CHAPTER 5

ROTORS

5-1. ROTOR SYSTEM.

5-2. DESCRIPTION — ROTOR SYSTEM.

The rotor system is comprised of the main rotor system and the tail rotor system. Refer to paragraph 5-4 for description of the main rotor system. Refer to paragraph 5-73 for description of the tail rotor system.

SECTION I. MAIN ROTOR SYSTEM

5-3. MAIN ROTOR SYSTEM.

5-4. DESCRIPTION — MAIN ROTOR SYSTEM.

The main rotor system consists of the main rotor hub and blade assembly, swashplate assembly, scissors and sleeve assembly and connecting tubes (pitch links). The main rotor hub trunnion (2, figure 5-1) and the main rotor mast (11) are splined in the area where the trunnion mounts on the mast so that the main rotor rotates with the mast. The trunnion is supported on the lower side with a cone set (not illustrated) and is secured by the mast nut (3). The mast nut also serves as a cap for the hollow mast and as a lifting eye.

NOTE

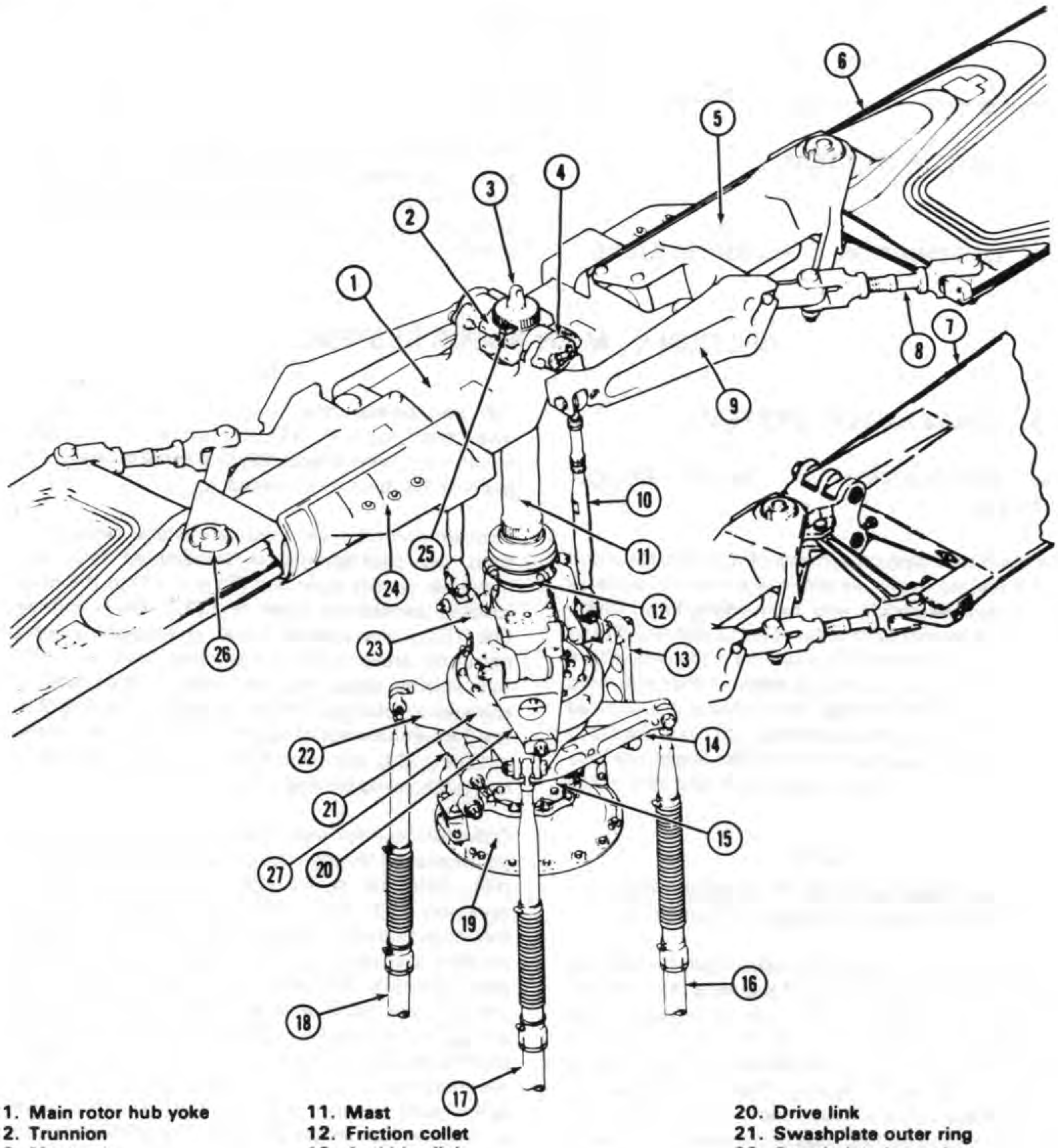
Refer to paragraph 5-25 for description of K747 main rotor blades (7, figure 5-1).

The main rotor hub is of the semi-rigid, underslung design consisting basically of the yoke (1), trunnion (2), elastomeric bearing (4), yoke extensions, pitch horns (9), drag braces (8), and grips (5). The yoke is mounted to the trunnion by elastomeric bearings (4) which permit rotor flapping. Cyclic and collective pitch change inputs are received through pitch horns mounted on the trailing edge of the grips. The grips in turn are permitted to rotate about the yoke extensions on teflon impregnated fabric friction bearings, resulting in the desired blade pitch. Adjustable drag braces (8) are attached to the grips (5) and main rotor blades maintaining alignment. Blade centrifugal loads are transferred from the blade grips to the extensions by wire wound, urethane coated, tension-torsion straps.

The swashplate inner ring (22), outer ring (21), swashplate support (15), anti-drive link (13) and scissors and sleeve assembly (23) serve to control the pitch of the main rotor blades.

Forward and aft cyclic input and lateral cyclic input from the pilot/gunner is transmitted from the hydraulic control cylinders (18 and 17) to the non-rotating swashplate inner ring (22). The anti-drive link (13) is connected to the aft swashplate support horn and prevents the swashplate inner ring (22) from rotating about the outer ring (21). The control is changed to rotating at the swashplate outer ring (21). It is then transmitted through the scissors and sleeve assembly (23), and pitch links (10) to the main rotor hub pitch horns (9) and main rotor blades.

Collective control input from the pilot/gunner is accomplished through the collective control cylinder (16), collective levers (14), scissors and sleeve assembly (23) and the friction collet (12). The collective lever (14) is attached to the lower end of the scissors and sleeve assembly (23) and moves these parts vertically. The sleeve is inside the swashplate and does not rotate, and the scissors are mounted at the top of the sleeve with a hub and bearings. A spline plate, bolted to the top of the hub, contacts splines on the main rotor mast (11). An extension on top of the spline plate carries a friction collet (12) which bears on a sleeve bonded on the mast. The spline plate can move vertically on the main rotor mast to permit vertical movement of the scissors and sleeve assembly. The spline plate rotates with the main rotor mast and causes the scissors hub, scissors and swashplate outer ring (21) to rotate with the mast. Collective pitch control input and cyclic pitch control input to the scissors is transmitted through the pitch links (10) to the main rotor blade pitch horns (9).



1. Main rotor hub yoke
2. Trunnion
3. Mast nut
4. Elastomeric bearing
5. Grip
6. Main rotor blade B-540
7. Main rotor blade K-747
8. Drag brace
9. Pitch horn
10. Connecting tube (pitch link)
11. Mast
12. Friction collet
13. Antidrive link
14. Collective lever
15. Swashplate support
16. Collective control hydraulic cylinder
17. Lateral cyclic control hydraulic cylinder
18. Fore and aft cyclic control hydraulic cylinder
19. Transmission
20. Drive link
21. Swashplate outer ring
22. Swashplate inner ring
23. Scissors and sleeve assembly
24. Sand deflector
25. Mast nut lock
26. Main rotor blade retention bolt
27. Collective idler

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Figure 5-1. Main Rotor System

5-5. ADJUSTMENT — MAIN ROTOR SYSTEM.

Refer to Section VIII.

5-6. OPERATIONAL CHECK — MAIN ROTOR SYSTEM.

Perform the following checks after installation of main rotor system.

a. Track main rotor blades (paragraph 5-114).

b. Perform functional test flight (TM 55-1520-236-MTF).

c. If functional test flight performed in preceding step indicates that additional adjustments and/or maintenance is required, troubleshoot the main rotor system in accordance with paragraph 5-7.

5-7. TROUBLESHOOTING — MAIN ROTOR SYSTEM.

Utilize figures 5-93 through 5-96 to troubleshoot the main rotor system.

SECTION II. MAIN ROTOR HUB AND BLADES

5-8. B540 MAIN ROTOR HUB AND BLADES.

5-9. B540 DESCRIPTION — MAIN ROTOR HUB AND BLADES.

The semi-rigid type main rotor consists of two metal blades (11, figure 5-2) and the hub. The hub yoke (24) is underslung relative to the trunnion (1). The trunnion is attached to the yoke with elastomeric bearings (2). The splined hub trunnion mounts on the main rotor mast. The elastomeric bearings allow the hub yoke and blades to move on the flapping axis. The grips (19) rotate on the yoke extensions for change in blade pitch when pitch horns (20) are raised or lowered by control linkage. Blade alignment is maintained by adjustable drag braces (12). Refer to paragraph 5-25 for K747 blades.

5-10. CLEANING — MAIN ROTOR HUB AND BLADES.

a. Clean blades thoroughly with cleaning compound (C38).

b. Rinse with clear water and allow to dry.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

The erosion guard on K747 main rotor blades is very susceptible to solvents. Use care to prevent spillage or run-off of solvent onto the guard.

c. Remove stubborn deposits with a cloth dampened with solvent (C112), except on K747 blade the erosion guard shall be cleaned only with detergent (C50) or cleaning compound (C33).

d. Clean main rotor hub with cloths dampened with solvent (C112).

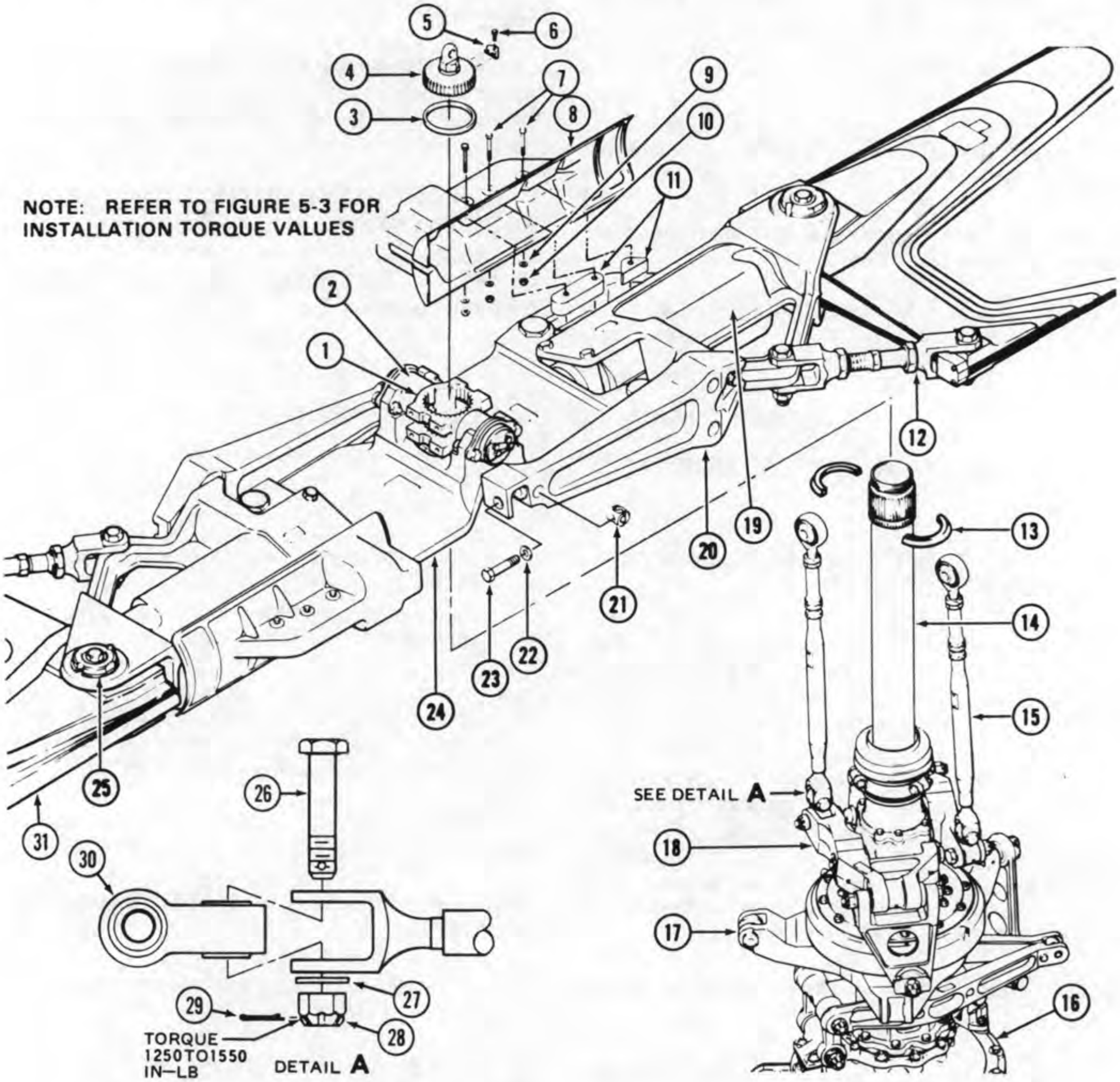
5-11. INSPECTION — MAIN ROTOR HUB AND BLADES.

Refer to TM 55-1500-322-24 for inspection criteria of Teflon lined bearings.

5-12. REMOVAL — MAIN ROTOR HUB AND BLADES.

Premaintenance Requirements for Removal of Main Rotor Hub and Blades

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All



1. Trunnion
2. Elastomeric bearing
3. Washer
4. Mast nut
5. Lock
6. Bolt
7. Bolts (3 reqd)
8. Sand deflector
9. Washer (3 reqd)
10. Nut (3 reqd)
11. Spacers
12. Drag brace assembly
13. Cone set
14. Mast
15. Pitch link (connecting tube)
16. Transmission
17. Swashplate and support assembly
18. Scissors and sleeve assembly
19. Grip
20. Pitch horn
21. Barrel nut and retainer
22. Washer
23. Bolt
24. Yoke
25. Blade retention bolt assembly
26. Bolt
27. Washer
28. Nut
29. Cotter pin
30. Universal bearing
31. Main rotor blade

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Figure 5-2. Main Rotor Installation

Conditions	Requirements
Special Tools	(T15), (T16), (T17) (T24), (T29), (T34), (T35), (T45), (T59)
Test Equipment	None
Support	None
Minimum Personnel Required	Four
Consumable Materials	None
Special Environmental Conditions	None

a. Remove trunnion bolt and install eyebolt (figure 5-4).

b. Remove bolts (23, figure 5-2) and washers (22) at each pitch horn (20), secure barrel nuts and retainers (21) in position. Secure pitch links (15) to mast (14) with masking tape to prevent damage in the event the mast is rotated while pitch links are disconnected from pitch horns.

c. Install main rotor grip locks (T59) on each pitch horn (figure 5-4).

d. Remove bolt (6, figure 5-2) and lock (5).

e. Install socket (T16) (6, figure 5-5) on mast nut (8). Position torque adapter (T17) (7) on trunnion (10). Ensure that it is in correct position on top of trunnion. Position torque multiplier (T15) (4) on adapter (7) and ensure that the through pins on the wrench reaction arm engage the holes in the adapter. Position the 3/4 inch square drive bar (5) into the square drive of the power wrench and turn the ratchet indexer (3) counterclockwise until the drive bar drops into socket (6). Install crank handle (2) on power wrench (4).

f. Turn crank handle (2) in a counterclockwise direction, observing indicator (1) on power wrench as crank handle is turned. When breakaway torque of approximately 650 foot-pounds is reached, the indicator will reverse as the mast nut loosens. When this occurs, remove the special tools and complete removal of the mast nut (8) and washer (9) manually.

g. Remove three nuts (10, figure 5-2), washers (9), bolts (7), sand deflector (8), and spacers (11). Remove opposite sand deflector in the same manner.

h. Position hoist (T45) (or equivalent) directly over mast in accordance with instructions contained in paragraph 1-48.

i. Position two slings (T24) on main rotor hub and attach to hoist. (Do not wrap lifting sling cable around sharp corners on rotor hub.)

j. Attach a tie down assembly on each rotor blade for use in guiding and steadying rotor during removal.

k. Carefully hoist the main rotor hub and blade assembly clear of the mast.

l. Remove cone set (13). Attach cone set halves together and retain as a matched set.

m. Place adapter plate (T34) on buildup bench (T29) and position hub and blade assembly on the bench. Place padded supports under each blade. See figure 5-6 for view of hub mounted on buildup bench.

n. Install sand deflectors (8), and spacers (9 and 10) that were removed in step g.

5-13. ALIGNMENT — MAIN ROTOR HUB AND BLADES.

Premaintenance Requirements for Alignment of Main Rotor Hub and Blades

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T59), (T34), (T29), (T30), (T31), (T38), (T39)
Test Equipment	Protractor
Support Equipment	Main rotor blade support with wheels (two required)
Minimum Personnel Required	Two

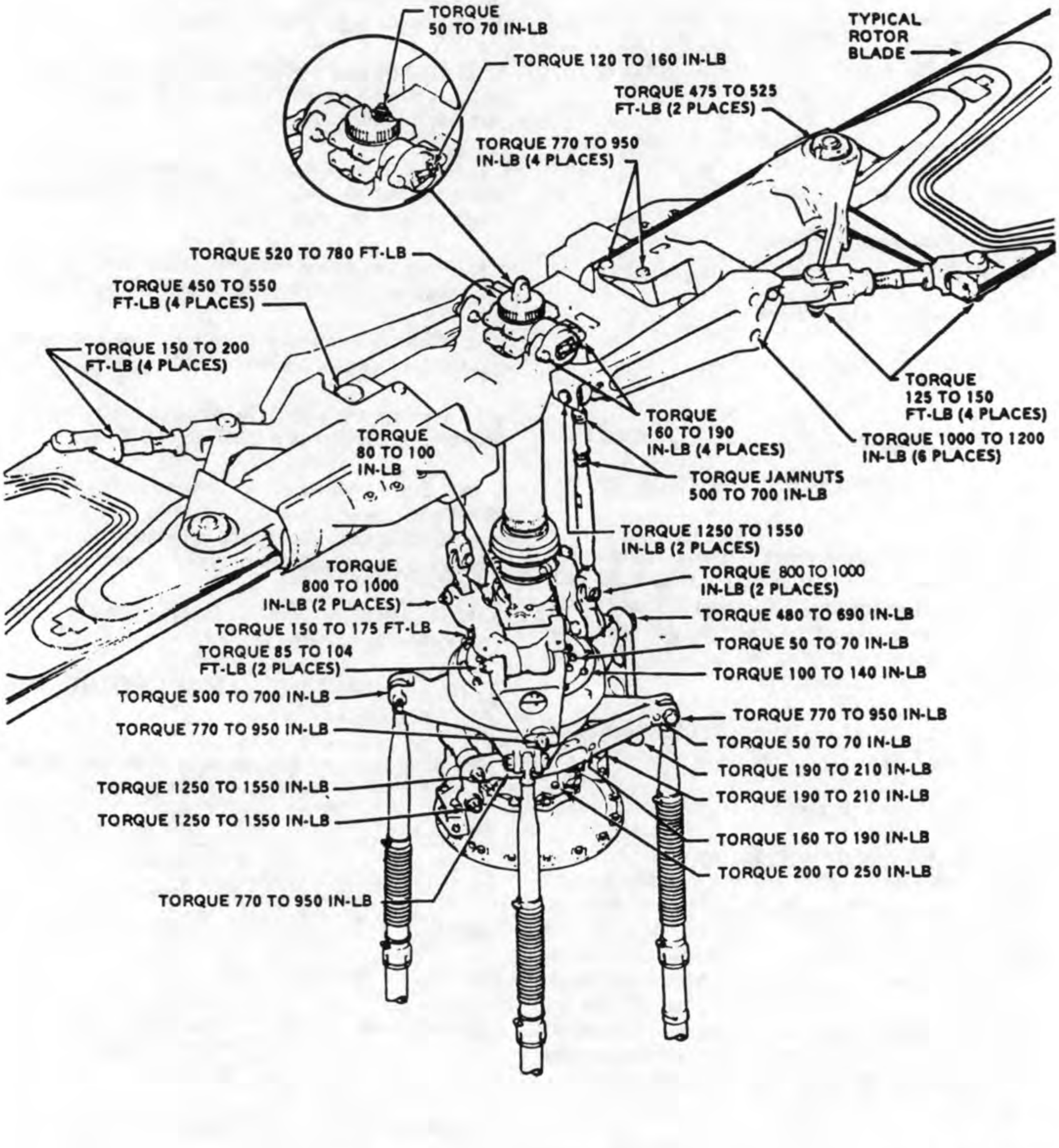


Figure 5-3. Main Rotor Installation Torque Values

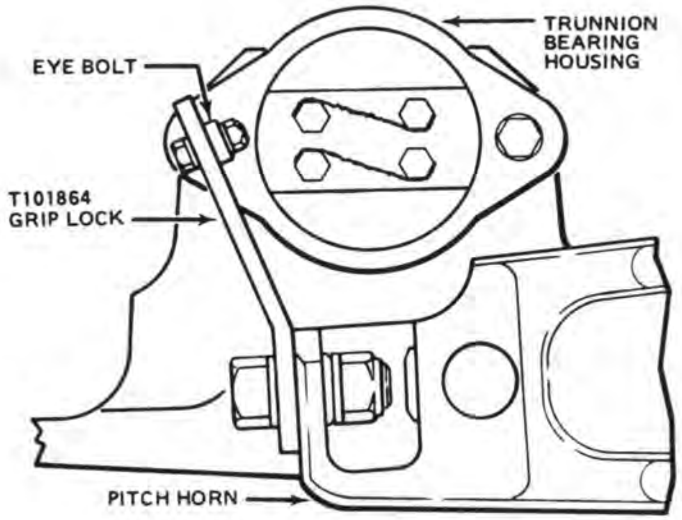


Figure 5-4. Tool Application — Grip Lock Installation on Pitch Horn

Conditions	Requirements
Consumable Materials	None
Special Environmental Conditions	None

a. Install main rotor grip locks (T59) on each pitch horn if not previously accomplished (figure 5-4).

b. Install flap step plates (T39) to lock trunnion.

c. Position main rotor hub and blade assembly on stands for accomplishment of alignment procedure as follows:

(1) Place adapter plate (T34) on build-up bench (T29).

(2) Place main rotor hub and blade assembly on build-up bench shown on figure 5-6.

(3) Place stand equipped with wheels under each blade to support the blades at a precone angle of approximately 2-1/2 degrees up so blades will move easily in grips if drag brace adjustment is required.

(4) Place a protractor on machined surface adjacent to blade retention bolt (25, figure 5-2) and record chordwise angle. Repeat for opposite blade. If both blades are not at zero degrees chordwise, ensure that grip locks (T59) and flap stop (T39) installed in step 6 are correctly installed. If both blades are still not at zero degrees chordwise, adjust build-up bench.

d. Position alignment scope support (T38) over elastomeric bearings as shown in figure 5-6.

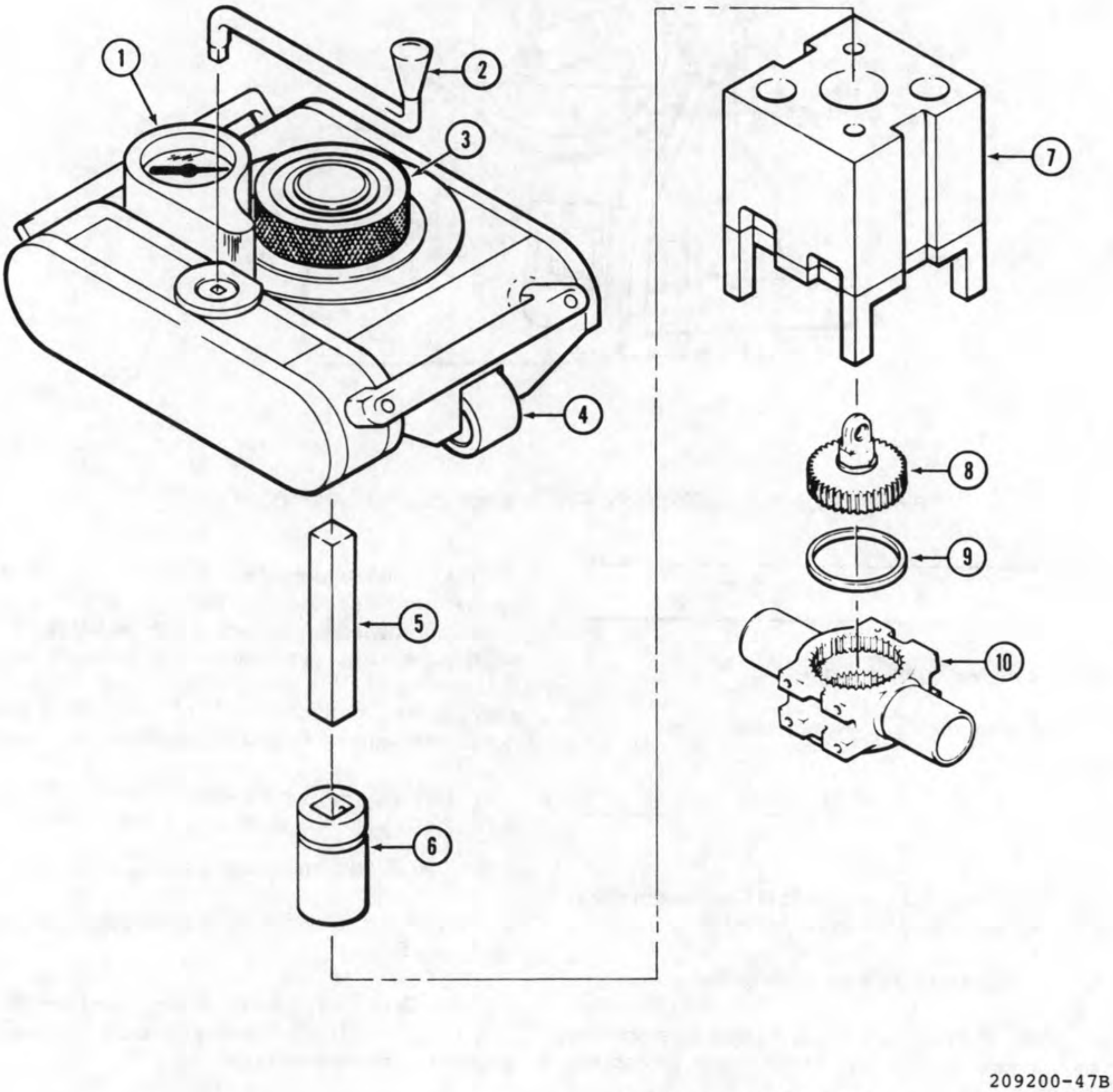
e. Install and adjust scope (T30) as follows:

(1) Position scope (T30) on support as shown on figure 5-6.

(2) Zero cross-hair on an object approximately fifty feet away. Draw a vertical line on the object to align with the vertical cross-hair.

(3) Loosen clamp screws, rotate scope 180 degrees on scope tube axis, and tighten clamp screws.

(4) Observe vertical line drawn in step (2). If vertical cross-hair aligns with first vertical line drawn in step (1), proceed to step f. If vertical cross-hair does not align with first vertical line drawn, draw a second vertical line on object to align with vertical cross-hair. Measure one half the distance between the two vertical lines and draw a third vertical line.



1. Power wrench indicator
2. Input crank handle
3. Knurled ratchet indexer
4. Power wrench PD1201
5. Drive bar
6. Socket PD2659
7. Reaction torque adapter PD2660
8. Mast nut
9. Washer
10. Trunnion

Figure 5-5. Tool Application — Main Rotor Mast Nut Removal/Installation

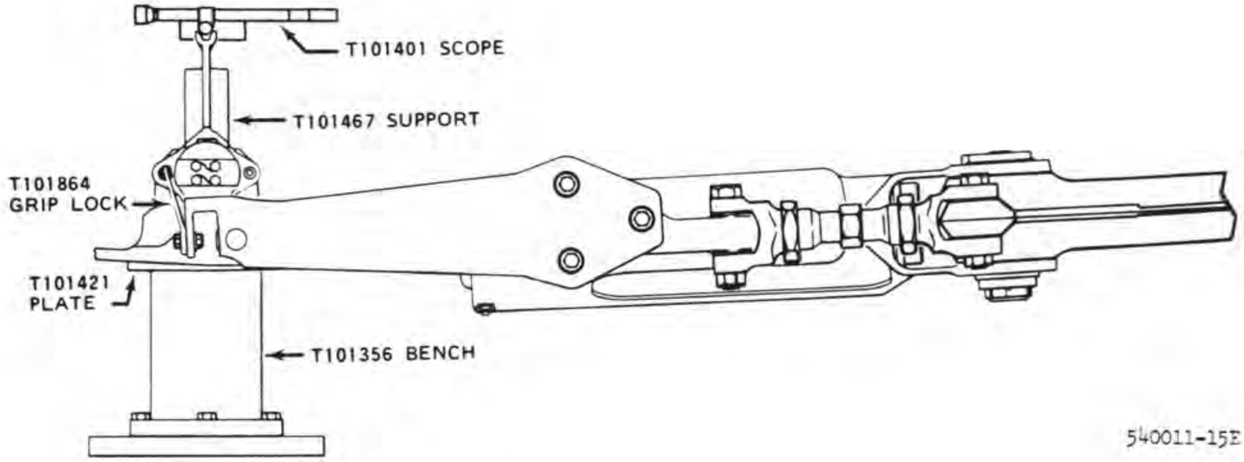


Figure 5-6. Tool Application — Alignment of Main Rotor Hub and Blade

(5) Adjust screw on side of scope to align vertical cross-hair with third vertical line drawn in step (4).

(6) Loosen clamp screws, rotate scope 180 degrees on scope tube axis, and tighten clamp screws.

(7) Observe third vertical line drawn in step (4). If vertical cross-hair in scope aligns with third vertical line drawn in step (4), proceed to step f. If vertical cross-hair in scope does not align with third vertical line drawn in step (4), repeat adjustment procedure as required until vertical cross-hair in scope will align with same vertical mark when scope is rotated 180 degrees.

f. Locate alignment drive screw (12, figure 5-13). Sight through alignment scope (T30) and determine whether the alignment drive screw is lined up with the scope crosshair within **0.000** inch forward to **0.100** inch aft. If drive screw is aligned within tolerance, proceed to step g. If drive screw is not aligned within tolerance, align blade as follows:

(1) Remove locking screw (20, figure 5-10), nut (18) and washer (19).

(2) Loosen nut (17) with socket wrench (T31).

(3) Loosen nuts (11) and (21).

(4) Loosen two jamnuts on drag brace (15).

g. Adjust drag brace (15, figure 5-10) to move blade tip and bring alignment drive screw within tolerance. Ensure that the wheels under the stand supporting the blade are free to roll when the drag brace is adjusted. After the blade is aligned, torque jamnuts on the drag brace **150 TO 200** foot-pounds and recheck to ensure that blade alignment is still within limits.

h. Reverse scope to check and adjust alignment of opposite blade. Maximum tolerance of alignment between two blades is **0.050** inch.

i. Torque nuts (11) and (21) on both blades **125 TO 150** foot-pounds after blades are aligned.

j. Torque nuts (17) on both blades **475 TO 525** foot-pounds after blades are aligned. Use socket wrench (T31) to tighten nuts. Align a notch in nut (17) with a hole in bolt (8) and install locking screw (20), washer (19) and nut (18).

k. Verify blade alignment.

5-14. INSTALLATION — MAIN ROTOR HUB AND BLADES.

Premaintenance Requirements for Installation of Main Rotor Hub and Blades

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All

Conditions	Requirements
Special Tools	(T15), (T16), (T17), (T24), (T30), (T31), (T45), (T59)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C1), (C7), (C14), (C19), (C20), (C23), (C27), (C31), (C32), (C33), (C40), (C41), (C43), (C55), (C58), (C66), (C68), (C69), (C74), (C75), (C77), (C83), (C88), (C91), (C102), (C103), (C112), (C115), (C123), (C125), (C126), (C127), (C135) (C137)
Special Environmental Conditions	None

CAUTION

If torque multiplier (T15) is not available, main rotor mast nut must be re-torqued after five to ten hours operation. Refer to paragraph 1-57, Special Inspection.

a. Install main rotor grip locks (T59) on each pitch horn if not previously accomplished (figure 5-4).

b. Remove sand deflectors (8, figure 5-2) if not previously accomplished, by removing three nuts (10), washers (9), bolts (7), sand deflector (8) and spacers (11).

c. Position hoist (T45) (or equivalent) directly over mast in accordance with instructions contained in paragraph 1-48.

d. Position two slings (T24) on main rotor hub and attach to hoist. (Do not wrap lifting sling cable around sharp corners on rotor hub.) Hoist hub and blade assembly into position above mast. Use blade tie down assemblies to guide and steady the blades during hoisting.

CAUTION

Never apply corrosion preventive compound or any kind of grease on or near teflon bearings. Teflon bearings are used in the hub, the friction collet, and the swashplate and support assembly. This instruction applies regardless of helicopter status (operation, in storage, or in preparation for overseas shipment).

e. Coat splines of mast (14) with corrosion preventive compound (C41 or C43).

CAUTION

Ensure that cone set is a matched set. Rotor hub must be aligned carefully to avoid damaging mast threads.

NOTE

Do not coat the mast threads or split cone groove with corrosion preventive compound (C41 or C43).

Split cones are installed with equal end gap spacing. If the split cones touch at any time thereafter, there is no need to respace them.

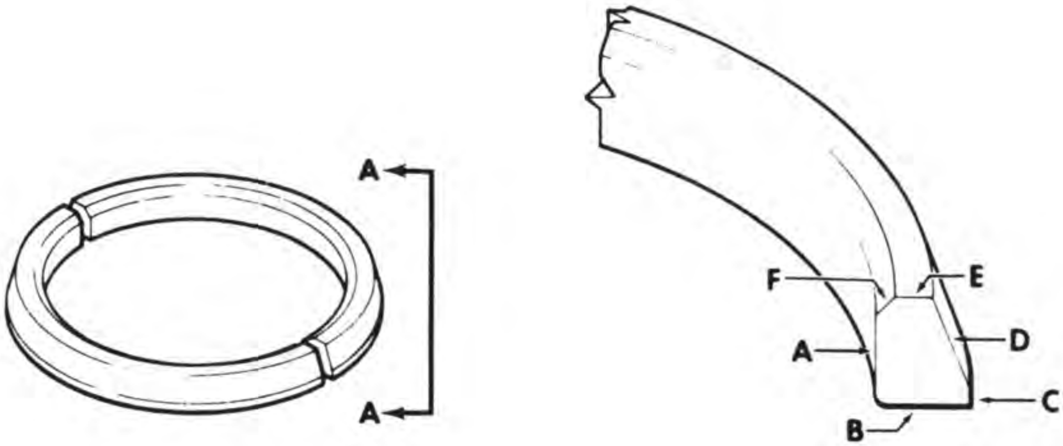
f. Inspect split cones (13) for any nicks, scratches, indentions, and deformities of any type. Dropping the split cone does not constitue automatic replacement unless the damage limits shown in figure 5-7 are exceeded. Place cone set (13, figure 5-2) in groove of mast upper splines with bevel side up and the gaps evenly spaced.

g. Align master spline in hub with master spline on mast. Carefully lower the hub and blade on the mast splines to avoid damage to mast threads. Lower the hub assembly slowly until it rests on the cone set.

h. Remove excess corrosion preventive compound.

i. Remove hoisting slings.

j. Install washer (3, figure 5-2) and mast nut (4). Tighten mast nut snug with socket (T16). Install main rotor mast nut special installation tools in accordance with paragraph 5-12(e). Turn input crank handle (2, figure 5-5) in a clockwise direction and observe indicator (1) on torque multiplier (T15). Torque to **650** foot-pounds. Continue to observe the indicator for **three** full minutes. It will be normal if the indicator reading decreases. This is caused by seating of the cone set. Do not back off torque if the indicator reading decreases.



1. No cracks are acceptable.

2. Damage to surfaces A, C, E and F may be considered negligible and not requiring repair if the depth of damage does not exceed 0.010 and if the minimum radii observed in the damage area are not less than 0.025.

3. Nicks, scratches and dents on surface B up to 0.005 inch deep are acceptable if polished out as follows:

   a. Place a sheet of 600 grit sandpaper (C102) on a surface plate or on a piece of smooth glass as large as the sheet of sand paper.

   b. Hold two halves of split cone set together and polish out damage on surface B by moving the split cone set (surface B) on the sandpaper. The same amount of material must be removed from both halves on the set.

   c. When damage has been polished out, the minimum acceptable dimension from surface B to surface E is 0.370; also, the dimension must be equal at all points.

4. Surfaces A and D must not have any protrusions above the surrounding surface. Dents and scratches not in excess of 0.010 in depth may be polished out with crocus cloth.

5. Al edges may be chamfered 0.030.

6. All dimensions are inches unless otherwise noted.

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Figure 5-7. Damage Limits — Cone Set

k. If the indicator reading decreases during the three minute observation period in the preceding step, retorque to **650** foot-pounds and monitor for **one** minute. Repeat one additional time if necessary. After obtaining **650** foot-pound indication with no loss, turn the crank counterclockwise until the torque indicator returns to **zero** (green) to remove holding force on the wrench.

l. Remove crank handle, power wrench, drive bar, adapter and socket.

m. Check lock (5) installation to ensure that it will align. If lock (5) will not align, reinstall the power wrench and increase torque, but do not exceed **780** foot-pounds. Use the protractor on the face of the power wrench (3, figure 5-5) to estimate the degree of turn required to obtain alignment.

n. Install lock (5, figure 5-2) and bolt (6). Lockwire bolt head.

o. Install spacers (11) and sand deflectors (8) with three bolts (7), washers (9), and nuts (10). If spacers do not fit snugly in place, wrap with tape (C126) until snug fit is obtained.

p. Remove main rotor locks (T59) from pitch horns. Remove eyebolts shown on figure 5-4 and replace with trunnion bearing retaining bolts. Torque bolts **160 TO 190** inch-pounds. If more than five threads show at nut, add a washer under the nut.

CAUTION

Close-tolerance, high-tensile bolts and special washers are used in the main rotor flight control linkage. Refer to TM 55-1520-236-23P for part numbers.

NOTE

If same rotor and associated parts are being reinstalled, the pitch links (15) should already be installed on the scissors and it will not be necessary to adjust pitch links to nominal length. In this case, skip steps (1) through (3) and install pitch links per steps (4) through (6).

q. Install pitch links (15, figure 5-2).

WARNING

Use only new, unused nut referenced for installation in step (1) below.

(1) If previously removed, install universal bearing (30) on pitch link (15) with bolt (26), washer (27) installed on thread portion only, and new nut (28). Torque nut **800 to 1000** inch-pounds and install cotter pin (29). (Repeat for other pitch link.)

NOTE

During installation of pitch link (15), assure that the universal link bolts are installed and torqued correctly. The upper universal bolt will be installed with the bolt head inboard (toward mast). The lower universal bolt will be installed with the bolt head toward opposite scissors link. Torque nuts on bolts 800 TO 1000 inch-pounds and install cotter pins.

(2) Measure both pitch links, and if necessary adjust length to **27.05** inches as shown in figure 5-8. Also, comply with the equal thread requirement shown. Tighten jamnuts at each end of barrel snug (do not torque at this time).

WARNING

Use only new, unused nut referenced for installation in step (3) below.

(3) Install universal bearing end of pitch link (15, figure 5-2) on scissors (18) with bolt, washer, and new nut. Torque nut **800 TO 1000** inch-pounds and install cotter pin. Repeat for other pitch link.

NOTE

Bolt (23) may not extend past barrel nut (21) the necessary minimum three threads. As long as the end of the bolt is visible and flush with aft side of barrel nut and proper torque has been accomplished, this is an acceptable condition.

(4) Install barrel nut (21, figure 5-2) if not previously accomplished in pitch horn (20). Prior to installing pitch link, insert bolt (23), check and record tare torque (friction torque). Tare torque must be a minimum of 32 inch-pounds. If tare torque is below limits, replace barrel nut (21) and recheck. Remove bolt (23) and install barrel end of pitch link (15) to pitch horn (20). Install recessed washer (22) (with recess toward bolt head) and install bolt (23). Torque bolt (23) **1250 TO 1550** inch-pounds above the tare torque previously reocrded. For example: If tare torque was 100 inch-pounds, you would torque the bolt **1350 TO 1650** inch- pounds. Lockwire (C137) bolt (23) to the hole in pitch horn (20). Repeat the procedure for the opposite side.

WARNING

Ensure that the self-locking feature of barrel nut (21) has adequate tare torque, minimum of 32 inch-pounds.

Ensure that the correct recessed washer (22) is being used and that the recess is turned toward the bolt head.

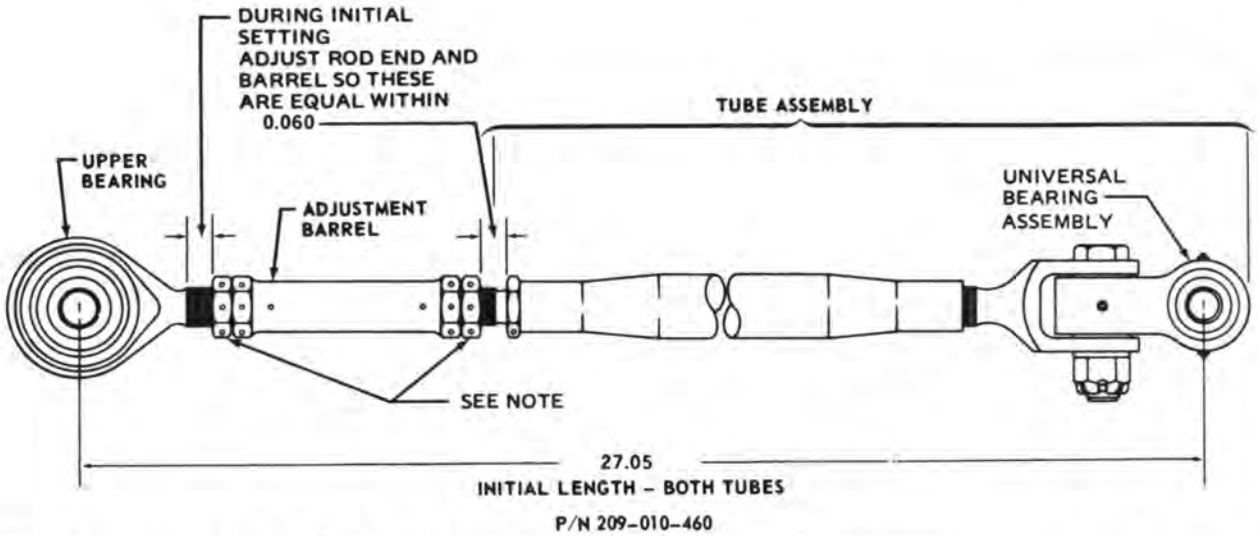
Ensure that the safety wire is installed correctly.

Ensure that threads are showing in barrel inspection holes.

(5) B540 Adjust length of pitch links to set main rotor hub grips to a minimum pitch angle of 8-1/2 degrees (± 1/4 degree) as follows:

(a) Position collective controls to full down position. Set cyclic to center position.

(b) Place a protractor on machined surface of one blade grip near blade retention bolt and measure angle. Record reading and repeat for opposite grip. The total reading for both blades should be **17** degrees (±**1/2** degree). If angle is not within limits, adjust both pitch links in same direction and in equal amounts until angle is within limits.



NOTE: Torque jamnuts 500 To 700 inch-pounds after upper end is centered in main rotor blade pitch horn at time of installation.

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ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Figure 5-8. Pitch Link Adjustments

WARNING

Threads must show in barrel inspection holes.

NOTE

Additional pitch link adjustment may be required at time of maintenance test flight. It is not necessary to maintain exposed threads equal within 0.060 inch after initial adjustment.

(c) Check rod end bearings on both pitch links to ensure that both are centered (figures 5-8 and 5-9). Adjust upper rod end bearing to obtain alignment if necessary. After alignment is correct, torque both jamnuts on barrel **500 TO 700** inch pounds. Lockwire (C137) upper jamnut to barrel. Lockwire (C137) barrel and lower jamnut to pitch link tube.

(6) K747 Adjust length of pitch links to set main rotor hub grips to a minimum pitch angle of **9-3/4** degrees (±**1/2** degree) as follows:

(a) Position collective controls to full down position. Set cyclic to center position.

(b) Place a protractor on machined surface of one blade grip near blade retention bolt and measure angle. Record reading and repeat for opposite grip. The total reading for both blades should be **19-1/2** degrees (±**1** degree). If angle is not within limits, adjust both pitch links in same direction and in equal amounts until angle is within limits.

WARNING

Threads must show in barrel inspection holes.

NOTE

Additional pitch link adjustment may be required at time of maintenance test flight. It is not necessary to maintain exposed threads equal within 0.060 inch after initial adjustment.

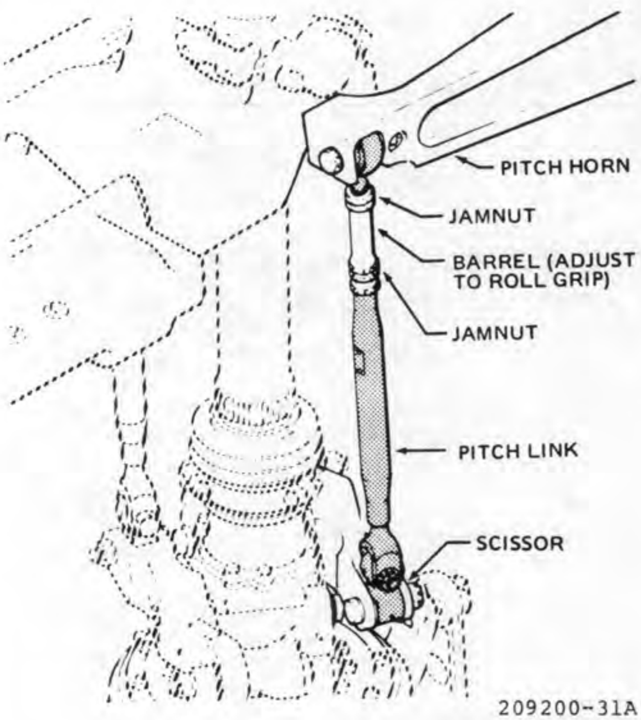


Figure 5-9. Pitch Link Assembly

(c) Check rod end bearings on both pitch links to ensure that both are centered (figures 5-8 and 5-9). Adjust upper rod end bearing to obtain alignment if necessary. After alignment is correct, torque both jamnuts on barrel **500 TO 700** inch-pounds. Lockwire (C137) upper jamnut to barrel. Lockwire (C137) barrel and lower jamnut to pitch link tube.

(7) Lubricate lower bearing on pitch links (15, figure 5-2) with grease (C58).

WARNING

K747 main rotor blades have a tendency to attain a higher percent RPM during autorotation than B540 main rotor blades. DO NOT RIG beyond the limits established in paragraph 5-14, step (q) to obtain a lower main rotor percent RPM.

r. Perform maintenance test flight to ensure that main rotor rigging is satisfactory (TM 55-1520-236 MTF).

s. If the maintenance test flight indicates the need for rotor adjustment, recheck blade alignment with blades on helicopter. Using alignment scope (T30), make required adjustments. (Maximum tolerance of alignment between two blades is **0.050** inch.)

5-15. ADJUSTMENT — MAIN ROTOR HUB AND BLADES.

Refer to paragraph 5-114.

5-16. B540 MAIN ROTOR BLADES.

WARNING

Use of paragraphs 5-17 through 5-24 for K747 main rotor blades will result in severe damage.

NOTE

Refer to paragraph 5-25 for maintenance of K747 main rotor blades.

5-17. DESCRIPTION — B540 MAIN ROTOR BLADES.

The main rotor blades are metal, bonded assemblies. Each blade is attached in the hub with a retaining bolt assembly and is held in alignment by adjustable drag braces.

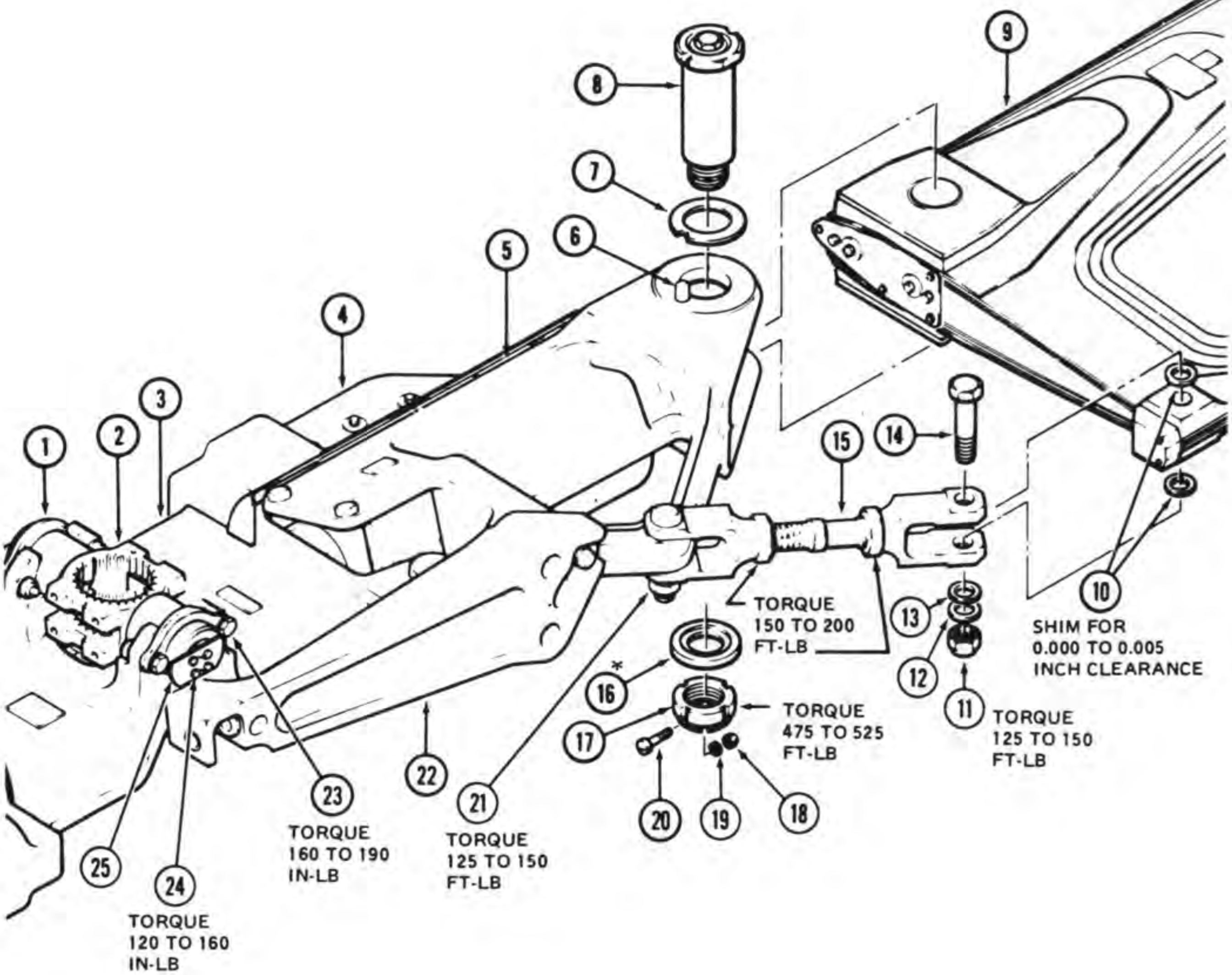
5-18. REMOVAL — B540 MAIN ROTOR BLADES.

a. Position main rotor hub and blade assembly on buildup bench (paragraph 5-12, step m). Place padded supports under blades so that leading edge is approximately straight.

b. Remove locking screw (20, figure 5-10), washer (19), and nut (18).

c. Remove nut (17) and washer (16) with blade bolt wrench (T31).

d. Remove nut (11), washers (12 and 13), and bolt (14). Loosen nut (21) and swing drag brace (15) away from rotor blade. Retain shims (10) for reinstallation.



1. Elastomeric bearing
2. Trunnion
3. Yoke
4. Sand deflector
5. Grip
6. Locating pin
7. Washer
8. Blade retaining bolt
9. Main rotor blade (typical)
10. Shims
11. Nut
12. Washer
13. Washer
14. Bolt
15. Drag brace
16. Washer *(installed with counterbore up against blade)
17. Nut
18. Nut
19. Washer
20. Screw
21. Nut
22. Pitch horn
23. Bolt
24. Bolts
25. Retainer

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Figure 5-10. Main Rotor Hub and Blade Assembly

CAUTION

Avoid blade contact with the drag brace and hub during removal procedure to prevent possible blade damage.

e. Remove blade retaining bolt (8) and washer (7). Slowly raise and lower blade tip while tapping bolt with fiber mallet. If bolt is difficult to remove, use a bolt removal work aid similar to the one shown in figure 5-11 as follows:

(1) Remove threaded plugs from upper and lower ends of blade retaining bolt. If weights are present in bolt, retain for reinstallation.

(2) Position work aid on bolt as shown in figure 5-12 and place a piece of hard rubber or similar material between work aid tube and grip to prevent marring the grip. Hold puller rod and tighten hexagon nut to remove blade retaining bolt.

(3) Remove work aid from blade retaining bolt. Reinstall weight and plugs in blade retaining bolt and identify the blade retaining bolt for reinstallation in the same grip.

f. Remove blade from grip and place in a padded stand.

g. Remove opposite blade from hub in same manner.

5-19. CLEANING — B540 MAIN ROTOR BLADES.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

a. Clean main rotor blade with cleaning compound (C33).

b. Remove stubborn deposits with a cloth dampened with solvent (C112).

5-20. INSPECTION — B540 MAIN ROTOR BLADES.

a. Inspect blade historical records and the blade for evidence that the blade has been subjected to an accident or incident outside the realm of normal usage. If such evidence exists, perform Special Inspections outlined in paragraph 1-57.

b. Inspect blade for nick, scratch, dent and corrosion damage (figure 5-14).

(1) Nicks and scratches anywhere on the surface of the skins or trailing edge strip that do not exceed **0.008** inch in depth are acceptable if they are polished out.

NOTE

If a nick or scratch in the skin in excess of 0.008 inch depth can be polished smooth without leaving the skin in the polished area so thin that skin can be dented with fingernail pressure, a patch may be applied over the area. Refer to paragraph 5-21 for instructions to apply patch to this type damage.

(2) Nicks and notches in the extreme trailing edge of the blade that are **0.120** inch or less in depth are acceptable if they are polished and faired out over a minimum distance of **2** inches on each side of the nick or notch.

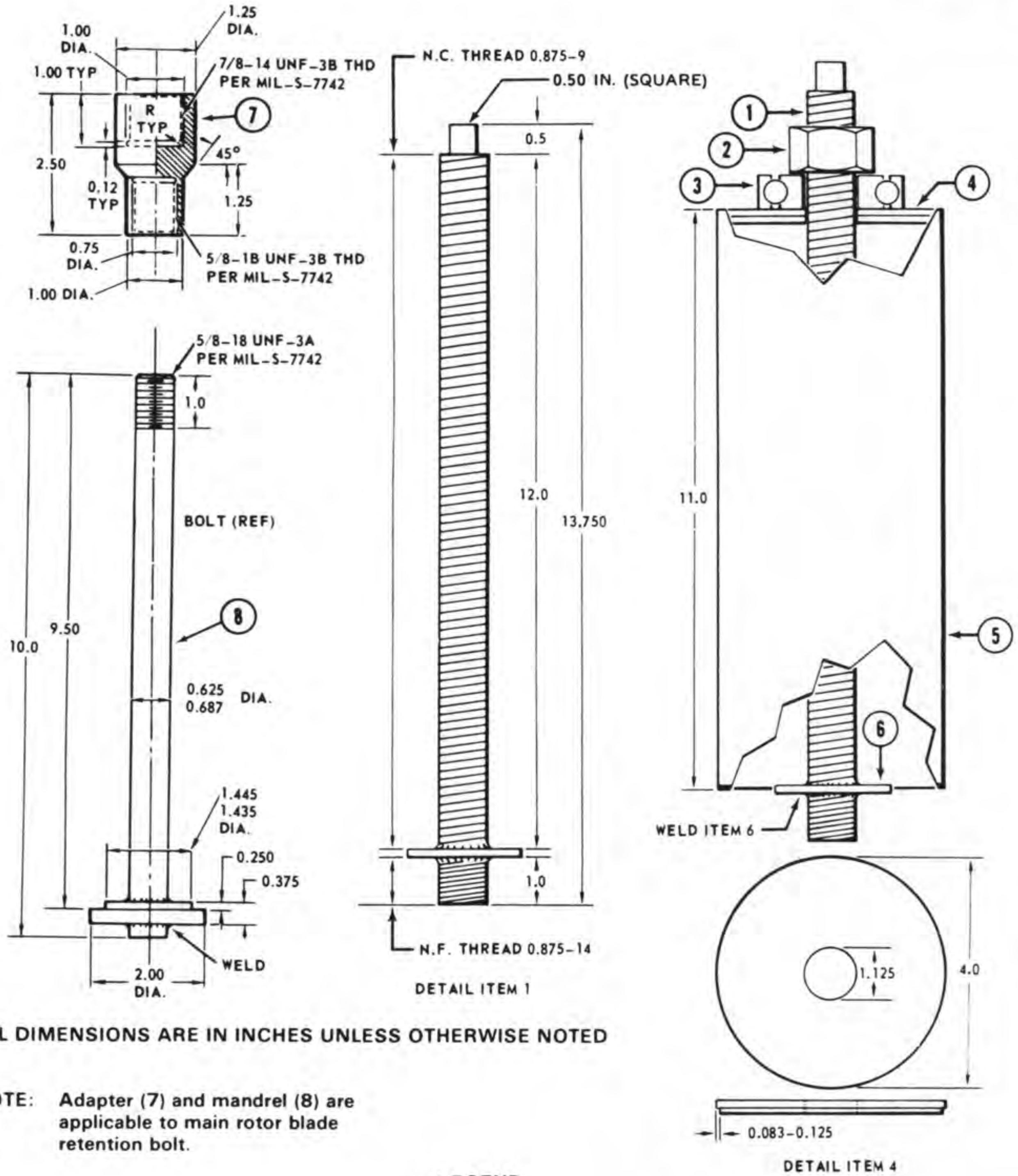
(3) Any dent in the skin in the outboard four feet of the blade that does not tear the skin, produce an unacceptable void or affect flight characteristics is acceptable without repair.

(4) Dents in the skin inboard of the station located four feet inboard of the tip of the blade that do not exceed **0.060** inch are acceptable without repair.

(5) If a nick or scratch exists in a sharp dent in the skin, the total depth of both must not exceed **0.060** inch. Nicks and scratches must be polished out. Refer to step (1).

(6) Nicks or scratches in the abrasion strips, doublers, grip plates or drag plates that are not in excess of **0.012** inch in depth are acceptable if they are polished out.

(7) If a leading edge abrasion strip is worn, eroded or damaged so that any holes appear, the



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTE: Adapter (7) and mandrel (8) are applicable to main rotor blade retention bolt.

LEGEND

1. Pull rod assembly 4130 (or better), 1.0 O.D. — 13.750 long
2. Hex nut 0.875 NC (9) thread
3. Bearing (thrust) inner race I.D. 0.080 — 0.093
4. Plate, steel or aluminum, 4.0 O.D., 0.375 thick
5. Tube, steel or aluminum, wall thickness 0.083 — 0.125
6. Steel flat washer, 2.0 O.D. — 0.875 I.D.
7. Adapter 4130 (or better)
8. Mandrel 4130 (or better)

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Figure 5-11. Work Aid for Main Rotor Blade Bolt Removal — Fabrication Instructions (AVIM)

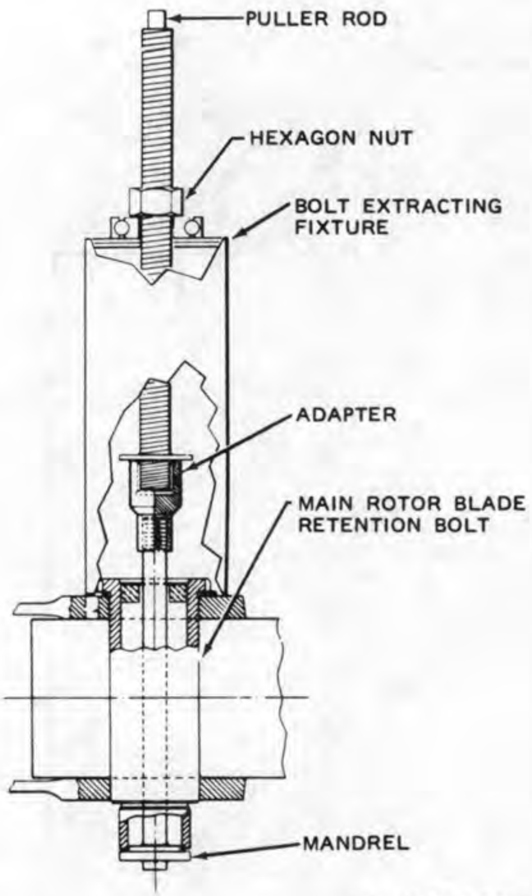


Figure 5-12. Work Aid Application — Main Rotor Blade Retaining Bolt Removal

blade must be sent to next higher maintenance level for repair.

c. Inspect blade abrasion strip splice joints.

NOTE

Main rotor blade abrasion strip splice joints (8 and 10, figure 5-13) may have no covers, may be covered with polyurethane Tape, or may have splice covers (6 and 9) installed.

(1) If no covers or tape are installed on splice joints (8 and 10), inspect for loss of filler material and corrosion. If damage is detected, send blade to next higher maintenance level for repair.

(2) If polyurethane tape is bonded over splice joints (8 and 10), inspect the tape for security and wear. Replace tape if insecure or worn (paragraph 5-21, e).

(3) If splice covers (6 and 9) are installed over splice joints (8 and 10), preform following inspection:

(a) Inspect covers for wear, corrosion, distortion and holes. If damage is detected, replace cover (paragraph 5-21, e).

(b) Inspect covers for secure bonding. If bond voids exist, replace covers (paragraph 5-21, e).

d. Inspect blade for void damage.

NOTE

A void is defined as an unbonded area that is supposed to be bonded. Many sub-definitions of voids are given such as lack of adhesive, gas pocket, misfit, etc. However, this manual makes no distinction among these, grouping them all under one general term ("Void").

(1) Voids between the spar assembly and the abrasion strip outboard of station 100.

(a) A **1.0** inch wide maximum void between abrasion strip and spar at extreme leading edge is acceptable, to within **1.0** inch of the tip of the blades.

(b) Other voids shall not exceed **40** square inches in any single void. If voids come closer than **1.0** inch to each other, consider them a single void.

(c) Voids within **0.38** inch of edge of abrasion strip are not acceptable.

(d) Edge voids **0.25** inch deep or less between the abrasion strip and the splice cover are acceptable when sealed with adhesive.

(2) Voids between the spar assembly and the abrasion strip inboard of station 100.

(a) A **1.0** inch wide maximum void between abrasion strip and spar is acceptable at the extreme leading edge.

(b) Voids between abrasion strip and spar shall not exceed **10.0** square inches in any single void. Minimum spacing between void centers must exceed **3.0** inches.

(c) Voids within **0.38** inch of edge of the abrasion strip are not acceptable except at the butt end, per step (a) above.

(d) Edge voids **0.25** inch deep or less between the abrasion strip and the splice cover are acceptable when sealed with adhesive.

(e) Voids defined in steps (a), (b), and (c) that are apparent at the butt end of the blade must be sealed with adhesive (paragraph 5-21, f).

(3) Voids at butt end of blade.

(a) Voids are not acceptable within **0.5** inch of the front or rear edge of either grip plate or grip pads, viewing the "Section" of the butt end.

(b) Voids between trailing edge extrusion and skin deeper than **1.0** inch nor wider than **1.0** inch are acceptable if sealed with adhesive.

(c) Any other void not longer than **1.0** inch or deeper than **0.35** inch is acceptable if sealed with adhesive.

(d) Voids are not acceptable between the spar and spar closure.

(4) Voids in the retention area, inboard of station 100.00.

(a) Edge voids of **0.10** inch maximum depth on edge of the doublers are acceptable if sealed with adhesive. Edge voids are not acceptable in outboard **7** inches of each finger of the doublers. Edge voids in the outer **3** inches of grip plate and outer **1.5** inches of the drag plate are not acceptable. Up to **0.50** inch maximum may be removed from the outboard tip in the drag plate tang, grip plate tang, or outboard tip of doublers to eliminate a void.

(b) Voids between the doublers, doubler and skin, doubler and grip plate, grip plate and grip pad are not acceptable, except as allowed in steps (3) (c) and (4) (a) above.

(c) Voids between the skin and the core shall not exceed **1.0** inch by **25.0** inches spanwise. The total area of all voids must not exceed **30** square inches.

(d) Edge voids between the edge of the skin and the trailing edge extrusion that are less than **0.06** inch wide by any length or less than **0.25** inch wide by **7** inches long are acceptable if they are sealed with adhesive.

(e) Other voids between the skin and the trailing edge extrusion which do not exceed **one-half** the width of the faying surfaces by **20.0** inches long or **0.50** inch wide by any length are acceptable.

(f) Voids other than edge voids between the skin and the spar that are less than **1.25** inch and less than **one-half** the width of faying surfaces are acceptable.

(5) Voids under skin, outboard of Station 100.

(a) Voids between the skin and trailing edge extrusion shall not exceed **one-third** the width of the faying surfaces.

(b) Voids between the skin and the core must not exceed **1.0** inch in width chordwise. If two voids are within **1.0** inch of each other, consider them as one void.

Voids between the skin and core adjacent to the spar shall not exceed **1.0** inch wide by **15** inches long spanwise. At the splice between the inboard and outboard core (Station 156), a void of **0.50** inch maximum spanwise by the full chordwise width of the core is acceptable.

(c) Voids between the skin and the spar not wider (chordwise) than **one-third** the width of the mating surfaces are acceptable. Edge voids are not acceptable.

(d) Edge voids between the edge of the skin and the trailing edge extrusion that are less than **0.06** inch wide by any length or less than **0.25** inch wide by **10.0** inches long are acceptable if they are sealed with adhesive.

NOTE

Where two voids of two different types are closer than 1.0 inch apart, consider them as one void and apply the more strict limitations. (Example: Voids between skin and trailing edge extrusion next to a void between the skin and the core.)

e. Inspect blade for worn retention bolt hole and worn drag brace bolt hole.

(1) If wear allowance listed in steps (2) or (3) below is exceeded, send blade to next higher maintenance level.

(2) Main retention bolt hole is oversize when the diameter exceeds **2.505** inches.

(3) Drag plate bolt hole is oversize when the diameter exceeds **0.877** inch.

f. Inspect blade for cracks.

(1) Visually inspect top and bottom surfaces along entire length of blade for damage. Any fatigue crack at any location is cause for blade replacement. Evaluate cracks caused by strikes and other damage to other damage criteria.

(2) Penetration through spar or trailing edge strip is cause for blade replacement.

(3) Damage penetrating skin and at least **1.0** inch from doublers may be repaired, provided that after cleanup, damage does not exceed **2.0** inches in diameter.

(4) Spanwise damage penetrating skin at least **1.0** inch from doublers may be repaired, provided that after cleanup, using an oblong hole, damage does not exceed **4.0** inches by **1.0** inch and direction of oblong hole falls within **15** degrees of a line parallel to leading or trailing edge of blade.

g. Inspect blade for holes in skin. If any holes are found, classify them as reparable by patching or nonreparable in accordance with the following limits (figure 5-14):

CAUTION

Repairs inboard of station 210 must be inspected daily for cracks.

(1) No patches are permitted within **1.0** inch of doublers.

(2) Inboard of station 216, only one repair on same chordline is permitted. After cleanup, holes are limited to **2.0** inches maximum diameter and are restricted to a minimum of **2.0** inches between repairs.

(3) Between station 216 and station 240, two holes are permitted on same chordline on same skin surface. Maximum diameter of holes is **2.0** inches and a minimum spacing of **2.0** inches after cleanup is required between repairs.

(4) Between station 240 and outboard tip of blade, two holes are permitted on same chordline on same skin surface. Maximum diameter of holes is **3.0** inches and a minimum spacing of **2.0** inches is required between repairs after cleanup.

(5) Spanwise holes may be repaired providing that after cleanup, damage does not exceed **1.0** inch wide and **4.0** inches long. Direction of oblong hole must fall within 15 degrees of a line parallel to leading or trailing edge of blade. Ends of the hole must have a minimum radius of **0.25** inch to break corners.

(6) Any damage or defect in the skin that can be polished smooth without leaving the skin in the area so thin that it can be dented with fingernail pressure does not require a cut out. In these cases a patch must be applied as though a hole exists. Maximum diameter of a patch of this type is **4.0** inches with a minimum of **0.75** inch of bonded area around the perimeter of the dent.

h. Inspect main rotor blade trim tab for the following defects:

(1) Distortion that can be repaired by straightening.

(2) Cracks, tears, rips and holes. This type damage must be repaired by replacement of the trim tab.

i. Inspect blade for secure installation of balance weights (18, figure 5-13). Inspect cover plate (1) and tip cap (13) for secure installation. If the cover plate and/or tip cap is loose, inspect weights under the cover plate and/or tip cap for secure installation of weights.

j. Inspect main rotor blade for the following defects and replace blades damaged to the extent described:

(1) Any penetration damage through spar or trailing edge strip, doublers, grip plates or drag plates.

(2) Skin penetration in any area exceeding limits allowed for patching.

(3) Water in honeycomb core.

(4) Voids between skin and honeycomb core larger than **30** square inches.

(5) Edge voids deeper than **0.50** inch in tip end of any of doublers or grip plates.

(6) Edge voids in the leading edge of the doublers that exceed **0.060** inch in depth and at the trailing edge of the doublers that exceed **0.10** inch in depth.

(7) Any corrosion that penetrates entirely through skin.

(8) If one or more cracks develop and extend from a previously repaired area.

(9) More than two patches on the same chordline on the same side (paragraph 5-20, g, (4).

(10) Obvious deformation of blade.

5-21. REPAIR — B540 MAIN ROTOR BLADES.

NOTE

Repair at AVIM is limited by available tools, equipment, personnel and skills. Send blades to Depot Maintenance for major repair.

a. Polish out nick and scratch damage in skin that is within limits stated in inspection paragraph 5-20b. Use 320 grit sandpaper (C102) to polish out damage. Use fine aluminum wool (C20) or scotchbrite (C103) to finish polishing the area. Rub spanwise to remove sandpaper marks and polish to a fine finish. Touch up repair area with alodine (C31), primer (C88 or 91) and paint to match surrounding area (paragraph 5-24).

b. Polish out nick and scratch damage in the abrasive strips, doublers, grip plates, and drag plates that is within limits stated in inspection paragraph 5-20b. Use 400 grit sandpaper (C102) or equivalent. Steel wool (C115) may also be used providing that no aluminum parts are touched with it. Touch up repair area with primer and paint to match surrounding area (paragraph 5-24).

c. Repair nick, scratch, and notch damage in the trailing edge strip that is within limits stated in inspection paragraph 5-20, b. Use varying grades of sandpaper (C102) to polish out damage and fair out over a distance of **2.0** inch minimum on each side of damage. Touch up repair area with primer (C88 or C91) and paint to match surrounding area (paragraph 5-24).

d. (AVIM) Repair hole damage and nick or scratch damage in skin that is within limits stated in inspection paragraph 5-20, g.

NOTE

If a nick or scratch in the skin in excess of 0.008 inch depth can be polished smooth without leaving the skin in the polished area so thin that skin can be dented with fingernail pressure, apply patch over area without cutting a hole. (Comply with step (1). Skip steps (2) and (3) and proceed with step (4). Otherwise, proceed with steps (1) through (8).

(1) Draw a circle around the damaged area just large enough to encompass damage.

(2) Remove skin just inside the circled area, disturbing the honeycomb core as little as possible. Heat the cut out disk to **200** degrees F (**93** degrees C) maximum and lift out the disk of skin while heated.

(3) Deburr edges of hole and polish out scratches and nicks.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Do not allow MEK to enter the blade.

(4) Remove paint from repair area with MEK (C74). Remove paint primer by sanding spanwise using 300 grit sandpaper (C102).

(5) Prepare a patch to cover the hole that will overlap by **0.75** inch. Fabricate patch from 2024-T3 aluminum (1, table 2-1) large enough to overlap the hole at least **0.75** inch all around the perimeter. Deburr and blend out edges. Sand the bond area of patch and blade with 400 grit sandpaper (C102).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(6) Clean bond area on patch and blade with MEK (C74). Dry with a clean cloth.

CAUTION

Area must be clean, dry, and free of grease, oil and wax.

(7) Apply adhesive (C14) to patch area around hole and to patch. Apply patch to blade and move slightly under pressure to expel air and prevent voids in bond. Blend out excess adhesive.

(8) Hold patch in place with rubber bands (made from inner tube) or other mechanical means. Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule.

e. Repair blade abrasion strip splice joints.

(1) Splice joints covered with polyurethane tape.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

NOTE

Polyurethane tape bonded in place over the splice joints is recommended for dusty or sandy environments to provide protection for the joint filler material.

(a) Remove insecure or worn polyurethane tape from splice joint (8 or 10, figure 5-13) with sharp, plastic scraper and small amount of MEK (C74).

(b) Remove tape residue from abrasion strip with cloth dampened with MEK (C74) and plastic scraper, then sand with 100 grit or finer sandpaper (C102). Sand in spanwise direction.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(c) Clean leading edge of rotor blade, in area where tape will be applied, with clean cloth dampened with aliphatic naptha (C75).

(d) Cut a piece of polyurethane tape (C125) **seven** inches long.

(e) Center polyurethane tape chordwise over the splice joint, press into place, and force out all air bubbles. If necessary, make pin hole in tape to allow trapped air to escape.

(2) Splice joints covered with splice cover.

CAUTION

Do not exceed 200 degrees F (93 degrees C) during splice cover removal or damage to rotor blade may result.

(a) Heat damaged or insecure splice cover to **200** degrees F (**93** degrees C) maximum with a heat gun and maintain temperature during removal of cover.

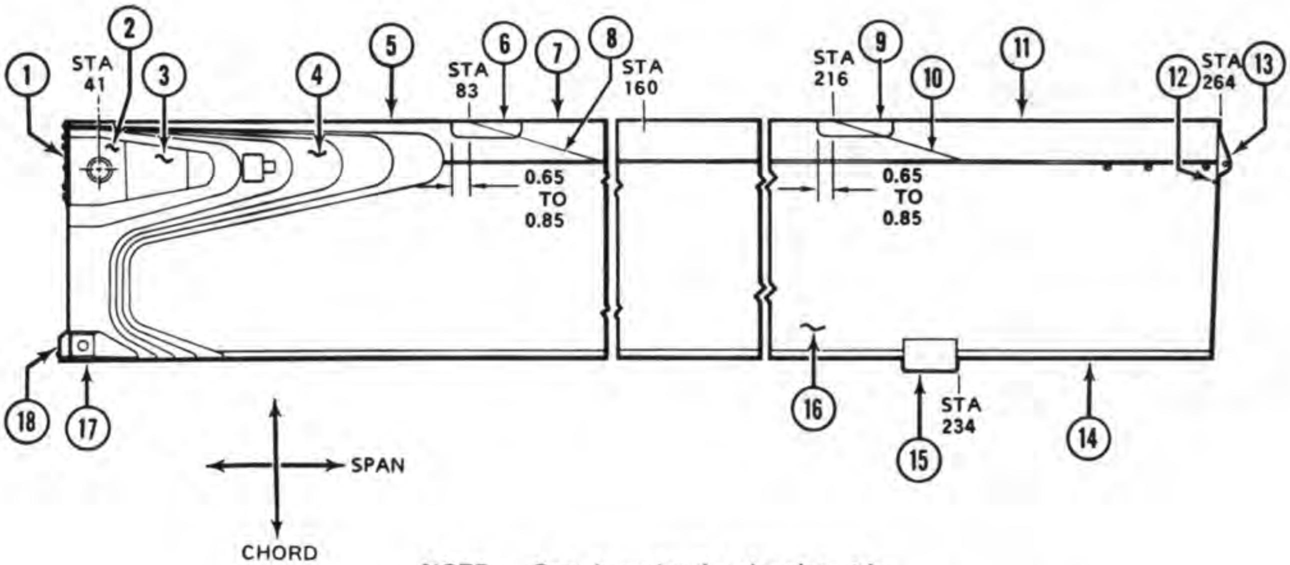
WARNING

When removed, cover will be extremely hot. Handle only with appropriate tools, and place in safe area to cool after removal.

(b) Remove cover with putty knife or chisel, being careful not to damage rotor blade.

WARNING

Allow rotor blade to cool completely before proceeding.



NOTE: Spar is under the abrasive strip.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

1. Cover plate
2. Grip pad
3. Grip plate
4. Doublers
5. Abrasive strip
6. Splice cover
7. Abrasive strip
8. Splice joint (scarf joint)
9. Splice cover
10. Splice joint (scarf joint)
11. Abrasive strip
12. Alignment screw
13. Tip cap
14. Trailing edge strip
15. Trim tab
16. Skin
17. Drag plate
18. Balance weight

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Figure 5-13. B540 Main Rotor Blade

(c) After rotor blade is cool, mask area of rotor blade around splice cover installation area with tape (C133). Leave a **one** inch border between where new splice cover will go and masking tape.

(d) Remove old adhesive, paint and other contaminants from masked-off area with 100 grit or finer sandpaper (C102). Sand in spanwise direction.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(e) Clean masked-off area with clean cloth dampened with MEK (C74) and wipe dry with clean cloths.

NOTE

Wear clean, dry gloves when handling parts that have been prepared for bonding. Avoid contamination of parts with oil, grease, or mold release.

(f) Remove peel ply from inside surface of new splice cover.

(g) Lightly sand cured adhesive on new splice cover with 300 grit sandpaper (C102). Wipe off residue with clean cloth.

(h) Refer to table 1-11 for instructions to mix adhesive (C14). Apply thin coat of adhesive (C14) to inside surface of new splice cover and to mating surface of rotor blade. Use wooden spatula and rub adhesive around on splice cover and blade to assure complete wetting of mating surfaces.

(i) Position new splice cover (6 or 9, figure 5-13) on rotor blade as shown in figure 5-13.

(j) Move splice cover back and forth slightly to expell air pockets.

(k) Wipe off excess adhesive and fair in adhesive at edges of cover.

(l) Place a sheet of peel ply (C83) and cellophane (C27) over splice cover to prevent adhesion to bands installed in following step.

(m) Place heavy rubber bands or bungee cords around rotor blade to hold splice cover in place.

(n) Allow adhesive to cure in accordance with instructions in table 1-11.

(o) Fair in adhesive by sanding with 180 grit or finer sandpaper (C102). Touch up finish on rotor blade (paragraph 5-24).

f. Repair voids as follows:

(1) Repair voids up to a maximum of **0.50** inch from tips of drag plate tang, grip plate tang, or outboard tip of doublers as follows:

(a) Cut material from grip, drag plate or doubler a maximum of **0.50** inch, following the same radius as original tip. Use extreme care to avoid cutting into adjacent parts.

(b) After cutting, deburr and break sharp edges.

(c) Refinish in accordance with procedures in paragraph 5-24.

(2) Seal edge voids **0.25** inch deep or less between the abrasion strip and the splice cover by cleaning the area and filling void with adhesive (C14).

(3) Repair void damage that is within limits defined in inspection paragraph 5-20 steps d. (3), d. (4), and d. (5) by sealing with adhesive. Clean area to be sealed and fill void with adhesive (C14).

g. Repair distorted main rotor blade trim tab that is within limits stated in inspection, paragraph 5-20, h.

(1) Straighten the trailing edge of the main rotor trim tab with a mallet and a heavy back-up block.

(2) Set trim tab to trail with tab bending tool (T47) and tab bending gage (T41).

h. (AVIM) Remove damaged main rotor blade trim tab and install new trim tab if replacement is indicated by inspection paragraph 5-20, h.

(1) Cut through the trim tab (8, figure 5-14) at a line approximately **one-eighth** inch aft, and parallel to blade trailing edge.

(2) Drill out rivets, if installed, attaching trim tabs to rotor blade.

(3) Apply heat to tab with a heat gun, but do not exceed **200** degrees F (**93** degrees C). Start at outer corner of trim tab and peel tab off blade in spanwise direction.

(4) Mask blade area around trim tab; allow **one-half** inch border from trim edge for squeeze-out.

(5) Remove old adhesive in masked area by sanding spanwise with 180 grit sandpaper (C102). Use progressively finer sandpaper 320 and 400 grit to obtain a smooth finish.

WARNING

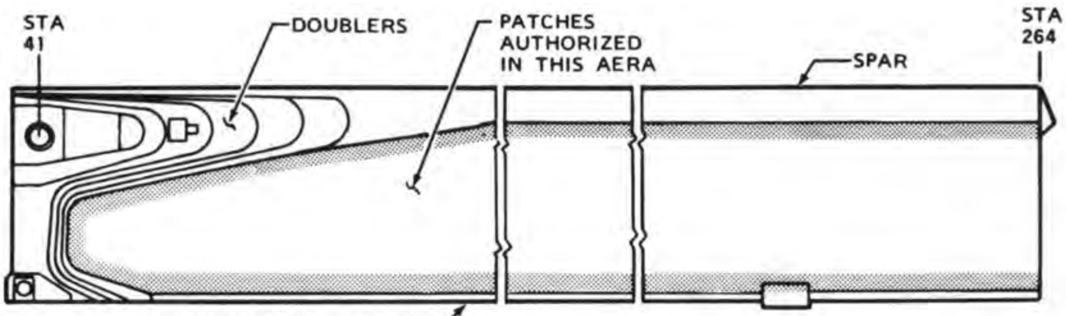
Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(6) Clean trim tab area of blade with cloths moistened with MEK (C74). Dry the area with dry, clean cloth.

(7) Fill rivet holes in trim tab area of rotor blade, if existing, with adhesive (C8). Refer to table 1-11 for instructions to mix adhesive.

(8) Drill **nine** Number **30** holes in new trim tab as illustrated in figure 5-15. (If the previous trim tab was riveted, reverse top and bottom hole locations with trim tab.) Deburr all holes.

(9) Position trim tab on rotor blade in the install position and using holes in trim tab as template, drill matching Number **30** holes to a maximum depth of **0.125** inch in rotor blade.



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. No patches are permitted within one inch of the doublers, spar, trailing edge strip and the tip of the blade (shaded area). Refer to note 2 and the table below to accurately define the patchable area.

2. On blade P/N 540-015-001-1, the trailing edge strip tapers uniformly between station 95.0 and 220.0. Trailing edge strip width is constant either side of these stations.

Chordwise limits of patchable area at various stations for blades			
BLADE P/N	BLADE STATION	AFT OF LEADING EDGE	FORWARD OF AFT EDGE
540-015-001-1	80.0	9.76	——
540-015-001-1	140.0	6.70	——
540-015-001-1	95.0	——	4.145
540-015-001-1	220.0	——	2.245

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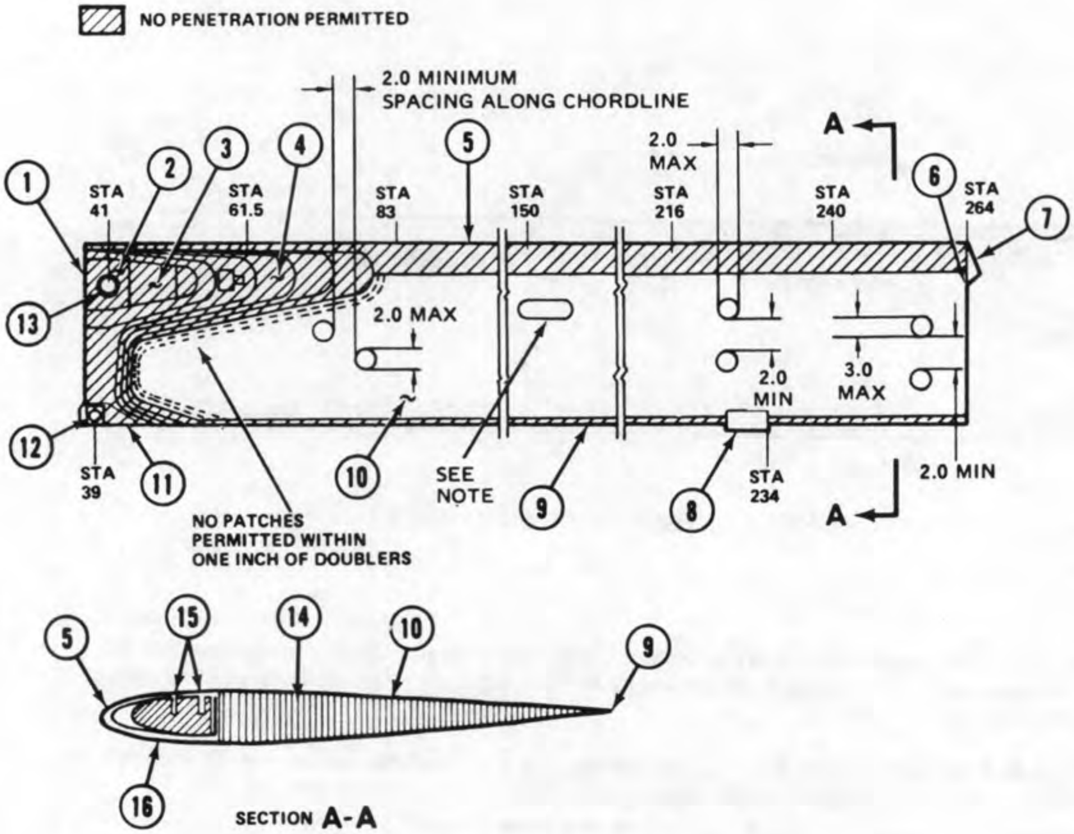
Figure 5-14. B540 Main Rotor Blade Authorized Patch Area (AVIM) (Sheet 1 of 2)



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

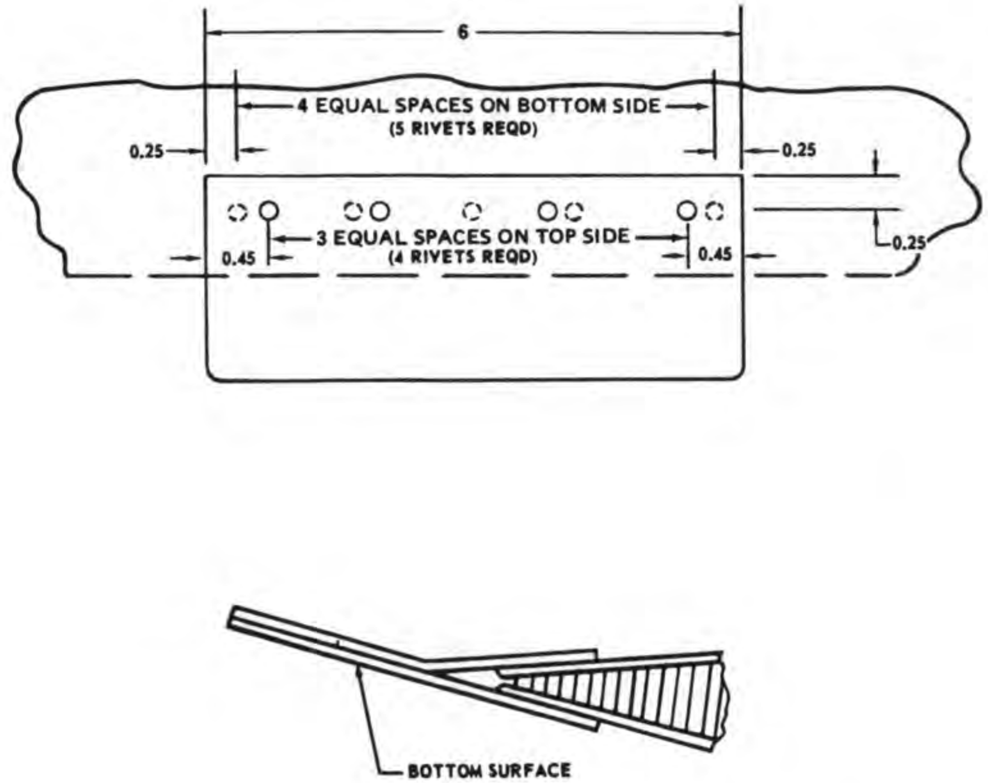
NOTE

An oblong hole is permissible if the general direction of the hole is within 15 degrees of a line parallel to the leading or trailing edge of the blade. Maximum size of the hole shall not exceed 1 inch wide by 4 inches long. The ends of the hole must have a minimum radius of 0.25 inch to break corners.

1. Cover plate
2. Grip pad
3. Grip plate
4. Doublers
5. Abrasive strip
6. Alignment screw
7. Tip cap
8. Trim tab
9. Trailing edge strip
10. Skin
11. Drag plate
12. Bushing, drag brace
13. Bushing, retention bolt
14. Honeycomb core
15. Screw
16. Spar

540011-186-2B

Figure 5-14. B540 Main Rotor Blade Authorized Patch Area (AVIM) (Sheet 2 of 2)



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

209011-32C

Figure 5-15. B540 Main Rotor Blade Trim Tab Installation

(10) Remove trim tab from rotor blade, sand and smooth areas around drilled holes in trim tab and blade.

(11) Sand inside mating sides of trim tab with 200 grit sandpaper (C102) and finish with 400 grit sandpaper (C102).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(12) Clean mating surfaces of rotor blade and trim tab with cloth moistened with MEK (C74); then dry surfaces with clean, dry cloth.

(13) Spread a thin film of adhesive (C14) on mating areas of rotor blade and trim tab.

(14) Position and secure trim tab in install position on rotor blade, with holes in trim tab aligned with corresponding holes in rotor blade.

(15) Install a special blind rivet in each of nine holes drilled in trim tab and blade; dip each rivet in adhesive used in step (13) before installation.

(16) Use two wooden blocks approximately the same size as trim tab and two sections of hard rubber **0.0625** inch thick and approximately the same size as the wooden blocks to use as pressure pads. Place the rubber sections next to the trim tab bond area and place the wooden blocks over the rubber sections; apply **2 TO 10** PSI pressure on the trim tab bond area. Allow adhesive to cure in accordance with instructions in table 1-11.

(17) Remove pressure pads after curing time and smooth squeeze-out with 180, 320, and 400 grit sandpaper (C102).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(18) Clean up adhesive squeeze out in trim tab area with MEK (C74) and dry with clean, dry cloth.

(19) Apply ten percent solution of chromic acid (C1) and dry with clean, dry cloth.

(20) Apply one coat of epoxy primer (C88 or C91) to trim tab, and adjacent blade area and allow to dry for period of 30 minutes to four hours.

NOTE

Adhesion difficulty will be encountered if acrylic lacquer is not applied within a four hour period.

(21) Apply lacquer (C66) to trim tab and adjacent blade area.

i. Send blade to next higher maintenance level if any weights are missing or if there is any evidence of loose mounting or shifting of weights.

j. Preparation for storage or shipment of main rotor blades.

NOTE

The following instructions cover storage or shipment of main rotor blades in either cardboard or metal containers.

(1) Condemn, demilitarize and locally dispose of any blade which has incurred non-reparable damage. Refer to inspection paragraph 5-20, j.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(2) Thoroughly remove foreign matter from entire exterior surface of blade. Use clean cheese cloth dampened with naphtha (C75).

(3) Tape all holes in the blade such as bullet damage, tree damage, foreign object damage, etc. to protect the interior of the blade.

(4) Apply a coating of wax (C135) to all exterior surfaces of the blade, except the main retention bolt hole and the drag brace retention hole. If non-siliconed composition wax is not available, coat exterior blade surfaces with oil (C77).

(5) Apply grease (C55) to main bolt hole and drag brace retention bolt hole.

(6) Wrap blade with barrier material (C23), shiny side next to the blade, at all locations where the blade will contact the hog hair supports (5 places) and secure with tape (C127).

(7) Secure contours to the blade at the paper wrapped areas.

(8) Attach a properly filled out DD Form 15772 (Unserviceable/Repairable Tag) directly to the blade.

(9) Secure blade to shock mounted support.

(10) Secure lid. If cardboard container is used, band container shut with 0.50 inch steel bands. If metal container is used, install top half of container with top cushions attached, on lower half of container and secure with turnlock fasteners.

5-22. INSTALLATION — B540 MAIN ROTOR BLADES.

WARNING

Main rotor blades (540-011-001-5) shall not be intermixed with main rotor blades (540-011-250-1/540-015-001-1) because of weight and stiffness variations.

NOTE

Main rotor blades (540-011-250-1) and main rotor blades (540-015-001-1) may be intermixed.

a. Postion main rotor hub on a build-up bench in accordance with instructions contained in paragraph 5-12, l. Check that locating pin (6, figure 5-10) is installed in upper surface of each grip (5) at inboard side of retaining bolt hole.

b. Apply corrosion preventive compound (C41) to blade retaining nuts in hub grip and blade butts. Insert blade (9) in grip. Place washer (7) on retaining bolts (8). Align bolt holes carefully and insert bolt from top. If bolt binds, move tip of blade up and down slowly to find position which allows bolt to pass through without binding. Seat bolt and washer with notches on locating pin (6).

c. Place padded support under blade approximately one third blade length inboard from blade tip.

CAUTION

Install washer (16) with counterbore up facing grip.

d. Install washer (16) with counterbore up as illustrated and install nut (17). Do not tighten nut at this time.

e. Align drag brace (15) and blade for installation of bolt (14). Select shims (10) that will give a clearance of **0.000 TO 0.005** inch. Install bolt (14), shims (10), washers (12 and 13), and nut (11). Install washers (12 and 13) on lower side as illustrated. Do not tighten nut at this time. Apply corrosion preventive compound (C43) to drag brace bolts and clevis holes.

f. Install opposite blade in the same manner.

g. If the blades are to be aligned in the hub, follow instructions contained in paragraph 5-13.

h. If the blades are not to be aligned in the hub, torque both nuts (11) **125 TO 150** foot-pounds.

i. If the blades are not to be aligned in the hub, torque both nuts (17) **475 TO 525** foot-pounds with blade bolt wrench (T31). Select a notch in the nut that is aligned with a hole in the bolt and install locking screw (20) with head of screw inboard. Install washer (19) and nut (18).

j. Install main rotor grip locks (T59) on each pitch horn if not previously accomplished (figure 5-4).

5-23. ALIGNMENT — B540 MAIN ROTOR BLADES.

Refer to paragraph 5-13.

5-24. PAINTING — B540 MAIN ROTOR BLADES (AVIM).

a. Remove tip cap assembly (7, figure 5-14) and plug the holes in the end of the spar and inertia weight to keep paint out.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin and eyes.

b. Degrease with naphtha (C75) or any good degreasing solvent.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

c. Using MEK (C74), strip old paint from blade area to be refinished.

d. If skins are pitted or eroded (especially in the area just behind the abrasion strip) polish out the pits with 320 grit sandpaper (C102). Use fine aluminum wool (C20) and 320 grit sandpaper (C102) to finish polish the damaged area. Rub spanwise to remove burnishing or sandpaper marks and all traces of pitting. If the depth of the repaired area is no greater than **0.008** inch the repair is satisfactory.

NOTE

Prior to refinishing, blade must have all scratches, nicks, dents, etc. repaired as shown under repair or nicks, dents, scratches, notches, and bent trim tab.

e. Using abrasive cloth (C36) or equivalent, remove all surface oxides and all aged chemical conversion coatings from all bare aluminum surfaces.

f. Wash blade with compound (C32) or equivalent. Achieve water break free surface, which will be evident by continuous unbroken film of water on the surface after thoroughly rinsing the soap from the surface.

NOTE

From completion of f. above through final painting, surfaces of blades should not be handled with bare hands.

g. On all surfaces where corrosion was present, use application of all phosphoric solution (C19). On all bare aluminum, apply brush or spray application of alodine (C31).

h. Thoroughly dry the cleaned surfaces. Apply a **0.3 TO 0.5** mil thick coat of primer (C88 or C91). Allow to air dry from **45** minutes to **8** hours before next step.

i. Paint main rotor blades as follows:

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(1) Mix a small quantity of adhesive (C7) according to directions on container. Mix **13** to **15** percent by weight of primer (C88 or C91) into the adhesive (C7). Mix thoroughly, and then to sprayable consistency by adding MEK (C74). Do not exceed **50** percent by volume; **35** percent should produce a sprayable consistency. The pot life of the epoxy primer mixture is approximately **3** hours.

(2) Apply **three** wet spray coats of adhesive mixture from the butt end of the blade to a distance of **0.75** inch to **3** inches outboard (follow contour of the largest doubler, including the tip and root covers. Do not apply to surfaces of the grip plates and drag plates that become faying surfaces with the grips and drag braces.

(3) Apply **three** wet spray coats of adhesive mixture over all adhesive squeeze-outs and surfaces of the trim tab. Extend outer edge of the adhesive onto the blade surface a minimum **0.50** inch beyond the squeeze-out.

(4) Apply **one** wet spray coat of adhesive the entire length of both sides of the blade, using the skin stop on the spar as the centerline of spray.

(5) Apply **one** wet spray coat of adhesive the entire length of both sides of the blade, using the butt joint between the trailing edge strip and the skin as the centerline of spray.

(6) Apply first coat of lusterless black lacquer (C65) to the upper and lower surfaces of the blade. Allow one hour minimum drying time, then apply second coat. Allow one hour minimum drying time before putting any other paint over the second coat. Spray only the repaired areas. Paint thickness to be approximately **1.2 TO 1.5** mils.

j. Unplug holes in end of spar and interia weight and install tip cap assembly.

5-25. K747 MAIN ROTOR BLADES.

5-26. DESCRIPTION — K747 MAIN ROTOR BLADES.

The main rotor blades are glass fiber epoxy resin bonded assemblies with a rubber erosion guard. The skin is basket weave which will not be as smooth as a metal blade. Each blade is attached in the hub with a retaining bolt assembly and is held in alignment by adjustable drag braces.

5-27. REMOVAL — K747 MAIN ROTOR BLADES.

a. Position main rotor hub and blade assembly on build-up bench (paragraph 5-12, m). Place padded supports under blades so that leading edge is approximately straight.

b. Remove locking screw (20, figure 5-10).

c. Remove nut (17) with blade bolt wrench (T31).

d. Remove nut (11) and bolt (14). Loosen nut (21) and swing drag brace (15) away from rotor blade. Retain shims (10) for reinstallation.

CAUTION

Avoid blade contact with the drag brace and hub during removal procedure to prevent possible blade damage.

e. Remove blade retaining bolt (8). Slowly raise and lower blade tip while tapping bolt with fiber mallet. If bolt is difficult to remove, use a bolt removal work aid similar to the one shown in figure 5-11. Remove blade retaining bolt as follows:

(1) Remove threaded plugs from upper and lower ends of blade retaining bolt. If weights are present in bolt, retain for reinstallation.

(2) Position work aid on bolt as shown in figure 5-12, and also place a piece of hard rubber or similar material between work aid tube and grip to prevent marring the grip. Hold puller rod and tighten hexagon nut to remove blade retaining bolt.

(3) Remove work aid from blade retaining bolt. Reinstall weight and plugs in blade retaining bolt and identify the blade retaining bolt for reinstallation in the same grip.

f. Remove blade from grip and place in a padded stand.

g. Remove opposite blade from hub in same manner.

5-28. CLEANING — K747 MAIN ROTOR BLADES.

a. Clean main rotor blade with one part cleaning compound (C33) and nine parts water.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

The erosion boot is very susceptible to solvents. Use care to prevent spillage or run-off of solvents onto the boot.

b. Remove stubborn deposits with a cloth dampened with solvent (C112) except the boot shall be cleaned only with detergent (C50) or one part cleaning compound (C33) and nine parts water.

5-29. INSPECTION — K747 MAIN ROTOR BLADES.

a. Inspect blade historical records and the blade for evidence that the blade has been subjected to an accident, overspeed or incident outside the realm of normal usage. If such evidence exists, perform Special Inspections outlined in paragraph 1-57.

b. Inspect blades for damage. Classify damage as acceptable or repairable, using the limits in table 5-1. See figure 5-16. Acceptable damage shall not be repaired.

c. Method of measuring damage in blades. The top of the painted surface shall be used to measure dents, cuts and scratches by using a dial indicator with a probe. The fibers of the basketweave may appear to be raised or rough; this is not cause for rejection. (See table 5-1.)

5-30. REPAIR OR REPLACEMENT — K747 MAIN ROTOR BLADES.

WARNING

The following protective equipment must be used when working with fiber-glass repair Kits:

Respirator, Chemical Cartridge
Respirator, Disposable half-mask
Gloves, Rubber: Acid, Alkali resistant black
Apron, Impermeable: Duck, Rubber Coated
Goggles, Industrial for chemical handling
Faceshield, Industrial Hinged Window

a. Main rotor blades meeting all of the following requirements shall be repaired.

(1) Blade shall have only damage that is listed as repairable or acceptable in table 5-1, and damage shall not be in any area previously repaired. Damage listed as acceptable shall not be repaired.

(2) All required repairs shall be within the proximity limits shown in figure 5-19.

(3) Blade shall contain sufficient existing balance weight to permit adjustment of blade balance as shown in figure 5-20.

b. Main rotor blades not meeting the requirements of paragraph a. above, shall be repalced.

WARNING

K-747 main rotor blades shall not be intermixed with main rotor blades of any other type on the same helicopter, because of performance differences.

Table 5-1. Classification of Damage — K747 Main Rotor Blades

TYPE OF DAMAGE A = Acceptable. Do not repair. R = Reparable if within requirements of paragraph 5-30

ALL DIMENSIONS ARE IN INCHES.

MAIN ROTOR BLADE COMPONENT	NICKS, SCRATCHES	DENTS	VOIDS	CUTS,TEARS,CRACKS	OTHER
a. Skin Over Core (Top or Bottom) NOTE 0.015 is full depth of skin.	A to 0.005 deep. If 0.005 deep any intersections must be 0.50 apart min. R 0.005-0.015 deep if within area of 7.0 dia circle. (by skin patch)	A To 0.050 deep if no cracks or voids. If 0.050 deep must be 6.0 apart min. R If within area of 7.0 dia circle. (under 1.0 dia by skin patch, over 1.0 dia by plug patch)	A To 2.0 dia, and must be 2.0 apart min. R If within area of 7.0 dia circle. (by plug patch)	R If within area of 7.0 dia circle. (under 1.0 dia by skin patch, over 1.0 dia by plug patch) R Resin starved skin is revealed along the 45° basket-weave. The dry rovins stop where it goes under the adja-cent basketweave. The pain system will be cracked & the fiberglass will show as white strains. Repair with skin patch.	Punctures R If within area of 7.0 dia circle. (under 1.0 dia by skin patch, over 1.0 dia by plug patch) R Erosion of Paint IAW 5-31i refinishing paint. A Diagonal ripples aft of spar stations 48-70 & 224-260.
b. Skin Over Spar or Trailing Edge Assy. (Top or Bottom) NOTES (1) 0.015 is full depth of skin (2) Critical areas are two bands ex-tending length of blade 0.5 fwd from spar/core joint. and 0.5 aft from trailing edge/core joint.	A No limit on length proximity or inter-sections. (1) To 0.005 deep in critical areas. (2) To 0.015 deep in other areas. R To 0.015 deep in crit-ical areas if within area of 7.0 dia circle. (by skin patch)	A To 0.015 deep if no cracks or voids. If 0.015 deep center must not be in critical area, and must be 1.5 apart min. R Outboard of STA 65.7: over 0.015 deep, if not over 1.0 from blade trail-ing edge, and not over 3.0 spanwise. (by trailing edge doubler)	A (1) Within 0.25 of blade trailing edge, no limit on length. (2) Over 0.25 from blade trailing edge, to 1.0 dia and must be 2.0 apart min.	R (1) Outboard of STA 65.7: if not over 1.0 from blade trailing edge, and not over 3.0 span-wise. (by trail-ing edge doubler) (2) If 0.50 min from spar of trailing edge assy, and within area of 7.0 dia circle (by skin patch)	R Cracks - Rout out damage to 0.060. Bond with (C14). R Blisters: Remove paint with 220 sandpaper (C102) & repaint IAW 5-31i.
c. Skin Doublers at Inboard end. (Top or Bottom)	A To 0.015 deep on ex-posed surfaces only. No limit on proximity.	A To 0.015 deep if no cracks or voids. No limit on proximity.	A (1) Leading edge doublers: 0.125 max at any edge. No limit on cumulative length. (a) 0.025 max at any edge. No limit on cumulative length. (b) 1.0 max dia if at least 2.0 from edge and any other void.		

209747-I-I

Table 5-1. Classification of Damage — K747 Main Rotor Blades (Continued)

MAIN ROTOR BLADE COMPONENT	TYPE OF DAMAGE A = Acceptable. Do not repair. R = Reparable if within requirements of paragraph 5-30.				ALL DIMENSIONS ARE IN INCHES.
	NICKS, SCRATCHES	DENTS	VOIDS	CUTS,TEARS, CRACKS	OTHER
d. Trim Tab, Area Attached to Blade.	A To 0.010 deep. R (1) 0.010-0.020 deep covering to 50% of area. (by polishing) (2) 0.010-0.020 deep covering over 50% of surface, and any over 0.020 deep (by replacement)	A To 0.015 deep if no cracks or voids. If 0.015 deep centers must be 1.50 apart min. R To 0.015 deep with cracks or voids, and any over 0,015 deep. (by replacement)	A Any length if 0.25 min from edge. R Any closer than 0.25 to edge. (by replacement)		Punctures R Any (by replacement) Corrosion R (1) To 0.020 deep. (by polishing) (2) Over 0.020 deep (by replacement)
e. Trim Tab, Area Aft of Blade	A To 0.020 deep. R Over 0.20 deep. (by replacement)	A To 0.032 deep if no voids. R Over 0.032 deep. (by mechanical straightening)	A To 3.0 sq. in. total area. R Over 3.0 sq. in. total area. (by replacement)	R (1) Any chordwise. (2) Spanwise to 2.0 total length. (1 and 2 stop drilling) (3) Spanwise over 2.0 total length. (by replacement.)	Punctures R Any (by replacement) Corrosion R (1) To 0.032 deep. (by polishing) (2) Over 0.32 deep. (by replacement) Bends, Distortion A To 0.032 deep R Other 0.032 deep. (by menchanical straightening)

209747-I-2

Table 5-1. Classification of Damage - K747 Main Rotor Blades (Continued)

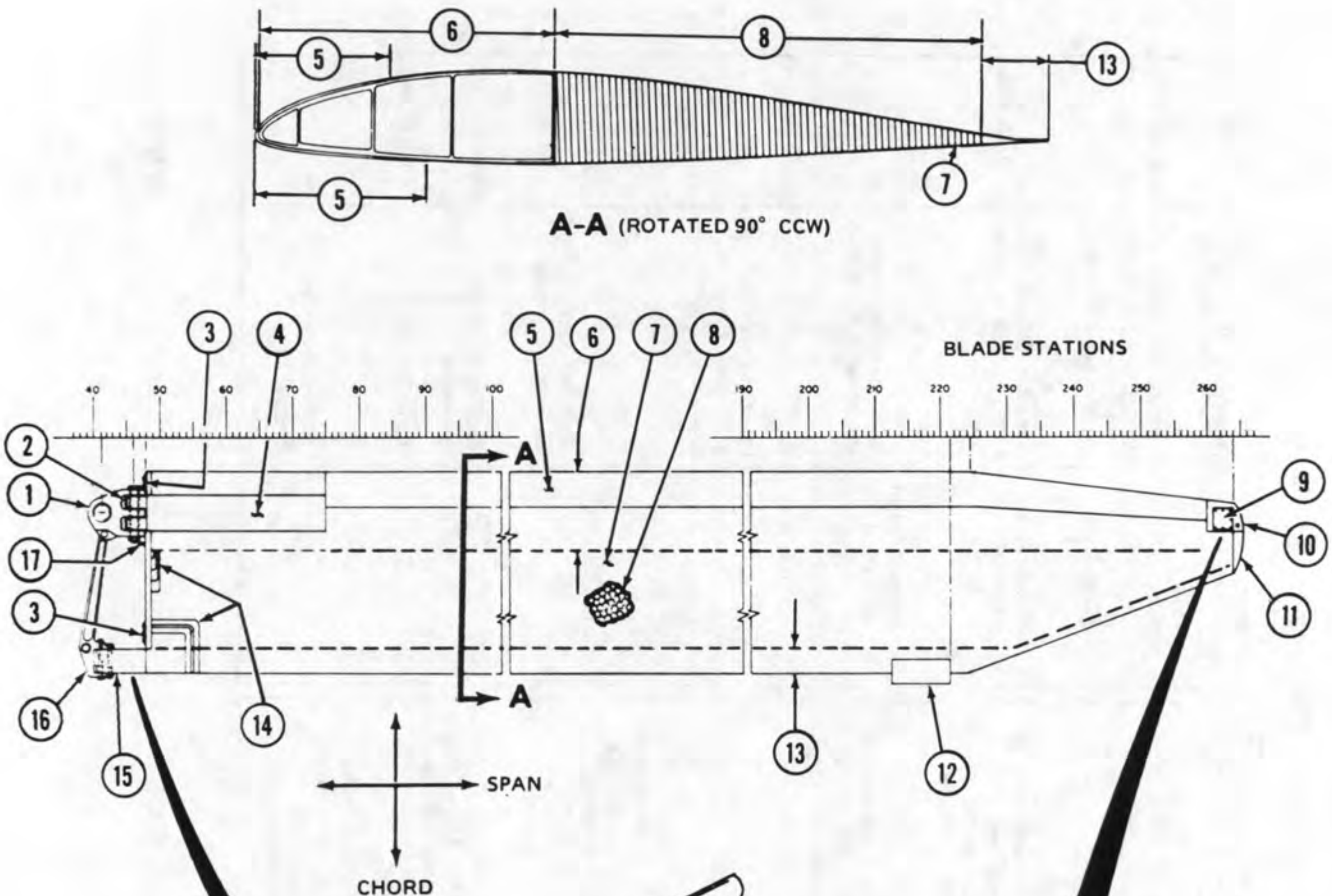
MAIN ROTOR BLADE COMPONENT	TYPE OF DAMAGE A = Acceptable. Do not repair. R = Reparable if within requirements of paragraph 5-30.				ALL DIMINSIONS ARE IN INCHES.
	NICKS, SCRATCHES	DENTS	VOIDS	CUTS,TEARS, CRACKS	OTHER
f. Trailing Edge Assembly. NOTE Depths listed are in addition to the 0.015 depth of overlying skin.	A (1) Inboard of STA 48.0 : to 0.015 deep. (2) STA 48.0 to 65.7 (a) To 0.010 deep any length. (b) 0.010-0.030 deep, total cumulative length must be under 5.0 in any 10.0 length of span. (3) Outboard of STA 65.7. (a) To 0.010 deep. (b) To 0.030 deep if within 1.0 of trailing edge, total cumulative length must be under 5.0 in any 10.0 length of span. R Outboard of STA 65.7: if not over 1.0 from blade trailing edge, and not over 3.0 spanwise. (by trailing edge doubler patch)		A (1) Inboard of STA 48.0 if not within 0.50 of blade trailing edge or joint with core. (2) Outboard of STA 48.0 to 0.125 forward from blade trailing edge. R Outboard of STA 65.7 if not over 1.0 from blade trailing edge and not over 3.0 spanwise. (by trailing edge doubler) patch	A Inboard of STA 48.0 to 0.015 deep. R Outboard of STA 65.7: if not over 1.0 from blade trailing edge, and not over 3.0 spanwise. (by trailing edge doubler) patch	Punctures R Outboard of STA 65.7 if not over 1.0 from blade trailing edge and not over 3.0 spanwise
g. Leading Edge Erosion Guard. Seal all blemishes regardless of depth with sealing iron.	A (1) To 0.050 if distance from guard trailing edge is over 1.0 on top or 2.0 on bottom. (2) To a depth that does not expose under surfaces if distance from guard is not over 1.0 on top or 2.0 on bottom.		A (1) Any length if within 0.250 of edge. (2) 1.5 max dia if at least 4.0 from edge and any other void. R (1) Edge void of any length to 1/2 of guard chordal width, top or bottom. (2) At spanwise ends (STA 75.0 and 260.0) to 2.0 spanwise. (3) Voids in midspan shall be injected with (C98) & apply pressure.	(by trailing edge doubler) patch	Erosion A Until loss of weight causes helicopter vibration. Return to Depot. Punctures R (1) To 0.125 width, any length. (2) To 0.5 width, 6.0 max length. (3) To 0.75 width, 2.0 max length.

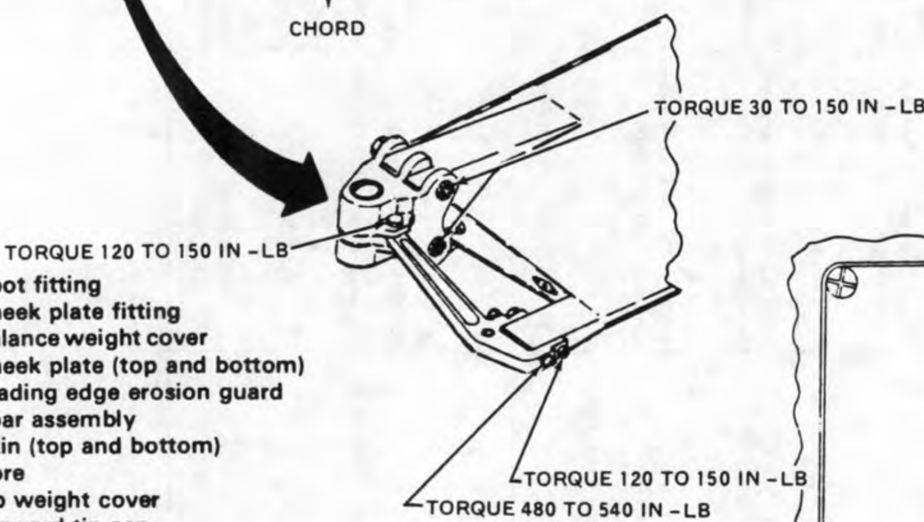
209747-I-3

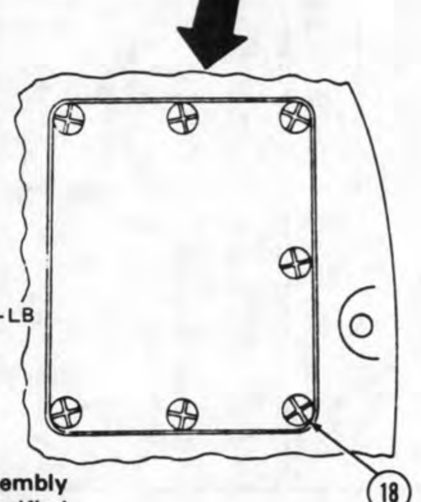
Table 5-1. Classification of Damage - K747 Main Rotor Blades (Continued)

COMPONENT	NICKS, SCRATCHES	CORROSION	COMPONENT	NICKS, SCRATCHES	CORROSION
	TYPE OF DAMAGE A = Acceptable. Do not Repair R = Reparable if within requirements of paragraph 5-30.	ALL DIMENSIONS ARE IN INCHES.			
h. Root Fitting	See figure 5-14.2		i. Drag Strut	See figure 5-14.3.	
j. Root Fitting Bolt.	A To 0.050 deep on hex head and explsed thread area.	R To 0.050 deep on hex head and exposed thread area. (by polishing)	k. Cheek Plate Assembly	A Inboard of STA 48.0 to 0.015, no limit on length or number.	R To 0.035 deep.
l. Cheek Plate Fitting	A To 0.015 deep on exposed surfaces. R 0.015 0.030 deep on exposed surfaces. (by polishing)	R To 0.030 deep on exposed surfaces (by polishing)	m. Balance Weight covers	A Nicks, scratches, dents, and bends to 0.035 deep R Bends and distortion over 0.035 deep. (by mechanical straightening)	
n. Trailing Edge Fitting	A To 0.015 deep on exposed surfaces. R 0.015 0.030 deep on exposed surfaces. (by polishing)	R To 0.030 deep on exposed surfaces (by polishing)	o. Tip Cap Aft	A To 0.060 deep. No limit on length or number.	
p. Tip Cap, Forward	No limit on length or number. A To 0.030 deep. R 0.030 0.060 deep. (by polishing)	Erosion: A Until loss of weight causes helicopter vibration. R Gap around tip cap. Sealer missing. Apply (C104) Sealant.	q. Tip Cover	No limit on length or number A To 0.030 deep. R 0.030-0.060 deep. (by polishing)	Erosion: A To 0.030 deep.

209747-1-4







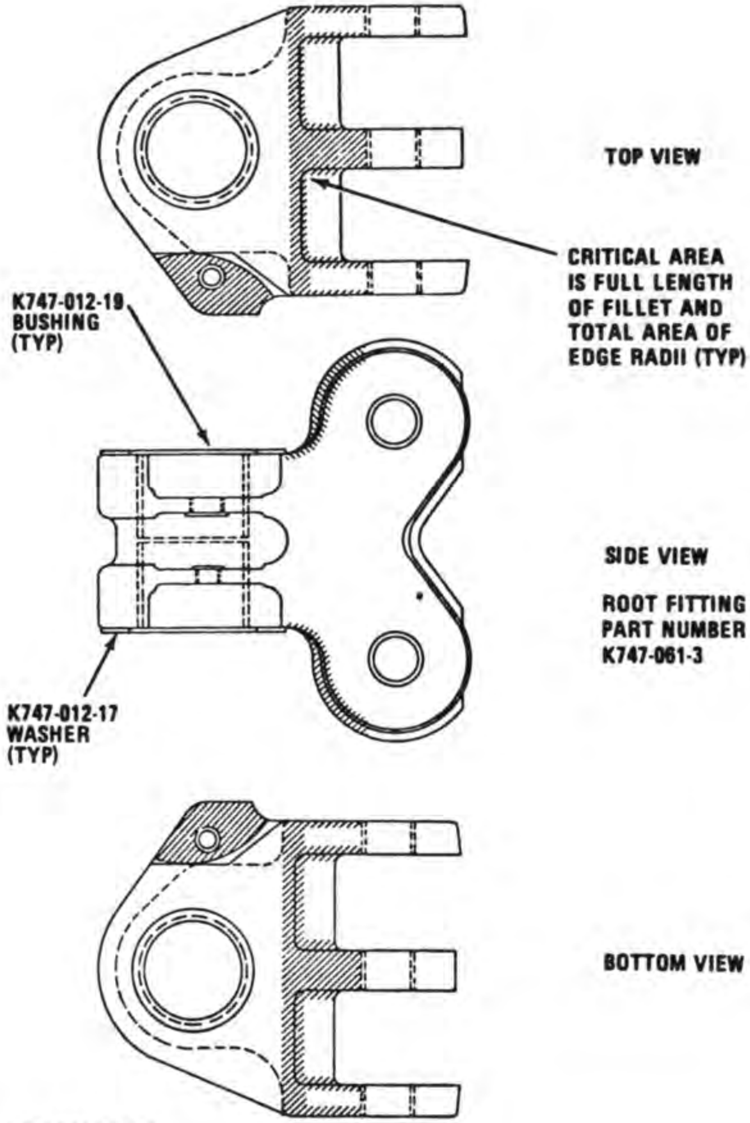
1. Root fitting
2. Cheek plate fitting
3. Balance weight cover
4. Cheek plate (top and bottom)
5. Leading edge erosion guard
6. Spar assembly
7. Skin (top and bottom)
8. Core
9. Tip weight cover
10. Forward tip cap
11. Aft tip cap
12. Trim tab
13. Trailing edge assembly
14. Doublers (top and bottom)
15. Trailing edge fitting
16. Drag strut
17. Spar valve
18. Alignment screw

NOTE

Spar, core, and trailing edge assembly areas underlying the skin can be identified by the difference in sound when the blade surface is tapped with a coin.

209747-2

Figure 5-16. K747 Main Rotor Blade



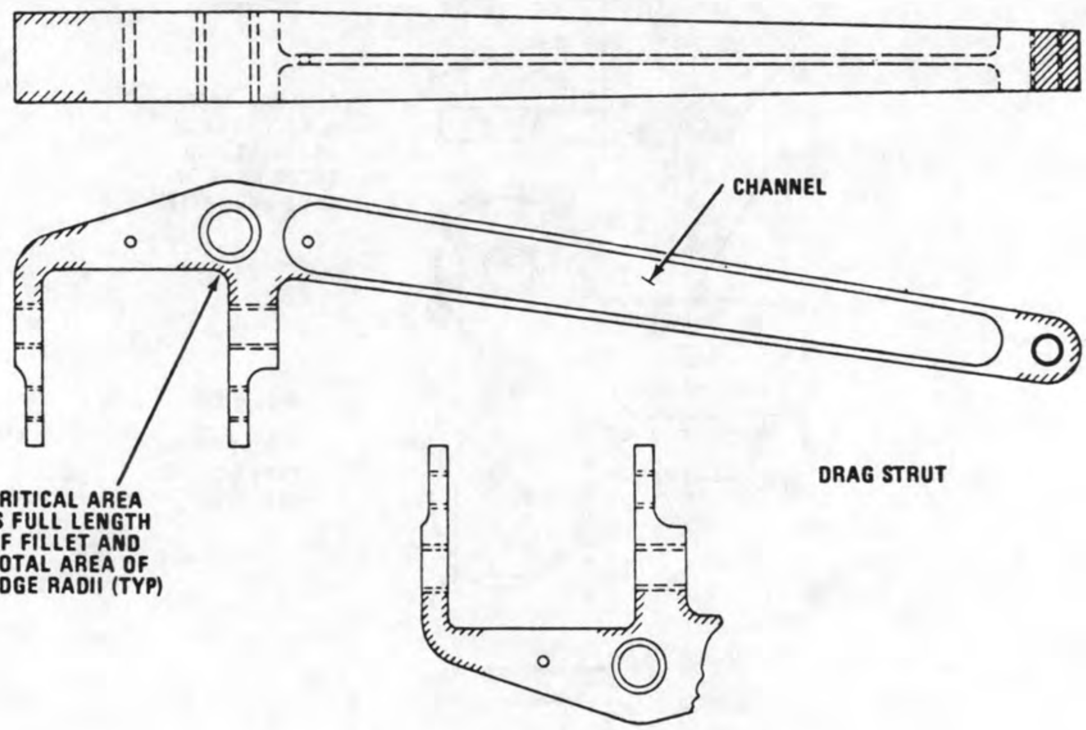
NO CRACKS PERMITTED

TYPE OF DAMAGE	MAXIMUM DEPTH ALLOWED	
	CRITICAL AREA	NON-CRITICAL AREA
NICKS, SCRATCHES	0.005 IN. ACCEPTABLE *0.010 IN. REPARABLE‡	†0.015 IN. ACCEPTABLE †0.030 IN. REPARABLE‡
CORROSION	*0.010 IN. REPARABLE‡	0.030 IN. REPARABLE‡

†Except for exterior surfaces of K747-012-19 bushing flange and K747-012-17 washer.
These limits are: 0.030 in. is acceptable.
0.030 - 0.060 in. is reparable to 20% of surface area.
*Rework may extend to 100% of surface area.
‡By polishing.

209747-3

Figure 5-17. Damage Limits — Root Fittings (K747 Blade)



NO CRACKS PERMITTED

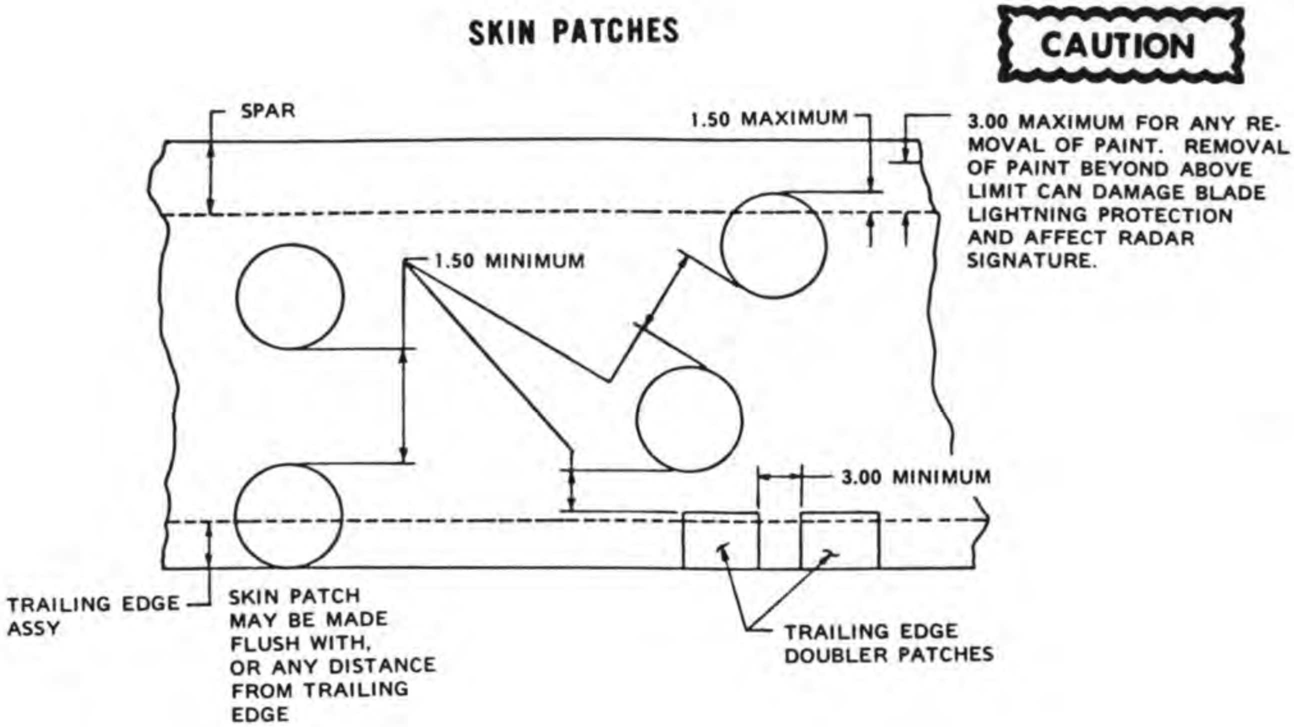
TYPE OF DAMAGE	MAXIMUM DEPTH ALLOWED	
	CRITICAL AREA	NON-CRITICAL AREA
NICKS, SCRATCHES	0.005 IN. ACCEPTABLE 0.015 IN. REPARABLE‡	†0.005 IN. ACCEPTABLE †0.030 IN. REPARABLE‡
DENTS		††0.020 IN. ACCEPTABLE
CORROSION	0.015 IN. REPARABLE‡	*†0.030 IN. REPARABLE‡

NOTES

† If both surfaces of the channel must be reworked, minimum thickness of channel well shall be 0.150 in.
†† Provided dent has radius larger than 0.50 inch. If radius is smaller than 0.50 inch and dent is short, treat as nick and blend to 0.020 in.
* Rework may extend to 100% of surface area.
‡ By polishing.

209747-4

Figure 5-18. Damage Limits — Drag Strut (K747 Blade)



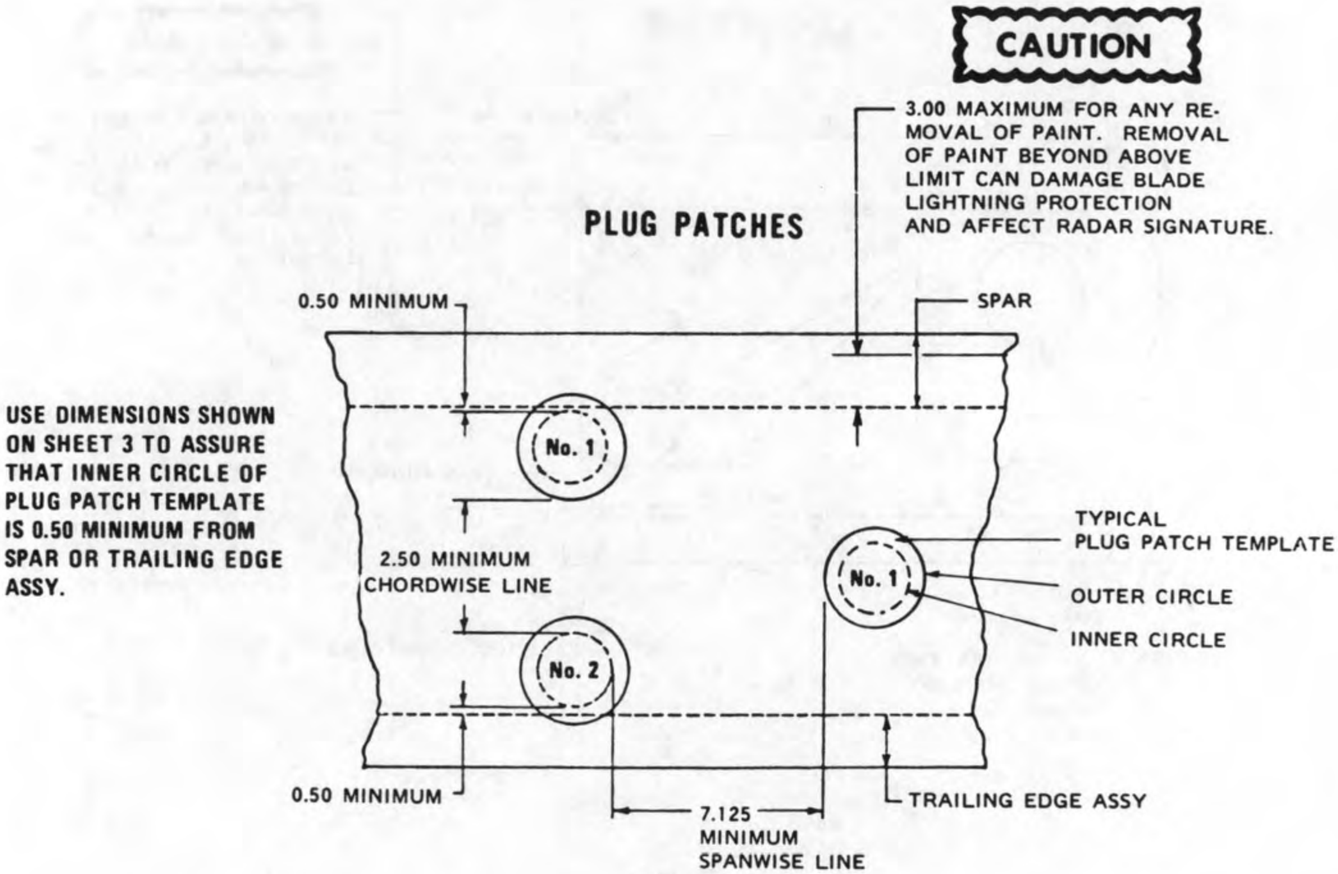
NOTE

FOR EACH KIND OF PATCH (SKIN, TRAILING EDGE, OR PLUG) MINIMUM PROXIMITY LIMITS SHOWN FOR DISTANCES BETWEEN PATCHES ARE ALSO THE MINIMUM PROXIMITY LIMITS BETWEEN THE PATCH SHOWN AND:

1. CHEEK PLATES
2. DOUBLERS
3. TRIM TAB
4. ANY OTHER PATCH OF ANY KIND

ALL DIMENSIONS ARE IN INCHES.

Figure 5-19. Proximity Limits for Patches — K747 Main Rotor Blades (Sheet 1 of 3)



NOTE

FOR EACH KIND OF PATCH (SKIN, TRAILING EDGE, OR PLUG) MINIMUM PROXIMITY LIMITS SHOWN FOR DISTANCES BETWEEN PATCHES ARE ALSO THE MINIMUM PROXIMITY LIMITS BETWEEN THE PATCH SHOWN AND:

1. CHEEK PLATES
2. DOUBLERS
3. TRIM TAB
4. ANY OTHER PATCH OF ANY KIND

ALL DIMENSIONS ARE IN INCHES.

209747-5-2

Figure 5-19. Proximity Limits for Patches — K747 Main Rotor Blades (Sheet 2 of 3)

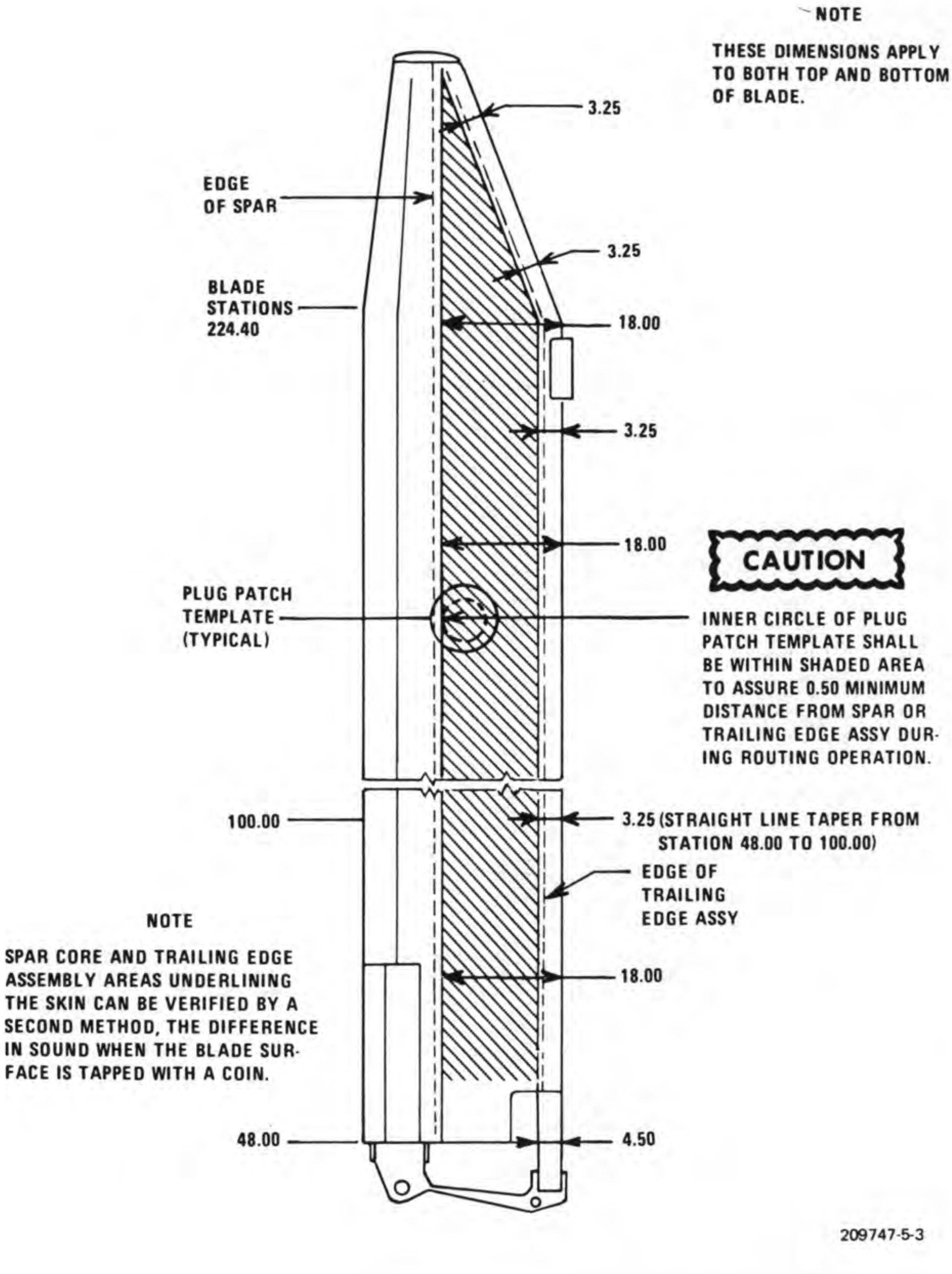
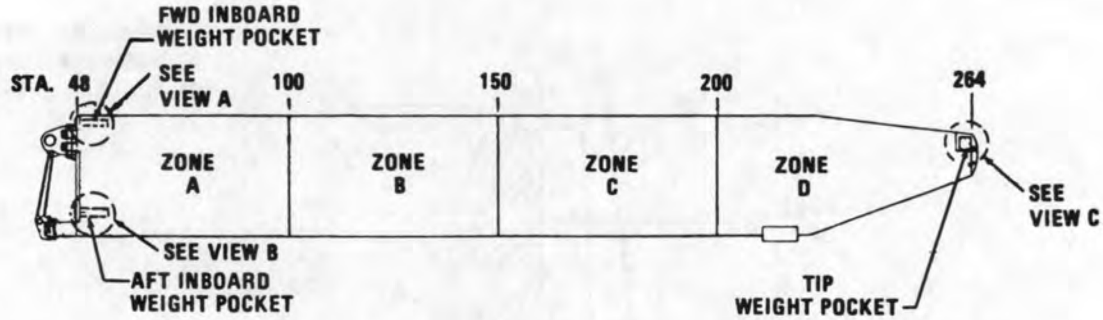


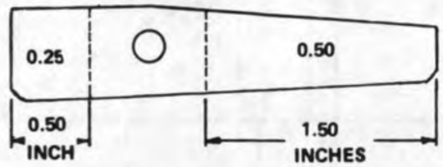
Figure 5-19. Proximity Limits for Patches — K747 Main Rotor Blades (Sheet 3 of 3)



TYPE OF PATCH	SPANWISE CORRECTION SEE NOTES 1 AND 2				CHORDWISE CORRECTION SEE NOTE 3
	ZONE A	ZONE B	ZONE C	ZONE D	
TRAILING EDGE DOUBLER	0.75	1.25	1.75	2.00	3
3 - IN. SKIN	0.00	0.25	0.25	0.25	0
5 - IN. SKIN	0.50	0.75	1.00	1.25	1
9 - IN. SKIN	1.25	2.00	2.75	3.75	3
3 x 0.25 - IN. PLUG	0.25	0.75	1.00	1.25	1
3 x 0.50 - IN. PLUG	0.50	0.75	1.00	1.25	1
3 x 1.25 - IN. PLUG	0.75	1.25	1.75	2.00	1
3 x 1.75 - IN. PLUG	0.75	1.25	1.75	2.00	1
7 x 0.25 - IN. PLUG	1.75	2.75	3.75	4.75	4
7 x 0.50 - IN. PLUG	1.75	2.75	3.75	4.75	4
7 x 1.25 - IN. PLUG	2.25	3.75	5.00	6.25	4
7 x 1.75 - IN. PLUG	2.50	4.25	5.75	7.00	4
EROSION GUARD PATCH	0.50	0.75	1.00	1.25	1

NOTES

1. Remove listed quantity of K747-063-11 tip weights for each patch made in each zone. See view C, sheet 2.
2. To remove partial K747-063-11 tip weights, cut off 0.25 and/or 0.50 using following dimensions:



3. Move listed quantity of K747-056-11 weight washers from aft inboard weight pocket to forward inboard weight pocket for each blade patch made. See views A and B, sheet 2.
4. For each leading edge erosion guard patch made, move one K747-056-11 weight washer from forward inboard weight pocket to aft inboard weight pocket. See views A and B, sheet 2.
5. If a single patch is in two zones, use data for the most outboard of the two zones.

209747-6-1

Figure 5-20. Balance Adjustment for Patches (K747 Blade) (Sheet 1 of 2)

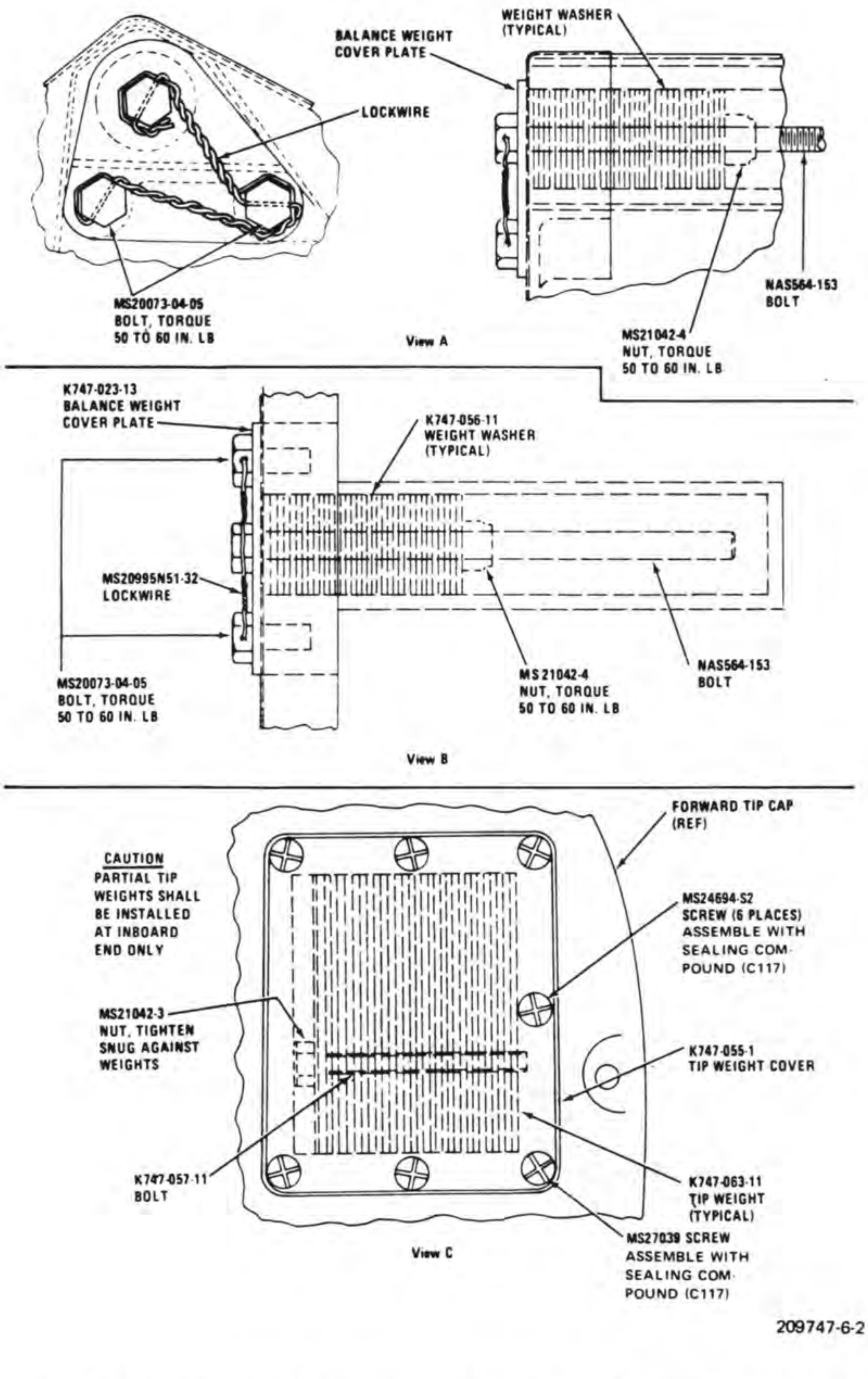


Figure 5-20. Balance Adjustment for Patches (K747 Blade) (Sheet 2 of 2)

5-31. REPAIR PROCEDURES — K747 MAIN ROTOR BLADES. (AVIM)

CAUTION

Repairs shall be made only on main rotor blades meeting the requirements of paragraph 5-30. Otherwise, blade can be seriously weakened.

NOTE

The following repairs can be made on the top or bottom of main rotor blades while blades are installed on helicopter. When repair limits are questioned proceed to next critical repair procedure.

a. Polishing and Corrosion Treatment.

(1) Polish out nicks, scratches, and corrosion on exposed metallic parts with No. 320 or finer sandpaper (C102), and touch-up, as required, in accordance with step i. below.

(2) Repairs requiring removal of root fitting (1, figure 5-16) and/or drag strut (16) may be made by removing attaching hardware. Following repairs as specified in step (1) above, reinstall root fitting and/or drag strut using figure 5-16 as a guide.

b. Application of Skin Patch.

CAUTION

Blade must contain sufficient balance weight to permit adjustment of blade balance after repair. Refer to paragraph 5-30, Repair or Replacement, before starting any repair.

CAUTION

Grease pencils shall not be used. Only lead pencil lines shall be made as shown. Pencil marks other than those specified in the instructions can weaken the repair.

NOTE

Repairs are required to be logged in DA Form 2408-13 and -16. A permanent record in the -16 must be maintained because once a skin or plug patch has been installed it is not possible to determine which type of patch has been applied.

NOTE

A clock or watch is required to time adhesive curing.

(1) Position blade for access to damaged area (Figure 5-21). Support blade to prevent movement and droop.

(2) Measure diameter of damage.

(3) Obtain adhesive package (C4).

(4) Obtain skin patch repair kit, no larger than necessary to overlap damage **1** inch all around. Skin patch kits are available in the following sizes:

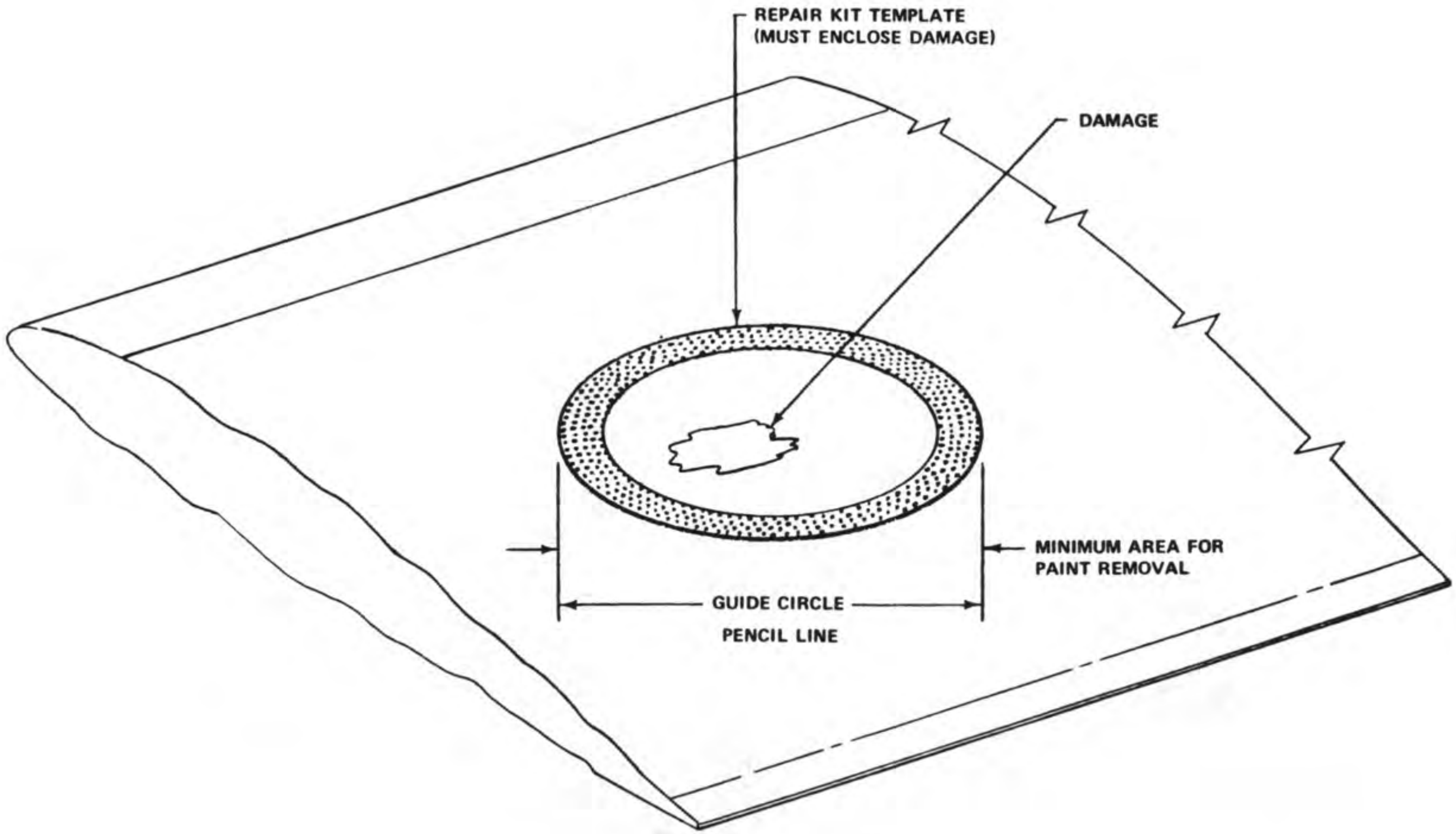
Kit No.	Patch Dia.
K747-201-1	3 in.
K747-201-3	5 in.
K747-201-5	9 in.

(5) Damage passing through both skins with core damage of less than **1** inch diameter shall be repaired by applying a skin patch to both top and bottom sides of blade.

(a) Place the kit template on the blade. Position the inner circle to enclose the damage. Hold the template from slipping, and draw a pencil-line around the outer circle of the template (View A, figure 5-21).

WARNING

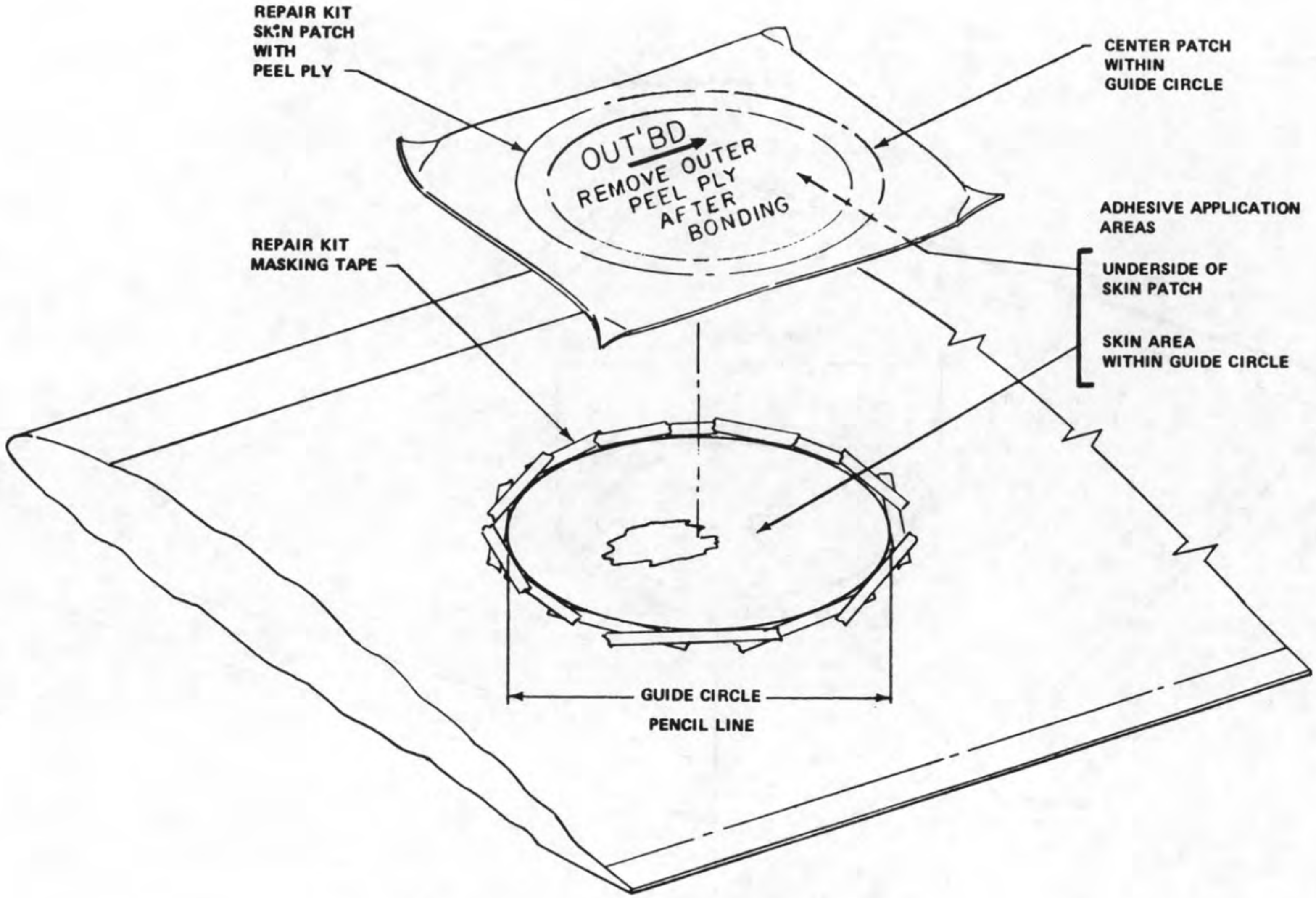
Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.



View A. Marking work area

209747-7-1

Figure 5-21. Application of Skin Patch (K747 Blade) (Sheet 1 of 2)



View B. Application of adhesive, and positioning of patch

209747-7-2

Figure 5-21. Application of Skin Patch (K747 Blade) (Sheet 2 of 2)

CAUTION

Care shall be taken to prevent MEK (C74) from entering core area of blade. Spillage shall be avoided. MEK can damage leading edge erosion guard.

(b) Put on cotton gloves (kit) and then plastic gloves (kit). Dampen cheesecloth (kit) with MEK (C74) and rub off paint from skin in area within the guide circle.

CAUTION

Excessive sanding will weaken blade skin. Sand only until yellow color is removed.

(c) Starting with 120 grit and finishing with 220 grit abrasive paper (from kit), sand the paint and the yellow primer from the blade from the area within the guide circle. Sand only until yellow color is removed. Do not sand skin fibers. Also, sand off any damaged material raised above normal contour of blade. (View A, figure 5-21).

(d) Wipe off all sanding dust.

(e) Use template to redraw guide circle.

(f) Cut short lengths of the masking tape (kit) and mask around the outside of guide circle (View B, figure 5-21).

(g) Put on cotton gloves (kit) and then plastic gloves (kit). Leave gloves on until completion of step (m).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent MEK from entering core area of blade. Spillage shall be avoided. MEK can damage leading edge erosion guard.

CAUTION

Surfaces to be bonded must be clean, dry, and free of finger prints and all foreign material.

(h) Dampen clean cheesecloth (kit) with MEK (C74) and clean inside masked area. Wipe with clean, dry cheesecloth before dampness evaporates.

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect the skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning the skin.

NOTE

Never mix less than a complete 32-gram two part package of adhesive. Mix the full batch and then discard the excess after the repair is completed.

A 3-inch skin patch will require approximately 0.100 package of adhesive (refer to table 5-2). A 5-inch skin patch will require approximately 0.125 package, and a 9-inch skin patch will require approximately 0.333 package (refer to table 5-2).

(i) Open the adhesive package and empty the tube (curing agent) into the cup (resin). Stir with kit wooden spatula until all streaks have disappeared and color is uniform.

NOTE

Pot life of adhesive is 15 minutes at 72°F (22.0°C). It is shorter at higher temperatures. Repair procedures shall be completed without delay.

(j) Using clean one-inch kit brush, apply a light coat of adhesive to blade skin, within guide circle, and to underside of skin patch (View B, figure 5-21).

(k) Center skin patch within guide circle, with stenciled arrow pointing outboard (spanwise), and press firmly into place. Slide patch back and forth slightly under hand pressure to even adhesive. Use light hand pressure to squeeze the patch from the center to edge to work out any air bubbles.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent MEK from entering core area of blade. Spillage shall be avoided. MEK can damage leading edge erosion guard.

(l) Using clean cheececloth (kit) dampened with MEK (C74), temporarily lift edges of peel-ply and wipe off excess adhesive.

(m) Place masking tape over edge of patch in four places to prevent movement of patch. Place two long pieces of masking tape at right angles, centered over the patch spanwise and chordwise and extending beyond the dimensions of the blade repair fixture bladder.

(n) Install blade repair fixture (figure 5-22).

1 Install from trailing edge side of blades only.

2 Center bladder over repair area, and secure.

3 Center pad opposite bladder, and secure.

CAUTION

Tightening of locking knobs so that metal skirt around bladder is closer than 0.125 inch to blade can damage blade.

Grease pencils shall not be used. Only lead-pencil lines shall be made as shown. Pencil marks other than those specified in the instructions can weaken the repair.

4 Tighten fixture channel locking knobs until metal skirt around bladder is approximately **0.125** inch from blade skin.

5 Actuate hand pump to obtain **4** psi reading on pressure gage. Disconnect pump hose clamp from air valve.

NOTE

During curing, it may be necessary to periodically reconnect hose and to actuate pump to maintain 4 psi.

6 Connect **110-volt** ac electrical power for following curing time:

a **30** minutes for patches that overlap spar or trailing edge assembly.

b **15** minutes for patches that no not overlap areas defined in step a.

7 At end of curing time, disconnect electrical power and relieve air pressure by lifting center portion of relief valve.

8 Remove repair fixture from blade.

(o) Refinish repair area.

1 Remove peel-ply and masking tape from blade.

CAUTION

Sanding skin fibers can weaken blade.

2 Using 220 or finer grit abrasive paper (kit), feather edge of adhesive squeeze-out around patch.

3 Paint repaired area in accordance with paragraph 5-31, i.

(p) Adjust blade balance weights as required by figure 5-20.

(q) K747 blade repairs are required to be logged in DA Form 2408-13 and -16. A permanent record must be maintained to determine the minimum spacing requirement between patches. Once a patch has been installed it is not possible to determine which type of repair has been applied.

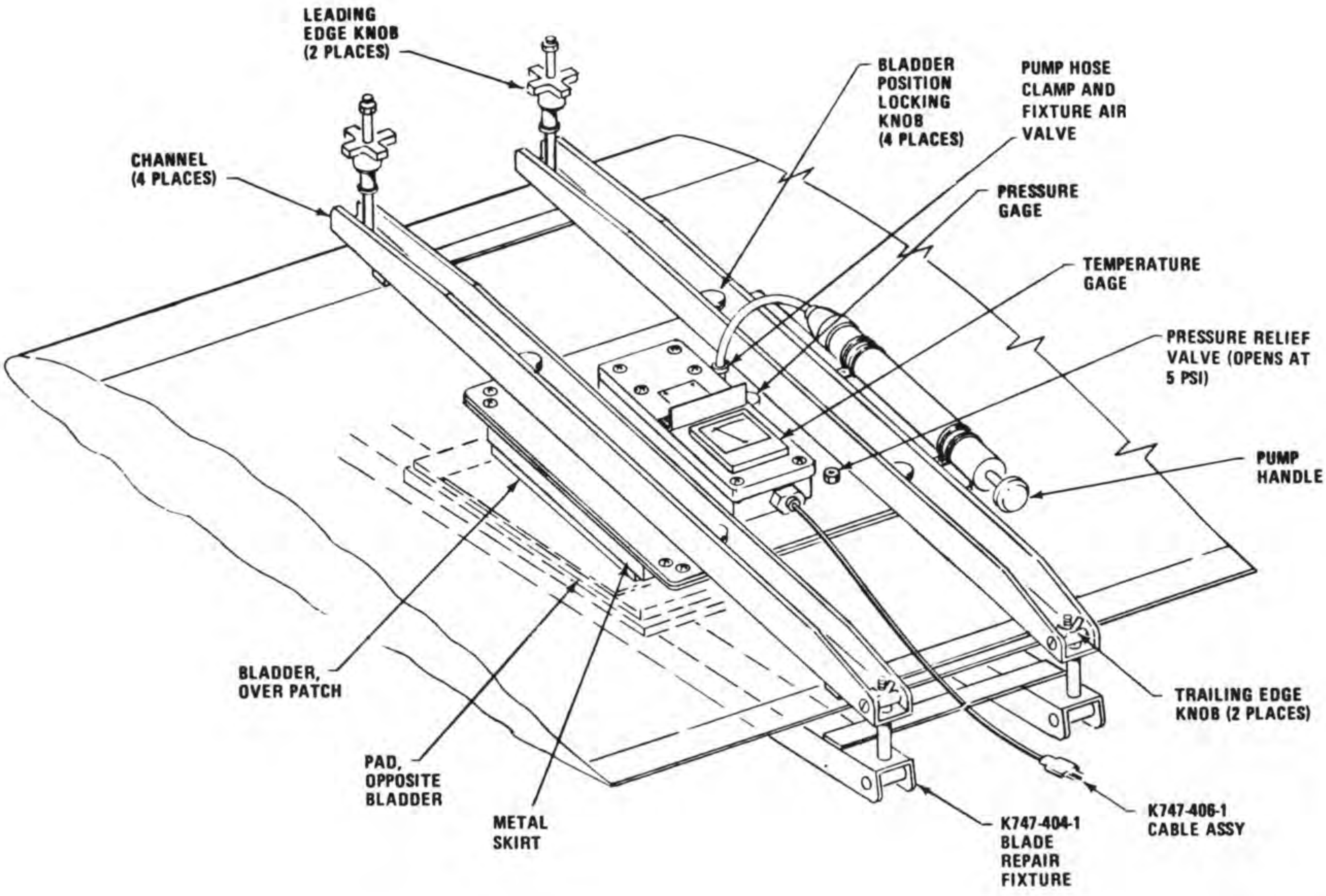


Figure 5-22. Curing Patch with Blade Repair Fixture (K747 Blade)

c. **Installation of Plug Patch (figure 5-23).**

CAUTION

Blade must contain sufficient balance weight to permit adjustment of blade balance after repair. Refer to paragraph 5-30, Repair or Replacement before starting any repair.

Grease pencils shall not be used. Only lead pencil lines shall be made as shown. Pencil marks other than those specified in the instructions can weaken the repair.

NOTE

A clock or watch is require to time adhesive curing.

(1) Position blade for access to damaged area. Support blade to prevent movement and droop.

(2) Measure diameter and depth of damage.

(3) Obtain plug patch repair kit, no larger than necessary to replace damage. A core void **1**-inch or less in diameter is permitted after repair. Plug patch kits are available as shown in table 5-2.

(4) Damage deeper than can be repaired with a single patch or damage that passes completely through blade and is larger than **1** inch diameter, will be repaired by installing plug patches from both top and bottom sides of blade. Install larger diameter and depth plug patch first (figure 5-21).

(a) Obtain required number of adhesive packages (4) as shown in table 5-2.

CAUTION

Grease pencils shall not be used. Only lead pencil lines shall be made as shown. Pencil marks other than those specified in the instructions can weaken the repair.

CAUTION

It is absolutely necessary to take every precaution not to damage the spar and trailing edge during routing. The spar in the leading edge and trailing edge can be located by using the instructions in figure 5-19.

Table 5-2 Plug Patch Data

Kit Part No.	Plug Dia.	Plug Depth	Adhesive Pkg. Req.	Minutes Cure Patch Over Core Only	Minutes Cure Patch Over Core/Spar Core/Trailing Edge
K747-201-7	3 in.	0.250 in.	0.333	15	30
K747-201-9	3 in.	0.500 in.	0.333	15	30
K747-201-101	3 in.	1.250 in.	0.666	30	30
K747-201-103	3 in.	1.750 in.	1.0	30	30
K747-201-105	7 in.	0.250 in.	1.0	15	30
K747-201-107	7 in.	0.500 in.	1.250	15	30
K747-201-109	7 in.	1.250 in.	2.0	45	45
K747-201-111	7 in.	1.750	2.500	45	45

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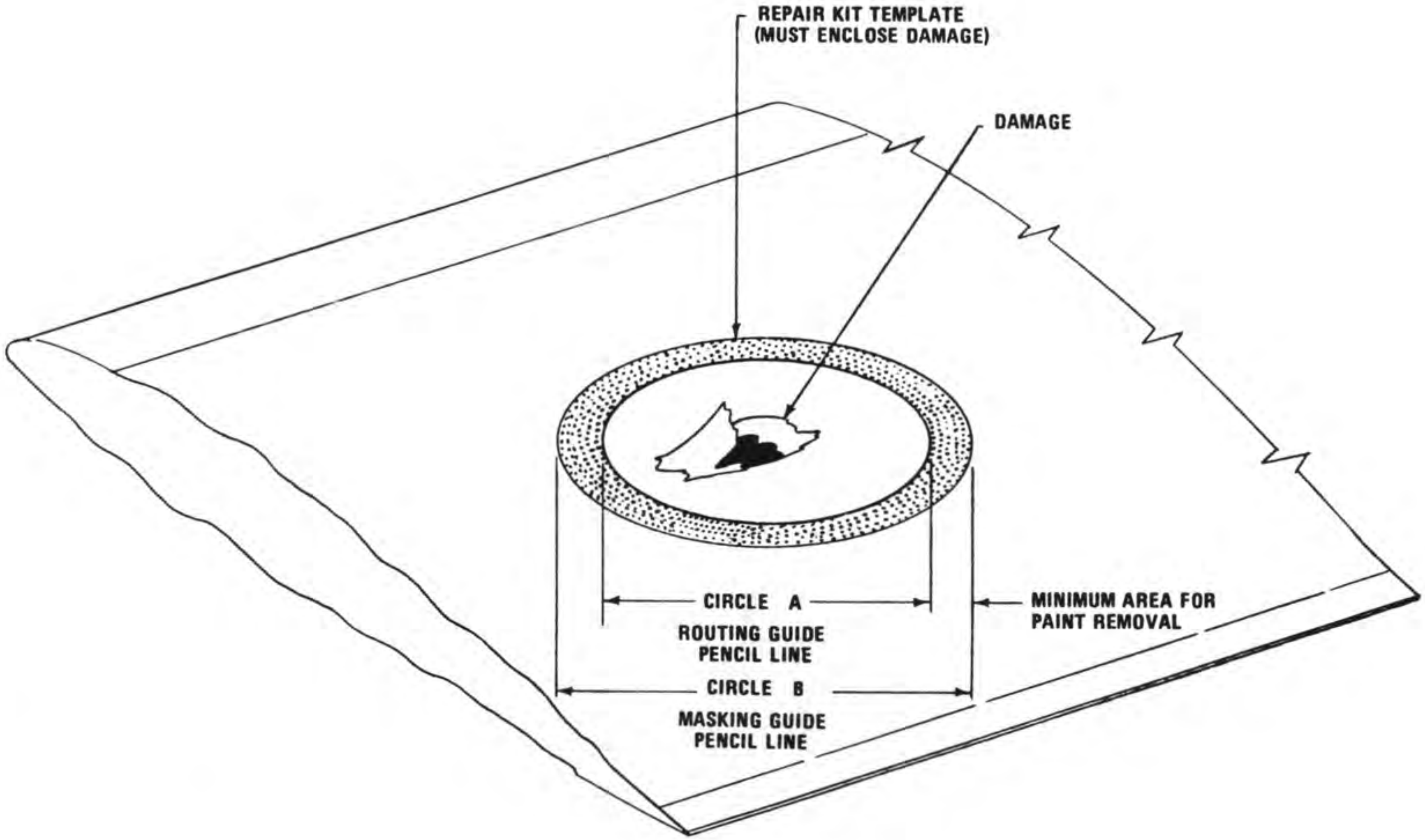
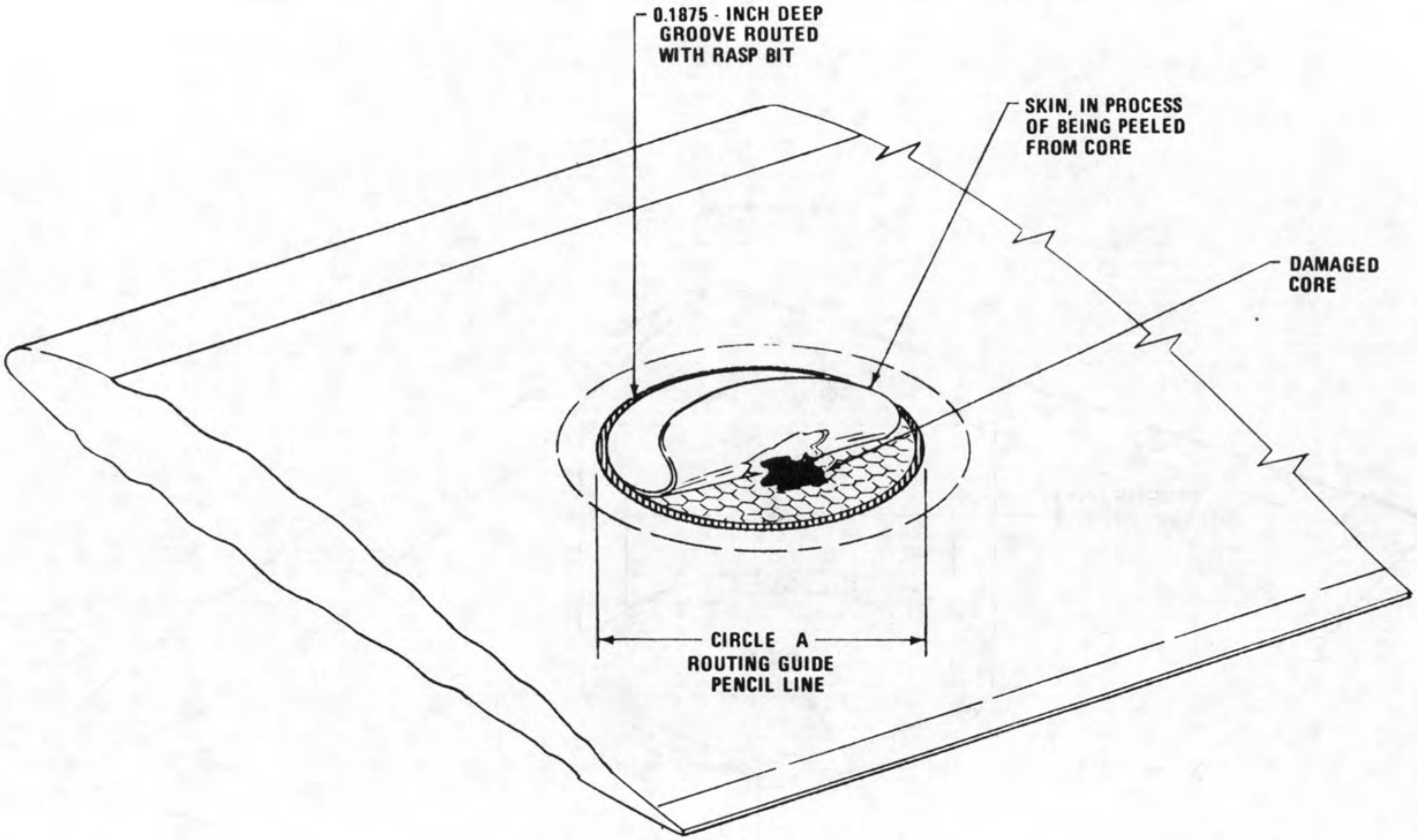


View A. Marking work area

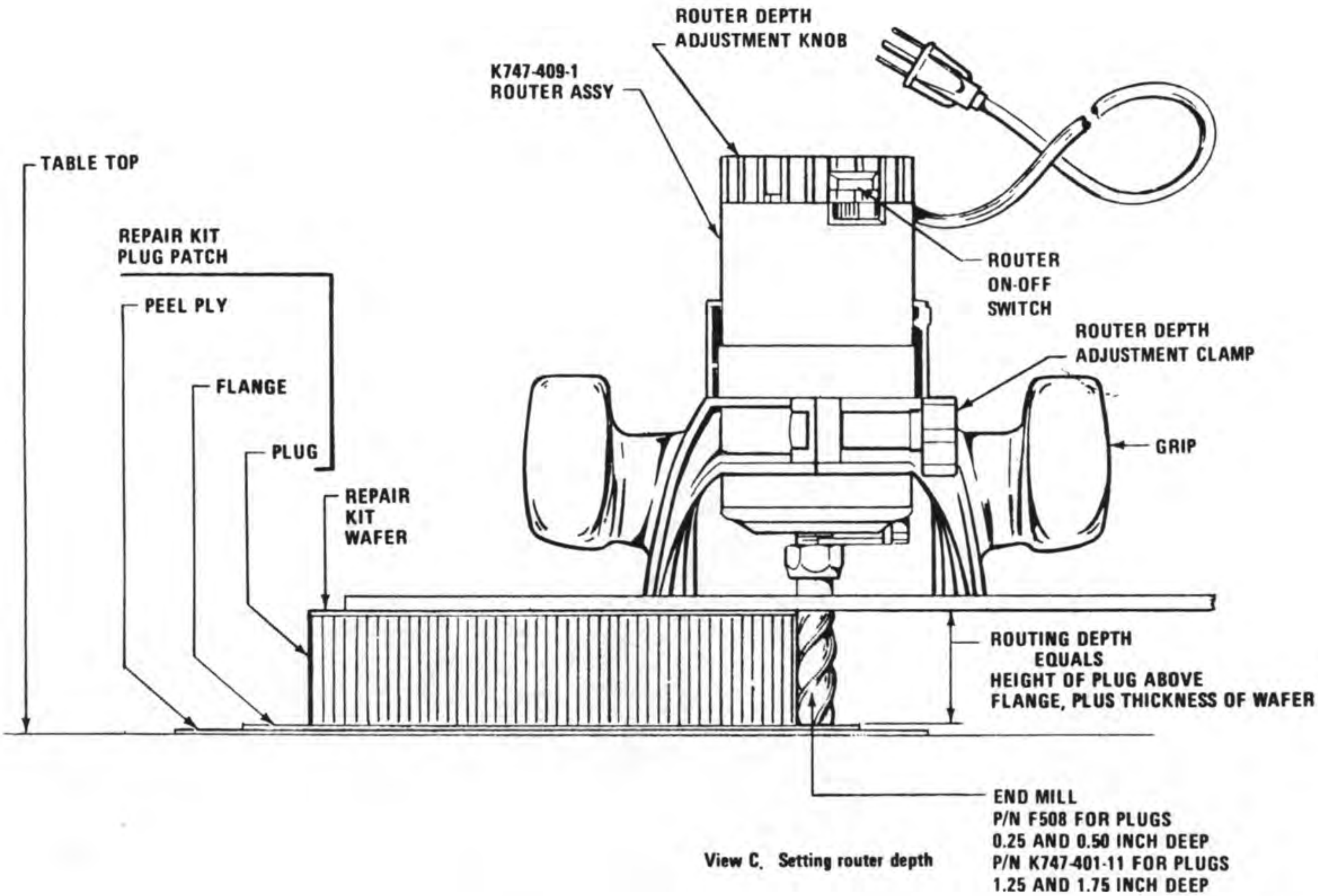
Figure 5-23. Installation of Plug Patch (K747 Blade) (Sheet 1 of 4)



View B. Removal of damaged skin

209747-9-2

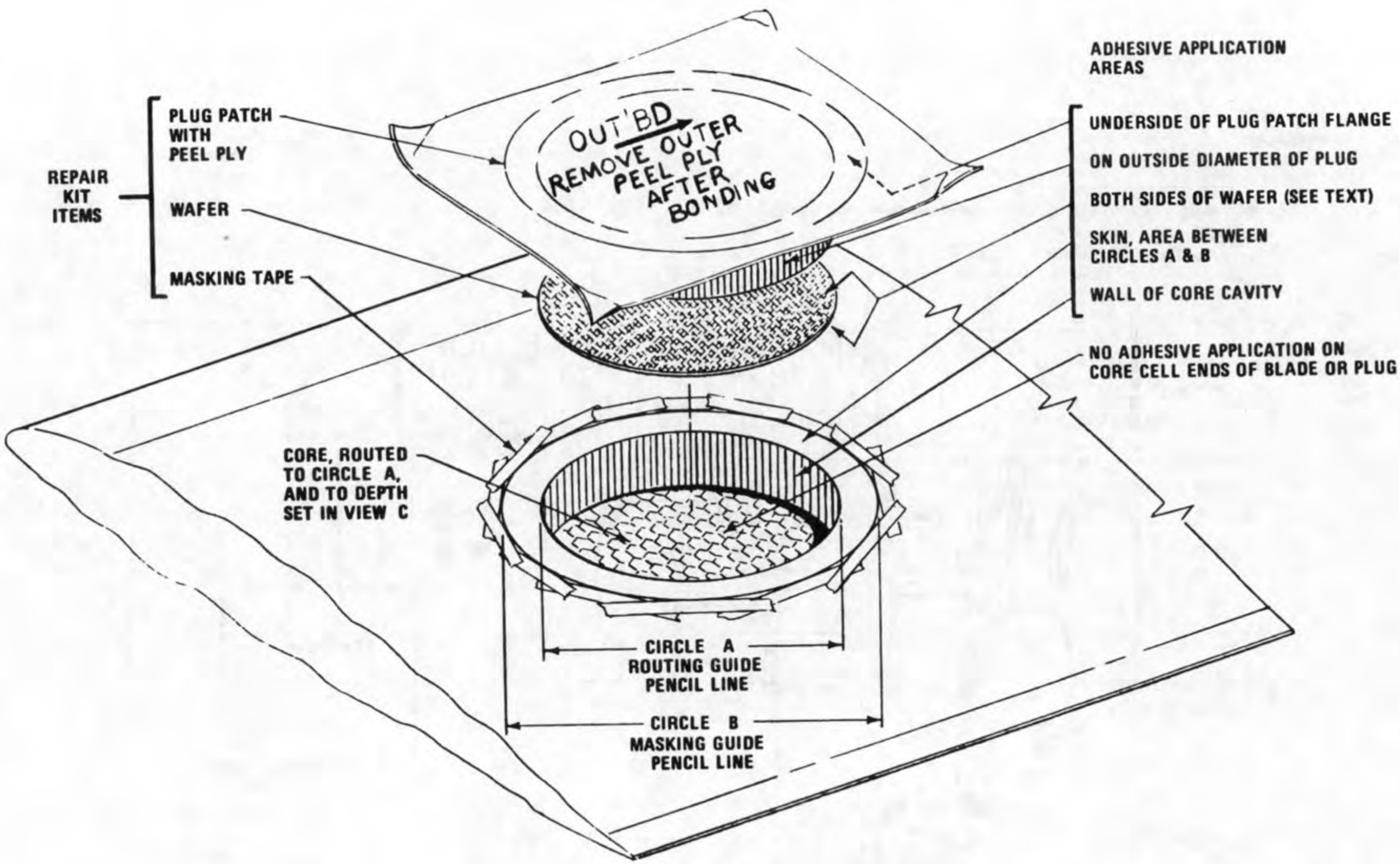
Figure 5-23. Installation of Plug Patch (K747 Blade) (Sheet 2 of 4)



View C. Setting router depth

209747-9-3

Figure 5-23. Installation of Plug Patch (K747 Blade) (Sheet 3 of 4)



View D. Insertion of patch

209747-9-4

Figure 5-23. Installation of Plug Patch (K747 Blade) (Sheet 4 of 4)

NOTE

Spar, core, and trailing edge assembly areas underlying the skin can be verified by a second method by the difference in sound when the blade surface is tapped with a coin.

(b) Place the kit template on the blade. Position the inner circle to enclose the damage. Hold the template from slipping and draw pencil lines around the inner and outer circles of the template (View A, figure 5-23).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent MEK from entering core area of blade. Spillage shall be avoided. MEK can damage leading edge erosion guard.

(c) Put on cotton gloves (kit) and then plastic gloves (kit). Dampen cheesecloth (kit) with MEK (C74) and rub off paint from skin in area between circles A and B.

CAUTION

Excessive sanding will weaken blade skin. Sand only until yellow color is removed.

(d) Starting with 120 grit and finishing with 220 grit abrasive paper (from kit), sand the paint and the yellow primer from the blade from the area between circles A and B. Sand only until yellow color is removed. Do not sand skin fibers (View A, figure 5-23).

(e) Redraw circle A. This circle is the routing guideline.

WARNING

Disconnect router cord from outlet before changing or installing bits or end mills, or making adjustments.

Ensure router switch is in off position before connecting router to electrical power.

Keep hands and fingers away from rotating bits and end mills.

Guide router with both hands on router grip.

Use personnel protection equipment, respirator, goggles, apron, etc.

CAUTION

During all routing operations, long dimension of route base shall be kept in spanwise direction.

End mills will burn out if used to cut skin.

(f) Insert rasp-type bit, P/N 4-BR, in router collet. Set router depth of cut for 0.020 inch. Rout a complete circle through the skin, inside of, and following circle A (View B, figure 5-23).

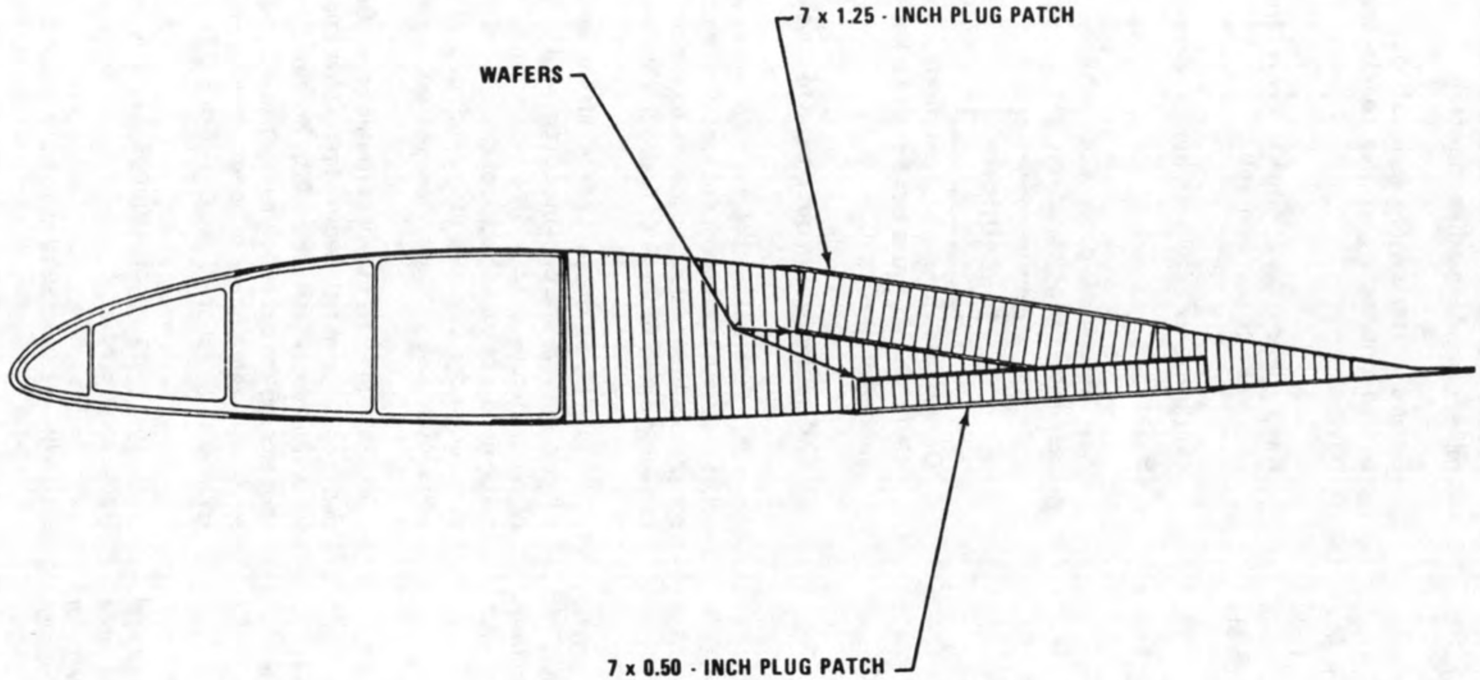
(g) Using duckbill pliers, lift the edge of the cut circle of skin and peel the cut circle of skin off core (View B, figure 5-23). After removing skin, check depth of core at trailing edge of circle. Core thickness at trailing edge side less than depth of plug selected will require use of more shallow plug.

(h) Insert end mill in router collet. Set router depth of cut to match depth of plug plus thickness of kit wafer (View C, figure 5-23). Rout out core. First rout a complete circle, following inside circle A. Then rout out remainder of core moving router in chordwise direction (View D, figure 5-23).

(i) Wipe off all cuttings, sanding dust, etc. from repair area.

(j) Use template to redraw circle B.

(k) Cut short lengths of the masking tape (kit) and mask around the outside of circle B (View D, figure 5-23).



NOTE

LARGER PLUG PATCH IS INSTALLED FIRST

209747-11

Figure 5-24. Typical Double Plug Patch Repair (K747 Blade)

(1) Put on cotton gloves (kit) and then plastic gloves (kit). Leave gloves on until completion of step (s).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent MEK from entering core area of blade. Spillage shall be avoided. MEK can damage leading edge erosion guard.

Surfaces to be bonded must be clean, dry, and free of finger prints and all foreign matter.

(m) Dampen clean cheesecloth (kit) with MEK (C74) and clean skin inside masked area. Also, clean both sides of kit wafer and underside of plug patch flange. Wipe with clean, dry cheesecloth before dampness evaporates.

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect the skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning the skin.

NOTE

Never mix less than a complete 32-gram two part package of adhesive. When less than a full batch is required, mix the full batch and then discard the excess after the repair is completed.

(n) Open the adhesive and empty the tube (curing agent) into the cup (resin). Stir with wooden spatula (kit) until all streaks have disappeared and color is uniform. Repeat if more than one package is required.

NOTE

Pot life of adhesive is 15 minutes at 75 degrees F (22 degrees C). It is shorter at higher temperatures. Repair procedure shall be completed without delay.

(o) Using clean one-inch brush (kit) apply a liberal coat of adhesive to one side of wafer (kit) (View D, figure 5-23).

1 If repair is on top of blade, place wafer in routed cavity with adhesive side down.

2 If repair is on bottom of blade, place adhesive side of wafer against plug (kit), with open ends of plug core up.

CAUTION

Adhesive should not be packed into cells of blade core or plug patch. Excess adhesive can cause blade to be out of balance.

(p) Using spatula or brush (kit), apply a liberal coat of adhesive to walls of cavity in blade core.

(q) Using brush (kit), apply a light coat of adhesive to:

1 Blade skin in masked off area around core cavity.

2 Plug patch flange surrounding plug.

3 Outside diameter of plug.

4 Second side of wafer (wafer was previously coated and placed in step **(o)**.

(r) Position plug patch in cavity with stenciled arrow pointing outboard (spanwise) and press firmly into place. Use light hand pressure to squeeze patch area overlapping blade skin to expel excess adhesive and air bubbles.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent MEK from entering core area of blade. Spillage shall be avoided. MEK can damage leading edge erosion guard.

(s) Using clean cheesecloth (kit) dampened with MEK (C74), temporarily lift edges of peel-ply and wipe off excess adhesive.

(t) Place two long pieces of masking tape at right angles, centered over the patch spanwise and chordwise and extending beyond the dimensions of the blade repair fixture bladder. Install blade repair fixture (figure 5-22).

1 Install from trailing edge side of blade only.

2 Center bladder over repair area and secure.

3 Center pad opposite bladder, and secure.

CAUTION

Tightening of locking knobs so that metal skirt around bladder is closer than 0.125 inch to blade can damage blade.

4 Tighten fixture channel locking knobs until metal skirt around bladder is approximately **0.125** inch from blade skin.

5 Actuate hand pump to obtain **4** psi reading on pressure gage. Disconnect pump hose clamp from air valve.

NOTE

During curing, it may be necessary to periodically reconnect hose, and to actuate pump to maintain 4 psi.

6 Connect **110-volt** ac electrical power for curing time shown in table 5-2.

7 At end of curing time, disconnect electrical power, and relieve air pressure by lifting center portion of relief valve.

8 Remove repair fixture from blade.

(u) Refinish repair area.

1 Remove peel-ply and masking tape from blade.

CAUTION

Sanding skin fibers can weaken blade skin.

2 Using 220 grit abrasive paper (kit), feather edge of adhesive squeeze-out around plug patch.

3 Paint repaired area in accordance with paragraph i. below.

(v) Adjust blade balance weights as required by figure 5-20.

(w) K747 blade repairs are required to be logged in DA Form 2408-13 and -16. A permanent record must be maintained to determine the minimum spacing requirement for patches. Once a patch has been installed it is not possible to determine which type of repair has been applied.

d. Application of Trailing Edge Doubler Patch (figure 5-25).

CAUTION

Blade must contain sufficient balance weight to permit adjustment of blade balance after repair. Refer to paragraph 5-30, Repair or Replacement, before starting any repair.

Grease pencils shall not be used. Only lead pencil lines shall be made as shown. Pencil marks other than those specified in the instructions can weaken the repair.

NOTE

A clock or watch is required to time adhesive curing.

(1) Position blade for access to damaged area.

(2) Support blade to prevent movement and droop.

(3) Obtain trailing edge doubler patch repair kit, P/N K747-201-113, and adhesive package (C4).

(4) Place the kit template on the blade, centering it spanwise over the damage. Hold the template from slipping and draw a pencil-line around the template on both the top and bottom of the blade (View A, figure 5-25).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Spillage of MEK shall be avoided. MEK can damage leading edge erosion guard.

(5) Put on cotton gloves (kit) and then plastic gloves (kit). Dampen kit cheesceloth with MEK (C74) and rub off paint from skin in area within the guide lines on both sides of blade and along trailing edge.

CAUTION

Excessive sanding will weaken blade skin. Sand only until yellow color is removed.

(6) Starting with 120 grit and finishing with 220 grit abrasive paper (from kit), sand the paint and the yellow primer from the blade from the area within the guide lines on both sides of blade and along trailing edge. Sand only until yellow color is removed. Also sand off any material that may be raised above the normal contour of the blade at edges of damage. Do not sand undamaged skin fibers (View A, figure 5-25).

(7) Wipe off all cuttings, sanding dust, etc., from repair area.

(8) Use template to redraw guide lines (View A, figure 5-25).

(9) Cut lengths of the masking tape (kit) and mask around the outside of the guide lines (View B, figure 5-25).

(10) Put on cotton gloves (kit) and then plastic gloves (kit). Leave gloves on until completion of step (16).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect the skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning the skin.

CAUTION

Spillage of MEK shall be avoided. MEK can damage leading edge erosion guard.

Surfaces to be bonded must be clean, dry and free of finger prints and all foreign matter.

(11) Dampen clean cheesecloth (kit) with MEK (C74) and clean skin inside masked area. Wipe with clean, dry, cheesecloth before dampness evaporates.

NOTE

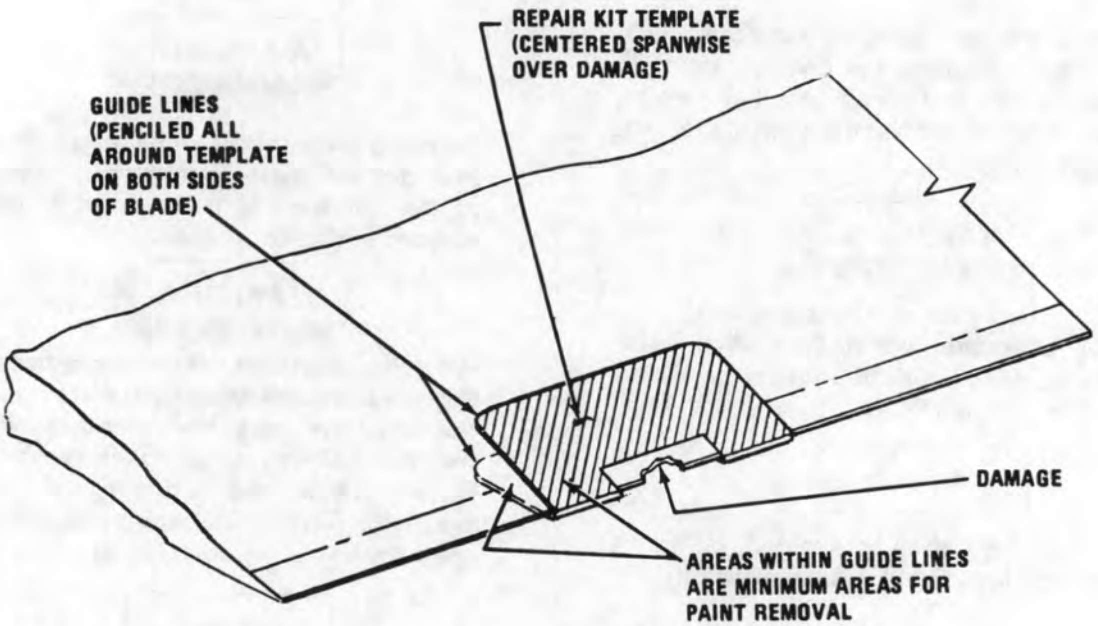
Never mix less than a complete 32-gram two part package of adhesive. When less than a full batch is required, mix the full batch and then discard the excess after the repair is completed.

(12) Open the adhesive package and empty the tube (curing agent) into the cup (resin). Stir with wooden spatula (kit) until all streaks have disappeared and color is uniform.

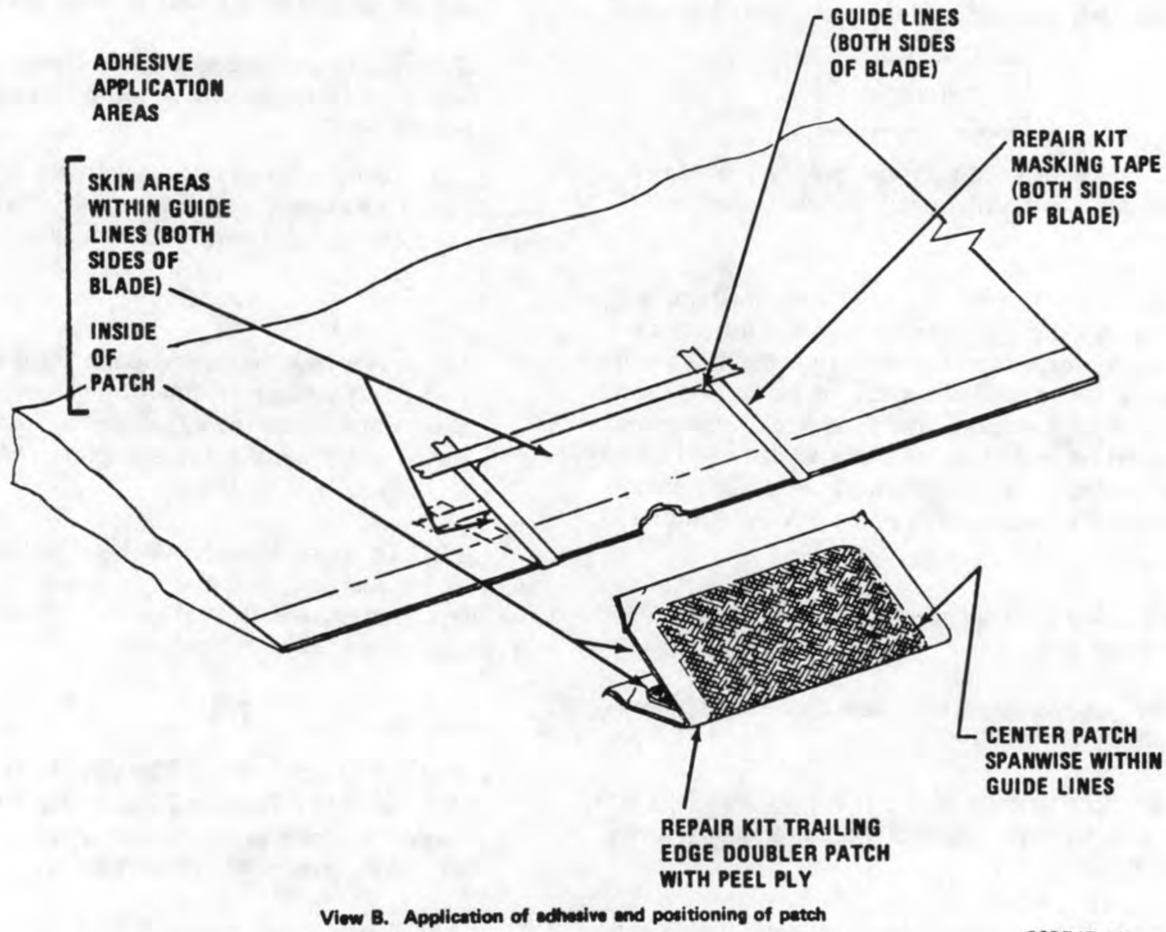
NOTE

Pot life of adhesive is 15 minutes at 75 degrees F (22 degrees C). It is shorter at higher temperatures. Repair procedures shall be completed without delay.

(13) Using clean one-inch brush (kit), apply a light coat of adhesive to inside surfaces of doubler patch (View B, figure 5-25).



View A. Marking work area



View B. Application of adhesive and positioning of patch

209747-12

Figure 5-25. Application of Trailing Edge Doubler Patch (K747 Blade)

(14) Center doubler patch within guide lines and press into place. Slide patch back and forth slightly under hand pressure to even adhesive. Push patch firmly against trailing edge and center within guide lines. Use light hand pressure to squeeze the patch from the center to edges to work out any air bubbles.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Spillage of MEK shall be avoided. MEK can damage leading edge erosion guard.

(15) Using clean cheesecloth (kit) dampened with MEK (C74), temporarily lift edges of peel-ply and wipe off excess adhesive.

(16) Place masking tape over edges of patch to prevent movement of patch.

(17) Install blade repair fixture (figure 5-22).

(a) Install from trailing edge side of blade only.

(b) Position bladder over repair area, and secure.

(c) Center pad opposite bladder, and secure.

CAUTION

Tightening of locking knobs so that metal skirt around bladder is closer than 0.125 inch to blade can damage blade.

(d) Tighten fixture channel locking knobs until metal skirt around bladder is approximately 0.125 inch from blade skin.

(e) Actuate hand pump to obtain 4 psi reading on pressure gage. Disconnect pump hose from air valve.

NOTE

During following 30 minute curing time, it may be necessary to periodically reconnect hose and to actuate pump to maintain 4 psi.

(f) Connect 110-volt ac electrical power for 30 minutes.

(g) At end of 30 minutes, disconnect electrical power and relieve air pressure by lifting center portion of relief valve.

(h) Remove repair fixture from blade.

(18) Refinish repair area.

(a) Remove peel-ply and masking tape from blade.

CAUTION

Sanding fibers can weaken blade skin.

(b) Using 220 grit abrasive paper (kit) feather edge of adhesive squeeze-out around patch.

(c) Paint repaired area in accordance with paragraph i. below.

(19) Adjust blade balance weights as required by figure 5-20.

(20) Make proper form entry for repair.

e. Replacement of Trim Tab (figure 5-26).

CAUTION

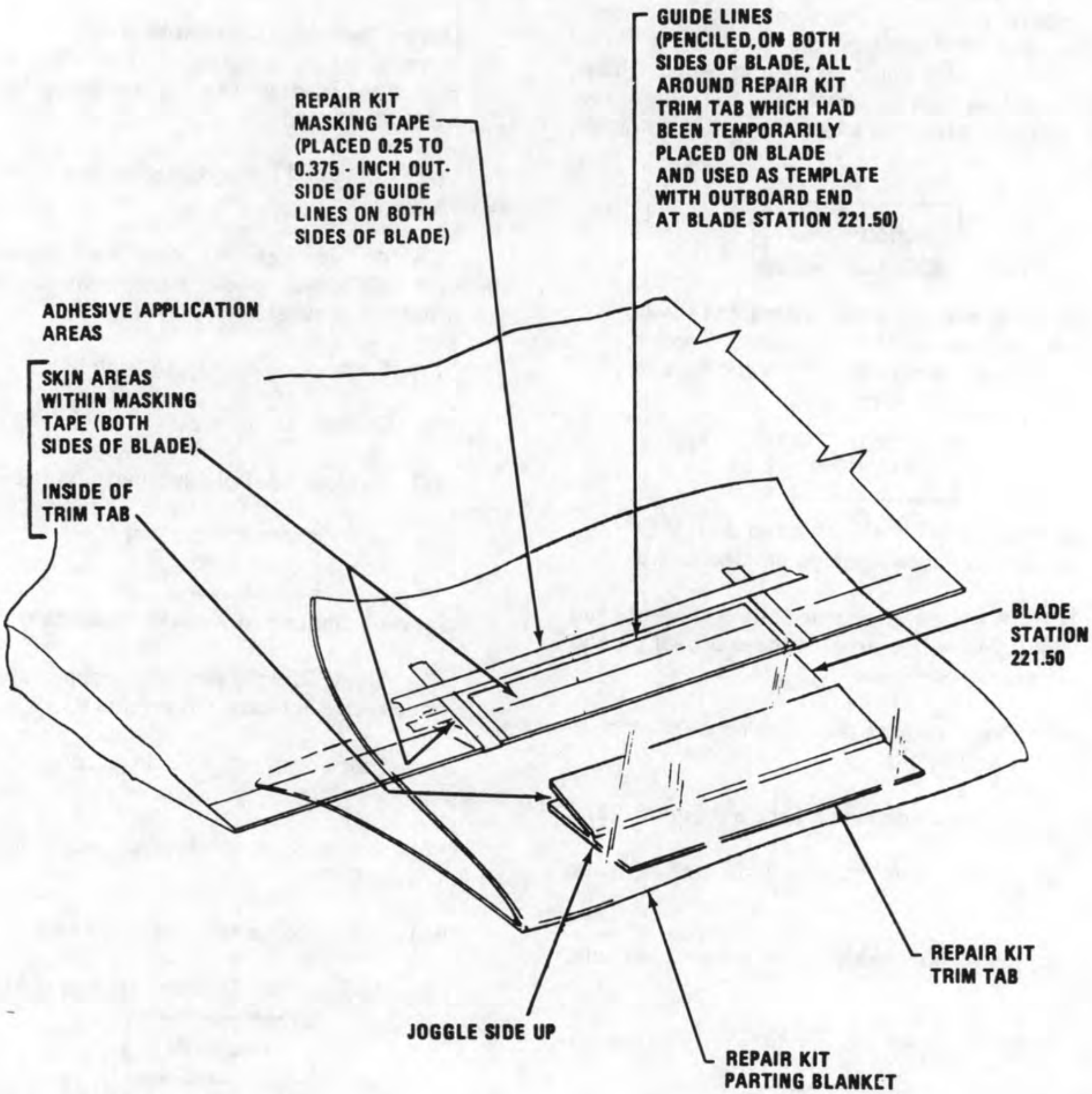
Grease pencils shall not be used. Only lead pencil lines shall be made as shown. Pencil marks other than those specified in the instructions can weaken the repair.

NOTE

A clock or watch is required to time adhesive curing.

(1) Position blade for access to damaged trim tab. Support blade to prevent movement and droop.

(2) Obtain trim tab repair kit, P/N K747-201-115, and adhesive package (C4).



NOTE

PAINT PREVIOUSLY REMOVED FROM BOTH SIDES OF BLADE IN AREAS NOW DEFINED BY MASKING TAPE.

CAUTION

OUTBOARD END OF TRIM TAB SHALL BE AT BLADE STATION 221.50. MISLOCATION WILL DISTURB BLADE BALANCE.

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Figure 5-26. Replacement of Trim Tab (K747 Blade)

(3) Remove damaged trim tab.

CAUTION

Extreme care must be taken to prevent damage to underlying skin to which the trim tab is bonded.

(a) Make a pencil mark on blade skin along outboard end of trim tab.

(b) Use a standard wood chisel (bevel side down) to carefully pry up a forward corner of the trim tab.

(c) Once a corner is raised, grip it with pliers and peel it back while continuing to pry with the chisel.

(d) After removal of the trim tab, inspect the underlying area of the blade for damage. Damage beyond limits listed in table 5-1 is not reparable at AVIM.

(e) Extend pencil mark made in step (a), about **6** inches toward blade leading edge.

CAUTION

Sanding fibers can weaken blade skin.

(4) Using 120 grit abrasive paper (from kit) remove old adhesive from top and bottom of blade.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Spillage of MEK shall be avoided. MEK can damage leading edge erosion guard.

(5) Put on cotton gloves (kit) and then plastic gloves (kit). Dampen kit cheesecloth with MEK (C74). Rub off paint from top and bottom skin in areas at least **0.25** inch larger all around than old trim tab.

CAUTION

Excessive sanding will weaken blade skin. Sand only until yellow color is removed.

(6) Starting with 120 grit and finishing with 220 grit abrasive paper (from kit), sand the yellow primer from the blade from the areas in which paint was removed. Sand only until the yellow color is removed. Do not sand skin fibers.

(7) Wipe off all sanding dust.

(8) Put on cotton gloves (kit) and then plastic gloves (kit).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Spillage of MEK shall be avoided. MEK can damage leading edge erosion guard.

(9) Dampen clean cheesecloth (kit) with MEK (C74) and clean skin in sanded areas. Wipe with clean, dry cheesecloth before dampness evaporates.

CAUTION

Mislocation of trim tab will disturb blade balance.

(10) Temporarily slide repair kit trim tab onto blade with outboard end of trim tab at pencil mark made in step (3) above (blade station 221.50). On top and bottom blade skin, mark pencil guide lines around trim tab. Remove trim tab.

(11) Cut lengths of the masking tape (kit) and mask off top and bottom blade skin **0.25 TO 0.38** inch outside guide lines.

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning the skin.

NOTE

Never mix less than a complete 32-gram two part package of adhesive. When less than a full batch is required, mix the full batch and then discard the excess after the repair is completed.

(12) Open the adhesive package and empty the tube (curing agent) into the cup (resin). Stir with kit wooden spatula until all streaks have disappeared and color is uniform.

NOTE

Pot life of adhesive is 15 minutes at 75 degrees F (22 degrees C). It is shorter at higher temperatures. Repair procedure shall be completed without delay.

(13) Using clean one-inch kit brush, apply a light coat of adhesive to top and bottom blade skin within masked areas and to inside of trim tab.

(14) Align trim tab with guide lines and press firmly into place. Slide trim tab back and forth slightly under hand pressure to even adhesive. Use light finger pressure to squeeze trim tab from center to edges to work out any air bubbles.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent MEK from entering core area of blade. Spillage shall be avoided. MEK can damage leading edge erosion guard.

(15) Using clean cheesecloth (kit) dampened with MEK (C74), wipe off excessive adhesive around trim tab.

(16) Check that trim tab is aligned with guide lines. Place masking tape over edges of trim tab to prevent movement of tab.

CAUTION

Other materials shall not be substituted for repair kit parting blanket. Substitutes can cause repair fixture to be bonded to blade.

(17) Place parting blanket on blade to completely cover both top and bottom of work area. Place masking tape (kit) over edges of parting blanket to prevent movement.

(18) Install blade repair fixture (figure 5-22).

(a) Install from trailing edge side of blade only.

(b) Position bladder over trim tab with aft edge of bladder aligned with joggle in trim tab and secure.

(c) Center pad opposite bladder and secure.

CAUTION

Tightening of locking knobs so that metal skirt around bladder is closer than 0.125 inch to blade can damage blade.

(d) Tighten fixture channel locking knobs until metal skirt around bladder is approximately 0.125 inch from blade skin.

(e) Actuate hand pump to obtain 4 psi reading on pressure gage. Disconnect pump hose from air valve.

NOTE

During following 30-minute curing time, it may be necessary to periodically reconnect hose and to actuate pump to maintain 4 psi.

(f) Connect 110-volt ac electrical power for 30 minutes.

(g) At end of **30** minutes, disconnect electrical power and relieve air pressure by lifting center portion of relief valve.

(h) Remove repair fixture from blade.

(19) Refinish repair area.

(a) Remove parting blanket and masking tape from blade.

CAUTION

Sanding skin fibers can weaken blade skin.

(b) Using 220 grit abrasive paper (kit) feather edge of adhesive squeeze-out around trim tab.

(c) Paint repaired area in accordance with paragraph i. below.

f. Rebonding Delaminated Leading Edge Erosion Guard (figure 5-27).

(1) Position blade for access to delaminated erosion guard. Support blade to prevent movement and droop.

(2) Obtain erosion guard rebonding kit, P/N K747-210-117, and epoxy resin (C98).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Isopropyl alcohol can damage leading edge erosion guard - avoid spillage.

(3) Using cotton tipped swab (kit) dipped in isopropyl alcohol (C64) solvent clean surfaces to be bonded.

(4) Using masking tape (kit), mask blade along trailing edge of boot to prevent squeezed-out adhesive from coming in contact with the exposed blade surface.

(5) Put on cotton gloves (kit) and then plastic gloves (kit).

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect the skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning the skin.

Protective equipment must be used when performing these repairs.

CAUTION

Surfaces to be bonded must be clean, dry, and free of finger prints and all foreign matter.

NOTE

Suggested mix ratio: 100 grams of resin to 12 grams of DTA by weight.

(6) Mix **100** parts by weight of epoxy resin (C98) with **12** parts by weight of DTA activator (C98) in a clean glass, metal, polyethylene, or plastic coated paper container.

NOTE

Pot life of adhesive is 15 minutes at 75 degrees F (22 degrees C). It is shorter at higher temperatures. Repair procedure shall be completed without delay.

(7) Using clean **0.25** inch brush (kit), apply a light coat of adhesive to both surfaces to be bonded.

(8) Using finger pressure, press erosion guard to blade while working out excess adhesive from under the erosion guard. Wipe away excess adhesive with clean cheesecloth (kit) to prevent adhesive from running off the masking tape onto the exposed blade surface.

(9) Lay teflon parting blanket (kit) over repair. Place masking tape (kit) over edges of parting blanket to prevent movement.

(10) Obtain two wooden blocks approximately **0.75 x 2 x 6** inches and a "C" clamp (**8** inch opening by **6** inches deep). Place **0.25** inch thick strip of

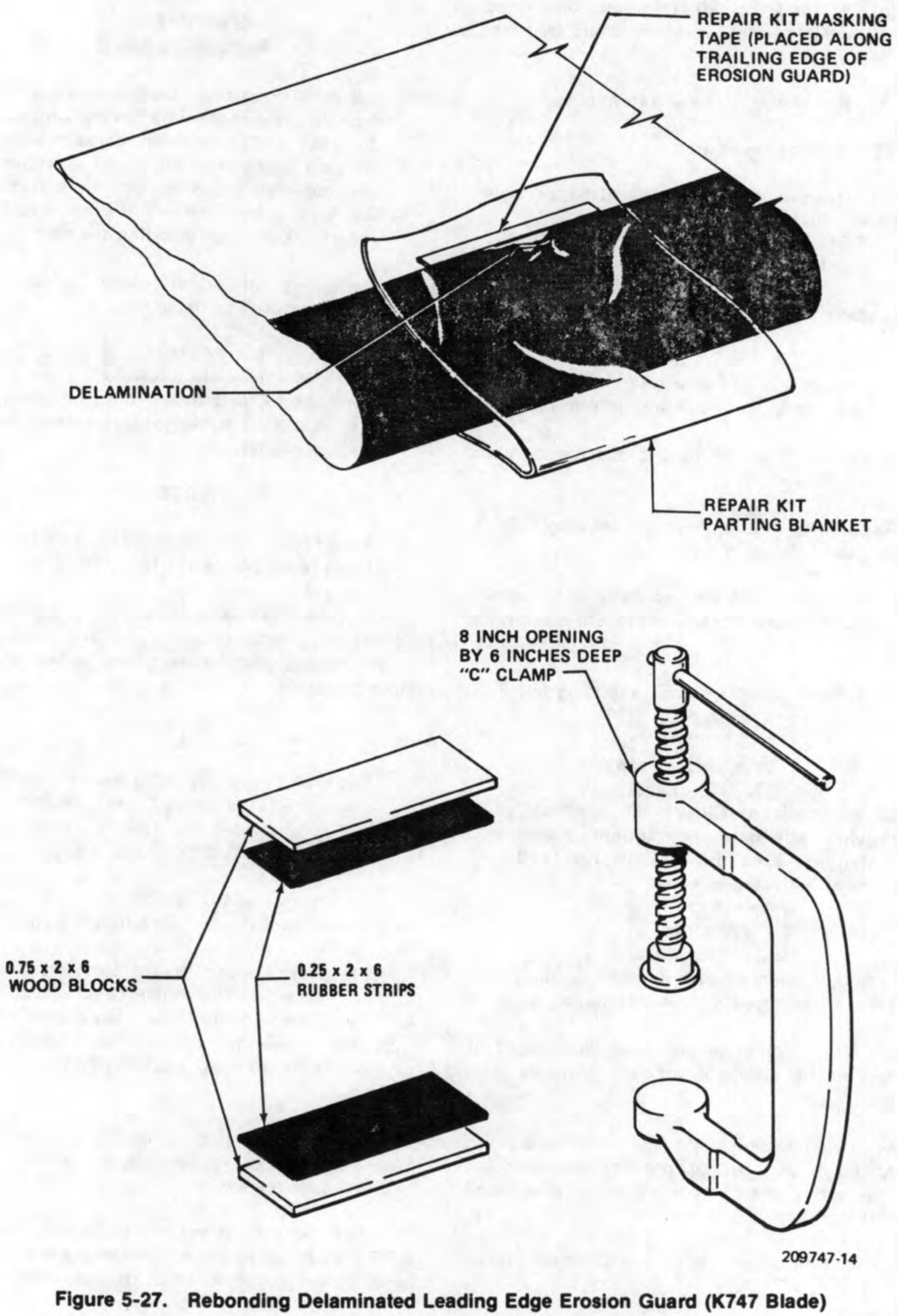


Figure 5-27. Rebonding Delaminated Leading Edge Erosion Guard (K747 Blade)

rubber, approximately **2 x 6** inches between block and parting blanket. Place remaining block on opposite surface and, using "C" clamp, apply light pressure to rebonded area.

(11) At end of **four** hours, at room temperature, remove clamp, blocks, rubber strip, parting blanket, and masking tape.

f.1 Repair of Nicks and Cuts on Erosion Guard.

(1) The cuts and nicks are repaired by softening the guard with the sealing iron (T-89).

CAUTION

Excessive heat will cause the Estane to loose its properties and bulge. Use care to keep at low heat.

(2) Set the temperature at the minimum temperature. Use just enough heat to cause the Estane guard material to be soft. Keep the iron moving.

(3) Small damage can be repaired by moving the material from each side of the damage with the sealing iron.

(4) A 0.25 inch damage can be repaired by adding slivers of Estane guard (kit).

(5) Using a clean 1-inch brush, apply one medium thick coat of MEK (C74). Do not overbrush the same area more than three times.

(6) Allow to air dry for a minimum of 1 hour.

NOTE

The coating will develop optimum durability in approximately 6 to 8 hours. Flying in rain conditions with less drying time may cause rapid erosion of resurfaced area.

Refinishing Paint: When actual operational emergencies require immediate use of the helicopter, touch-up painting may be deferred until termination of the actual emergency.

CAUTION

The only paint refinishing authorized is the touch-up of repaired areas. This restriction is necessary to maintain lightning protection and radar signature characteristics of the blade.

g. Application of Leading Edge Erosion Guard Patch (figure 5-28).

CAUTION

Blade must contain sufficient balance weight to permit adjustment of blade balance after repair, Refer to paragraph 5-30, Repair or Replacement, before starting any repair.

Grease pencils shall not be used. Only lead pencil lines shall be made as shown. Pencil marks other than those specified in the instructions can weaken the repair.

NOTE

A clock or watch is required to time adhesive curing.

(1) Position blade for access to damaged leading edge erosion guard. Support blade to prevent movement and droop.

(2) Obtain leading edge erosion guard patch kit, P/N K747-201-119, and erosion coating (C39).

(3) Place the kit template on the erosion guard centering it over the damage. Hold template from slipping and, using lead pencil, mark outline of template on erosion guard.

(4) Cut lengths of masking tape (kit) and mask around outside of the guide lines.

(5) Using 180 or 220 grit sandpaper, (kit), abrade area of erosion guard inside guidelines and underside surface of patch.

(6) Put on cotton gloves (kit) and then plastic gloves (kit). Leave gloves on until completion of step 11.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(7) Using clean cheesecloth (kit) and isopropyl alcohol (C64) solvent wipe surfaces to be bonded.

(8) Using clean one-inch brush (kit), apply a light coat of erosion guard resurfacing coating (C39) within masked area of erosion guard and to the underside surface of the patch. Allow to air dry for five minutes.

CAUTION

Patch will adhere to erosion guard on contact. Make certain that patch is correctly aligned before making contact.

(9) Starting towards leading edge of blade, install patch, working it carefully into place with fingers, using extreme care not to entrap air under patch. Press all areas of patch firmly into contact with erosion guard.

(10) Remove masking tape.

(11) Using one-inch brush (kit) apply a medium thick coat of erosion guard (C39) to the patch, extending over the edges of the patch to blend into adjacent area of the erosion guard.

(12) Adjust blade balance weights as required by figure 5-20.

(13) Allow to air dry **twelve** hours.

h. Restoration of Leading Edge Erosion Coating.

(1) Position blade for access to eroded leading edge erosion guard. Support blade to prevent movement and droop.

(2) Using 180 to 240 grit sandpaper (C102), abrade the part of the erosion guard requiring restoration of surface coating.

(3) Wipe away residue with clean cheesecloth (C34).

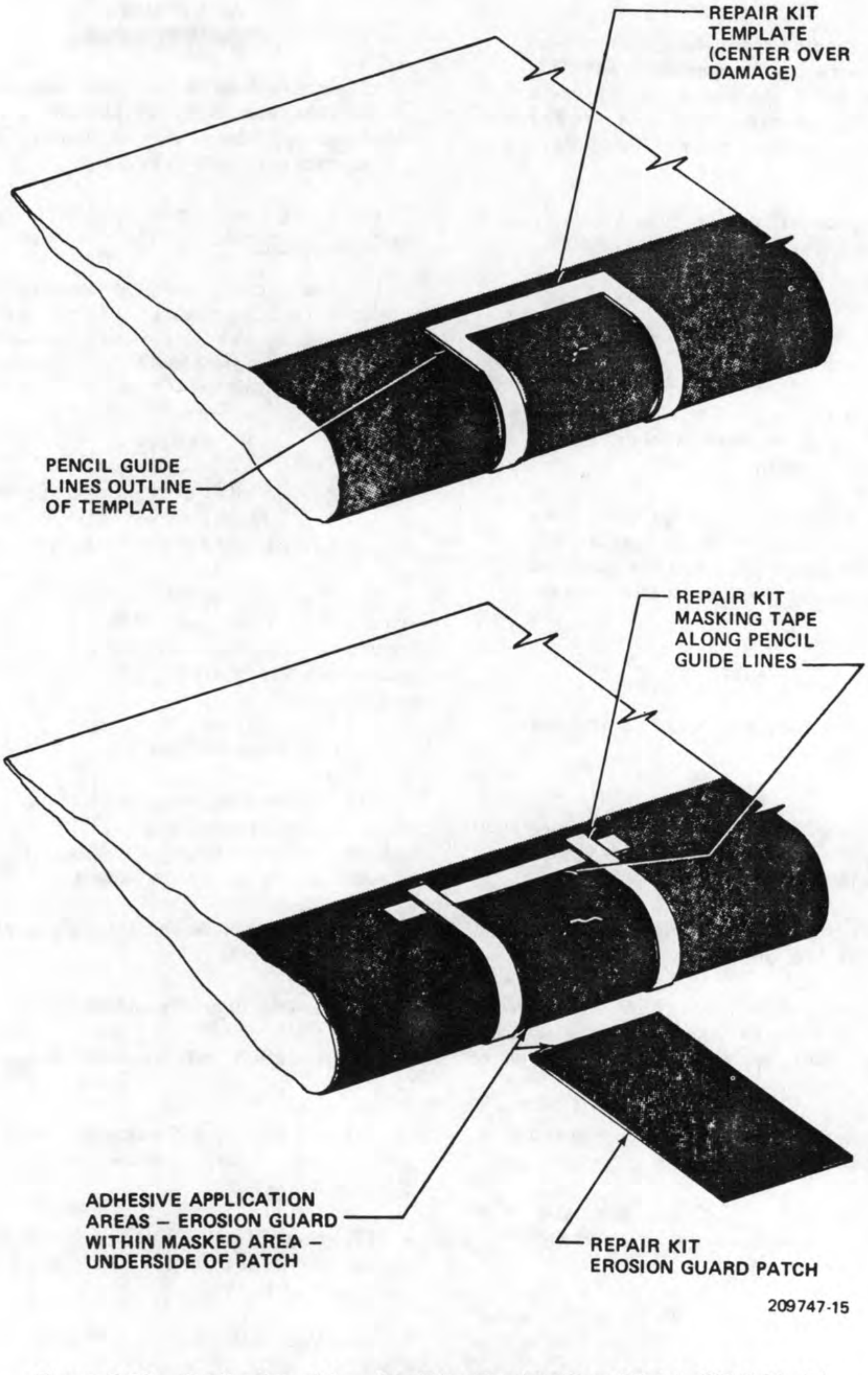


Figure 5-28. Application of Leading Edge Erosion Guard Patch (K747 Blade)

(4) Using a clean one-inch brush, apply one medium thick coat of erosion coating (C39). Do not overbrush the same area more than three times.

(5) Allow to air dry for a minimum of **one**-hour.

NOTE

The coating will develop optimum durability in approximately six to eight hours. Flying in rain conditions with less drying time may cause rapid erosion of resurfaced area.

h.1. Replacing Sections of Erosion Guard

(1) Position blade for access to damaged leading edge erosion guard. Support blade to prevent movement and droop.

(2) Using sharp knife, remove all damage from guard including separated guard. Cut the guard in such a pattern that can be duplicated with a like patch (circle, square, rectangle).

(3) Use 180 to 240 grit sandpaper (C102) to remove guard adhesive. Avoid removing any of the spar. This will appear as white dust.

WARNING

Isopropyl alcohol is flammable. Keep away from heat and open flame. Provide adequate ventilation when using. Avoid breathing vapors and prolonged contact with skin.

CAUTION

Isopropyl alcohol can damage leading edge erosion guard. Avoid spillage.

(4) Using cotton tipped swab (kit), dip in isopropyl alcohol (C64) solvent. Clean surfaces to be bonded.

(5) Using masking tape (kit), mask around cut out section to protect guard from solvents and adhesive.

(6) Make a pattern from cut out section. This pattern will be used to make the replacement patch. Use the 4 in. x 8 in. patch from patch kit, P/N K747-201-119. Fit patch to mate removed section.

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect the skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning the skin. Protective equipment must be used when performing these repairs.

CAUTION

Surfaces to bonded must be clean, dry, and free of finger prints and all foreign matter.

(7) Bonding the Guard Patches: The preferred method to secure the guard patch to the guard is to use MEK (C74). Cure time is 30 minutes.

NOTE

Patch should overlap by 0.50 inch.

WARNING

Once the contact cement and the patch come in contact, the patch cannot be moved if it is mislocated. It will be necessary to enlarge the repair section.

(8) Alternate Method. **(a)** The alternate method to secure the guard patch to the guard is to use EA 828 (C98). The patch can be moved into position after contacting the adhesive.

NOTE

Suggested Mix Ratio: 100 grams of resin to 10 grams of DTA by weight.

(b) Mix 100 parts by weight. of EPON 828 resin (C98) with 12 parts by weight of DTA activator (C98) in a clean glass, metal, polyethylene, or plastic coated paper container.

NOTE

Pot life of adhesive is 15 minutes at 75°F (22.2°C). It is shorter at higher temperatures. Repair procedure shall be completed without delay.

(c) Using 0.25 inch brush (kit), apply a light coat of adhesive to both surfaces to be bonded.

(d) Using finger pressure, press erosion guard to blade while working out excess adhesive from under the erosion guard. Wipe away excess adhesive with clean cheesecloth (kit) to prevent adhesive from running off the masking onto the exposed blade surface.

(e) Lay Teflon parting blanket (kit) over repair. Place masking tape (kit) over edges of parting blanket to prevent movement.

(f) Obtain two wooden blocks approximately 0.75 in. x 2 in. x 6 in. and a C-clamp (8 in. opening by 6 in. deep). Place 0.25 in. rubber thick strip (or suitable substitute), approximately 2 in. x 1 in. between block and parting blanket. Place remaining block on opposite surface and, using C-clamp, apply light pressure to rebonded area.

NOTE

Pressure can be applied by vacuum or strips of rubber around the blade. These methods should be used on the leading edge where clamps would not be practical.

(g) At the end of four hours at room temperature, remove clamp, blocks, rubber strip, parting blanket, and masking tape.

(h) After cure cycle, bond the patch to the guard by applying heat with a sealing iron as described in new paragraph 5.31f1.

i. Refinishing Paint. Apply refinishing paint as follows:

CAUTION

The only paint refinishing authorized is the touch-up of repaired areas. This restriction is necessary to maintain lightning protection and radar signature characteristics of the blade.

NOTE

When actual operational emergencies require immediate use of the helicopter touchup painting may be deferred until termination of the actual emergency.

(1) Apply primer (C88 or C91) to the repair area as follows:

CAUTION

Only material from the same kit shall be mixed, except that two or more kits may be mixed in the same vessel, provided the kits are all manufactured by the same vendor. Do not mix Component I or Component II from different manufacturers. Established mixing ratios must be followed closely; otherwise, the primer will exhibit unsatisfactory film properties, such as poor adhesion, poor chemical resistance, or inadequate drying. Component II shall always be added to Component I.

NOTE

The epoxy polyamide primer is supplied as a two-component kit. Pot life is limited and only that amount which can be used in less than 8 hours should be mixed.

(a) Each component shall be well agitated and shall be poured separately into the proper capacity container. The material temperature should be at least 70 degrees F (21 degrees C). Component I shall first be poured into the empty container, then Component II shall be slowly poured into Component I with constant stirring.

(b) Thinning (for spraying). The mixed epoxy polyamide primer shall be reduced for spraying with one volume of thinner (C131) to two volumes of mixed primer. The thinned primer shall be stirred thoroughly, strained, and allowed to stand for about 30 minutes prior to use. The thinning ratio may be varied slightly to obtain the proper spraying viscosity. The 30 minute standing period is necessary to:

1. Permit the chemical components to partly react.

2. Shorten the drying time.

3. Reduce cratering.

4. Preclude Component II from "sweating out" or migrating.

5. Allow any bubbles (formed while stirring) to escape..

(c) Remove sanding dust using clean cheesecloth dampened with thinner (C131).

(d) Mask off touchup area.

(e) Apply a cross coat of primer allowing the first coat to air dry about **5** minutes and the final coat about **30** minutes. If temperature is below **70** degrees F. (**21.1** degrees C), allow to dry about **2 TO 3** hours. Do not apply below **50** degrees F (**19** degrees C).

(f) Brush Application. Mix **one** volume of Component I to **one** volume of Component II. If thinning is required, use thinner (C131). Apply only **one** brush coat of primer. The same temperature limitations in step (e) above apply.

(2) Spray black, lusterless acrylic lacquer (C65) over the primer.

(a) Thin lacquer to spraying viscosity. Mix **one** volume of lacquer with approximately **one** and **one-half** volumes of thinner (C129).

(b) Spray **two** coats. Allow **5 TO 10** minutes drying time between coats. Only the minimum thickness that will hide the primer shall be applied.

(c) Allow to dry approximately **5** hours before releasing helicopter for flight.

5-31.1. REPAIR OF AFT TIP CAP.

a. Cracks in aft tip cap may be sanded and routed to a depth of 0.060 inch.

b. Apply EA 934. Smooth to contour of cap by sanding.

c. Paint repair area in accordance with paragraph 5-31i.

5-32. PREPARATION FOR STORAGE OR SHIPMENT — K747 MAIN ROTOR BLADES.

a. The following instructions cover storage or shipment of main rotor blades in container P/N KB 747-001.

(1) Thoroughly remove foreign matter from entire exterior surface of blade, using clean cheesecloth (C30).

NOTE

Tape all holes in the blade (bullet damage, tree damage, foreign object damage, etc.) to protect the interior of the blade.

(2) Apply grease (C55) to root fitting bolt hole, and drag brace bolt hole.

(3) Wrap blade with barrier material (C23), shiny side next to the blade, at all locations where the blade will contact the molded hair supports (5 places) and secure with pressure sensitive tape (C127).

(4) Attach a properly filled out DD Form 1577-2 (Unserviceable/Repairable) tag directly to the blade.

(5) Place blade in container.

(6) Secure blade to shock mounted support.

(7) Secure lid.

(8) Secure blade log in container log compartment.

5-33. INSTALLATION — K747 MAIN ROTOR BLADES.

a. Obtain a balanced main rotor hub (paragraph 5-45).

b. Support main rotor hub on a build-up bench in accordance with instructions contained in paragraph 5-12, m. Check that locating pin (6, figure 5-10) is installed in upper surface of each grip (5) at inboard side of retaining bolt hole.

c. Install drag strut (16, figure 5-16).

c.1. Remove preservative grease from blade grip bore and retaining bolt.

d. Apply corrosion preventive compound (C41) to blade retaining bolt, hub grip and blade butts. Slide blade (9, figure 5-10) gently into grip (use of sling is optional). Place washer (7) on retaining bolt (8). Align bolt holes carefully and insert bolt from top. If bolt binds, move tip of blade up and down slowly to find position which allows bolt to pass through without binding. Seat bolt and washer with notches on locating pin (6).

e. Place padded support under blade approximately one third blade length inboard from blade fin.

CAUTION

Install washer (16) with counterbore up facing grip.

The erosion guard is a polycarbonate material which will cut easily upon impact with a rigid structure. Seal all openings immediately with sealing iron.

f. Install washer (16) with counterbore up as illustrated and install nut (17). Do not tighten nut at this time.

g. Preset drag brace (15) length to **14.750** inches, hole center to hole center. Align drag brace (15) and blade for installation of bolt (14). Select shims (10) that will give a clearance of **0.000 TO 0.005** inch. Install bolt (14), shims (10), washers (12 and 13) and nut (11). Install washers (12 and 13) on lower side as illustrated. Do not tighten nut at this time.

h. Install opposite blade in the same manner.

i. If the blades are to be aligned in the hub follow instructions contained in paragraph 5-13.

j. If the blades are not to be aligned in the hub, torque both nuts (11) **125 TO 150** foot-pounds.

k. If the blades are not to be aligned in the hub, torque both nuts (17) **475 TO 525** foot-pounds with socket wrench (T31). Select a notch in the nut that is aligned with a hole in the bolt and install locking screw (20) with head of screw inboard. Install washer (19) and nut (18).

l. Install grip locks (T56) on each pitch horn, if not previously accomplished (figure 5-4).

5-34. ALIGNMENT — K747 MAIN ROTOR BLADES.

Refer to paragraph 5-13.

5-35. MAIN ROTOR HUB.

5-36. DESCRIPTION — MAIN ROTOR HUB.

The Main Rotor Hub major components are the yoke, trunnion, yoke extensions, blade grips, drag braces, pitch horns, and elastomeric bearings (figures 5-29 and 5-30). The elastomeric bearings (6, figure 5-30) are composed of alternating layers of an elastic material (elastomer) with concentric cylindrical metal laminations molded to steel inner and outer housings. The bearing outer housing is bolted to the trunnion. Movement of the hub and blades on the flapping axis is accomplished by flexing of the bearing elastomer.

5-37. REMOVAL — MAIN ROTOR HUB.

Premaintenance Requirements for Removal of Main Rotor Hub

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T59), (T16), (T17), (T15), (T24), (T29), (T45)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	None
Special Environmental Conditions	None

a. Remove main rotor hub and blades from helicopter (paragraph 5-12).

b. Remove main rotor blades from hub (paragraph 5-18).

5-38. INSPECTION — ASSEMBLED MAIN ROTOR HUB.

a. Inspect exposed surfaces of assembled main rotor hub for nicks, scratches, and corrosion. See figures 5-31, 5-34, 5-35, 5-36, 5-37, 5-38, 5-40, and 5-41 for damage limits. Inspect sand deflectors for cracks (paragraph 5-41, m).

b. Inspect open bolt holes for scratches, gouges and corrosion.

c. Inspect elastomeric bearings for elastomer squeeze-out and delamination. Crazing and slight cracking of elastomer due to weather exposure is not cause for replacement.

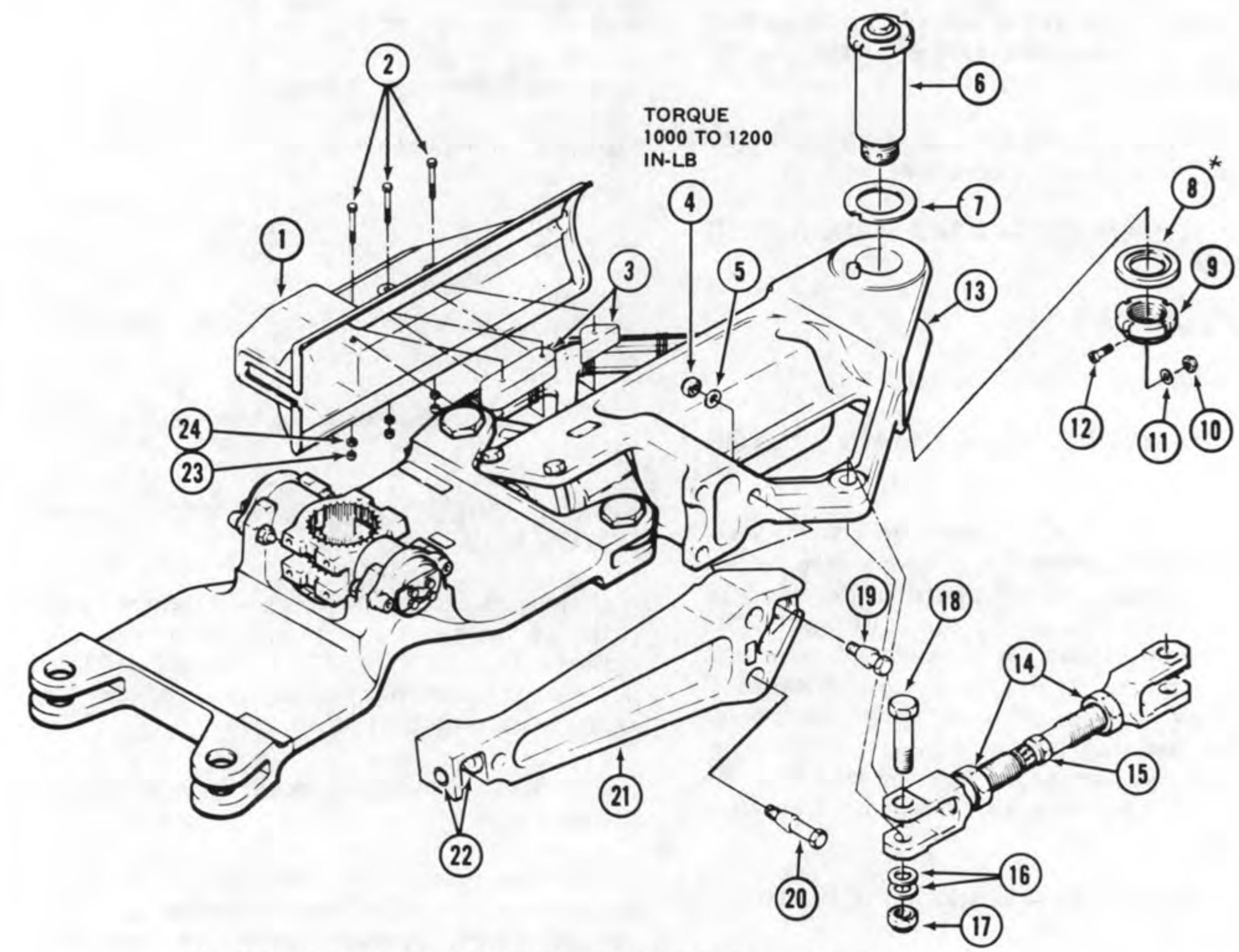
d. Inspect chafing pad (figure 5-42) for scuffing due to contact between parts. If chafing pad is worn through, inspect yoke (figure 5-34) and grip (figure 5-35).

NOTE

Interference will not occur in normal operation, but can occur at extreme control positions during ground operation of controls with external hydraulic power applied while main rotor is static.

e. Inspect trunnion for damaged splines. See figure 5-40 for allowable damage limits.

f. If any damage is present for which no limits are specified and/or there is damage beyond limits shown on figure 5-40, replace the affected part.



*NOTE: Install Washer (8) With Counterbore Up Against Grip.

1. Sand deflector
2. Bolts
3. Shims (spacers)
4. Special nut
5. Special washer
6. Bolt assembly
7. Keyway washer
8. Special washer
9. Special nut
10. Extended washer nut
11. Steel washer
12 Screw
13. Grip
14. Jam nut
15. Drag brace
16. Steel washers
17. Nut
18. Bolt
19. Special bolt
20. Special bolt
21. Pitch horn assembly
22. Bushings
23. Nuts
24. Washers

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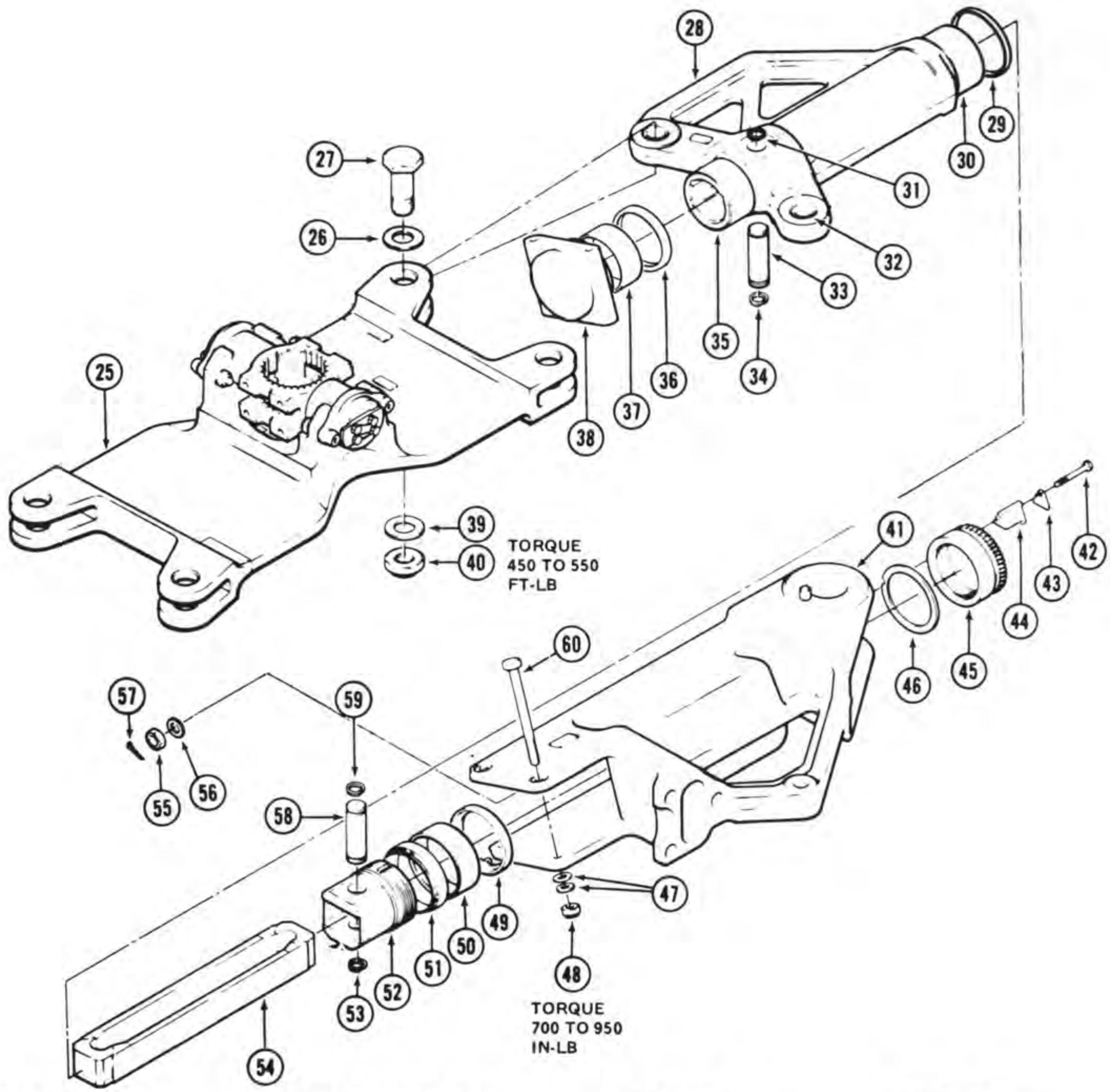
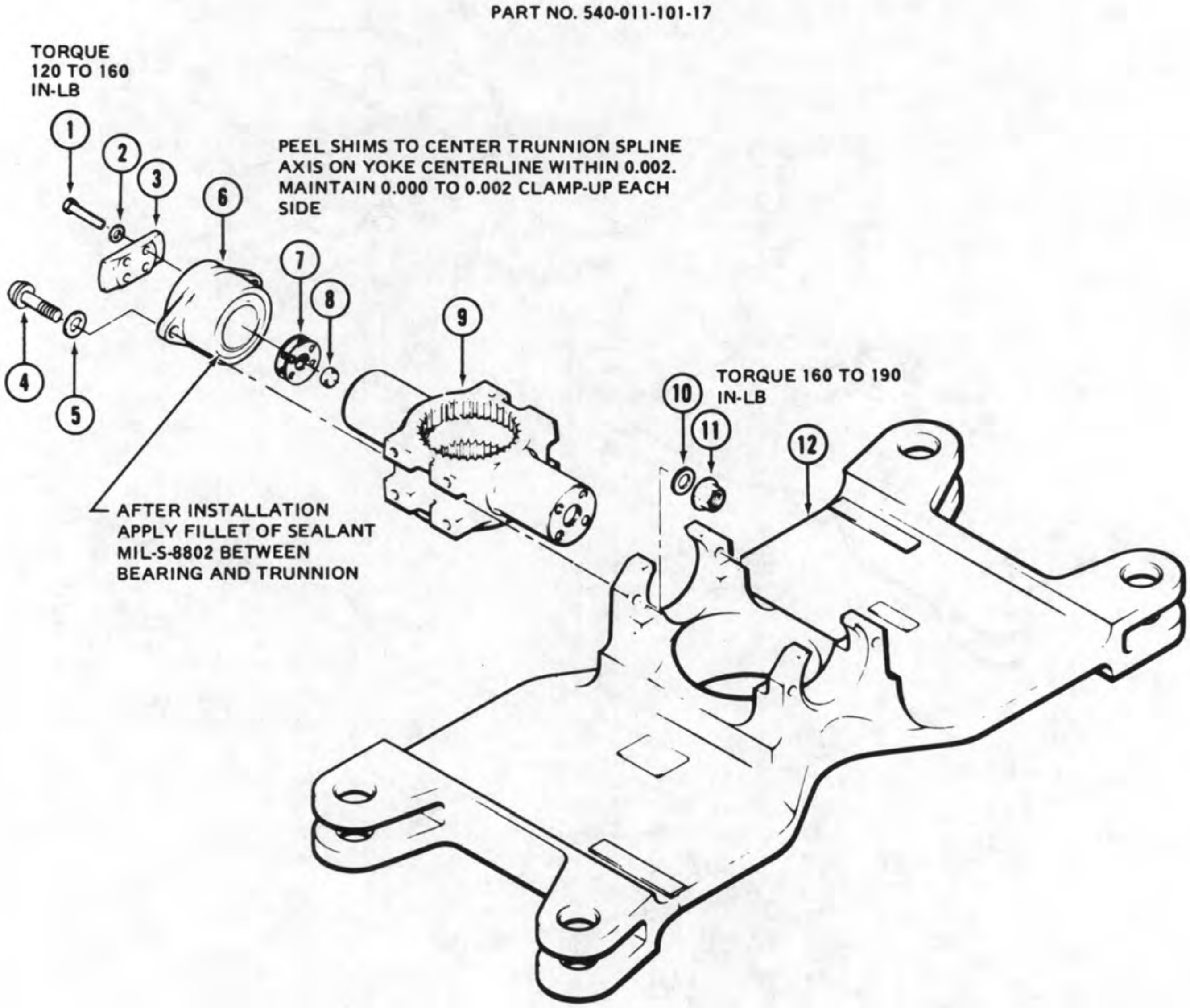
Figure 5-29. Main Rotor Hub Yoke Extension and Grip Assembly (Sheet 1 of 2)



25. Yoke
26. Special washer
27. Bolt
28. Yoke extension
29. Yoke ring (radius rings)
30. Sleeve
31. Retaining ring
32. Shim (buffer pad)
33. Pin
34. Retaining ring
35. Sleeve
36. Seal
37. Bearing
38. Housing
39. Special washer
40. Self-locking nut
41. Grip
42. Bolt
43. Clamp
44. Retainer (lock)
45. Dome nut
46. Washer
47. Steel washer
48. Self-locking nut
49. Strap indexing ring
50. Bearing
51. Grip bearing dust seal
52. Fitting
53. Retaining ring
54. Strap
55. Slotted nut
56. Thin steel washer
57. Cotter pin
58. Pin
59. Retaining ring
60. Bolt

540011-241

Figure 5-29. Main Rotor Hub Yoke Extension and Grip Assembly (Sheet 2 of 2)



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

1. Bolt
2. Steel washer
3. Retainer
4. Internal hex bolts
5. Recessed washer
6. Elastomeric bearing
7. Shims
8. Disk
9. Trunnion
10. Recessed washer
11. Ring base nut
12. Yoke

540011-190C

Figure 5-30. Main Rotor Hub Yoke and Trunnion

g. Inspect hub historical records and the hub for evidence that the hub has been subjected to an accident or incident outside the realm of normal usage. If such evidence exists, perform special inspections outlined in paragraph 1-57.

h. Identify hub components which will reach retirement time prior to next scheduled inspection for replacement (paragraph 1-58).

5-39. DISASSEMBLY — MAIN ROTOR HUB (AVIM).

Premaintenance Requirements for Disassembly of Main Rotor Hub

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T29), (T31), (T34), (T39), (T40), (T42), (T44), (T53), (T59)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C6), (C8), (C25), (C31), (C36), (C37), (C51), (C74), (C87), (C88), (C91), (C102), (C112), (C116)
Special Environmental Conditions	None

a. Position main rotor hub on build-up bench (T29) equipped with adapter plate (T34) if not previously accomplished in accordance with instructions contained in paragraph 5-12, m.

b. Remove main rotor blades from hub if not previously accomplished (paragraph 5-18).

c. Identify blade retaining bolt assemblies (6, figure 5-29), including washers (7, 8, 11), screw (12), and nuts (9 and 10), for reinstallation in the same grip. Use paint or felt tip pen. Remove both bolts. Use socket wrench (T31) to remove nuts from blade retaining bolts. Use work aid shown in figure 5-12 to remove blade retaining bolts if necessary (paragraph 5-18).

d. Remove three bolts (2, figure 5-29), nuts (23), washers (24), sand deflector (1), and spacers (3). Remove opposite sand deflector in the same manner.

e. Remove bolt (18), washers (16), nut (17), and drag brace (15). Remove opposite drag brace in same manner.

f. Remove bolts (19 and 20) and pitch horn (21). Remove opposite pitch horn in the same manner.

g. Remove cotter pin (57), nut (55), and washer (56) from bolt (42). Remove bolt (42), clamp (43) and lock (44). Remove dome nut (45) and washer (46).

h. Remove nuts (48) and washers (47) from bolts (60). Remove bolts. Remove blade grip (41) from yoke extension (28). Use care to prevent damage to threads on fitting (52) and damage to dust seal (51). The dust seal (51), bearing (50) and strap indexing ring (49) should be bonded to the grip near the outboard end.

i. Remove the opposite grip in the same manner outlined in steps g. and h.

j. Remove nuts (40), washers (39), bolts (27) and washers (26). Remove yoke extension (28) and housing (38) from yoke (25). Remove housing (38) from extension. Remove opposite yoke extension in the same manner.

k. Clean sealent from retaining rings (31 and 34) with a sharp plastic scraper. Remove pin (33) and strap (54). Remove opposite strap in the same manner.

l. Remove yoke and trunnion from build-up stand and place on a work bench with supports under the flat portion of the yoke.

m. Identify elastomeric bearings (6, figure 5-30) trunnion (9) and yoke (12) with felt-tipped marker so the bearings and trunnion can be reinstalled in the same position on the yoke.

n. Remove four bolts (1), washers (2) and retainer (3) from each side of trunnion.

o. Remove two nuts (11), washers (10), bolts (4) and washers (5) to free one elastomeric bearing from yoke. Thread a bolt with 1/2 x 20 UNF threads into tapped hole in elastomeric bearing (6). Torque bolt **100** foot-pounds maximum to remove elastomeric bearing from yoke and trunnion. Heat to **200** degrees F maximum if necessary to aid removal. Remove opposite elastomeric bearing in the same manner and remove trunnion from yoke.

p. Remove shims (7) from both sides of trunnion and identify for reinstallation in the same location.

5-40. CLEANING MAIN ROTOR HUB (AVIM).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

a. Clean all metal parts with solvent (C112) and dry with compressed air.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Do not allow MEK to saturate the Teflon bearings or contact the elastomer portion of elastomeric bearings.

b. Clean Teflon bearings in housing (38, figure 5-29) and grip (41) with clean cloths dampened with MEK (C74).

c. Clean sealant and zinc chromate primer from spindles of trunnion and inner metal housing of elastomeric bearings (6, figure 5-30). Use a sharp plastic scraper and cloths moistened with MEK (C74). Do not allow the MEK to contact the elastomeric bearings.

5-41. INSPECTION — DIASSEMBLED MAIN ROTOR HUB (AVIM).

NOTE

Bearings (37 and 50, figure 5-29) will normally be inspected while installed in housing (38) and grip (41), respectively.

a. Inspect liner portion of bearings (37 and 50, figure 5-29) for secure bonding to the stainless steel sleeve (outer portion) of bearings. Inspect liner portion of the bearings for wear and damage. See figure 5-31 for examples of bearing wear patterns to determine if bearings are satisfactory for further service.

b. Inspect yoke extension for damaged, worn or loose bearing sleeves (30 and 35, figure 5-29). If the bearing sleeves are loose or have damage in excess of limits shown in figure 5-33, the yoke extension must be replaced. If bearing sleeves have any superficial marks, polish out marks with Scotchbrite (C103) and reinspect the bearing sleeves. If tungsten carbide coated sleeves (i.e. 540-011-153-17 extensions or new spare sleeves) are found to have mechanical/corrosion damage within limits, repair by using jewelers files or similar items capable of cutting a surface with a hardness of RC70. If such items are not available, replace sleeves.

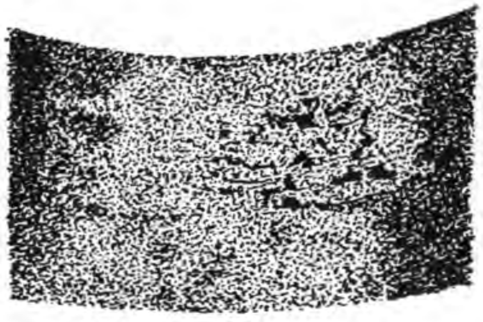
c. Inspect yoke extensions for worn or missing buffer pads (32, figure 5-29) - four pads on each extension.

d. Inspect mating surfaces of the hub components for damage. See figure 5-32, 5-34, 5-35 and 5-36 for damage limits for individual hub components to determine whether damage exceeds limits. All hub components must assemble without misalignment or cocking after polishing out mechanical and corrosion damage.

e. Inspect the holes in the hub components illustrated in figure 5-33 for wear in excess of limits.

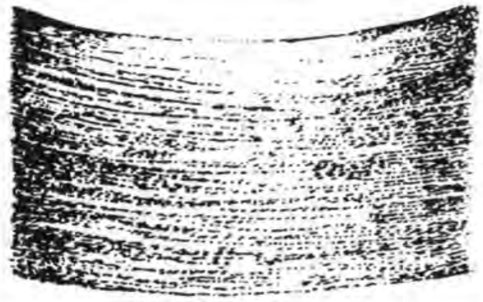
f. Inspect seals (36, figure 5-29) for damage which would affect function and for secure bonding to housings.

g. Inspect grip bearing dust seals (51) for damage which would affect function and/or secure bonding to grips.



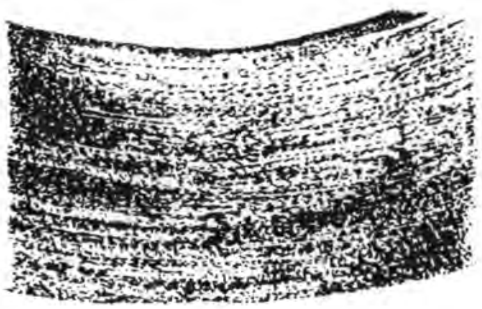
A

Typical bearing surface satisfactory for reuse. Transfer of material is normal, will appear as glazed surface.



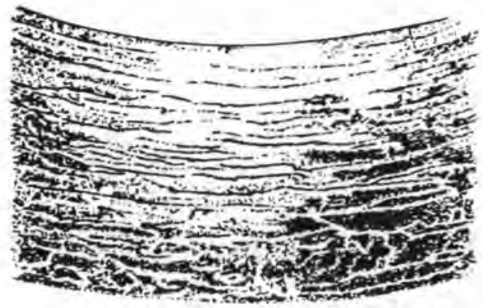
B

Slight wear resulting from normal usage. Bearing is reusable.



C

Acceptable wear pattern, will appear to be glazed.



D

Unacceptable. Bearing must be replaced.

540011-197C

Figure 5-31. Main Rotor Bearing Wear Patterns

h. Inspect radius rings (29) for damage and wear. Replace radius rings if the following limits are exceeded:

(1) Cracks in the carbon face running from the inside diameter to the outside diameter.

(2) Grooves in the carbon face which reveal uneven contact with seal.

(3) Any chips of carbon missing from the carbon face.

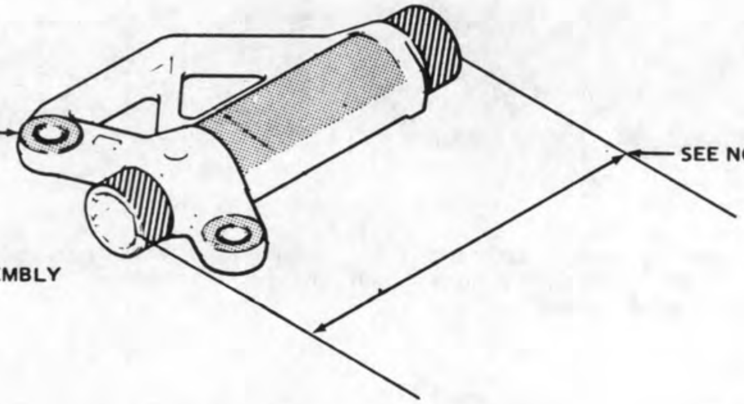
(4) Unbonded abrasion shield.

NOTE

Partially unbonded abrasion shield, discoloration of the shield and/or less than 10 cracks in the shield are not cause for replacement.

i. Inspect straps (54) for damage and wear in excess of the following maximum limits:

(1) Fifty loose wire ends protruding through the urethane coating of strap in any one corner and/or **400** loose ends over the entire strap assembly. If a lesser number of wire ends are found,



TYPE OF DAMAGE	DAMAGE LOCATION SYMBOLS (hatched)	(shaded)	(blank)
	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
CRACKS ALLOWED	None	None	None
NICKS, SCRATCHES DENTS AND CORROSION	0.002	0.020	0.060
MAXIMUM AREA PER FULL DEPTH REPAIR	0.25 Sq. In.	Not Critical	Not Critical
NUMBER OF REPAIRS	Not Critical	Not Critical	Not Critical
EDGE CHAMFER	0.040	0.040	0.080
BORE DAMAGE	0.002 for 1/4 Circumference		

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:
1. The area of repair on surfaces mating with the yoke should not exceed one-half of any quadrant.
2. Thickness of barrel wall is 0.100 minimum.

540011-191C

Figure 5-32. Damage Limits - Main Rotor Hub Yoke Extension

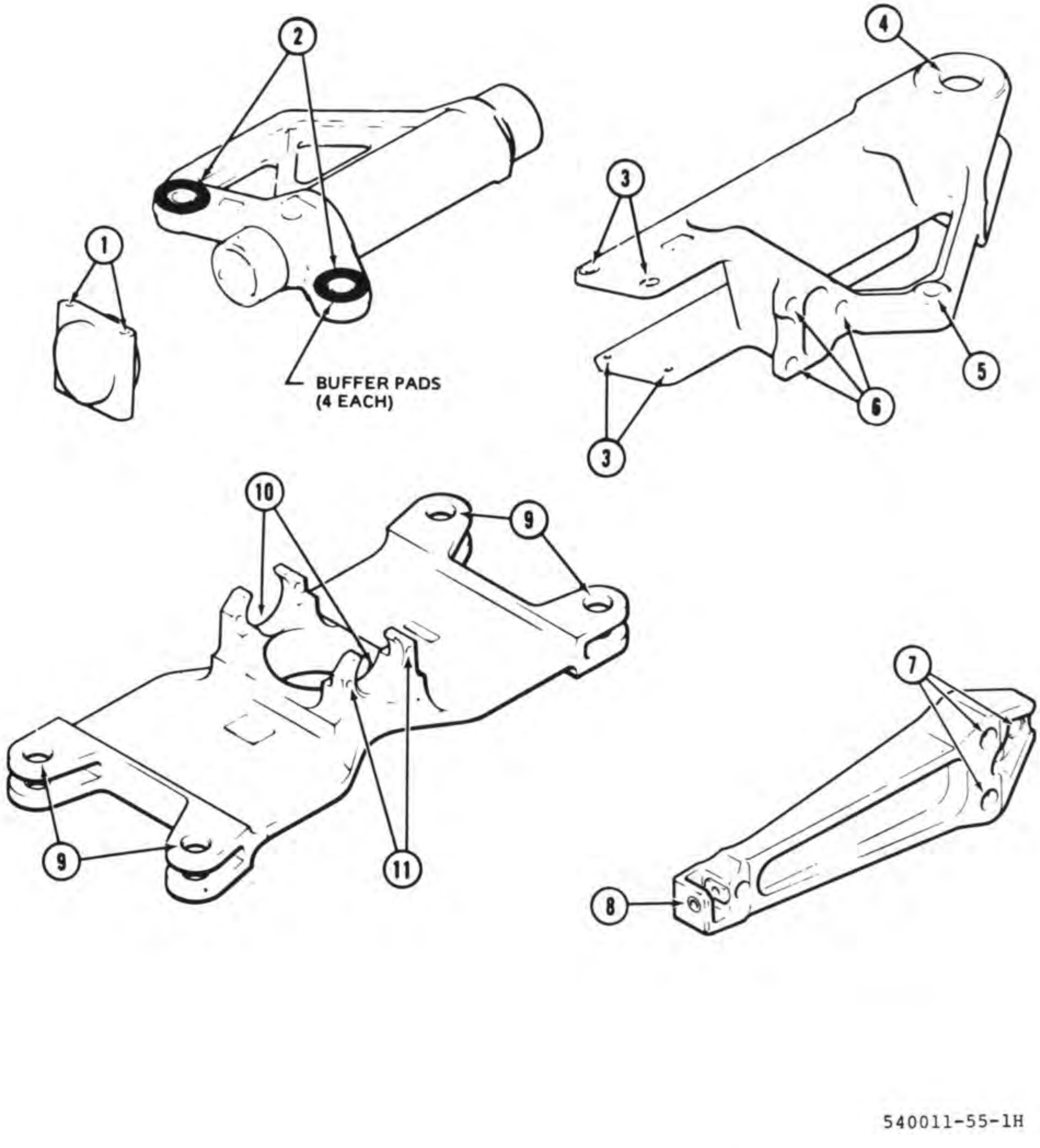


Figure 5-33. Damage Limits — Main Rotor Hub Bolt Holes (Sheet 1 of 2)

MAIN ROTOR HUB BORE INSPECTION

NOMENCLATURE	HOLE NO.	BORE	MAX. I.D.
Inboard Bearing Housing	1	Attachment Bolt Holes I.D.	0.5070
Yoke Extension	2	Attachment Bolt Holes	1.2510
Grip	3	Inboard Bearing Housing Attachment Bolt Holes	0.5030
	4	Blade Retention Bolt Holes	2.5040
	5	Drag Brace Attachment Bolt Holes	0.8760
	6	Pitch Horn Bushing Holes	0.8740
Pitch Horn	7	Attachment Bolt Holes	0.8740
	8	Inboard Bushing	0.6280
Yoke	9	Extension Attachment Bushing Holes	1.2510
	10	Trunnion Bore	3.2540
	11	Trunnion Attach Holes	0.3850

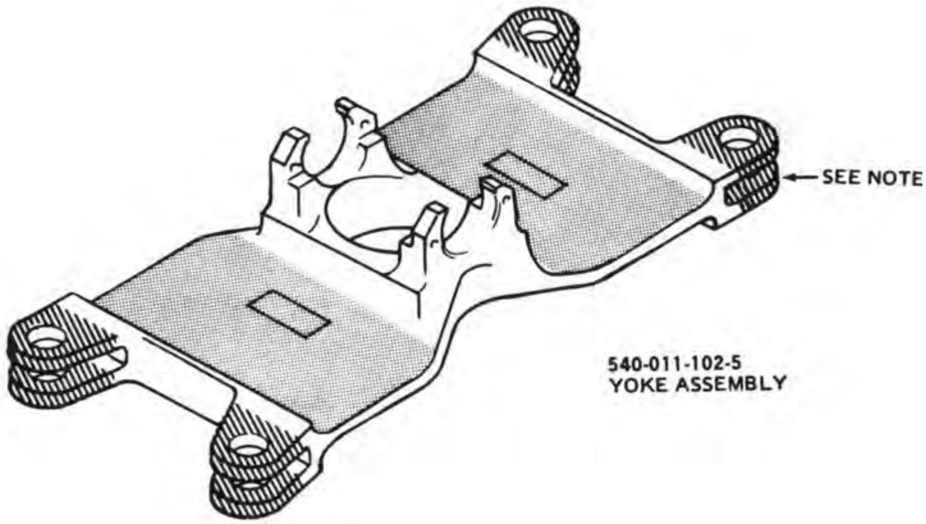
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. **Damage and repair to the walls of hole No. 3 are limited to maximum depth of 0.005 and to holes No. 10, 0.002.**
2. **Repaired area in trunnion bore, hole No. 10, may not exceed one-fourth the circumference.**
3. **Damage and repairs on the walls of bolt holes 2, 4, 5, 9 is limited to a maximum depth of 0.010.**
4. **Repaired area on walls of holes No. 2, 3, 4, 5, 6, 7, 9 may not exceed one-fourth circumference.**
5. **Damage and repairs on the walls of bolt holes 7 is limited to a miximum depth of 0.001.**
6. **Damage and repair limit on trunnion attach holes, No. 11, is 0.002 on the full circumference.**

54011-55-2H

Figure 5-33. Damage Limits — Main Rotor Hub Bolt Holes (Sheet 2 of 2)



DAMAGE LOCATION SYMBOLS

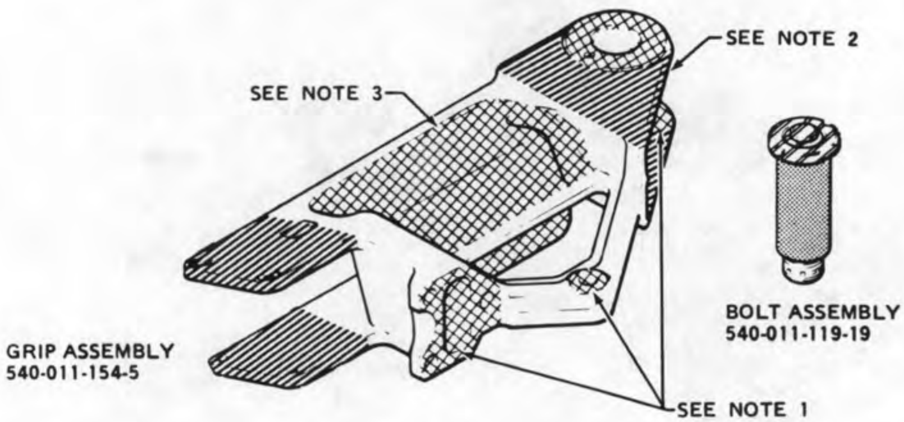
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
	(hatched)	(shaded)	(clear)
CRACKS ALLOWED	None	None	None
NICKS, SCRATCHES DENTS AND CORROSION	0.010	0.020	0.060
MAXIMUM AREA PER FULL DEPTH REPAIR	Not Critical	0.10 Sq. In.	Not Critical
NUMBER OF REPAIRS	Not Critical	Not Critical	Not Critical
EDGE CHAMFER	0.040	0.060	0.10
BORE DAMAGE	0.002 for 1/4 Circumference		

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTE:
The maximum area of repair on inner surfaces of lugs is one-half of any quadrant.

540011-194D

Figure 5-34. Damage Limits — Main Rotor Hub Yoke



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED				
CRACKS ALLOWED	None	None	None	None	None
NICKS, SCRATCHES, DENTS AND CORROSION	0.010	0.020	0.040	0.005	0.060
MAXIMUM AREA PER FULL DEPTH REPAIR	Not Critical	Not Critical	Not Critical	0.25 Sq. In.	Not Critical
NUMBER OF REPAIRS	Not Critical	Not Critical	Not Critical	Two	Not Critical
EDGE CHAMFER	0.030	0.040	0.060	--	0.080
BORE DAMAGE	0.002 for 1/4 Circumference				
THREAD DAMAGE					
Depth	One-Third of Spline				
Length	0.5				
Number	One				

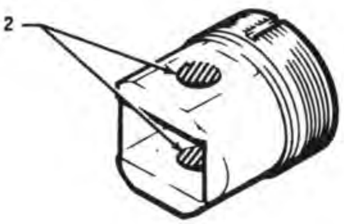
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. The maximum allowable area of repair on surfaces mating with the blade, drag brace and pitch horn is one-half of any quadrant.
2. Thickness of blade tang must be 0.280 minimum.
3. Thickness of wall must be 0.090 minimum.

540011-126-2H

Figure 5-35. Damage Limits — Main Rotor Hub Grip



FITTING, RETENTION STRAP

540-011-113-1

TYPE OF DAMAGE	DAMAGE LOCATION SYMBOLS (hatched)	DAMAGE LOCATION SYMBOLS (open)
	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED		None
MECHANICAL DAMAGE	0.0005	0.005
CORROSION DAMAGE	0.0005	0.005
MAXIMUM AREA PER FULL DEPTH REPAIR		0.5 Sq. In.
NUMBER OF REPAIRS		One Inside One Outside
EDGE CHAMFER		0.020
BORE DAMAGE	NOTES 1 and 2.	
THREAD DAMAGE		
Depth	One-quarter of Thread	
Length	0.50	
Number	One	

NOTES:

1. If retention strap pin holes are out of round in excess of 0.001, replace retention strap fitting.
2. If retention strap pin holes are out of round in excess of 0.0015 with the larger dimension in spanwise direction, scrap the main rotor hub assembly that the retention strap fitting was installed.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

540011-153D

Figure 5-36. Damage Limits — Main Rotor Hub Strap Fitting record the serial number of the strap and the number of wire ends found in the historical record of the main rotor hub.

(2) Use a ten power magnifying glass to check for cracks in flanges of strap bushings and urethane wedges. A crack in these parts is cause for rejection of the strap.

(3) Severe rupture of the urethane coating is cause for rejection.

(4) Displacement of urethane wedges between bushing and inner surface of wire bundle is cause for rejection.

NOTE

A permanent set twist in the strap and/or a slight bulging of wire cross section is normal and not cause for rejection of the strap.

j. Inspect attaching bolts, nuts, and washers for damage and corrosion.

k. Inspect retainers (3, figure 5-30) for obvious damage.

l. Inspect disks (8) for obvious damage.

m. Inspect sand deflectors (1, figure 5-29) for cracks, abrasion damage, oversize bolt holes and corroded, worn, damaged, separated or missing washers. Replace sand deflectors having any cracks greater than two inches in length in any portion. Cracks less than two inches in length are acceptable if stop drilled, provided crack does not permit material fallout.

n. Inspect elastomeric bearings for damage in accordance with instructions on figure 5-41.

o. Inspect elastomeric bearing housing for cracks by magnetic particle method (TM 43-0103) if cracks are suspected.

p. Inspect hub components illustrated in figures 5-32 through 5-41 for damage in excess of limits.

q. Inspect yoke for damages and/or missing chafing pads (13, figure 5-30).

5-42. REPAIR — MAIN ROTOR HUB (AVIM).

NOTE

If allowable repair limits on yoke are exceeded, send the yoke to Depot Maintenance. Replace other parts that have damage in excess of repair limits.

a. Polish out all traces of corrosion and mechanical damage on hub components. Polish out corrosion damage on aluminum parts to **twice** the depth of the pit. Use fine to medium grades of abrasive cloth (36) or fine India stone (C116). Blend the edges of the repair into the surrounding area with a smooth contour. Make final cleanup with crocus cloth (C37) to obtain a smooth, scratch-free surface. If damage exceeds limits specified in paragraph 5-41 dispose of part locally.

b. If cadmium plate is removed, touch up with a brush coat of cadmium plate (C25).

c. Touch up rework areas on aluminum parts with chemical film (C31).

d. Replace damaged or missing buffer pads (32, figure 5-29) as follows:

CAUTION

Do not remove cadmium plate from yoke extension except in the area where buffer pads will be installed.

(1) Remove any buffer pad material that remains bonded to the yoke extension with a plastic or aluminum scraper.

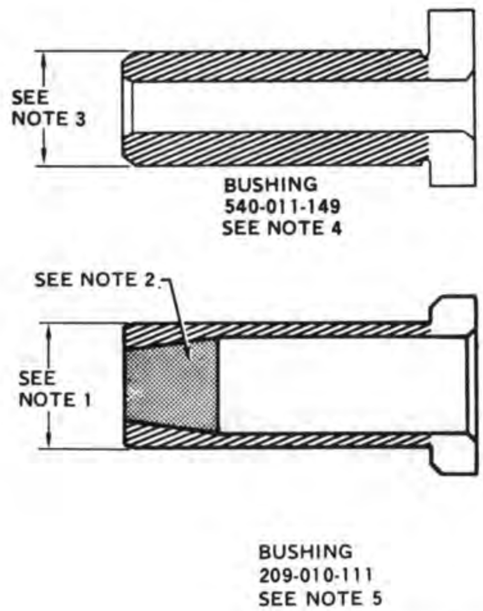
WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(2) Clean area where the new buffer pad will be installed with 400 grit sandpaper (C102). Remove residue with clean cloths dampened with MEK (C74). Clean the side of the new buffer pad that will be bonded in the same manner.

WARNING

Use primer in a well ventilated area away from open flame.



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
MECHANICAL AND CORROSION	0.002 in.	0.002 in.	0.010 in.
MAXIMUM AREA PER FULL DEPTH REPAIR	Not critical	Not critical	Not critical
NUMBER OF REPAIRS	Not critical	Not critical	Not critical

NOTES:
1. Outside diameter to be within 0.8679 to 0.8721 inches.
2. Internal tapered area only.
3. Outside diameter to be within 0.8725 to 0.8730 inches.
4. Usable on pitch horn (P/N 540-011-147).
5. Usable on pitch horn (P/N 209-010-109).

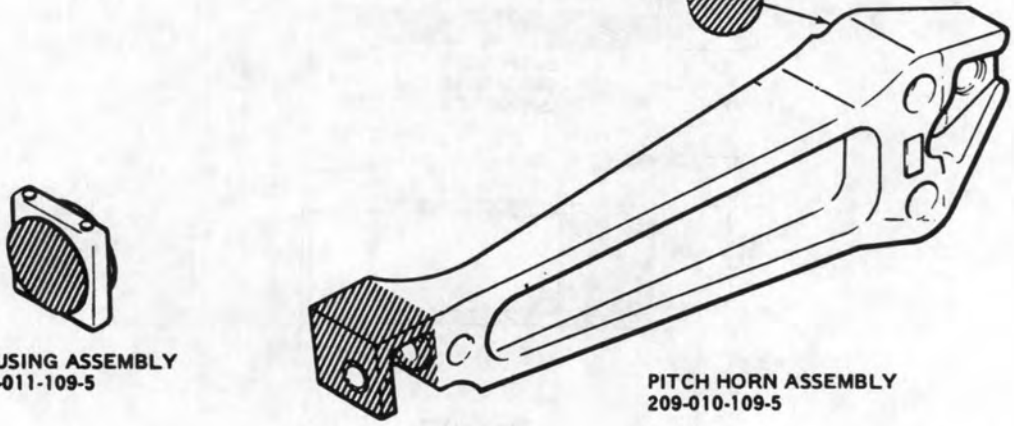
540011-213

Figure 5-37. Damage Limits — Pitch Horn Bushing

(3) Apply a coat of primer (C87) to the cleaned surfaces of the yoke extension and allow to cure for thirty minutes.

(4) Mix adhesive (C8). Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule. Apply a thin coat of adhesive to the mating surfaces of the buffer pad and the yoke extension. Position the buffer pad on the yoke extension and clamp in place. Use a C-clamp and two flat smooth plates or use a bolt and two plates with holes in the plates for the bolt. Use a cellophane or polyethylene tape between the buffer pad and the plates. Refer to table 1-11 for adhesive, mix ratio, pot life, and curing schedule.

(5) Remove clamp and use 180 grit sandpaper (C102) to remove any excess adhesive that was squeezed out during bonding. Avoid removing cadmium plate from yoke extension. If necessary, touch up cadmium plate (step b).



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED (hatched)	(open)
CRACKS ALLOWED	None	None
NICKS, SCRATCHES AND SHARP DENTS	0.020	0.060
CORROSION		
Before Repair	0.010	0.030
After Repair	0.020	0.060
MAXIMUM AREA PER FULL DEPTH REPAIR	0.25 Sq. In.	Not Critical
NUMBER OF REPAIRS	Two Per Segment	Not Critical
EDGE CHAMFER	0.050	0.10
BORE DAMAGE TO BUSHING	0.001 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

540011-126-5E

Figure 5-38. Damage Limits — Main Rotor Hub Pitch Horn

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
	(hatched)	(solid)	(open)
CRACKS ALLOWED	None	None	None
NICKS, SCRATCHES DENTS AND CORROSION	0.010	0.020	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.25 Sq. In.	0.25 Sq. In.	Not Critical
NUMBER OF REPAIRS	One Per Tange	Two Per Segment	Not Critical
EDGE CHAMFER	0.030	0.030	0.060
THREAD DAMAGE			
Depth	One-third of Thread		
Length	0.25		
Number	Two Per Segment		
BORE DAMAGE	0.001 for 1/4 Circumference		

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

540011-132E

Figure 5-39. Damage Limits — Main Rotor Drag Brace

(6) Check fit of yoke extension to yoke. If the new buffer pads are too thick, sand the pads with fine grit sandpaper (C102) to obtain a slip fit. The correct dimension is **1.377 TO 1.379** inches over the yoke extension and the buffer pad on each side of the extension.

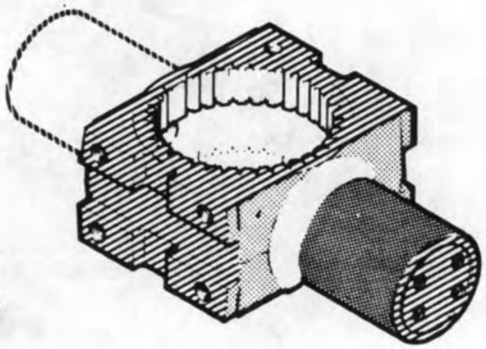
e. Replace radius ring (29, figure 5-29) which failed to pass inspection as follows:

(1) Remove radius ring (29) with a soft aluminum drift.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(2) Clean adhesive from yoke extension with a plastic scraper and clean cloths, moistened with MEK (C74).



540-011-192-3
TRUNNION

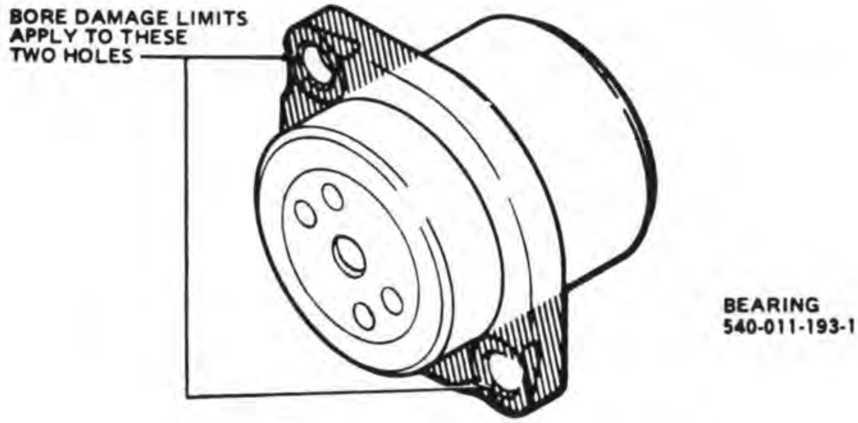
DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED		
CRACKS ALLOWED	None	None	None
NICKS, SCRATCHES, DENTS AND CORROSION	0.002	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	0.10 Sq. In.	0.50 Sq. In.
NUMBER OF REPAIRS	One Per Segment	Not Critical	Not Critical
EDGE CHAMFER	0.040	0.040	0.040
SPLINE DAMAGE			
Depth	One-third of Spline		
Length	One-half Spline		
Number	Three Splines		
THREAD DAMAGE			
Depth	One-third of Thread		
Length	One Per Segment		

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

540011-126-4G

Figure 5-40. Damage Limits — Main Rotor Hub Trunnion



DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	DOES NOT APPLY TO BORES
CRACKS ALLOWED (See Note 1)	None	None
NICKS, SCRATCHES, SHARP DENTS AND CORROSION	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	0.10 Sq. In.
NUMBER OF REPAIRS	One Per Lug	Not Critical
EDGE CHAMFER	0.030	0.060
BORE DAMAGE	0.002 for 1/4 Circumference	
ELASTOMER (See Note 2)		

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. Inspect elastomeric bearing housing for cracks by magnetic particle method (TM 43-0103) if cracks are suspected.

2. Inspect elastomeric bearings for delamination and elastomer degradation. Elastoner failure will be gradual crumbling around the circumference beginning in the inner most layers and progressing uniformly to the outer layer. Crazing or cracking of the elastomer or shedding off of small scraps at end of bearing due to weather exposure is not cause for rejection.

Use a magnifying glass to inspect for signs of delamination. Delamination from shims may be detected by noting darker than normal lines along the shims. Replace bearing if delamination occurs.

Replace any bearing found to have a cracked shim. Cracked shims may be detected by either visual inspection or by running a fingernail along the edge of the shim.

540011-126-6H

Figure 5-41. Damage Limits — Main Rotor Hub Elastomeric Bearing

WARNING

Use primer in a well ventilated area and away from open flame.

(3) Apply a light coat of primer (C87) to mating surfaces of yoke extension and radius ring and allow to cure for **thirty** minutes.

(4) Mix adhesive (C8). Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule. Apply a thin coat of adhesive to the mating surfaces of the yoke extension and the radius ring.

(5) Press the radius ring into position on the yoke extension. Ensure that the radius ring is completely seated. Wipe off excess adhesive. Install grip (41) and housing (38) on yoke extension (28). Install dome nut (45) and tighten until grip bearing dust seal (51) evenly contacts radius ring (29) and then tighten an additional **one-half** turn. Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule.

(6) Remove dome nut (45), grip (41) and housing (38) and ensure that radius ring is completely seated on yoke extension (28).

NOTE

Chafing pads are located on the upper and the lower surfaces of the yoke.

f. Replace damaged or missing chafing pads (figure 5-42).

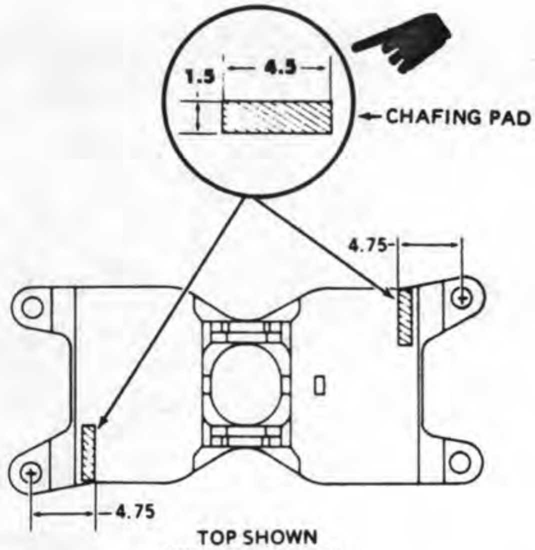
WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(1) Remove any chafing pad material that remains on the yoke with a plastic scraper and clean cloths dampened with naphtha (C75). Do not remove paint.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.



NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

2. FABRICATE CHAFING PADS (4 REQUIRED) FROM TEFLON FILM (1.5 X 4.5 X .030 — AMS3651).

540011-131C

Figure 5-42. Main Rotor Hub Yoke Chafing Pad Installation Dimensions

(2) Clean new chafing pad with MEK (C74) Treat the side of the pad that is to be bonded with tetra-etch (C51).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(3) After etching, rinse the chafing pad with MEK (C74).

(4) Mix adhesive (C14). Refer to table 1-11, for adhesive mix ratio, pot life, and curing schedule. Apply a thin coat of adhesive to the mating surfaces of the chafing pad and the yoke.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(5) When adhesive applied in preceding step becomes tacky, install chafing pad at location illustrated in figure 5-42. Work out any air pockets and excess adhesive with a cloth dampened with MEK (C74). Apply weights or use a clamp to hold chafing pad firmly in position. Refer to table 1-11 for adhesive, mix ratio, pot life, and curing schedule.

g. Replace seal (36, figure 5-29) and bearing (37) in bearing housing (38) as follows:

(1) Grasp seal (36) with duck bill pliers and tap pliers with mallet to remove the seal.

(2) Install bearing puller (T44) into housing (38). Use the aluminum block as shown in figure 5-42 to prevent damage to the housing. Apply moderate tension with puller.

CAUTION

Do not use flame of any form on the housing assembly.

(3) Apply heat to housing with heat lamp for approximately **thirty** minutes or until yielding of adhesive is evident. Increase tension with puller and remove bearing (37).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(4) Clean all traces of adhesive from bearing housing (38) with a plastic scraper and cloths moistened with MEK (C74).

WARNING

Use primer in a well ventilated area and away from open flame.

(5) Apply a light coat of primer (C87) and allow to cure for **thirty** minutes.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Ensure that adhesive does not contact teflon bearing fabric.

(6) Mix adhesive (C8). Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule. Apply a coat of adhesive to the mating surfaces of bearing (37) and housing (38). Install bearing in housing and seat fully as shown in figure 5-43. Wipe off excess adhesive with a cheese cloth moistened with MEK (C74). Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule.

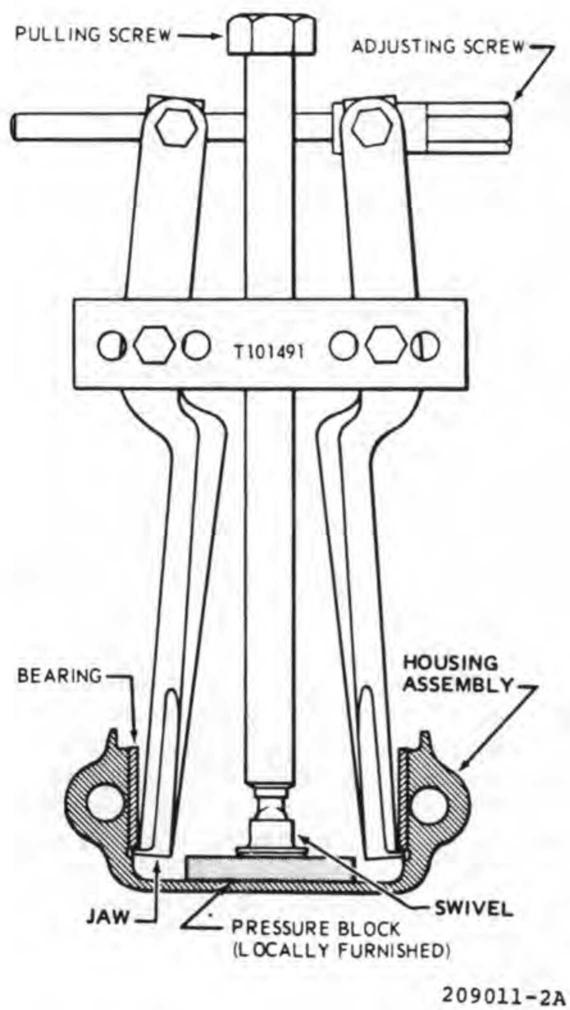


Figure 5-43. Tool Application-Bearing Removal From Housing

(7) Apply a thin, even coat of adhesive (C6) to mating surface of seal (36, figure 5-29). Allow adhesive to dry about **ten** minutes or until it becomes tacky and press seal into housing (38) with lip of seal facing outboard. Allow it to cure for **four** hours at **70 TO 80** degrees F (**21 TO 27** degrees C).

h. Replace seal (51, figure 5-29) and bearing (50) in grip (41) as follows:

NOTE

If bearing (50) is satisfactory for further service, perform only the steps applicable to removal and installation of seal (51).

(1) Grasp seal (51) with duck bill pliers and tap pliers with mallet to remove seal.

(2) Install bearing remover (T40) in grip with slot of tool over tang of strap indexing ring (49). See figure 5-44 for view of installed tool. Drive ring and bearing from grip.

(3) Clean all old adhesive from grip with plastic scraper.

(4) Install strap indexing ring (49, figure 5-29) in grip with lugs on ring engaged with slots in grip. Fill keyway gap between strap index ring and grip with sealant (C105).

(5) Press new bearing (50) into grip with arbor (T42). See figure 5-45 for view of installed tool with ring of tool positioned to engage bearing. Press bearing into grip as described in figure 5-45 until it fully engages the strap indexing ring. Remove dome nut and special tools.

(6) Apply a thin even coat of adhesive (C6) to mating surfaces of dust seal (51, figure 5-29) and grip (41). Allow adhesive to dry about **ten** minutes or until it becomes tacky. Position dust seal on arbor (T42) as shown on figure 5-45 and position in grip. Press dust seal into grip as described in the note in figure 5-45, until it fully engages the seat. Remove dome nut and special tools. Spread any excess cement that has squeezed out to form a filler between the dust seal and the grip.

i. Repair sand deflector.

(1) Cracks of **two** inches in length or less may be stop drilled.

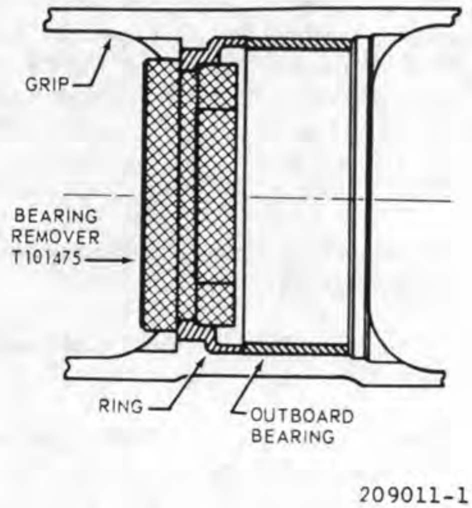


Figure 5-44. Tool Application — Bearing Removal From Grip

(2) Corrosion, erosion, or damage to doublers may be polished out and painted with epoxy primer (C88 or C91).

(3) Surface damage (nicks, scratches, sharp dents) on doubler (aluminum strip) must not exceed **0.020** inch in depth. Corrosion damage shall be polished out to twice the depth of the pit, but must not exceed **0.020** inch in depth. Polish out damage using fine India Stone (C116), 400 grit or finer sandpaper (C102) or soft wire brush on air motor. Treat all polished areas with alodine (C31).

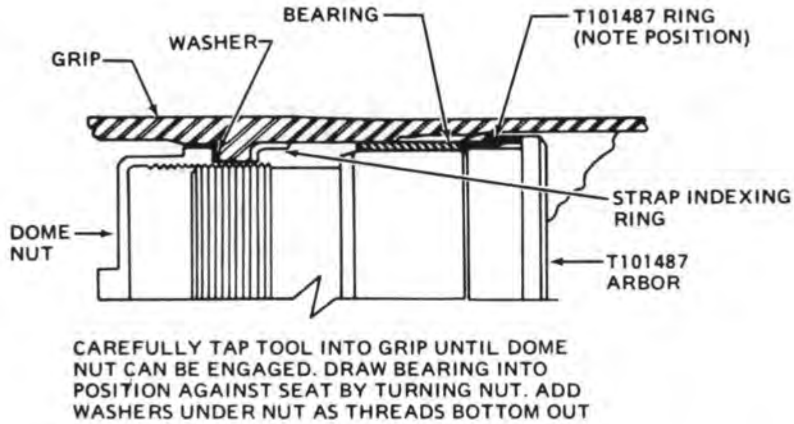
(4) Replace corroded, worn, damaged, separated, or missing washers (AN970-4) as follows:

(a) Remove all remaining adhesive using aluminum or plastic scraper.

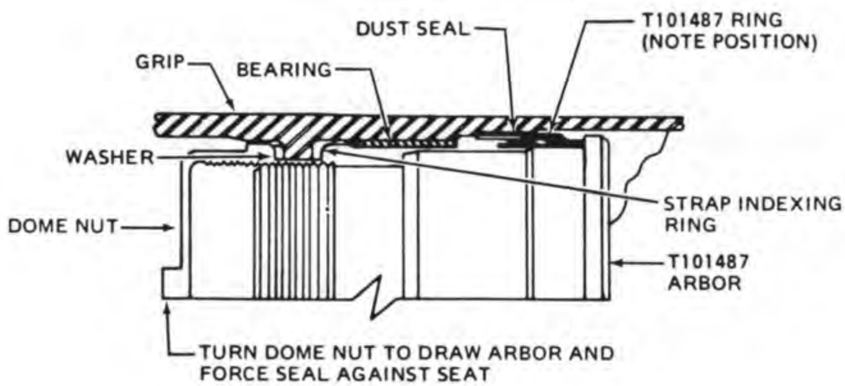
WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(b) After removing all traces of old adhesive, wipe area with MEK (C74) and allow to dry.



BEARING INSTALLATION



DUST SEAL INSTALLATION

209011-3A

Figure 5-45. Tool Application — Bearing and Seal Installation in Grip

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(c) Lightly sand surface on one side of new washer using 320 grit sandpaper (C102). Clean area with MEK (C74) and allow to dry.

(d) Apply a thin coat of adhesive (C8) to sanded and cleaned surface of washer and position on deflector.

NOTE

Two, flat smooth plates may be clamped on deflector using C clamps, or plates with holes through both plates. Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule.

(5) Paint repaired sand deflector.

(a) Upon completion of repair apply **one** coat of epoxy primer (C88 or C91) followed by **one** coat of epoxy coating (MIL-C-22750B Color 16473 per FEDERAL STANDARD 595).

(b) Air dry. Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule.

5-43. ASSEMBLY — MAIN ROTOR HUB.

NOTE

After assembly, trunnion must have 0.000 to 0.002 inch clamp-up on each end (0.002 to 0.004 inch total) and must be centered within 0.002 inch.

a. Position trunnion (9, figure 5-30) in ears of yoke (12).

b. Install disk (8) in counterbore in end of each trunnion spindle.

c. Obtain four new shims (7).

d. Place two new shims (7) in each elastomeric bearing (6). Align holes in shims and bearings. Use two bolts (1) to maintain alignment.

e. Carefully push bearings over end of trunnion spindles. Thread bolts (1) into trunnion finger tight.

f. Install two bolts (4) to secure each elastomeric bearing (6) to the yoke (12). Install recessed washers (5) on bolts (4) with recessed side toward bolt heads. Install recessed washers (10) with recessed side toward nuts (11). Tighten nuts (11) on one bearing (6) sufficiently to hold flange of bearing against yoke. Leave nuts (11) on opposite bearing loose.

g. Ensure that trunnion spindles are fully seated in bearings (6) against shims (7).

h. Use a feeler gage and measure gap between flange of elastomeric bearing (6) and yoke (12) on side where nuts (11) are loose, record this dimension. If no gap is present, shims (7) are too thin. Remove elastomeric bearings (6) and add equal amount of shims (7) to each bearing until gap is achieved. Measure and record gap dimensions as described above.

i. Remove elastomeric bearings (6) from trunnion and remove shims (7) from bearings. Keep shims with bearing from which they were removed.

j. Divide the dimension recorded in step (h) by two. Record this dimension. Peel laminations equal to this dimension plus **0.002** minus**0.000** from shim (7) for each bearing (6). See the following example:

Dimension of original measured gap..... 0.22 inch

Original gap divided by two .... 0.011 inch

Thickness of laminations to be removed from shim for each bearing .... 0.012 inch

k. Measure thickness of shims after adjustment. The thickness of shims (7) for each elastomeric bearing must be equal within **0.002** inch.

l. Reinstall bearings to trunnion as prescribed above and check for gap under trunnion bearing flange. Repeat above procedure until a clamp-up of **0.000 TO 0.002** inch is obtained between yoke and bearing flange on each side (**0.000 TO 0.004** inch gap between yoke and bearing housing flange on side being checked). Torque nuts (11) **160 TO 190** inch pounds.

m. Center trunnion as follows:

(1) Modify plug of grip spacing tool (T53) as shown in figure 5-46, to make work aid for centering trunnion.

(2) Position work aid in trunnion as shown in figure 5-46.

(3) Remove paint from housing in line with stud of work aid.

(4) Using a feeler gage, measure gap between end of stud and inboard face of housing, record measurement.

(5) Rotate work aid 180 degrees and repeat steps (3) and (4).

(6) If recorded measurements are not equal within **0.002** inch, determine difference and divide this dimension by two. This determines the thickness of shim which must be transferred from side with higher measurement to side with lower measurement.

(7) Disassemble the trunnion/bearing assembly as necessary to gain access to the shims under both bearings and transfer shims as determined necessary above.

(8) Reinstall bearings to trunnion as described above and recheck trunnion centering. Repeat process if trunnion is not centered within **0.002** inch.

NOTE

During the following operation, ensure shims are retained with their respective bearings.

n. When trunnion is centered within **0.002** remove nuts (11, figure 5-30), washers (10), bolts (4), and washers (5). Remove trunnion (9) and elastomeric bearings (6) from yoke (12) and separate.

o. Bond elastomeric bearings (6) to trunnion (9) as follows:

(1) Abrade mating areas of trunnion (9) and elastomeric bearings (6) with 400 grit abrasive cloth (C36).

(2) Clean abraded areas of trunnion and bearings with alcohol (C18).

(3) Apply a heavy coat of prepared adhesive (C15) to spindles of trunnion (9).

NOTE

Ensure that shims (7) are installed in the correct elastomeric bearing (6).

(4) Place disks (8) in counterbore in each end of trunnion (9). Place shims (7) in elastomeric bearings (6). Align holes in shims and bearings. Use two bolts (1) to maintain alignment.

(5) Apply unreduced zinc chromate primer (C91) to mating surfaces of elastomeric bearings (6) and yoke (12).

(6) Carefully push bearings over ends of trunnion spindles. Remove bolts (1), place retainers (3) on elastomeric bearings (6). Install bolts (1) and washer (2), tighten bolts fingertight.

(7) Place assembled trunnion and bearings on yoke (12). Install bolts (4), recessed washers (5 and 10), and nuts (11). Torque nuts (11) **160 TO 190** inch-pounds.

(8) Torque bolts (1) **120 TO 160** inch-pounds and lockwire (C137) in pairs. Remove excess adhesive from trunnion spindles and bearings.

(9) Allow adhesive to cure for 24 hours before using hub assembly.

(10) Apply fillet of sealant (C11) between bearings (6) and trunnion (9) as shown in figure 5-46.

p. Place an adapter plate (T34) on buildup bench (T29). Install the yoke and trunnion on the buildup bench (figure 5-47).

q. Inspect both yoke extensions (28, figure 5-29) to ensure that radius rings (29) are installed and are in satisfactory condition. Position yoke extension (28) on yoke with web on leading edge side and install bolt (27), special washers (26 and 39) and nut (40) at this time. Install opposite yoke extension in the same manner.

r. Position strap (54) in fitting (52). Install retaining ring (59) on pin (58). Install pin through fitting and strap. Install retaining ring (53). Coat ends of pin with sealant (C104). Assemble opposite strap and fitting in same manner.

s. Insert assembled strap (54) and fitting into outboard end of yoke extension (28). Install retaining ring (31) on pin (33) and install pin through yoke extension and strap. Install retaining ring (34). Coat both ends of pin with sealant (C105). Install opposite strap in same manner.

t. Hinge yoke extension (28) forward on bolt (27). Inspect housing (38) to ensure that a serviceable bearing (37) and seal (36) are properly installed. Position housing (38) on yoke extension. Hinge the yoke extension back into position and install bolt (27), special washers (26 and 39) and nut (40) in trailing edge hole. Torque nut (40) **450 TO 550** foot-pounds. Install opposite housing in the same manner.

CAUTION

Do not install washers under heads of bolts (60).

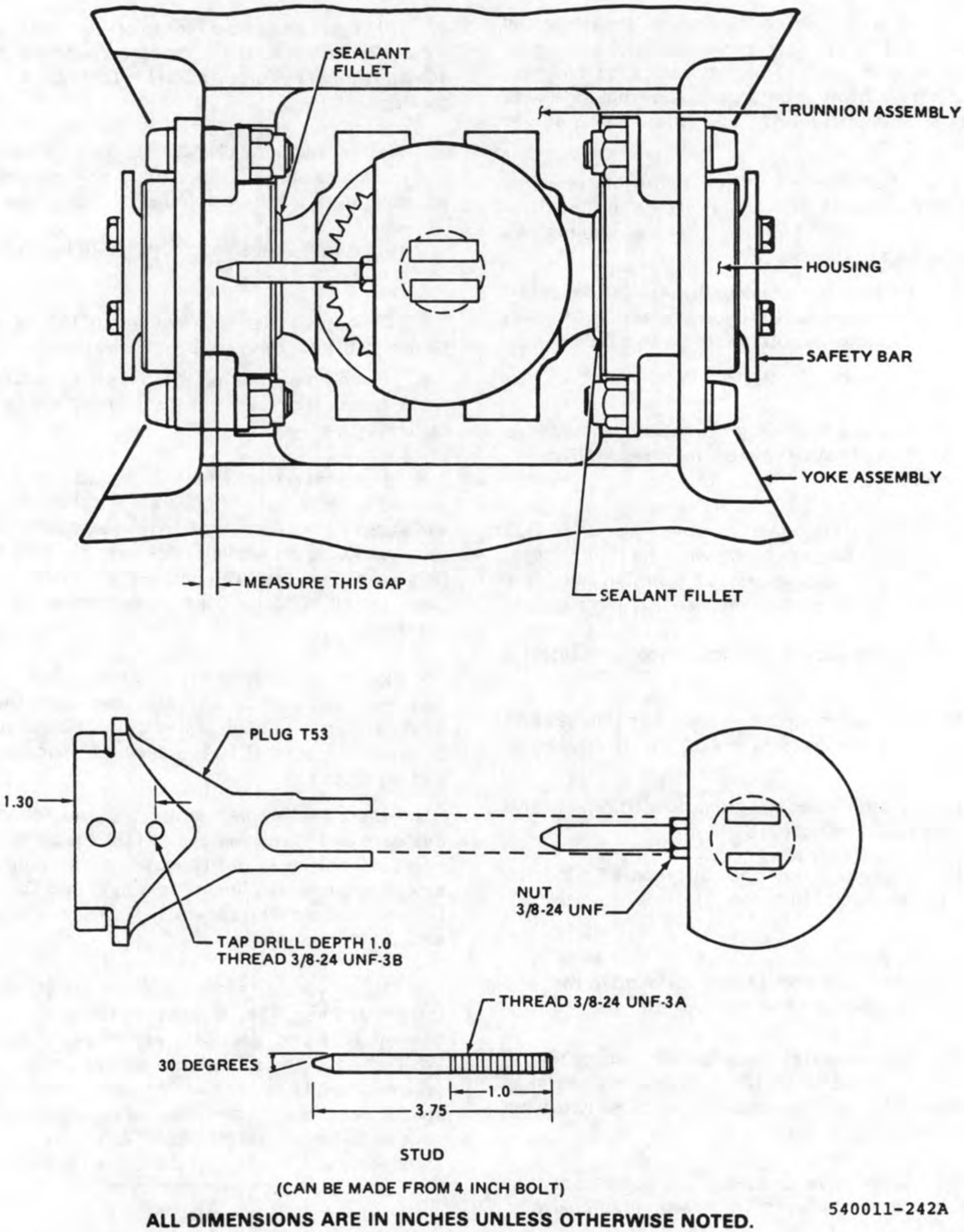


Figure 5-46. Tool Application — Main Rotor Hub Trunnion Centering

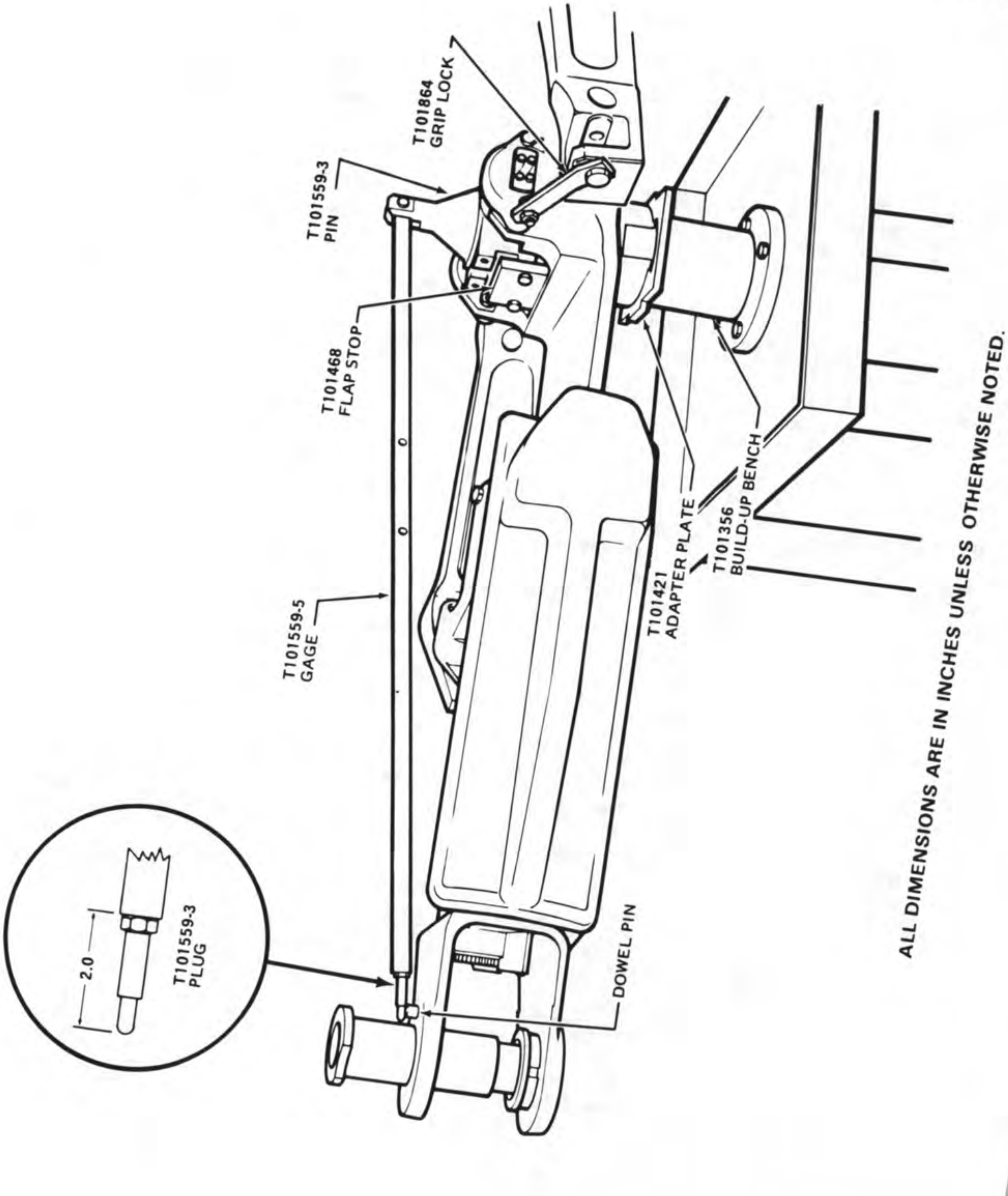


Figure 5-47. Tool Application — Grip Spacing Adjustment

u. Inspect grip (41) to ensure that strap indexing ring (49), bearing (50) and dust seal (51) are properly installed. Apply a coating of sealant (C105) to both slots in fitting (52) so that this area will be sealed when the grip is installed. Slide the grip (41) on the grip extension with the side with provisions for mounting the pitch horn on the trailing edge side. Engage the lugs on the strap indexing ring in the grip with the slots in fitting (52). Work grip onto extension far enough to expose three threads on fitting (52). Use a fiber mallet to tap grip onto extension.

v. Install washer (46) and start dome nut (45). Install two bolts (60) through grip and housing. Install a maximum of four steel washers (47) on each bolt as required and install nuts (48). Torque nuts **770 TO 950** inch-pounds. Install opposite grip in same manner.

w. If drag brace (15) was disassembled, install jamnuts (14) and clevis ends on drag brace. Adjust clevis until approximately **0.25** inch of threads are exposed on each end and the dimension between centers of clevis holes is **14.732** inches. Tighten jamnuts (14) snug but do not torque. Position drag brace on grip and install bolt (18), washers (16) and nut (17). Do not torque nut (17) at this time. Install opposite drag brace in the same manner.

x. Position pitch horn on grip and install special bolts (19 and 21). Install the longer bolts in the inboard holes. Install a maximum of two washers (5) under each nut (4). Torque nuts (4) evenly **1000 TO 1200** inch-pounds. Install opposite pitch horn in the same manner.

NOTE

The pitch horn bolts are properly installed when tapered shoulders on bolts are seated in bushings in the pitch horn. The bolt heads will not be in contact with the pitch horn or bushings.

y. Replace tape (C127) on inboard spacer (3) if required to obtain a snug fit. Position two spacers (3) in web of yoke extension. Position sand deflector (1) on yoke extension and install three bolts (2) through sand deflector and spacers. Ensure that there is adequate clearance between deflector and yoke (25) at both upper and lower surfaces. Install opposite sand deflector in the same manner.

z. Adjust grip space as follows:

(1) Install bolt assembly (6) in each grip.

(2) Install two flap stops (T39) on trunnion with 540 side down as shown on figure 5-47. Use 3/8 inch UNF threaded bolts of suitable length to secure flap stops to trunnion.

(3) Remove one bolt (4, figure 5-30) from each trunnion bearing and install two grip locks (T59) as shown on figure 5-47.

CAUTION

During all grip spacing procedures, ensure that grips are seated against dome nuts by tapping grip outboard with a fiber mallet.

NOTE

When checking dimension "A", grip must be feathered zero degrees, with respect to trunnion.

(4) Tighten dome nut (45, figure 5-29), installed in step g. until dimension between radius ring (29) and dust seal (51) is **0.001** inch. See dimension "A" on figure 5-48. Adjust opposite grip in the same manner.

(5) Install grip spacing gage (T53, figure 5-47). Adjust tip on gage to **2.0** inch dimension as illustrated. Install plug in trunnion and secure with knurled screw. Locate hole marked "540-011-101" on gage of spacing gage (T53) and attach gage to plug with bolt through this hole. Raise blade bolt and position tip of spacing gage (T53) so that it rests on dowel pin in grip as shown. Measure and record distance between blade bolt and tip of grip spacing tool. Reverse grip spacing gage and measure distance on opposite blade bolt.

CAUTION

During all grip spacing procedures, ensure that grips are seated against dome nuts by tapping grip outboard with a fiber mallet.

(6) Loosen dome nut (45, figure 5-29) on grip (41) that was found to be most inboard in the preceding step. Adjust this dome nut as required until the dimension is equal to that of the most outboard grip within **0.002** inch.

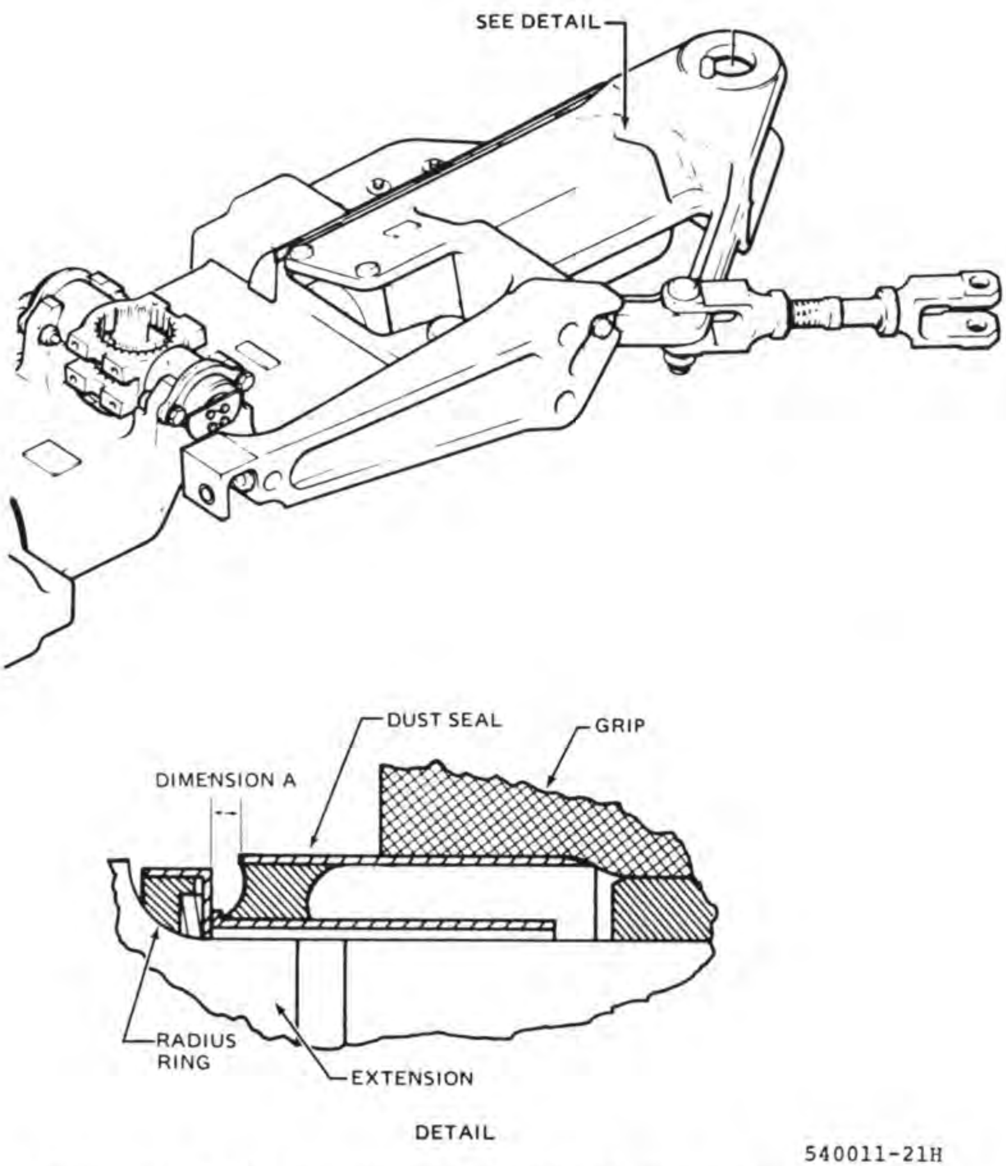


Figure 5-48. Main Rotor Hub Grip Dust Seal to Radius Ring Dimension

(7) Check seal gap dimension "A" shown on both grips. Dimension "A" must be **0.001 TO 0.040** inch.

(8) Install lock (44), clamp (43), bolt (42), thin steel washer (56), nut (55), and cotter pin (57).

(9) Remove grip spacing gage.

(10) Install blade bolt (6), keyway washer (7), special washer (8), special nut (9), screw (12), washer (11), and nut (10). Do not torque special nut (9).

(11) Remove two flap stops (T39).

(12) Remove two grip locks (T59). Install bolts (4, figure 5-30) with recessed washers (5). Install washer with recessed side toward bolt head. Install recessed washer (10) with recessed side next to nut (11). Use more than one special washer (10) to obtain proper engagement of nut if necessary. Torque all four nuts (11) **160 TO 190** inch-pounds plus tare torque.

CAUTION

After nuts (11) are tightened, no more than five threads of bolts are permitted to be exposed beyond nuts (11), and a minimum of three threads must be exposed to ensure the self-locking feature of the nuts is engaged.

5-44. PAINTING — MAIN ROTOR HUB.

NOTE

Painting an assembled main rotor hub is limited to touch-up of damaged finish on yoke, grips and pitch horns.

a. Clean the area to be repaired by sanding with 320 grit or finer sandpaper (C102). Either wet or dry sanding is satisfactory. Fair-in the undamaged lacquer finish around the repair area.

b. Apply chemical film treatment (C31) to bare metal areas on the aluminum pitch horns after sanding. Use the following procedure:

NOTE

Chemical film treatment is not required on the yoke or the grips. If these parts are being touched-up, proceed to step c.

(1) If the area where chemical film is to be applied is not completely clean from the sanding operation, scrub the area with Scotchbrite (C103) and rinse with clean water.

(2) Apply chemical film (C31) to bare metal with a brush or swab for **one to three** minutes then rinse with clear water. Allow to air dry, use compressed air, or clean dry cloths to dry area.

c. Apply primer to repair area as follows:

(1) Prepare two-part epoxy primer (C88 or C91) according to instructions on container.

(2) Mask-off areas adjacent to repair area with masking tape (C123).

(3) Immediately prior to applying primer, clean area with a tack rag (C119).

(4) Spray on very thin coat of primer prepared in step (1).

NOTE

Apply acrylic lacquer over primer within one to eight hours.

d. Apply acrylic lacquer to repair area as follows:

NOTE

If primer applied in preceding step has dried for more than eight hours, apply a mist coat of the same primer then apply lacquer per this paragraph within one hour.

(1) Prepare gray acrylic lacquer in accordance with instructions on container.

(2) Spray on very thin coat. Allow to dry **thirty** minutes and apply second coat. If second coat is not applied within **one** hour, clean with tack rag (C119), or equivalent, prior to application of second coat.

(3) Remove masking tape from repair area.

5-45. BALANCING — MAIN ROTOR HUB (AVIM).

NOTE

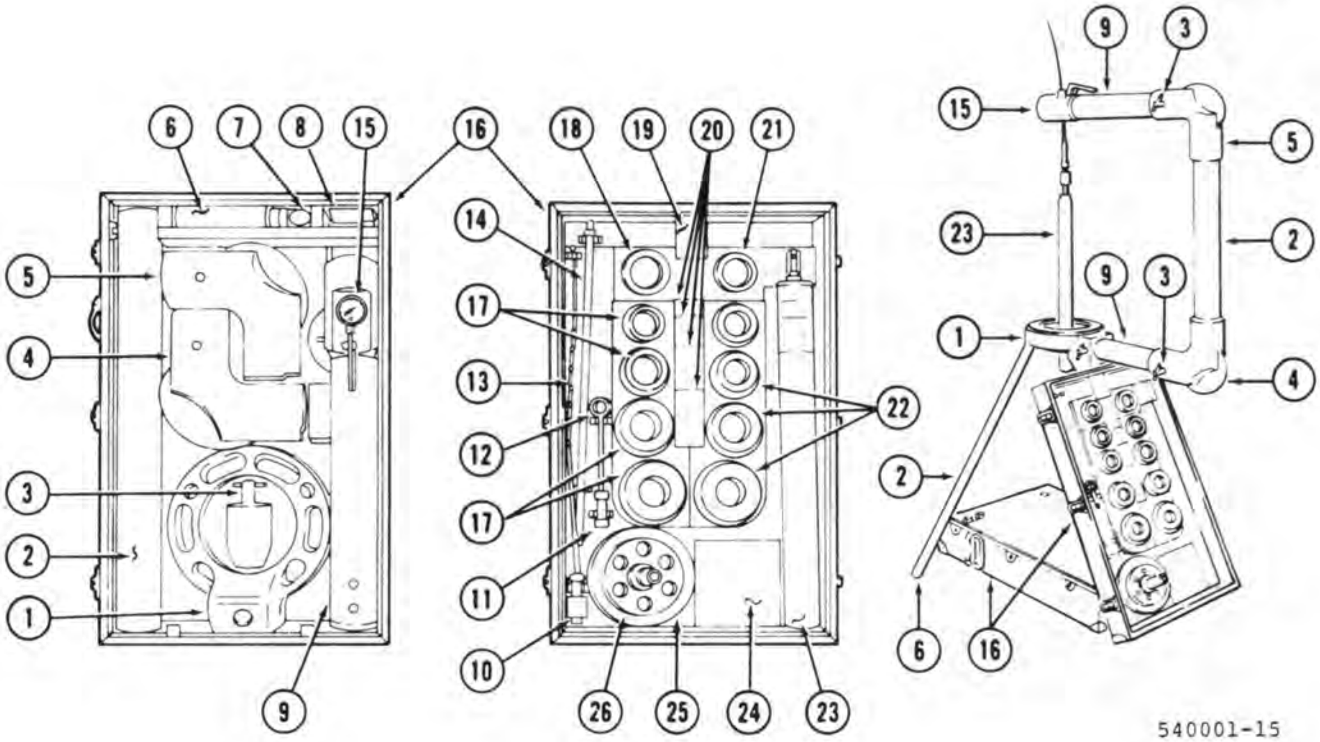
Refer to TM 55-4920-201-15 for additional information on balancing tools if required.

a. Set up the hub balancing stand and accessories from balance kit (T73) as follows:

(1) Assemble hoist support structure with tube assembly P/N 2769 instead of tube assembly P/N 2288 shown in figure 5-49 to provide additional hoist arm height.

(2) Center fixture (11, figure 5-50) from kit (T73) on work stand.

(3) Install adapter (12), heavy end downward, over top of fixture (11) and seat on upper shoulder of fixture central projection. Lock adapter in this position by tightening adapter setscrew (13) using 1/8 hex wrench from kit (T73), (T70), or (T69).



1. Stand table assembly (2291)
2. Tube, 2-7/8 inch diameter long (2288) with leg assemblies — stand long (2364)
3. Pin — hoist support (2285)
4. Elbow (2284-1)
5. Elbow (2284-2)
6. Stand leg extensions (2365)
7. Stub leg (2366)
8. 1/8 Inch hex wrench
9. Tube, 3 inch diameter (2286) with tube, 2-7/8 inch diameter — short (2287)
10. Quick-disconnect coupling (2266)
11. "Quickie" coupling (2260-1)
12. Alternate hoist eye assembly
13. 3/16 inch suspension cable (2264)
14. 1/16 Inch suspension cable (2262)
15. Hydraulic pump assembly (2282)
16. Storage, carrying, and work support case (2272)
17. SAE 20, 30, 40, 50, and 51 spline rear cones (2223, 2205, 2207, and 2228)
18. Flange type 1, 2, 3, and 4 rear bushing (2210)
19. Work stand stub leg support
20. Spacers (2201, 2202, 2203, and 2204)
21. SAE 20 spline front bushing (2211)
22. SAE 20, 30, 40, 50, and 51 spline front cones (2224, 2206, 2208 and 2227)
23. Balancing arbor (2259)
24. Packing layout
25. Flanged type 1, 2, 3, and 4 front plate (2209)
26. Hand wheel (2215)

Figure 5-49. Rotor Balancing Kit P/N 7A050

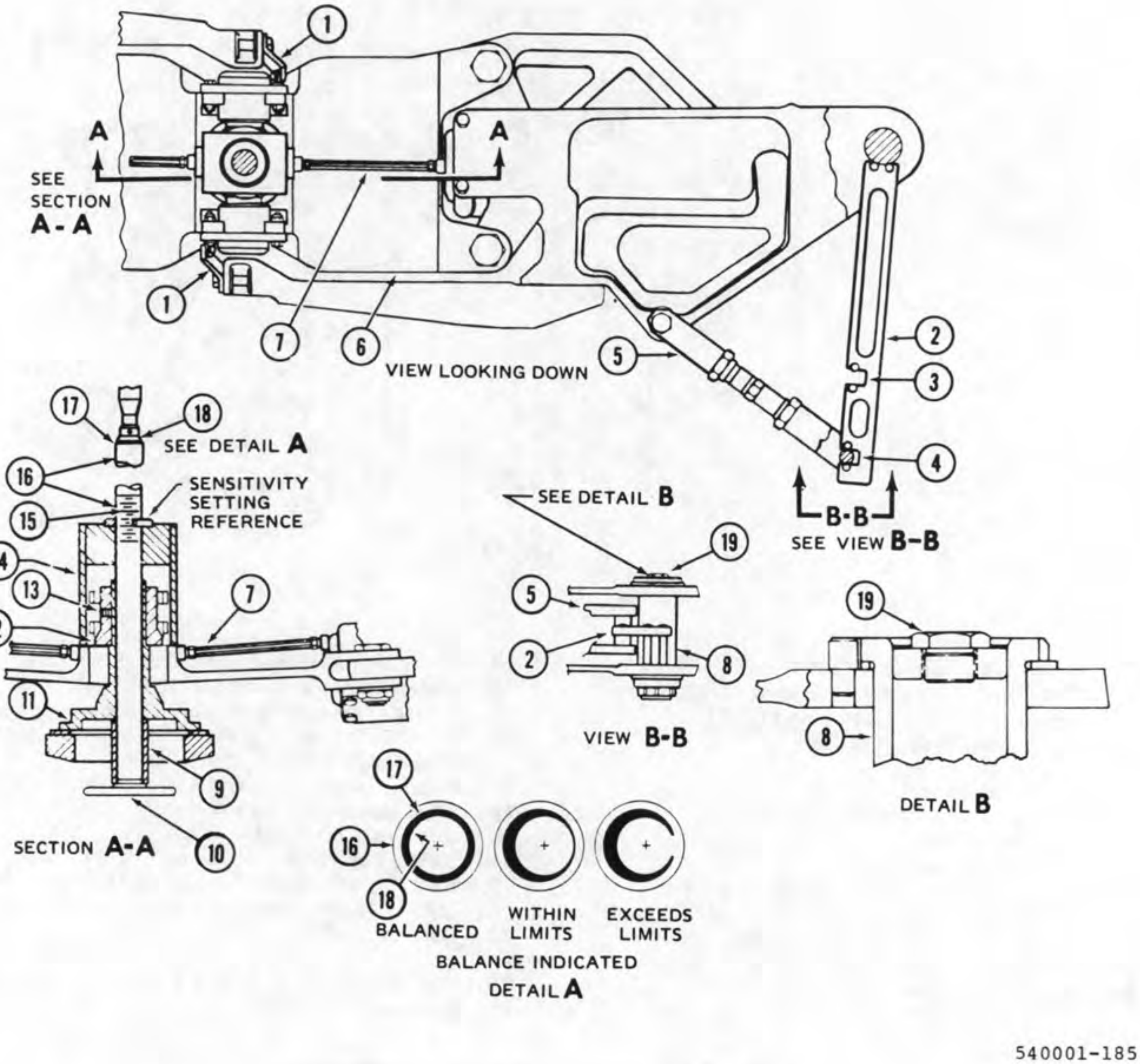
b. Balance main rotor hub assembly as follows:

(1) Carefully lower rotor hub assembly (6, figure 5-50) over fixture (11); align inside diameter of splined trunnion with piloting diameter of adapter (12), and ensure that cone surface of splined trunnion seats firmly on cone surface of adapter (12).

(2) Install yoke (14), legs downward, on arbor (16) and position so that top surface of its locking collar sensitivity setting reference aligns with 15-3/8 inch position on arbor scale (15). Lock yoke firmly in this position on arbor with its collar screw, using 3/16 inch hex wrench from kit (T73).

(3) Install arbor (16) downward through rotor trunnion and fixture assembly. Seat legs of yoke (14) in milled areas on top surfaces of hub yoke; center with scribed lines.

(4) Position jacks (7) on top surface of the rotor hub yoke so that their inboard ends bear against the central boss of the hub yoke, centered below the



1. Grip lock (Bell P/N T101864)
2. Gage (Marvel P/N 2486 from 7HELO66 kit)
3. Gage inner position
4. Gage outer position
5. Drag brace
6. Rotor hub assembly
7. Jack (Marvel P/N 2865 from 7HELO66 kit)
8. Blade retaining bolt
9. Spacer (Marvel P/N 2203 from 7A050 kit)
10. Handwheel (Marvel P/N 2215 from 7A050 kit)
11. Fixture (Marvel P/N 2337 from 7HELO54 kit)
12. Adapter (Marvel P/N 2588 from 7HELO66 kit)
13. Adapter set screw
14. Yoke (Marvel P/N 2846 from 7HELO66 kit)
15. Arbor scale
16. Balancing arbor (Marvel P/N 2259 from 7A050 kit)
17. Indicator disk
18. Indicator collar
19. Plug (AN814-10D)

Figure 5-50. Tool Application — Main Rotor Hub Balancing

scribe lines mentioned in step (3). Position outboard ends of jacks (7) against the shoulders of the inboard bearing housing of the blade grip assemblies. Adjust jacks to provide uniform outward pressure sufficient to ensure blade grips are seated in their full outward positions.

(5) Install spacer (9) over lower end of arbor; install handwheel (10) in lower end of arbor and tighten to clamp both legs of yoke firmly against top surfaces of hub yoke.

(6) Position two gages (2) on hub as illustrated to adjust drag braces (5) to symmetrical angular positions. Remove gage from rotor hub during subsequent balance check.

(7) Install quick-disconnect assembly with 3/16 inch cable from kit (T73) on arbor suspension rod and hoist balancing assembly approximately **1/4** inch off work stand with hydraulic pump (15, figure 5-49). Check to ensure that suspended assembly is free from interference with work stand and adjacent objects. If handwheel (10, figure 5-50) is not free of interference with the stand table, adjust the level of the stand assembly by installing suitable blocks under the two tubular stand leg extensions (6, figure 5-49).

(8) After it is determined that the handwheel (10, figure 5-50) suspends free of interference, lower the hub to rest on the stand.

(9) Place a bubble protractor on the machined surfaced next to the blade retaining bolt and set both blade grips to **zero** degrees. Both grips must be equal within **zero** degrees, **five** minutes.

(10) Raise assembly approximately **0.25** inch off work stand to obtain balance readings.

(11) Observe balance indication at indicator disk (17, figure 5-50) to determine whether the hub is in balance. See figure 5-50, Detail A for examples of balance indications at indicator disk.

(12) Balance hub assembly chordwise by placing weight on pitch horn (light) at blade station 0.000. See Detail A, figure 5-50 for balance indications.

NOTE

Chordwise balance is accomplished only to aid in spanwise balance. The weight will be removed from the pitch horn after spanwise balance is complete.

(13) Balance spanwise about blade station 0.000 by inserting lead wire, lead wool slugs or **0.44** inch diameter shot into cavity of blade bolt assembly (8). Hub shall be balanced within limits shown in detail A, figure 5-50.

(14) Install plug (19) into blade bolt (8) when balance has been accomplished. Remove balance weight that was used for chordwise balance in step (12).

(15) Color code hub assembly parts after balance to ensure that parts of hub remain in same respective position as they were when hub was balanced.

(16) Remove hub balance stand and accessories.

5-46. INSTALLATION — MAIN ROTOR HUB.

Refer to paragraph 5-14.

SECTION III. MAIN ROTOR CONTROLS

5-47. MAIN ROTOR CONTROLS — PYLON ASSEMBLY.

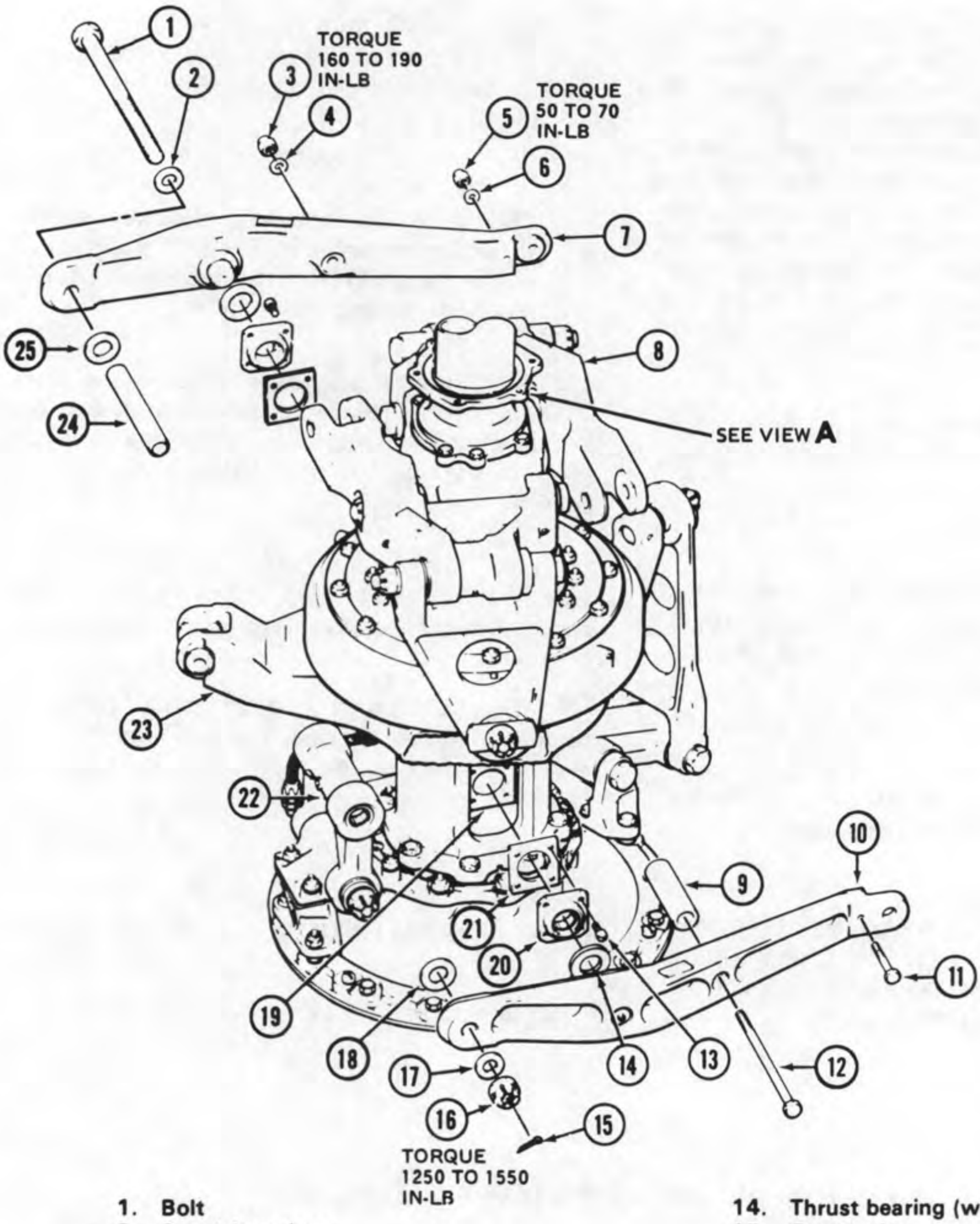
5-48. DESCRIPTION — MAIN ROTOR CONTROLS.

The two major assemblies of the main rotor controls are the swashplate and support assembly and the scissors and sleeve assembly. The pitch links (10, figure 5-1), collective lever (14), the idler assembly (27) that attaches the forward end of the collective lever to transmission case (19), and the collective friction mechanism shown in figure 5-51, detail view A, are included in the main rotor controls. Refer to paragraph 5-4 for description of main rotor controls function. Refer to paragraph 5-65 for description of swashplate. Refer to paragraph 5-55 for description of scissors and sleeve.

5-49. REMOVAL — MAIN ROTOR CONTROLS.

CAUTION

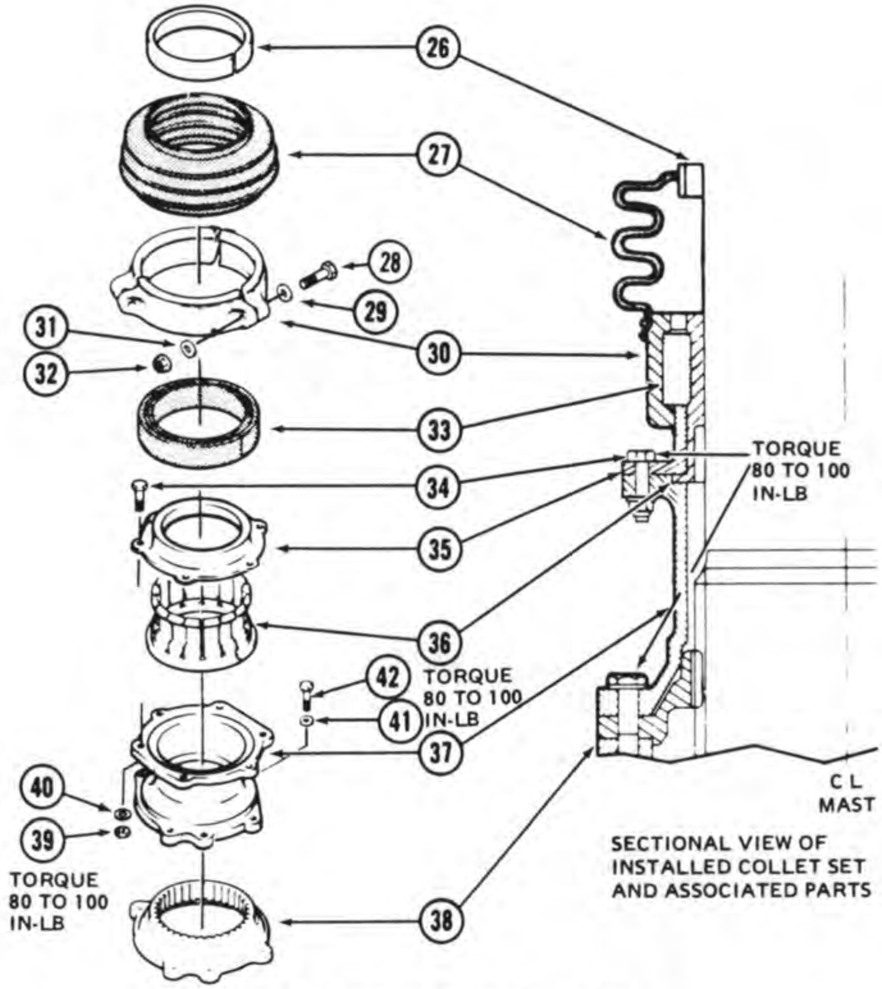
Remove scissors and sleeve with caution to avoid damage to mast.



1. Bolt
2. Special washer
3. Nut
4. Washer
5. Nut
6. Washer
7. Lever assembly
8. Scissors and sleeve assembly
9. Spacer
10. Lever assembly
11. Bolt
12. Bolt
13. Screw
14. Thrust bearing (washer)
15. Cotter pin
16. Nut
17. Special washer
18. Thrust washer
19. Collective sleeve
20. Bearing assembly
21. Spacer plate
22. Idler assembly
23. Swashplate and support assembly
24. Bearing inner race
25. Thrust washer

209200-44-1A

Figure 5-51. Main Rotor Controls Installation (Sheet 1 of 3)

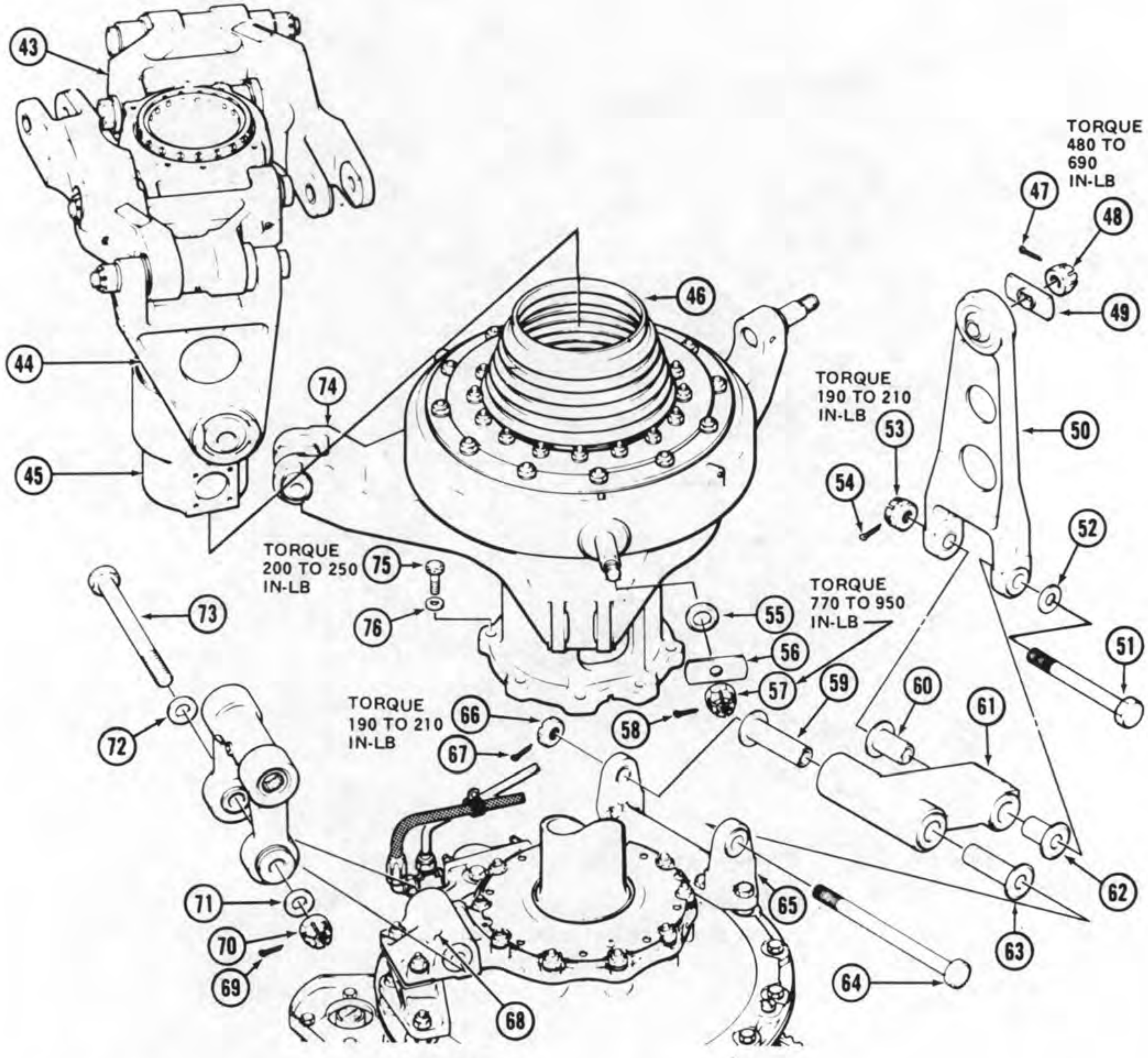


DETAIL VIEW **A** EXTENSION INSTALLATION

26. Spacer
27. Upper boot
28. Bolt
29. Washer
30. Clamp assembly
31. Washer
32. Nut
33. Rubber ring
34. Bolt
35. Retainer
36. Collet set
37. Extension
38. Spline plate
39. Nut
40. Washer
41. Washer
42. Bolt

209200-48C

Figure 5-51. Main Rotor Controls Installation (Sheet 2 of 3)



43. Scissors and sleeve assembly
44. Drive link
45. Collective sleeve
46. Lower boot
47. Cotter pin
48. Nut
49. Special washer
50. Anti-drive link
51. Bolt
52. Special washer
53. Nut
54. Cotter pin
55. Special washer
56. Special washer
57. Nut
58. Cotter pin
59. Sleeve bushing
60. Sleeve bushing
61. Bellcrank
62. Sleeve bushing
63. Sleeve bushing
64. Bolt
65. Support
66. Nut
67. Cotter pin
68. Boss
69. Cotter pin
70. Nut
71. Special washer
72. Special washer
73. Bolt
74. Swashplate and support assembly
75. Bolt
76. Washer

209200-44-3A

Figure 5-51. Main Rotor Controls Installation (Sheet 3 of 3)

a. Remove main rotor hub and blades (paragraph 5-12).

b. Remove pitch links (15, figure 5-2) from scissors.

c. Remove friction collet set (36, figure 5-51) as follows:

(1) Cut lockwire and remove spacer (26) and upper boot (27).

(2) Remove bolts and clamp assembly (30). (Keep three parts of clamp together as a set.)

(3) Remove rubber ring (33).

(4) Remove nuts (39) and bolts (34). Remove retainer (35) and collet set (36). Identify collet set for reinstallation as a set.

d. Remove extension (37) and spline plate (38) as follows:

(1) Check wear on spline plate prior to removal.

(a) Attach dial indicator on mast as shown in figure 5-52 with indicator probe against flat of one of the attachment bolts.

(b) Measure and record amount of radial looseness by rotating scissors and sleeve assembly hub (6, figure 5-52) forward and then back to spline contact. Maximum allowable amount of radial looseness measured in this manner is **0.040** inch.

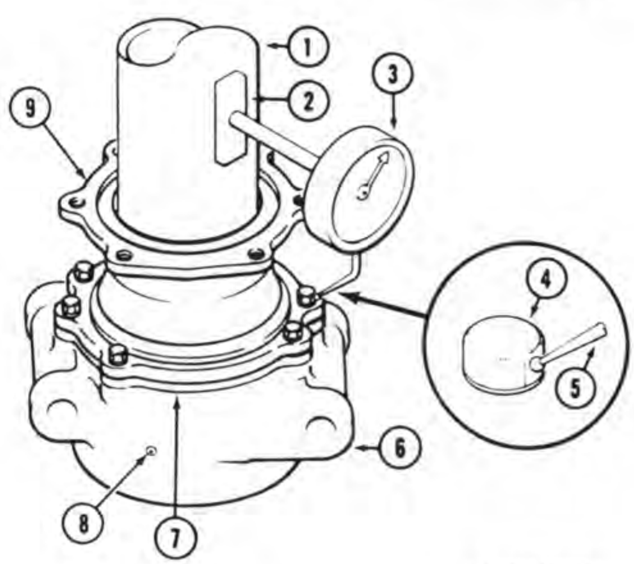
(2) If scissors and sleeve assembly is to be reinstalled without complete disassembly and inspection, check wear on thrust washers (7, figure 5-53) prior to removal. Maximum allowable looseness at thrust washers is **0.060** inch as shown in illustration.

(3) Remove bolts (42, figure 5-51) and remove extension and spline plate. Identify spline plate as satisfactory or as worn beyond limits noted in preceding step (1).

e. Remove collective levers as follows:

(1) Disconnect collective system control tube from collective lever assemblies (7 and 10).

(2) Remove bolts (1, 11, and 12). Separate collective lever halves (7 and 10) from collective



1. **Mast**
2. **Magnet**
3. **Dial indicator**
4. **Bolt head**
5. **Indicator probe**
6. **Hub assembly**
7. **Spline plate**
8. **Grease fitting**
9. **Extension**

Figure 5-52. Tool Application — Spline Plate Wear Measurement

sleeve (19) and link (22). Keep spacer (9), thrust bearing washer (14), thrust washer (18), bearing inner race (24) and similar parts on the opposite side with the collective lever halves for reassembly.

f. Remove link assembly (22) as follows:

(1) Remove cotter pin (69), nut (70), washers (71 and 72) and bolt (73).

(2) Remove link assembly from boss (68).

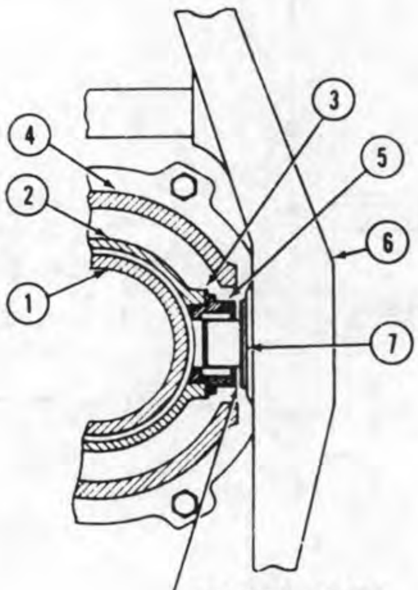
g. Remove anti-drive link (50) as follows:

(1) Remove cotter pin (54), nut (53), bolt (51) and washer (52).

(2) Remove cotter pin (47), nut (48) and special washer (49).

(3) Remove anti-drive link.

(4) Install bolt (51) in bellcrank (61) to secure sleeve bushings (60 and 62).



1. Mast
2. Collective sleeve
3. Bearing housing
4. Swashplate support
5. Bearing
6. Lever
7. Thrust washer

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

209200-38B

Figure 5-53. Collective Lever Thrust Washer Wear Limits

h. Remove bellcrank assembly (61) as follows:

(1) Remove cotter pin (67), nut (66) and bolt (64).

(2) Remove bellcrank (61) from support (65).

(3) Install bolt (64) in bellcrank (61) to secure sleeve bushings (59 and 63).

i. Remove support assembly (65) as follows:

(1) Remove four bolts, nuts and washers that secure support assembly (65) to transmission.

(2) Use a sharp plastic scraper to separate bead of sealant from support assembly.

(3) Remove support assembly from transmission.

j. Remove scissors and sleeve assembly (paragraph 5-58).

k. Remove swashplate and support (paragraph 5-68).

5-50. INSPECTION — MAIN ROTOR CONTROLS.

a. Inspect pitch links (10, figure 5-1) for damage such as metal to metal contact on upper bearing housing, normal bearing wear, surface wear and straightness of tube assembly. All damage limits are given on figure 5-54.

(1) When inspecting the pitch change tube, mask the ends of the tube to prevent liquid material from contacting the metal set material. Mask the center of the tube length so that only the top and bottom three inches of the tube are exposed.

NOTE

The success and reliability of penetrant inspection depend upon the thoroughness with which the inspector prepares the part from the precleaning process all the way through to the final interpretation of the indications. All inspections should be with the fluorescent penetrant (Type I, Method C) in strict accordance with TM 43-0103.

WARNING

Prolonged or repeated inhalation of vapors or powders may result in irritation of the mucous membrane areas of the body. Provide adequate ventilation.

Continual exposure to penetrant inspection materials may cause skin irritation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

Injury to eyes and skin may occur when blacklight is not used in accordance with manufacturer's inspections. Unfiltered light sources (if filter is required) may possibly damage the eyes.

WARNING

Temperatures in excess of 120 degree F may cause bursting of pressurized cans and injury to personnel.

Volatile fumes may occur, creating both a fire and health hazard.

NOTE

Paint will not be removed by any mechanical means under any circumstances because it may mask over any potential surface cracks.

(2) With a soft hair brush, apply MEK (Metyl-Ethyl-Ketone) (C74), or paint remover (TTR 248B) and remove the paint.

NOTE

The gold colored finish on the metal is a very thin chem-coat metal primer. This material is not, repeat, not to be removed.

(3) Clean the prepared surfaces with a soft cloth.

(4) Apply a fluorescent dye penetrant to the prepared surfaces from either a spray can or with a soft hair brush and in strict conformance to the procedure specified in TM 43-0103, Chapter 6.

(5) Allow penetrant to dwell for a minimum of 30 minutes.

(6) Clean off all excess penetrant in accordance with TM 43-0103, standard procedures. (Check for complete excess penetrant removal from surface by using a blacklight.)

(7) Apply applicable developer consistent with Type I, Method C penetrant method in TM 43-0103.

(8) Inspect suspected area with blacklight source in subdued white light.

NOTE

Normal manufacturing machining marks may be observed on the tube surfaces. These will not be cause of part rejection.

(9) If any apparent cracks appear (or suspect surface defects), the suspect area must be reevaluated utilizing certified NDI personnel with the Eddy Current method per TM 43-0103, Chapter 3. (Tube material is 2024 aluminum.)

NOTE

If a physical or penetrant crack is observed and confirmed, report failures on QDR Form 368 in accordance with TM 38-750 and hold tube as an exhibit.

(10) Clean tube with solvent and wipe dry.

(11) Inspecting for straightness is done by doing a Total Inline Runout (TIR).

(12) Remove upper bearing (209-010-443-10, barrell (209-010-414-1) and universal bearing (209-010-461-1).

(13) Set up bearing blocks fro pitch tube so that the edges of tube are resting between roller bearings.

(14) Set up indicator within a 1/4-inch from the edge of the larger diameter of the pitch tube. Dial indicator must not contact necked down area.

(15) Rotate pitch tube to find highest and lowest reading and zero dial at that position.

(16) Rotate pitch tube and record the total bend. Maximum allowed TIR is 0.020 inch; tubes in excess of 0.020 inch shall be reported and held as an exhibit.

(17) Repaint areas to original color of tube.

b. Inspect friction collet set (36, figure 5-51) for missing fingers, cracks and scoring.

c. Inspect rubber ring (33), boot (27), and boot (46), for damage and deterioration.

d. Inspect extension (37) and retainer (35) for obvious damage that would affect function.

e. Inspect spline plate (38) as follows.

(1) Inspect for damage in excess of limits shown in figure 5-55.

(2) Inspect for cracks by fluorescent penetrant method Refer to TM 43-0103.

(3) Refer to paragraph 5-49, d. for instructions to check spline plate for excessive wear while installed.

f. Inspect clamp assembly (30, figure 5-51) for cracks, corrosion and deformation.

g. Inspect collective levers (7 and 10) as follows:

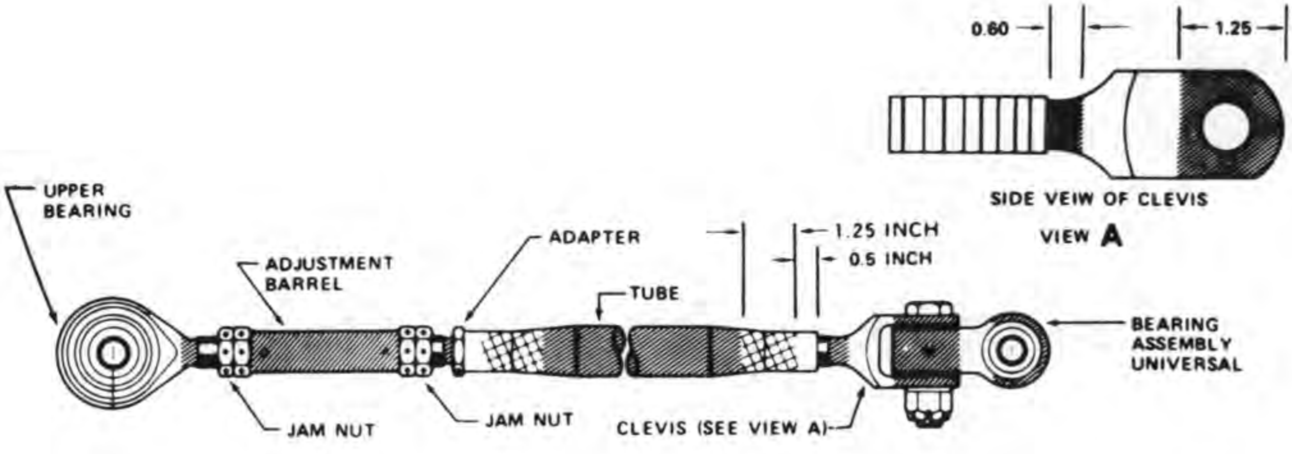
(1) Inspect for damage in excess of limits shown in figure 5-56.

(2) Inspect for cracks by magnetic particle method. Refer to TM 43-0103.

h. Inspect collective lever link assembly (22) as follows:

(1) Inspect for damage in excess of limits shown in figure 5-57.

(2) Inspect bearings (3 and 5, figure 5-58) for secure installation in link and for missing or damaged rollers. Install bearing inner race (24, figure 5-51) and

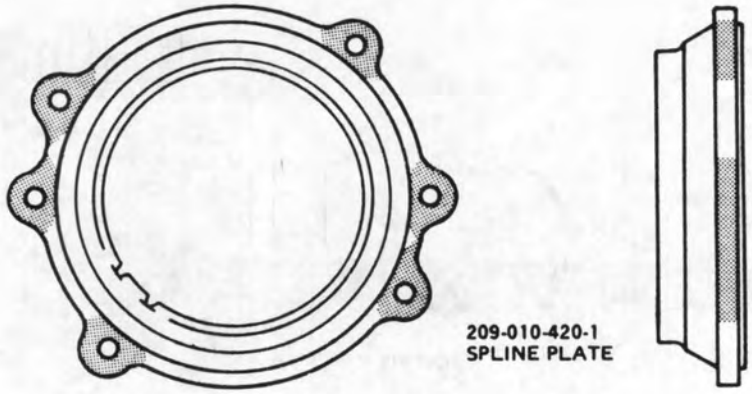


TYPE OF DAMAGE AND AREA OF REPAIR	AREA A	AREA B	AREA C
NO CRACKS ALLOWED			
NICKS SCRATCHES SHARP DENTS	0.005 INCH MAX DEPTH BEFORE AND AFTER REPAIR	0.010 INCH MAX. DEPTH BEFORE AND AFTER REPAIR	0.010 INCH MAX. DEPTH BEFORE AND AFTER REPAIR
CORROSION	0.0025 INCH MAX. DEPTH BEFORE REPAIR AND 0.005 INCH AFTER REPAIR	ON ALUMINUM PARTS 0.0025 INCH MAX. DEPTH BEFORE REPAIR AND 0.005 INCH AFTER REPAIR ON STEEL PARTS 0.010 INCH BEFORE AND AFTER REPAIR	ON ALUMINUM PARTS 0.005 INCH MAX. DEPTH BEFORE REPAIR AND 0.010 INCH AFTER REPAIR ON STEEL PARTS 0.020 INCH BEFORE AND AFTER REPAIR
AREA OF FULL DEPTH REPAIR	0.250 SQ. INCH ON ALUMINUM	0.10 SQ. INCH ON STEEL NOT CRITICAL ON ALUMINUM	0.10 SQ. INCH

NOTES

1. All edges may be radiused or chamfered 0.030 inch to remove nicks or dents.
2. Repair of nicks and dents on threads must not exceed one-third of the thread depth. Length of repair shall not exceed 0.250 inch. Each threaded segment may have two repair areas.
3. Coat repair areas on steel parts with brush cadmium or zinc chromate and aluminum parts with zinc chromate. Do not use zinc chromate on threads.
4. Corrosion must be cleaned up to twice the depth of damage on aluminum. Corrosion must be cleaned up to remove all trace of damage on steel.
5. Minimum radius of repair on adapter is 0.100 inch. The repair must be polished to match the surrounding surfaces.
6. Maximum play in bearing Part No. 209-010-443-1 is 0.020 inch axial or radial.
7. Maximum play in bearings in universal Part No. 209-010-461-1 or 214-010-434-1 is 0.020 inch axial or radial.
8. Do not remove adapter or clevis from tube.
9. Visual irregularities caused by the swaging operation at each end considered acceptable provided there are no sharp ridges or groves.
10. Visually inspect tubes for any indications of bending. No bending allowed.
11. Do not change color of tube when repainting or touching-up.
12. Every 150 hours at phase inspect control tubes for TIR. No more than 0.020 inch is allowed. Set up indicator within 0.250 inch from edge of larger diameter of pitch tube. Dial indicator must not contact necked down area.
13. Repaired areas may over lap on the aluminum part of the tube.

Figure 5-54. Damage Limits — Pitch Link Assembly



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED (shaded)	(unshaded)
CRACKS ALLOWED	None	None
NICKS AND DENTS	0.010	0.020
CORROSION	0.005	0.010
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	0.25 Sq. In.
NUMBER OF REPAIRS	One Per Segment	Not Critical
EDGE CHAMFER	0.030	0.060
SPLINE DAMAGE		
Depth	One-Third of Spline	
Length	One-Half of Spline	
Number	Three	
BOLT BORE DAMAGE	0.002 Full Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209010-80C

Figure 5-55. Damage Limits — Spline Plate

COLLECTIVE LEVER
209-010-406-5

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
NICKS AND DENTS CORROSION	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	0.50 Sq. In.
NUMBER OF REPAIRS	Two Per Segment	Not Critical
EDGE CHAMFER	0.030	0.060
BORE DAMAGE	0.002 Depth for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209010-75C

Figure 5-56. Damage Limits — Collective Lever

check for radial looseness. (Maximum allowable radial looseness is **0.010** inch.)

(3) Inspect bushings (6, figure 5-58) for secure installation in link and for deterioration and separation.

(4) Inspect lubrication fitting (7) for damage that would affect function.

(5) Inspect for cracks by fluorescent penetrant method. Refer to TM 43-0103.

i. Inspect swashplate anti-drive link (50, figure 5-51) as follows:

(1) Inspect for damage in excess of limits shown in figure 5-59.

(2) Inspect bushings (5, figure 5-60) for wear and damage.

(3) Inspect identification plate (3) for secure installation and legible markings.

(4) Inspect link (4) by fluorescent penetrant method. Refer to TM 43-0103.

j. Inspect swashplate anti-drive assembly bellcrank (61, figure 5-51) as follows:

(1) Inspect four teflon lined bearing bushings in the bellcrank for damage, wear and corrosion.

(2) Inspect for cracks by fluorescent penetrant method. Refer to TM 43-0103.

(3) Inspect for damage in excess of limits shown in figure 5-61.

k. Inspect sleeve bushings (59, 60, 62 and 63, figure 5-51) for distortion of teflon and mechanical damage.

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
NICKS SCRATCHES, DENTS AND CORROSION	0.010	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	0.25 Sq. In.
NUMBER OF REPAIRS	One Per Lug	Not Critical
EDGE CHAMFER	0.030	0.060
BORE DAMAGE	0.002 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209010-76C

Figure 5-57. Damage Limits — Collective Lever Idler Link

l. Inspect support assembly (65) as follows:

(1) Inspect for damage in excess of limits shown in figure 5-62.

(2) Inspect bushings (2, figure 5-63) for secure installation in the support.

(3) Inspect for cracks by fluorescent penetrant method. Refer to TM 43-0103.

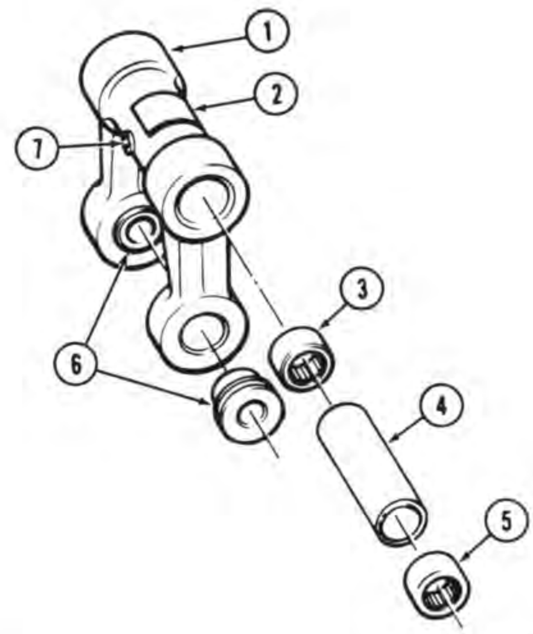
m. Inspect scissors and sleeve assembly (paragraph 5-60).

n. Inspect swashplate and support (paragraph 5-69).

5-51. REPAIR — MAIN ROTOR CONTROLS (AVIM).

a. Repair pitch links (10, figure 5-1) as follows:

(1) Polish out corrosion and mechanical damage that is within limits shown in figure 5-54 with 300 grit or finer sandpaper (C102). Touch-up repair areas as described in figure 5-54.



1. Link assembly
2. Identification plate
3. Roller bearing
4. Sleeve
5. Roller bearing
6. Bushing
7. Lubrication fitting

Figure 5-58. Collective Lever Idler Link Assembly

(2) Replace bearings if worn beyond limits shown in figure 5-54. Set pitch links to **27.05** inch initial length as shown in figure 5-8.

b. Replace the following parts if worn or damaged in excess of limits:

(1) Friction collet set (36, figure 5-51).

(2) Rubber ring (33).

(3) Boot (27).

(4) Boot (46).

c. Replace extension (37) and/or retainer (35) if damaged to the extent that function would be affected.

d. Repair spline plate (38) as follows:

(1) Polish out mechanical and corrosion damage that is within limits shown in figure 5-55. Use fine to medium abrasive cloth (C36) or fine India stone (C116). Blend repair smoothly into surrounding area. Replace part if repair exceeds allowable area and/or depth limits.

(2) Touch-up repair areas with primer (C88 or C91).

e. Replace clamp assembly (30, figure 5-51) if any of the sections are cracked, deformed, or severely corroded.

f. Repair collective levers (7 and 10) as follows:

(1) Polish out mechanical and corrosion damage that is within limits shown in figure 5-56 with 300 grit or finer sandpaper (C102) and scotchbrite (C103).

(2) Touch-up repair areas with primer (C88 or C91).

g. Replace components of collective lever idler link (22, figure 5-51) which have damage in excess of limits specified in inspection paragraph 5-50, as follows:

(1) Replace damaged lubrication fitting (7, figure 5-58), as follows:

(a) Carefully remove old lubrication fitting to avoid damage to link.

(b) Press new lubrication fitting into link.

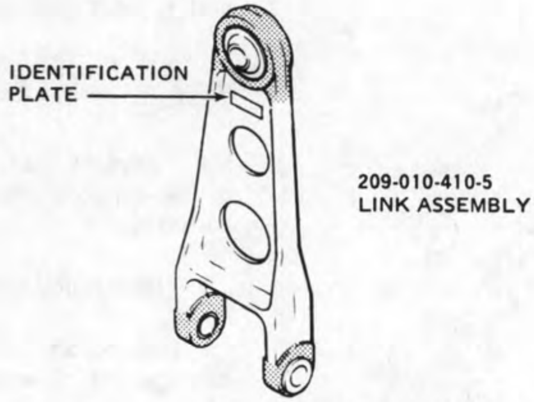
(c) Attach a grease gun serviced with clean grease (C58) to fitting and check to ensure that fitting is properly installed.

(2) Replace damaged identification plate (2) as follows:

NOTE

If data to be stamped on identification plate is not available, send affected assembly to Depot Maintenance for evaluation.

(a) Stamp all data from the old identification plate on the new identification plate.



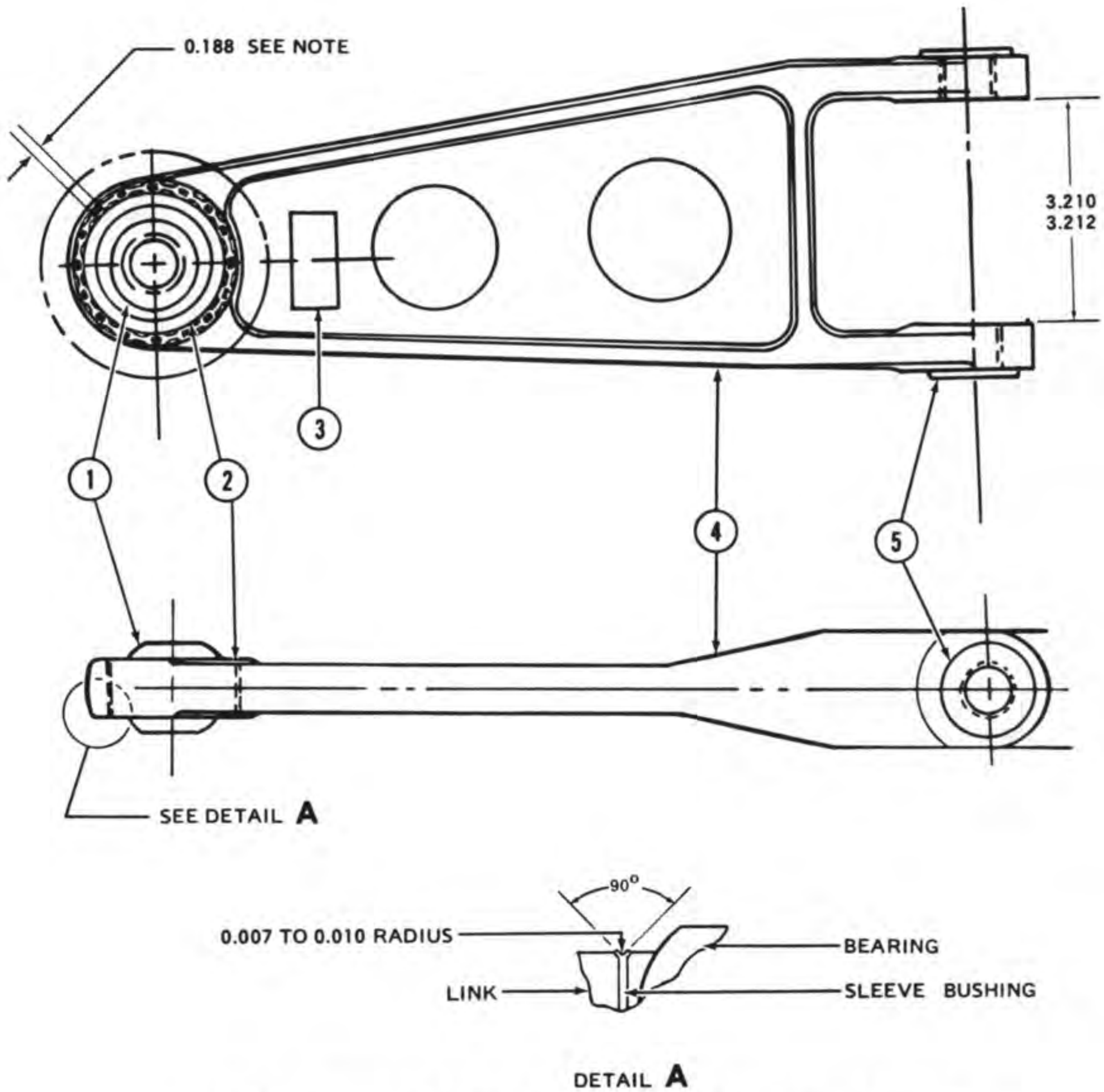
DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, SHARP DENTS	0.010 Before and After Repair	0.030 Before and After Repair
CORROSION	0.005 Before Repair 0.010 After Repair	0.010 Before Repair 0.020 After Repair
AREA OF FULL DEPTH REPAIR	0.10 Sq. In.	0.25 Sq. In.
NUMBER OF REPAIR AREAS	One Per Lug	Not Critical
EDGE CHAMFER	0.030	0.060
BORE DAMAGE	0.002 Depth for 1/4 Circumference	
BUSHING OR BEARING SLEEVE LOOSENESS	Scrap Link if Bushings or Bearing Sleeve is Loose in Link.	
BEARING AXIAL PLAY	Maximum Allowable Axial Play in Bearing is 0.015.	
BEARING RADIAL PLAY	0.020 inch Maximum	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

204010-24H

Figure 5-59. Damage Limits — Swashplate Anti-Drive Link



ALL DIMENSIONS ARE IN INCHES UNLES OTHERWISE NOTED.

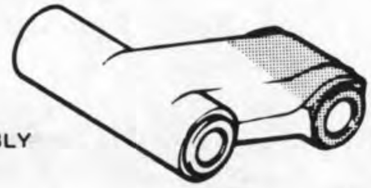
NOTE:

Use a staking tool with eight segments that will make 0.188 segments as illustrated. Stake two times to make 16 equally spaced segments. Refer to text for additional instructions to stake bearing.

1. Bearing
2. Sleeve bushing
3. Identification plate
4. Anti-drive link
5. Bushing

209010-108A

Figure 5-60. Swashplate Anti-Drive Link Assembly



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED (shaded)	(unshaded)
CRACKS ALLOWED	None	None
NICKS, SCRATCHES AND DENTS	0.020	0.040
CORROSION	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	Not Critical	Not Critical
NUMBER OF REPAIRS	Two	Not Critical
EDGE CHAMFER	0.040	0.080
BORE DAMAGE	0.002 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

540001-14C

Figure 5-61. Damage Limits — Swashplate Anti-Drive Assembly Bellcrank

CAUTION

Do not heat link assembly (1) to temperature above limit noted in following step.

(b) Remove old identification plate from link assembly. Heat link assembly to 200 ±**15** degrees F (**93** ±**9** degrees C) to loosen adhesive.

(c) Mask off face side of new identification plate and the area of the link assembly where identification plate will be installed.

(d) Clean masked-off area on link assembly with 300 grit or finer sandpaper (C102).

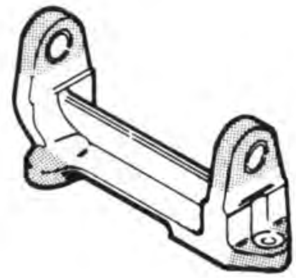
(e) Form new identification plate to fit closely on link assembly.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(f) Scrub mating surfaces of identification plate and link assembly with cheesecloth (C30) dampened with aliphatic naphtha (C75). Wear clean white cotton gloves (C54) when handling parts after cleaning and prior to bonding.

(g) Mix two-part adhesive (C7) in accordance with instructions on container. Apply a thin coat of adhesive to each of the mating surfaces as soon as possible after mixing. Place identification plate on link and anchor in position with clamps or rubber bands.



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
NICKS, DENTS AND AND SCRATCHES	0.020	0.040
CORROSION	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	0.010	Not Critical
NUMBER OF REPAIRS	One Per Lug	Not Critical
EDGE CHAMFER	0.040	0.060
BORE DAMAGE	0.002 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

540001-13C

Figure 5-62. Damage Limits — Swashplate Anti-Drive Assembly Support

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(h) Clean adhesive squeeze-out from parts with cheesecloth and MEK (C74) before adhesive cures.

(i) Remove masking tape before adhesive cures.

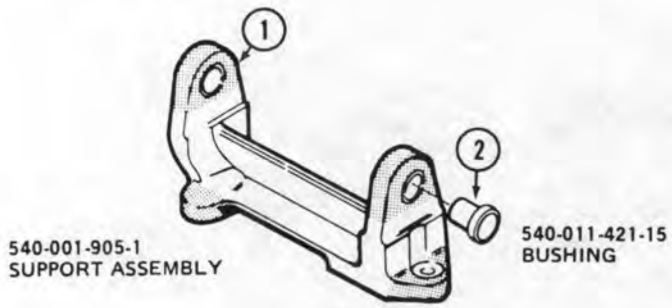
(j) Allow adhesive to cure for **24** hours at room temperature (approximately **75** degrees F) (**24** degrees C). Full strength will be reached in **six to seven** days.

(3) Replace damaged bushing (6) as follows:

CAUTION

Do not heat link assembly (1) to temperature above limits noted in following step.

(a) Support link assembly with suitable sleeves and supports to avoid distortion and press out two bushings (6). The bushings must be pressed outboard from the link as illustrated. If bushings are a tight fit in the link, to a maximum of **200** ± **15** degrees F (**93** ± **9** degrees C). Then press bushings out.



1. Swashplate anti-drive support assembly
2. Bushing

Figure 5-63. Swashplate Anti-Drive Assembly Support

(b) Clean bores where two bushings (6) will be installed.

(c) Select suitable sleeves and support blocks to support legs of link assembly (1) during installation of bushings (6).

CAUTION

Do not heat link assembly (1) to temperature above limit noted in following step.

CAUTION

Do not chill bushings (elastomeric-type bushings) (6) during installation procedure.

(d) Heat link assembly (1) to **200 ±15** degrees F (**93 ±9** degrees C). Coat mating surface of bushings (6) with primer (C88 or C91) and install with flanges outboard as illustrated while primer is wet.

(4) Replace damaged bearings (3) and (5) as follows:

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(a) Clean bore of link assembly (1) where bearings will be installed. Clean new bearings (3 and 5) and sleeve (4) with dry cleaning solvent (C112). Allow bearings to dry thoroughly and hand pack with grease (C58).

(b) Apply a thin coat of corrosion preventive compound (C44) to mating surfaces of sleeve (4) and bearings (3 and 5). Press spacer and bearings into link.

(c) Polish out mechanical and corrosion damage that is within limits shown in figure 5-57.

h. Repair swashplate anti-drive link (50, figure 5-51) as follows:

(1) Polish out corrosion and mechanical damage that is within limits shown in figure 5-59 with 300 grit or finer sandpaper (C102) and scotchbrite (C103). Touch-up repair areas with alodine (C31).

(2) Replace damaged or missing identification plate (3, figure 5-60) as outlined in step g. (2) (b) above for the collective lever idler link. Install identification plate on side of link illustrated in figure 5-60.

(3) Replace anti-drive link if bearing (1, figure 5-60) is damaged or radial looseness is in excess of limit shown in figure 5-59, or if the bearing is loose in the sleeve bushing.

(4) Replace damaged bushings (5) as follows:

(a) Support link (4) and press out damaged bushings (5).

(b) Inspect link bore where bushings were removed for damage in excess of limit shown in figure 5-59. If damage exceeds limits, dispose of link locally.

(c) Support link (4) and press new bushings (5) into place with bushing flanges outboard as illustrated.

(d) Check for **3.210 TO 3.212** inch dimension between two bushings (5) as illustrated. Mill ends of bushings if necessary.

(e) Check for **0.6241 TO 0.6255** inch inside diameter of bushings after installation.

i. Repair swashplate anti-drive assembly bellcrank (61, figure 5-51) as follows:

(1) Replace teflon lined bearing bushings that failed to pass inspection as follows:

CAUTION

Do not heat bellcrank to temperature in excess of 200 degrees F (93 degrees C).

NOTE

The four teflon lined bearing bushings are bonded in the bellcrank.

(a) Remove damaged bearing bushings from bellcrank. If only one bearing bushing is damaged, also remove the opposite bearing bushing. If the bearing bushings are difficult to remove, heat the bellcrank to **200** degrees F (**93** degrees C) maximum to aid in removal.

(b) Inspect bore where bearing bushings were removed. If bore damage is in excess of the limit shown in figure 5-61, dispose of bellcrank locally.

(c) Clean the bore where the new bearing bushings will be installed with technical trichloroethylene (C132) and clean cloths. Clean the mating surfaces of the new bearing bushings in the same manner.

(d) Apply sealing and retaining compound (C106) to mounting surfaces of bearing bushings and bellcrank with a clean cotton swab. Allow to dry for three minutes prior to application of sealant.

(e) Position new bearing bushings in bellcrank. Hold in alignment with flanges against bellcrank. Use a bolt or other work aid to secure bearing bushings.

(f) Apply sealing and retaining compound (C106) to joint around flanges of bearing bushings. Capillary action will draw the sealant into the joint. Clean off excess sealant with a clean cloth. Allow to cure for **60 TO 90** minutes at room temperature.

(2) Polish out corrosion and mechanical damage that is within limits shown in figure 5-61.

j. Replace sleeve bushings (59, 60, 62 and 63, figure 5-51) that were found to be damaged during inspection.

k. Repair support assembly (65) as follows:

(1) Polish out corrosion and mechanical damage that is within limits of figure 5-62.

(2) Replace damaged or missing bushings in support assembly (65, figure 5-51) as follows:

(a) Press damaged bushings (2, figure 5-63) out of support assembly. Use suitable supports to avoid distortion during pressing operation. Inspect bores where bushings were removed. If bore damage is in excess of limit shown in figure 5-62, dispose of support assembly locally.

(b) Coat new bushings (2, figure 5-63) with primer (C88 or C91) and press into support (1) while primer is wet. Install the bushings with flanges outboard. Use suitable supports to avoid distortion during pressing operation.

l. Repair scissors and sleeve assembly (paragraph 5-61).

m. Repair swashplate and support assembly (paragraph 5-70).

5-52. INSTALLATION — MAIN ROTOR CONTROLS.

a. Install swashplate and support assembly (paragraph 5-71).

b. Install scissors and sleeve assembly (paragraph 5-63).

5-53. ADJUSTMENT — MAIN ROTOR CONTROLS.

a. Rig main rotor controls (paragraph 11-7 and 11-29).

b. B540 Track main rotor blades (paragraph 5-114), step b).

c. K747 Track main rotor blades (paragraph 5-114, step c .

d. Adjust pitch links (paragraph 5-14).

e. Adjust swashplate uniball friction (paragraph 5-66).

f. Adjust friction on collet set (36, figure 5-51) (paragraph 5-63).

g. Lubricate link assembly (22, figure 5-51) (paragraph 1-29).

5-54. SCISSORS AND SLEEVE.

5-55. DESCRIPTION — SCISSORS AND SLEEVE.

The scissors and sleeve assembly is a component of the main rotor controls. The scissors are attached to the swashplate by the drive links for cyclic control of the main rotor. The scissors are attached to the collective control system through the hub (12, figure 5-64) and collective sleeve (19, figure 5-51) and lever assemblies (7 and 10) for collective pitch control of the main rotor. Refer to paragraph 5-4 for description of the funciton of the scissors and sleeve in the main rotor system.

Premaintenance Requirements for Scissors and Sleeve Assembly

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C23), (C36), (C58), (C74), (C91), (C112), (C116), (C137)
Special Environmental Conditions	None

5-56. CLEANING — SCISSORS AND SLEEVE.

a.Clean installed scissors and sleeve with clean cloths.

b. Clean scissors and sleeve that has been removed from helicopter as follows:

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(1) Clean hub (12, figure 5-64) and sleeve (13) with clean cloths dampened with dry cleaning solvent (C112). Do not allow solvent to contaminate bearings located inside hub (12).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(2) Remove bearing inner races (4, 16 and 32). Do not remove bearings from scissors. Clean all parts with dry cleaning solvent (C112). Ensure that all old grease and dirt particles are removed from bearings.

5-57. LUBRICATION — SCISSORS AND SLEEVE.

a. Lubricate an installed scissors and sleeve as shown on lubrication chart in Chapter 1.

b. Lubricate disassembled scissors and sleeve assembly as follows:

WARNING

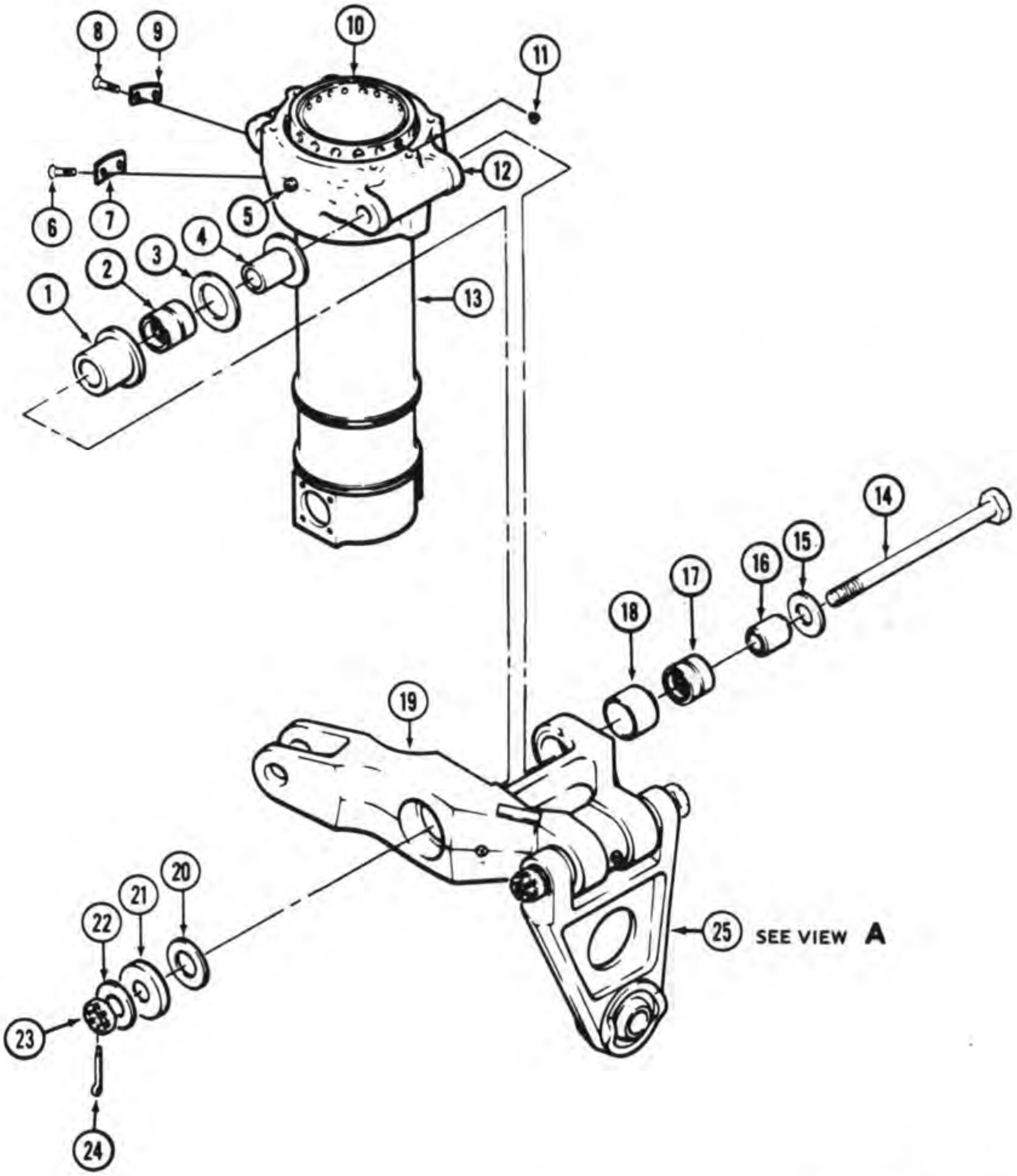
Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

NOTE

Do not remove bearings (2, 17, 35 and 37, figure 5-64) from scissors.

(1) Clean bearings (2, 17, 35 and 37, figure 5-64) with dry cleaning solvent (C112). Allow bearings to dry thoroughly.

(2) Inspect bearings to ensure that they are satisfactory for further service (paragraph 5-61).



1. Retainer
2. Bearing
3. Spacer
4. Bearing inner race
5. Lubrication fitting
6. Screw (Round head drive screw)
7. Identification plate
8. Screw (Round head drive screw)
9. Identification plate
10. Nut
11. Pin
12. Hub assembly
13. Collective sleeve
14. Bolt
15. Special washer
16. Bearing inner race
17. Bearing
18. Sleeve bushing
19. Scissors assembly
20. Special washer
21. Cap washer
22. Special washer
23. Nut
24. Cotter pin
25. Link assembly

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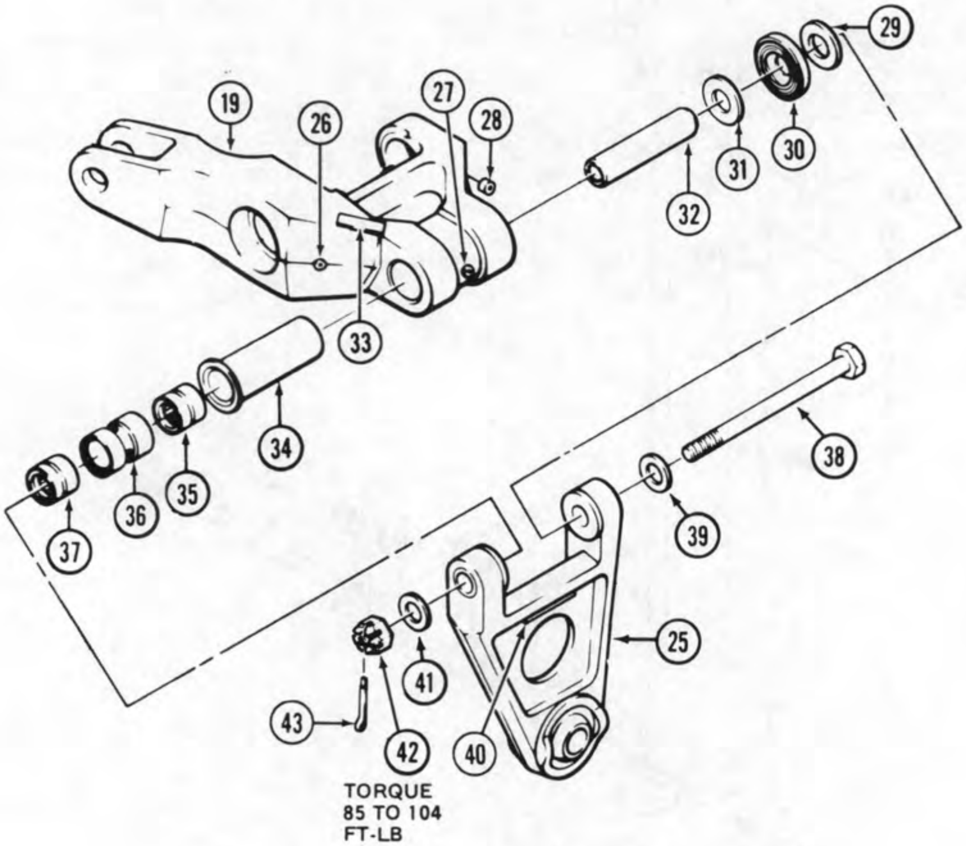
Figure 5-64. Scissors and Sleeve Assembly (Sheet 1 of 2)



VIEW A

26. Lubrication fitting
27. Lubrication fitting
28. Lubrication fitting
29. Shim
30. Housing and seal
31. Washer
32. Bearing inner race
33. Identification plate
34. Retainer
35. Bearing
36. Sleeve spacer
37. Bearing
38. Bolt
39. Washer
40. Identification plate
41. Washer
42. Nut
43. Cotter pin

209010-107-2A

Figure 5-64. Scissors and Sleeve Assembly (Sheet 2 of 2)

(3) Handpack bearings (2, 17, 35 and 37) with grease (C58).

(4) If scissors and sleeve assembly is not to be assembled immediately, position inner races in bearings (2, 17, 35 and 37) and wrap scissors with clean barrier material (C23) to protect bearings from contamination.

5-58. REMOVAL — SCISSORS AND SLEEVE.

CAUTION

Remove scissors and sleeve with caution to avoid damage to mast.

a. Remove main rotor (paragraph 5-12).

b. Cut lockwire and remove spacer (26, figure 5-51) and upper boot (27).

c. Remove bolts, nuts and washers and remove clamp assembly (30). (Keep three parts of clamp together as a set.)

d. Remove rubber ring (33).

e. Remove nuts (39) and bolts (34). Remove retainer (35) and collet set (36). Identify collet set for reinstallation as a set.

f. Check wear on spline plate prior to removal (paragraph 5-49).

g. If scissors and sleeve assembly is to be installed without complete disassembly and inspection, check wear on thrust washers (7, figure 5-53) prior to removal. Maximum allowable play at thrust washers is **0.060** inch as shown on illustration.

h. Remove bolts (42, figure 5-51) and remove extension and spline plate. Identify spline plate as satisfactory or as worn beyond limits noted in preceding step f.

i. Disconnect collective system control tube from collective lever assemblies (7 and 10). Remove bolts (1, 11, and 12). Separate collective lever halves (7 and 10) from collective sleeve (19) and link (22). Keep spacer (9), thrust bearing washer (14), thrust washer (18), bearing inner race (24) and similar parts on the opposite side with the collective lever halves for assembly.

j. Remove screws (13), bearing assembly (20) and spacer plate (21). Remove similar parts from opposite side.

k. Remove cotter pin (58), nut (57), and special washer (56). Remove drive link from swashplate. Remove special washer (55). Remove opposite drive link in the same manner.

l. Cut lockwire and detach lower boot (46) from collective sleeve.

CAUTION

Do not allow scissors lever to contact scissors hub as damage to lever could result. Block scissors lever with wood or other suitable material to prevent damage.

m. Lift scissors and sleeve assembly (43) out of swashplate and off mast. Use caution to prevent damage to friction sleeve and mast splines during removal.

n. If swashplate is not to be removed, cover open area around top of lower boot (46) to prevent entry of foreign materials.

o. If scissors and sleeve assembly is to be installed without complete inspection, make the following inspections to ensure that parts are suitable for installation on helicopter:

(1) Check end play between scissors and sleeve assembly (43) and link (44) for maximum axial looseness of **0.090** inch.

(2) Upper and lower boots (27 and 46) for tears and deterioration.

(3) Rubber ring (33) for deterioration and damage.

(4) Collet set (36) for missing fingers, cracks, scoring or other damage.

(5) Bearing assemblies (20) for binding, roughness and maximum radial play of **0.010** inch.

(6) Spherical bearing in drive link (44) for roughness, binding, and maximum axial play of **0.015** inch if excessive vibration does not occur.

(7) Scissors levers for gouges and scratches especially on underside of pivot leg (figure 5-65).

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
SCRATCHES, DENTS AND CORROSION	0.010	0.035
MAXIMUM AREA PER FULL DEPTH REPAIR	0.15 Sq. In.	0.25 Sq. In.
NUMBER OF REPAIRS	One Per Lug	Not Critical
EDGE CHAMFER	0.020	0.050
THREAD DAMAGE		
Depth	One-Third of Thread	
Length	One-Half of Thread	
Number	Two	
BORE DAMAGE	0.002 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

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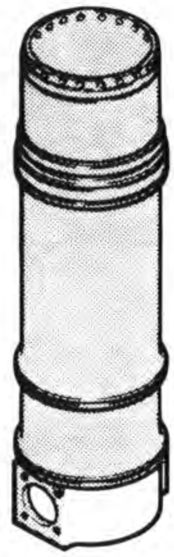
Figure 5-65. Damage Limits — Hub, Sleeve, Scissors and Link (Sheet 1 of 4)



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED (shaded)	(unshaded)
CRACKS ALLOWED	None	None
NICKS, SCRATCHES DENTS AND CORROSION	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	0.50 Sq. In.	0.50 Sq. In.
NUMBER OF REPAIRS	Not Critical	Not Critical
EDGE CHAMFER	0.020	0.040
THREAD DAMAGE		
Depth	One-Third of Thread	
Length	One-Quarter Inch	
Number	Two Per Segment	
BORE DAMAGE	0.002 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

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Figure 5-65. Damage Limits — Hub, Sleeve, Scissors and Link (Sheet 2 of 4)

SCISSOR ASSEMBLY
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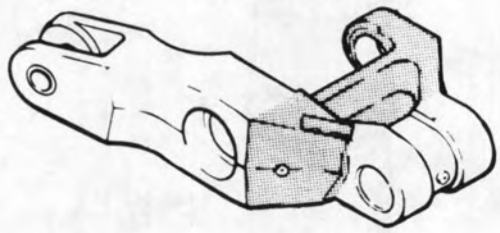

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED (shaded)	(unshaded)
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, SHARP DENTS	0.020	0.030
CORROSION DAMAGE		
Before Repair	0.010	0.015
After Repair	0.020	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.25 Sq. In.	0.40 Sq. In.
NUMBER OF REPAIRS	Not Critical	Not Critical
EDGE CHAMFER	0.040	0.060
BORE DAMAGE	0.001 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

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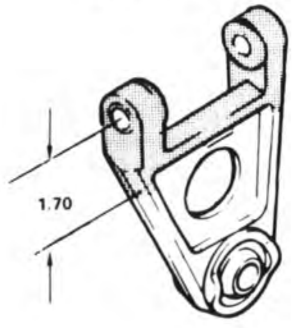
Figure 5-65. Damage Limits — Hub, Sleeve, Scissors and Link (Sheet 3 of 4)



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED (shaded)	(unshaded)
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, SHARP DENTS	0.020	0.030
CORROSION DAMAGE		
Before Repair	0.010	0.015
After Repair	0.020	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	0.25 Sq. In.
NUMBER OF REPAIRS	One Per Lug	Not Critical
EDGE CHAMFER	0.040	0.060
BORE DAMAGE	0.001 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209010-79C

Figure 5-65. Damage Limits — Hub, Sleeve, Scissors and Link (Sheet 4 of 4)

(8) Swashplate horns for scoring.

(9) Spline plate wear in excess of **0.040** inch limit measured in step f.

5-59. DISASSEMBLY — SCISSORS AND SLEEVE (AVIM).

a. Remove nut (23, figure 5-64), bolt (14), and washers (15, 20, 21 and 22). Remove scissors assembly (19) from hub.

b. Remove inner races (4 and 16) and spacer (3).

c. Remove bolt (38) and remove link (25). Retain shim (29) for reassembly.

d. Remove housing (30), washer (31) and inner race (32) from scissor.

e. Remove opposite scissor and link in the same manner described in the preceding steps.

5-60. INSPECTION — SCISSORS AND SLEEVE (AVIM).

a. Identify scissors and sleeve components which will reach retirement time prior to next scheduled inspection for replacement. Refer to overhaul and retirement schedule.

b. Clean the scissors and sleeve assembly parts if not previously accomplished (paragraph 5-56).

c. Inspect upper and lower boots (27 and 46, figure 5-51) for damage and deterioration.

d. Inspect rubber ring (33) for damage deterioration.

e. Inspect collet set (36) for missing fingers, cracks and scoring.

f. Inspect bearing assemblies (20) for binding, roughness and radial play in excess of **0.010** inch.

g. Inspect hub, sleeve, scissors and link for corrosion and mechanical damage in excess of limits shown in figure 5-65. Do not disassemble hub (12, figure 5-64) from sleeve (13), and do not remove bearings and bearing retainers (1) or (34) to make this inspection.

h. Inspect bolts (14 and 38) and spacer (washer) (3), special washer (20), cap washer (21), and special washer (22) for damage that would affect function.

i. Inspect inner races (4, 16 and 32) for damage. If other than a smooth, unscored surface is found, replace the affected inner race and the bearing that matches the damaged area.

j. Inspect bearings (2, 17, 35 and 37) while bearings are installed in scissors. If any bearing damage is detected replace the scissors assembly.

k. Inspect nut (10) and similar nut in lower side of hub (12) with the nuts installed in the hub. Inspect for mechanical damage and corrosion. Inspect pin (11) for secure installation. Inspect locking plate device on nut in lower side of hub (12) for secure installation.

l. Inspect cap washer (21) and housing and seal (30) for cracks, corrosion and deformation.

m. Inspect lubrication fittings (5, 26, 27 and 28) for damage that would affect function.

n. Inspect identification plates (7, 9, 33 and 40) for secure installation and legible markings.

o. Inspect the following parts by magnetic particle method code M, or fluorescent penetrant method, Code F (TM 43-0103). Items are indexed to figure indicated.

FIGURE	ITEM	NOMENCLATURE	CODE
5-64	19	Scissors	F
5-64	14	Bolt	M
5-64	38	Bolt	M
5-64	25	Link	F

p. Position unworn bolt (38, figure 5-64) in link (25). If the bolt does not fit freely through bushings, replace the link. Check the opposite link in the same manner.

q. Use a straight edge to check the cylindrical portion of the collective sleeve for deformation. If warpage is in excess of **0.005** inch in a **5.0** inch length, replace the sleeve.

r. Use straight edge to check all machined flat surfaces surrounding lugs, holes and bushings for deformation. If deviations exceed **0.002** inch, replace the part.

5-61. REPAIR — SCISSORS AND SLEEVE (AVIM).

CAUTION

Repair by use of grinding wheel is not allowed.

a. Polish out corrosion and mechanical damage on hub, sleeve, scissors and link that is within limits stated in paragraph 5-60. Use fine to medium abrasive cloth (C36) or fine India stone (C116). Blend repair smoothly into surrounding area. Replace part if repair exceeds allowable area and/or depth limits.

b. Replace the following parts if worn or damaged in excess of limits:

(1) Upper and lower boots (27 and 46, figure 5-51).

(2) Rubber ring (33).

(3) Collet set (36).

(4) Bearing assemblies (20).

c. Replace damaged or missing lubrication fittings (5, 26, 27 and 28, figure 5-64) by procedure outlined in paragraph 5-51, g.

d. Replace damaged or missing identification plates as follows:

NOTE

If data to be stamped on identification plate and is not available, send affected assembly to Depot Maintenance.

(1) Identification plates (33 and 40, figure 5-64) are bonded in place. Replace these identification plates by same procedure outlined for collective lever idler link (paragraph 5-51).

(2) Identification plates (7 and 9, figure 5-64) are secured with screws (round head, drive screws) (6 and 8). Replace these identification plates by the same procedure outlined in the preceding step except attach the identification plates to the hub with screws instead of adhesive.

5-62. ASSEMBLY — SCISSORS AND SLEEVE (AVIM).

a. Ensure that bearings (2, 17, 35 and 37, figure 5-64) have been lubricated (paragraph 5-57).

b. Position inner race (32) in scissors. Install link (25) on scissors with washer (31) and housing and seal (30) in position illustrated. Do not install shim (29) at this time. Install nut (42) on bolt (38) finger tight.

c. Measure gap between housing (30) and bushing face of link (25) with feeler gauge. Record this figure. Prepare a shim (29) by peeling off laminations to obtain a shim thickness **0.000 TO 0.002** inch less than measured gap.

d. Remove bolt (38) and install with shim (29), housing (30), washer (31), washer (39) and washer (41) in position. Install nut (42). Torque nut (42) **85 TO 104** foot-pounds and install cotter pin (43).

NOTE

An end play of 0.025 TO 0.058 inch between scissors and link is necessary and normal. Maximum allowable play is 0.090 inch.

e. Repeat steps b. through d. to install opposite link.

f. Position inner race (4), spacer (3) and inner race (16) in scissors (19). Install scissors on hub (12) with bolt (14), special washer (15), special washer (20), cap washer (21), and special washer (22). Install bolt (14) with head in direction of rotation. Install washers in positions illustrated. Install nut (23). Torque nut **150 TO 175** foot-pounds and install cotter pin.

g. Repeat step f. to install opposite scissors assembly (19).

h. Lubricate all bearings in scissors and hub as shown on lubrication chart in Chapter 1.

5-63. INSTALLATION — SCISSOR AND SLEEVE.

a. Install swashplate and lower boot if not previously accomplished (paragraph 5-71).

b. Coat mating splines on mast and in scissors and sleeve assembly spline plate (38, figure 5-51) with grease (C58).

c. Carefully lower scissors and sleeve assembly over mast. Insert lower end of collective sleeve down through lower boot (46) and top of swashplate support. Use care to avoid damage to teflon-lined bearing inside support.

d. Turn collective sleeve (19) so that the two bearing mounting bosses at lower end are aligned with openings in swashplate support as illustrated. Position spacer plate (21) and bearing assembly on boss with the "TOP" marking up so that curved inner surface of bearing housing is aligned to mast surface. Install screws (13) and lockwire (C137) in pairs vertically. Install opposite bearing assembly in same manner.

e. Install collective lever halves (7 and 10) as follows:

(1) Place a thrust bearing (washer) (14) over the bearing boss of each lever half.

(2) Mount lever halves on bearing assemblies (20) and install bolt (11), washer (6) and nut (5). Install nut finger tight.

(3) Position lever halves on link (22), with inner race (24) and thrust washers (18 and 25) in place. Install bolt (1), washers (2 and 17) and nut (16). Install nut finger tight.

(4) Position spacer (9) between levers and install bolt (12). Install washer (4) and nut (3). Install nut finger tight.

(5) Torque nut (5) **50 TO 70** inch-pounds.

(6) Torque nut (3) **160 TO 190** inch-pounds.

(7) Torque nut (16) **1250 TO 1550** inch-pounds and install cotter pin.

(8) Check for required **0.015 TO 0.060** inch clearance between thrust washers and bearing housings as shown in figure 5-53.

CAUTION

Special washers (49 and 56, figure 5-51) are not interchangeable and must be installed in correct location to perform fail-safe function.

f. Place a special washer (55, figure 5-51) with chamfer facing outboard on swashplate outer ring as illustrated. Position drive link (44) on swashplate. Install special washer (56) with collar inboard and the letters "AFT" facing outboard. Install nut (57) and torque **770 TO 950** inch-pounds and install cotter pin. Bend cotter pin ends closely around nut to avoid contact with swashplate during operation. Install opposite drive link in the same manner.

g. Slip lower boot (46) on grooved ring on collective sleeve hub and on grooved ring on collective sleeve below hub. Secure both ends of boot with lockwire (C137).

h. Install extension (37) and associated parts shown on detail view A as follows:

(1) Coat mating splines on mast and spline plate (38) with grease (C58). Position spline and extension (37) on mast and install bolts (42) and washers (41). Torque bolts evenly **80 TO 100** inch-pounds and lockwire (C137) in sets of three.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(2) Clean friction sleeve on mast, clamp assembly (30), retainer (35), collet set (36) and extension (37) with MEK (C74).

(3) Seat collet set (36) in top of extension (37) and install retainer (35) with bolts (34), washers (40) and nuts (39). Torque nuts evenly **80 TO 100** inch-pounds. Check that no gap exists between collet set and friction sleeve on mast.

(4) Position rubber ring (33) around collet set (36) and on top of retainer (35). Place clamp assembly (30) around rubber ring and install bolts (28), washers (29 and 31) and nuts (32). Tighten nuts evenly so that gaps between clamp sections are equal within **0.0625** inch.

i. Adjust collet mast friction collet as follows:

(1) Disconnect collective controls from collective lever halves (7 and 10) if connected.

CAUTION

Do not exceed 130 inch-pounds torque on nuts (32) when performing step (2) below.

(2) Attach a force gage (fish scale) to collective lever halves (7 and 10) at point where collective controls are normally attached. Place collective levers in full down position and measure amount of force in pounds required to raise the collective levers. Adjust torque on nut (32) as required to obtain a load of **125 TO 135** pounds on the force gage (fish scale) as required to raise the collective levers.

(3) Attach collective controls to collective lever halves (7 and 10) with bolt, washers, nut and cotter pin.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Do not exceed 130 inch-pounds torque on nuts (32) when performing step (4) below.

(4) After **five** hours of operation following installation, check friction as outlined in step (2) above. If friction is not within limits, adjust torque on nuts (32) as required. If correct friction cannot be obtained within limits, check for grease on mast friction sleeve and clean with MEK (C74) if applicable. Recheck friction and adjust as required.

j. Install upper boot (27) with spacer (28). Secure upper boot with lockwire (C137).

k. Install main rotor hub and blade assembly (paragraph 5-14).

l. Perform maintenance test flight (TM 55-1520-236-MTF).

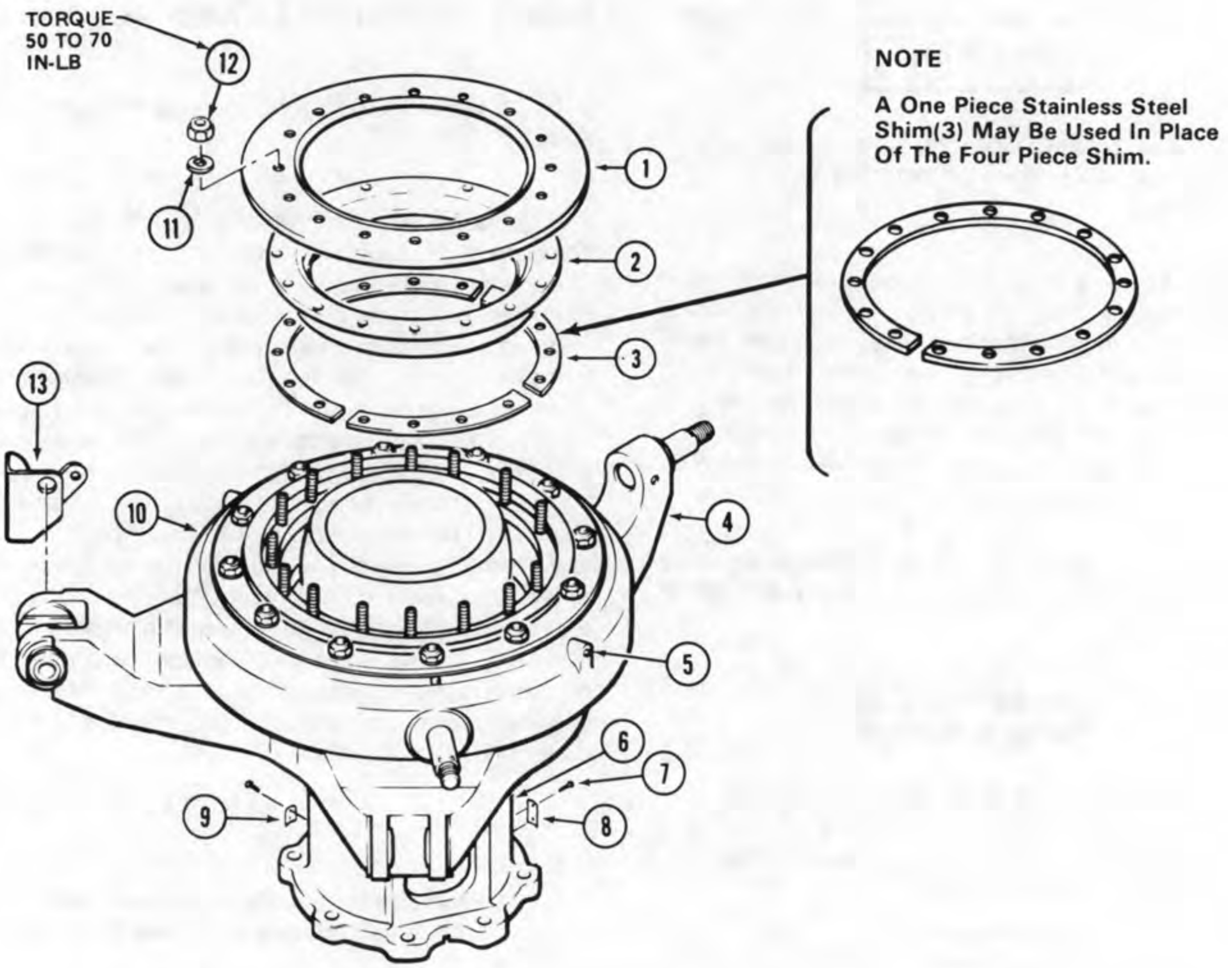
5-64. SWASHPLATE AND SUPPORT.

5-65. DESCRIPTION — SWASHPLATE AND SUPPORT.

The swashplate and support assembly is a component of the main rotor controls (figure 5-66). The swashplate support is an open cylinder with a flange for mounting to the transmission at the lower end and spherical surface or uniball at the upper end for mounting the swashplate. Side openings are provided to accommodate the collective lever halves which move the collective sleeve. The swashplate inner ring is clamped on the pivot ball of the support by upper and lower sets of contoured, teflon-lined bearings. This design allows the swashplate to tilt in any direction when actuated by the cyclic control rods. The anti-drive link prevents the inner ring from rotating. The swashplate outer ring tilts with the inner ring, but rotates with the scissors and mast. It is mounted to the inner ring through a duplex ball thrust bearing, and is connected to the scissors with two drive links.

Premaintenance Requirements for Swashplate and Support

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C14) (C43) (C58) (C74) (C87) (C105) (C112) (C137)
Special Environmental Conditions	None



1. Shield
2. Upper bearing
3. Shim
4. Inner ring assembly
5. Grease fitting
6. Support assembly
7. Screw (Round head drive screw)
8. Identification plate
9. Identification plate
10. Outer ring
11. Washer
12. Nut
13. Bracket

209010-109B

Figure 5-66. Swashplate and Support Assembly

5-66. ADJUSTMENT — SWASHPLATE AND SUPPORT.

a. Adjust friction on swashplate installed on helicopter as follows:

(1) Disconnect anti-drive link (50, figure 5-51), lateral control tube (17, figure 5-1) and fore and aft control tube (18) from swashplate inner ring assembly.

(2) Disconnect scissors and sleeve drive links (44, figure 5-51) from swashplate outer ring assembly.

(3) Apply a force gage (fish scale) to a bolt inserted through either lateral or fore and aft clevis on control horn inner ring.

(4) Check for **15.5 TO 20** pounds of force required to actuate swashplate about the uniball. If

friction is within limits, reconnect the items that were disconnected in steps (1) and (2). If friction is not within limits, adjust and recheck thickness of shim (3, figure 5-66).

CAUTION

Ensure that wood wedges remain in position to support inner ring during shim adjustment procedure or uniball damage may result.

(a) Insert two wood wedges under swashplate inner ring to support the ring during shim adjustment procedure.

NOTE

A one piece stainless steel shim (3) may be used in place of the four piece shim in the steps below.

(b) Remove shield (1), upper bearing (2) and shims (3). Measure thickness of each section of shim with a micrometer. All four shim sections must be the same thickness.

(c) Remove or add one shim laminate to each of the four shim sections (pieces).

CAUTION

Do not apply more than 70 inch-pounds torque to nuts (12) that secure upper bearing and shield (1) for any reason.

(d) Recheck shim (3) to be sure all sections (pieces) are the same thickness and install the shim. Ensure that the inner diameter of shim (3) does not extend over the edge of inner ring (4). Fill gaps between ends of sections of shim (3) with corrosion preventive compound (C43). Install upper bearing (2) and shield (1). Install aluminum washers (11) and nuts (12). Torque nuts evenly **50 TO 70** inch-pounds while rocking ring assembly to ensure seating of bearings.

(e) Repeat friction check and if friction is not within limits, disassemble and make additional adjustment of thickness of shims (3).

(f) After friction is adjusted within limits, apply a continuous bead of polysulfide sealant (C105) around entire outer circumference of joint between cap and outer ring (10).

(g) Remove wood wedges that were placed under inner ring in step (a).

(h) Lubricate thrust bearing through fittings on outer ring (10) with grease (C58).

(5) Install anti-drive link (50, figure 5-51) and drive links (44).

b. Install hydraulic control cylinders for lateral and fore and aft controls (paragraphs 7-63, P 7-203 E M).

5-67. LUBRICATION — SWASHPLATE AND SUPPORT.

Lubricate swashplate and support as shown on lubrication chart in Chapter 1.

5-68. REMOVAL — SWASHPLATE AND SUPPORT.

CAUTION

Remove swashplate and support carefully to avoid damage to mast.

a. Remove main rotor hub and blade assembly (paragraph 5-12).

b. Remove scissors and sleeve assembly (paragraph 5-58).

c. Remove nut (48, figure 5-51), special washer (49) and disconnect anti-drive link (50) from rear horn of swashplate.

d. Disconnect cyclic control cylinder tube, elevator control tube and spring from right forward horn of swashplate.

e. Disconnect cyclic control cylinder and spring from left forward control horn.

CAUTION

Do not rotate inner ring unnecessarily while swashplate linkage is disconnected.

f. Remove bolts (75) and washers (76). Lift swashplate and support off mast. Use caution to avoid damage to mast friction sleeve and mast splines.

g. Remove bolt (51) and remove anti-drive link (50). Remove bolt (64) and remove bellcrank (61). Remove support (65).

5-69. INSPECTION — SWASHPLATE AND SUPPORT.

NOTE

If allowable inspection limits are exceeded, forward swashplate and support to depot maintenance.

a. Inspect swashplate inner ring horns for wear caused by improperly installed cotter pins in drive link to swashplate attachment bolts. Maximum permissible wear is **0.060** inch.

b. Rotate outer ring and check for binding and roughness of bearings. No binding or roughness is acceptable.

NOTE

Rotation of the swashplate inner ring, measured at the swashplate aft horn pin, in excess of 0.110 inch indicates worn anti-drive link bushings or bellcrank bushings.

c. Inspect swashplate and support assembly for nicks, dents, and corrosion. Refer to figure 5-67 for limits.

d. Inspect swashplate and support for specific damage as follows:

(1) Inspect flat surfaces at ends of collective lever pivot boss and for a distance of **0.75** inch on support from flat surface faces of boss. Mechanical damage shall not exceed **0.010** inch in depth and corrosion shall not exceed **0.005** inch in depth in these areas. **Measure clearance between swashplate anti-drive link and bellcrank. Maximum allowable clearance is *0.015* inch. Also measure clearance between bellcrank and support. Maximum allowable clearance is *0.015* inch.**

(2) Inspect hard anodized surface of pivot ball for any visible damage to surface. Minor damage (nicks, gouges, dents, scratches) to the hard coat surfaces of spherical ball is acceptable within the following:

(a) On spherical surface outside of teflon bearing working area — a maximum number of four (4), **0.160** inch in any one direction, and **0.005** inch in depth. Scratch maximum length is **0.500** inch.

(b) On spherical surface within the teflon bearing working area — a maximum number of four (4), **0.100** inch in any one direction, and **0.003** inch in depth. Scratch maximum length is **0.500** inch.

(c) Minute pinhead size nicks that are not clustered - maximum of nine (9).

(d) Combination of **(a)** and **(b)** above — a maximum of four (4) if damage is on the maximum side, or a maximum of six (6) if damage is on the minimum side.

e. Check security of pin in aft horn of swashplate inner ring. No noticeable looseness is acceptable.

f. Check friction of swashplate to uniball. Refer to paragraph 5-66.

NOTE

If friction check is made with swashplate and support installed on transmission, disconnect drive links, anti-drive link, control tube and spring from inner ring.

g. Inspect bushings in inner ring at control tube attaching points for looseness, wear and mechanical damage. Maximum allowable wear on bushing inner faces contacted by control tube bearings is **0.060** inch.

h. Inspect support, inner ring and outer ring for damaged grease fitting and missing or damaged identification plates.

i. Inspect bracket (13, figure 5-66). Replace if loose or missing. Clean mating surface of inner ring (4) with MEK (C74) and wipe dry with a clean cloth. Apply primer (C87) to surface and allow to air dry. Remove protective peel ply from film adhesive on bracket (13). Coat mating surface of bracket (13) with adhesive (C14). Install bracket (13) on inner ring (4) with radius of bracket parallel to edge of inner ring and with holes aligned. Use caution to prevent adhesive squeeze-out from obstructing bolt hole. Maintain firm contact pressure while adhesive cures.

5-70. REPAIR — SWASHPLATE AND SUPPORT.

NOTE

Replace swashplate and support if allowable inspection limits are exceeded. Send unserviceable swashplate and support to next higher maintenance level.

a. Polish minor damage to the hard anodized surface if required with crocus cloth (C37) to remove all sharp edges. Use caution when polishing out damage. The hard anodized surface is 0.001 to 0.003 inch thick. Refer to figure 5-67 to identify area that has hard anodized surface. If hard anodized surface is removed during cleanup, return swashplate and support assembly for overhaul.

b. Replace grease fitting. Refer to paragraph 5-51g.

c. Replace identification plates secured with drive screw as follows: (AVIM)

NOTE

If data to be stamped on identification plate is not available, send affected assembly to Depot Maintenance.

(1) Stamp all data from old identification plate on the new identification plate.

(2) Remove screws (7, figure 5-66) and remove old identification plate (8 or 9) from support assembly.

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED		
CRACKS ALLOWED	None	None	None
NICKS, SCRATCHES, AND SHARP DENTS	0.020	This is Hard Anodized Surface	0.040
CORROSION DAMAGE			
Before Repair	0.010		0.020
After Repair	0.020		0.040
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	See Note 2	Not Critical
NUMBER OF REPAIRS	One Per Lug		Not Critical
EDGE OF CHAMFER	0.060		0.060

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. Mount bolt hole bore damage limits is 0.002 on full circumference.
2. If corrosion damage penetrates the hard anodized surface, replace the support. Complete description of specific damage criteria and repair is provided in paragraphs 5-69 and 5-70.

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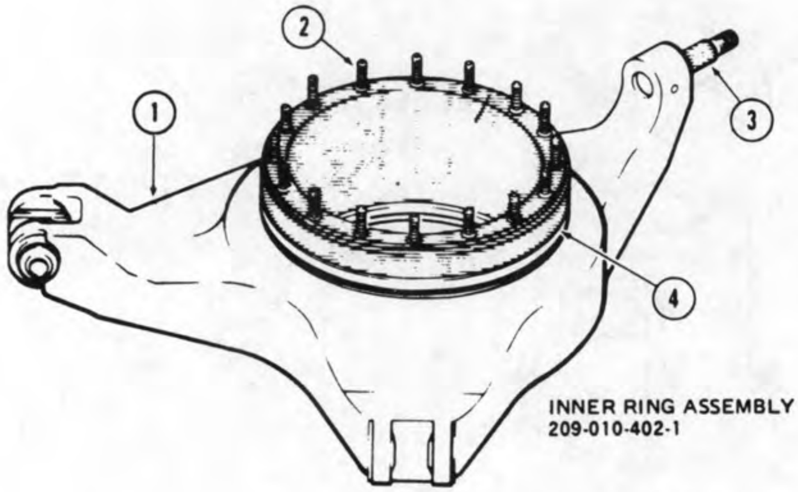
Figure 5-67. Damage Limits — Swashplate and Support Assembly (Sheet 1 of 3)



1. Swashplate inner ring
2. Stud
3. Pin
4. Sleeve

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, AND SHARP DENTS	0.010	0.040
CORROSION DAMAGE		
Before Repair	0.005	0.020
After Repair	0.010	0.040
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	Not Critical
NUMBER OF REPAIRS	Not Critical	Not Critical
EDGE CHAMFER	0.060	0.060
BORE DAMAGE	0.001 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. Pivot bore dmage is 0.001 for one-fourth of circumference.
2. Thread Damage:
   - Depth: One-Third of Thread
   - Length: 0.25
   - Number: One Stud or Pin
3. Replace sleeve (4) if seal mating surface is damaged.
4. Damage to anti-drive gear by cotter pin may be polished to 0.060 maximum depth.

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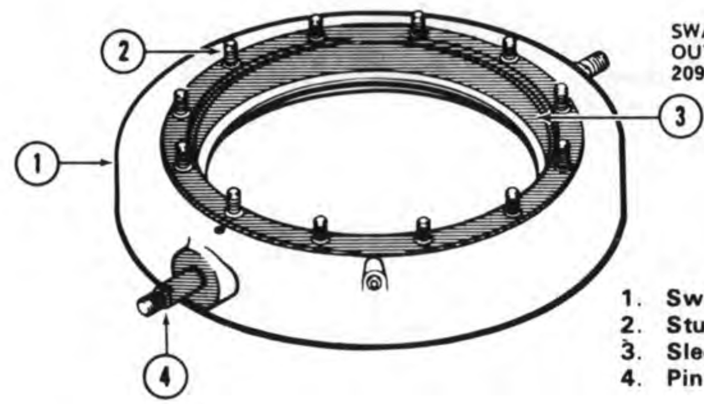
Figure 5-67. Damage Limits — Swashplate and Support Assembly (Sheet 2 of 3)



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED (hatched)	(clear)
CRACKS ALLOWED	None	None
NICKS, SCRATCHES,AND SHARP DENTS	0.010	0.040
CORROSION DAMAGE		
Before Repair	0.005	0.020
After Repair	0.010	0.040
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	Not Critical
NUMBER OF REPAIRS	Not Critical	Not Critical
EDGE CHAMFER	0.060	0.060
THREAD DAMAGE		
Depth	One-Third of Thread	
Length	0.25	
Number	One Per Stud or Pin	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

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Figure 5-67. Damage Limits — Swashplate and Support Assembly (Sheet 3 of 3)

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(3) Clean area for identification plate on support assembly with clean cloth saturated with solvent (C112).

CAUTION

Do not overtorque screws.

(4) Position new identification plate on support (6). Place drive screw (7) through identification plate and in hole in support. Drive screw in until identification plate is tight against support.

5-71. INSTALLATION — SWASHPLATE AND SUPPORT.

a. Install swashplate and support as follows:

(1) Install support assembly (65, figure 5-51) on transmission.

(2) Install bellcrank (61) on support (65) with bolt (64) and nut (66). Torque nut **190 TO 210** inch-pounds and install cotter pin.

(3) Install anti-drive link (50) on bellcrank (61) with bolt (51), washer (52), and nut (53). Torque nut **190 TO 210** inch-pounds and install cotter pin.

(4) Lower swashplate and support assembly over mast on to top of transmission. Avoid damage to mast splines.

(5) Align holes in swashplate support with holes in transmission cap. Install bolts (75) with washers (76) and torque **200 TO 250** inch-pounds. Lockwire (C137) bolt heads in pairs.

(6) Turn swashplate inner ring to align stud with anti-drive link (50). Position link on stud and install special washer (49) with marked surface facing aft. Install nut (48) and torque **480 TO 690** inch-pounds. Install cotter pin.

b. Connect lateral control tube (16, figure 5-1) to left horn of swashplate inner ring (21).

c. Connect fore-and-aft hydraulic cylinder control tube (4, figure 11-12), elevator control tube (3), and spring (2) to right horn of swashplate (1).

d. Position lower boot (46, figure 5-51) loosely on swashplate.

e. Install scissors and sleeve assembly (paragraph 5-63).

SECTION IV. TAIL ROTOR SYSTEM

5-72. TAIL ROTOR SYSTEM.

5-73. DESCRIPTION — TAIL ROTOR SYSTEM.

A two blade, controllable pitch tail rotor hub and blade is located on the right side of the tail rotor gearbox. It is composed of two assemblies, the hub assembly, blades, and controls. The hub assembly employs a preconed, flex-beamed type yoke connected to the blades by means of self-lubricated spherical pitch change bearings, and a two-piece, trunnion, connected to the yoke by self-lubricated spherical flapping bearings. The trunnion, splined to the tail rotor shaft, drives the tail rotor hub and rotor blade and serves as a flapping stop for the tail rotor.

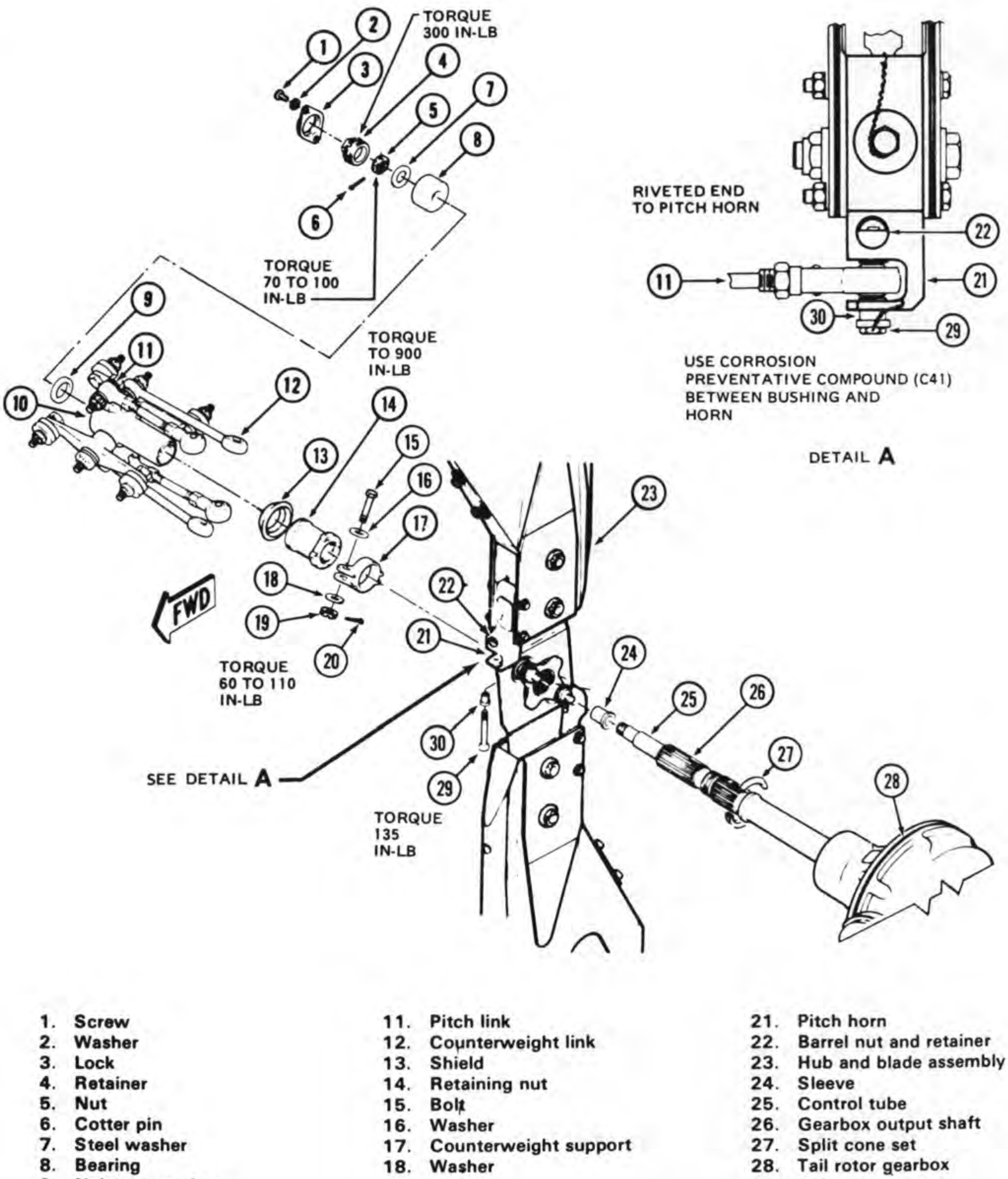
5-74. CLEANING — TAIL ROTOR SYSTEM.

a. Clean tail rotor blades (23, figure 5-68) with cleaning compound (C33).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

b. Remove stubborn deposits with a clean cloth dampened with solvent (C112).



1. Screw
2. Washer
3. Lock
4. Retainer
5. Nut
6. Cotter pin
7. Steel washer
8. Bearing
9. Nylatron washer
10. Crosshead
11. Pitch link
12. Counterweight link
13. Shield
14. Retaining nut
15. Bolt
16. Washer
17. Counterweight support
18. Washer
19. Nut
20. Cotter pin
21. Pitch horn
22. Barrel nut and retainer
23. Hub and blade assembly
24. Sleeve
25. Control tube
26. Gearbox output shaft
27. Split cone set
28. Tail rotor gearbox
29. Bolt
30. Bushing

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Figure 5-68. Tail Rotor Installation

c. Clean hub assembly (23) with solvent (C112) and dry with filtered, compressed air.

5-75. LUBRICATION — TAIL ROTOR SYSTEM.

Lubricate tail rotor system as shown on lubrication chart in Chapter 1.

5-76. ADJUSTMENT — TAIL ROTOR SYSTEM.

Refer to paragraph 5-115 for adjustment.

5-77. INSPECTION — TAIL ROTOR SYSTEM.

a. Inspect tail rotor assembly and control linkage for security, completeness and lubrication.

b. Inspect tail rotor blades in accordance with paragraph 5-110.

c. Inspect tail rotor hub assembly in accordance with paragraph 5-93.

5-78. TROUBLESHOOTING — TAIL ROTOR SYSTEM.

Troubleshoot problems in the tail rotor system using table 5-3.

NOTE

Before using Table 5-3, ensure that all normal operational checks have been performed. If there is a malfunction which is not listed in this table, notify the next higher level of maintenance.

Table 5-3. Troubleshooting — Tail Rotor System

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

1. High Frequency Vibration.

STEP 1. Check tail rotor track (paragraph 5-115).

Adjust pitch link to bring tail rotor in track (paragraph 5-115).

STEP 2. Tail rotor out of balance.

Remove tail rotor and balance (paragraph 5-86).

STEP 3. Check for worn or loose trunnion bearings (paragraph 5-93).

Replace trunnion bearings (paragraph 5-94).

STEP 4. Check for loose or worn blade retention bearings (paragraph 5-93).

Replace blade retention bearings (paragraph 5-94).

STEP 5. Check for loose tail rotor hub retaining nut (paragraph 5-87).

Inspect and retorque nut (paragraph 5-87).

Table 5-3. Troubleshooting — Tail Rotor System (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

STEP 6. Check for bent pitch change links (paragraph 5-102).

Replace pitch change link (paragraph 5-104).

STEP 7. Check for worn or loose pitch change link bearings (paragraph 5-102).

Replace pitch change link (paragraph 5-104).

STEP 8. Check for worn or loose pitch change crosshead bearing (paragraph 5-102).

Replace pitch change bearing (paragraph 5-104).

STEP 9. Check for loose or improperly torqued bipod and tripod engine mounts (paragraphs 2-192 and 2-198).

Retorque bipod and tripod engine mount bolts (paragraphs 2-194 and 2-200).

STEP 10. Check for loose mounting bolts on intermediate and tail rotor gearboxes (paragraphs 6-99 and 6-115).

Retorque mounting bolts (paragraphs 6-105 and 6-121).

STEP 11. Check for elongated mounting bolt holes for intermediate and tail rotor gearboxes.

Refer to paragraph 6-121 for limits for tail rotor mounting bolt holes in support fitting. Refer to paragraph 6-105 for limits for intermediate gearbox mounting bolt holes.

STEP 12. Check hanger bearings and couplings for loss of lubrication, seal failure, and coupling clamps for loose retention bolts.

Refer to table 6-1 drive train.

2. Inability to make normal right or left turn in flight.

STEP 1. Check tail rotor rigging.

Refer to paragraph 11-73 for rigging check. Refer to paragraph 5-115 for tracking instructions.

SECTION V. TAIL ROTOR HUB AND BLADE ASSEMBLY

5-79. TAIL ROTOR HUB AND BLADE ASSEMBLY.

5-80. DESCRIPTION — TAIL ROTOR HUB AND BLADE ASSEMBLY.

The tail rotor hub and blade assembly counteracts torque of the main rotor and provides directional control. It consists of the hub and two blades. The hub assembly has a preconed, flex-beamed-type yoke and a two-piece, trunnion, connected to the yoke by self-lubricating spherical flapping bearings. The trunnion, splined to the tail rotor gearbox shaft drives the blades, and serves as a flapping stop for the tail rotor. The yoke has two self-lubricating, spherical bearings for attaching points for each rotor blade. Rotor pitch change is accomplished at these bearings. The blades are all metal bonded assemblies with a stainless steel spar and honeycomb core. A system of counterweights is attached to the pitch control system to balance control forces and assist in controlling blade pitch.

Premaintenance Requirements for Tail Rotor Hub and Blade Assembly

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T4)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C60) (C114) (C138)
Special Environmental Condition	None

5-81. REMOVAL — TAIL ROTOR HUB AND BLADE ASSEMBLY.

a. If the rotor and controls are to be reinstalled, check color code dots and, if missing, reapply color code so that parts can be reinstalled in the same relative position.

b. Remove bolts and separate both counterweight links (12, figure 5-68) from counterweight support (17).

c. Remove lockwire, screws (1), washer (2), lock (3), and retainer (4) from crosshead (10).

d. Push right pedal forward against stop and remove cotter pin (6), nut (5) and washer (7) from end of pitch change control tube (25).

e. Grip both tail rotor blades firmly with hands and twist blades to disengage bearing (8) from control tube (25). Remove nylatron washer (9) from crosshead.

NOTE

If outer race of bearing (8) separates from inner race, remove inner race as outlined in step f., and dispose of bearing locally.

f. Push left pedal forward against stop and place 1 1/16 wrench between inner race of bearing (8) and crosshead (10). Push right pedal to disengage inner race from control tube (25).

g. Disconnect pitch links (11) from each tail rotor blade pitch horn (21) by removing lockwire and bolt (29). If same tail rotor is to be reinstalled, secure bushing (30) and barrel nut and retainer (22) in place with bolt (29). If new tail rotor is being installed, remove bushing (30) and barrel nut and retainer (22).

h. Remove crosshead assembly (10, figure 5-68) from gearbox output shaft (26).

i. Cut lockwire and remove shield (13) and retaining nut (14) as an assembly. Remove counterweight support (17).

j. Move hub and blade assembly (23) outboard on splines and remove split cone set (27) as it is released. Secure and retain cone set (27) as a matched set. Remove hub and blade assembly from gearbox and place on a rack to prevent damage to blades.

NOTE

Sleeve (24) normally remains on control tube (25) unless the sleeve or control tube is to be replaced.

k. If sleeve (24) is to be replaced, pull sleeve outboard to engage threads and turn until disengaged.

5-82. DISASSEMBLY — TAIL ROTOR HUB AND BLADE ASSEMBLY. (AVIM)

a. Remove tail rotor hub and blade assembly from helicopter (paragraph 5-81). Place the tail rotor assembly on a padded bench or similar work area to prevent damage.

b. Prior to disassembly, check condition of retention bearings in the yoke. Move the blades through full throw on the pitch change axis and check the bearings by feel. If the blades do not move freely on the bearings, identify the faulty bearings for replacement.

NOTE

The tail rotor hub and blade assembly must be rebalanced if any parts are replaced or repaired. It is good practice to index special balance washers and bolts at time of disassembly so that these parts can be reassembled in the same location. This will make rebalancing easier.

c. Remove nuts (5 and 10, figure 5-69) and all balance washers. Remove bolts (20 and 25) and special washers (19 and 26).

d. Remove opposite blade in the same manner.

5-83. INSPECTION — TAIL ROTOR HUB AND BLADE ASSEMBLY.

a. Inspect tail rotor hub assembly (paragraph 5-93).

b. Inspect tail rotor blade assembly (paragraph 5-110).

c. Inspect pitch change horn (paragraph 5-110).

d. Inspect bolts and nuts for thread damage and general condition.

5-84. REPAIR — TAIL ROTOR HUB AND BLADE ASSEMBLY.

a. Repair tail rotor hub assembly (paragraph 5-94).

b. Repair tail rotor blade assembly (paragraph 5-111).

c. Repair pitch horn assembly (paragraph 5-111).

d. Replace worn or damaged bolts and nuts.

5-85. ASSEMBLY — TAIL ROTOR HUB AND BLADE ASSEMBLY.

a. Position hub assembly (1, figure 5-69) on bench with data plate side up. Install blade (14) on hub yoke with the data plate side up. Install bolts (20 and 25) with special washers (19 and 26) under bolt heads. Install special washers (2 and 13) next to blade. If balance washers (3, 4, 11, and 12) were indexed at time of disassembly; reinstall them in the same position. If they were not indexed, do not install them until the assembly is balanced. Install nuts (5 and 10) but do not torque until after the assembly has been balanced.

b. Install opposite blade in the same manner. The four blade retention bolts (20 and 25) may be installed from either side, but all four bolts must be installed from the same side.

c. Position pitch horn (15) on blade and install bolts (22 and 23) with steel washers (21 and 24) under heads. Install the bolts with heads in same directions as bolts (20 and 25). Install steel washers (6 and 9) and nuts (7 and 8). Torque nuts **60** inch-pounds. If balance washer (18) was indexed at disassembly, install it at this time with steel washer (17) and bolt (16). If the balance washers were not indexed, install bolt (16) and steel washer (17). Do not torque until after the assembly has been balanced.

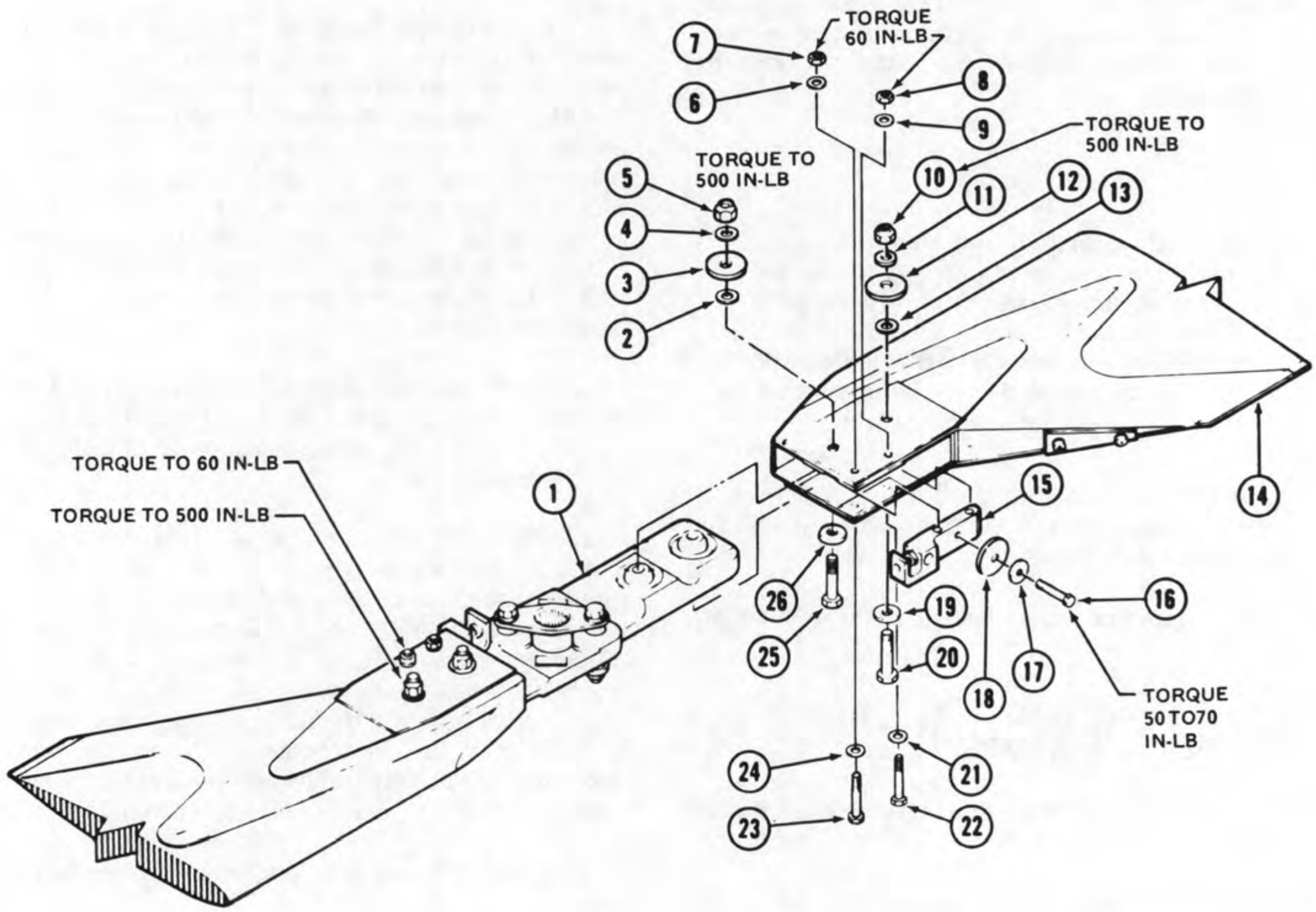
d. Install the opposite pitch horn in the same manner.

e. Balance tail rotor hub and blade assembly in accordance with paragraph 5-86.

5-86. BALANCING — TAIL ROTOR HUB AND BLADE ASSEMBLY.

Premaintenance Requirements For Tail Rotor Hub and Blade Assembly

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T73)
Test Equipment	None



1. Hub
2. Special washer
3. Balance washer
4. Balance washer
5. Nut
6. Steel washer
7. Nut
8. Nut
9. Steel washer
10. Nut
11. Steel washer
12. Balance washer
13. Balance washer
14. Blade
15. Pitch horn
16. Bolt
17. Steel washer
18. Balance washer
19. Special washer
20. Bolt
21. Steel washer
22. Bolt
23. Bolt
24. Steel washer
25. Bolt
26. Special washer

212010-61B

Figure 5-69. Tail Rotor Hub and Blade Assembly

Condition	Requirements
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C41) (C58) (C112) (C137)
Special Environmental Conditions	Draft-free room

NOTE

The area used for balancing must be a room which can be closed off to provide a draft-free environment.

a. Assemble parts of rotor balancing kit (T73) that are shown on the right side of figure 5-49, except do not install balancing arbor (23). Use arbor (6, figure 5-70) to balance tail rotor.

b. Install fixture (2, figure 5-70) on lower end of arbor (6) and tighten the two lower set screws (10). There are a total of four set screws in fixture (2). Do not tighten the two upper set screws (10).

c. Install two post assemblies (15) in the outboard holes in fixture (2). These holes are designated "A" in View A. Thread the posts into the fitting to full thread depth and tighten finger tight.

d. Place the arbor and fixture on a work bench with the arbor vertical. Install pilot bushing (4) on arbor with larger diameter end down as illustrated.

e. Place the tail rotor hub and blade assembly on the arbor with the data plate side of the rotor yoke (3) facing up.

f. Install a floating bushing (9) in each pitch horn (16) if not previously accomplished. Rotate the rotor on the arbor until indexing pins (8) are fully seated in the floating bushings and the floating bushings are fully seated in the pitch horns.

g. Install positioning yoke (5) on arbor in same relative position to rotor yoke as illustrated in "top view". Locate the **6-3/8** inch mark on the scale marked on arbor (6). Align the upper surface of the positioning yoke, which is identified on figure 5-70, "Sensitivity Setting Reference Surface", with the **6-3/8** inch mark on the scale. Tighten two set screws (7) to secure the positioning yoke to the arbor.

h. Move the tail rotor assembly and balancing tools to the stand that was assembled in step a. Attach arbor (6) to the stand with cable P/N 2264, (13, figure 5-49) and quick disconnect coupling P/N 2266 (10). Operate hydraulic pump (15) to take up slack in cable.

i. Loosen two lower set screws (10, figure 5-70). (The two upper set screws should already be loose as directed in step b.) This will allow fixture (2) to slide down and contact workstand (1). Open the hydraulic pump valve to lower the arbor and rotor assembly until these parts are resting on fixture (2). Ensure that all the following conditions are met, and then tighten two lower set screws (10).

(1) Fixture (2) must be seated firmly on workstand (1).

(2) Pilot bushing (4) must be seated firmly on fixture (2).

(3) The rotor yoke (3) must be seated firmly on pilot bushing (4).

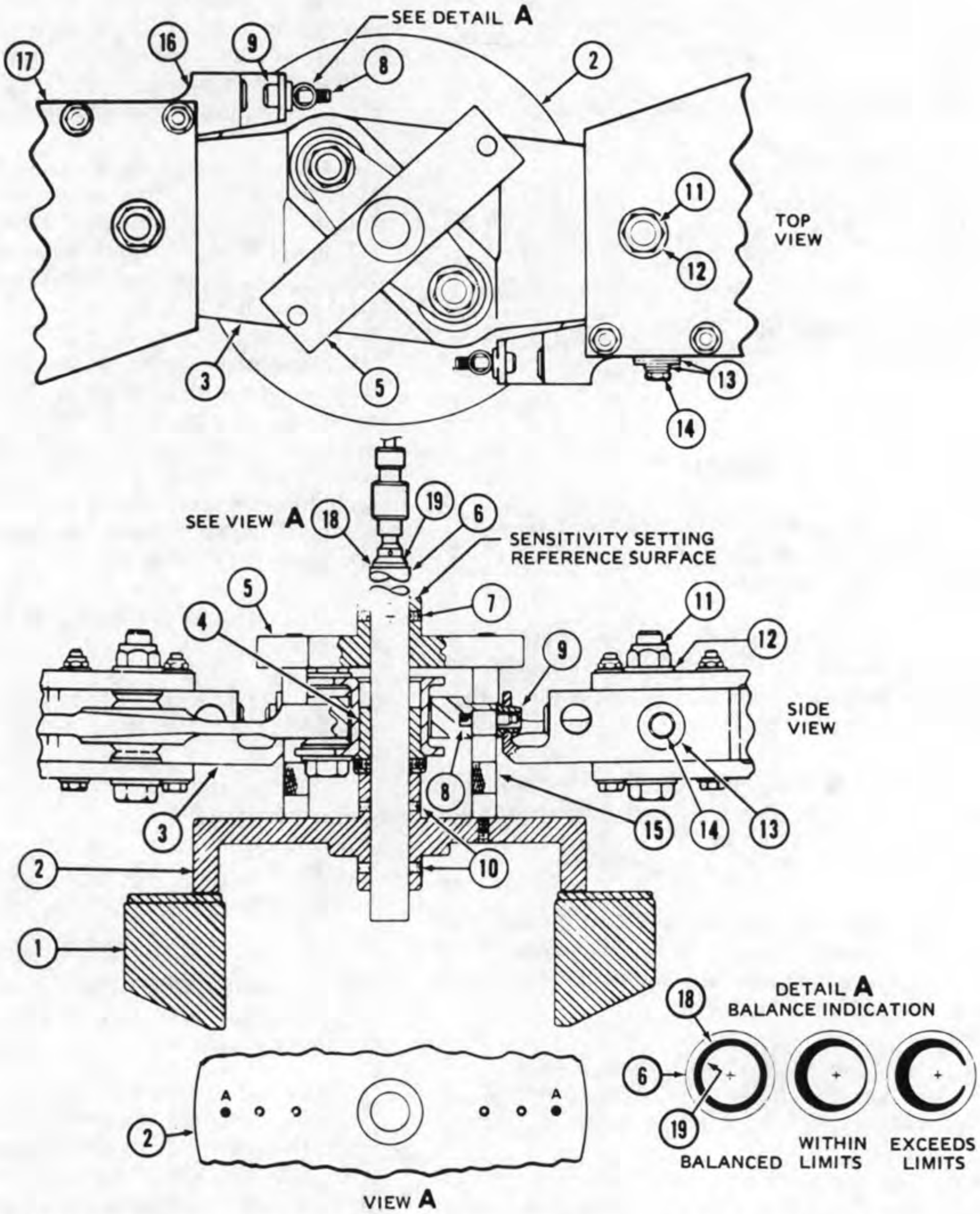
(4) The pitch horns (16), floating bushings (9) and indexing pins (8) must be fully engaged.

(5) The positioning yoke (5) must be oriented with the rotor yoke as shown in the "top view". The legs of positioning yoke (5) must contact a flat surface of the rotor yoke.

j. Operate hydraulic pump (15, figure 5-49) to raise the assembly approximately **0.25** inch above stand table. Close doors and windows, stop fans, etc., to make the area draft free. Allow the rotor to stabilize and observe the balance indication on the black disc (detail A, figure 5-70). Record the indication and correct imbalance as outlined in steps k. and l.

k. Correct chordwise balance by adding balance washers (18, figure 5-69) and steel washers (17) within the following limitations:

(1) Use any combination of balance washers (18) P/N AN970-4 and steel washers (17) P/N AN960-416 with a maximum of ten washers used on one bolt.



1. Workstand (7A050 KIT)
2. Fixture, 2532 (7HEL153 KIT)
3. Rotor Yoke
4. Pilot Bushing, 2529 (7HEL153 KIT)
5. Positioning Yoke, 3091 (7HEL074 KIT)
6. Arbor, 2516 (7HEL153 KIT)
7. Set Screw
8. Indexing Pins
9. Floating Bushing
10. Set Screws
11. Bolts, Blade Attaching
12. Washers, Spanwise Balance
13. Washers, Chordwise Balance
14. Bolt
15. Post Assemblies, 2539 (7HEL153 KIT)
16. Pitch Horn
17. Rotor Blade
18. Indicator Disc
19. Indicator Bushing

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Figure 5-70. Tool Application — Tail Rotor Hub and Blade Assembly Balancing

(2) Use a bolt (16) of proper length to accommodate washers. Minimum length bolt is P/n AN4H-4A. Maximum length bolt is P/N AN4H-10A.

(3) At least one washer (17) or (18) must be used.

(4) After chordwise balance is attained, lower the assembly until it rests on stand. Torque bolts (16) **50 TO 70** inch-pounds. Do not lockwire at this time.

l. Correct spanwise balance by adjusting balance washers (3, 4, 11 and 12). Operate hydraulic pump on stand to raise the rotor assembly approximately **0.25** inch above stand table and add washers within the following limitations:

(1) When adding washers to balance the rotor assembly spanwise, add balance washers to outboard bolts (22) first. Leave special washers (2, 26, 19, and 13) P/N 140-007-33-32C4 next to blade. Assemble the washers listed in step (2) below with the heaviest washers next to washers (2 and 13).

(2) Use combinations of balance washers (3 and 23) P/N AN970-8, balance washers (4 and 11) P/N AN960-816 and thin steel washers P/N AN960-816L (not illustrated) as required to balance the assembly.

(3) Use bolts (20) and (25) of the proper length to accommodate washers. Minimum length bolt is P/N NAS1308-34. Maximum length bolt is P/N NAS1308-36.

(4) After spanwise balance is attained, recheck chordwise balance and then lower the rotor assembly until it rests on the stand. Torque nuts (5 and 10) and corresponding nuts on opposite blade to **500** inch-pounds.

(5) Lockwire two bolts (16) to hole in pitch horn with lockwire (C137).

m. Remove tail rotor assembly from balancing tools as follows:

(1) Disconnect arbor (6, figure 5-70) from stand.

(2) Remove the tail rotor assembly and arbor from the stand and place on a work bench.

(3) Loosen two set screws (7) and remove positioning yoke (5) from arbor (6).

(4) Rotate tail rotor assembly to disengage indexing pins (8) from pitch horns and remove tail rotor assembly from arbor (6). Secure floating bushings (9) to pitch horns.

(5) Disassemble pilot bushing (4), arbor (6), post assemblies (15) and fixture (2).

5-87. INSTALLATION — TAIL ROTOR HUB AND BLADE ASSEMBLY.

a. Position hub and blade assembly (23, figure 5-68) on gearbox output shaft (26) with data plate side of hub outboard and trunnion flap stops inboard. Align master tooth of trunnion with master spline of gearbox output shaft and install hub and blade assembly on shaft until trunnion is just started on second set of splines.

b. Place cone set (27), with bevel outboard, in groove between splines and shoulder on gearbox output shaft. Ensure that cone set end gaps are equal and slide hub and blade assembly inboard to seat trunnion to cone set.

c. Install counterweight support (17) on gearbox output shaft and seat against hub. Install retaining nut (14) and shield (13) as an assembly. Hold rotor at hub, rotate counterweight support (17) as far clockwise as possible and hold in position. Torque retaining nut (14) to **900** inch-pounds with spanner wrench. Make final check to ensure that split cone set (27) is properly seated. Lockwire retaining nut (14) to counterweight support with lockwire (C137).

d. Install control tube (25) and sleeve (24) if not previously accomplished (paragraph 5-105).

e. Assemble crosshead and controls if not previously accomplished (paragraph 5-104).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

f. Wash bearing (8) and cavity of retainer (4) with dry cleaning solvent (C112) and allow to air dry.

g. Handpack bearing (8), fill cavity of retainer (4) and lubricate spline surfaces or crosshead (10) with grease (C58).

WARNING

Ensure that cotter pin (6) is properly installed during the following step. After installation of retainer (4) it will not be possible to inspect cotter pin.

h. Place nylatron washer (9) and bearing (8) in outboard end of crosshead (10). Align master splines and position crosshead assembly on gearbox output shaft. Install steel washer (7) and new nut (5) on end of control tube (25). Ensure that nylatron washer (9) is properly seated. Torque nut **70 TO 100** inch-pounds and install cotter pin (6).

i. Connect counterweight link (12) to counterweight support (17) with bolt (15), two washers (16 and 18) and nut (19). Torque nut **60 TO 110** inch-pounds and install cotter pin (20). Install opposite link in same manner.

j. Coat mating surface of both bushings (30) and pitch horns (21) with corrosion preventive compound (C41).

k. Position barrel nut and retainer (22) in hole in pitch horn (21). Position riveted end of pitch link (11) in pitch horn (21) and install bolt (29) and bushing (30) with flange next to bolt head. Torque bolt **135** inch-pounds and lockwire bolt to pitch horn with lockwire (C137). Install opposite pitch link in same manner. Check both bushings (30) to ensure that bushing flanges do not seat against pitch horn (21).

WARNING

Ensure that cotter pin (6) is correctly installed prior to installation of retainer (4).

l. Install retainer (4) on crosshead (10) and torque retainer to **300** inch-pounds.

WARNING

Ensure that lock (3) is properly installed to secure retainer (4) to crosshead (10).

Failure to comply can result in loss of directional control.

m. Install lock (3) on crosshead with two washers (2) and two screws (1). Lockwire (C137), screws and deform lock (3) into notches of retainer (4) in two places near screws (1).

n. Lubricate at grease fitting in retainer (4) with two shots of grease (C58).

5-88. TEST PROCEDURES — TAIL ROTOR HUB AND BLADE ASSEMBLY.

a. Perform rigging check (paragraph 11-73).

b. Perform tracking checks (paragraph 5-115).

SECTION VI. TAIL ROTOR HUB AND CONTROLS

5-89. TAIL ROTOR HUB.

5-90. DESCRIPTION — TAIL ROTOR HUB.

The hub assembly employs a preconed, flex-beamed type yoke connected to the blades by means of self-lubricated spherical pitch change bearings, and a two-piece, trunnion, connected to the yoke by self-lubricating spherical flapping bearings. The trunnion, splined to the tail rotor gearbox output shaft, drives the tail rotor hub and blade, and serves as a flapping stop for the tail rotor.

Premaintenance Requirements for Tail Rotor Hub

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T54)

Condition	Requirements
Test Equipment	None
Support Equipment	Drill Press
Minimum Personnel Required	One
Consumable Materials	(C25) (C37) (C66) (C88 or C91) (C102) (C103) (C112) (C116)
Special Environmental Conditions	None

5-91. REMOVAL — TAIL ROTOR HUB.

Remove tail rotor hub assembly (paragraph 5-81).

5-92. DISASSEMBLY — TAIL ROTOR HUB (AVIM).

a. Remove nut (9, figure 5-71), washer (8), bolt (1) and washer (2). Remove similar parts on the opposite side of the trunnion.

b. Remove trunnion halves (3 and 7). (The trunnion halves are a matched set, keep the parts together for reinstallation.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

c. Clean hub parts with solvent (C112).

5-93. INSPECTION — TAIL ROTOR HUB (AVIM).

a. Conditional inspection of tail rotor hub.

(1) Inspect the tail rotor historical records, and the tail rotor hub for evidence that the tail rotor has been subjected to an accident or incident outside the realm of normal usage. If such evidence exists, perform applicable special inspections for overspeed, sudden stoppage, engine compressor stall and overtorque outlined in Chapter 1 and steps (2) through (5).

(2) Inspect yoke (5, figure 5-71) and trunnion halves for obvious damage such as deformation. Replace hub if any part is deformed.

(3) Inspect parts for surface damage in excess of limits shown in figure 5-72 and 5-73.

(4) Inspect trunnion retention bolts (1, figure 5-71) and blade retention bolts for shear offset. Replace hub if any bolts show shear offset.

(5) Inspect bearings (4 and 6) for looseness in yoke, step b. (2).

b. Normal inspection of tail rotor hub.

(1) Move bearings (4 and 6) through full throw and check for corrosion. If any corrosion is detected, remove with Scotchbrite (C103) and clean cloths.

(2) Check bearings (4 and 6) for roughness and for axial looseness by feel. If bearings are rough, tag them for replacement. If bearings are loose, check them with a dial indicator or other method. Maximum allowable axial looseness is **0.015** inch. Tag bearings that exceed this limit for replacement. Any brinelling or scoring of spherical ball in trunnion bearing, (4, Figure 5-71), is cause for replacement of trunnion bearing.

(3) Inspect yoke (5) and trunnion halves (3 and 7) by fluorescent penetrant method. Refer to TM 43-0103.

NOTE

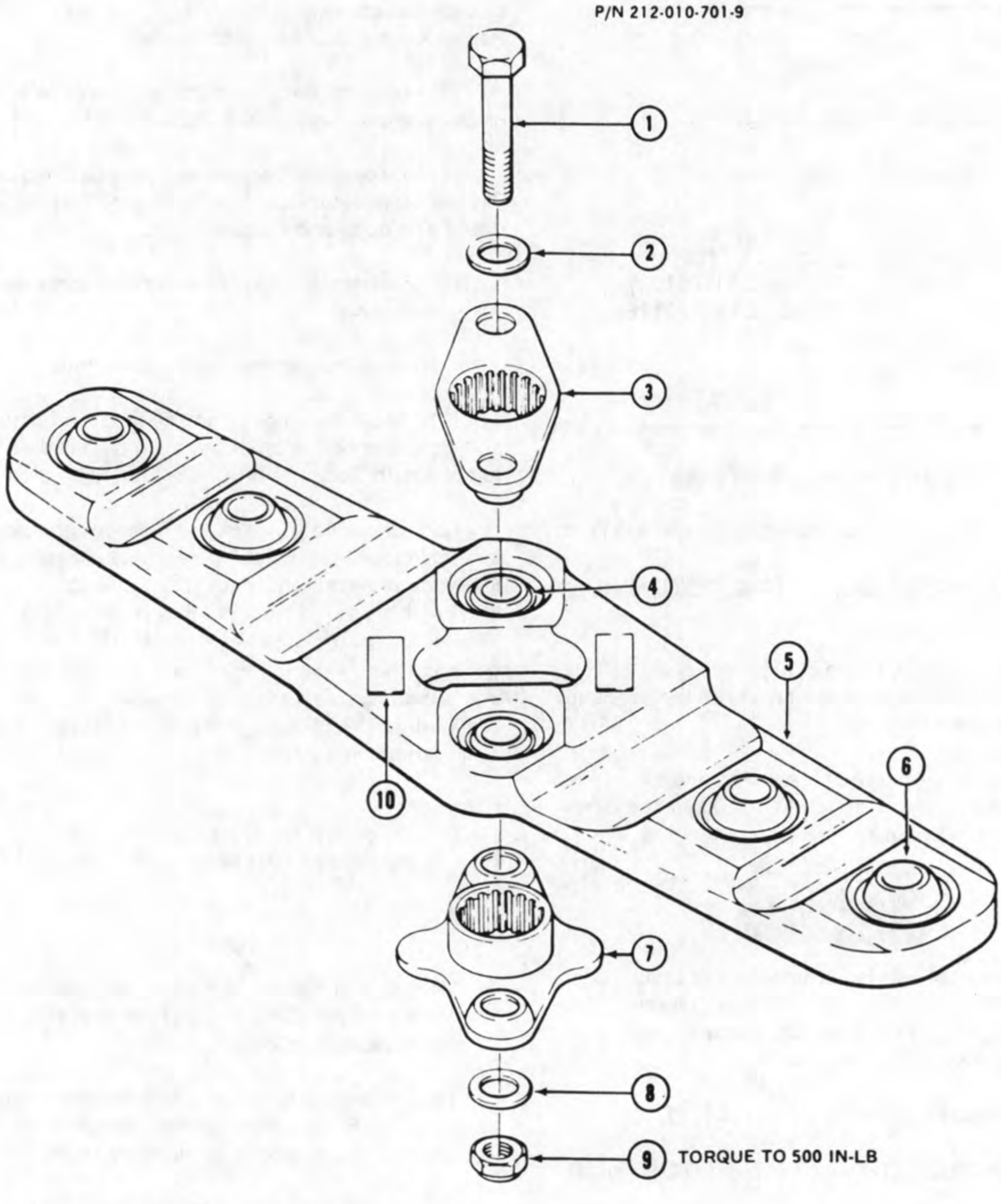
If finish is removed from yoke, repaint using primer (C88 or C91) and overspray with lacquer (C66).

(4) Inspect yoke for mechanical and corrosion damage. If damage exceeds limits shown in figure 5-72, send to next higher maintenance level.

(5) Inspect trunnion set for mechanical and corrosion damage, and wear damage on the splines. If damage and/or wear exceeds the limits shown in figure 5-73 on either trunnion half, dispose of both halves of set locally.

5-94. REPAIR — TAIL ROTOR HUB (AVIM).

a. Replace bearings (4 and 6, figure 5-71) which did not pass inspection.



1. Bolt
2. Washer
3. Trunnion half
4. Trunnion bearing
5. Yoke
6. Blade retention bearing
7. Trunnion half
8. Washer
9. Nut
10. Data plate

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Figure 5-71. Tail Rotor Hub Assembly

HUB YOKE ASSEMBLY
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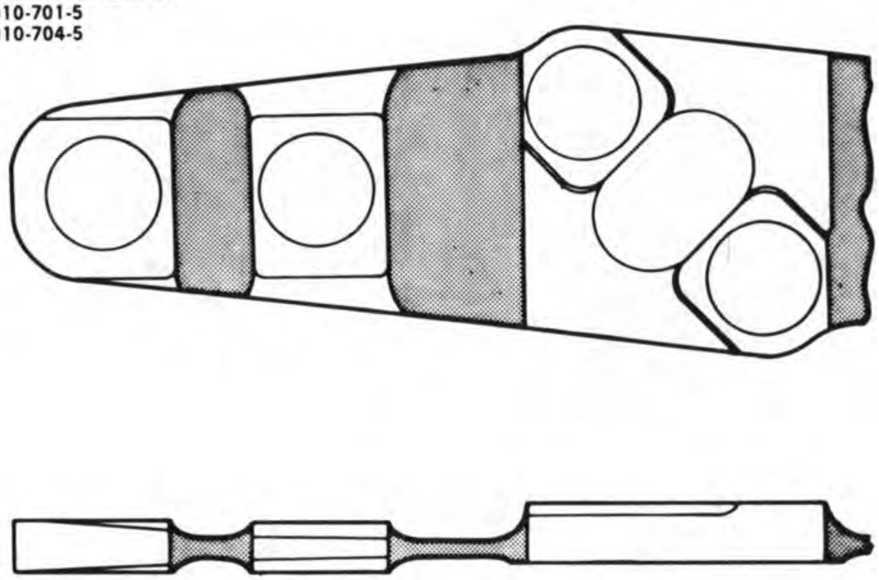
212-010-704-5



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED (shaded symbol)	(unshaded symbol)
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, DENTS AND CORROSION	0.002	0.005
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	0.15 Sq. In.
NUMBER OF REPAIRS	One Per Segment	Not Critical
EDGE CHAMFER	0.010	0.020
BORE DAMAGE	0.002 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

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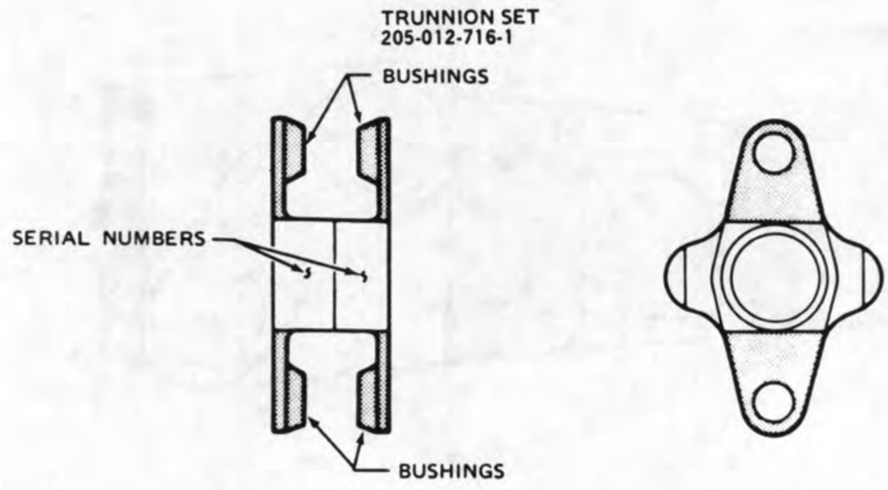
Figure 5-72. Damage Limits — Tail Rotor Hub Yoke



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED (shaded)	(unshaded)
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, DENTS AND CORROSION	0.005	0.010
MAXIMUM AREA PER FULL DEPTH REPAIR	0.05 Sq. In.	0.10 Sq. In.
NUMBER OF REPAIRS	One Per Lug	Two
EDGE CHAMFER	0.010	0.020
SPLINE DAMAGE		
Depth	One-Third of Spline	
Length	One-Half of Spline	
Number	Three Splines	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

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Figure 5-73. Damage Limits — Tail Rotor Hub Trunnion Set

(1) Press worn bearings from yoke. Use a sleeve of slightly larger diameter than the bearing outside diameter to support the yoke. Use a sleeve of slightly smaller diameter than the bearing sleeve to press the bearing and bearing sleeve out of the yoke.

(2) Clean primer and dirt from the yoke.

(3) Apply primer (C88 or C91) to mating surface of yoke and of new bearing.

(4) Position bearing in yoke while primer is still wet. Use a backstop so that bearing can be set with one operation. Clean off excess primer and prevent primer from entering bearing.

(5) Select proper anvil (backstop) and staking tool from staking tool set (T54) for the bearing being installed. Use staking tool, T101577-11, and anvil (backstop), T101557-13, to stake bearings (6). Use staking tool, T101577-17, and anvil (backstop), T101577-19, to stake bearings (4). (See figure 5-74) for views of assembled staking tools).

(6) Install staking tool, selected in preceding step, in chuck of a hand-feed-type drill press. Lubricate staking tool rollers with lubricating oil.

(7) Place anvil (backstop) selected in step (5) on drill press table with flanged side down (figures 5-75, detail A.) Position yoke on drill press with data plate side up and with bearing to be staked in contact with anvil. Lower the drill press chuck and the staking tool and check to ensure that the anvil bearing and staking tool are aligned and that the staking tool rollers are in contact with the groove in the bearing.

(8) Set drill press speed at **250 TO 350** rpm. Start the drill press and apply steady hand pressure to the feed lever for a minimum of **ten** seconds. Raise drill press chuck and staking tool. Check to determine the amount that the bearing has been staked in comparison with figure 5-75, detail B.

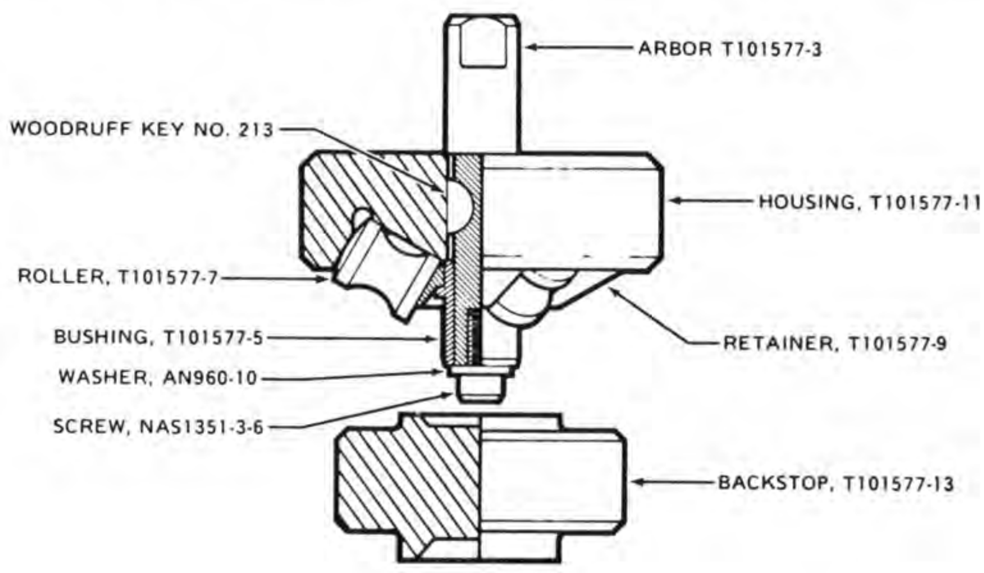
(9) Reposition the anvil (backstop) with the flanged side up. Invert the yoke and stake the opposite side of the bearing in the same manner. Repeat staking the bearing in small increments to attain the **0.008** inch maximum gap shown in figure 5-75, detail B.

(10) Check the bearing position in the yoke to ensure that it is within the limits shown in figure 5-75, detail B.

(11) Check the bearing by feel for smooth operation. Check the bearing visually to ensure that the ball was not scored by the staking tool.

b. Polish out any mechanical damage and corrosion damage on the yoke and on the trunnion that was not accomplished during inspection. Polish out damage on trunnion splines as well as the outer surfaces. Use crocus cloth (C37) 300 grit sandpaper (C102), and fine India stone (C116) to polish out the damage and to leave a smooth, scratch-free surface. If damage exceeds the limits shown in figures 5-72 and 5-73, dispose of the damaged part locally.

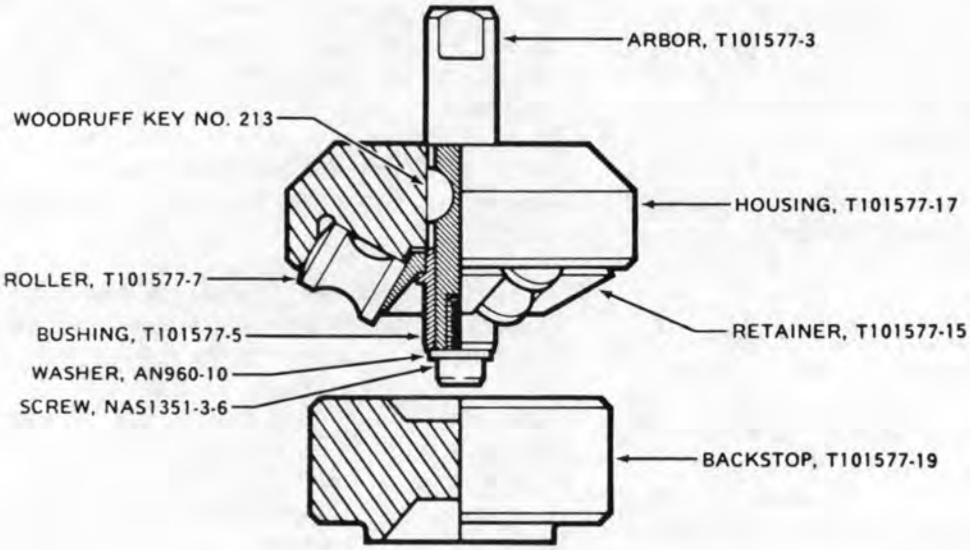
c. Touch up repair areas with brush cadmium plate (C25) or primer (C88 or C91). Do not apply coating to trunnion splines.



NOTE

Assemble tool as illustrated above for staking tail rotor blade retention (pitch change) bearings.

Figure 5-74. Bearing Staking Tool P/N T101577 (Sheet 1 of 2)



NOTE

Assemble tool as illustrated above for staking tail rotor yoke trunnion (flap) bearings.

Figure 5-74. Bearing Staking Tool P/N T101577 (Sheet 2 of 2)

5-95. Assembly — Tail Rotor Hub (AVIM).

a. Inspect trunnion halves (3 and 7, figure 5-71) to ensure that they are a matched set.

b. Position trunnion half (3), on the data plate side of yoke (5). Position trunnion half (7), with the flapping stop ear, on the opposite side of yoke with the master spline of trunnion halves aligned.

c. Install two bolts (1) with washers (2) under bolt heads and washers (8) under nuts (9). Torque nuts evenly to **500** inch-pounds.

5-96. INSTALLATION — TAIL ROTOR HUB.

Install tail rotor hub (paragraph 5-87).

5-97. TAIL ROTOR CONTROLS.

5-98. DESCRIPTION — TAIL ROTOR CONTROLS.

The tail rotor controls consist of a lever assembly, idler, control tube, crosshead, pitch links, counterweight links, weights, retainer, support and cone set. Pedal movement is transmitted through linkage to lever assembly (48, figure 5-76). The idler (47) attaches lever (48) to the tail rotor gearbox. The idler also serves as the pivot for lever (48). Movement from lever (48) is transmitted through control tube (34) to the crosshead (13). Pitch change links (31), attached to the crosshead and pitch horn, change blade pitch. Two counterweight assemblies, consisting of a bellcrank (27) with weights (17) attached to each end is mounted on spindles extending from crosshead perpendicular to pitch link clevises. A fixed link (26) connects mid-point of each bellcrank to a common support (33) mounted next to hub.

5-99. REMOVAL — TAIL ROTOR CONTROLS.

a. Remove crosshead, bellcrank weights and links as an assembly (paragraph 5-99).

b. Remove counterweight support (paragraph 5-99).

c. Slide sleeve (35, figure 5-76) outboard on control tube (34) slightly and rotate counterclockwise to engage threads. Continue to rotate

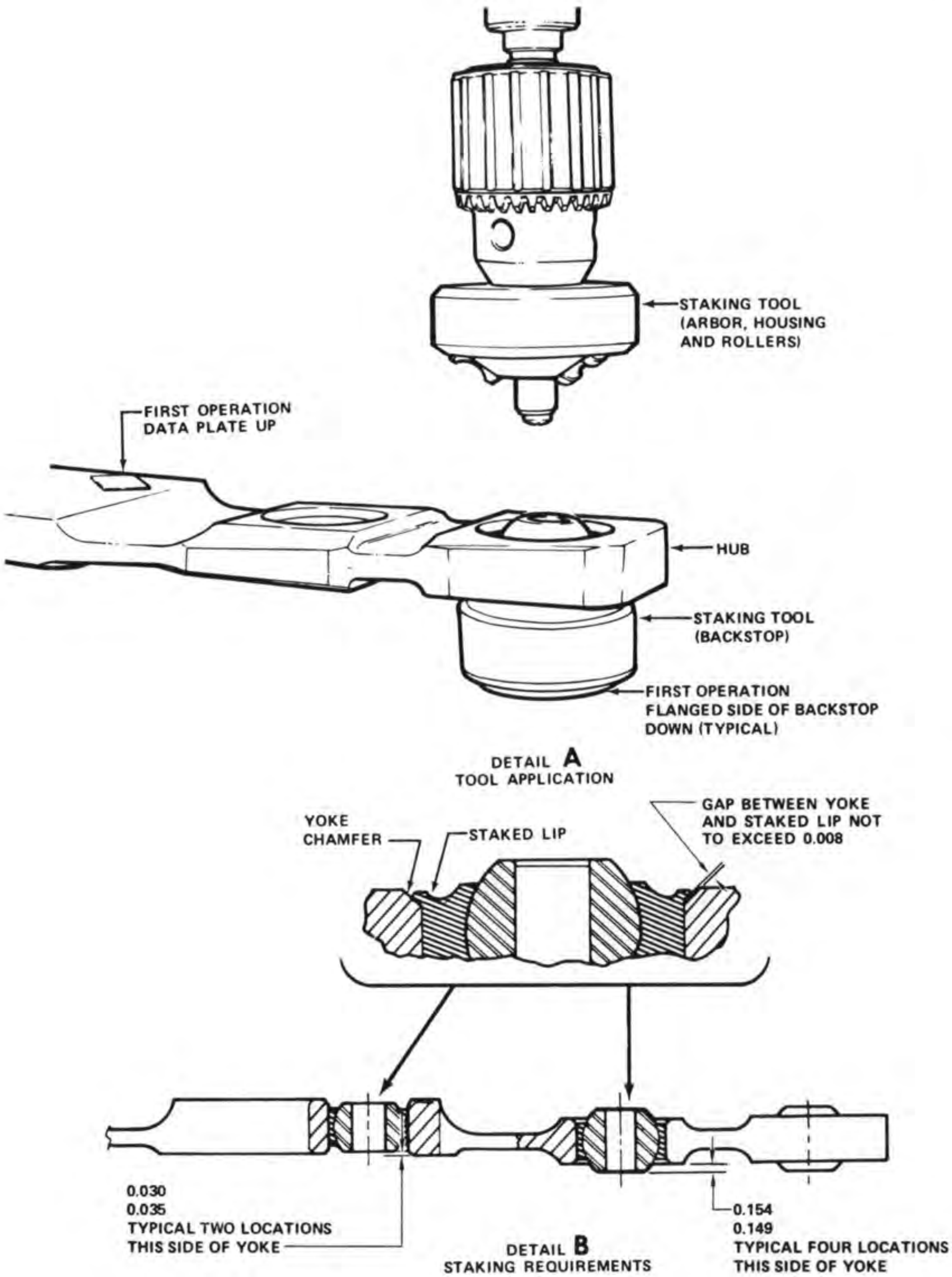


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Figure 5-75. Tool Application — Bearing Installation (Staking) in Tail Rotor Yoke

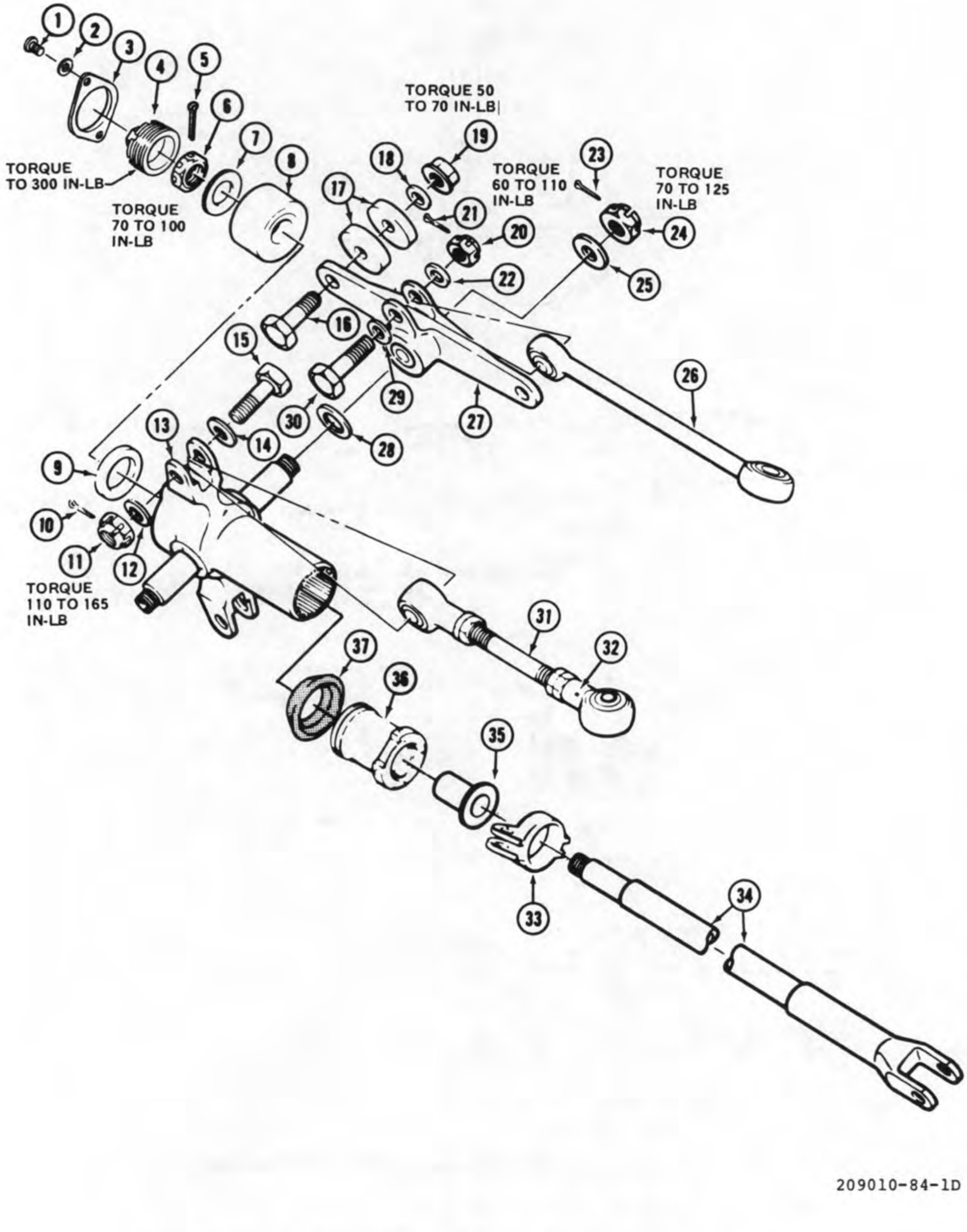
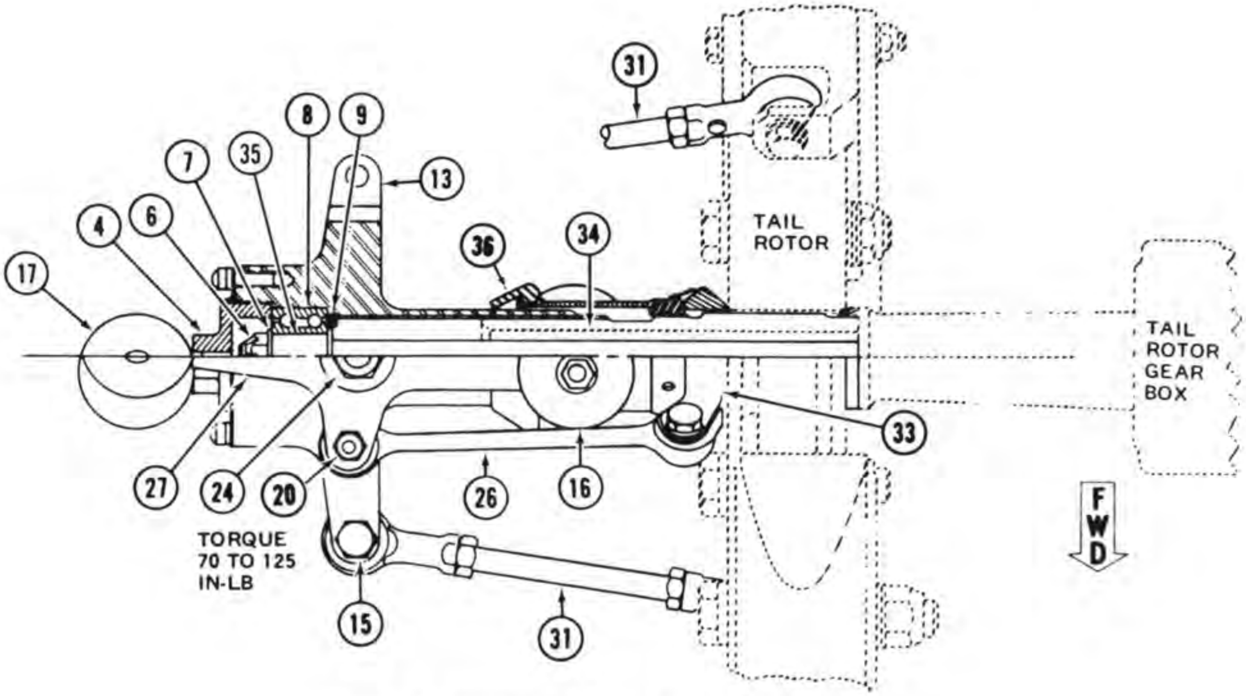


Figure 5-76. Tail Rotor Controls — Crosshead, Weights, Links and Control Tube (Sheet 1 of 3)



VIEW OF ASSEMBLED TAIL ROTOR CONTROLS
PARTIALLY SECTIONED TO SHOW INTERNAL PARTS

1. Screw
2. Steel washer
3. Lock
4. Retainer
5. Cotter pin
6. Nut
7. Steel washer
8. Bearing
9. Nylatron washer
10. Cotter pin
11. Nut
12. Steel washer
13. Crosshead
14. Steel washer
15. Bolt
16. Bolt
17. Weight
18. Steel washer
19. Nut
20. Nut
21. Cotter pin
22. Steel washer
23. Cotter pin
24. Nut
25. Special washer
26. Counterweight link
27. Counterweight bellcrank
28. Nylatron washer
29. Steel washer
30. Bolt
31. Pitch link
32. Rivet
33. Counterweight support
34. Control tube
35. Sleeve
36. Tail rotor retaining nut
37. Shield
38. Packing
39. Nut and steel washer
40. Housing
41. Housing
42. Retaining ring
43. Excluder
44. Race
45. Bolt, steel washer, nut and cotter pin
46. Bolt, steel washers, nut and cotter pin
47. Idler
48. Lever assembly
49. Bolt, steel washers, nut and cotter pin
50. Bolt, steel washers, nut and cotter pin
51. Link assembly
52. Bearing
53. Bolt, steel washers, nut and cotter pin

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Figure 5-76. Tail Rotor Controls — Crosshead, Weights, Links and Control Tube (Sheet 2 of 3)

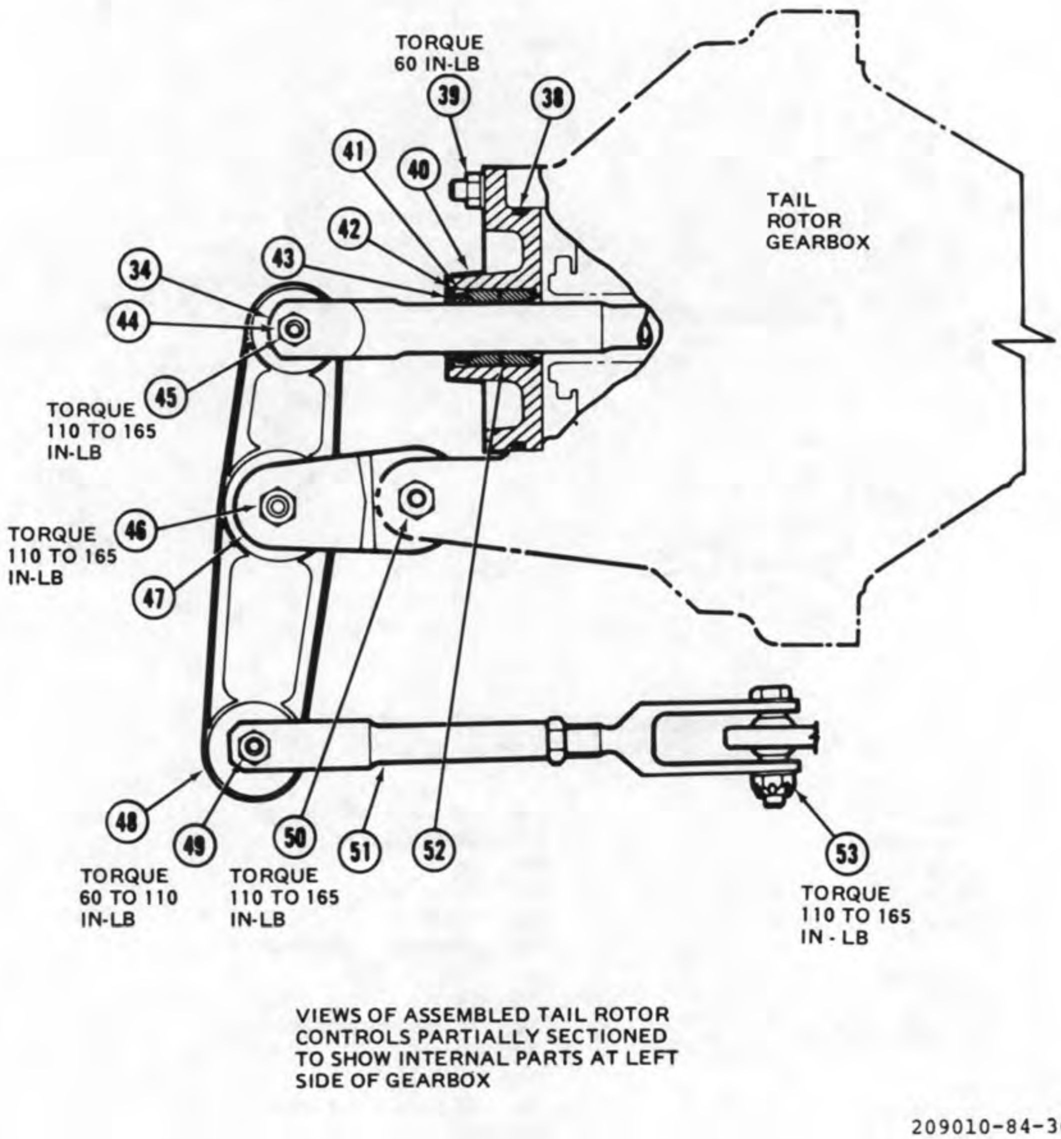


Figure 5-76. Tail Rotor Controls — Crosshead, Weights, Links and Control Tube (Sheet 3 of 3)

counterclockwise until threads are disengaged and remove sleeve.

d. Remove attaching bolts and remove lever (48), idler (47) and link (51).

e. Remove control tube (34) from left side of gearbox.

f. Remove nuts and washers (39). Remove housing (40). Remove retaining ring (42), housing (41), excluder (43) and bearing (52).

5-100. DISASSEMBLY — TAIL ROTOR CONTROLS.

a. Remove tail rotor retaining nut (36, figure 5-76) and shield (37) from crosshead (13) if not previously accomplished.

b. Remove cotter pin (10). Remove nut (11), bolt (15) and pitch link (31). Remove opposite pitch link in the same manner.

c. Remove nut (19), bolt (16), washer (18) and weights (17). Remove remaining weights in the same manner.

d. Remove cotter pin (21). Remove nut (20), washer (22), bolt (30), washer (29) and counterweight link (26). Remove opposite counterweight link in the same manner.

e. Remove cotter pin (23). Remove nut (24), washer (25), bellcrank (27), and washer (28). Remove opposite bellcrank in the same manner.

5-101. CLEANING — TAIL ROTOR CONTROLS.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

Clean the parts disassembled in paragraph 5-100 with solvent (C112) and dry with filtered, compressed air. Use only solvent (C112) on bearing (8, figure 5-76).

5-102. INSPECTION — TAIL ROTOR CONTROLS.

a. Inspect crosshead (13, figure 5-76) for damage in excess of limits shown in figure 5-77.

b. Inspect counterweight bellcrank (27, figure 5-76) for damage in excess of limits shown in figure 5-78.

c. Inspect pitch links (31, figure 5-76) for damage in excess of limits shown in figure 5-79.

d. Inspect counterweight links (26, figure 5-76) for damage in excess of limits shown in figure 5-80.

e. Inspect counterweight support (33, figure 5-76) for damage in excess of limits shown in figure 5-81.

f. Inspect tail rotor control tube (34, figure 5-76) for damage in excess of limits shown in figure 5-82. Mount the control tube on centers and check runout. Maximum allowable runout in other areas is **0.020** inch. Inspect two corks for secure installation in tube and for damage. Inspect threads for damage.

g. Inspect link assembly (51, figure 5-76) for damage in excess of limits shown in figure 5-83.

h. Inspect idler (47, figure 5-76) for damage in excess of limits shown in figure 5-84.

i. Inspect lever assembly (48, figure 5-76) for damage in excess of limits shown in figure 5-85. Inspect bearings in lever for wear.

j. Inspect housing (40, figure 5-76) for corrosion and mechanical damage.

k. Inspect retaining ring (42) for damage that would affect function.

l. Inspect housing (41) and excluder (43) for damage that would affect function.

m. Inspect bearing (52) for damage that would affect function.

n. Inspect shield (37) for cuts and deterioration.

o. Inspect tail rotor retaining nut (36, figure 5-76) for damage in excess of limits shown in figure 5-86.

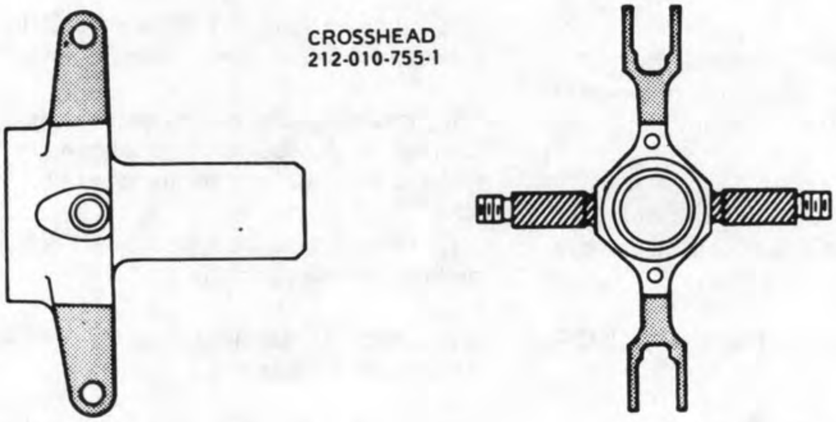
p. Inspect race (44) for corrosion and wear that would affect function.

q. Inspect sleeve (35) for corrosion, wear, and damaged threads.

r. Inspect bearing (8) for evidence of separation of races. Rotate bearing manually. If roughness is noted or if axial looseness exceeds **0.005** inch, dispose of bearing locally.

s. Inspect the following parts by magnetic particle method, Code M, or fluorescent penetrant method, Code F, (TM 43-0103). Items are indexed to figure 5-78.

ITEM	NOMENCLATURE	CODE
13	Tail Rotor Controls Crosshead	F
26	Counterweight Link	F
27	Counterweight Bellcrank	F
33	Counterweight Support	F
34	Tail Rotor Control Tube	M
36	Tail Rotor Retaining Nut	M
47	Idler	F
48	Lever Assembly	F
51	Link Assemly	M



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED		
CRACKS ALLOWED	None	None	None
NICKS, SCRATCHES, DENTS AND CORROSION	0.002	0.005	0.010
MAXIMUM AREA PER FULL DEPTH REPAIR	0.05 Sq. In.	0.05 Sq. In.	0.15 Sq. In.
NUMBER OF REPAIRS	One Per Zone	One Per Lug	Not Critical
EDGE CHAMFER	Not Applicable	0.010	0.020

SPLINE DAMAGE

Depth	One Third of Spline
Length	One Third of Spline
Number	Two

THREAD DAMAGE

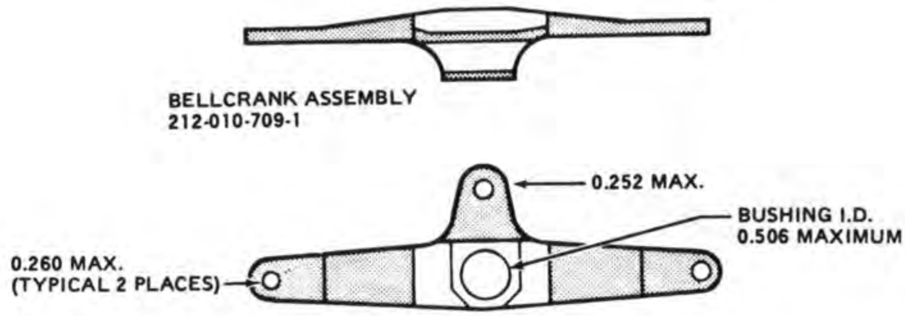
Depth	One Third of Thread
Length	0.25
Number	One Per Segment

BORE DAMAGE 0.002 for 1/4 Circumference

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

212010-45E

Figure 5-77. Damage Limits — Tail Rotor Control Crosshead



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, DENTS AND CORROSION	0.005	0.010
EDGE CHAMFER	0.020	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.	0.15 Sq. In.
NUMBER OF REPAIRS	One Per Lug	One
BORE DAMAGE	0.002 for 1/4 Circumference	
BEARING LIMIT	Diameter Cannot Exceed 0.506	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTE: Coat repair areas with primer (C88 or C91).

212010-43H

Figure 5-78. Damage Limits — Tail Rotor Control Counterweight Bellcrank

5-103. REPAIR — TAIL ROTOR CONTROLS.

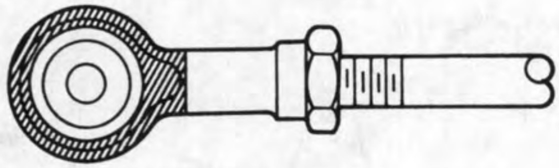
a. Replace any part which failed to pass inspection in paragraph 5-102.

b. Polish out mechanical and corrosion damage that is within limits specified in paragraph 5-102. Use 300 grit or finer sandpaper (C102) and scotchbrite (C103). Touch up repair areas with primer (C89).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

c. Replace loose or damaged corks in control tube. Clean area where cork will be installed with



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, DENTS AND CORROSION	0.005	0.010
EDGE CHAMFER	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	0.05 Sq. In.	0.10 Sq. In.
NUMBER OF REPAIRS	One Per Segment	One Per Segment

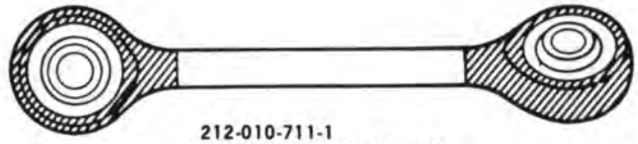
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. Repair of nicks and dents on threads must not exceed one-third of the thread depth. Length of repair shall not exceed 0.250. Each threaded segment may have one repair.
2. Minor damage to jam nut is acceptable.
3. Coat repair areas with primer (C88 or C91).
4. Replace link if axial or radial play in either bearing exceeds 0.020.
5. Maximum width of polish-out repair on rod is one-third of the circumference of the rod.

212010-44D

Figure 5-79. Damage Limits — Tail Rotor Controls Pitch Link



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED (hatched area)	(clear area)
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, AND DENTS	0.005	0.010
CORROSION		
Before Repair	0.002	0.005
After Repair	0.005	0.010
MAXIMUM AREA PER FULL DEPTH REPAIR	0.05 Sq. In.	0.10 Sq. In.
NUMBER OF REPAIRS	One Per End	One
EDGE CHAMFER	0.020	Not Applicable

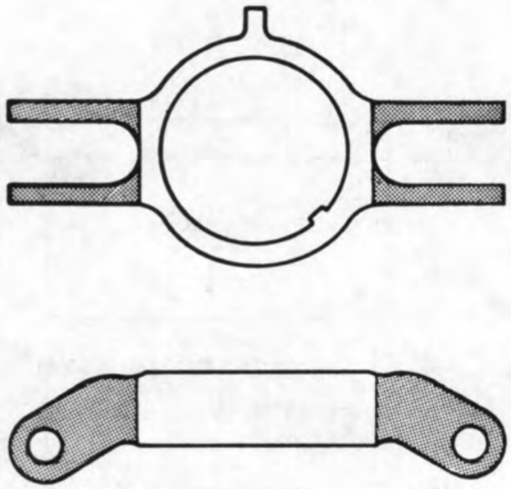
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. Polish out nicks and dents in edges to remove all damage and finish with a smooth radius or chamfer. If maximum depth to remove all damage exceeds 0.020 and/or the width of the repair exceeds one-third circumference, dispose of link locally.
2. Touch up repair area with primer (C88 or C91).
3. Spherical bearing axial wear limit is 0.020. If either bearing is worn beyond this limit, dispose of link locally. Repair of the link by replacement of bearings is not authorized.

212010-47H

Figure 5-80. Damage Limits — Tail Rotor Control Counterweight Link



DAMAGE LOCATION SYMBOLS

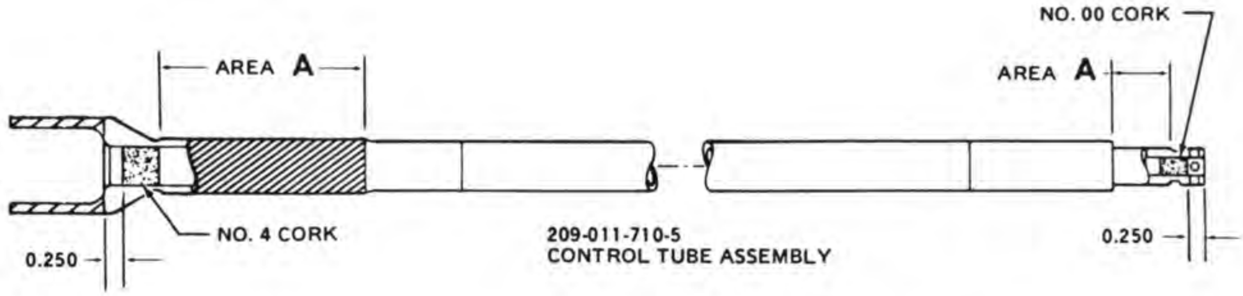
TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, DENTS AND CORROSION	0.005	0.010
EDGE CHAMFER	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	0.05 Sq. In.	0.10 Sq. In.
NUMBER OF REPAIRS	One Per Lug	Two
BORE DAMAGE	0.002 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTE: Coat repair areas with primer (C88 or C91).

212010-16L

Figure 5-81. Damage Limits — Tail Rotor Active Counterweight Support



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED		
CRACKS ALLOWED	None	None	None
NICKS, SCRATCHES, DENTS AND CORROSION	0.002	0.005	0.010
MAXIMUM AREA PER FULL DEPTH REPAIR	0.05 Sq. In.	0.05 Sq. In.	0.25 Sq. In.
NUMBER OF REPAIRS	One per tang	Two	Not Critical
EDGE CHAMFER	0.010	0.020	0.030
THREAD DAMAGE			
DEPTH	One-third of thread		
LENGTH	0.10		
NUMBER	Two		

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTE: Maximum allowable runout, with control tube mounted on centers, is 0.010 TIR (Total Indicator Reading) in areas designated A. Maximum allowable run out in other areas is 0.020 TIR.

209011-28C

Figure 5-82. Damage Limits — Tail Rotor Control Tube

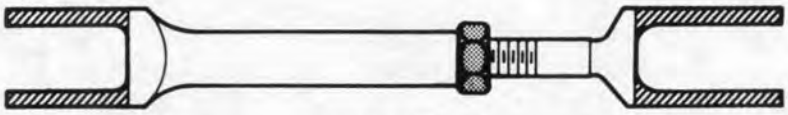
solvent (C112) and allow to dry. Coat new cork with shellac (C108) and press into position illustrated in figure 5-82.

5-104. ASSEMBLY — TAIL ROTOR CONTROLS.

a. Position nylatron washer (28, figure 5-76), bellcrank (27) and special washer (25) on crosshead (13). Install nut (24) and torque **70 TO 125** inch-pounds. Install cotter pin (23). Install opposite bellcrank in the same manner. If cotter pins do not engage castellations in nuts, add one thin steel washer under nuts (24).

CAUTION

Weights (17) must be installed on outboard side of bellcranks (27) as illustrated or interference may occur.



209-011-713-1
LINK ASSEMBLY

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED		
CRACKS ALLOWED	None	None	None
NICKS, SCRATCHES, SHARP DENTS	0.005	0.010	0.020
CORROSION	0.0025	0.005	0.010
AREA OF FULL DEPTH REPAIR	0.05 Sq. In.	0.20 Sq. In.	0.20 Sq. In.
NUMBER OF REPAIRS	One Per Lug	See Note 5	Two

THREAD DAMAGE:
DEPTH: One-third of thread
LENGTH: One-quarter inch
NUMBER: Two

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. **Damage and subsequent repair to threads must not exceed one-third of the thread depth. Length of repair shall not exceed 0.25. The threaded segment may have two repairs.**
2. **All edges may be radiused or chamfered 0.020 to remove nicks and dents.**
3. **Corrosion must be cleaned up to twice the damage depth.**
4. **Coat repair areas with primer (C88 or C91).**
5. **Long clevis — two repairs; short clevis — one repair.**

209011-29C

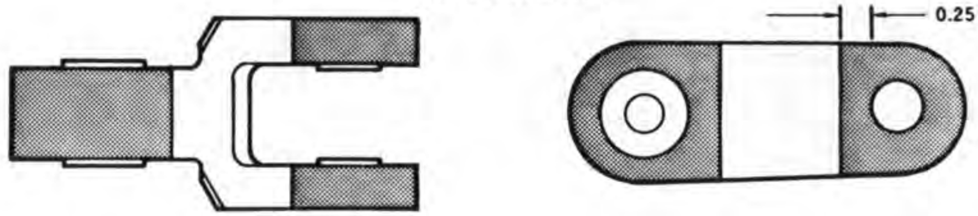
Figure 5-83. Damage Limits — Link Assembly

b. Install weights on each end of the two bellcranks (27). Install the same weights that were removed if they were indexed; if not, install two weights (17) and one steel washer (18) at each of the four locations. Install bolt (16) and nut (19). Torque nut **50 TO 70** inch-pounds.

c. Position counterweight link (26) in bellcrank (27) and install bolt (30) with steel washer (29) under head and steel washer (22) under nut (20). Torque nut **60 TO 110** inch-pounds and install cotter pin (21). Install opposite counterweight link in the same manner. If cotter pins do not engage castellations in nuts, add one thin steel washer under nuts (20).

d. Adjust both pitch links (31) to **6.115** ±**0.010** inch dimension between centers of bearings. (Refer to chapter 11 for additional rigging instructions.)

e. Position pitch link (31) in crosshead (13) with the end with rivet (32) installed away from the crosshead as illustrated. Install bolt (15) with steel washer (14) under head and steel washer (12) under nut (11). Torque nut **110 TO 165** inch-pounds and



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED (shaded)	(unshaded)
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, SHARP DENTS	0.010	0.030
CORROSION		
Before Repair	0.005	0.015
After Repair	0.010	0.030
MAXIMUM AREA PER FULL DEPTH REPAIR	0.25 Sq. In.	0.50 Sq. In.
NUMBER OF REPAIRS	One Per Segment	Two

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. Edges may be radiused or chamfered 0.040 to remove nicks and dents.
2. Corrosion must be cleaned up to twice damage depth.
3. Coat repair areas with brush on chemical film (C31).

209011-13F

Figure 5-84. Damage Limits — Idler

install cotter pin (10). Install opposite pitch link in same manner. If cotter pins do not engage castellations in nuts, add one thin steel washer under nuts (11).

5-105. INSTALLATION — TAIL ROTOR CONTROLS.

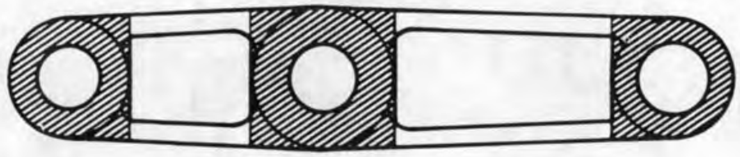
a. Install bearing (52, figure 5-76) in housing (40). Install excluder (43) with lip outboard and housing (41) in housing (40) and secure with retaining ring (42).

b. Install new packing (38) on housing (40).

c. Apply unthinned primer (C88 or C91) to surface of housing (40) that contacts gearbox and install housing while primer is wet.

d. Install steel washers and nuts (39). Torque evenly to **60** inch-pounds. Apply sealing compound (C107) around joint where housing contacts gearbox.

e. Position idler (47) on gearbox case and secure with bolts, steel washers and nuts (50). Apply sealing



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, SHARP DENTS	0.010	0.020
CORROSION		
Before Repair	0.005	0.010
After Repair	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	One-Half of Any Quadrant	0.50 Sq. In.
NUMBER OF REPAIRS	One Per Segment	One Per Segment

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. Edges may be radiused or chamfered 0.040 to remove nicks and dents.
2. Corrosion must be cleaned up to twice damage depth.
3. Coat repair areas with brush on chemical film (C31).

209011-12G

Figure 5-85. Damage Limits — Lever

compound (C107) to mating surfaces of washers and case during assembly procedure. Torque nut **110 TO 165** inch-pounds and install cotter pin.

WARNING

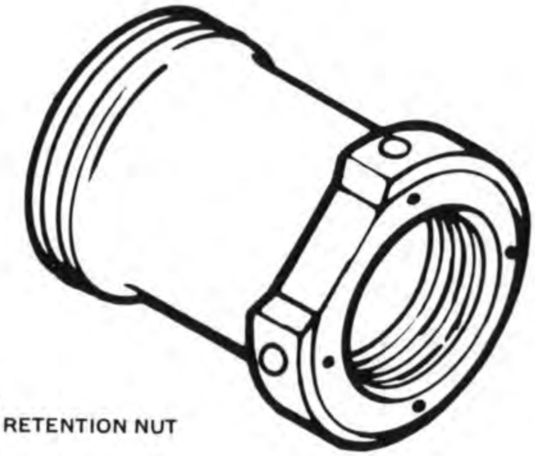
Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

f. Using solvent (C112) wash bearing in lever assembly (48) which attaches to control tube (34) to remove preservative and/or dirt. Hand pack bearing with grease (C58).

g. Position lever assembly (48) on idler (47) and install bolt, steel washer and nut (46). Torque nut **110 TO 165** inch-pounds and install cotter pin.

h. Disassemble link assembly (51). Apply corrosion preventive compound (C41) to the threads and barrel section of the link assembly but not to the clevis section. Assemble the link and adjust to length of **7.5** inches between centers of bolt holes. Tighten jamnut to secure link assembly parts in position.

i. Secure link assembly (51) to lever (48) with bolt, steel washers, and nut (49). Torque nut **60 TO 110** inch-pounds and install cotter pin.



DAMAGE LOCATION SYMBOL

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
CRACKS ALLOWED	None
SCRATCHES, DENTS AND CORROSION	0.010
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. In.
NUMBER OF REPAIRS	2
EDGE CHAMFER	0.030
THREAD DAMAGE	
Depth	One-third of thread
Length	One-fourth of inch
Number	One

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED

209010-116

Figure 5-86. Damage Limits — Tail Rotor Retention Nut

j. Secure link assembly (51) to control linkage with bolt, steel washers and nut (53). Torque nut **110 TO 165** inch-pounds and install cotter pin.

k. Secure control tube (34) to lever assemly (48). Position race (44) through bearing in lever and secure with bolt, steel washers and nut (45). Torque nut **110 TO 165** inch-pounds and install cotter pin.

l. Position sleeve (35) on control tube (34) with flange inboard. Rotate sleeve clockwise to engage threads. Continue to rotate until sleeve is past threads and fully seated on control tube shoulder.

m. Install assembled crosshead, weights, and links. Refer to pragraph 5-87, step e. through step n. to complete installation of control and tail rotor.

n. Ensure that weights (17) are installed on outboard side of bellcranks as illustrated and that weights do not contact other parts when controls are moved through full throw.

o. Check rigging of tail rotor (paragraph 11-73).

p. Track tail rotor (paragraph 5-115).

5-106. LUBRICATION — TAIL ROTOR CONTROLS.

Lubricate tail rotor controls as shown on lubrication chart in Chapter 1.

SECTION VII. TAIL ROTOR BLADES

5-107. TAIL ROTOR BLADES.

5-108. DESCRIPTION — TAIL ROTOR BLADES.

The tail rotor blade is of all-metal, bonded construction. Upper and lower aluminum alloy skins are bonded to an aluminum honeycomb core. Externally attached balance weights and balance screws inside the blade tip facilitate blade balancing.

Premaintenance Requirements For Tail Rotor Blade Assembly

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	Paint Spray Equipment
Minimum Personnel Required	One
Consumable Materials	(C1) (C5) (C14) (C19) (C20) (C31) (C32) (C44) (C68) (C69) (C74) (C75) (C88 or C91) (C102) (C103) (C112)
Special Environmental Conditions	None

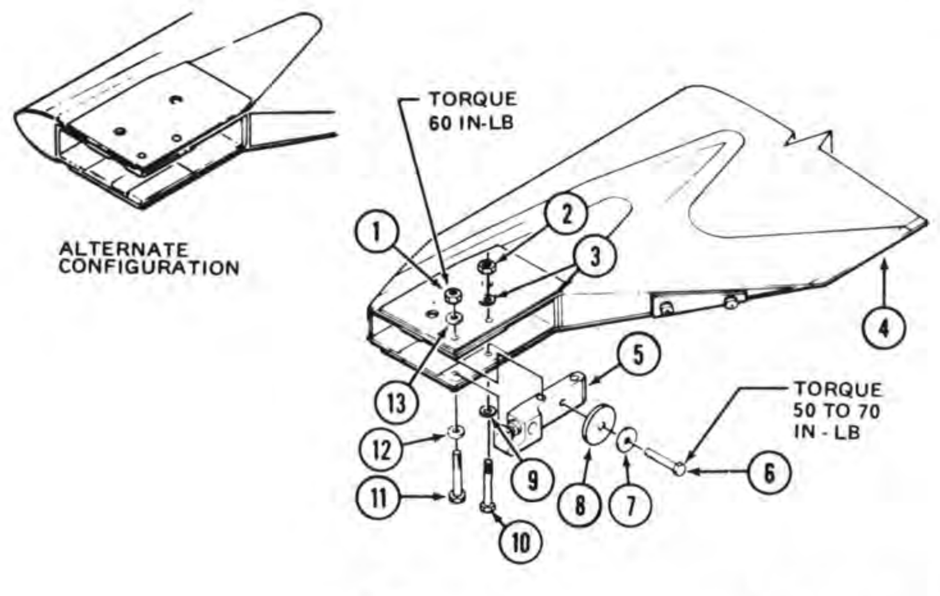
5-109. REMOVAL — TAIL ROTOR BLADES

a. Remove tail rotor hub and blade assembly from helicopter (paragraph 5-81). Place the tail rotor assembly on a padded bench or similar work area to prevent damage. Disassemble tail rotor hub and blade assembly (paragraph 5-82).

NOTE

The tail rotor hub and blade assembly must be rebalanced if any parts are replaced or repaired. It is good practice to index special balance washers and bolts at time of disassembly so that these parts can be reassembled in the same location. This will make rebalancing easier.

b. Cut lockwire and remove bolt (6, figure 5-87) and washers (7 and 8) from blade. Remove corresponding parts from opposite blade.



1. Nut
2. Nut
3. Steel washer
4. Blade
5. Pitch horn
6. Bolt
7. Steel washer
8. Special washer
9. Steel washer
10. Bolt
11. Bolt
12. Steel washer
13. Steel washer

209010-97C

Figure 5-87. Tail Rotor Blade Pitch Horn Installation

c. Remove nuts (1 and 2), and washers (3 and 13). Remove bolts (10 and 11) and washers (9 and 12). Remove pitch horn. Remove opposite pitch horn in the same manner.

5-110. INSPECTION — TAIL ROTOR BLADES.

a. Inspect tail rotor historical records and the tail rotor blades for evidence that the blades have been subjected to an accident or incident outside the realm of normal usage. If such evidence exists, perform applicable special inspections fro overspeed, sudden stoppage, hard landing and overtorque outlined in Chapter 1 and the following:

NOTE

If there is no evidence of accident or incident, proceed to step b.

(1) Overspeed inspection:

(a) Check for bond separation anywhere on the blade. If any separation exists, dispose of the blade locally.

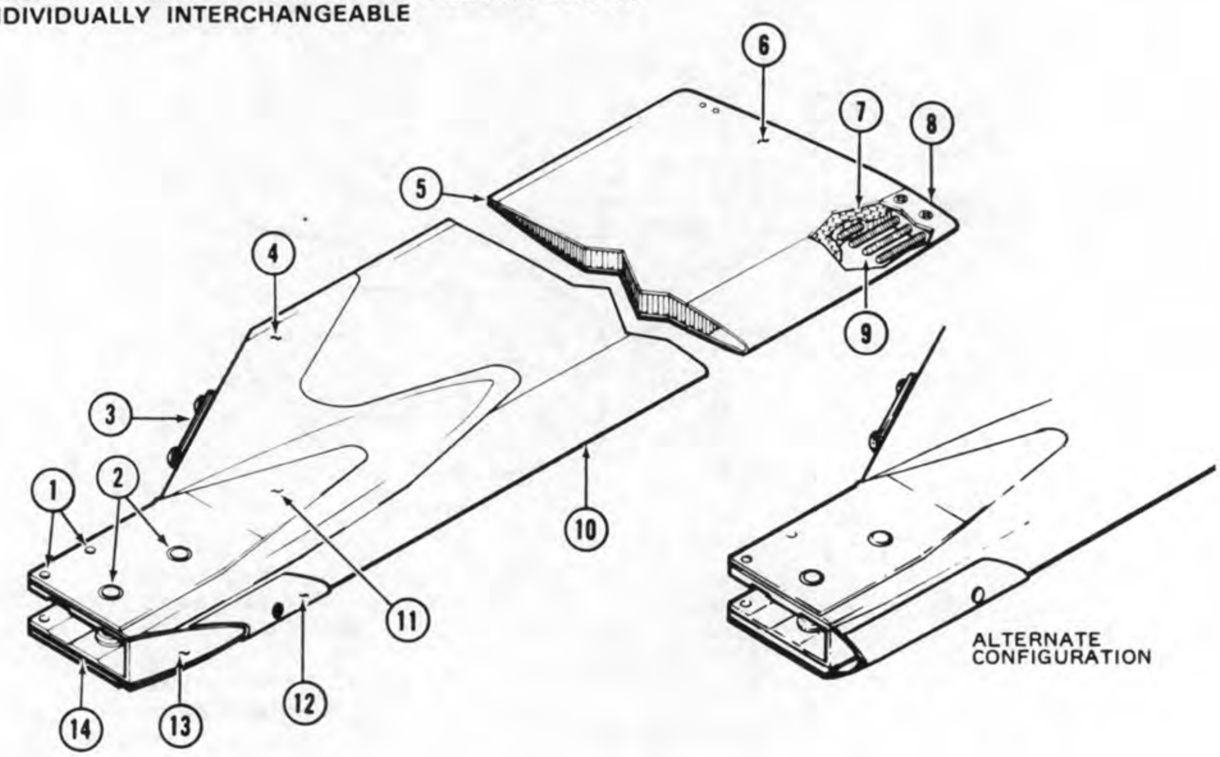
(b) Check balance screws (9, figure 5-88) and external balance weights (3) for movement. If any of these parts have moved outboard due to centrifugal force, dispose of blade locally.

(c) Check the blade grip bolt hole bushings (2) for evidence of looseness. If any of the four bushings are loose, forward the blade to next higher maintenance level for repair.

(d) Inspect four external buffer pads (figure 5-92) for looseness or damage. If any of the four buffer pads are loose or damaged, forward the blade to next higher maintenance level for repair.

(e) If blade passes inspections noted in steps (a), (b), (c), and (d), and there is no other visible damage, the blade is serviceable.

NOTE: ALTERNATELY CONFIGURED TAIL ROTOR BLADES ARE INDIVIDUALLY INTERCHANGEABLE



1. Pitch horn bolt holes
2. Blade grip bolt hole bushings
3. External balance weights
4. Doubler
5. Trailing edge
6. Skin
7. Honeycomb core
8. Tip block
9. Balance screws
10. Spar
11. Grip plate
12. Drain hole doubler
13. Butt block
14. Inner grip plate

209010-62B

Figure 5-88. Tail Rotor Blade Assembly

(2) Sudden stoppage inspection:

(a) Inspect the blades visually for evidence that the blade has come in contact with the ground, tailboom or other foreign object. If such evidence is found, replace both blades.

(b) Inspect the blade skin visually for wrinkles and deformations. If this damage is present, replace damaged blade. Inspect opposite blade for damage and replace as necessary.

(c) If blade passes inspections noted in steps (a) and (b), and there is no other visible damage due to sudden stoppage, the blade is serviceable.

(3) Hard landing inspection:

(a) Inspect the blades visually for evidence that the blade has come in contact with the ground, tailboom or other foreign object. If such evidence is found, return both blades to depot level maintenance.

(b) Check for bond separation anywhere on the blade. If any separations exist, dispose of blade locally.

(c) Check root end weights for evidence they have moved. If such evidence is found, dispose of blade locally.

(d) If one of the blades of a pair has been damaged badly enough that metal has been torn or any bond lines have been separated, dispose of blades locally.

(e) If one of the blades of a pair has been damaged slightly by denting, scrap that blade; but the other blade may be reused after inspection by depot level maintenance for water tightness and spanwise balance.

b. Accomplish normal inspecion of tail rotor blades and pitch horns by inspecting blades visually and with standard inspection equipment. Classify any damage present as negligible, reparable at AVIM level, reparable at Depot, or nonreparable.

(1) Neligible damage:

NOTE

Blades with only negligible damage may be returned to service without repair.

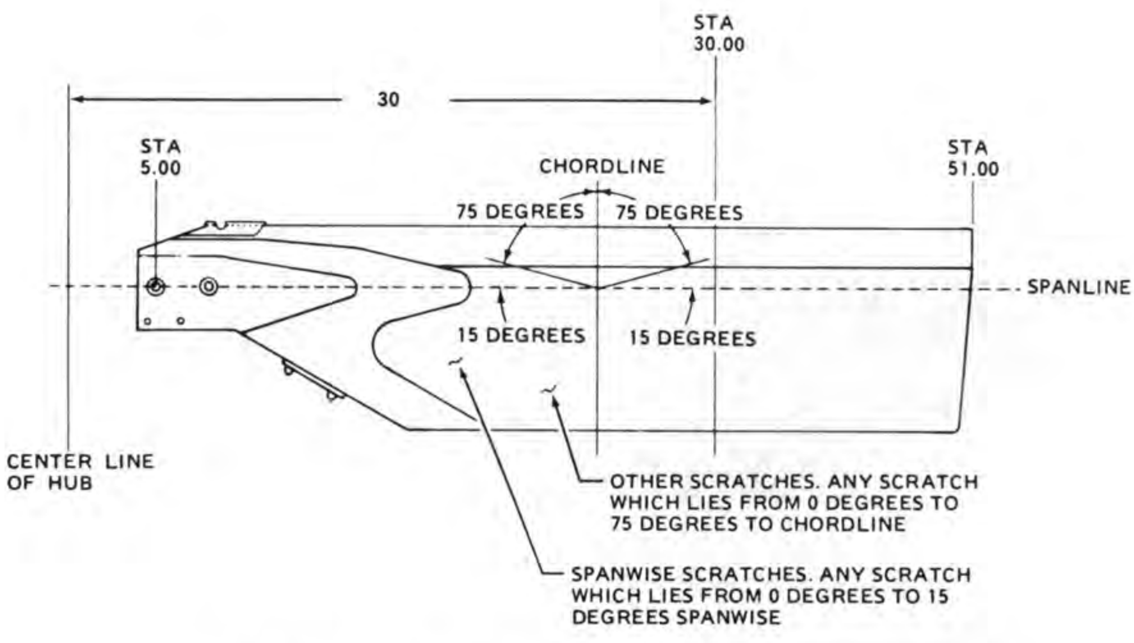
(a) Non-sharp dents located inboard of Station 30.0 that are not in excess of **0.015** inch deep are negligible (figure 5-89).

(b) Non-sharp dents located outboard of Station 30.0 that are not in excess of **0.030** inch are negligible (figure 5-89).

(c) Voids between doublers (4, figure 5-88) and skin (6) or spar (10) which do not exceed **0.50** inch chordwise by **2.0** inches spanwise and are not within **0.50** inch of the edge of doubler are negligible.

(d) Voids between the skin (6) and spar (10) which do not exceed **0.50** inch chordwise by **2.0** inches spanwise and are not within **0.250** inch of the edge of the skin and are not in the outboard area where the skin overlaps the spar are negligible. Voids between the skin and spar in the outboard area where the skin overlaps the spar which do not exceed **0.250** inch chordwise and **2.0** inches spanwise are negligible.

(e) Voids between the skin (6) and honeycomb core (7) which do not exceed **0.50** inch chordwise by **2.0** inches spanwise are negligible.



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

212010-38C

Figure 5-89. Tail Rotor Blade Station Diagram and Scratch-Type Damage Area Locations

(2) Nick, dent and scratch type damage reparable at AVIM level maintenance:

NOTE

Blades with the type damage defined in this paragraph require that the damage be polished out to the depth required to remove the damage including any nicks or scratches which may be present in dents. Use 300 grit or finer sandpaper (C102) and scotchbrite (C103). Do not fair-in or fill sharp or non-sharp dents with adhesive as this would interfere with subsequent inspections for cracks. Touch-up paint in areas where mechanical damage is polished out.

(a) Nicks and scratches inboard of Station 30.0 which run within **0 TO 15** degrees of the span line and are not in excess of **0.005** inch depth (figure 5-89).

(b) Nicks and scratches inboard of Station 30.0 which run within **0 TO 75** degrees of the chordline and are not in excess of **0.003** inch in depth (figure 5-89).

(c) Sharp dents inboard of Station 30.0 which are not in excess of **0.010** inch in depth.

(d) Non-sharp dents inboard of Station 30.0 which are not in excess of **0.030** inch in depth.

(e) Nicks and scratches outboard of Station 30.0 which are not in excess of **0.010** inch in depth.

(f) Sharp dents outboard of Station 30.0 which are not in excess of **0.015** inch in depth.

(g) Non-sharp dents outboard of Station 30.0 and also outside of patchable area which are not in excess of **0.040** inch in depth.

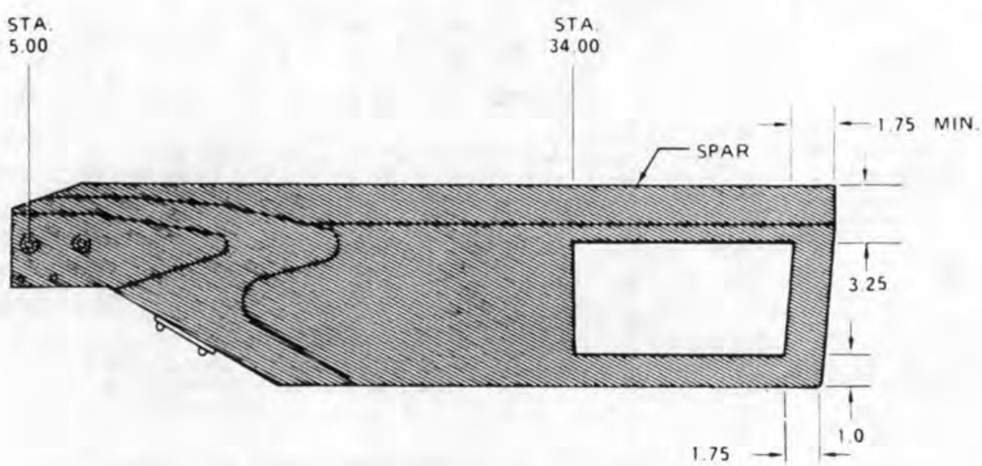
(h) Non-sharp dents outboard of Station 30.0 and also within patchable area as shown in figure 5-90 which are not in excess of **0.125** inch in depth.

(i) Nicks and scratches in the trailing edge up to **0.030** inch in depth chordwise are reparable, but the damage must be polished out over a distance of three inches on each side of the defect.

(3) Voids reparable at AVIM level maintenance:

NOTE

Blades which have voids within the limits defined in this paragraph require that the voids be repaired to return the blades to serviceable condition. Refer to paragraph 5-111 for repair instructions.



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

NOTE: NO REPAIR PERMITTED IN HATCHED AREA EXCEPT AS NOTED IN TEXT.

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Figure 5-90. Tail Rotor Blade — Area Authorized for Patch-Type Repair

NOTE

A void is defined as an unbonded area that is supposed to be bonded. Many sub-definitions of voids have been made such as lack of adhesive, gas pocket, misfits, etc. However, the general term "void" as used herein makes no distinction between those definitions.

(a) Determination of limits when two or more separate voids are involved:

1 When separate voids are closer together than one inch, consider them as one void.

2 If the voids are in two areas, such as one void between the core and the skin that is located within one inch of a void between the skin and the doubler, consider them as one void and use the limits for the area that are most strict.

(b) Edge voids between butt block (13, figure 5-88) and spar (10) or inner grip plates (14) within the following limits:

1 Butt block and spar: any length and **0.250** inch in depth.

2 Butt block and inner grip plate: **1.50** inches in length and **0.250** inch in depth.

(c) Edge voids which are a maximum of **0.060** inch in depth or **2.0** inches in length and are located between the following components.

1 Grip plates (11) and doublers (4).

2 Doublers (4) and skin (6).

3 Doublers (4) and spar (10).

4 Inner grip plates (14) and skin (6).

5 Inner grip plates (14) and spar (10).

6 Butt block (13) and skin (6).

7 Skin (6) and spar (10).

(d) Edge voids which are a maximum of **0.120** inch in depth (chordwise) and **3.0** inches in length (spanwise) and are located between skin (6) and trailing edge strip (5).

(e) Edge voids which are a maximum of **0.50** inch in width (chordwise) between the spar (10) and tip block (8).

(4) Damage to skins that is reparable at AVIM level maintenance.

(a) Damage caused by a foreign object that results in a crack or hole in the skin and is located in the authorized area for repair by patching as shown in figure 5-90.

(b) Nick and scratch type damage that exceeds the limits defined in step b. (2), and is located in the authorized area for repair by patching as shown in figure 5-90.

(c) The maximum size of hole that can be repaired is restricted by the requirement that all of the defect must be cut out and the maximum size of cut is **1-1/2** inch diameter.

(5) Cracks in adhesive at bond line that are reparable at AVIM level maintenance:

(a) Cracks in adhesive at bond line between the phenolic blocks and skin, spar inside the drain hole, inner grip plates or joint between phenolic blocks are reparable by sealing. Inspect adhesive at bond lines in blade butt area for cracks. Place inspection emphasis on the areas shown in figure 5-91.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Do not saturate the bond lines with MEK as it will soften the adhesive.

(b) If cracks in adhesive are suspected, remove paint from area with clean cloths dampened with MEK (74) and reinspect.

(6) Blade damage that is nonreparable:

(a) Fatigue cracks at any location on the blade require local disposition of the cracked blade.

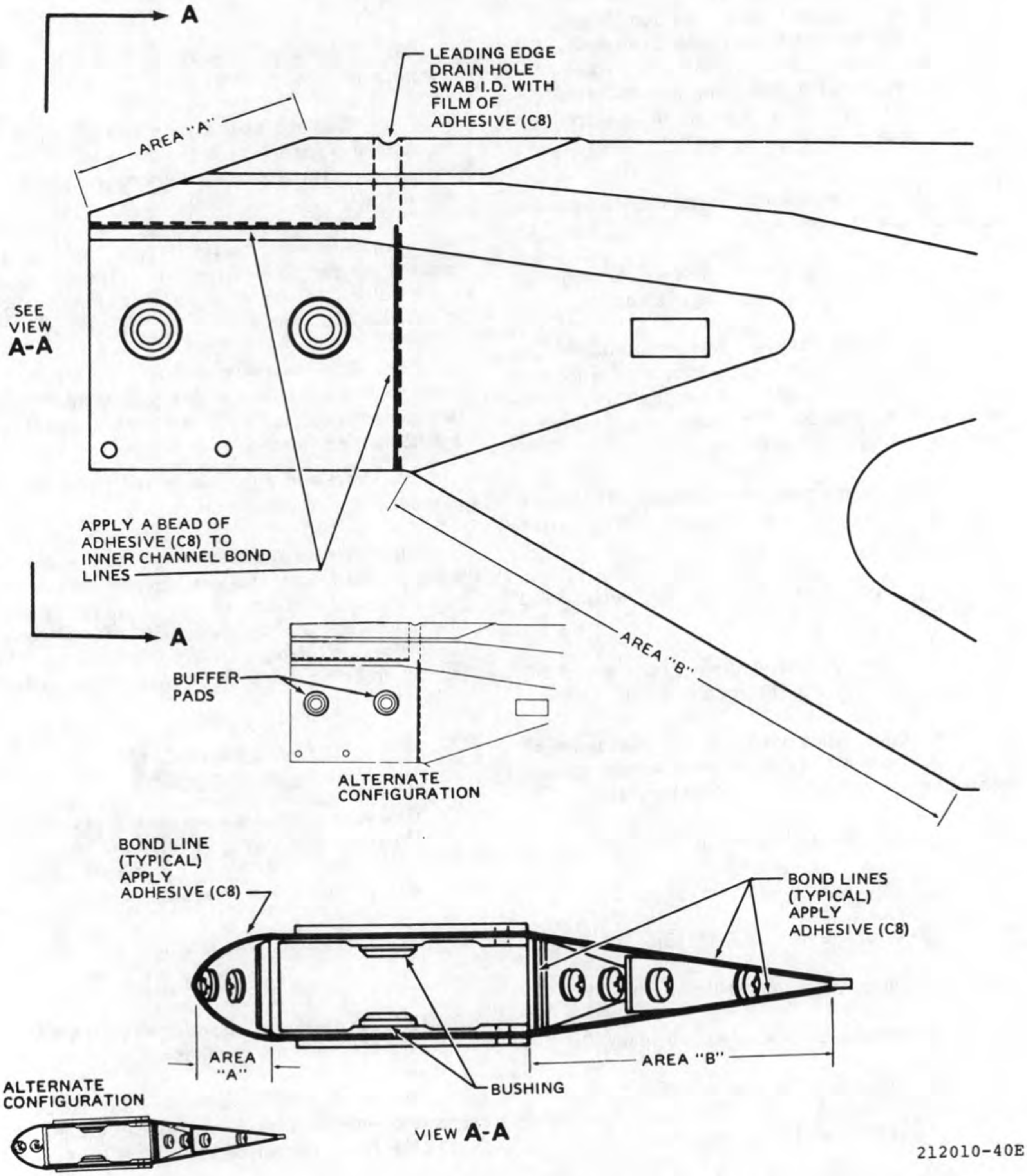


Figure 5-91. Tail Rotor Blade Butt Area Repair

(b) A blade with water in honeycomb core.

(c) A blade with one or more cracks developed in a previously repaired area.

(d) A blade with nicks or cracks that are located in dents and the total depth is in excess of the limits specified in steps b. (2) (c) through b. (2) (h) if damage is not within area where patches are allowed.

(e) A blade with any void within **0.50** inch of the edges of the drain hole doubler (12, figure 5-88).

(f) A blade with any void between the drain hole doubler (12) and spar (10) within **0.50** inch of the edge of the drain hole.

(g) A blade with one or more holes that do not fall within the area authorized for patches as shown in figure 5-90 and/or a blade with a hole that exceeds the **1.5** inch diameter restriction noted in step b. (4) (c).

(h) A blade with any corrosion that penetrates entirely through the skin.

(i) A blade that is worn completely through the spar at the tip.

(j) A blade with edge voids deeper than **0.1** inch at the tip end of any of the root end doublers or grip plates.

(k) A blade with edge voids in the leading edge or trailing edge of the doublers that are **0.25** inch or more in depth and show indications of corrosion in the void.

(l) A blade that failed to pass the special inspections for overspeed, overtorque and sudden stoppage.

(7) Inspect tail rotor pitch horns as follows:

(a) Inspect pitch horns for damage in excess of the limits shown in figure 5-92.

(b) Inspect threaded insert for damage to threads.

(c) Slide a new pitch link bolt through the bushing and matching hole used for attaching the pitch link. If the bolt does not fit freely through the holes, the pitch horn is not suitable for further service.

(d) Inspect for distortion of the pitch horns with a straight edge placed against the machined surfaces. Any distinct deviation from flat indicates that the pitch horn is distorted and not suitable for further service.

(e) Inspect pitch horns for cracks by fluorescent penetrant method (TM 43-0103).

5-111. REPAIR — TAIL ROTOR BLADES (AVIM).

a. Replace any blade which has incurred nonreparable damage (paragraph 5-110).

b. Repair blades with voids that are within the limits specified in paragraph 5-110.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

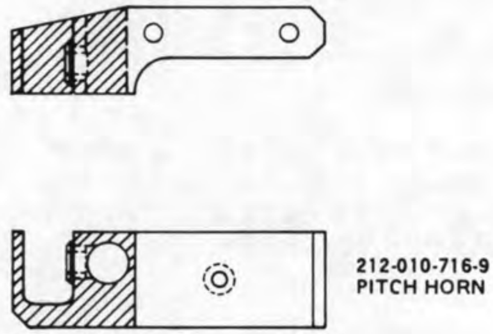
Do not allow MEK to enter rotor blade when removing paint to inspect for cracks or when cleaning prior to sealing edge voids. MEK will soften the adhesive used in manufacture of the rotor blades.

(1) Clean area around reparable edge voids with a clean cloth moistened with MEK (C74) and dry with a clean cloth.

(2) Prepare a small quantity of adhesive (C14) in accordance with the manufacturers instructions. Apply the adhesive to the edge void with the flat side of an applicator such as a wooden tongue depressor. Fill the void with adhesive as deeply as possible.

c. Repair blades with crack and hole type damage in the skin by patching if the damage is within limits specified in paragraph 5-110.

(1) Ensure that the damage to be patched is in the authorized area for patches (figure 5-90).



DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED	
		
CRACKS ALLOWED	None	None
NICKS, SCRATCHES, AND DENTS	0.010	0.020
CORROSION		
Before Repair	0.005	0.010
After Repair	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	0.05 Sq. In.	0.10 Sq. In.
NUMBER OF REPAIRS	One	Two
EDGE CHAMFER	0.020	0.040
BORE DAMAGE	0.002 for 1/4 Circumference	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

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Figure 5-92. Damage Limits — Tail Rotor Blade Pitch Horn

(2) Remove paint in area to be patched with 120 grit sandpaper (C102). After paint is removed, smooth the area with 250 grit sandpaper (C102).

(3) Cut out the damaged skin with a hole saw or use a sharp instrument to cut through the skin. Do not exceed the **1.50** inch diameter maximum cut out.

(4) Heat the cut out disc of skin to **200** degrees F (maximum) and remove the disc while it is heated. Avoid damage to the honeycomb core.

(5) Deburr the edges of the hole and polish out any scratches and nicks. Use 350 grit or finer sandpaper (C102) and scotchbrite (C103).

(6) Cut a patch from aluminum alloy sheet **0.020** inch thick. The patch must be large enough to overlap the hole at least **0.750** inch all around the perimeter. Deburr the edges of the patch.

(7) Clean the side of the patch that will be bonded by sanding with 250 grit sandpaper (C102).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(8) Wipe the mating surfaces of the patch and blade with a clean cloth dampened with MEK (C74).

(9) Apply a thin coat of adhesive (C14) to the mating surfaces of the patch and blade. Place the patch on the blade, press down on the patch and move it back and forth slightly to expel all air pockets in the adhesive. Blend the excess adhesive around the edge of the patch.

(10) Maintain pressure on the patch. Use weights, clamps or rubber bands cut from inner tubes.

(11) Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule.

(12) Touch up paint in area of patch (paragraph 5-112 and TB 746-93-2).

d. Repair blades with nick, scratch, dent and notch damage that is within the limits specified in paragraph 5-110.

(1) Polish out all nicks and scratches. Use aluminum wool (C20) on aluminum parts. Use sandpaper (C102) on stainless steel spar.

(2) Polish out damage in trailing edge over a distance of three inches on each side of the defect. Use a steel hand file to remove most of the damage then smooth out the area with aluminum wool (C20).

(3) Touch up paint in area of repair (paragraph 5-112 and TB 746-93-2).

e. Replace loose or damaged buffer pads.

NOTE

Exercise extreme care to ensure grip plates are not gouged or otherwise damaged.

(1) Remove old pad, using a knife or similar tool.

(2) Remove any remaining adhesive by sanding in a spanwise direction to bare metal. Surface finish shall be 32 RMS or better.

NOTE

Use cellophane or similar material between washers and buffer pads to prevent adhesive squeeze-out from contacting washers.

(3) Bond new buffer pads to blade, using adhesive (C14). Apply pressure to pad by installing a **0.5** inch diameter bolt through a blade bolt hole with an AN970-8 washer under both the bolt head and the nut. Tighten nut to apply pressure on buffer pad. Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule.

(4) Refinish blade as required.

f. Repair blades with cracks in adhesive at bond line detected in inspection described in paragraph 5-110, as follows:

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Do not saturate the bond lines with MEK as it will soften the adhesive.

(1) Clean area around cracks in adhesive at bond line in area illustrated in figure 5-91 with MEK (C74). Dry area with clean cloths.

(2) Apply a thin film of adhesive (C14) to the bond lines shown in figure 5-91 areas A and B.

(3) Apply a small bead of adhesive (C14) to area shown in figure 5-91.

(4) Swab the inside diameter of the leading edge drain hole with a thin film of adhesive (C14) to ensure that adequate sealing exists (figure 5-91).

(5) Refer to table 1-11, for adhesive, mix ratio, pot life, and curing schedule.

(6) Touch up paint in repair area (paragraph 5-112 and TB 746-93-2).

(7) Balance the tail rotor hub and blade assembly prior to installation on helicopter (paragraph 5-86).

g. Repair pitch horn as follows:

(1) Polish out mechanical and corrosion damage on pitch horns. Use 300 grit or finer sandpaper (C102) and scotchbrite (C103). Inspect repaired areas to ensure that limits shown in figure 5-92 have not been exceeded.

(2) Touch up repaired areas with chemical film (C31).

(3) Replace pitch horn (5, figure 5-87) if hole for floating bushing exceeds **0.5005** inch or is corroded.

(4) Replace bushing (30, figure 5-68) if bolt is loose in bushing or if bushing is loose in pitch horn.

5-112. PAINTING — TAIL ROTOR BLADES (AVIM).

a. Paint touchup is required when paint is deteriorated and/or the paint is removed to repair scratches, nicks, or dents. Refer to TB 746-93-2.

b. Prepare blade for painting as follows:

(1) Polish out nick, scratch, and dent damage (paragraph 5-111).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(2) Clean area where paint is to be applied with aliphatic naphtha (C75).

(3) Mask off or plug retention bolt holes and mask off holes for attaching the pitch horns to prevent entry of refinishing materials.

(4) Remove all surface oxides and aged paint from aluminum surfaces.

(5) Wash blade with cleaning and polishing compound (C32). Thoroughly rinse soap from blade and check for a water break free surface which is a continuous unbroken film of water on the surface. Repeat washing as required until the water break free surface is attained.

CAUTION

Do not touch blades with bare hands during remaining procedures or quality of paint will be adversely affected.

(6) Apply coat of chemical film (C31) to bare aluminum surfaces.

NOTE

If chemical film is not available, substitute commercial "Metal-Prep", alcoholic phosphoric solution (C19) or solution of chromic acid (C1).

c. Apply finish to blade as follows:

(1) Apply one coat of primer (C88 or C91) to the touch up area.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(2) Mix a small quantity of adhesive (C5) according to directions on container. Mix **13 TO 15** percent by weight of primer (C88 or C91) into the adhesive (C5). Mix thoroughly and thin to sprayable consistency by adding MEK (C74). Do not exceed **50** percent by volume; **35** percent should produce a sprayable consistency. The pot life of the epoxy primer mixture is approximately **three** hours.

(3) Ensure that masking tape applied in step b.(3) is still in place. Apply **three** wet spray coats of the adhesive prepared in the preceding step to all surfaces at the root of the blade for a distance of **0.750** inch to **2** inches outboard of the perimeter of the doublers. Allow each coat to dry **45 TO 60** minutes. Make each coat **1.5 TO 2.0** mils thick. Apply **one** wet spray coat of the same adhesive material to the entire length of the blade on both sides. Use the leading edge of the skin as the centerline of the spray.

(4) After the final coat is applied in preceding step, allow the blade to air dry for **16 TO 24** hours.

(5) Apply one thin mist coat of primer (C88 or C91) to all touch up areas and allow to dry for a minimum of **45** minutes and a maximum of **8** hours prior to applying next coat.

NOTE

It is necessary to cover all touch up areas with primer (C88 or C91) and comply with the time limit noted in step (5) or the finish coat of lacquer will not adhere to the blade.

(6) Apply the final coats of lacquer to the touch up areas only. Use lacquer (C68) to touch up areas except on the blade tip. Use lacquer (C69) on touch up areas of the six inch wide band on the blade tip. Paint thickness to be approximately **1.2 TO 1.5** mils.

(7) Air dry the blade for **3** hours prior to handling and for **48** hours prior to flying. If a faster cure time is required, air dry the blade **1** hour. Remove the masking tape and oven dry the blade at **180 TO 190** degrees F (**82 TO 88** degres C) for **1** hour.

(8) Apply a coating of corrosion preventive compound (C44) to the inside of the retention bolt bushings.

5-113. INSTALLATION — TAIL ROTOR BLADES (AVIM).

a. Position hub assembly (1, figure 5-69) on bench with data plate side up. Slide blade (14) on hub yoke with the data plate side up. Install bolts (20 and 25) with special washers (19 and 26) under bolt heads. Install special washers (2 and 13) next to blade. If special balance washers were indexed at time of disassembly, reinstall them in the same position. If they were not indexed, do not install them until the assembly is balanced. Install nuts (5 and 10) but do not torque until after the assembly has been balanced.

b. Install opposite blade in the same manner. The four blade retention bolts (20 and 25) may be installed from either side but all four bolts must be installed from the same side.

c. Position pitch horn (5, figure 5-87) on blade and install bolts (10 and 11) with steel washers (9 and 12) under heads. Install bolts with heads facing same direction as blade retention bolts (20 and 25, figure 5-69). Install steel washers (3 and 13, figure 5-87) and nuts (1 and 2). Torque nuts **50 TO 70** inch-pounds. If special washer (8) was indexed at disassembly, install it at this time with steel washer (7) and bolt (6). If special washer (8) was not indexed, install steel washer (7) and bolt (6). Do not torque until assembly has been balanced.

d. Install the opposite pitch horn in the same manner.

SECTION VIII. TRACKING AND BALANCING PROCEDURES

5-114. TRACKING AND BALANCING — MAIN ROTOR BLADES.

Premaintenance Requirements for Main Rotor Hub and Blade Assembly — Tracking

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T41) (T47)
Test Equipment	NA
Support Equipment	NA
Minimum Personnel Required	Two
Consumable Materials	(C123) (C137)
Special Environmental Conditions	NA

a. Following replacement or installation of the main rotor hub, blades or pitch links, track the main rotor blades.

b. B540 Perform following procedures as required for acceptable smooth operation of main rotor. Recommended sequence of procedures is also provided in charts (figures 5-93, 5-94, and 5-95).

WARNING

Runup of helicopter shall be performed only by personnel authorized by AR95-1.

NOTE

The VIBREX 4591 system is the preferred method of tracking main rotor blades. (Refer to paragraph 5-116.)

(1) Coat tracking tips of rotor blades with suitable grease pencils, using different colors on each blade as preparation for use of tracking flag. Set both trim tabs at trail (**zero** degrees) using gage (T41) and tab bender (T47).

(2) Perform a low speed blade track at 91 percent rpm (figure 5-97). If track is satisfactory, omit step (3) and proceed to step (4).

(3) Correct a low speed out-of-track condition by shortening pitch link attached to the low blade to roll the blade up (figure 5-9). Loosen jam nuts and turn barrel to shorten tube. Turning barrel **three** turns will change blade track approximately **0.375** inch. Tighten and lockwire (C137) nuts. Repeat checks and adjustments until satisfactory.

(4) Perform a high speed track at **100** percent rpm. If out-of-track, record which blade is low but make no adjustments.

(5) Test fly helicopter. If vertical vibration is not evident, proceed to step (6). If vertical vibration requires correction, begin sequence of adjustments indicated in figure 5-94 as applicable according to airspeed where vibration occurs.

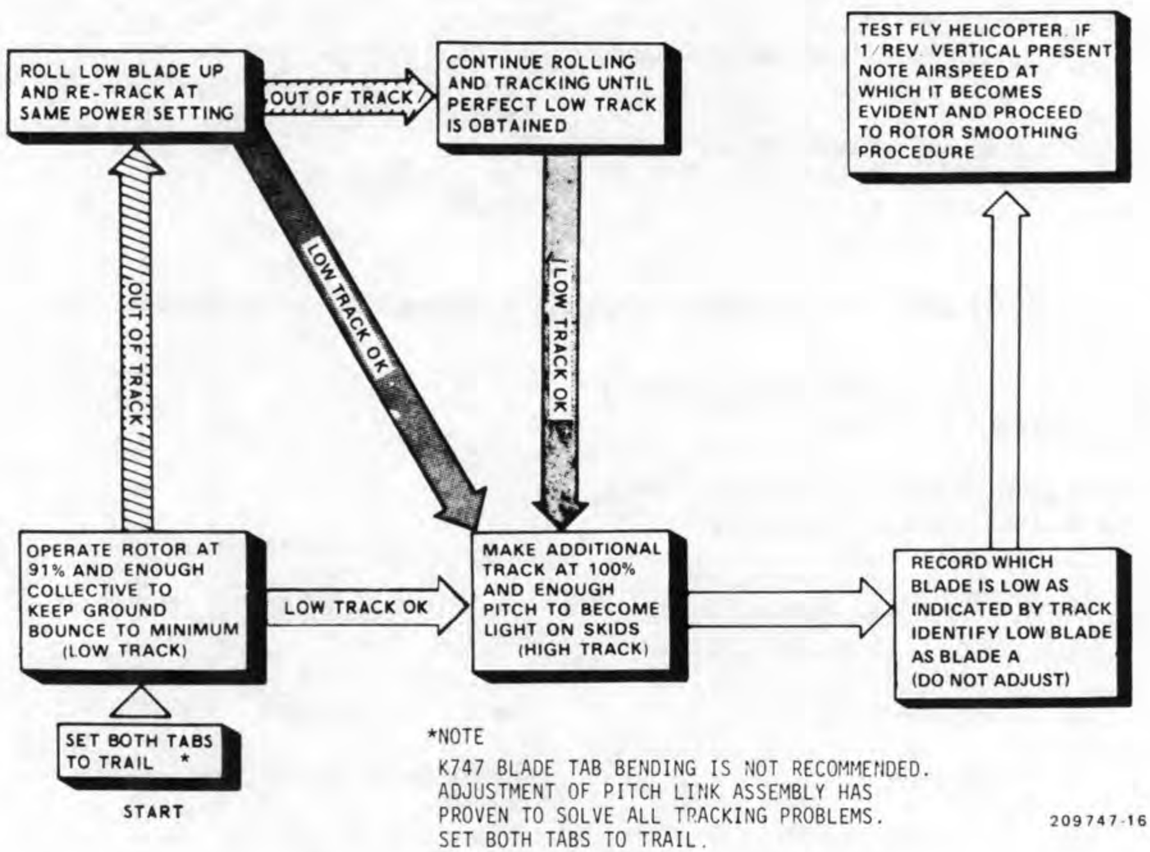


Figure 5-93. Main Rotor Tracking Chart

(a) When bending blade trim tabs, do not exceed 8 degrees up and/or 8 degrees down (16 degrees maximum both blades).

(b) To roll a blade, adjust pitch link as in step (3) above.

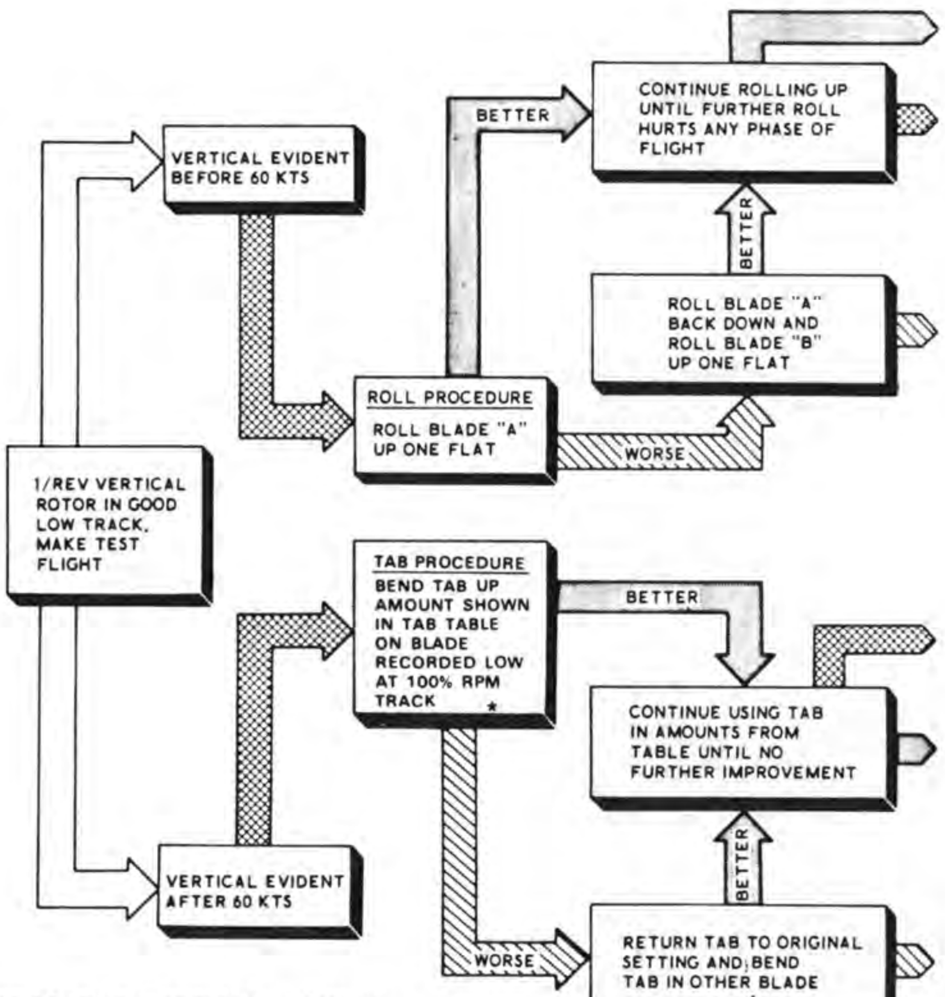
(c) To sweep a blade, loosen jam nuts on blade drag brace (12, figure 5-2) enough to turn barrel one full turn as shown by decal arrows. Torque jam nuts **150 TO 200** foot-pounds without moving barrel. Record all such adjustments, and do not exceed **TWO** full turns total adjustments.

NOTE

The blade sweep adjustment is also used to correct lateral vibration. (Refer to step (6)).

NOTE

If maximum blade sweep adjustment fails to correct rotor vibrations, remove main rotor hub and blade assembly and align blades (paragraphs 5-12 and 5-13).



*TAB BENDING PROCEDURE IS NOT REQUIRED FOR TRACKING K747 BLADES. SEE FIGURE 5-95.

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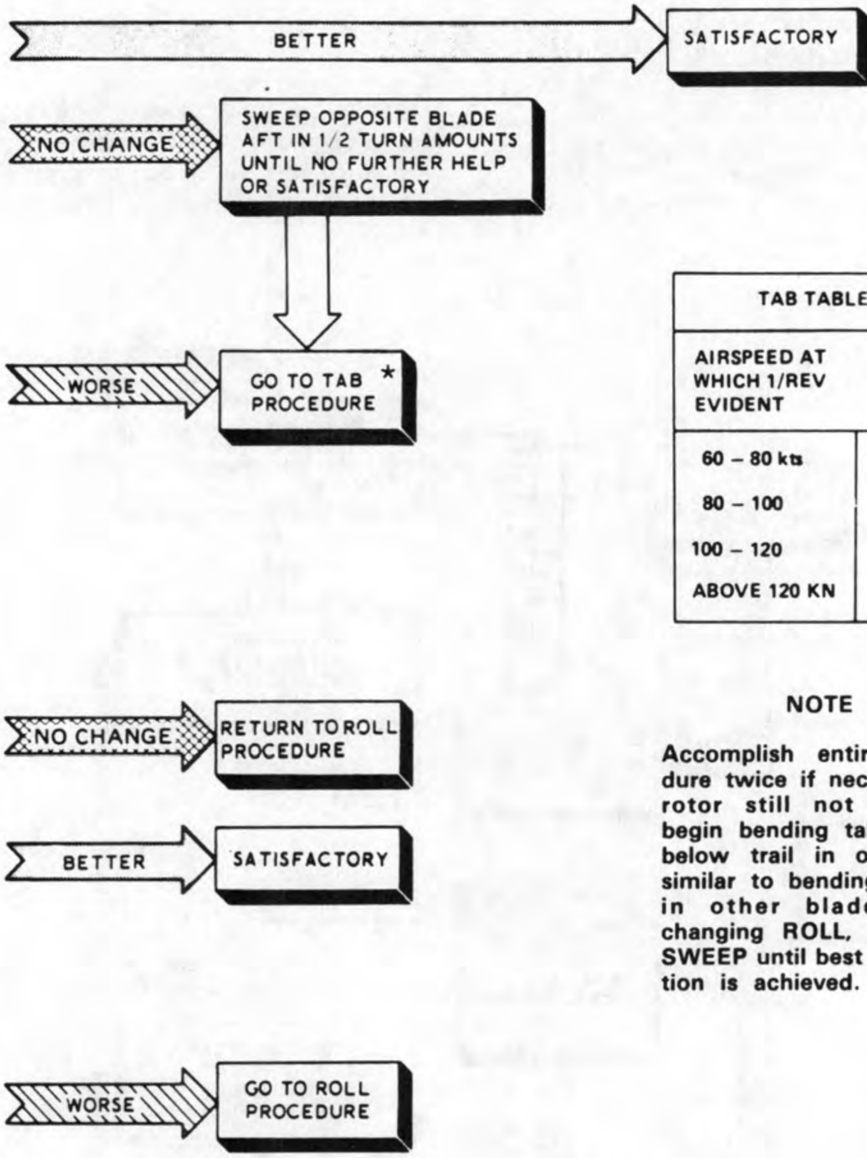
Figure 5-94. Vertical Vibration Correction Chart (Sheet 1 of 2)



TAB TABLE *	
AIRSPEED AT WHICH 1/REV EVIDENT	TAB
60 – 80 kts	4°
80 – 100	3°
100 – 120	2°
ABOVE 120 KN	1°

NOTE

Accomplish entire procedure twice if necessary. If rotor still not smooth, begin bending tab DOWN below trail in one blade similar to bending tab UP in other blade. Keep changing ROLL, TAB and SWEEP until best combination is achieved.

* TAB BENDING PROCEDURE IS NOT REQUIRED FOR TRACKING K747 BLADES SEE FIGURE 5-95.

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Figure 5-94. Vertical Vibration Correction Chart (Sheet 2 of 2)

1/2 X 1/2 inch pine stick, approximately **4** feet long or any other flexible device. Coat sponge rubber with Prussian blue (C92) or similar type of coloring thinned with oil.

WARNING

The runup shall be performed by personnel authorized in accordance with AR 95-1.

WARNING

Do not approach the tail rotor area for the purpose of tracking until 100 percent rpm has been established and it is certain that the helicopter is not going to yaw left or right due to rigging error or slippery parking surface. Injury or death could result from being struck by the tail rotor blades.

c. Start engine. Run at **100** percent rpm with pedals in neutral position. Rest tracking stick on underside of tail fin assembly as shown in figure 5-98. Slowly move tracking stick toward disc of tail rotor just far enough to lightly contact a blade approximately one inch from tip. Pull stick back immediately.

d. After contact is made, stop engine and allow rotor to stop. Shorten pitch link on unmarked blade **1/2** turn of rod end. Reinstall pitch link bolt, washers and cotter pin.

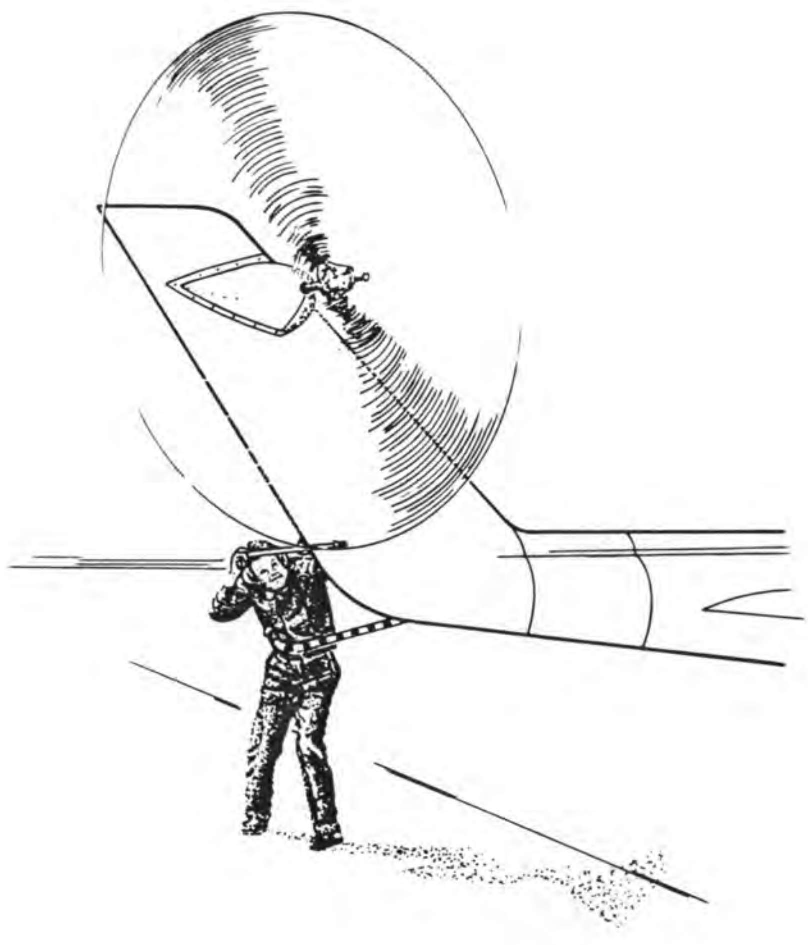

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Figure 5-98. Tracking Tail Rotor

e. Recheck track of blades. Proceed with adjustments, if required, by adjusting pitch links equally in opposite directions.

f. Make operational test flight and check that normal right and left turn can be made in autorotational and powered flight.

g. Check tail rotor forces as follows:

CAUTION

Identical weight must be maintained at all four positions on bellcrank (27, figure 5-76). Two weights (17) and one AN960-416 washer (18) must be installed at each position.

(1) Start engine and run at **100** percent rpm, with pedals in neutral position.

(2) Move HYDR test switch to system No. 2 position and hold.

(3) If left pedal or right pedal creeps forward, check to ensure that weights (17) and washers (18) are properly installed.

(4) Release HYDR test switch, allow to return to neutral position and shut down engine.

5-116. TRACKING AND BALANCING ROTOR BLADES AND TROUBLESHOOTING OTHER ROTATING ELEMENTS USING THE VIBREX 4591 SYSTEM.

5-117. DESCRIPTION — VIBREX 4591 SYSTEM.

a. The Vibrex 4591 System may be used to electronically track and balance main and tail rotor blades and troubleshoot other rotating elements. See figure 5-99 for view of Vibrex System components.

b. Description and specifications of the Vibrex 4591 System are presented in FO3 (foldout 3). Using the synchronized Strobex, track is visually displayed by rotor Tip Targets. One-per-revolution vibration is measured from an Accelerometer mounted laterally on the airframe to indicate the condition of main rotor balance. Another Accelerometer, mounted vertically in the front cockpit, reads vertical vibration from out-of-track. The Balancer meter indicates amount, and the Phazor shows location of the required correction, when interpreted by the Track and Balance Charts. Tail rotor balancing is done by mounting an Accelerometer on the fin near the tail rotor gear box. Amplitude of vibration is read from the Balancer meter to indicate the amount of weight change required, and the Strobex, triggered by the Balancer, shows "Clock Angle" that tells where to put the weight. Tail rotor Balance Charts interpret these readings. To locate sources of vibration other than the rotors, the Accelerometer is relocated and the Balancer's filter is tuned to the peak vibration levels. The RPM rate of these vibrations is related to known component RPM to identify the offending element.

c. Track and Balance Charts, Checklist, and "Clock Angle" Corrector. Charts tell what to do to rotor, in response to reading from Balancer, to correct track or balance.

d. Magnetic Pickup, Bracket, and Cable. Mounted on stationary swashplate of main rotor, the Magnetic Pickup delivers an electrical pulse that serves as a trigger for the Strobex for main rotor tracking, and as a phase reference for the phase meter in the Balancer.

e. Accelerometers, Accelerometer Bracket, and Cable. Accelerometers sense the vibration induced by rotors, shafts, fans, bearings, gears, etc.

f. Tip Targets. One is mounted on each main rotor blade tip. Used for viewing main rotor track.

g. VIBREX Tester. For functional test of the VIBREX 4591 System.

h. Strobex Blade Tracker. Used for tracking both main and tail rotors, and for measuring "Clock Angle" when balancing tail rotors.

i. Gram Scale. For weighing balance weights.

j. Carrying Case. For all the equipment.

k. Interrupters. Two Interrupters are mounted on the rotating swashplate of the main rotor, 180° apart. Each time an Interrupter passes the Magnetic Pickup, an electrical pulse is generated in the Pickup. These pulses cause the Strobex to flash twice-per-revolution to illuminate reflective Targets on the blade tips for visual tracking.

One of the Interrupters is double, delivering a double pulse from the Magnetic Pickup, once-per-revolution.

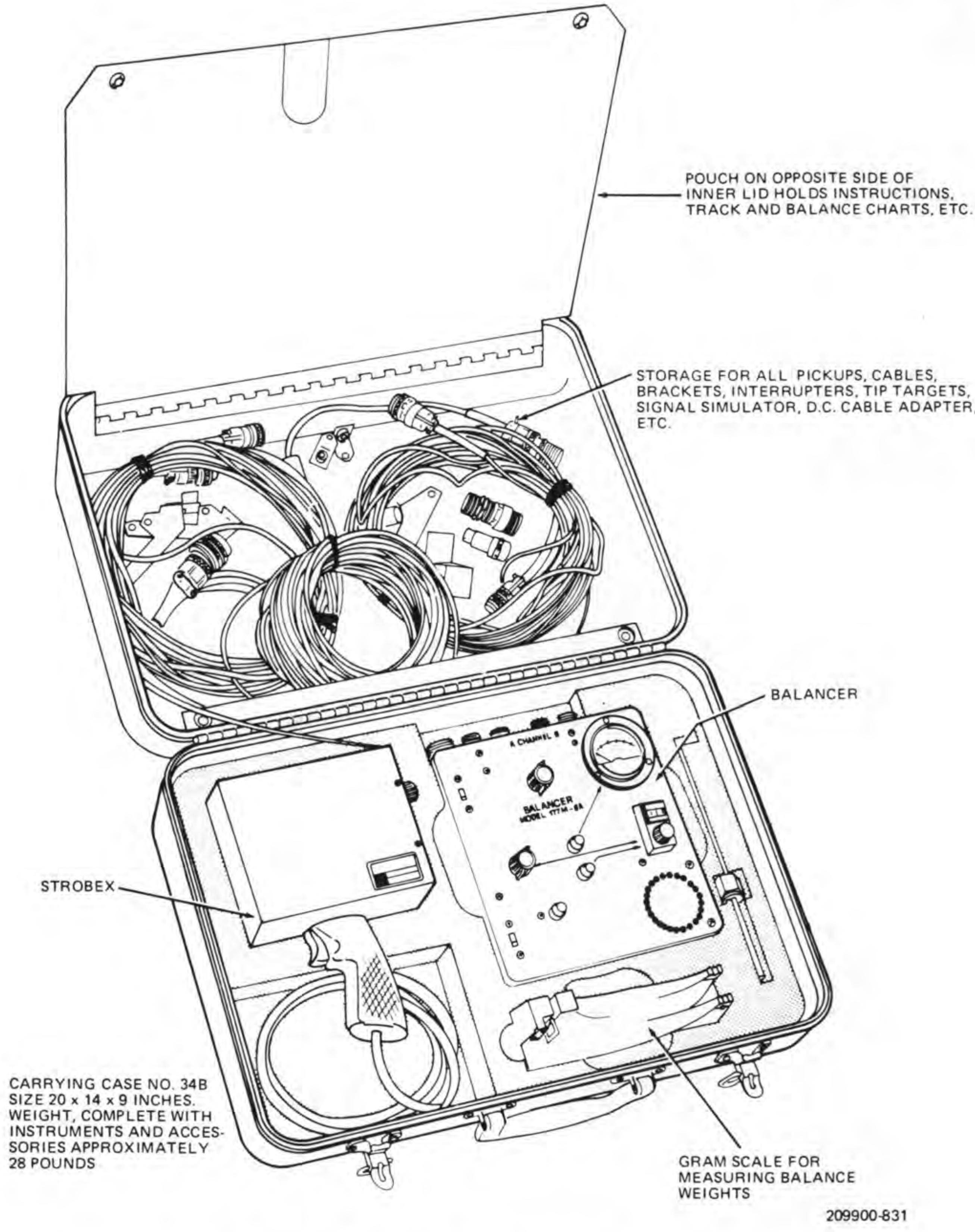


Figure 5-99. Vibrex 4591 System Components and Carrying Case

This serves as the needed one-per-revolution phase reference signal for the Phazor section of the Balancer.

l. Balancer/Phazor Unit. Measures amplitude and phase, or "Clock Angle," of the vibration induced by rotors and other components that are out-of-balance or track.

5-118. GENERAL NOTES.

CAUTION

Do not plug the VIBREX into 110 volt power. The instruments may be damaged. Do not set Balancer "RPM Tune" dial below 100. The circuits are unstable and the readings useless.

a. There are two basics which **MUST** be understood and mastered to utilize the System effectively.

One is the tuning of the Balancer band-pass filter. This procedure is spelled out in detail and takes but little practice. Follow the instructions carefully!

The other requirement is a good grasp of the Charts. It is important to know the direction in which the "Move Line" SHOULD go in response to a certain change on the rotor. (The "Move Line" is the line connecting the data points before and after a change on the rotor.) Only then can it be determined whether the Chart is "matched" to the helicopter being worked. Chart examples are given, with explanations.

b. It is normal operation for the "Clock Angle" to become uncertain and erratic as balance is improved. A "jittery" "Clock Angle" is generally an indication of a good balance.

c. When the Balancer is first plugged in (or power applied), the meter will deflect to full scale for a few seconds. This is normal, and the meter is protected so no damage results.

d. Do not change the connector on the Balancer DC Cable. Use DC Adapter #3140-9 which is a foot-long Cable with a connector at one end to mate with the Balancer's connector, and a connector at the other end to mate to the helicopter.

e. When tracking rotor blades, look directly over top of Strobex when viewing retro-reflective Targets. Those who are sitting or standing to the side of the user will see the Targets very dimly, or not at all, because the reflected light returns to the source and not to the observer to the side.

f. A RULE-OF-THUMB: As long as a good "Clock Angle" can be measured in the Phazor, or with the Strobex, the balance or track can, and should, be made better. When balance is perfected to the point where the "Clock Angle" becomes too unsteady or erratic, it can no longer be determined where to put the weight, and the job must be considered complete.

g. It may not be possible to achieve a satisfactory ride over a wide speed and load range due to differences in rotor blade characteristics. These differences in flight characteristics are usually revealed when working track with the vertical Accelerometer.

h. FOCUS OF THE FLASH TUBE IN ITS PARABOLIC REFLECTOR IS ESSENTIAL! Periodically shine the light on a wall 10 to 20 feet distant and check for a bright spot 1 to 2 feet in diameter. If this is not seen, FOCUS IN ACCORDANCE WITH INSTRUCTIONS IN TM 55-4920-402-13&P.

(1) "IPS" (inches-per-second) or maximum velocity as the object passes through the center of its vibratory motion. Knowing frequency, or RPM, this can be related to displacement (mils) or G force (G) as follows.

$$D \text{ (mils, peak-to-peak)} = \frac{\text{"IPS"} \times 19{,}000}{\text{RPM}}$$

$$G \quad \text{(peak)} \quad = \frac{\text{"IPS"} \times \text{RPM}}{3686}$$

(2) When the filter is properly tuned, there should be no change in either "Clock Angle" or "IPS" when the "Verify Tune" button is pushed. The Accelerometer is sensitive only along its cylinderical axis. If shaken radially, it will have little or no output.

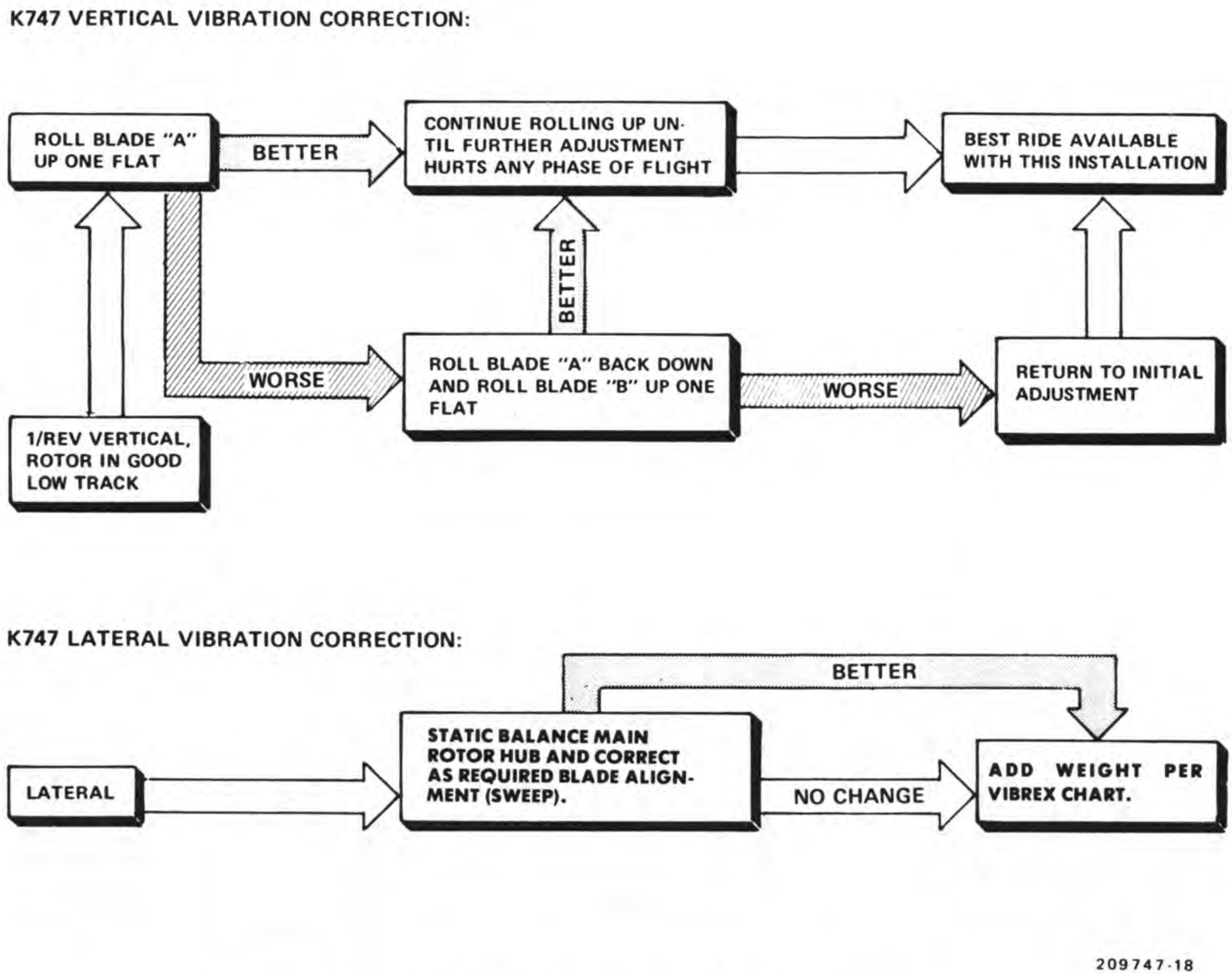


Figure 5-95. Vertical and Lateral Vibration Chart for K747 Rotor Blades

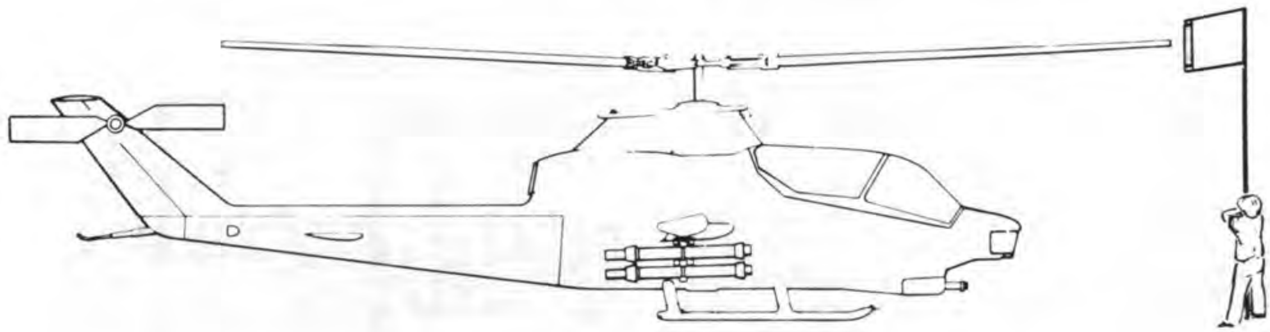


Figure 5-97. Tracking Main Rotor

(6) Test fly helicopter through full airspeed range to check for lateral vibrations. If lateral vibration is severe enough to require correction, request AVIM assistance to check alignment of installed blades (sweep).

WARNING

K747 main rotor blades have a tendency to attain a higher percent RPM during autorotation than B540 main rotor blades. DO NOT RIG (adjust length of pitch links) beyond the limits established in paragraph 5-14, step q to obtain a lower main rotor percent RPM.

(7) Check rotor rpm in autorotation. If rotor overspeeds, shorten both pitch links equally. If rotor underspeeds, lengthen both pitch links equally. One turn of barrels will change rotor rpm approximately 3 percent. Lockwire (C137) jamnuts. Repeat flight check and adjustment as necessary.

5-115. TRACKING — TAIL ROTOR BLADES.

Premaintenance Requirements For Tracking of Tail Rotor System

Condition	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	NA
Test Equipment	Tracking stick
Support Equipment	NA
Minimum Personnel Required	Two
Consumable Materials	(C92)
Special Environmental Conditions	None

NOTE

The VIBREX 4591 system is the preferred method of tracking tail rotor blades. (Refer to paragraph 5-142.)

a. Following replacement or installation of the tail rotor hub, blades or pitch change systems, check the tail rotor system rigging and tracking the tail rotor blades.

NOTE

The strobe-type tracking device may be used if available (paragraph 5-116).

b. Make a tracking stick by attaching a small piece of sponge rubber **1/8 TO 1/4** inch thick to end of a

5-119. TRACK AND BALANCE CHARTS.

a. The Charts are the "computers" that are used to plot the measurement of vibration ("Clock Angle" and amplitude) obtained from the Balancer/Phazor. (The Strobex is used to measure "Clock Angle" in the case of tail rotors.) The main rotor Charts tell the weight or sweep required to balance the main rotor, pitch-link, or tab required to track it. Tail rotor Charts show amount and location of weight needed to balance.

A different Chart is provided for each rotor of each helicopter type. A Chart (Figure 5-100) consists of:

(1) A clock face (12 radial lines) representing "Clock Angle," or location of the vibration;

(2) A set of 10 concentric circles representing "IPS," or amplitude of vibration, drawn over the clock face, with zero at the center and 1.0 "IPS" at the outside; and

(3) A graph over the clock face and "IPS" circles, whose axes are geometrically related to the points at which rotor changes (weight, sweep, pitch-link, or tab) can be made.

b. The intersection of "IPS" circle and "Clock Angle" line defines a point on the Charts. From this point, lines to the axes of the graph show amount and location of change or adjustment to accomplish track or balance. The objective is to reduce the vibration to the lowest possible level, or the center of the Chart. "Clock Angle" is not important, except as a means of getting there (it tells where to make the change). Low "IPS" (vibration) level is the only important consideration.

5-120. MAIN ROTOR CHART EXAMPLES AND CORRECTIONS.

NOTE

Take balance readings only when blades are in-track.

5-121. READING A MAIN ROTOR BALANCE CHART. (Figure 5-101).

a. Assume a reading of 10:00 o'clock and 0.6 "IPS."

b. Plot this on the Chart, labeling it point #1. Sketch lines to the two axes of the Chart.

c. The Chart calls for about 180 grams in the "blank" blade bolt, and for sweeping the "blank" blade aft about 6 flats.

d. The first "move" should involve only one change. Sweep should be selected, because it is further from the zero line and calls for the greater change.

e. If the "move" were perfect, the next reading should be at 11:45 o'clock and about 0.4 "IPS." Label this point #2.

f. Now, addition of 180 grams to the blank blade should reduce the lateral vibration to near zero. Label it #3.

NOTE

Observe that when weight is added to a blade, the "Move Line" should be parallel to the weight arrow along the edge of the Chart. If sweep is changed, the "Move Line" should be parallel to the sweep axis arrows.

NOTE

It can be seen that if weight were subtracted from the "target" blade, it would have exactly the same effect as weight addition to the "blank." The blade bolts should always be checked, and weight subtracted whenever possible.

5-122. WORKING WITH A HELICOPTER THAT DOES NOT "MATCH" THE CHART (INCORRECT "CLOCK ANGLE"). (Figure 5-102).

It is very seldom that a Chart needs to be corrected, but an explanation of its simplicity is important. The dynamic response (vibration characteristics) of one helicopter of a given type may not be exactly the same as another. This can cause the vibration of the airframe to occur at a different time (or different phase) in response to a given pitch-link or weight change. Thus, the helicopter does not "match" the Chart. It is easy to correct the Chart. The process is described here:

a. Assume the same reading of 10:00 o'clock and 0.6 "IPS." Label it point #1.

b. Make the same 6 flat sweep change to the "blank" blade, as indicated.

BALANCE DATA

READINGS MUST BE MADE IN HOVER. READ CHANNEL "A" (LATERAL) ACCELEROMETER.

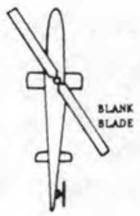
	1st Run	2nd Run	3rd Run	4th Run	5th Run	6th Run
Check TRACK after each balance move						
READINGS — Clock Angle						
READINGS — "IPS"						

MOVE	GRAMS in TARGET Blade Bolt					
	GRAMS in BLANK Blade Bolt					
	SWEEP TARGET Blade Aft					
	SWEEP BLANK Blade Aft					

Never sweep blade forward of "scoped" or "strung" position.

Target Blade is at about 11:00 O'Clock when double interrupter is over magnetic pickup.

DO NOT ATTEMPT TO BALANCE UNLESS SHIP IS IN GOOD HOVER TRACK.



Viewed from top.

Set Balancer to 324 RPM.

The amount of weight or sweep required may be somewhat different for the various models of Cobra.

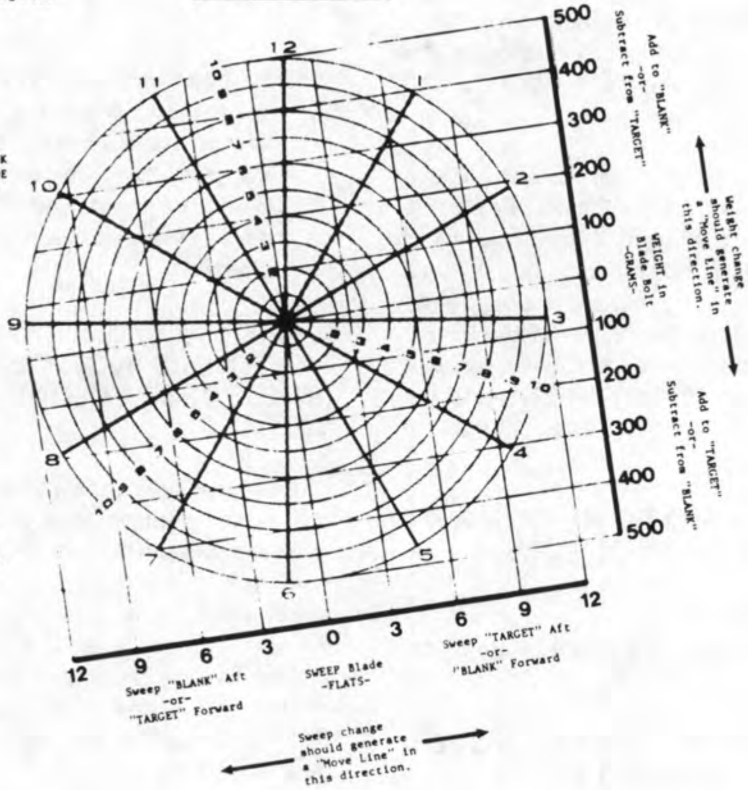


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Figure 5-100. A Main Rotor Balance Chart

BALANCE DATA

READINGS MUST BE MADE IN HOVER. READ CHANNEL "A" (LATERAL) ACCELEROMETER.

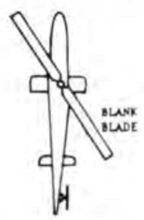
		1st Run	2nd Run	3rd Run	4th Run	5th Run	6th Run
Check TRACK after each balance move							
READINGS	Clock Angle	10:00	11:45	12:00			
	"IPS"	0.6	0.4	0.02			

MOVE	GRAMS in TARGET Blade Bolt					
	GRAMS in BLANK Blade Bolt		180 gms			
	SWEEP TARGET Blade Aft					
	SWEEP BLANK Blade Aft	6 flats				

Never sweep blade forward of "scoped" or "strung" position.

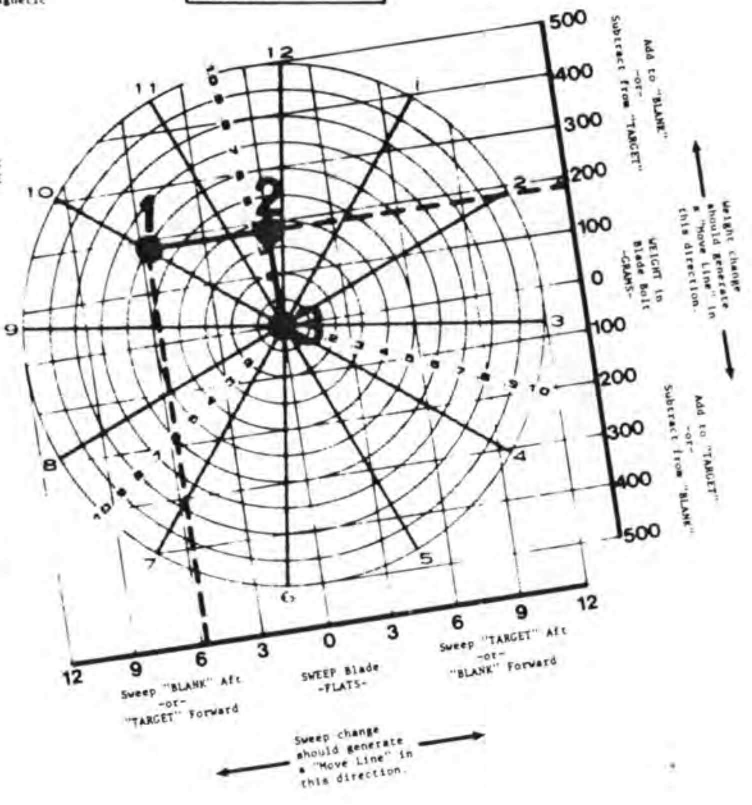
Target Blade is at about 11:00 O'Clock when double interrupter is over magnetic pickup.

DO NOT ATTEMPT TO BALANCE UNLESS SHIP IS IN GOOD HOVER TRACK.



Set Balancer to 324 RPM.

The amount of weight or sweep required may be somewhat different for the various models of Cobra.



209900-846

Figure 5-101. Reading a Main Rotor Balance Chart

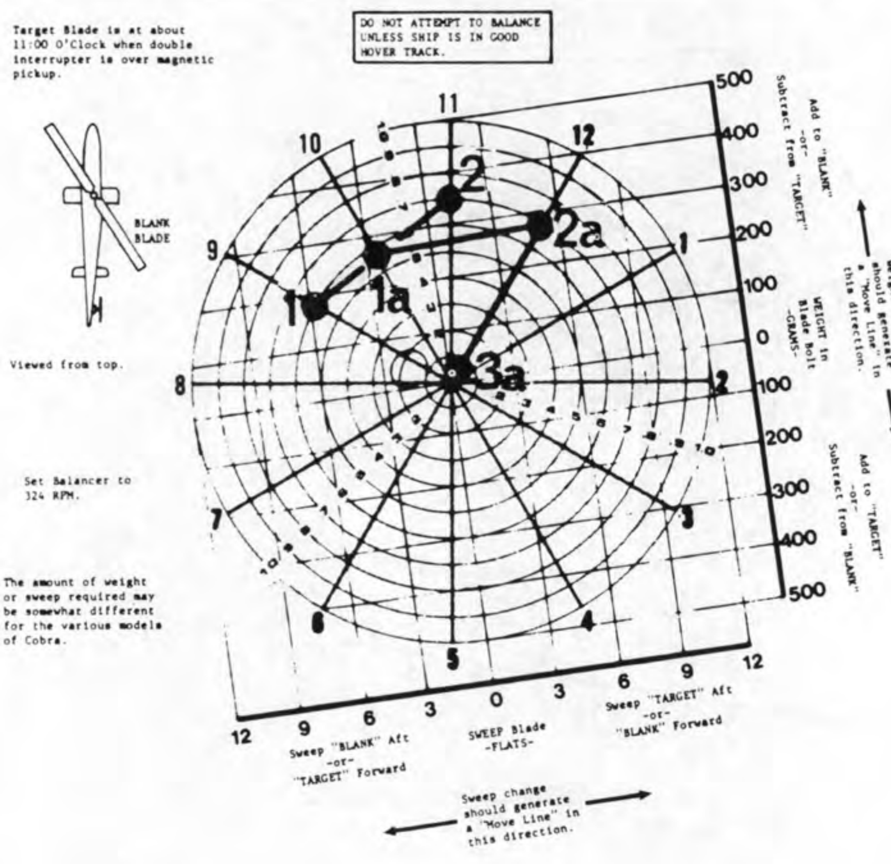
BALANCE DATA

READINGS MUST BE MADE IN HOVER. READ CHANNEL "A" (LATERAL) ACCELEROMETER.

		1st Run	2nd Run	3rd Run	4th Run	5th Run	6th Run
Check TRACK after each balance move							
READINGS	Clock Angle	10:00	12:00	12:00			
	"IPS"	0.6	0.7	0.05			

MOVE	GRAMS in TARGET Blade Bolt					
	GRAMS in BLANK Blade Bolt		280 gms.			
	SWEEP TARGET Blade Aft					
	SWEEP BLANK Blade Aft	6 flats	(FWD) 4 flats			

Never sweep blade forward of "scoped" or "strung" position.



209900-835

Figure 5-102. Reading a Main Rotor Balance Chart With an Incorrect "Clock Angle"

c. This time, however, assume the next reading is 12:00 o'clock and 0.7 "IPS." Label it #2.

NOTE

The "Move Line" between points #1 and #2 correctly shows a change in sweep (although the amount is not correct). The problem, though, is that if the points are traced back to the weight axis, a change is indicated there, too. THIS CANNOT BE CORRECT, BECAUSE NO WEIGHT CHANGE WAS MADE.

d. Thus, "Clock Angle Corrector" #3597 must be used to make the Chart "match" the helicopter as follows:

NOTE

It is not necessary to be concerned about the length of the "Move Line" because it is quite obvious that too great a change will cause too long a "Move Line", etc. DIRECTION OF THE "MOVE LINE" IS THE BIG CONCERN.

(1) Place eyelet "A" of "Clock Angle Corrector" on the first reading.

(2) Rotate the body of "Corrector" so line "A-O" lies in the direction "Move Line" SHOULD HAVE GONE (parallel to the sweep arrow along the edge of the Chart).

(3) Swing index "A-B" in the direction the "Move Line" DID GO.

(4) Read the required correction to the "Clock Angle" on the Chart, and assign new numbers to the clock. In this case, it says to subtract one hour.

(5) Replot points #1 and #2, on the renumbered clock. Label the new points #1a and #2a.

NOTE

Observe that the new "Move Line" #1a and #2a, is now parallel to the arrow associated with sweep change.

(6) It can be seen that the blade should have been swept only 2 flats, and that 280 grams of weight will be required, instead of the 180 originally called for.

(7) Try both changes at once and see if point #3a is about right.

NOTE

Make all subsequent plots on the "corrected" clock. If there are questions about the validity of the corrected clock, make a substantial change to one blade only. Then, verify that the "Move line," as a result of that change, is correct (parallel to the arrow associated with the blade change).

If subsequent "moves" are erratic and inconsistent (appearing to require a different "Clock Angle" correction each time), the trouble is probably due to faulty rotor bearings, linkages, dampers, etc. LOOK FOR THE PROBLEM!

5-123. READING THE TAIL ROTOR CHART (FIGURE 5-103).

The tail rotor Chart is used in the same manner as the main rotor Charts. Assume a first reading of 3:00 o'clock and 0.75 "IPS". This calls for addition of about 30 grams to "target" B and 15 grams to "target" A. Since the 30 gram point "B" is farther from the zero axis, that weight is added there first. The next reading should be 11:30 o'clock and 1.1 "IPS". Then, addition of 15 gram to "target" A should reduce the vibration to a satisfactory level.

NOTE

Tail rotor vibration amplitude is read from the Balancer meter, but since there is no Magnetic Pickup on the tail rotor to deliver the needed Phazor input, "Clock Angle" is determined with the Strobex instead of the Phazor. The Phazor lights will light, but they are meaningless and should be ignored, since there is no Magnetic Pickup input.

Weight addition to one point only, for the first "move", is good practice to be sure the Chart and helicopter are matched. With experience, both weights can be changed at once.

Date:

TAIL ROTOR | Serial No:

A

READINGS		1st Run	2nd Run	3rd Run	4th Run	5th Run
	Clock Angle	3:00	11:30	12:00		
	"IPS"	0.75	1.1	0.05		

C

MOVE					
	TARGET **A**		+15		
	BLANK **A**				
	TARGET **B**	+30			
	BLANK **B**				

NOTES: 1) Track tail rotor. Viewing tail rotor disc from side, adjust Strobex oscillator so the single grip target appears as a STOPPED image of 4. Then, view rotor edge-on, from aft of the right stub-wing, and observe track of Tip Targets.

2) Set Balancer to 1650 RPM ("RPM Tune" dial to 165, and "RPM Range" to "X 10"), switch "Function" switch to Channel B, and Strobex oscillator "OFF". View "Clock Angle" of grip target from side of tail rotor disc.

3) Now, press "Verify Tune" button and adjust "RPM Tune" dial, WHILE BUTTON IS PUSHED, to return target to angle observed BEFORE BUTTON WAS PUSHED. Release, observe angle, depress and adjust again to match new "unpushed" angle. Repeat until there is NO CHANGE WHETHER BUTTON IS PUSHED OR RELEASED. TUNE ONLY WITH BUTTON PUSHED.

4) Read "Clock Angle" with button released and "IPS" without Strobex flashing. Record in section A of Chart. Plot in section B (label it point #1), and note required changes in C.

5) Change the weight on one bolt only, for the first move (select the one farthest from the zero axis). Run ship and check that the "Move Line" (point #1 to #2) is in the correct direction, or parallel to the fine lines extending perpendicular from the unchanged axis. If both weights are changed, the "Move Line" should go through the center. If "Move Line" is in the correct direction, proceed to balance. If not, use "Clock Angle Corrector" #3597 to correct the clock, and then proceed to balance to .2 "IPS" or less.

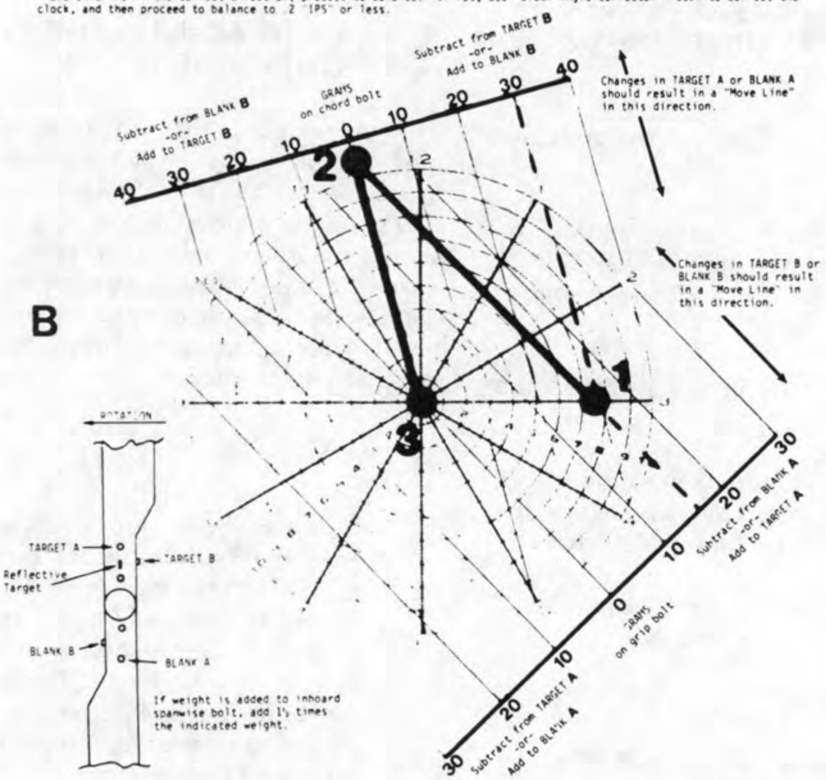


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Figure 5-103. Reading the Tail Rotor Charts

5-124. USING THE VIBREX.

In order to use the VIBREX, the helicopter must be fitted as follows:

5-125. MAIN ROTOR.

5-126. NECESSARY EQUIPMENT.

QUANTITY	EQUIPMENT NEEDED	MODEL NUMBER
1	Balancer/Phazor	177M-6A
1	Strobex Tracker	135M-11
1	Gram Scale	47
*1	Magnetic Pickup Cable	3319-2
*1	Magnetic Pickup	3030
*1	Magnetic Pickup Bracket	4559
*1	Interrupters	3251
*2	Accelerometers	4177B
*2	Accelerometer Cables	4296-2
*2	Accelerometer Brackets	3382
*1	Set of Tip Targets	3387
*1	DC Adapter Cable	3140-9
1	M/R Track and Balance Chart	4273

*Denotes equipment physically mounted to the aircraft. Installation and removal should be double checked.

NOTE

This list should be checked prior to and after balancing to ensure that the proper equipment is or hand before proceeding and that all equipment is removed upon completion.

5-127. ATTACH MAGNETIC PICKUP (FIGURES 5-104 AND 5-105).

Attach Magnetic Pickup Bracket #4559 to the left-front pitch-horn of the fixed swashplate.

a. Remove cotter pin, nut, and washer from bolt through left lateral pitch-horn of fixed swashplate.

NOTE

The half inch bolt must be installed with its head to the front-right (toward center line of ship) and the nut to the left-rear (outboard).

b. Place Magnetic Pickup Bracket #4459 on the bolt. The two plastic coated "fingers" must straddle the pitch-horn, to prevent the Bracket from rotating. The flange with the 0.625 inch diameter hole will be pointing up.

c. Replace the nut (do not use the washer), torque, and replace the cotter pin.

d. Place Magnetic Pickup #3030 in 0.625 inch hole with connector away from mast. Use thin jamnut on each side of Bracket, leaving them loose, with the tip of the Pickup extending as little as possible. Adjust and tighten nuts later.

5-128. Attach Interrupters (Figures 5-104 and 5-105). Mount Interrupter #3251 on the rotating swashplate.

a. Remove nuts and washers from four studs indicated by "X" on the outer ring of the rotating swashplate.

b. Turn the head so the red blade is at 11:00 o'clock and place the double Interrupter, with pointed flanges down, at the left-front of the swashplate. This becomes the "target" blade. (Later, you will put the horizontal Target on the red blade tip — so RED = target = horizontal.)

c. Place single Interrupter on the opposite pair of studs (at right-rear).

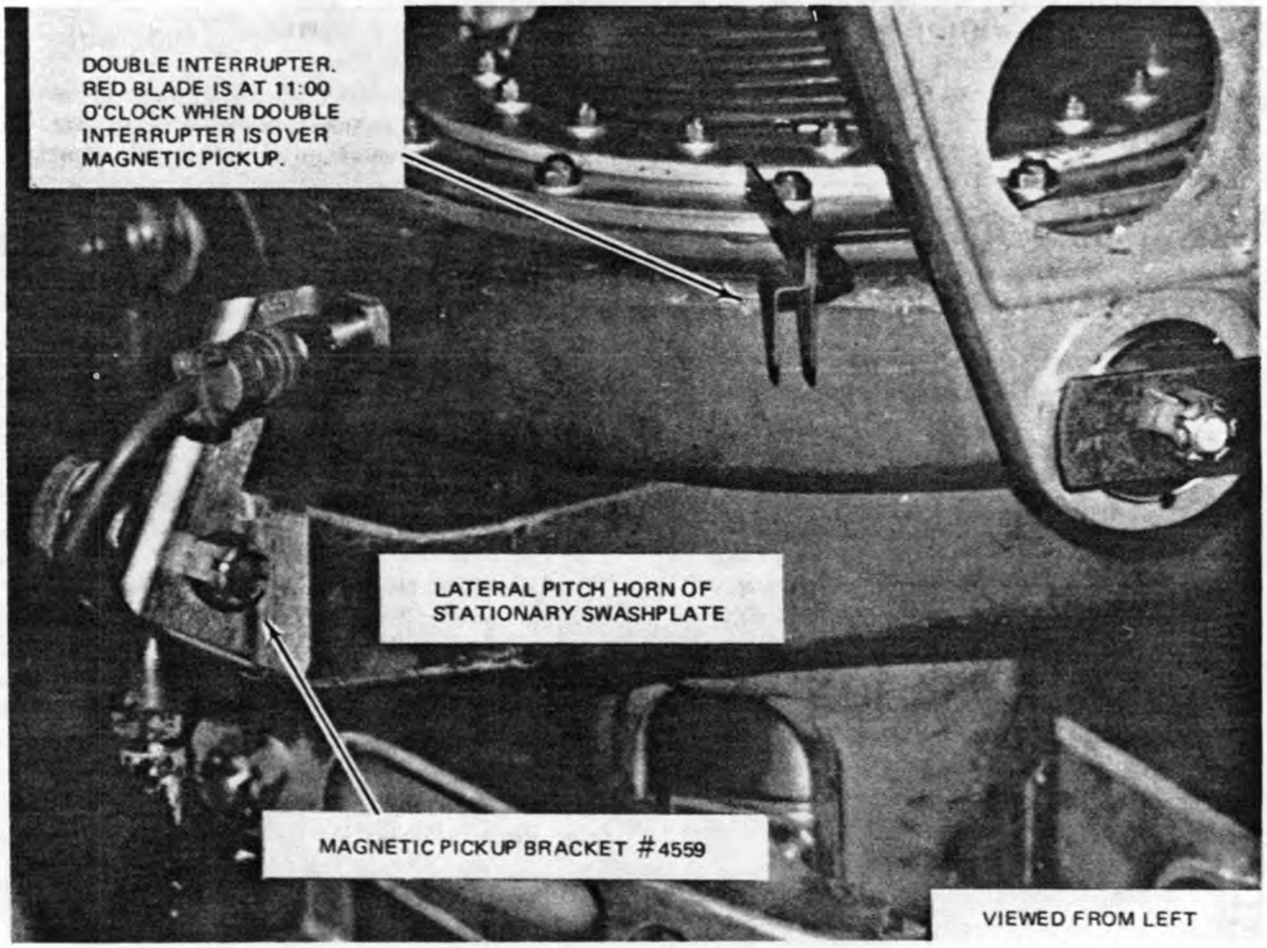

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Figure 5-104. Magnetic Pickup and Double Interrupter Installation.

d. Replace washers and nuts, and torque nuts.

NOTE

When installing Interrupters, push them in toward mast as the nuts are tightened so they will both "seat" the same.

5-129. Adjust Magnetic Pickup Gap. Carefully — BY HAND — pull the rotor head through to line up an Interrupter with the Magnetic Pickup.

a. Adjust the Pickup for a 0.060 ±0.010 inch clearance. HINT: A coin can be used as a feeler gauge. A penny is about 0.060 inch thick. A nickel is about 0.075 inch thick. A dime is about 0.050 inch thick and a quarter about 0.070 inch thick.

b. Tighten and safety jamnuts on Pickup.

c. Pull head through to other Interrupter. Check for proper clearance. (Clearances need not be precisely the same; 0.010 or 0.020 inch difference is acceptable.)

d. If difference is too great, loosen nuts on Interrupter and adjust as required.

5-130. Connect Magnetic Pickup Cable (Figure 5-106). Connect Cable #3319-2 to Magnetic Pickup.

a. Move cyclic stick of helicopter to its farthest right-rear position, so left-front control rod is in its farthest up position (left-front corner of swashplate farthest up).

b. Plug Cable #3319-2 into Magnetic Pickup. Tape or tie Cable to control rod, just below rivets in swaged end, with only an inch or so of slack.

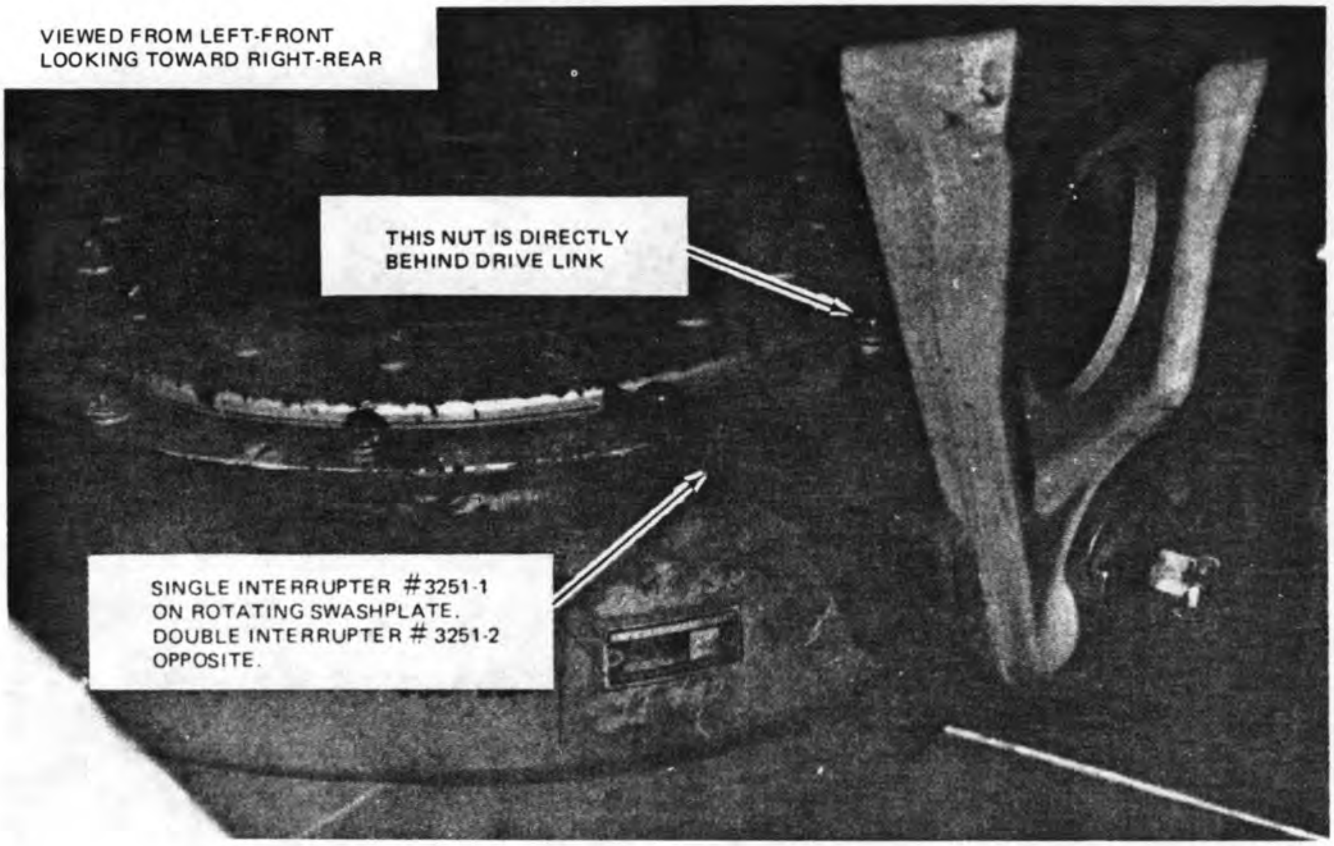

Figure 5-105. Single Interrupter Installation

c. Bring Cable out the swashplate access door. Secure it with enough slack to allow complete and free movement of controls, but not enough so Cable can foul in any moving parts. Pinch Cable in door.

d. Open hydraulics access door and pinch Cable in door (in top and out bottom). Then, dress forward under left-side of pilot's canopy, taping about twice. Pass Cable into gunner's cockpit, behind headrest, and coil excess Cable between armor at gunner's right shoulder and canopy.

e. Remove gunner's elbow pads. Place Balancer on the right-side and the Strobex on the left. Leave enough Cable slack so Balancer may be used in observer's lap.

CAUTION

Avoid using tape in front of the engine air intake where it could F.O.D. the engine. Be sure instruments cannot jam controls. Check for free movement of cyclic, collective, and pedals.

5-131. Connect Balancer to DC Power (Figure 5-107). Plug Balancer into helicopter DC power. Use DC Adapter Cable #3140-9 and plug into map light at gunner seat. Remove retaining clip from front glass. Remove glass and bulb. Plug Cable #3140-9 into lamp socket. Be sure to turn lamp intensity to full brightness (CW).

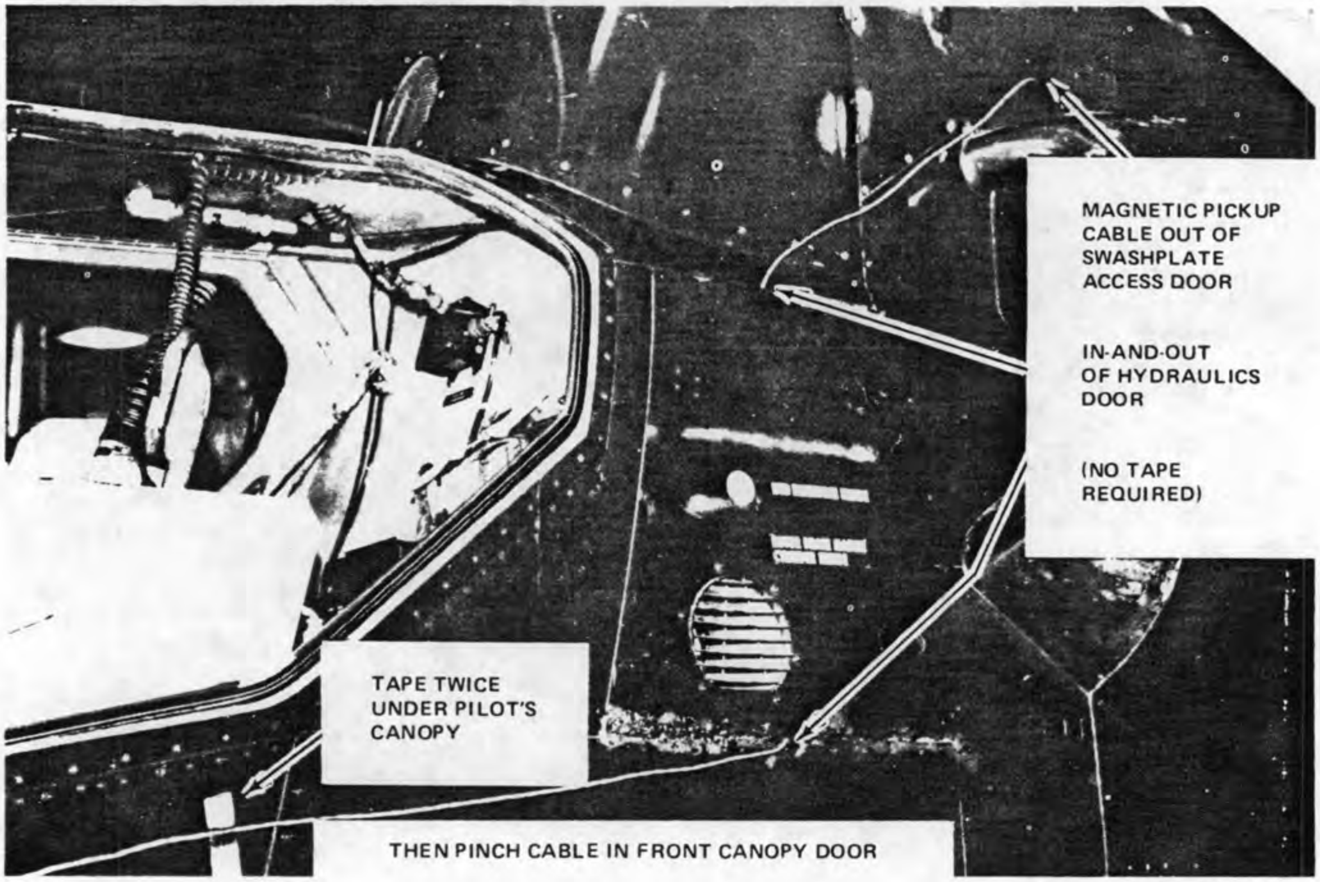

Figure 5-106. Magnetic Pickup Cable Installation

NOTE

In the older map lights, the lamp is removed from the side of the fixture, with its receptacle. When Cable #3140-9 is plugged into the receptacle, it cannot be replaced in the fixture; therefore, there is no ground connection. Use alligator clip on ground lead and clip onto a convenient screw or protrusion for the ground connection.

5-132. Mount Accelerometers and Connect Cables. (Figures 5-108 and 5-109.)

a. Using the 3382 bracket (2, figure 5-108), install one accelerometer (1) on the pilots compartment aft bulkhead with the connector pointing to the right side of the helicopter. Connect accelerometer to the A input on Balancer with one of the accelerometer cables.

b. Mount another accelerometer (figure 5-109) using another bracket #3382, to the right side of the front cockpit. Mount it with the lower forward screw of the copilot canopy removal system, arm and fire mechanism mount bracket. The accelerometer should be vertical with the CONNECTOR DOWN. Any other convenient screw may be used in the same area. Accelerometers are both inside the canopy. Connect this to Channel B using another cable #4296-1.

5-133. Attach Tip Targets.

a. Attach Tip Targets #3387 to blade tips (figure 5-111). Use 1/4-28 inch bolts and self-locking nuts and bolt them through the tie-down holes in the tips. The Retro-reflective bar on the target must face

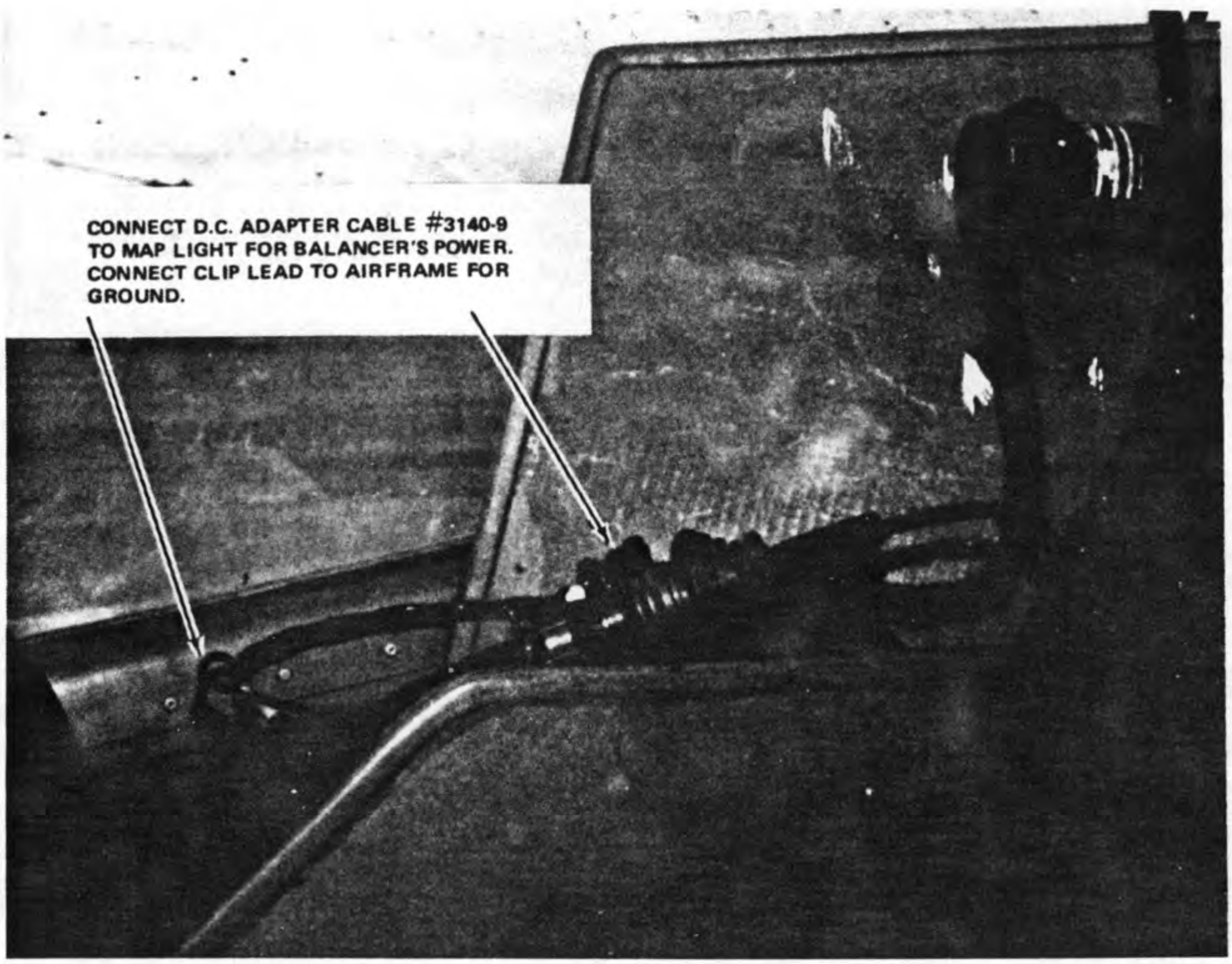

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Figure 5-107. Balancer Installation

inboard (to be viewed from the cockpit). Put the HORIZONTAL bar on the RED blade tip, and the vertical bar on the opposite.

CAUTION

Tip Targets MUST BE TANGENT to tip path (parallel to blade tip).

b. Use Reflective strips #4270 and stick them on underside of blade tip as illustrated (figure 5-112). Clean the area where the targets are to be applied. Don't use fuel because it is too oily.

5-134. SET CONTROLS.

5-135. SET BALANCER 177M-6A AS FOLLOWS:

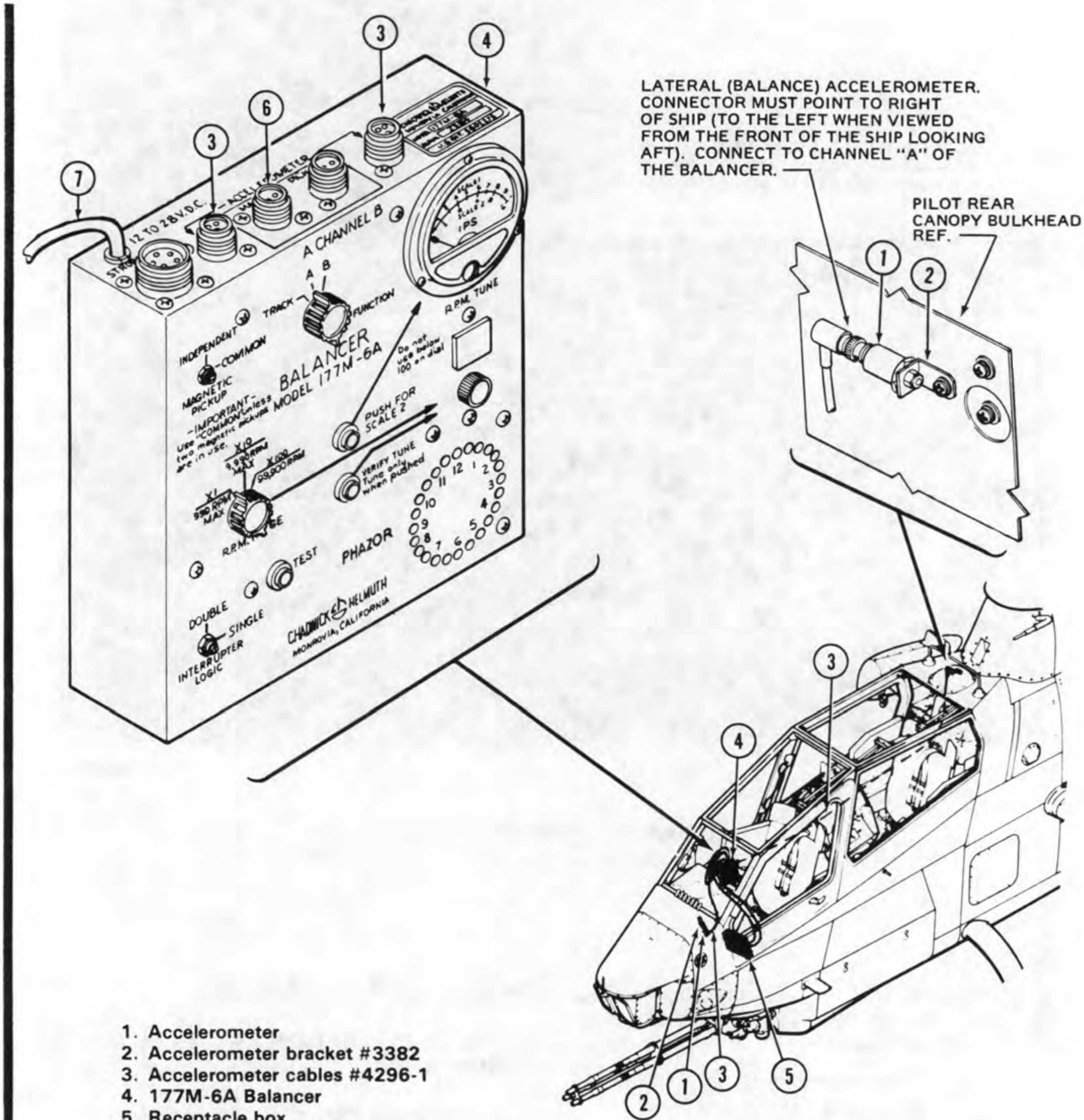
a. "Magnetic Pickup" to "Common."

b. "Interrupter Logic" to "Double."

c. "Function" switch to "Track."

d. "RPM Range" to "X 1." } Main rotor RPM.

e. "RPM Tune" to "324." } Main rotor RPM.



1. Accelerometer
2. Accelerometer bracket #3382
3. Accelerometer cables #4296-1
4. 177M-6A Balancer
5. Receptacle box
6. Magnetic pickup cable
7. D.C. Power cable

210010-81

Figure 5-108. Lateral Accelerometer Installation

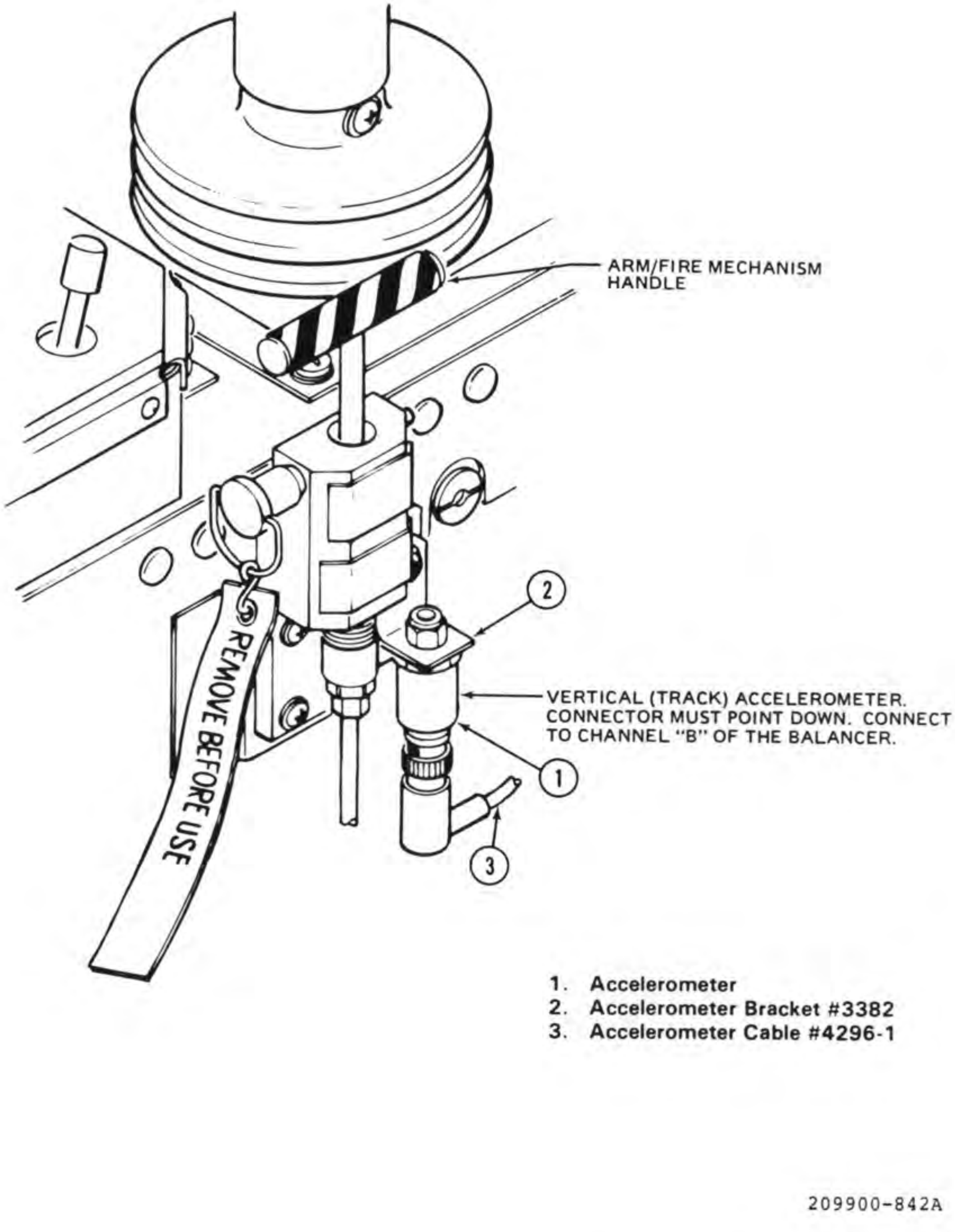


Figure 5-109. Vertical Accelerometer Installation
(Page 5-206, Figure 5-110 Deleted)

5-136. SET STROBEX 135M-11 AS FOLLOWS:

a. "Mode" switch to "A" in which case oscillator is inoperative and setting of the "RPM" dial has no effect and is unimportant. Targets will be seen at about 1:00 o'clock.	Light is in low intensity mode.
b. "Mode" switch to "B" and "RPM" dial to about 240 or less. See formula on back of Strobex. This allows viewing the Targets at the front of the ship. Setting the "RPM" dial to about 500 or less allows viewing the Targets at 11:00 o'clock, and about 2:00 and 8:00 o'clock as well (for advancing and retreating blades).	Light is in high intensity mode.

CAUTION

Oscillator MUST BE SET IN MODE "A" or "B" except for tail rotor track.

5-137. BALANCE MAIN ROTOR.

a. Zero tabs and hover helicopter. Use Strobex and search tip path in a "W" pattern to find the Tip Targets at about 11:00 o'clock. Observe track and correct as required, using pitch-link adjustment.

b. When hover track is set, switch Balancer "Function" switch to "A". (Lateral Accelerometer for balance.) Balancer is set to 324 RPM. While hovering, push "Test" button and check for 12:00 and 6:00 o'clock lights in Phazor.

Release "Test" button and observe "Clock Angle" of lighted light in the ring-of-lights.

c. Push "Verify Tune" button, and adjust "RPM Tune" dial WHILE BUTTON IS PUSHED, to return light to angle observed BEFORE button was pushed. Release, observe angle, push and adjust again to match new "unpushed" angle. Repeat until there is NO CHANGE whether button is pushed or released.

d. After tuning, read "Clock Angle" and "IPS" and record on the Balance Chart.

NOTE

The "Clock Angle" readings (the lighted light in the Phazor) will seldom be perfectly steady. It will become much less steady (more jittery) as balance is improved ("IPS" reading is lowered). When the "verify Tune" button is pushed, the "Clock Angle" should be less jittery than with the button released. Tuning must be adjusted so the "pushed" pattern lies in the center of the "unpushed" pattern. Simply judge the center of the "jittery range" of the lights.

e. Land helicopter and plot a point on the Balance Chart at the intersection of "Clock Angle" line and "IPS" circle. Lable it point #1. Determine changes required in blade bolt weight and sweep, and record in Data Section. Change either blade bolt weight, or sweep, whichever is farthest from the zero line.

NOTE

Make only one change for the first "move." This makes it easier to check the correctness of the Chart.

f. Hover helicopter and check results (label second point #2). If "Move Line" (point #1 to #2) is in correct direction, proceed to balance until reading is 0.1 "IPS" or less. If "Move Line" is not in correct direction, use "CLock Corrector" #3597 and assign new numbers to clock. Then, proceed to balance using relabeled clock.

NOTE

Good balance is essential for good results! As long as you can get a reasonably usable "Clock Angle" you can make the balance better, and should.

5-138. READING THE MAIN ROTOR CHART (FIGURE 5-113).

The main rotor chart is used in the following manner. Assume a first reading of 10:00 o'clock and 0.65 "IPS". Sketching lines to the edges of the charts, this reading calls for a sweep change of 6 flats aft to the "blank" blade and addition of 200 grams to the "blank" blade. Since the sweep change is farther from the zero axis, that adjustment is made first. The next reading should be 11:45 o'clock at 0.4 "IPS". Then addition of 200 grams to the "blank" blade should reduce the vibration to a satisfactory level.

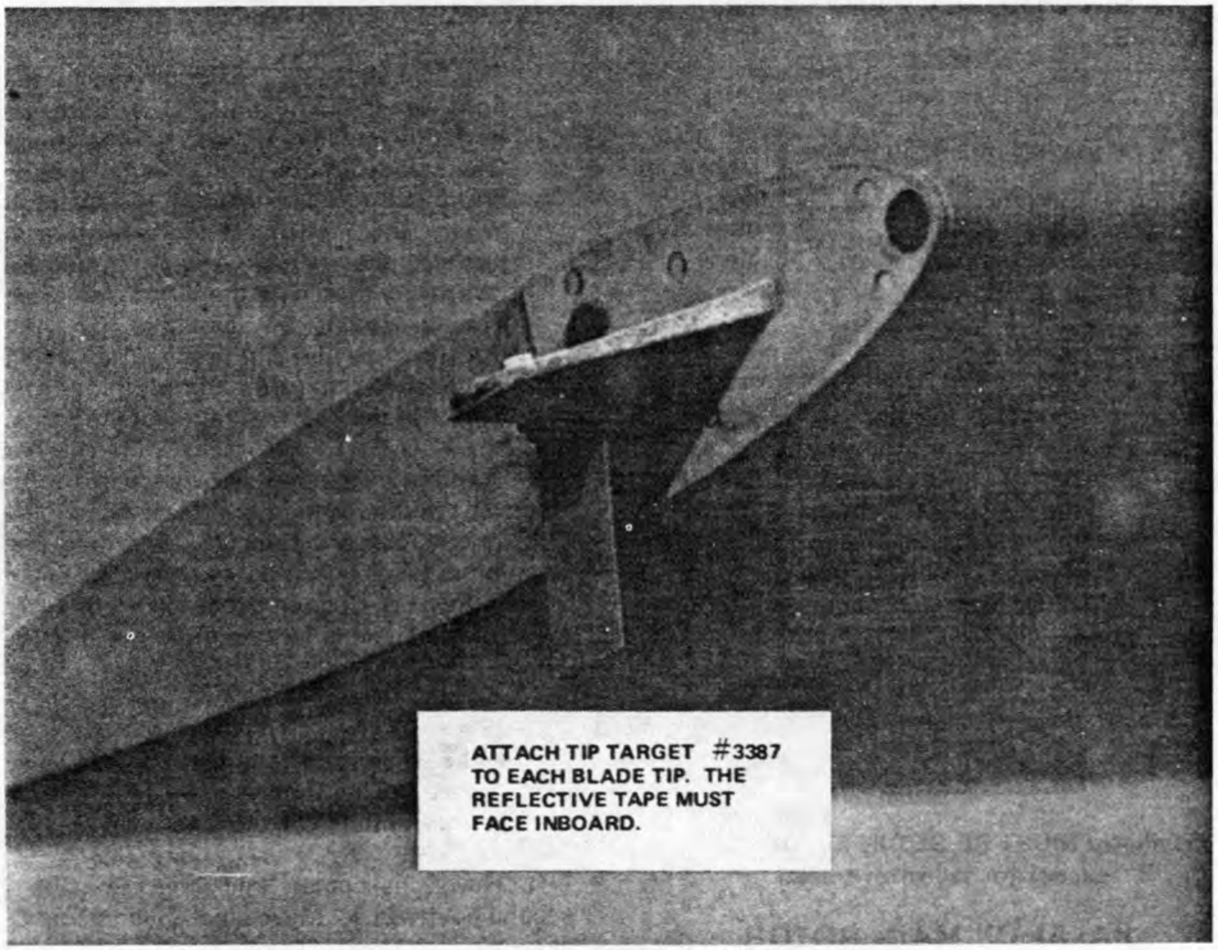


Figure 5-111. Tip Targets Installation

5-139. IN-FLIGHT TRACK MAIN ROTOR.

a. Switch Balancer "Function" switch to "track." (Everything else is the same.)

Strobex may be used in position "A" or "B", see "Set Controls" Section.

b. Fly the helicoper and sketch, in the spaces provided on Tracking Chart, the track observed at 90 and 140 knots. (Do not exceed a reasonable airspeed for the conditions of track, density, altitude, load, etc.) while still flying, switch Balancer "Function" switch to "B" (vertical Accelerometer). Press "Test" button and look for 12:00 and 6:00 o'clock lights.

c. Release "Test" button and observe "Clock Angle" of lighted light in ring-of-lights.

d. Push "Verify Tune" button, and adjust "RPM Tune" dial WHILE BUTTON IS PUSHED, to return light to angle observed BEFORE button was pushed. Release, observe angle, push and adjust again to match new "unpushed" angle. Repeat until there is NO CHANGE whether button is pushed or released. After tuning, record "Clock Angle" and "IPS" at 90 and 140 knots, in the spaces provided.

NOTE

Tuning is exactly the same as when taking balance readings.

e. Land the helicopter. Plot the 140 knot (or highest speed reached) readings on the Tracking Chart, at the intersection of "Clock Angle" line and "IPS" circle. (USE "B" VERTICAL ACCELEROMETER FOR IN-FLIGHT TRACK).

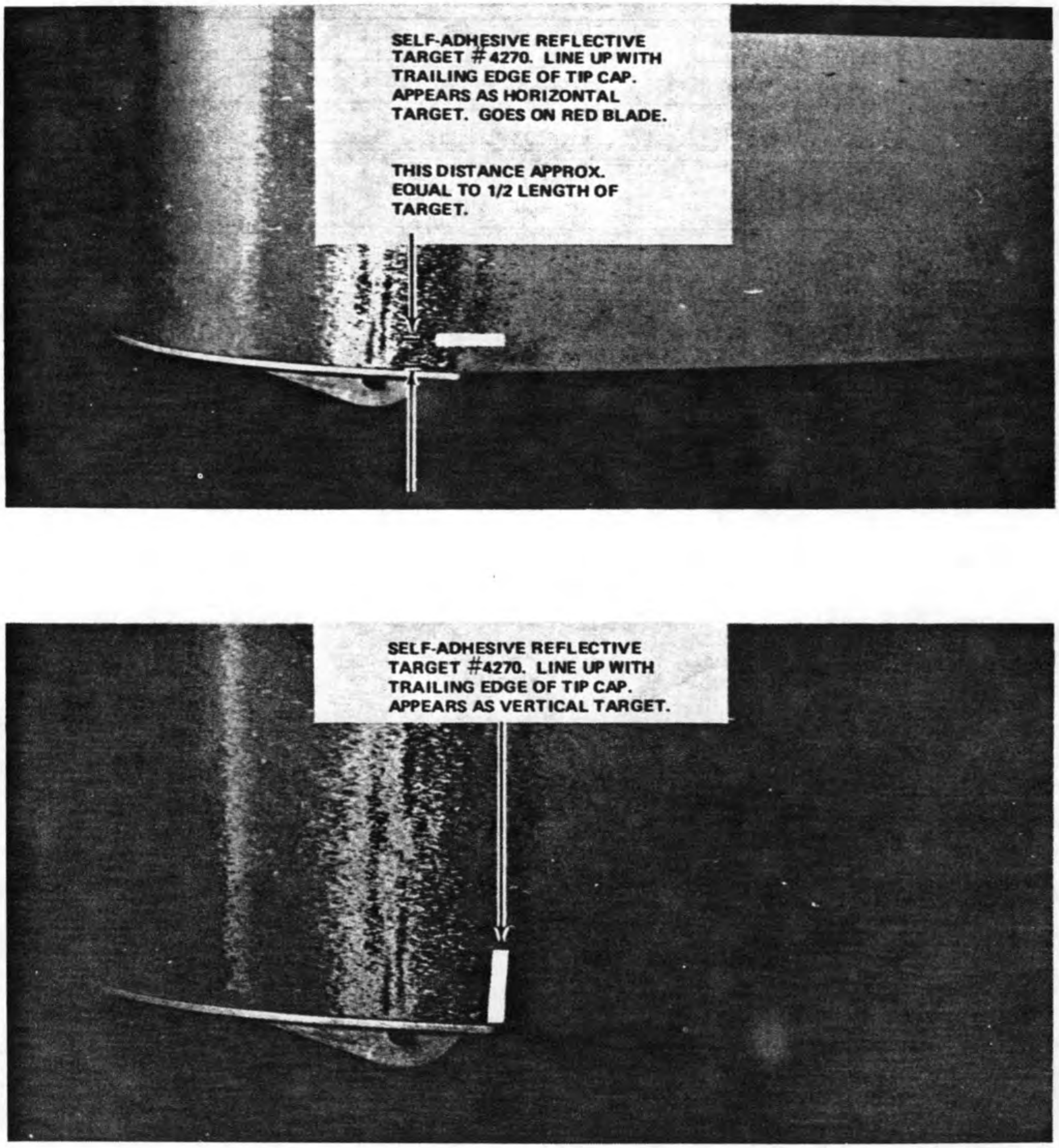


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Figure 5-112. Reflective Target Installation

BALANCE DATA

READINGS MUST BE MADE IN HOVER. READ CHANNEL "A" (LATERAL) ACCELEROMETER.

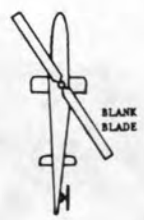
	1st Run	2nd Run	3rd Run	4th Run	5th Run	6th Run
Check TRACK after each balance move	+	+	+			
READINGS — Clock Angle	10:00	11:45	12:00			
READINGS — "IPS"	0.65	0.4	0.05			

MOVE	GRAMS in TARGET Blade Bolt					
MOVE	GRAMS in BLANK Blade Bolt		+200 grams			
MOVE	SWEEP TARGET Blade Aft					
MOVE	SWEEP BLANK Blade Aft	6 flats				

Never sweep blade forward of "scoped" or "strung" position.

DO NOT ATTEMPT TO BALANCE UNLESS SHIP IS IN GOOD HOVER TRACK.

Target Blade is at about 11:00 O'Clock when double interrupter is over magnetic pickup.



Viewed from top.

Set Balancer to 324 RPM.

The amount of weight or sweep required may be somewhat different for the various models of Cobra.

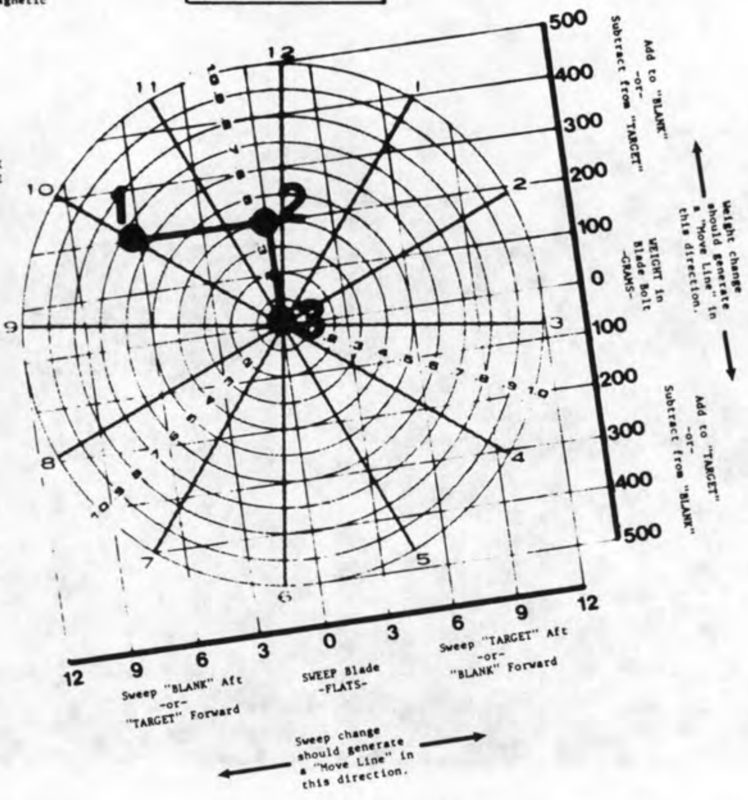


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Figure 5-113. Reading the Main Rotor Chart

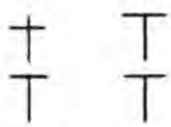
5-140. READING THE MAIN ROTOR TRACKING CHART (FIGURE 5-114).

The main rotor Tracking Chart is read in the same manner as the main rotor Balance Chart. Assume a first reading of 9:00 o'clock and 0.4 "IPS" at 140 knots. The visual track can be seen to spread with airspeed and the vibration level increase with airspeed indicating a tab change is necessary. Sketching a line to the edge of the chart, this reading indicates an adjustment of about 3 degrees up to the "blank" blade. The next reading, 9:00 o'clock and 0.05 "IPS" indicates a satisfactory vibration level.

5-141. Correct Track.

a. If the blades are seen to spread an airspeed is increased (the Tip Targets show substantially more vertical separation at 140 knots than at 90) use trim-tab. If the blades are out-of-track about the same amount at all airspeeds, use pitch-link.

90 140



This calls for TAB change.

This calls for PITCH-LINK change.

Use the vertical one-per-revolution reading for final pitch-link adjustment.

CAUTION

Use as little tab as possible. Excessive tab tends to wash out, and may deteriorate the ride in let-down or other conditions of loading (gross weight), etc.

b. Fly the helicopter again and check results. Repeat if required to reduce "B" readings (vertical one-per-revolution) to 0.2 "IPS' or less. Check all airspeeds.

NOTE

The "Move Line", in response to EITHER tab or pitch-link, should fall roughly along the 3:00 through 9:00 o'clock line. If the "Move Line" is approximately parallel to this, BUT DOES NOT GO THROUGH THE CENTER OF THE CHART, it is likely that due to variations in the blade flight characteristics that THEY CANNOT BE MADE TO FLY TOGETHER without some degree of vibration since there is no control available to cause a "Move Line" in the 12:00 to 6:00 o'clock direction, the point where the "Move Line" is tangent to the "IPS" circles is the best ride attainable with that pair of blades.

Conditions of rod-ends and linkages may have some effect, but with everything tight it is probably blades.

After in-flight tracking, check auto-rotation RPM, and correct as required. Track changes will have some effect on balance readings. Therefore, balance should be checked in hover after each track change, before the check flight.

5-142. TAIL ROTOR TRACK AND BALANCE.

5-143. NECESSARY EQUIPMENT.

QUANTITY	EQUIPMENT NEEDED	MODEL NUMBER
1	Balancer/Phazor	177M-6A
1	Strobex Tracker	135M-11
1	Gram Scale	47
*1	Accelerometer	4177B
*1	Accelerometer Bracket	3382
*1	Accelerometer Cable	4296-2
*1	DC Adapter Cable	3140-9
*1	DC Extension Cable	3529
3	Reflective Targets	3300
1	T/R Balance Chart	4471

*Denotes equipment physically mounted to the aircraft. Installation and removal should be double checked.

a. Check the above list prior to and after balancing to ensure that the proper equipment is on hand before proceeding, and that all equipment is removed upon completion.

b. Static balance the tail rotor in accordance with paragraph 5-86 prior to installation.

5-144. CONNECT ACCELEROMETER, CABLES, TARGETS, AND INSTRUMENTS (FIGURE 5-115).

a. Attach Accelerometer, on Bracket #3382, under the bottom screwhead that secures gearbox

INSTRUCTIONS
=IN-FLIGHT TRACK=

1) After balancing, switch Balancer "Function" Switch to "Track" and sketch the track observed with the Strobex at 90 and 140 knots STRAIGHT and LEVEL. Switch Balancer to "B" (vertical) and take "Clock Angle" and "IPS" readings at the same airspeeds. (DON'T EXCEED A COMFORTABLE AIRSPEED.) Tune Balancer as described in 2) and 3) on previous page. Land ship, plot point on "Tracking Chart" (label it #1), and record changes to tab or pitch link in "Data" Section. Plot 140 knot, or fastest airspeed.

=IMPORTANT=

	90	140
Use tab if blade "spread" increases greatly with airspeed	+	T
Use pitch link if "spread" is fairly uniform with airspeed	+	+

=CAUTION=
Use the minimum possible tab to do the job. Excessive tab tends to "wash out" and may deteriorate the ride in some flight regimes.

2) Make the indicated changes and fly again to check result. Repeat as required to reduce vertical one-per-rev to .2 or less.

=NOTE=
With some rotors, you will find that the plotted points, ("Move Line") as track is changed, will not go thru the center, but rather will be tangent to some "IPS" circle. This point of tangency is the best track attainable, for tab and pitch link both generate a "Move Line" in generally the same direction. There is no known control to move perpendicular to this.

This may indicate a mis-match of blades and/or loose control linkages. You must be satisfied with this ride....or change blades, and this can be determined in two or three flights.

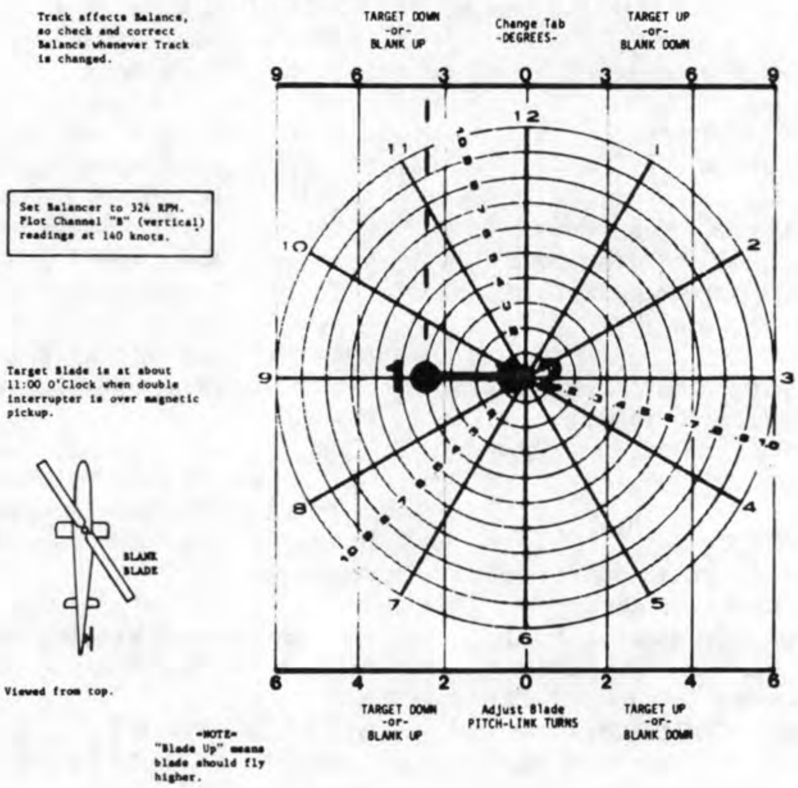


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Figure 5-114. Reading the Main Rotor Tracking Chart (Sheet 1 of 2)

IN-FLIGHT TRACKING DATA

FLIGHT NUMBER		HOVER BALANCE READING (CHANNEL A)	TRACK (CHANNEL "B") AT AIRSPEED		CHANGE BEFORE NEXT FLIGHT
			90	140	
1	TRACK	+	+	⊤	Blank blade tab up 3 degrees
	CLOCK ANGLE	9:00	9:00	9:00	
	"IPS"	0.05	0.2	0.4	
2	TRACK	+	+	+	
	CLOCK ANGLE	9:00	9:00	9:00	
	"IPS"	0.05	0.05	0.05	
3	TRACK				
	CLOCK ANGLE				
	"IPS"				
4	TRACK				
	CLOCK ANGLE				
	"IPS"				
5	TRACK				
	CLOCK ANGLE				
	"IPS"				
6	TRACK				
	CLOCK ANGLE				
	"IPS"				

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Figure 5-114. Reading the Main Rotor Tracking Chart (Sheet 2 of 2)

Figure 5-115. Accelerometer Cable Installation (Typical)

cover on fin opposite tail rotor. Connector must point to lower-right (4:30). Connect Accelerometer Cable #4292-2 to Accelerometer. Dress Cable down "back" of fin, loop around tail stinger, then forward along tailboom and over left elevator, and under tailboom to right-rear of helicopter, about 20 feet to the side of the tail rotor.

b. Using DC Extension Cable #3529 and DC Adapter Cable #3140-9, plug Balancer into map light for DC power. Place Balancer at the right-rear of the helicopter (where the Cable was left from step (1). Plug Accelerometer Cable into Channel "B" Accelerometer receptacle. Plug Strobex into Balancer.

CAUTION

Tie DC power and Accelerometer Cables together about the mid-point of their run, so Accelerometer Cable cannot foul in tail rotor. Take slack out of cables when tying so there is nothing loose to get into tail rotor.

c. Apply a Retro-reflective "target patch," part #3300 or #4270, to grip plate area of one blade. This becomes the "target" blade. Apply another target to one blade tip along the chord (to be viewed edge-on), and on the opposite tip across the chord. They must be centered, and about the same distance back from leading edge.

5-145. SET CONTROLS.

a. Set Balancer as Follows:

(1) "Function" switch to "B".

(2) "RPM Range" to "X 10"

(3) "RPM Tune" to "166" for AH-1S

1661 RPM (tail rotor rate for AH-1S)

b. Set Strobex as Follows:

(1) 135M-11 "Mode" switch to "D".

(2) "RPM" dial to "664" for AH-1S.

6644 RPM, which is 4-per-revolution of tail rotor for AH-1S

NOTE

Switching the Strobex as described activates its internal oscillator and disconnects any external commands (as from the Balancer, Accelerometer, etc.).

5-146. TRACK TAIL ROTOR (FIGURE 5-116).

a. Run helicopter at 100% AH-1S flat pitch, center pedals, head into wind, on-the-ground.

(1) Stand at the side of the tail rotor and observe the four images of the single grip target. Fine tune "RPM" dial so the four Targets are STOPPED.

(2) Move, dragging the Cables with Balancer and Strobex to stub wing (on tail rotor side). Look aft at edge of rotor disc to view the superimposed Tip Targets and judge track (left-to-right relation).

NOTE

If the horizontal bar appears above or below the vertical, it indicates that the Targets were not placed an equal distance aft of the leading edge of the blade. This is not important, if the difference is only an inch or two; the important observation is the left-to-right relation of the vertical to horizontal bars.

NOTE

FINE adjustment of "RPM" knob will position and stop Targets as desired.

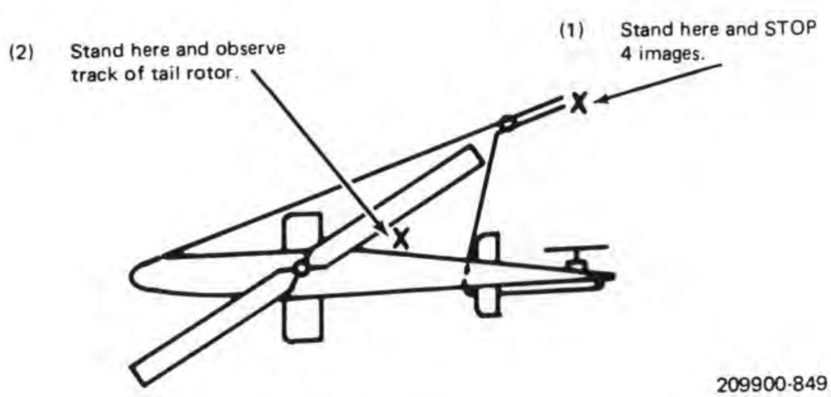

Figure 5-116. Tracking Tail Rotor

b. Shut down and adjust track if required. If track looks good, keep running and proceed to balance.

NOTE

The finest adjustment available is one-half turn of rod end, so track can probably not be made perfect.

5-147. BALANCE TAIL ROTOR (FIGURE 5-117).

NOTE

The rotor must be in track at the time balance readings are taken.

a. Return, with Balancer and Strobex, to position at side of tail rotor. Set Strobex "Mode" switch to "A". (This turns off the Strobex oscillator and makes it respond ONLY to commands from the Balancer). Check that Balancer is set to Channel "B" (into which tail rotor Accelerometer is plugged) and 1650 RPM.

NOTE

The Phazor section of the Balancer is used only for main rotor balancing (it needs reference signal from Magnetic Pickup). It is NOT operable when working the tail rotor, so IGNORE THE PHAZOR LIGHTS WHEN WORKING THE TAIL ROTOR.

b. With the Strobex, view "Clock Angle" of the single grip target. Push the "Verify Tune" button. WHILE THE BUTTON IS PUSHED, adjust the "RPM Tune" dial to return the Target to the "Clock Angle" observed BEFORE THE BUTTON WAS PUSHED. Release button, observe angle, push and adjust again to match "unpushed" angle. Repeat until there is NO CHANGE whether button is pushed or released.

c. Record "Clock Angle" and "IPS" on Balance Chart #4471. (Read "IPS" without Strobex flashing.)

d. If the "Move Line" is in the correct direction, proceed to balance to 0.2 "IPS" or less. Both span and chord weights can be changed at once for subsequent moves.

e. If the "Move Line" is not in the correct direction, use "Clock Angle Corrector" #3597, and assign new numbers to clock.

NOTE

If the rotor does not respond in an orderly fashion after a few moves, the weights should be restored to original and the first reading be repeated. If the first reading cannot be repeated, look for faulty bearings, shafts, etc.

5-148. TROUBLESHOOTING.

a. The Balancer is used to measure the frequency, or RPM, of unknown vibrations in order to try to locate their source. The Accelerometer is mounted, or held, in the area where the vibration is felt. If there is no reading on the "IPS" meter, it means there is no vibration at the RPM at which the Balancer electronic filter is set. If the meter reads, it is because there is vibration at the RPM at which the filter is set. In use, the Balancer filter is tuned, or adjusted, across the RPM range of interest and the meter is watched for response. Then the "Verify Tune" button is pushed, sharpening the filter, while the "RPM Tune" dial is adjusted to peak the meter. When the meter reading is maximized, the RPM is read directly from the "RPM Tune" dial, and "RPM Range" switch. After the vibration rate is measured, it can usually be related to known rotor or component rates. It is important, too, to consider multiples, or harmonics, of these rates.

Transmission mounts and loose skid gear can cause excessive six-per-revolution (1944 per minute) that may feel like tail rotor (1661 for AH-1S).

The source of other vibrations may be determined by securing an Accelerometer in the area of the noticed disturbance. The measured vibration rate is generally the same as, or harmonically related to, the source (forcing function) of the vibration. The Accelerometer can often be hand-held at various points on a structure, while "searching" with the "RPM Tune" dial. When hand-holding the Accelerometer, take care to select "hard points" where the vibration will not be damped (suppressed). Avoid sheet metal panels, etc.

b. To facilitate determination of the offending component, the following operating RPM's are printed. Components of the different models may turn at a different RPM than those shown here. Refer to the helicopter manual for your particular model.

NOTES: 1) Track tail rotor. Viewing tail rotor disc from side, adjust Strobex oscillator so the single grip target appears as a STOPPED image of 4. Then, view rotor edge-on, from aft of the right stub-wing, and observe track of Tip Targets.

2) Set Balancer to 1650 RPM ("RPM Tune" dial to 165, and "RPM Range" to "X 10"), switch "Function" switch to Channel B, and Strobex oscillator "OFF". View "Clock Angle" of grip target from side of tail rotor disc.

3) Now, press "Verify Tune" button and adjust "RPM Tune" dial, WHILE BUTTON IS PUSHED, to return target to angle observed BEFORE BUTTON WAS PUSHED. Release, observe angle, depress and adjust again to match new "unpushed" angle. Repeat until there is NO CHANGE WHETHER BUTTON IS PUSHED OR RELEASED. TUNE ONLY WITH BUTTON PUSHED.

4) Read "Clock Angle" with button released and "IPS" without Strobex flashing. Record in section A of Chart. Plot in section B (label it point #1), and note required changes in C.

5) Change the weight on one bolt only, for the first move (select the one farthest from the zero axis). Run ship and check that the "Move Line" (point #1 to #2) is in the correct direction, or parallel to the fine lines extending perpendicular from the unchanged axis. If both weights are changed, the "Move Line" should go through the center. If "Move Line" is in the correct direction, proceed to balance. If not, use "Clock Angle Corrector" #3597 to correct the clock, and then proceed to balance to .2 "IPS" or less.

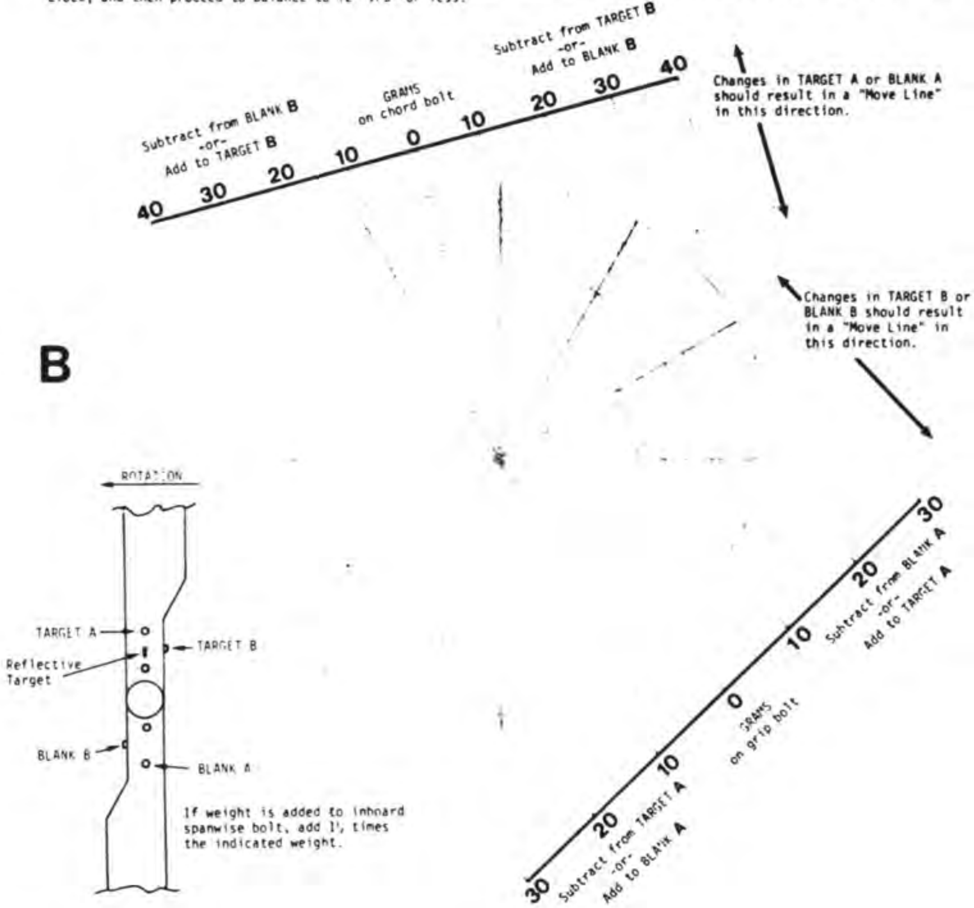

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Figure 5-117. Balancing Tail Rotor

ROTORS	OPERATING RPM
Main rotor (1/rev)	324
Main rotor (2/rev)	648
Main rotor (4/rev)	1296
Main rotor (6/rev)	1944
Tail rotor	1661

DRIVE TRAIN AND ACCESSORIES	
Oil pump (transmission)	4498
Hydraulic pump	4300
Ecu quill	6600
Tail rotor drive-shaft	4300
Main drive-shaft	6600
Hanger assemblies	4300
Intermediate gearbox	4300
Tail Rotor Drive Gearbox Input Quill	4300
Tail Rotor Drive Gearbox Output Quill	1661

c. The VIBREX Tester, model 11, provides a complete and simple functional test and calibration of the entire VIBREX 4591 System. Use of the Tester will identify most problems that are likely to occur with the VIBREX (Table 5-4).

Table 5-4. Troubleshooting the VIBREX 4591 System with the VIBREX Tester, Model 11

SYMPTOMS	PROBABLE CAUSES	CURES
No lights in Balancer/Phazor.	DC polarity wrong.	Check polarity (Pin B is hot +, Pin A is ground).
	Breaker, to circuit in use, is not turned on.	Turn breaker on.
Unsteady tail rotor image when balancing.	Oscillator not in position "A".	Strobex must be in "A", when balancing tail rotor.
	Vibration level is very low.	When vibration level is low, "Clock Angle" is uncertain. Jittery image is indicator of good balance.
Can't see Targets.	Strobex out of focus.	Remove rear panel and adjust focus.
	Reflective Targets worn or dirty.	Replace, and avoid handling reflective surface. Replace as necessary.
	Flash Tube cracked (weak blue flash).	Replace Flash Tube.
	Not aiming Strobex correctly and/or not in-line with light source.	Look directly over top of Strobex, and search in a "W" pattern along the tip path.
	Strobex and/or balancer switched to wrong position.	Check settings.
	Protective varnish or coating over reflector material.	Coating kills reflective properties of exposed bead material. DO NOT COAT!

Table 5-4. Troubleshooting the VIBREX 4591 System with the VIBREX Tester, Model 11 (Cont)

SYMPTOMS	PROBABLE CAUSES	CURES
Targets appear "scattered" when tracking main rotor.	Strobex oscillator "ON."	Check oscillator switch. MUST be in "A" or "B".
	Interrupter assembly bent.	Straighten or replace Interrupter.
Don't get "Test" pattern in Phazor when "Test" button is pushed.	Magnetic Pickup gap too large.	Close gap between Magnetic Pickup and Interrupter.
	Faulty Magnetic Pickup Cable or Magnetic Pickup.	Check and repair or replace as required. Magnetic Pickup should read about 1000 ohms.
	"Interrupter Logic" switch set incorrectly.	Must be set to "double".
	Polarity of Magnetic Pickup incorret.	Pulse should first go negative, then sharply positive where Phazor triggers, then go negative to zero.
	Magnetic Pickup Cable plugged into Magnetic Pickup "backwards" (wrong polarity).	Check that indexing key is correctly lined up. It is not easy, but connector can be plugged in backwards.
	"RPM Range" switch set to wrong range	Set "RPM Range" to "X1".
Meaningless Phazor light pattern when working tail rotors.	NORMAL.	Phazor is NOT used for all tail rotor workm so don't worry about it.
"IPS" and "Clock Angle" readings not repeatable, i.e., restoring weights to original condition does not give same readings.	Mechanical components on rotor are faulty. Bearings, dampers, rod-ends, etc., should all be rechecked.	Correct or replace faulty components.
False reading on on Balancer's "IPS" meter.	When the Balancer's "RPM Tune" dial is set below 100 (on any "RPM Range") the circuitry is unstable and causes false readings on the "IPS" meter.	DO NOT USE BALANCER WITH "RPM TUNE" DIAL SET BELOW 100.

CHAPTER 6

DRIVE TRAIN SYSTEM

SECTION I. DRIVE TRAIN

6-1. DRIVE TRAIN SYSTEM.

6-2. DESCRIPTION — DRIVE TRAIN SYSTEM.

The drive train is a system of shafts and gearboxes through which the engine drives the main rotor, tail rotor, and such accessories as rotor tachometer generator and hydraulic pump (figure 6-1). The system consists of the main driveshaft, transmission, main rotor mast, tail rotor driveshafts, intermediate gearbox, and tail rotor drive gearbox.

6-3. TROUBLESHOOTING — DRIVE TRAIN SYSTEM.

The troubleshooting chart (table 6-1) is a brief summary of drive train troubles which may be encountered in Aviation unit and Intermediate maintenance. Conditions and possible causes listed have been limited to those reasonably probable (though not necessarily frequent in normal service) which could become known through pilot reports or by inspection methods applicable in Aviation unit and Intermediate maintenance and which would be subject to some evaluation by Aviation unit and Intermediate maintenance personnel. Final corrective action by a higher level of maintenance might be required in some instances. Conditions involving obvious major damage are omitted as are those caused by accident or an unusual chain of events which would require evaluation by a competent authority.

NOTE

Before you use this table, be sure you have performed all normal operational checks. If you have a malfunction which is not listed in this table, notify the next higher level of maintenance.

Table 6-1. Troubleshooting Drive Train System

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

1. Metal chips found on magnetic sump plug or pump screen, (paragraphs 6-176 and 6-169).

STEP 1. Internal transmission failure of gears or bearings.

Replace transmission (paragraphs 6-24 and 6-33).

Replace oil cooler and flush lines. Drain and refill with oil (paragraphs 6-143 and 6-146).

2. Excessive pylon motion (Approximately one-half revolution).

Table 6-1. Troubleshooting Drive Train System (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

STEP 1. Pylon mounts worn or installed wrong.

Repair or replace mounts (paragraph 2-225).

STEP 2. Leaking pylon mount dampers.

Replace or repair dampers (paragraph 2-239).

3. Water in transmission.

STEP 1. Water in drain lines.

Clear obstructions from lines. Disconnect lines and purge with compressed air.

MAIN DRIVESHAFT:

1. Grease leakage.

STEP 1. Cut or torn packing or boot.

Replace packing or boot assembly with care. (paragraph 6-12).

2. Abnormal coupling wear.

STEP 1. Faulty lubrication or wrong lubricant (paragraph 6-12).

Clean and lubricate coupling or replace driveshaft (paragraphs 6-12 and 6-13).

3. Lubricant breakdown in forward coupling.

STEP 1. Misalignment or wrong lubricant (paragraphs 6-7 and 6-12).

Align engine and transmission; replace driveshaft and associated parts as required (paragraphs 6-7 and 6-13).

4. Suspected vibration.

STEP 1. Coupling clamps loose, improperly installed, or not matched.

Install clamp sets by instructions (paragraph 6-13).

STEP 2. Loose engine adapter.

Replace adapter and any worn associated parts (paragraph 6-19).

Table 6-1. Troubleshooting Drive Train System (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

STEP 3. Main driveshaft improperly assembled or missing spring.

Disassemble, inspect, and assemble properly (paragraphs 6-8, 6-10, and 6-12).

TAIL ROTOR DRIVE SYSTEM:

1. Suspected vibration.

STEP 1. Worn hanger bearings or couplings (paragraph 6-85).

Replace hanger assembly (paragraph 6-84 and 6-88).

STEP 2. Shaft balance weights lost or shaft bent (paragraph 6-79).

Replace shaft section (paragraphs 6-77 and 6-81).

STEP 3. Misaligned driveshaft clamps (paragraph 6-81).

Align clamps properly (paragraph 6-81).

2. Binding or roughness when manually checked (paragraph 6-85).

STEP 1. Dry or faulty bearing (paragraph 6-85).

Isolate faulty hanger by disconnecting shafts (paragraph 6-85).

Replace hanger assembly (paragraph 6-84 and 6-88).

STEP 2. Defective gearbox.

Check gearboxes, replace defective unit (paragraphs 6-96 and 6-113).

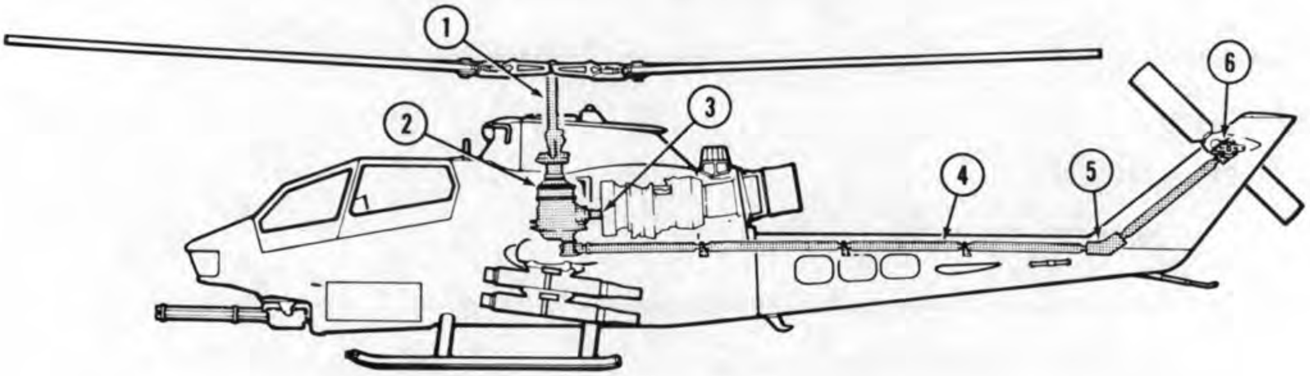
STEP 3. Faulty lubrication of couplings (paragraph 6-87).

Replace hanger, gearbox, or gear quills (paragraphs 6-84, 6-88, 6-100, 6-105, 6-117, 6-121, 6-124, and 6-128).

3. Metal chips on gearbox chip detector (figure 6-2).

STEP 1. Internal failure of gears or bearings.

Replace gearbox (paragraphs 6-100, 6-105, 6-117, and 6-121).



1. **Mast**
2. **Transmission**
3. **Main driveshaft**
4. **Tail rotor driveshafts**
5. **Intermediate gearbox**
6. **Tail rotor drive gearbox**

209900-858

Figure 6-1. Drive Train (Typical)

a. For main driveshaft troubleshooting, apply the following:

(1) Trouble conditions of main driveshaft can seldom be detected in operation, since there are no reliable indications except possibly in an extreme condition. "Suspected vibration" is only partially accurate as a term for conditions such as dynamic out-of-balance or faulty coupling action. Vibration would result from these conditions, as well as abnormal stresses and wear, but would be absorbed in structure and pylon mounts or effectively masked by normal vibrations of the helicopter, providing no distinct indication to pilot.

(2) Driveshaft trouble indications are usually those revealed by careful inspection.

(3) The principal causes of driveshaft trouble are faulty installation procedures and inadequate or improper lubrication of spherical tooth couplings.

b. For tail rotor drive system troubleshooting, apply same principles as for main driveshaft.

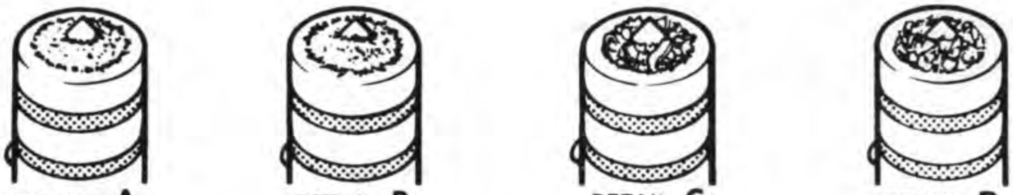
c. Indication of trouble, probable causes, and corrective action are shown on table 6-1.

6-4. METAL PARTICLES IDENTIFICATION — GEARBOXES.

Metal particles found on gearbox oil strainer screens, oil filters, or chip detectors may indicate failure of an internal part of the gearbox. The presence of metal particles, however, is not necessarily an indication that the gearbox is no longer serviceable. The quantity, source, form, and type of metal found, together with the service history of the particular gearbox, must be taken into consideration. The time accumulated since the gearbox was new or overhauled, previous failures, and the type of operation are important factors in determining the further serviceability of the unit. The particles found may be steel, cadmium, aluminum, magnesium, copper (bronze), silver, or phenolic in various shapes and quantities. See figure 6-2 for a detailed explanation of the action made necessary by the presence of various types of particles in the gearbox.

WARNING

When any particles found are readily identifiable as fragments of gearbox parts, such as gears, nuts, bearings, oil slingers, thrust washers, snaprings, safety wire, or other components, replace gearbox.



DETAIL A DETAIL B DETAIL C DETAIL D

METAL PARTICLES CONTAMINATION-GEARBOX OIL

KIND OF METAL	QUANTITY AND/OR SIZE	ACTION REQUIRED	NOTES
Steel	Fuzz, fine hair-like particles (detail A.)	None	Result of normal wear. May have exaggerated appearance because of oil.
	Particles in splinter or granular form (details B and C).	Take oil sample from sump drain for spectrograph oil analysis. Examine oil filter and determine if chips are excessive. If chips are not excessive, flush gearbox oil system and refill with new oil. Accomplish aircraft ground run, take oil sample, check chip detector and oil filter for metal. If no particles are found, hover aircraft for 30 minutes, take oil sample, check chip detector and oil filter for metal. If no metal is present, release helicopter for flight. If metal is present, replace gearbox.	Usually indicates failure.
	Thin flakes not exceeding 1/64 (0.015) inch in thickness and 1/16 (0.060) inch in length. Quantity not to exceed 10 flakes (detail D).	Replace gearbox.	Small quantity may not indicate bearing failure.

214040-290-1A

Figure 6-2. Gearbox Oil Contamination — Description and Corrective Action (Sheet 1 of 2)

METAL PARTICLES CONTAMINATION — GEARBOX OIL

KIND OF METAL	QUANTITY AND/OR SIZE	ACTION REQUIRED	NOTES
	More than 10 flakes not exceeding 1/64 (0.015) inch in diameter and 1/16 (0.060) inch in length; and quantity of flakes exceeding the above dimensions.	Replace gearbox.	Usually indicates failure. May be bearing in one of accessory quills.
Aluminum or Magnesium	Particles in granular form, or like miniature lathe turnings.	Replace gearbox.	May be result of use of these materials as mallets or drifts during assembly. May indicate wear of oil pump interior surfaces or abnormal interference.
Bronze	Particles in granular form.	Replace gearbox.	May indicate excessive wear of bearing cages as result of bearing failure.
Phenolic		None	Result of the use of mallets and drifts during assembly or same as Copper (Bronze) above.
Silver	Particles, flakes or chips form.	None	Result of flaking from lower planetary roller bearing retainers.

214040-290-2B

Figure 6-2. Gearbox Oil Contamination — Description and Corrective Action (Sheet 2 of 2)

a. A visual inspection of color and hardness will occasionally suffice to identify metal particles found on gearbox oil strainer screens, oil filters, or chip detectors. When visual inspection does not positively identify the particle, the kind of particle present may be determined by a few simple tests. Equipment to perform tests includes a permanent magnet, an electric soldering iron, hydrochloric (muriatic) acid (C4), and nitric acid (C5). Proceed as follows: (figure 6-2).

(1) Steel. Isolate steel particles with permanent magnet.

(2) Aluminum. Determine aluminum particles by their reaction to hydrochloric acid. When a particle of aluminum is dropped into hydrochloric acid (C4), it will fizz with a rapid emission of bubbles. The particles will gradually disintegrate and form a black residue.

NOTE

Since magnesium and aluminum react similarly in hydrochloric acid, when in doubt drop particle into nitric acid. Aluminum does not react noticeably in nitric acid.

(3) Bronze or Magnesium. Differentiate bronze or magnesium by their respective reactions to nitric acid. When a particle of bronze is dropped into nitric acid, it forms a bright green cloud in the acid. When a particle of magnesium is dropped into nitric acid, it fizzes with a rapid emission of bubbles. Phenolic and aluminum do not react noticeably to nitric acid.

(4) **Silver.** Dissolve particles in nitric acid. Add a few drops of distilled water and small amount of table salt or hydrochloric acid (C4). Check for appearance of white (milky) cloud in the solution.

b. When the Army Oil Analysis Program is being utilized, check for particles at three places: the transmission, intermediate gearbox, and tail rotor drive gearbox. Instructions for taking oil sample and description of probable source of particles are as follows:

(1) **Transmission.** Take a sample from sump drain immediately after engine shut down. Allow one-half to three-fourths pint of oil to drain through the line before taking sample.

(a) Any of the gear trains, bearings, or a loose or worn shim under the mast bearing will give a high count of iron, copper, aluminum, and magnesium.

(b) A loose fitting on the sump may also show the same trace elements, with the rate of increase suspected to be slightly above normal.

(c) A high iron, copper, and aluminum count could be caused by one or both of the planetary systems with the rate of increase suspected to be above that for normal wear rate.

(d) High iron, high copper, and aluminum content could be from the input quill triplex bearing or the mast bearing. This will increase rapidly and will probably progress to failure.

(2) Intermediate and Tail Rotor Drive Gearboxes. Take sample from gearbox immediately after shut down. Use a plastic syringe or take from drain. Clean area before removing drain plug.

(a) High iron count, suspect gear scuffing, or bearing inner races fretting, suspected rate of increase slightly above normal.

(b) High iron and copper count could be roller bearings and cage or duplex bearings in quills.

SECTION II. MAIN DRIVESHAFT

6-5. MAIN DRIVESHAFT.

6-6. DESCRIPTION — MAIN DRIVESHAFT.

A main driveshaft with crowned tooth couplings is installed between an adapter on engine output shaft and the freewheel coupling of the transmission input drive quill (figure 6-3). Two clamp sets, of split V-band type, hold the mating curvic splined faces of couplings in secure contact. Flexibility of couplings is provided by sliding an inner coupling in splines of an outer coupling to accommodate movement of transmission on pylon mountings. A spring in each coupling assists centering of shaft during operation and tends to hold shaft assembly in place if clamps are removed during maintenance.

6-7. ALIGNMENT — MAIN DRIVESHAFT.

a. Check alignment for main driveshaft installation between transmission input drive quill coupling and engine output shaft adapter when any of the following conditions apply:

(1) Main driveshaft inspection reveals excessive wear of coupling splines.

(2) Main driveshaft has multi-color appearance indicating excessive heating.

(3) Driveshaft misalignment is suspected for any reason.

(4) Engine tripod mount, engine bipod mount, or engine forward support tube mount is replaced.

(5) Any engine mount to service deck fitting is changed.

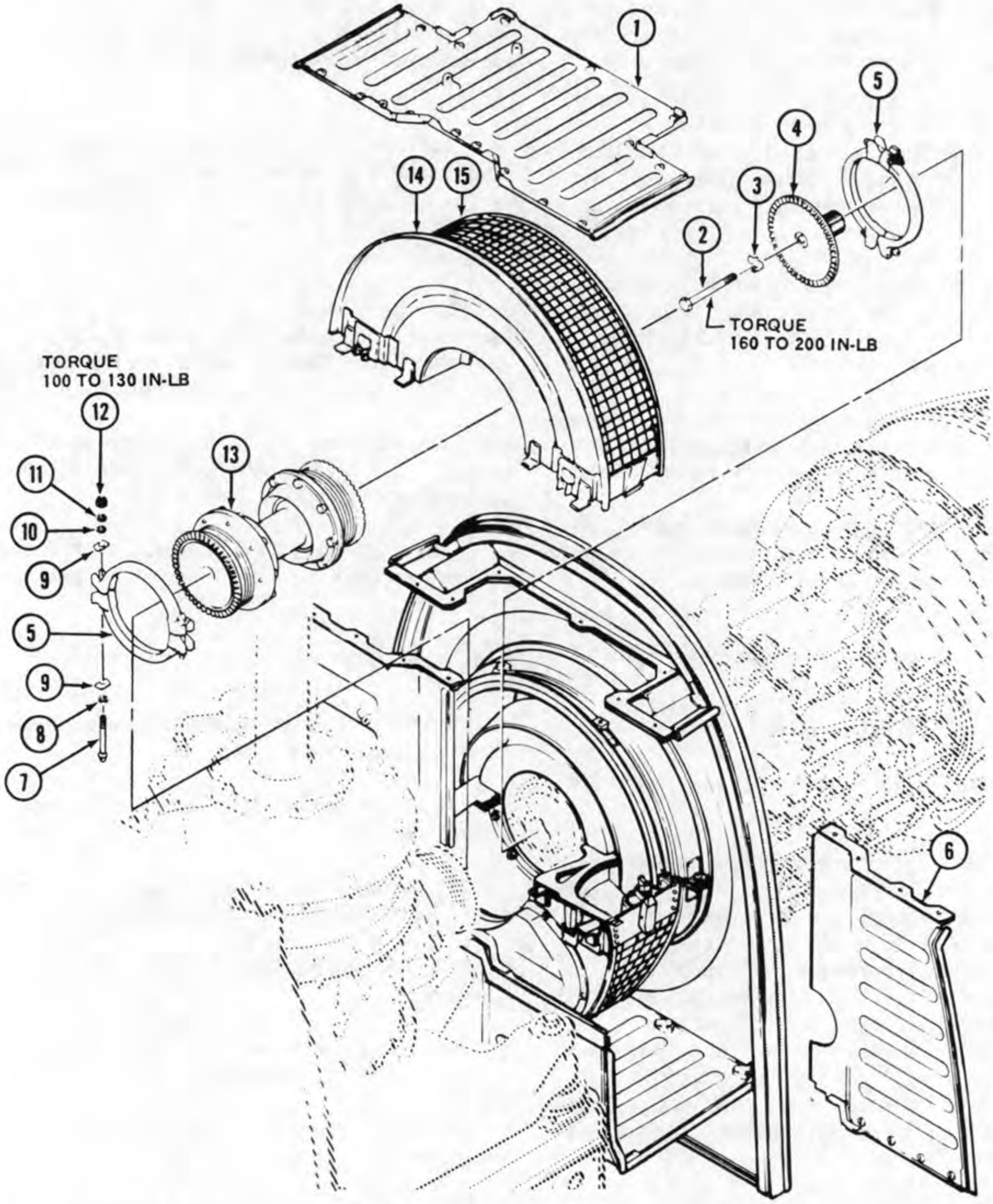
(6) Shim stack-up under any engine mount to service deck fitting is changed.

(7) Major repair to the center fuselage section and tailboom.

(8) Driveshaft couplings have multi-colored or straw colored appearance, indicating overheating.

NOTE

When engine is replaced, driveshaft alignment check is not required, provided engine mount components, deck fittings, or shim stack-up is not changed.



1. Baffle panel
2. Bolt
3. Locking washer
4. Adapter
5. Clamp sets
6. Baffle panel
7. Bolt
8. Chamfered washer
9. Pivots
10. Steel washer
11. Thin steel washer (if reqd)
12. Nut
13. Main driveshaft assembly
14. Particle separator upper half
15. FOD screen upper half

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Figure 6-3. Main Driveshaft Installation

Premaintenance Requirements for Main Driveshaft Alignments

Conditions	Requirements
Model	AH-IS
Part Number or Serial Number	All
Special Tools	(T45) (T32) (T35)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	None
Special Environmental Conditions	None

b. Remove main driveshaft (paragraph 6-8). Leave adapter (4, figure 6-3) installed in end of engine output shaft.

CAUTION

Do not attempt to raise transmission with jacks only. Hoist must be used in conjunction with jacks while lifting.

c. Attach hoist (T45) or other suitable hoist to main rotor retaining nut at top of mast. Install four jacks (T35), two at each side between transmission support case and top of pylon supports (figure 6-4).

d. Remove nut and washer from lower bolt of lift link, and operate hoist to raise tranmission until bolt can be freely moved with fingers. Adjust jacks to hold pylon at this position with hoist slack. Replace bolt if binding occurs due to corrosion or galling.

e. Check that transmission support points are parallel symmetrically with pylon support structure. Measure at each mount with a micrometer depth gage as shown in figure 6-4.

(1) Measure dimension from top surface of support case mounting plate to top of pylon support. All four dimensions should now be equal within **0.020** inch.

(2) When all four points cannot be adjusted to same dimension, take average of two front points and adjust two rear points accordingly.

f. Install target plate of alignment tool set, (T32) on transmission input quill coupling (figure 6-5). Index arrow of center at 3.5 on inner scale. Secure by tightening two washer-head screws at back of plate. Position plate on coupling with 1.75 index of outer scale at top of vertical centerline (figure 6-5). Secure with coupling clamp set.

g. Install alignment gage of tool set on engine output shaft adapter. Secure with coupling clamp set (figure 6-5).

h. Check horizontal and vertical alignment by extending plunger of gage toward target plate hole. Push plunger forward against tension of retracting spring.

(1) Largest diameter of plunger must enter target hole to indicate correct alignment.

(2) If misalignment is indicated, observe amount and direction.

NOTE

No correction should be attempted before completing angularity check in following step. Shim requirements can be determined best on basis of both checks.

i. Perform angularity check with a dial indicator mounted on end of alignment gage housing as follows:

(1) Position indicator for contact at 2.5 inch radius (just inside outer scale numerals) on target plate (part of T32).

(2) Rotate gage through a full turn to find area of plate nearest to engine. This should occur at left side of plate between 8 and 10 o'clock position. Zero indicator in this area.

(3) Check run-out through a full turn of gage to be within **0.016** inch maximum total indicator reading. If runout is greater than **0.016** inch, make correction of engine alignment by use of shims under engine mount deck fitting as required (figure 6-5).

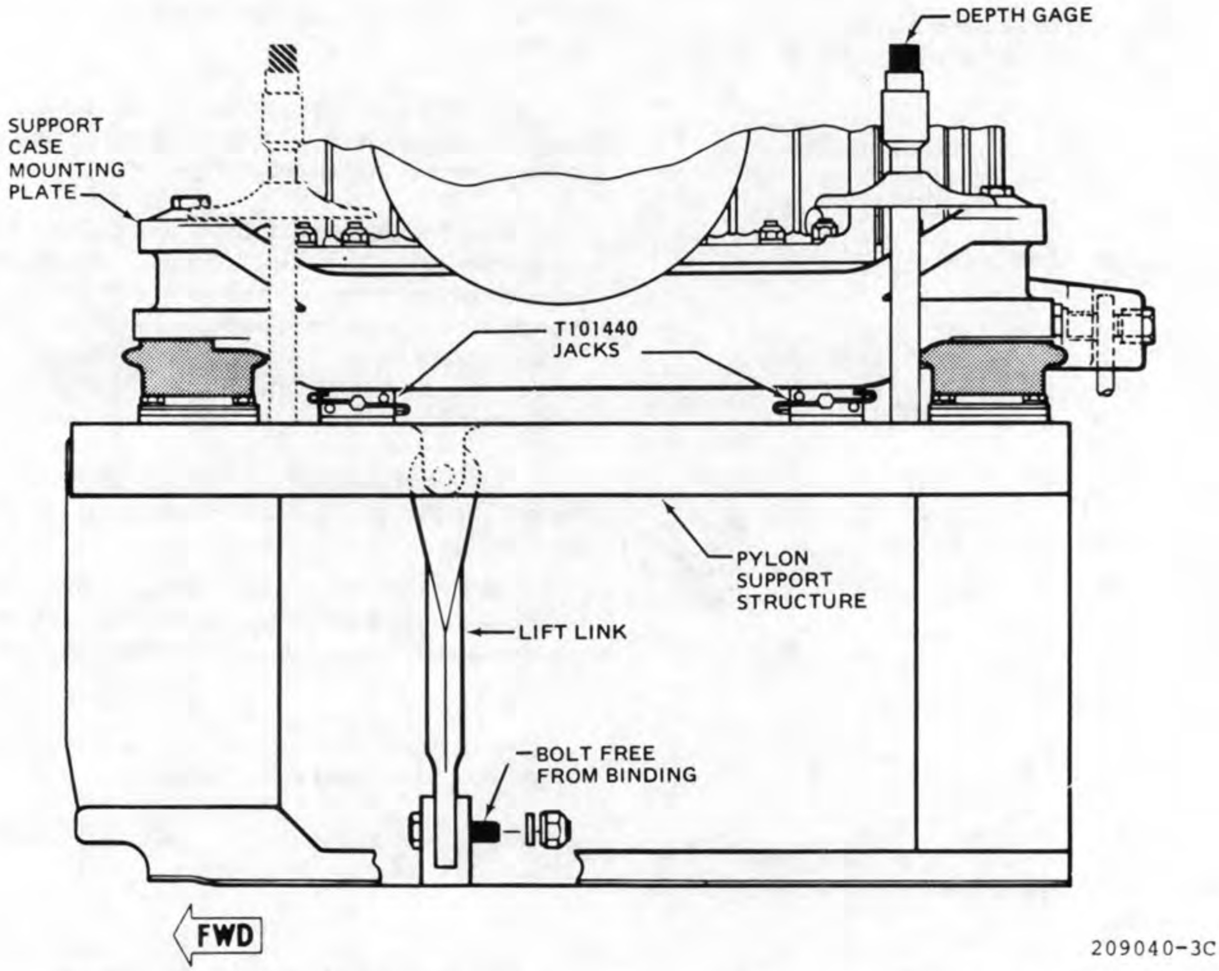


Figure 6-4. Tool Application — Transmission Positioning Jacks P/N T101440 (T35)

CAUTION

Do not exceed 0.312 inch shim thickness under any fitting.

j. Repeat alignment and angularity check after any change of shims.

k. When alignment is complete, reinstall washer and nut on lift link lower bolt. Torque nut **30 TO 50** foot-pounds. Remove jacks (T35) and hoist (figure 6-4).

l. Install driveshaft (paragraph 6-13).

6-8. REMOVAL — MAIN DRIVESHAFT.

a. Open cowling on left and right side of pylon. Remove baffle panel 6, (figure 6-3).

b. Remove top half of FOD screen (15) (paragraph 4-35).

c. Remove particle separator (14). Cover open ends of lower air filter assembly to keep out dirt and foreign objects.

d. Remove clamp sets (5) from each end of shaft, with attaching parts (7) through (12). Keep serialized clamps and attaching parts in sets.

e. Push shaft assembly (13) toward either end to shift one coupling inward and disengage coupling at opposite end. Remove shaft assembly. Apply enough force to compress springs in couplings.

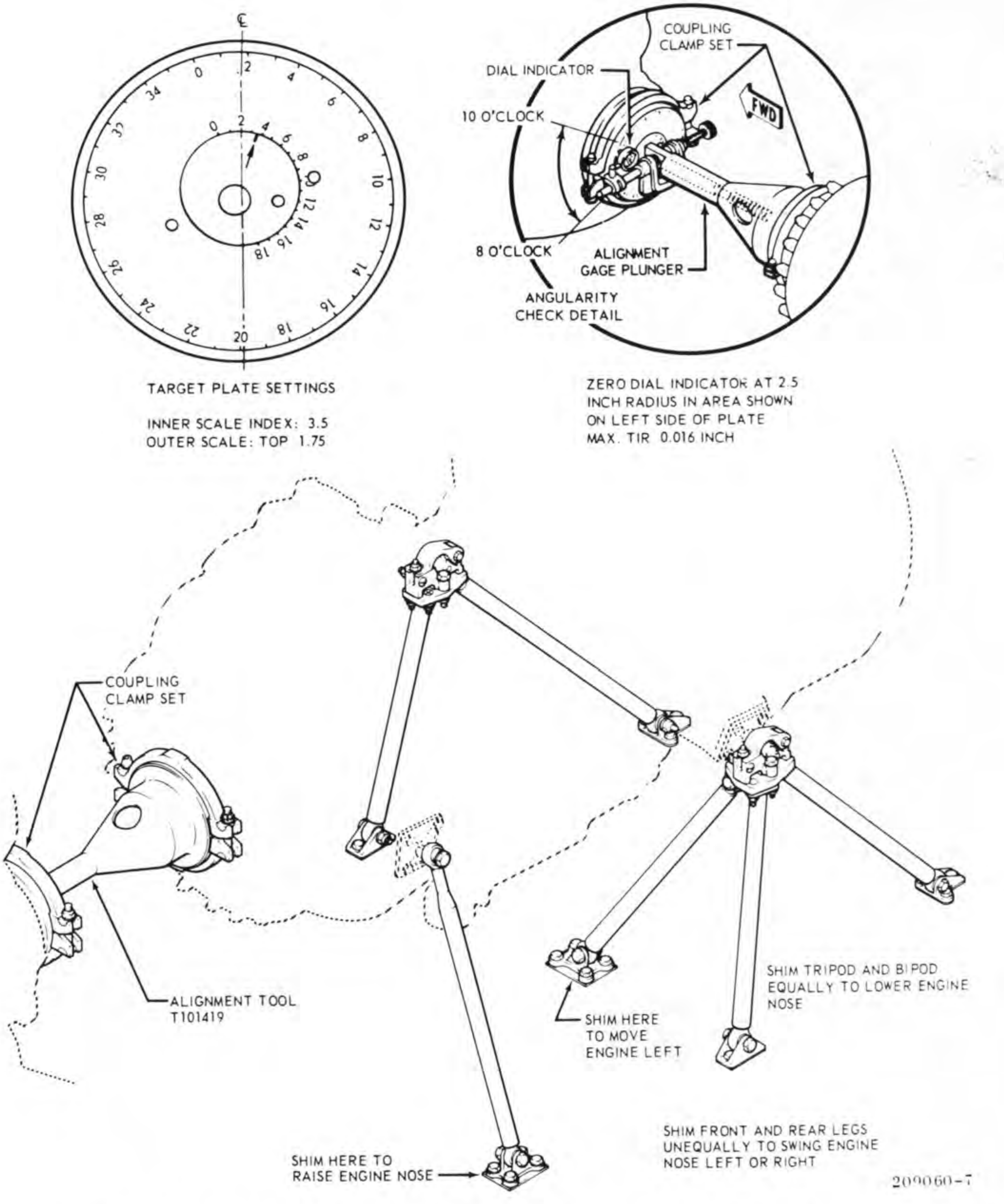


Figure 6-5. Tool Application — Engine to Transmission Driveshaft Alignment P/N T101419 (T32)

6-9. DISASSEMBLY — MAIN DRIVESHAFT.

Premaintenance Requirements for Main Driveshaft Disassembly

Conditions	Requirements
Model	AH-IS
Part Number or Serial Number	All
Special Tools	(T25) (T33)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C19) (C31) (C37) (C88 or C91)(C103)(C112)(C116)
Special Environmental Conditions	None

a. Place shaft assembly on a suitable work table. Remove retaining ring (1, figure 6-6). Use care in removing ring, which must be replaced if bent or damaged. See details A and B in figure 6-7 for removal technique.

b. Push down on outer coupling (13, figure 6-6) just enough to force out retainer (3). Remove retainer packing (2), spring (4), and locking spring (5). See details C and D, figure 6-7 for removal technique.

c. Repeat steps a. and b. at opposite end of shaft.

d. Attaching holding fixture (T33) with a clamp set on one coupling of shaft with retainer reinstalled as a spacer to keep inner coupling in place. Secure fixture in a vise (detail E).

e. Use transmission wrench (T25) to loosen nut (6, figure 6-6). Do not remove nut. Remove shaft from holding fixture.

f. Repeat steps d. and e. to loosen nut in opposite end of shaft.

g. Remove nut (6) and spring retainer (7) from one end of shaft. See details G and H, figure 6-7, for removal technique.

h. Remove couplings from end of shaft (detail I).

i. Carefully remove inner coupling (14, figure 6-6) from outer coupling (13). See detail J, figure 6-7, for removal technique.

CAUTION

Inner coupling may be tight in boot ring. Use extreme care not to damage boot.

j. Remove bolts (9, figure 6-6) and washers (10) to separate boot (11) from outer coupling (13) and remove packing (12).

k. Record serial numbers of mating inner and outer couplings.

l. Repeat steps g. through k. to remove parts from opposite end of shaft.

m. Clean main driveshaft as follows:

WARNING

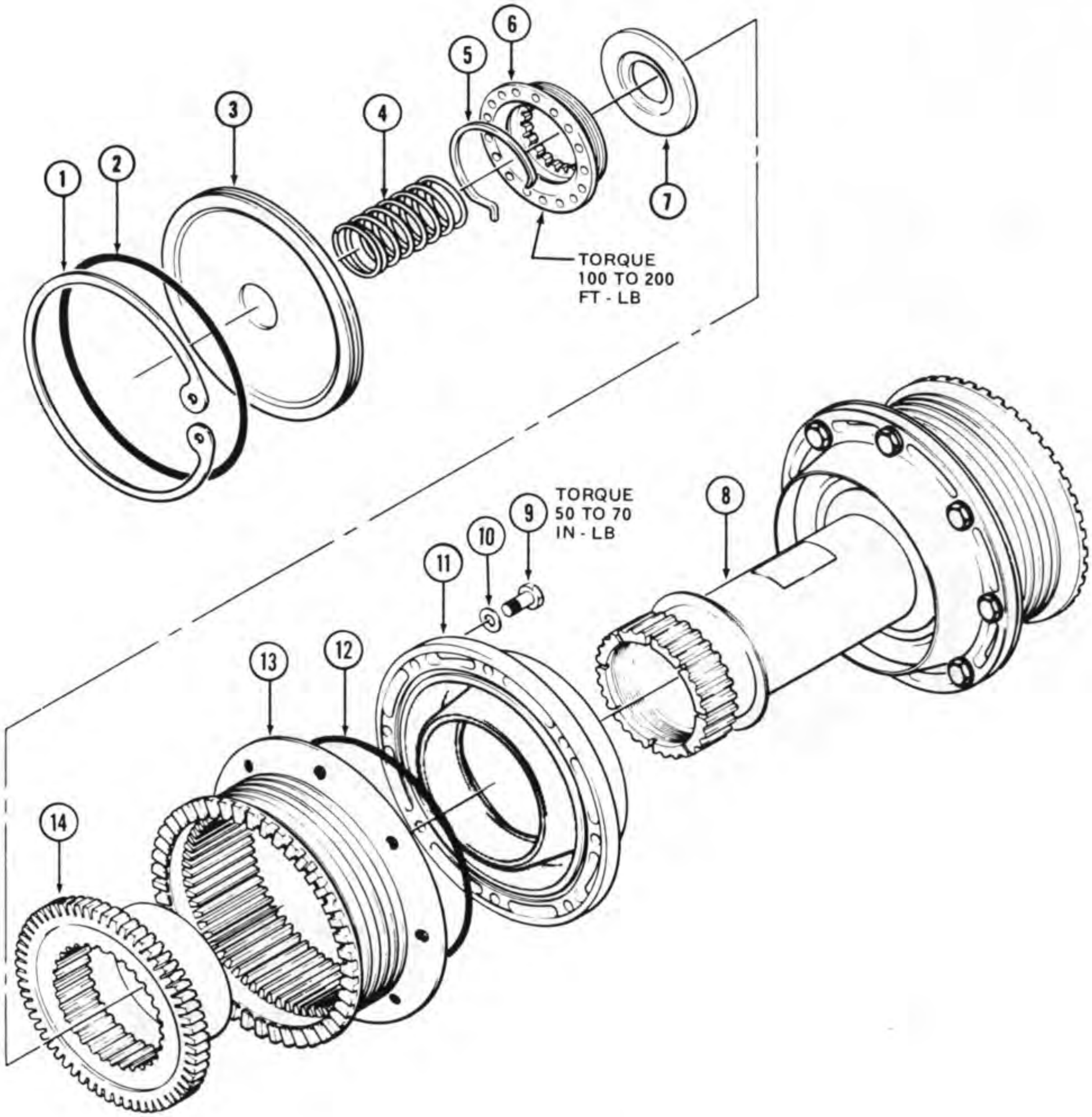
Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Do not use solvent to clean assembled driveshaft. Residue may remain in assembly and prevent proper lubrication. Do not clean boot (11) with cleaning solvent.

(1) Clean shaft assembly, adapter and attaching parts by wiping with clean cloth. Solvent (C112) may be used if driveshaft is completely disassembled.

(2) Remove all grease from inner and outer couplings.



1. Retaining ring
2. Packing
3. Retainer
4. Spring
5. Locking spring
6. Nut
7. Spring retainer
8. Shaft
9. Bolts
10. Washer
11. Boot
12. Packing
13. Outer coupling
14. Inner coupling

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Figure 6-6. Main Driveshaft Assembly

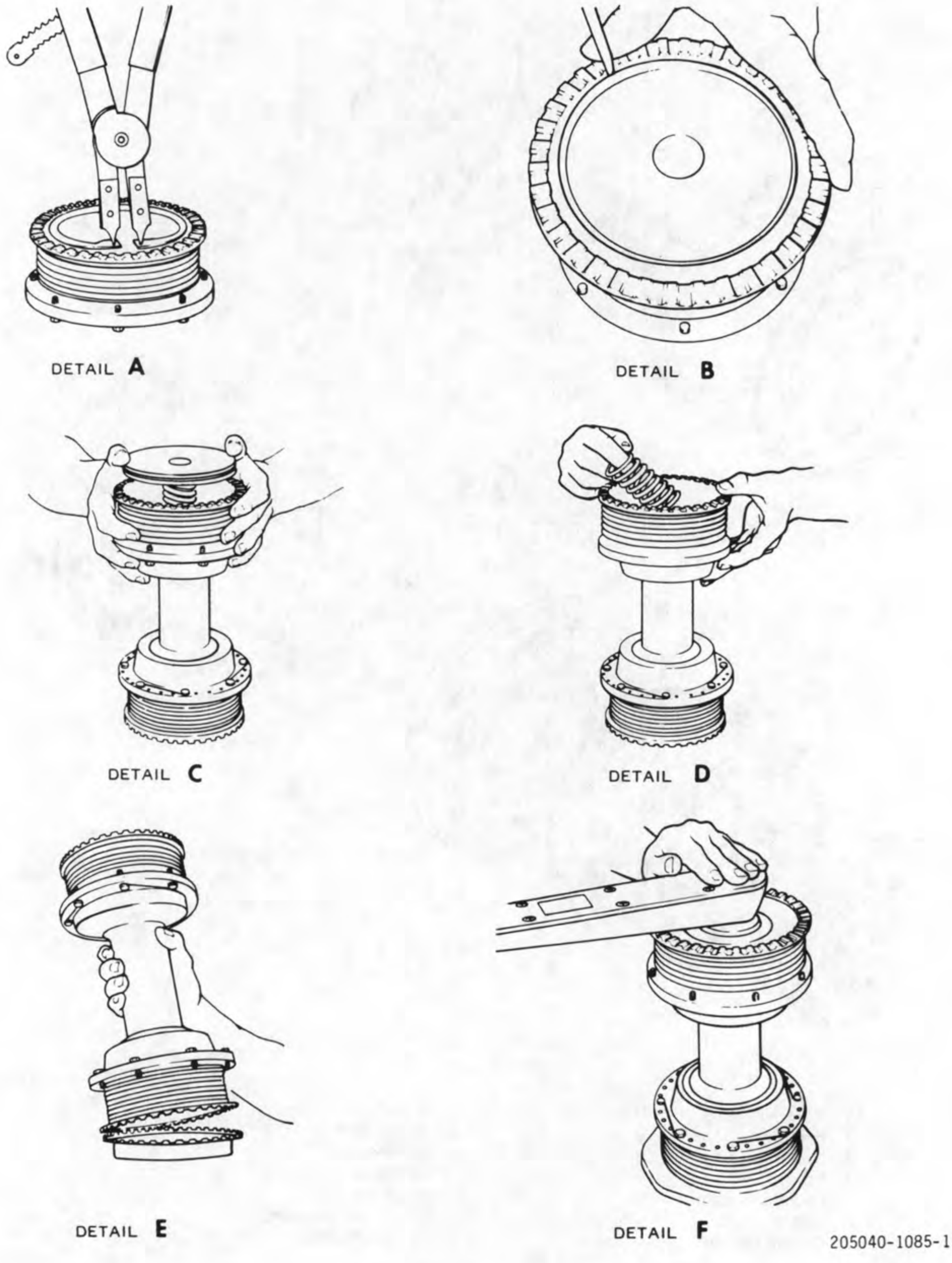


Figure 6-7. Inspection and Lubrication of Main Driveshaft (Sheet 1 of 3)

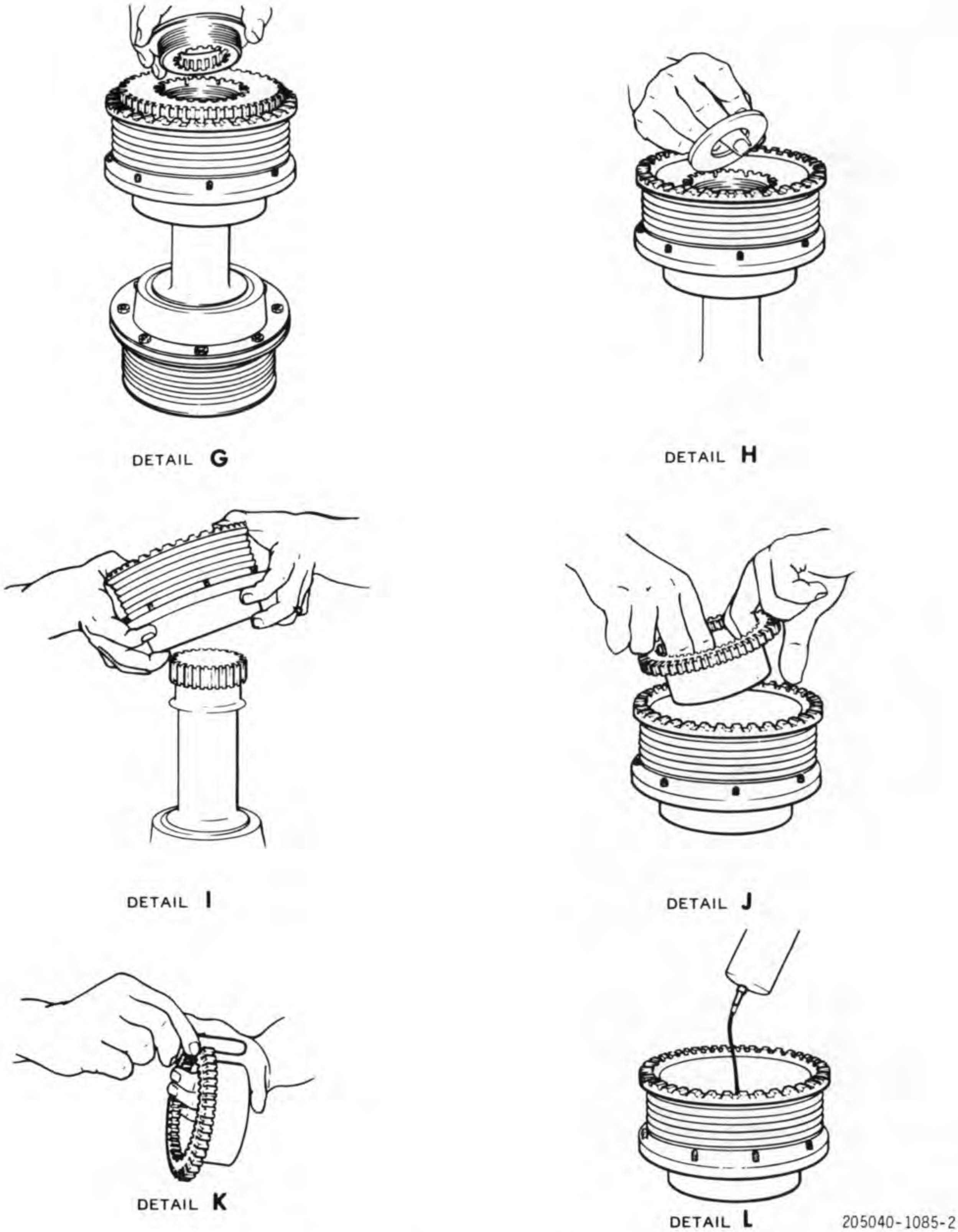
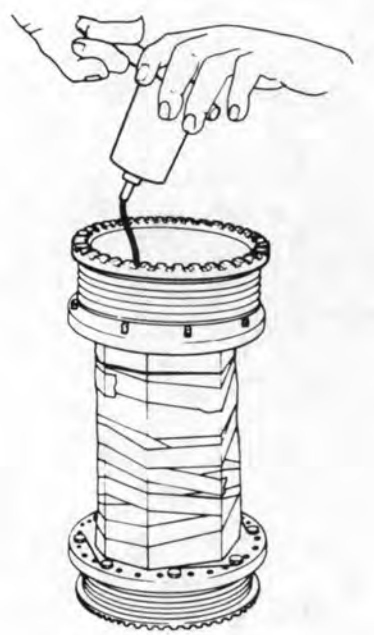


Figure 6-7. Inspection and Lubrication of Main Driveshaft (Sheet 2 of 3)



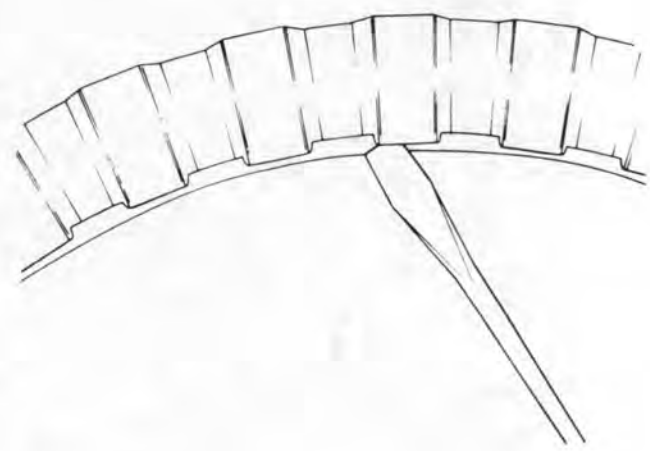


Figure 6-7. Inspection and Lubrication of Main Driveshaft (Sheet 3 of 3)

CAUTION

Do not use alcoholic phsophoric solution on couplings (12) and (13).

(3) If necessary, clean corrosion from parts using wire brush or Scotch-brite (C103). If necessary to remove all corrosion, wipe pitted area with cotton swab dipped in alcoholic phosphoric (C19) diluted three parts water to one part (C19). Wash area clean with water and dry with hot air.

6-10. INSPECTION — MAIN DRIVESHAFT.

a. Inspect installed driveshaft for security, grease leakage, and evidence of damage.

b. Inspect main driveshaft after disassembly as follows:

(1) Outer surface of shaft (8, figure 6-6) for nicks, scratches or pits to the following limits:

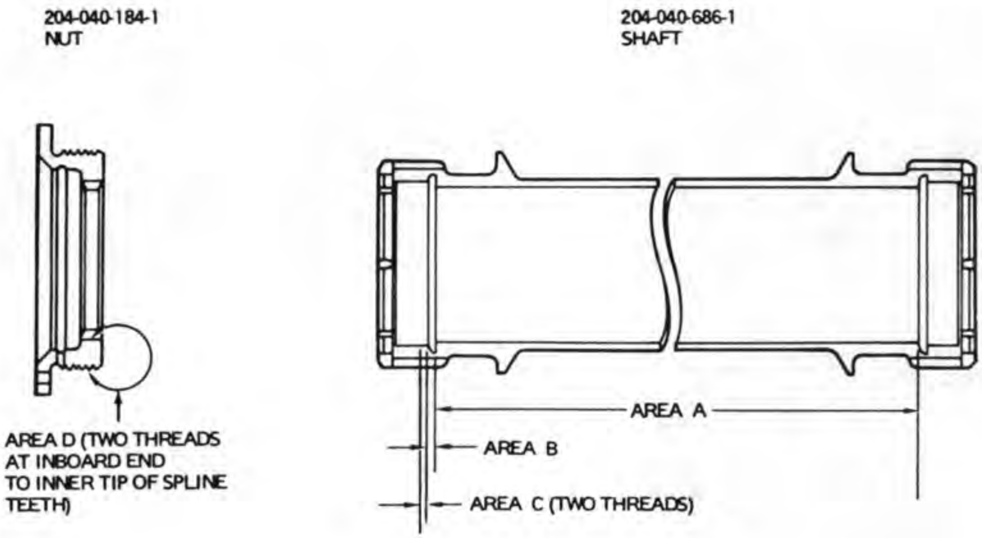
(a) Nicks and scratchs, running within **15** degrees of shaft axis, which are not in excess of **0.005** inch in depth are permissible without polishing out.

(b) Nicks and scratches, running within **15** degrees of shaft axis, which are not in excess of **0.010** inch depth are permissible if polished out. Total polished area must not exceed **20** percent of circumference of shaft at any point.

(c) Nicks and scratches not running within **15** degrees of shaft axis must be polished out. A maximum depth of **0.005** inch may be polished out on 100 percent of shaft circumference. A maximum depth of **0.010** inch may be polished out, provided the total polished area does not exceed **20** percent of shaft circumference at any point.

(2) Inner surface of shaft (8) for corrosion pits to the following limits:

(a) In area A, figure 6-7.1, pits to a maximum depth of **0.005** inch are acceptable without polishing out. Pits greater than **0.005** inch in depth must be polished out. Maximum acceptable depth of rework to completely polish out pits is **0.015** inch, or to a maximum inside diameter of **2.430** inch provided rework is done by honing or other suitable means



1. **Area A, inside diameter of shaft. That portion in the middle with constant bore, extending from chamfer at thread relief at one end, to the similar chamfer at the other end.**
2. **Area B, thread relief, including all surfaces from Area A to the inner end of the threads.**
3. **Area C, includes two threads at the inner end.**
4. **Area D, on nut, includes two threads at the inboard end, and extends around the end face to the inner tip of the spline teeth.**

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Figure 6-7.1. Main Driveshaft Internal Corrosion Areas

such that material removal is uniform around the full inside diameter. Minimum acceptable radius in reworked area is **0.50** inch, and surface finish must be 63 microinches or better.

(b) In Area B, figure 6-7.1, pits to a maximum depth of **0.010** inch are acceptable without polishing out. Pits greater than **0.010** inch in depth must be polished out. Maximum acceptable depth of rework to completely polish out pits is **0.025** inch. Minimum acceptable wall thickness after rework is **0.060** inch. Minimum acceptable radius in reworked area is **0.09** inch, and surface finish must be 63 microinches or better.

(c) In Area C, figure 6-7.1, pits to a maximum depth of **0.030** inch are acceptable.

c. Inspect couplings as follows:

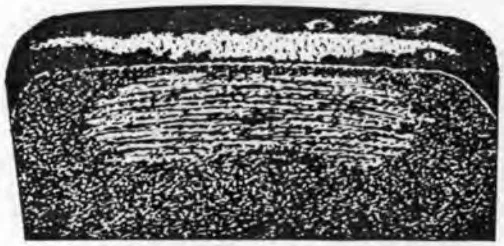
(1) Inspect packing groove in each retainer (3, figure 6-6) and areas of outer couplings (13), where packing and retaining ring will seat, for burrs or sharp edges. Remove any such defects with a fine India stone (C116) or crocus cloth (C42). Carefully remove any foreign material.

(2) Inspect splines of couplings for wear conditions (figure 6-8). Use a white card or a tongue depressor at root of each tooth to reflect light on spline surfaces. See detail K, figure 6-7 for inspection technique.

(3) Inspect exterior of outer couplings for discoloration of cadmium plating as evidence of overheating. Extensive discoloration or blistering of cadmium plating is cause for return to next higher maintenance level for repair.

(4) Inspect shaft (8, figure 6-6) inner coupling (14) and outer coupling (13) for chipped teeth, cracks, and damage.

d. Inspect boot (11) for breaks or tears.



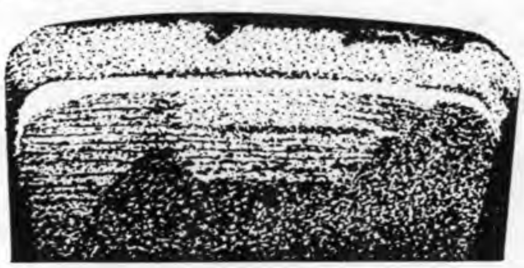
DETAIL A

DETAIL B

Details A and B show typical acceptable patterns of wear on spherical teeth of male coupling. Patterns will vary due to differences in time in service, alignment, and extent of operation at high power.

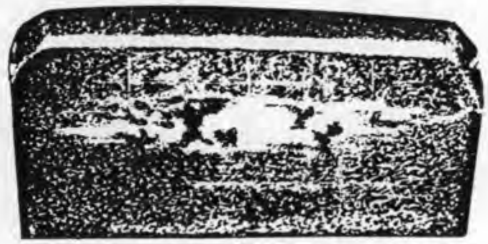
DETAIL C

Small defects as shown in detail C can occur in either Detail A or B. This type of defect is not detrimental to the coupling.

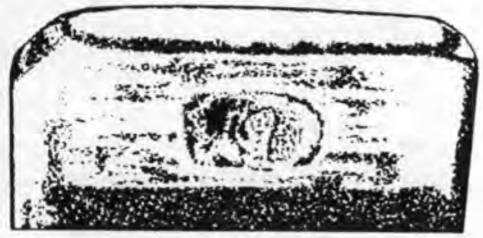


DETAIL D

Grooves, as shown in detail D, of any length are acceptable on not more than twelve consecutive teeth or twenty four teeth total.



DETAIL E



DETAIL F

Condition as shown in detail E or F are acceptable on not more than five consecutive teeth or twelve teeth total.

Note

When male coupling is replaced for defects like detail E or F, female coupling may require honing to remove any buildup of transferred metal.

DETAIL G

Defects as in detail G which cover over 1/2 the tooth length and 1/2 the tooth depth are to be rejected. Care should be taken in inspection of the female. If metal buildup is not excessive it may be honed down.

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Figure 6-8. Coupling Wear Criteria for Driveshaft (Sheet 1 of 2)

DETAIL H

DETAIL I

Conditions shown in Detail H or I are not acceptable. This type of failure has only been found when an improper lubricant had been used. These photos show that the entire tooth surface has been spalled.

All or at least 30 of the 60 teeth will exhibit this failure. Check for the proper kind of lubricant, and be sure the proper amount of lubricant is installed.

Normally if the male coupling is as shown in Details H, I, or J the surface of the female will be damaged and should be scrapped.

DETAIL J

Detail J shows a group of teeth from a coupling which was run with an improper lubricant. The type of failure as shown in Details H and I.

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Figure 6-8. Coupling Wear Criteria for Driveshaft (Sheet 2 of 2)

e. Inspect spring retainer (7) for corrosion damage. Pits to a maximum depth of **0.030** inch are acceptable.

f. Inspect nut (6) for damaged threads or for corrosion damage. In Area D, figure 6-7.1, pits to a maximum depth of **0.030** inch are acceptable.

g. Inspect spring (4, figure 6-6) for corrosion damage. Corrosion pits are unacceptable.

h. Inspect clamp set (5, figure 6-3) for cracks, distortion, and damage.

i. Inspect driveshaft assembly for wear in accordance with figure 6-9.

6-11. REPAIR — MAIN DRIVESHAFT.

a. Return to next higher level of maintenance for repair if damage or wear to inner coupling (14, figure 6-6) or outer coupling (13) exceeds allowable inspection limits.

b. Replace all packings at reassembly.

c. Replace retaining ring (1) if broken or damaged.

d. Replace retainer (3) if broken or cracked.

e. Replace spring (4) if broken, damaged, or pitted. Remove superficial corrosion with Scotch-brite (C103).

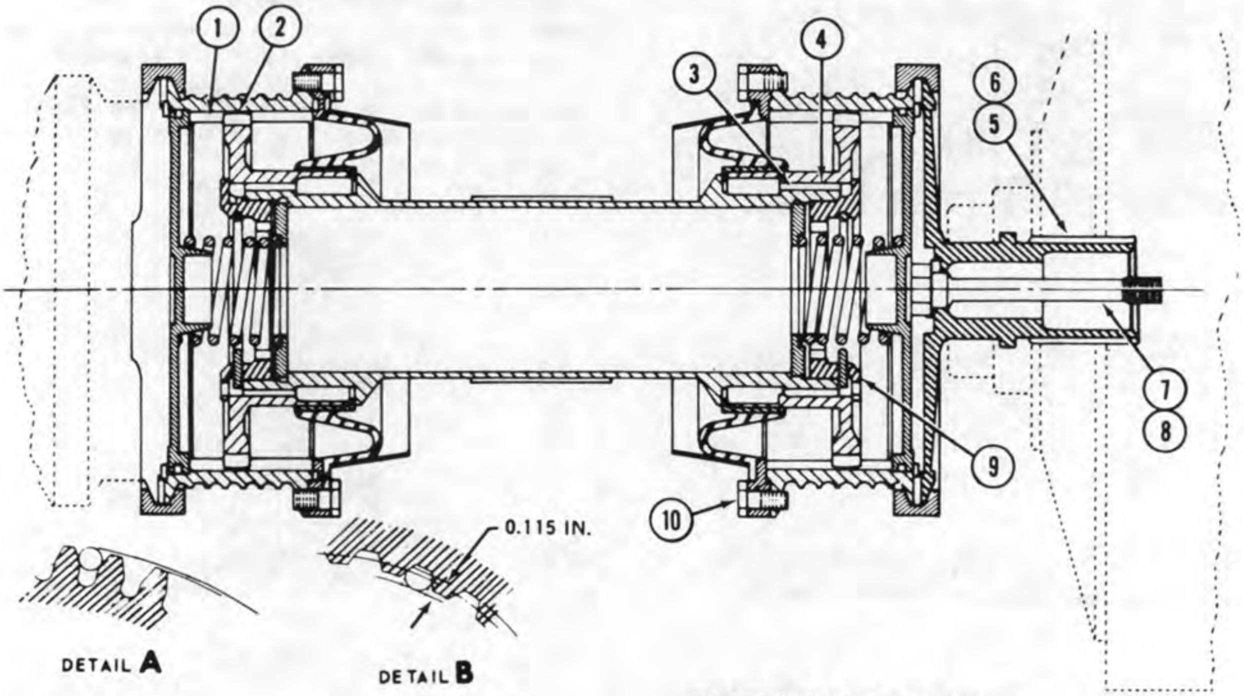
f. Treat with brush Alodine (C31) after corrosion removal

g. Replace clamp set (5, figure 6-3) if cracked, damaged, distorted, or if not a numbered matched set.

h. Replace boot (11, figure 6-6) if broken or torn.

i. Replace locking spring (5) if broken or damaged.

j. Replace spring retainer (7) if worn, damaged, or if corrosion pits exceed allowable limits.



ITEM	NOMENCLATURE	MIN	MAX	REPLACE
		DIMENSIONS (Inches)		
1	Cracks	None		
2	Outer coupling — internal spline (dim between pins) (use 0.1440 dia pins) (detail B)	4.8812	4.8852	
3	Inner coupling — spherical teeth (dim over pins) (use 0.1440 dia pins) (detail A)	5.1800	5.1841	5.1549
4	Inner coupling — internal spline (dim between pins) (use 0.1440 dia pins) (detail B)	2.8427	2.8445	**2.8464
5	Shaft — spline (use 0.1920 dia pins) (dim over pins)	3.2928	3.2952	3.2909
6	Adapter — spline (use 0.1200 dia pins) (dim over pins)	1.8007	1.8038	1.8017
		TORQUE		
7	Bolts — adapter retaining	160	200	in-lb.
8	Nuts — coupling retaining	100	200	ft-lb.
9	Bolts — seal housing retaining	50	70	in-lb.

NOTE

*Maximum allowable depth of wear 0.0055 (measure from unworn face of tooth) (Dimension between pins is mfg. dimension for new parts).

NOTE

**Use pins with one side ground flat to provide clearance between pins and root of spline teeth.

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ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

Figure 6-9. Damage Limits — Main Driveshaft Assembly

k. Polish out nicks, scratches, or pits on shaft (8) using fine India stone (C116) or crocus cloth (C37).

NOTE

Minimum acceptable radius in reworked areas is 0.50 inch, except in Area B, figure 6-7.1,0.09 inch minimum radius is acceptable. Surface finish in reworked areas must be 63 microinches or better. Polished areas, or cleaned areas with pits within allowable limits must be refinished with two coats of primer (C91).

(1) Nicks and scratches on the outside of shaft running within **15** degrees of shaft axis may be in excess of **0.010** inch depth. Polished area must not exceed **20** percent of circumference of shaft at any point.

(2) Nicks and scratches on outside of shaft not running within **15** degrees of shaft axis, which are not polished out. A maximum depth of **0.005** inch may be polished out on **100** percent of shaft circumference. A maximum depth of **0.010** inch may be polished out, provided the total polished area does not exceed **20** percent of shaft circumference at any point.

(3) Corrosion pitting on inside of shaft must be reworked or polished out in accordance with limits stated in paragraph 6-10.

(4) Replace shaft if cracked, dented or if damage exceeds acceptable limits.

l. Remove any defects such as burrs or sharp edges in packing groove in retainer (3, figure 6-6) and areas of outer coupling (13) where packing and retaining ring will seat. Use a fine India stone (C116) or crocus cloth (C37). Carefully remove any foreign material.

m. Replace couplings (13) and (14) if teeth are chipped, pitted, corrosion pitted, discolored or blistered plating indicating overheating or if patterns are not within acceptable limits.

n. Replace nut (6) if corrosion damage exceeds acceptable limits, or if threads are galled. Repair minor nicks or dents on threads using a fine India stone (C116).

o. Replace any parts that are cracked or exceed acceptable dimensional limits.

6-12. ASSEMBLY — MAIN DRIVESHAFT.

Premaintenance Requirements for Assembly of Main Driveshaft

Conditions	Requirements
Model	AH-IS
Part Number or Serial Number	All
Special Tools	(T25) (T33)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C81) (C56) (C91) (C116) (C137) (C103)
Special Environmental Conditions	None

a. Lubricate and assemble driveshaft as follows:

(1) Install boot (11, figure 6-6) and packing (12) on outer coupling (13), making sure large holes in boot mate with the tapped holes in the outer coupling. Install bolts (9) and washers (10). Torque bolts **50 TO 70** inch pounds and install lockwire.

(2) Position each coupling and boot assembly with boot down. Squeeze one-fourth of a tube of lubricant (C56) into boot of one coupling, keeping remainder of tube for later use. Apply lubricant from a second tube in other coupling booth in same manner. See detail L, figure 6-7. Coat inner diameter of shaft (8, figure 6-6) with a light film of coupling lubricant (C56). Coat threads and thread relief in shaft, threads and flange on nut (6) and mating surface on coupling (13) and spring retainer (7) with coupling lubricant (C56).

(3) Carefully place inner couplings (14) into outer couplings (13). See detail J, figure 6-7. Be sure that couplings are correctly mated according to serial numbers recorded at disassembly. No special indexing of splines is necessary.

(4) Place a coupling assembly on end of shaft. See detail I. Install spring retainer (7, figure 6-6) and nut (6) finger-tight to hold parts in place. Repeat procedure at opposite end of shaft.

(5) Secure shaft assembly on holding fixture (T33) in a vise.

CAUTION

Before apply torque on nuts, be sure splines of inner and outer couplings are fully engaged, to avoid wrinkling and damaging boots.

(6) Torque nut (6) **100 TO 200** foot-pounds, using splined wrench (T25). See detail F, figure 6-7. Install locking spring (5, figure 6-6) with tang inserted through a hole in nut (6) and slot in end of shaft (8).

(7) Repeat steps (4) and (5) on opposite end of shaft. Remove tools.

(8) Cut a piece of corrugated cardboard approximately **7.25** by **16** inches. Fully extend couplings outward on shaft and wrap cardboard around shaft to hold in position.

(9) Apply remaining three-fouths tube of lubricant (C56) evenly inside one outer coupling with care to keep grease out of shaft. See detail M, figure 6-7.

NOTE

Six-ounce tube of grease provides correct amount of grease for one end of shaft.

(10) Install a new packing (2, figure 6-6) coated with grease (C56) in groove around retainer (3). Place spring (4) in center of spring retainer (7). Place retainer (3) on spring, and carefully press retainer inward to normal position. Check that retaining ring groove is clean and that there are no rubber slivers to indicate packing damage. See detail N, figure 6-7.

(11) Install retaining ring (1, figure 6-6). Ensure that ring is seated securely in groove of outer coupling. See details A and B, figure 6-7.

(12) Turn shaft assembly over, with incomplete coupling up.

(13) Repeat step (8), (9), and (10) to lubricate and complete assembly of other coupling. Remove cardboard from shaft.

b. Clean all traces of grease from exterior of driveshaft assembly with clean dry cloth.

c. Inspect coupling boots (11, figure 6-6) for any damage that may have occurred during assembly. Wrinkles and tears could be caused if inner and outer coupling splines were not engaged before retaining nut was tightened and couplings were then twisted to align and engage splines.

6-13. INSTALLATION — MAIN DRIVESHAFT.

NOTE

Before installing driveshaft, carefully wipe clean the area surrounding the driveshaft, especially the particle separator, fifth mount support fitting, and collective tube.

a. If removed, install adapter (4, figure 6-3) into engine shaft (paragraph 6-19). Install bolt (2) and locking washer (3), with short tab of washer in slot of adapter. Torque bolt **160 TO 200** inch-pounds and secure head to tab on washer (3), using lockwire (C137).

b. Place driveshaft assembly (13) between engine adapter and transmission input drive quill.

c. Install clamp sets (5) to secure each end of shaft.

(1) Wipe inside grooves of clamp (5) clean of grease. Fit clamp halves around coupling joint, checking that serial numbers on both halves are alike and on same side. Clamp halves should fit snugly and hold themselves in place without bolts.

(2) Install two bolts (7) as follows:

(a) Place chamfered washer (8) on each bolt (7) with chamfered side next to bolt head. Install pivots (9) on each bolt (7) with curved side toward clamp set (5) with heads in direction of rotation.

(b) Install steel washer (10) and thin steel washers (11) on bolts (7) as required to obtain proper thread engagement with nuts (12). Use equal number of washers on opposite bolts to maintain balance.

(c) Install nuts (12) on bolts (7). Tighten nuts evenly and keep gap between ends of clamps equal within **0.030** inch. Torque nuts **100 TO 130** inch-pounds. Tap on clamp set (5) with fiber mallet to ensure good seating.

(d) Recheck torque on nuts (12) and install cotter pins.

(3) Install opposite end clamp set, positioned 90 degrees around shaft in relation to previously installed clamp set in same manner as outlined in step (2). Wipe any grease from shaft exterior. Install upper air filter assembly (paragraph 4-24). Install top half of FOD screen (figure 4-7).

d. Install baffle panel (6, figure 6-3). Close cowling.

e. After first ground runup, inspect areas around both main driveshaft couplings, in line with coupling clamps, for evidence of grease slinging. If grease leakage is indicated:

(1) Remove clamp sets to check for grease in grooves. If grease is found in clamp grooves, remove shaft and inspect couplings for lubrication and proper installation of packings.

(2) If no grease is found, reinstall clamps. Watch for further evidence of leakage in next runup.

6-14. ADAPTER — MAIN DRIVESHAFT.

6-15. DESCRIPTION — ADAPTER — MAIN DRIVESHAFT.

The main driveshaft adapter is installed between the engine output shaft and the main driveshaft. The adapter attaches to the outer coupling of the main driveshaft with a clamp set.

6-16. REMOVAL — ADAPTER — MAIN DRIVESHAFT.

a. Remove main driveshaft (paragraph 6-8).

b. Remove lockwire, bolt (2, figure 6-3), and locking washer (3). Pull adapter (4) out of engine output shaft.

6-17. INSPECTION — ADAPTER — MAIN DRIVESHAFT.

a. Inspect adapter splines visually for wear. If there is any evidence of wear, inspect dimensionally in accordance with figure 6-9.

b. Inspect splines for chipped or worn teeth. Replace if local damage exceeds **0.002** inch depth and/or **10** percent of the total effective spline surface.

c. Inspect for nicks, burrs, and scratches. Minor nicks, burrs, and scratches are acceptable if polished out and maximum area of damage after polishing out is less than **5** percent of the plated area.

d. Inspect adapter for cracks. No cracks are acceptable.

6-18. REPAIR — ADAPTER — MAIN DRIVESHAFT.

a. Replace adapter If damaged in excess of acceptable limits noted in paragraph 6-17.

b. Polish out scratches, nicks, and burrs that are within limits noted in paragraph 6-17. Use fine India stone (C116). Touch-up repair area with primer (C88 or C91).

c. Remove superficial corrosion with Scotch-brite (C103).

6-19. INSTALLATION — ADAPTER — MAIN DRIVESHAFT.

a. Insert adapter (4, figure 6-3) into engine output shaft.

b. Install bolt (2) and locking washer (3) with short tab of washer in slot of adapter. Torque bolt **160 TO 200** inch-pounds and lockwire (C137) head to tab on washer.

SECTION III. MAIN TRANSMISSION

6-20. TRANSMISSION ASSEMBLY.

6-21. DESCRIPTION — TRANSMISSION ASSEMBLY.

a. The transmission is located directly ahead of engine. It is supported in the helicopter pylon structure by four main mounts and the fifth mount. The engine furnishes power to the transmission through the main driveshaft. The transmission drives the main rotor mast through a spiral bevel gear set and two planetary reduction stages. A free-wheeling unit in the input quill coupling disengages to allow main rotor and gear train to turn freely when engine is stopped or is idling below rotor-driving speed, as in autorotational descent. Secondary gear trains drive tail rotor shaft, rotor tachometer generator, hydraulic pumps, transmission oil pump, and alternator. See figure 6-10 for view of quills which drive these components.

b. **E** **M** An input bevel gear also drives alternator drive quill (5, figure 6-10) on the left side of transmission main case (11).

6-22. SERVICING — TRANSMISSION ASSEMBLY.

Refer to paragraph 1-5.

6-23. ALIGNMENT — TRANSMISSION ASSEMBLY.

Refer to paragraph 6-7.

6-24. REMOVAL — TRANSMISSION ASSEMBLY.

Premaintenance Requirements for Transmission

Conditions	Requirements
Model	AH-IS
Part Number or Serial Number	All
Special Tools	(T45) (T49) (T66) (T72)
Test Equipment	None
Support Equipment	(S4)
Minimum Personnel Required	Two
Consumable Materials	(C25) (C26) (C41) (C46) (C52) (C53) (C57) (C86) (C79) (C80) (C88 or C91) (C114) (C121) (C127)
Special Environmental Conditions	None

CAUTION

If the transmission is being removed prior to normal overhaul, for internal failure or metal particles, clean all oil lines, replace cockpit air blower drive quill, hydraulic pump and tachometer drive quill, oil cooler, mast assembly, and transmission external oil filter.

a. When the transmission is to be replaced, unless conditions prevent operation, perform a ten minute ground runup and drain opearting oil. If runup is not practical, remove mast assembly and spray the interior of the transmission through the top opening with approximately one gallon lubricating oil (C79) or (C80) of the type that has been used in the transmission. While spraying, manually rotate internal gears and bearings by turning the input drive quill (3, figure 6-10) clockwise. Drain oil from transmission. Attach tag to the transmission stating: TRANSMISSION PRESERVED WITH LUBRICATING OIL, MIL-L-7808 or MIL-L-23699, as applicable.

NOTE

Transmission and mast may be removed with swashplate and support, collective lever, and pitch links attached.

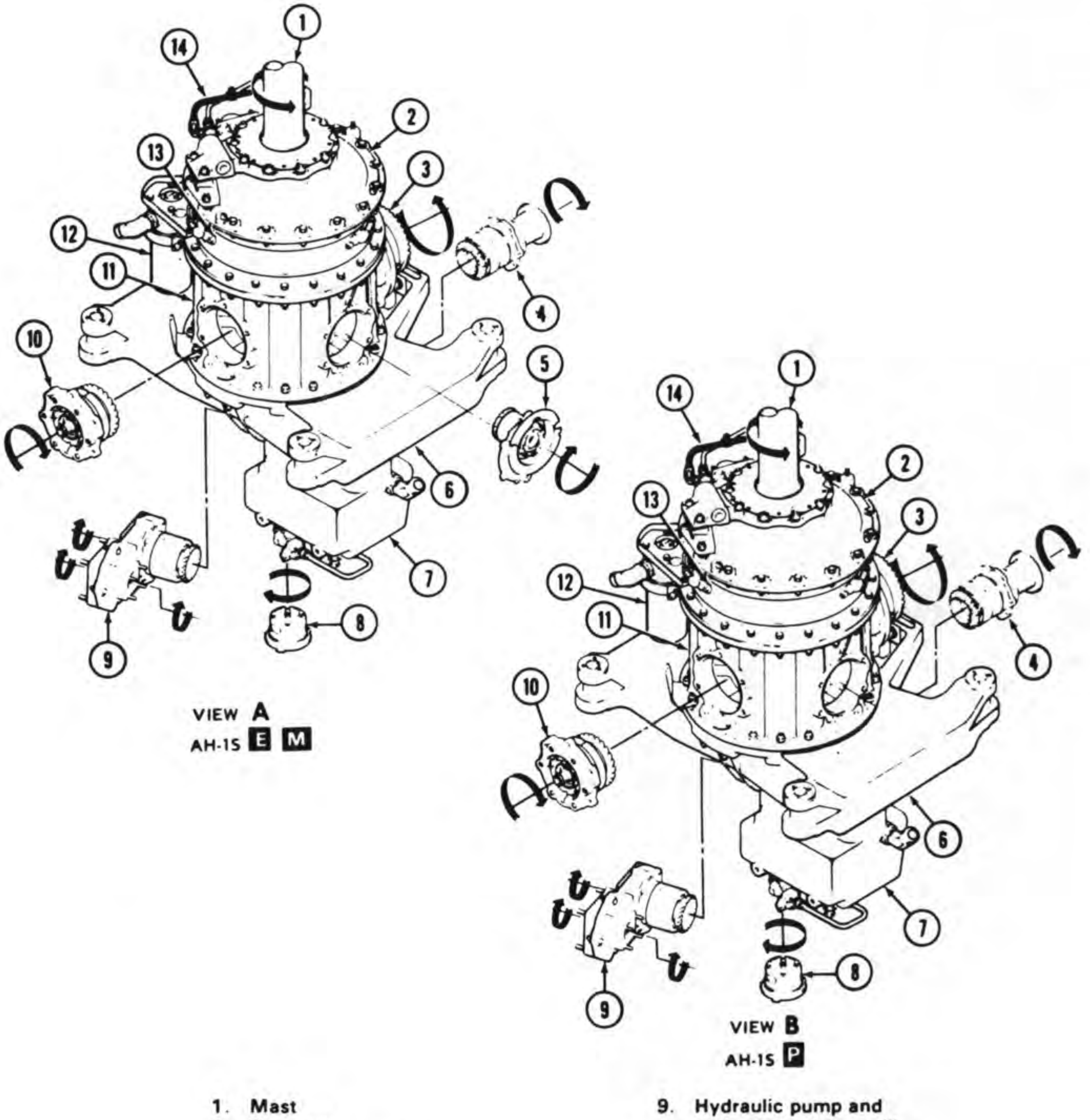
b. Open cowl doors on both sides of engine compartment Detach both forward doors from helicopter by removing nuts, washers, and bolts in hinges. Disconnect electrical harness at door.

c. Remove both upper fairing side panels.

d. Disconnect battery and electrical connections.

e. Remove main driveshaft (paragraph 6-8).

f. Remove tail rotor forward driveshaft (paragraph 6-77).



1. Mast
2. Top case
3. Input drive quill
4. Tail rotor drive quill
5. Alternator drive quill
6. Support case
7. Accessory drive and sump case
8. Transmission oil pump
9. Hydraulic pump and tachometer drive quill
10. Fan drive quill
11. Main case
12. Oil filter
13. Ring gear case
14. Mast bearing oil hose

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Figure 6-10. Transmission Quills

g. Without disconnecting hydraulic lines, remove the two hydraulic pumps from drive pad on right side of transmission sump case and set back clear of transmission. Remove oil tube from sump case (14, figure 6-11).

h. Disconnect two oil hoses from oil cooler bypass valve (23, figure 6-12). Disconnect sump drain coupling (24).

i. Detach ducting from blower at front of transmission.

j. E M Disconnect electrical wires and electrical connectors from alternator. Identify location of wires for use on installation. Protect wires, receptacles, and plugs with caps or electrical tape (C121).

k. P Remove transducer at fifth mount (paragraph 11-118).

l. Disconnect transmission instrumentation wiring electrical connector at right side of transmission compartment.

m. Remove main rotor (paragraph 5-12). If mast controls are to be removed, refer to paragraph 5-49.

n. Install mast nut (1, figure 6-11) on mast (2). Attach hoist (T45) and take up cable slack.

o. Disconnect cyclic control tubes and elevator control tube from swashplate control horns. Disconnect collective control tube from collective lever.

p. Remove bolt assembly (10). If bolt is binding, apply slight tension on hoist to lift transmission slightly.

q. Remove bolt assembly (30). Move lift link (17) out of lift beam (29) and reinstall bolt assembly (30), washer (31), and nut (32) in lift link.

r. Remove four bolts (22), washers (23), and retaining washers (24).

CAUTION

Extreme care must be taken when removing transmission to prevent damage to lines, hoses, and airframe components.

s. Carefully hoist mast and transmission assembly clear of fuselage structure.

t. If transmission is not to be reinstalled, remove bolt assembly (21). Remove lift link from transmission and reinstall bolt assembly (21), washer (20), and nut (19) in lift link (17).

u. Place transmission on stand (T72) equipped with adapter (T49). Secure with bolts through transmission support case.

v. If transmission is being replaced, transfer the following components to the new transmission.

(1) Electrical harness.

(2) All accessories.

(3) Cockpit air blower (paragraph 13-51).

(4) E M Alternator.

6-25. REMOVAL — TRANSMISSION RELATED PARTS.

CAUTION

If the transmission was removed due to internal failure and/or metal particles on oil filters or magnetic chip detector, replace oil cooler, mast assembly, hydraulic pump drive quill and alternator drive quill, E/M. Attach a tag to each of these parts and to the transmission, showing that the parts are suspected of being metal particle contaminated. Clean all metal particles from all oil hoses and tubes prior to installing the hoses and tubes on a replacement transmission.

a. Remove number 8 oil jet hose (6, figure 6-12) and clamp.

b. Remove mast assembly (paragraph 6-69).

c. Remove oil cooler (paragraph 6-143).

d. P Remove two nuts (6, figure 6-13) aluminum washers (7) and transducer mounting bracket from tail rotor driveshaft quill.

6-26. INSPECTION — TRANSMISSION RELATED PARTS.

a. Inspect all threaded fittings for damaged threads and cracks.

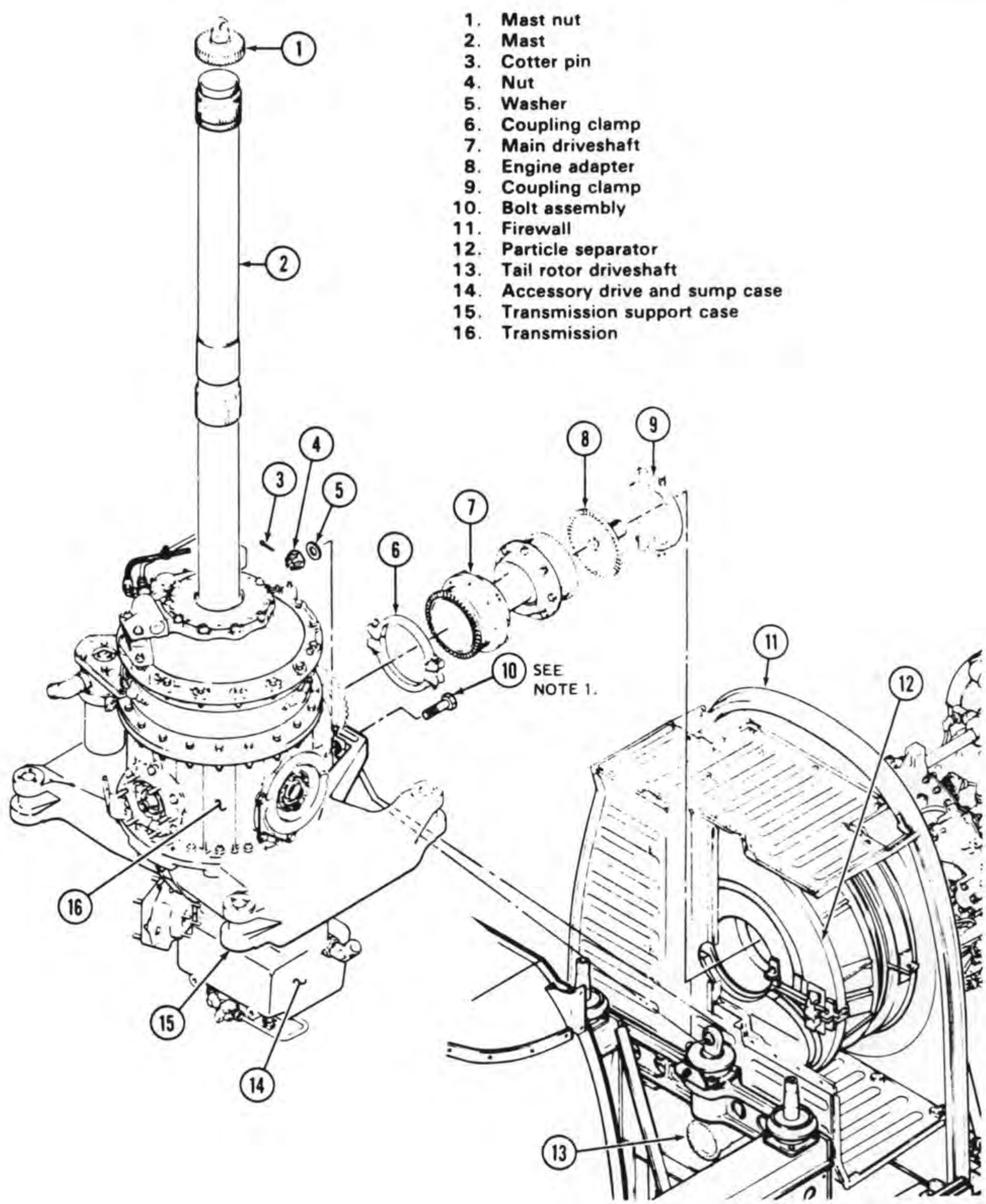
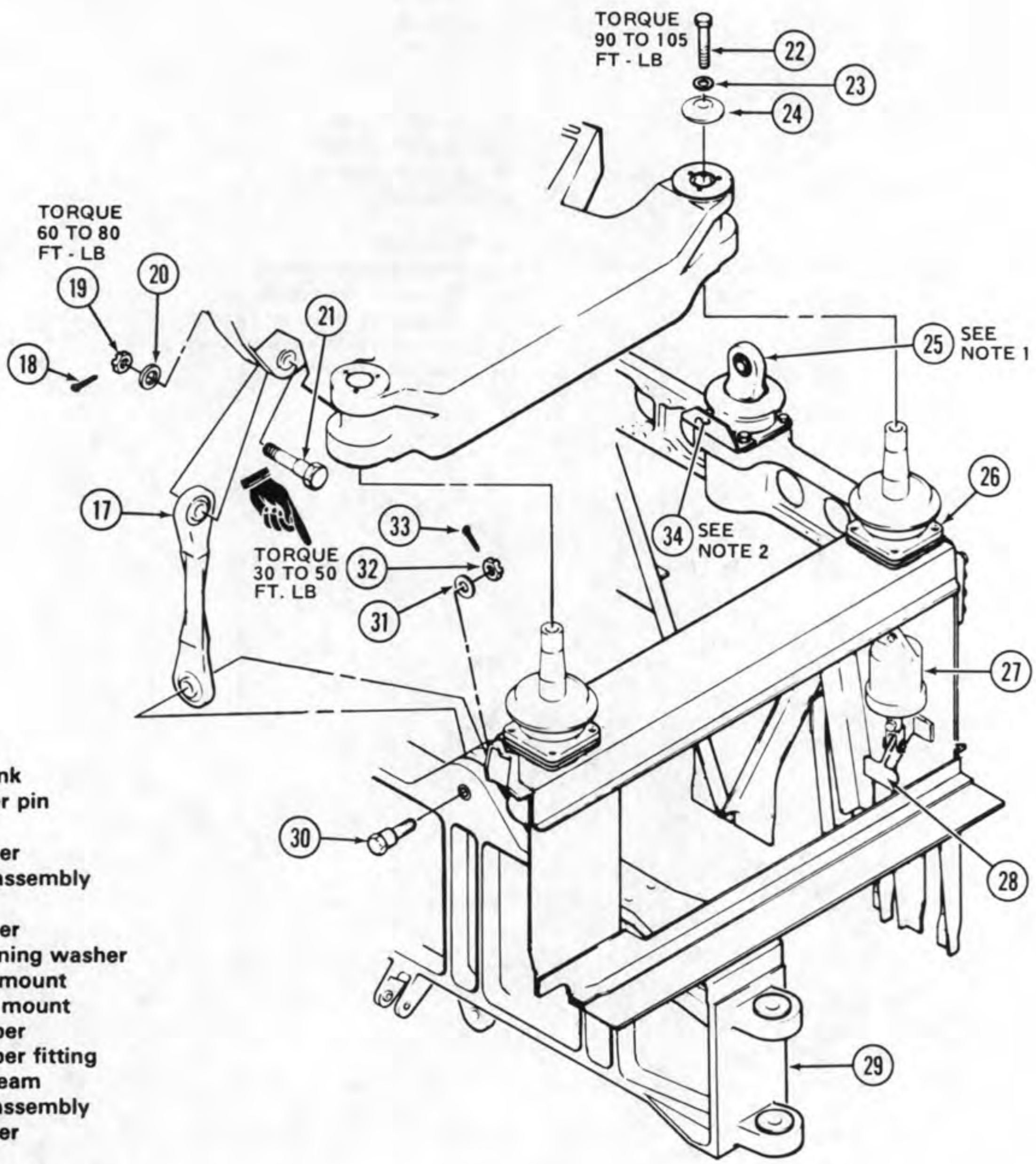


Figure 6-11. Transmission Installation (Sheet 1 of 2)



17. Lift link
18. Cotter pin
19. Nut
20. Washer
21. Bolt assembly
22. Bolt
23. Washer
24. Retaining washer
25. Fifth mount
26. Main mount
27. Damper
28. Damper fitting
29. Lift beam
30. Bolt assembly
31. Washer
32. Nut
33. Cotter pin
34. Transducer bracket

NOTES:

1. Refer to chapter 2 for instructions to install fifth mount to transmission attachment bolt or bolt assembly as applicable.
2. Transducer attachment bracket is not used on E or M coded helicopters.

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Figure 6-11. Transmission Installation (Sheet 2 of 2)

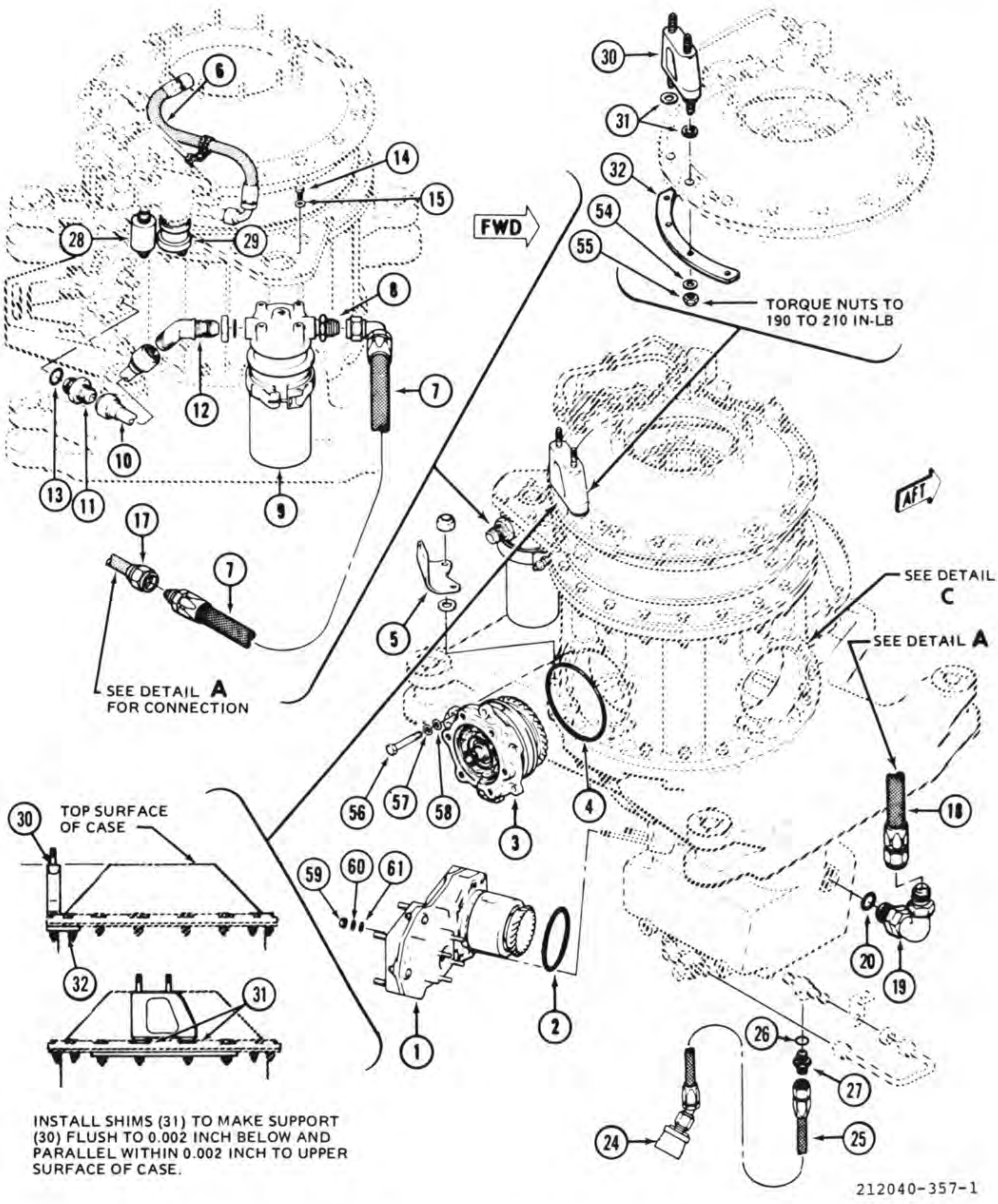


Figure 6-12. Transmission Buildup (Sheet 1 of 3)

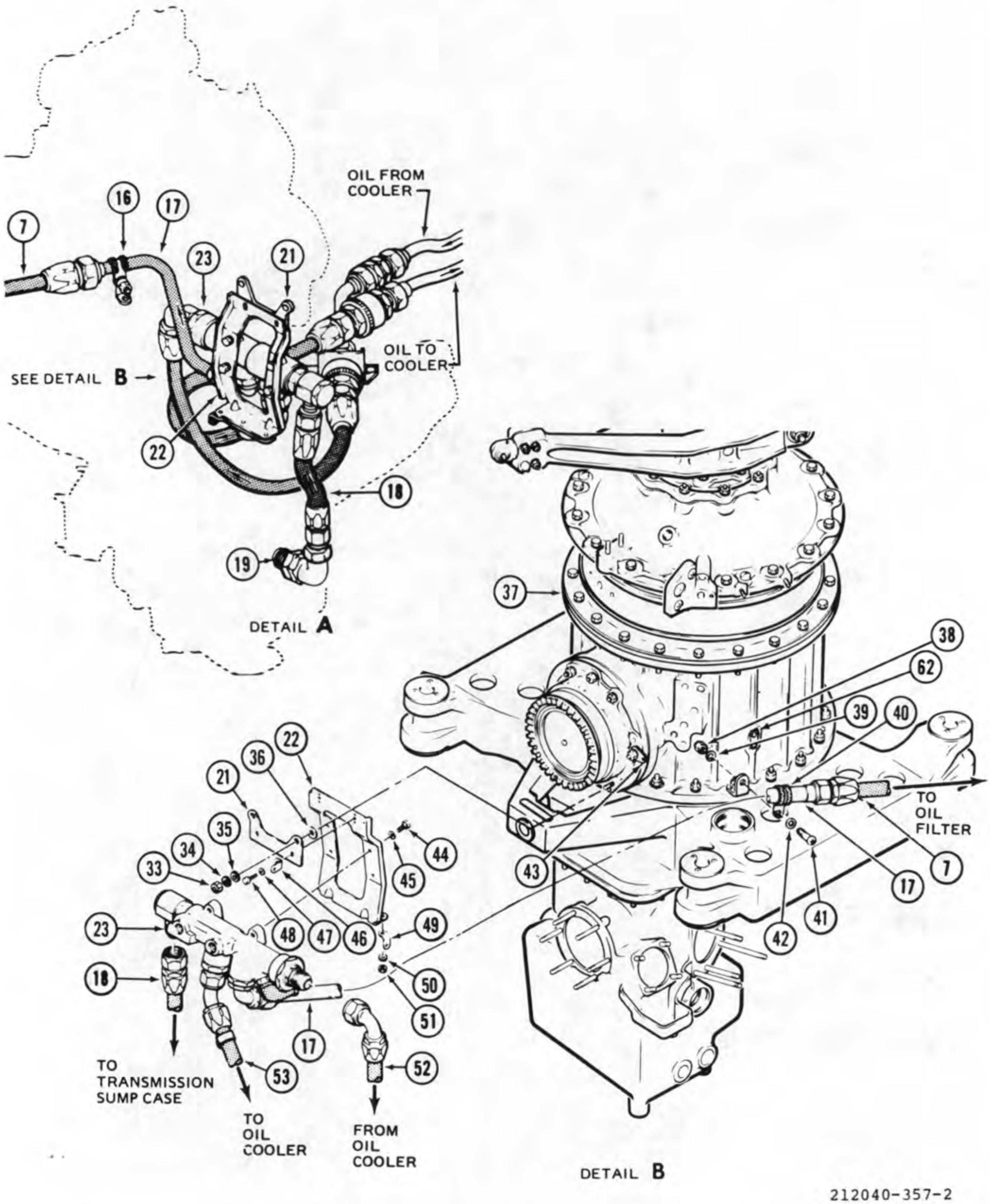
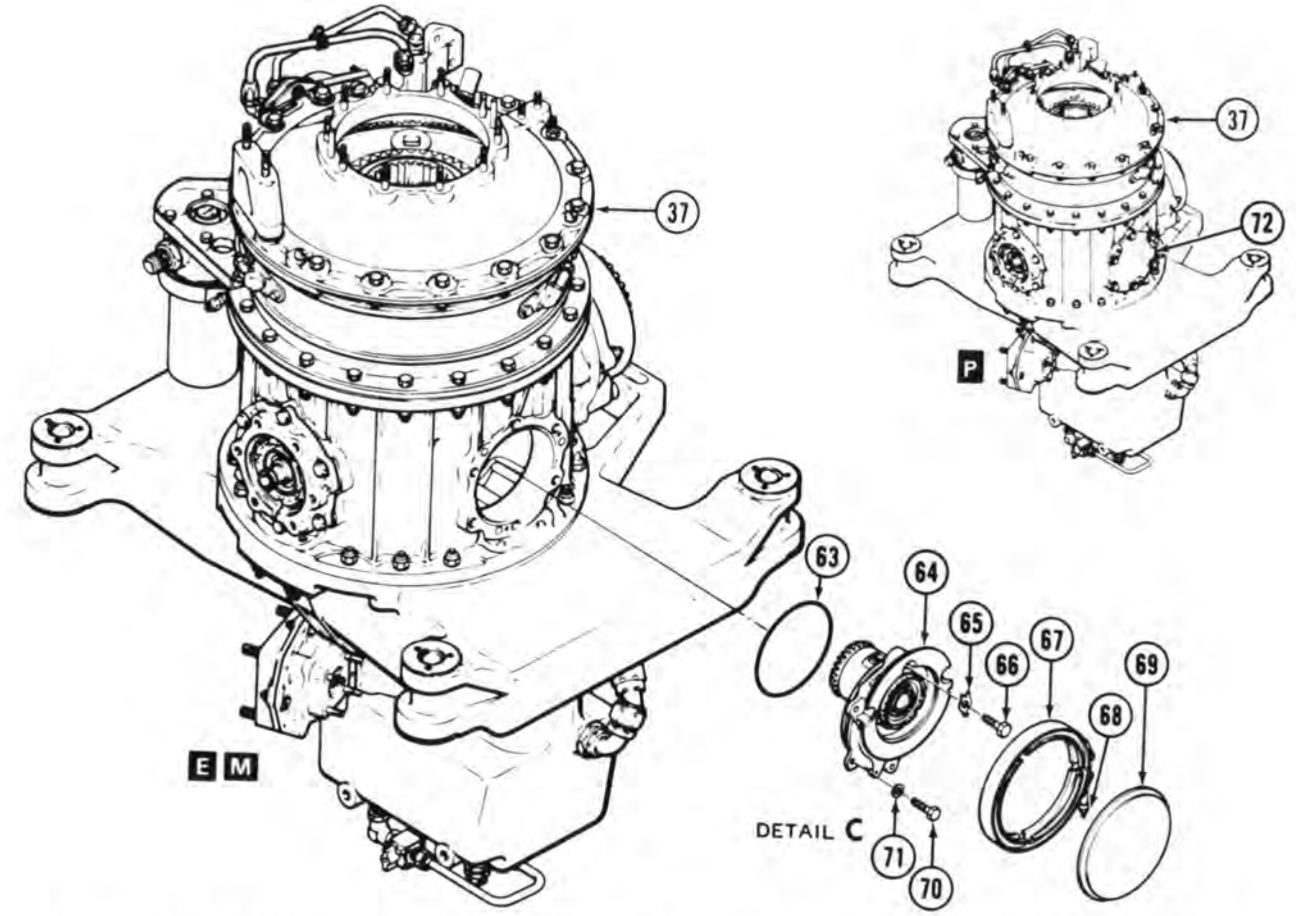


Figure 6-12. Transmission Buildup (Sheet 2 of 3)



1. Hydraulic pump and tachometer drive quill
2. Packing
3. Fan drive quill
4. Packing
5. Bracket
6. Hose assembly
7. Hose
8. Union
9. External oil filter
10. Tube
11. Union
12. Elbow
13. Packing
14. Bolt
15. Aluminum washer
16. Clamp
17. Hose assembly
18. Hose assembly
19. Elbow adapter
20. Packing
21. Bracket
22. Bracket
23. Bypass valve
24. Coupling half
25. Hose assembly
26. Packing
27. Union
28. Oil pressure switch
29. Oil pressure transmitter
30. Support
31. Shim
32. Support plate
33. Self-locking nut
34. Thin steel washer
35. Aluminum washer
36. Aluminum washer
37. Transmission
38. Nut
39. Thin aluminum washer
40. Clamp
41. Screw
42. Thin aluminum washer
43. Clip
44. Bolt
45. Thin steel washer
46. Bracket
47. Steel washer
48. Bolt
49. Bracket
50. Thin aluminum washer
51. Nut
52. Hose
53. Hose
54. Thin steel washer
55. Self-locking nut
56. Bolt
57. Steel washer
58. Aluminum washer
59. Self-locking nut
60. Thin steel washer
61. Aluminum washer
62. No. 6 oil jet
63. Packing
64. Alternator drive quill
65. Lock (tab) washer
66. Bolt
67. Rim clenching clamp
68. Nut
69. Alternator drive quill cap
70. Bolt
71. Steel washer
72. Alternator drive quill pad cover

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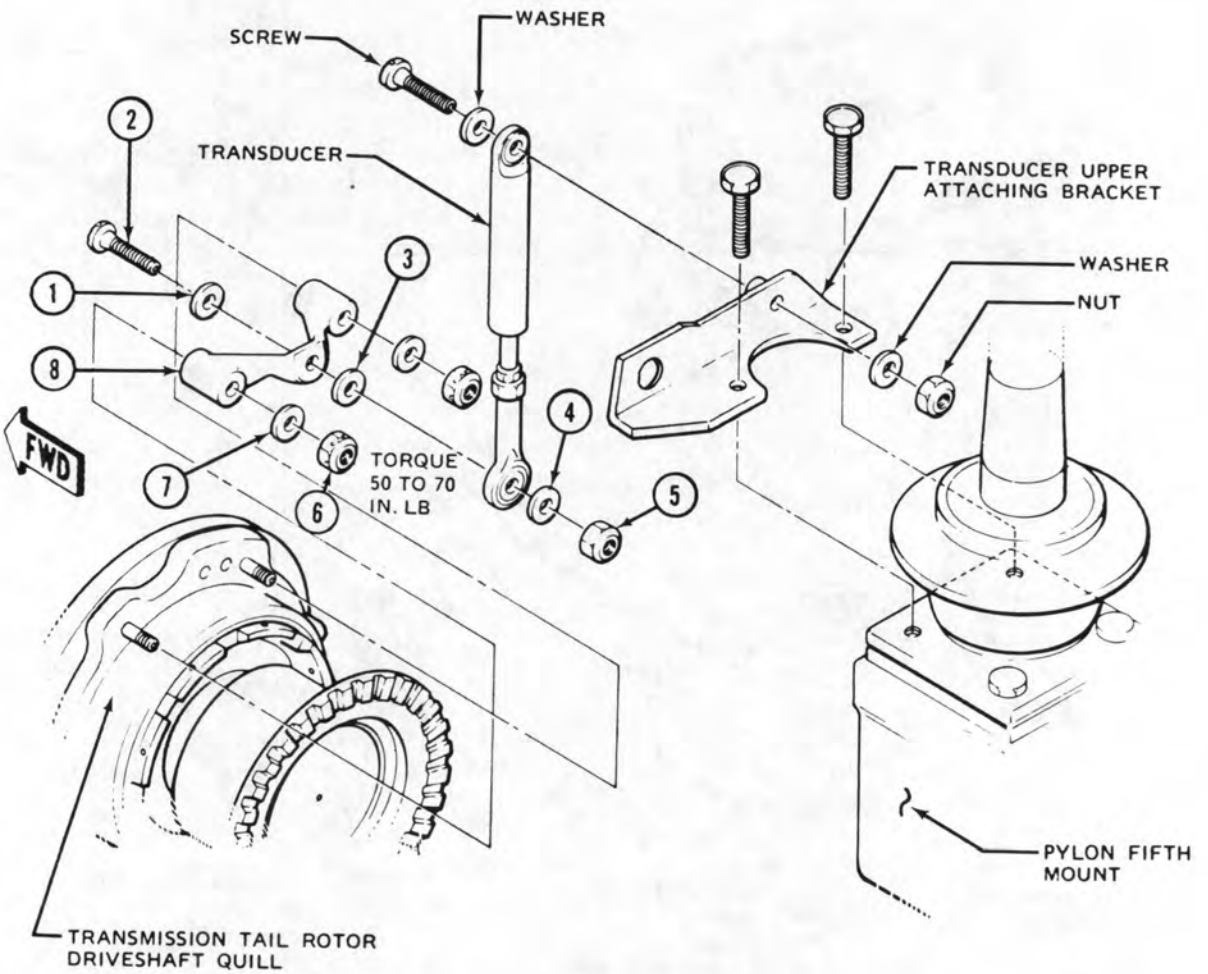
Figure 6-12. Transmission Buildup (Sheet 3 of 3)



1. Aluminum washer
2. Screw
3. Aluminum washer
4. Aluminum washer
5. Nut
6. Nut
7. Aluminum washer
8. Transducer mounting bracket

Figure 6-13. P Transducer Bracket Installation

b. Inspect all brackets and clamps for distortion and cracks.

c. Inspect all hose assemblies for deterioration and damaged fittings.

d. Inspect all tubes for distortion and damaged fittings.

6-27. REPAIR — TRANSMISSION RELATED PARTS.

a. Replace all transmission related parts that failed to pass inspection requirements.

b. Clean hoses and tubes thoroughly.

6-28. INSPECTION — INSTALLED TRANSMISSION AND MAST ASSEMBLY.

a. Inspect the following oil strainers and magnetic chip detector for metal particles. If any particles are found, refer to paragraph 6-4 for required corrective action.

(1) Magnetic chip detector (paragraph 6-176).

(2) External oil filter (paragraph 6-158).

(3) Internal oil filter (transmission sump primary) (paragraph 6-161).

b. Inspect transmission for loose, missing, and damged bolts and studs.

c. Inspect transmission for damage in accordance with figure 6-14.

d. Inspect transmission for oil leakage. If any defects are noted, refer to appropriate paragraph in Section VII.

e. Inspect transmission for corrosion and mechanical damage.

f. Inspect main rotor mast (paragraph 6-71).

6-29. REPAIR OR REPLACEMENT — TRANSMISSION ASSEMBLY.

a. Replace transmission if damaged in excess of reparable limits.

b. Replace any loose or damaged standard type studs as follows:

NOTE

These instructions are for studs of standard type; threaded directly into transmission case and for studs and thread inserts which have a serrated locking ring, with inner teeth engaged on a serrated collar of stud or insert and outer teeth broached into material of transmission case. Tools for installation and removal are made by manufacturer of these parts. When such tools are not available, replacement can be accomplished with other tools, provided careful workmanship is applied.

(1) Measure stud height, if possible, before removal. Use suitable tool to grip stud and turn out slowly and evenly to avoid seizure and breakage. If broken off, drill hole in stud on center to use any easy-out type extractor.

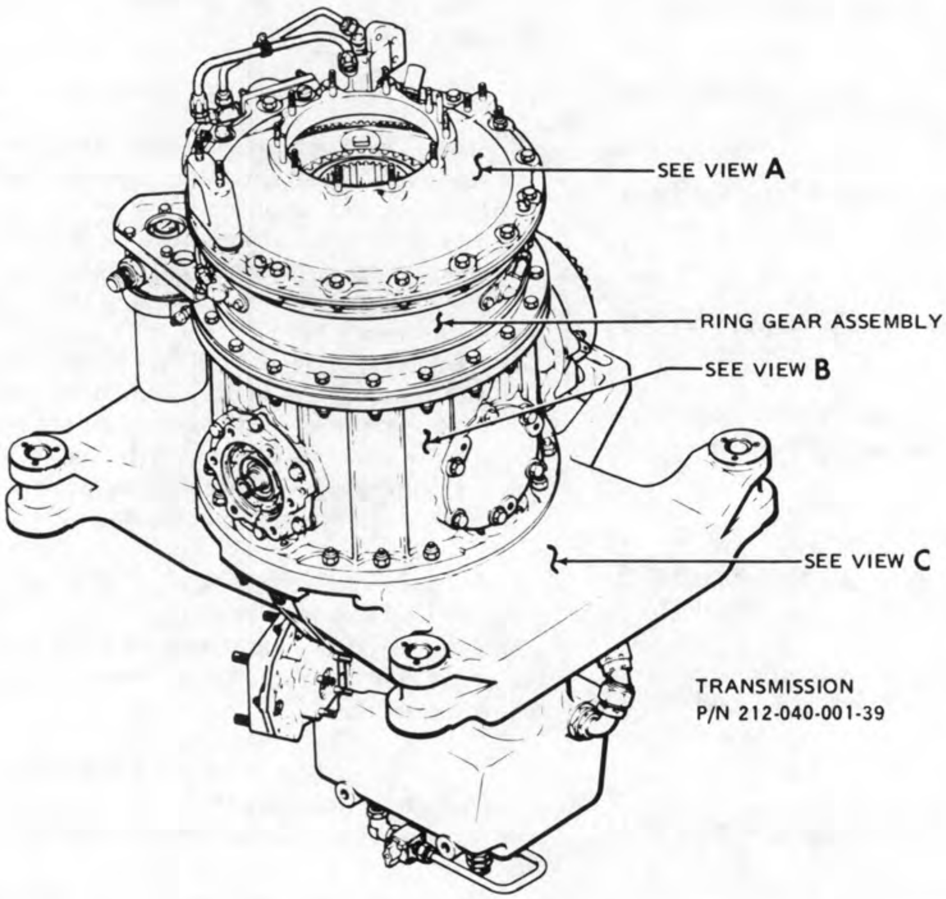
(2) If tapped hole in case has a small vent hole at the bottom of the tapped hole, ensure that the vent hole is open prior to installing the new stud.

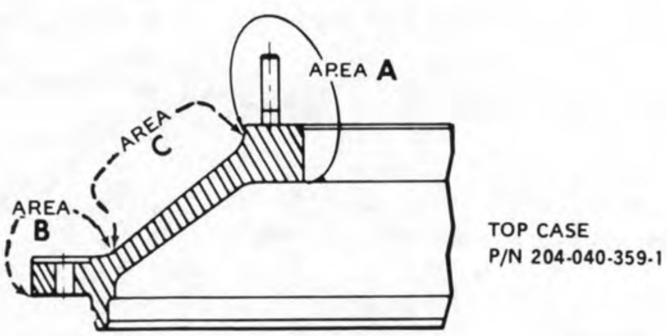
(3) Select replacement stud by reference to Repair Parts Appendix, which provides an undersize and four oversizes (by 0.003 inch increments) to each standard stud. Generally, next larger oversize will be required for proper installation torque. Start new stud into tapped hole with fingers. If it turns freely beyond two turns, select next oversize which will engage in one or two turns with fingers.

(4) Remove replacement stud, and coat end with primer (C88 or C91) to prevent contact of dissimilar metals. Start stud into tapped hole.

(5) Use a suitable tool to turn stud slowly and evenly into hole. Check stud for squareness with machined surface of case. As stud is installed to proper depth, check that torque is within limits of following table:

Stud Size	Inch-Pounds Torque
1/4	50 TO 95
5/16	100 TO 225
3/8	175 TO 375





VIEW A

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Figure 6-14. Damage Limits — Transmission (Sheet 1 of 6)

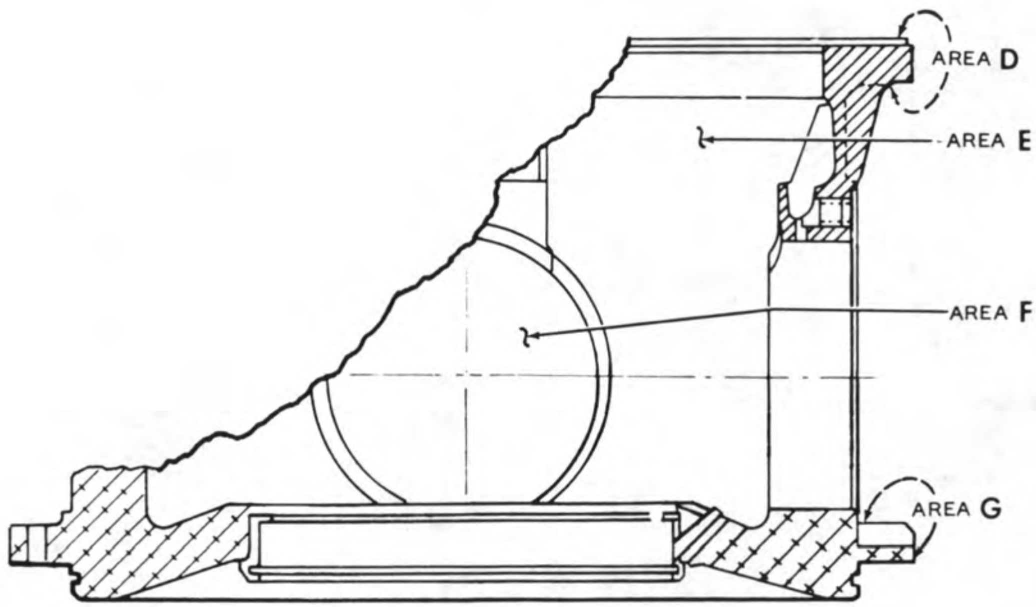

Figure 6-14. Damage Limits — Transmission (Sheet 2 of 6)

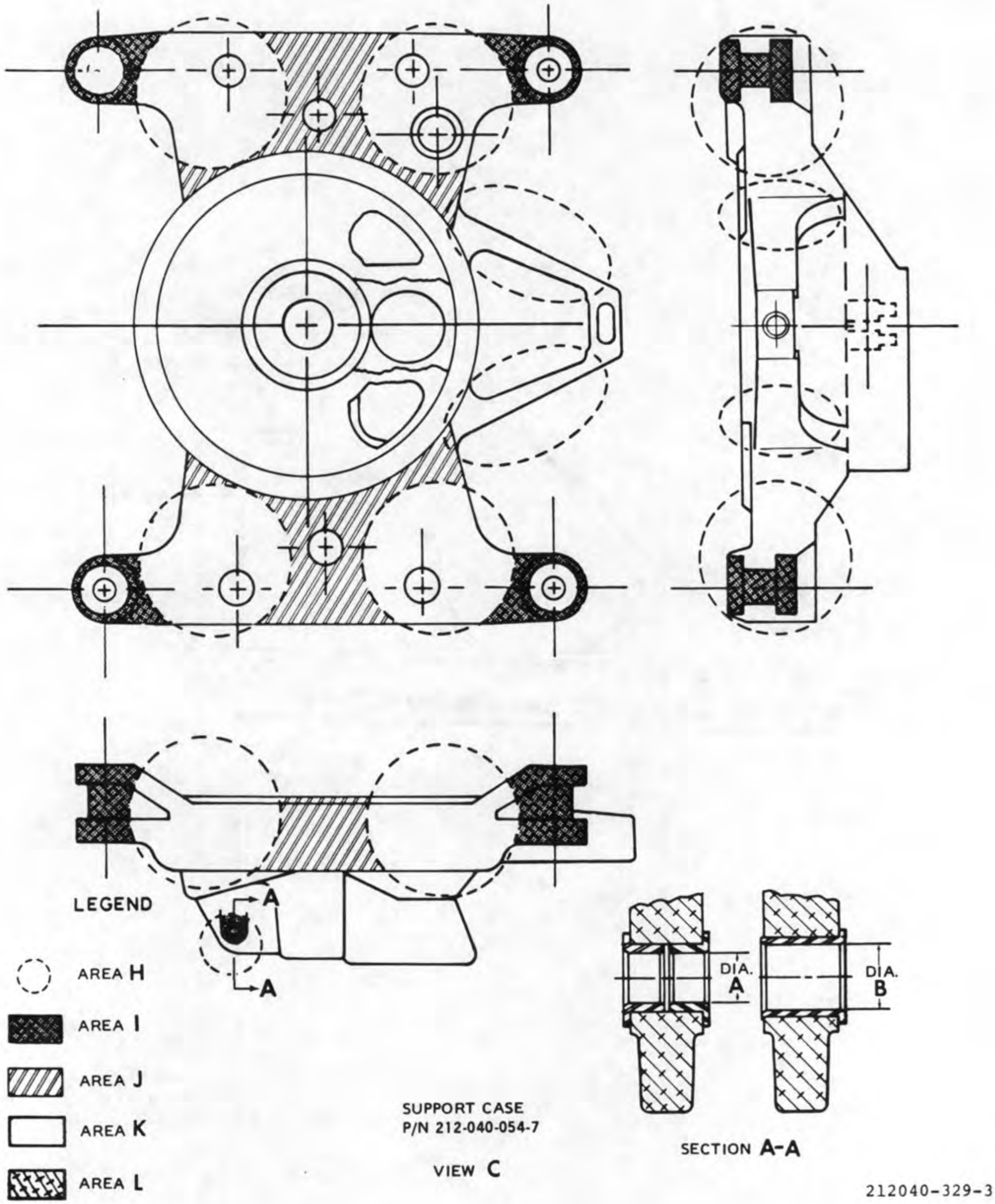

Figure 6-14. Damage Limits — Transmission (Sheet 3 of 6)

AREA	LIMITS
All	No cracks allowed.
A and B	Corrosion in Area "A" at mast mounting port or in Area "B" where top case to ring gear assembly attaching bolts are installed is cause to replace transmission.
C	Mechnical or corrosion damage on top case outside areas noted in preceding paragraph is acceptable if following conditions are met: 1. Maximum depth after polishing out damage is 0.020 inch. 2. Maximum area of damage is 25 percent of the total area, 3. Damaged area is treated for corrosion protection in accordance with general instructions.
D	Corrosion in Area "D" where main case to ring gear attaching bolts are installed is cause to replace transmission.
E	Mechanical and corrosion damage limits on exterior surface of main case and outside Area "D" and "G" are the same as stated for Area "C".
F	A loose bearing liner for the bearing that supports the forward end of the input drive quill and/or corrosion between the bearing liner and the case is cause to replace the transmission.
D and G	Corrosion in Area "D" where main case to ring gear attaching bolts are installed is cause to replace transmission. Corrosion in Area "G" where main case to support case attaching studs are installed is cause to replace transmission. Mechanical or corrosion damage in Area "D" and Area "G" that does not extend under nuts and washers is acceptable if following conditions are met: 1. Maximum depth after polishing out damage is 0.020 inch. 2. Maximum area of damage within any one square inch is 20 percent. 3. Maximum area of damage in total area is 10 percent. 4. Damaged area is treated for corrosion protection in accordance with general instructions.
H	Mechanical or corrosion damage in Area "H" is acceptable if following conditions are met: 1. Maximum depth after polishing out damage on flat surfaces is 0.010 inch, and maximum length is 1.0 inch. 2. Maximum depth after polishing out damage on radii is 0.030 inch, and maximum length is two inches.

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Figure 6-14. Damage Limits — Transmission (Sheet 4 of 6)

AREA	LIMITS
H	3. Damage is polished out and blended smoothly into surrounding surface. 4. Damaged area is treated for corrosion protection in accordance with general instructions.
I	Mechanical or corrosion damage in Area "I" is acceptable if following conditions are met: 1. Maximum depth after polishing out damage on flat surfaces is 0.040 inch. 2. Maximum depth after polishing out damage on radii is 0.060 inch. 3. Damaged area is treated for corrosion protection in accordance with general instructions.
J	Mechnical or corrosion damage in Area "J" is acceptable if following conditions are met: 1. Maximum depth after polishing out damage on flat surfaces and radii is 0.060 inch. 2. Damaged area is treated for corrosion protection in accordance with general instructions.
K	Mechnical or corrosion damage in Area "K", which consists of all areas not covered by Areas "H", "I", and "J", is acceptable if following conditions are met: 1. Maximum depth after polishing out damage is 0.010 inch. 2. Damage area is treated for corrosion protection in accordance with general instructions.
L	Wear and damage to lift link bushings installed in Area "L" is acceptable if following conditions are met: 1. Diameter "A" must not be greater than 0.7505 inch. 2. Diameter "B" must not be greater than 0.1005 inch. 3. Surface finish inside bushings must be 40 RHS (roughness height ratio) or better. 4. Bushings must be securely mounted in case. Loose bushings, signs of yielding, and/or cracks in lift link bushing support lugs is cause to replace transmission.

GENERAL INSTRUCTIONS

1. Evidence of corrosion under shim plates at quill mounting ports is cause to replace the transmission and/or affected quill.
2. Loose or damaged studs at Area "A" and loose studs or inserts at any of the quill mounting ports are cause to replace the transmission.

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Figure 6-14. Damage Limits — Transmission (Sheet 5 of 6)

GENERAL INSTRUCTIONS (Continued)

3. Polish out corrosion damage to twice the depth of the corrosion. Finish polishing out with 400 grit abrasive paper (C102) to blend repairs smoothly into surrounding surface. Ensure that depth and/or area of repair does not exceed acceptable limits specified for the areas designated above. Treat reworked areas for corrosion protection with MIL-M-3171C, Type VI treatment. This is commercial designation Dow No. 19. Refer to TM 43-0105 for application procedures. Prime all rework areas that were painted prior to repair. Use polyamide epoxy primer (C88). Paint to match existing finish.

4. Polish out mechanical damage to depth to remove all traces of the damage. Finish polishing out with 400 grit abrasive paper (C102) to blend repair smoothly into surrounding surface. Ensure that damage does not exceed acceptable limits. Apply corrosion protection, prime, and paint in same manner prescribed in preceding step.

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Figure 6-14. Damage Limits — Transmission (Sheet 6 of 6)

c. Replace loose or damaged lock-in studs as follows:

(1) To remove a threaded insert, select a drill equal in diameter to that of serrations between locking ring and insert. Drill to depth equal to ring thickness. Remove insert with a square-type extracting tool. If lockring fails to come out, collapse remaining portion of ring with punch.

(2) To remove a stud, use a hollow mill with outside diameter 1/64 inch less than root diameter of outer serrations of lockring. Mill to depth equal to ring thickness. Remove stud and any remaining portion of ring. If hollow mill is not available, saw stud off, use drill as in step (1), and remove stud with an easy-out extractor.

(3) Check condition of tapped hole and counterbore. Holes are tapped with standard Class 3 tap. Counterbore has 90 degree shoulder and can be cleaned up as necessary. Avoid enlargement of holes, since this would require oversize parts.

(4) If tapped hole in case has a small vent hole at the bottom of the tapped hole, ensure that the vent hole is open prior to installing the new stud.

(5) Coat threads of new stud or insert with unreduced primer (C91). Install the new stud or insert into tapped hole with suitable tool until top surface of serrated collar is **0.010 TO 0.020** inch below surface of parent material.

(6) Place locking ring over stud or insert and line up teeth of ring with teeth of serrated collar. Drive ring into material flush with top of insert or stud collar.

d. Replace transmission oil system components that fail to pass inspection requirements. Refer to appropriate paragraph in chapter 6, section VII.

e. Repair transmission oil system components that have damage within repairable limits. Refer to appropriate paragraph in chapter 6, section VII.

6-30. INSPECTION — TRANSMISSION MOUNT COMPONENTS.

a. Inspect pylon structure and lift beam (29, figure 6-11) for damage.

b. Inspect lift link (17) for damage.

c. Inspect four main mounts (26) (paragraph 2-224).

d. Inspect two dampers (27) for damage and leakage (paragraph 2-236). Inspect dampers for secure installation in pylon structure.

e. Inspect damper fitting (28) for damage and for secure installation in pylon structure.

f. Inspect fifth mount (25) (paragraph 2-226).

6-31. REPAIR — TRANSMISSION MOUNT COMPONENTS.

a. Replace transmission mount components that fail to pass inspection requirements. Refer to appropriate paragraph in chapter 2 for main mounts

(26, figure 6-11), fifth mount (25), dampers (27), and damper fittings (28).

b. Repair dampers (27) that have damage within reparable limits (paragraph 2-251).

c. Replace damper fitting (28) if loose or damaged (paragraph 2-241).

6-32. INSTALLATION — TRANSMISSION RELATED PARTS.

a. Place serviceable transmission on a suitable stand.

b. Remove pad covers, caps, and plugs from serviceable transmission. See figure 6-15.

c. Install pad covers, caps, and plugs that were removed in preceding step on unserviceable transmission.

d. Clean all sealant from serviceable transmisison where quill pad covers were removed. Use a sharp plastic scraper.

e. Install electrical harness using clamps and hardware. Attach harness to electrical components.

f. Install main rotor mast (paragraph 6-73).

g. Connect number 8 oil jet hose (6) and secure with clamp.

h. P Install transducer mounting bracket (8, figure 6-13).

6-33. INSTALLATION — TRANSMISSION ASSEMBLY.

a. Install main mast if not previously accomplished (paragraph 6-73).

b. Install air distribution blower (fan). Refer to paragraph 13-59.

c. Ensure that transmission mount components have been inspected in accordance with paragraph 6-30.

d. Install mast nut (1, figure 6-11). Attach hoist (T45) to mast nut, using clevis (S4).

e. Position lift link (17) on transmission and install bolt assembly (21), washer (20), and nut (19). Torque nut **60 TO 80** foot-pounds. Install cotter pin (18).

f. Carefully hoist transmission into position above helicopter with input quill facing aft. Lower the transmission onto mounts (26) and guide lift link (17) into clevis on lift beam (29).

g. Position height of transmission with hoist to align holes in lift link (17) and lift beam (29). Install bolt assembly (30), washer (31) and nut (32). Torque nut **30 TO 50** foot-pounds. Install cotter pin (33).

NOTE

The minimum breakaway torque is the minimum torque required to start removal of bolt (22) from the completely installed untorqued position. The purpose of determining breakaway torque in the following step is to ensure that the self-locking feature of the nylon insert bolt (22) is serviceable.

h. Install four bolts (22), washers (23), and retaining washers (24). Thread bolts into mounts to obtain full thread engagement but do not torque. Check breakaway torque of each bolt (22). Minimum acceptable breakaway torque is **24** inch-pounds. Replace bolts which have less than acceptable breakaway torque. Torque four bolts (22) **90 TO 105** foot-pounds.

i. Install fifth mount to transmission attaching bolt assembly (10) (paragraph 2-232).

j. Install hydraulic cylinder extension tubes on swash-plate and on collective lever (paragraph 11-152).

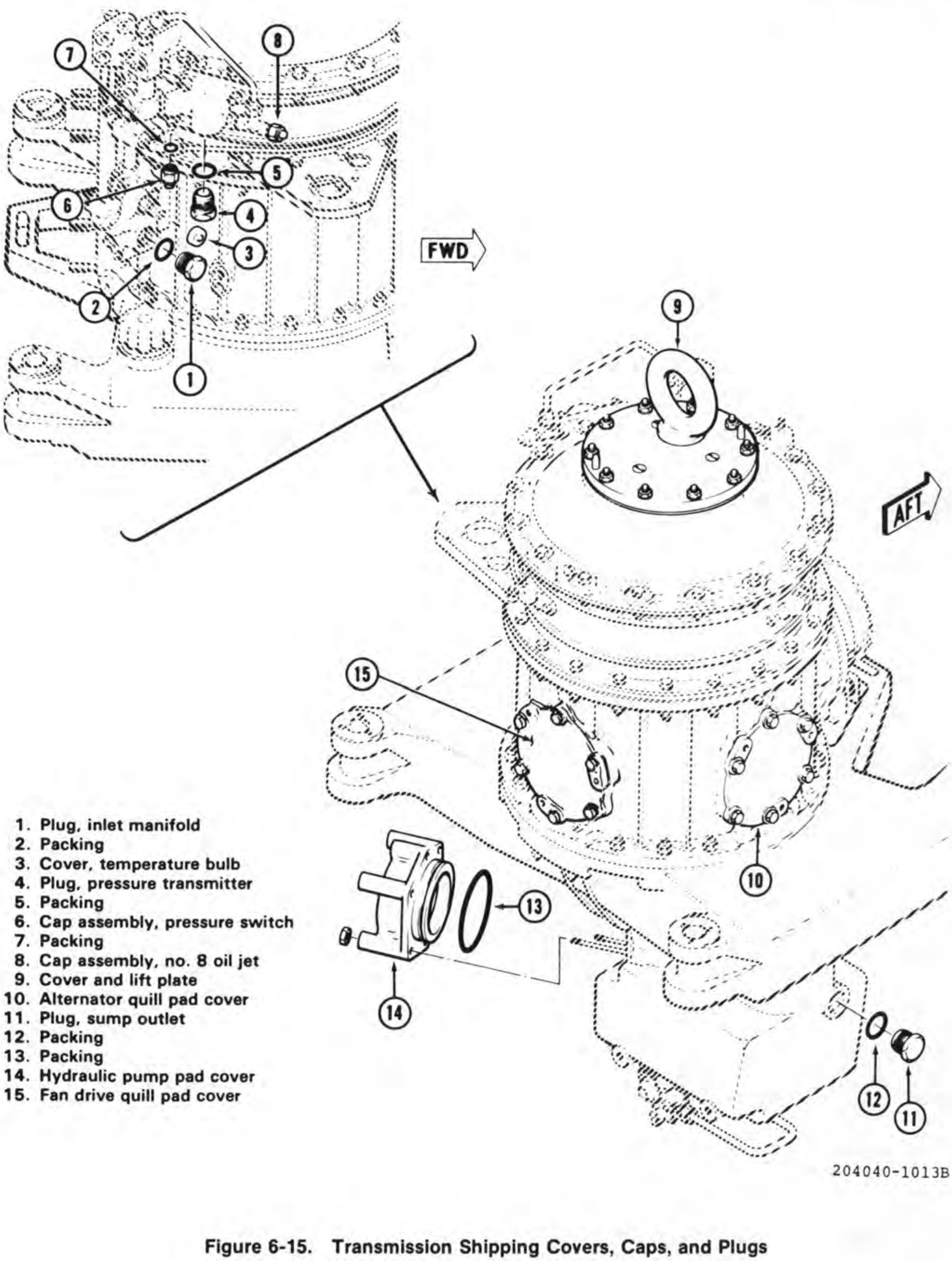
k. Install main rotor hub and blade assembly (paragraph 5-14).

WARNING

Ensure that crowned tooth coupling is properly lubricated prior to installation of driveshaft.

l. Install tail rotor driveshaft (paragraph 6-81).

m. If required, make engine to transmission alignment check (paragraph 6-7).



1. Plug, inlet manifold
2. Packing
3. Cover, temperature bulb
4. Plug, pressure transmitter
5. Packing
6. Cap assembly, pressure switch
7. Packing
8. Cap assembly, no. 8 oil jet
9. Cover and lift plate
10. Alternator quill pad cover
11. Plug, sump outlet
12. Packing
13. Packing
14. Hydraulic pump pad cover
15. Fan drive quill pad cover

Figure 6-15. Transmission Shipping Covers, Caps, and Plugs

n. Install main driveshaft (paragraph 6-13).

o. Connect two oil hoses from oil cooler to oil cooler automatic emergency bypass valve (13, figure 6-47). Ensure that oil filter (2) and external oil lines are properly installed on transmission.

p. Connect sump drain coupling (6, figure 6-47).

q. Attaching ducting to blower at front of transmission.

r. E M Install alternator (paragraph 9-165) and connect electrical wires and electrical connectors to alternator.

s. P Install transducer (figure 6-13) at fifth mount (TM 11-1520-236-20).

t. Connect transmission instrumentation electrical wiring connector at right side of transmission compartment.

u. Service transmission with oil (C79) or (C80).

v. Close transmission cowling.

w. Perform maintenance test flight (TM 55-1520-236-MTF).

6-34. PREPARATION FOR SHIPMENT — TRANSMISSION ASSEMBLY.

a. Remove main rotor mast assembly if not previously accomplished (paragraph 6-69).

b. Spray the interior of the transmission through the top opening with approximately one gallon lubricating oil (C79 or C80). Turn the main input quill clockwise while spraying to rotate the internal gears and bearings. After spraying is completed, drain lubricating oil from the transmission sump.

c. Install cover and lift plate (9, figure 6-15) immediately after the mast has been removed and the interior preservation has been completed.

d. Cap or plug all lines, as applicable, see figure 6-15. Cover breather hole and all other openings with barrier material (C23) or protective cap (C26) and secure with tape (C127). Secure all loose wires and lines to assembly with tape (C127) to prevent damage during shipment.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Keep rubber portions of container transmission pylon mounts free of any oil, grease, and solvents to prevent deterioration and weakening of bonds between rubber and metal.

e. Clean the exterior of the transmission to include splines and the threaded areas with solvent (C112). Air dry or wipe with a clean lint-free cloth.

CAUTION

Do not allow corrosion preventive compound to contact rubber parts.

f. Apply corrosion preventive compound (C41) to all exterior bare metal surfaces to include splines, studs, and threaded areas.

g. Cover the couplings on the input and tail rotor drive quills and all open accessory mounting pads with barrier material (C23) and secure with tape (C127).

h. Attach a tag to the transmission stating: TRANSMISSION PRESERVED WITH LUBRICATING OIL, MIL-L-7808 or MIL-L-23699.

i. Fill out a DD Form 1577-2 (Unserviceable/Repairable tag) and attach it directly to the transmission.

j. Fill out a DD form 1577-3 (tag or label) and attach it to the exterior of the transmission container in such a manner that will afford maximum protection from handling and weather. Refer to TB 750-126.

k. Fill out a DA form 2410, component removal and repair/overhaul record, in accordance with TM 38-750.

l. Install the transmission in a metal storage and shipping container as follows:

NOTE

If the container noted is not available, proceed to step m.

(1) Inspect the shipping container and be sure it is clean and satisfactory for use. Repair and/or clean the container if necessary.

(2) Carefully lower the transmission into the shipping container and align with shock mounts in the container. Install four mounting bolts, washers, and nuts. Torque nuts **700 TO 900** inch-pounds.

CAUTION

Desiccant bags must be secured in the transmission container in a manner to prevent contact with the transmission or corrosion damage will result. Do not use desiccant bags if an airtight container is not available.

(3) Place 56 units of dry desiccant (C49) into the transmission container in such a manner that the desiccant cannot touch the transmission during shipment.

(4) Position top of container over transmission and install bolts, washers, and nuts; torque nuts **265 TO 285** inch-pounds.

(5) Paint over old markings that do not apply to transmission in container. Mark container in accordance with MIL-STD-129.

m. If a metal storage and shipping container is not available, prepare the transmission for shipment as follows:

NOTE

This procedure is based on the assumption that the provisions of paragraph j cannot be complied with, that the work will be done under less than ideal conditions with limited equipment, and that on some occasions by personnel who are not experts in the field of preservation. Use this procedure only at locations where facilities for the application of normal preservation procedures do not exist.

(1) Comply with steps **a** through **k**.

(2) If caps, plugs, and barrier materials specified in steps d. and g. are not available, use barrier material and tape as substitutes.

(3) If corrosion preventive compound specified in step f is not available, substitute other grease-type corrosion preventive compound or bearing grease (C57).

(4) Cover the transmission with barrier material (C22) and secure with tape. Do not use desiccant.

(5) Install the transmission in the best available container or stand. Cushion, block, and brace the transmission as necessary to prevent damage.

(6) Mark the container as follows: Paint over old markings that do not apply to transmission in container. Mark the container in accordance with MIL-STD-129 and also include the following: THIS TRANSMISSION IS NOT PRESERVED FOR STORAGE. OVERHAUL OR PRESERVE FOR STORAGE AS SOON AS PRACTICABLE.

6-34.1. PYLON LIFT LINK — TRANSMISSION.

6-34.2. DESCRIPTION — PYLON LIFT LINK.

A pylon lift link is used to attach transmission to helicopter fuselage. The lift link transmits rotor lift to fuselage structure. The lift link is forged steel with self-aligning end bearings and is connected between transmission support case and a lift link support beam, which is attached to the fuselage.

6-34.3. REMOVAL — PYLON LIFT LINK.

Premaintenance Requirements for Pylon Lift Link — Transmission

Conditions	Requirements
Model	AH-1S
Part Number or Serial Number	All

Conditions	Requirements
Special Tools	(T45)
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C31), (C33), (C74), (C91), (C96)
Special Environmental Conditions	None
Test Equipment	None

a. Open and secure transmission cowl door on left side.

b. Attach hoist (T45), or other suitable lifting device, to main rotor retaining nut.

c. Remove cotter pins (18 and 33, figure 6-11), nuts (19 and 32), and washers (20 and 31), from bolts (21 and 30).

d. Using hoist, raise transmission until bolts (21 and 30) can be removed. Remove both bolts and lift link.

6-34.4. INSPECTION – PYLON LIFT LINK.

a. Inspect upper and lower lift link ends in bearing area, using 10X magnifying glass.

b. Suspected cracks should be inspected by the magnetic particle method (refer to TM 43-0103). Scrap lift link if any cracks are found.

WARNING

Paint remover (C96) is toxic and contains ingredients harmful to skin and eyes. Observe safety precautions printed on the container.

(1) Remove paint from lug areas, using paint remover (C96).

(2) Perform non-destructive inspection.

(3) After inspection thoroughly clean and dry the areas using cleaning compound (C33) and MEK (C74).

(4) Apply two cross-coats of primer (C91) to stripped areas.

c. Corrosion or mechanical damage, not exceeding **0.005** inch is permissible after cleanup, except in outboard **2.50** inches. No damage is permitted in outboard **2.50** inches, on either end of lift link.

d. Inspect bearings for a maximum allowable play of **0.008** inch radial and/or **0.016** inch axial.

6-34.5. REPAIR OR REPLACEMENT – PYLON LIFT LINK.

a. Replace lift link if cracked, damaged beyond allowable limits, or if bearing play exceeds limits.

b. Polish out corrosion or mechanical damage that is within allowable limits (refer to TM 43-0105).

c. Refinish polished area with primer (C91).

6-34.6. INSTALLATION – PYLON LIFT LINK.

a. Position lift link in transmission case recess and install shouldered bolt (21, figure 6-11), washers (20), and nut (19). Torque nut **60 TO 80** foot-pounds and install cotter pin (18).

b. Align lower end of lift link and install bolt (30), washer (31), and nut (32). Torque nut **30 TO 50** foot-pounds and install cotter pin (33).

c. Disconnect and remove hoist.

d. Close and secure transmission cowl.

6-34.7. LIFT LINK ATTACHING POINT.

6-34.8. DESCRIPTION – LIFT LINK ATTACHING POINT.

The lift link attaching point is an integral part of the lift beam (29, figure 6-11) and provides a means of attaching the transmission to the fuselage by the lift link (17).

6-34.9. INSPECTION — LIFT LINK ATTACHING POINT.

NOTE

Refer to paragraph 6-34.3. if removal of lift link is required.

a. Nicks and scratches on any lug surface within the enclosed 120 degree area as shown in figure 6-15.1 may be smoothed and polished out by removing material enclosed within a **0.75** inch diameter to a maximum depth of **0.025** inch below **0.813** inch lug minimum thickness. No repair allowed within **0.75** inch radius of bolt hole center.

b. Nicks and scratches on any surface below the 120 degree area and outside the **0.75** inch radius around the bolt hole center may be smoothed and polished out by removing material enclosed in a **1.00** inch diameter to a depth of **0.050** inch below **0.813** inch lug minimum thickness.

c. Corrosion limits are half the depth of mechanical damage limits, because clean-up requires material removal to twice the depth of corrosion damage.

d. No looseness of bushings allowed.

e. No cracks allowed.

f. Inspect bushings for wear (View A-A, figure 6-15.1).

6-34.10. REPAIR — LIFT LINK ATTACHING POINT.

a. Polish out corrosion and mechanical damage within limits of previous paragraph.

b. Replace loose or worn bushings.

c. Treat repaired area with chemical film treatment (C31).

d. Paint repaired area with primer (C91).

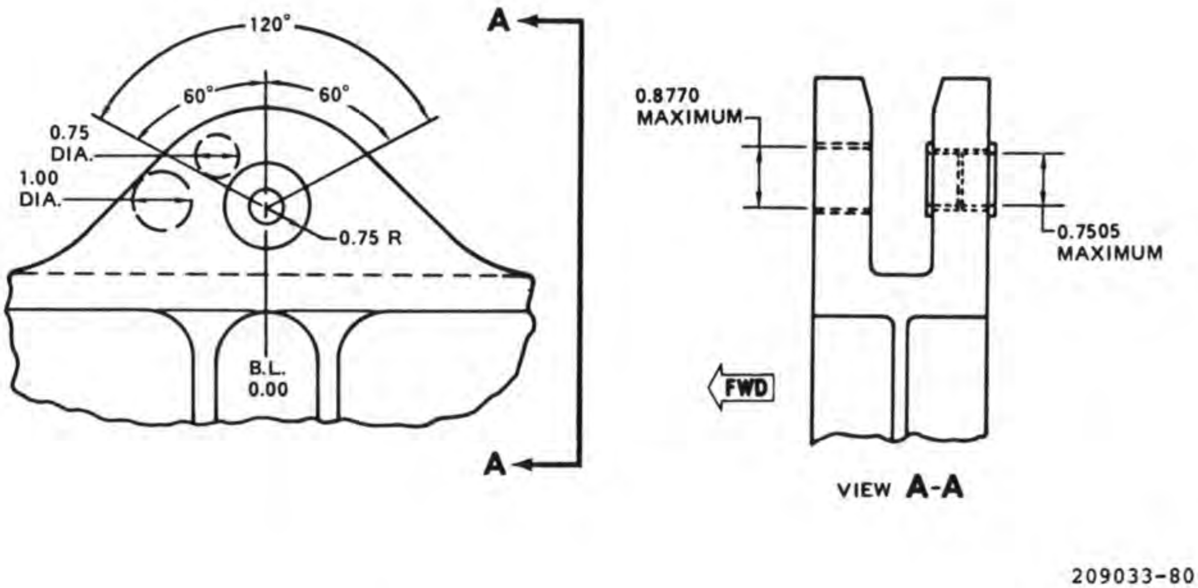


Figure 6-15.1. Lift Link Attaching Point

6-35. TRANSMISSION QUILLS.

6-36. DESCRIPTION — TRANSMISSION QUILLS.

The transmission contains a varied assortment of quills. The quills may be replaced individually without shimming.

6-37. MAIN INPUT QUILL.

6-38. DESCRIPTION — MAIN INPUT QUILL.

The main input quill (3, figure 6-10) is located on the aft side of the transmission. The engine transmits power to the transmission through the main driveshaft and the main input quill. A freewheel (one-way) clutch located in the main input quill operates automatically, engaging to allow engine to drive rotor or disengaging the idling engine during autorotational descent.

6-39. REMOVAL — MAIN INPUT QUILL.

Premaintenance Requirements for Input Quill

Conditions	Requirements
Model	AH-1S
Part Number or Serial Number	All
Special Tools	(T27) (T43)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C79) (C80) (C74) (C111) (C105) (C137)
Special Environmental Conditions	None

a. Open cowling on both sides of transmission. Remove baffling and particle separator from intake section.

b. Remove driveshaft (paragraph 6-8).

c. Disconnect drain tube (18, figure 6-16) from union (17).

d. Remove bolts, nuts, and washers that secure bracket (21, figure 6-12) to bracket (22) and to input quill. Remove bracket (21) and bracket (46).

e. Remove clip (43).

f. Remove four remaining nuts (33) that secure main input quill in transmission.

g. Use a sharp plastic scraper and cut sealant around periphery of quill. Also remove sealant from jackscrew holes.

CAUTION

Do not apply uneven pressure to input quill with jackscrews during removal procedure. Do not pry behind input quill flange during removal procedure.

CAUTION

Do not use open flame to heat transmission case during input quill removal procedure.

h. Install three jackscrews (T27) in holes provided in input quill. Tighten jackscrews evenly to remove quill. If the quill is difficult to remove, apply heat to the transmission case with a heat lamp and then remove the quill with the jackscrews.

i. Remove drain tube (10, figure 6-16).

j. Cover mounting port for main input quill to prevent accidental entry of foreign objects into transmission.

k. Do not remove shims from main input quill sleeve or from transmission case.

6-40. INSPECTION — MAIN INPUT QUILL.

NOTE

External leakage around seals is not acceptable; however, a small amount of seepage is acceptable and does not indicate an unsatisfactory seal condition. Continuous flow (droplets) is excessive and requires seal replacement.

a. Inspect main input quill for evidence of oil leakage. See note above.

b. Inspect main input quill for mechanical and corrosion damage. Any evidence of corrosion where the shim is attached to sleeve assembly (11, figure 6-16) is cause to replace the quill.

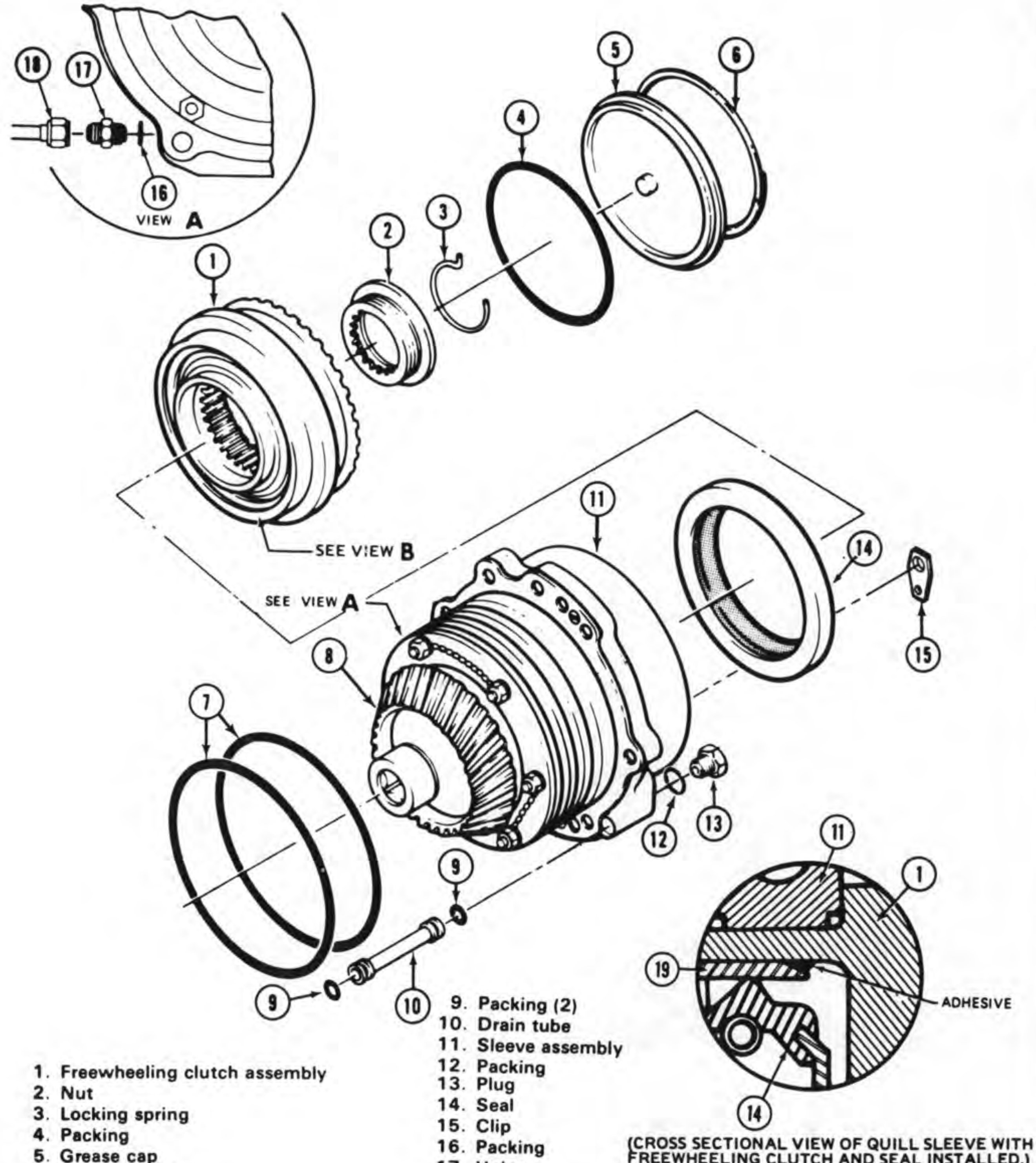
c. Inspect teeth on pinion gear (8) for evidence of abnormal wear and for chipped teeth.

d. Inspect freewheeling clutch assembly (1, figure 6-16) surface that contacts main driveshaft for nicks, dents, and cracks.

6-41. REPAIR — MAIN INPUT QUILL (AVIM).

CAUTION

Do not allow clutch flange to move axially in relation to inner race when handling freewheeling clutch assembly (1, figure 6-16). Axial movement is possible with grease cap (5) removed.



1. Freewheeling clutch assembly
2. Nut
3. Locking spring
4. Packing
5. Grease cap
6. Retaining ring
7. Packing (2)
8. Pinion gear
9. Packing (2)
10. Drain tube
11. Sleeve assembly
12. Packing
13. Plug
14. Seal
15. Clip
16. Packing
17. Union
18. Tube assembly
19. Wear sleeve

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Figure 6-16. Main Input Quill Assembly

a. Fabricate a work aid (figure 6-16.1, sheet 1). Secure work aid to clutch assembly (figure 6-16.1, sheet 2), using tape or other suitable material.

a.1. Remove retaining ring (6, figure 6-16) and grease cap (5) from input drive quill. Remove packing (4) from grease cap.

b. Secure quill and remove locking spring (3). Insert wrench (T43) into the quill; match the spline teeth on the tool with splines of nut (2). Insert a 3/4 inch square drive extension through wrench and engage inner end of pinion gear (8). Remove nut (2).

b.1. Reinstall grease cap (5, figure 6-16) (without packing (4)) and retaining ring (6). Remove work aid (figure 6-16.1, sheet 2).

CAUTION

Handle clutch assembly carefully and do not disassemble clutch when replacing input drive seal.

c. Remove freewheeling clutch assembly (1) from sleeve (11).

NOTE

Wear sleeve (19) is bonded to the clutch assembly in the area contacted by the seal (14). The wear sleeve will be removed with the clutch assembly (1), and the seal (14) will remain in the sleeve (11) assembly when the clutch is removed.

d. Remove seal (14) from sleeve (11).

e. Inspect wear sleeve (19) for wear and rough surface at area of contact with seal (14). If wear sleeve is smooth, replace seal (14) only. If wear sleeve is rough, replace as follows:

(1) Remove wear sleeve (19) from clutch assembly (1). Remove adhesive from clutch assembly with a plastic scraper and scothbrite (C103).

(2) Clean area of clutch assembly, where wear sleeve is to be installed, with MEK (C74).

(3) Press new wear sleeve on clutch assembly with spherical relief on OD of wear sleeve positioned at outer edge of clutch assembly, flush to **0.020** inch recessed.

(4) Bond wear sleeve to clutch assembly. Apply adhesive (C7) to inside diameter chamfer of wear sleeve (detail B). Maintain **0.06** minimum radius of adhesive contour. Cure at room temperature for 24 hours.

(5) Inspect area of wear seal contacted by seal (14) and remove any trace of adhesive.

f. Install a new seal (14) in sleeve assembly (11) as follows:

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(1) Clean sleeve assembly in area where seal is to be installed using MEK (C74).

(2) Apply **0.025** inch band of sealant (C107) to O.D. of the seal (14).

(3) Press seal (14) into sleeve assembly (11). Wipe excess adhesive.

(4) Cure at **70 TO 80** degrees F (**21 TO 27** degrees C) for 24 hours.

NOTE

If seal replacement does not stop leakage, forward quill to next higher maintenance level.

f.1. Install work aid (figure 6-16.1, sheet 2) and secure with tape or other suitable material. Remove retaining ring (6) and grease cap (5).

g. Lubricate seal (14) with transmission oil (C79) or (C80) and position clutch assembly (1) in sleeve (11). Install nut (2) and torque **350 TO 400** foot-pounds with tools described in step b.

h. Install locking spring (3). Ensure that spring tang engages nut and pinion properly to perform locking function.

i. Inspect groove in grease cap (5) provided for packing (4). Remove any burrs which might damage packing. Install new packing (4) on cap (5). Lubricate packing with transmission oil (C79) or (C80) and install retainer in sleeve (11). Install retaining ring (6).

j. Remove work aid (figure 6-16.1, sheet 2).

6-42. INSTALLATION — MAIN INPUT QUILL.

a. Remove cover from main input quill mounting pad on transmission case. Check that mating surfaces of case and quill are clean. Inspect grooves provided for packings (4 and 7, figure 6-16). Remove any burrs which might damage packing.

b. **P** Remove cover (10, figure 6-15).

c. **E** **M** Remove alternator drive quill (paragraph 6-63).

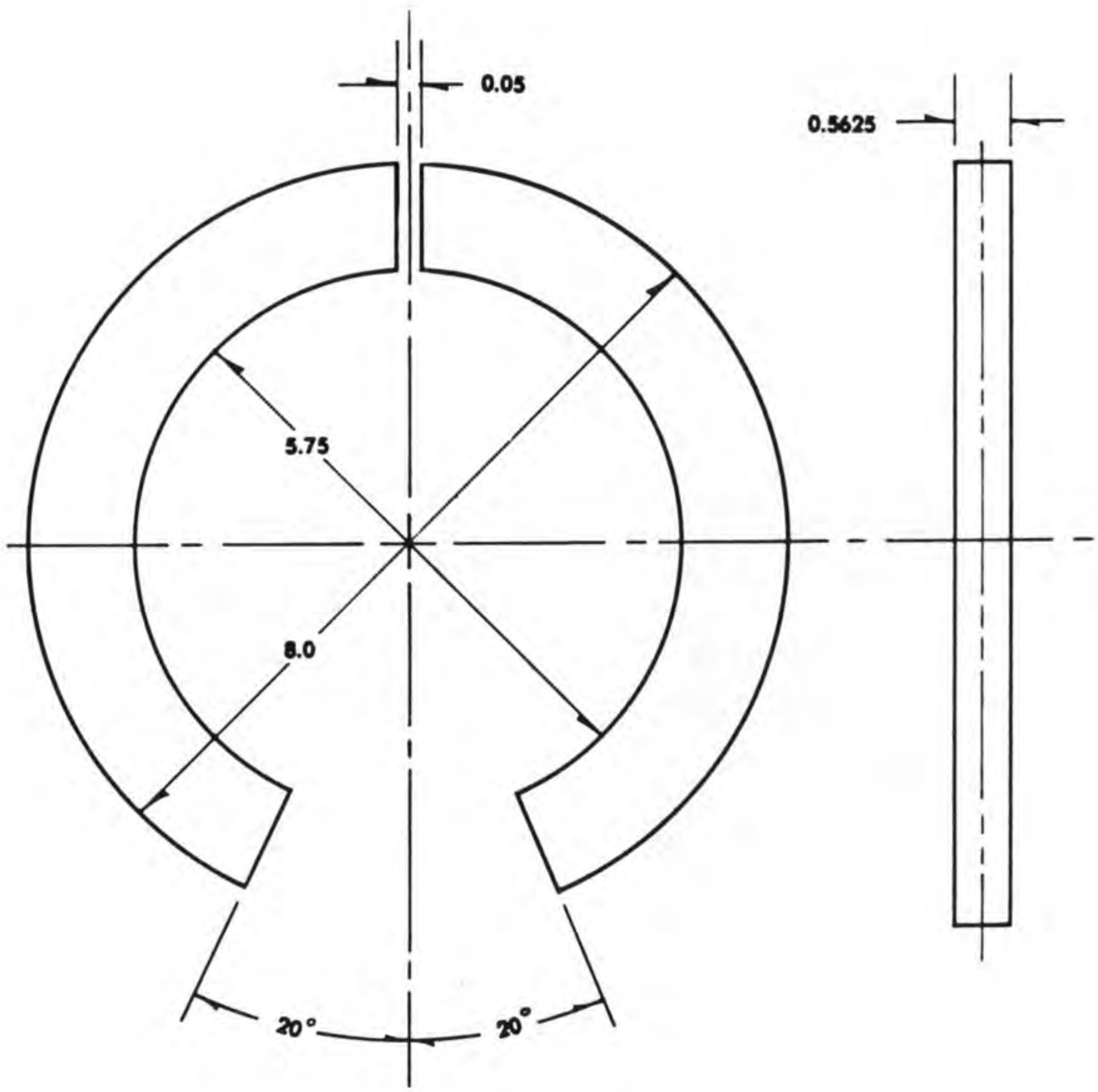
d. Remove number 6 oil jet (62, figure 6-12) from right side of main transmission case.

CAUTION

Rubber plug installation procedure must be followed to prevent damage to bearings.

e. Fabricate rubber plug as follows:

(1) Cut a rubber plug (figure 6-17) slightly larger than the diameter of the roller bearing liner race on the inboard end of the input pinion.



MAKE FROM BAKELITE OR OTHER SIMILAR MATERIAL

Figure 6-16.1. Transmission Input Quill Work Aid (Sheet 1 of 2)

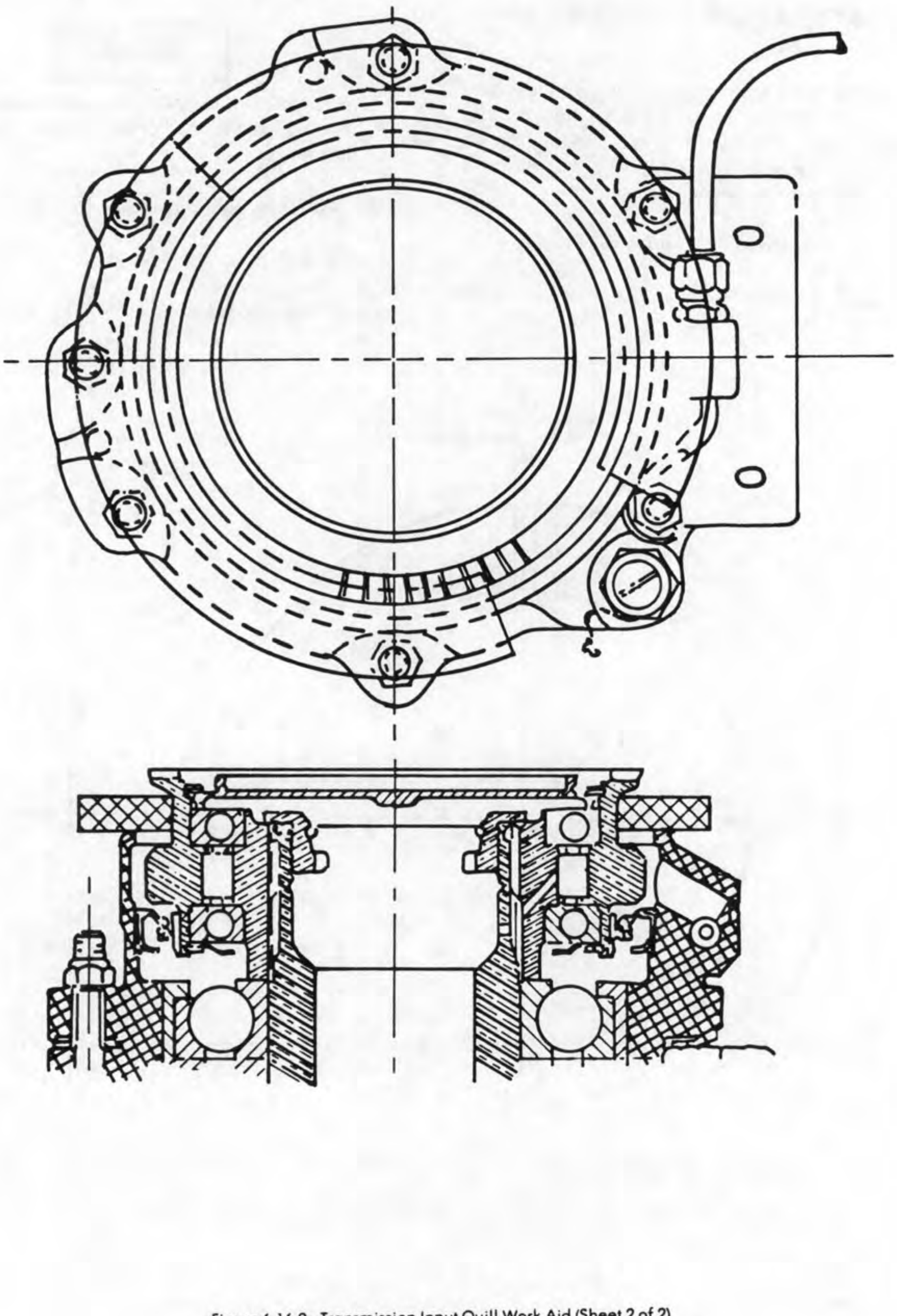
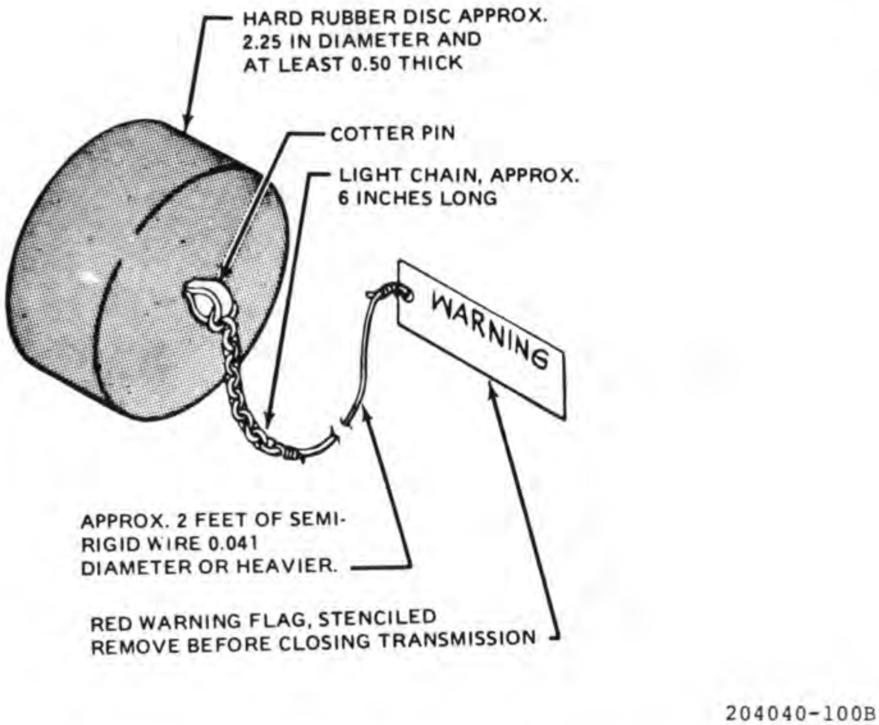


Figure 6-16.2. Transmission Input Quill Work Aid (Sheet 2 of 2)



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

Figure 6-17. Work Aid — Main Input Drive Quill Installation

(2) Insert a 3/32 inch cotter pin through center of rubber plug and through a washer.

(3) Bend ends of cotter pin back against washer and plug.

(4) Attach a piece of light chain or 1/8 inch nylon cord approximately two feet long, to the eye of the cotter pin. See figure 6-17 for view of rubber plug.

f. Using quill port in side of transmission, position the rubber plug in the forward side of the main input quill support bearing in such a manner that the rollers are held against the bearing outer race. Ensure that chain or cord extends outside alternator drive quill port.

g. Install two new packings (9, figure 6-16) on drain tube (10). Lubricate packings with transmission oil (C79) or (C80) and install tube (10) in hole provided in transmission case.

CAUTION

Do not use open flame to heat transmission case during main input quill installation procedure.

h. Install a new packing (7) in each of the two outside grooves of drive quill (11), leaving the middle groove open for oil flow. Lubricate packings (7) with transmission oil (C79) or (C80) and position quill in transmission. Exercise care to engage gear teeth by rotating the input pinion until engagement is felt. Align nose of pinion into roller bearings as quill is installed. Be sure tube (10) is properly installed. Do not tap on freewheeling clutch. If quill is difficult to install, heat transmission case with heat lamp.

i. Position two aluminum washers (36, figure 6-12) and bracket (21) on two lower stud. Install two aluminum washers (35), two thin steel washers (34), and two self-locking nuts (33). Do not torque nuts (33) at this time.

j. Install clip (43, figure 6-12), thin steel washer, and self-locking nut at position illustrated. Do not torque nut at this time.

k. Position one aluminum washer on remaining four studs and install remaining four self-locking nuts. Tighten seven nuts (33) evenly.

l. Install brackets (22) and (46), using bolts, nuts, and washers removed in paragraph 6-39d.

m. Ensure that roller bearing separator plug, installed in step e. is removed when the input pinion has sufficiently engaged the roller alignment bearing. This will prevent jamming the plug against the vertical shaft. Remove rubber plug installed in step d.

n. P Install cover (10, figure 6-15).

o. E M Install alternator drive quill (paragraph 6-66).

p. Install number 6 oil jet (62, figure 6-12).

q. Install union (17, figure 6-16) with new packing (16). Install tube assembly (18).

r. Install plug (13) and new packing (12) at lower right side of quill. Lockwire plug with lockwire (C137).

s. Apply sealant (C105) to quill case joints, jack screw holes, and around drain tube (10, figure 6-16).

6-43. TAIL ROTOR DRIVE QUILL.

6-44. DESCRIPTION — TAIL ROTOR DRIVE QUILL.

The tail rotor drive quill is located in the aft side of the transmission sump case. The forward tail rotor driveshaft is attached to a splined coupling which is part of the tail rotor drive quill.

6-45. REMOVAL — TAIL ROTOR DRIVE QUILL.

Premaintenance Requirements for Removal and Repair of Tail Rotor Drive Quill

Conditions	Requirements
Model	AH-IS
Part Number or Serial Number	All
Special Tools	(T28) (T55) (T26) (T35.1)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C56) (C105) (C137)
Special Environmental Conditions	None

a. Open cowling at either side of transmission.

b. Remove forward section of tail rotor driveshaft paragraph 6-77).

c. P Remove transducer (figure 6-13). Refer to paragraph 11-148.

d. Remove six nuts (6, figure 6-13) and washers (7).

e. P Remove transducer mounting bracket (8).

f. Use sharp plastic scraper and cut sealant around periphery of quill. Also remove sealant from jackscrew holes.

CAUTION

Do not heat case with open flame.

g. Install three jackscrews (T28) in tapped holes in quill flange. Turn jackscrews evenly to pull quill from case. If quill is difficult to remove, heat case with heat lamp.

h. Install cover on open port on transmission case.

6-46. INSPECTION — TAIL ROTOR DRIVE QUILL.

a. Inspect tail rotor drive quill for damage in accordance with figure 6-18.

b. Inspect grease seal (6, figure 6-19) for cracks and deterioration.

c. Inspect inner coupling (16) and outer coupling (7) while disassembled (paragraph 6-47).

6-47. REPAIR — TAIL ROTOR DRIVE QUILL.

a. Replace tail rotor drive quill if damage exceeds acceptable limits (paragraph 6-46).

b. Polish out corrosion and mechanical damage in accordance with figure 6-18.

NOTE

Remove seal plate (9, figure 6-19) slowly so centering spring (10) will not fly out.

c. Secure quill, then remove retaining ring (8), seal plate (9), and centering spring (10).

d. Remove lock-spring (11) and retainer plug (12).

e. Remove bolt (14) using a 1/2 inch square drive extension and holding wrench (T26). Remove washer (15).

f. Remove inner coupling (16) with outer coupling (7), and spacer (5).

CAUTION

Do not use solvent to clean interior of coupling.

g. Clean grease from inner coupling (16) and outer coupling (7). With clean cloth (C30), inspect internal splines of inner coupling (16) for evidence of excessive wear, nicks, and cracks. Inspect external teeth on inner coupling for wear. See figure 6-32 for view of acceptable coupling teeth wear patterns. Inspect outer coupling on internal splines for evidence of excessive wear, nicks, and cracks.

h. Cut and remove lockwire from nut (20) figure 6-19.

i. Remove nut (2) with wrench (T55) and holding fixture (T35.1).

j. Position tail rotor quill in holding fixture (T35.1); then press oil seal (3) from nut (2) and install new seal. Remove packing (1) from nut and install new packing.

k. Install nut (2) with wrench (T55); torque to **1200 TO 1800** inch-pounds and lockwire (C137).

l. Replace grease seal (6) by installing new seal in small end of outer coupling (7) with seal lip toward flange end of coupling.

m. Press seal, using tongue depressor, into slot between end of coupling teeth and flange. Hand pack grease to 0.12 inch deep over top of internal spline teeth. Use grease (C56).

n. Install packing (4), spacer (5), outer coupling (7), with inner coupling (16) on pinion shaft and splines.

o. Install washer (15) and coupling bolt (14) on pinion shaft; torque coupling bolt **960 TO 1200** inch-pounds.

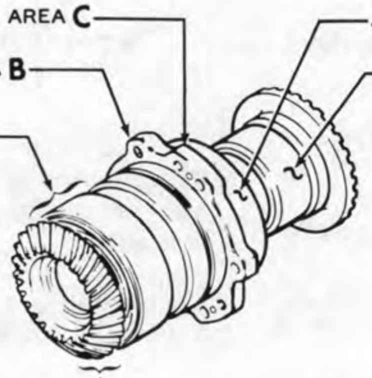
p. Install new packing (13) on retainer plug (12). Install retainer plug (12) and secure with lockspring (11) through grooves in the outboard end of inner coupling (16)

WARNING

Ensure that crowned tooth coupling is lubricated prior to installation of tail rotor drive quill (paragraph 1-29).

q. Coat internal splines of outer coupling (7) with grease (C56) to 0.12 inch depth over top of spline teeth.

r. Install centering spring (10), seal plate (9), and retaining ring (8).



AREA	LIMITS
All	**No cracks allowed.**
A	**Scratches, nicks, and dents up to 0.030 inch in depth are acceptable provided that the following conditions are complied with:** **1. Raised material around damage must be polished off to original surface.** 2. Small burrs that oculd damage packing must be polished off. Repair area must not affect sealing of packing. Extensive damage and rework around packing groove is prohibited. **3. Sleeve diameter must not be less than 3.6247 inches at any location after damage is polished out.** **4. Blend radius must be 0.025 inch or better. Surface finish must be 63 RMS or better.** **5. Repair area must be treated for corrosion protection in accordance with general instructions.**
A	Corrosion damage up to 0.015 inch in depth is acceptable if polished out to remove all traces of corrosion and the requirements for mechanical damage are complied with.
B	**Scratches, nicks, and dents up to 0.040 inch in depth are acceptable provided the following conditions are complied with:** **1. Damage must be polished out to a surface finish of 63 RMS or better with a blend radius of 0.250 inch or more.** **2. Damage must not extend into holes for studs or into spotface for stud** washers in a manner that would cause studs to bend when holddown **nuts are tightened.** **3. Repair area must not exceed forty percent of total flange area.** **4. Repair area must be treated for corrosion protection in accordance with general instructions.**

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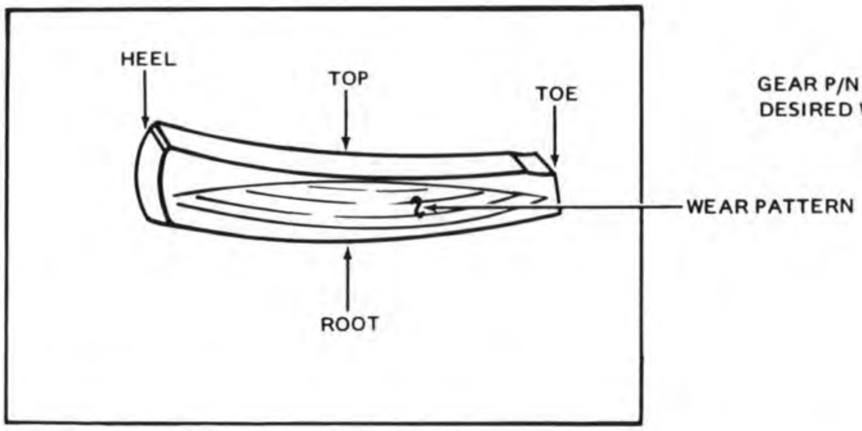
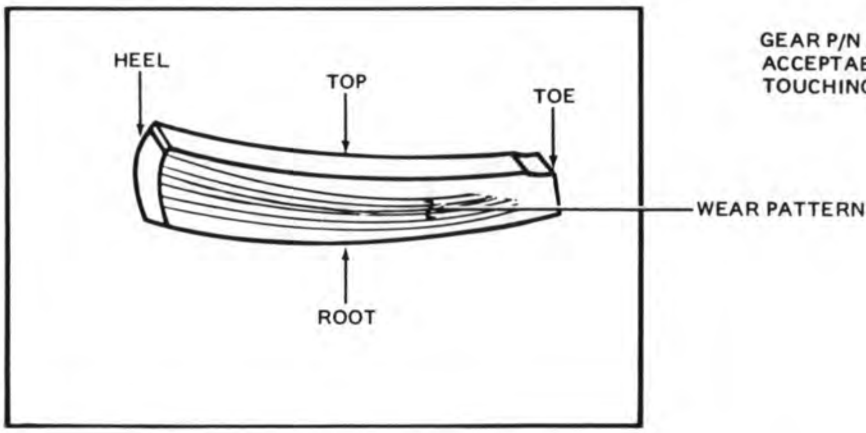
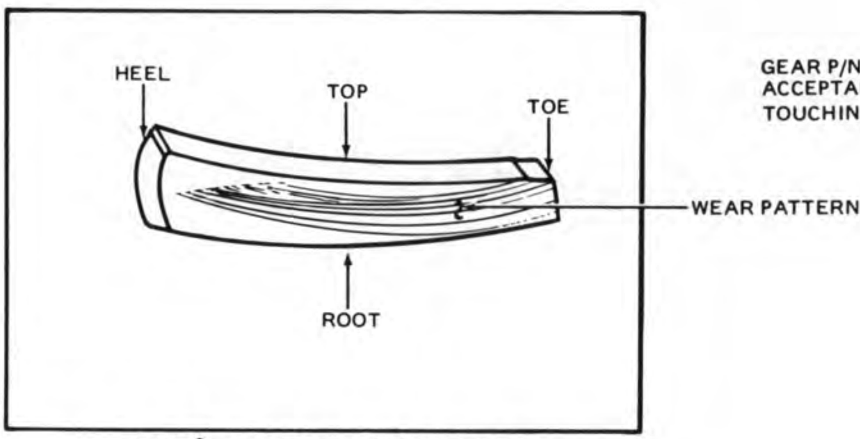
Figure 6-18. Damage Limits — Tail Rotor Drive Quill (Sheet 1 of 3)



GEAR P/N 212-040-151-9
DESIRED WEAR PATTERN



GEAR P/N 212-040-151-9
ACCEPTABLE WEAR PATTERN
TOUCHING HEEL



GEAR P/N 212-040-151-9
ACCEPTABLE WEAR PATTERN
TOUCHING TOE

VIEW **A** ACCEPTABLE WEAR PATTERN

212040-327-2

Figure 6-18. Damage Limits — Tail Rotor Drive Quill (Sheet 2 of 3)

AREA	LIMITS
B	Corrosion damage up to 0.020 inch in depth is acceptable if polished out to remove all traces of corrosion and the requirements specified for mechanical damage are complied with.
C	**Evidence of corrosion under shim in area C is cause to replace the quill.**
D	**Evidence of corrosion on sleeve adjacent to externally threaded ring (nut) that retains bearings in sleeve is cause to replace quill.**
D	Scratches, nicks, dents, and gouges on external surface up to 0.040 inch in depth are acceptable providing the following conditions are complied with: **1. The repaired area must be blended in smoothly.** **2. The repair area bottom radius must be 0.500 inch or more.** **3. The finish must be 63 RMS or better.** **4. Reworked areas must be treated for corrosion protection in accordance with general instructions.**
D	Corrosion damage on external surface up to 0.020 inch in depth is acceptable if polished out to remove all traces of corrosion and the requirements specified for mechanical damage are complied with.
E	Minor scratches and burrs on external surface of coupling are acceptable if polished out with India stone (C116). **Indication of overheating of coupling, such as multi-color appearance, is cause to remove the outer coupling and inspect splines and teeth. Inspection procedure is furnished in text.**
F	**Damage and wear on pinion teeth must be within limits shown on view A. Wear patterns outside acceptable patterns illustrated and/or roughness, scoring chips and other evidence of damage is cause to replace the tail rotor drive quill and to perform detailed inspection of mating quill inside the transmission sump.**
General	**1. Treat all rework areas on interior and external surfaces with Alodine for corrosion protection. Refer to TM 43-0105 for additional corrosion protection procedures.** 2. Apply zinc chromate (C91) or polyamide epoxy prime (C88) to rework areas on surfaces that were painted originally, then paint to match surrounding surface.

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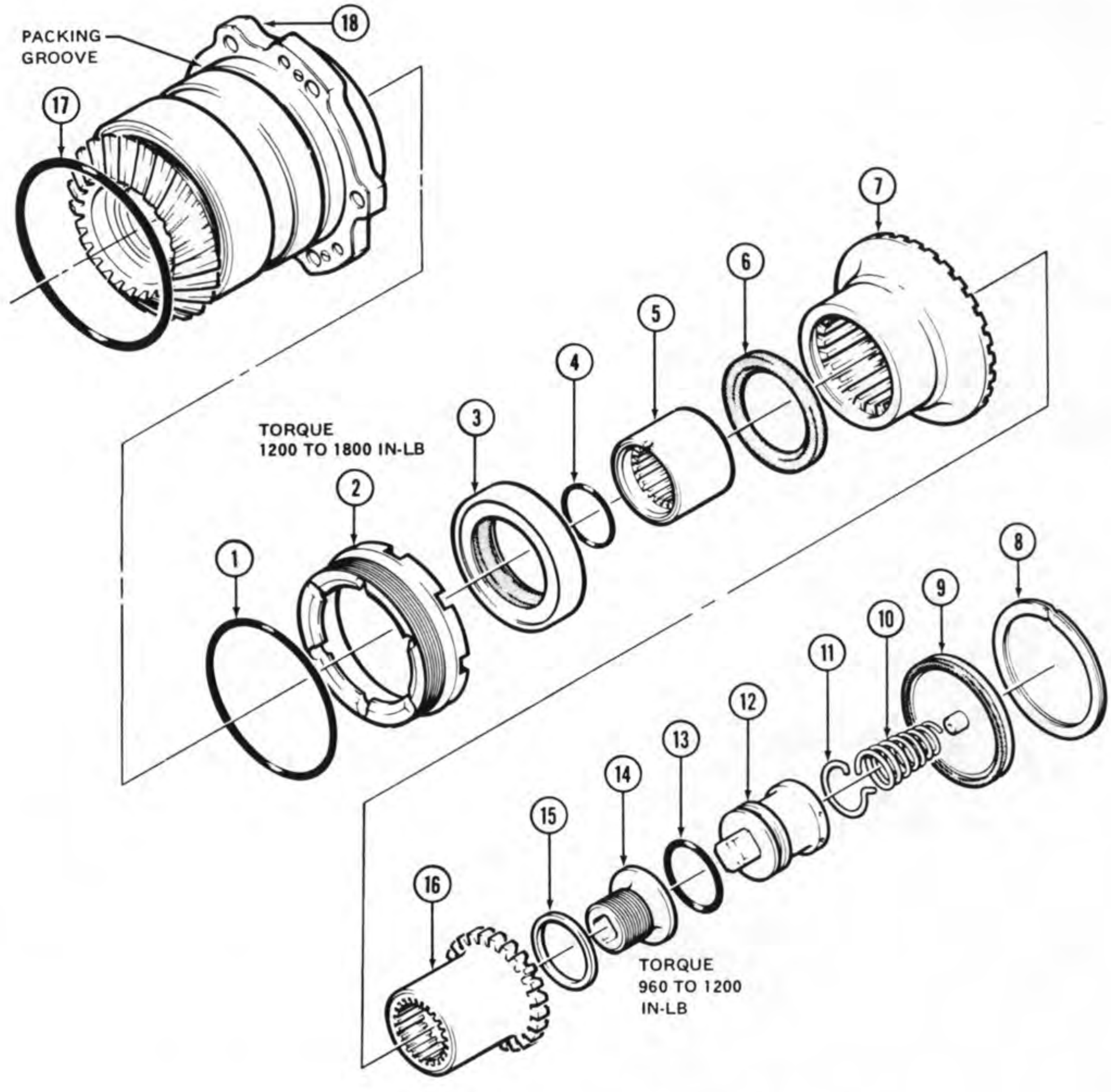
Figure 6-18. Damage Limits — Tail Rotor Drive Quill (Sheet 3 of 3)



1. Packing
2. Nut
3. Oil seal
4. Packing
5. Spacer
6. Grease seal
7. Outer coupling
8. Retaining ring
9. Seal plate
10. Centering spring
11. Lock-spring
12. Retainer plug
13. Packing
14. Bolt
15. Washer
16. Inner coupling
17. Packing
18. Quill sleeve

204040-1004C

Figure 6-19. Tail Rotor Drive Quill Assembly

6-48. INSTALLATION — TAIL ROTOR DRIVE QUILL.

CAUTION

Do not use torch or open flame to heat quill and/or cases during installation of transmission quills.

a. Remove cover from mounting port on aft side of transmission sump case.

b. Install new packing (17, figure 6-19) in groove around quill sleeve (18). Lubricate packing and mating surfaces of sleeve and case port with lubricating oil (C79 or C80).

CAUTION

When inserting tail rotor drive quill, exercise care to engage gear teeth properly to avoid damage.

NOTE

The quill flange has a staggered mounting hole pattern to ensure correct location during installation. Locate the two studs and quill flange holes that are 2.0 inches between centers and align these during installation.

c. Heat sump case at tail rotor drive quill mounting port with a heat lamp until drive quill can be installed. Insert tail rotor drive quill into case and engage studs through mounting flange.

d. P Position transducer mounting bracket (8, figure 6-13) on tail rotor drive quill studs. Install aluminum washers (7) and nuts (6) to secure transducer mounting bracket (8). Install aluminum washers next to quill on remaining four studs. Torque nuts evenly **50 TO 70** inch-pounds.

e. P Install transducer. Refer to TM 11-1520-236-20.

f. E M Install aluminum washer next to quill on six studs. Install thin steel washer and nut on each stand. Torque nuts evenly **50 TO 70** inch-pounds.

g. Check for backlash between mating gear teeth by slight back and forth movement of quill coupling to feel metal-to-metal contact. Backlash must be evident. Allowances must be made for backlash in couplings.

h. Fill jackscrew holes and seal flange of quill sleeve and transmission mating points with sealant (C105).

i. Fill transmission to proper level with lubricating oil (C79) or (C80).

WARNING

Ensure that crowned tooth coupling is properly lubricated prior to installation of driveshaft (paragraph 1-29).

j. Install forward section of tail rotor driveshaft (paragraph 6-81).

k. Close cowling.

6-49. HYDRAULIC PUMP AND TACHOMETER DRIVE QUILL.

6-50. DESCRIPTION — HYDRAULIC PUMP AND TACHOMETER DRIVE QUILL.

The hydraulic pump and tachometer drive quill (9, figure 6-10) is located on the right side of the transmission sump case. The quill has pads for two hydraulic pumps and the rotor tachometer generator.

6-51. REMOVAL — HYDRAULIC PUMP AND TACHOMETER DRIVE QUILL.

Premaintenance Requirements for Hydraulic Pump and Tachometer Drive Quill

Conditions	Requirements
Model	AH-IS
Part Number or Serial Number	All
Special Tools	(T27)
Test Equipment	None
Support Equipment	None

Conditions	Requirements
Minimum Personnel Required	One
Consumable Materials	(C105) (C137)
Special Environmental Conditions	None

a. Open cowling at right side of transmission.

b. Cut sealant at mating flanges of tachometer generator and quill, hydraulic pumps and quill, transmission sump case, and quill. Use a sharp plastic scraper to cut sealant. Also, remove sealant from jackscrew holes.

c. Remove rotor tachometer generator by disconnecting electrical connector and removing nuts and washers from four mounting studs.

CAUTION

Do not kink hoses. Refer to TM 55-1500-204-25/1 for hose limitations.

d. Detach hydraulic pump or pumps (paragraph 7-25). Leave hoses connected except seal drain hose at lower side next to mounting flange. Stow pumps on service deck.

e. Remove nuts and washers from two remaining studs through flange of drive quill.

CAUTION

Apply even pressure to hydraulic pump and tachometer drive quill with jackscrews during removal procedure.

Do not pry behind quill flange during removal procedure.

Do not use open flame to heat transmission case during removal procedure.

f. Install three jackscrews (T27) in holes provided in quill (figure 6-20). Tighten jackscrews evenly to remove quill. If the quill is difficult to remove, apply heat to the transmission case with a heat lamp and then remove quill with jackscrews. Cover the quill mounting port to prevent accidental entry of foreign objects into the transmission.

6-52. INSPECTION — HYDRAULIC PUMP AND TACHOMETER DRIVE QUILL.

a. Visually inspect all accessible parts for damage.

b. Inspect outer quill sleeve for wear and corrosion.

c. Inspect bearings for smoothness, binding, and freedom of operation.

d. Inspect gear teeth for cracks, chipping, scoring, and excessive wear.

e. Inspect seals in cover for evidence of leakage.

6-53. REPAIR — HYDRAULIC PUMP AND TACHOMETER DRIVE QUILL.

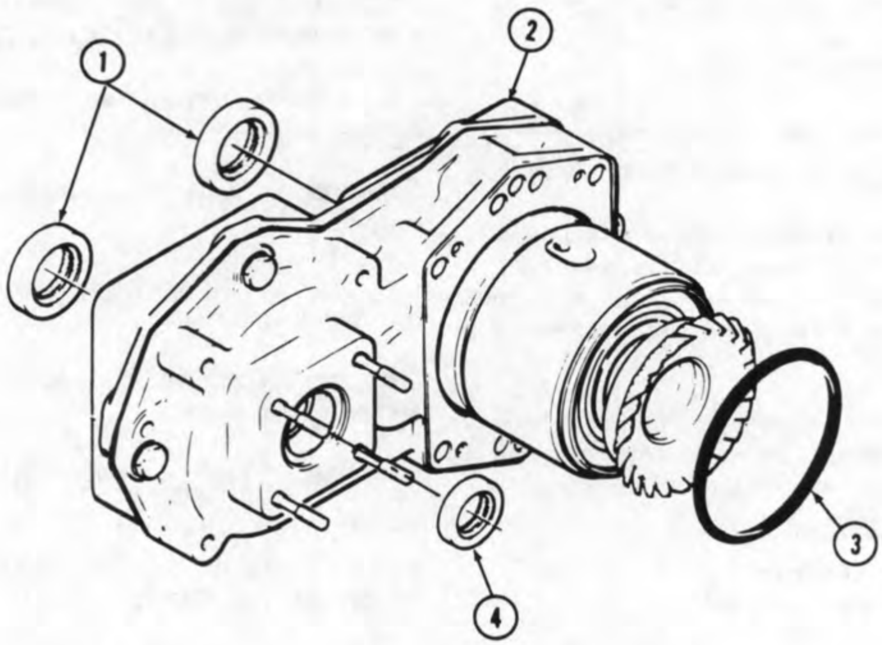
a. Replace quill as a complete assembly when quill does not meet inspection requirements, abnormal gear pattern is evident, or there is evidence of bearing failure.

b. Replace seals in cover assembly as follows:

(1) Remove seals (1 and 4, figure 6-20). Avoid damage to seal housing when removing seal.

(2) Clean seal housing using a solvent (C112) dampened cloth.

(3) Press in replacement seals. Ensure that seal is fully seated in cover.



1. Seals
2. Hydraulic pump and tachometer drive quill
3. Packing
4. Seal

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Figure 6-20. Hydraulic Pump and Tachometer Drive Quill Assembly

6-54. INSTALLATION — HYDRAULIC PUMP AND TACHOMETER DRIVE QUILL.

a. Install packing (2, Figure 6-12) in groove around quill sleeve, and lubricate with oil (C79) or (C80).

CAUTION

When inserting drive quill, exercise care to engage gear teeth properly to avoid damage.

b. Uncover mounting pad at right side of transmission sump case. Heat sump case at drive quill mounting pad with a heat lamp until drive quill can be installed. Insert drive quill, engaging studs through mounting flange. Rotate main input quill clockwise to ensure proper engagement of quill gear teeth with sump drive during installation.

c. Install washers and nuts on two shortest studs, at top and bottom of drive quill flange. Use thin aluminum washer next to flange and standard steel washer next to each nut.

NOTE

Check backlash between mating teeth by slight back and forth movement of tail rotor drive quill coupling (4, figure 6-10) until metal-to-metal contact is felt and heard between hydraulic pump quill and sump drive pinion and gear teeth. Backlash must be evident.

d. Install hydraulic pump, or pumps (paragraph 7-169), engaging pump shaft in drive quill.

e. Install rotor tachometer generator with electrical connector 45 degrees up. Secure with nuts and washers on four studs. Connect and lockwire (C137) electrical cable connector.

f. Seal areas around mating flanges of quill and transmission sump case, quill and hydraulic pumps, and quill and tachometer generator with sealant (C105). Also fill jackscrew holes with sealant.

6-55. FAN DRIVE QUILL.

6-56. DESCRIPTION — FAN DRIVE QUILL.

The fan drive quill (10, figure 6-10) is located on the forward side of the transmission. This quill transmits power from the transmission input bevel gear to drive the air distribution blower (fan).

6-57. REMOVAL — FAN DRIVE QUILL.

Premaintenance Requirements for Fan Drive Quill

Conditions	Requirements
Model	AH-IS
Part Number or Serial Number	All
Special Tools	(T60) (T36) (T35.1)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C105)
Special Environmental Conditions	None

a. Open cowling at left side of transmission.

b. Remove ambient air blower (fan). (Paragraph 13-53).

c. Remove lockwire and remove six bolts and washers that secure fan drive quill (10, figure 6-10).

d. Cut sealant at mating flange of fan drive quill and transmission case with sharp plastic scraper. Also remove sealant from jackscrew holes.

CAUTION

Apply even pressure to quill with jackscrews during removal procedure. Do not pry behind quill flange during removal procedure. Do not use open flame to heat transmission case during quill removal procedure.

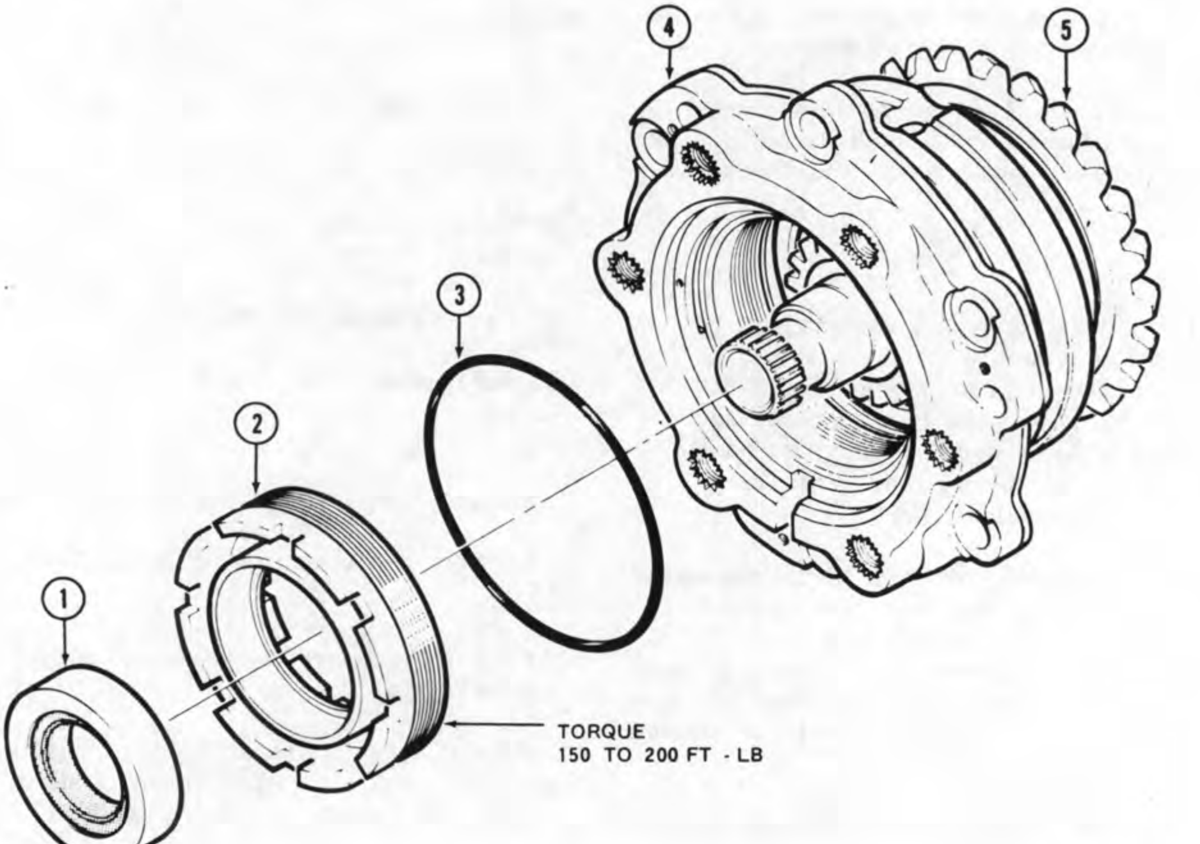
e. Install three jackscrews (T60) in threaded holes provided in quill. Tighten jackscrews evenly to remove quill. If the quill is difficult to remove, apply heat to the transmission case with a heat lamp and then remove the quill with the jackscrews.

f. Cover the quill mounting port to prevent accidental entry of foreign objects into transmission.

6-58. INSPECTION — FAN DRIVE QUILL.

a. Visually inspect all accessible parts for damage.

b. Inspect outer quill sleeve (4, figure 6-21) for wear and corrosion.



1. Seal
2. Nut
3. Packing
4. Sleeve
5. Gear

Figure 6-21. Fan Drive Quill Assembly

c. Inspect for bearing smoothness, binding, and freedom of operation.

d. Inspect gear teeth (5) for cracks, chipping, scoring, and wear.

e. Inspect seal (1) for leakage.

6-59. REPAIR — FAN DRIVE QUILL.

a. Mount quill flange over pins in holding fixture (T35.1).

b. Remove lockwire from nut (2, figure 6-21) and quill sleeve (4). Use care so as not to remove material from lockwire hole in sleeve (4).

c. Remove nut (2, figure 6-21) from front side of sleeve (4) using wrench (T36).

d. Press seal (1) from nut (2).

e. Press new seal (1) into nut (2) with open side of lip positioned toward inboard side of nut.

f. Lubricate and install new packing (3) on outside of nut and thread nut (2) into sleeve (4). Torque nut **150 TO 200** foot-pounds.

6-60. INSTALLATION — FAN DRIVE QUILL.

a. Install lubricated packing (3, figure 6-21) in groove around quill sleeve.

CAUTION

When inserting fan drive quill, exercise care to engage gear teeth properly to avoid damage.

b. Uncover mounting port at forward side of transmission case. Heat main case at mounting port for fan drive quill (10, figure 6-10) with a heat lamp until drive quill can be installed.

c. Use three studs and three pushers as shown on figure 6-22 to push quill into transmission. Install three studs into case threads at equally spaced intervals.

d. Start the quill into the case port.

e. Install a steel washer on the top of the quill sleeve flange, then thread the pusher onto the stud.

CAUTION

Be sure gears of quill and driving gear are properly meshed before seating the quill. Rotate fan drive quill gearshaft while drawing quill into main case and feel for engagement of gear teeth.

f. Tighten pushers evenly until the quill is seated.

g. Remove pushers and studs. Install six bolts through sleeve flange into threaded inserts of case.

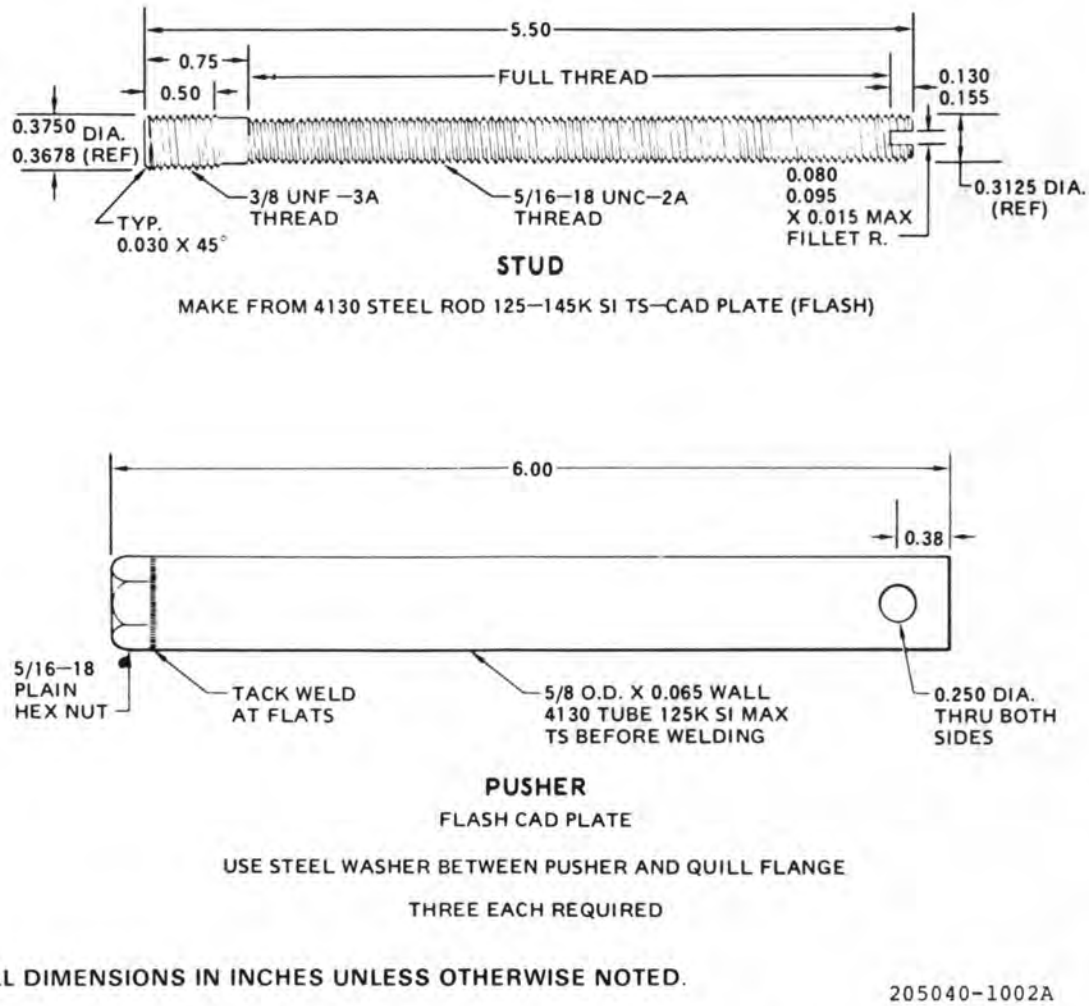


Figure 6-22. Work Aid — Quill Installation

h. Install thin aluminum washer next to quill flange, and standard steel washer next to each bolt head.

i. Check for backlash between mating teeth by slight back and forth movement of quill coupling until metal-to-metal contact is felt and heard. Backlash must be evident.

j. Seal around flange of fan drive quill and transmission with sealant (C105). Also fill jackscrew holes with sealant.

k. Install air distribution blower fan (paragraph 13-59).

6-61. E M ALTERNATOR DRIVE QUILL.

6-62. E M DESCRIPTION — ALTERNATOR DRIVE QUILL.

The alternator drive quill (5, figure 6-10) is located on the left side of the transmission. The purpose of this quill is to take power from the input bevel gear of the transmission to drive the alternator.

6-63. E M REMOVAL — ALTERNATOR DRIVE QUILL.

Premaintenance Requirements for Alternator Drive Quill

Conditions	Requirements
Model	AH-IS E M
Part Number or Serial Number	S/N 77-22763 and Sub.
Special Tools	(T60)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C121)
Special Environmental Conditions	None

a. Open cowling at left side of main transmission

b. If alternator is installed, identify wires attached to alternator for reinstallation in same location. Disconnect wires and electrical connector from alternator. Remove alternator (paragraph 9-163).

c. If alternator drive quill cap (69, figure 6-12) is installed instead of alternator, loosen nut (68) and remove rim clenching clamp (67) and cap (69.

d. Straighten tang on lock washer (65). Remove bolt (66). Remove five bolts (70) and washers (71).

e. Cut sealant at mating flange of alternator drive quill and transmission case with a sharp plastic scraper. Remove sealant from jackscrew holes.

CAUTION

Apply even pressure to quill with jackscrews during removal procedure. Do not pry behind quill flange during removal procedure. Do not use open flame to heat transmission case during quill removal procedure.

f. Install three jackscrews (T60) in threaded holes provided in quill. Tighten jackscrews evenly to remove quill. If the quill is difficult to remove, apply heat to the transmission case with a heat lamp and then remove the quill with the jackscrews.

g. Cover the quill mounting port to prevent accidental entry of foreign objects into transmission.

6-64. E M INSPECTION — ALTERNATOR DRIVE QUILL.

a. Visually inspect all accessible parts for damage.

b. Inspect outer quill sleeve for wear and corrosion.

c. Inspect for bearing smoothness, binding, and freedom of operation.

d. Inspect gear teeth for cracks, chipping, scoring, and wear.

e. Inspect seal for leakage.

6-65. E M REPAIR — ALTERNATOR DRIVE QUILL.

Premaintenance Requirements for Alternator Drive Quill Repair

Conditions	Requirements
Model	AH-IS E M
Part Number or Serial Number	S/N 77-27763 and Sub.
Special Tools	(T57) (T58)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C79) (C80) (C105) (C137)
Special Environmental Conditions	None

a. Mount quill over pins in holding fixture (T57).

b. Remove lockwire from nut (2, figure 6-23) and quill wear sleeve (4), using caution during removal to avoid damage to lockwire tab.

c. Remove nut (2) from front side of sleeve of quill (6) using wrench (T58).

d. Press seal (1) from nut (2).

e. Apply sealant (C105) to seal (1) on surface, mating with nut (2) and to nut (2) on surface mating with wear sleeve (4).

f. Press new seal (1) into nut (2) with open side of lip positioned toward inboard side of nut.

g. Lubricate new packing (3) with oil (C79 or C80). Install packing on nut (2). Install nut (2) in quill sleeve. Torque nut **150 TO 200** foot-pounds.

h. Lockwire (C137) nut (2) to quill assembly (6).

6-66. E M INSTALLATION — ALTERNATOR DRIVE QUILL.

Premaintenance Requirements for Alternator Drive Quill

Conditions	Requirements
Model	AH-IS E M
Part Number or Serial Number	S/N 77-22763 and Sub.
Special Tools	(T56)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C79) (C80) (C105)
Special Environmental Conditions	None

a. Lubricate new packing (63, figure 6-12) with oil (C79 or C80). Install packing in groove in alternator drive quill sleeve.

b. Uncover mounting port at left side of transmission main case.

c. Install quill using three studs and three pushers (figure 6-22) as follows:

CAUTION

When inserting alternator drive quill, exercise care to engage gear teeth properly to avoid damage.

(1) Start the quill into the case port.

(2) Install three work aid studs (figure 6-22) at equally spaced intervals. Ensure that work aid studs have full thread engagement with transmission.

(3) Install a steel washer on the top of the quill sleeve flange on each work aid stud. Install work aid pusher (figure 6-22) on each stud.

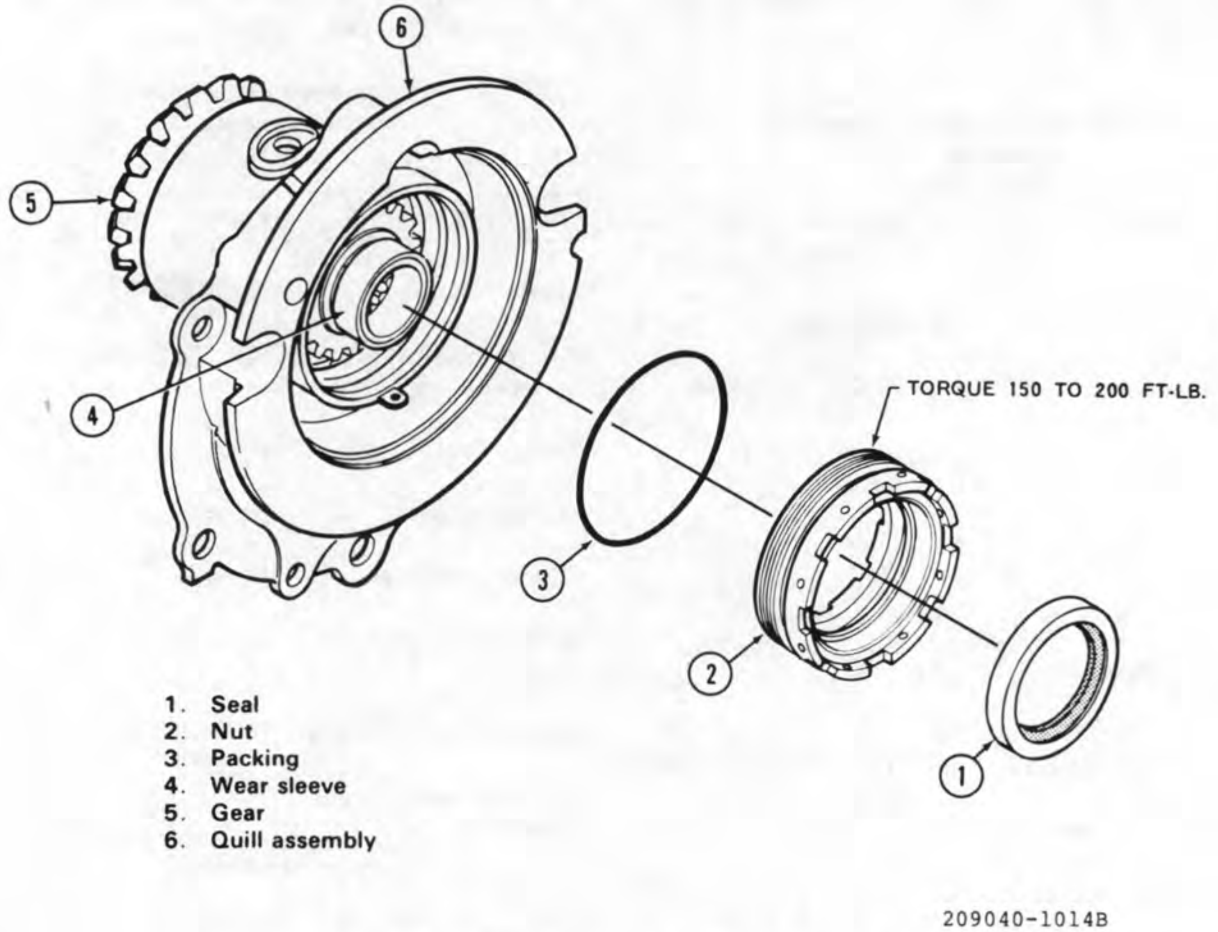


Figure 6-23. E M Alternator Drive Quill Assembly

CAUTION

Rotate alternator drive quill generator while drawing quill into transmission and feel for engagement of gear teeth.

NOTE

If quill is difficult to install, heat main case at mounting port for alternator drive quill with a heat lamp.

(4) Tighten work aid pushers evenly until the quill is seated.

(5) Remove work aid pushers, washers and studs.

d. Position lock (tab) washer (65, figure 6-12) on bolt (66) and install bolt in top center hole. Position one steel washer (71) on each of five bolts (70) and install bolts. Torque bolts (66 and 70) evenly **160 TO 190** inch-pounds.

e. Check for backlash by slight back and forth movement of quill gear shaft until metal-to-metal contact is felt. Backlash must be evident. As alternate procedure, use backlash measurement tool (T56). Backlash must be **0.005 TO 0.013** inch.

f. Seal area around flange of alternator drive quill and transmission with sealant (C105). Also fill jackscrew holes with sealant and the gap between the quill and cam case.

g. Install alternator (paragraph 9-165), or position alternator drive quill cap (69) and rim clenching clamp (67) on quill. Tighten nut (68) to secure clamp.

h. Close cowling at left side of main transmission.

6-67. MAIN ROTOR MAST ASSEMBLY.

6-68. DESCRIPTION — MAIN ROTOR MAST ASSEMBLY.

The main rotor mast assembly is a tubular steel shaft fitted with two bearings, which support it vertically in the transmission. Mast driving splines are engaged with transmission upper stage planetary gear providing counterclockwise rotation as viewed from above. Splines on upper portion of mast provide mounting for main rotor and control assemblies.

6-69. REMOVAL — MAIN ROTOR MAST ASSEMBLY.

Premaintenance Requirements for Removal — Main Rotor Mast

Conditions	Requirements
Model	AH-IS
Part Number or Serial Number	All
Special Tools	(T45)
Test Equipment	None
Support Equipment	(S4)
Minimum Personnel Required	Two
Consumable Materials	(C22) (C36) (C41) (C46) (C47) (C70) (C74) (C91) (C105) (C107) (C112) (C116) (C123)
Special Environmental Conditions	None

NOTE

This procedure is for removal of mast from a transmission that has previously been removed from helicopter.

a. Install mast nut (1, figure 6-24) on top of mast. Attach clevis (S4) to nut (1). Attach hoist (T45) to clevis (S4) and take up cable slack.

b. Disconnect oil hose (6, figure 6-12) from jet assembly (19, figure 6-24).

c. Remove two nuts (21), washers (22), and washers (23).

d. Remove eight nuts (13), washers (11), and washers (12).

e. Carefully lift mast assembly out of transmission.

6-70. CLEANING — MAIN ROTOR MAST ASSEMBLY.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

a. Clean mast with solvent (C112) and dry with filtered compressed air. Keep solvent off seal (16, figure 6-24).

6-71. INSPECTION — MAIN ROTOR MAST ASSEMBLY.

WARNING

Inspect mast for the word "REWORKED" on flange in area I, figure 6-25. If the word "REWORKED" is on the flange and there is corrosion damage that will require polishing out (figure 6-26), reject the mast; rework is permitted one time only.

a. Inspect friction sleeve (3, figure 6-24) as follows:

NOTE

Friction sleeve may be inspected for wear and for bonding failure with mast installed on helicopter.

(1) If friction sleeve is to be inspected with mast installed on helicopter, remove collet set and attaching parts to gain access to friction sleeve. Refer to paragraph 5-47.

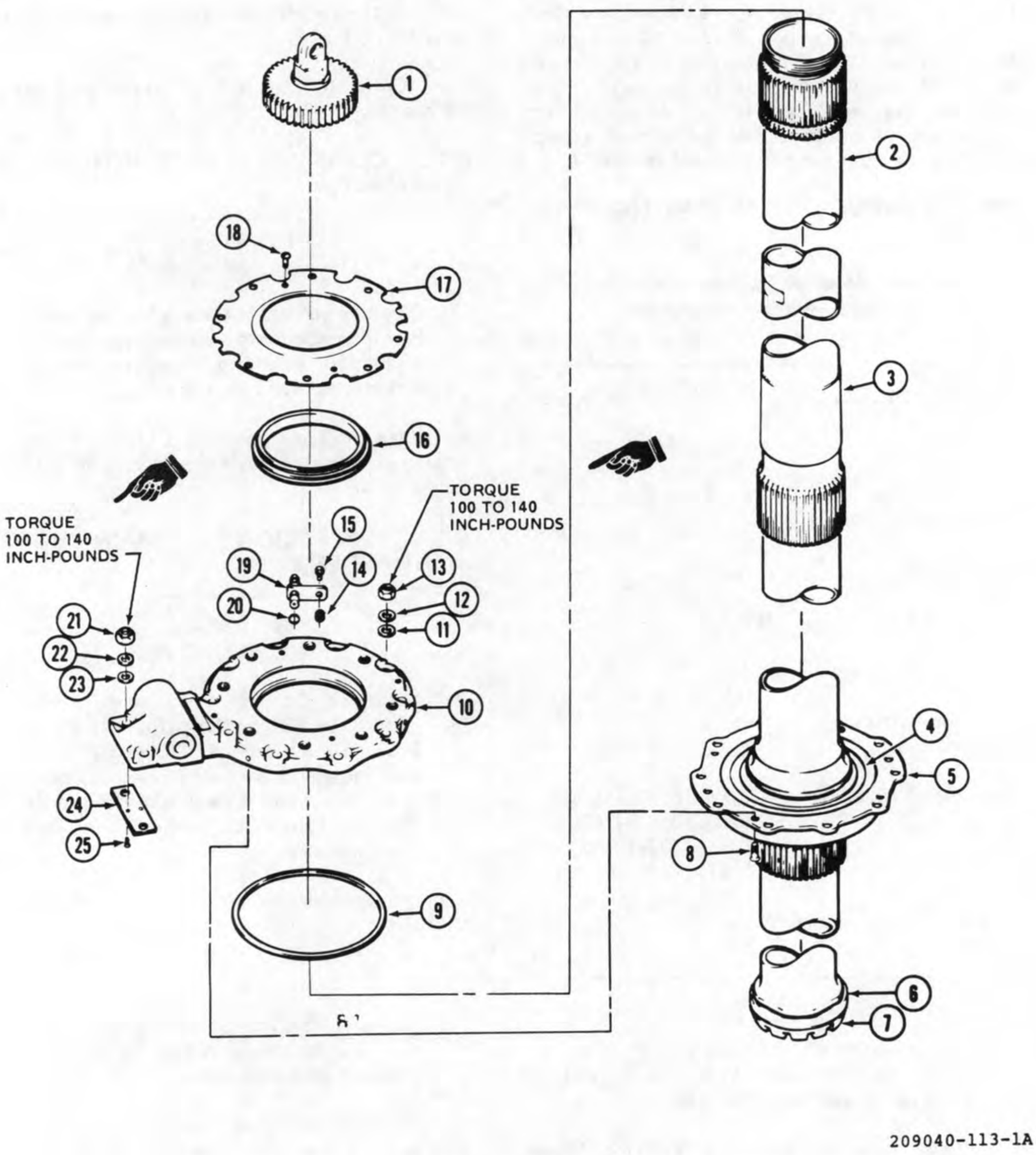


Figure 6-24. Main Rotor Mast Assembly (Sheet 1 of 2)

1. Mast nut
2. Mast
3. Friction sleeve
4. Bearing
5. Mast liner
6. Roller alignment bearing inner race
7. Nut
8. Screw
9. Shim
10. Retainer plate
11. Aluminum washer
12. Thin steel washer
13. Nut
14. Insert
15. Screw
16. Seal
17. Plate
18. Screw
19. No. 8 oil jet assembly
20. Packing
21. Nut
22. Thin steel washer
23. Aluminum washer
24. Shim
25. Screw

209040-113-2

Figure 6-24. Main Rotor Mast Assembly (Sheet 2 of 2)

(2) Using a soft carbon pencil lay out four reference marks, 90 degrees apart, along entire length of friction sleeve (figure 6-25).

(3) Using a standard 3 to 4 inch micrometer, check friction sleeve diameter over full length at reference marks made in step (2). Record dimensions as they are measured. See figure 6-25, sheet 2, for taper limits and out-of-round limits.

(4) Inspect friction sleeve for bond voids. Use a 0.002 inch feeler gage to determine void dimensions. See figure 6-25 for bond void limits.

b. Inspect mast for mechanical and corrosion damage. See figure 6-25 for damage limits.

c. Inspect mast for damage in area of main rotor hub flapping stop contact. See figure 6-26 for deformation damage limits.

d. Inspect mast bearing and mast bearing retaining plate as follows:

(1) Inspect mast bearing for roughness and damage in accordance with instructions on figure 6-27.

(2) Inspect mast bearing retaining plate for mechanical and corrosion damage. See figure 6-27 for damage limits.

e. Remove screw (15, figure 6-24). Remove no. 8 oil jet assembly (19). Inspect jet assembly for damage and obstructions. Inspect insert (14) for damaged threads and for secure installation in retainer plate (10). If insert (14) and jet assembly (19) are satisfactory for further service, install jet assembly with new packing (20).

f. Inspect for evidence of oil leakage in area of seal (16, figure 6-24). If there is evidence of oil leakage, replace seal (paragraph 6-72). Inspect mast for mechanical and corrosion damage in area contacted by seal. See figure 6-25 for damage limits. Inspect mast bearing retainer for mechanical and corrosion damage while seal is removed. See figure 6-27 for damage limits.

6-72. REPAIR — MAIN ROTOR MAST ASSEMBLY.

WARNING

Rework on mast is permitted one time only. Do not polish out mechanical and/or corrosion damage if mast has the word "REWORKED" on the flange in area I, figure 6-25.

a. Replace mast assembly if damaged in excess of acceptable limits (paragraph 6-71).

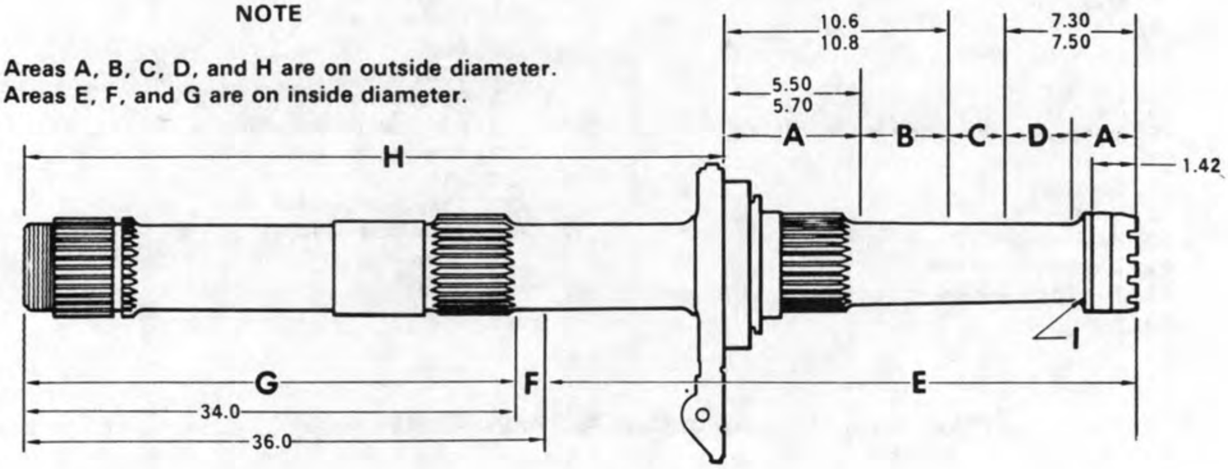
b. Replace seal (16, figure 6-24) if there is evidence of leakage.

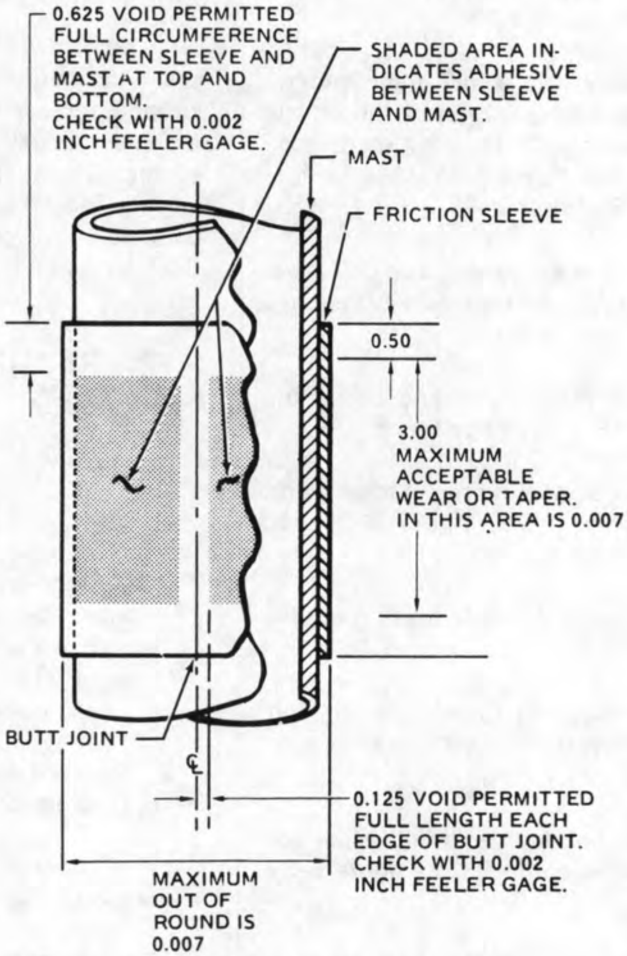
(1) If not previously accomplished, remove mast from helicopter (paragraph 6-69).

(2) Support mast assembly in a suitable stand. Keep mast nut (1) installed to protect threads.

NOTE

Areas A, B, C, D, and H are on outside diameter.
Areas E, F, and G are on inside diameter.





COLLECTIVE PITCH FRICTION SLEEVE

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209010-118-1

Figure 6-25. Damage Limits — Main Rotor Mast Assembly (Sheet 1 of 2)

MAXIMUM ALLOWABLE DEPTH OF CLEANUP TO REMOVE CORROSION AND MECHANICAL DAMAGE

AREA A—Surface Corrosion. Only that which can be removed by wire brush or steel wool.
AREA B—0.002 Inch
AREA C—0.015 Inch
AREA D—0.020 Inch

NOTE

Cleanup on the inner diameter is allowable within the following limits provided cleanup is accomplished by honing or similar method so that material removal is uniform around the diameter. This must be accomplished at depot level.

AREA E—0.005 Inch — Or to a maximum I.D. of 2.980 inches.
AREA F—2.970 Inch Maximum I.D.
AREA G—See table below:

NOTE

Table for AREA G, indicates maximum allowable I.D. for various O.D.'s at stations measured in inches from top of mast.

O.D. →	3.545	3.550	3.555
Max. I.D. Sta. 0-10	2.980	2.986	2.993
Max. I.D. Sta. 10-20	2.976	2.982	2.989
Max. I.D. Sta. 20-34	2.970	2.976	2.983

AREA H — 0.010 Inch Local Cleanup.
AREA I — After cleanup; mark "REWORKED" on flange, using vibration stylus. This does not apply if rework is limited to removal of surface corrosion that can be removed by wire brush or steel wool.

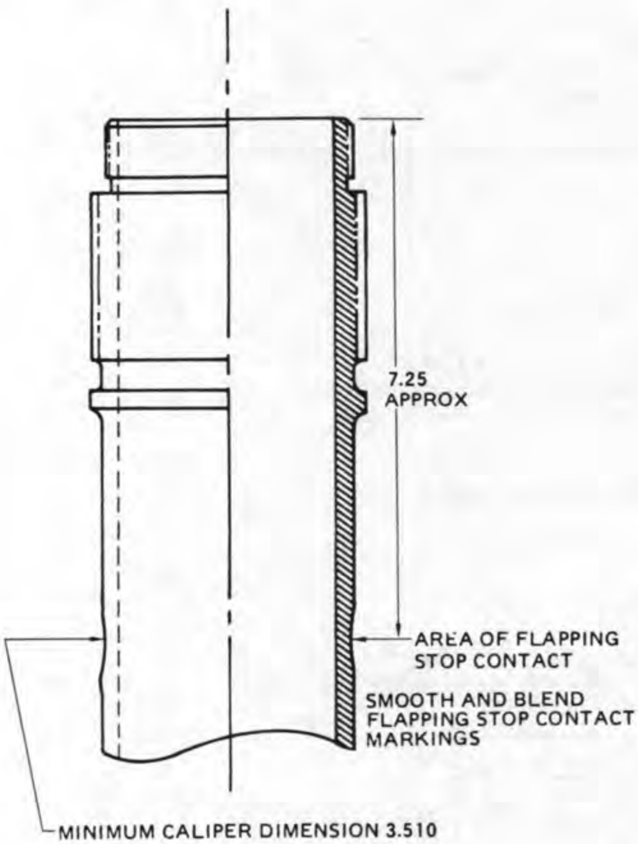
Note: Pitting must be completely removed within allowable cleanup depth for mast to be acceptable. Finish reworked areas to 32 RMS.

NO CRACKS ALLOWED

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209010-118-2

Figure 6-25. Damage Limits — Main Rotor Mast Assembly (Sheet 2 of 2)



209-010-450-5
MAIN ROTORMAST

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

209040-12D

Figure 6-26. Deformation Limits — Main Rotor Mast

(3) Remove two screws (18) and remove plate (17).

CAUTION

Ensure that shim (9) is indexed and reinstalled in the same location. If shim (9) is lost or intermixed with similar shims, send mast assembly to next higher maintenance level.

(4) Remove four screws (8). Carefully remove retainer plate (10). Remove shim (9) and index for reinstallation in the same location. Do not remove shim (24).

(5) Press seal (16) out of retainer plate. Clean old sealant out of retainer plate with a sharp plastic scraper.

(6) Apply a thin coat of sealant (C105) on retainer plate (10) surfaces where seal will be installed. Press new seal (16) onto retainer plate with lip of seal up. Remove excess sealant with clean cloth. Ensure that four drain holes are not plugged with sealant.

CAUTION

Shim (9) that was removed in step (4) must be reinstalled. If shim (9) is defective or there is any doubt that shim has been intermixed with similar shims, send mast assembly to next higher level of maintenance.

(7) Ensure that shim (24) was not removed from retainer plate (10). Position shim (9) of correct thickness in mast liner (5). Install retainer plate (10) on mast carefully to avoid damage to seal (16). Install four screws (8). Ensure that heads of countersunk screws are below surface of mast liner (5). Position plate (17) on retainer plate (10) and install two screws (18).

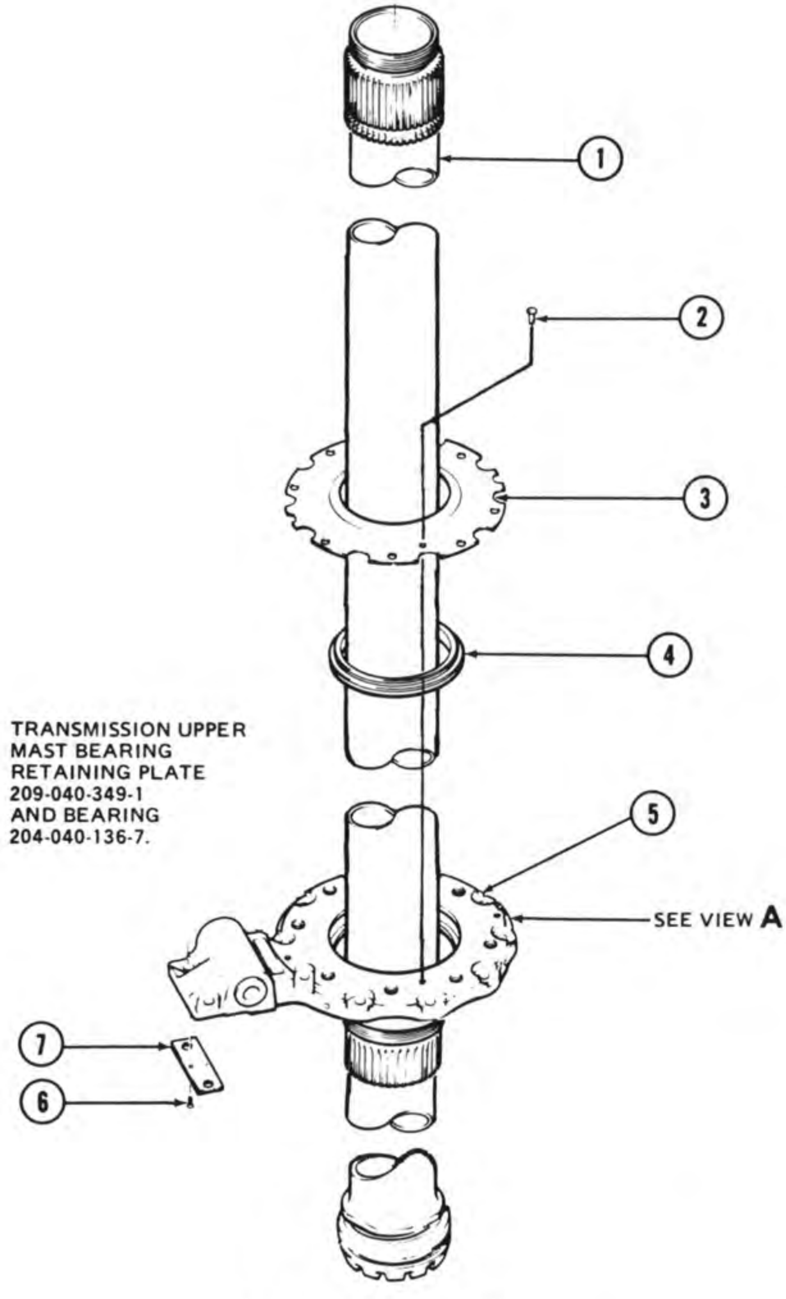
c. Remove nicks and scratches that are within acceptable limits of paragraph 6-71 from mast splines with fine India stone (C116).

d. Polish out nick, scratch, and corrosion damage that is within acceptable limits noted in paragraph 6-71, b. Use abrasive cloth (C36), and polish to a surface finish of 32 RMS or better. If acceptable limits are exceeded after complete clean-up of damage, forward mast assembly to next higher maintenance level.

CAUTION

Ensure compliance with following step e prior to returning mast assembly to service.

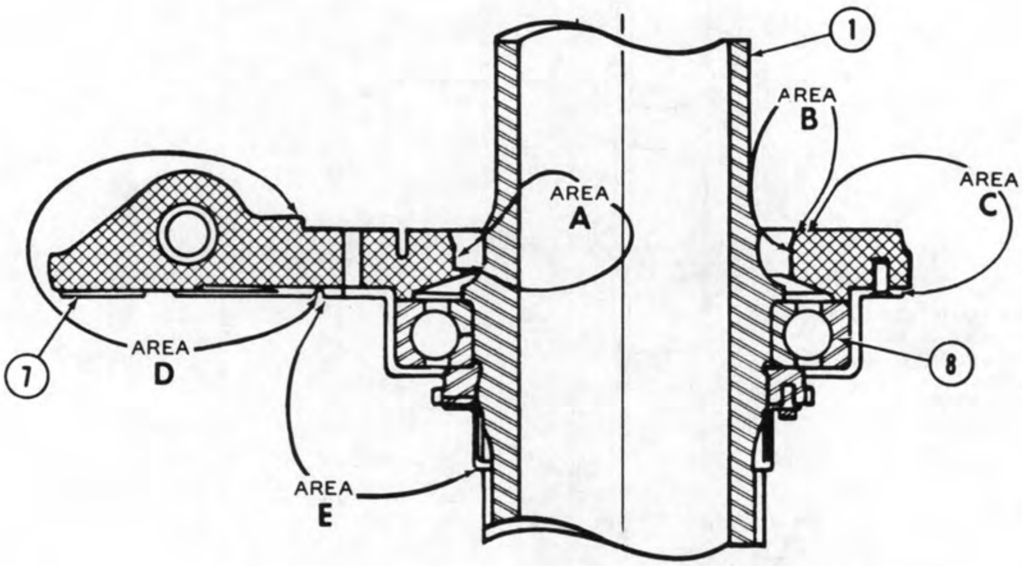
e. If any polishing out work was accomplished on mast, mark the word "REWORKED" on flange in area I as described on figure 6-25.



1. Mast assembly shaft
2. Screw
3. Seal retaining plate
4. Seal
5. Bearing retaining plate
6. Screw
7. Shim
8. Bearing

209040-118-1

Figure 6-27. Damage Limits — Main Rotor Mast Bearing and Main Bearing Retaining Plate (Sheet 1 of 4)



SECTIONAL VIEW WITH SEAL RETAINING PLATE (3) AND SEAL (4) REMOVED.

VIEW A

209040-118-2

Figure 6-27. Damage Limits — Main Rotor Mast Bearing and Main Bearing Retaining Plate (Sheet 2 of 4)

AREA	LIMITS
All	No cracks acceptable.
A - - -	Mechanical and corrosion damage on the plate assembly in area A is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits: 1. Rework is no more than 0.010 inch deep. 2. No more than twenty percent of the total surface area and no more than thirty percent of any one inch square is affected. 3. Damage will not prevent sealing of outside diameter of seal in plate. 4. Minimum blend radius in rework areas is 0.5 inch. 5. Surface finish in rework areas must be 63 RMS or better. 6. Damage must be polished out and the area treated for corrosion protection in accordance with general instructions.
B - - -	Mechanical and corrosion damage on the plate assembly in area B is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits: 1. Rework is no more than 0.020 inch deep. 2. No more than twenty percent of the total surface area and no more than forty percent of any one inch square is affected. 3. Minimum blend radius in rework areas is 0.5 inch. 4. Surface finish in rework areas must be 63 RMS or better. 5. Damage must be polished out and the area treated for corrosion protection in accordance with general instructions.
C - - -	Mechanical and corrosion damage on the plate assembly in area C is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits: 1. Rework is no more than 0.020 inch deep. 2. No more than forty percent of the total surface area and no more than fifty percent of any one inch square is affected. No more than twenty percent of any washer mating surface or hole is affected. 3. Minimum blend radius in rework areas is 0.5 inch. 4. Surface finish in rework area must be 63 RMS or better. 5. Damage must be polished out and the area treated for corrosion protection in accordance with general instructions.

209040-118-3

Figure 6-27. Damage Limits — Main Rotor Mast Bearing and Main Bearing Retaining Plate (Sheet 3 of 4)

D - - - Mechanical and corrosion damage on the plate assembly in area D is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits:

CAUTION

Do not remove shim (7). If there is evidence of corrosion under shim (7), send mast assembly to next higher maintenance level.

1. Rework is no more than 0.005 inch deep.

2. No more than 10 percent of each surface is affected.

3. Minimum blend radius in rework areas is 0.5 inch.

4. Surface finish in rework area must be 63 RMS or better.

5. Damage must be polished out and the area treated for corrosion protection in accordance with general instructions.

E - - - Any corrosion damage and/or mechanical damage in excess of superficial marks in area E is not acceptable. Forward mast assembly to next higher maintenance level.

Any damage to bearing (8) that can be detected visually or by feel is not acceptable. Support mast assembly vertically with a hoist or place mast in suitable padded stand. Press bearing retaining plate (5) toward lower end of mast to load bearing (8) and simultaneously turn retaining plate. If bearing roughness is detected, forward mast assembly to next higher maintenance level.

Threaded Inserts Thirteen threaded inserts are installed in bearing retaining plate (5). Loose, missing, or damaged threaded inserts are not acceptable. Replace unacceptable inserts or forward mast assembly to next higher maintenance level.

GENERAL INSTRUCTIONS.

Repair mechanical and corrosion damage on the plate assembly as follows:

1. Polish out mechanical and corrosion damage in areas A, B, and C with varying grades of aluminum oxide paper. Use 400 grit paper on final clean up to obtain a finish of 63 RMS or better. Ensure that all traces of damage are removed.

2. Polish out mechanical and corrosion damage in area D with fine emery cloth or fine India Stone to obtain a finish of 63 RMS or better. Ensure that all traces of damage area removed.

3. Treat rework areas on the aluminum plate with alodine chemical film. Refer to TM 43-0105 for application procedures.

4. Treat rework areas on bushings in area D with brush cadmium plate. Refer to TM 43-0105 for application procedures.

5. Prime all rework areas that were painted prior to repair. Use polyamide epoxy primer. Paint to match existing finish.

209040-118-4

Figure 6-27. Damage Limits — Main Rotor Mast Bearing and Main Bearing Retaining Plate (Sheet 4 of 4)

f. Touch up repair areas on mast above retainer plate (10) with a spray coat of primer (C88 or C91), then spray on a coat of aluminum lacquer (C70).

6-73. INSTALLATION — MAIN ROTOR MAST ASSEMBLY.

a. Ensure that proper shim (24, figure 6-24) is installed.

b. Uncover opening in top of transmission.

c. Perform dimensional check between upper surface of transmission case and upper surface of planetary adapter as follows:

(1) Measure distance from planetary adapter (2, figure 6-28) to top of top case (1). Minimum acceptable dimension is **2.570** inches.

WARNING

Exercise caution during reindexing of parts to prevent injury to fingertips.

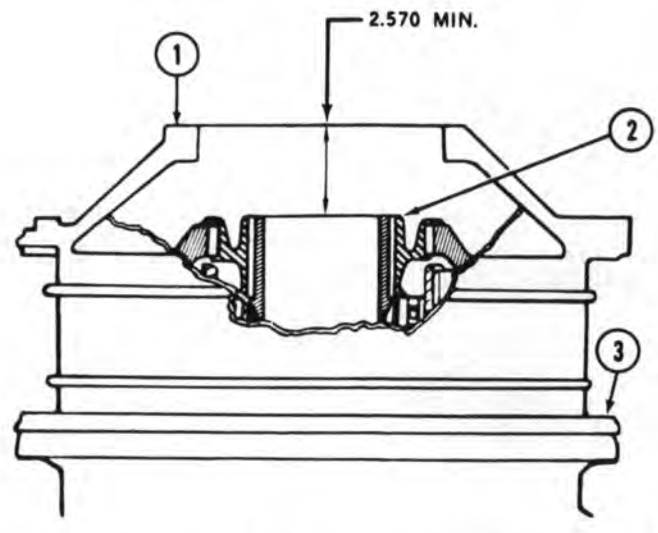
(2) If minimum measurement is not obtained, examine upper and lower sun gear in planetary assemblies to determine if tangs of planetary support liner are engaged with mating slots of lower planetary liner. This can be determined by use of fingertips. If tangs are disengaged, a gap of approximately **0.250** inch will be felt between the two liners.

(3) If gap exists, reindex two liners by inserting the hands into the adapter and liner, palms outboard, lifting adapter slightly and rotating until the liners are correctly aligned.

d. Seal mating surface of the transmission and the mast liner prior to the installation of the mast. Use the following procedure:

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.



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204040-1059A

1. Top case
2. Planetary adapter
3. Transmission

Figure 6-28. Transmission Top Case — Dimension Check

(1) Clean the mating surfaces of the transmission top case and the mast liner with MEK (C74). Wipe dry with a clean cloth before solvent evaporates.

(2) Mix two-part sealant (C107) in accordance with directions on the container. Use the sealant before the pot life times expires.

(3) Run a small bead of sealant on both mating surfaces and smooth with wooden spatula. The correct amount of sealant application will result in a small amount of squeeze-out when the mast is installed.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(4) If the sealant cures before the mast can be installed, clean the sealant from both surfaces with a sharp plastic scraper and repeat cleaning procedure with MEK (C74). Reapply sealant as outlined in steps (2) and (3).

e. Lift mast assembly to position directly over transmission opening. Carefully lower the mast assembly into the transmission opening. Guide inner race (6, figure 6-24) into bearing.

f. Install two aluminum washers (23), two thin steel washers (22), and two nuts (21). Do not torque nuts at this time.

g. Install eight aluminum washers (11), eight thin steel washers (12), and eight nuts (13). Torque nuts (13) and (21) evenly, **100 TO 140** inch-pounds.

h. Seal area where flange of retainer plate (10) joins transmission as follows:

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(1) Clean the sealant area with MEK (C74) and wipe dry with a clean cloth before solvent evaporates.

(2) Prepare two-part sealant (C107) in accordance with instructions on the container.

(3) Run a small bead of sealant (C107) around the mating flanges and fill jackscrew holes with plastic caps or sealant (C107). Use an extrusion gun if available. If necessary, smooth the sealant before it cures, using a wooden spatula wetted with MEK (C74), or finger wetted with water.

(4) Connect oil hose from tee fitting on left rear side of transmission top case to No. 8 oil jet assembly (19).

6-74. PREPARATION FOR SHIPMENT — MAIN ROTOR MAST ASSEMBLY.

a. Clean main rotor mast assembly (paragraph 6-70).

NOTE

Do not coat bearings with oil. Refer to subparagraph (c) below.

b. Remove corrosion from the mast (paragraph 6-72).

c. Coat the entire mast assembly, including bearings, with corrosion preventive compound (C41).

d. Attach an unserviceable reparable tag, DD Form 1577-2, which has been properly filled out, to the mast assembly.

e. Prepare DA Form 2410 (Component Removal and Repair/Overhaul Record) in accordance with TM 38-750.

f. Place copies of the DA Form 2410 in a grease-proof envelope and stow them with the mast in the container after completion of step h. or i. as applicable.

g. Wrap entire mast assembly with barrier material (C22) and securely wrap with pressure-sensitive tape (C127) to protect mast from cushioning material and prevent preservative from rubbing off.

h. Reusable Metal Container (Preferred Method). If a reusable metal container, P/N 204-040-366 MUSC-A19, NSN 8115-00-083-8335, complete with molded hair pads is available, insert the wrapped mast in the container. If hair pads are not available, follow procedures as closely as possible, center the wrapped mast assembly in container with adequate cushioning material (C46) surrounding assembly. Be certain the mast assembly is held firmly in the container and that all open spaces are filled with cushioning material.

i. Plywood Container (Alternate Method). If a plywood shipping container is available, place the preserved mast assembly in the plywood container between the molded hair pads and secure lid.

j. Obliterate old markings from the container that do not coincide with the item to be returned. Mark container in accordance with MIL-STD-129. Stencil DA Form 2410 control number on exterior of container.

SECTION IV. TAIL ROTOR DRIVESHAFT

6-75. TAIL ROTOR DRIVESHAFT.

6-76. DESCRIPTION — TAIL ROTOR DRIVESHAFT.

Five driveshaft sections transmit power from the transmission to the tail rotor through two gearboxes. The shaft sections are identical and are supported by three hanger assemblies on the tailboom and engine deck.

6-77. REMOVAL — TAIL ROTOR DRIVESHAFT.

Premaintenance Requirements for Tail Rotor Driveshaft

Conditions	Requirements
Model	AH-IS
Part Number or Serial Number	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C37) (C112)
Special Environmental Conditions	None

a. Open hinged access doors along top of tailboom and vertical fin by releasing fasteners on left side. Also remove tailpipe fairing, transmission cowling, and intermediate gearbox cover, as necessary to gain access.

CAUTION

Clamp set must be removed from both ends of shaft before removing either end of shaft from its mating curvic coupling to avoid coupling tooth or bearing damage.

NOTE

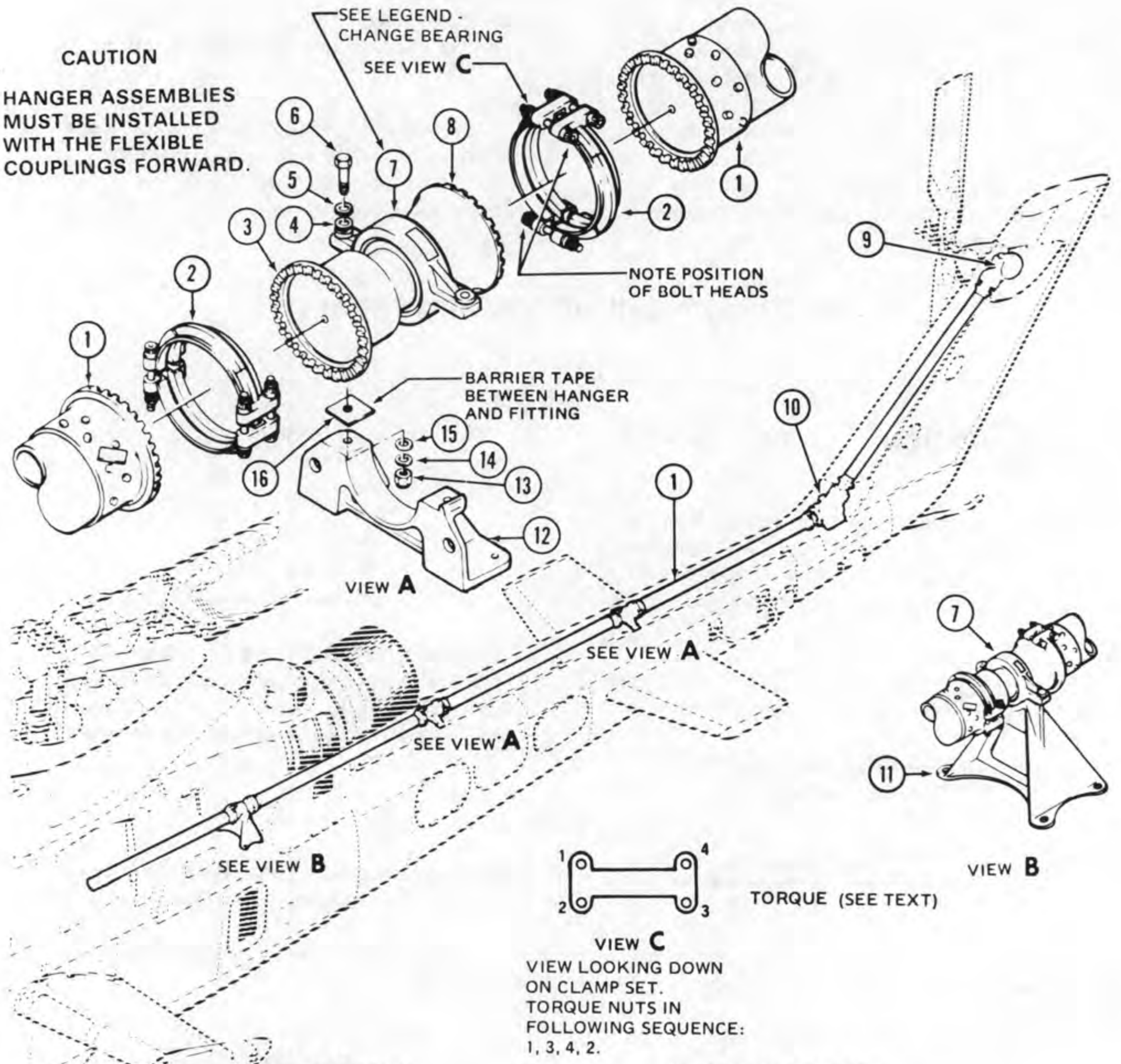
Retain clamp set as a unit when removed to preclude intermix of set halves.

b. If chafing strips come loose, replace with new chafing strips.

WARNING

Secure the tail rotor blades to prevent personnel injury and equipment damage any time a segment of the tail rotor drive system is disconnected. The tail rotor blades may cause uncontrolled system rotation should there be a sudden gust of wind when they are not secured.

c. Remove clamp set (2, figure 6-29) from coupling at each end of driveshaft (1). Push shaft against flexible coupling to disengage opposite end,



1. Driveshaft
2. Clamp set
3. Coupling (outer flexible)
4. Aluminum washer (Note 1)
5. Thin steel washer
6. Bolt
7. Hanger assembly
8. Coupling (non-flexible)
9. Tail rotor gearbox
10. Intermediate gearbox
11. Bearing hanger support fitting
12. Bearing hanger support fitting
13. Nut (extended base)
14. Thin steel washer
15. Aluminum washer
16. Barrier tape

NOTE: OMIT WASHER (4) FROM UNDER BOLT HEAD WHEN BEARING HANGER MATERIAL IS STEEL OR STAINLESS STEEL.

204040-1174

Figure 6-29. Tail Rotor Driveshaft Installation

and lift out shaft. Remove remaining shafts aft of forward bearing hanger in same manner.

d. To remove forward shaft, remove clamp set from tail rotor drive quill coupling. With shaft disconnected from hanger coupling, move shaft against flexible coupling to disengage and remove shaft carefully rearward and to right through firewall tunnel.

e. Remove second shaft section.

6-78. CLEANING — TAIL ROTOR DRIVESHAFT.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

Clean all shaft surfaces using clean cloth moistened with dry cleaning solvent (C112) with care to avoid marring anodized surfaces. Dry with filtered compressed air.

6-79. INSPECTION — TAIL ROTOR DRIVESHAFT.

a. Inspect shaft for cracks.

b. Inspect shaft for rivet failures. No loose, cracked, or missing rivets are acceptable.

c. Inspect tail rotor driveshaft sections for trueness. Mount driveshaft section on V-blocks or support on centers. Measure runout with dial indicator. Maximum acceptable runout is **0.050** inch TIR (total indicator reading) at any point on the shaft.

d. Check for loss or partial detachment of balance strips which are bonded on tube near center.

NOTE

Do not mistake a single empty imprint in bonding material next to balance strip as an indication of a missing balance strip. This spot results from removal of a test coupon to inspect for bonding voids.

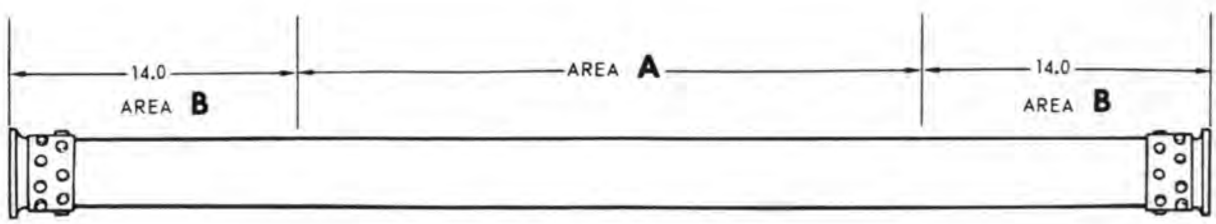
e. Inspect driveshafts which have more than a single empty bonding imprint for the following configurations:

(1) Review last dated balance strip for vibro-etched note "BALANCED (DATE) CCAD"

(2) Review area B (figure 6-30) of shaft for a tab and note "REWORKED AT CCAD (NUMBER) STRIPS". (Number of remaining balance strips, less data plate).

(3) Driveshaft identified by either of the above configurations has been properly balanced by CCAD and is serviceable. Epoxy paint applied at time of shaft rework is optional.

f. Inspect for damaged or excessively worn curvic coupling teeth. There should be no radial play or



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

205040-9B

Figure 6-30. Tail Rotor Driveshaft Inspection Diagram

backlash between mating teeth when fully meshed with V-band clamp (2, figure 6-29) removed.

g. Inspect shaft for grooves worn by V-band clamp on shaft coupling to extent that such wear prevents proper clamping.

h. Inspect shaft for surface damage of shaft tube in excess of limits in (i) below.

i. Classify surface damage on shaft tube as acceptable, reparable, or excessive by following limits. Define "Area A" as central portion of shaft and "Area B" as portions within 14 inches of ends (figure 6-30).

(1) Any damage to anodized finish or grey epoxy paint requires anti-corrosion treatment in accordance with TM 43-0105.

(2) Nicks or scratches aligned within 15 degrees of spanwise axis are acceptable without repair to maximum depth of **0.002** inch in "Area A" or **0.004** inch in "Area B".

(3) Other nicks or scratches must be polished out with crocus cloth (C42) provided depth of material removed does not exceed **0.008** inch in "Area A" or **0.012** inch in "Area B".

NOTE

If total reworked area on one side of shaft is 8 square inches greater than the total reworked area on opposite side, shaft may be out of balance and should be replaced.

(4) Sharp dents are permissible to maximum depth of **0.010** inch in "Area A" and **0.015** inch in "Area B"

(5) Nonsharp dents are permissible to maximum depth of **0.020** inch in "Area A" and **0.030** inch in "Area B"

NOTE

All dents should be carefully inspected for cracks, nicks, and scratches. No cracks permitted. Nicks or scratches shall be within limits. When nicks or scratches are present in a dent, total depth of a dent and nick or scratch combined may not exceed the limits for dent above.

(6) Corrosion must be polished out with crocus cloth (C37), provided depth of material removal does not exceed **0.012** inch in "Area B". Deeper corrosion is cause for rejection.

NOTE

If total reworked surface on one side exceeds the reworked surface on the opposite side by eight square inches, the shaft may be out of balance and should be replaced.

j. Inspection - Driveshaft Clamps.

(1) Check bolt holes for wear, nicks, and scratches.

(2) Inspect spot face, lug fillets, and internal V-groove for nicks and scratches in excess of **0.008** inch, and gouges or wear pattern extending into the fillet radius at bottom of internal V.

(3) Inspect all remaining surfaces for nicks and gouges exceeding **0.010** inch.

6-80. REPAIR — TAIL ROTOR DRIVESHAFT.

a. Replace driveshaft sections that are damaged in excess of acceptable limits (paragraph 6-79).

b. Send tail rotor driveshaft sections that require painting to next higher maintenance level for painting and balancing.

6-81. INSTALLATION — TAIL ROTOR DRIVESHAFT.

WARNING

Ensure that crowned tooth coupling is properly lubricated prior to installation of driveshaft (paragraph 1-29).

NOTE

If driveshaft misalignment is suspected, refer to paragraph 6-79.

a. Engage shaft couplings with mating couplings. Install clamp sets (2, figure 6-29) at each end with nuts in trailing direction of rotation and bolted joints indexed 90 degrees to those of adjacent clamps for balance in operation.

CAUTION

Use new nuts each time clamps are installed.

NOTE

Ensure clamp halves match. All bolts and nuts on any one clamp must be identical parts to maintain balance.

b. Install tail rotor clamp set (2, figure 6-29) bolts and nuts as follows:

(1) Start four new nuts onto clamp bolts by hand.

(2) Thread new nuts on bolts to obtain complete thread engagement.

(3) Measure and record tare torque for each nut.

(4) Torque each nut in sequence illustrated in figure 6-29 **30 to 35** inch-pounds above tare torque recorded in preceding step. Keep gaps in ends of clamp set (2) equal within **0.020** inch.

(5) Tap very lightly around outer surface of clamp with fiber mallet and re-check torque.

c. Install tailpipe fairing or gearbox cover as required. Close access doors and cowling.

6-82. TAIL ROTOR DRIVESHAFT HANGER ASSEMBLY.

6-83. DESCRIPTION — TAIL ROTOR DRIVESHAFT HANGER ASSEMBLY.

Three hanger assemblies connect and support tail rotor driveshaft along top of tailboom and above the engine deck. Each assembly consists of couplings on a short, splined shaft, mounted through a single-row sealed ball bearing in a ring-shaped hanger equipped with two mounting lugs for attachment on a support fitting (figure 6-29).

6-84. REMOVAL — TAIL ROTOR DRIVESHAFT HANGER ASSEMBLY.

Premaintenance Requirements for Driveshaft Hanger Assembly

Conditions	Requirements
Model	AH-1S
Part Number or Serial Number	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C56) (C116) (C120)
Special Environmental Conditions	None

a. Open hinged access doors along top of tailboom by releasing fasteners on left side. Open engine access doors.

CAUTION

Use caution when removing driveshaft. Damage to shaft or coupling may result from improper handling.

b. Remove tail rotor driveshafts from each side of hanger (paragraph 6-77).

c. Remove bolt (6, figure 6-29) with nut (13) and washers (4, 5, 14, and 15) at each side to detach hanger assembly from its bearing hanger support fitting (11 or 12).

6-85. INSPECTION — TAIL ROTOR DRIVESHAFT HANGER ASSEMBLY.

a. Inspect three driveshaft hanger assemblies for metal particles and/or rust-colored fretting debris adjacent to bearing in bearing and shaft assembly (10, figure 6-31). If particles are found, replace affected parts.

b. Inspect three bearing and shaft assemblies (10) for overheating.

(1) The bearings in bearing and shaft assemblies (10) normally operate at a temperature of **100 TO 160** degrees F (**38 TO 71** degrees C). This is cool enough to touch. Investigate any installed bearing and shaft assembly that is too hot to touch. Replace affected parts if bearing continues to run hot.

(2) Indications of overheating such as discoloration of bearing (blue to blue/black in color) or multicolor appearance of hanger that darkens adjacent to bearing is cause for replacement.

(3) Brown coloring of bearing shield is normal and is not an indication of overheating.

c. Inspect three bearing and shaft assemblies (10) and outer flexible couplings (8) for grease leakage. Wetting of adjacent areas by grease is cause for replacement of affected parts with the following exception: A small amount of grease expelled from around lip of seal in bearing and shaft assembly (10) indicates slight over-lubrication and is not cause for hanger replacement. Perform an evaluation of bearing and shaft assembly (10) as follows:

CAUTION

Do not clean or spray bearing or hanger assembly with any type of solvent during inspection. Use only clean cloths without solvent to clean exterior of hanger.

(1) Wipe grease from shaft of inner (spherical) coupling (11), bearing and shaft assembly (10) with clean, lint-free cloth.

(2) Record on DA Form 2408-13, indicating bearing by location and keep under observation for next 10 flight hours.

(3) If amount of grease expelled from seal of hanger bearing does not decrease after this period of time, replace bearing and shaft assembly (10).

d. Inspect three bearing and shaft assemblies (10) for cracks, elongated bolt holes, and corrosion.

e. Inspect three bearing and shaft assemblies (10) for excessive bearing wear, roughness, or binding. If condition of bearing is in doubt, check as follows:

(1) Remove driveshaft from each end of hanger assembly (paragraph 6-77).

(2) Rotate bearing while pressing in axially on end of hangar. Obvious roughness, catching, or binding when turned by hand is cause for replacement.

(3) If ratcheting noise is detected when coupling assembly is spun, while attached to airframe, replace bearing.

f. Inspect three non-flexible couplings (11) for scratches, nicks, dents, and cracks. Minor damage that can be polished out with fine India stone (C116) is acceptable.

g. Inspect three outer flexible couplings (8) for discoloration due to overheating. If the coupling has a mult-color appearance, disassemble the coupling and inspect splines and teeth.

h. Inspect three outer flexible couplings (8) for scratches, nicks, dents, and cracks. Minor damage that can be polished out with fine India stone (C116) is acceptable.

i. Inspect three seals (9) for protrusion, leakage, cuts, tears and deterioration. Replace unserviceable seals.

j. Disassemble three outer flexible couplings (8) from inner flexible couplings (7) and inspect as follows:

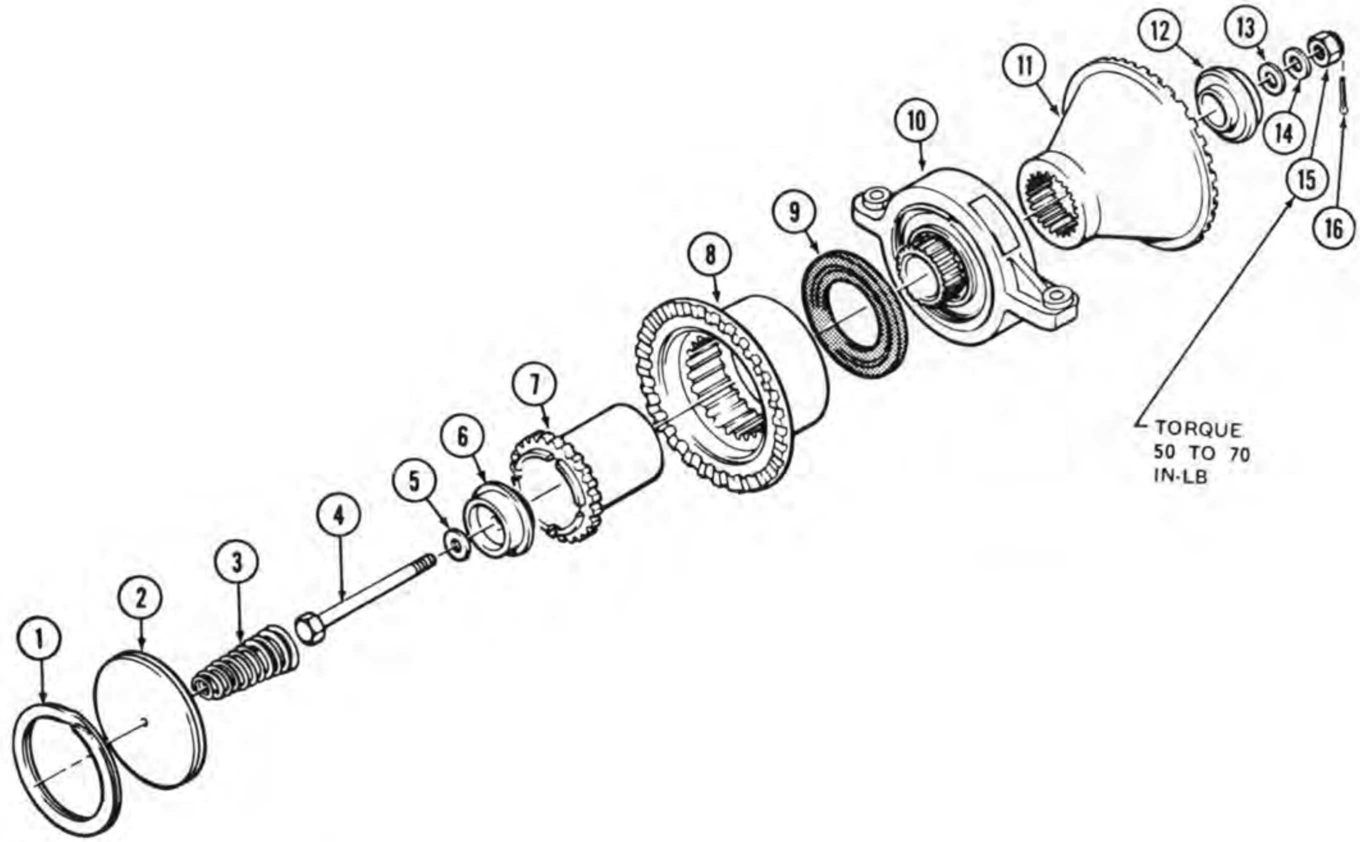
(1) Remove retaining ring (1). At the same time hold seal plate (2) against spring pressure.

(2) Remove seal plate (2) and spring (3).

CAUTION

Do not use cleaning solvent inside coupling. Solvent leaves residue.

(3) Hold outer flexible coupling (8) at full outward position and use a clean lint-free cloth to remove all old grease. Clean coupling splines thoroughly.



1. Retaining ring
2. Seal plate
3. Spring
4. Retaining bolt
5. Washer (aluminum)
6. Plate
7. Coupling (inner flexible)
8. Coupling (outer flexible)
9. Seal
10. Bearing and shaft assembly
11. Coupling (non flexible)
12. Plate
13. Washer (aluminum)
14. Washer (steel)
15. Nut
16. Cotter pin

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Figure 6-31. Tail Rotor Driveshaft Hanger Assembly

(4) Visually inspect splices of outer flexible coupling (8) for unusual wear patterns, nicks, dents, and cracks. Inspect inner flexible coupling teeth for unusual wear patterns, nicks, dents and cracks. See figure 6-32 for examples of acceptable wear patterns. Maximum acceptable wear is **0.005** inch.

(5) Assemble outer flexible coupling (8) on inner flexible coupling (7). Move outer flexible coupling (8) forward and aft with clockwise and counterclockwise preload and feel for roughness. If any roughness or resistance is felt, reinspect internal splines of outer flexible coupling (8) and teeth on inner flexible coupling (7). Refer to step (4).

(6) Lubricate and assemble three inner and outer flexible couplings (7 and 8) (paragraphs 6-86.c. and 6-87).

k. Install tail rotor driveshaft sections that were removed at step e (paragraph 6-81).

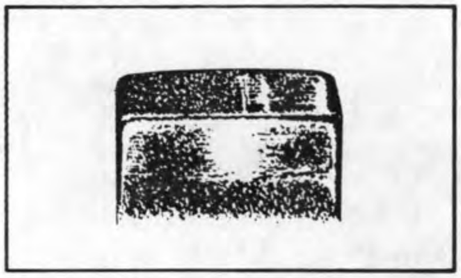
6-86. REPAIR — TAIL ROTOR DRIVESHAFT HANGER ASSEMBLY.

a. Replace parts of driveshaft hanger assemblies that are damaged in excess of acceptable limits (paragraph 6-85).

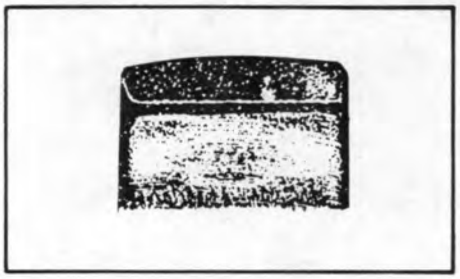
b. Disassemble hanger assembly as follows:

(1) Remove spiral retaining ring (1, figure 6-31), seal plate (2) and spring (3) from outer flexible coupling (8).

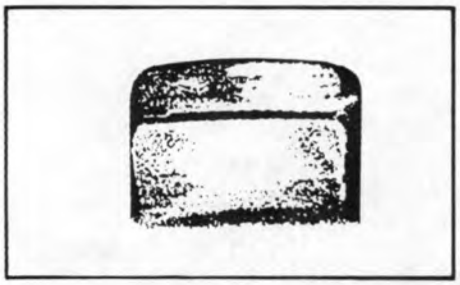
(2) Remove cotter pin (16), nut (15), and retaining bolt (4). Remove aluminum washers (5 and



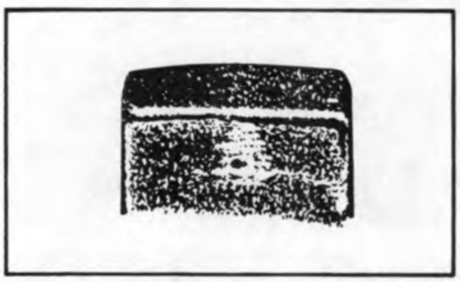
A Acceptable pattern typical of low operating time.



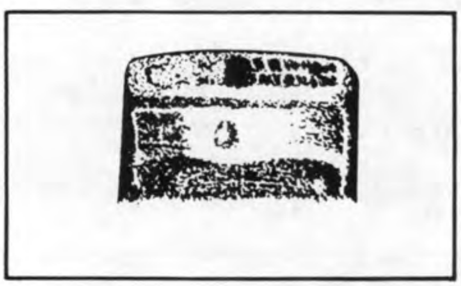
B Acceptable pattern typical of couplings which have operated with normal misalignment for a longer period of time than that shown in A.



C Acceptable pattern denoting operation at higher torque than that shown in A and B.



D Acceptable pattern showing a pitted tooth. This condition is acceptable on all teeth.



E Pattern shows a more severe condition of tooth pitting than that shown in D. There is no metal projecting above the normal face of the tooth, indicating that the pitted area is polishing over. This condition may exist on all teeth. Couplings with pits larger than 1/32 inch diameter should be replaced.

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Figure 6-32. Coupling Teeth Wear Patterns

13) and steel washer (14). Remove inner flexible coupling (7), outer flexible coupling (8) and non-flexible coupling (11) from bearing and shaft assembly (10). Remove seal (9) from outer flexible coupling (8).

c. Assemble hanger assembly as follows:

CAUTION

It is possible to erroneously intermix outer coupling (8, figure 6-31) inner coupling (7) and bearing on bearing and shaft assembly (10) with similar parts manufactured for other helicopters. Confirm that all driveshaft hanger assembly parts are correct part number (TM 55-1520-236-23P).

(1) Install seal (9, figure 6–31) into groove at small end of outer flexible coupling (8) with seal lip toward flange end of coupling. Use a burnishing tool to seat seal between gear teeth and end of coupling.

(2) Apply lubricant (C56) to splines of inner flexible coupling (7) and insert into outer flexible coupling (8).

(3) Install nonflexible coupling (11). Install inner flexible coupling (7) and outer flexible coupling (8) to the (forward) retaining ring side of bearing and shaft assembly (10).

(4) Install aluminum washer (5) and plate (6) against head of retaining bolt (4) and insert bolt through previously assembled parts.

(5) Install plate (12), aluminum washer (13), steel washer (14), and nut (15) on retaining bolt (4). Torque nut (15) **50 TO 70** inch-pounds. Install cotter pin (16).

(6) Hold outer flexible coupling (8) at full outward position. Hand–pack lubricant (C56) to **0.12** inch depth over top of internal spline teeth.

(7) Install spring (3), seal plate (2), and retaining ring (1).

6-87. LUBRICATION — TAIL ROTOR DRIVESHAFT HANGER ASSEMBLY.

NOTE

Tail rotor driveshaft hanger assemblies can be lubricated while installed on tailboom.

a. Hold seal plate (2, figure 6-31) against spring (3) and remove retaining ring (1).

b. Remove seal plate (2) and spring (3).

CAUTION

Do not use cleaning solvent inside flexible coupling. Solvent leaves residue.

c. Hold outer flexible coupling (8) full outboard and clean old grease from coupling with clean cloths.

d. Hand pack grease (C56) to **0.12** inch depth over top of spline teeth on outer flexible coupling (8).

e. Keep outer flexible coupling (8) at full outboard position. Install spring (3), seal plate (2), and retaining ring (1).

6-88. INSTALLATION — TAIL ROTOR DRIVESHAFT HANGER ASSEMBLY.

NOTE

If driveshaft misalignment is suspected, refer to paragraph 6-95.

a. Place dissimilar metals tape (C120) (16, figure 6-29) on bearing hanger support fitting (12).

b. Position hanger assembly (7) on bearing hanger support fitting (12) with outer flexible coupling (3) forward.

NOTE

Use additional washers if required to obtain proper thread engagement on bolts (6).

c. Install bolts (6), thin steel washers (5), steel washers (4), aluminum washers (15), thin steel washers (14) and nuts (13). Ensure that aluminum washers (15) are installed next to the support fitting. Torque nuts (13) evenly **50 TO 70** inch-pounds in sequence shown in figure 6-29.

6-89. TAIL ROTOR DRIVESHAFT BEARING HANGER SUPPORT FITTING.

6-90. DESCRIPTION — TAIL ROTOR DRIVESHAFT BEARING HANGER SUPPORT FITTING.

Two bearing hanger support fittings (12, figure 6-29) are located on the tailboom. One bearing hanger support fitting (11) is located on the engine service deck. The bearing hanger support fittings support the three bearing hanger assemblies (7) and the tail rotor driveshaft.

6-91. REMOVAL — TAIL ROTOR DRIVESHAFT BEARING HANGER SUPPORT FITTINGS.

a. Remove tail rotor driveshaft sections as required (paragraph 6-77).

b. Remove tail rotor driveshaft hangers as required (paragraph 6-84.)

CAUTION

Identify shims under bearing hanger support fittings (11 and 12, figure 6-29) for reinstallation in same position. Do not attempt to remove or change shims.

c. Remove bearing hanger support fitting (11) by removing four screws and washers securing support to engine deck.

6-92. INSPECTION — TAIL ROTOR DRIVESHAFT BEARING HANGER SUPPORT FITTINGS.

Inspect bearing hanger support fittings (11 and 12, figure 6-29) for scratches, nicks, dents, cracks, and corrosion. Superficial scratches and nicks are acceptable.

6-93. REPAIR — TAIL ROTOR DRIVESHAFT BEARING HANGER SUPPORT FITTINGS.

a. Replace tail rotor driveshaft bearing hanger support fittings that are damaged in excess of acceptable limits (paragraph 6-92).

b. Touch up paint on tail rotor driveshaft bearing hanger support fittings to match existing finish.

6-94. INSTALLATION — TAIL ROTOR DRIVESHAFT BEARING HANGER SUPPORT FITTING.

CAUTION

Identify shims under bearing hanger support fittings (11 and 12, figure 6-29) for reinstallation in same position. Do not attempt to remove or change shims.

a. Place dissimilar metals tape (C120) on shims prior to installing bearing hanger support fittings (11 and 12).

b. Position bearing hanger support fitting (12, figure 6-29) with tab on left side on tailboom and shims in position. Secure to tailboom with screws and washers.

c. Position bearing hanger support fitting (11) with tab on left side on engine deck and shims in position. Secure with screws and washers.

d. Install tail rotor driveshaft hanger (paragraph 6-88).

WARNING

Ensure that flexible couplings are properly lubricated prior to installation of driveshaft (paragraph 1-29).

e. Install tail rotor driveshaft sections (paragraph 6-81).

6-95. ALIGNMENT — TAIL ROTOR DRIVESHAFT BEARING HANGER SUPPORT FITTING.

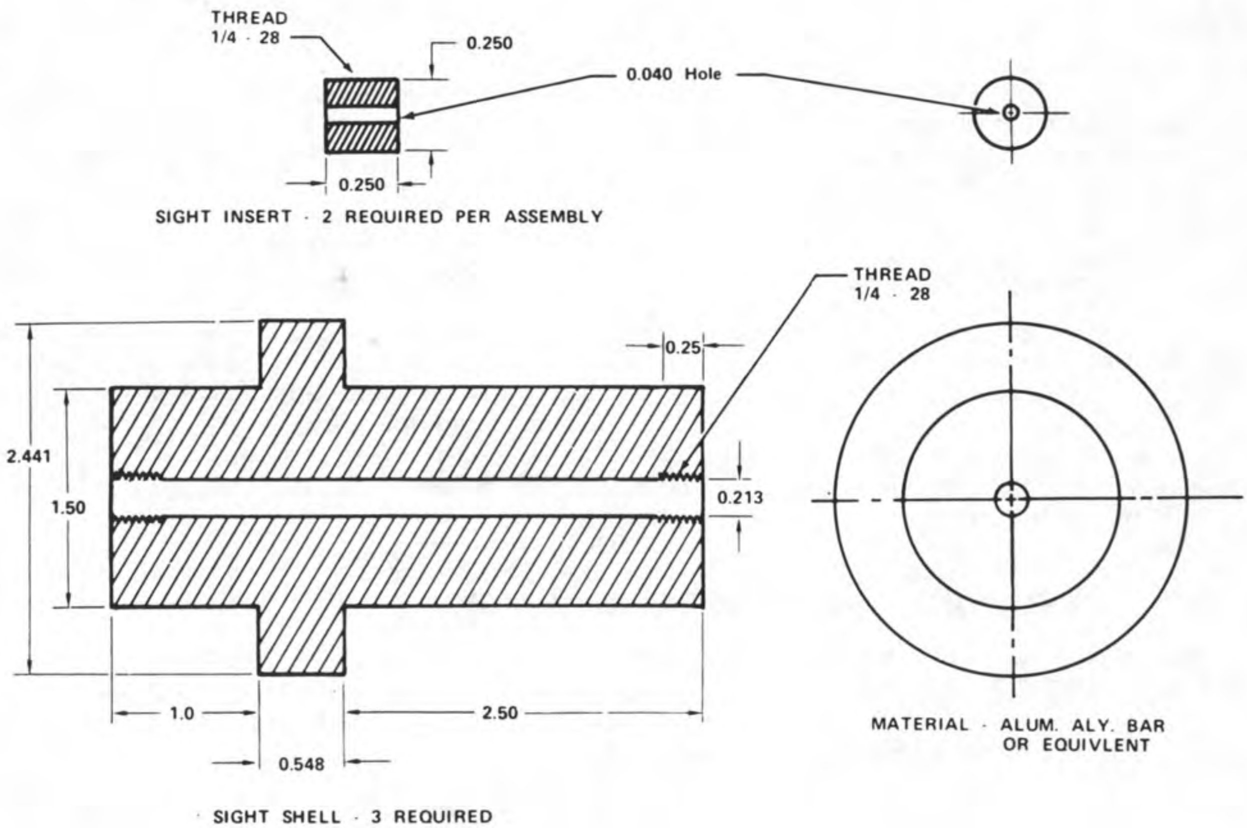
CAUTION

Procedures herein are for aligning the fitting on engine deck with fittings on tailboom. Alignment of fittings on tailboom is a depot function.

a. Remove four driveshaft sections (1, figure 6-29) between transmission and intermediate gearbox (10) (paragraph 6-77).

b. Remove three hanger assemblies (7) paragraph 6-84).

c. Attach an alignment workaid (figure 6-33) to each of the three bearing hanger support fittings (11 and 12, figure 29). Bolts (6) with nuts and washers may be used to attach workaids to fittings.



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

MATERIALS

Aluminum Alloy Bar Stock 2.5 x 12.5	**1 each**
Bolts, AN-4	**6 each**
Hanger, Driveshaft (obtained from stock)	**3 each**
Ring, Lock P/N R244C or Equivalent	**3 each**

1. **Fabricate three alignment sight shells from aluminum bar stock to dimensions shown.**
2. **Fabricate six sight inserts from AN-4 bolts. Install bolts in threaded ends of sight shells and cut off flush with face of shell. Center drill bolts to 0.040 inch diameter, using a No. 60 drill.**
3. **Press each of the sight assemblies into a tail rotor driveshaft hanger (obtained from stock) and secure with a lock ring P/N R244C or equivalent.**

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Figure 6-33. Work Aid — Driveshaft Hanger Support Alignment

d. Place flashlight or suitable light against forward end of work aid attached to bearing hanger support fitting (11) on engine deck.

e. Look through aft end of work aid attached to the most aft bearing hanger support fitting (12) at the light. If light is not visible, bearing hanger support fitting (11) on engine deck is misaligned.

f. If necessary, shim bearing hanger support fitting as follows:

(1) Remove bearing hanger support fitting (11) (paragraph 6-91).

(2) Remove or add shims until light is visible through all three work aids. Bond shims to engine deck with adhesive (C14).

(3) Install bearing hanger support fitting (11) (paragraph 6-94).

g. Remove all three work aids from fittings.

h. Install three hanger assemblies (7) (paragraph 6-88).

WARNING

Ensure that crowned tooth coupling is properly lubricated prior to installation of driveshaft (paragraph 1-29).

i. Install four driveshaft sections (1) (paragraph 6-81).

SECTION V. INTERMEDIATE GEARBOX

6-96. INTERMEDIATE GEARBOX.

6-97. DESCRIPTION — INTERMEDIATE GEARBOX.

The intermediate gearbox (15, figure 6-34) is located on the tailboom at the base of the vertical fin. The gearbox provides a forty-two degree change in direction of tail rotor driveshaft. It consists of a case with a gear quill in each end. The case is fitted with a breather-type oil filler cap, an oil level sight gage and a drain plug equipped with a chip detector which activates warning lights on the pilot and gunner caution panels and the miscellaneous controls panel when excessive metal particle contamination occurs. The input and output quills have flexible couplings for attachment of drive-shafts. Access is provided by a cover with quick-release fasteners.

6-98. LUBRICATION — INTERMEDIATE GEARBOX.

a. Service gearbox with oil to proper level (paragraph 1-7).

b. Lubricate gearbox flexible couplings as follows:

NOTE

Couplings can be lubricated with gearbox installed on tailboom and driveshafts disconnected.

(1) Remove retaining ring (1, figure 6-35) while holding seal plate (2) against pressure of centering spring (3).

(2) Remove seal plate (2), centering spring (3), and spacer (5).

CAUTION

Do not use cleaning solvent inside coupling. Solvent leaves residue.

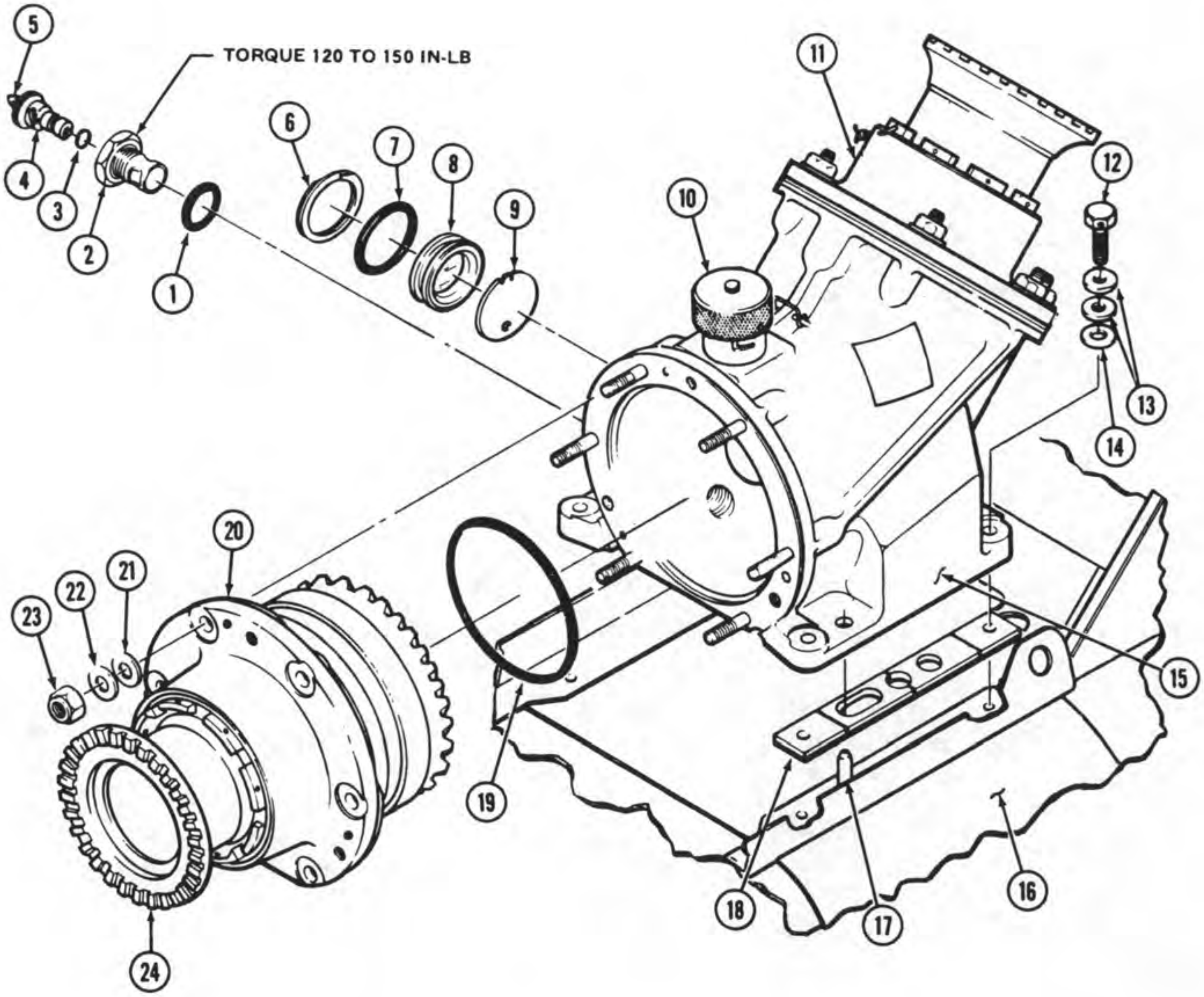
NOTE

Care must be taken to ensure that the retainer plug does not become unsealed from inner coupling.

(3) Hold couplings at full outward position. Remove old grease as thoroughly as possible.

(4) Hand pack grease (C56) to 0.12 inch depth over top of internal spline teeth.

(5) Keep coupling at full outward position. Ensure retainer (6) and lock spring (4) are properly seated. Reinstall spacer (5), centering spring (3), seal plate (2), and spiral retaining ring (1).



1. Gasket
*2. Chip detector self-closing valve
3. Packing
4. Chip detector
5. Nut
6. Retaining ring
7. Packing
8. Sight glass
9. Sight gage
10. Filler cap
11. Output quill
12. Bolt
13. Steel washer
14. Aluminum washer
15. Gearbox
16. Tail boom
17. Alignment pin
18. Shim
19. Packing
20. Input quill
21. Aluminum washer
22. Steel washer
23. Nut
24. Flexible coupling

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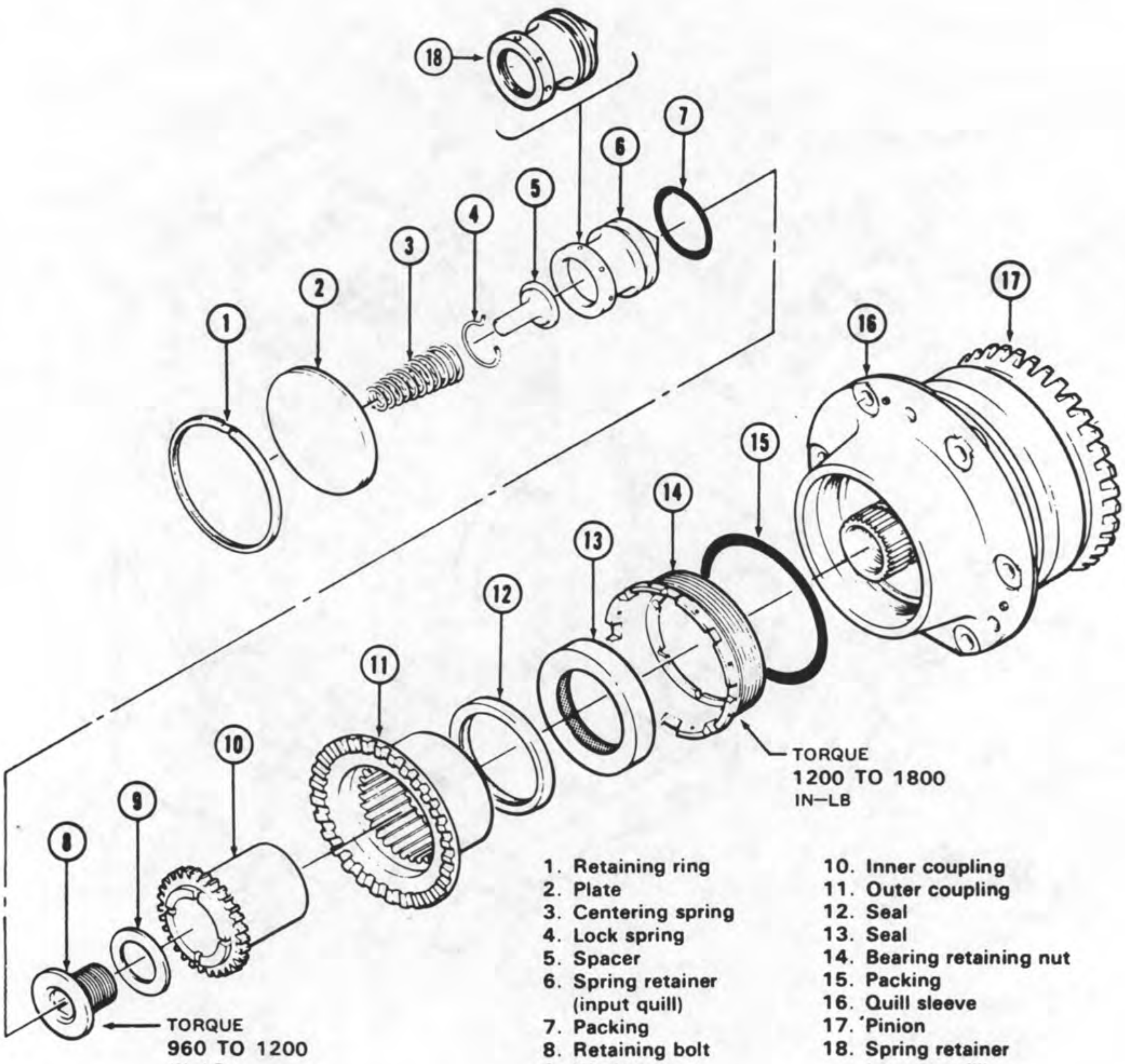
Figure 6-34. Intermediate Gearbox Installation



1. Retaining ring
2. Plate
3. Centering spring
4. Lock spring
5. Spacer
6. Spring retainer (input quill)
7. Packing
8. Retaining bolt
9. Washer
10. Inner coupling
11. Outer coupling
12. Seal
13. Seal
14. Bearing retaining nut
15. Packing
16. Quill sleeve
17. Pinion
18. Spring retainer (output quill)

CAUTION

Input quill spring retainer (6) P/N 204-040-607-7 and output quill spring retainer (18) P/N 204-040-607-5 are not interchangeable.

Input centering spring is not interchangeable with output centering spring.

Input quill pinion (17) P/N 212-040-500-7 and output quill gear (not illustrated) P/N 212-040-500-6 are not interchangeable.

Be sure correct part number is installed in each quill.

Figure 6-35. Intermediate Gearbox Quill, Seals, and Couplings (Typical) (Sheet 1 of 2)

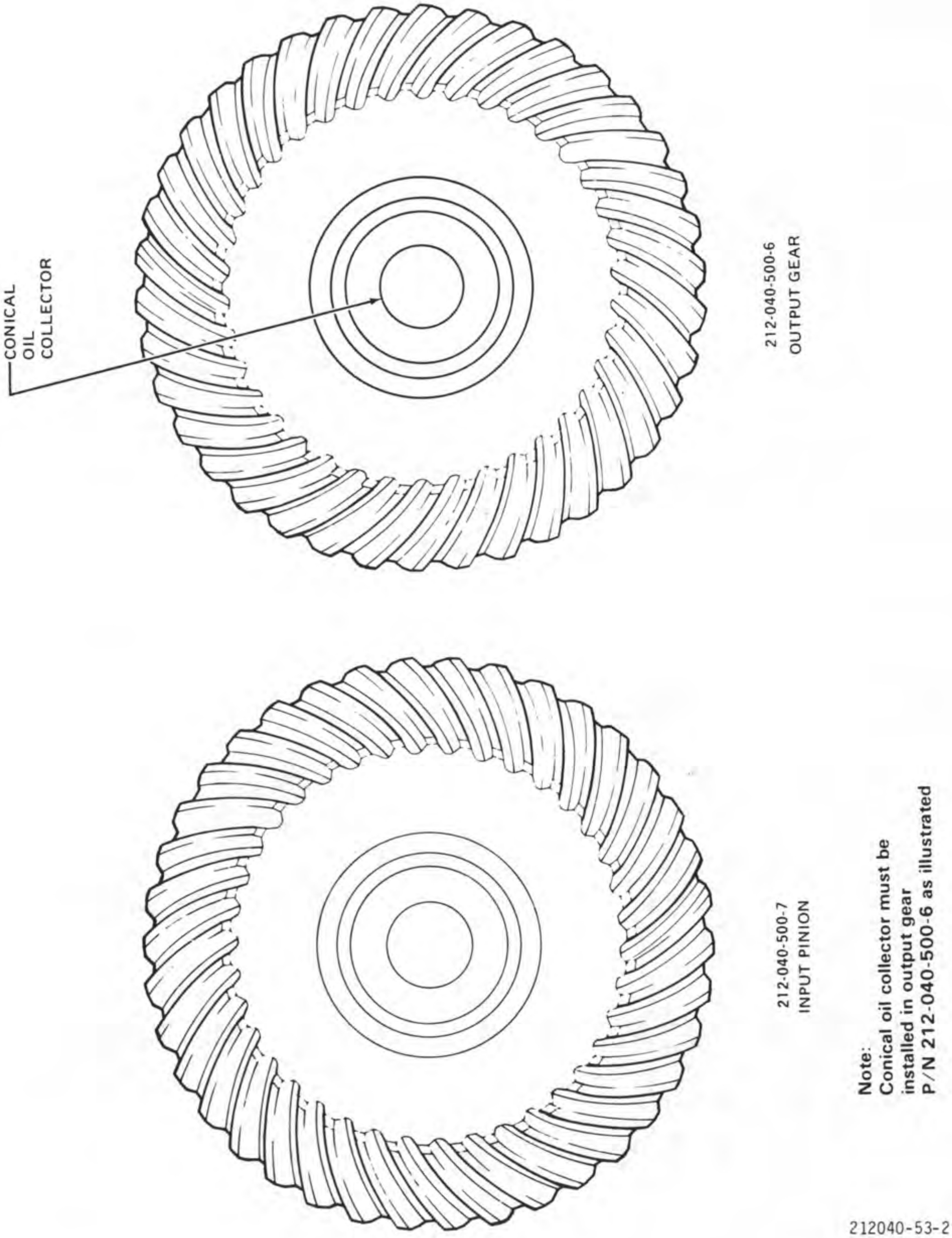


Figure 6-35. Intermediate Gearbox Quill, Seals, and Couplings (Typical) (Sheet 2 of 2)

6-99. INSPECTION — INSTALLED INTERMEDIATE GEARBOX.

a. Remove intermediate gearbox cover (fairing).

b. Inspect installed intermediate gearbox (15, figure 6-34) as follows:

(1) Obvious mechanical and corrosion damage. Refer to paragraph 6-102 for acceptable limits.

(2) Oil sight glass for correct oil level.

(3) Oil leakage.

(4) Lubricant leakage at flexible couplings (24) on input quill and output quill.

(5) Secure installation of four bolts (12) that secure gearbox to tailboom. If lockwire and/or torque lacquer on bolts indicates that bolts have moved, remove all four bolts, inspect, and reinstall (paragraph 6-105).

(6) Shake gearbox and check for looseness on tailboom. No looseness is acceptable.

(7) Check for evidence of fretting corrosion at mating surface between gearbox and tailboom that could be caused by movement of the gearbox on the tailboom.

(8) Magnetic chip detector (4) and wiring for secure installation and for damage.

(9) Inspect oil filler cap (10) for security of installation.

(10) Inspect tail rotor driveshaft clamp set (four bolts) for security of installation.

(11) Check for overheating of two flexible couplings (24) evidenced by multi-color appearance. Refer to paragraph 6-110 if overheating is suspected.

c. Install tail rotor gearbox covers (fairings) and close vertical fin driveshaft door.

6-100. REMOVAL — INTERMEDIATE GEARBOX.

a. When the intermediate gearbox is to be replaced, unless conditions prevent operation, perform a ten minute ground runup and drain operation oil. If runup is not practical, remove intermediate gearbox and flush with its own operating oil. Attach tag to intermediate gearbox stating: "PRESERVED WITH OPERATING LUBRICANT".

b. Remove gearbox cover and open tail rotor driveshaft access doors.

c. Disconnect tail rotor driveshafts from gearbox input and output couplings (paragraph 6-77).

CAUTION

To avoid damage to driveshaft hanger bearing or coupling, either remove clamp set from both ends of driveshaft before removing either end of shaft from its mating curvic coupling, or support unattached end of shaft to hold shaft aligned on normal operating axis while gearbox is removed.

d. Disconnect electrical lead from chip detector (4, figure 6-34).

e. Remove lockwire, four bolts (12), and washers (13 and 14). Remove gearbox 15) from tailboom. Do not remove shims 18).

6-101. CLEANING — INTERMEDIATE GEARBOX.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Do not force dirt or solvent into bearings or flexible couplings by use of compressed air.

Clean removed parts and exterior of gearbox assembly with solvent (C112).

6-102. INSPECTION — INTERMEDIATE GEARBOX (GEARBOX REMOVED FROM HELICOPTER).

a. Inspect gearbox and historical records for evidence gearbox has been involved in an accident or incident that requires special inspection (paragraph 6-103).

b. Inspect gearbox for oil leakage.

c. Inspect both gearbox flexible couplings for lubricant leakage.

NOTE

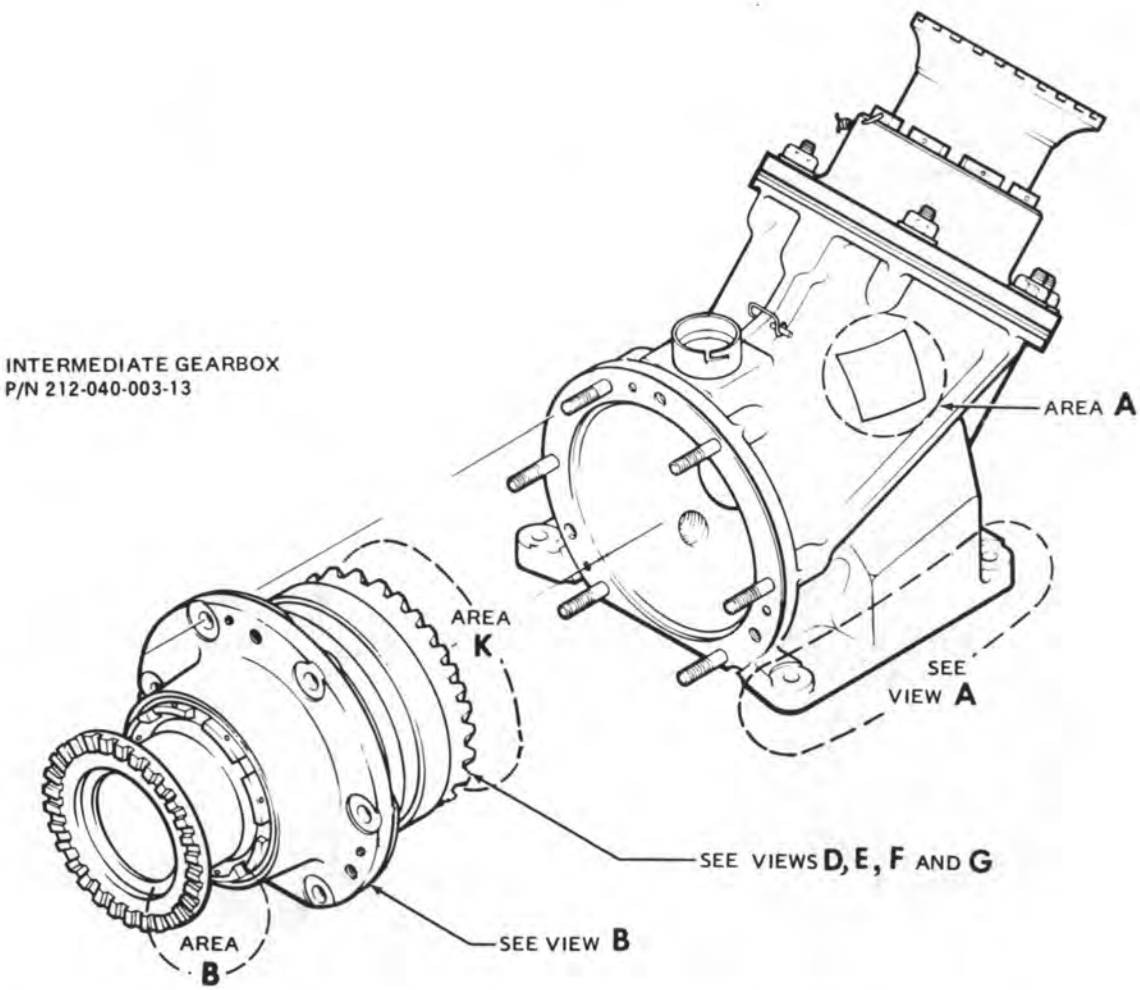
To remove chip detector (4, figure 6-34) push body of detector in and turn left to disengage bayonet pins, then withdraw from chip detector self-closing valve (2).

d. Inspect chip detector (4) for metal particles (paragraph 6-4).

e. Inspect gearbox for elongated mounting bolt holes. See figure 6-36 for maximum acceptable elongation.

f. Inspect gearbox for mechanical and corrosion damage. See figure 6-36 for acceptable damage limits and instructions to rework damaged gearbox cases.

g. Inspect oil filler cap (10, figure 6-34) for damage that would affect function.



NOTE: The damage limits shown for the input quill are also applicable to the output quill.

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Figure 6-36. Damage Limits — Intermediate Gearbox (Sheet 1 of 7)

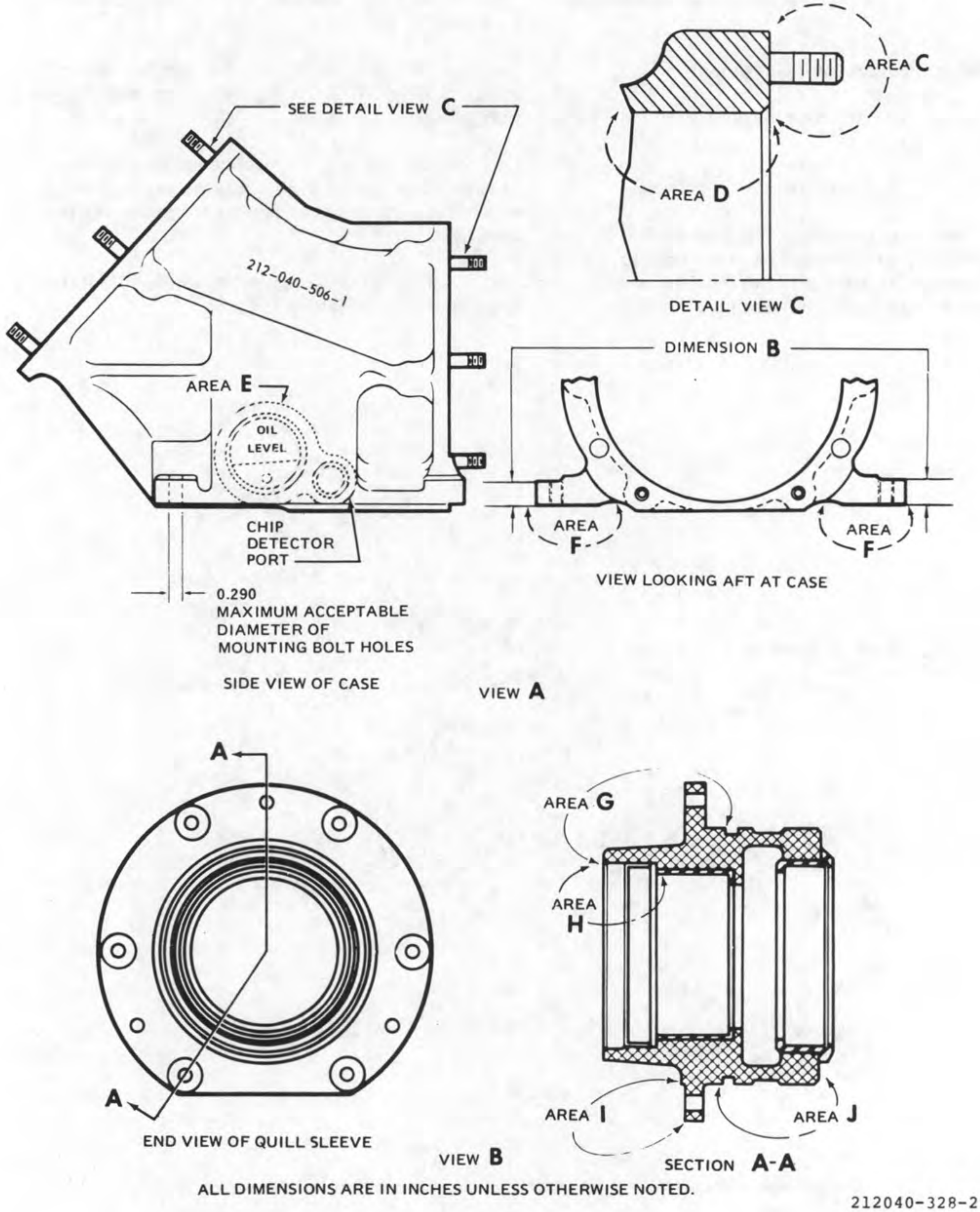
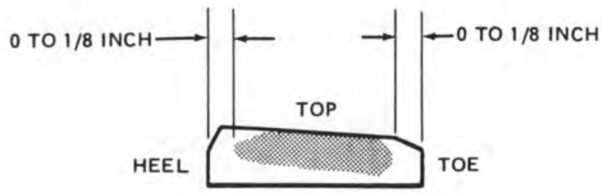


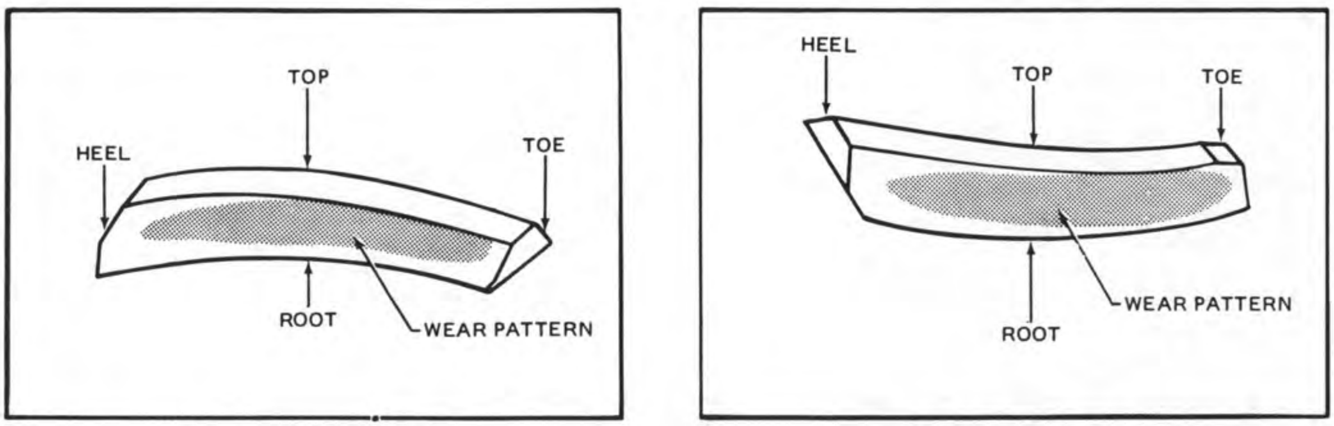
Figure 6-36. Damage Limits — Intermediate Gearbox (Sheet 2 of 7)



ROOT (CONVEX SIDE)

GEAR P/N 212-040-500-6

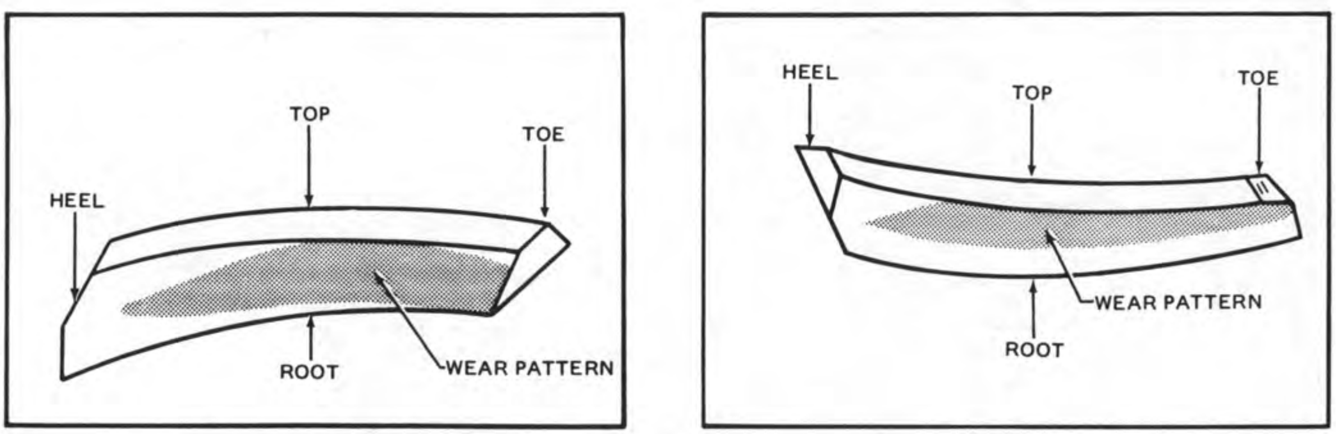
VIEW **D** PATTERN TOLERANCES AT TOE AND HEEL



PINION P/N 212-040-500-7

GEAR P/N 212-040-500-6

VIEW **E** DESIRED WEAR PATTERN



PINION P/N 212-040-500-7

GEAR P/N 212-040-500-6

VIEW **F** ACCEPTABLE WEAR PATTERN TOUCHING TOE

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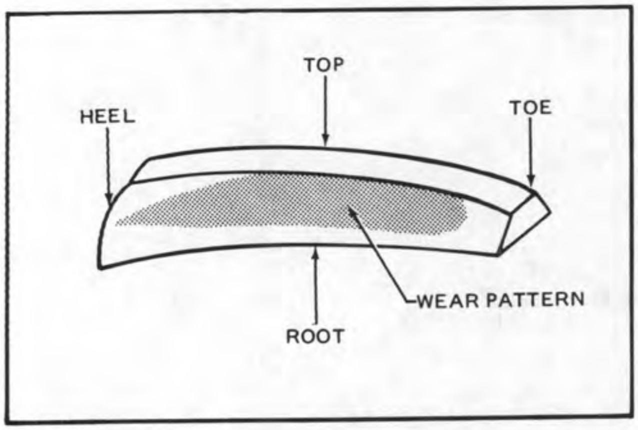
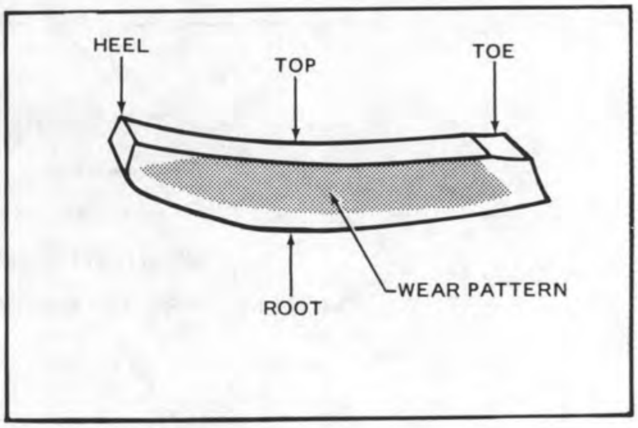
Figure 6-36. Damage Limits — Intermediate Gearbox (Sheet 3 of 7)



PINION P/N 212-040-500-7



GEAR P/N 212-040-500-6

VIEW **G** ACCEPTABLE WEAR PATTERN

AREA	LIMITS
All - - - - - -	No cracks acceptable
Case Assembly Undesignated areas	Mechanical damage and/or corrosion pitting on the case outside "designated" areas is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits: 1. Rework is no more than 0.020 inch deep. 2. No more than forty percent of the area within one square inch or more than twenty percent of the total area is damaged. 3. Damaged area must be treated for corrosion protection in accordance with general instructions
A - - - - - -	Identification plate legible and securely bonded to case.
B - - - - - -	Minor scratches and burrs on external surface of coupling are acceptable if polished out with India stone. Indication of overheating of coupling, such as multi-color appearance, is cause to remove the outer coupling and inspect splines and teeth. Inspection procedure is furnished in text. These limits are also applicable to the coupling on the output quill.
C - - - - - -	Corrosion damage in area C may be reparable at higher level of maintenance. If there is evidence of corrosion under shims or around base of studs, send gear box to higher level of maintenance.

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Figure 6-36. Damage Limits — Intermediate Gearbox (Sheet 4 of 7)

AREA	LIMITS
D - - - - - -	Mechanical damage and/or corrosion pitting on case in area D is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits: 1. Rework is no more than 0.010 inch deep. 2. No more than twenty percent of the total surface area and no more than ten percent of any one inch square is damaged. 3. Damaged area must be treated for corrosion protection in accordance with general instructions.
E - - - - - -	Mechanical and corrosion damage limits for area E are the same as limits for area D.
F - - - - - -	Mechanical damage and/or corrosion fittings in area F on the lower surface of the case is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits: 1. Rework is no more than 0.030 inch deep. 2. No more than forty percent of area within any one inch square or more than twenty percent of the total surface is damaged. Mechanical damage and/or corrosion pitting on upper machined surface at four mounting bolt holes is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits: 1. Rework is no more than 0.020 inch deep. 2. No more than twenty percent of total area is damaged. 3. No more than ten percent of the area contacted by the washer is damaged. 4. Minimum thickness of flange in damaged area is no less than 0.430 inch. 5. Damaged area must be treated for corrosion protection in accordance with general instructions. NOTE Damage on area F that is in excess of limits noted above may be reparable at higher level of maintenance. Elongation of four mounting bolt holes is acceptable up to maximum diameter of 0.290 inch.
G - - - - - -	Mechanical damage and/or corrosion pitting on quill sleeves in area G (exclusive of area I and under shim) is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits: 1. Rework is no more than 0.030 inch deep.

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Figure 6-36. Damage Limits — Intermediate Gearbox (Sheet 5 of 7)

AREA	LIMITS
	2. No more than forty percent of the area within any one inch square or more than twenty percent of the total area of any surface or diameter is damaged.
	NOTE
	Corrosion damage under shim may be reparable at higher level of maintenance. If there is evidence of corrosion under shim, send gear box to higher level of maintenance.
H - - - - - -	Mechanical damage and/or corrosion pitting in area H is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits:
	1. Rework is no more than 0.010 inch deep.
	2. No more than twenty percent of the total area and no more than thirty percent of any one inch square is damaged.
	3. No sharp corners that could damage packings are acceptable.
	4. Damaged area must be treated for corrosion protection in accordance with general instructions.
I - - - - - -	Mechanical damage and/or corrosion pitting on the spot faced surface at holes for quill attaching studs is acceptable provided the damage is polished out and the rework to completely remove the damage is within the following limits:
	1. Rework is no more than 0.020 inch deep.
	2. No more than twenty percent of the spot faced area of any hole is pitted.
	3. No more than twenty percent of the total area normally contacted by the washer is pitted.
	4. No more than fifty percent of the width of the area normally contacted by the washer may be pitted at any point around the hole.
J - - - - - -	Mechanical and corrosion damage limits for area J are the same as limits for area H.
K - - - - - -	The wear pattern information in this section is applicable to input quill pinions P/N 212-040-500-7 and output quill gear P/N 212-040-500-6. The wear pattern appears on the concave side of the pinion teeth and on the convex side of the gear teeth. Wear patterns on any tooth of the pinion or gear that are defined as unacceptable are cause to replace the intermediate gearbox.
	1. Desired Wear Pattern: The desired wear pattern is shown in view C. A speckled or mottled appearance in the flank of the pinion or top of the gear due to dulite removal is permissible. The wide and not too well defined toe pattern is characteristic of this gear set. The area of the wear pattern in the flank of the gear is very faint and proper lighting must be used in order to see it.

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Figure 6-36. Damage Limits — Intermediate Gearbox (Sheet 6 of 7)

AREA	LIMITS
	2. Acceptable Wear Patterns: Examples of acceptable wear patterns are shown in views F and G. These figures show various pattern toe and heel locations.
	3. Pattern Limits at Toe: The pattern may touch the toe or be a maximum of 1/8 inch from toe on gear number, see view D. Usually, the pattern will touch the toe in the flank of the pinion and at the top of the gear as shown on view F. If the pattern touches the toe, but is more than 1/8 inch from heel on gear member, then the pattern is off the toe and is unacceptable. This method of inspection must be used, due to the wide toe pattern, to determine whether the pattern is just touching the toe or is running off the toe. If pattern variation at the toe exceeds 1/32 inch, it is unacceptable.
	4. Pattern Limits at Heel: The pattern may touch the heel or be maximum of 1/8 inch from heel on gear member, see view D. If pattern variation of the heel exceeds 1/32 inch it is unacceptable.
	5. Pattern Profile: The pattern in the profile direction must touch or extend over the top of the pinion as shown by views E,F, and G. On the gear, the pattern may be 1/32 inch from the top or may extend over the top. Most of the gear patterns will extend over the top as shown by views E, F, and G. A bright line occurring at the top of pinion or in the flank of the gear is unacceptable.
	6. In addition to pattern size and location, examine the drive face of all gear teeth for the following unacceptable defects: non-clean up, grinding scratches, pitting, corrosion, cuts, nicks, dents, grinding flats or barber poling (evidenced by diagonal streaks in the wear pattern), scuffing, scoring, or inclusions. If any of these defects can be felt with a scribe having a 0.002 inch radius spherical point, the affected part is unacceptable.

GENERAL INSTRUCTIONS.

Repair mechanical and corrosion damage to case and quill sleeve as follows:

1. Polish out corrosion damage to completely clean up surface. Use sandpaper (C102) or crocus cloth (C37). Blend repair in with surrounding surface and make minimum radius 0.250 inch. Use 400 grit abrasive paper (C102) to make repair area surface 63 microinches or better. Ensure that depth and/or area of repair does not exceed acceptable limits specified for the areas designated above. Treat reworked areas for corrosion protection with MIL-M-3171C, Type VI treatment (commercial designation Dow No. 19) (C42). Refer to TM 43-0105 for application procedures. Prime all rework areas that were painted prior to repair. Use polyamide epoxy primer (C88). Point to match existing finish.

2. Polish out mechanical damage to depth to remove all traces of the damage. Finish polishing out with 400 grit abrasive paper (C102) to blend repair smoothly into surrounding surface. Ensure that damage does not exceed acceptable limits. Apply corrosion protection, prime, and paint in the same manner as described in preceding step.

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Figure 6-36. Damage Limits — Intermediate Gearbox (Sheet 7 of 7)

h. Inspect sight glass (8) for damage that could cause leakage and for staining that would prevent seeing oil level.

i. Inspect shims (18) for secure installation on tailboom.

j. If quill or quills are removed, refer to paragraph 6-110 for inspection procedure for gear wear patterns.

k. Inspect couplings for mechanical damage and for evidence of overheating. Refer to paragraph 6-110 if overheating is suspected.

6-103. SPECIAL INSPECTION — INTERMEDIATE GEARBOX.

NOTE

Special inspections of intermediate gearbox are required after tail rotor drive system overtorque, sudden stoppage, compressor stall, etc. Refer to paragraph 1-55, Special Inspection.

a. Remove output quill from intermediate gearbox (paragraph 6-108).

b. Inspect output quill gear teeth for scoring. See figure 6-36 for procedure to check teeth for roughness with a scribe having a **0.002** inch spherical point.

c. Inspect output quill gear teeth for wear patterns outside acceptable limits. See figure 6-36 for instructions to evaluate gear patterns.

d. If scoring, abnormal wear patterns, or other discrepancies are detected, send gearbox to next higher maintenance level.

6-104. REPAIR — INTERMEDIATE GEARBOX.

a. Replace gearbox if damaged in excess of acceptable limits (paragraphs 6-102 and 6-103).

b. Repair leaking quills by replacing seals or packings (paragraph 6-111).

c. Replace oil filler cap and packing if damaged or unserviceable. If filler cap contains an insufficient amount of aluminum wool, replace as follows:

(1) Remove pin (1, figure 6-37) from cap (10).

(2) Remove ring (11), cap (10), and spring assembly (9) from plug (7).

(3) Remove packing (8) from plug (7). Discard packing.

(4) Remove ring spiralox (4), washer (5), and packing (6) from plug (7). Discard packing (6).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(5) Clean parts with solvent (C112).

(6) Fill plug (7) with new aluminum wool packing (6) (C20) and place washer (5) in plug. Check to determine whether correct amount of aluminum wool is installed. Push washer (5) inward **0.06** inch. If washer springs back to its original position, the correct amount of aluminum wool is installed. Add or remove aluminum wool as required. Secure washer (5) in place with ring spiralox (4).

(7) Coat packing (8) with oil (C79 or C80) and position packing on plug (7).

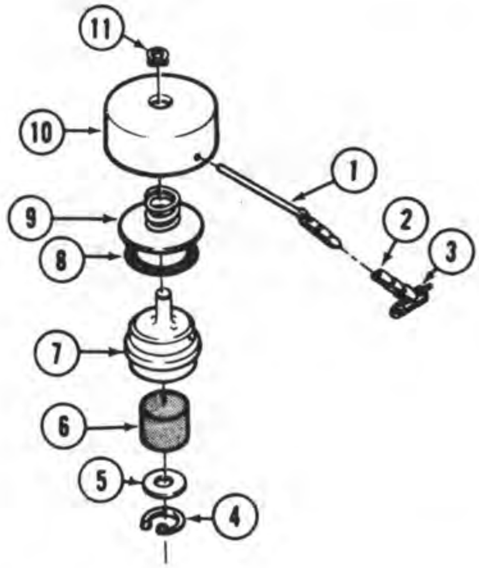
(8) Install spring assembly (9), cap (10), and ring (11) on plug (7). Insert pin (1) through cap (10) and bend end of pin to secure.

d. Replace sight glass (8, figure 6-34) if damaged or leaking.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(1) Remove retaining ring (6, figure 6-34), packing (7), sight glass (8), and sight gage (9). Clean sight gage (9) with solvent (C112).



1. Pin
2. Chain
3. Pin (safety)
4. Ring spiralox
5. Washer
6. Packing (aluminum wool)
7. Plug
8. Packing
9. Spring assembly
10. Cap
11. Ring

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Figure 6-37. Oil Filler Cap Assembly

(2) Position sight gage (9) in gearbox. Place new packing (7) on sight glass (8). Install sight glass with flat side out. Install retaining ring (6).

e. Polish out mechanical and corrosion damage on gearbox case that is within limits shown on figure 6-36. Comply with "General Instructions" on figure 6-36.

f. Replace gasket (1, figure 6-34) if leaking. Torque self-closing valve (2) **120 TO 150** inch-pounds and secure with lockwire (C137).

6-105. INSTALLATION — INTERMEDIATE GEARBOX.

CAUTION

Do not remove or change shims installed on tailboom under gearbox, as any resulting misalignment could cause excessive stresses, vibration, wear, and possible eventual failure of components in tail rotor drive train.

a. Apply primer (C88 or C91) to mating surfaces of gearbox (15, figure 6-34), shims (18) and tailboom (16).

b. Position intermediate gearbox, with oil sight gage and chip detector at right side, on tailboom. Ensure that hole in gearbox case is positioned over alignment pin (17).

NOTE

Steel washers (13) may be removed or added to ensure proper thread engagement. Minimum acceptable washers is one steel and one aluminum with steel washer under bolt head.

c. Install four bolts (12) with steel washers (13) next to bolt heads and aluminum washers (14) next to gearbox. Torque bolts evenly **50 TO 70** inch-pounds. Secure bolts with lockwire (C137). Lockwire left rear bolt to left forward bolt. Lockwire right rear bolt to drain plug, then lockwire right forward bolt to drain plug.

WARNING

Ensure that flexible coupling is properly lubricated prior to installation of driveshaft (paragraph 1-29).

d. Install driveshafts (paragraph 6-81).

e. Connect electrical wire to chip detector (4) with nut (5). Do not overtorque nut (5).

6-106. INTERMEDIATE GEARBOX QUILLS.

6-107. DESCRIPTION — INTERMEDIATE GEARBOX QUILLS.

The intermediate gearbox input and output quills consist of a pinion gear bearing mounted in a sleeve. Each quill has a flexible coupling for attachment of driveshafts. The output quill has an oil collector cone installed on the inboard end of the pinion gear.

6-108. REMOVAL — INTERMEDIATE GEARBOX QUILLS.

Premaintenance Requirements for Removal of Intermediate Gearbox Quills

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T26) (T27) (T37) (T55)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C56) (C106) (C112) (C116) (C137)
Special Environmental Conditions	None

a. Remove gearbox and drain oil (paragraph 6-99).

NOTE

Either quill can be removed using the following procedures.

b. Remove nuts (23, figure 6-34) and aluminum and steel washers (21 and 22).

c. Cut sealant around quill sleeve and gearbox case with a sharp plastic scraper. Remove sealant from jackscrew holes.

d. Install three jackscrews (T27) in jackscrew holes in quill sleeve. Tighten jackscrews evenly to pull quill from case.

NOTE

Do not remove shims from quill sleeve or from gearbox case.

e. Cover opening in gear case port to prevent entry of foreign material.

6-109. CLEANING — INTERMEDIATE GEARBOX QUILLS.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contacts with skin or eyes.

CAUTION

Do not force dirt or solvent into bearings or flexible couplings by use of compressed air.

a. Prior to cleaning inspect quills for evidence of oil and/or grease leakage (paragraph 6-110).

b. Clean exterior of quill with solvent (C112).

c. Clean sealant from quill sleeve and gearbox case with a plastic scraper.

NOTE

The following cleaning pertains to a disassembled quill. Do not use cleaning solvent inside couplings. Solvent leaves residue.

d. Use a clean dry cloth to clean lubricant from inner and outer coupling.

e. Clean old sealant from bearing retaining nut and inside of quill sleeve with a plastic scraper. Ensure that sealant does not contaminate quill bearings.

6-110. INSPECTION — INTERMEDAITE GEARBOX QUILLS.

a. Inspect quills for evidence of oil leakage at seal (13, figure 6-35).

b. Inspect quills for evidence of grease leakage at seal (12).

c. Inspect inner couplings (10) on both quills for wear and damage on surface contacted by seal (12) during operation. Wear is allowable to minimum diameter of **1.587** inches, provided groove is uniform and smooth.

d. Inspect outer coupling (11) on input and output quills for discoloration due to overheating. If the coupling has a multi-color appearance, disassemble the coupling and inspect splines and teeth as outlined in step g.

e. Inspect outer couplings (11) on input and output quills for scratches, nicks, dents, and cracks. Minor damage that can be polished out with fine India stone (C116) is acceptable.

f. Inspect seals (12) on input and output quills for protrusion, leakage, cuts, tears, and deterioration.

g. Disassemble outer couplings (11) from inner couplings (10) and inspect as follows:

(1) Remove retaining ring (1). At the same time, hold seal plate (2) against spring pressure.

(2) Remove seal plate (2) and centering spring (3).

CAUTION

Do not use cleaning solvent inside coupling. Solvent leaves residue.

(3) Hold outer coupling (11) at full outboard position, and use clean, lint-free cloth to remove all old grease. Clean coupling splines thoroughly.

(4) Visually inspect splines of outer coupling (11) for unusual wear patterns, nicks, dents, and cracks. Inspect inner coupling (10) teeth for unusual wear patterns, nicks, dents, and cracks. See figure 6-32 for examples of acceptable wear patterns. Maximum acceptable wear is **0.005** inch measured from unworn surface of tooth.

(5) Assemble outer coupling (11, figure 6-35) coupling (10). Move outer coupling (11) forward and aft, preload against coupling (10). Rotate clockwise and counterclockwise, feel for roughness. If any roughness or resistance is felt, reinspect splines on outer coupling (11) and teeth on inner coupling (10). Refer to step (4).

(6) Lubricate and assemble outer coupling (11) and inner coupling (10) (paragraph 6-111).

h. Inspect teeth on input quill pinion and output quill gear for abnormal wear patterns, roughness, and cracks. See figure 6-36 for instructions to perform this inspection.

i. Inspect quill sleeves for mechanical and corrosion damage. See figure 6-36 for damage limits and instructions to rework damaged quills.

6-111. REPAIR — INTERMEDIATE GEARBOX QUILLS. (AVIM)

a. Replace quills (or intermediate gearbox if required) that have damage in excess of limits noted in paragraph 6-110.

b. Polish out mechanical and corrosion damage that is within limits shown on figure 6-36. Comply with "General Instructions" on figure 6-36.

c. Disassemble quill as follows:

(1) Remove retaining ring (1, figure 6-35), plate (2), centering spring (3), lock spring (4), and spacer (5).

(2) Remove retainer (6) with packing (7). If retainer is difficult to remove, install a 1/4-20 threaded bolt in center of retainer and pull on bolt to withdraw retainer. Remove packing.

(3) Install wrench assembly (T26) on outer coupling (11). Insert a square-drive tool through wrench and remove retaining bolt (8) and washer (9).

(4) Remove and separate inner and outer couplings (10 and 11). Remove seal (12) from outer coupling.

(5) Position holding plate (T37) on quill sleeve (16) with pins engaged in bolt holes. Remove lockwire and use wrench (T55) to remove bearing retaining nut (14). Remove packing (15) and press seal (13) from nut.

(6) Clean disassembled quill (paragraph 6-109).

(7) Inspect disassembled quill (paragraph 6-110).

d. Assemble quill as follows:

(1) Coat seal (13) with oil used in gearbox. Press seal into bearing retaining nut (14) from outboard side, with lip of seal facing inboard. Place new packing (15) on nut.

(2) Position holding plate (T37) on quill sleeve (16) with pins engaged in bolt holes. Coat threads of bearing retaining nut (14) with oil used in gearbox and start into sleeve. Use wrench (T55) to torque nut **1200 TO 1800** inch-pounds. Remove tools. Secure nut to sleeve with lockwire (C137).

(3) Examine inner coupling (10) for damage or wear on surface contacted by seal (12). Polish out any minor nicks, dents, burrs or scratches. Wear is allowable to minimum diameter of 1.587 inches, if groove is uniform and smooth.

(4) Install new seal (12) onto outer coupling (11) with lip of seal facing outboard. Place a small amount of grease (C56) on internal splines of coupling. Insert inner coupling (10) into outer coupling (11).

(5) Position coupling assembly on splined shaft of gear (17). Place washer (9) on retaining bolt (8), coat bolt threads with oil and start into end of gear shaft. Hold outer coupling (11) with wrench T26) and use a square-drive extension to torque retaining bolt (8) **960 TO 1200** inch-pounds.

(6) Coat internal splines of outer coupling with grease (C56) to **0.12** inch depth over top of spline teeth.

CAUTION

Input quill spring retainer (6) P/N 204-040-607-7 and output quill spring retainer (18) P/N 204-040-607-5 are not interchangeable.

Input quill pinion (17) P/N 212-040-500-7 and output quill gear (not illustrated) P/N 212-040-507-6 are not interchangeable.

Be sure correct part number is installed in each quill.

(7) Place packing (7) on retainer (6). Insert retainer into retaining bolt (8). Check for alignment of one hole in rim of retainer with a notch in end of inner coupling (10). If necessary, reposition retainer by one-fourth turn increments to obtain alignment.

(8) Place spacer (5) into retainer (6). Install lock spring (4) with tang through aligned hole and notch. Place small end of centering spring (3) on boss of plate (2), and insert large end of spring into retainer. Compress plate into coupling and secure with retaining ring (1).

(9) Hold quill sleeve and manually turn coupling. Check for smooth rotation of gear with only a very light drag caused by preload of bearings.

6-112. INSTALLATION — INTERMEDIATE GEARBOX QUILLS.

a. Remove gearbox port cover.

NOTE

Output drive quill has conical oil collector projecting from center of gear.

b. Ensure that input drive quill is installed in forward port of gear case and output drive quill is installed in aft port of gear case.

c. Install new packing (19, figure 6-34) on quill (20). Carefully align holes in mounting flange of sleeve with studs on gearbox and position flange.

d. Install aluminum washer (21), steel washer (22) and nut (23) on each stud. Manually check meshing of gears while tightening nuts evenly to seat quill sleeve flange on gear case. Torque nuts **50 TO 70** inch-pounds.

e. Check backlash between mating teeth by slight back and forth rotary movement of quill coupling until metal-to-metal contact is felt and heard. Backlash must be evident.

NOTE

Backlash has been permanently set with shims during manufacture. Measurement is not required. Do not change shims on gearbox quill case.

f. Apply a bead of sealant (C105) around joint of quill flange gearbox and jackscrew holes.

g. Install and service gearbox. Refer to paragraph 6-105.

SECTION VI. TAIL ROTOR DRIVE GEARBOX

6-113. TAIL ROTOR DRIVE GEARBOX.

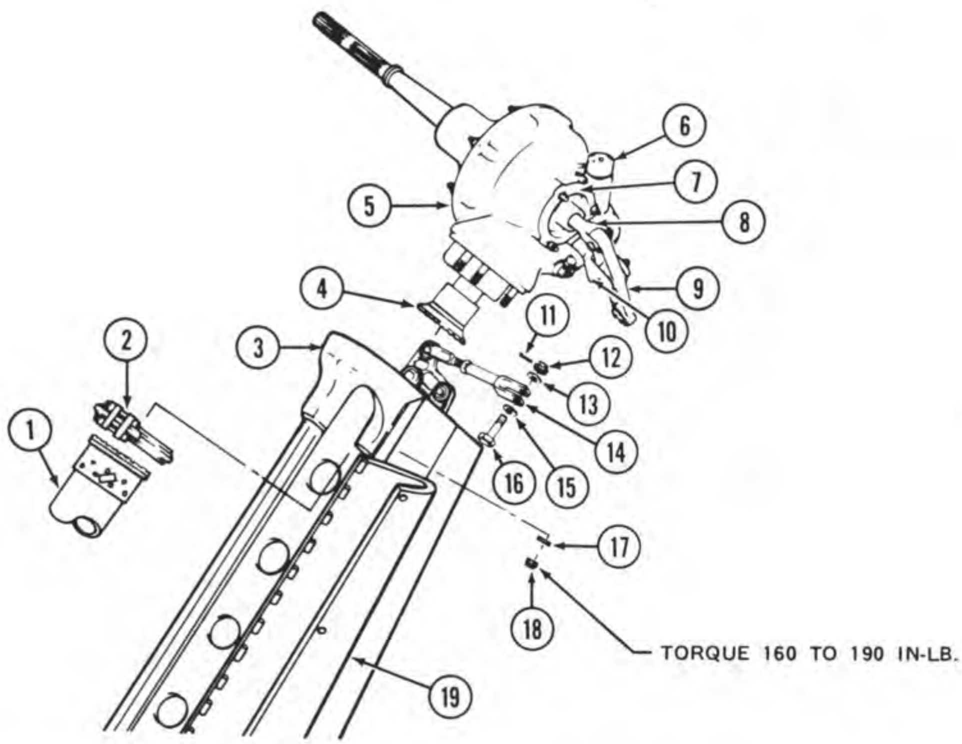
6-114. DESCRIPTION — TAIL ROTOR DRIVE GEARBOX.

A gearbox at top of tailboom vertical fin provides ninety-degree change in direction of drive and speed reduction between the input driveshaft and the output shaft on which the tail rotor is mounted. The gearbox consists of mating input and output gear quill assemblies set into gear case provided with a breather-type oil filler cap, oil level sight gage, and a drain plug with a chip detector. The input quill has a flexible coupling for attachment of driveshaft. Control linkage is attached on the left side, with a control rod extending through the rotor shaft.

6-115. INSPECTION — INSTALLED TAIL ROTOR DRIVE GEARBOX.

a. Open vertical fin cover (19, figure 6-38) and remove tail rotor gearbox covers (fairings).

b. Shake gearbox and check for looseness on tail rotor gearbox support fitting (3).



1. Driveshaft
2. Clamp
3. Tail rotor gearbox support fitting
4. Coupling
5. Tail rotor gearbox
6. Filler cap
7. Tail rotor control housing
8. Control tube
9. Lever
10. Idler
11. Cotter pin
12. Nut
13. Steel washer
14. Link
15. Steel washer
16. Bolt
17. Thin steel washer
18. Nut
19. Vertical fin cover

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Figure 6-38. Tail Rotor Drive Gearbox Installation

c. Inspect for evidence of fretting corrosion at mating surface between tail rotor gearbox (5) and tail rotor gearbox support fitting (3) that could be caused by movement of the gearbox on the support. A grey residue is an indication of fretting. Remove gearbox if residue is present (paragraph 6-117).

d. Inspect six nuts (18) for secure installation, correct torque, and correct thread engagement (paragraph 6-121).

e. Inspect clamp set (2) for secure installation.

f. Inspect control tube (8) and lever (9) for secure installation.

g. Inspect flexible coupling (4) for grease leakage and for overheating evidenced by multi-color appearance.

h. Inspect tail rotor gearbox (5) for scratches, nicks, dents, cracks, corrosion, and oil leakage.

i. Inspect magnetic chip detector (11, figure 6-39) for metal chips.

j. Inspect oil filler cap (4) for damage and correct amount of aluminum wool (paragraph 6-102).

k. Inspect oil sight glass (8) for correct oil level.

l. Install tail rotor gearbox fairings and close vertical fin cover (19, figure 6-38).

6-116. LUBRICATION — TAIL ROTOR DRIVE GEARBOX.

a. Service gearbox with oil to proper level (paragraph 1-6).

b. Remove driveshaft (paragraph 6-77).

c. Lubricate gearbox flexible coupling as follows:

(1) Remove retaining ring (18, figure 6-40) while holding seal plate (17) against spring pressure.

(2) Remove seal plate (17), spring (16), and spacer (14).

CAUTION

Do not use cleaning solvent inside coupling. Solvent leaves residue.

(3) Hold couplings at full outward position. Remove old grease as thoroughly as possible using clean cloths.

(4) Hand pack grease (C56) to **0.12** inch depth over top of internal spline teeth.

(5) Ensure that retainer plug (13) and lock spring (15) are properly installed. Keep outer coupling (1) at full outboard position. Install spacer (14), spring (16), plate (17) and retaining ring (18).

6-117. REMOVAL — TAIL ROTOR DRIVE GEARBOX.

a. Remove tail rotor (paragraph 5-81).

b. Disconnect control link (14, figure 6-38) from lever (9).

c. Disconnect electrical lead from chip detector (11, figure 6-39).

d. Open cover on front of vertical fin. Remove driveshaft (paragraph 6-77).

e. Remove six nuts (18, figure 6-38) and thin steel washers (17). Remove gearbox from tail rotor gearbox support fitting (3).

f. Install spacers, thin steel washers (17) and nuts (18) on gearbox studs to hold input quill in gearbox while the gearbox is removed from the helicopter.

g. If the gearbox is not to be reinstalled, remove lever (9), idler (10), control tube (8), and tail rotor control housing (7). Install a cover fabricated from plywood or similar material to cover port where control housing was removed.

6-118. CLEANING — TAIL ROTOR DRIVE GEARBOX.

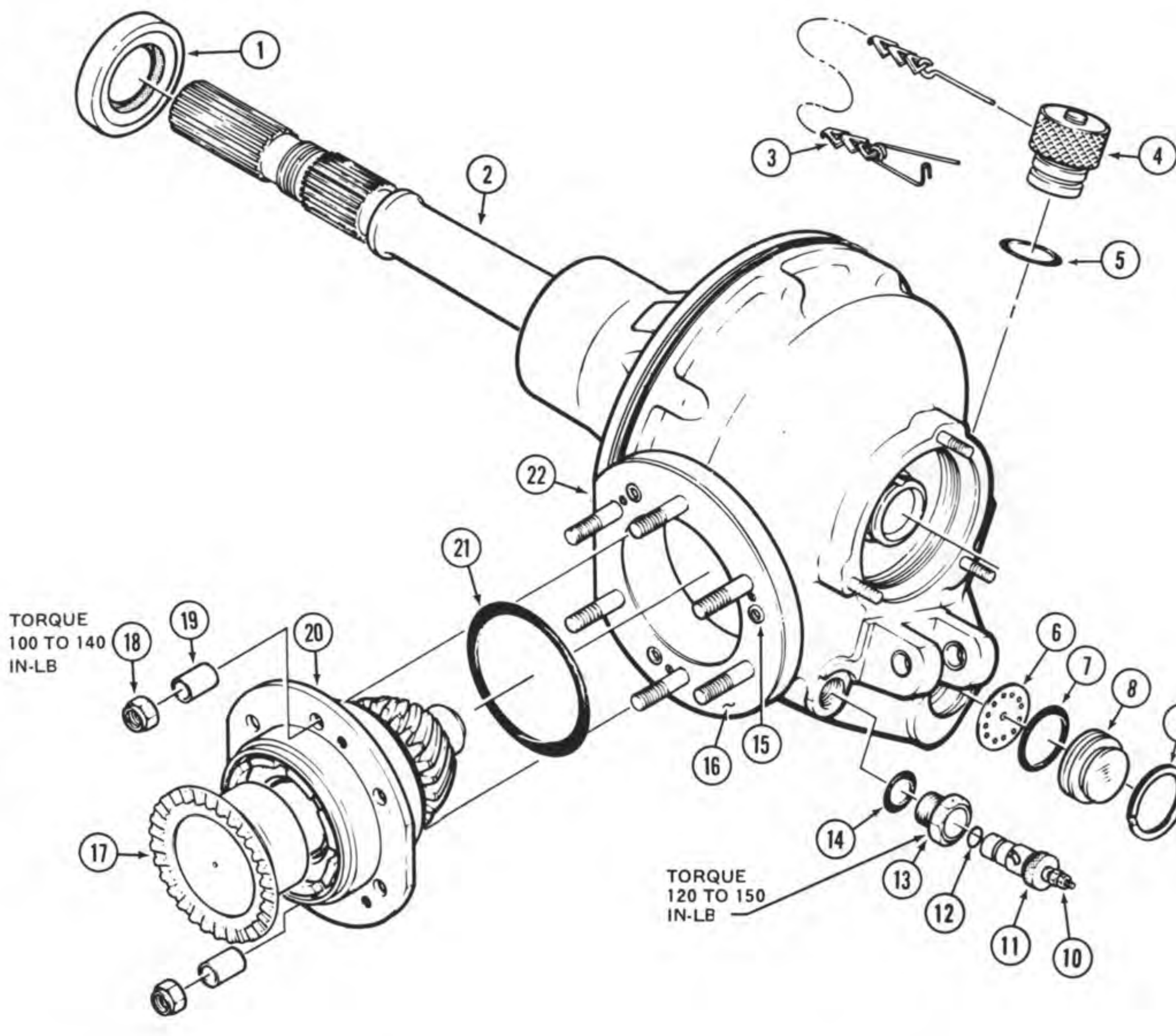
WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Do not permit solvent or dirt to be forced into flexible coupling when using compressed air.

Clean exterior of gearbox and removed parts with solvent (C112).



1. Seal
2. Output shaft
3. Chain and pin
4. Cap
5. Packing
6. Oil level indicator
7. Packing
8. Sight glass
9. Retaining ring
10. Nut
11. Chip detector
12. Packing
13. Chip detector self-closing valve
14. Gasket
15. Screw
16. Shim
17. Flexible coupling
18. Nut
19. Shipping spacer
20. Input quill
21. Packing
22. Case

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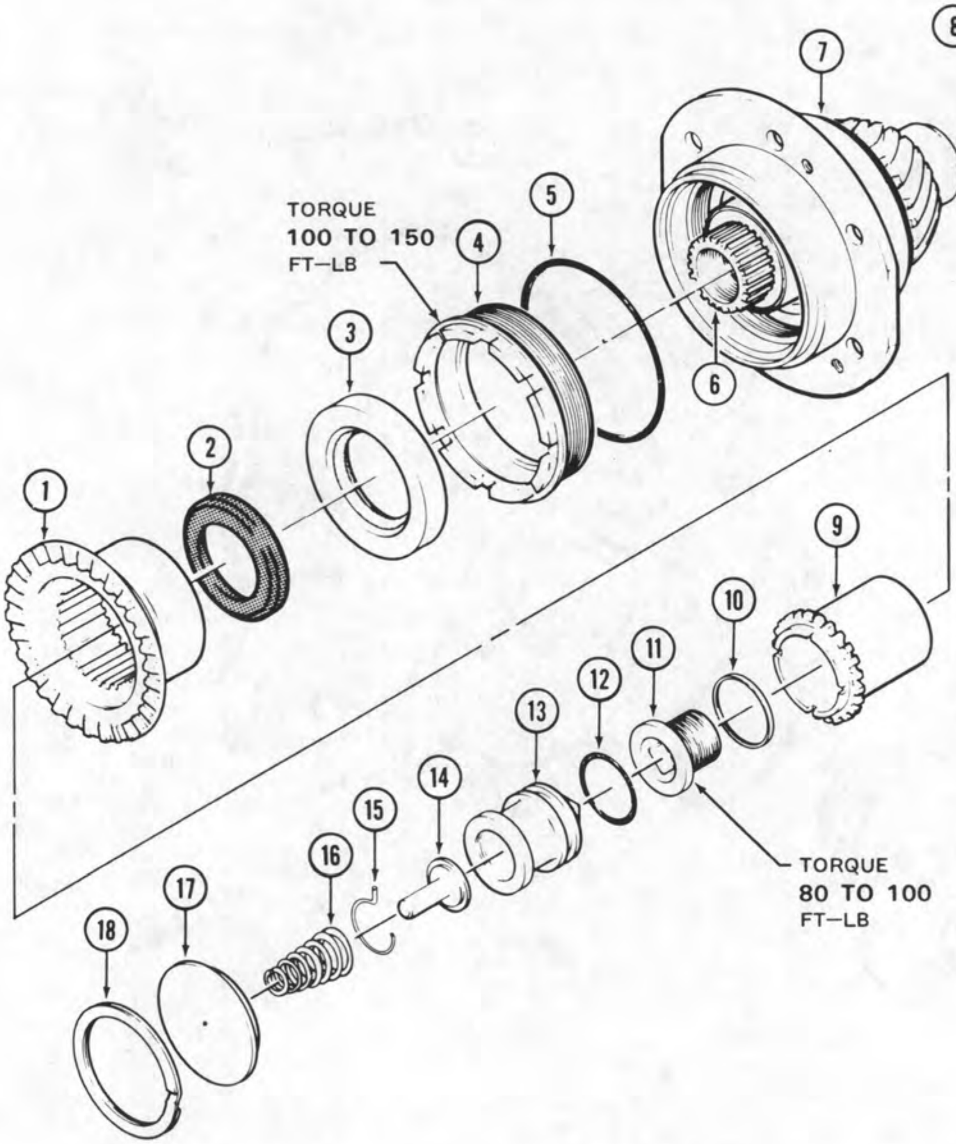
Figure 6-39. Tail Rotor Drive Gearbox Assembly



1. Outer coupling
2. Seal
3. Seal
4. Retainer nut
5. Packing
6. Pinion shaft
7. Sleeve
8. Cork
9. Inner coupling
10. Washer
11. Retainer bolt
12. Packing
13. Retainer plug
14. Spacer
15. Lock spring
16. Spring
17. Plate
18. Retaining ring

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Figure 6-40. Tail Rotor Drive Gearbox Input Quill

6-119. INSPECTION — TAIL ROTOR DRIVE GEARBOX (GEARBOX REMOVED FROM HELICOPTER).

a. Inspect chip detector (11, figure 6-39) for metal particles. If particles are found, refer to paragraph 6-4 to determine required action.

b. Inspect oil filler cap (4) for damage and correct amount of aluminum wool (paragraph 6-104).

c. Inspect gearbox for damage in accordance with figure 6-41.

6-120. REPAIR — TAIL ROTOR DRIVE GEARBOX.

a. Forward gearbox to next higher maintenance level if damage in excess of acceptable limits is detected during inspection.

b. Polish out mechanical and corrosion damage that is within acceptable limits shown on figure 6-41. Treat rework areas for corrosion protection and touch-up as outlined on figure 6-41.

c. Replace leaking seals and/or packings (paragraph 6-127).

d. Replace oil filler cap (4, figure 6-39) and packing (5) if damaged or unserviceable. If filler cap contains an insufficient amount of aluminum wool, replace wool. Refer to paragraph 6-104.

e. Replace sight glass (8) if damaged, discolored or leaking.

(1) Remove retaining ring (9), sight glass (8), packing (7) and oil level indicator (6). Clean parts.

(2) Position oil level indicator (6) in gearbox port. Place packing (7) in groove around sight glass (8). Install glass with flat side out and secure with retaining ring (9).

6-121. INSTALLATION — TAIL ROTOR DRIVE GEARBOX.

CAUTION

Prior to installation of tail rotor gearbox ensure that splined coupling has been properly lubricated in accordance with paragraph 6-116.

CAUTION

Prior to installation of tail rotor drive gearbox ensure that lubricating oil or preservative oil has been drained. Service gearbox with new lubricating oil after installation.

a. Remove sealant from mating surfaces of gearbox and tail rotor gearbox support fitting (3, figure 6-38) using plastic scraper.

b. Apply primer (C88 or C91) to mating surfaces of gearbox and support fitting.

NOTE

Spacers removed in following step are used to hold input quill in gearbox when the gearbox is removed from the helicopter. The spacers are not used on an installed gearbox.

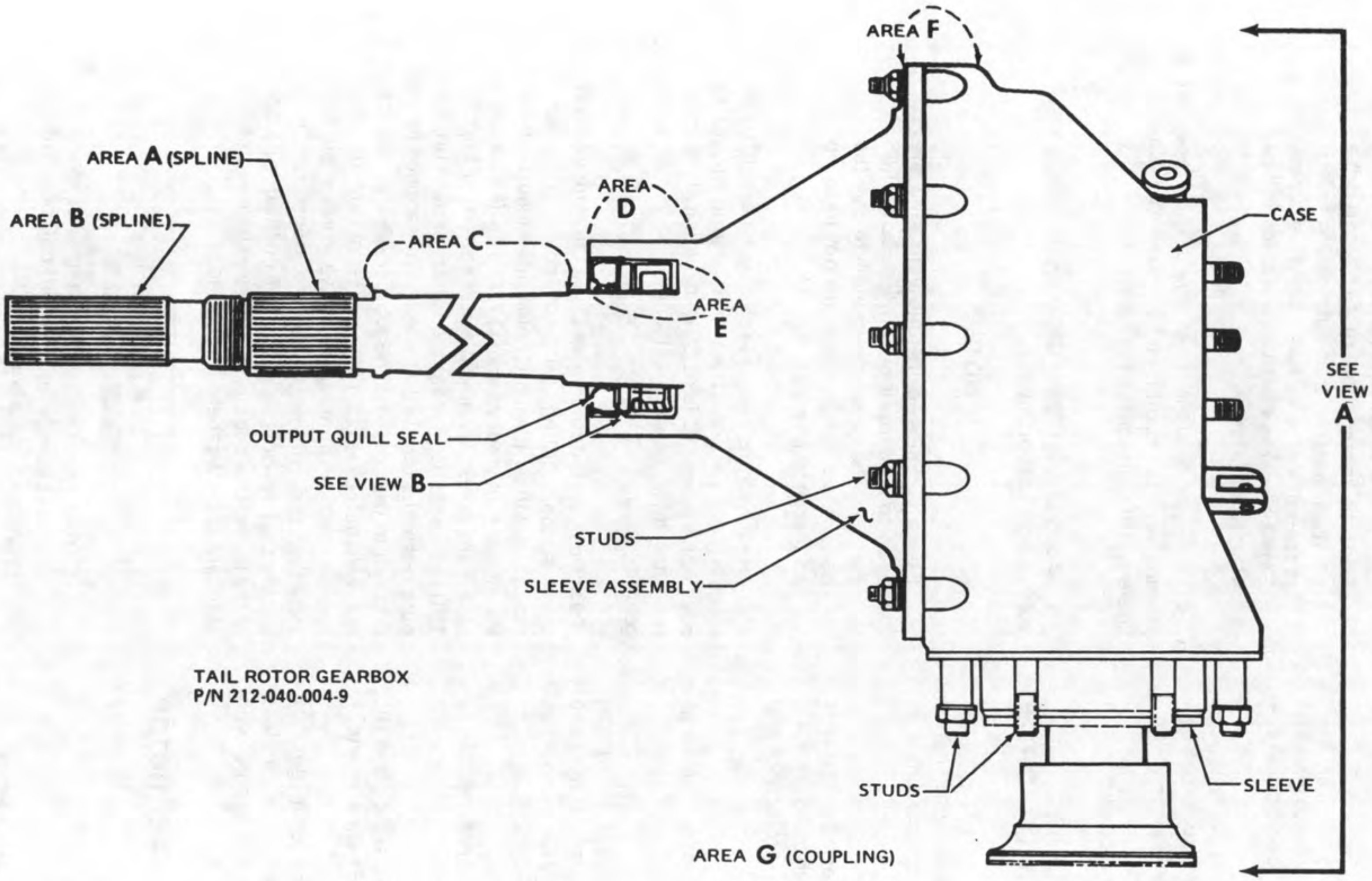
c. Remove nuts (18), thin steel washers (17), and spacers (not illustrated) from studs around input drive quill. Apply primer (C88 or C91) to mating surfaces of tail rotor drive gearbox (5) and to tail rotor drive gearbox support fitting (3).

d. Position tail rotor drive (5) on tail rotor gearbox drive support fitting (3) with coupling (4) and mounting studs through holes in support fitting. Install one thin steel washer (17) and nut (18) on each stud. Torque nuts evenly in a star pattern to **160 TO 190** inch-pounds. Repeat the torque pattern until all nuts retain the torque that was initially applied to the first nut in the pattern. The torque value of the first nut will decrease as the other nuts are torqued. Ensure that a minimum of two thread pitches, including the chamfer, extend through nuts (18). Ensure that the nuts do not bottom on the grip portion of the studs. Use additional thin steel washers (17) or standard steel washers if required.

WARNING

Ensure that flexible coupling is properly lubricated prior to installation of driveshaft (paragraph 1-29).

e. Install driveshaft (paragraph 6-81).

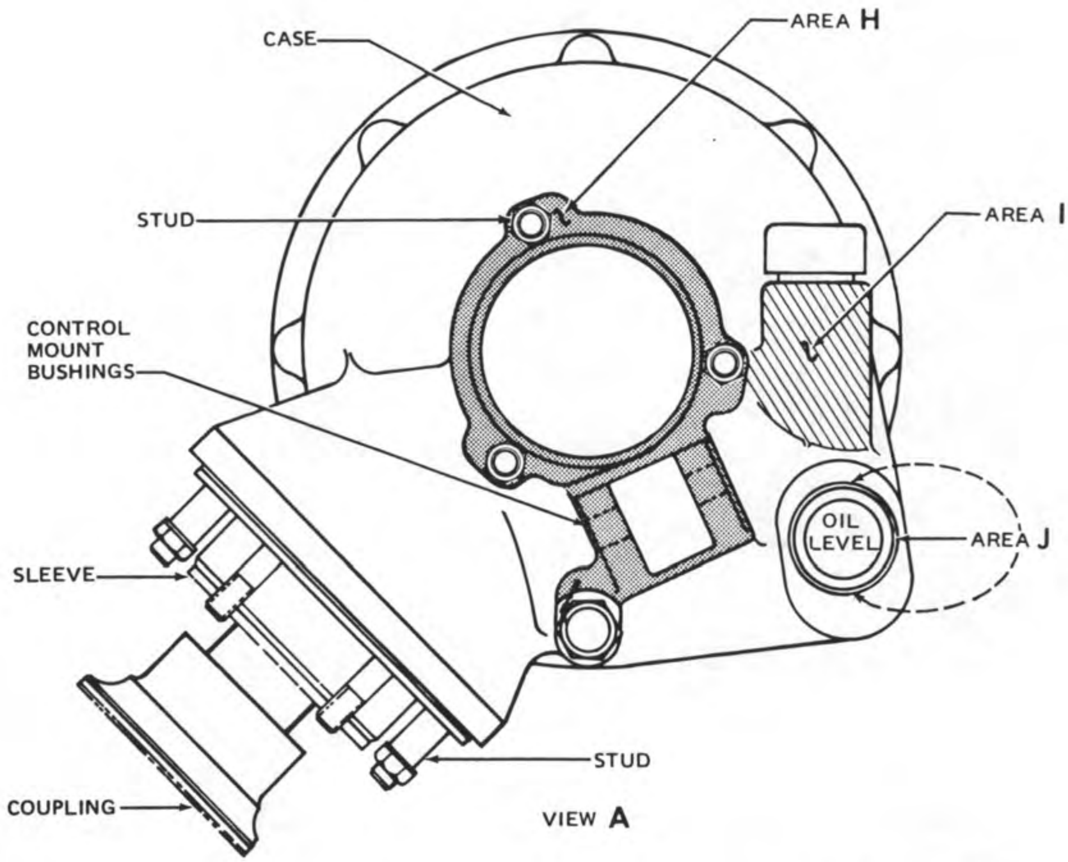


ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

AREA	LIMITS
A	Small nicks, burrs, and scratches on splines are acceptable if they are blended out with fine India stone (C116).
B	Same as Area A.

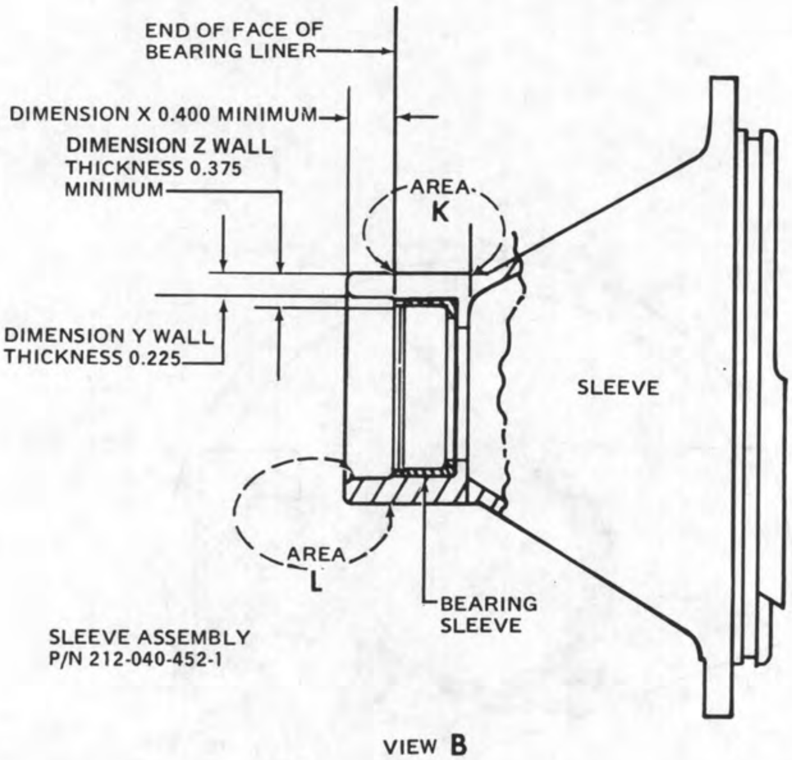
212040-321-1A

Figure 6-41. Damage Limits — Tail Rotor Drive Gearbox (Sheet 1 of 5)



212040-321-2

Figure 6-41. Damage Limits — Tail Rotor Drive Gearbox (Sheet 2 of 5)



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. Minimum acceptable wall thickness (dimension Y) in area L is 0.225 at any location after rework is complete.

2. Minimum acceptable wall thickness (dimension Z) in area K is 0.375 at any location after rework is complete.

3. Minimum acceptable dimension X is 0.400 at any location after rework is complete.

212040-321-3A

Figure 6-41. Damage Limits — Tail Rotor Drive Gearbox (Sheet 3 of 5)

AREA	LIMITS
ALL	No cracks allowed.
C	Nicks, dents, scratches, and corrosion up to 0.005 inch deep are acceptable if polished out with 400 grit emery cloth to blend with surrounding area and have a bottom radius of 0.50 inch. Area C is the outer diameter of the portion of the shaft outside the gearbox between the diameter of the oil seal and the shoulder adjacent to the splines.
D	Nicks, dents, and scratches up to 0.030 inch deep are acceptable if polished out and treated in accordance with general instructions. Corrosion damage up to 0.030 inch deep after clean-up, is acceptable. Treat in accordance with general instructions. Mechanical and corrosion damage maximum area after polishing out is forty percent of the area within one square inch and/or twenty percent of the total area. Also, minimum wall thickness and dimension X specified in notes 1, 2, and 3 in view B must be maintained.
E	Wear limit on the shaft in the area contacted by the output quill seal is 0.002 inch or a minimum shaft diameter of 1.430 inch. Check prior to installing a new output quill seal. Corrosion damage up to 0.005 inch deep is acceptable on the case in the area contacted by the output quill seal if polished out to twice the depth of the corrosion and treated in accordance with general instructions. Mechanical damage up to 0.010 inch deep is acceptable on the case in the area contacted by the output quill seal if polished out and treated in accordance with general instructions. Also lubricating oil must not leak past the seal after installation. Mechanical and corrosion damage maximum area after polishing out is twenty percent of the total area contacted by the output quill seal. Also, minimum wall thickness and dimension X specified in notes 1, 2, and 3 in view B must be maintained. When output quill seal is removed, bearing sleeve shown in view B may be inspected. Evidence of corrosion between bearing sleeve and the sleeve and/or a loose bearing sleeve is cause for replacement of the gearbox.
F	Mechanical and corrosion damage limits are the same as the limits for Area D except that evidence of corrosion under shims and around base of studs is cause to replace gearbox.
G	Small nicks, burrs, and scratches on couplings are acceptable if they are blended out with fine India stone (C116).
H	Mechanical and corrosion damage limits are the same as limits for area D with the exception that no damage is permissible in the following areas: 1. Adjacent to studs. 2. Adjacent to control mount bushings. 3. Inside case bore where pitch change control shaft seal housing pilots.
I	Nicks, dents, and scratches up to 0.040 inch deep are acceptable if polished out and treated in accordance with general instructions.

212040-321-4A

Figure 6-41. Damage Limits — Tail Rotor Drive Gearbox (Sheet 4 of 5)

AREA	LIMITS
I	Corrosion damage up to 0.040 inch deep, after clean-up, is acceptable. Treat in accordance with general instructions.
	Mechanical and corrosion damage maximum area after polishing out is thirty percent of the total area.
J	Mechanical damage in machined area of case, where oil level sight gage is installed, up to 0.010 inch deep is acceptable if polished out to form a smooth contour and treated in accordance with general instructions. Also, lubricating oil must not leak past sight gage.
	Corrosion damage limits in area J are 0.010 inch after clean-up. Corrosion prevention treatment and lubricating oil leakage requirements are the same as noted for mechanical damage limits.
All areas of the case and sleeve except areas previously designated D, E, etc.	Nicks, dents, and scratches up to 0.010 inch deep are acceptable if polished out and treated in accordance with general instructions.
	Corrosion damage up to 0.010 inch deep, after clean-up, is acceptable. Treat in accordance with general instructions.
	Mechanical and corrosion damage maximum area after polishing out is forty percent of the area within one square inch and/or twenty percent of the total area.

GENERAL INSTRUCTIONS

1. Repair mechanical and corrosion damage to case and sleeve as follows:

   a. Polish to remove corrosion damage. Use sandpaper and/or crocus cloth (C102). Blend repair in with surrounding surface and make minimum radius 0.250 inch. Use 400 grit crocus cloth (C102) to make repair area surface 63 microinches or better. Inspect to ensure that depth and/or area of repair does not exceed acceptable limits specified for the various areas above. Treat reworked areas for corrosion protection with MIL-M-3171C, type VI treatment (commercial designation DOW No. 19) (C42). Refer to TM 43-0105 for additional procedures. Prime with polyamide epoxy primer (C88) and paint all areas that were painted prior to repair to match existing finish.

   b. Polish out mechanical damage to remove all traces of the damage. Complete repair in same manner prescribed for corrosion damage in step a.

2. Evidence of corrosion damage around base of studs is cause to replace the gearbox. Structural damage to threads in case is not acceptable.

3. Evidence of corrosion damage under the shims where quills are attached to case is cause to replace the gearbox.

212040-321-5A

Figure 6-41. Damage Limits — Tail Rotor Drive Gearbox (Sheet 5 of 5)

f. If not previously accomplished, install control linkage on gearbox as follows:

(1) Remove cover at port for tail rotor drive control housing (7).

(2) Install control tube (8) and tail rotor drive control housing (7).

(3) Install idler (10).

(4) Install lever (9) on idler (10) and control tube (8).

g. Connect electrical lead to magnetic chip detector (11, figure 6-39).

h. Service gearbox with oil (paragraph 1-6).

i. Close vertical fin (19, figure 6-38).

j. Install and rig tail rotor (paragraph 5-105).

6-122. QUILLS, TAIL ROTOR DRIVE GEARBOX.

6-123. DESCRIPTION — QUILLS, TAIL ROTOR DRIVE GEARBOX.

The tail rotor drive gearbox has an input and output quill. The input quill consists of a pinion gear and bearing mounted in a sleeve. The input quill has a flexible coupling for attachment of driveshaft. The output quill has an output shaft for mounting the tail rotor assembly. A gear mounted on the inboard end of the output shaft meshes with the pinion gear of the input quill.

6-124. REMOVAL — TAIL ROTOR DRIVE GEARBOX INPUT QUILL.

Premaintenance Requirements for Removal of Tail Rotor Gearbox Quills

Conditions	Requirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T26) (T37) (T55) (T27)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C37) (C56) (C78) (C79) (C80) (C104) (C105) (C112) (C116) (C137)
Special Environmental Conditions	None

NOTE

Removal procedure only covers the input quill since the output quill is not normally removed in the field.

a. Remove gearbox from helicopter and drain oil (paragraph 6-117).

b. Remove nuts (18, figure 6-39) and shipping spacers (19). The spacers are used to hold the input quill in position during shipment. They may not be present on all gearboxes received for repair.

c. Remove sealant from three threaded holes provided for jackscrews in the input quill sleeve and from the groove at the point where the input quill (20) and the case (22) join.

d. Install three jackscrews (T27) in threaded holes in input quill (20). Tighten jackscrews evenly to remove input quill. Use heat lamp on case (22), if quill is very hard to remove, but do not use open flame. Remove input quill (20) and locally dispose of packing (21).

CAUTION

Do not remove screws (15) and shim plate (16) or the matching shim plate and screws installed on input quill. The correct thickness for these shim plates is determined at time of manufacture, and they must not be removed except at a depot level maintenance facility.

e. Immediately after quill removal, inspect for evidence of corrosion around edges of the two shim plates described in the caution above, but do not remove the shim plates. If there is any evidence of corrosion, preserve and reassemble the gearbox and forward it to next higher maintenance level.

f. Cover opening in case (22) and also cover the open end of the quill to prevent contamination by dust or other foreign material until the gearbox can be inspected.

6-125. CLEANING — TAIL ROTOR DRIVE GEARBOX INPUT QUILL.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

CAUTION

Do not permit dirt or solvent to be forced into bearing of input quill flexible coupling by use of compressed air.

NOTE

Do not use cleaning solvent inside coupling. Solvent leaves residue.

a. Clean exterior of quill with solvent (C112).

b. Clean oil sealant from quill sleeve and gearbox case with a plastic scraper.

NOTE

The following cleaning pertains to a disassembled input quill. Do not use cleaning solvent inside coupling. Solvent leaves residue.

c. Clean lubricant from inner and outer coupling using a clean dry cloth.

d. Clean old sealant from bearing, retaining nut, and inside of quill sleeve with a plastic scraper. Ensure that sealant does not contaminate quill bearings.

6-126. INSPECTION — TAIL ROTOR DRIVE GEARBOX INPUT QUILL.

a. Inspect bearing inside tail rotor drive gearbox that supports forward end of input quill pinion. Inspect the bearing for spalling, scoring, pitting, brinnelling, flaking, corrosion, cracked or broken retainers, discoloration due to overheating, and for roughness when the bearing is rolled by hand. See figure 6-42 for views of acceptable and unacceptable roller bearings.

b. Inspect teeth on input quill pinion for abnormal wear and chipped teeth. See figure 6-43 for acceptable and unacceptable wear patterns.

c. If inspections in steps a. and b. reveal unacceptable wear or damage, do not disassemble quill for repair. Reinstall quill, preserve gearbox, and forward gearbox to higher level of maintenance.

d. Inspect quill for evidence of oil leakage at seal (3, figure 6-40).

e. Inspect quill for grease leakage at seal (2).

f. Inspect outer coupling (1) for discoloration due to overheating. If the coupling has a multi-colored appearance, disassemble the coupling and inspect splines and teeth.

g. Inspect outer coupling (1) for scratches, nicks, dents, and cracks. Minor damage that can be polished out with a fine India stone (C116) is acceptable.

h. Inspect seal (2) for protrusion, leakage, cuts, tears, and deterioration.

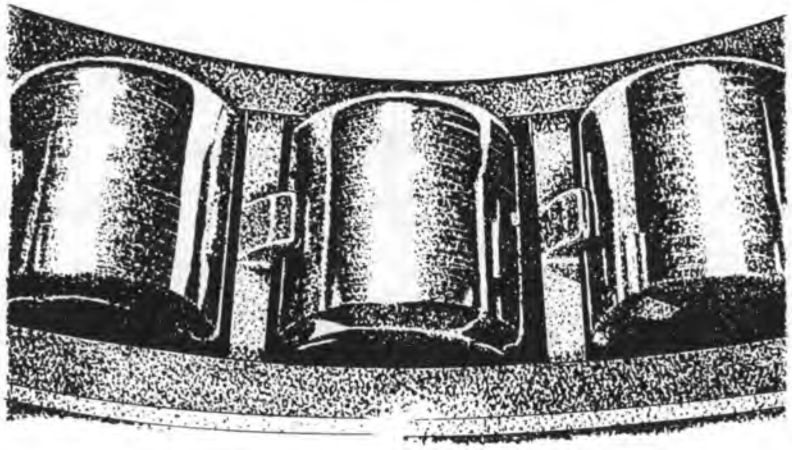
i. Disassemble outer coupling (1) from inner coupling (9) and inspect as follows:

(1) Remove retaining ring (18). At the same time hold seal plate (17) against spring pressure. Remove seal plate (17) and spring (16).

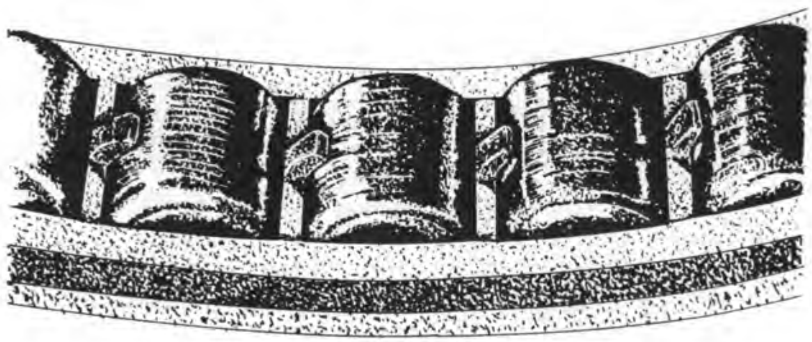
CAUTION

Do not use cleaning solvent inside coupling. Solvent leaves residue.

(2) Hold outer coupling (1) at full outboard position, and use clean, lint-free cloth to remove all old grease. Clean coupling splines thoroughly.



ACCEPTABLE



UNACCEPTABLE

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Figure 6-42. Roller Bearing Wear Patterns

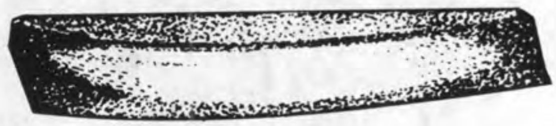
(3) Visually inspect splines of outer coupling (1) for unusual wear patterns, nicks, dents, and cracks. Inspect inner coupling (9) teeth for unusual wear patterns, nicks, dents, and cracks. See figure 6-32 for examples of acceptable wear patterns. Maximum acceptable wear is **0.005** inch measured from unworn surface of tooth.

(4) Assemble outer coupling (1 figure 6-40) on inner coupling (9). Move outer coupling (1) forward and aft with clockwise and counterclockwise preload and feel for roughness. If any roughness or resistance is felt, reinspect splines on outer coupling (1) and teeth on inner coupling (9). Refer to step (3).

(5) Inspect inner coupling (9) for wear in the area contacted by seal (3). Measure the diameter of the coupling in the worn area and in the adjacent unworn area. A maximum of **0.002** inch of wear is allowable if the diameter in the worn area is not less than **1.587** inch. The worn area must be free of nicks and dents that would affect function of seal (3).

(6) Inspect seal plate (17) for scratches, nicks, dents, and corrosion. Minor damage is acceptable if polished out, but any damage within **0.030** inch of the seal area is cause to replace the seal plate.

Desired wear pattern on pinion
View A



Desired wear pattern on gear
View B

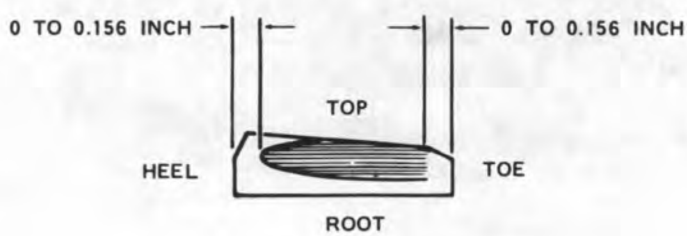
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

NOTES

1. **Wear Pattern Inspection: Observe the visible gear contact wear pattern on the concave side of the pinion teeth and on the convex side of the gear teeth.**

2. **The desired wear pattern is shown in views A and B. A slight bright line at top of pattern on gear and in flank of pinion is permissible.**

90° Gearbox



Pattern tolerances at toe and heel on gear and pinion
View C

NOTES

3. **Acceptable wear patterns are shown in views D, E, F, G, H and I. View C is furnished to further define wear limits.**

4. **Pattern Limits at Toe: The wear pattern may touch the toe or may be a maximum of 0.156 from the toe (see views C, D, G and I). Pattern variation at the toe must not exceed 0.156. Normally, the pattern will touch the toe on the pinion but will not touch the toe on the gear (views D and E). It is permissible for the pattern to touch the toe on the gear if the pattern does not go off the toe of the pinion.**

5. **Pattern Limits at Heel: The wear pattern may touch the heel or may be a maximum of 0.156 from the heel. Pattern variation at the heel must not exceed 0.031. The heel positions shown in views A, B, D, E, F, G, H and I are within these limits.**

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Figure 6-43. Tail Rotor Drive Gearbox Gear Patterns (Sheet 1 of 2)

Acceptable wear pattern on pinion
(touching toe)
View D

Acceptable wear pattern on gear

View E

NOTES

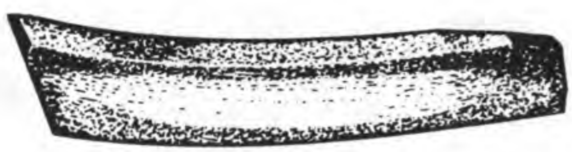
6. Pattern Profile: The pattern must be positioned on the tooth in a profile direction such that the pattern extends over the top of the pinion and is 0.031 to 0.063 inch from the top of the gear (views A, B, D, E, F, G, H and I). A pattern which does not extend over the top of the pinion or touches the top of the gear shall be rejected. A bright line occurring at the top of the pinion or in the flank of the gear is also cause for rejection.

7. Unacceptable Defects: In addition to pattern size and location, examine the drive face of all gear teeth for the following defects which are not acceptable if they can be felt with a scribe having a 0.002 spherical point:

   a. non-clean up
   b. grinding scratches
   c. pitting
   d. corrosion
   e. cuts
   f. nicks
   g. dents
   h. grinding flats or barber poling (evidenced by diagonal streaks in the wear pattern)
   i. scuffing
   j. scoring
   k. inclusions

Acceptable wear pattern on pinion

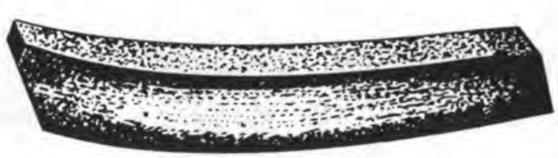
View F



Acceptable wear pattern on gear
(0.156 inch from toe)
View G

Acceptable wear pattern on pinion

View H



Acceptable wear pattern on gear
(touching heel and 0.156 from toe)
View I

212040-351-2

Figure 6-43. Tail Rotor Drive Gearbox Gear Patterns (Sheet 2 of 2)

(7) Lubricate and assemble outer coupling (1) and inner coupling (9) (paragraph 6-127).

j. Inspect retainer nut (4) for damaged threads and corrosion.

k. Inspect seal (1, figure 6-39) for protrusion, leakage, cuts, tears, and deterioration.

l. Inspect area adjacent to shim (16) and area on input quill (20) adjacent to similar shim for corrosion. If any corrosion is detected, send gearbox to higher level of maintenance. Do not remove shim (16) or similar shim on input quill.

6-127. REPAIR — TAIL ROTOR DRIVE GEARBOX QUILLS. (AVIM)

NOTE

Repair of gearbox input quill is limited to replacement of components of the flexible coupling, seals (2 and 3, figure 6-40), and packing (21, figure 6-39). Repair of the output quill is limited to replacement of seal (1, figure 6-39).

a. Disassemble input quill as follows:

(1) Remove retaining ring (18, figure 6-40), plate (17), spring (16) and spacer (14).

(2) Remove lockspring (15), retainer plug (13), and packing (12).

(3) Place holding plate (T37) in a vise. Secure quill in holding plate. Secure wrench (T26) to quill as shown on figure 6-44.

(4) Install square drive extension in retainer bolt (11, figure 6-40), hold wrench, (T26), and loosen retainer bolt. Remove retainer bolt (11) and washer (10).

(5) Remove outer coupling (1), and inner coupling (9). Remove seal (2) from outer coupling.

(6) Cut lockwire on retainer nut (4). Install wrench (T55) as shown in figure 6-45. Remove retainer nut (4, figure 6-40).

(7) Press seal (3) from retainer nut (4) and remove packing (5).

b. Clean disassembled quill. Refer to paragraph 6-125.

c. Polish out raised metal on teeth on outer coupling (1, figure 6-40) when the raised metal is caused by dents, nicks, or scratches. Use crocus cloth (C37) to remove the raised metal. Do not rework the internal teeth in the coupling.

d. Assemble input quill as follows:

(1) Press seal (3) in retainer nut (4) with lip of seal facing inboard. Position packing (5) on retainer nut (4). Lubricate packing, seal, and threads of nut with the type oil used in the gearbox.

(2) Place holding plate (T37) in a vise and secure quill sleeve in holding plate as shown in figure 6-45.

(3) Install retainer nut (4, figure 6-40) in quill with wrench (T55) as shown in figure 6-45. Torque nut **100 TO 150** foot-pounds. Lockwire (C137) nut to sleeve. Apply a bead of sealer (C104) around mating joint of nut and sleeve. Remove wrench (T55).

(4) Use clean lint-free cloths to remove any film of grease or cleaning solvent from outer coupling (1, figure 6-40) and inner coupling (9).

(5) Lubricate new seal (2) with grease (C56) and press into outer coupling (1) with lip of seal facing toward curvic coupling teeth on coupling. Coat teeth of inner coupling (9) with grease (C56) and install inner coupling in outer coupling.

(6) Install the couplings on pinion shaft (6). Place washer (10) on retainer bolt (11) and thread nut into pinion shaft (6). Install special tools as shown on figure 6-44. Torque retaining bolt **80 TO 100** foot-pounds.

(7) Position packing (12, figure 6-40) on retainer plug (13) and lubricate with small amount of grease from coupling. Install retainer plug and lock spring (15). Ensure that tang of lock spring (15) is fully seated.

(8) Hold outer coupling (1) full outboard. Lubricate splines of outer coupling (1) with grease (C66) to cover splines to a depth of **0.12** inch.

(9) Install spacer (14), spring (16), plate (17), and retaining ring (18).

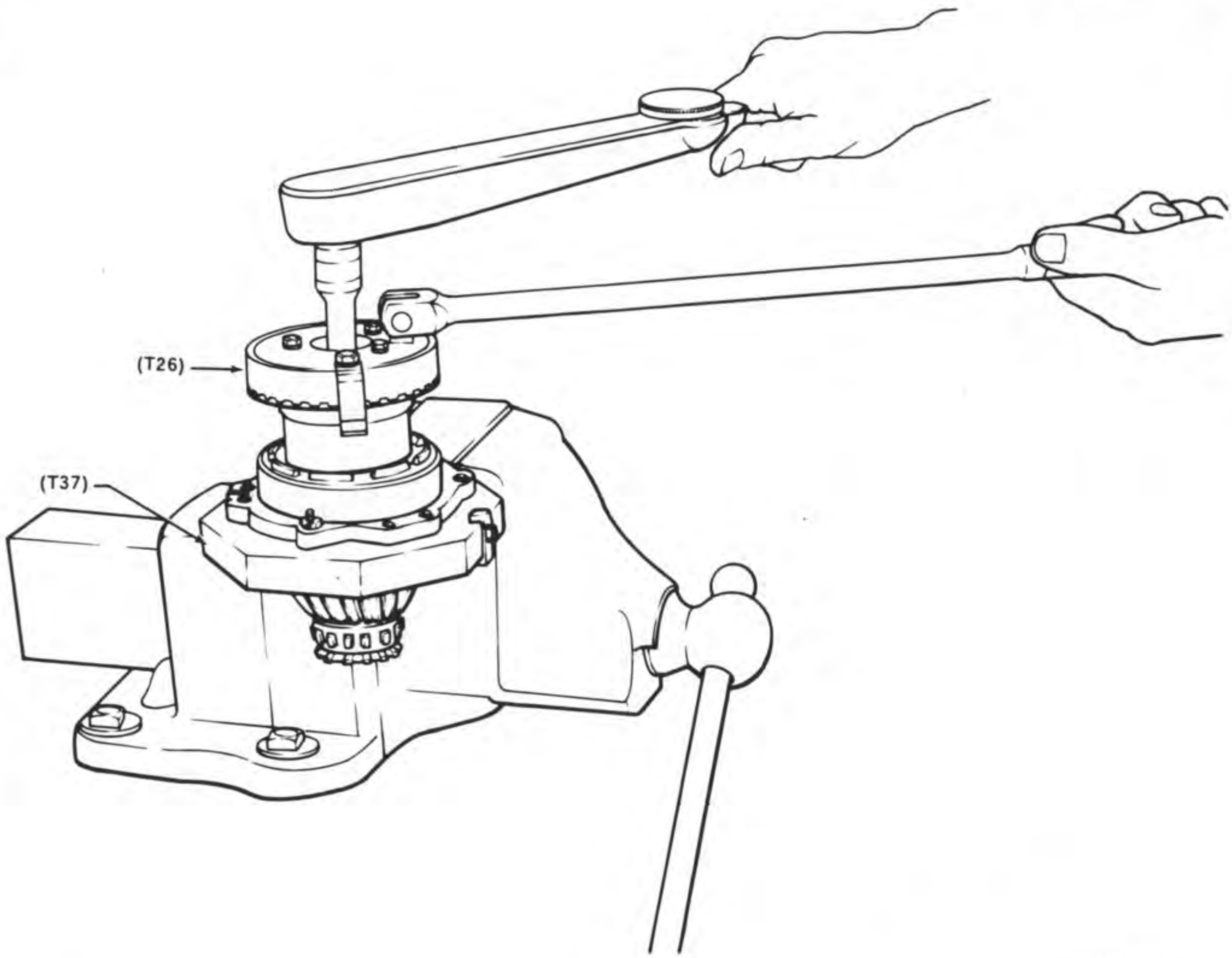


Figure 6-44. Tool Application — Removal/Installation of Tail Rotor Drive Gearbox Input Quill Retainer Bolt

e. Replace output quill seal (1, figure 6-39) as follows:

(1) Remove tail rotor assembly (paragraph 5-91).

(2) Using a suitable tool, pry seal (1) from quill sleeve. Use a wooden block between quill sleeve and tool to prevent damage to sleeve.

(3) Coat lip of new seal with gearbox oil and press into place.

(4) Install tail rotor assembly (paragraph 5-77).

6-128. INSTALLATION — TAIL ROTOR DRIVE GEARBOX INPUT QUILL.

WARNING

Ensure that crowned tooth coupling is properly lubricated prior to installation of driveshaft (paragraph 1-29).

CAUTION

Exercise care during installation of quill to engage gear teeth and to keep quill aligned so that nose of pinion enters the roller bearing properly to avoid damage.

NOTE

Installation procedures only cover the input quill since the output quill is not normally removed in the field.

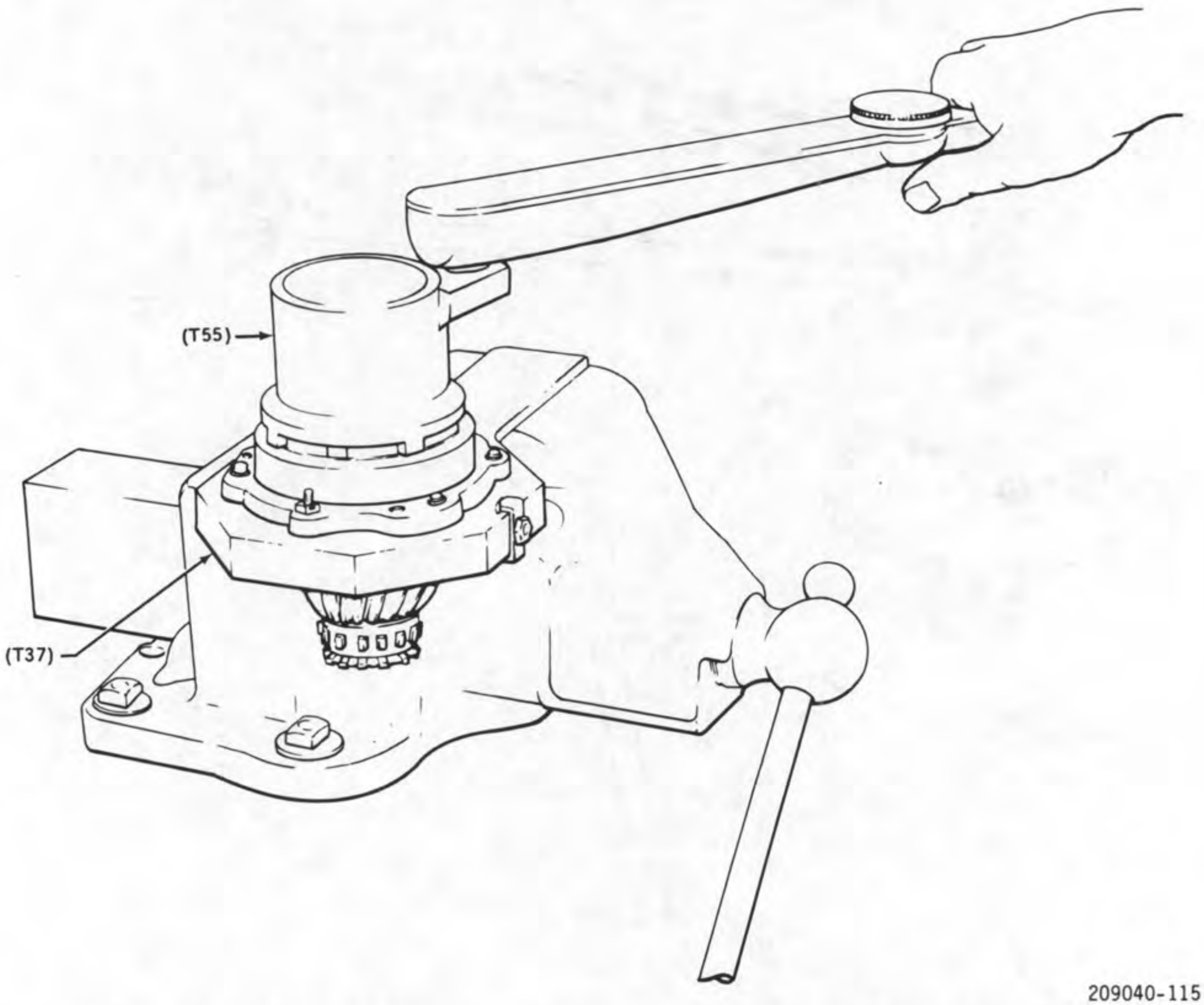


Figure 6-45. Tool Application — Removal/Installation of Tail Rotor Drive Gearbox Input Quill Retainer Nut

a. Ensure that shim (16, figure 6-39) and similar shim on input quill are installed.

b. Heat gear case with a heat lamp. Lubricate new packing (21) and mating surfaces of quill and case with oil (C79 or C80). Install packing on quill and install quill into case. Use care to engage bearing and gear teeth properly. Install shipping spacers (19) and nuts (18). Torque nuts **100 TO 140** inch-pounds to hold input quill in place.

c. Rotate quill by hand and check for free rotation and for a small amount of backlash clearance.

d. Apply a bead of sealant (C105) around mating joint of quill and case and also fill three jackscrew holes.

SECTION VII. TRANSMISSION OIL SYSTEM

6-129. TRANSMISSION OIL SYSTEM.

6-130. DESCRIPTION — TRANSMISSION OIL SYSTEM.

The transmission oil system is entirely separate from that of the engine. It includes a pump, an external and an internal filter, a pressure relief valve, an automatic emergency by-pass valve, an oil cooler with an integral temperature regulating valve, and connecting lines. See figures 6-46 and 6-47. Oil is distributed within the transmission by a series of jets and internal passages. Oil pressure and temperature indications are provided by a thermobulb and a pressure transmitter. A thermo-switch and a pressure switch illuminate caution panels lettered **P** (pilot) XMSN OIL HOT, (gunner) XMSN OIL TEMP and XMSN OIL PRESS and **E** **M** TRANS OIL HOT and TRANS OIL PRESS to warn of abnormal conditions. Servicing and drain provisions are located on the right side of the transmission. Oil level sight gages on the sump case can be viewed through a window in the right-hand cowl door. Access through this same door is provided to the oil filter on the main case and to the oil filter screen and chip detector on the sump case. A manual valve, located beneath the sump, drains oil overboard through an outlet in the bottom of the fuselage. Access to this valve is through the access panel under the right wing.

6-131. TROUBLESHOOTING — TRANSMISSION OIL SYSTEM.

See table 6-2 for troubleshooting transmission oil system. Observe the following during system troubleshooting.

a. Low oil level will not cause a low oil pressure indication, provided sump contains enough oil to cover pump inlet. Oil temperature might rise, however.

b. Effects of an oil leak will depend on its location in system and rate of leakage. An external leak can eventually allow sump to be pumped dry, causing internal failure of transmission. While oil remains to supply the pump, the pressure relief valve will tend to maintain normal system pressure, compensating for leakage. This applies especially to leaks located between the pump and the relief valve. Leaks occuring beyond the relief valve could cause indication of low oil pressure. Leakage to interior of transmission; while not affecting oil level, could starve lubrication areas beyond the leak and might affect indicated oil pressure and temperature. Leakage in the oil cooler circuit, unless very minor, causes the oil cooler automatic emergency bypass valve to shift and direct oil directly to the transmission manifold instead of directing it through the oil cooler. Leaks in the oil cooler and connecting lines may cause above normal oil temperatures.

c. Cumulative clogging of oil filter screens will not be shown by a gradual drop of indicated oil pressure. Pressure relief valve will maintain normal system pressure even if filter screens become so clogged as to force oil flow through filter bypass valve.

d. "Use of wrong oil" is omitted from troubleshooting chart because such a case would require special investigation as to damage and corrective action. As to detecting such a condition, little can be said except that most oils which might be available to use by error would tend to cause high oil pressure and high oil temperature indications, or excessive seal leakage.

Table 6-2. Troubleshooting - Transmission Oil System

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

NOTE

Before you use this table, be sure you have performed all normal operational checks. If you have a malfunction which is not listed in this table, notify the next higher maintenance level.

1. Low oil pressure on caution panel or pressure gauge, but not on both.

STEP 1. Check for faulty caution panel (paragraph 9-276).

Replace faulty caution panel. Return faulty panel to next higher maintenance level.

Table 6-2. Troubleshooting — Transmission Oil System (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

STEP 2. Check for faulty pressure gauge (paragraph 8-233 and 8-234).

Replace faulty pressure gage (paragraphs 8-235 and 8-237).

STEP 3. Check electrical circuit for faulty wiring (paragraph 9-11).

Repair faulty electrical wiring (paragraph 9-12).

2. Low oil pressure on both caution panel and pressure gage.

STEP 1. Check pressure relief valve for adjustment or malfunction (paragraph 6-150).

Repair pressure relief valve (paragraph 6-151).

Replace pressure relief valve (paragraph 6-153).

STEP 2. Check for leakage and for restriction between pressure relief valve and transmitter.

Repair oil line or clean oil line to remove restriction as required.

STEP 3. Check for faulty oil pump (paragraph 6-135).

Replace faulty oil pump (paragraph 6-140).

3. No oil pressure with normal oil level in sump.

STEP 1. Check for faulty gage or transducer (paragraphs 8-243, 8-244, 8-251, and 8-252).

Replace faulty gage or transducer (paragraphs 8-245, 8-247, 8-253, and 8-255).

STEP 2. Check electrical circuits for faulty wiring (paragraph 9-11).

Repair faulty electrical wiring (paragraph 9-12).

STEP 3. Check for faulty oil pump (paragraph 6-135).

Replace transmission or replace oil pump only if not damaged internally and oil system not contaminated with metal particles.

4. No oil pressure - check reveals no oil supply in transmission sump.

STEP 1. Check system to determine cause of oil loss.

Replace transmission and oil cooler (paragraphs 6-33 and 6-146).

Flush oil lines and repair as needed.

Table 6-2. Troubleshooting — Transmission Oil System (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

5. High oil pressure.

STEP 1. Check for faulty gage or faulty transducer (paragraphs 8-234, 8-235, 8-241, and 8-242).

STEP 2. Check for electrical circuit for faulty wiring (paragraph 9-11).

Repair faulty electrical wiring (paragraph 9-12).

STEP 3. Check pressure relief valve for adjustment or malfunction (paragraph 6-150).

Adjust pressure relief valve (paragraph 6-152).

Repair pressure relief valve (paragraph 6-151).

Replace pressure relief valve (paragraph 6-153).

6. High oil temperature on caution panel or gage but not both.

STEP 1. Check for faulty caution panel or gage (paragraphs 8-233 and 9-279).

Replace caution panel. Return faulty panel to next higher level of maintenance.

Replace faulty temperature gage (paragraphs 8-235 and 8-237).

STEP 2. Check electrical circuits for faulty wiring (paragraph 9-11).

Repair faulty wiring (paragraph 9-12).

7. High oil temperature on both caution panel and gage.

STEP 1. Check area around transmission for obstructed air flow.

Clean cowl opening and sump area.

STEP 2. Check oil cooler for obstructed air passage.

Clean cooler core air passage.

STEP 3. Check oil cooler for clogged internal oil passage (paragraph 6-144).

Replace cooler if internally clogged. Flush oil lines.

Check transmission filters, pump screen magnetic plug (paragraph 6-158).

Table 6-2. Troubleshooting — Transmission Oil System (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

STEP 4. Check oil cooler for thermostatic valve malfunction.

Replace oil cooler (paragraphs 6-143 and 6-146).

STEP 5. Check for clogged transmission oil jets (paragraph 6-196).

Clean or replace jets.

Replace transmission if internally damaged (paragraph 6-33).

STEP 6. Check transmission magnetic plug and filters for evidence of seized bearings or other internal failure.

Replace transmission and oil cooler. Flush external oil lines (paragraphs 6-33 and 6-146).

STEP 7. Check for oil leaks in cooler or oil lines which could cause the emergency bypass valve to operate and bypass cooler.

Repair leaks as necessary (paragraph 6-145).

STEP 8. Test emergency bypass valve for malfunction.

Repair or replace emergency bypass valve (paragraph 6-151).

8. Oil bypass caution light on.

STEP 1. Check caution light circuit for short or faulty wiring (paragraph 9-11).

Repair electrical circuit as necessary (paragraph 9-12).

STEP 2. Check for low oil level in sump.

Service transmission with oil (paragraph 1-5).

STEP 3. Check oil cooler and lines for leaks.

Repair leaks as necessary.

STEP 4. Test emergency bypass valve for malfunction (paragraph 6-152).

Repair or replace emergency bypass valve (paragraph 6-151).

9. Oil leak at internal primary oil filter.

STEP 1. Check cooler line couplings (9 and 10, figure 6-47) for proper seating and/or connection.

Reconnect cooler line couplings.

Ensure indicators on quick disconnects are locked.

Table 6-2. Troubleshooting — Transmission Oil System (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

STEP 2. Check disconnects for wear and damage.

Replace defective cooler line couplings.

Replace packing (19, figure 6-47).

6-132. OIL PUMP.

6-133. DESCRIPTION — OIL PUMP.

The oil pump is mounted into the underside of the transmission sump case and is driven by a splined shaft from the accessory and tail rotor drive gear.

6-134. REMOVAL — OIL PUMP.

a. Open access panel under wing on right side of helicopter.

b. Place a container under oil drain outlet beneath fuselage. Open valve beneath sump and drain oil.

c. Disconnect drain tubes from valve and tee. Provide a container to collect trapped oil as pump is removed.

d. Remove pump retaining nuts and drain tee bracket from three mounting studs.

CAUTION

Tapped hole in pump body base is for attaching puller only. Do not attempt to use for a jackscrew.

e. Pull pump from sump. When necessary, use threaded puller in 1/4 UNF tapped hole in base at center of pump body.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

f. Wash assembled pump in solvent (C112) prior to disassembly. Drain thoroughly and dry with filtered compressed air.

6-135. INSPECTION — OIL PUMP.

a. Inspect assembled pump as follows:

(1) Rotate pump shaft and check for binding.

(2) Visually inspect pump for evidence of wear or damage.

(3) If evidence of binding, wear, or damage is found, do not disassemble pump but forward to next higher level of maintenance.

NOTE

The following inspection for wear pertains to a disassembled pump.

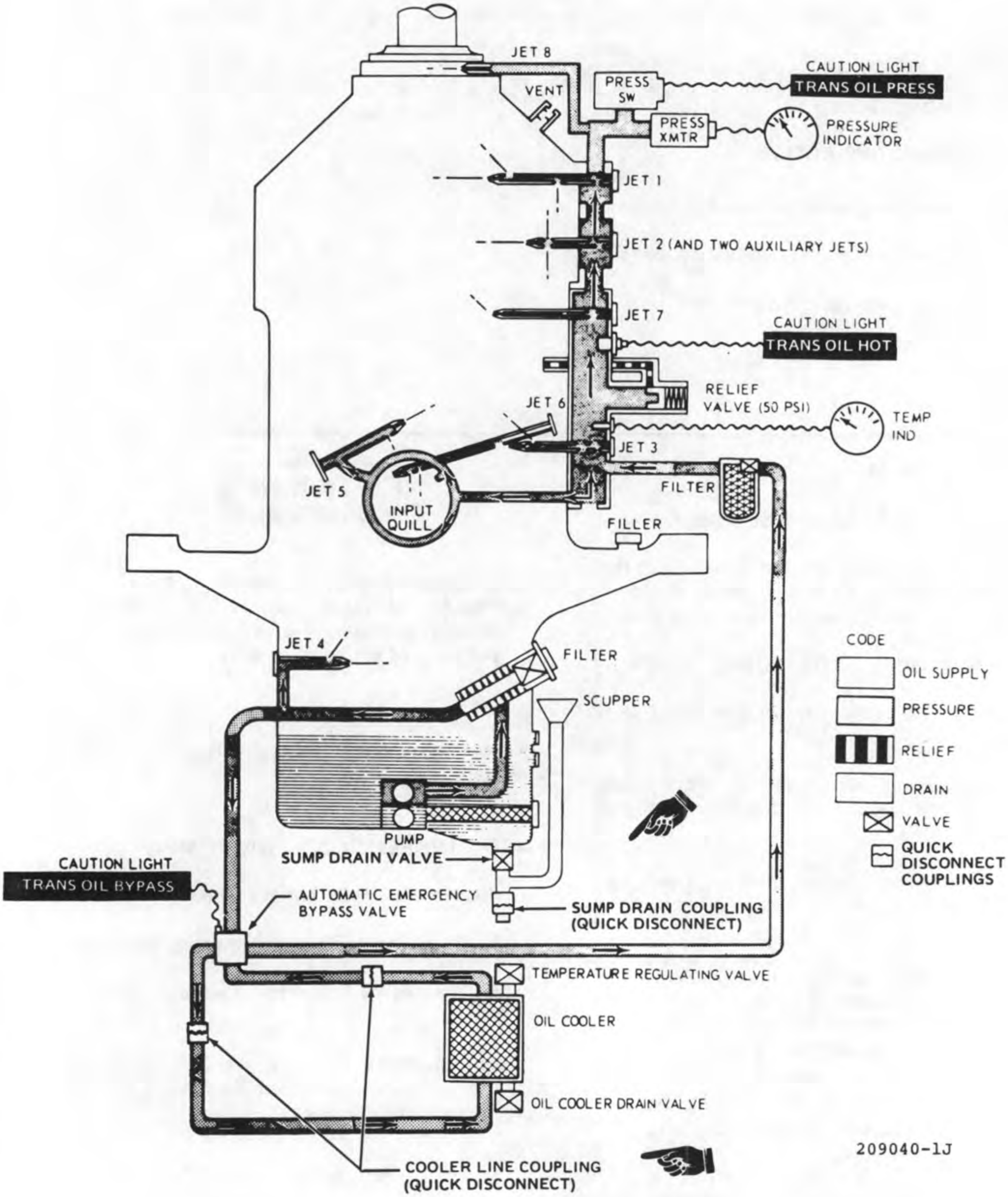


Figure 6-46. Transmission Oil System Schematic (Typical)

1. Vent
2. External oil filter
3. Pressure transmitter
4. Pressure switch
5. Filler cap
6. Sump drain coupling
7. Cooler drain valve
8. Transmission oil cooler
9. Cooler line coupling
10. Cooler line coupling
11. Transmission sump
12. Sump outlet fitting
13. Oil cooler automatic emergency bypass valve
14. Oil manifold assembly

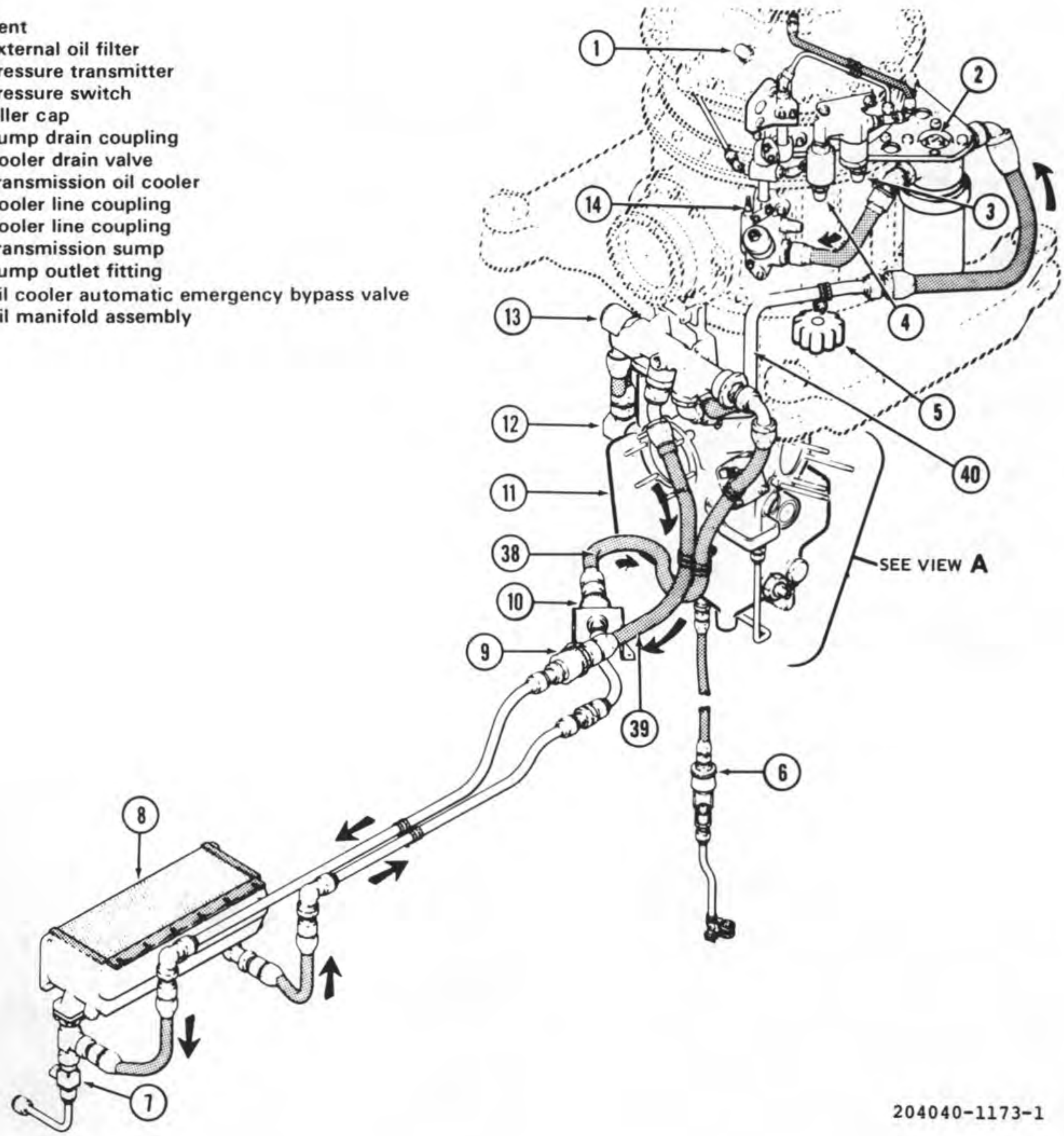
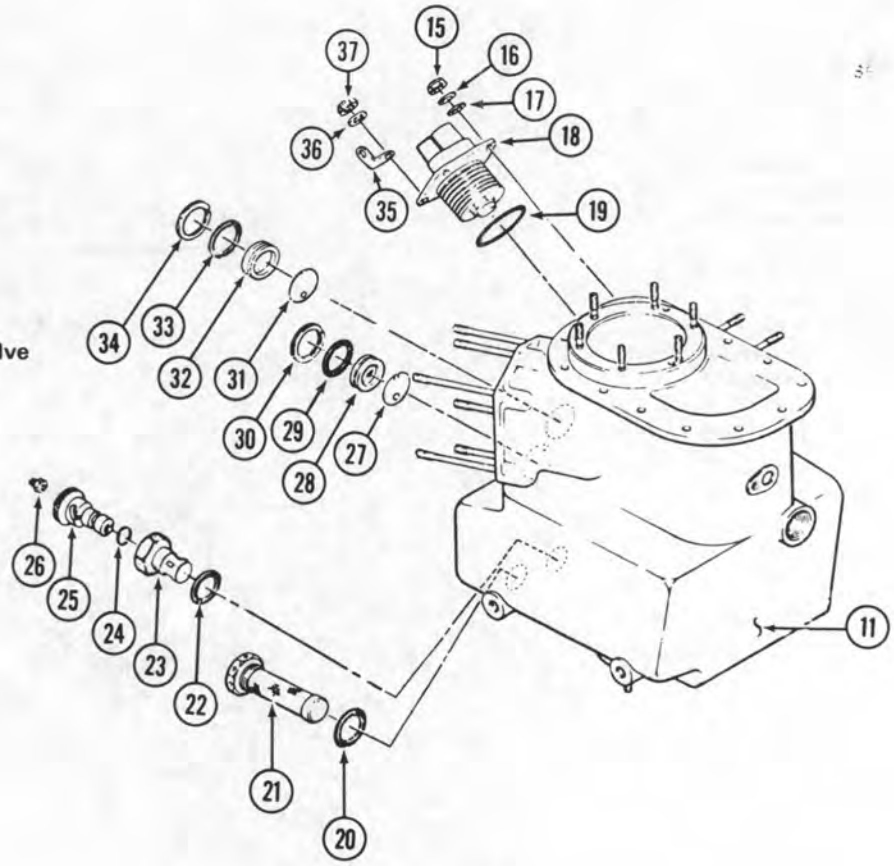


Figure 6-47. Transmission Oil System Installation (Sheet 1 of 2)

15. Nut
16. Thin steel washer
17. Thin aluminum washer
18. Oil filter (sump)
19. Packing
20. Gasket
21. Oil screen
22. Gasket
23. Chip detector self-closing valve
24. Packing
25. Chip detector
26. Nut
27. Indicator (Low)
28. Sight glass
29. Packing
30. Retaining ring
31. Indicator (full)
32. Sight glass
33. Packing
34. Retaining ring
35. Bracket
36. Thin steel washer
37. Nut
38. Hose assembly
39. Hose assembly
40. Outlet tube



VIEW **A**

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Figure 6-47. Transmission Oil System Installation (Sheet 2 of 2)

b. Inspect disassembled pump as follows:

(1) Check corners, grooves, and oil passageways for sludge.

(2) Inspect parts for damage and excessive wear. Use following table showing dimensions of new parts in parentheses and allowable clearances after wear in last column.

Outer Gerotor Body	Width (0.7080/0.7085)
Chamber	Width (0.7100/0.7105)
Allowable Chamber Face Clearance	0.0015/0.0025
Outer Gerotor OD	(2.1220/2.225)
Body ID	(2.1220/2.1255)
Allowable Clearance	0.0025/0.0040
Driveshaft OD	(0.4985/0.4990)
Bearings ID	(0.5000/0.5005)
Allowable Clearance	0.0010/0.0025

6-136. DISASSEMBLY — OIL PUMP. (AVIM)

NOTE

Do not remove any part of pump by forcing or prying. Loose parts by tapping lightly with a fiber hammer. Do not disassemble pump in a damp or dusty room.

a. Remove retainer ring (1, figure 6-48) from body (10).

b. Remove retainer plate (2). Do not remove bearing from plate.

CAUTION

Inner and outer gerotors are a matched set. Do not intermix.

c. Remove retaining ring (3), inner gerotor (5), outer gerotor (4), and woodruff key (6) from shaft (7).

d. Remove retaining ring (8).

e. Do not remove bearing from body (10).

f. Clean disassembled pump as follows:

WARNING

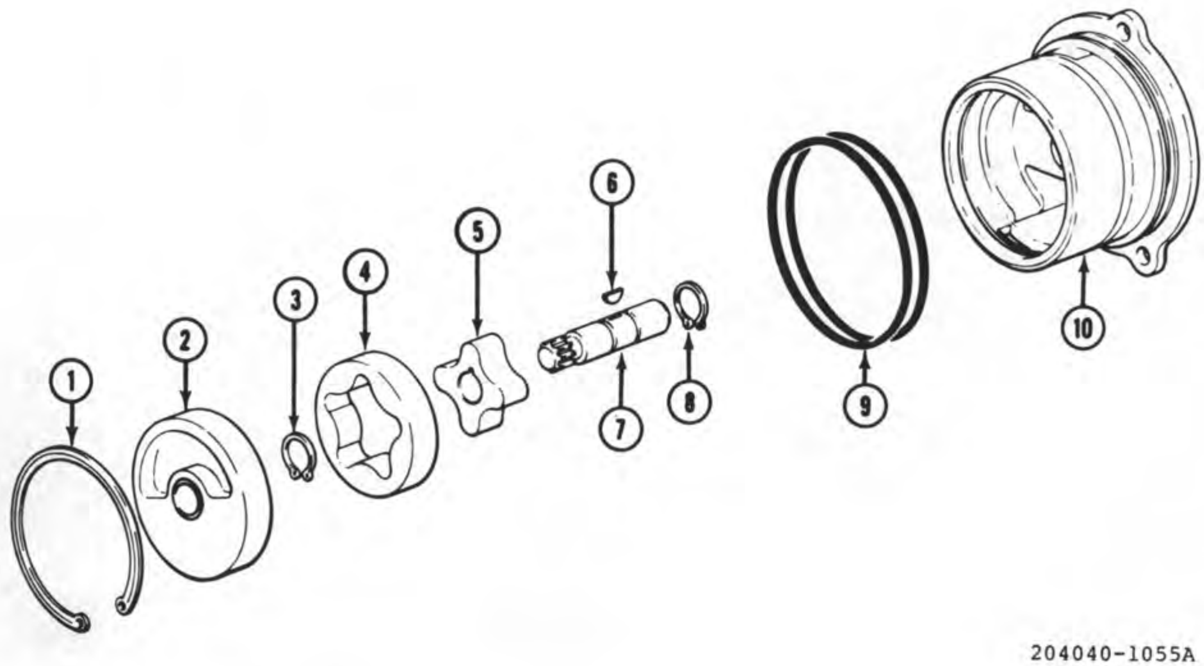
Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(1) Wash all metal parts with solvent (C112) and dry with clean, filtered, compressed air.

(2) Clean corners, grooves, and threads with a short-bristled brush such as a toothbrush.

6-137. REPAIR — OIL PUMP (AVIM).

Repair is limited to inspection of pump for wear or damage and testing pump output in accordance with paragraph 6-139. If wear limits, defined in paragraph



1. Retaining ring
2. Retainer plate
3. Retaining ring
4. Outer gerotor
5. Inner gerotor
6. Woodruff key
7. Shaft
8. Retaining ring
9. Packing (2)
10. Body

Figure 6-48. Transmission Oil Pump

6-135, are exceeded or if pump fails to meet test requirements, forward pump to depot maintenance.

6-138. ASSEMBLY — OIL PUMP. (AVIM)

a. Lubricate parts with oil (C79 or C80) for ease in assembly.

b. Install retaining ring (8, figure 6-48) on shaft (7) inboard groove.

c. Insert woodruff key (6) in shaft (7) and install inner gerotor (5) so that keyway engages key. Install retaining ring (3) on outboard end of shaft.

d. Install shaft (7) in body (10). Install outer gerotor (4) over inner gerotor (5).

e. Install retainer plate (2) in body (10). Make sure locating pin is properly seated. Install retainer ring (1) in body (10) with beveled side of ring facing up. Make sure ring is firmly seated in body groove.

f. Check that shaft (7) will rotate without binding.

6-139. TEST PROCEDURES — OIL PUMP (AVIM).

a. Use lubricating oil (C79 or C80). Oil must be clean and free from foreign matter.

b. Oil must be **110 TO 130** degrees F (**43 TO 54** degrees C) for duration of test.

c. Check pump shaft rotation in both directions. Shaft must rotate freely; replace the pump if any binding is noted.

d. Place pressure and vacuum gages as close to the pump as possible. See figure 6-49. Use piping that will cause no appreciable pressure changes between the gages and the pumps. Use gages which are accurate within 0.5 percent full scale.

CAUTION

Be sure shutoff valves are open before starting pump.

e. Make flow measurements with a meter that is accurate within plus or minus 1.0 percent.

f. Measure pump speed with a tachometer directly coupled to the pump shaft. The tachometer must be accurate within plus or minus 1.0 percent or 20 RPM, whichever is greater.

g. Observe the following:

(1) Operate pump at **3575** RPM.

(2) Oil temperature of **110 TO 130** degrees F (**43 TO 54** degrees C).

(3) Inlet pressure of **24 TO 30** inches of mercury.

(4) Discharge pressure shall be **50** psig.

h. Minimum pump flow shall be **10.5** gpm.

6-140. INSTALLATION — OIL PUMP.

a. Install new packings (9, figure 6-48) in two grooves around pump housing. Lubricate packing with transmission oil.

CAUTION

Ensure that splines of pump shaft (7) align with splines of oil pump shaft located inside transmission.

b. Insert pump into mounting port, while main rotor is slowly rotated until pump shaft is positively engaged to splined driveshaft in transmission sump. Install washers and nuts on studs, with drain tee bracket on forward stud. Torque nuts **50 TO 70** inch-pounds.

c. Apply a bead of sealant (C105) around mating joint of oil pump and transmission.

d. Connect drain line tubes to valve and tee.

e. Fill sump with oil (C79 or C80) to normal level on sight gages. Close access openings and cowling.

6-141. OIL COOLER.

6-142. DESCRIPTION — OIL COOLER.

A radiator type oil cooler (1, figure 6-50) with an internal temperature and bypass control valve is connected into the transmission oil pressure external lines. The cooler is mounted beside the engine oil system cooler, under an opening in the engine

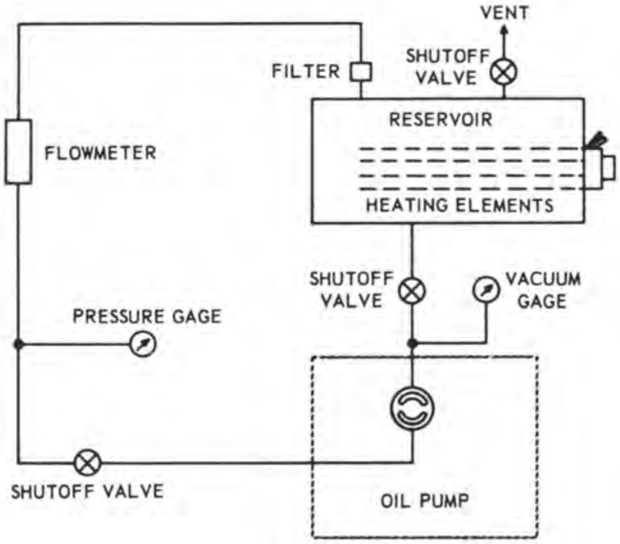


Figure 6-49. Transmission Oil Pump — Test Setup

compartment deck. The two coolers are bolted together and share the same cooling air flow, but have no oil circulation between them. The inlet fitting is equipped with a manual drain valve and overboard drain line.

6-143. REMOVAL — OIL COOLER.

CAUTION

Use back-up wrenches when removing and installing oil cooler drain fittings, valves, and lines.

a. Remove oil cooler duct on left side of fuselage below engine combustion section.

b. Drain oil from both coolers (paragraph 4-78).

c. Remove bleed air-driven turbine and fan duct (paragraph 4-78).

d. Disconnect engine oil cooler hoses (paragraph 4-78), hoses (2 and 17, figure 6-50), and drain tube (18). Cover open fittings and hose ends.

e. Remove bolts (4) and washers (3). Lower cooler assembly (1) out of compartment.

f. Separate engine oil cooler (paragraph 4-78) from transmission oil cooler by removing bolts (11), washers (6) and nuts (5).

g. If cooler is being replaced, remove fittings for use on replacement assembly.

(1) Loosen nut (16) and remove elbow (14) with packings (15 and 13) and union (12). Remove nut (16).

(2) Remove nuts (10) and washers (9); then remove adapter (8), gasket (7).

(3) Loosen nut (20); then remove packing (21) drain valve and tee assembly (19). Remove nut (20).

(4) Remove nuts (22) and washers (23); then remove adapter (25) and gasket (24).

6-144. INSPECTION — OIL COOLER.

a. Inspect fittings for damage.

b. Inspect cooler core and body for evidence of leakage.

c. Inspect cooler core for clogged air passages and cleanliness.

6-145. REPAIR — OIL COOLER.

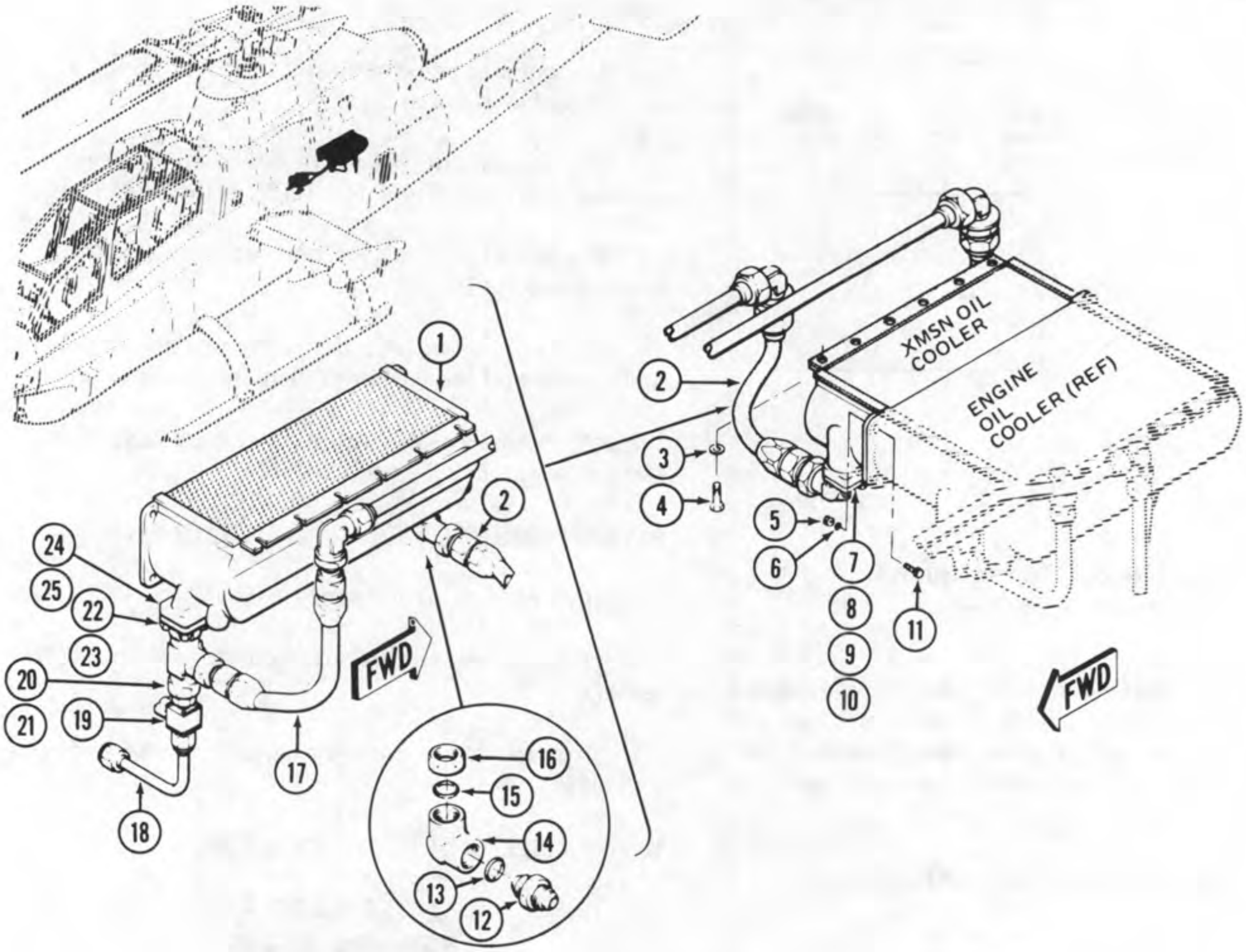
WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

If transmission internal failure has occurred, replace cooler and thoroughly flush all connecting lines and fittings with solvent (C112). Dry with filtered compressed air.

a. If cooler core shows evidence of external clogging, clean core using solvent (C112) and compressed air.

b. If cooling fins on core are bent enough to disrupt air flow, straighten using flat nose pliers. Use care to prevent damage to cooler core.



1. Cooler assembly
2. Hose assembly
3. Washer
4. Bolt
5. Nut
6. Washer
7. Gasket
8. Adapter
9. Washer
10. Nut
11. Bolt
12. Union
13. Packing
14. Elbow
15. Packing
16. Nut
17. Hose assembly
18. Flared tube
19. Valve and tee assembly
20. Nut
21. Packing
22. Nut
23. Washer
24. Gasket
25. Adapter

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Figure 6-50. Transmission Oil Cooler Installation

c. Replace cooler if damaged or leaking.

d. Replace damaged fittings.

6-146. INSTALLATION — OIL COOLER.

a. If replacing cooler, install fittings from removed cooler assembly (1, figure 6-50).

(1) Install adapter (25) and gasket (24), using nuts (22) and washers (23).

(2) Install nut (20); then install packing (21) and valve and tee assembly (19). Tighten nut (20).

(3) Install adapter (8) and gasket (7), using nuts (10) and washers (9).

(4) Install nut (16); then install packings (15 and 13), elbow (14), and union (12). Tighten nut (16).

b. Connect engine and transmission oil coolers, using bolts (11), washers (6) and nuts (5).

c. Place coolers in position in helicopter and secure, using bolts (4) and washers (3). Hold coolers in place with suitable clamps while installing bolts.

d. Install turbine fan and duct (paragraph 4-91).

CAUTION

Check proper fit of flared ends of tubing to valves and fittings. Do not allow preloading or stresses due to misalignment or improper fit.

e. Connect hoses (17 and 2) and flared drain line (18) to transmission oil cooler and hoses to engine oil cooler (paragraph 4-82).

f. Install oil cooling duct on left side of fuselage compartment.

g. During first run-up after installing cooler, carefully observe transmission and engine instruments. Check oil cooler installation for leaks. After a brief period of running, add oil (C79 or C80) to transmission and engine oil tank, as oil level will have lowered by the filling of empty lines and cooler.

6-147. AUTOMATIC EMERGENCY BYPASS VALVE.

6-148. DESCRIPTION — AUTOMATIC EMERGENCY BYPASS VALVE.

The bypass valve (13, figure 6-47) is located on the aft side of the transmission below the power input quill. The valve protects the transmission against total loss of oil if a leak occurs in the oil cooler and its connecting lines, by isolating the cooler circuit from the oil system proper. It consists of a body enclosing nozzles, piston assemblies, a compensating spring, and a warning switch. Passageways within the valve provide for normal and bypass flow of transmission oil. The warning switch illuminates a light on the pilot caution panel when the valve shifts into the by-pass position

6-149. REMOVAL — AUTOMATIC EMERGENCY BYPASS VALVE.

a. Disconnect electrical lead from terminal at right lower side of valve (13, figure 6-47).

CAUTION

When disconnecting hose from right end of valve, do not allow nut on fitting to turn while loosening flare nut of hose elbow. Any turning of valve fitting nut will destroy calibration of valve.

b. Disconnect outlet tube (12) and three oil hoses (38, 39, 40) from fittings on valve. Cap fittings and open ends of tube and hoses.

NOTE

In step c. and d. two electrical cable brackets will be detached but remain on wiring.

c. Remove two nuts which secure bottom of valve mounting bracket on transmission case studs.

d. Remove two bolts to detach top valve bracket from upper bracket, which remains attached on input drive quill studs.

e. Remove valve and bracket assembly.

f. Detach valve from bracket by removing lockwire, four bolts, and washers.

6-150. INSPECTION — AUTOMATIC EMERGENCY BYPASS VALVE.

a. Inspect valve and fitting for leakage.

b. Inspect fittings and valve mounting holes for damaged threads.

6-151. REPAIR — AUTOMATIC EMERGENCY BYPASS VALVE. (AVIM)

Premaintenance Requirements for Repair of Automatic Emergency Bypass Valve

Conditions	Rquirements
Model	AH-1S
Part No. or Serial No.	All
Special Tools	(T49) (T50) (T51) (T52)
Test Equipment	Test Stand
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C74) (C78) (C79) (C80) (C88) (C91) (C102) (C105) (C112) (C116) (C137)
Special Environmental Conditions	Dust Free

a. Disassemble valve as follows:

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(1) Soak "return end" of cooler bypass valve assembly (figure 6-51) in MEK (C74) for one hour, then remove sealant.

NOTE

Be careful not to damage valve components while removing sealant.

(2) Clamp fixture (T49) in vise, with drilled surface in horizontal position. Attach oil cooler valve assembly to the tool with four bolts (AN4-5A) or equivalent.

(3) Cut and remove lockwire from fitting (28, figure 6-51), nut and switch (11).

(4) Remove union (3) and packing (14).

(5) Loosen checknut on elbow fitting (1). Loosen adapter (13) and remove fitting.

(6) Remove switch (11) and packing (12).

(7) Remove bolt (32) and elbow (30).

WARNING

Use extreme care in disassembly of remaining valve parts to avoid nicking or scratching. Package each part individually to avoid damage while handling.

(8) Remove fitting (28).

NOTE

Nozzle (21) will come out with the fitting; therefore, hold threaded end of fitting upward after removal to prevent dropping nozzle.

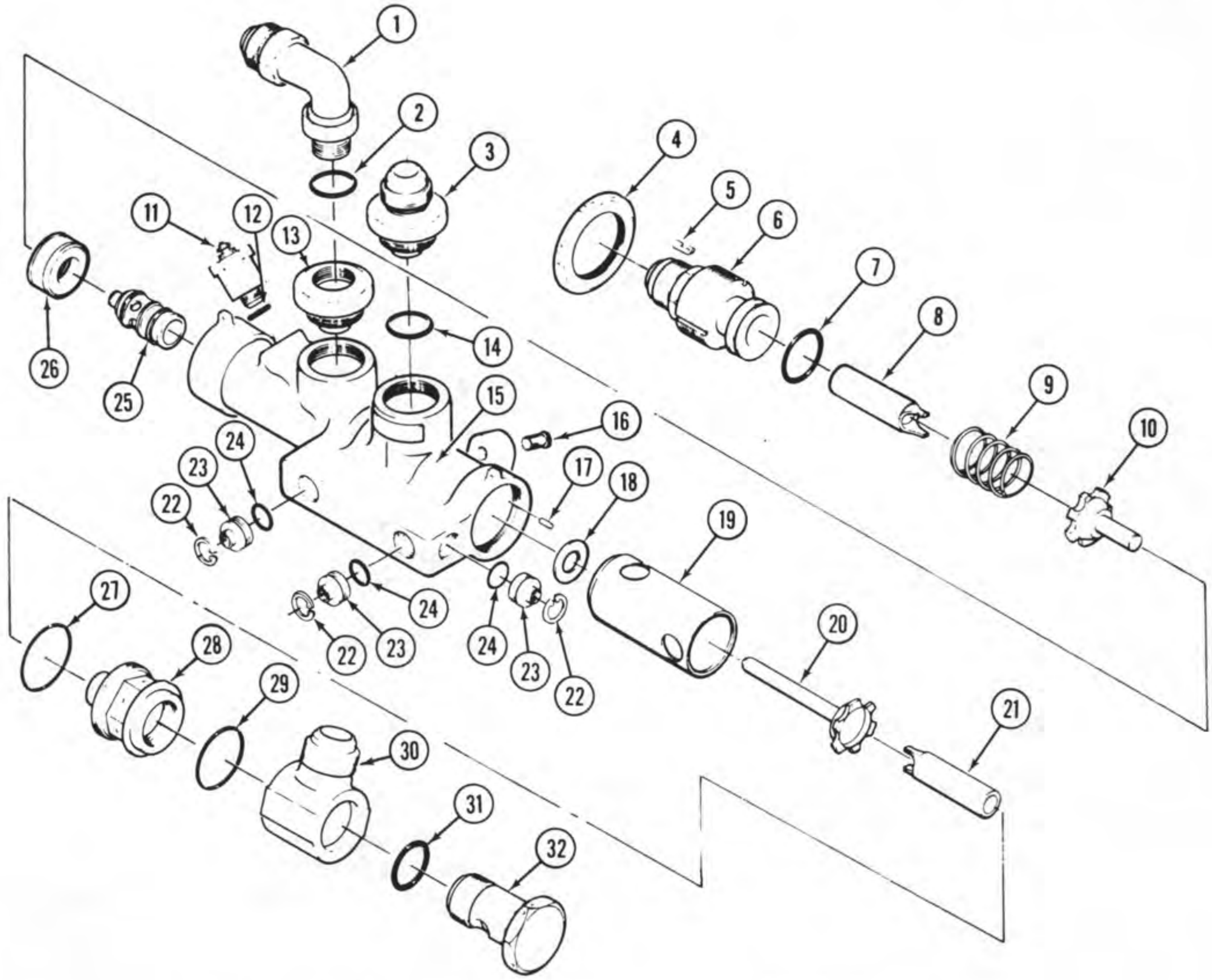
(9) Remove nozzle (21) from fitting (28).

(10) Insert end of finger into open end of valve assembly and gently remove sleeve (19) and piston (20) from valve housing.

(11) Remove piston (20) from sleeve (19), being very careful not to bend or scratch the piston stem.

(12) Remove and discard washer (18) from sleeve (19).

(13) Loosen nut (4) and remove nut and key (5) from fitting (6). Remove fitting (6) and nozzle (8) from



1. Fitting and check nut
2. Packing
3. Union
4. Nut
5. Key
6. Fitting
7. Packing
8. Nozzle
9. Spring
10. Piston
11. Switch
12. Packing
13. Adapter
14. Packing
15. Valve housing
16. Rosan insert
17. Pin
18. Washer
19. Sleeve
20. Piston
21. Nozzle
22. Retaining ring
23. Plug
24. Packing
25. Plunger and retaining ring
26. Seat
27. Packing
28. Inlet fitting
29. Packing
30. Elbow
31. Packing
32. Bolt

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Figure 6-51. Oil Cooler Automatic Emergency Bypass Valve Assembly

valve housing (15). Be careful not to drop nozzle when removing fitting because nozzle comes out with the fitting.

(14) Remove nozzle (8) from fitting (6).

(15) Remove spring (9) from valve housing (15).

(16) Remove piston (10) from valve housing (15) as follows:

(a) Insert finger into end of valve housing (15) from which fitting (6) was removed. Push piston (20) seat (26), and plunger (25) as far as possible toward opposite end of housing.

(b) Remove three retaining rings (22). Pull three plugs (23) and packings (24) from valve housing (15) with puller (T51).

(c) Insert tool (T50) into transfeed port and separate plunger (25) and piston (20).

(d) Remove piston (20) from valve housing (15).

NOTE

Plunger (25) and housing (15) are match fitted and are either discarded or reused as a unit.

(17) Remove temporary cloth plug from end of valve housing (15) and remove plunger by inserting finger into open end of plunger (25) and slowly pulling plunger from valve housing.

(18) Remove and discard all packings from valve components.

b. Clean disassembled bypass valve as follows:

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(1) Clean detail parts (6, 8, 9, 10, 19, 20, and 21, figure 6-51) individually with solvent (C112).

CAUTION

Wash and clean each of the below items carefully and individually to prevent nicking, scratching, or other damage to the parts.

(2) Plug all ports and holes in oil cooler bypass housing (15) to prevent entrance of any liquid into internal areas of valve housing.

(3) Remove paint from exterior portion of oil cooler bypass housing (15) by use of MEK (C74) and a suitable brush.

(4) Dry detail parts of oil cooler bypass valve assembly by use of low pressure, filtered air, or by placing parts on dry clean cloth in such manner that no part will contact any other part of the assembly.

c. Inspect parts of disassembled bypass valve as follows:

(1) Inspect all threaded parts of oil cooler bypass valve for torn, crossed, or otherwise damaged threads.

(2) Inspect all metal detail parts of oil cooler bypass valve assembly for nicks, scratches, surface finishes, and all other limits as shown and designated in figure 6-52 through 6-61.

(3) Inspect Rosan inserts (16, figure 6-51) for secure installation and for damaged threads.

NOTE

Housing assembly and plunger (15 and 25, figure 6-51) are mated parts and are used or discarded as a unit.

d. Repair parts of bypass valve as follows:

(1) Do not repair the following parts (1, 3, 4, 5, 9, 10, 11, 13, 17, 18, 19, 20, 22, 23, 26, and 30, figure 6-51). Do not rework nicks or scratches within tolerance as indicated in figure 6-52 through 6-60. Replace any of the parts listed above that have damage in excess of limits shown on illustrations.

(2) Replace fittings (6 or 28, figure 6-51) if threads are damaged.

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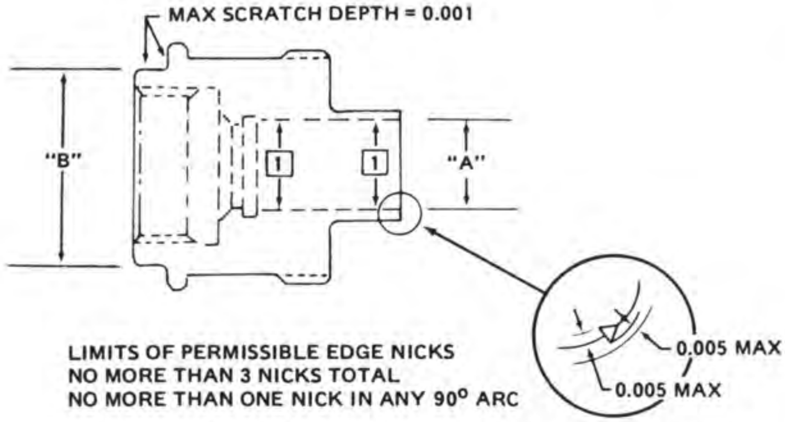

DIA "A"

1 MEASURE DIA WHERE INDICATED

MIN	MAX	REPLACE
0.6255	0.6260	0.6267
SURFACE FINISH		
	16	REPLACE AT 20
NICKS, SCRATCHES, CORROSION		
REPLACE FITTING IF SCRATCHES, NICKS, CORROSION VISIBLE		

DIA "B"

MIN	MAX	REPLACE
1.313	1.315	1.312
SURFACE FINISH		
	32	45

NO CRACKS ALLOWED

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

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Figure 6-52. Damage Limts — Inlet Fitting

(3) Repair fittings (6 or 28) with a fine round India stone (C116). Break sharp edges, and remove other damage, to the tolerances shown in figure 6-62. Replace fittings if damage exceeds the allowable limits shown on figure 6-52 and 6-53.

(4) Repair nozzles (8 and 21, figure 6-51) as follows:

(a) Use a fine, round India stone (C116) and break the outside sharp edge within **0.002 TO 0.005** inch limit as shown in figure 6-63.

(b) Remove nicks and scratches on nozzles (8 and 21, figure 6-51) to depth and width illustrated on figure 6-63).

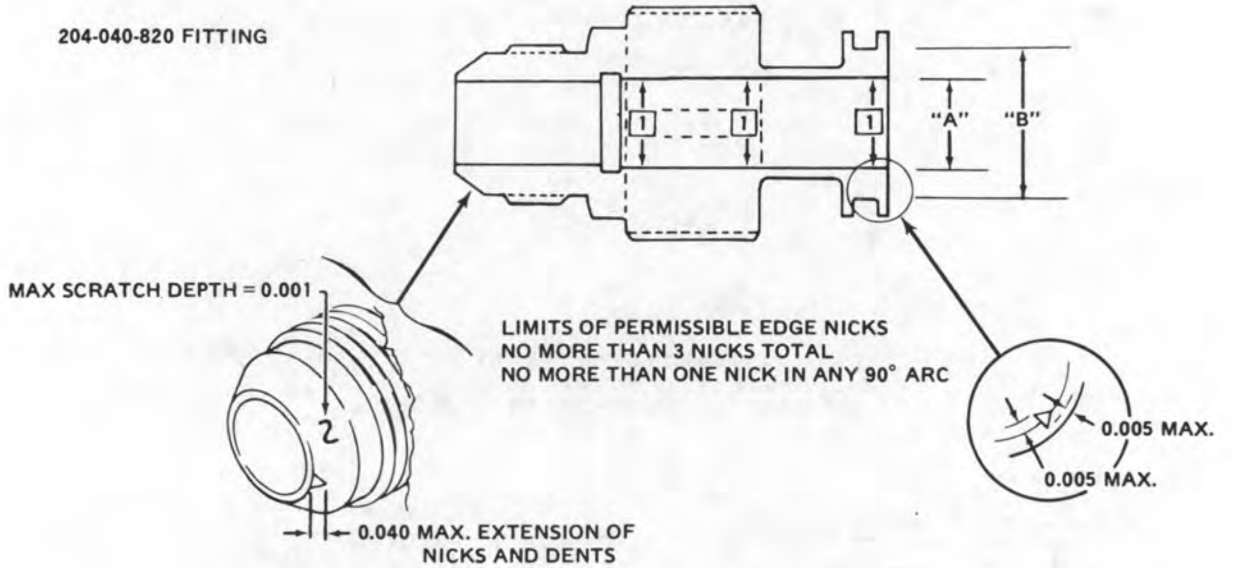
(c) Replace nozzles if inspection limits of figure 6-56 are exceeded.

(5) Rework plunger (25, figure 6-51) as follows:

CAUTION

Use extreme care when mounting plunger in collet, to prevent damage to the plunger.

(a) Chuck or mount plunger (3, figure 6-64) in a suitable resilient chuck with O.D. of plunger true



DIA. "A"

1 MEASURE DIA WHERE INDICATED

MIN.	MAX.	REPLACE
0.6255	0.6260	0.6267
SURFACE FINISH		
	16 ✓	20 ✓
NICKS, SCRATCHES, CORROSION		
		REPLACE FITTING IF SCRATCHES, NICKS, CORROSION VISIBLE

DIA. "B"

MIN.	MAX.	REPLACE
1.020	1.024	1.0195
SURFACE FINISH		
	32 ✓	45 ✓
NICKS AND SCRATCHES		
		REPLACE FITTING IF GREATER THAN 0.001 DEEP

NO CRACKS ALLOWED

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209040-26D

Figure 6-53. Damage Limits — Return Bypass Fitting

within **0.0005** inch. Machine retention ring (1) to **0.648 TO 0.650** inch diameter for width of **0.166 TO 0.278** inch.

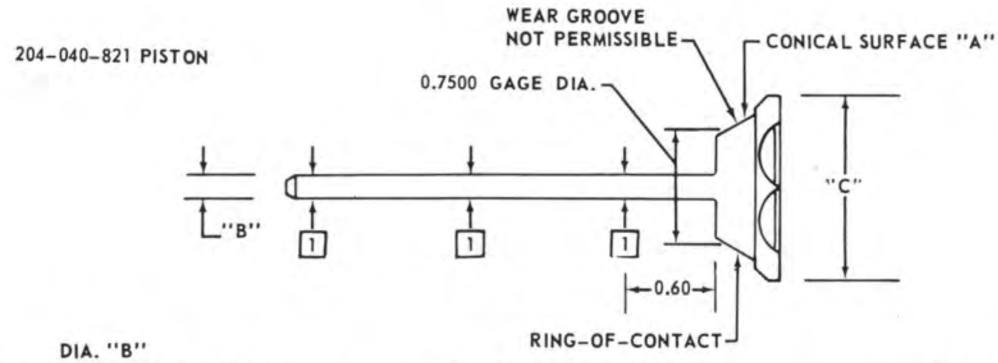
(b) Split and remove the remainder of retention ring (1) from plunger with suitable sharp pointed tool; use care not to nick or scratch the plunger.

(c) Remove and discard packing (2).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

(d) Clean plunger (3) with solvent (C112) and coat with oil (C79).



DIA. "B"

[1] MEASURE DIA. WHERE INDICATED

MIN.	MAX.	REPLACE
0.1245	0.1249	0.1244
SURFACE FINISH		
	8√	12√
NICKS, SCRATCHES & CORROSION		
		REPLACE FITTING IF SCRATCHES, NICKS, CORROSION VISIBLE

CONICAL SURFACE "A"

REPLACE IF:

1. SCRATCHES, NICKS, ETC. AT RING-OF-CONTACT
2. ECCENTRICITY AT GAGE DIA. EXCEEDS 0.001 T.I.R. RELATIVE TO AXIS OF DIA. "B"
3. SURFACE FINISH EXCEEDS 12√

DIA. "C"

MIN.	MAX.	REPLACE
1.2470	1.2480	1.2466
SURFACE FINISH		
	16√	25√
		REPLACE IF ECCENTRICITY IS GREATER THAN 0.001 T.I.R. RELATIVE TO DIA. "B"

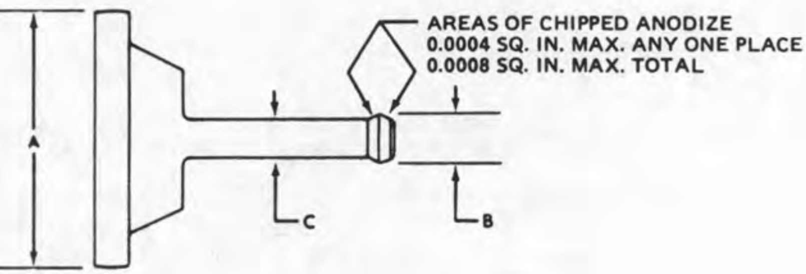
209040-27C

NO CRACKS ALLOWED

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

Figure 6-54. Damage LImits — Inlet Bypass Piston

204-040-822 PISTON



DIA. B

MIN.	MAX.	REPLACE
0.2140	0.2155	0.2132

DIA. A

MIN.	MAX.	REPLACE
1.2470	1.2480	1.2467
SURFACE FINISH		
	16	25

DIA. C

MIN.	MAX.	REPLACE
0.190	0.192	0.189

NO CRACKS ALLOWED.
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

209040-28B

Figure 6-55. Damage Limits — Piston

(e) Lubricate new packing (2) with oil (C79) and install in groove of plunger.

(f) Heat new retention ring (1) **140 TO 170** degrees F (**60 TO 77** degrees C) and lubricate retention I.D. with oil (C78).

(g) Position plunger (3) into holding fixture (T52) and press new retention ring (1) into place using tool (T52).

(h) Break sharp edges **0.002 TO 0.005** inch as illustrated.

(i) Replace plunger if it fails to meet inspection requirements of figure 6-60.

(6) Repair housing (15, figure 6-51) as follows:

(a) Replace any broken thread inserts in housing mount pads, to depth of **0.000 TO 0.010** inch after coating the external insert threads with unreduced primer (C88 or C91).

(b) Remove nicks and scratches from exterior of housing (15) by filing, then polish with 320 grit sandpaper (C102).

CAUTION

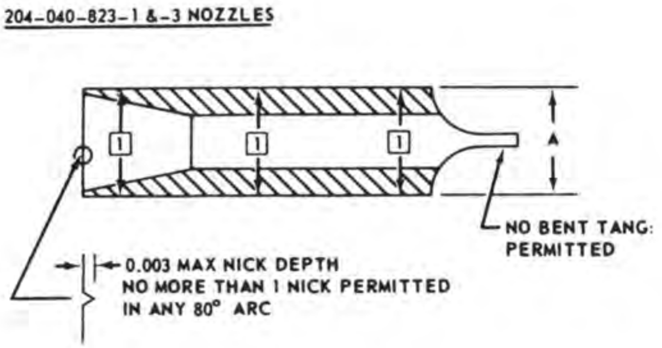
Make certain that thickness of housing wall is at least 0.090 inch after rework.

(c) Do not attempt to remove all traces of nicks or scratches on ports or bosses on valve housing. Remove only the raised, disturbed metal.

(d) Replace housing and mating plunger if housing fails inspection requirements of figure 6-59.

e. Assemble bypass valve as follows:

(1) Position holding fixture (T49) in vise Attach valve housing to fixture in horizontal position with four bolts and nuts.



DIA. A

1 MEASURE DIA WHERE INDICATED

MIN.	MAX.	REPLACE
0.6247	0.6250	0.6240
SURF. FINISH		
	16	20
REPLACE FOR ANY VISIBLE-EVIDENCE OF NICKS, SCRATCHES OR CORROSION.		

NO CRACKS ALLOWED

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209040-34A

Figure 6-56. Damage Limits — Nozzles

(2) Lubricate internal ports and passages of housing (15, figure 6-51) with oil (C79).

NOTE

Make certain that plunger (25) and housing (15) have the same serial number. They are mated pairs and are to be used or discarded as a unit.

(3) Lubricate plunger (25) with oil (C79). Place plunger on end of finger and insert plunger in housing (15).

(4) Attach plunger (25) to piston (10) by exerting pressure on outboard ends of wooden dowel pins held in contact with outboard ends of plunger and piston. See figure 6-65.

(5) Rotate housing (15, figure 6-51) end-for-end several times to check freedom of movement of plunger and piston.

NOTE

Plunger (25) and piston (10) assembly should slide the full length of their travel with no applied force other than their own weight. If plunger binds in its housing, check serial numbers of plunger and housing for mating. Also inspect for nicks, scratches, and foreign particles.

(6) Lubricate a new washer (18) with oil (C78) and install in groove at end of sleeve (19).

(7) Install sleeve (19) in inlet end of housing (15) with pin (17) at end of sleeve inserted into index hole in bottom of housing bore.

(8) Install piston (20) in sleeve (19) after first lubricating piston stem with oil (C79).

(9) Lubricate packing (27) with oil (C79) and install in housing (15) around end of sleeve (19).

(10) Lubricate nozzle (21) with oil (C79) and insert nozzle in end of fitting (28).

NOTE

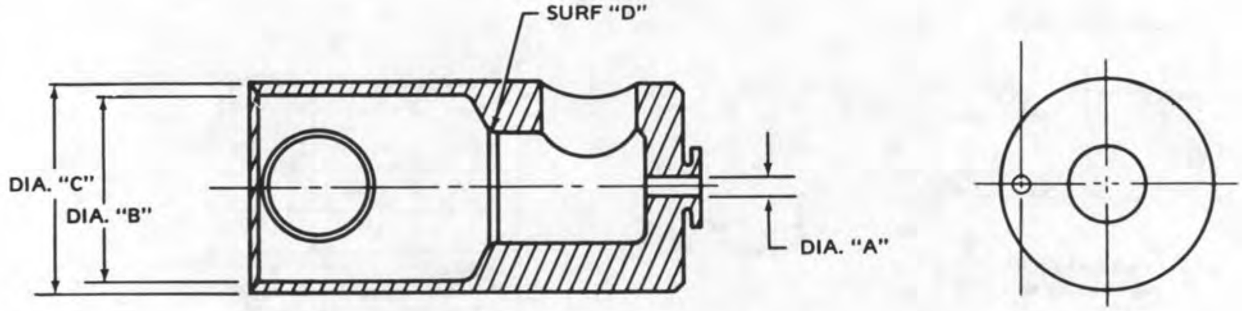
Nozzle should slide freely under its own weight. If drag exists, again inspect for burrs on nozzle edges, on fitting (28) and/or dirt on components.

(11) Install fitting (28) and nozzle (21) in the inlet port of housing (15). Torque fitting (28) **250 TO 300** inch-pounds. Lockwire (C137) fitting to hole in housing (15).

(12) Install spring (9) in return port of housing (15).

(13) Lubricate packing (7) with oil (C79) and install on fitting (6).

(14) Lubricate nozzle (8) with oil (C79) and insert in fitting (6).



DIA. A

MIN.	MAX.	REPLACE
0.1252	0.1255	0.1256
SURFACE FINISH		
	16	REPLACE IF 20
ECCENTRICITY		

DIA. B

MIN.	MAX.	REPLACE
1.2475	1.2500	1.2502
SURFACE FINISH		
	16	REPLACE IF 20

DIA. C

MIN.	MAX.	REPLACE
1.3742	1.3747	1.3741

REPLACE IF ECCENTRICITY EXCEEDS 0.001 T.I.R. RELATIVE TO DIA. B

REPLACE IF ANY VISIBLE EVIDENCE OF NICKS, SCRATCHES, OR CORROSION.

SURF "D"

CONICAL SEAT MUST BE FREE OF ALL NICKS, SCRATCHES, AND CORROSION

209040-35C

NO CRACKS ALLOWED

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Figure 6-57. Damage Limits — Sleeve

NOTE

Nozzle should slide freely under its own weight.

(15) Install fitting (6) and nozzle (8) in return end of valve housing (15) approximately three and one-half turns.

(16) Install nut (4) and key (5) on bypass valve and snug up against housing (15).

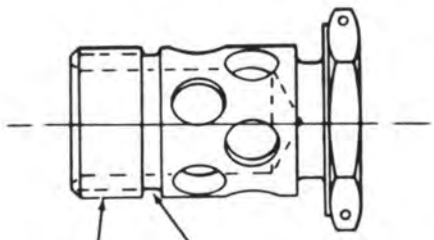
(17) Lubricate packing (31) with oil (C79) and install against head of bolt. (32).

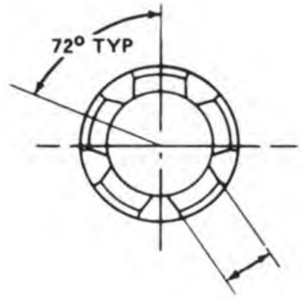
(18) Lubricate packing (29) and install on end of fitting (28).

(19) Install elbow (30) on fitting (28) with countersunk end of elbow (30) against packing (29) on end of fitting (28).

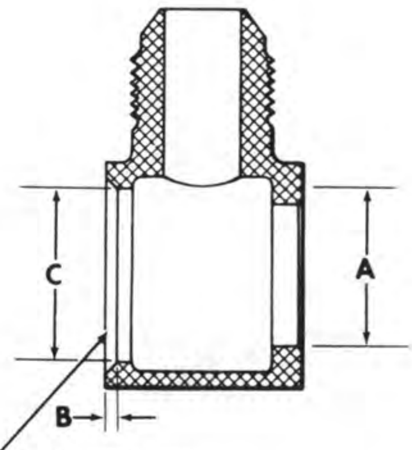
(20) Insert bolt (32) through elbow (30) thread into fitting (28) and snug up bolt.

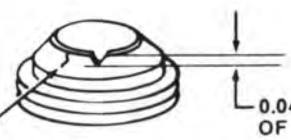
(21) Lubricate packings (2 and 14) with oil (C79). Install one packing on adapter end of elbow fitting (1) and one packing on union (3).





209-040-807-1 FITTING





DIA. A

MIN.	MAX.	REPLACE
1.062	1.064	1.065
SURFACE FINISH		
	32	REPLACE AT 45

DIA. C

MIN.	MAX.	REPLACE
1.316	1.317	1.318

DIM. B

MIN.	MAX.	REPLACE
0.092	0.097	0.098

NO CRACKS ALLOWED

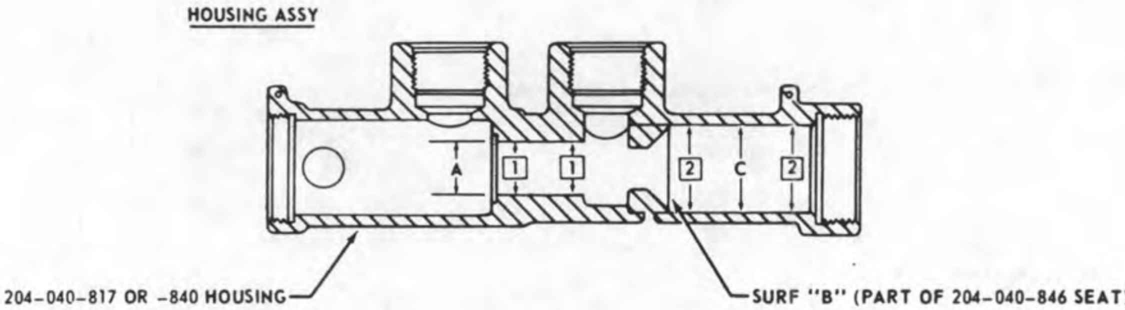
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209040-29D

Figure 6-58. Damage Limits — Universal Fitting Bolt and Elbow

NOTE

Housing and mating -832 plunger are selectively fitted. Replacement of either housing or plunger necessitates replacement of the mating part.



INSPECT HOUSING BY FLUORESCENT PENETRANT INSPECTION IN ACCORDANCE WITH TM 43-0103.

DIA. A

[1] MEASURE DIA. WHERE INDICATED

MIN.	MAX.	REPLACE
CLEARANCE BETWEEN THIS DIA. & DIA. "A" OF MATING 204-040-832 PLUNGER IS AS FOLLOWS		
0.00030	0.00045	0.00050
SCRATCHES, NICKS, & CORROSION		
REPLACE IF ANY VISIBLE EVIDENCE OF SCRATCHES, NICKS, OR CORROSION		
SURFACE FINISH (-840)		
	MAX. 4	REPLACE IF 6
SURFACE FINISH (-817 HOUSING)		
	MAX 50	REPLACE IF 60

DIA. C

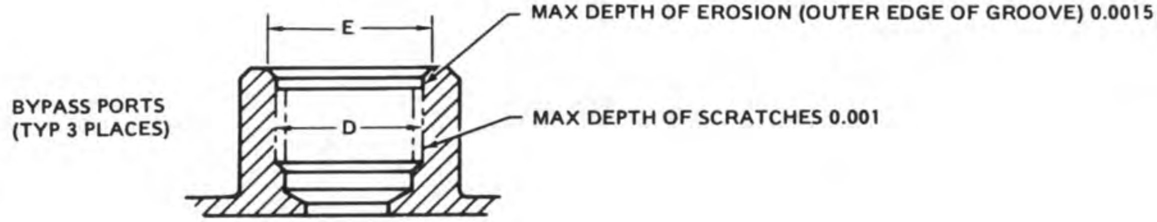
[2] MEASURE DIA. WHERE INDICATED

MIN.	MAX.	REPLACE
1.2495	1.2500	1.2503
SCRATCHES, NICKS, & CORROSION		
REPLACE FOR ANY SIGN OF CORROSION. MAXIMUM DEPTH OF NICK OR SCRATCH - 0.0005.		
SURFACE FINISH (-840)		
	MAX. 16	REPLACE IF 25
SURFACE FINISH (-817)		
	MAX. 80	REPLACE IF 100

NO CRACKS ALLOWED
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209040-30D

Figure 6-59. Damage Limits — Housing Assembly (Sheet 1 of 2)



DIA "E"

MIN	MAX	REPLACE
0.663	0.667	0.669

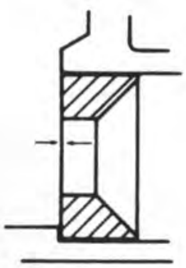
DIA"D"

MIN	MAX	REPLACE
0.625	0.630	0.631

SURFACE "B"

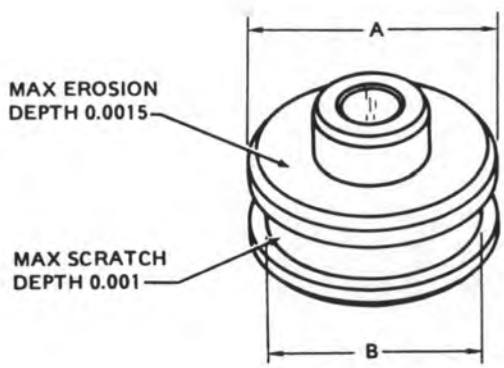
REPLACE HOUSING ASSEMBLY IF

(1) VISIBLE EVIDENCE OF NICKS, SCRATCHES OR CORROSION IN PLUNGER-CONTACT AREA.



(2) SEAT WEAR AT PLUNGER-CONTACT AREA IS 0.0015 OR GREATER

(3) SURF (AT PLUNGER CONTACT AREA) IS OUT OF SQUARE MORE THAN 0.001 RELATIVE TO AXIS OF DIA "A"



DIA "A"

MIN	MAX	REPLACE
0.621	0.623	0.620

DIA "B"

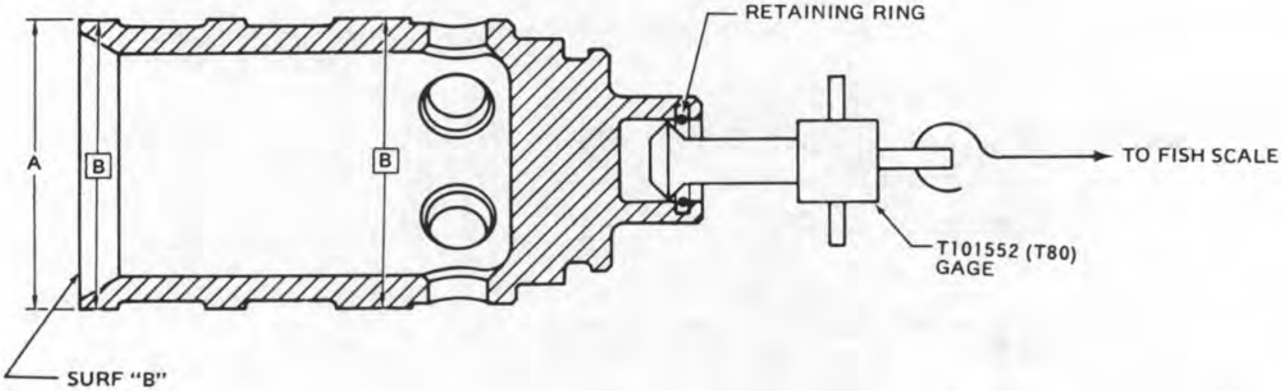
MIN	MAX	REPLACE
0.514	0.525	0.513

NO CRACKS ALLOWED

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209040-31C

Figure 6-59. Damage Limits — Housing Assembly (Sheet 2 of 2)



DIA A

[B] MEASURE DIA. WHERE INDICATED

MIN.	MAX.	REPLACE
CLEARANCE BETWEEN THIS DIA. & DIA. "B" OF MATING VALVE HOUSING IS AS FOLLOWS:		
0.00030	0.00045	0.00050
NICKS, SCRATCHES, & CORROSION		
REPLACE FOR ANY VISIBLE EVIDENCE OF NICKS, CRACKS, OR CORROSION.		

SURF B

REPLACE IF
(1) ANY NICKS OR SCRATCHES GREATER THAN 0.001 DEEP
(2) OUT OF SQUARE RELATIVE TO AXIS OF DIA. "A" MORE THAN 0.001 T. I. R.

REPLACE RING IF
(1) IF BROKEN
(2) IF FORCE REQUIRED TO PULL T101552 FROM PLUNGER IS LESS THAN 7 OZ.
(3) IF EXCESSIVE BURRS ARE PRESENT AT RING GAP (CHECK NOSE OF MATING 204-040-822 PISTON FOR EXCESSIVE ANODIZE CHIPPING).

NO CRACKS ALLOWED

ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE NOTED

209040-32C

Figure 6-60. Damage Limits — Plunger

(22) Install adapter (13) in transmission feed port of housing (15) and torque **500 TO 550** inch-pounds. Install fitting and checknut (1) into adapter (13). Install union (3) into cooler feed port and torque **500 TO 550** inch-pounds.

(23) Lubricate packing (12) with oil (C79) and install packing on switch (11). Install switch (11) in valve housing (15) and torque **40 TO 60** inch-pounds.

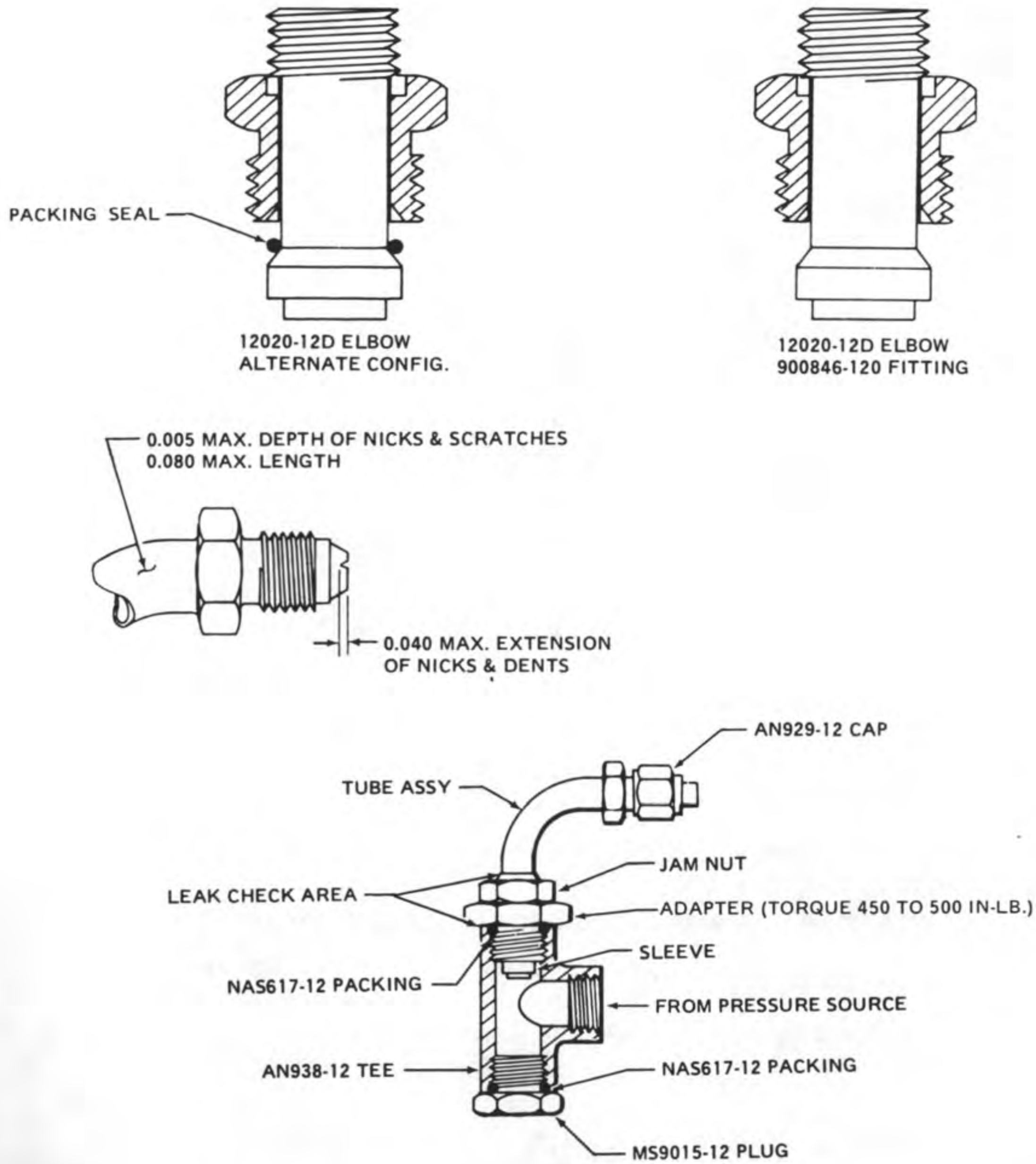
(24) Lubricate three packings (24) with oil (C79) and install one packing (24) on plug (23) and one retaining ring (22) in each of bypass ports.

6-152. TEST PROCEDURES — AUTOMATIC EMERGENCY BYPASS VALVE. (AVIM)

a. Install the bypass valve in a test stand. See figure 6-66 for schematic of test stand. The accuracy of the test equipment must be certified within following tolerances: pressure gages: 1 percent, temperature gages: 2 percent.

b. Perform seal bond test as follows:

(1) Tighten checknut in fitting and checknut (1, figure 6-51) not to exceed **200** inch-pounds torque.



NO CRACKS ALLOWED

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

209040-33C

Figure 6-61. Damage Limits — Elbow Fitting

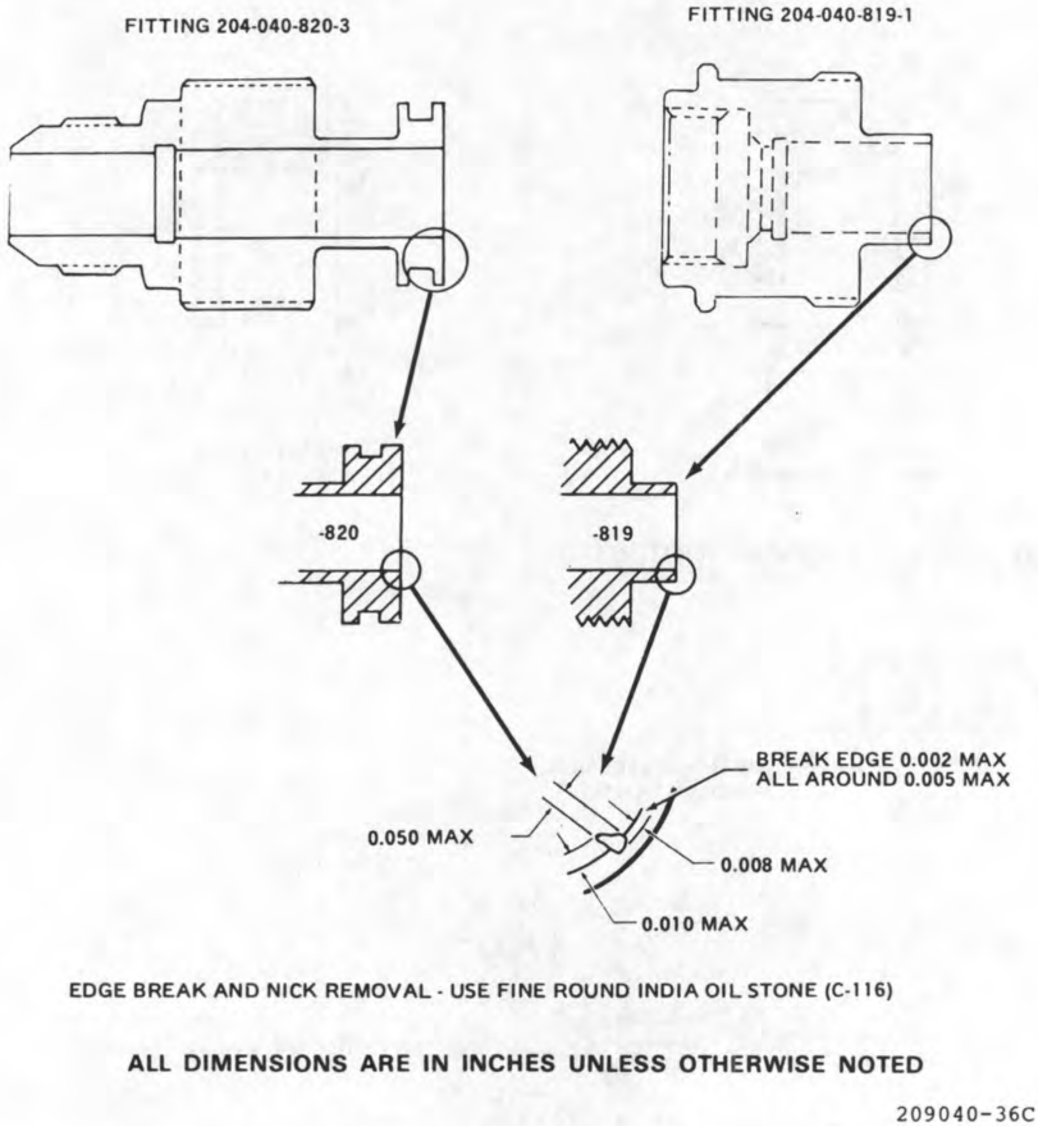


Figure 6-62. Fittings — Repair

(2) Remove compensator spring (9, figure 6-51) in order to ensure proper placement of other shifting elements of valve.

(3) Position valves: V1-closed; V2-open; and V3-closed (figure 6-66).

(4) Monitor fluid discharged by means of V2 by flowmeter No. 2 and P1, at pressures of **13±5** and **210±10** pounds per square inch. Leakage at the higher pressure must be no more than **5cc/min** greater than the flow at the lower pressure.

c. Perform valve sensitivity test as follows:

(1) Install compensator spring (9, figure 6-51) in the oil cooler bypass valve and complete assembly of valve.

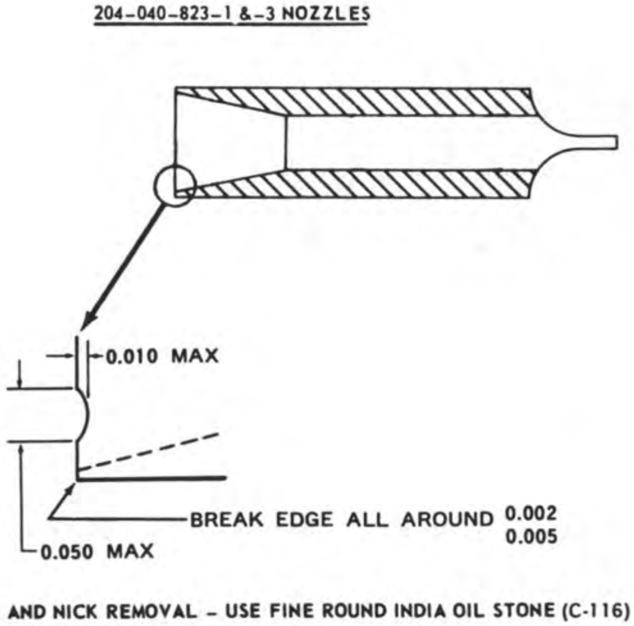
(2) Set pressures as follows (figure 6-66):

P1 = 115 ±2 PSIG

P2 = 95 ±2 PSIG

P3 = 84 ±2 PSIG

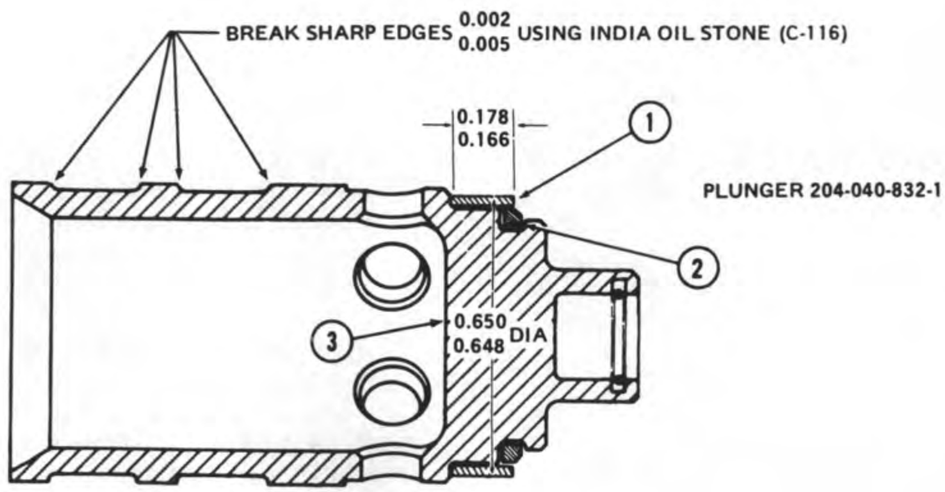
P4 = 64 ±2 PSIG



ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

209040-37C

Figure 6-63. Nozzles — Repair



1. Retention ring
2. Packing
3. Plunger

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

209040-38F

Figure 6-64. Plunger — Repair

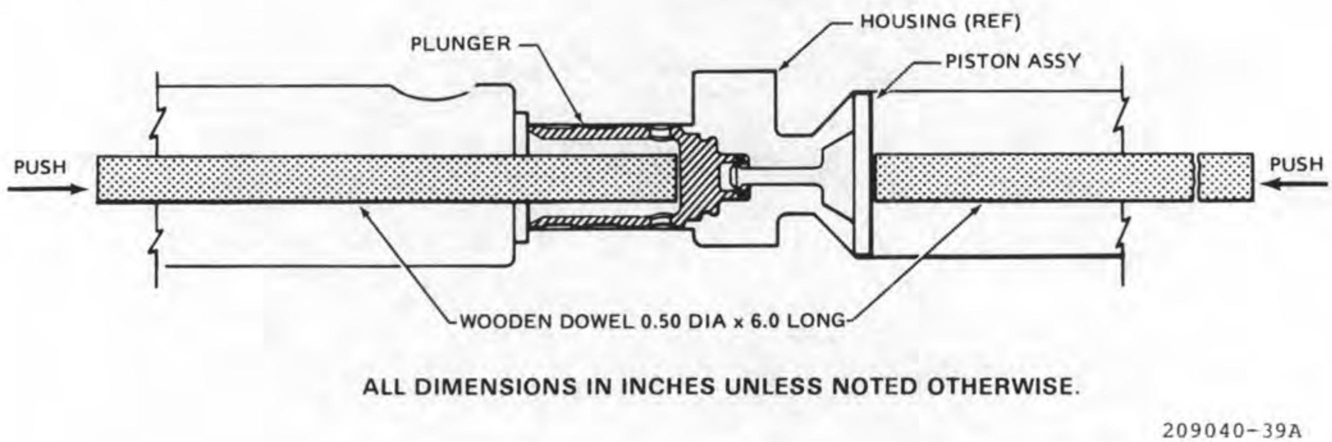


Figure 6-65. Work Aid Application — Plunger and Piston

(3) Set valves in position as follows (figure 6-66):

V1 = Open

V2 = Open at controlled rate to measure valve sensitivity.

V3 = Open

(4) Adjust oil temperature so that it reads **100** degrees ± **5** degrees F on circuit temperature gage.

(5) Adjust input flow rate, which is regulated by pump, to read **11.8** gal per minute on flow meter No. 1.

(6) Adjust the valve sensitivity to sense and shift oil flow to bypass the cooler as follows (figure 6-66):

NOTE

The bypass valve must sense and shift at a cooler leakage rate of 1.12 TO 1.37 gallons per minute.

(a) Regulate leakage flow with valve V2 and measure by flowmeter number 2 (figure 6-66). Adjust the valve shift to open oil bypass at leakage rate of **1.12 TO 1.37** gallons per minute.

(b) Adjust bypass valve sensitivity by threading fitting (A), in or out of valve housing. Decrease sensitivity by turning the fitting clockwise (figure 6-66).

(c) Torque nut (4, figure 6-51) on fitting (6) **250 TO 300** inch-pounds. Lockwire (C137) nut (4) and key (5) to hole in valve housing (15).

(d) After completion of step (c), the valve must reset when input flow rate is reduced to **zero** gallons per minute and input pressure is **zero** PSIG. Operate valve through at least **six** consecutive cycles. Make certain that valve resets at completion of each cycle.

NOTE

Pump run-up time, which is time lapse between start of pump and attainment of required system pressure and flow rate, must not be less than 10 seconds or more than 15 seconds.

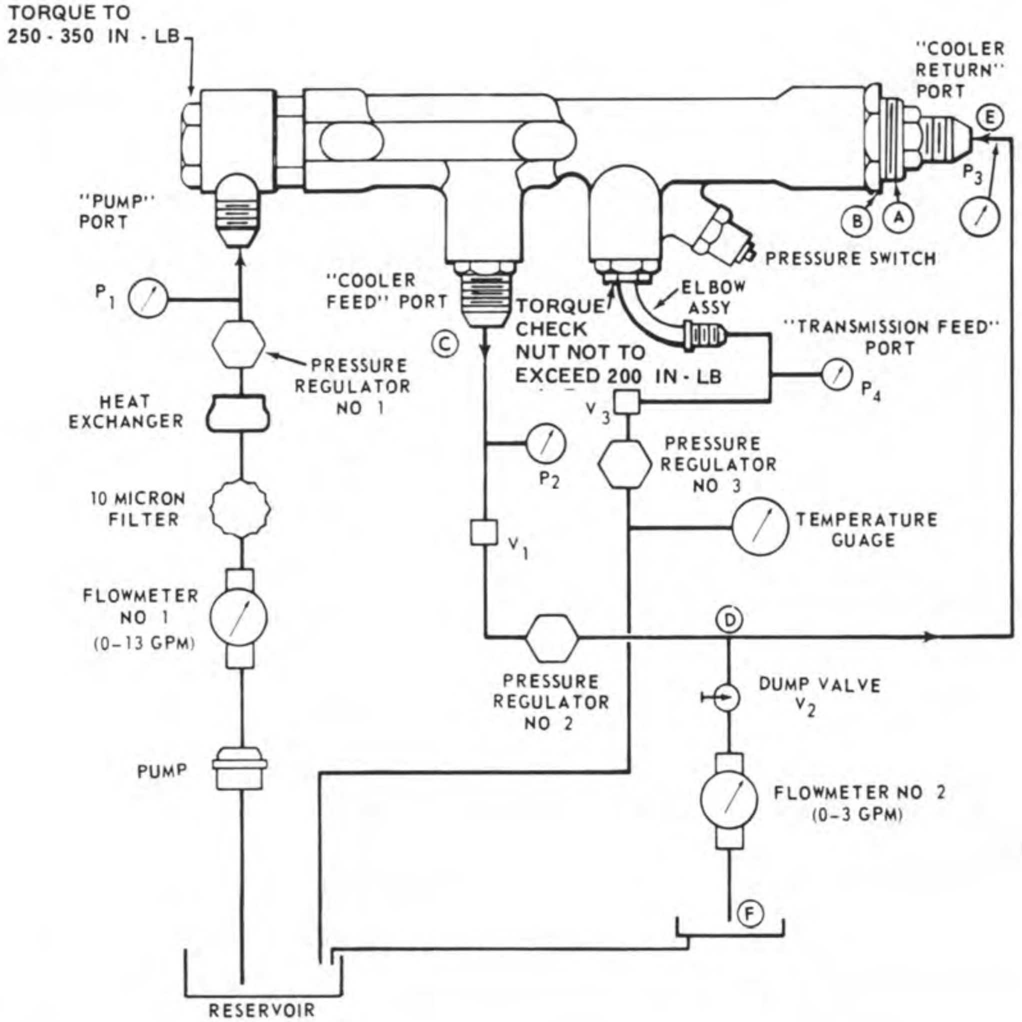
d. Apply sealant (C105) as a fairing to fill open key slots in nut (4) and around fitting (6) next to nut.

e. Loosen bolt (32) and checknut on checknut and fitting (1) after completion of test.

6-153. INSTALLATION — AUTOMATIC EMERGENCY BYPASS VALVE.

a. Attach valve (13, figure 6-47) to mounting bracket with four bolts and washers. Lockwire (C137) bolt heads in pairs.

b. Position valve braçket on transmission, with lower flange on two sump case mounting studs and upper and aligned on inner side of upper bracket



NOTE

10 micron filter and flowmeter may be placed in any convenient sequence between pump and P1 gage. Heat exchanger may be located at any convenient point between reservoir and valve under test.

No point in circuits C-D-F or E-D-F may be more than 22 inches higher or lower than point "C".

204-040-816-1 and -3 BENCH TEST SCHEMATIC.

209040-40D

Figure 6-66. Oil Cooler Automatic Emergency Bypass Valve — Bench Test Schematic

(which is attached on input drive quill mounting studs).

c. Attach valve bracket to upper bracket with two bolts, using a washer on left bolt and attaching electrical cable bracket on right bolt.

d. Attach lower end of bracket with nuts on studs, using a washer on left stud and attaching electrical cable bracket on right stud.

e. Position elbow (30, figure 6-51) to align with hose from transmission sump. Torque bolt (32) **250 TO 350** inch-pounds. Lockwire (C137) bolt (32) to elbow (30). Connect hose to elbow (30).

f. Connect valve-to-cooler hose on union (3).

g. Position fitting (1) to align with valve-to-filter tube. Connect tube to fittings.

CAUTION

Do not allow nut on valve fitting to turn when tightening flarenut of hose elbow. Any turning of this nut will destroy calibration of valve.

h. Connect cooler-to-valve hose on fitting (6) at right end of valve.

i. Connect electrical lead of caution panel circuit to terminal at right underside of valve (11). Cover terminal with rubber nipple.

j. At next ground run check for leaks and proper operation of oil system.

6-154. OIL FILTER (EXTERNAL).

6-155. DESCRIPTION — OIL FILTER (EXTERNAL).

An external oil filter (2, figure 6-47) for the transmission oil system is bracket mounted on the right side of the transmission main case and is connected to the external oil line between cooler and pressure relief valve manifold. The unit contains a pleated paper type filter element, and incorporates a bypass valve set to open at 18 to 22 psi to assure oil flow if filter element should become clogged. A visual indicator at top of filter will pop out when bypass occurs, but has a temperature lock-out device to prevent actuation below **50** degrees F.

6-156. REMOVAL — OIL FILTER (EXTERNAL).

a. Open cowl door at right side of transmission.

b. Remove filter element (11, figure 6-67) for inspection or replacement.

(1) Place suitable container below filter to catch trapped oil.

(2) Open V-band clamp (8).

(3) Remove filter (body) (13) downward.

(4) Remove filter element (11) and packings (9) and (10).

c. Remove filter (head) (4) and bracket (3) as follows:

(1) Disconnect hose assemblies (7 and 17) from filter (head) (4). Drain oil from hoses into a container. Cap or plug open hoses.

(2) Remove lockwire and four bolts (1) with washers (2) to detach filter (head) (4) from bracket (3).

(3) If filter (head) (4) is being replaced, remove union (6), elbow (16), nut (15), and packings (5 and 14).

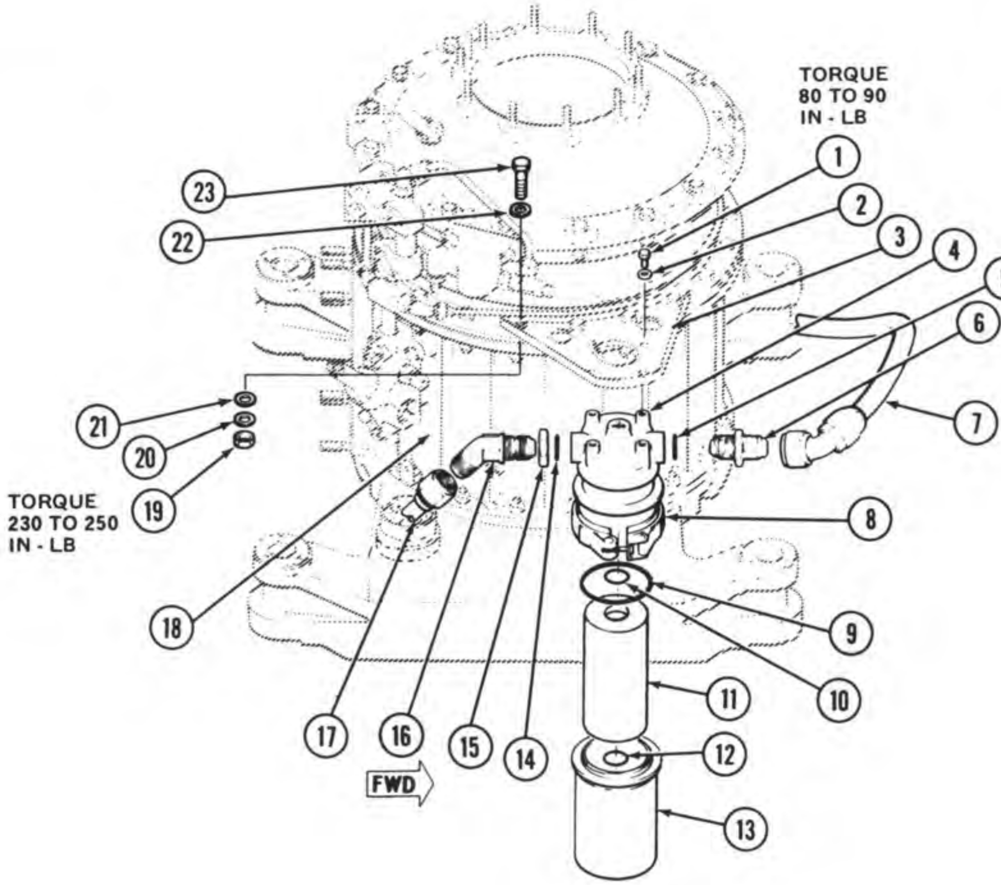
(4) Remove four bolts (23), washers (20, 21, 22) and nuts (19). Remove bracket (3).

6-157. CLEANING — OIL FILTER (EXTERNAL).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

Clean filter (head) (4, figure 6-67), filter (body) (13) and bracket (3) with solvent (C112). Dry thoroughly with filtered compressed air.



1. Bolt	7. Hose assembly	13. Filter (body)	19. Nut
2. Aluminum washer	8. V-band clamp	14. Packing	20. Thin steel washer
3. Bracket	9. Packing	15. Nut	21. Special washer P/N 212-040-199-1
4. Filter (head)	10. Packing	16. Elbow	22. Thin aluminum washer
5. Packing	11. Filter element	17. Hose assembly	23. Bolt
6. Union	12. Packing	18. Transmission case	

209040-111

Figure 6-67. Transmission External Oil Filter Installation (Typical)

6-158. INSPECTION — OIL FILTER (EXTERNAL).

a. Inspect bracket (3, figure 6-67), filter (head) (4) and filter (body) (13) for scratches, nicks, dents, cracks, and corrosion. Minor mechanical damage and superficial corrosion that will not affect function is acceptable. No cracks are acceptable.

b. Inspect filter element (11) for metal particles. If any particles are found, refer to paragraph 6-4.

6-159. REPAIR — OIL FILTER (EXTERNAL).

a. Replace bracket (3, figure 6-67), filter (head) (4) and/or filter (body) (13) if damaged in excess of acceptable limits (paragraph 6-158).

b. Replace filter element (11) and all packings that were removed.

6-160. INSTALLATION — OIL FILTER (EXTERNAL).

a. Position bracket (3, figure 6-67) on top of lower flange of transmission ring gear as illustrated. Install four bolts (23) with thin aluminum washers (22) under bolt heads. Install special washers (21) next to transmission case (18). Install thin steel washers (20) next to nuts. Install nuts (19). Torque nuts (19) evenly **230 TO 250** inch-pounds.

b. Position filter (head) (4) under bracket (3) with outlet aft. Install four bolts (1) with aluminum washers (2) under bolt heads. Torque bolts evenly **80 TO 90** inch-pounds. Lockwire (C137) bolt heads in pairs.

c. Install union (6) and packing (5).

d. Install hose assembly (7) on union (6).

e. Install elbow (16), packing (14), and nut (15).

f. Install hose assembly (17) on elbow (16).

g. Manually reset bypass indicator on filter (head) (4).

h. Install filter element (11) and filter (body) (13) as follows:

(1) Install packing (10) on boss in filter (head) (4).

(2) Install packing (9) on filter (head) (4).

(3) Install packing (12) on boss in filter (body) (13).

(4) Place filter element (11) in filter (body) (13) and seat firmly on boss.

(5) Position filter (body) (13) and filter element (11) on filter (head) (4) and install V-band clamp (8) around flanges of filter (head) and filter (body). Torque clamp nut **50** inch-pounds.

6-161. OIL FILTER (PRIMARY).

6-162. DESCRIPTION — OIL FILTER (PRIMARY).

The oil filter (primary) is located in the upper right aft corner of the transmission sump case. The filter assembly consists of a stack of wafer-disc screens assembled with spacers on a perforated tube, attached on a body which incorporates two bypass valves to allow continued oil flow in the event screens become clogged. The filter is mounted into a sump case chamber with inlet and outlet through internal passages. A cast scupper on the sump case is located below the filter mounting pad and connected to the overboard oil drain line to dispose of any oil spilled when servicing filter.

6-163. REMOVAL — OIL FILTER (PRIMARY).

a. Remove two nuts (15, figure 6-47) and washers (16 and 17). Remove two nuts (37), washers (36) and bracket (35).

b. Remove oil filter (18) from sump case. Allow excess oil to drain through scupper into suitable container placed under overboard drain outlet at left underside of fuselage.

6-164. CLEANING — OIL FILTER (PRIMARY).

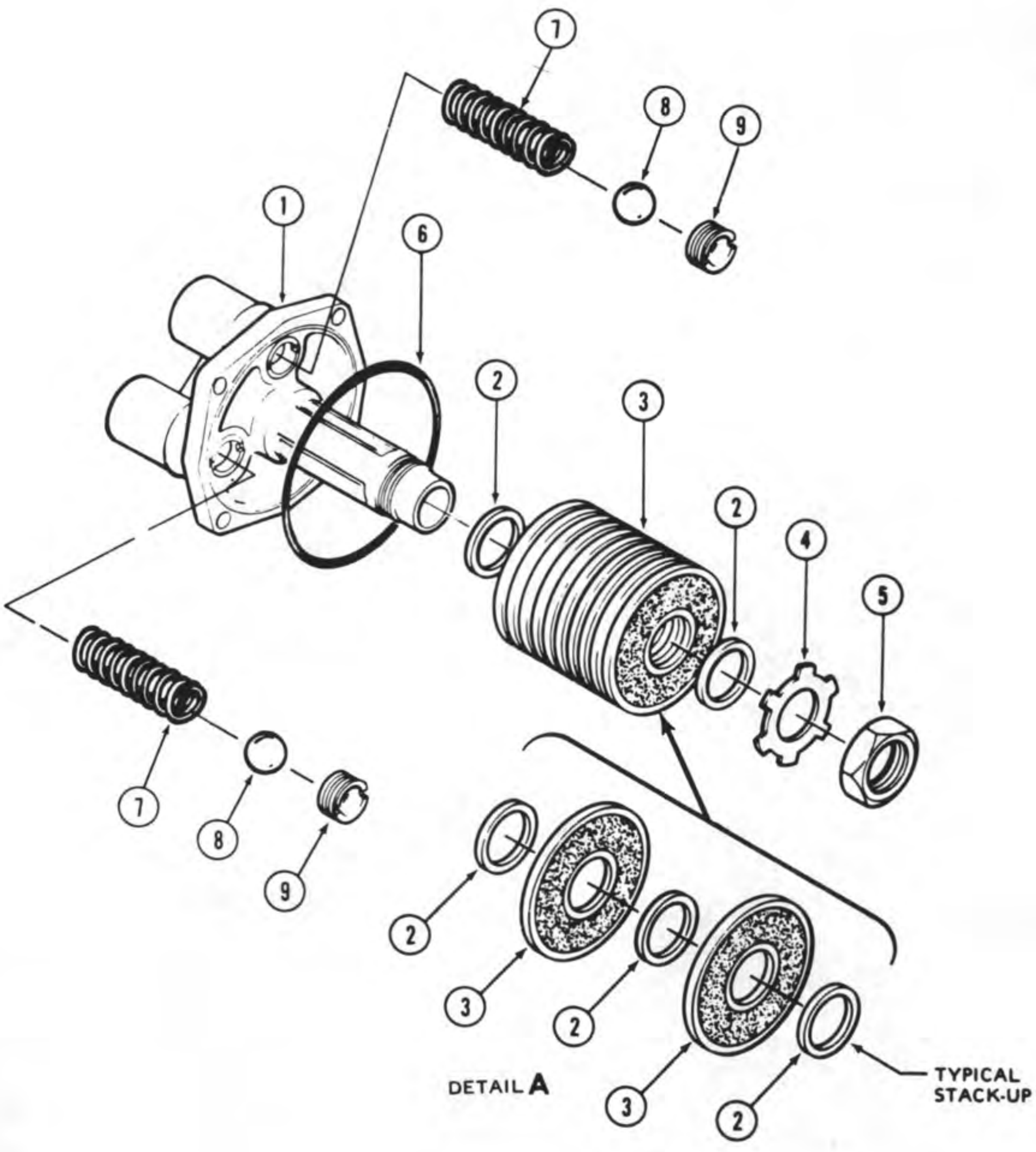
a. Visually inspect filter screens (3, figure 6-68) for metal particles, other contamination and damaged screens.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

b. Plug or cap end of tube, wash filter in solvent (C112), and dry thoroughly with filtered compressed air. A small soft bristle brush may be used to assist cleaning. Remove plug or cap from end of tube prior to installation.

c. Filter may be disassembled for cleaning if necessary but should be done only if impossible to clean while assembled. If necessary, disassemble screens (3) and spacers (2) from filter tube on valve body (1) by removing retaining nut (5) and lockwasher (4). Make sure inner surfaces of screens do not become contaminated before reassembling. Replace screens if damaged or unable to clean. Reassemble



1. Valve body, oil filter
2. Spacer, (11) each
3. Screen, (10) each
4. Lockwasher
5. Nut
6. Gasket
7. Spring
8. Ball
9. Seat valve

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Figure 6-68. Transmission Oil Filter (Primary) Assembly filter by alternatley installing spacers (2) then screens (3). Eleven spacers and ten screens are required. Install lockwasher (4) and nut (5). Tighten until spacers and screens cannot be rotated individually, then tighten additional one-quarter turn. Bend lockwasher (4) tab against flat of nut (5).

6-165. INSTALLATION — OIL FILTER (PRIMARY).

a. Install new packing (19, figure 6-47) on oil filter (18).

b. Install oil filter (18) in transmission sump (11) with one bypass valve at the top.

c. Place one bracket (35) on each of the two lower studs. Install one thin steel washer (36) on each bracket. Install two nuts (37). Do not tighten nuts at this time.

d. Place one thin aluminum washer (17) on each of the two upper studs. Install one thin steel washer (16) on each of the two upper studs. Install two nuts (15). Torque two nuts (15) and two nuts (37) evenly **50 TO 70** inch-pounds. Wait a minimum of fifteen minutes and retorque nuts to same torque noted above.

e. Fill transmission to proper level with oil (paragraph 1-5).

6-166. OIL SCREEN.

6-167. DESCRIPTION — OIL SCREEN.

The oil screen (21, figure 6-47) is located in the transmission sump. It prevents any particles, larger than the oil screen mesh, from entering the oil pump.

6-168. REMOVAL — OIL SCREEN.

a. Drain oil from transmission oil system at cooler drain valve (7, figure 6-47). Alternate procedure is to drain oil at sump drain valve on bottom of transmission.

b. Remove lockwire and remove screen (21) and gasket (20).

6-169. INSPECTION — OIL SCREEN.

a. Inspect screen (21, figure 6-47) for metal particles and other foreign objects. If any particles are found, refer to paragraph 6-4.

b. Inspect screen for damaged threads, distortion, and holes.

6-170. REPAIR — OIL SCREEN.

Replace screen (21, figure 6-47) if damaged in excess of limits noted in paragraph 6-169.

6-171. CLEANING — OIL SCREEN.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

Clean oil screen with solvent (C112).

6-172. INSTALLATION — OIL SCREEN.

a. Position gasket (20, figure 6-47) on oil screen (21). Install oil screen in transmission sump (11) and torque **300 TO 400** inch-pounds.

b. Lockwire (C137) oil screen to chip detector.

c. Fill transmission to correct level with lubricating oil (paragraph 1-5).

6-173. CHIP DETECTOR.

6-174. DESCRIPTION — CHIP DETECTOR.

The transmission is equipped with a chip detector (25, figure 6-47) located in the right side of the sump. It is wired to lights on the pilot and gunner caution panels. The lights are illuminated when metal particles are present in sufficient quantity on the detector element.

The element is held in the self-closing valve (23) plug by a bayonet type connector. Removal without loss of oil is made possible by the self-closing valve which seats when the chip detector is removed.

6-175. REMOVAL — CHIP DETECTOR.

a. Remove nut (26, figure 6-47) and remove electrical wire.

b. Press chip detector (25) in, turn counterclockwise and withdraw chip detector from self-closing valve (23).

c. If self-closing valve (23) is to be removed, drain oil from transmission at drain valve (7). Remove lockwire and remove self-closing valve from transmission sump.

6-176. INSPECTION — CHIP DETECTOR.

a. Inspect chip detector (25, figure 6-47) for metal particles. If any metal particles are found, refer to paragraph 6-4.

b. Inspect chip detector (25) for distortion and damaged threads.

c. Inspect self-closing valve (23) for damaged threads and proper operation of self-closing valve.

d. Inspect nut (26) for damaged threads.

e. Inspect gasket (22) and packing (24) for nicks, cuts, and deterioration.

6-177. CLEANING — CHIP DETECTOR.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

Clean chip detector (25, figure 6-47) and self-closing valve (23) with solvent (C112).

6-178. REPAIR — CHIP DETECTOR.

Replace chip detector (25, figure 6-47), self-closing valve (23), nut (26), packing (24), and/or gasket (22) if damaged.

6-179. INSTALLATION — CHIP DETECTOR.

a. Position gasket (22, figure 6-47) on self-closing valve (23). Install self-closing valve in transmission sump. Torque **300 TO 400** inch-pounds. Lockwire (C137) self-closing valve to screen (21) and to sump drain plug.

b. Fill transmission to proper level with lubricating oil (paragraph 1-5). Inspect self-closing valve (23) for oil leakage.

c. Install packing (24) on self-closing valve (23).

d. Push chip detector (25) into self-closing valve (23) and turn clockwise. Ensure that chip detector locks in self-closing valve.

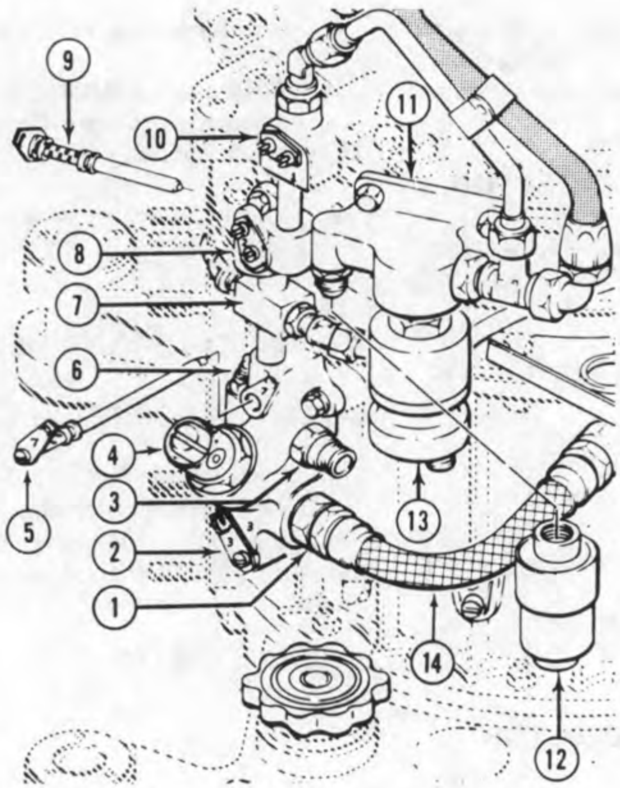
e. Place electrical wire on chip detector and install nut (26).

6-180. OIL MANIFOLD.

6-181. DESCRIPTION — OIL MANIFOLD.

The oil manifold (14, figure 6-47) is installed on the right side of transmission case. The manifold provides mounting points for the pressure relief valve temperature bulb, thermoswitch, and No. 3 and No. 7 oil jets.

6-182. DELETED.



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1. Manifold inlet
2. Jet No. 3
3. Temperature bulb
4. Pressure relief valve
5. Jet No. 7
6. Thermoswitch
7. Fitting assembly
8. Jet No. 2
9. Jet No. 5
10. Jet No. 1
11. Pressure tap manifold
12. Pressure switch
13. Pressure transmitter
14. Hose assembly

Figure 6-69. Transmission Oil Manifold Installation

6-183. INSPECTION — OIL MANIFOLD.

a. Inspect manifold for damage or leakage.

b. Inspect components installed on manifold for damage, leakage, or malfunction.

6-184. REPAIR — OIL MANIFOLD.

NOTE

Components can be replaced with manifold installed on transmission.

a. Replacement — Temperature Bulb (3, figure 6-69).

(1) Remove lockwire and remove temperature bulb (3).

(2) Install new bulb with new gasket.

(3) Lockwire (C137) temperature bulb to pressure relief valve.

b. Replacement — Thermoswitch (6, figure 6-69).

(1) Remove lockwire and remove thermoswitch (6).

(2) Install new thermoswitch with new gasket. Torque thermoswitch **12** inch-pounds and lockwire (C137).

c. Replacement and Repair — Pressure Relief Valve (4, figure 6-69).

(1) Remove lockwire and remove pressure relief valve.

NOTE

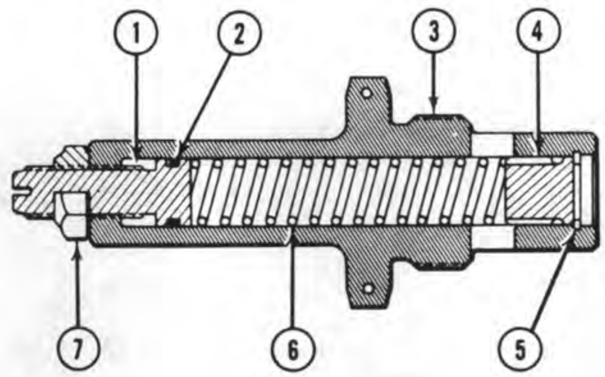
If pressure relief valve is repaired or replaced, transmission oil pressure must be checked and adjusted. Refer to step (4).

(2) Repair pressure relief valve as follows:

(a) Depress piston (4, figure 6-70) and remove retaining ring (5) from valve body (3).

(b) Remove piston (4) and spring (6) from valve body. If there has been leakage at top of valve, also remove nut (7) and screw (1), replace packing (2), and reinstall screw and nut.

(c) Check valve body (3) and piston (4) for damage or obstructions.



1. Screw
2. Packing
3. Body
4. Piston
5. Retaining ring
6. Spring
7. Nut

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Figure 6-70. Transmission Oil Pressure Relief Valve Assembly

(d) Install serviceable spring (6) and piston (4) in valve.

(e) Install retaining ring (5).

(3) Install pressure relief valve (4, figure 6-69) with new packing. Lockwire (C137) valve to temperature bulb and thermoswitch. Check and adjust relief valve. Refer to step (4).

(4) If pressure relief valve was replaced or repaired adjust as follows:

(a) Check transmission oil pressure on runup. Correct oil pressure is **50** ± **5** psi.

(b) Loosen nut (7, figure 6-70) while holding screw (1) at top of body (3).

(c) Turn screw (1) in to increase or out to decrease indicated oil pressure.

(d) Tighten nut (7).

(e) Recheck oil pressure in operation.

6-185. DELETED.

6-186. SIGHT GAGES.

6-187. DESCRIPTION — SIGHT GAGES.

Visual indication of oil level in transmission is provided by two transparent sight gages (28 and 32 figure 6-47) set into right side of sump case, backed by indicator discs with FULL and LOW markings.

6-188. REMOVAL — SIGHT GAGES.

a. Drain oil below gage level.

b. Remove retaining ring (34, figure 6-47), packing (33), sight glass (32), and indicator (31).

c. Remove retaining ring (30), packing (29), sight glass (28), and indicator (27).

6-189. INSPECTION SIGHT GAGES.

a. Inspect sight glasses (28 and 32, figure 6-47) for cracks, excessive scratches, and stains. Cracked and/or damaged glasses that obstruct view of indicators are not acceptable.

b. Inspect indicators (27) and (31) for stains. If words "full" and "low" as applicable are not legible, the indicators are not acceptable.

c. Inspect retaining rings (30 and 34) for distortion.

6-190. REPAIR — SIGHT GAGES.

a. Replace sight glasses (28 and 32, figure 6-47), indicators (27 and 31), and retainers (30 and 34) if damage is excess of acceptable limits (paragraph 6-189).

6-191. INSTALLATION — SIGHT GAGES.

a. Position new packing (29, figure 6-47) on sight glass (28).

b. Position indicator "LOW" (27) in lower sight gage port in transmission sump.

c. Install sight glass (28) with flat side out.

d. Install retaining ring (30).

e. Position new packing (33) on sight glass (32).

f. Position indicator "FULL" (31) in upper sight gage port in transmission sump.

g. Install sight glass (32) with flat side out.

h. Install retaining ring (34).

i. Fill transmission to full level with lubricating oil (paragraph 1-5). Check for oil leaks at sight gages.

6-192. OIL JETS.

6-193. DESCRIPTION — OIL JETS.

Eight jet assemblies are used in the transmission oil system to deliver aimed sprays of oil to gears and bearings. Each jet is identified to its mounting port by matching stamped numerals on the jet and on the transmission case. Locations and functions of the jets are as follows: See figure 6-46.

No. 1 - Top right aft section of top case. Sprays upper mast bearing, mast driving spline, and upper stage planetary pinion bearings.

No. 2 - On housing at right aft on ring gear case, with two auxiliary jets fed by external tubes and located 120 degrees apart on ring gear case. Sprays pinion bearings and gears of both planetary stages.

No. 3 - On bottom of oil manifold at right aft on main case. Sprays input bevel gears (leaving mesh) and delivers oil to No. 6 jet inside case.

No. 4 - On left side of sump case. Lubricates accessory and tail rotor drive quills.

No. 5 - Left aft main case, beside input drive quill. Lubricates input quill gears entering mesh.

No. 6 - Right side on main case, near oil manifold. Receives oil from No. 3 jet inside case. Sprays inboard bearing of input drive quill, and through end of gear to lubricate freewheeling clutch.

No. 7 - Top of oil manifold at right aft on main case. Lubricates upper bearings of input drive quill.

No. 8 - Located on the mast bearing retaining plate. Lubricates the upper mast bearing.

6-194. REMOVAL — OIL JETS.

a. Remove any jet, except auxiliary No. 2 jets, as follows:

NOTE

Before removing No. 7 jet, remove oil pressure relief valve.

(1) Cut lockwire between two screw heads on jet and loosen both screws. Remove screw that secures plate of jet to case.

(2) Pull jet, with packings, from case. Exercise care not to bend jet during removal. Cover open port to prevent contamination.

b. Remove No. 2 auxiliary jets as follows:

CAUTION

Do not attempt to remove the housing of number 2 auxiliary oil jets. This housing is attached by two bolts, nuts and cotter pins inside the transmission case. Tampering with bolts may cause leaks.

(1) Disconnect oil tube from jet. Cap open end of tube.

(2) Remove lockwire and screw from jet mounting plate.

(3) Pull jet and packing from housing. Cover open port.

6-195. CLEANING — OIL JETS.

a. Remove packing. Also remove screw, with seal, from outer end of jet (except auxiliary No. 2 jets) to permit thorough cleaning, drainage, and inspection.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of solvent vapors and contact with skin or eyes.

b. Wash in solvent (C112). A suitable brush can be used, if needed. Drain and dry with filtered compressed air. Be sure all jet openings are clear.

c. Install screw, with new seal, in outer end of tube.

6-196. INSPECTION — OIL JETS.

a. Inspect jet openings for foreign material not removed during cleaning.

b. Inspect jets for bending or other damage which would render them unserviceable.

6-197. REPAIR — OIL JETS.

Repair of oil jets is limited to replacement of jets which cannot be cleaned or jets which are bent or otherwise damaged. Replace all packing during installation.

6-198. INSTALLATION — OIL JETS.

a. Uncover mounting port. Check matching numerals beside port and on jet.

b. Install packings on jet tube in grooves at each side of inlet slot.

c. Coat packings with oil (C80). Insert jet, align lug, and secure to case with screw. Tighten both screws and lockwire (C137) heads together.

(1) For number 3 jet, use manifold attachment bolt for attachment. Install electrical harness clamp under bolt head when oil jet is installed.

(2) Connect oil tube to auxiliary number 2 jets. Lockwire (C137) attaching screw to elbow fitting next to tube connector nut.

(3) After installing number 7 jet, install oil pressure relief valve.

(4) Check for oil leaks at next runup.

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81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN.

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