universal block. Note the shim position(s) and retain the order for reassembly.

NOTE: If shims are installed behind DU washers, remove, note position, and save for reassembly.

B. Disassembly – Retention Assembly with Lamiflex Bearing (Figure 9-4)

NOTE: The blade grip, lamiflex bearing, and lamiflex bearing shims can be removed with the retention assembly installed on the hub assembly.

(1) Remove the main rotor blade (Para. 9-8) and disconnect the pitch change link (2) from the pitch change bellcrank (5) (Figure 9-1) if the retention assembly is installed on the hub assembly.

CAUTION: USE BRASS PROTECTOR PLATES ON THE VISE JAWS TO PREVENT DAMAGE TO SPINDLE SURFACE

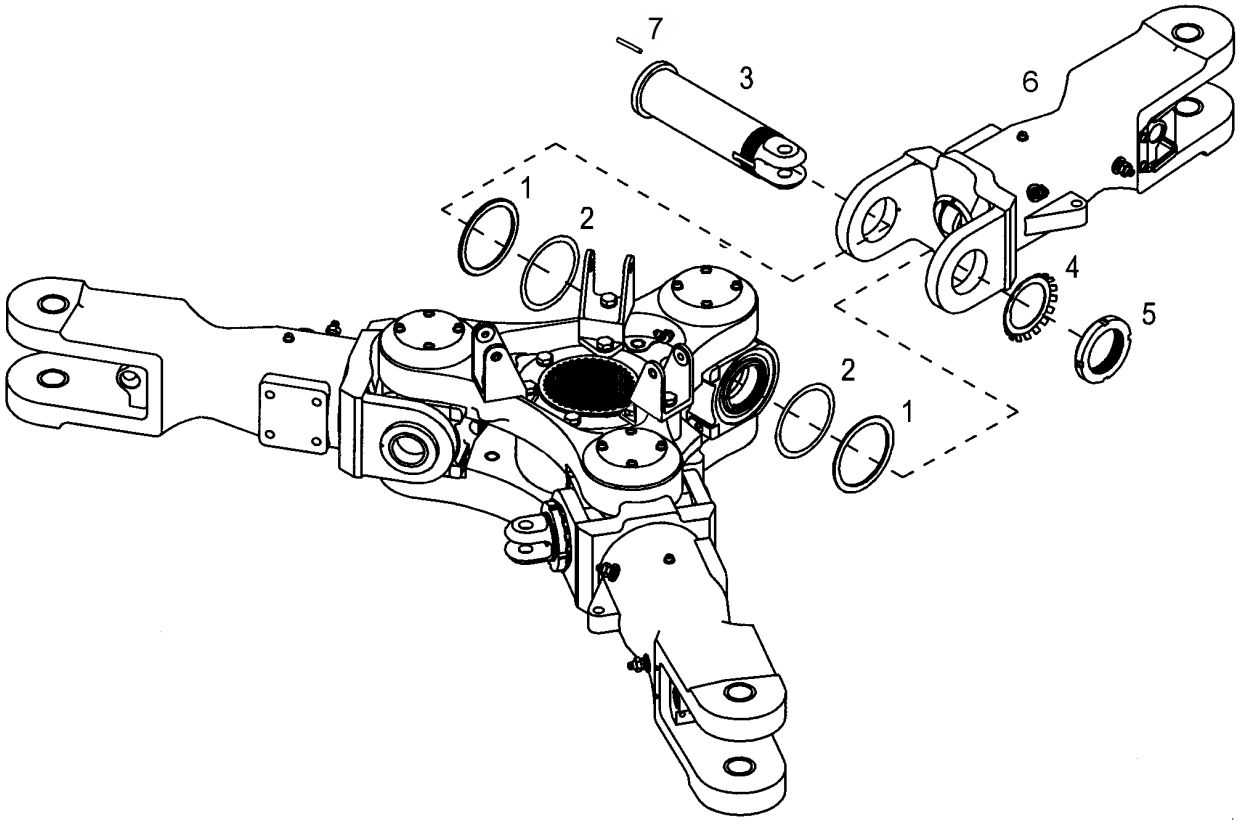
(2) Clamp the retention assembly in a vise in a vertical position.

(3) Remove hardware from the dust cover (18) and remove cover. Inspect for brass residue (chips or flakes) from the lamiflex bearing.

(4) Remove screw and inboard grease fitting.

(5) Remove cotter pin (17) from nut (16).

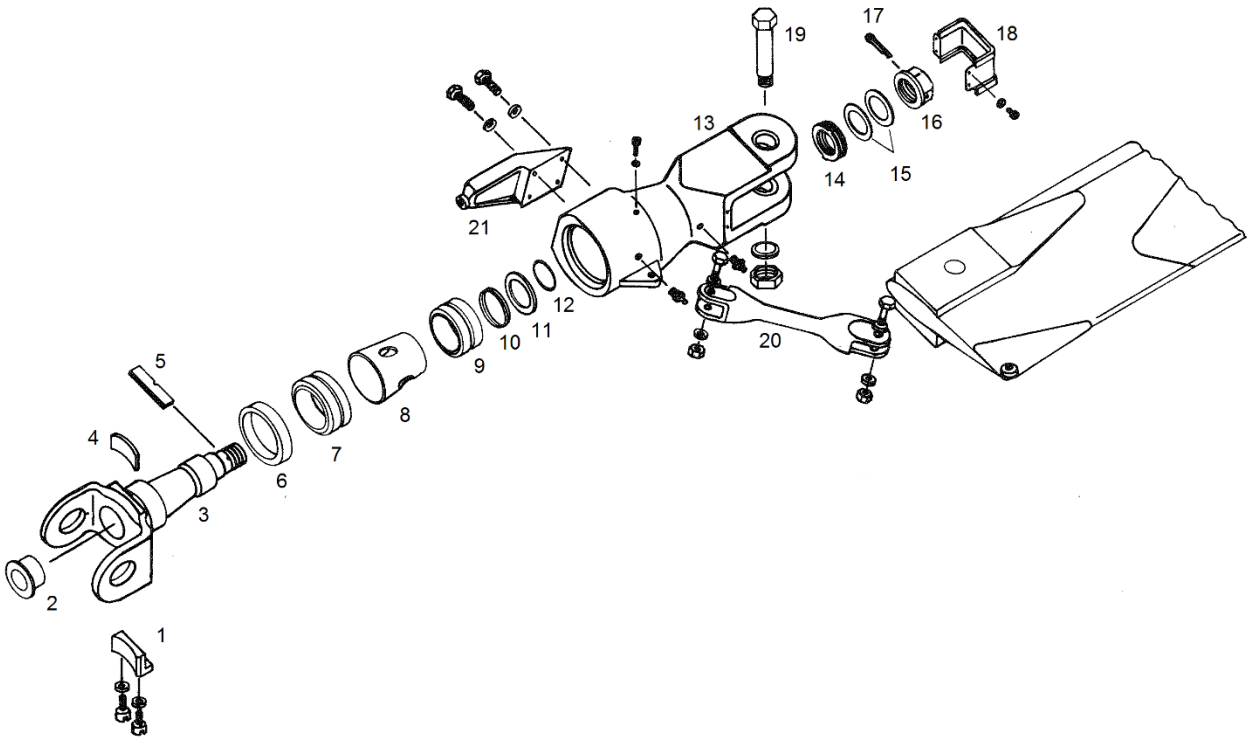
(6) Install tool T-0013 on nut (16) and remove nut.



NOTE: One shim P/N 28-14019-5 (Item 2) is installed, either the left or right side of the universal block.

1. DU Washer
2. Shim
3. Flapping Hinge Pin
4. Lock Washer
5. Nut
6. Retention Assembly
7. Pin

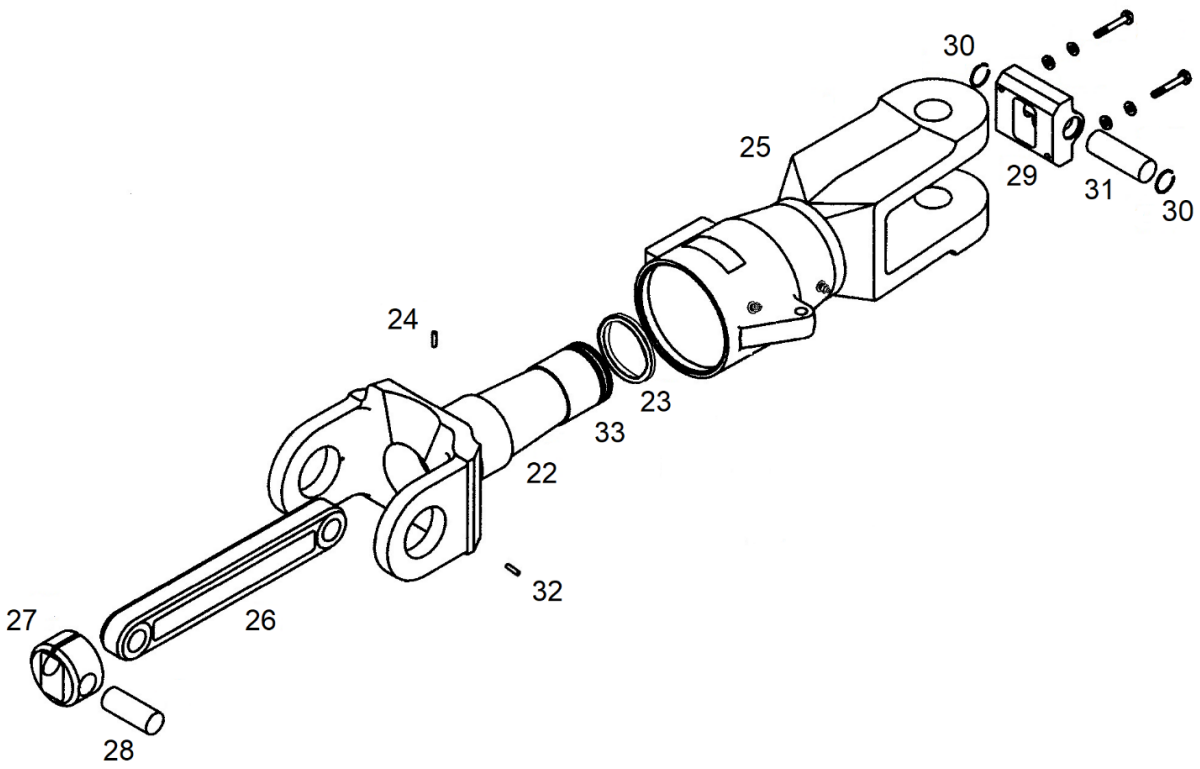
Figure 9-3. Retention Assembly Installation



1. Droop Stop
2. Dust Cap
3. Spindle
4. Flapping Stop
5. Nylatron Strap
6. Seal
7. Bearing
8. Spacer
9. Bearing
10. Retaining Ring
11. DU Washer
12. O-Ring
13. Blade Grip
14. Lamiflex Bearing
15. Shim
16 Retaining Nut
17. Cotter Pin
18. Dust Cover
19. Blade Retention Pin
20. Drag Link
21. Pitch Arm

Sheet 1 of 2
Lamiflex Bearing (Discontinued)

Figure 9-4. Retention Assembly

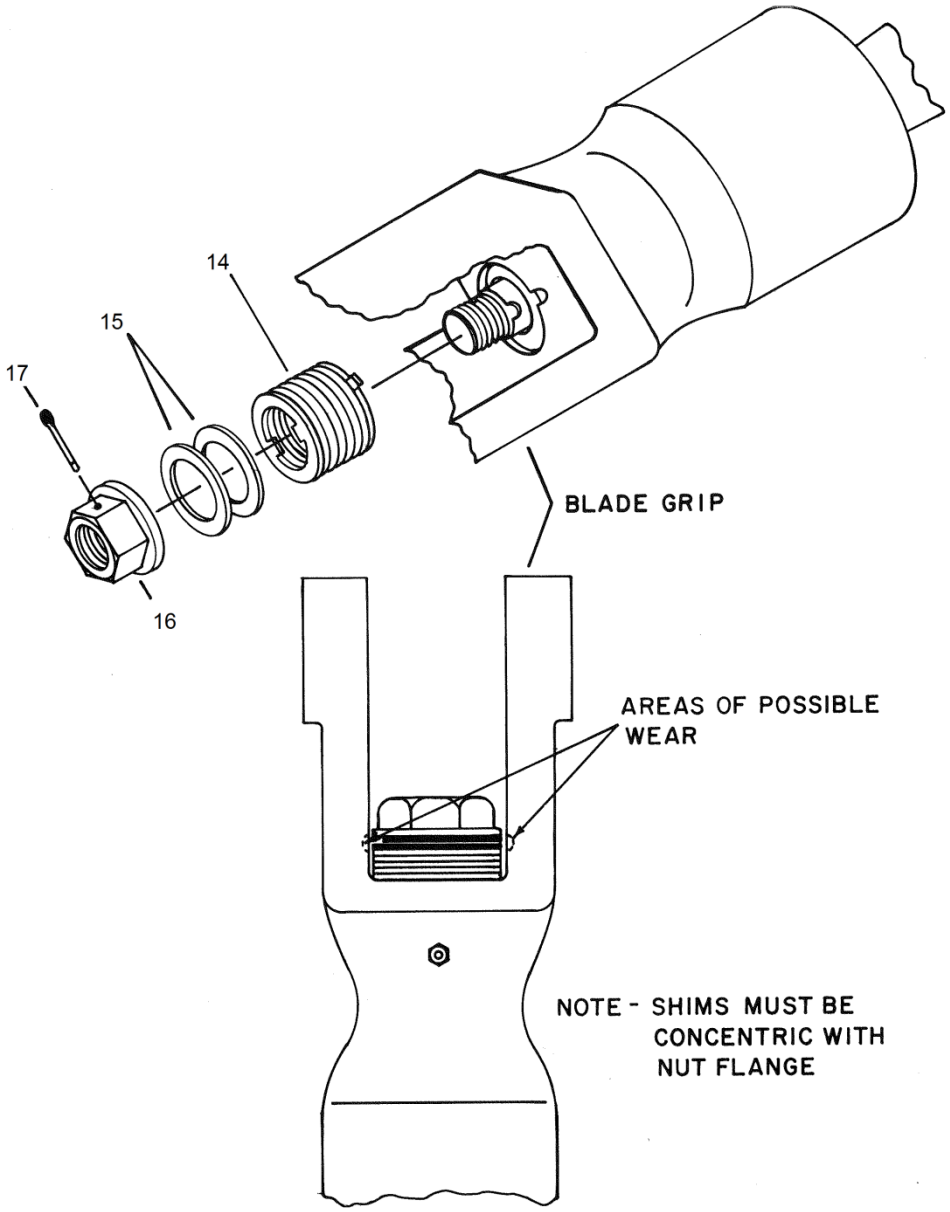


22.	Spindle	28.	Pin
23.	Seal	29.	Lug (Assembly) (Note 1)
24.	Pin	30.	Retaining Ring
25.	Grip Assembly	31.	Pin
26.	Tension-Torsion Strap	32.	Pin
27.	Cylinder (Assembly) (Note 1)	33	Adapter (Note 2)

Note 1: Component includes a cover.
Note 2: Shown as installed on the spindle.

Sheet 2 of 2
TT Strap (STC SR03465CH)

Figure 9-4. Retention Assembly



NOTE: Lamiflex bearings are discontinued.

Figure 9-5. Lamiflex Bearing Installation

(7) Remove shims (15), lamiflex bearing (14), and nylatron strap (5).

(8) Tap blade grip (13) with a plastic mallet to remove.

CAUTION: IF LAMIFLEX BEARING WEARS THROUGH THE NYLATRON STRAP, A CAREFUL INSPECTION OF THE SPINDLE IS REQUIRED. THE MAXIMUM DEPTH ALLOWED FOR A GROOVE WORN IN THE SPINDLE IS .020 INCH. GROOVE MUST BE BLENDED OUT BEFORE INSTALLING A NEW NYLATRON STRAP.

(9) Remove O-ring (12) and DU washer (11) from the spindle.

(10) Remove retainer ring (10) from the groove in the main rotor spindle (3).

(11) Remove the hinge pin alignment roll pin from ear of spindle by tapping from the inside out with a small punch; do not drive through.

(12) Install press tool between seal (6) and bearing (7) on the spindle.

(13) Place in a hydraulic press and press bearings (7) and (9), and spacer (8) from the spindle (press one bearing at a time).

(14) Remove seal (6) from the spindle.

(15) Removal and replacement of retention stops (1) and (4) are necessary only if the stops are damaged or adhesive has loosened.

(16) Remove cap (2) from the bore of the spindle.

CAUTION: WHEN CLEANING PARTS FOR INSPECTION DO NOT SUBMERGE LAMIFLEX BEARING IN ANY TYPE OF CLEANING SOLVENT OR DAMAGE TO BEARING WILL RESULT. CLEAN BEARING BY HAND USING DENATURED ALCOHOL.

B.1 Disassembly – Retention Assembly with TT Strap (STC SR03465CH)

NOTE: Refer to Figure 9-4 Sheet 1 and Sheet 2 for item number references.

NOTE: Refer to Para. G for removing the TT strap without disassembling the retention assembly.

(1) Remove the retention assembly from the main rotor hub (Para. 9-3, A).

(2) Clamp the retention assembly vertically in a vise.

CAUTION: USE BRASS PROTECTOR PLATES IN THE VISE JAWS TO PREVENT FROM DAMAGING THE RETENTION ASSEMBLY.

(3) Remove the dust cover (18) from the blade end of the retention assembly.

(4) Remove one of the retaining rings (30) securing the pin (31) in the lug (29) at the outboard end of the retention assembly. Remove the pin (31) and the remaining retaining ring (30).

(5) Pull the blade grip (25) from the spindle (22).

(6) Remove the seal (23) from the blade grip (25).

NOTE: Only remove the seal from the blade grip if replacing a defective seal or blade grip.

(7) Remove the spindle (22) from the vise and push the TT strap (26) back through the spindle.

(8) Remove the pin (28) from the cylinder (27) and separate the TT strap (26) from the cylinder.

NOTE: The pin used to secure the TT strap at the inboard end is not secured with retaining rings.

(9) Remove the retaining ring (10) from the spindle (22).

(10) If required, remove the pin (32) from the ear of the spindle (22) and remove pin (24) using a small punch.

NOTE: Do not remove the pin (24) from the spindle unless required.

(11) Install a press tool between the seal (6) and the bearing (7) on the spindle. Using a hydraulic press, press the bearings (7 and 9) and spacer (8) from the spindle.

(12) Remove the seal (6).

(13) Remove the retention stops (1 and 4).

NOTE: Removal/replacement of the retention stops are necessary only if the stops are damaged or the adhesive has loosened.

(14) Remove the hardware securing the lug (29) to the blade grip (25) and remove the lug.

(15) Remove the pitch arm (21) from the blade grip (25).

C. Inspection – Retention Assembly

(1) Refer to Table 9-2 and Table 9-2.1 for detailed inspection requirements.

D. Assembly – Retention Assembly with Lamiflex Bearing (Figure 9-4)

(1) If installing new retention stops (1) and (4) proceed as follows:

(a) Clean blocks (1) and (4) and spindle (3) with acetone or equivalent.

(b) Apply adhesive (DP 420 or equivalent) to the bonding surface of the stop and install the stop into position on the spindle. Install the screws to secure the droop stop.

(c) Allow the adhesive to dry until hard.

(2) Apply zinc chromate to the bore of the spindle (3) and install plug (2) in the end of the bore.

(3) Clamp spindle (3) in vise in a vertical position.

(4) Apply lubrication (MIL-PRF-81322) to seal surface of the spindle (3) and install seal (6).

NOTE: Seal is installed with the spring side of the seal facing toward the ears of the spindle.

(5) Grease bearings (7) and (9) through the small hole in the bearing.

NOTE: It is helpful to heat the bearings with a heat gun to aid installation.

WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

(6) Apply lubrication (MIL-PRF-81322) to the bearing surface and press bearing (7) onto spindle.

(7) Install spacer (8) on spindle.

(8) Lubricate (MIL-PRF-81322) the bearing surface and press the bearing (9) onto the spindle using a plastic mallet.

NOTE: Be sure bearings (7) and (9) are seated firmly against the shoulders of the spindle.

(9) Install retainer ring (10) in the groove of the spindle.

(10) Install DU washer (11) on the spindle (3).

NOTE: DU washer must be installed with the chamfered side of the washer facing inboard toward bearings.

(11) Install O-ring (12) on the spindle until seated against DU washer (11).

(12) Install tool T-0036 behind seal (6) with the chamfered side of the tool toward the large radius of the spindle.

(13) Lubricate (MIL-PRF-81322) the bore of blade grip (13) and install on the spindle and bearings. Tap the grip down with a plastic mallet until seal (6) is seated in the grip.

(14) Remove tool T-0036 and tap the blade grip down until fully seated.

(15) Install nylatron strap (5) inside lamiflex bearing (14). Ensure that the ends of the nylatron do not overlap.

(16) Install lamiflex bearing (14) while aligning tabs to slots in spindle and blade grip.

(17) Install nut (16) and torque until the grip is fully seated on the spindle. Release the torque on the nut.

(18) Shim (15) the nut until the cotter pin hole in the nut aligns with the hole in the spindle when the nut is tightened (5-15 in-lb/0.6-1.7 Nm).

NOTE: Add or subtract shims until the cotter pin hole in the nut aligns with the hole in the spindle when the nut is tightened finger tight. Do not under tighten the nut to align the holes. Do not over tighten the nut align the holes.

CAUTION: THE SHIMS MUST BE INSTALLED WITH THE O.D. OF THE SHIMS CONCENTRIC TO THE O.D. OF THE NUT AND THE LAMILFEX BEARING. IMPROPER ALIGNMENT OF THESE SHIMS CAN CAUSE WEAR TO THE INNER SURFACES OF THE MAIN ROTOR BLADE GRIP (FIGURE 9-5).

(19) Install nut (16) on the spindle and tighten until finger tight.

(20) Install cotter pin (17) after nut (16) has been properly shimmed and torqued. Bend the cotter pin ends to secure.

CAUTION: TO PREVENT LAMIFLEX BEARING DAMAGE, DO NOT OVER-ROTATE THE GRIP WITH THE PITCH CHANGE LINKS DISCONNECTED.

(21) Install dust cover (18) and secure with hardware.

(22) Install the flapping pin alignment pin into the spindle ear if it was removed.

(23) Install the pitch arm onto the blade grip. Install the hardware and torque to 75 in-lb/8.5 Nm. Lockwire the hardware (MS20995C32) in horizontal pairs.

(24) If the retention assembly is installed on the hub assembly, connect the pitch link (2) to the pitch change bellcrank (5) (Figure 9-1).

(25) Install the main rotor blade (Para. 9-13).

D.1 Assembly – Retention Assembly with TT Strap (STC SR03465CH)

(1) If removed, install the seal (23) into the blade grip (25) using the following procedure:

(a) Place the replacement seal on the seal installation tool (T-0149-13) with the open face against the tool.

(b) Place the blade grip over the seal installation tool.

(c) Place tool T-0149-11 onto the blade grip and using a press or other suitable device, press the seal into the blade grip seal bore.

(d) Remove the installation tools.

(2) If required, bond the covers for the cylinder (27) and lug (29) using the following procedure (Figure 9-4):

(a) Remove residual adhesive from the cover and cylinder/lug as required.

(b) Slightly abrade the bonding surfaces of the covers, cylinder, and lug.

(c) Bond the cover to the cylinder and/or lug using DP420 adhesive. Allow the DP420 adhesive to cure for 24 hours.

NOTE: Follow the mixing and application instructions for the DP420 adhesive or the DP420 will not cure or adhere properly.

(d) Apply a light bead of silicone sealant (732-RTV) around the cover.

(3) If installing new retention stops (1 and 4), follow the procedures in Para. 9-3, D, (1).

(4) Clamp the spindle (22) in a vise in the vertical position.

CAUTION: USE BRASS PROTECTOR PLATES IN THE VISE JAWS TO PREVENT FROM DAMAGING THE RETENTION ASSEMBLY.

(5) If removed, apply a small amount of Loctite 635 (green) to the pin (24) and press the pin into the spindle (22) until the end is slightly recessed from the seal surface

(6) Lubricate (MIL-PRF-81322) the seal surface of the spindle (22) and install the seal (6) with the spring side facing toward the ears of the spindle.

(7) Lubricate (MIL-PRF-81322) the bearing surface and install the bearing (7) using a plastic mallet.

(8) Install the spacer (8).

(9) Lubricate (MIL-PRF-81322) the bearing surface and install the bearing (9) using a plastic mallet.

NOTE: Ensure the bearings are seated firmly against the spindle shoulders.

(10) Install the retaining ring (10).

(11) Install tool (T-0036) behind the seal with the chamfered side of the tool toward the large radius of the spindle (22).

(12) Remove the spindle (22) from the vise and insert the grip installation pilot tool (T-0149-12) into the spindle.

(13) Lubricate (MIL-PRF-81322) the seal surface on the adapter (33) in the outboard end of the spindle.

(14) Lubricate (MIL-PRF-81322) the bore of the blade grip and install the grip (25) on the spindle (22). Tap the grip onto the spindle with a plastic mallet until the seal in seated in the grip. Remove the pilot tool (T-0149-12) and the seal tool (T-0036) from the spindle.

(15) Install the lug (29) onto the end of the blade grip. Apply Loctite® 222MS to the threads of the hardware and install the hardware and torque.

(16) Install the TT strap (26) into the cylinder (27) so that the chamfer on the cylinder is facing inboard (center of main rotor hub) when the TT strap is installed in the spindle and install the retention pin (28).

(17) Lubricate (MIL-PRF-81322) the portion of the inner spindle bore (22) that contacts the O.D. of the cylinder (27).

(18) Install the TT strap (26) into the spindle (22) and ensure the groove in the cylinder engages the pin (24) in the spindle.

(19) Install one of the retaining rings (30) into the lug (29). Align the TT strap (26) to the lug (29) and install the retention pin (31). Install the other retaining ring (30).

(20) Apply a bead of silicone sealant (732-RTV) around the perimeter of the cylinder assembly to form a seal between the cylinder and the spindle.

(21) Install pin (32) into the spindle ear if it was removed.

(22) Install the retention assembly onto the main rotor hub assembly (Para. 9-3, E).

(23) Install the pitch arm (21) onto the blade grip (25). Install the hardware and torque to 75 in-lbs/8.5 Nm. Lockwire (MS20995C32) the hardware in horizontal pairs.

(24) Service (purge lubricate) the blade grip (Para. 4-28).

NOTE: It is necessary to rotate the grip in the feather axis while purge lubricating the retention assembly. This will prevent damage to the seal.

CAUTION: DO NOT OVER ROTATE THE GRIP WHEN THE PITCH LINKS ARE DISCONNECTED (18° MAX).

(a) Ensure the seal (6) is not dislocated from the blade grip (25). If it has moved:

1 Remove the purge screw from the top of the blade grip.

2 Insert the blade of a flathead screwdriver between the seal and the spindle.

3 Carefully work the seal back into the grip.

NOTE: It is normal if grease is displaced out of the purge hole as the seal is pushed back into place.

4 Reinstall the purge screw.

(25) Install the dust cover (18).

E. Installation (Method 1) – Retention Assembly (Figure 9-3)

NOTE: Use the following procedure to install a retention assembly if the flapping bearings are installed in the universal blocks using the shimming procedure in Para. 9-4, C. (If not shimmed per Para. 9-4, C, use the procedure in Para. 9-3, F.)

NOTE: Match each retention assembly to the location marked in the upper hub adapter (reference Para. 9-2, B (3)).

NOTE: Installing a pilot (Figure 9-6) will keep the spacer and shims in the proper location while installing the hinge pin.

(1) Lubricate hinge pin (3) with grease (MIL-G-25537).

(2) Apply grease (MIL-G-25537) to both sides of one DU washer (1) recess and to both sides of a P/N 28-14019-5 shim (2). Install the shim on the greased bearing groove.

NOTE: If installing the shim to the right side of the universal block, then install the shims for the other two universal blocks on the right. Likewise, if installing the shim to the left side, then install all shims to the left of the universal block.

(3) Install DU washers (1) in each side of U-block with the chamfered side of DU washers facing inboard toward the U-block.

NOTE: Ensure that the correct retention assembly is being installed on the shimmed universal block.

(4) Carefully slide the retention assembly into position over the DU washer and U-block.

NOTE: Enstrom recommends replacing Flapping Hinge Pin, P/N 28-14233-1, with Flapping Hinge Pin, P/N 28-14233-3, when reinstalling the main rotor retention assemblies after the flapping bearings have been shimmed. The Flapping Hinge Pin, P/N 28-14233-3, is manufactured to closer tolerances for bearing fit and will improve service life. Flapping Hinge Pin, P/N 28-14233-1, is an acceptable alternate and serviceable pins may be reinstalled.

(5) Twist the grip slightly to allow the hinge pin (3) to be installed; do not over twist to avoid damaging the lamiflex bearing, if equipped. Align the roll pin slot in the hinge pin with the roll pin and seat the hinge pin. Tap the roll pin flush with the hinge pin if it protrudes from the hinge pin.

(6) Lubricate nut (5) (MIL-PRF-2105, -23699, -81322) in the threads and on the surface of the nut where it will contact the lock washer (4).

(7) Install the lock washer (4) and nut (5) on the hinge pin (3).

(8) Insert a long punch into the damper rod-end attach holes in the flapping pin. Torque the nut using tool (T-0051-3) to 150-175 ft-lb/203.4-237.3 Nm. The nut may be torqued to 175 ft-lb/ 238.6 Nm for aligning one of the lockwasher tabs. While torqueing the nut, pull against the punch to avoid shearing off the roll pin that locates the head of the pin against the spindle on the pitch arm side of the retention assembly.

CAUTION: DO NOT PROCEED UNLESS THE UNIVERSAL BLOCK HAS BEEN ASSEMBLED (SHIMMED) IN ACCORDANCE WITH PARA. 9-4, C.

(9) Check the flapping bearing drag resistance at the blade pin. Initially, the grip should not stay up. Add shim thickness in 0.005 inch increments to achieve sufficient resistance to hold the grip in the up-stop position at 150 ft-lb/203.4 Nm. Remove one shim and verify the flapping bearing moves freely.

(10) Secure the nut by bending one of the tabs on the lockwasher (4) into a slot in the nut.

(11) Lubricate (MIL-G-25537) the flapping bearings (Para. 4-29).

(12) Repeat the procedure for the remaining retention assemblies.

(13) Install the main rotor damper (Para. 9-5, H), connect the pitch change link to the pitch change bellcrank and the pitch arm, and install the main rotor blade (Para. 9-13).

(14) Perform a maintenance test flight (Para. 12-13).

F. Installation (Method 2) – Retention Assembly (Figure 9-3)

NOTE: Enstrom recommends internal shimming (Method 1) to increase the service life.

NOTE: Use the following procedure to install a retention assembly until the flapping bearings are installed in the universal blocks using the shimming procedure in Para. 9-4, C.

NOTE: Match each retention assembly to the location marked in the upper hub adapter (reference Para. 9-2, B (3)).

NOTE: Installing a pilot (Figure 9-6) will keep the spacer and shims in the proper location while installing the hinge pin.

(1) Lubricate hinge pin (3) with grease (MIL-G-25537).

(2) Install DU washers (1) in each side of U-block with the chamfered side of DU washers facing inboard toward the U-block.

(3) Carefully slide the retention assembly into position over the DU washer and U-block.

NOTE: Enstrom recommends replacing Flapping Hinge Pin, P/N 28-14233-1, with Flapping Hinge Pin, P/N 28-14233-3, when reinstalling the main rotor retention assemblies after the flapping bearings have been shimmed. The Flapping Hinge Pin, P/N 28-14233-3, is manufactured to closer tolerances for bearing fit and will improve service life. Flapping Hinge Pin, P/N 28-14233-1, is an acceptable alternate and serviceable pins may be reinstalled.

(4) Twist the grip slightly to allow the hinge pin (3) to be installed; do not over twist to avoid damaging the lamiflex bearing, if equipped. Align the roll pin slot in the hinge pin with the roll pin and seat the hinge pin. Tap the roll pin flush with the hinge pin if it protrudes from the hinge pin.

(5) Install the lock washer (4) and nut (5) on the hinge pin (3).

(6) Torque the nut to 50-100 ft-lb/68.2-136.4 Nm using tool (T-0051-3). Ensure the retention assembly does not remain in the up-stop position.

(a) Check the flapping bearing drag resistance at the flapping pin. Initially, the grip should not stay up. If the retention assembly stays up, remove shims in 0.005-inch increments until the retention assembly will drop with no resistance when the nut is torqued.

NOTE: Shims may be installed as required on the inboard side of the DU washers to avoid excessive torque in obtaining the flapping preload. All three retention assemblies should have an equal flapping preload.

(7) Lubricate the U-block lead lag and flapping bearings (Figure 4-2, Para. 4-30) and re-check the retention assembly in accordance with step (6). Reshim and retorque the nut, if required.

(8) Bend one of the tabs on the lockwasher (4) into a slot in the nut when the proper preload has been obtained.

(9) Install the main rotor damper (Para. 9-5, H), connect the pitch change link to the pitch change bellcrank and the pitch arm, and install the main rotor blade (Para. 9-13).

(10) Perform a maintenance test flight (Para. 12-13).

G. Tension-Torsion Strap Removal

NOTE: The following procedure is performed for changing the tension-torsion (TT) straps. The blade grip does not need to be removed from the spindle when changing the TT straps

(1) Remove the retention assembly from the main rotor hub (Para. 9-3, A).

(2) Remove the dust cover (18) from the blade end of the retention assembly (Figure 9-4, Sheet 1).

(3) Remove one of the retaining rings (30, Figure 9-4, Sheet 2) securing the pin (31) in the lug (29) at the outboard end of the retention assembly. Remove the pin and the remaining retaining ring (30).

(4) Use a razor blade or sharp knife to cut the sealer securing the cylinder (27) into the root of the spindle (22).

CAUTION: TAKE CARE NOT TO DAMAGE THE SPINDLE OR CYLINDER.

(a) Using a non-metallic scraper remove the silicone sealant from the surfaces of the cylinder (27) and of the spindle (22).

(5) Push the TT strap (26) back through the spindle (22).

(6) Remove the pin (28) from the cylinder (27) and separate the TT strap (26) from the cylinder.

NOTE: The pin (28) used to secure the TT strap at the inboard end is not secured with retaining rings.

H. Tension-Torsion Strap Installation

(1) Install the TT strap (26) into the cylinder (27) so that the chamfer on the cylinder is facing inboard (center of main rotor hub) when the TT strap is installed in the spindle and install the pin (28).

(2) Lubricate (MIL-G-25537) the portion of the inner spindle bore (22) that contacts the O.D. of the cylinder (27).

(3) Install the TT strap (26) into the spindle (22) and ensure the groove in the cylinder (27) engages the pin (24) in the spindle.

(4) Install one of the retaining rings (30) into the lug (29). Align the TT strap (26) to the lug and install the pin (31). Install the other retaining ring (30).

(5) Verify proper installation of both retaining rings (30).

(6) Apply a bead of silicone sealant (732-RTV) around the perimeter of the cylinder (27) to form a seal between the cylinder and the spindle (22).

(7) Install the dust cover (18).

(8) Reinstall retention assembly (Para. 9-3, E or F).

Table 9-2. Inspection Requirements – Retention Assembly

Part Number	Figure 9-4 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-14240-1	1	Droop Stop	General Condition	.003 wear	Not Repairable	Replace Stop
28-14282-13 (See Note 3)	3	Spindle	Lamiflex bearing tab slot width .187 to .189	+.002	Not Repairable	Replace Spindle
			Small bearing surface Dia. 1.9996 to 2.0003	-.0003	Not Repairable	Replace Spindle
			Large bearing surface Dia. 2.4996 to 2.5002	-.0003	Not Repairable	Replace Spindle
			Seal surface Dia. 2.872 to 2.878	-.002	Not Repairable	Replace Spindle
			Flapping pin bore Dia. 1.7495 to 1.7500	+.0005	Not Repairable	Replace Spindle
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Spindle
			Nicks, scratches, or corrosion	None Allowed	≤ .010 deep	Blend and polish out smooth
			Cracks	None Allowed	Not Repairable	Replace Spindle
28-14231-1	4	Up Stop	General condition	.003 wear	Not Repairable	Replace Stop
			Cracks	None Allowed	Not Repairable	Replace Stop
28-14311-1	5	Nylatron Strap	Cracks or worn through	None Allowed	Not Repairable	Replace Strap

Table 9-2. Inspection Requirements – Retention Assembly

P/N	Figure 9-4 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
40NBC20-52YZP	7	Bearing	O.D. 3.2492 to 3.2500	No Tolerance Allowed	Not Repairable	Replace Bearing
			I.D. 2.4993 to 2.5000	No Tolerance Allowed	Not Repairable	Replace Bearing
			Ratcheting or roughness	None Allowed	Not Repairable	Replace Bearing
28-14261-1	8	Spacer	Length 3.061 to 3.062	-.001	Not Repairable	Replace Spacer
			Ends parallel	Within .0012 FIM	Not Repairable	Replace Spacer
32NBC20-44YZP	9	Bearing	O.D. 2.7494 to 2.7500	No Tolerance Allowed	Not Repairable	Replace Bearing
			I.D. 1.9993 to 2.0000	No Tolerance Allowed	Not Repairable	Replace Bearing
			Ratcheting or roughness	None Allowed	Not Repairable	Replace Bearing
28-14313	11	DU Washer	Thickness .090 to.093	-.003	Not Repairable	Replace Washer
28-14279-1, -3 (See Note 3)	13	Grip Assembly	Blade retention bolt bore Dia. .875 to .876	+.0005	Not Repairable	Replace Blade Grip
			Large bearing bore Dia. 3.2512 to 3.2522	+.0018	Not Repairable	Replace Blade Grip
			Small bearing bore Dia. 2.7511 to 2.7519	+.0011	Not Repairable	Replace Blade Grip
			Thru bore Dia. 1.5145 to 1.5165	+.0015	Not Repairable	Replace Blade Grip
			Drag link ear width .745 to .747	-.001	Not Repairable	Replace Blade Grip

Table 9-2. Inspection Requirements – Retention Assembly

P/N	Figure 9-4 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-14279-1, -3 (continued) (See Note 3)	13	Blade Grip (continued)	Threads (crossed or missing)	None Allowed	Not Repairable	Replace Blade Grip
			Nicks, scratches, or corrosion	None Allowed	≤ .010 deep	Blend and polish out smooth
			Cracks	None Allowed	Not Repairable	Replace Blade Grip
28-14320-12, -15	14	Lamiflex Bearing	Thickness .770-.790	(See Notes 1, 2)	Not repairable	(See Note 3)
			External to internal tab angle 12° (-12)	±1/2°	Not repairable	(See Note 3)
			External to internal tab angle 15° (-15)	±1/2°	Not repairable	(See Note 3)
			Column for separations	None allowed	Not repairable	(See Note 3)
28-14335	16	Nut	Thrust face for flatness	.0015	Not Repairable	Replace Nut
			Threads (rolled or missing)	None Allowed	Not Repairable	Replace Nut
28-14007-1,-3	19	Blade Retention Bolt	O.D. .8738 to .8745 (-1) O.D. .8733 to .8740 (-3)	-.0002	Not Repairable	Replace Bolt

Notes:
1. Lamiflex bearings that are found swelled from grease contamination should be cleaned with denatured alcohol and checked for delamination. If the bearing is swelled beyond the limits (.790” thick), they may still be serviceable if they can be reinstalled in accordance with Para. 9-3 and do not cause binding in the controls.
2. Any bearing that shows evidence of bulging around the outer circumference of the elastomer segments, excessive axial swelling, visual delamination of the segments or the expulsion of shim fragments on the outside diameter, should be replaced by an airworthy bearing prior to the next flight.
3. Lamiflex bearings are discontinued. If the Lamiflex bearings must be replaced, the aircraft must be converted to TT strap retention assembly. Spindle P/N 28-14282-13 and Grip Assembly P/N 28-14279 may be reworked for the TT strap installation. Refer to Enstrom F-28/280 series Illustrated Parts Catalog, Figure 4-2.1 for parts. See Table 9-2.1 for inspection requirements for STC items.

Table 9-2. Inspection Requirements – Retention Assembly

P/N	Figure 9-4 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-14007 (continued)	19	Blade Retention Bolt (continued)	Threads (crossed or missing)	None Allowed	Not Repairable	Replace Bolt
			Nicks, scratches, or corrosion	None Allowed	≤ .010 deep	Blend and polish out smooth
			Cracks	None Allowed	Not Repairable	Replace Bolt
28-14283	20	Drag Link	Distance between blade grip ears .748	± .001	Not Repairable	Replace Link
			Distance between blade root ears .564 to .566	± .0005	Not Repairable	Replace Link
			Retention bolt hole Dia. (2 places) .3745 to .3750	-.0002	Not Repairable	Replace Link
			Nicks, scratches, or corrosion	None Allowed	≤ .010 deep	Blend and polish out smooth
			Cracks	None Allowed	Not Repairable	Replace Link
28-14278	21	Pitch Arm	Pitch change link bolt and mount bolt hole Dia. (5 places) .312 to .315	-.001	Not Repairable	Replace Arm
			Nicks, scratches, or corrosion	None Allowed	≤ 0.10 deep	Blend and polish out smooth
			Cracks	None Allowed	Not Repairable	Replace Arm

* All dimensions are in inches.

Table 9-2.1. Inspection Requirements – Retention Assembly

P/N	Figure 9-4 Sheet 2 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
AA-28-14385-13 28-14385-13 28-14385-15	22	Spindle	Refer to manufacturer's instructions for continued airworthiness (ref. Table 2-2)			
28-14386-5 AA- 28-14386-1	25	Grip Assembly	Refer to manufacturer's instructions for continued airworthiness (ref. Table 2-2)			
AA-ECD-084-280	26	Tension-Torsion Strap	Refer to manufacturer's instructions for continued airworthiness (ref. Table 2-2)			

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9-4 UNIVERSAL BLOCK ASSEMBLY

A. Disassembly – Universal Block (Figure 9-2)

(1) Remove upper and lower bearings (22) and DU washers (23) from U-block (15).

(2) Press flapping bearings (22), spacer (24), and shims (25) from bore of U-block.

NOTE: Flapping bearings can be removed from the universal blocks using the Flapping Bearing Removal/Installation Tool T-0151-1 when the universal blocks are installed on the aircraft.

(3) Remove screws and stop blocks (21) if visual damage appears on the blocks.

(4) Remove grease fittings (20).

B. Inspection – Universal Block

(1) Refer to Table 9-1 for detailed inspection requirements.

C. Assembly – Universal Block (Figure 9-2, Figure 9-6, Figure 9-7, Figure 9-8, Figure 9-9)

(1) Install stop blocks (21) and secure with screws.

(2) Index mark the universal blocks and retention assemblies as sets.

(3) Measure the stack up of two bearings (22) and one spacer (24) and measure the distance between the spindle fork (refer to Figure 9-6).

(4) If the bearing and spacer stack up (DIM. X) is less than the distance between the spindle fork (DIM. Y), add shims (25) (P/N 28-14009-x) between the bearings and the spacer to create a zero tolerance fit.

NOTE: Use an arbor press to install the flapping bearings if the main rotor hub is disassembled. If the main rotor hub is assembled, use the Universal Block Bearing Tool, T-0151-1, to install the flapping bearing.

(5) Lubricate (MIL-G-25537) the bore of the U-block and the O.D. of the flapping bearings. Install a DU washer (23) in the recessed area on the "forward" side of the U-block and place the U-block in an arbor press with the "forward side" and DU washer up. Press a flapping bearing (22) into the U-block until it is flush with the DU washer (Figure 9-7).

NOTE: If desired, an alignment/installation pilot (included with the tool, T-0151-1) can be fabricated to aid in the installation of the bearing, spacer, and shims into the universal block (refer to Figure 9-9). This pilot may also be used to aid in installation of the flapping pin when installing the retention assemblies.

(6) Rotate the U-block in the press and install the spacer (24) and shims (25) (P/N 28-14009-x), if required. Press the other flapping bearing into the bore until seated against the spacer. Ensure that the first flapping bearing is still flush with the DU washer.

(7) Remove the DU washer.

(8) Repeat the procedure for the remaining universal blocks.

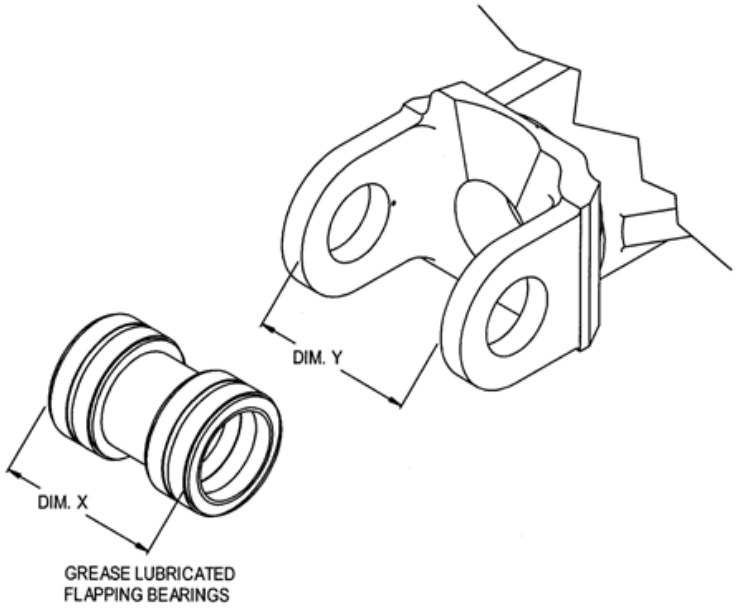


Figure 9-6. Flapping Bearing and Spindle Dimension Check

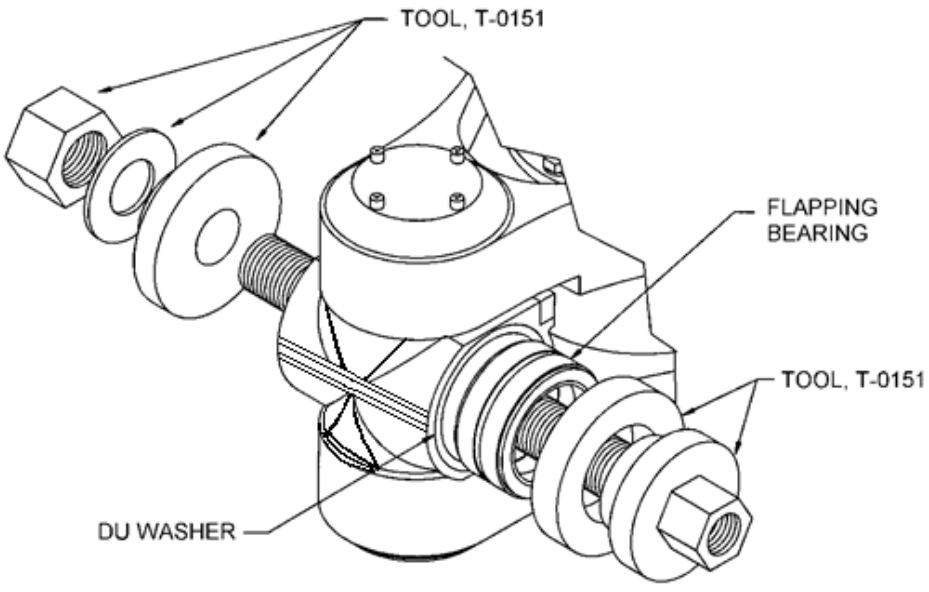


Figure 9-7. “Forward” Flapping Bearing Installation

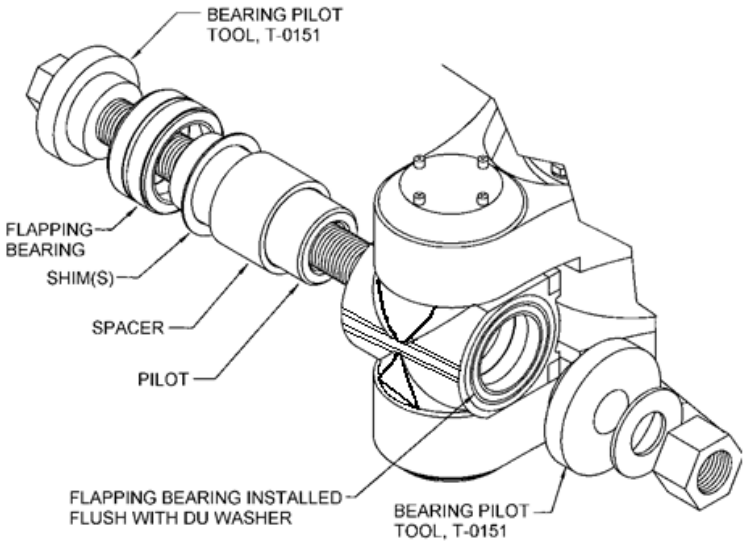


Figure 9-8. "Aft" Flapping Bearing and Spacer Installation

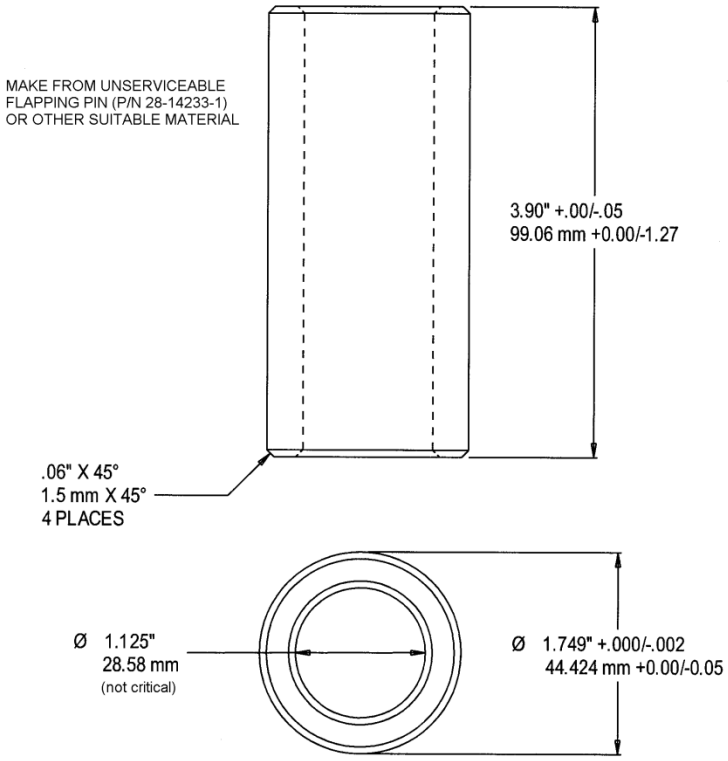


Figure 9-9. Flapping Bearing Installation Alignment Tool

9-5 DAMPERS

A. General Information – Dampers

The damper assembly consists of a damper housing, a piston and restrictor assembly, and a reservoir with two relief valves. The damper is used to damp lead-lag movement of the main rotor blades. Proper servicing and maintenance are required to keep the dampers operating at an equal rate.

B. Troubleshooting – Dampers

(1) Refer to Para. 12-1, for damper-related main rotor system troubleshooting.

(2) Lead-Lag Check

(a) Move blade slowly fore and aft to cycle damper.

NOTE: The damper should offer resistance through the complete cycle – no undamped motion.

C. Removal – Dampers

(1) Remove the damper as follows (Figure 9-10):

(a) Remove cotter pin (8), nut (7) and washers (6).

(b) Remove bolt (5) and washer (6).

(c) Pivot the damper to remove spacers (9) on top and bottom of damper rod end.

(d) If required, remove the center bolt (4) and hardware of the pitch change bellcrank (Figure 9-1).

NOTE: If the bolt is installed in the reverse direction, the bolt (4) and hardware must be removed to facilitate removal of the inboard damper pivot bolt.

(e) Remove nut (4) and washer (3) from inboard damper pivot bolt (1) and remove bolt (1) and washer (2).

(f) Remove the damper from the hub assembly.

D. Disassembly – Dampers (Figure 9-11)

(1) Remove the damper from the helicopter (Para. 9-5, C).

(2) Disengage the locking feature on the rod end (20), as applicable:

(a) Straighten the locking washer tabs (29) (-1 and -5 dampers) or remove the safety wire from the locking key (18).

(3) Loosen jam nut (19) and remove the rod end (20) from the piston (6) or (30):

(a) Use tool T-0005 to hold the piston.

(4) Remove reservoir plugs (26) and pour the damper fluid from the reservoir.

(5) Remove reservoir plugs (23) and O-rings (24).

(6) Remove bolts (28) and washers (16) securing the reservoir to the damper and remove the reservoir.

(7) Remove sleeves (27) and O-rings (25).

(8) If troubleshooting indicates a malfunctioning relief valve, remove the relief valve (22) using a 9/16" deep-well socket. Refer to Para. 9-5, F for replacement instructions.

CAUTION: THE RELIEF VALVE PRESSURE HAS BEEN PRESET AT THE FACTORY AND CANNOT BE ADJUSTED IN THE FIELD. RETURN A FAULTY VALVE TO ENSTROM HELICOPTER SERVICE FOR INSPECTION AND VALVE ADJUSTMENT/EXCHANGE.

(9) Remove bolts (17) and washers (16) from the damper housing and cap (10).

(10) Rotate end cap (10) approximately 45° using a soft mallet, and remove the end cap by tapping outward on its corners.

NOTE: Remove all burrs from piston shaft to prevent damage to the brass sleeve and seals during end cap removal.

(11) Pour the damper fluid from the damper housing.

(12) Tap piston (6) or (30) out of housing with a nylon drift and remove O-ring or seal pack (9) from the piston.

CAUTION: DO NOT DAMAGE THE I.D. OF THE SLEEVES DURING SEAL AND WIPER REMOVAL.

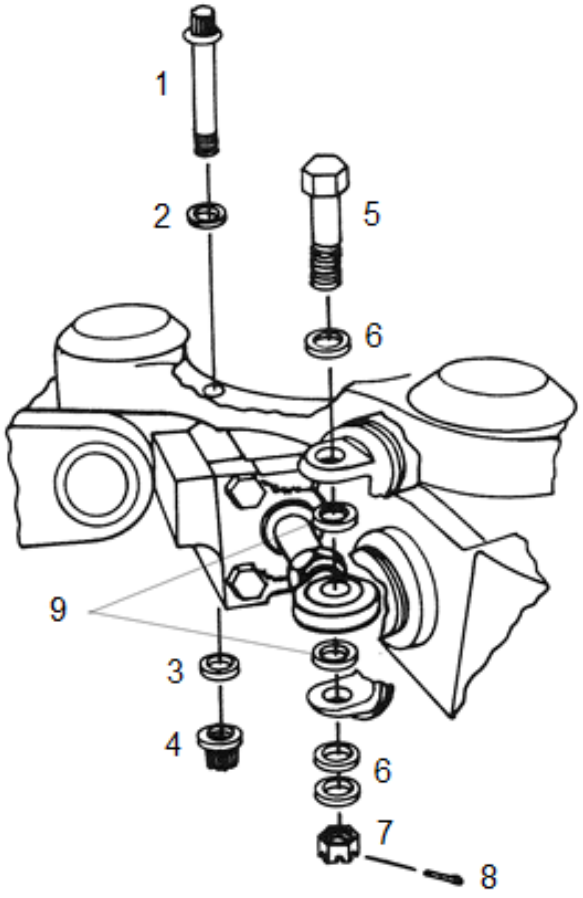
NOTE: Remove the brass sleeve assemblies only if the seals are going to be replaced so as to reduce wear on the cover (10) and damper housing (1) bore.

NOTE: Threadlocker is applied to the sleeves (5) and (12) upon initial installation at the factory. Heating the housing and the end cap to 250°F/121°C may aid removal of the sleeves.

(13) Press the brass sleeves (5) and (12) from the end cap (10) and the damper housing (1). Remove seals (14) and wipers (13) from the brass sleeves. If evident, remove threadlocker residue with a suitable hand tool (pick).

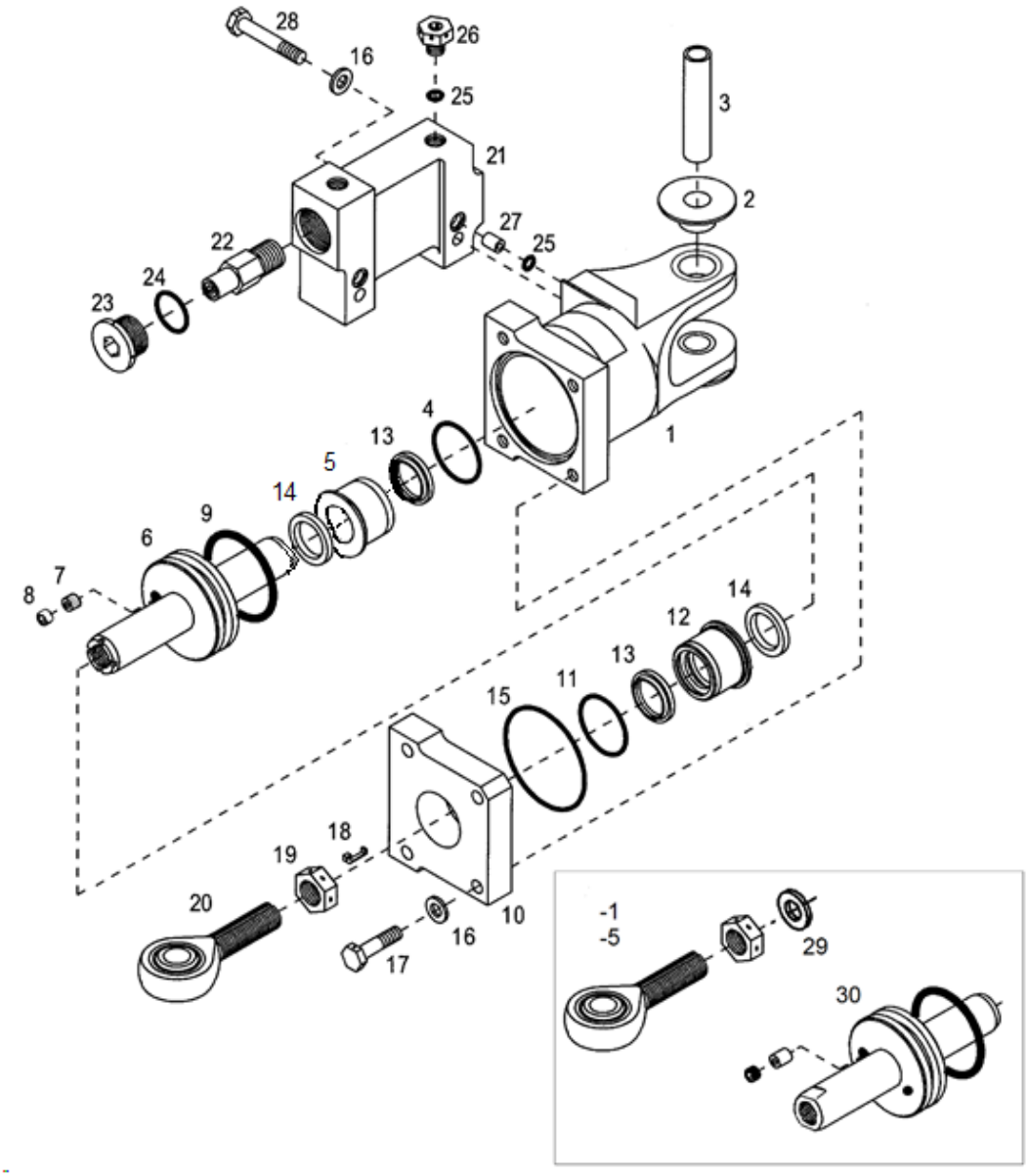
(14) Install tool T-0095 between ears of damper housing and press bushing (3) out using a suitable size drift.

(15) Inspect the face of the bushings (2) for fretting and wear. DO NOT remove the bushings unless replacement is required. Upon replacement, bushings must be reamed with a ½" line reamer.



1. Inboard Pivot Bolt
2. Chamfered Washer
3. Washer
4. Nut
5. Bolt
6. Washer
7. Nut
8. Cotter Pin
9. Spacer

Figure 9-10. Damper Installation



1.	Damper Housing	11.	O-Ring	21.	Reservoir
2.	Bushing	12.	Sleeve	22.	Valve Assembly
3.	Bushing	13.	Wiper	23.	Cap Plug
4.	O-Ring	14.	Seal	24.	O-Ring
5.	Sleeve	15.	O-Ring	25.	O-Ring
6.	Piston	16.	Washer	26.	Plug
7.	Restrictor Sleeve	17.	Bolt	27.	Sleeve
8.	Set Screw	18.	Lock Key	28.	Bolt
9.	O-Ring or Seal Pack	19.	Jam Nut	29.	Washer
10.	End Cap	20.	Damper Rod End Bearing	30.	Piston (-1, -5)

Figure 9-11. Hydraulic Damper Assembly

E. Damper – Inspection

(1) Refer to Table 9-3 for inspection criteria.

F. Relief Valve Replacement (Figure 9-11)

NOTE: The relief valve pressure has been preset at the factory and cannot be adjusted in the field. Return faulty valves to Enstrom Helicopter Service for inspection and valve adjustment/exchange.

(1) Remove damper from the aircraft (Para. 9-5, C).

(2) Remove plugs (26) and O-rings (25).

(3) Drain the damper fluid.

(4) Remove plugs (23) and O-rings (24).

(5) Remove relief valve (22) through the open ports with a 9/16” deep-well socket.

(6) Install new relief valve (22). Torque 350 in-lb/39.8 Nm.

(7) Install O-rings (24) and plugs (23). Torque plugs 350 in-lb/39.5 Nm.

(8) Fill reservoir with fluid (SF96-20) through the top bleeder ports.

(9) Install O-rings (25) and plugs (26). Torque plugs 40-60 in-lb/4.5-6.8 Nm

(10) Follow the servicing procedure to ensure all air is purged from the damper (Para. 4-18).

(11) Safety wire the plugs.

G. Assembly – Dampers (See Figure 9-11)

CAUTION: DO NOT DAMAGE THE I.D. OF THE SLEEVES DURING SEAL AND WIPER INSTALLATION.

(1) Install O-rings (4) and (11) on the sleeves (5) and (12).

(2) Install the sleeves (5) and (12) as follows:

(a) Install seals (14) in the inboard groove of the sleeves with the O-ring side toward the piston. Ensure that the seal (14) has the O-ring installed in it.

(b) Install wiper (13) in the outboard groove of the sleeves with the lip of the wiper facing outboard.

(3) Press sleeve assemblies into the end cap (10) and the damper housing (1).

(4) If bushings (2) were removed, apply a small bead of Loctite 277 around the O.D. of the bushing (2) and install tool (T-0095) between the ears of the damper housing. Using an arbor press, install the bushings into the housing. If new bushings are installed, they must be line reamed with a ½ in. line reamer.

(5) Place the damper housing in a vise with the bore up.

CAUTION: ENSURE COMPONENTS ARE FREE OF DIRT OR OTHER CONTAMINANTS PRIOR TO ASSEMBLY.

CAUTION: DO NOT DAMAGE THE O-RINGS OR SEALS DURING THE ASSEMBLY PROCESS.

(6) Lubricate (SF96-20) the bore of the housing and the I.D. of the seal (14) of the installed sleeve assembly.

(7) Install O-ring or seal pack (9) using the following procedure:

(a) Lubricate O-ring or seal pack (9) with damper oil and install on the piston (6) or (30). Use tool T-0160 to install the seal pack.

(b) Install piston (6) or (30) into damper housing by gently tapping with a plastic mallet until piston is bottomed out. Tool T-0160-1 installation collar, or equivalent, must be used to install the piston if a seal pack is used.

NOTE: Threaded end of piston must face the end cap (10).

(8) Fill damper housing (1) with SF96-20 damper oil and install O-ring (15) into the recess of the damper housing (1).

(9) Lubricate the I.D. of the seal (14) in end cap (10) with SF96-20 oil and gently slide the end cap over the end of piston (6) or (30). Tap gently to seat the end cap into the damper housing.

NOTE: Care must be used not to cut O-rings and seals on installation.

(10) Secure end cap (10) to the housing with bolts (17) and washers (16). Torque the bolts using cross pattern tightening sequence (50-70 in-lb/5.6-7.9 Nm).

(11) If relief valve (22) has been removed for cleaning or replacement, re-install the valve in the reservoir (21) using a 9/16” deep well socket. Torque the valve to 350 in-lb/39.8 Nm.

(12) Reposition the damper to horizontal position in a vise with the reservoir parts up.

(13) Install O-rings (25) onto sleeves (27) and insert sleeves into ports in the damper housing.

(14) Align reservoir (21) with sleeves (27) on the damper housing and position the reservoir in place. Secure with bolts (28) and washers (16) and torque bolts (50-70 in-lb/5.6-7.9 Nm).

(15) Place O-rings (24) on plugs (23) and install the plugs into the reservoir. Torque plugs 350 in-lb/39.5 Nm and safety.

(16) Reposition the damper in vise with bleeder ports up. Move the damper piston approximately 2 inches off bottomed out position.

(17) Fill the reservoir with SF96-20 damper oil and install O-rings (25) and plugs (26). Torque plugs 40-60 in-lb/4.5-6.8 Nm and safety.

(18) Install the damper rod end bearing assembly (20).

NOTE: The rod end bearing assembly may have been previously treated with ACF-50 or MIL-PRF-23377 Type I Class 2C or Class N epoxy primer corrosion inhibitor per SDB 0127. If continuing use of ACF-50, removal of prior ACF-50 application is unnecessary. If changing from ACF-50 to epoxy primer, ACF-50 residue must be removed before reinstallation. For helicopters S/N 833 (F-28F) and subsequent and S/N 2157 (280FX) and subsequent, the rod ends are treated with epoxy primer at the time of manufacture.

(a) Remove jam nut (19).

(b) For new epoxy primer application, remove any ACF-50 residue from the threads of the rod end and the interior threads of the piston with a suitable solvent.

(c) If applying a touch-up of epoxy primer, remove any loose epoxy primer residue from the threads of the rod end and the interior threads of the piston with a brush and a small amount of solvent.

CAUTION: DO NOT ALLOW THE EPOXY PRIMER TO DRY PRIOR TO ASSEMBLY OF THE ROD END.

CAUTION: MASK THE BEARING AREA PRIOR TO APPLYING EPOXY PRIMER TO AVOID DAMAGING THE BEARING.

NOTE: Follow the manufacturer's instructions for corrosion inhibitor application.

(d) Apply the applicable corrosion inhibitor to the entire thread length of the rod end, as required.

NOTE: Installing the jam nut will tend to wipe away corrosion inhibitor that was freshly applied. Re-apply to ensure complete coverage.

(e) Install jam nut (19) and locking key (18) or flat lock washer (29), as applicable.

(f) Re-apply corrosion inhibitor to the threads below the jam nut, as required.

(g) Install the damper rod end bearing assembly (20) into the damper piston (6) or (30) until the correct rod end dimension is obtained (Figure 9-12):

1 (-1 and -5 dampers) Dimension equals 0.975 in ± .025 in/26.7 mm ± .13 mm from centerline of rod end to outboard edge of jam nut (19).

2 (-3, -7, -101, and -105 dampers) Dimension equals 1.050 in ± .005 in/26.7 mm ± .13 mm from centerline of rod end to outboard edge of jam nut (19).

NOTE: Locking key (18) must be aligned into piston slots before jam nut will seat against end of piston (-3, -7, -101, and -105 dampers).

(h) Re-apply corrosion inhibitor to the threads above the jam nut, as required.

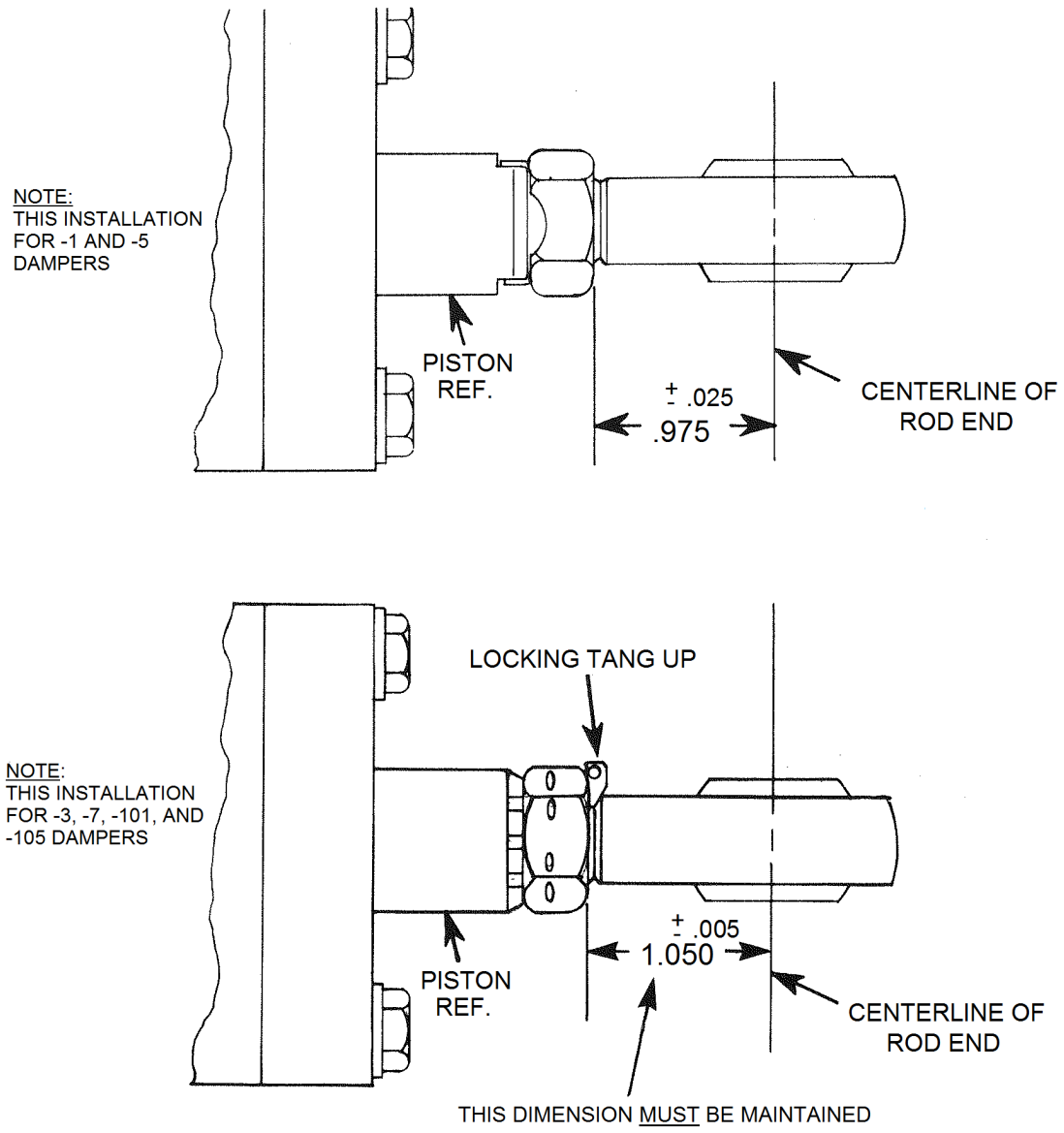


Figure 9-12. Damper Rod End Installation

(19) Hold the rod end with a wrench or tool T-0005 and tighten the jam nut (19) when the correct position is set.

1 (-1 and -5 dampers) Bend the locking washer tabs (29).

2 (-3, -7, -101, and -105 dampers) Position the locking key toward the top of the damper. Safety wire the jam nut (19) to locking key (18).

(20) Bleed the dampers and safety (Para. 4-18).

H. Installation – Damper (Figure 9-10)

NOTE: Refer to SDB 0127 regarding rod end inspection.

NOTE: The bellcrank center attachment bolt is installed in the reverse direction as the other two bolts (Figure 9-1).

(1) Install damper assembly on main rotor hub.

NOTE: The slotted-style rod end using the locking key (tang) must be installed with the slot facing up. This position for the locking key prevents interference with the hinge pin.

(2) Install chamfered washer (2) on inboard damper bolt (7).

NOTE: Chamfered side of washer must go against bolt head.

(3) Install inboard bolt (7) through the hub plates and the damper. Install the bottom washer (3) and nut (4).

(4) Torque the bolt to 190 in-lb/21.5 Nm.

(5) Ensure that the damper will pivot on the inboard bolt and bushing.

(6) Pivot the damper to align the rod end with the hole in the hinge pin.

(7) Install spacers (9) on each side of the rod end and slide the rod end into the hinge pin while aligning the spacers with the hole.

(8) Install washer (6) on the bolt (5) and install the bolt through the hinge pin and the rod end. Install two washers (6) and locknut (7) on bolt.

(9) Torque the bolt (5) to 450-500 in-lb/50.8-56.5 Nm while aligning cotter pin hole. Install the cotter pin (8).

Table 9-3. Inspection Requirements – Damper Assembly

Part Number	Figure 9-11 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-14357-5 28-14357-3 28-14357-1	1	Housing	Sleeve fore Dia. 1.1250 to 1.255	+.0002	Not Repairable	Replace Housing
			Flanged bushings in the ears for excessive fretting	1/3 of total face light fretting	½ of total face light fretting	Blend and polish out smooth
			Obstruction in the flow ports	None Allowed		Clear with compressed air
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Housing
			Security of chrome sleeve in bore of the Housing	No movement allowed	Not Repairable	Replace Housing
			Surface scratches	None Allowed	≤ .020 deep	Blend and polish out smooth
28-14277-1	3	Bushing	O.D. .4995 to .5005	-.0005	Not Repairable	Replace Bushing
			I.D. .3747 to .3757	+.0005	Not Repairable	Replace Bushing
			Nicks and scratches	.005 deep	≤ .005 deep	Blend and polish out smooth
28-14359-17			O.D. .4994 to .4999	-.0005	Not Repairable	Replace Bushing
			I.D. .3765 to .3775	+.0005	Not Repairable	Replace Bushing
			Nicks and scratches	.005 deep	≤ .005 deep	Blend and polish out smooth

Table 9-3. Inspection Requirements – Damper Assembly

Part Number	Figure 9-11 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-14356-5	5 and 12	Sleeve	O.D. 1.1260 to 1.1265	-.0002	Not Repairable	Replace sleeve
			Piston shaft bore Dia. .749 to .751	+.002	Not Repairable	Replace sleeve
			O.D. to I.D. concentricity	.002 FIM	Not Repairable	Replace sleeve
28-14370-17 28-14370-15 28-14267-13	6, 30	Piston	Piston shaft O.D. .746 to .748	-.001	Not Repairable	Replace Piston
			Concentricity	.001 TIR	Not Repairable	Replace Piston
			Obstruction in the flow restrictor	None Allowed		Clear with compressed air
			Nicks or scratches in surface	None Allowed	≤ .5” long and ≤ .005 deep	Blend and polish out smooth
			Threads	No crossed or missing threads	Not Repairable	Replace Piston
28-14265-3 28-14265-1	10	End Cap	Sleeve bore dia. 1.1250 to 1.1255	+.0002	Not Repairable	Replace Cap
			Obstruction in the fluid port	None Allowed		Clear with compressed air
			Surface for nicks and scratches	None Allowed	≤ .020 deep	Blend and polish out smooth
			Cracks	None Allowed	Not Repairable	Replace Cap

Table 9-3. Inspection Requirements – Damper Assembly

Part Number	Figure 9-11 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
ECD091-1	20	Damper Bearing	Radial Play	.007	Not Repairable	Replace Bearing
			Axial Play	.005	Not Repairable	Replace Bearing
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Rod End
28-14366-1	21	Reservoir	Obstruction in the flow ports	None Allowed		Clear with compressed air
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Reservoir
			Nicks, scratches, or corrosion	.020 deep	≤ .020 deep	Blend and polish out smooth
			Cracks	None Allowed	Not Repairable	Replace Reservoir
			If the valves are removed, valve threads and ports for contamination	None Allowed		Flush with cleaning solvent and dry with compressed air
28-14368-2	23	Plug	Threads (crossed or missing)	None Allowed	Not Repairable	Replace Plug
AN814-2DL	26	Plug	Threads (crossed or missing)	None Allowed	Not Repairable	Replace Plug
28-14369-1	27	Sleeve	O.D. and I.D. for nicks or scratches	None Allowed	Not Repairable	Replace Sleeve
		All O-Rings, Wiper, and Seals	Inspect for obvious defects	None Allowed	Not Repairable	Replace as required

* All dimensions are in inches.

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NOTE: Figure 9-13 through Figure 9-15 are reserved for future use.

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9-6 Main Rotor Blades

9-7 Description – Main Rotor Blades (Figure 9-16)

The main rotor blades are of hollow construction. Upper and lower skins are bonded to the extruded leading edge spar which is twisted 7.25. Doublers are bonded to the root end of the blade for retaining the blades to the main rotor hub. The blades are retained by a single retention pin to the blade grip and a non-adjustable drag brace connected to the trailing edge of the blades. Provisions for spanwise and cordwise balance weights are provided in the tip caps that are bonded in the tip end of the blades. Two tracking tabs are riveted to the trailing edge of each blade.

9-8 Removal – Main Rotor Blades (Figure 9-17)

NOTE: Lifting the tip of the blade until the blade is parallel to the retention assembly will allow the retention bolt and the drag brace bolt to be easily removed and will allow the blade to be removed from the blade grip without spreading the ears of the grip.

A. Remove the bolt (1) securing the drag link to the rotor blade.

B. Remove the blade retention bolt (2).

C. Carefully slide the blade from the grip.

D. Place the blade into a blade rack or on a suitable device that will prevent the blades from being damaged.

E. Repeat the process for the other 2 blades.

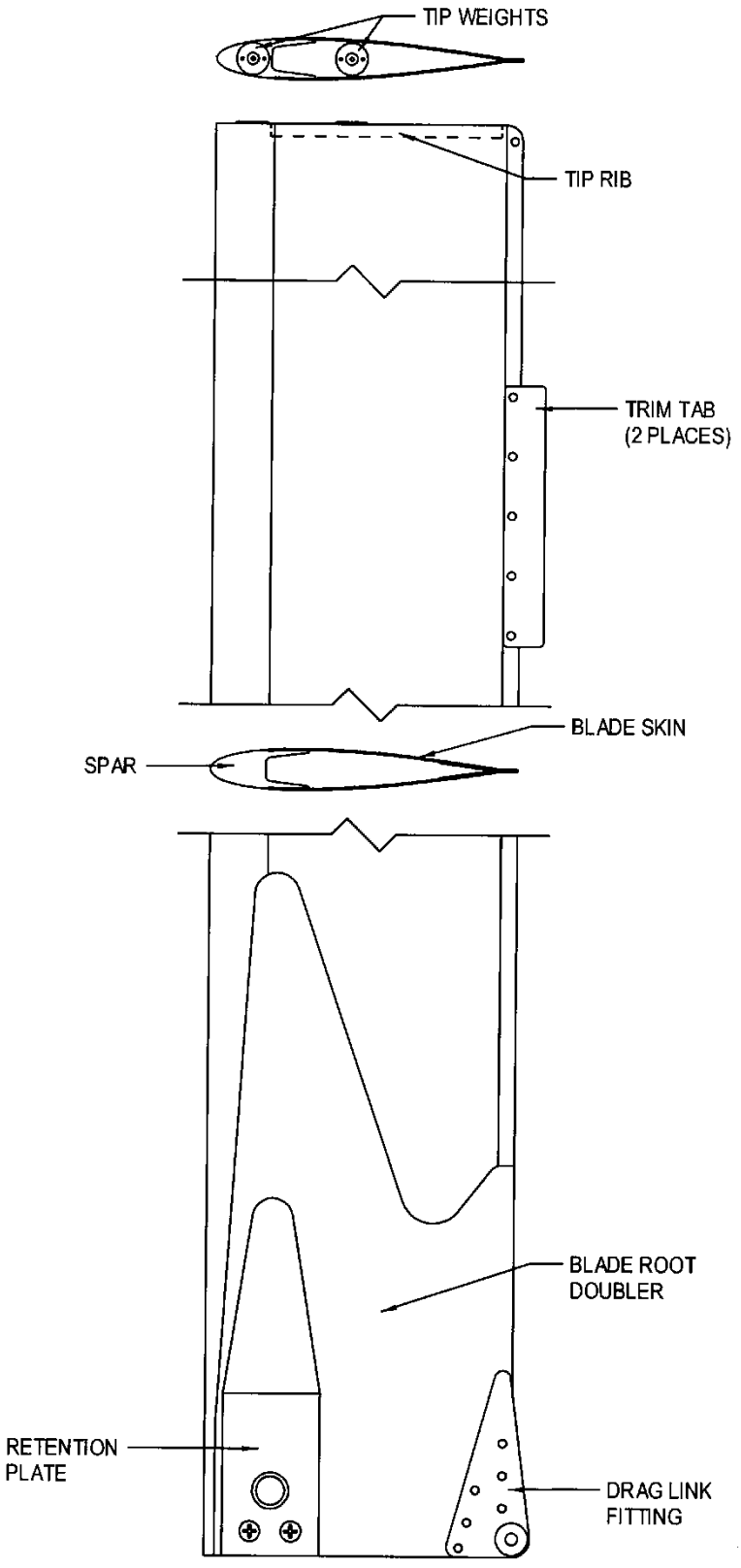

Figure 9-16. Main Rotor Blade

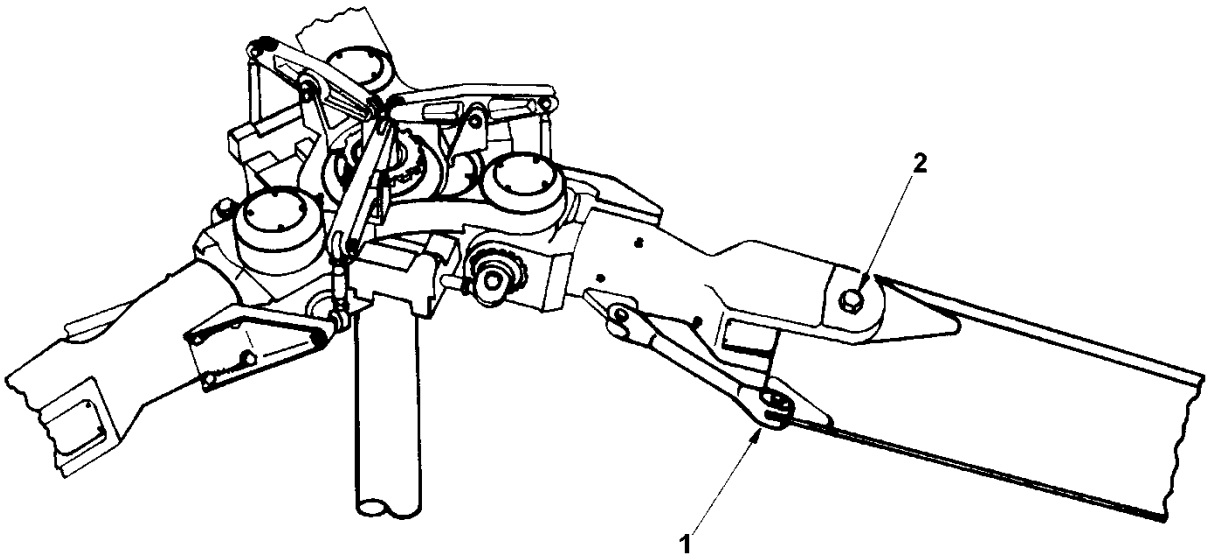

Figure 9-17. Main Rotor Blade Installation

9-9 Inspection – Main Rotor Blades

A. Inspect the paint finish of the blades for blistering, erosion, cracking, chipping, peeling, and overall oxidation.

B. Inspect the main rotor blade spar (especially on blades that have erosion of the paint finish) for slivering or flaking of the exposed spar surface, and for a grainy surface appearance (Figure 9-19).

C. Inspect the spar bond lines for raised sections or voids, dark deposits, corrosion, and bubbly or scaly paint (Figure 9-20). Use the coin tap method to inspect suspect areas for voids.

D. Inspect the trailing edge bond lines for voids or openings, dark deposits, corrosion, and bubbly or scaly paint (Figure 9-20). Use the coin tap method to inspect suspect areas for voids. Use only plastic shim stock (.001"/.025 mm) for determining the depth of voided areas.

E. Inspect the bond lines at the root doubler and retention plate edges for paint cracking or scaling, dark deposits, corrosion, and void in the fairing compound (Figure 9-20). Use the coin tap method to inspect suspect areas for voids. Use only plastic shim stock (.001"/.025mm) for determining the depth of the voided areas.

F. Inspect the main rotor blade spar (Figure 9-21 and Figure 9-22), skins, trim tabs, retention plates, drag link fittings, and root doublers for nicks, scratches, dents, and cracks.

G. Inspect the blade tip rib, trim tabs and drag link fittings for loose rivets.

NOTE: Normal service life for the blade tape is 200 - 300 hours: however, if the aircraft is operated in rain, service life for the tape can be considerably shortened.

NOTE: Visually inspect the blade tape for security and damage after the aircraft is operated in rain.

H. If installed, inspect the main rotor leading edge blade tape for security of installation, tears or punctures, and bubbles or lumpy surface.

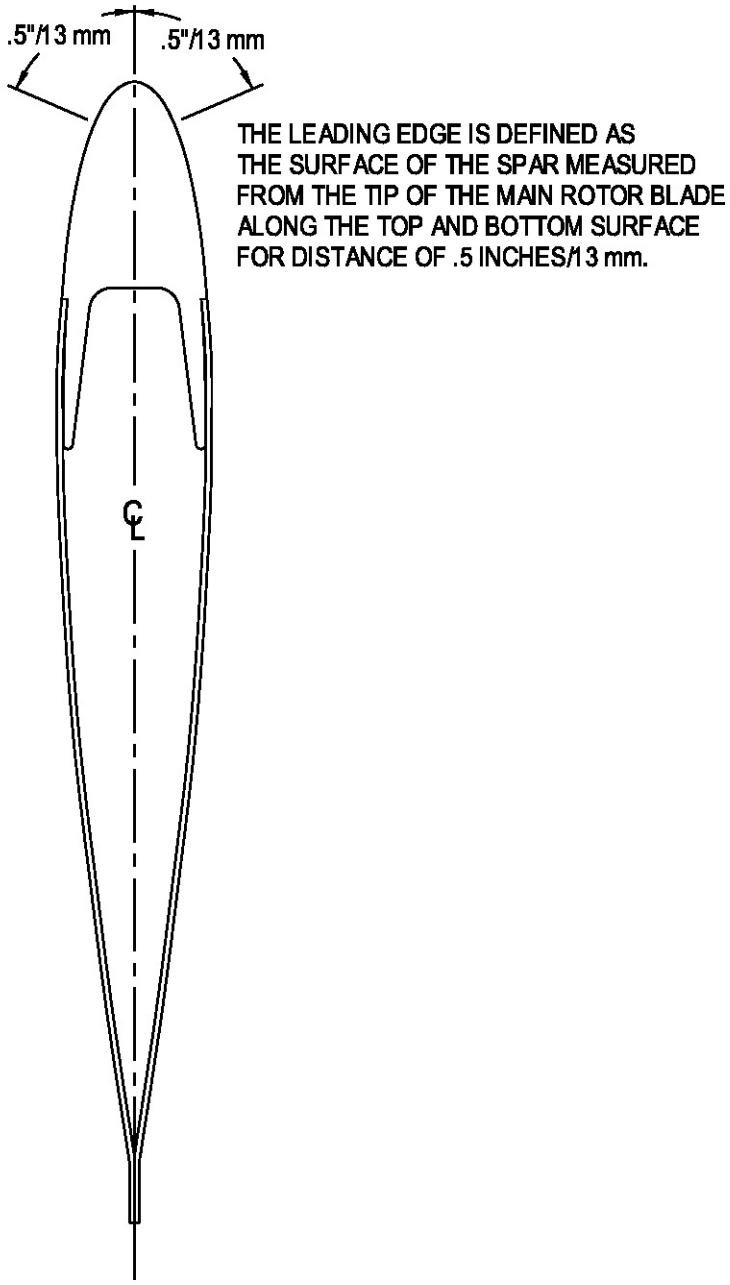

Figure 9-18. Main Rotor Blade Leading Edge Definition

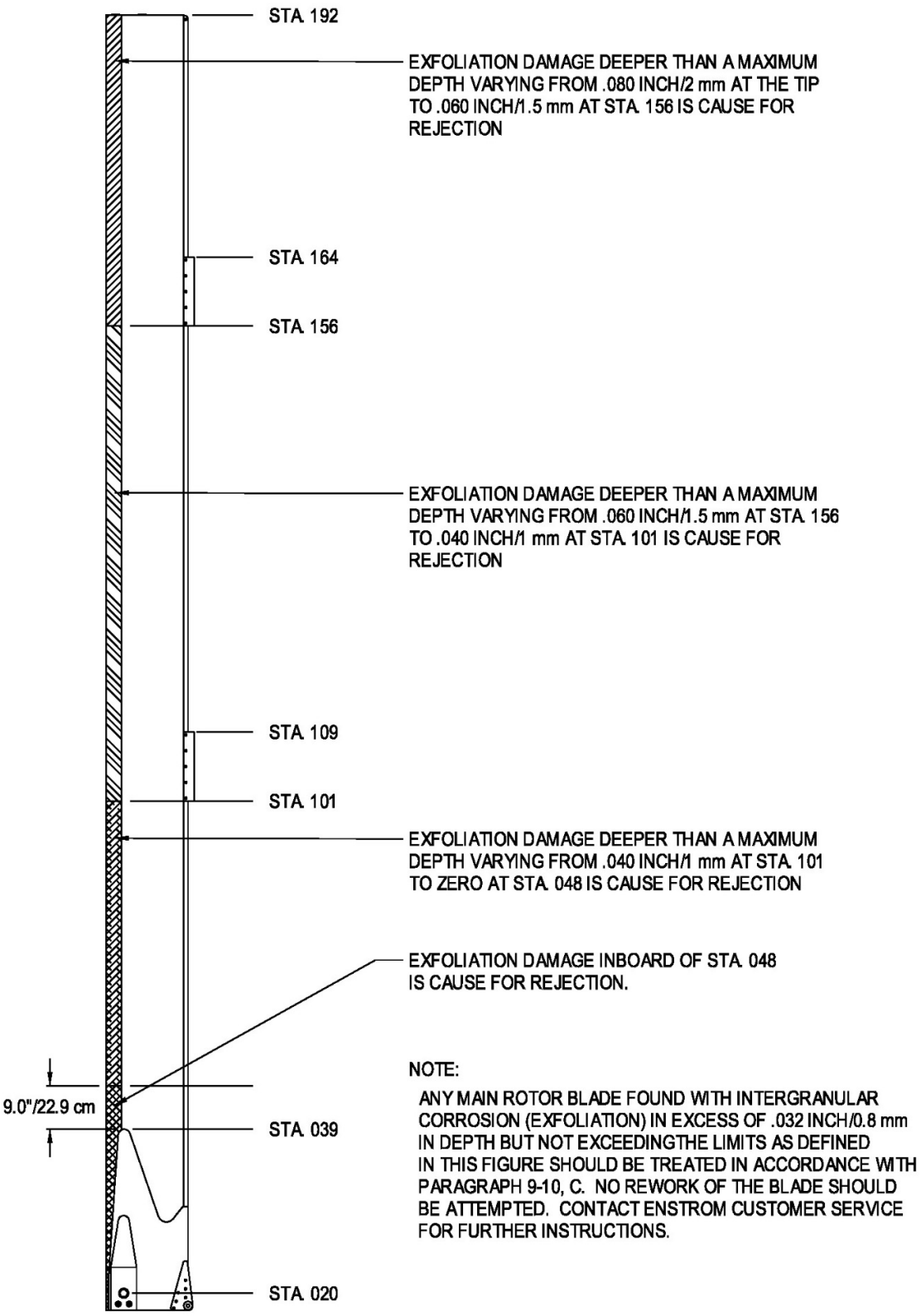

Figure 9-19. Main Rotor Blade Spar Corrosion Limits

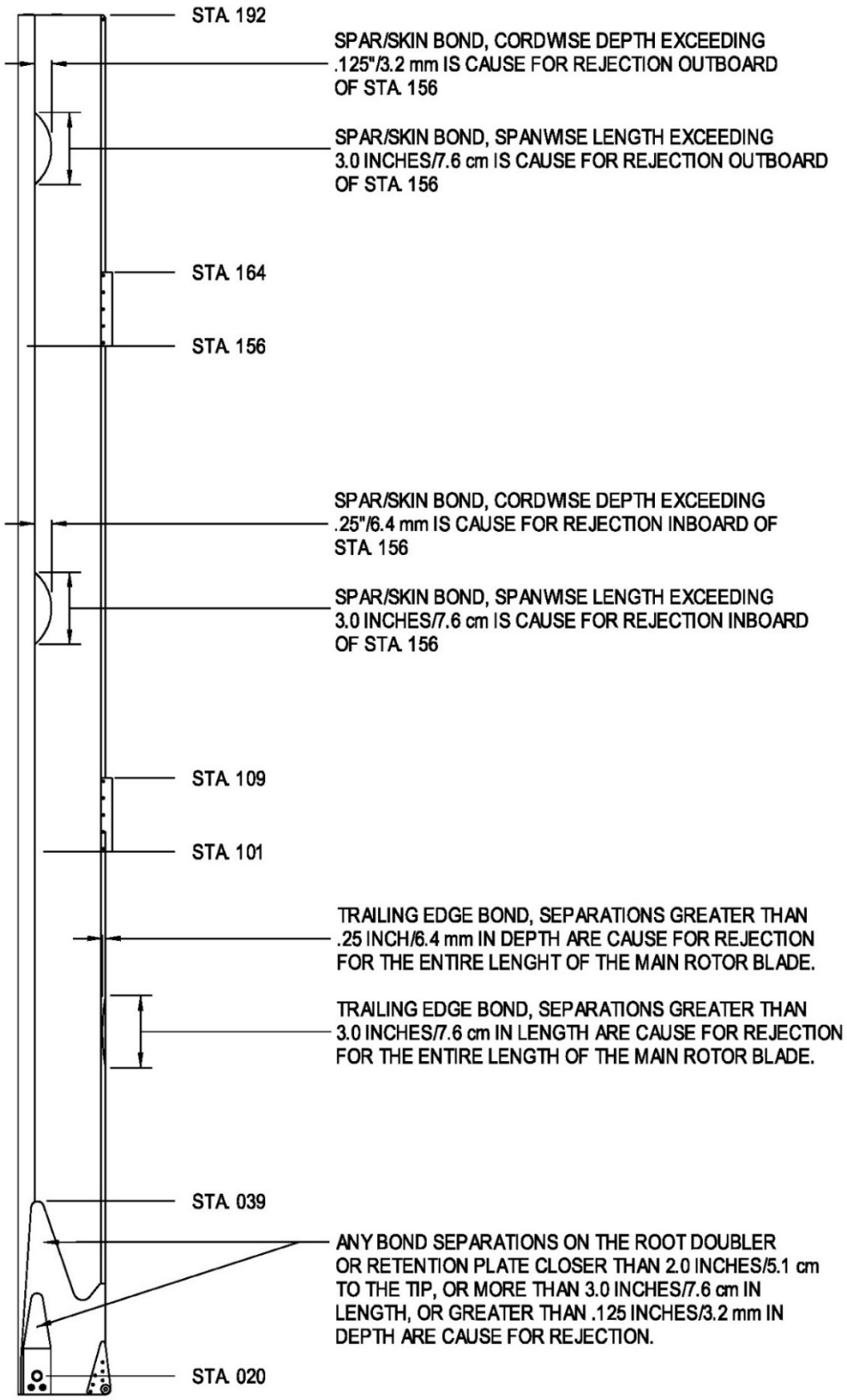

Figure 9-20. Main Rotor Blade Bond Separation Limits

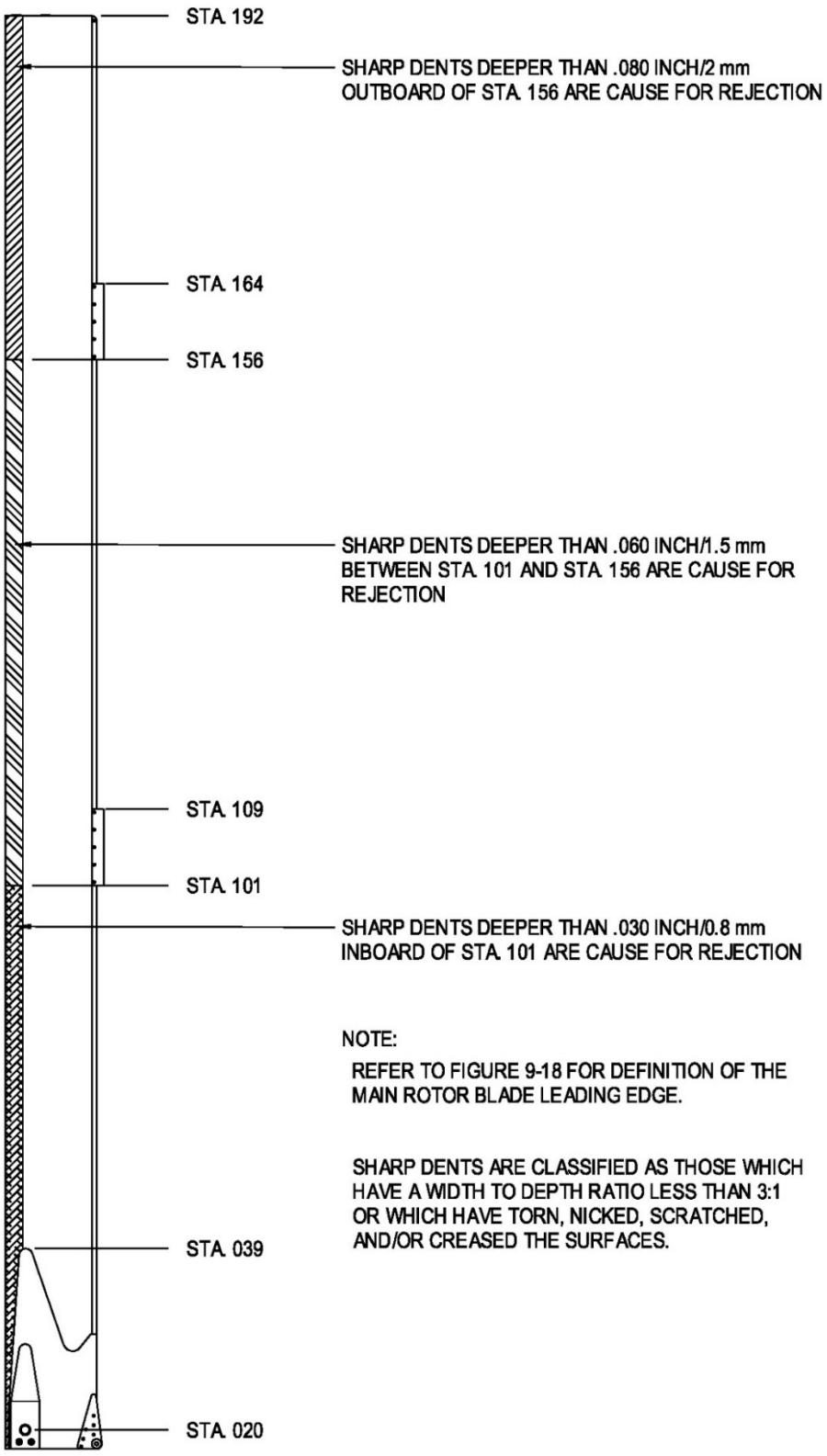

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Figure 9-21. Main Rotor Blade Leading Edge Damage Limits

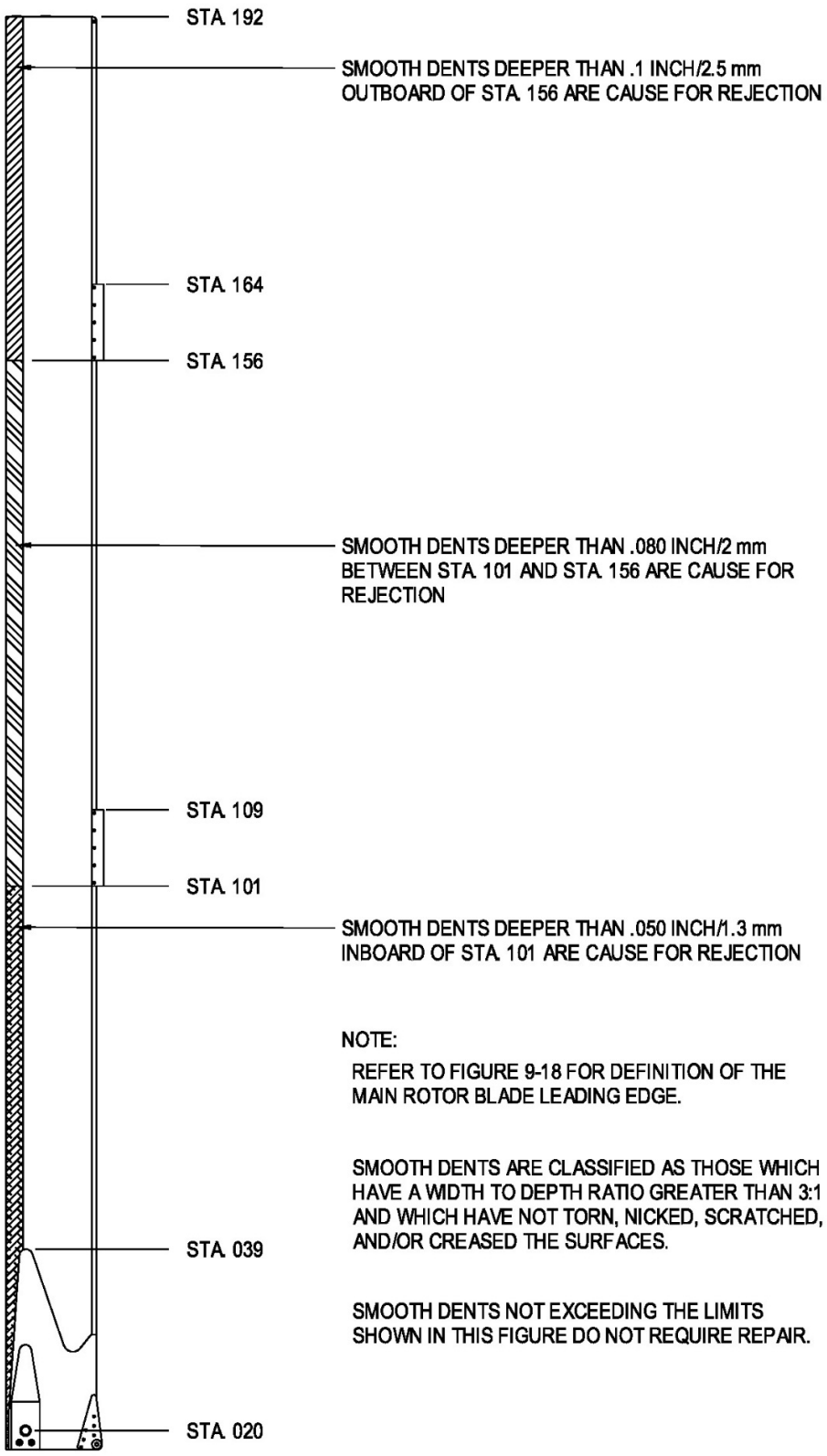

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Figure 9-21. Main Rotor Blade Leading Edge Damage Limits

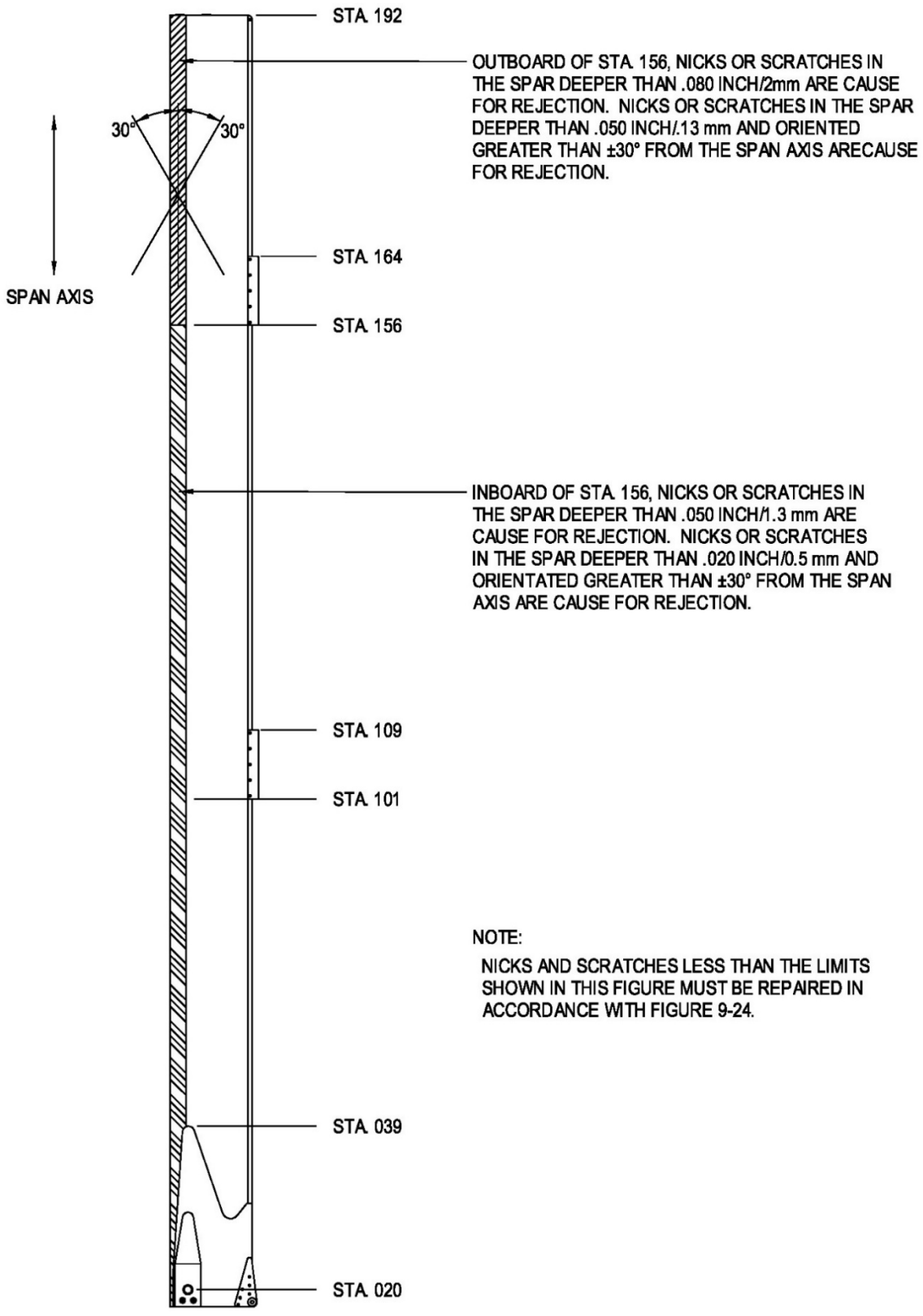

Figure 9-22. Main Rotor Blade Spar Damage Limits

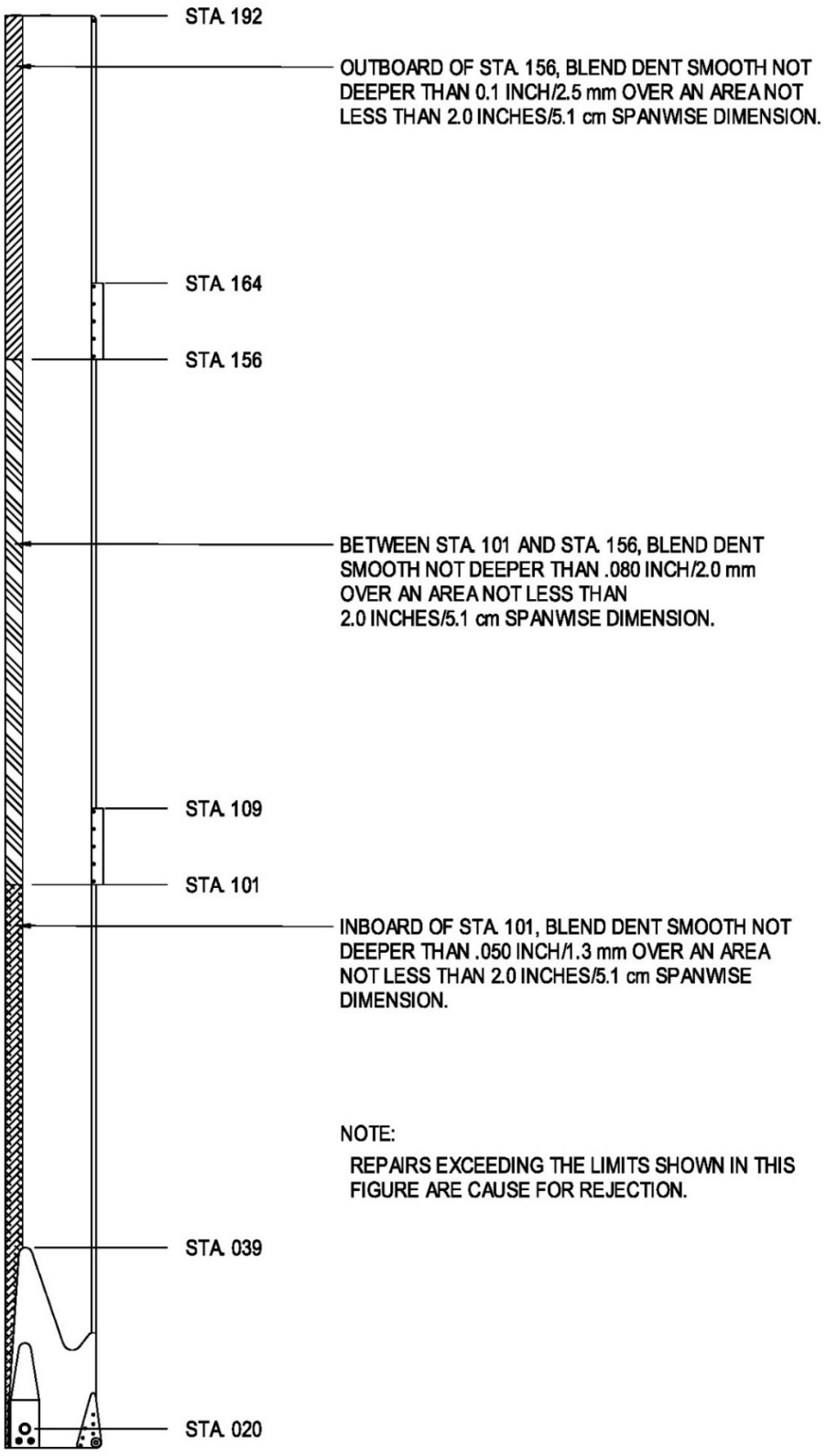

Figure 9-23. Main Rotor Blade Leading Edge Repair Limits

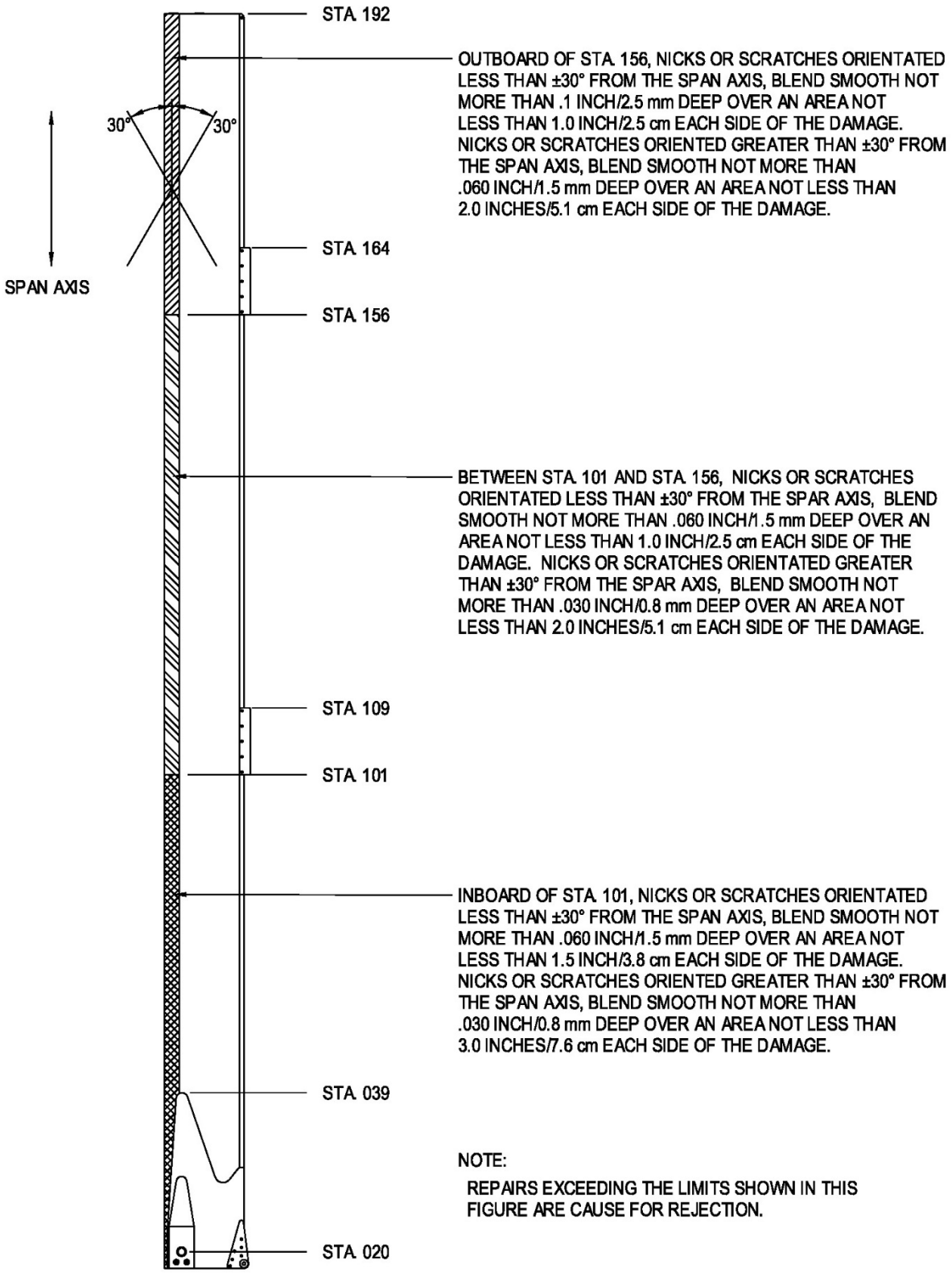

Figure 9-24. Main Rotor Blade Spar Repair Limits

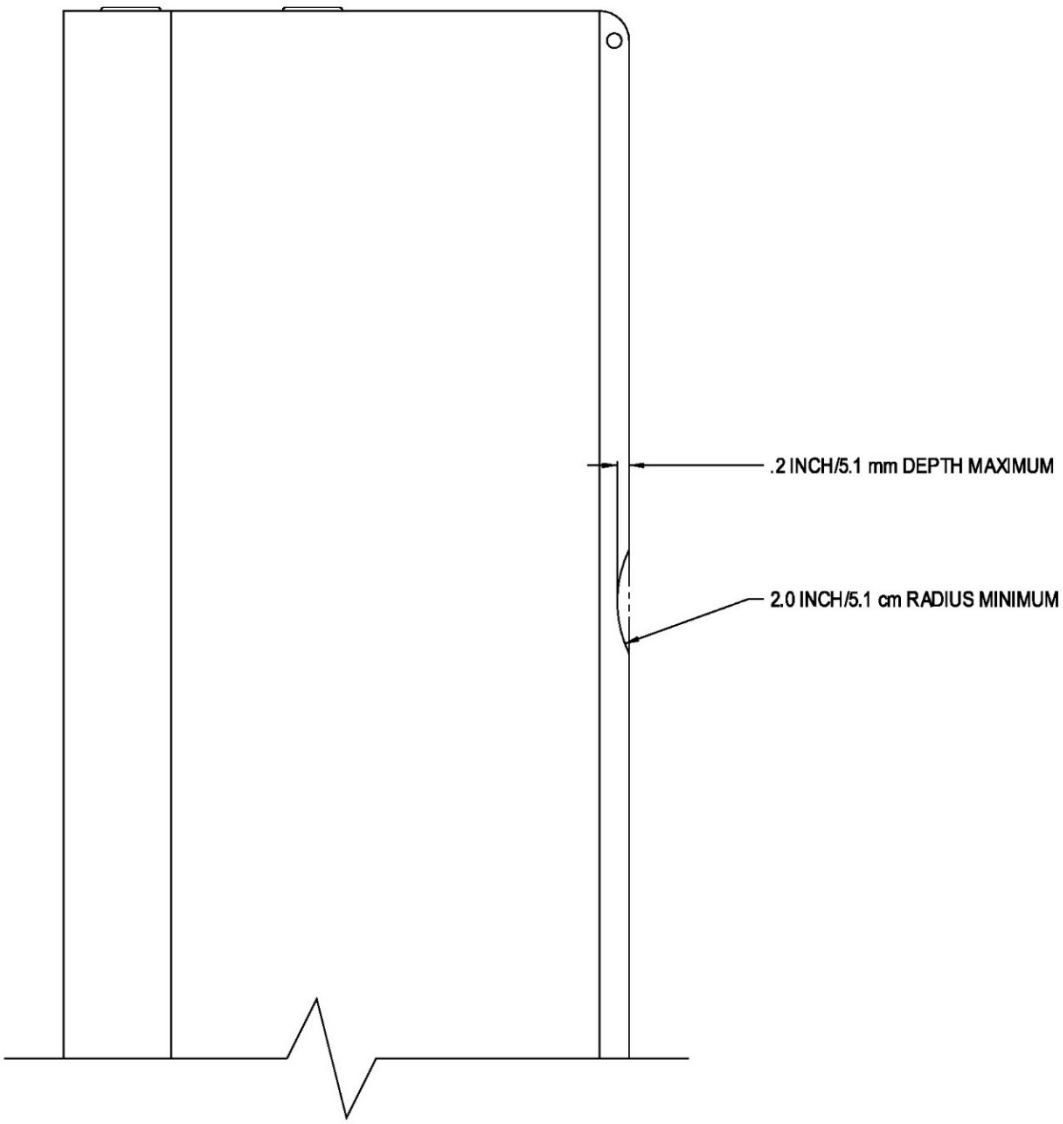

Figure 9-25. Main Rotor Blade Trailing Edge Repair Limits

9-10 Repair – Main Rotor Blades

A. Repair small areas of the paint finish using the following:

NOTE: Refinish the blades equally if refinishing a larger area (outboard leading edge for example) to maintain the continuity of the weight between the blades.

(1) Work the area lightly with medium grit aluminum oxide abrasive paper/cloth.

(2) Wash the area with mild soap and water.

WARNING: ACETONE AND METHYLETHYLKETONE (MEK) ARE TOXIC AND MUST BE USED WITH EXTREME CAUTION. MAKE SURE ADEQUATE VENTILATION IS PROVIDED. REPEATED OR PROLONGED CONTACT WITH THE SKIN SHOULD BE AVOIDED. A LOW-VOLATILE SUBSTITUTE, SUCH AS EXTREME SIMPLE GREEN, IS A PREFERRED SOLVENT.

(3) Degrease the area with denatured alcohol, Extreme Simple Green, or equivalent.

NOTE: Application of the chemical conversion coating is only required if the bare metal is exposed on the main rotor blade.

WARNING: USE THE PROPER PROTECTIVE EQUIPMENT WHEN WORKING WITH THE METAL PREP. OBSERVE THE PRECAUTIONARY INFORMATION AND INSTRUCTIONS PROVIDED WITH THE METAL PREP.

(4) Treat the repaired area of the blade with a metal prep. Flush thoroughly with fresh water and allow to dry.

WARNING: USE THE PROPER PROTECTIVE EQUIPMENT WHEN WORKING WITH THE CHEMICAL CONVERSION COATING. OBSERVE THE PRECAUTIONARY INFORMATION AND INSTRUCTIONS PROVIDED WITH THE CHEMICAL CONVERSION COATING.

(5) Treat the blade as required with a chemical conversion coating complying with MIL-DTL-5541/MIL-DTL-81706 or equivalent.

(6) Clean the area with Extreme Simple Green, or equivalent.

(7) Apply a coat of Desoto # 593 X 300 epoxy primer or equivalent and allow to dry.

(8) Finish the area with a flat acrylic aerosol paint.

B. Repair blade spars with flaking or slivering less than .032"/0.8 mm in depth or a light grainy surface as follows:

NOTE: Contour the reworked area evenly along the blade and rework the blade set equally to maintain the blade weight continuity of the blade set.

NOTE: Use care when removing the corrosion contamination to prevent from contaminating other areas or blades.

(1) Remove the surface corrosion from the area using medium grit aluminum oxide abrasive paper/cloth or an aluminum oxide flapping wheel.

(2) Wash the reworked area thoroughly with mild soap and water, flush thoroughly.

WARNING: USE THE PROPER PROTECTIVE EQUIPMENT WHEN WORKING WITH THE METAL PREP. OBSERVE THE PRECAUTIONARY INFORMATION AND INSTRUCTIONS PROVIDED WITH THE METAL PREP.

(3) Treat the repaired area of the blade with a metal prep. Flush thoroughly with fresh water and allow to dry.

WARNING: USE THE PROPER PROTECTIVE EQUIPMENT WHEN WORKING WITH THE CHEMICAL CONVERSION COATING. OBSERVE THE PRECAUTIONARY INFORMATION AND INSTRUCTIONS PROVIDED WITH THE CHEMICAL CONVERSION COATING.

(4) Treat the blade as required with a chemical conversion coating complying with MIL-DTL-5541/MIL-DTL-81706 or equivalent.

(5) Refinish the area either using the small area repair in Para. 9-10, A, or if the entire blade needs refinishing, use Para. 9-11.

C. Repair blade spars with flaking or slivering exceeding .032"/0.8 mm in depth but not the limits in Figure 9-19 as follows:

(1) Apply corrosion inhibitor to the affected area daily.

(2) Contact the Enstrom Customer Service Department for further instructions.

NOTE: Main rotor blades with intergranular spar corrosion (exfoliation) exceeding the limits of Figure 9-19 must be rejected as unairworthy.

D. Repair voids in the spar to skin bond lines that do not exceed the limits of Figure 9-20 as follows:

NOTE: Bond separations (voids) in the main rotor blade bond joints cannot be repaired/rebonded. The following repair provides corrosion treatment and sealing of the voided area until the void exceeds the allowable limits and the main rotor blade must be rejected as unairworthy.

(1) Remove the paint and or surface corrosion from the voided area with aluminum oxide abrasive paper.

(2) Degrease the area with denatured alcohol, Extreme Simple Green, or equivalent.

CAUTION: DO NOT HEAT THE BOND LINE TO MORE THAN 250°F/121°C.

(3) Warm the area to approximately 180-200°F/82-93°C to evacuate any residual moisture.

(4) Apply corrosion inhibitor and allow to dry for 30 minutes.

(5) Wipe the area with denatured alcohol, Extreme Simple Green, or equivalent.

(6) Seal the area with Hysol Type EA 9309.2NA epoxy sealant.

(7) Refinish the area in accordance with Para. 9-10, A, above or Para. 9-11 depending on the paint condition of the rest of the blade.

(8) Enter into the maintenance log book the main rotor blade serial number and the location of the repair.

(9) Visually inspect the repaired area for further growth of the bond separation during the preflight check or daily inspection. Inspect the repaired area for further growth of the bond separation using the coin tap method at 25 hour intervals.

E. Repair voids in the trailing edge bond lines not exceeding the limits in Figure 9-20 using the procedure in Para. 9-10, D, except for the following:

(1) Inspect repairs outboard of Sta. 101 using the coin tap method at the normal periodic inspection interval.

(2) Inspect repairs inboard of Sta. 101 using the coin tap method at 25 hour intervals.

F. Repair voids in the root doubler and retention plate edge bond lines not exceeding the limits in Figure 9-20 using the procedure in Para. 9-10, D.

G. Damage to the blade spar not exceeding the limits in Figures 9-21 and Figure 9-22 must be repaired I/A/W Figure 9-23 and Figure 9-24. Reject any blades that have damage exceeding the limits in Figures 9-21 and Figure 9-22.

H. Reject blades with the following blade skin damage:

(1) Punctures in the blade skin.

(2) Sharp dents with a width to depth ratio less than 3:1 and deeper than .020"/.51 mm.

(3) Smooth dents which have resulted in permanent skin deformation greater than .060"/1.5 mm in depth.

(4) Nicks and scratches in the cordwise direction greater than .010"/.25 mm in depth.

(5) Nicks and scratches orientated within ± 30° of the spanwise direction greater than .020"/.51 mm in depth.

(6) Trailing edge cordwise dents or nicks deeper than .20"/5.1 mm.

(7) Trailing edge flapwise kinks extending more than .20"/5.1 mm.

(8) Cracks.

I. Repair blade skins with damage not exceeding the limits in Para. 9-10, H, above as follows:

(1) Buff out all light scratches.

(2) Polish out nicks, scratches, and sharp dents and blend the area to approximately .50"/13 mm around the damaged area.

(3) Repair damage to the trailing edge in accordance with Figure 9-25.

(4) Smooth dents that do not exceed the damage limits are acceptable and no repair is required.

NOTE: Refinish the repaired area in accordance with Para. 9-10, A, or Para. 9-11 depending on the condition of the rest of paint finish.

J. Reject blades with the following root doubler damage:

(1) Nicks, scratches, and sharp dents in the cordwise direction greater than .010"/.25 mm in depth.

(2) Nicks, scratches, and sharp dents orientated within ± 30° of the spanwise direction greater than .020"/.51 mm in depth.

(3) Smooth dents deeper than .020"/.51 mm.

(4) Cracks.

K. Repair blade doublers with damage not exceeding the limits in Para. 9-10, J, as follows:

(1) Buff out all light scratches.

(2) Polish out nicks, scratches, and sharp dents and blend the area to approximately .50"/13 mm around the damaged area.

(3) Smooth dents that do not exceed the damage limits are acceptable and no repair is required.

NOTE: Refinish the repaired area I/A/W Para. 9-10, A, or Para. 9-11 depending on the condition of the rest of paint finish.

L. Reject blades with the following blade retention plate damage:

(1) Nicks, scratches, and sharp dents greater than .050"/1.3 mm in depth.

(2) Cracks.

M. Repair blade retention plates with damage not exceeding the limits in Para. 9-10, L, as follows:

(1) Buff out all light scratches.

(2) Polish out nicks, scratches, and sharp dents and blend the area to approximately 2.0"/5.1 cm diameter area.

NOTE: Refinish the repaired area I/A/W Para. 9-10, A, or Para. 9-11 depending on the condition of the rest of paint finish.

NOTE: Do not paint the blade grip mating surface of the retention plates.

N. Repair or replace trim tabs as follows:

(1) Repair:

(a) Flatten dents or kinks and polish out scratches and nicks.

(b) Drill out and replace loose rivets.

(2) Replace:

(a) Drill out rivets and remove the trim tab.

(b) Open pilot holes in the replacement trim tab with a #40 drill.

(c) Position the trim tab on the main rotor blade and install the rivets.

O. Reject blades with the following drag link fitting damage:

(1) Nicks or scratches greater than .010"/.25 mm deep.

(2) Cracks.

(3) Loose rivets.

P. Repair drag link fittings with damage not exceeding the limits in Para. 9-10, O, as follows:

(1) Buff out all light scratches.

(2) Polish out nicks, scratches, and sharp dents.

NOTE: Refinish the repaired area I/A/W Para. 9-10, A, or Para. 9-11 depending on the condition of the rest of paint finish.

NOTE: Do not paint the drag link mating surface of the drag link fittings.

Q. Reject blades that have a cracked tip rib. Replace loose rivets.

R. Install the leading edge blade tape as follows (for blade tape repairs, go to step S):

NOTE: Prior to installation of the blade tape, the spar should be inspected according to Para. 9-9, B.

CAUTION: NEW BLADE TAPE SHOULD NOT BE INSTALLED WITHOUT PROPER LEADING EDGE PREPARATION AND PAINT COVER (PARA. 9-10, A OR B). DO NOT INSTALL BLADE TAPE ON BLADES WITH LEADING EDGE/SPAR CORROSION WITHOUT FIRST TREATING THE CORROSION.

(1) Clean the blade with a mild soap and water solution, and rinse with fresh water.

(2) Allow the blade to dry.

(3) Coat the area to be taped with MIL-PRF-23377 epoxy primer or equivalent or quality top coat paint such as Sherwin-Williams “Acry Glo” or similar.

(4) Mark and mask the non-blade tape area as follows:

NOTE: The blade surface area adjacent to the taped area must be masked to avoid sanding the non-taped area.

(a) Measure 108.4” from the end of the blade tip, mark with a pencil, and apply masking tape at this measurement from the spar edge to at least 0.100” beyond the spar seam. Measure, mark, and mask the bottom side of the blade as well.

(b) Apply masking tape along the blade length from the blade tip to the pencil marks at a distance of 0.100” from the spar seam.

(5) Sand the exposed area to be taped with 400 grit sand paper or Scotch Brite 7447B to produce a smooth surface. Remove the masking tape after sanding is completed.

NOTE: The blade tape is installed in three 36-inch long sections.

(6) Mark the area for blade tape as follows:

(a) Measure a distance of 0.100” from the blade tip. This marks the start of the blade tape.

(b) Measure a distance of 108.4” from the blade tip. This marks the end of the blade tape.

(c) Measure from the leading edge of the blade back on the topside of the airfoil ½ the distance of the width of the tape (2 ½ inches) and mark the surface with a pencil. Do this at the tip of the blade and toward the root end of the blade at the 108.4” mark.

(7) Above the marks, stretch a length of masking tape from the blade tip to the 108.4” mark to create a straight reference line.

(8) Butt the top edge of three 8681HS tape sections against the masking tape reference line applied in step (7) above and use 1 inch long tabs of masking tape to hold it in place. Maintain a 0.100” gap between each section of 8681HS tape.

(9) Apply another 1 inch wide strip of masking tape along the entire top edge of the 8681HS tape to form a soft hinge (Figure 9-26, a).

(10) Fold the 8681HS tape back onto the top of the blade (Figure 9-26, b).

(11) Apply 3M Adhesion Promoter # 86A to the entire area that will be covered by 8681HS tape. Use pre-wetted wipes or the adhesion promoter P/N 86 A and clean cheese cloth to apply the 86A and rubber gloves to protect hands. Apply only enough to wet the surface, so it appears shiny. Wipe off any excess to ensure no runs or drips. Allow to dry for 10 to 20 minutes or until the surface does not appear shiny.

(12) Spray the surface of the treated area of the blade with a previously prepared solution of water, isopropyl alcohol, and detergent.

(a) Solution: Mix 70% water with 30% isopropyl alcohol in a 1 pint spray bottle. Add 4 drops of a non-ionic detergent such as Joy brand dish detergent.

(13) Beginning at the edge of the blade tape, remove the first protective liner strip from the blade tape nearest the soft hinge. Spray the sticky side of the tape with solution from step 12(a). There are four protective liner strips for each 36-inch long section. Fold the tape down onto the blade and allow it to float into its favored location (Figure 9-26, c).

(14) Use a soft plastic squeegee to force the liquid out from behind the tape, starting at the hinge corner and working forward (Figure 9-26, d). Carefully work to end of the tape section. Repeat steps (13) and (14) for the remaining three protective liner strips.

(a) Avoid touching the exposed adhesive tape surface.

(b) Use a dry towel to mop up excess solution on the back edge.

(c) Carefully work around the leading edge and around toward the trailing of the tape on the other side.

(d) If a bubble of liquid or air is trapped under the tape, pull the tape back up to free the bubble, re-spray the area and squeegee to make it smooth and bubble free. DO NOT puncture bubbles to relieve entrapped air or liquid, especially on the leading edge.

NOTE: A smooth, continuous taped surface is necessary for optimal blade performance.

(e) Repeat the process for the remaining two 36-inch long tape sections.

(15) Remove the “hinge” tape on the top edge and squeegee out excess fluid, while mopping excess up with a dry towel. Minute quantities of fluid which may be trapped, such as around fasteners, dissipate quickly.

(16) Seal the space between the ends of the sheets and the trailing edges with 3M DP190 epoxy adhesive using the following procedure:

(a) Mask off both sides of the 8681HS tape approximately 1/16” from the edge with “3M Fine Line” tape.

(b) Apply sealant between the masked off area and use a stiff applicator to screed off the excess. Remove the strips of masking tape within a few minutes, before complete gelling has occurred, to allow the sealant to flow to a nice tapered edge. DP190 will gel in 90 minutes at 72°F and full cure will be achieved in about 8 hours. It will cure faster in warmer temperatures, slower in cooler temperatures. In warm weather it helps to allow the top surface to cure before turning the blade over to seal the second side so that the sealer does not form a bulge.

(c) After the sealant is cured, inspect the sealant bead at the tape joints and the trailing edge.

(17) Lightly sand excess sealant to match the blade contour.

NOTE: A sealant bead flush with the blade contour is necessary for optimal blade performance.

(a) Mask the sealant line around the area to be sanded. Lightly sand the contour using 3M 214U 80 grit and then 3M 214U 150 grit to blend the edges.

S. Repair the leading edge blade tape as follows:

CAUTION: THE BLADE MUST BE INSPECTED AND CERTIFIED TO BE IN AIRWORTHY CONDITION PRIOR TO INSTALLATION OR REPAIR OF THE TAPE. THE AREA WHERE THE TAPE WILL BE APPLIED MUST BE SMOOTH AND CLEAN. NEW BLADE TAPE SHOULD NOT BE INSTALLED WITHOUT PROPER LEADING EDGE PREPARATION AND PAINT COVER. REFER TO THE PARA. 9-10, A OR B, FOR REPAIR AND REFINISH INSTRUCTIONS PRIOR TO TAPE APPLICATION. THE AREA TO BE TAPED WILL BE COATED WITH MIL-PRF-23377 EPOXY PRIMER OR EQUIVALENT OR QUALITY TOP COAT PAINT SUCH AS SHERMAN-WILLIAMS “ACRY GLO” OR SIMILAR.

(1) Mark a line on the blade on either side of the damaged section at right angles to the edge of the tape line (Figure 9-27, a).

WARNING: USE EXTREME CARE NOT TO CUT INTO OR NICK THE BLADE UNDER THE TAPE WHEN CUTTING OUT THE DAMAGED SECTION OF TAPE. NICKING THE SPAR COULD LEAD TO CATASTROPHIC BLADE FAILURE.

(2) Use a razor blade to cut the tape along this line.

(3) Carefully remove the section of tape between the cut lines.

(4) Use a sharp blade or knife to scrape the gray epoxy edge sealer from the top and the bottom of the blade tape line. Take care not to damage the paint on the blade.

(5) Use sandpaper (400 grit) to remove any corrosion on the blade and treat as follows:

(a) Coat blade tape repair area with MIL-PRF-23377 epoxy primer, or equivalent, or quality top coat paint such as Sherman-Williams “Acry Glo”, or similar, prior to application (Figure 9-27, b).

(6) Stretch a piece of masking tape along the forward edge of the epoxy tape sealer on the top of the blade.

(7) Cut a repair piece of tape from the 8681HS tape that is a total of 1/8 inch (.318 cm) shorter than the area of the tape that has been cut out for repair.

(8) Butt the top edge of the 8681HS tape against the forward edge of the already installed masking tape and apply a second length of masking tape along the aft edge of the patch to form a soft hinge.

(9) Fold the 8681HS tape back onto the top of the blade.

(10) Apply the 3M adhesion Promoter #86A to the entire area of the blade that will be covered by the 8681HS tape. Use pre-wetted wipes or the adhesion promoter P/N 86A applied to clean cheese cloth (use rubber gloves for protection). Apply only enough to wet the surface so it appears shiny. Wipe off any excess to ensure no runs or drips. Allow to dry for 10 to 20 minutes or until the surface does not appear shiny.

(11) Remove the protective liner from the adhesive surface of the blade tape and spray the adhesive surface of the tape and the treated area of the blade with a wetting solution of water and isopropyl alcohol (step R, (1), a).

(12) Fold the 8681HS tape down onto the blade and allow it to float into position. The top and bottom of the tape should be butted against the line where the epoxy adhesive DP190 has been scraped off. There should be approximately a 1/16 inch (.157 cm) gap between both sides of the patch and the already installed leading edge tape.

(13) Remove the “hinge tape” on the top edge and use a soft plastic squeegee to force the liquid out from behind the 8681HS tape, starting at the leading edge and working back towards the trailing edge on both the top and the bottom of the blade. Use a dry towel to mop up excess solution at the edges of the tape.

NOTE: If a bubble of liquid or air is trapped under the tape, pull the tape back up to free the bubble, re-spray the area and squeegee the tape back down to make it smooth and bubble free. DO NOT puncture bubbles to relieve entrapped air or liquid, especially on the leading edge.

(14) Seal the space between the patch and the older pre-existing leading edge tape, and the trailing edges of the patch with the DP190 epoxy adhesive using the following procedure (Figure 9-27, c):

(a) Mask off both sides of the edge of the patch, all the way around the patch, with masking tape approximately 1/16 inch (.157 cm) from the edge of the patch. Use fine line tape or equivalent.

(b) Apply sealant between the masked off area and use a stiff applicator, or your finger, to screed off the excess sealant. Immediately remove the strips of masking tape to allow the sealant to flow to a nice tapered edge. DP190 will gel in 90 minutes at 72° and full cure will be achieved in about 8 hours. It will cure faster in warmer temperatures and slower in colder temperatures.

(15) After full cure, check the sealant to see how much bulge remains. If the bulge is higher than the sealer at the aft edge of the original tape, use a sharp blade to scrape the top of the bulge down so it is flush with the existing sealer.

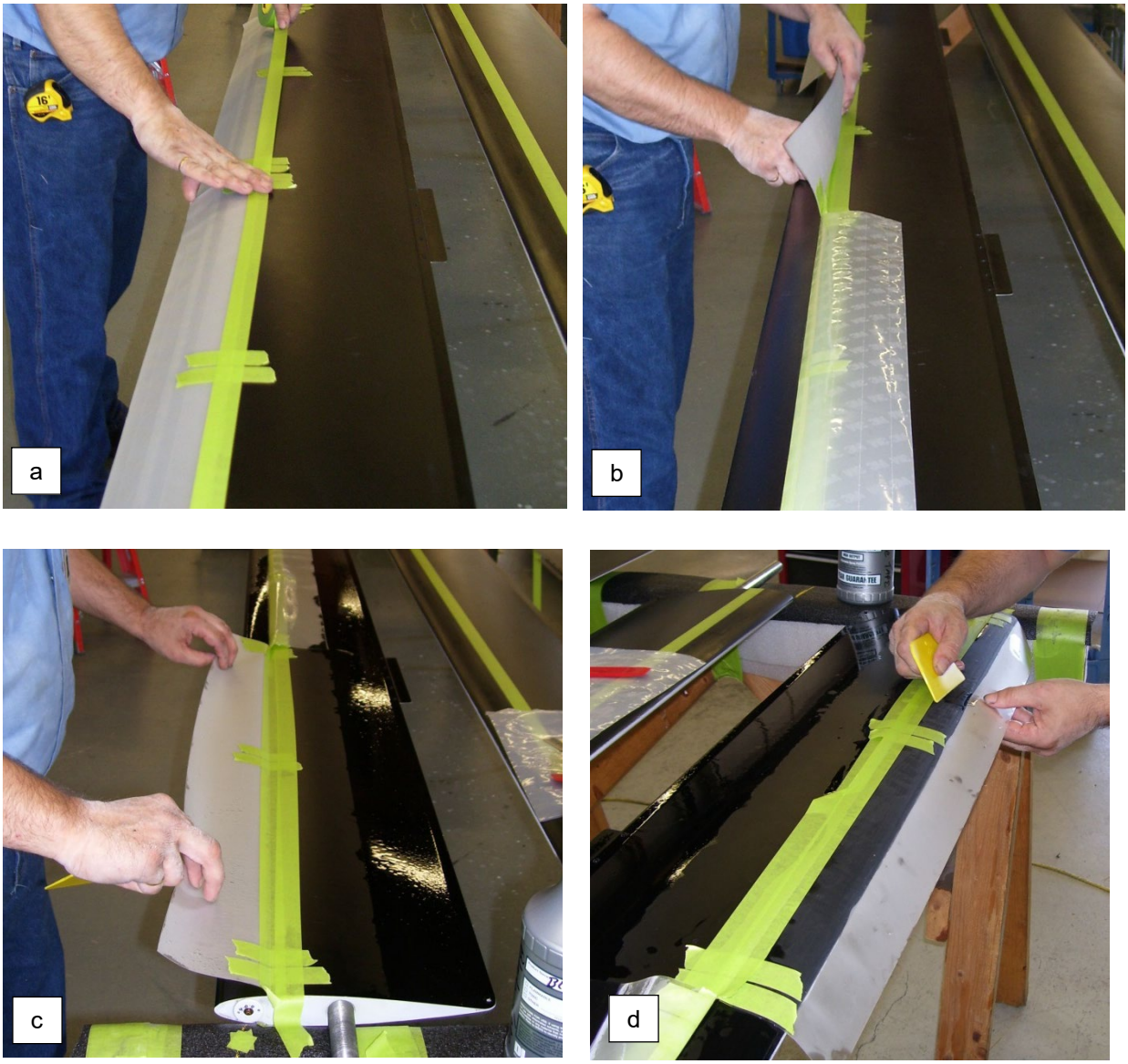

Photo a: Applying masking tape to provide the soft hinge (step 9).

Photo b: Folding the blade tape back (step 10) in preparation for blade surface treatment (steps 11 and 12).

Photo c: Positioning the blade tape for application (step 13).

Photo d: Applying blade tape to the blade top side and using a squeegee to remove liquid from under the tape as the tape is applied around the forward edge of the blade (step 14).

Figure 9-26. Blade Tape Installation

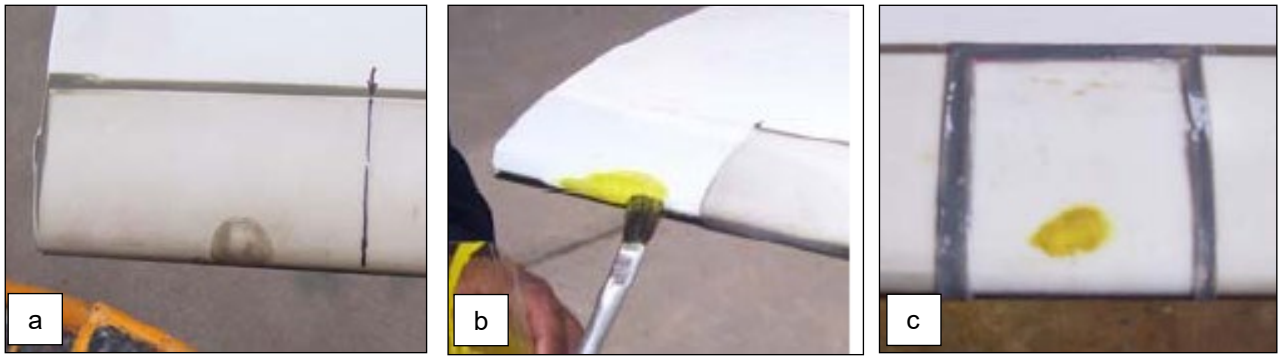

Photo a: Marking area for repair (step 1).

Photo b: Applying epoxy primer (step 5, a).

Photo c: Sealant applied to repair area (step 14).

Figure 9-27. Blade Tape Repair

9-11 Refinishing – Main Rotor Blades

WARNING: USE THE PROPER PROTECTIVE EQUIPMENT WHEN WORKING WITH THE PAINT STRIPPER. OBSERVE THE PRECAUTIONARY INFORMATION AND INSTRUCTIONS PROVIDED WITH THE PAINT STRIPPER.

NOTE: The main rotor blades are treated with a chemical conversion coating (alodine) during the manufacturing process. Attempt to preserve the coating as much as possible during the paint removal process.

A. Apply Eldorado PR-3500 paint stripper or other suitable stripper to the blade. Remove the paint residue with a plastic (body putty) spatula when the paint starts to wrinkle. Apply additional stripper as required. Finish cleaning the main rotor blade using water and a Scotch-Brite™ Pad (7447B).

B. Inspect the blade I/A/W Para. 9-9 (tail rotor blade Para. 10-1, F).

C. Repair the blade I/A/W Para. 9-10 (tail rotor blade Para. 10-1, G).

D. Wash the blade with mild soap and water and flush thoroughly.

WARNING: USE THE PROPER PROTECTIVE EQUIPMENT WHEN WORKING WITH THE METAL PREP. OBSERVE THE PRECAUTIONARY INFORMATION AND INSTRUCTIONS PROVIDED WITH THE METAL PREP.

E. Treat the repaired area of the blade with a metal prep. Flush thoroughly with fresh water and allow to dry.

WARNING: USE THE PROPER PROTECTIVE EQUIPMENT WHEN WORKING WITH THE CHEMICAL CONVERSION COATING. OBSERVE THE PRECAUTIONARY INFORMATION AND INSTRUCTIONS PROVIDED WITH THE CHEMICAL CONVERSION COATING.

F. Treat the blade as required with a chemical conversion coating complying with MIL-DTL-5541/MIL-DTL-81706.

G. Wipe the blade with Extreme Simple Green, or equivalent using clean rags.

NOTE: Do not paint the drag link mating surface of the drag link fittings.

H. Apply DeSoto Epoxy Polyamide Primer 513 X 390 (MIL-PRF-23377) or other suitable epoxy primer as follows:

NOTE: Apply the primer in thin, even coats.

NOTE: It is important that the trailing edges of the main and tail rotor blades have good coverage.

(1) Apply two coats to the spar and feather the coats past the spar to skin bond lines. Apply two coats to the trailing edge straight on. Apply the third coat to the whole blade.

(2) The application is the same for the tail rotor blades except that the whole blade gets all three coats.

I. Paint the finish coat with any good quality flat or satin finish polyurethane paint.

CAUTION: REFINISHING MAIN ROTOR BLADES WILL REQUIRE RETRACKING THE MAIN ROTOR SYSTEM. THE ROTOR SYSTEM MAY ALSO BE DYNAMICALLY BALANCED USING A CHADWICK BALANCING SYSTEM.

CAUTION: TIP WEIGHT CHANGES MUST BE MADE TO KEEP 75% OF THE BLADE TIP WEIGHT IN THE FORWARD POCKET TO MAINTAIN THE CORDWISE BALANCE.

CAUTION: REFINISHED TAIL ROTOR BLADES WILL BE REQUIRED TO BE STATICALLY AND DYNAMICALLY REBALANCED.

9-12 Corrosion Prevention – Main Rotor Blades

A. Refer to Para. 4-83 and SIL 0170 for the application of corrosion prevention compound to the main rotor blades.

9-13 Installation – Main Rotor Blades (Figure 9-17)

WARNING: DO NOT ALIGN THE HOLES IN THE GRIP AND BLADE BY PLACING YOUR FINGER IN THE RETENTION BOLT HOLE.

NOTE: Lifting the tip of the blade so the blade is parallel to the retention assembly will allow easy installation of the blade into the blade grip, installation of the blade bolt, and the drag brace bolt. If desired, use the main rotor blade bolt guide bullet, T-0009, to aid installation of the blade bolts.

A. If required, apply corrosion prevention compound to each blade. (Refer to SIL 0170.)

B. Install the root end of the blade into the blade grip.

C. Align the retention bolt hole in the grip with the hole in the blade. Install the bolt (2), washer, and nut. Torque the nut to 600 in-lb/68.2 Nm.

D. Connect the drag link to the trailing edge of the blade and secure with the hardware (1). Torque the nut to 140 in-lb/15.9 Nm.

E. Repeat the process for the other blades.

F. Perform a maintenance test flight if maintenance was performed on the main rotor blades.

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SECTION 12

FLIGHT CONTROLS

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FLIGHT CONTROLS

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12-1 TROUBLESHOOTING THE ARTICULATED ROTOR SYSTEM

A. General Information

Helicopter vibration and cyclic feedback are often attributed to an out-of-track main rotor system when the actual cause can be traced to components within the system that are worn, damaged or out of adjustment.

The following troubleshooting guide is provided to direct maintenance personnel to possible problem areas within the rotor system that can cause vibration or roughness. This guide covers some of the problems and related causes that can be checked prior to attempting to track the blades. Performing the suggested checks and attention to routine maintenance schedules will help reduce time unnecessarily spent in attempting to track blades that may not be the cause of the problem.

B. Problems, Checks, and Solutions

NOTE: While this is not a complete listing of possible problems that could produce system vibration, it illustrates the fact that proper maintenance and inspection of system components can reduce maintenance time involved in trying to track blades that are reacting to problems elsewhere in the system.

NOTE: Lamiflex bearings are discontinued. If the Lamiflex bearings must be replaced, the aircraft must be converted to a TT strap retention assembly. Refer to Table 2-2 *Vendor Contact Information* to obtain the TT strap retention assembly installation (STC SR03465CH). Installation instructions and instructions for continued airworthiness publications are provided with the STC. (F-28F S/N 832 and subsequent and 280FX S/N 2147 and subsequent are equipped from the factory with the TT strap retention assembly installation, STC SR03465CH.)

(1) Aircraft develops a sudden roughness or cyclic feedback during flight.

Problem	Check	Action
Lamiflex bearing failure.	Disconnect the rotor pitch links at the upper walking beams (See Figure 1, Item A) and flex the blade grip in no more than a 30° (i.e. ± 15°) arc. Failure of the blade grip to spring back indicates a failed lamiflex bearing.	Install T-T strap retention assembly. Refer to Enstrom F-28/280 series Illustrated Parts Catalog, Figure 4-2.1 for parts.
Main rotor damper seized or relief valve stuck or open.	Cycle blades fore and aft to move damper piston in and out. Failure of damper to cycle indicates a restrictor is plugged.	Disassembly and clean damper and restrictor. Replace relief valves.
Leading edge tape bubbling, loosening, or peeling (if blade tape is used).	Inspect tape for separation from blades.	Repair or replace leading edge tape (Para. 9-10, S).
Main rotor blade/ leading/trailing edge separation occurring.	Inspect blades for evidence of separation.	Replace or repair blade.

NOTE: Replacement blades must be matched by Enstrom Helicopter Service. Provide serial numbers of good blades and helicopter serial number. Blade repairs must be performed by an authorized blade repair facility.

Main rotor blade suffered strike.	Inspect blades for evidence of strike damage.	Extent of damage will determine if the blade requires replacement.

(2) Aircraft's first flight is rough or has cyclic feedback; previous day's flight was smooth.

Problem	Check	Action
Trapped air in the dampers.	Check air in dampers.	Bleed damper.
Lamiflex bearing failure	Disconnect the rotor pitch links at the upper walking beams and flex the blade grip in no more than a 30° (i.e. ± 15°) arc. Failure of the blade grip to spring back indicates a failed lamiflex bearing.	Install T-T strap retention assembly. Refer to Enstrom F-28/280 series Illustrated Parts Catalog, Figure 4-2.1 for parts.
Leading edge tape bubbling, loosening, or peeling (if blade tape is used).	Inspect tape for separation from blades.	Repair or replace leading edge tape (Para. 9-10, S).
Grip seal pushed out during servicing	Check that the seals are installed in the grips.	Remove purge plug and push seal back in.
Main rotor blade tab inadvertently bent.	Check tab angles. Inspect tabs for damage or deformation.	Reset tab angles as recorded on the "Blade Information Sheet", or replace tabs if damaged.

NOTE: If tab angles are not available, contact Enstrom Helicopter Service for original angles. Provide aircraft serial number.

Main rotor blades suffered "hangar rash" damage.	Inspect blades for evidence of damage.	Extent of damage will determine if blade replacement is required.
Improper main rotor blade grip servicing	Check lubrication procedure in accordance with Para. 4-28.	Relieve any internal pressure by removing purge screw feathering the blade grip. Then replace the purge screw.

(3) Aircraft generally develops in increasing roughness or cyclic feedback over a period of days.

Problem	Check	Action
Trapped air in the dampers.	Check air in dampers.	Bleed damper.
Lamiflex bearing failure.	Disconnect the rotor pitch links at the upper walking beams and flex the blade grip in no more than a 30° (i.e. ± 15°) arc. Failure of the blade grip to spring back indicates a failed lamiflex bearing.	Install T-T strap retention assembly. Refer to Enstrom F-28/280 series Illustrated Parts Catalog, Figure 4-2.1 for parts.

Problem	Check	Action
Leading edge tape bubbling, loosening, or peeling (if blade tape is used).	Inspect tape for separation from blades.	Repair or replace leading edge tape (Para. 9-10, S).
Worn linkage.		
Dogleg uni-ball bearings worn excessively (Figure 12-22, Item 10).	Check the swashplate dog leg assemblies for excessive bearing play/wear (Para. 12-11, D).	Reswage or replace bearings as required.
Overall control system rod end bearings or bellcrank spacers/bushings are worn.		Replace worn components as required.
Blade paint, spar flaking, voids, skin, doublers, or retention plate damage.	Check the blade assembly condition. (See Para. 9-9 and limits in Figure 9-20.)	Repair damage in accordance with Para. 9-10, A, as applicable. If voids exceed limits, replace blade.
If aircraft is new, touching up the blade track may be required due to wear in and seating of system components.	Check track. NOTE: Refer to the tracking procedures in Section 12-2, F.	Track blades.

12-2 MAIN ROTOR BLADE TRACKING

NOTE: The Honeywell Chadwick 2000 system installation and operation are described in the following instructions. Follow the operating instructions for the equipment being used if different than the instructions for the Chadwick 2000.

NOTE: This procedure should be followed when using the MicroVib™II and ACES or DynaVibe systems with modifications required by the individual system used.

NOTE: Blades manufactured with Universal spars must be hover tracked to .2 IPS or less before any attempt is made to work out the cyclic feedback; otherwise, the cyclic feedback will return when the hover is tracked.

NOTE: Do not change the tip weights in the blades from original factory settings.

NOTE: If there is no cyclic feedback and the helicopter has been flying satisfactorily, it is recommended not to change outboard tab settings.

The purpose in tracking the main rotor blades is to obtain a smooth ride. This is accomplished by adjusting the blade track to reduce vibration. An out-of-track condition will produce a vibration, usually a one-per rev which is felt as a vertical vibration, however for the rotor system to be in track, it does not necessarily mean that the blades are flying in the same plane. With the advent of modern digital tracking equipment it has been found that the best ride is not necessarily the result of the blades flying in plane, but in a track that gives the least magnitude of vertical vibration. For this reason, Enstrom recommends that the strobe light only be used on the ground for initial ground track or for initial hover track if the initial ride is unacceptably rough.

The tracking procedure (vertical) follows this flow chart:

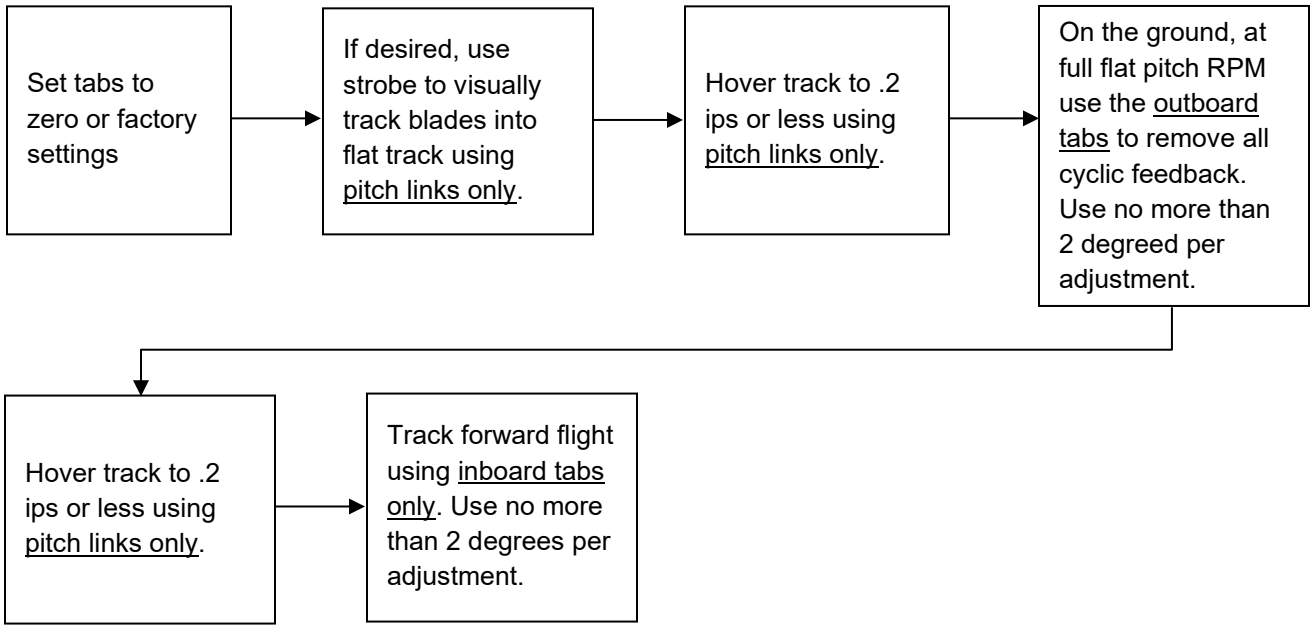


Figure 12-1. Tracking Procedure Flow Chart

A. Installation of Equipment

(1) Install the optical sensor on the fuel tank (F-28F) or on the top air intake fairing (280FX) (Figure 12-2).

(2) The number one blade (Target blade) must be at the 12 o'clock position relative to the front of the helicopter when the magnetic pick-up is opposite the interrupter on the swashplate, or when the optical sensor is opposite the reflective tape on the mast.

(3) Install the vertical velocimeter on the right side of the instrument panel pedestal (Figure 12-3).

NOTE: Enstrom recommends not using a strobe light to track blades. Three-blade rotor systems do not necessarily fly in track and the strobe may produce misleading information and lengthen the tracking procedure.

(4) Install the strobe light, if desired, or if there is reason to believe that the initial hover will be unacceptably rough.

(5) Set up the analyzer using the manufacturer's instructions and the following parameters:

(a) Three main rotor blades

(b) Counterclockwise rotation when viewed from above

(c) 350 RPM

B. Tracking Procedure

(1) Grease the flapping bearings (Para. 4-30).

(2) Bleed the main rotor dampers (Para. 4-18).

NOTE: If the helicopter is already flying reasonably well do not make any adjustments to the tabs at this time.

(3) Set the tabs at recorded angles on the "Blade Information Sheet" or zero all the tabs.

WARNING: THE FOLLOWING STEPS ARE TO BE PERFORMED BY AUTHORIZED PERSONNEL.

(4) Ground run helicopter with rotor engaged at full "flat pitch" rpm.

(5) If the strobe light is being used, observe the track of the blades and use pitch links to adjust the track into a reasonable flat track.

(6) Hover the helicopter into the wind at 350 RPM.

NOTE: The best results are obtained if the helicopter is loaded so that the helicopter is relatively heavy. Normally, adding weight will make the blades fly at a higher angle of attack and will increase the roughness of the ride, while as the helicopter gets lighter from fuel burn, the ride will improve.

Figure 12-2. Optical Sensor Installation (280FX)

Figure 12-3. Velocimeter Installation (280FX)

(7) Record the ips reading and the clock angle. Using the Vertical Velocimeter Channel B Polar Chart (Figure 12-4), adjust track for ips readings of less than .2 using pitch links.

NOTE: If the move line of the weight change does not coincide with the move lines on the chart, use the “Clock Angle Correction” procedure (Para. 12-G).

NOTE: The rotor system must be hover tracked to .2 ips or less before performing the procedure to tab out cyclic feedback.

C. Tabbing Out Feedback

Cyclic feedback is a pulsing felt in the cyclic stick at main rotor 1/rev frequency. Tabbing out cyclic feedback is the most difficult and the most important procedure in achieving optimum ride in Enstrom helicopters with minimum cyclic vibration. Less than optimum outboard tabbing will result in excessive inboard tab to achieve a smooth ride and also excessive cyclic stick vibration. Unfortunately there is no reliable method of determining the correct outboard tab other than trial and error.

(1) Create a chart such as the one shown below to record the results of the tabbing runs.

Tab	Result
1 Up	
1 Down	
2 Up	
2 Down	
3 Up	
3 Down	

(2) Operate the helicopter on the ground at full flat pitch blade RPM (350 RPM).

(3) Move the cyclic six to eight inches in a forward and aft movement at approximately one cycle per second and feel for feedback in the cyclic motion.

NOTE: Feedback will not necessarily be indicated by cyclic stick shake, although stick shake will result from significant feedback.

(4) Stop the blades and add 2 degrees up to the #1 blade outboard tab.

(5) Run the helicopter again using the same procedures and check the cyclic for feedback again. The purpose of this procedure is to compare the feedback to the original tabbing and to the last tab attempt. The severity of the feedback will stay the same, get better or get worse. Record this result in the table above.

(6) If the feedback is eliminated, this procedure is finished. If the magnitude of the cyclic feedback either stays the same, or worsens, then change the setting on the same outboard tab to two degrees down. If the feedback gets better but is still present, add one more degree. Do not use more than 4° in any tab.

(7) Run the helicopter again and using the same procedure, compare the magnitude of the cyclic feedback. Again, it should either be eliminated, stay the same or get worse. If it stays the same or gets worse, then set the #1 blade outboard tab back to zero, and add two degrees up to the #2 blade outboard tab.

(8) Continue this procedure until each blade has been checked for both up and down tab, or until the feedback has been eliminated.

(9) By following this procedure it should be possible to eliminate the cyclic feedback with one outboard tab adjustment on one blade.

D. Hover Tracking

(1) Using pitch links, re-track the hover to less than .2 ips using Figure 12-4 (vertical polar chart). If the above procedure is followed, once the hover has been tracked smooth, the cyclic feedback should not reoccur.

E. Forward Flight Tracking

(1) Forward flight is tracked using the inboard blade tabs.

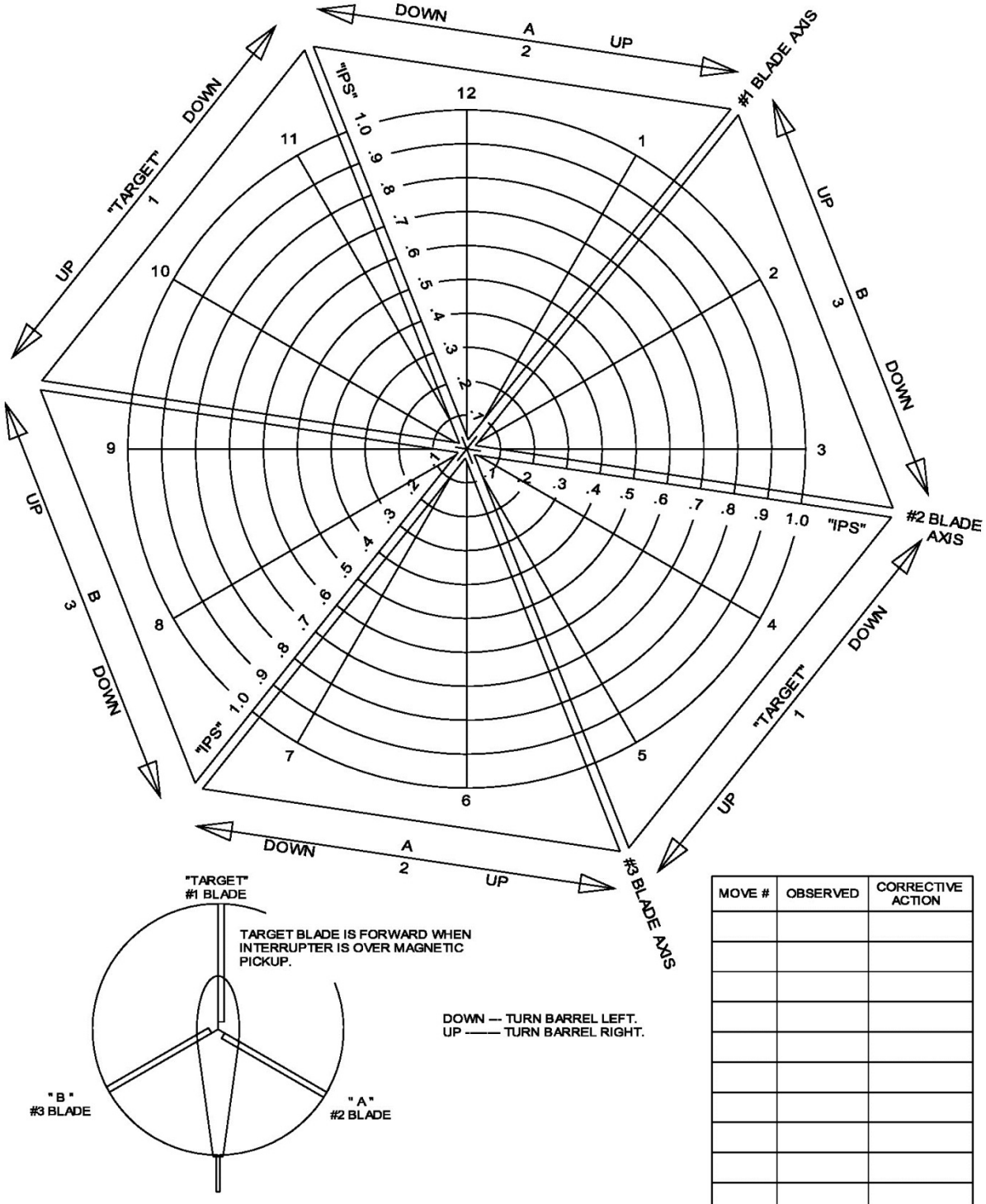
(a) Fly the helicopter at normal cruise settings (29 in MP) and record the ips reading and the clock angle.

(b) Using the same polar chart (Figure 12-4) adjust the forward flight to less than .2 ips with the inboard tabs.

NOTE: If addition of inboard tab affects the hover, take that tab out again and try opposite tab on the other two blades.

NOTE: When making clock angle corrections, if a tab change does not improve the ips reading, it is advised to take the tab adjustment out again and try adjusting the inboard tab on another blade. Failure to follow this procedure will result in excessive tab amounts on all the blades.

(2) Continue this procedure until the forward flight ips reading is .2 or less.



DOWN --- TURN BARREL LEFT.
UP ——— TURN BARREL RIGHT.

MOVE #	OBSERVED	CORRECTIVE ACTION

Figure 12-4. Vertical Accelerometer Channel “B” Polar Chart

F. Lateral Balancing

CAUTION: READING THE LATERAL CHANEL IS RECOMMENDED AS A TROUBLESHOOTING PROCEDURE TO ISOLATE A FAULTY COMPONENT THAT IS CREATING AN OUT OF BALANCE CONDITION.

IF WORK HAS BEEN DONE TO THE BLADES AS PER PARA. 12-1, FOLLOW THE PROCEDURES LISTED BELOW.

(1) It is not recommended to change tip weights in the Enstrom rotor system because there is no centering mechanism in the hydraulic lead-lag dampers. Changing tip weights usually results in the blade flying in different lead-lag position but will not cure the underlying cause of a lateral imbalance.

(2) If a set of blades is suspected to be out of balance, they can be statically balanced as a set. Contact Enstrom Product Support for information about static balancing blades or obtaining a static balance kit.

(3) The Lateral Accelerometer Channel “A” Polar Chart (Figure 12-5) can be used to help determine which axis (lead-lag bearing, damper, or out-of-balance blade is causing the lateral vibration.

(a) Install the optical sensor and a velocimeter on a top fuel tank screw, indexed 90° to the longitudinal axis of the helicopter.

(b) Obtain a vertical and lateral ips and clock angle reading. The higher of the two readings is usually the axis that is causing the vibration.

1 IPS readings around .2 or less are unreliable for determining if the vibration is vertical or lateral.

2 A significant ips vibration in either axis will pull up the ips reading of the other axis also. (A high vertical will also cause a high lateral and vice-versa.)

3 Plot the clock angle of the lateral reading. This should indicate the blade axis that is causing the lateral vibration.

4 It may be necessary to make a temporary weight change in the indicated blade to establish if there is a clock angle correction required on the “A” chart.

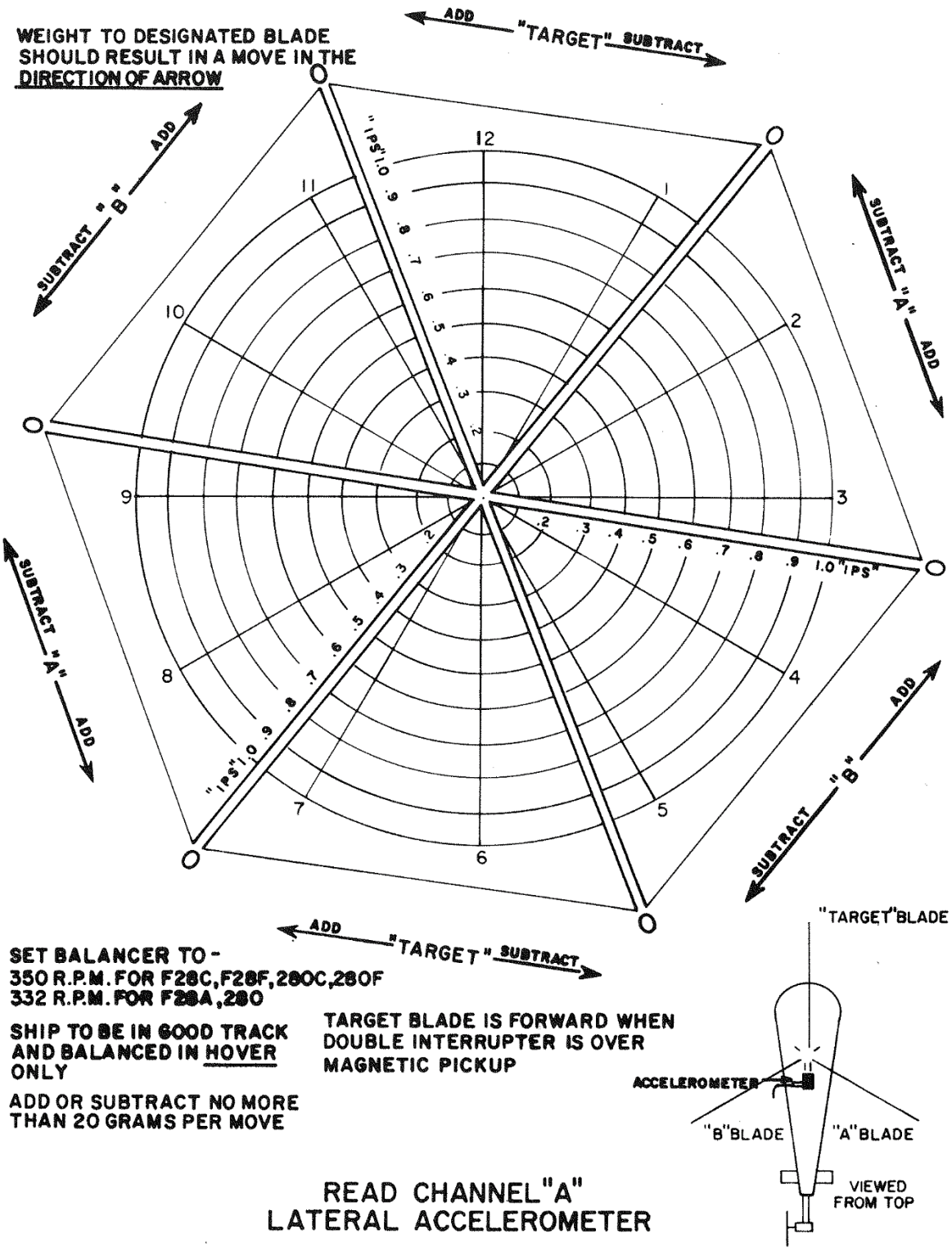


Figure 12-5. Lateral Accelerometer Channel “A” Polar Chart

G. Clock Angle Corrections

NOTE: The clock angle correction is seldom the same in hover as it is in forward flight so when the tracking progresses to the forward flight phase, a new chart should be used, and the correction will have to be figured again.

NOTE: In some cases, particularly when the ips readings progress from a large number to a small number, the clock angle correction may change or go away entirely. The technician needs to plot all the moves and to be ready to recalculate or abandon the clock angle correction, if needed.

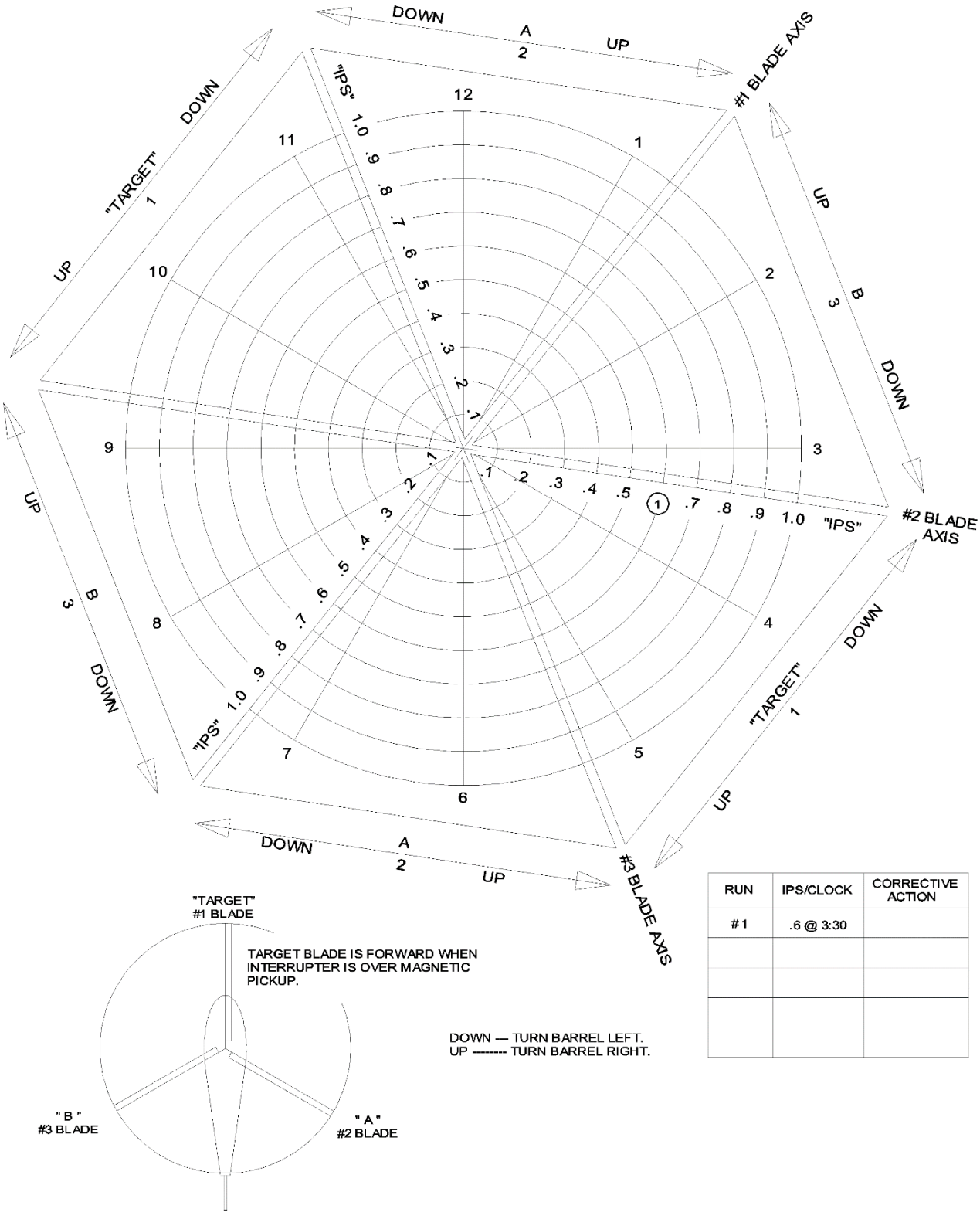
If a series of plotted blade track corrections move in a circular direction on the polar chart rather than moving toward the center of the chart, a clock angle correction is required. The following procedure was developed using the Chadwick Vibrex 2000 balance system. The procedure can be adapted for use with any of the digital balance boxes when the internal learning program is disabled.

(1) A reading of .6 ips at a clock angle of 3:30 for the first hover run is plotted on the polar chart (Figure 12-6).

(2) #2 blade is adjusted approximately 1/3 flat down. A reading of .5 ips at a clock angle of 1:30 for the second hover run is plotted (Figure 12-6.1). Clearly, the adjustment did not produce the expected move on the polar chart. This indicates that the polar chart is not correctly aligned to the helicopter.

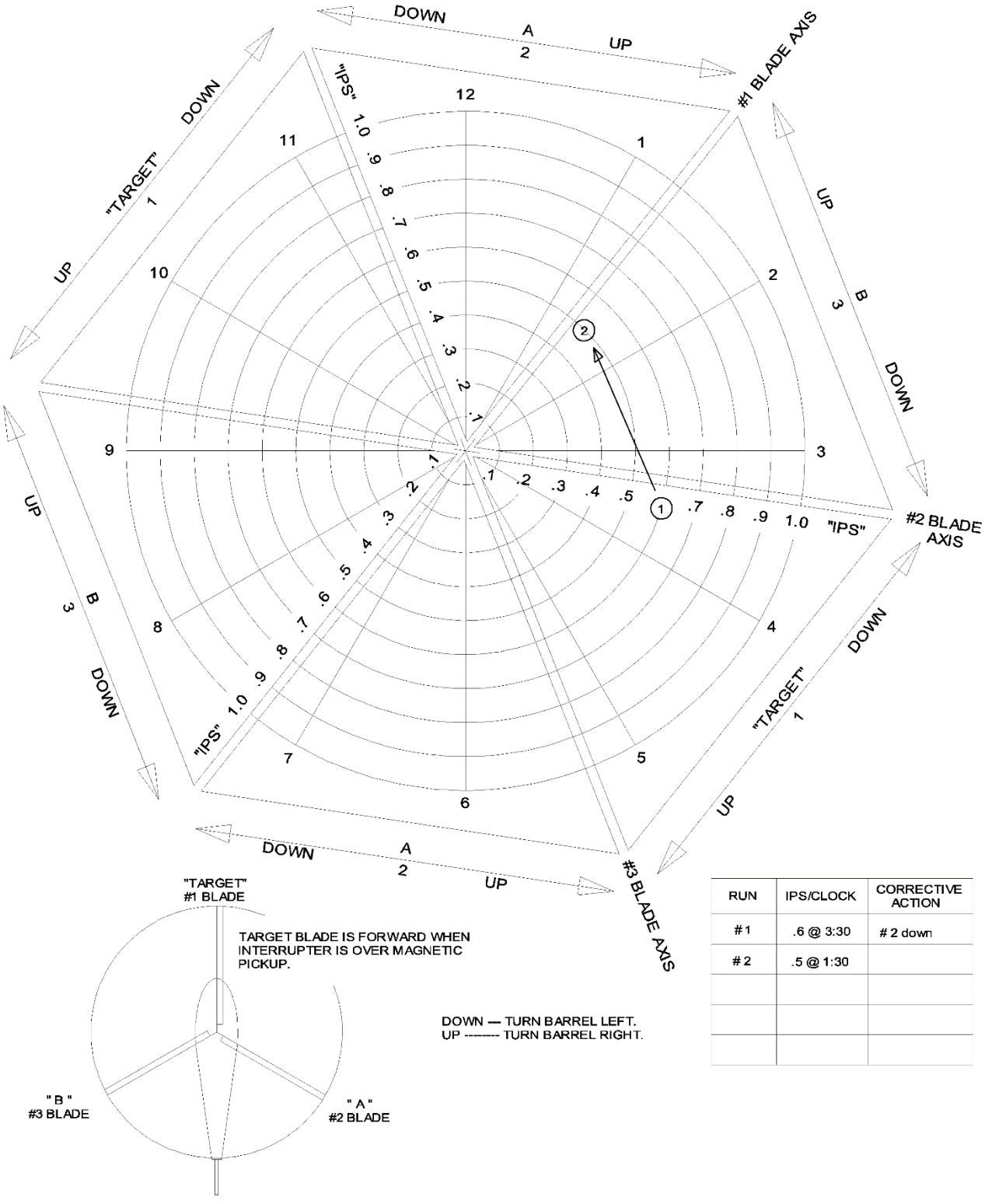
(3) Observation of run #1 and run #2 plots indicates that the tracking response is following the #3 blade axis line. Therefore, the blade correction move lines must be shifted clockwise one flat (60°) (Figure 12-6.2). This is the Clock Angle Correction.

(4) According to the corrected chart, the #3 blade should be adjusted 1/3 flat down. A reading of .2 ips at a clock angle of 1:00 for the third hover run is plotted on the corrected chart (Figure 12-6.3). The move corresponds well with the corrected chart and the tracking procedure is complete.



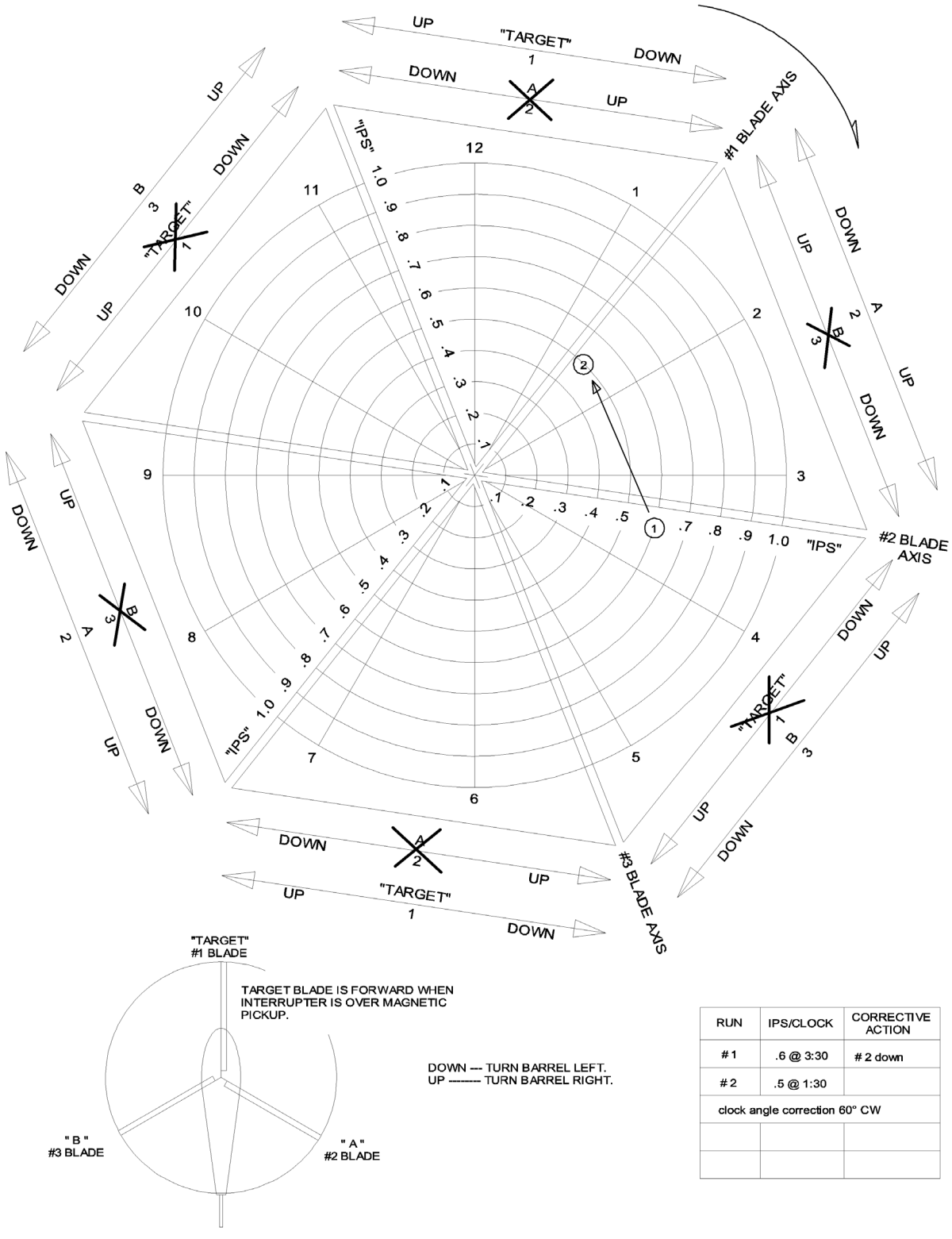
RUN	IPS/CLOCK	CORRECTIVE ACTION
#1	.6 @ 3:30	

Figure 12-6. Main Rotor Clock Angle Correction Example



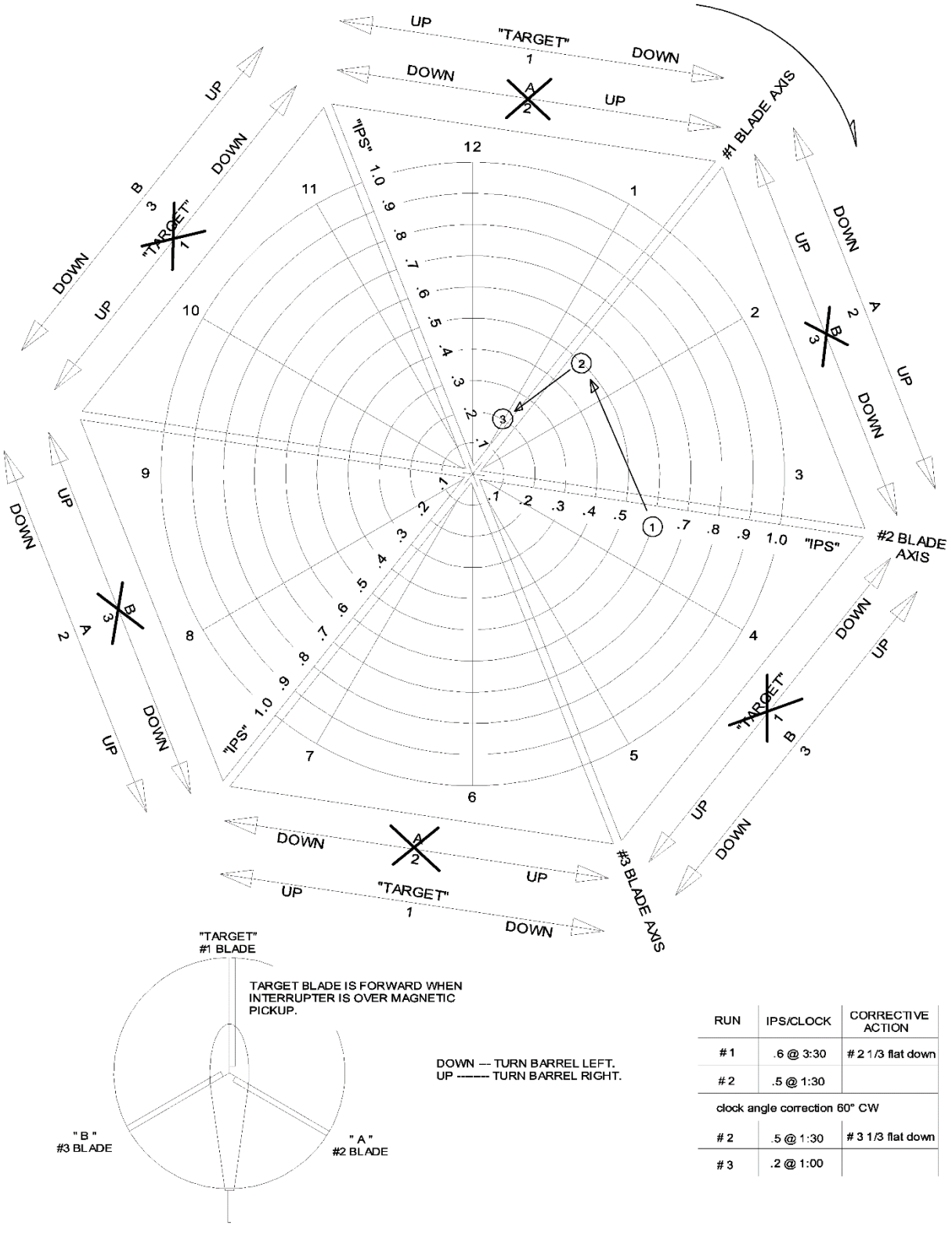
RUN	IPS/CLOCK	CORRECTIVE ACTION
#1	.6 @ 3:30	# 2 down
#2	.5 @ 1:30	

Figure 12-6.1. Main Rotor Clock Angle Correction Example



RUN	IPS/CLOCK	CORRECTIVE ACTION
#1	.6 @ 3:30	# 2 down
#2	.5 @ 1:30	
clock angle correction 60° CW		

Figure 12-6.2. Main Rotor Clock Angle Correction Example



RUN	IPS/CLOCK	CORRECTIVE ACTION
#1	.6 @ 3:30	# 2 1/3 flat down
#2	.5 @ 1:30	
clock angle correction 60° CW		
#2	.5 @ 1:30	# 3 1/3 flat down
#3	.2 @ 1:00	

Figure 12-6.3. Main Rotor Clock Angle Correction Example

12-3 COLLECTIVE PITCH CONTROL STICK

A. Description

The collective pitch control stick controls rate of climb when pulled upward by increasing the pitch of all three main rotor blades simultaneously and to the same degree. Downward movement of the collective stick decreases the pitch of the blades which decreases lift on the rotor and allows for a controlled descent. The collective pitch control stick is incorporated into the throttle correlator system. This mechanism combines the throttle motion with the collective stick movement such that the proper power inputs are automatically established as the collective stick is moved. The correlator is designed to keep the rotor/engine rpm within the desired green band for the majority of all flight regimes. Friction control is provided on the throttle grip of the collective stick. See Figure 12-7 for locations of the friction control points.

For F-28F S/N 809 through S/N 832 and 280FX S/N 2001 through S/N 2166, the engine starter button is located on the end of the pilot's and co-pilot's collective sticks (if equipped with dual start). Subsequent S/N are equipped with an illuminated control switch box mounted on the forward end of the collective stick. The control box includes the starter button, and forward and aft landing light switches.

B. Removal – Pilot Collective (Figure 12-7)

(1) Remove the fiberglass cowl over the collective stick.

(2) Disconnect the electrical wiring, as applicable.

(a) Disconnect the starter button wires at the the quick disconnect terminals.

(b) (Illuminated collective control only) Disconnect the electrical harness from the electrical connector on the forward side of the seat deck.

(3) Remove bolt (1) connecting the throttle bellcrank to the collective stick

NOTE: Do not disconnect the co-pilot collective linkage or the correlator linkage attached to the throttle bellcrank.

(4) Cut safety wire and remove bolt (2) from the top of the collective bellcrank.

(5) Remove the collective stick from the collective and throttle bellcranks. Keep the DU washer (3) for reinstallation.

C. Installation – Pilot Collective

(1) Install the collective stick into the collective bellcrank and align the holes.

(2) Install washer and bolt (2). Torque bolt and safety (MS20995C32).

(3) Lubricate (Tri-Flow brand or equivalent light viscosity lubricant) DU washer (3) and install on stick with the DU side of the washer facing forward toward grip.

(4) Install the throttle bellcrank and align holes.

(5) Install bolt (1), washers, nut and torque.

(6) Connect the electrical wiring, as applicable.

(a) Connect the wire terminals for the starter button.

(b) (Illuminated collective control only) Connect the electrical harness to the connector on the forward side of the seat deck.

(7) Cycle the collective stick up and down and rotate throttle to check freedom of movement.

(8) Install the fiberglass cowl and screws.

NOTE: Grease or oil build-up on torque tube may cause collective friction to slip. To remedy this problem spray Loctite 7471 Primer T, or equivalent, into slotted area of collective clamp on torque tube until oil is removed.

D. Removal – Copilot Collective

(1) (Illuminated collective control only) Disconnect the electrical harness from the electrical connector on the forward side of the seat deck.

(2) Lift tab of the expando pin (4) to a vertical position and pull to remove.

(3) Remove the co-pilot's stick from collective bellcrank.

E. Installation – Copilot Collective

(1) Align the slot in the end of collective stick with the bolt in the collective bellcrank and slide into place.

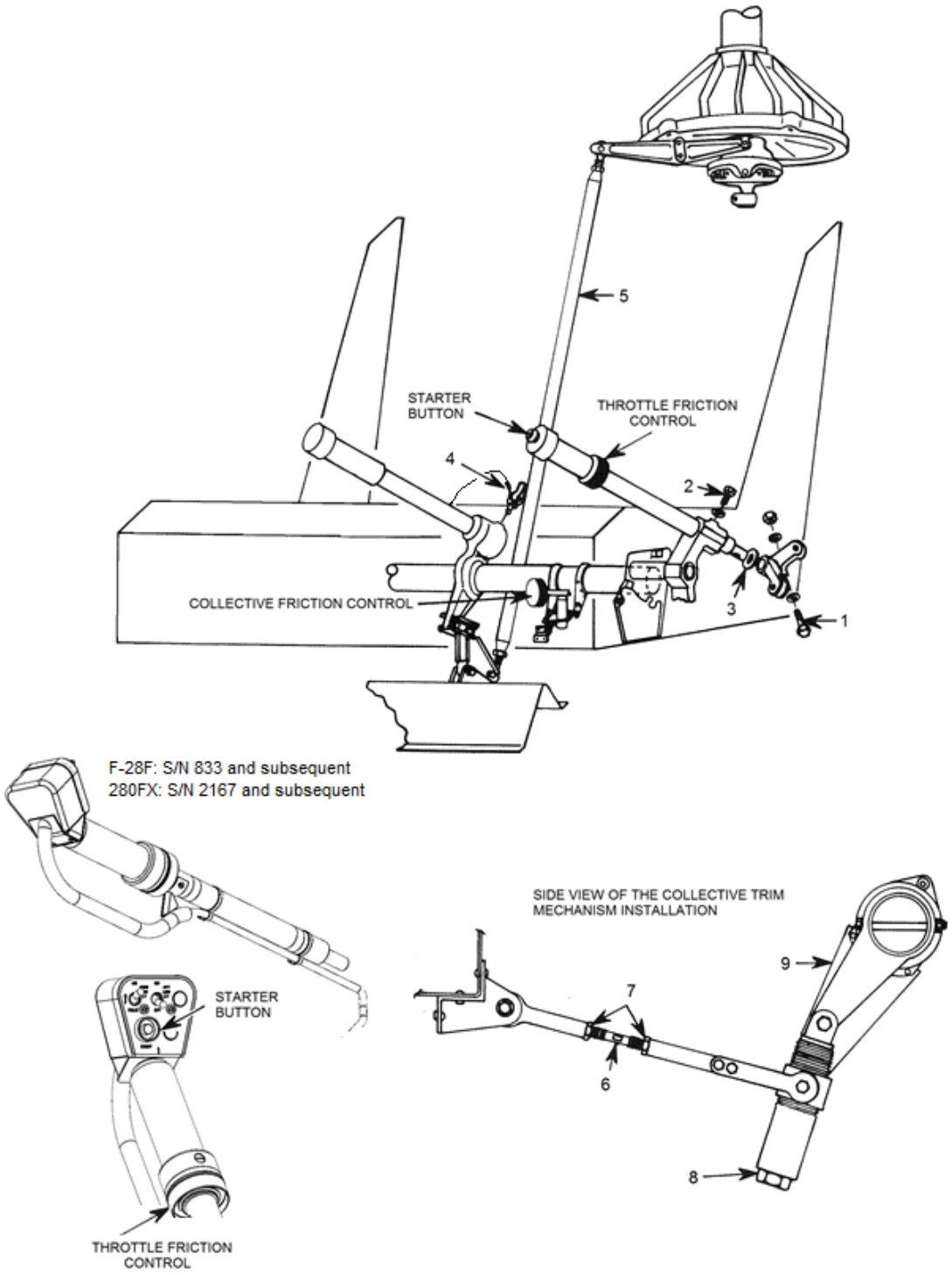
(2) Align the expando pin holes and install the pin.

(3) Flip eccentric tab of the expando pin to secure.

(4) (Illuminated collective control only) Connect the electrical harness to the connector on the forward side of the seat deck.

NOTE: To adjust tightness of the expando pin, loosen the set screw on side and rotate the pin to the required tension. Tighten the set screw. The expanding segments must be contained for tight fit.

NOTE: The expando pin can be folded down in one of two different positions but only one position locks it in place. The correct position is the when the cam causes the pin to expand and it is the position that requires the most force to push the lever down.



1. Bolt
2. Bolt
3. DU Washer
4. Expando Pin
5. Control Rod
6. Threaded Shaft
7. Check nut
8. Spring Capsule Assembly
9. Pivot Retainer Strap

Figure 12-7. Collective Control System

12-4 COLLECTIVE TRIM SYSTEM

NOTE: Refer to Service Information Letter SIL 0184, latest revision, regarding a collective trim system update to simplify collective balance adjustment.

A. Collective Trim Capsule Removal (Figure 12-9)

(1) Remove the fiberglass seat deck.

(2) With the collective stick down and the spring capsule in compressed position, install special tool T-0022 between bottom of the hex nut and the top of the spring housing.

(3) Secure tool T-0022 in position by wrapping upper end with safety wire (MS20995C32) (Figure 12-8).

(4) Release the collective friction and gently raise the collective so that the capsule is fully extended into tool T-0022.

WARNING: With the spring capsule in compressed position there is approximately 180 lbs of force exerted by the springs. Handle with extreme care.

(5) Remove nuts (1) and washers (2) from the spring capsule pivot (3).

(6) Remove bolts (5), washers (6), and nuts (7) from brackets (4). Remove brackets.

(7) Remove bolt (9), washers (10) and nut (11) from the pivot retainer straps (8). Remove spacer (12).

(8) Slide the pivot retainer straps (8) outboard on torque tube to detach from capsule pivot (3).

NOTE: The pivot retainer straps must rotate freely on the collective torque tube. Lubricate the strap bearing over the torque tube (Tri-Flow brand or equivalent light viscosity lubricant).

(9) Remove bolt (13), nut (15), and washers (14) from the upper end of spring capsule.

(10) Carefully remove the spring capsule assembly.

(11) To remove tie rod assembly from seat, remove bolt (19), washers (14) and (16), spacer (20) and nut (15).

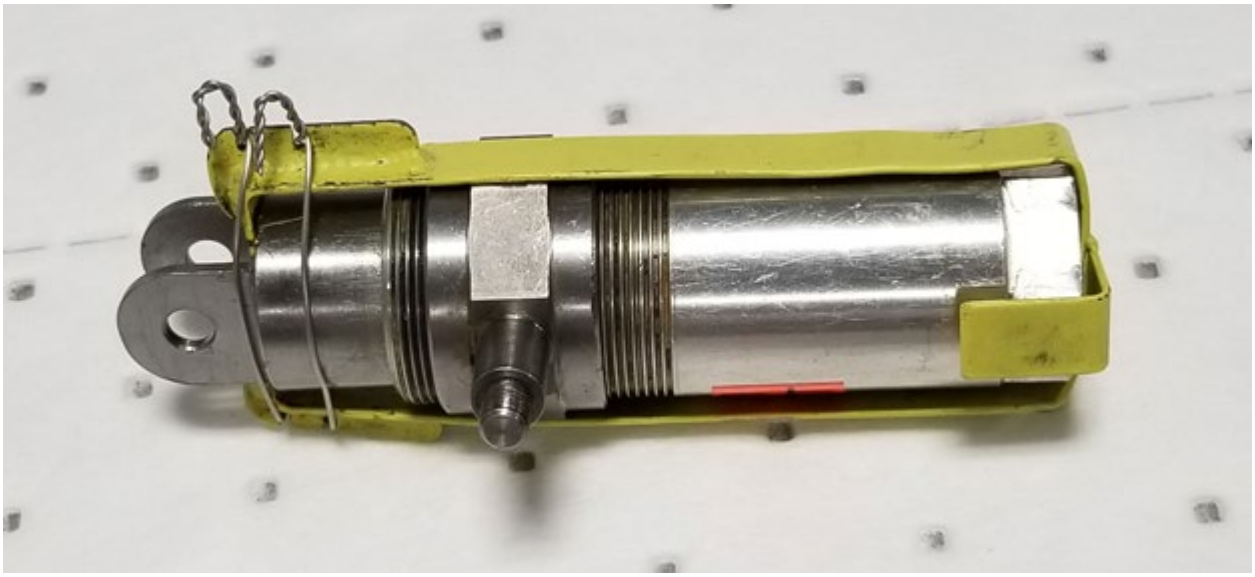
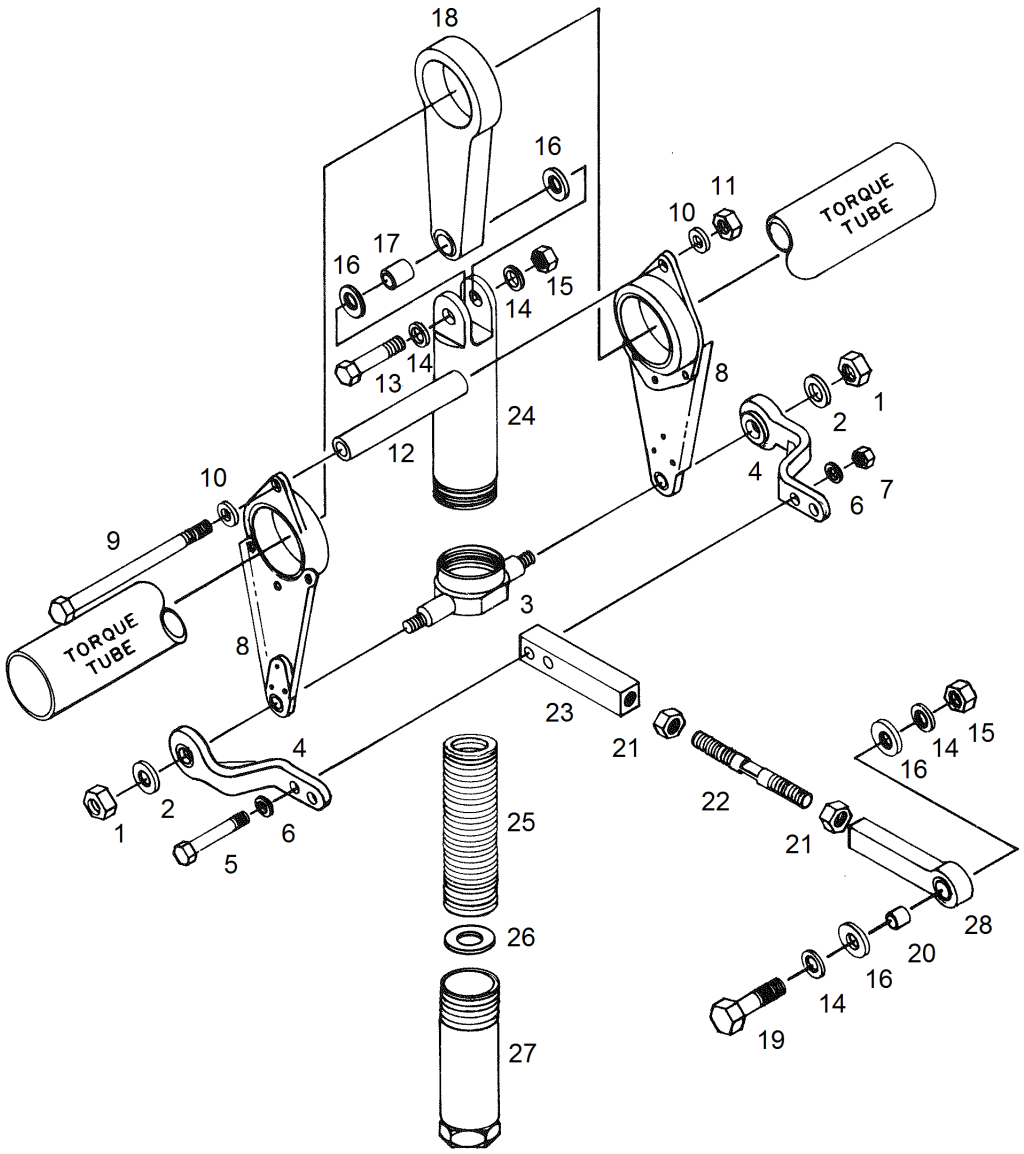


Figure 12-8. Collective Spring Capsule in Holding Tool T-0022
(As removed from the collective trim system)



1.	Nut	15.	Nut
2.	Washer	16.	Washer (P/N ECD050-11)
3.	Capsule Pivot	17.	Spacer
4.	Bracket	18.	Bellcrank
5.	Bolt	19.	Bolt
6.	Washer	20.	Spacer
7.	Nut	21.	Check Nut
8.	Pivot Retainer Strap	22.	Tie Rod
9.	Bolt	23.	Link
10.	Washer	24.	Spring Housing
11.	Nut	25.	Spring
12.	Spacer	26.	Washer
13.	Bolt	27.	Spring Retainer
14.	Washer	28.	Link Assembly

Figure 12-9. Collective Trim, Spring Capsule Assembly

B. Collective Trim – Disassembly

(1) Carefully place the spring capsule assembly horizontally between jaws of bench vise.

(2) Cut safety wire from special tool T-0022.

(3) Slowly rotate the vise handle to release spring pressure until all tension is relieved.

(4) Remove spring housing (24), spring (25), washer (26), and spring retainer (27).

(5) Remove the spring capsule pivot (3) from spring retainer (27).

(6) Rod assembly - break torque on the check nuts (21) and turn the link (23) and link assembly (28) to remove from the tie rod (22).

C. Collective Trim – Assembly (Figure 12-9)

(1) Apply grease (MIL-PRF-81322) to spring (25).

(2) Install the spring capsule pivot (3) on spring retainer (27) with 3 to 4 threads extended above spring capsule pivot.

(3) Install washer (26) in the spring retainer (27).

(4) Install spring (25) into spring retainer (27).

(5) Install spring housing (24).

(6) Place tool T-0022 on the spring capsule and carefully compress the capsule in vise until lip of tool locks between the ears of spring housing (24) (Figure 12-8).

WARNING: WITH THE SPRING CAPSULE IN COMPRESSED POSITION, THERE IS APPROXIMATELY 180 LB OF FORCE EXERTED BY THE SPRINGS. HANDLE WITH EXTREME CARE.

(7) With the spring capsule still in the vise, wrap tool T-0022 with safety wire (MS20995C32) to secure in position.

(8) Install check nuts (21) on the tie rod (22).

(9) Install link (23) and link assembly (28) on tie rod (22), leaving the check nuts loose for adjustment.

D. Collective Trim – Installation (Figure 12-9)

NOTE: Lubricate (Tri-Flow brand or equivalent light viscosity lubricant) all DU bushings and washers.

(1) Install bushing (20) into link assembly (28).

(2) Place washers (16) on each side of the link assembly (28) and install assembly into seat mount.

(3) Install bolt (19), washers (14) and nut (15). Torque (30-40 par/3.4-4.5 Nm). Ensure the link assembly (28) pivots in the seat mount.

(4) Install spacer (17) into bellcrank (18).

(5) Place washers (16) on each side of bellcrank (18) and carefully slide the spring capsule assembly into position.

(6) Attach the spring capsule to bellcrank (18) with bolt (13), washers (14), and nut (15). Torque (30-40 in-lb/3.4-4.5 Nm). Ensure the spring capsule rotates in the bellcrank (18).

(7) Slide pivot retainer straps (8) inboard and onto the spring capsule pivots (3).

(8) Install straps (4) onto spring capsule pivots (3).

(9) Place spacer (12) between upper end of the pivot retainer straps (8) and secure in place with bolt (9), washers (10), and nut (11). Torque 12-15 in-lb/1.4-1.7 Nm.

NOTE: Do not over torque bolt (9), as this will cause binding in the system. You must be able to rotate spacer (12) by hand after tightening.

(10) Install washers (2) and nuts (1) and torque (12-15 in-lb/1.4-1.7 Nm). Ensure straps (4) rotate on the capsule pivot (3).

(11) Install bolts (5) with washers (6) through brackets (4) and link (23). Adjustment of shaft (22) may be required to align bolt holes for the brackets. Install nuts (7) and torque (12-15 in-lb/1.4-1.7 Nm).

(12) Cut safety wire and remove tool T-0022.

E. Collective Trim – Rigging (Figure 12-7)

NOTE: Rigging adjustments to be made with collective stick in down position.

(1) Adjust threaded shaft (6) so the upper end of the spring capsule assembly (8) is slightly aft of the forward edge of the pivot retainer straps (9).

(2) Adjust the lower end of the spring capsule assembly (8) to balance out pilot's collective force load in flight.

NOTE: When correct adjustment is complete, the collective stick should stay in full down position with collective friction released. Collective should also have equal pressure in both directions of travel in flight.

CAUTION: FOR HELICOPTERS WITH T-T STRAPS, THE COLLECTIVE WILL NORMALLY STAY DOWN WITH THE BLADES TURNING.

NOTE: The most common adjustment is to set the length of the tie rod assembly (21, 22, 23, 28) so that the neutral position of the collective is at about 20% travel. At below 20% collective travel, the spring capsule pushes the collective down, and at above 20%, the spring capsule pushes the collective up. The spring retainer (27) is set properly if an equal number of threads are above and below the capsule pivot (3).

NOTE: If needed, contact Enstrom Product Support for additional assistance regarding collective trim adjustments.

(a) To correct for an out-of-balance condition, a light collective (easier up than down), release tension on the spring in the trim capsule.

(b) For a heavy collective, increase spring tension.

(3) Secure checknuts (7) against link (23) and link assembly (28).

12-5 CYCLIC PITCH CONTROL STICK

A. Description

The cyclic stick controls the movement of the helicopter forward, aft, left and right while in flight. Longitudinal control is obtained by the forward or aft motion of the cyclic stick, which causes the swashplate to tilt forward or aft at a 45° angle to the ship centerline, resulting in a variable pitch change of each rotor blade per revolution. With the swashplate in a forward angle, the rotor blades assume a higher pitch angle in the retreating sector of the plane of rotation, and a lower pitch angle to the advancing sector. This causes the blades to fly low in front and high in back, thus inducing a forward thrust component in the rotor system. This will cause forward flight at the desired speed when coordinated with the proper application of collective pitch and throttle. Rearward or lateral flight is similarly accomplished by moving the cyclic stick in the appropriate direction. The cyclic control stick has a grip that contains a cyclic trim switch, to reduce stick loads during flight

B. Cyclic Stick – Removal

(1) Disconnect the snap fasteners and remove boots.

(2) Disconnect the cannon plug from receptacle.

(3) Remove the two bolts connecting cyclic stick to bellcrank.

(4) Remove the stick assembly.

C. Cyclic Stick – Installation

(1) Install the cyclic stick on bellcrank.

(2) Install bolts, washers and nuts and torque.

(3) Connect the cannon plug to seat receptacle.

(4) Install the boot and snap fasteners.

12-6 LATERAL AND LONGITUDINAL TRIM ACTUATORS

A. Troubleshooting

Problem	Possible Cause	Action
Trim Actuator Inoperative	(1) Faulty motor (2) Faulty microswitch (3) Spring capsule binding on acme shaft (4) Binding of internal gears	Remove the actuator assembly. Troubleshoot in the following order to determine which area is causing problem. (1) Disconnect wires and remove the motor. Test motor with 12V or 24V battery for operation. (2) Remove microswitch assembly and inspect switches. (3) Rotate spring capsule on acme shaft and check for freedom of movement for full travel. (4) Remove rubber coupling and rotate internal gears with screw-driver to check for freedom of movement.

B. Removal – Lateral Trim Actuator (Figure 12-10)

(1) Identify wires and their location before disconnecting from microswitches.

(2) (12V) Disconnect wires from microswitches and from the quick disconnect attached to ground wire.

(3) (24V) Disconnect trim actuator electrical connector from the trim switch unit (TSU).

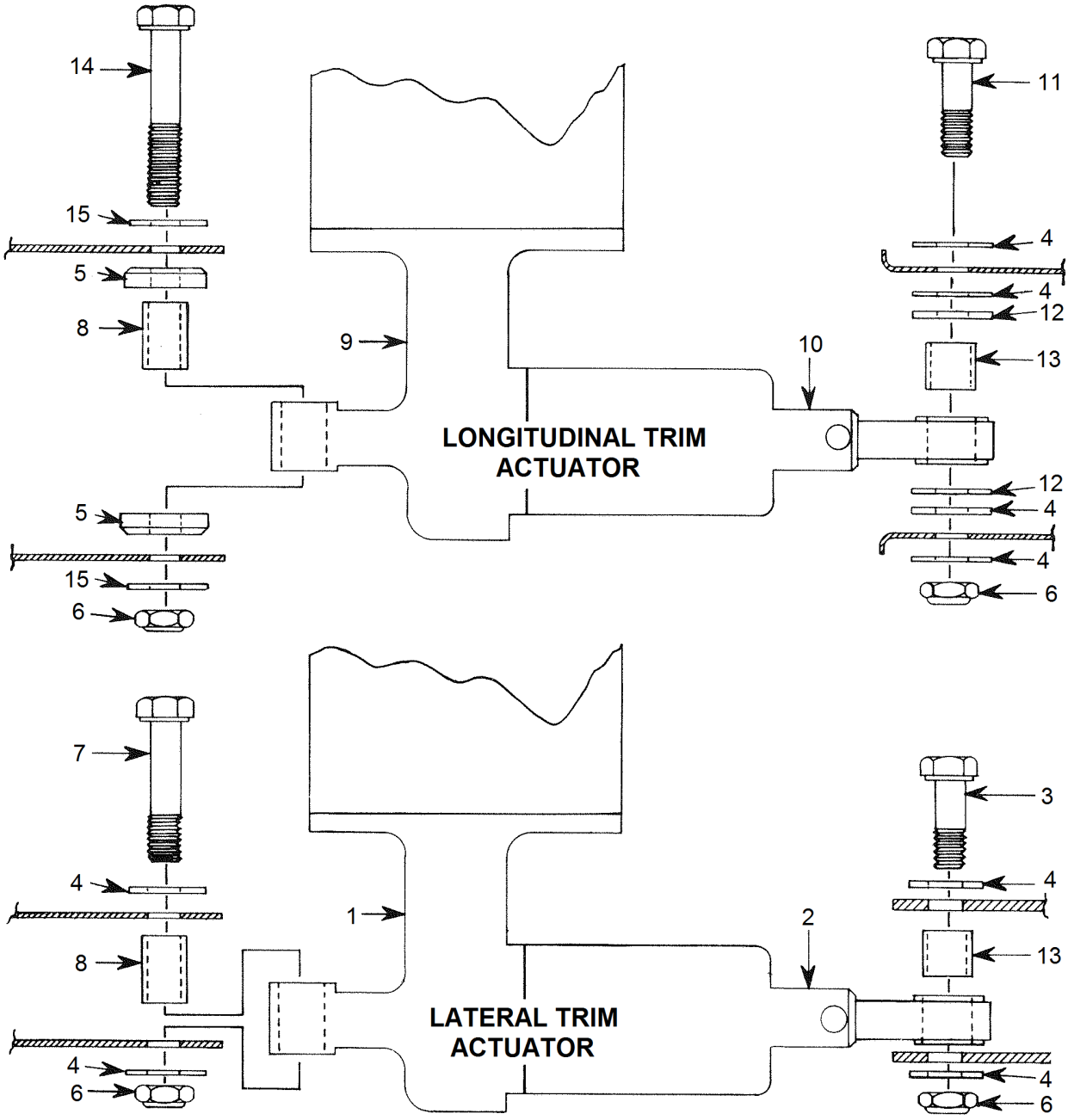
(4) Remove bolt (3), light washers (4), and nut (6) from the spring capsule (2).

(5) Remove bolt (7), washers (4), and nut (6) from the housing (1).

(6) Remove the lateral trim actuator from the seat structure.

(7) Remove spacers (8) from housing (1).

(8) Remove spacer (13) from the spring capsule (2).



1. Housing
2. Spring Capsule
3. Bolt
4. Light Washer (P/N ECD050-11)
5. Spacer
6. Nut
7. Bolt
8. Spacer
9. Housing
10. Spring Capsule
11. Bolt
12. Heavy Washer
13. Spacer
14. Bolt
15. Washer

Figure 12-10. Trim Motor Installation

C. Removal – Longitudinal Trim Actuator (Figure 12-10)

(1) Identify wires and their location before disconnecting from the microswitches.

(2) (12V) Disconnect wires from the microswitches and from the quick disconnect attached to ground wire.

(3) (24V) Disconnect the trim actuator electrical connector from TSU.

(4) Remove bolt (11), light washers (4), heavy washers (12), and nut (6) from the spring capsule (10).

(5) Remove bolt (14), harper washers (15), spacers (5), and nut (6) from the housing (9).

(6) Remove the longitudinal trim actuator from the seat structure.

(7) Remove spacer (8) from the housing (9).

(8) Remove spacer (13) from the spring capsule (10).

D. Disassembly – Trim Actuators (Figure 12-11)

(1) Separate the wire leads to the microswitch and disconnect.

(2) Remove screws (1) and washers (2) attaching the switch assembly. Remove the switch assembly.

(3) Rotate the spring capsule assembly (5) to remove from the acme shaft.

(4) Remove nuts (13), lockwasher (12) and washer (11) from motor (7). Remove the motor.

(5) Remove coupling (8) and snap ring (9).

(6) Remove the remaining screws (1) and washers (2) from the shaft and cover assembly (6).

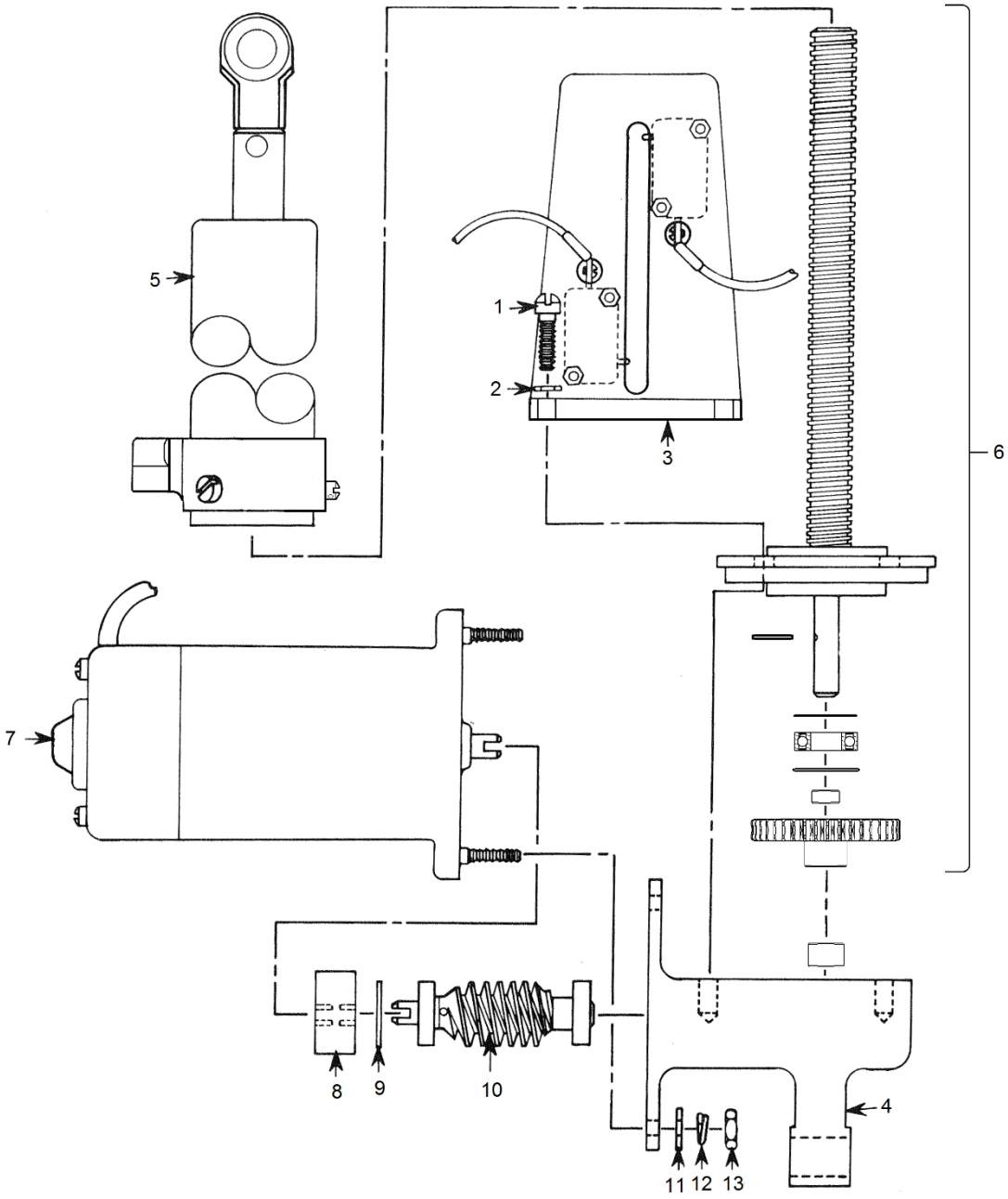
(7) Gently tap the cover to one side and pull the acme shaft to remove the shaft and cover assembly (6) from the housing (4).

(8) Tap face of housing (4) against work bench to remove the worm gear assembly (10).

E. Trim Actuator Part Replacement

NOTE: After determining which part of the trim actuator is causing a malfunction, replace the applicable item as follows:

(1) Microswitch - remove the two screws and washers holding the switch in place and remove switch. Install new switch and replace the screws.



1.	Screw	8.	Coupling
2.	Washer	9.	Snap Ring
3.	Switch Assembly	10.	Worm Gear Assembly
4.	Housing	11.	Washer
5.	Spring Capsule Assembly	12.	Lock Washer
6.	(ACME) Shaft and Cover Assembly	13.	Nut
7.	Motor		

Figure 12-11. Trim Motor Assembly

(2) Spring capsule assembly – Acme nut replacement is accomplished by removing the three screws at base of capsule. Remove and replace nut. Reinstall the switch activator and screws to the base of the capsule.

The rubber bumper at base of capsule is attached by applying contact cement adhesive to both the bumper and acme nut. Press bumper firmly into place

(3) Cover and acme shaft assembly, worm gear assembly, and motor assembly are replaced as assembly units.

F. Assembly – Trim Actuator (Figure 12-11)

(1) Install the worm gear assembly (10) into the housing (4) until the aft bearing is aligned with the bearing seat in the housing. Do not install into the bearing seat at this time.

(2) Apply grease (MIL-PRF-81322) in housing (4), packing the grease against the outer walls and the worm gear.

(3) Install cover and shaft assembly (6) into housing (4) with the cover turned to side exposing worm gear (10).

(4) With the cover seated in housing, push the worm gear assembly (10) into place, seating the bearings in place, and install the snap ring (9).

(5) Rotate the cover into position and install two screws (1) and washers (2) in the cover holes located opposite the worm gear.

(6) Rotate the worm gear with a screwdriver to check for binding in gears.

(7) Install the coupling (8) onto slotted end of worm gear.

(8) Align the slots in motor with the coupling and install the motor into position on the housing (4).

(9) Install washer (11), lockwasher (12) and nut (13) on the motor studs and torque.

(10) Apply grease (MIL-PRF-81322) to the threads of the acme shaft and turn the spring capsule (5) onto the acme shaft until the rubber bumper at the base of the spring capsule is approximately one inch from the cover.

(11) Turn the switch activator of spring capsule to align with slot in the microswitch assembly (3) and attach to housing (4) using screws (1) and washers (2).

(12) Torque the screws and lockwire (MS20995C32).

(13) Connect wires to the switch.

G. Installation – Lateral Trim Actuator (Figure 12-10)

(1) Install spacer (8) into housing (1).

(2) Install spacer (5) into spring capsule (2).

(3) Install the actuator assembly into the seat structure and align with mounts.

(4) Install bolt (7) through light washer (4), seat structure mount and spacer (8).

(5) Install light washer (4) and nut (6).

(6) Install bolt (3) through washer (4), seat structure mount and spacer (5).

(7) Install light washer (4) and nut (6). Torque nuts (6) in two places.

(8) (12V) Connect wires at ground and microswitches.

(9) (24V) Connect the electrical connector to the TSU.

(10) Test the trim actuator and trim limits (Para. 12-6, I) for freedom of movement and full travel in both directions.

H. Installation – Longitudinal Trim Actuator (Figure 12-10)

(1) Install spacer (17) into housing (9).

(2) Install spacer (13) into spring capsule (10).

(3) Install the actuator assembly into the seat structure and align with mounts.

(4) Install spacers (16) on each side of housing (9) with the chamfered side of spacer facing outboard.

(5) Install bolt (14) through harper washer (15), seat structure, and spacers (16) and (17).

(6) Install harper washer (15) and nut (6).

(7) Install a heavy washer (12) and light washer (4) on each side of the spring capsule (10).

(8) Install bolt (11) through washers (4), seat structure, washers (12), and spacer (13).

(9) Install washer (4) and nut (6). Torque nuts (6) in two places.

(10) (12V) Connect wires at ground and microswitches.

(11) (24V) Connect the electrical connector to the TSU.

(12) Test the trim actuator and trim limits (Para. 12-6, I) for freedom of movement and full travel in both directions

I. Trim Limit Operational Check

(1) Verify the trim operates in the correct direction.

(2) Cycle each time actuator full travel each direction to verify the limit switches work properly.

(3) Trim the cyclic full forward and verify the travel is not restricted in any direction.

(4) Repeat Step 2 for the other three directions.

(5) Return the trim to neutral (center the cyclic).

12-7 FLIGHT CONTROL RIGGING

NOTE: Cyclic and collective rigging must be done in sequence starting with the cyclic pitch controls. A rigging check must be accomplished any time components of the control system have been removed and exact dimensions such as rod lengths or bellcrank angles are not available prior to re-installation of that component.

NOTE: An inspection of the upper cabin mounts and security of installation and inspection of the lateral and longitudinal control rods should be performed during the Preliminary Rigging procedure.

NOTE: Install the connecting rod ends during rigging as follows:

1. HMVV5M right hand rod end to the right, top, and aft.
2. HMLVV5M left hand rod end to the left, bottom, and forward.

A. Preliminary Rigging (Figure 12-12)

(1) Level the helicopter with reference to the lower left hand and forward pylon bay tubes.

(2) Remove the fiberglass seat deck and flooring panels.

(3) Remove the side cowling panels above the engine compartment.

(4) Inspect the upper cabin mounts for cracks (Para. 12-7, F).

(5) Disconnect control rods (13) and (14) from bellcranks (9) and (11).

B. Cyclic Rigging – Seat Deck Area (Figure 12-12)

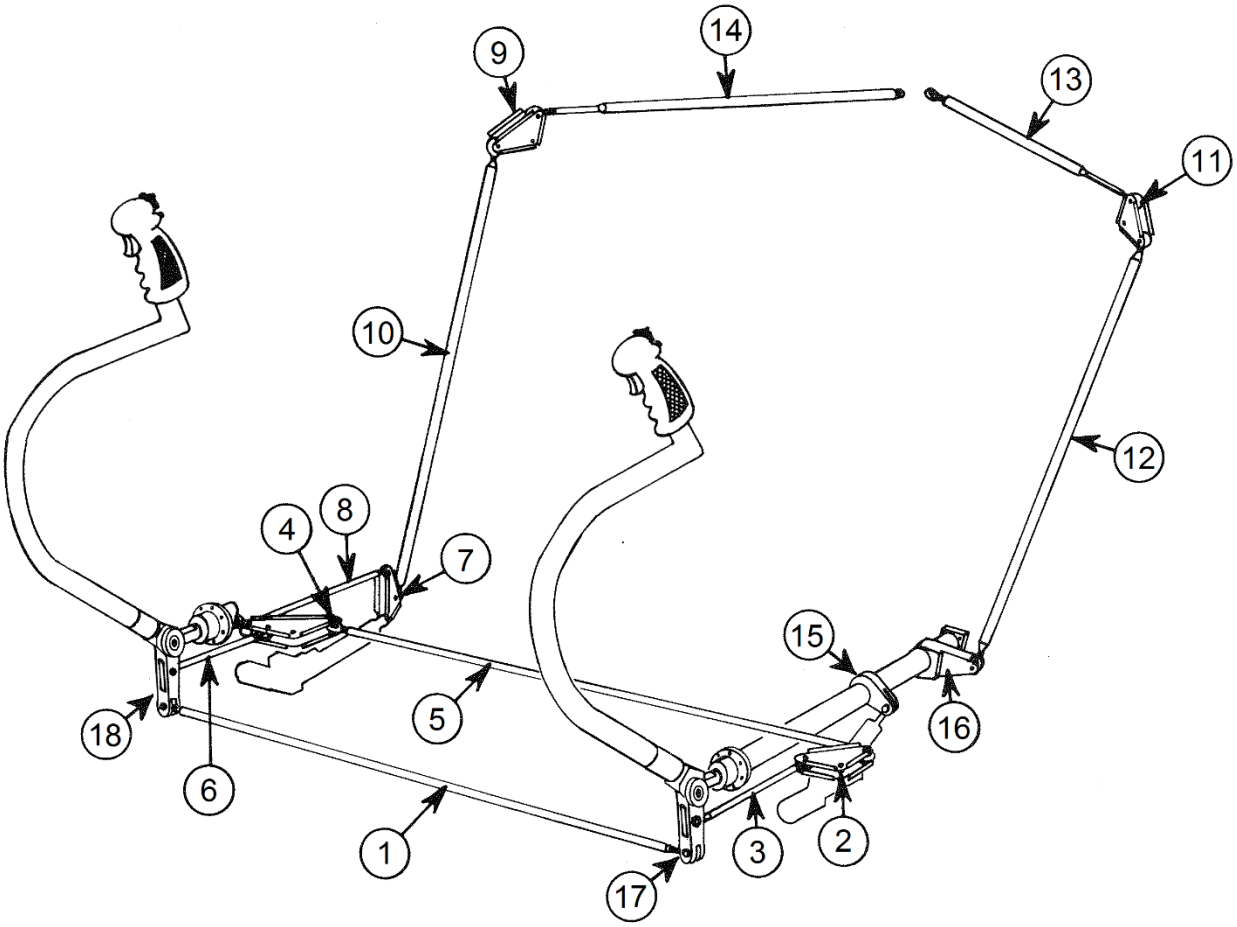
(1) Adjust rod (1) connecting the cyclic stick bellcranks until the bellcranks (17) and (18) are centered laterally in the stop ring hole. Secure the check nuts.

(a) Adjustment check - move the cyclic stick full left and full right to assure both bellcranks (17) and (18) hit the stops

CAUTION: CHECK INSPECTION HOLES IN CONTROL RODS FOR MINIMUM THREAD ENGAGEMENT OF ROD ENDS. ROD END BEARINGS MUST BE CENTERED BETWEEN THE BELLCRANK EARS TO ALLOW FULL PIVOT AFTER CHECK NUTS HAVE BEEN TIGHTENED.

(2) Adjust rod (5) until the outboard edge of bellcrank (2) and the inboard edge of bellcrank (4) are parallel to each other and perpendicular to the firewall. Secure the jam nuts.

NOTE: When adjusting rod (5), the left hand rod end HMLVV5M must be adjusted one turn past witness hole and secured. All adjustments must be made by rotating the right hand rod end only.



1.	Push-Pull Rod Assembly	10.	Push-Pull Rod Assembly
2.	Bellcrank Assembly	11.	Bellcrank Assembly
3.	Push-Pull Rod	12.	Push-Pull Rod Assembly
4.	Rod End	13.	Push-Pull Rod Assembly
5.	Push-Pull Rod Assembly	14.	Push-Pull Rod Assembly
6.	Push-Pull Rod	15.	Cyclic Torque Tube Assembly
7.	Bellcrank	16.	Bellcrank
8.	Push-Pull Rod	17.	Bellcrank
9.	Bellcrank Assembly	18.	Bellcrank

Figure 12-12. Cyclic Rigging Chart

(3) Move the cyclic stick full forward and adjust rods (3) and (6) until both bellcranks (17) and (18) hit the stop ring.

(a) Adjustment check - Pull the cyclic stick aft to assure the bellcranks are hitting the stops. Adjust if necessary.

(4) Secure jam nuts and move the cyclic stick laterally to assure the rod ends do not bind.

(a) Adjustment check - Rotate the pilot's cyclic stick around the cyclic stop ring. Check that both left and right bellcranks maintain contact with the stop ring through 360 degrees of travel.

NOTE: If binding or interference exists, make slight adjustments to the rod lengths or reposition the rod end bearings to correct the condition.

(5) Install cyclic centering tool T-1775 in the stop ring (Figure 12-13).

(6) Position bellcrank (7) by adjusting length of rod (8). Secure check nuts.

(a) Adjustment check - Remove centering tool T-1775 and move cyclic stick fore and aft to check rod end and check nut clearance to bellcrank.

(7) Place the pilot's cyclic stick in the full forward position (bellcrank aft against stop) and centered laterally. Adjust rod (10) such that the lower edge of bellcrank (9) is parallel to its cabin mount (Figure 12-14). Secure check nuts.

(a) Adjustment check - Cycle to check for interference.

(8) Connect longitudinal trim actuator to bellcrank (7) if disconnected (Para. 12-6, H).

(9) Place the pilot's cyclic stick in the full left position and centered longitudinally. Adjust rod (12) such that the lower edge of bellcrank (11) is parallel to its cabin mount (Figure 12-14). Secure check.

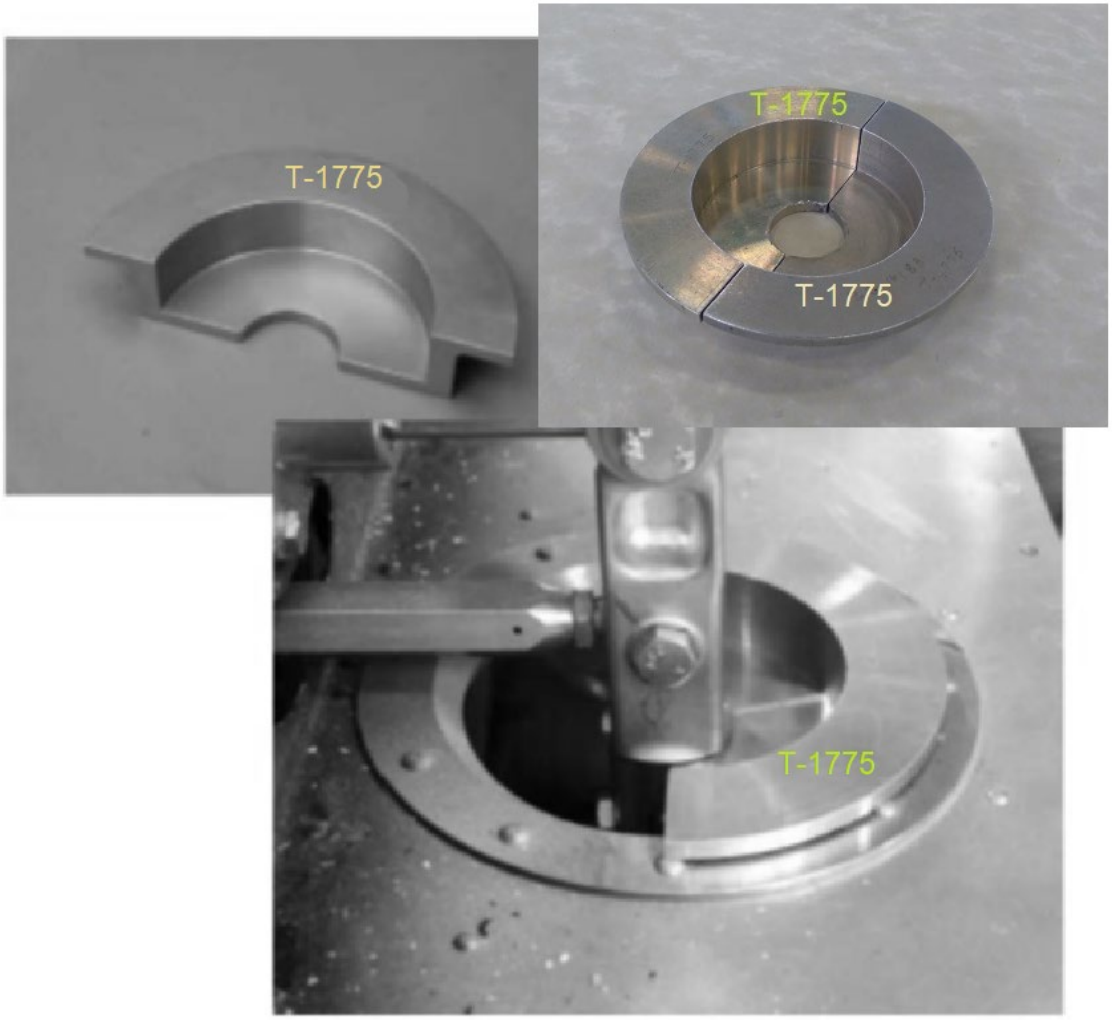
(a) Adjustment check - Cycle to check for interference.

NOTE: Recheck security of all check nuts and rod end clearances.

C. Collective Rigging – Seat Deck Area (Figure 12-7)

(1) Place the collective control stick in full down position and tighten friction.

(2) Adjust rod (5) to obtain 1/8" to 3/16" clearance between the collective bearing housing spacer and swashplate mount flange (Figure 12-15). Secure check nuts.



NOTE: Both halves of Tool T-1775 are sold in pairs on the Enstrom website.

Figure 12-13. Cyclic Stick Rigging, Tool T-1775 Installed

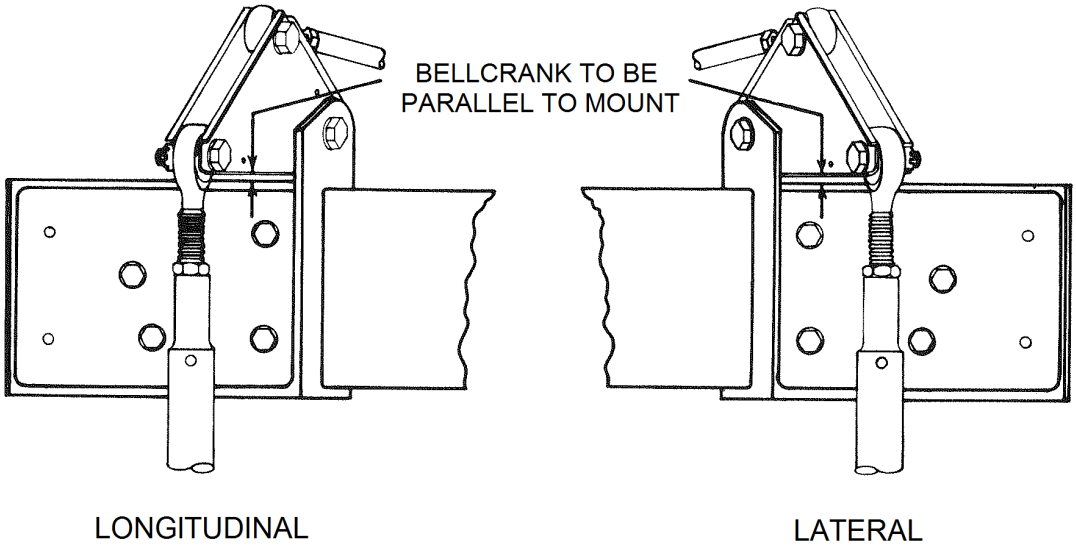


Figure 12-14. Cyclic Bellcranks Parallel to Mount

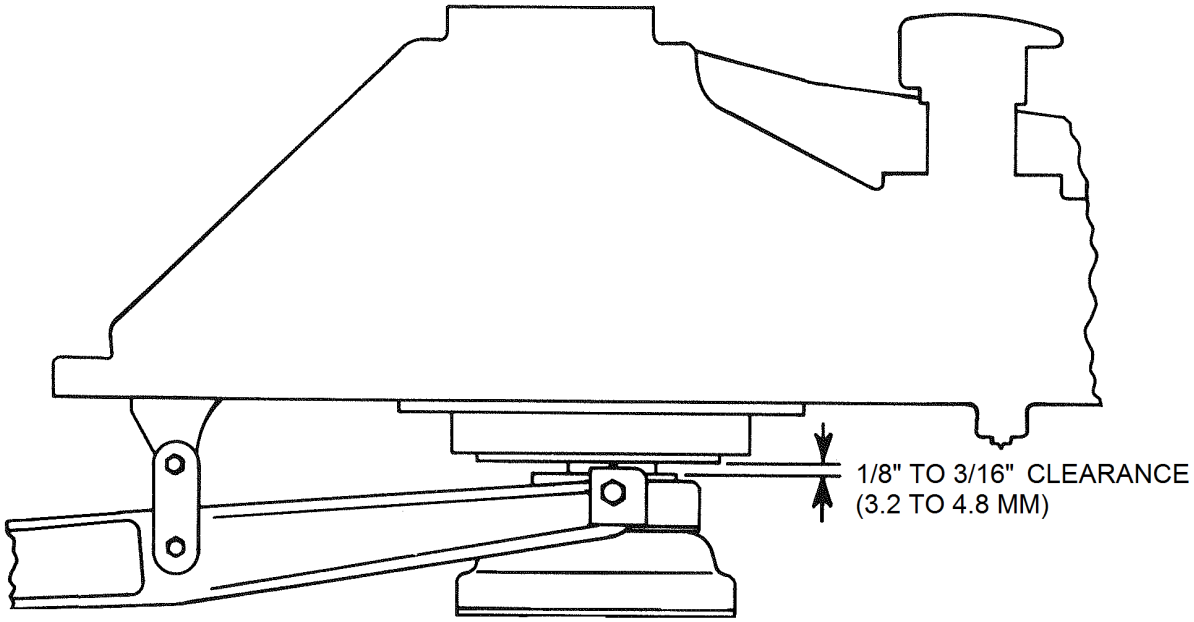


Figure 12-15. Collective Housing to Seal Housing Clearance

D. Cyclic Rigging – To Swashplate

(1) Install rigging tool T-1775 in the cyclic stop ring (Figure 12-13).

NOTE: Run the trim motors to slightly preload cyclic stick against tool.

(2) Install swashplate centering tools T-1575 to hold the swashplate perpendicular to the main rotor shaft (Figure 12-16).

(3) Connect rod (13) to the swashplate. Adjust the length of rod (13) until the attachment bolt slides freely into the bellcrank (11) (Figure 12-12). Install spacers and mount hardware. Secure the check nuts and hardware. See Para. 12-10, E, for hardware attachment to the swashplate.

(4) Connect rod (14) to the swashplate. Adjust the left hand rod end HMLVV5M at bellcrank (9) (Figure 12-12) until the attachment bolt slides freely into the bellcrank. Install spacers and mount hardware. Secure the check nuts and hardware. See Para. 12-10, E, for hardware attachment to the swashplate.

E. Main Rotor Hub – Cyclic and Collective Rigging

(1) Level the aircraft along pylon bay tube inside the left engine door. Install the tripod stand under the tail rotor guard to hold ship level.

NOTE: Avoid standing on or sitting in the aircraft after leveling.

(2) Phase main rotor blades 120° apart. This is accomplished by moving each blade grip until one inch of the damper piston shaft is exposed on each damper.

(3) Rotate the main rotor hub until #1 grip is at the 97° azimuth position (Figure 12-17).

NOTE: The 90° position is to the right side of the helicopter. The 97° position may be checked by observing that the dog leg rod end bearing controlling the #1 blade is directly over and in line with rod (14) of Figure 12-12, Cyclic Rigging.

(4) Place a digital protractor on the top flat area of the main rotor blade grip. Adjust the pitch change link to obtain 6.5 degrees ± .5 degree. Center the rod end bearings for full pivot and secure check nuts.

NOTE: Protractor will be positioned perpendicular to the leading edge of the blade.

(5) Repeat the sequence for blades 2 and 3. Recheck #1 blade.

(6) Remove tool T-1575.

(7) Place the collective control stick in full up position.

(8) Rotate #1 blade to the 97° azimuth position (Figure 12-17).

(9) Set protractor at +19° and position it on top of the flat area of the blade grip. Adjust the collective up stop at the seat deck until the bubble is centered, giving +19 degrees ± .5 degree. Secure the collective up-stop check nut.

(10) Remove tool T-1775.

NOTE: Use of tool T-1775 is depicted in Figure 12-16. Tool T-28-16101 may also be used for swashplate rigging, which is depicted in Figure 12-16.1.

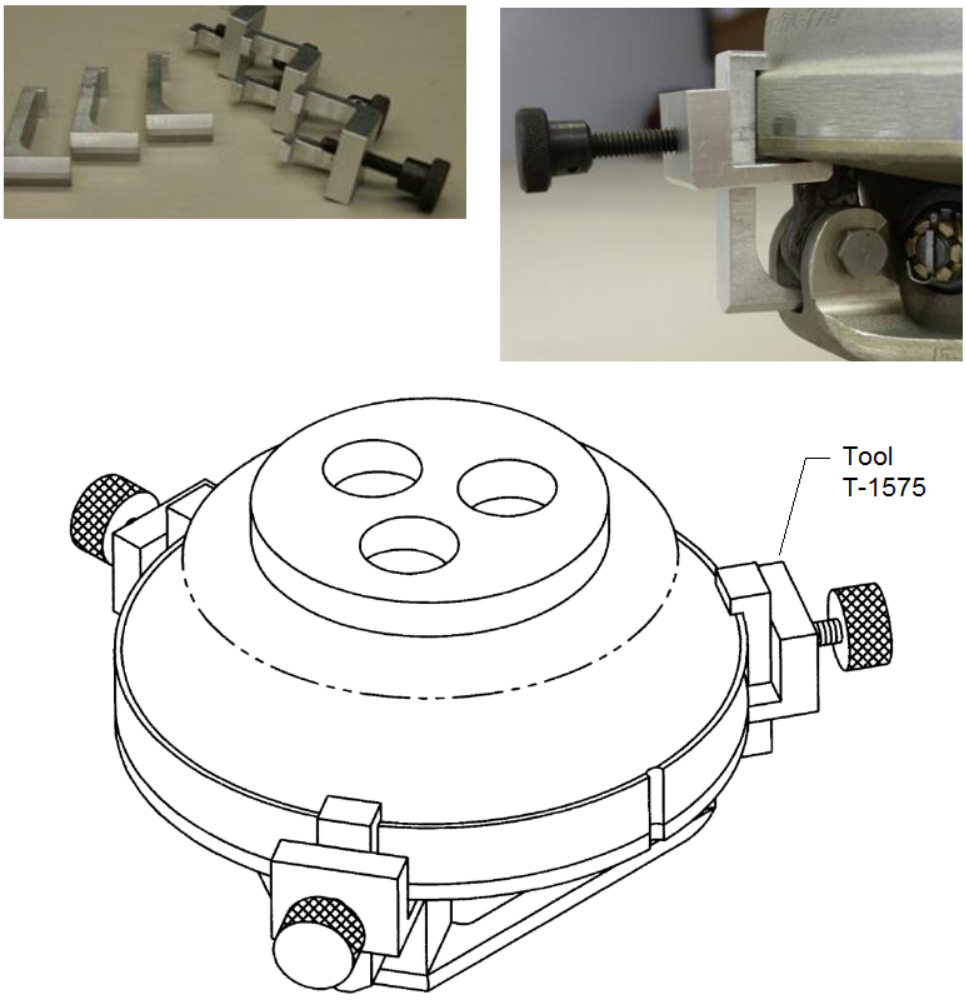


Figure 12-16. Installation of Swashplate Rigging Tool T-1575

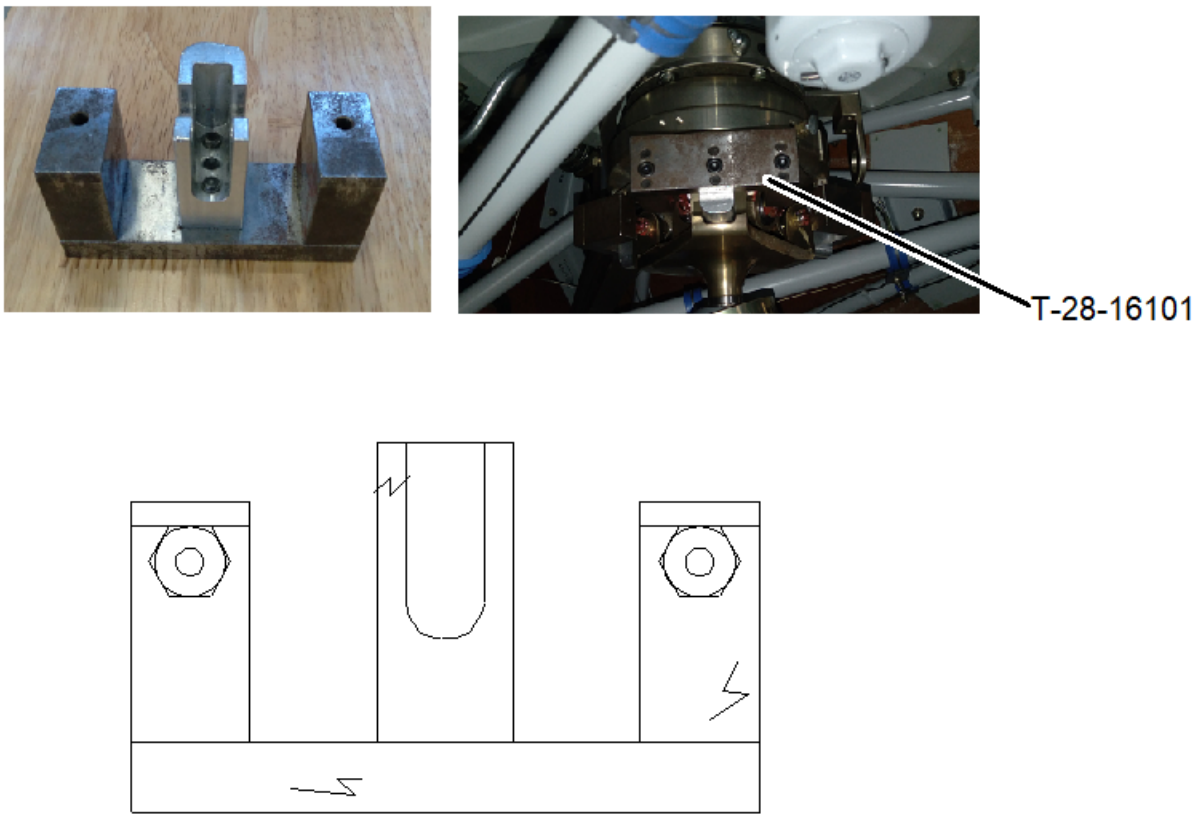


Figure 12-16.1. Installation of Swashplate Rigging Tool T-28-16101

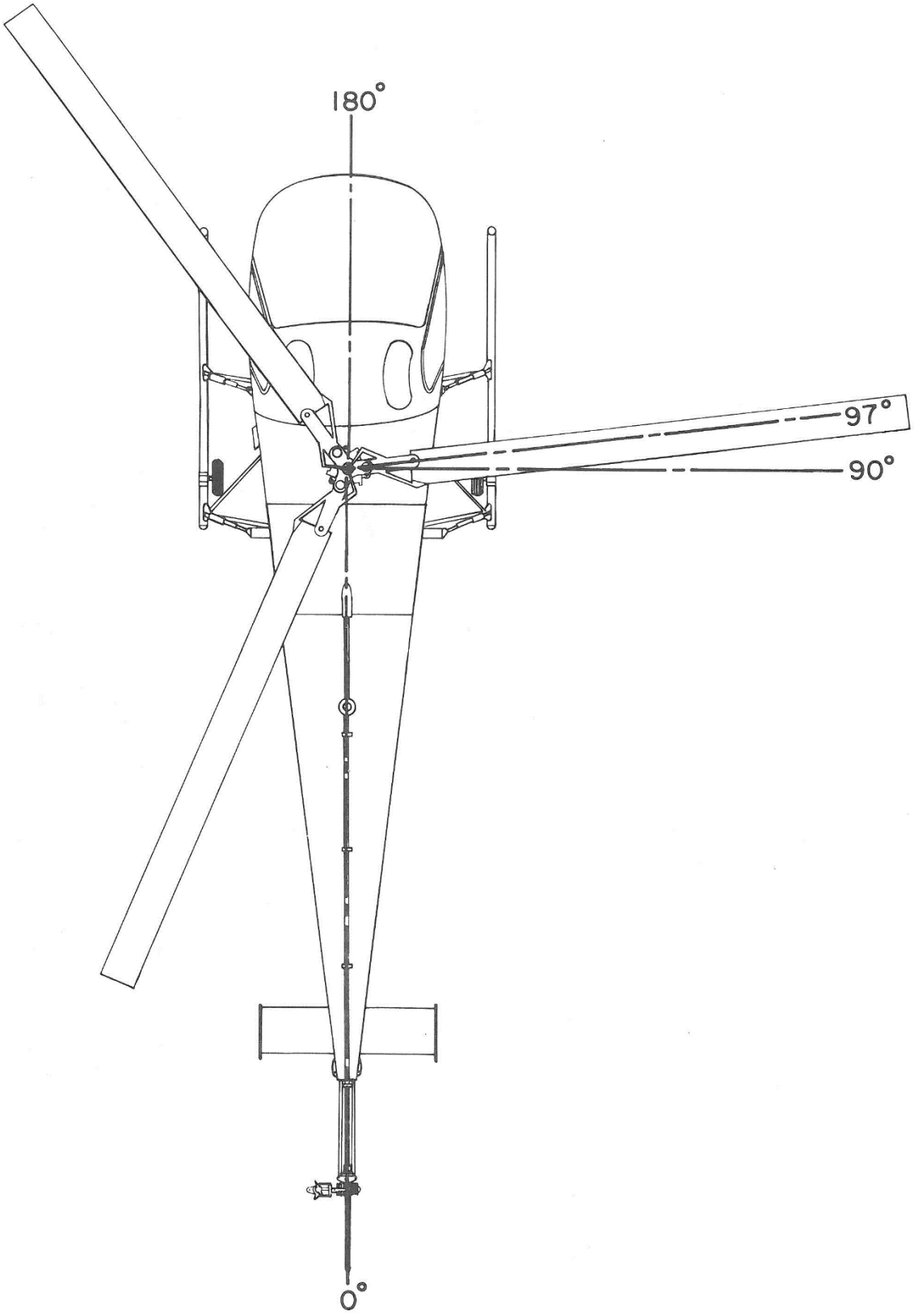


Figure 12-17. Main Rotor Azimuth Positions

F. Inspection – Cyclic Control, Upper Bellcrank Mounts

NOTE: Use the following procedure to inspect the upper bellcrank mounts for condition and security before accomplishing the Cyclic Rigging procedure (Para. 12-7, B-E) and during periodic inspections (100 Hour/Annual, Para. 4-51, Item 14).

NOTE: Denatured alcohol, mineral spirits, or equivalent solvent may be used to remove grease or oil residue from the cabin mount.

NOTE: If equipped with control tube covers, the covers may be left in place for visual inspection of the forward side of the upper cabin mount.

(1) Inspect cabin bellcrank mounts (lateral and longitudinal) for cracks as follows:

(a) Remove seat structure cover, if not already removed,

(b) If not equipped with control tube covers, remove the upper engine cowl, if not already removed.

(c) Remove grease or oil residue from the cabin mount.

(d) With the aid of a bright light source and inspection mirror, inspect the cabin mounts for cracks (Figure 12-17.1).

(2) Inspect all visible rivets for condition and looseness (Figure 12-17.1).

(3) Inspect cabin bellcrank mount installation hardware for looseness by moving the bellcrank side to side in the same axis as the installed hardware.

NOTE: Looseness (side-to-side movement) in the bellcrank installation is attributed to worn bearings, loose hardware, or improper stack-up, whereas binding is attributed to interference caused by constriction in the joint. This occurs when the torque load is carried through the bearings and the cabin mount rather than through the internal spacer (5) (Figure 12-17.2).

NOTE: F-28F, S/N S/N 833 and subsequent, and 280FX, S/N 2152 and subsequent may include shims (P/N 28-16209-X, P/N 28-16217-X) in the hardware stack-up. Refer to Figure 12-17.2.

(a) Refer to Para. 11-7, G for proper hardware stack-up and adjust, as required.

(b) If looseness is detected (deflection, audible clicking, slackness, etc.), the bearings (2) and spacers (4 and 5) must be replaced.

NOTE: Retain hardware stack-up in the order removed for re-installation.

1 Remove control tubes.

2 Remove nut (8), bolt (6), and washers (7).

3 Capture spacers (4), shims (11), and washers (3) and remove bellcrank (1).

4 Remove spacer (5) and press out bearings (2) from bellcrank (1).

5 Install new bearings (2) and ream in accordance with Figure 12-17.2.(b).

6 Install bellcrank with new spacers and shims, as required, and complete the installation (torque 50-70 in-lb/5.6-7.9 Nm) (Figure 12-17.2).

(4) Inspect the bellcrank for binding.

CAUTION: MAINTAINING THE REQUIRED TORQUE IS CRITICAL TO THE SECURITY OF THE BELLCRANK INSTALLATION AND PROPER PERFORMANCE OF THE CYCLIC CONTROL SYSTEM. INTENTIONALLY UNDER-TORQUING THE BELLCRANK ATTACHMENT HARDWARE TO ACHIEVE FREEDOM OF MOVEMENT MAY ULTIMATELY CAUSE A LOSS OF FLIGHT CONTROL.

(a) If binding is present, the length of spacer (5) must be verified, and the hat-end of the bearings (2) filed to increase the protrusion of the spacer.

1 Remove control tubes.

NOTE: Retain hardware stack-up in the order removed for re-installation.

2 Remove nut (8), spacers (4 and 5), shims (11), if present, bolt (6), and washers (7).

3 Capture spacers (4), shims (11), and washers (3) and remove bellcrank (1).

4 Remove spacer (5) from bellcrank (1).

5 Verify length of spacer (5) (0.817”/0.819”).

6 File the hat-end of bearing to reduce thickness. Deburr and remove any debris from the assembly.

(b) Complete the installation (torque 50-70 in-lb/5.6-7.9 Nm).

(c) Repeat step 4, as necessary, to obtain a freely moving bellcrank at the required torque.

(d) Safety nuts when check is completed.

(e) Reinstall control tube covers, if installed.

1 Reinstall the four cover fasteners.

2 Reposition the boot and secure with cable ties.

3 Seal the cover edge with RTV sealant (Dow Corning 732, or equivalent).

(f) Reinstall the fuel tanks.

(g) Reinstall the seat structure cover.

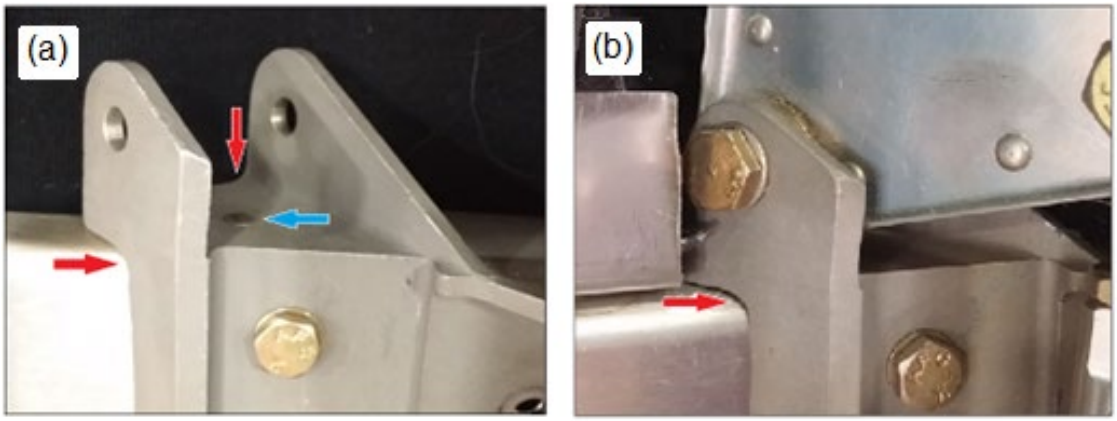
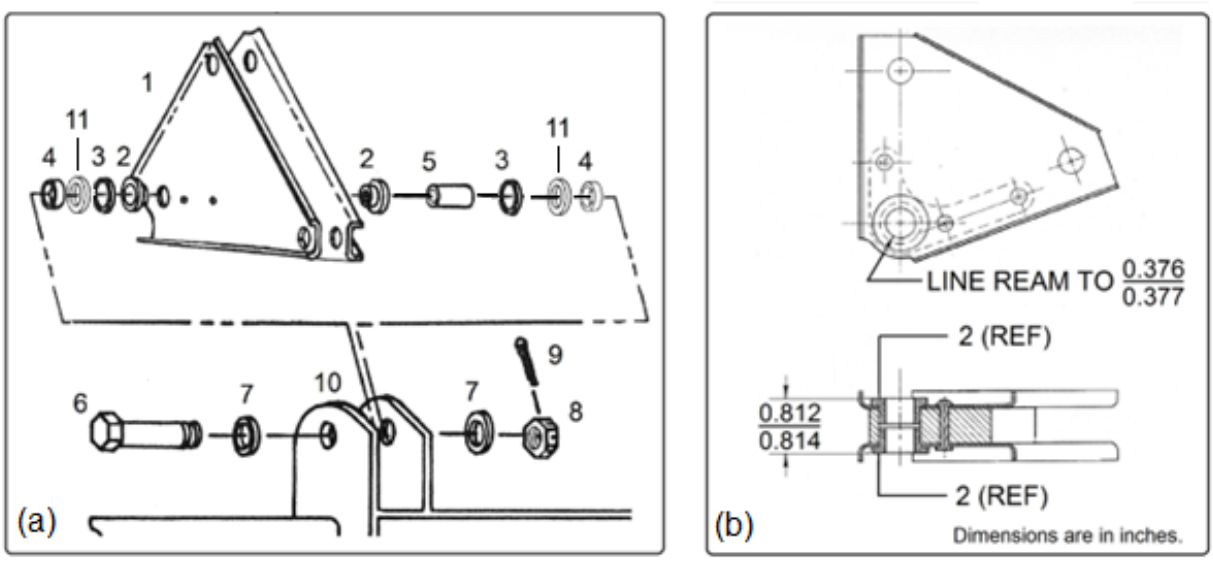


Figure 12-17.1. Upper Cabin Mount Inspection (LH Shown) (Incomplete installation shown in (a);

Red arrow indicates area for a possible crack, (a) and (b);
Blue arrow indicates area of rivet inspection, (a).



1. Bellcrank
2. Bearing
3. Washer (P/N ECD050-11)
4. Spacer: (0.095” or 0.105”, as required)
5. Spacer
6. Bolt
7. Washer
8. Nut
9. Cotter Pin
10. Cabin Mount (LH shown)
11. Shim: (0.0005”, 0.001”, 0.0015”, 0.002”, 0.003”, 0.005”, or 0.010”, as required)

Figure 12-17.2. Upper Cabin Mount Hardware (a) and Bellcrank Bearing Finish (b)

G. Hardware Stack-up – Cabin mount

NOTE: See Figure 12-17.2 (a).

(1) Measure the distance between the 0.250 inch diameter holes of P/N 28-11307-1 mount. This is Measurement A.

(2) Measure the length of spacer (Item 5). This is Measurement B.

(3) Measure the thickness of washer (Item 3, inboard). This is Measurement C.

(4) Measure the thickness of washer (Item 3, outboard). This is Measurement D.

(5) Solve for Δ using this formula: $A – (B + C + D) = \Delta$

(6) Determine spacer (Item 4) selection from this formula: $\Delta/2 = E$

(a) Select spacer P/N 28-16209-1 if E value is ≥ 0.101 inch.

(b) Select spacer P/N 28-16209-11 if E value is ≤ 0.100 inch.

(7) Measure the thickness of spacer (Item 4, inboard). This is Measurement F.

(8) Measure the thickness of spacer (Item 4, outboard). This is Measurement G.

(9) Determine the shim thickness required for the inboard side. This will be Measurement H.

(a) Solve for H using this formula: $E – F = H$

(b) Select P/N 28-16217-x as required to equal H.

(10) Determine the shim thickness required for the outboard side. This will be Measurement I.

(a) Solve for I using this formula: $E – G = I$

(b) Select P/N 28-16217-x as required to equal I.

(11) Verify that $(B + C + D + F + G + H + I) = A$ (+0/-0.001)

(12) Install P/N 28-16217-x (Item 16) shims, as required, between Item 3 and Item 4, inboard and outboard, respectively.

12-8 CYCLIC AZIMUTH CHECK

A. Verification of Rigging

(1) Rotate #1 blade to the 97° azimuth position (Figure 12-17).

NOTE: The 90° position is to the right side of the helicopter. The 97° position may be checked by observing that the dogleg rod end bearing controlling the #1 blade is directly over and in line with rod (14) of Figure 12-12.

(2) Lower the collective stick to full down position and tighten friction. Recheck 6.5 degrees ± .5 degree measurement of the main rotor blade grip.

(3) Move the cyclic stick to full aft position. Measure blade grip angle. Measurement to be 14.5 degrees ± .5 degree.

(4) Remove tool T-1775 from cyclic stick.

NOTE: If adjustments are required, adjust the left hand rod end HMLVV5M on rod (14) (Figure 12-12).

(5) Move the cyclic stick to full forward position. Measure the blade grip angle. Measurement to be -2.5 degrees ± .5 degree.

NOTE: Total travel must be 17 degrees ± .5 degree.

NOTE: Because push-pull rod adjustments in the cyclic rigging affect all three main rotor blades equally, it is only necessary to do an azimuth angel check on one blade.

(6) Rotate the main rotor hub until the dog leg rod end bearing controlling the #1 blade is directly over and in line with rod 13) of Figure 12-12, Cyclic Rigging.

(7) Move the cyclic stick to full right position. Measure the blade grip angle. Measurement to be 14.5 degrees ± .5 degree.

NOTE: If adjustments are required, adjust rod (13).

(8) Move the cyclic stick to full left position. Measure blade grip angle. Measurement to be -2.5 degrees ± .5 degree. Total travel must be 17 degrees ± .5 degree.

(9) Rotate the cyclic stick 360° around the stop ring to check for evidence of binding.

CAUTION: UPON COMPLETION OF ANY ADJUSTMENTS TO CONTROL SYSTEM CHECK TO SEE IF AUTOROTATIVE RPM IS IN A SAFE RANGE DURING FIRST GROUND RUN-UP.

Range: 16 to 20 inches manifold pressure at 3050 RPM

NOTE: A high manifold pressure indicates a low autorotation RPM. A low manifold pressure indicates a high autorotation RPM. See Item B for autorotative RPM adjustment.

B. Autorotative RPM Adjustment

NOTE: Content moved to Para. 12-13, E, (8).

12-9 CYCLIC TRIM SPRINGS RIGGING PROCEDURE

NOTE: The lateral bias spring installation is configured one of two ways. Helicopters certified to 2350 lb gross weight are configured as shown in Figure 12-18(a); Helicopters certified to 2600 lb gross weight (configured to Enstrom Specification Drawing 28-100015) are configured as shown in Figure 12-18(b).

NOTE: If the helicopter funs out of forward or right trim when the lateral bias spring is adjusted for left cyclic forces, the bias spring installation configured to Enstrom Specification Drawing 28-100015 should be installed.

A. Lateral Bias Spring Installation (Figure 12-18)

NOTE: The lateral bias spring is located on the left side of the seat structure.

(1) Attach spring (1) to bracket (2) and to the third hole from forward end of bracket (3).

(2) Flight check the helicopter to see if the desired lateral trim forces can be obtained.

B. Lateral Adjustment (Figure 12-18)

(1) Maximum left lateral trim is obtained by moving the spring outboard on bracket (3).

(2) Maximum right lateral trim is obtained by moving the spring inboard on bracket (3).

C. Longitudinal Bias Spring Installation (Figure 12-19)

NOTE: The longitudinal bias spring is located on the right side of the seat structure.

(1) Attach spring (1) to bracket (2) and to the fourth hole from top of bracket (3).

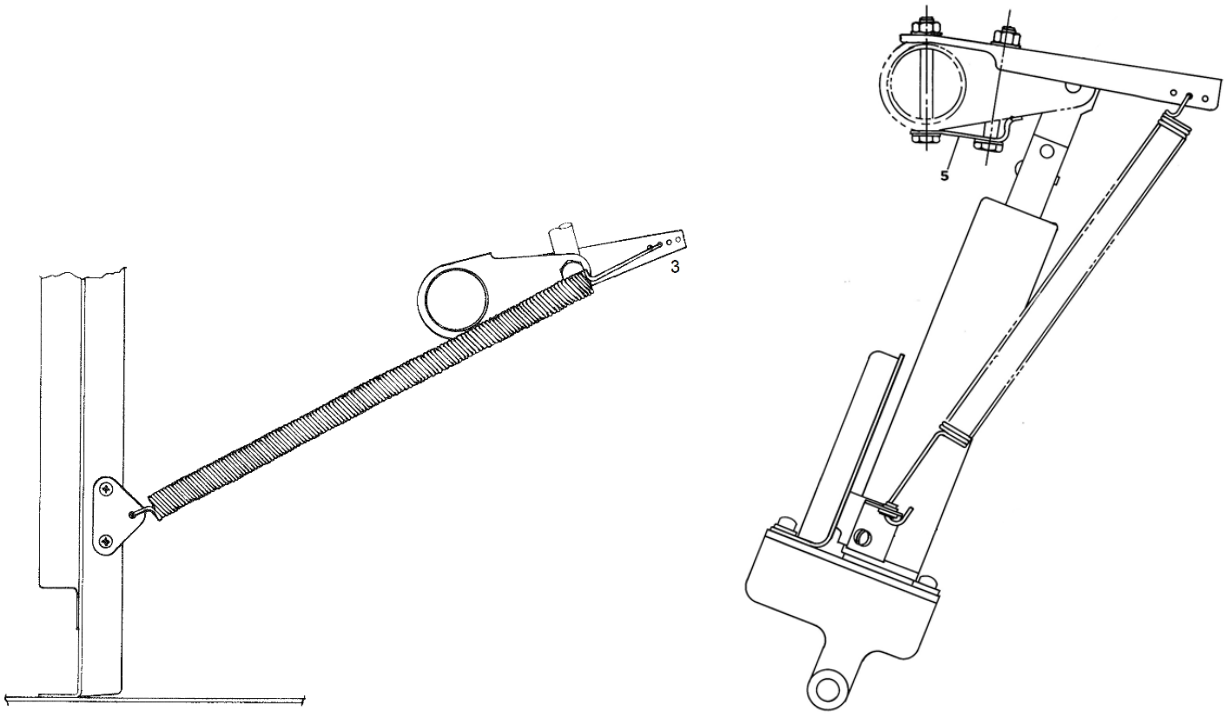
(2) Flight check the helicopter to see if the desired longitudinal trim forces can be obtained.

D. Longitudinal Adjustment (Figure 12-19)

(1) Moving spring down on bracket (3) will provide maximum forward trim force.

(2) Moving spring upward on bracket (3) will provide maximum aft trim force.

NOTE: Should locating the spring in the top hole of bracket (3) provide insufficient aft spring force, the bracket may be moved aft to the second notch and the choice of hole location repeated.



(a) (b)

Figure 12-18. Lateral Bias Spring Installation

(a) Applicable to 2350 lb gross weight helicopters

(b) Applicable to 2600 lb gross weight helicopters configured to Enstrom Specification 28-100015

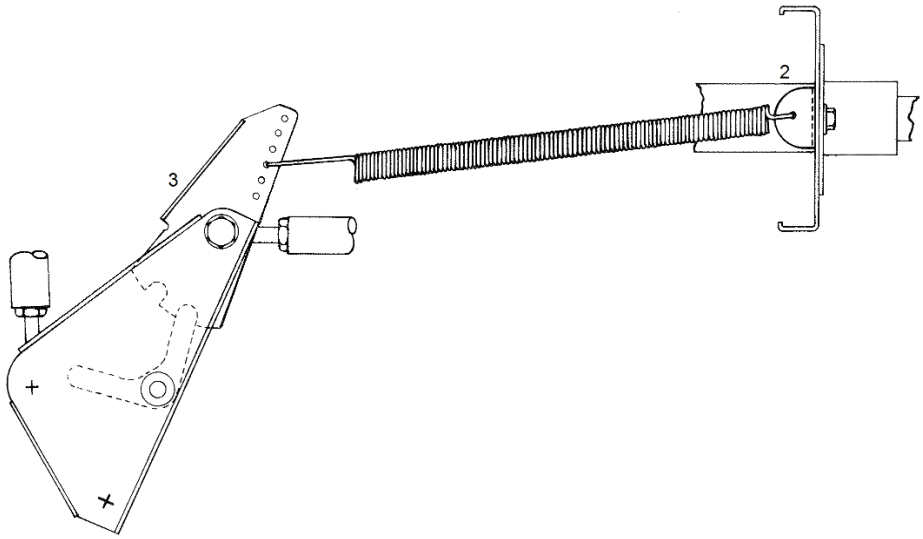


Figure 12-19. Longitudinal Bias Spring Installation

12-10 LOWER SWASHPLATE ASSEMBLY

A. Removal – Lower Swashplate Assembly (Figure 12-20)

(1) Remove both side panel cowls.

(2) Drain fuel tanks.

(3) Disconnect fuel lines and remove the left side fuel tank (Para. 13-10).

(4) Disconnect the longitudinal cyclic rod (2) from lower bearing housing (1) by removing bolt (3), washers (4) and (5), spacer (6) and nut (7).

(5) Disconnect the lateral cyclic rod (11) from bearing housing (1) by removing bolt (8), washers (9), and nut (10).

(6) Disconnect rod ends (15) in three places from the lower swashplate housing (17) by removing bolts (16), spacers (14), washers (13) and nuts (12).

(7) Cut safety wire and remove bolts (screws on older helicopters) (18) and washers (19) in six places.

(8) Pull downward on lower bearing housing (1) to remove lower swashplate assembly.

B. Disassembly – Lower Swashplate Assembly (Figure 12-21)

(1) Install tool T-0016 in the end of the tie rod (19). Place a wrench on the tool T-0016 to prevent the tie rod from rotating and remove the cotter pin (10), nut (11), light washer (21), washer (12), DU washer (13), and shims (14) from the tie rod.

(2) Tap the tie rod out of the bushings (15) using an aluminum drift. Separate the lower universal housing (7) from the upper universal housing (18). Remove the spacers (20) from inside the bushings (15) in the housing.

(3) Remove the shims (14) and the DU washer (13) from the tie rod (19).

(4) Temporarily install the tie rod (19) in the universal shaft (17) to prevent it from rotating and remove the cotter pins (10), nuts (11), washers (12), DU washers (13), and shims (14) from both ends of the shaft (17).

(5) Tap the end of the shaft with an aluminum drift to remove the shaft and sleeve (16) from the lower universal housing (7).

(6) Tap the opposite sleeve to remove it from the lower universal housing.

(7) Tap the sleeves from the upper universal housing (18) using an aluminum drift.

(8) Hold the bolt (1) with a wrench and remove the cotter pin (10), nut (9), and washer (8).

CAUTION: A VARIATION OF THE LOWER UNIVERSAL HOUSING HAS A SET SCREW PLUG THAT MUST BE LOOSENED TO ALLOW REMOVAL OF THE BOLT (1).

(9) If applicable, back out the set screw (22) in the lower universal housing (7).

(10) Pull the bolt (1) and bearing assembly (3) and (4) from the lower universal housing (7).

(11) Press the bolt (1) from the bearing (3) and remove slinger (6) and spacer (5).

(12) Remove the retaining ring (2) and grease fitting from the housing (4).

WARNING: USE EXTREME CAUTION WHEN REMOVING OR INSTALLING HEATED PARTS AND ASSEMBLIES TO PREVENT FROM INJURING PERSONNEL.

WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

(13) Heat the housing (4) to approximately 250°F/121°C and remove the bearing (3) from the housing.

(14) Press the DU bushings (15) from the sleeves (16).

C. Lower Swashplate Assembly – Inspection

(1) Use the following procedure to inspect the lower swashplate assembly during periodic inspections (100 Hour/Annual):

(a) Remove both side panel cowls, if not previously removed.

(b) Disconnect the pitch change bellcranks located on the main rotor hub from the main rotor push-pull rods located in the mast and from the pivot brackets.

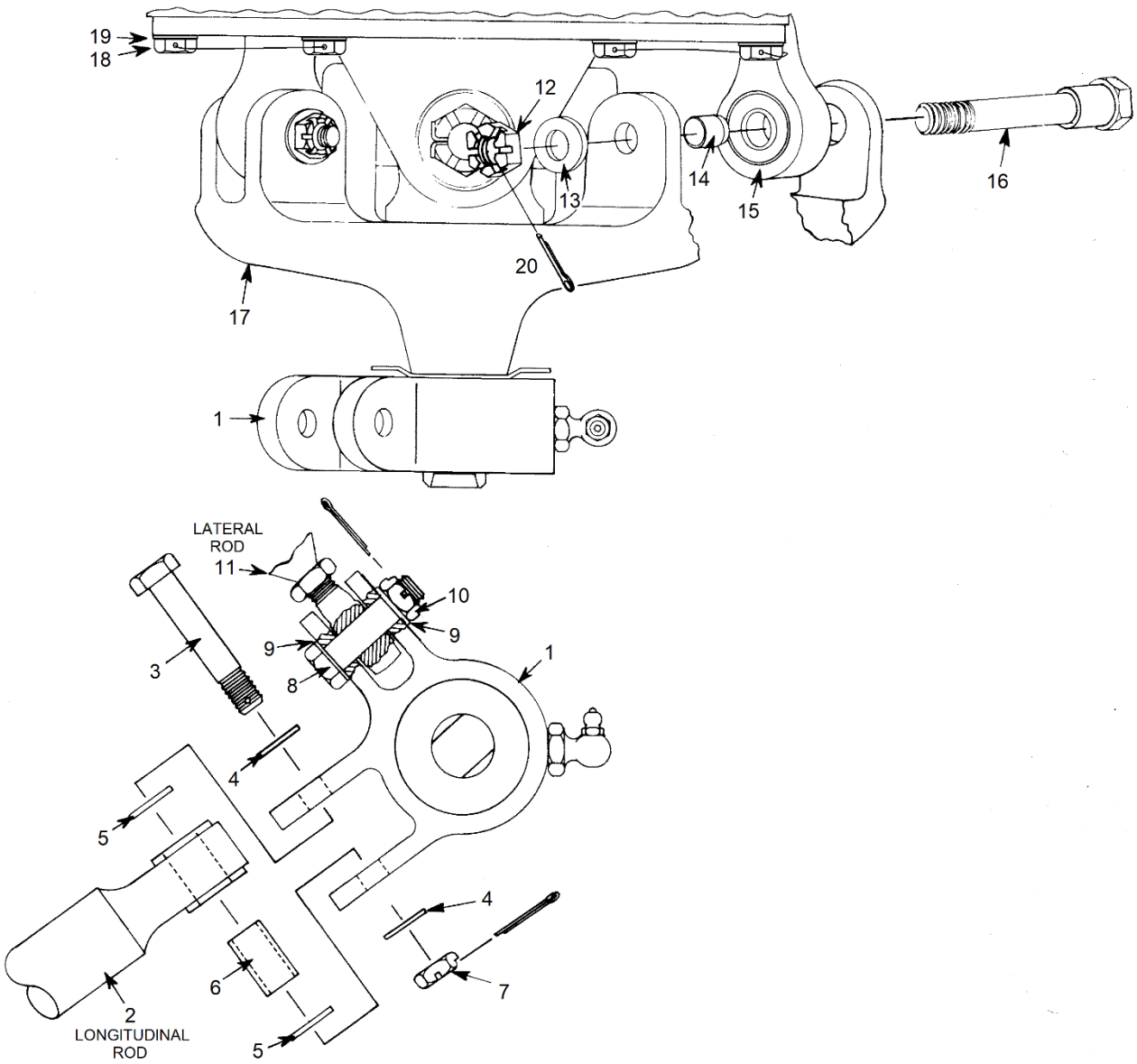
(c) With the aid of an assistant, remove the collective friction and move the collective up and down throughout the range and wiggle the cyclic stick (movement of the collective and cyclic stick does not have to occur simultaneously). Observe and ***carefully*** feel the lower swashplate assembly for any looseness (e.g. vertical play at the universal joint or end play along the universal shaft and tie rod axes). Any looseness is most noticeable with a collective control reversal and/or reversal of the cyclic controls.

NOTE: Vertical looseness may also be evident at the collective stick as a sudden change in stick force or may exhibit itself as a clinking sound. Using a 9/16 inch crows foot and torque wrench set to 60 in-lb/6.8 Nm, check that the torque required to rotate the tie rod assembly at the nut on the end of the tie rod assembly is more than 60 in-lb/6.8 Nm. Do not remove the cotter pin from the nut during the check and stop the torque check if 60 in-lb/6.8 Nm is reached without the tie rod assembly rotating. Any rotation of the tie rod with less than 60 in-lb/6.8 Nm of torque is unacceptable.

NOTE: Refer also to Para. 12-1, Troubleshooting.

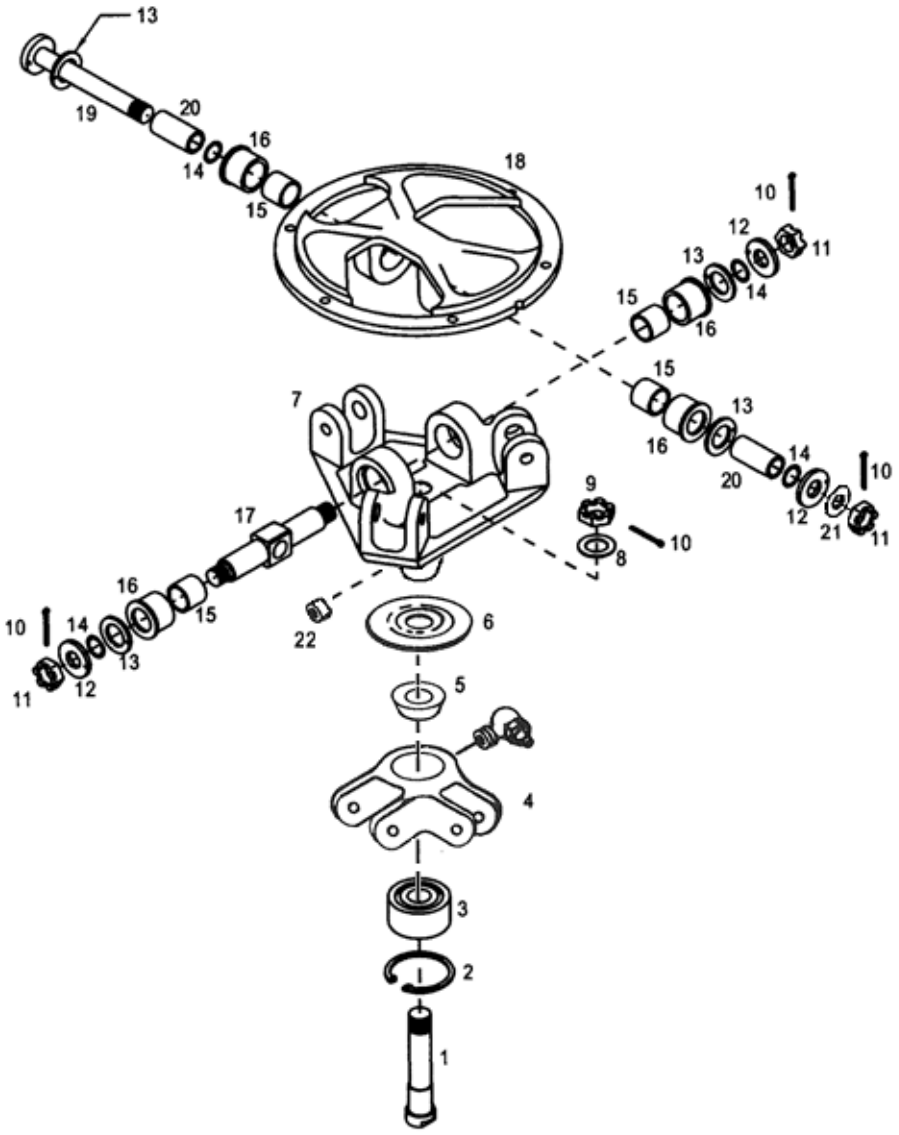
(d) If neither looseness nor loss of torque is evident, reconnect the pitch change bellcranks and return the aircraft to service.

(e) If any looseness or loss of torque is found, remove the lower swashplate assembly from the aircraft and perform the following additional inspections:



1.	Lower Bearing Housing	11.	Lateral Push-Pull Rod
2.	Longitudinal Push-Pull Rod	12.	Nut (P/N AN320-4)
3.	Bolt	13.	Washer (P/N AN960-416L)
4.	Washer	14.	Spacer (P/N 28-16124-1)
5.	Washer (P/N ECD050-11)	15.	Rod End (Dog Leg)
6.	Spacer	16.	Bolt (P/N 28-16129-2)
7.	Nut	17.	Lower Swashplate Housing
8.	Bolt	18.	Bolt
9.	Washer	19.	Washer
10.	Nut	20.	Cotter Pin (P/N AN381-2-8)

Figure 12-20. Lower Swashplate Installation



1.	Bolt (Shaft)	12.	Washer
2.	Retaining Ring	13.	DU Washer
3.	Bearing	14.	Shim
4.	Bearing Housing	15.	DU Bearing
5.	Spacer	16.	Sleeve
6.	Slinger	17.	Universal Shaft
7.	Lower (Universal) Housing	18.	Upper Housing
8.	Washer	19.	Tie Rod Assembly
9.	Nut	20.	Spacer
10.	Cotter Pin	21.	Light Washer
11.	Nut	22.	Set Screw (if equipped)

Figure 12-21. Lower Swashplate Assembly

1 Inspect the universal joint for looseness/play by twisting and pushing and pulling the upper and lower housings of the lower swashplate against each other.

2 Inspect the tie rod and universal shaft axis for end play by attempting to move the upper and lower housings against each other along the tie rod and universal shaft axes.

3 Check the pre-load of the tie rod and universal shaft axis. The pre-load should be between 0.5 and 2.0 pounds (.23 and .91 kg) using a spring scale, with no noticeable end play.

(f) Disassemble the lower swashplate assembly and inspect the detail parts in accordance with Table 12-1.

(g) Replace unserviceable parts as required and reassemble the lower swashplate in accordance with Para. 12-10, D.

(h) Reinstall the lower swashplate assembly and reconnect the pitch change bellcranks.

(2) See Table 12-1 for the detailed inspection requirements for the lower swashplate assembly.

D. Lower Swashplate – Assembly (Figure 12-21)

(1) Remove the seal from one side of the bearing (3).

WARNING: USE EXTREME CAUTION WHEN REMOVING OR INSTALLING HEATED PARTS AND ASSEMBLIES TO PREVENT FROM INJURING PERSONNEL.

WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

(2) Heat the bearing housing (4) to approximately 250°F/121°C.

(3) Apply a small amount of Loctite 277 to the O.D. of the bearing (3) and install the bearing (3) with the open side toward the “closed end” of the bearing housing (4). Allow the housing assembly to cool.

NOTE: Install the housing assembly onto the lower swashplate assembly with the retaining ring away from the swashplate.

(4) Install the retaining ring (2) and grease fitting in the housing (4).

NOTE: Install the bolt with the head on the same side as the retaining ring.

(5) Support the inner race of the bearing (3) and press the bolt (1) into the bearing.

(6) Install the spacer (5) with the narrow side of the spacer against the inner race of the bearing.

(7) Install the slinger (6) on the bolt (1).

(8) Lubricate (MIL-PRF-81322) the bolt (1) and install into the lower universal housing (7). Install the washer (8) and nut (9). Torque the nut and install a cotter pin. Apply VC3 Vibra-Tite over the end of the bolt, nut, and cotter pin.

NOTE: A variation of the lower universal housing (7) has a set screw plug (22) that must be installed upon reassembly.

(9) If applicable, apply a small amount of Loctite 277 to set screw (22) and install set screw into the lower universal housing (7).

(10) Install the DU bushings (15) into the sleeves (16) (4 places).

NOTE: Lubricate (Tri-Flow brand or equivalent light viscosity lubricant) DU washers and bushings.

(11) Check the fit of the universal shaft (17) and the tie rod (19) in the bushings. The universal shaft and tie rod should move freely in the bushings. If required, use an expandable reamer and lightly ream the bushings so that the shaft and tie rod move freely in the bushings. Do not ream the bushings so they have free play (loose fit).

NOTE: The lower universal housing should be heated with a heat gun to allow easier installation of the sleeves. Do not exceed 250°F/121°C. Allow the parts to cool before shimming.

WARNING: USE EXTREME CAUTION WHEN REMOVING OR INSTALLING HEATED PARTS AND ASSEMBLIES TO PREVENT FROM INJURING PERSONNEL.

WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

(12) Lubricate (MIL-PRF-81322) the O.D. of two of the sleeves (16) and the bores of the ears on the lower universal housing (7).

(13) Install one of the sleeves (16) into the lower universal housing using tool T-0100-1.

CAUTION: ENSURE THAT THE CORRECT UNIVERSAL SHAFT, P/N 28-16223-19, IS USED WHEN ASSEMBLING THE LOWER SWASHPLATE ASSEMBLY. (THE LENGTH OF THE BUSHING SURFACE IS 1.289 IN ± .001 IN/32.74 MM ± .03 MM). FAILURE TO INSTALL THE CORRECT UNIVERSAL SHAFT CAN RESULT IN PREMATURE WEAR OF THE TIE ROD AND UNIVERSAL SHAFT.

(14) Install the universal shaft (17) into the lower universal housing (7) though the ear without the sleeve and then install a sleeve (16) into the lower universal housing using T-0100-1. The shaft should rotate freely in the bushings.

(15) Shim the universal shaft using the following procedure:

NOTE: Lubricate (Tri-Flow brand or equivalent light viscosity lubricant) DU washers and bushings.

(a) Using a felt tip marker, place a mark on one of the ears on the lower universal housing and install a .020 in/.5 mm shim (14) on the end of the universal shaft (17). The mark indicates a .020 in/.5 mm shim is installed.

(b) Install a DU washer (13) on the shaft (17) with the Teflon (grey) side of the washer against the sleeve (16).

(c) Install a washer (12) on the shaft (17) with the pin towards the DU washer (13).

(d) Install the tie rod (19) into the universal shaft (17) to prevent the shaft from rotating and install a nut (11). Ensure the DU washer is properly seated on the retention pin on the washer (12). Torque the nut to 110-150 in-lb/12.5-17.0 Nm and check that the cotter pin hole is aligned. This may require installing different nuts until the proper torque and cotter pin hole alignment is achieved. Do not back the nut off for cotter pin alignment.

(e) Install a .020 in/.5 mm shim (14), DU washer (13), washer (12), and nut (11) on the opposite end of the universal shaft. Ensure the DU washer (13) is properly seated on the retention pin on the washer (12). Torque the nut to 110-150 in-lb/12.5-17.0 Nm and check that the cotter pin hole is aligned. This may require installing different nuts until the proper torque and cotter pin hole alignment is achieved.

(f) Tap each end of the universal shaft (17) with an aluminum drift and hammer to seat the stack up.

(g) Insert the tie rod or an appropriate size bolt in the tie rod bore of the universal shaft and check the preload with a spring scale at a 3 in/7.5 cm arm. The preload should be 1.5-2.0 lb/.68-.91kg. If too loose, fewer shims are required. If too tight, more shims are required. Ideal shimming of the assembly is to have equal amounts of shims on each end of the universal shaft; however, a .005 in/.13 mm maximum difference in shims is allowed from end to end to obtain proper preload.

NOTE: The upper universal housing should be heated with a heat gun to allow easier installation of the sleeves. Do not exceed 250°F/121°C. Allow the parts to cool before shimming.

WARNING: USE EXTREME CAUTION WHEN REMOVING OR INSTALLING HEATED PARTS AND ASSEMBLIES TO PREVENT FROM INJURING PERSONNEL.

WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

(15) Lubricate (MIL-PRF-81322) the O.D. of the two remaining sleeves (16) and the bores of the ears on the upper universal housing (18). Using tool T-0100-1, install the sleeves into the upper universal housing.

CAUTION: ENSURE THAT THE SPACERS USED ON THE TIE ROD ARE THE CORRECT LENGTH (REFER TO TABLE 12-1). FAILURE TO INSTALL THE CORRECT LENGTH SPACERS CAN RESULT IN PREMATURE WEAR OF THE TIE ROD AND UNIVERSAL SHAFT.

(16) Install a DU washer (13) onto the tie rod (19). Ensure the Teflon (grey) surface is facing inboard and the DU washer is properly seated on the retention pin. Install a spacer (20) and then a .020"/.5 mm shim (14) onto the tie rod (19).

NOTE: Lubricate (Tri-Flow brand or equivalent light viscosity lubricant) DU washers and bushings.

(17) Place the upper universal housing over the lower universal housing and align the proper openings.

(18) Insert the tie rod (19) through the sleeve in the upper housing that is in line with the dog leg ears of the lower housing, the universal shaft, and the opposite sleeve in the upper housing.

CAUTION: ENSURE THAT THE SPACERS (20) USED ON THE TIE ROD ARE THE CORRECT LENGTH (REFER TO TABLE 12-1). FAILURE TO INSTALL THE CORRECT LENGTH SPACERS CAN RESULT IN PREMATURE WEAR OF THE TIE ROD AND UNIVERSAL SHAFT.

(19) Install the remaining spacer (20) onto the tie rod.

(20) Install a .020 in/.5 mm shim, DU washer (13), washer (12), light washer (21), and nut (11) on the tie rod (19). Ensure the DU washer is properly seated on the retention pin on the washer. Using tool T-0016 to secure the tie rod, torque the nut to 110-150 in-lb/12.5-17.0 Nm and check that the cotter pin hole is aligned. This may require installing different nuts until the proper torque and cotter pin hole alignment is achieved.

(21) Tap each end of the tie rod (19) with an aluminum drift and hammer to seat the stack up.

(22) Install the lower swashplate assembly on tool, T-0134 (Plate Assembly), a spare bell housing, P/N 28-16112-1, clamped in a vise, or on the upper swashplate assembly.

(23) Insert a bolt though one of the ears on the cyclic bearing housing and check the preload of the tie rod axis. The preload on the tie rod axis should be the same as the universal shaft preload ± .25 lb/.11 kg. If too loose, fewer shims are required. If too tight, more shims are required. Ideal shimming of the assembly is to have equal amounts of shims on each end of the tie rod; however, a .005 in/.13 mm maximum difference in shims is allowed from end to end to obtain proper preload.

(24) Install the cotter pins when the preload is set.

E. Lower Swashplate – Installation (Figure 12-20)

(1) Install the lower swashplate with the attachment ears aligned to the doglegs (15).

(2) Secure in place with washers (19) and bolts (18). Torque (30-35 in-lb/3.4-4.0 Nm) and lockwire (.025) the bolts in pairs.

(3) Secure the doglegs (15) to the lower swashplate housing using bolts (16) and spacers (14).

(a) Clean/Degrease the threads on the three bolts (16) using a suitable cleaner (contact cleaner, brake cleaner, etc. procured from local source).

NOTE: Spacers (14) are installed with chamfer inboard toward bearing in dogleg.

(4) Install washers (13) and nuts (12) on bolts (16). Torque the nuts to 40-60 in-lb/4.5-6.8 Nm and install the cotter pins (20) (3 places). Liberally apply a coating of Vibra-Tite VC-3 onto the nut and cotter pin installations.

NOTE: When torqueing the nut to align the cotter pin hole, the nut must be turned in the direction of tightening; the nut may not be loosened to line up the cotter pin hole. Replace the nut, washer, spacer, and/or bolt as required if the cotter pin hole will not line up at the 40-60 in-lb/4.5-6.8 Nm torque application.

(5) Install spacer (6) in the longitudinal push-pull rod (2).

(6) With washers (5) on each side of spacer (6), insert push-pull rod (2) into the lower bearing housing (1).

(7) Install bolt (3), washers (4) and nut (7) to secure the rod in place. Torque (30-40 in-lb/3.4-4.5 Nm) the nut and install the cotter pin (20).

(8) Connect the lateral push-pull rod (11) to the housing (1) using bolt (8), washers (9) and nut (10). Torque (60-85 in-lb/6.8-9.6 Nm) the nut and install the cotter pin (20).

(9) Rotate the cyclic stick to check for binding in the system. Check all connections for security.

(10) Install the fuel tank and connect fuel lines. Install fuel and check for leaks.

(11) Replace side panel cowls.

(12) Perform a maintenance test flight (Para. 12-13).

Table 12-1. Inspection Requirements – Lower Swashplate Assembly

P/N	Fig. 12-21 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-16123-1, -11	1	Bolt	Bearing surface Dia. .4723 to .4726	-.0002	Not Repairable	Replace Bolt
			Threads (crossed or missing)	None allowed	Not repairable	Replace Bolt
ECD009-11	3	Bearing	O.D. 1.2593 to 1.2598	No Tolerance Allowed	Not Repairable	Replace Bearing
			I.D. .4721 to .4724	No Tolerance Allowed	Not Repairable	Replace Bearing
			Ratcheting or roughness	None allowed	Not Repairable	Replace Bearing
28-16361-1	4	Bearing Assembly	Bolt holes in pivot ears for elongation	None Allowed	Not Repairable	Replace Housing
			Surface nicks or scratches	None Allowed	≤ .010 deep	Blend and polish out smooth
			Bore size I.D. 1.2598 to 1.2604	None Allowed	Not Repairable	Replace Housing
			Cracks	None Allowed	Not Repairable	Replace Housing

Table 12-1. Inspection Requirements – Lower Swashplate Assembly

P/N	Fig. 12-21 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-16228-1	5	Spacer	Nicks and gouges	None Allowed	≤ .003 deep	Polish out smooth
28-16387-1	6	Slinger	Check for bends in outer edges	.005	Not Repairable	Replace Slinger
28-16119-3, -5	7	Housing	Bushing bores Dia. .7500 to .7505 (-3) .7495 to .7500 (-5)	+.0005	Not Repairable	Replace Housing
			Center bolt bore Dia. .4370 to .4380 (no galling allowed in this bore)	+.0005	Not Repairable	Replace Housing
			Large bolt bore Dia. in the pivot ears .375 to .376	+.0005	Not Repairable	Replace Housing Replace Housing
			Small bolt bore Dia. in the pivot ears .250 to .251	+.0005	Not Repairable	Replace Housing
			Cracks	None Allowed	Not Repairable	Replace Housing
28-16227-3	12	Washer	Nicks and gouges	None Allowed	Not Repairable	Replace Washer
28-16263-5	13	DU Washer	Thickness .0585 to .0605	-.008	Not Repairable	Replace DU Washer
08DU08	15	DU Bearing	**I.D. .4992 to .5019	+.0025	Not Repairable	Replace DU Bearing
28-16226-5	16	Sleeve	O.D. ..7503 to .7508	-.0003	Not Repairable	Replace Sleeve
			I.D. .5937 to .5941	+.0002	Not Repairable	Replace Sleeve

Table 12-1. Inspection Requirements – Lower Swashplate Assembly

P/N	Fig. 12-21 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-16223-19	17	Universal Shaft	O.D. .4991 to .4995	-.0003	Not Repairable	Replace Shaft
			Tie Rod Bore .3750 to .3752	+.0005	Not Repairable	Replace Shaft
			Concentricity	.0015 FIM	Not Repairable	Replace Shaft
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Shaft
28-16116-1, -11	18	Housing	Bushing bores Dia. .7500 to .7505	+.0005	Not Repairable	Replace Housing
			Cracks	None Allowed	Not Repairable	Replace Housing
28-16224-5	19	Tie Rod	O.D. .3746-.3749	-.0003	Not Repairable	Replace Tie Rod
			Concentricity	.002 FIM	Not Repairable	Replace Tie Rod
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Tie Rod
28-16225-19	20	Spacer	O.D. .4991 to .4995	-.0003	Not Repairable	Replace Spacer
			†Length 1.037 to 1.036	-.001	Not Repairable	Replace Spacer

* All dimensions are in inches.

** Inspect DU Bearing I.D. with the bearing installed in the sleeve, P/N 28-16226-5.

† Measure length at several locations to check for uneven wear.

12-11 UPPER SWASHPLATE ASSEMBLY

A. Removal – Upper Swashplate Assembly (Figure 12-22)

NOTE: Removal of the upper swashplate assembly can be accomplished with the removal of one fuel tank; however, the procedure can be facilitated by removing both fuel tanks.

(1) Remove both fuel tanks.

(2) Remove the screws and fiberglass cover over the collective push-pull rod located above the seat deck in the cabin.

(3) If required, remove screws (19) and washers (18) to remove the magnetic pickup bracket (17) (Figure 12-23).

(4) Remove the lower swashplate assembly (Para. 12-10, A).

(5) Remove bolt (1) connecting the push-pull rod (2) and the walking beam (6).

(6) Remove bolts (5), washers, and nuts from pivot straps (3). Pull the pivot straps (3) off of the studs.

(a) If the pivot strap bushings (4) are worn, press to remove from the pivot strap.

(b) If the pivot strap bushings are replaced, they will require reaming before reassembly.

(7) Cut the safety wire and remove bolts (7) and bushings (8) (if equipped) from the upper bearing housing (9, Figure 12-23). Pull the walking beam (6) outward to remove from the bearing housing.

NOTE: The upper swashplate assembly is assembled with one of two approved bearing housing configurations: P/N 28-16108-2 or P/N 28-16108-11. The outer bearing housing bolt holes for the collective walking beam attachment points are larger in P/N 28-16108-11 than P/N 28-16108-2 (approximately Ø.406 vs. Ø.312). This is to accommodate P/N 28-16109-13 bushings. Also, the gaps to accommodate the collective walking beam are wider, thus requiring longer bolts to provide security of attachment.

(8) Remove the cotter pins from the castle nuts (9) of the lower end of the push-pull rods (11).

NOTE: Index mark each dogleg (10) to its respective push-pull rod (11) before disassembly. Doglegs have tapered bores which are matched to push-pull rods.

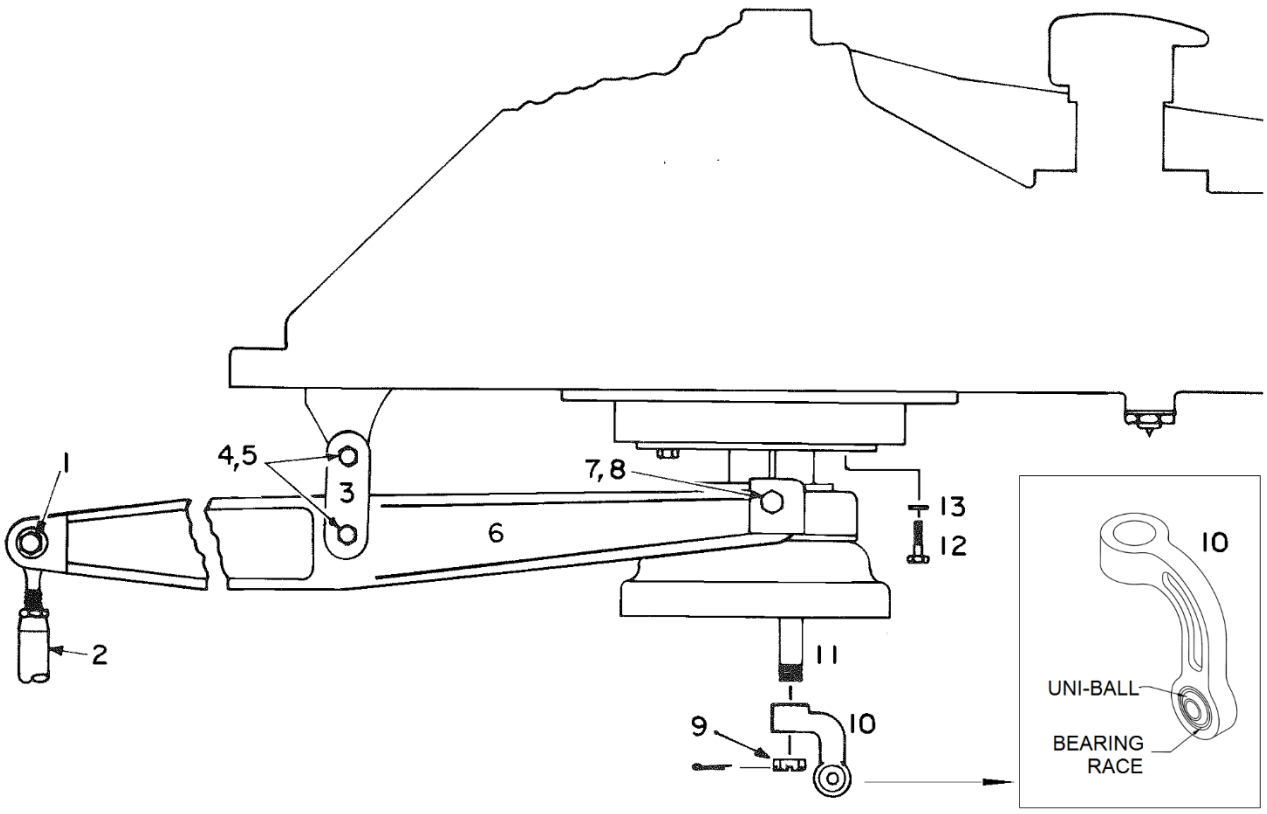
(9) Remove the castle nuts (9) from push-pull rods (11).

(10) Install puller tool T-0045 over dogleg (10) with center pivot of tool aligned with push-pull rod (11) and remove doglegs (10).

(11) Disconnect the upper end of push-pull rods (11) at the main rotor hub (Figure 9-1):

NOTE: Index mark the pitch change bellcranks to their respective push-pull rod.

(a) Remove bolt (3), washers, and nut from the pitch change bellcrank (5).



1. Bolt
2. Push-Pull Rod
3. Pivot Strap
4. Pivot Strap Bushing
5. Bolt
6. Walking Beam
7. Bolt
8. Bushing (Used only with 28-16108-11 bearing housing, Figure 12-23, Item 9)
9. Nut
10. Dogleg
11. Push-Pull Rod
12. Bolt
13. Washer

NOTE: See Figure 12-23 if equipped with optional magnetic pickup bracket.

Figure 12-22. Upper Swashplate Installation

(b) Remove bolt (4), washers, and nut from walking beam bracket (3) (Figure 9-2). Lift walking beam out of bracket and separate from the push-pull rod.

NOTE: Secure spacers (7) and (8) in push-pull rod and pitch change bellcrank with a piece of safety wire on disassembly and removal (Figure 9-1).

(12) Remove the push-pull rods (11) through upper end of mast.

(13) Remove bolts (12) and washers (13) connecting the swashplate to the gearbox (3 places).

(14) Slide bell of the upper swashplate up and down to tap the swashplate assembly from the lower end of the mast.

B. Disassembly – Upper Swashplate Assembly (Figure 12-23)

(1) Install blocks (T-1758) on each side of the control housing (14) and clamp blocks in a vise with the nuts (1) facing up for removal.

(2) Bend the locking tab (2) back to a flat position and remove nuts (1) with special socket tool T-0086. Remove the locking tab.

(3) Place the swashplate assembly in an arbor press using blocks T-1758 for support and positioned with bell housing (3) up.

(4) Position plug tools T-0102-1 three places in the threaded end of guide tube assembly (16) and press the swashplate assembly apart.

(5) If DU bearings (13) are worn, press to remove from the control housing (14).

CAUTION: SUPPORT THE CONTROL HOUSING (14) WHEN PRESSING THE DU BEARING (13) FROM THE CONTROL HOUSING.

(6) Press spacer (12) from the bearing housing assembly and remove the rain slinger (11).

(7) Cut the safety wire and remove screws (4), washers (5), bearing retainer (6), and shims (7).

(8) Heat the bearing housing (9) to approximately 250°F/121°C and press bearing (8) from housing.

C. Troubleshooting – Upper Swashplate Assembly

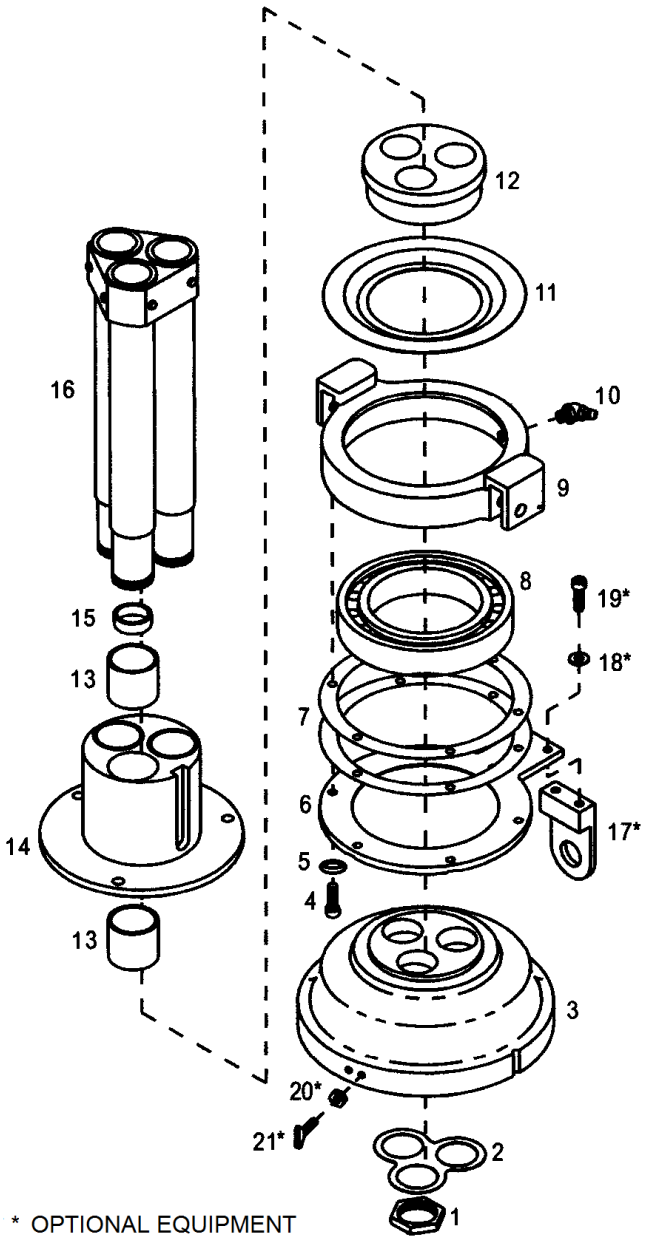
NOTE: If a lower swashplate has been operating in a worn condition, it may have caused the upper swashplate to wear also.

(1) Upon removal of the lower swashplate, check the upper swashplate as follows:

(a) Check the uni-ball in the doglegs for looseness or binding.

NOTE: The uni-ball preload should be equal in all three doglegs.

(b) Check the security of the doglegs to the push-pull rods.



1.	Nut	12.	Spacer
2.	Lock Plate	13.	Bushing
3.	Bell Housing	14.	Control Housing
4.	Bolt	15.	Bushing
5.	Washer	16.	Retainer and Guide Shaft Assembly (Guide Tube Assembly)
6.	Bearing Retainer		
7.	Shims	17.	Magnetic Pickup Bracket
8.	Bearing	18.	Washer
9.	Bearing Housing	19.	Screw
10.	Lube Fitting	20.	Nut
11.	Slinger	21.	Interrupter

Figure 12-23. Upper Swashplate Assembly

(c) Exert fore and aft force on the lower bell housing of the upper swashplate to check for DU bushing wear.

NOTE: The upper swashplate should be removed and rebuilt if the DU bushings have excess of .010 play.

(d) Check the upper collective bearing by disconnecting the yoke and rotating the bearing to check for roughness.

(e) Exert up and down force on the attachment of the walking beam to the transmission mount to check for pivot strap bushing wear.

D. Inspection – Upper Swashplate Assembly

(1) Inspect the swashplate rod end (dog leg) (10, Figure 12-22) assemblies for excessive bearing play/wear.

(a) Using a suitable light source and inspection mirror, as required, visually inspect each of the dog leg assemblies for condition and/or excessive radial play/wear between the bearing uni-ball and the uni-ball bearing race (Figure 12-22). To accomplish this inspection, a second person should slightly rotate, in the pitch axis, the main rotor blade corresponding to the dog leg assembly being inspected.

(b) If the visual inspection of the dog leg assemblies indicates obvious uni-ball play exceeding approximately .025 in/.635 mm, remove the lower swashplate assembly from the aircraft and remove the dog leg assemblies from the aircraft. Inspect and replace the dog leg assemblies with airworthy components as required.

(c) If the lower swashplate assembly has been removed, inspect the corresponding mounting lugs of the lower swashplate assembly for excessive wear/damage (Refer to Figure 12-20). Repair or replace the lower swashplate as applicable.

(d) If the lower swashplate assembly has been removed, inspect bolts (16) and spacers (14) for excessive wear/damage (Figure 12-20). Replace the bolts and/or spacers as required.

(2) See Table 12-2 for detailed inspection requirements of the upper swashplate assembly.

E. Assembly – Upper Swashplate Assembly (Figure 12-23)

(1) If installing a new bearing, remove the seal from one side of the bearing (8).

WARNING: USE EXTREME CAUTION WHEN REMOVING OR INSTALLING HEATED PARTS AND ASSEMBLIES TO PREVENT FROM INJURING PERSONNEL.

WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

(2) Heat bearing housing (9) to approximately 250°F/121°C.

(3) Apply a lubricant (MIL-PRF-81322) to O.D. of bearing (8) and I.D. of housing (9). Install the bearing in housing with the open side of the bearing facing up against the closed side of the housing. Allow the assembly to cool.

(4) Calculate the thickness of shims (7) required to preload the bearing in the housing using the following procedures:

(a) Use a depth micrometer to measure distance from face of bearing to face of housing.

(b) Subtract .003 in/.08 mm from measurement in step (a) to equal the shims required.

NOTE: Shims are available in thicknesses of .002, .003 and .005 inch.

(5) Place the shims (7) on the face of housing (9).

(6) Install the bearing retainer (6) in place and secure with washers (5) and screws (4). Torque (12-15 in-lb/1.4-1.7 Nm) the screws in an alternating sequence and lockwire in pairs with .025 safety wire.

(7) Install tool T-1709 on the inner race on the sealed side of the bearing (8). Place the slinger (11) on the open face of bearing and press the spacer (12) into the inner race of the bearing.

(8) Clean the guide tube bores of the control housing (14) and O.D. of DU bushings (13) with Loctite Primer.

(9) Press the DU bushings (13) into the control housing (16) until they are flush with the face of the control housing. Rotate the assembly and repeat the installation on the opposite end.

(10) Install the control housing (14) on the guide tube assembly (16) with the large flange of the housing facing toward threaded end of the guide tubes.

(11) Place the guide tube assembly in an arbor press with the threaded end of the guide tubes up.

(12) Lubricate (MIL-PRF-81322) the guide tubes (16) and the I.D. of the holes in spacer (12) installed in the bearing housing assembly. Press the bearing housing assembly onto the guide tubes with the slinger (11) facing the control housing (14) on the guide tube assembly (16).

(13) Lubricate (MIL-PRF-81322) holes in bell housing (3) and press the housing onto the guide tubes. Ensure the bell housing is seated into bearing (8).

(14) Slide the control housing (14) up and down on the guide tubes. If the housing is excessively tight or binding, mark the positions of the bell housing (3), spacer (12), and the bearing housing (9) on the guide tubes (16). Press the assembly apart, rotate the above items 120° on the guide tubes and re-assemble the components. Re-check to ensure the control housing (14) slides with no interference.

(15) Clean the threads of guide tubes and the nuts (1) with Loctite Primer.

(16) Install the aluminum blocks (T-1758) on the control housing (14) and clamp in a vise with the bell housing (3) up.

(17) Install the lock plate (2) on guide tubes.

(18) Apply Loctite 277 to the threads of the nuts (1) and install the nuts onto the guide tubes. Torque the nuts to 240 in-lb/27.1 Nm (3 places) using special socket T-0086.

(19) Secure the lock tab (2) by bending up on two flats for each nut.

F. Installation – Upper Swashplate Assembly and Guidetubes (Figure 12-22)

(1) Lubricate (MIL-PRF-81322) the bore of main rotor mast at the lower end.

(2) Align the slot in the control housing (14, Figure 12-23) with the locking pin in lower end of the mast and install the upper swashplate assembly into the mast. Gently tap the swashplate into position by sliding the swashplate assembly up and down on the guide tubes.

(3) Install washers (13) and bolts (12) in three places. Torque (30-40 in-lb/3.4-4.5 Nm) the bolts and lockwire (.025).

NOTE: Rotate the upper swashplate bearing housing with the swashplate in the full up position and ensure the lockwire does not interfere with the collective bearing housing.

(4) Install the walking beam (6) into the ears of the bearing housing (9, Figure 12-23).

(5) Install bolts (7) and bushings (8), if required, through the walking beam into the bearing housing. Torque (30-40 in-lb/3.4-4.5 Nm) and lockwire (MS20995C32).

NOTE: Ensure proper bolt (7) length for bearing housing with bushing (8). Bolt is P/N 28-16109-11 (1.12 inch shank length).

(6) If the pivot strap bushings (4) were replaced, apply a small amount of Loctite 277 on the O.D. of the bushings and press the pivot strap bushings (4) into the pivot straps (3). Ream with a 3/8” reamer.

(7) Install the pivot straps (3) on the gearbox and walking beam studs.

(a) Install the gearbox attachment bolt (5) and hardware. Torque (30-40 in-lb/3.4-4.5 Nm).

(b) Check the pivot strap for binding or freedom of movement. If the binding is detected, remove hardware. File the hat-end of the bushing (4) to reduce the thickness or protrusion. Deburr and remove any debris from the assembly.

(c) Repeat step (b) and check for binding.

(d) If there is no binding, then install the walking beam attachment bolt (5). Torque (30-40 in-lb/3.4-4.5 Nm).

(e) Perform step (b) and repeat as necessary until there is no binding of the pivot strap.

(f) Install cotter pins.

(8) Install the push-pull rod (2) into the walking beam (6) and connect with hardware (1). Torque (60-85 in-lb/6.8-9.6 Nm) and install cotter pin.

(9) Connect the push-pull rods to the pitch change bellcrank (Figure 9-1):

NOTE: Stuff a shop cloth into the upper end of the mast to prevent anything from being dropped into the mast when connecting the push-pull rods to the pitch change bellcranks. Remember to remove the shop cloth when installation is complete.

WARNING: IF ANYTHING IS DROPPED INTO THE MAST IT MUST BE REMOVED PRIOR TO MOVING THE FLIGHT CONTROLS.

(a) Insert stainless steel spacer (7) into the end of the push-pull rods (6) and spacer (8) into the center pivot of the pitch change bellcrank (5).

(b) Install push-pull rods (6) into mast and connect to the pitch change bellcrank (5) with bolts (3), washers, and nuts. Torque (30-40 in-lb/3.4-4.5 Nm) nuts and install cotter pins.

NOTE: Check for any binding in the installation by pivoting the walking beam. Apply a lubricant (Tri-Flow brand or equivalent light viscosity lubricant), as required.

(c) Connect the pitch change bellcrank (5) to the mount brackets (3, Figure 9-2) with bolts (4), washers, and nuts. Torque (60-85 in-lb/6.8-9.6 Nm) nuts and install cotter pins.

(10) Install the doglegs (10) as follows: (Figures 12-22)

(a) Position dogleg (10) on the push-pull rod (11) and install nut (9) finger-tight.

NOTE: Doglegs must be re-installed to the respective push-pull rods they were removed from.

(b) Position special tool T-0054 on bell housing of upper swashplate assembly while aligning the dogleg parallel to its respective walking beam on the main rotor hub. Install the screws to hold the tool in place. Place the spacer on each side of the swivel ball in the dogleg and install the bolt to position the dogleg on the tool (Figure 12-24).

(c) Torque the nut (9) to 130-140 in-lb/14.7-15.9 Nm and install cotter pin.

NOTE: When torqueing the nut to align the cotter pin hole, the nut must be turned in the direction of tightening; the nut may not be loosened to line up the cotter pin hole. Replace the nut, washer, spacer, and/or bolt as required if the cotter pin hole will not line up at the 130-140 in-lb/14.7-15.9 Nm torque application.

(d) Repeat steps (1) through (c) on each dogleg.

(11) Install the lower swashplate (Para. 12-10, E).

(12) If required, install the magnetic pickup bracket (17) with screws (19) and washers (18).

(13) Install the fuel tank and connect fuel lines. Install fuel and check for leaks.

(14) Replace side panel cowls.

(15) Perform a maintenance test flight (Para. 12-13).

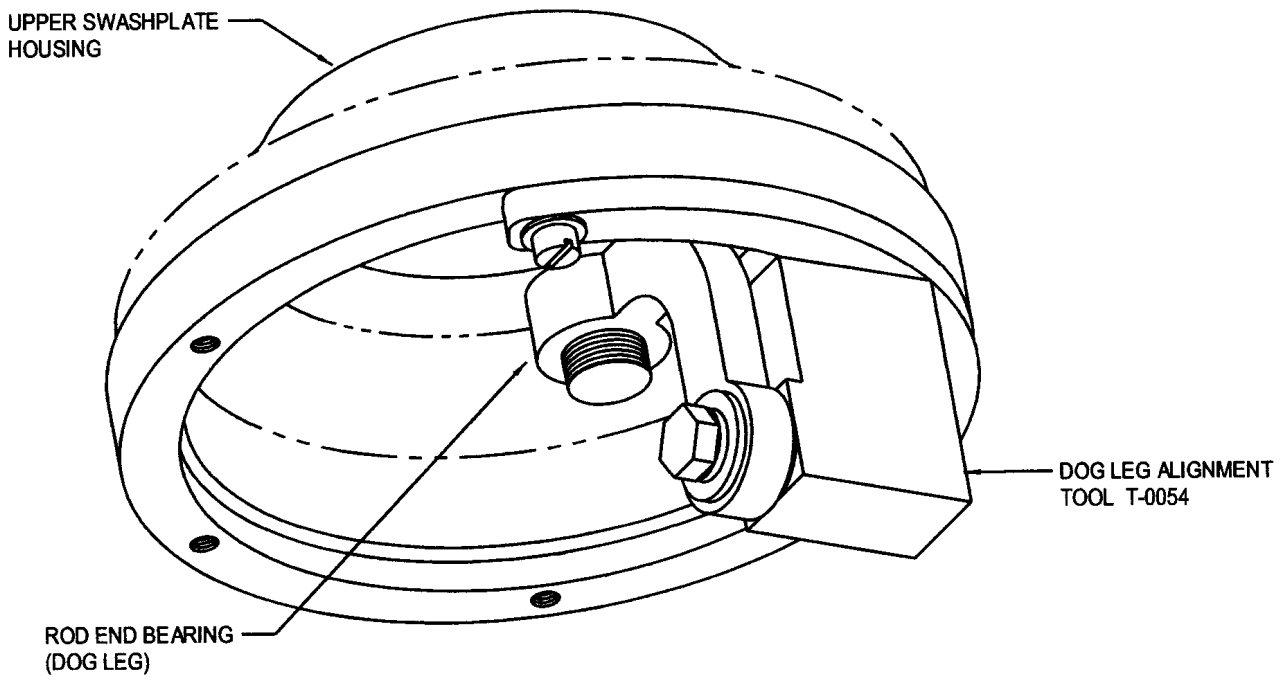


Figure 12-24. Alignment Tool T-0054 for Dog Leg Installation

Table 12-2. Inspection Requirements – Upper Swashplate Assembly

P/N	Fig. 12-22 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-16132-4	4	Pivot Strap Bushing	I.D. .3750 to .3755	+.0005	Not Repairable	Replace Bushing
P/N	**Fig. 12-23 Item #**	**Part Name**	**Inspection**	**Serviceable Limits***	**Repair Limits***	**Repair or Action**
28-16113-1	1	Nut	Threads (crossed or missing)	None Allowed	Not Repairable	Replace Nut
			Hex corners for rounding or deformation	None Allowed	Not Repairable	Replace Nut
28-16126-1	2	Locking plate				Replace on re-assembly
28-16112-15, -17	3	Bell Housing	Guide tube bore Dia. .9062 to .9069	+.0003	Not Repairable	Replace Housing
			Nicks and gouges	.005 deep	.025 deep	Blend and polish out smooth. Apply Iridite finish.
			Threads (crossed or missing)	None Allowed	Not repairable	Replace Housing
28-16043-19	6	Bearing Retainer	Nicks and scratches	.005 deep	≤.010 deep	Blend and polish out smooth
ECD013-11	8	Bearing	O.D. 3.9370	-.0004	Not Repairable	Replace Bearing
			I.D. 2.5591	+.0000 -.0004	Not Repairable	Replace Bearing
			Condition of balls and cage after cleaning	No pits or flat spots allowed	Not Repairable	Replace Bearing

Table 12-2. Inspection Requirements – Upper Swashplate Assembly

P/N	Fig. 12-23 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-16108-2, -11	9	Bearing Housing	Bearing bore Dia. 3.9365 to 3.9371	No Tolerance Allowed	Not Repairable	Replace Housing
			Pivot holes for galling or wear	None Allowed	Not Repairable	Replace Housing
			Threads	None Allowed	Not Repairable	Replace Housing
28-16386-1	11	Rain Slinger	Check for deformation	None Allowed	Not Repairable	Replace Slinger
28-16106-2	12	Spacer	Guide tube holes for galling	None Allowed	Not Repairable	Replace Spacer
16-DU-12	13	Bushing	O.D. 1.125	+.0000 -.0005	Not Repairable	Replace Bushing
			I.D. 1.000	+.0005 -.0000	Not Repairable	Replace Bushing
28-16103-1	14	Control Housing	Bushing bore Dia. 1.1250 to 1.1256	+.0004	Not Repairable	Replace Housing
			O.D. 2.6465 to 2.6470	-.0003	Not Repairable	Replace Housing
			O.D. for galling	.001 deep	.005 deep	Polish to Remove
			Cracks	None Allowed	Not repairable	Replace Housing

Table 12-2. Inspection Requirements – Upper Swashplate Assembly

P/N	Fig. 12-23 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-16260-1	16	Retainer and Guide Shaft Assembly	Sheared or worn rivets	None Allowed	If rivet is sheared with no other damage to assembly	Replace Rivet
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Guide Shaft in the retainer
			Looseness of guide shaft in the retainer	No movement allowed	Not Repairable	Replace Assembly
			Galling of guide shafts	.001 deep	≤.005 deep and ≤ 1.0” long	Blend and polish out smooth
			Cracks	None Allowed	Not Repairable	Replace Assembly

* All dimensions are in inches.

12-12 MAIN ROTOR PUSH PULL RODS

NOTE: The following was formerly contained in Section 23 and includes data incorporated from SIL 0156. See also SDB 0096.

A. Removal – Main Rotor Push-Pull Rods

(1) Remove the push-pull rod in accordance with Para. 12-11, A, steps 7 through 12.

B. Inspection – Main Rotor Push-Pull Rods (Figure 12-25, Figure 12-26, Figure 12-27)

(1) Inspect the main rotor push-pull rods for corrosion pitting.

(2) Inspect for excessive looseness between steel journal bushing (3) and Teflon bearing insert (2).

(3) Remove and inspect steel journal bushing (3) for galling or roughness.

(4) Inspect Teflon bearing insert (2) for linear damage or wear.

(5) If necessary, remove and replace the Teflon insert.

(6) Reinstall the steel journal bushing.

(7) Inspect bolt (5) for wear or damage and replace as necessary.

(8) Insert bolt (5) into the inboard end of bellcrank (8) and check for looseness.

(9) Inspect steel bushings (9) and (10) for roughness, galling, and wear.

(10) If necessary, press flanged bushings (9) and (10) out the bellcrank (8) and replace.

(11) Repeat for the other two bellcrank/push-pull rod assemblies.

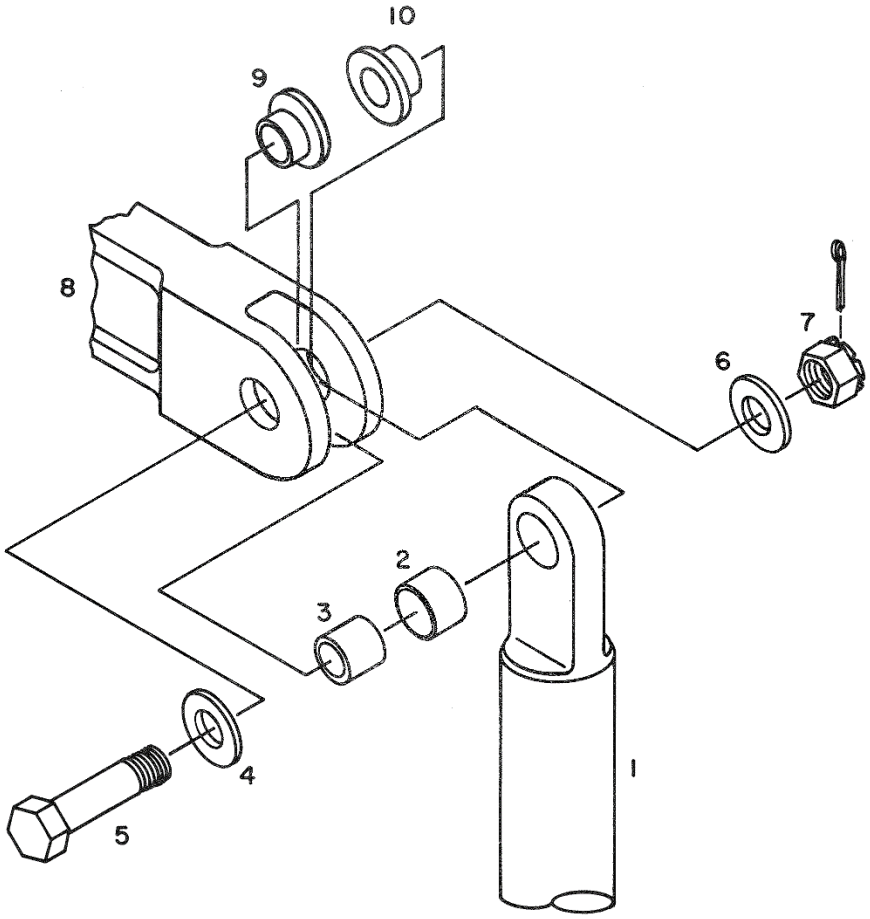
(12) See Table 12-3 for additional detailed inspection requirements for the main rotor push-pull rods.

NOTE: Refer to Table 12-3 to inspect the main rotor push-pull rods during replacement of the main rotor gearbox and whenever the push-pull rod(s) are removed from the aircraft.

C. Installation – Main Rotor Push-Pull Rods

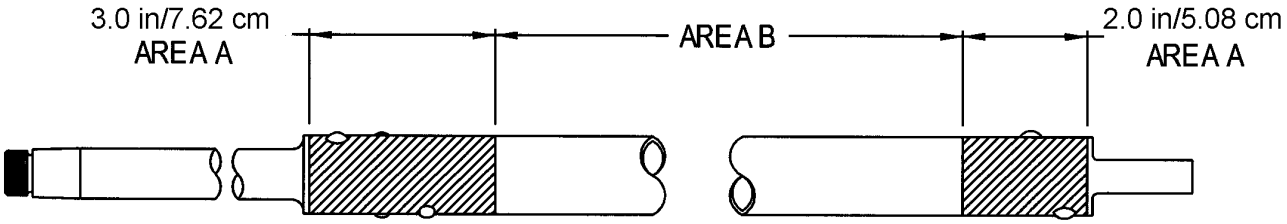
(1) Install the push-pull rods into the mast from the upper end and through the guide tubes in the upper swashplate.

(2) Complete the main rotor push-pull rod installation in accordance with Para. 12-11, F, steps 9 and 10.

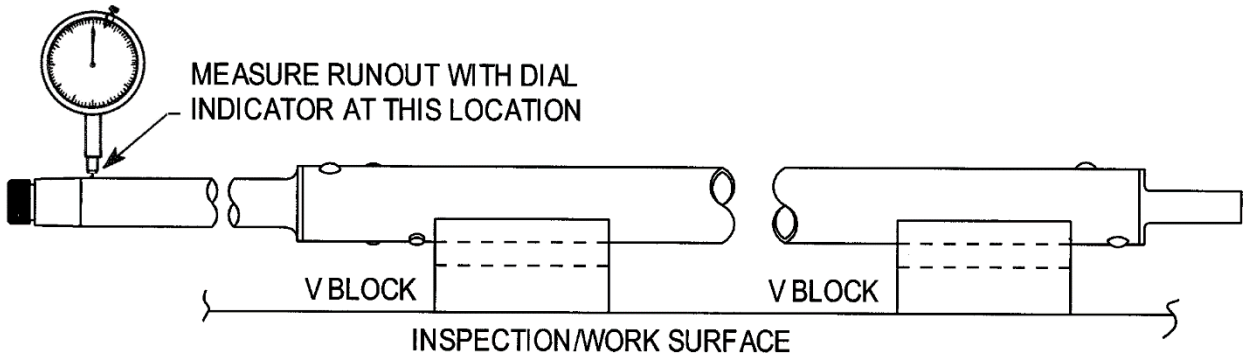


1.	Push-Pull Rod Assembly	6.	Washer
2.	Teflon Bearing Insert	7.	Nut
3.	Bushing	8.	Pitch Change Bellcrank
4.	Washer	9.	Bushing
5.	Bolt	10.	Bushing

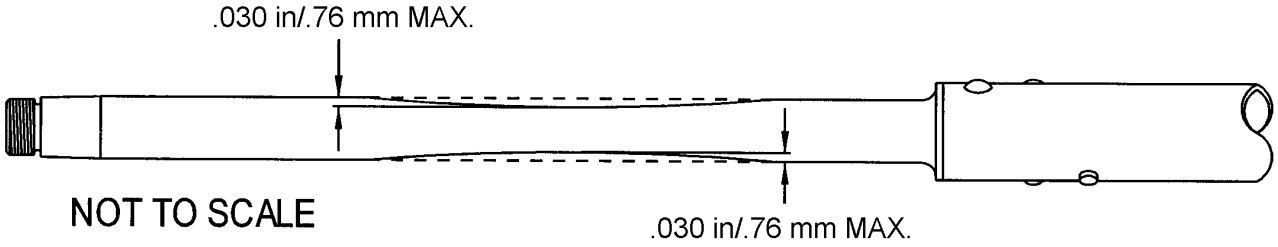
Figure 12-25. Main Rotor Push-Pull Rod Installation



a) Inspection Area Identification



b) Push-Pull Rod Runout Inspection



c) Lower Fitting Contact Wear Limits

Figure 12-26. Main Rotor Push-Pull Rod Inspections

Figure 12-27. Main Rotor Push-Pull Rod Corrosion Pitting

Table 12-3. Inspection Requirements – Main Rotor Push-Pull Rod

Part Name	Inspection	Serviceable Limits	Repair Limits	Repair or Action
Push-Pull Rod Assembly	Cracks or Dents	No Tolerance Allowed	Not Repairable	Replace Push-Pull Rod Assembly
	Nicks, scratches, or corrosion in Area A (See Figure 12-26,a)	.007 in /.18mm (See Repair or Action)	.007 in /.18 mm	Blend and polish out smooth
	Nicks, scratches, or corrosion in Area B (See Figure 12-26,a; Figure 27)	.015 in /.38mm (See Repair or Action)	.015 in /.38mm	Blend and polish out smooth
	Bent push-pull rod assembly (See Figure 12-26,b)	.030 in /.76 mm	.030 in /.76 mm	Replace Push-Pull Rod Assembly
Lower Fitting	Cracks	None Allowed	Not Repairable	Replace Push-Pull Rod Assembly
	Contact wear from guide tube assembly (See Figure 12-26,c)	.030 in /.76 mm (See Repair or Action)	.030 in /.76 mm	Blend and polish out smooth
	Threads (rolled or missing)	None Allowed	Not Repairable	Replace Push-Pull Rod Assembly
Upper Fitting	Cracks	None Allowed	Not Repairable	Replace Upper Fitting or Replace Push-Pull Rod Assembly
	Nicks, scratches, or corrosion	.010 in /.25 mm (See Repair or Action)	.010 in /.25 mm	Blend and polish out smooth
	Bore wear on Bearing, P/N MS21240-08-C-12	.505 in/12.83 mm	Not Repairable	Replace Bearing
Vinyl Sleeve	Wear	Worn Through	Not Repairable	Replace Vinyl Sleeve

* Contact wear can be repaired on two sides of the lower fitting. The rod assembly may be rotated 180° and reused when the contact wear reaches the repair limit on one side. Refer to Figure 12-26.

12-13 FLIGHT TEST PROCEDURE

A. Preliminary Checks

NOTE: Whenever a helicopter has had work accomplished to the flight controls, it is recommended that a flight test be conducted before returning the helicopter to service.

(1) Perform a preflight inspection. See Rotorcraft Flight Manual, Section 4.

(2) Perform a Verification of Rigging (Para. 12-7).

(3) Perform normal start and run-up checks to 2300 RPM.

B. Flat Pitch Test (low RPM checks)

NOTE: The following test is used to check rigging of the flight controls.

(1) Adjust engine RPM to 2300 with rotor engaged.

WARNING: CLEAR ALL PERSONS FROM TIP PATH PLANE AREA AS BLADES MAY DIP AS LOW AS 5 FEET DURING THIS TEST.

(2) Displace cyclic fore, aft, and laterally while visually inspecting for proper tip path plane reactions. Center cyclic stick after test.

(3) Displace cyclic laterally to the left until a slight mast bumping is felt through the airframe. Measure the gap between the cyclic stick and the stop ring in the floor. Repeat this procedure for right lateral, fore, and aft. All four positions should have approximately the same distance from stop ring, indicating proper rigging of push-pull tubes. Center cyclic after this procedure.

(4) Trim cyclic stick to neutral position and release cyclic grip. Visually watch cyclic stick for motion. Cyclic should remain centered and still. Move cyclic fore and aft without trimming and check smoothness. No hard vibrations should be present.

NOTE: If hard vibrations are present or the cyclic wanders, either the aircraft will have to be tracked or a problem exists in the main rotor control system.

(5) Displace the left tail rotor pedal approximately 2 inches. Observe engine tach for a drop in RPM indicating proper rigging. Return pedals to neutral position after performing this procedure.

CAUTION: IF AIRCRAFT IS ON A SLIPPERY SURFACE IT MAY TURN DURING THIS TEST.

(6) Retard throttle to idle position and check for disengagement of sprag clutch by observing tachometer needle split.

(7) Smoothly rejoin tach needles and set engine RPM at 3050. Perform normal run-up procedures.

(8) Check throttle for false limit at 3050 RPM. No stop should be contacted prior to 3050 RPM.

(9) Check that engine has 16-19 inches of manifold pressure at 3050 RPM.

NOTE: 19 inches of manifold pressure indicates that adequate autorotational RPM will be available in later tests.

C. Hover Test

(1) With rotor engaged and engine at 3050 RPM, release the collective friction and slowly increase collective pitch. While making minor adjustments to controls, watch for proper response as aircraft becomes light on the skids.

NOTE: If rocking or bouncing occurs at this point the aircraft may need tracking, oleo, or damper work performed.

(2) Bring aircraft to a hover with cyclic stick centered laterally and slightly forward of center in static stop ring.

NOTE: This test should be performed in low wind conditions. If winds are in excess of 10 MPH the cyclic will be displaced in that direction. If aircraft has rough ride, see troubleshooting and tracking procedures for hover track (Para. 12-1 and 12-2).

(3) Pedal position in a hover should be 1/2" to 1" right pedal.

NOTE: Improper pedal position requires tail rotor rigging check at this point. Collective should be in normal position and throttle must not be against false stop or into override.

(4) Stabilize aircraft at a hover and check the following:

(a) Change collective setting up and down approximately one inch and note collective spring loadings. If collective has equal forces in both directions, release throttle to check for override contact.

NOTE: Throttle and collective should remain in position without friction.

(b) Adjust cyclic trim to full left and full aft. The cyclic should have slight right force (approximately 2 lb) with pilot and passenger and "0" forces fore and aft. Record discrepancies in control forces and make adjustments for throttle, cyclic position, and collective position.

NOTE: Do not adjust for minor trim conditions until necessary adjustments for autorotation, V_{NE}, and cruise procedures have been completed which are discussed later in this test procedure.

(5) For left pedal and collective rigging low rpm check, proceed as follows:

(a) Stabilize aircraft at 1 foot hover and normal operating range with heading into the wind.

(b) Slowly reduce engine RPM while maintaining one foot hover. As aircraft reaches 220 rotor RPM, sufficient left pedal should be available to maintain heading into the wind.

(c) Continue to decrease engine RPM until aircraft contacts the ground. The collective up stop should not be contacted until touchdown. This indicates proper collective rigging to upper control arms.

(6) For right pedal rigging check, proceed as follows:

(a) Hover aircraft at one foot heading into wind.

(b) Perform hovering autorotation while maintaining one foot altitude.

(c) As the rotor passes through 220 RPM, the aircraft will settle to the ground.

NOTE: Collective should not contact the up stop prior to ground contact.

(d) Sufficient right pedal should be available until firmly on the ground.

NOTE: If above conditions cannot be met, check rigging of appropriate items.

(7) For 20 MPH hover checks - proceed as follows:

(a) Position aircraft over a flat smooth area.

(b) Hover aircraft at 20 MPH airspeed and normal operating RPM (3050 RPM). Check in both directions laterally, forward and rearward. No stops should be contacted during this phase.

(c) If no stops are contacted, repeat procedure at minimum RPM (2900 RPM).

D. Cruise Flight Test - 75% Power

(1) Perform normal takeoff and level off at 1000' AGL and set altimeter to 29.92. Record pressure altitude, temperature and gross weight information.

(2) Set engine RPM at 3050 and 29" manifold pressure with steady heading approximately 90-95 MPH.

NOTE: Allow two minutes for aircraft to stabilize.

(3) Visually check static ring for cyclic position on pilot's side. Cyclic stick should be centered and slightly aft in the ring.

(4) Trim aircraft to neutral forces. Release cyclic to ensure adequate trim is available.

(5) Change collective setting to check spring forces of collective bungee. Record if other than "0" forces.

(6) Release collective to check that throttle holds position.

E. Autorotation Checks at 60 MPH

NOTE: Pilot must calculate gross weight and predicted density altitude in accordance with the RPM correction chart (Figures 12-28 or 12-29) to avoid overspeeding the rotor while performing the autorotation check.

(1) Climb to 1500 ft AGL. Set up autorotational landing to suitable area.

CAUTION: ENTER AUTOROTATION BY LOWERING COLLECTIVE WHILE MAINTAINING ENGINE RPM. DO NOT EXCEED MAXIMUM ROTOR RPM. SPLIT TACH NEEDLES TO ENSURE ADEQUATE ROTOR RPM FOR AUTOROTATION.

(2) Enter straight into autorotation and adjust airspeed to 60 MPH.

(3) At 60 mph in stabilized autorotation, depress right pedal smoothly to pedal stop. Sufficient pedal should be available to yaw the aircraft to a minimum of 25° to the right of course.

(4) Re-establish autorotational glide at 60 MPH and full down collective.

CAUTION: DO NOT EXCEED MAXIMUM ROTOR RPM.

(5) Record temperature, pressure altitude, gross weight information, and autorotation RPM.

(6) As aircraft approaches 100 ft AGL, power recover by bringing engine rpm to low green. Rejoin tach needles by pulling collective pitch and adjust throttle as necessary while establishing climb.

CAUTION: LAND AIRCRAFT AND MAKE ADJUSTMENTS TO UNSAFE CONDITIONS BEFORE CONTINUING TESTS.

(7) Compare the autorotation RPM to the Autorotational RPM Correction Chart (Figures 12-28 or 12-29). The autorotational RPM should be within ± 5 RPM as indicated on the chart.

(a) Figure 12-28 should be used if the helicopter is based at a location below 6000 ft.

(b) Figure 12-29 should be used if the helicopter is based at a location above 6000 ft.

(8) If the autorotational RPM is not within ± 5 RPM as indicated on the chart, proceed as follows:

(a) Determine the helicopter gross weight for adjusting autorotative RPM by consulting the Autorotational RPM Correction Chart (Figures 12-28 or 12-29).

(b) Adjust rotor RPM.

1 Disconnect the pitch link rod ends at the walking beams on all three blades.

2 Rotate only the disconnected rod ends one full turn (360°).

NOTE: One 360° turn of the rod ends, shortening the pitch links, will decrease autorotative RPM by 10. One turn of the barrel = 20 RPM.

3 Connect the pitch links to walking beams and safety.

4 Secure the jam nuts.

(c) Flight check for performance.

F. V_H and V_{NE} Checks

(1) Fly aircraft to 1000 feet AGL. Record pressure altitude, temperature, and gross weight information.

(2) Adjust engine RPM to 3050 with 39" manifold pressure in level flight.

(3) Allow two minutes for aircraft to stabilize. Record airspeed.

CAUTION: DO NOT EXCEED V_{NE} SPEED ENVELOPE OR MAXIMUM MANIFOLD PRESSURE DURING THIS TEST.

(4) Visually inspect cyclic position in static stop ring. Cyclic should be centered laterally with a minimum of 1/2" clearance to aft portion of static stop ring.

(5) Trim aircraft and check for zero forces fore and aft. Check for zero lateral forces at 110 mph by momentarily releasing grip after trimming. Aircraft should maintain level flight.

(6) Adjust engine RPM and repeat step (4) above.

(7) Record discrepancies, land and make corrections.

G. Flight Check – Lateral Trim

NOTE: Flight check with a pilot and passenger, approximately 360 lb.

(1) Hover - Cyclic should have approximately 2 lb left force (pressure to the right) with full lateral trim.

NOTE: If aircraft is adjusted to obtain full lateral trim in a hover, it will not be able to obtain full lateral trim in forward flight.

(2) Forward Flight - Flying to 110 mph and trimmed laterally, the aircraft should fly straight and level with full trim (no yaw to left or right.

Lateral Cyclic Positions:

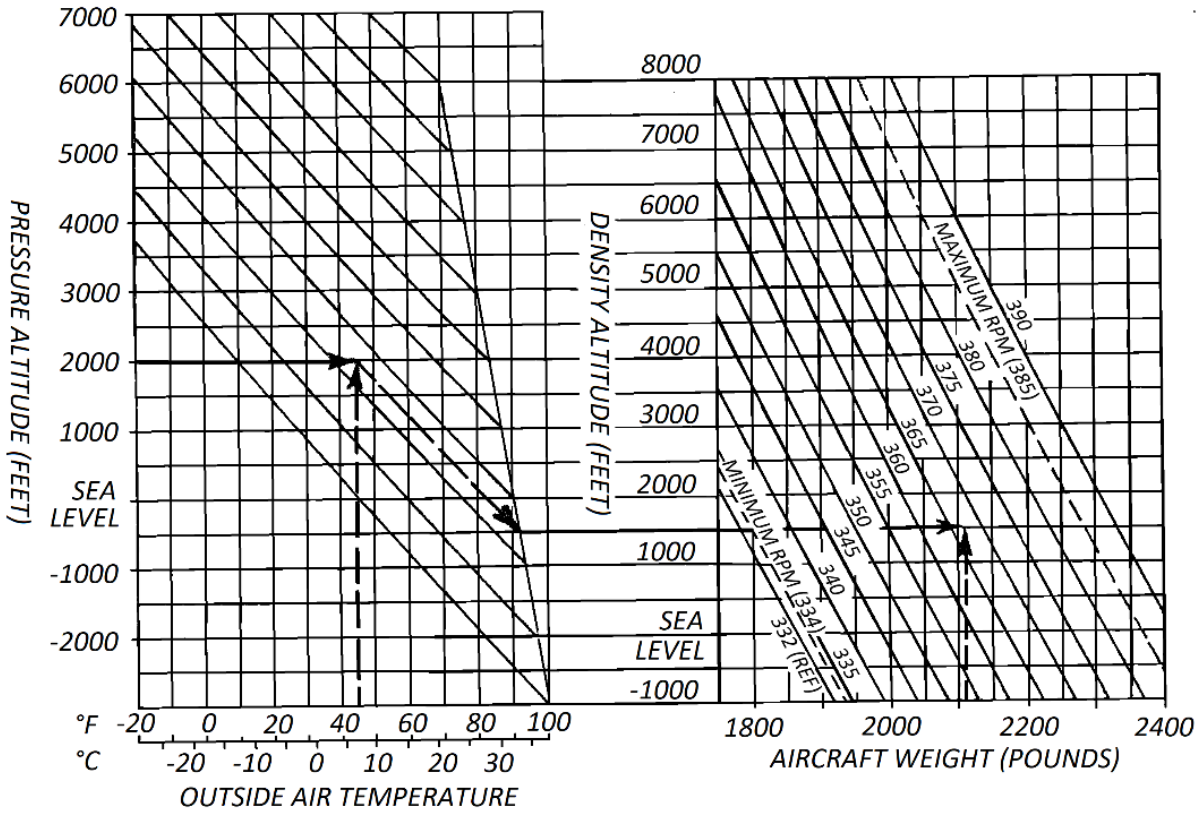
(3) Hover (no wind) - Cyclic stick bellcrank should be centered in cyclic stop ring in floor.

(4) Forward flight at 75% power (28" MP) – Cyclic stick should be centered (same as hover) but bellcrank should be slightly aft in stop ring.

(5) Forward Flight at V_{NE} – Cyclic stick bellcrank should be centered laterally and have approximately clearance from aft portion of stop ring.

(a) F-28F: Sea level conditions (112 mph), low rotor rpm – 334.

(b) 280FX: Sea level conditions (117 mph), low rotor rpm – 334.



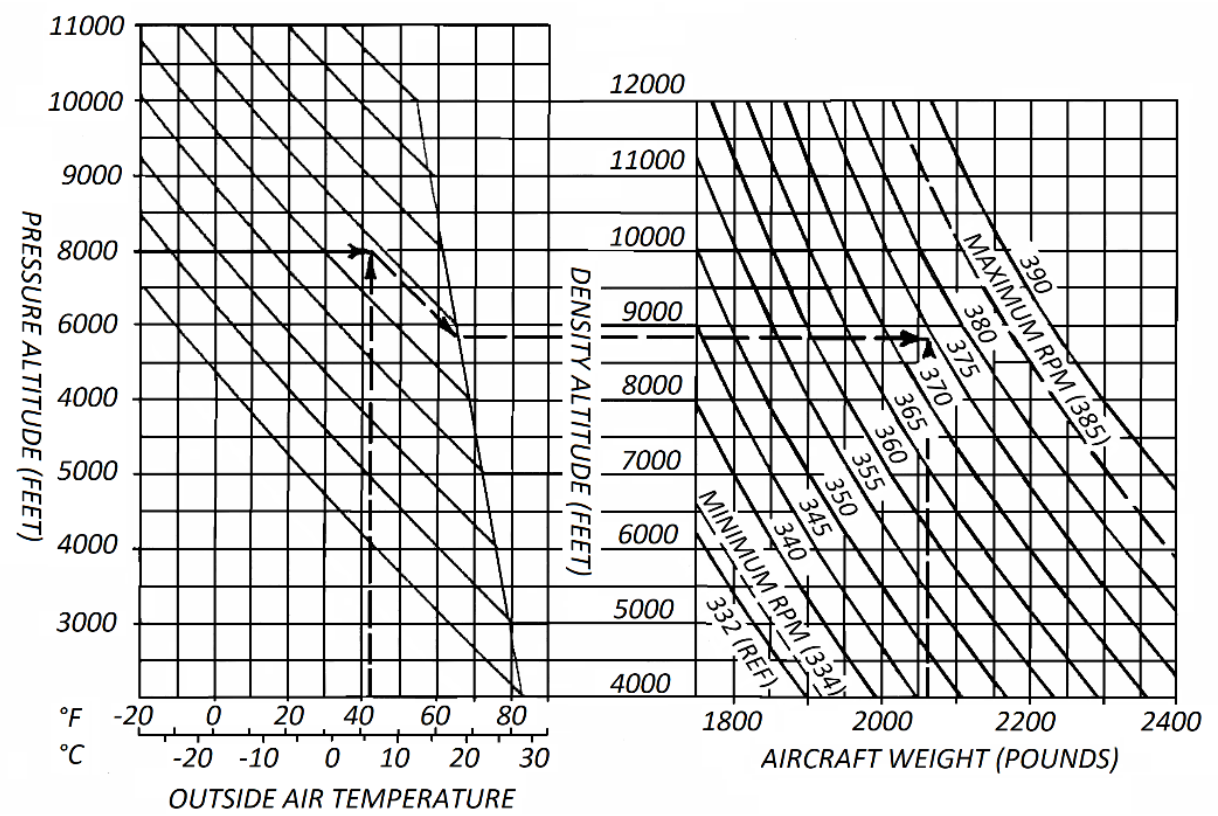
Example:

RPM checked passing through 2000 ft pressure altitude. OAT at this altitude: 45°F (7°C); Density altitude is 1500 ft; Aircraft weight when RPM was checked: 2110 lb.
* Autorotation RPM should be 367 with collective full down.

Check RPM in steady 60 MPH autorotation with the collective full down. Record pressure altitude (altimeter set to 29.92), OAT, rotor RPM, and aircraft weight.

Do not exceed 385 RPM or drop below 334 RPM

Figure 12-28. Autorotational RPM Correction Chart – Sea Level Base Altitude



Example:

RPM checked passing through 8000 ft pressure altitude. OAT at this altitude: 42°F (6°C); Density altitude is 8800 ft; Aircraft weight when RPM was checked: 2060 lb.
* Autorotation RPM should be 374 with collective full down.

Check RPM in steady 60 MPH autorotation with the collective full down. Record pressure altitude (altimeter set to 29.92), OAT, rotor RPM, and aircraft weight.

Do not exceed 385 RPM or drop below 334 RPM.

Figure 12-29. Autorotational RPM Correction Chart – 6000 Ft Base Altitude