CHAPTER 62 — MAIN ROTOR

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MAIN ROTOR

62-1. MAIN ROTOR

This chapter contains maintenance data for the main rotor hub, main rotor blades, and main rotor controls (stabilizer bar, stabilizer dampers, and swashplate and collective sleeve).

62-2. MAIN ROTOR — VIBRATION ANALYSIS

Refer to Chapter 18.

62-3. MAIN ROTOR — TROUBLESHOOTING

Potential problems that may occur in the main rotor assembly, are listed in Table 62-1 with the probable cause indicated and corrective action recommended.

62-4. MAIN ROTOR — OPERATIONAL CHECK

Refer to Chapter 18.

Table 62-1. Main Rotor Troubleshooting

TROUBLE INDICATION	PROBABLE CAUSE	CORRECTIVE ACTION
Lateral vibration	Rotor spanwise imbalance	Check and balance main rotor (Chapter 18)
	Rotor chordwise imbalance	Check and chordwise balance main rotor (Chapter 18)
	Stabilizer bar imbalanced	Check and balance stabilizer bar (BHT-212-CR&O)
Vertical 1/rev vibration	Rotor blades out of track	Track blades (Chapter 18)
	Worn bearings in collective lever assembly and link	Replace worn bearings
	Worn pitch change link rod end bearing	Replace if bearing wear is excessive.
	Excessive wear in collective scissors assembly	Replace scissors and sleeve assembly
	Internal wear or damage in main rotor hub assembly	Replace hub
2/rev vibration, approximately 10 per second	Pylon mount deteriorated	Replace mounts
Pylon rock	Defective pylon mount bolts	Check dampers for binding, rough movement, or lack of movement by stationing personnel around pylon mounting points and move pylon fore and aft using mast as a lever to rock pylon. Replace pylon dampers.
	Defective pylon mount	Inspect pylon mount for bond separation between rubber core and inner and outer sleeves. Replace mount if separation exceeds 0.25 inch (6.35 mm) maximum depth for 1/3 circumference of mount or if separation exceeds 0.75 inch (19.05 mm) at any one point.
	Defective pylon mount bolts	Inspect mount bolts for looseness, wear, bottoming and stripped threads. Replace or tighten mount bolts.
	Incorrect spring rate of pylon mounts	Check spring rate of pylon mounts. Replace pylon mounts if spring rate is incorrect (Chapter 63)
Rotor RPM high or low in autorotation	Low pitch blade angle incorrect	Check low pitch blade angle and adjust both pitch change tubes equally.

MAIN ROTOR HUB AND BLADE

62-5. MAIN ROTOR HUB AND BLADE ASSEMBLY

Main rotor blades are all-metal bonded assemblies, set into hub grips and secured by a retaining bolt in each group. Each blade consists of four major sections: Main spar, honeycomb core, trailing edge extrusion, and nose block extrusion, all bonded to skin by adhesive applied under heat and pressure. Reinforcing doublers, grip plates, and drag plates are attached on blade butt end. Stainless steel strips cover leading edges for resistance to abrasion. A trim tab is provided on trailing edge for tracking adjustments. A fitting on blade tip, which is used in flag-tracking procedure, has a hole for attachment of rotor tie-down. An adjustable drag brace connects trailing edge of blade to hub, providing a means of aligning blades. Oil levels of blade grips and hub pillow blocks can be checked through transparent covers. Torsion on retention strap within each blade grip counteracts aerodynamic forces which tend to reduce blade pitch. Control linkage connects to a pitch horn on leading side of each blade grip.

62-6. MAIN ROTOR HUB AND BLADE ASSEMBLY — MAINTENANCE

62-7. Main Rotor Hub and Blade Assembly — Removal

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
SWE 1243787B	Reaction Adapter
SWE 126377	Socket
SWE 393	Power Wrench
T101626	Lifting Sling (Qty 2)

1. Remove stabilizer bar (paragraph 62-27).

2. Remove lockwire, bolt, and retaining nut lock (1, Figure 62-2) at side of retaining nut (2). Use SWE 393, SWE 1243787B, and SWE 126377 to remove nut with washer (3).

3. Position suitable hoist above mast. Attach to hub of main rotor (4) with two T101626 lifting slings.

CAUTION

DO NOT ALLOW SPLIT CONES TO FALL FROM MAST. IF SPLIT CONES ARE DROPPED, INSPECT (PARAGRAPH 62-8).

4. Guide and steady rotor by means of tie-down assembly on blade tip, while lifting hub clear of mast (5). Remove split cone set (6).

62-8. Main Rotor Hub and Blade Assembly — Inspection and Repair

NOTE

If records or physical appearance indicate the hub has been involved in an accident or incident, refer to Chapter 5 for inspection requirements.

1. Inspect main rotor (4, Figure 62-2) for scratches, nicks, dents, and corrosion.

2. Inspect pitch change link (paragraph 62-24).

3. Inspect retaining nut (2) for scratches, nicks, dents, and corrosion. Repair as outlined in Figure 62-3.

4. Inspect retaining nut lock (1) for functional engagement, replace if cracked.

5. Inspect cone set (6) for mechanical and corrosion damage. Repair as outlined in Figure 62-4.

6. Inspect oil reservoir for evidence of leakage and discolored sight glass.

7. Polish out minor scratches, nicks, dents, and corrosion on main rotor hub.

8. Inspect blades (BHT-212-CR&O).

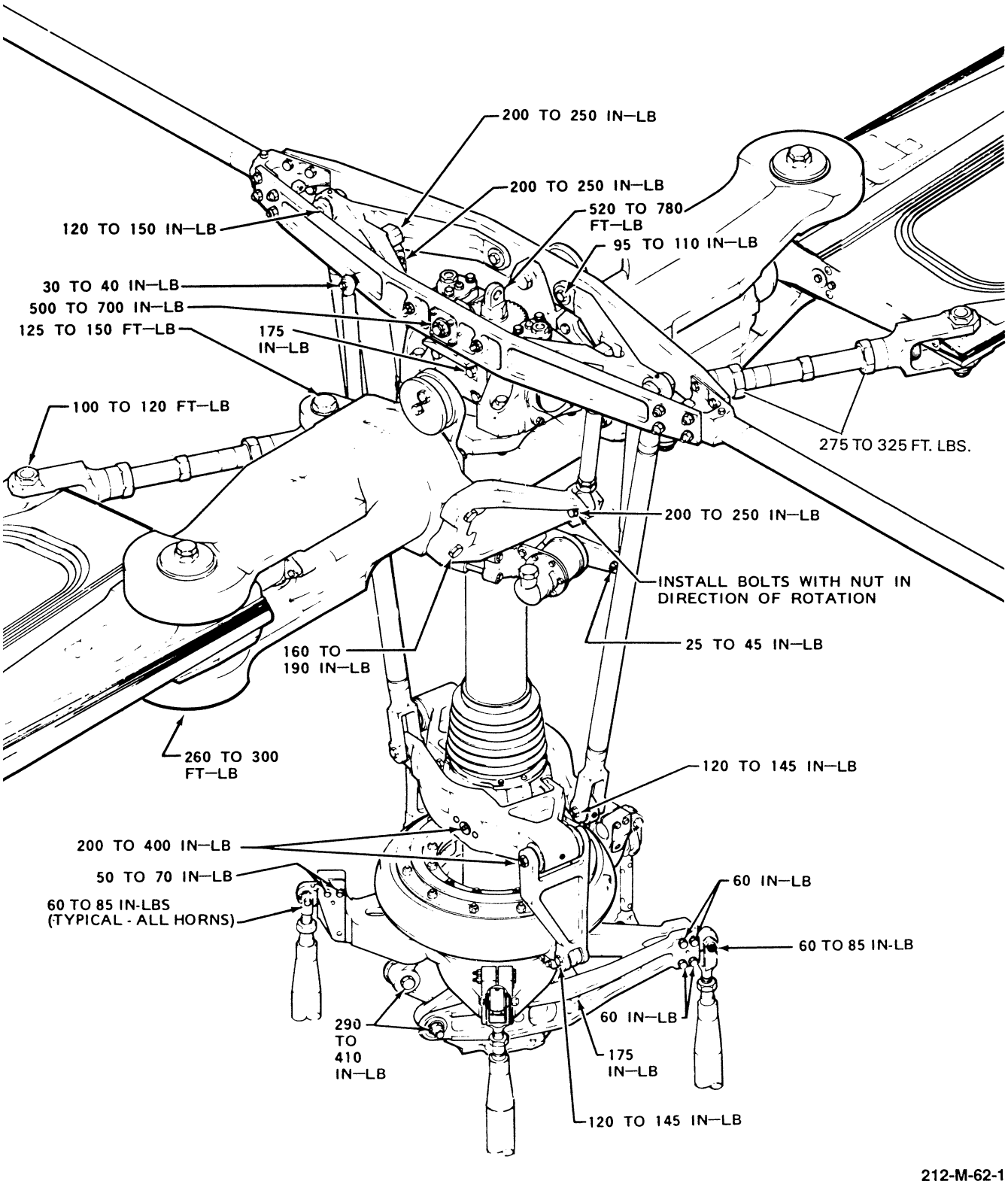
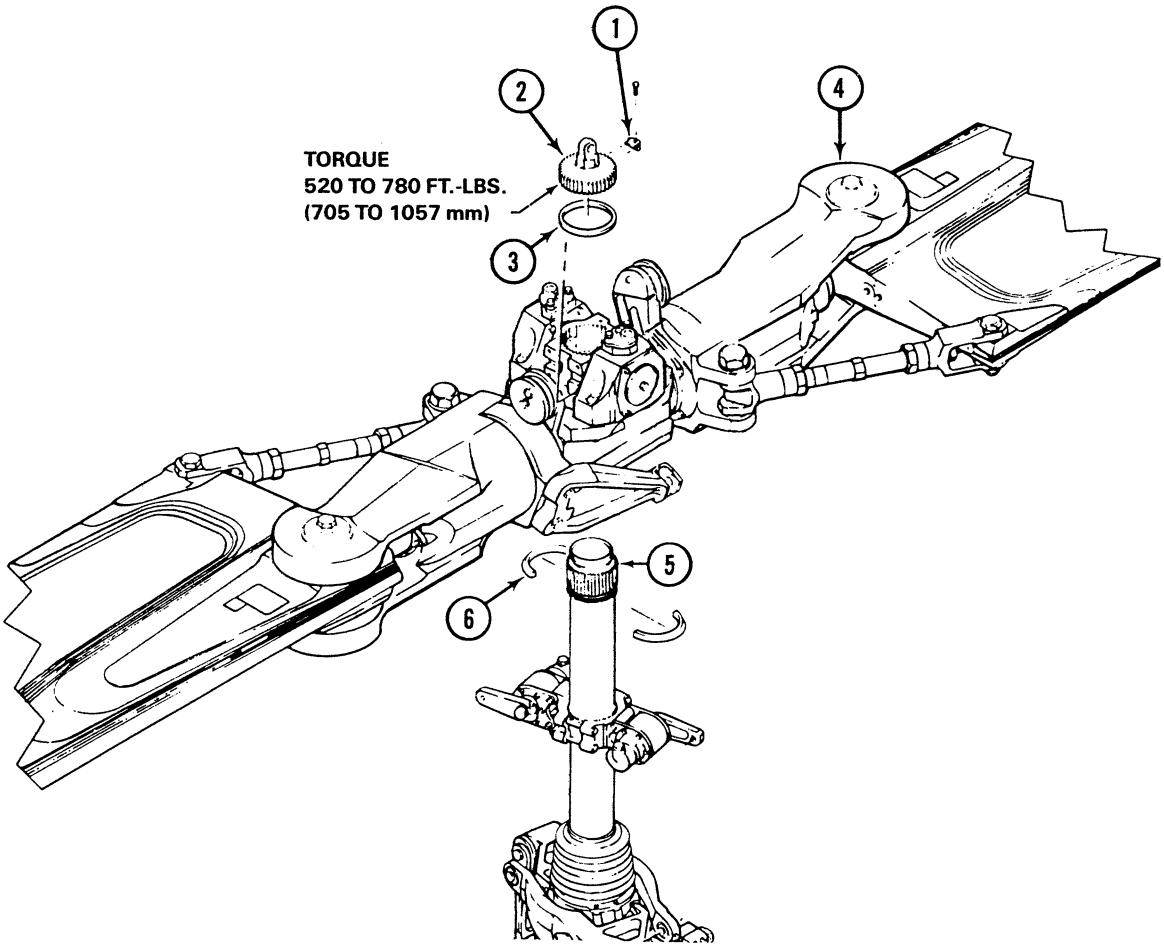


Figure 62-1. Main Rotor System Torque Values



1. Retaining nut lock
2. Retaining nut
3. Washer
4. Main rotor
5. Mast
6. Cone set

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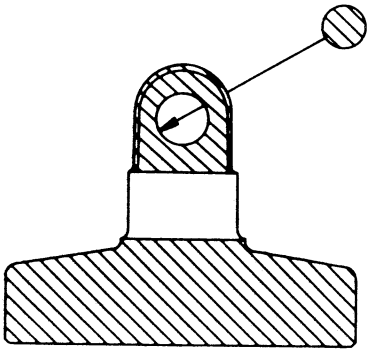
Figure 62-2. Main Rotor System



DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
NICKS, SCRATCHES, DENTS, AND CORROSION	0.010 IN. (0.254 mm)	0.030 IN. (0.762 mm)
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 SQ. IN. (64.52 mm^2)	Not Critical
NUMBER OF REPAIRS	Not Critical	Not Critical
EDGE CHAMFER	0.030 IN. (0.762 mm)	0.060 IN. (1.524 mm)
THREAD DAMAGE:	Length: 0.50 IN. (12.7 mm) Depth: 1/3 of thread Number: Two	

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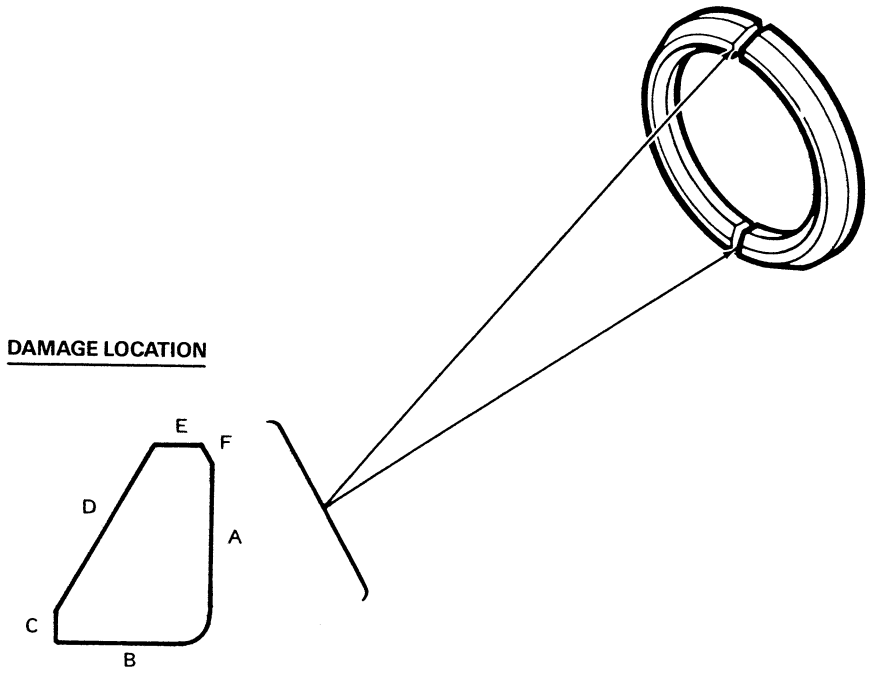
Figure 62-3. Main Rotor Retaining Nut Damage and Repair Limits



SURFACES	MAXIMUM DAMAGE AND REPAIR DEPTH
A, C, E, and F	Damage may be considered negligible and not requiring repair if the depth does not exceed 0.010 inch (0.254 mm), and the minimum radii observed in the damage area are not less than 0.025 inch (0.635 mm).
B	Damage not exceeding depth of 0.005 inch (0.127 mm) may be repaired with the use of a surface plate. Both halves of the cone set must be surfaced exactly the same amount so that the distance from surface B to D is identical for both halves.
D	Surface must not have any protrusions above the surrounding surface. Dents and scratches not exceeding depth of 0.010 inch (0.254 mm) may be polished out.
Edge Chamfer to Remove Damage	0.030 inch (0.762 mm).

212-M-62-4

Figure 62-4. Main Rotor Cone Set Damage Limits and Repair

62-9. Main Rotor Hub and Blade Assembly — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-104	Corrosion Preventive Compound
C-405	Lockwire

NOTE

If blade alignment is required, refer to BHT-212-CR&O.

1. Attach two T101626 lifting slings to suitable hoist and lift main rotor (4, Figure 62-2) to position above mast (5). Use rotor tie-down assembly on blade tip to guide and steady rotor during handling.

2. Coat splines of mast and rotor hub trunnion with a coat of corrosion preventive compound (C-104). Place cone set (6), with bevel side up, in groove of upper mast splines and with gaps equal at ends of cone sets.

3. Align master splines and lower rotor onto mast until seated on split cone. Verify gaps are still equal at end of cone sets.

CAUTION

ROTOR MUST BE ALIGNED DIRECTLY OVER MAST TO AVOID DAMAGING MAST THREADS.

4. Deleted.

5. Install washer (3) and retaining nut (2) on mast. Use SWE 393, SWE 1243787B, and SWE 126377 to tighten nut to a torque of 520 to 780 foot-pounds (705.0 to 1057.5 Nm).

6. Install retaining nut lock (1), engaged with nut splines, and secured to hub trunnion by a bolt. Torque bolt 60 inch-pounds (6.78 Nm) and secure bolt head to trunnion with lockwire (C-405).

7. Install stabilizer bar (paragraph 62-30).

8. Check minimum blade angle and secure pitch change link using lockwire (C-405) (paragraph 62-10).

NOTE

Step 9 is applicable to main rotor hub assemblies modified by TB 212-81-56 only.

9. After installation of hub and blade assembly, perform the following:

a. Purge lubricate hub assembly until grease passes through grip plate relief fitting and trunnion seals (Chapter 12).

b. Ground run helicopter (BHT-212-FM) for 5 minutes at 100%. After shutdown, purge lubricate hub assembly.

c. Purge lubricate hub assembly after first flight, after 10 flight hours, and at 50-hour intervals, as per Chapter 12.

10. Perform operational check (paragraph 62-4).

62-10. MINIMUM BLADE ANGLE

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire

1. Lock collective stick in full down position and cyclic stick at approximately neutral, using friction locking devices.

2. Holding main rotor and stabilizer bar assemblies from flapping, place a protractor chordwise on outboard machined surface of blade grips and record each reading.

3. Add readings in step 2 and divide by two. This will give minimum blade angle.

4. Adjust each pitch link equally until a total reading of 16° ±1° is obtained. This will give correct minimum

blade angle of 8° ±0.5°. The exposed threads on rod end bearing and clevis shall be equal with 0.0330 inch (0.8382 mm).

5. Torque locknuts to 650 to 800 inch-pounds (73.44 to 90.39 Nm). Secure lower locknut with double safety wire from nut to barrel and back to nut using lockwire (C-405). Secure upper locknut to barrel, back to nut, and then to clevis using lockwire (C-405).

NOTE

After final pitch link adjustment, exposed thread length of upper and lower fittings shall be equal within 2 1/2 threads for pitch links without thread engagement inspection holes. For pitch links with thread engagement holes, exposed thread lengths shall be equal within 5 threads, provided adequate thread engagement is indicated at inspection hole.

62-11. MAIN ROTOR BLADES

The main rotor blade is an all metal bonded assembly consisting of four major sections; a main spar, a honeycomb core, a trailing edge extrusion, and a nose block extrusion. On 212-015-501 main rotor blades, fiberglass straps are bonded inside upper and lower spar surfaces. These straps act as redundant structure to provide secondary load paths to carry primary loads should the spar be damaged or develop fatigue cracks. Skins, stabilized by honeycomb core, are bonded to the major section by adhesive applied under heat and pressure. Reinforcing doublers, grip plates, and drag plates are bonded to blade butt end. Stainless steel strips cover leading edge for resistance to abrasion. This basic portion of the blade has a chord length of 21 inches (533.4 mm). From station 85.00 to the tip of the blade, the trailing edge is extended aft 2.38 inches (60.45 mm). The extension consists of two skins 0.020 inch (0.508 mm) thick, a core 0.063 inch (1.6 mm) thick, and a spacer 0.050 inch (12.7 mm) thick. This extension will increase the length of the chord to 23.38 inches (593.85 mm) outboard of blade station 93.00. A trim tab is provided on the trailing edge for tracking adjustments. A fitting on blade tip, which is used in flag tracking procedure, has a hole for attachment of rotor blade tie-down.

62-12. Main Rotor Blades — Inspection and Repair

1. For inspection and repair of main rotor blades, refer to BHT-212-CR&O.

2. Use of polyurethane tape is optional with individual operator. Use is recommended for protection against abrasion of leading edge of blade in areas of high sand and dust conditions. The tape also provides medium protection against rain. Tape may be removed and replaced with new tape as often as necessary (BHT-212-CR&O).

62-13. BLADE INSPECTION SYSTEM

1. Diagnostic procedure performed on helicopter.

a. If a steady light on the detector unit assembly is present, this indicates that a possible blade crack or circuit malfunction exists. Use the diagnostic procedures to determine the cause (Figure 62-5).

b. Replace defective parts.

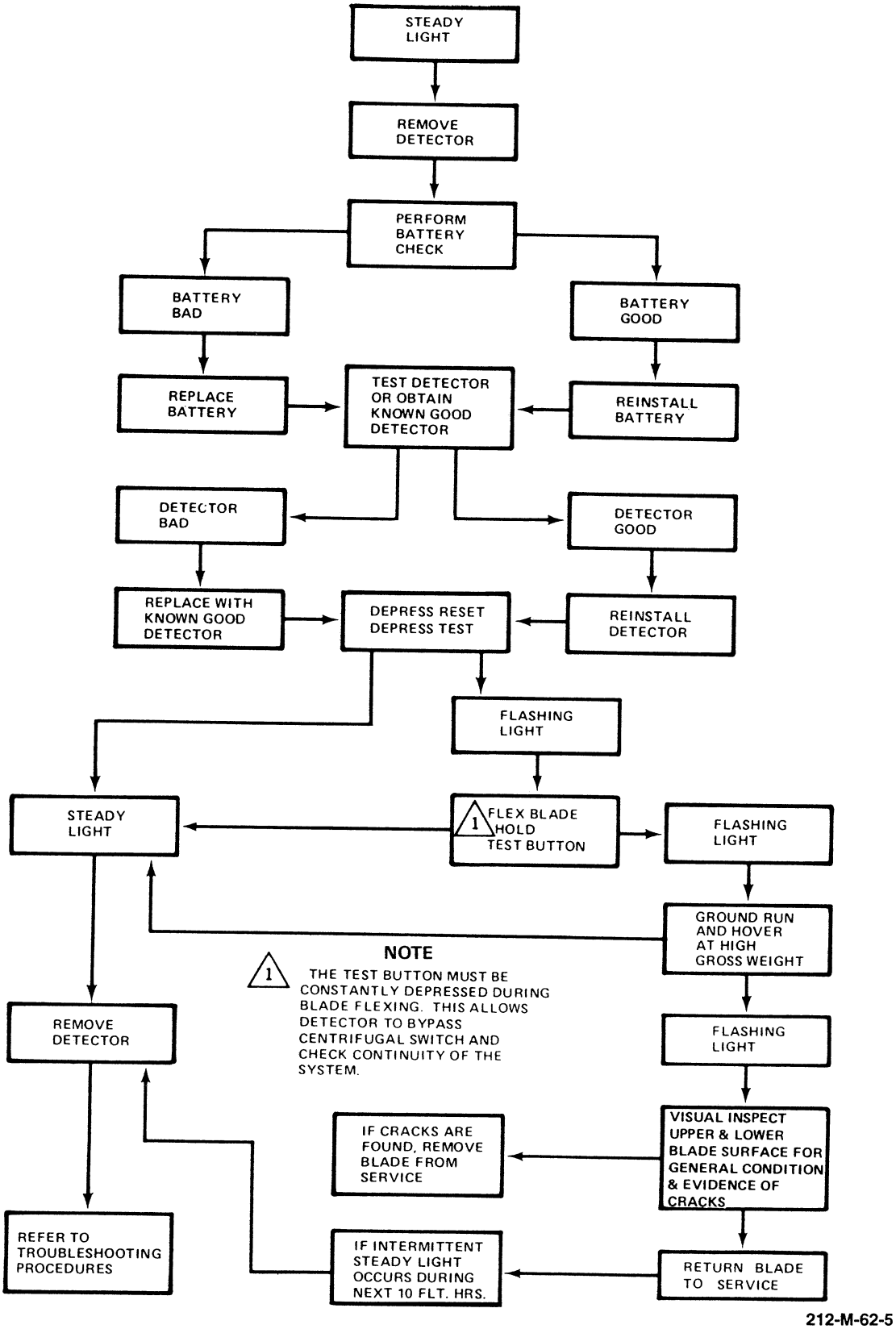


Figure 62-5. Diagnostic Procedures

62-14. Blade Inspection System — Repair

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-100	Chemical Film Material
C-204	Epoxy Polyamide Primer
C-207	Epoxy Enamel
C-224	Conductive Paint
C-307	Adhesive
C-309	MEK
C-405	Lockwire
C-423	Abrasive Paper

1. Repair blade inspection system conductive paint as follows:

a. Remove paint approximately 3 inches (76.2 mm) around area of break or damage in conductive paint, using cheesecloth dampened with MEK (C-309).

CAUTION

DO NOT SAND THROUGH CONDUCTIVE PAINT.

b. Gently remove remaining coats of primer by sanding lengthwise over conductive paint using 600 grit abrasive paper (C-423). Remove sanding residue with cheesecloth dampened with MEK (C-309). Expose conductive paint 0.25 to 0.50 inch (6.35 to 12.7 mm) each side of damage.

c. If damage breaks completely through finish to bare skin, sand damage smooth. Do not sand into skin more than 0.010 inch (0.254 mm) deep.

d. Touchup bare skin spot with chemical film material (C-100). Allow to dry.

e. Apply epoxy polyamide primer (C-204) to bare area only. Allow to dry 1 to 24 hours.

f. Apply a crosscoat (one spanwise, one chordwise) of epoxy enamel (C-207) (paragraph 62-15). Allow to dry 1 to 24 hours. Do not lap over onto conductive paint.

g. Mask off each side of the bare conductive paint continuing across touched up area.

h. Apply conductive paint (C-224) using a small brush across repaired area overlapping onto bare conductive paint on each side.

i. Remove 212-074-200-001 detector unit at butt of blade by removing four screws. Check for system continuity using an ohm meter between pin 2 and pin 9 (Figure 62-6) of connector inside 212-075-207-001 fitting. The reading shall be less than 1200 ohms. Check system for leakage between pin 8 and pin 9. The reading shall be greater than 50,000 ohms.

NOTE

If reading between pin 2 and pin 9 is more than 1200 ohms, apply additional conductive paint. A reading of less than 50,000 ohms between pin 8 and pin 9 indicates a short between blade body and conductive system. Add conductive paint in repair area if indicated, or rework the area to eliminate short by ensuring layer of epoxy polyamide primer is sufficiently thick to prevent a short between blade skin and conductive paint.

j. After system passes continuity and leakage checks, apply two coats of adhesive and primer mix, a mist coat of primer, and two coats of lacquer (paragraph 62-15).

2. Replace detector unit as follows:

a. Remove lockwire and screws, unplug detector unit.

b. Plug in new detector unit, apply adhesive (C-307) under screwheads.

c. Tighten screws and secure screws in pairs with lockwire (C-405).

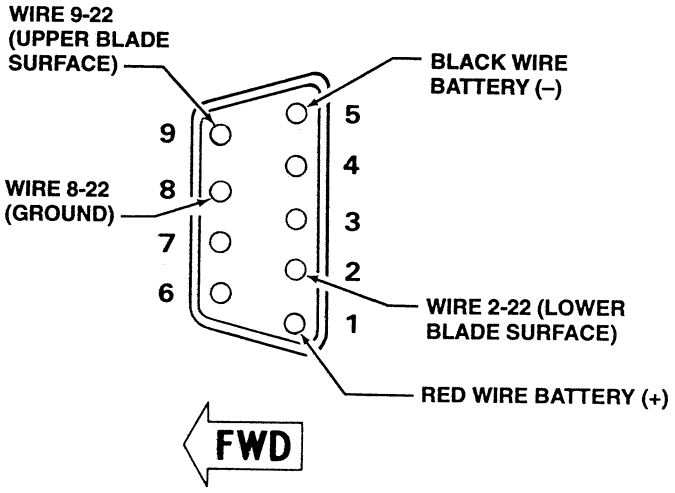


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Figure 62-6. Pin Location

d. Apply adhesive (C-307) around detector unit and fitting.

3. Perform battery condition check on new batteries under load of 220 ohms for 10 to 20 seconds. Battery shall have a minimum of 8.5 volts at end of test (Figure 62-7).

62-15. MAIN ROTOR BLADE PAINT TOUCHUP

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-100	Chemical Film Material
C-204	Epoxy Polyamide Primer
C-245	Polyurethane Coating
C-304	Drycleaning Solvent
C-309	MEK
C-318	Cleaning Compound
C-322	Adhesive
C-407	Abrasive Pad

NOTE

Use this procedure when only touchup refinishing of blade is required.

1. Clean area with drycleaning solvent (C-304).

NOTE

Before refinishing blade, repair all scratches, nicks, and dents within inspection limits. Care shall be taken to prevent damage to Blade Inspection System (BIS).

2. Using abrasive pad (C-407), remove all surface oxides and aged chemical conversion coating from all bare aluminum surfaces.

3. Wash blade with cleaning compound (C-318) mixing 10 to 15% by volume, in water. Achieve water break-free surface, evidenced by continuous unbroken film of water on surface after thoroughly rinsing soap from surface.

NOTE

Do not handle unpainted surfaces with bare hands for remainder of operation.

4. On all bare aluminum, apply brush or spray application of chemical film material (C-100).

5. Thoroughly dry the clean surfaces. Apply a light coat of epoxy polyamide primer (C-204). Allow to air dry from 1 hour minimum to 8 hours maximum before next step.

6. Apply adhesive (C-322) spray coating over reworked areas only. Three coats over trim tab and doublers, one coat over butt joint of skin to abrasive strip and skin to trailing edge extension, and one coat over a patch.

a. Mix adhesive (C-322). Mixing ratio is by weight, 100 parts of base to 140 parts of hardener, then mix 13 to 15% (by weight) of epoxy polyamide primer (C-204) into adhesive (C-322). Mix thoroughly.

NOTE

Pot life of mixture is approximately 3 hours.

b. Thin mixture to a sprayable consistency by adding MEK (C-309) not to exceed 50% by volume of mixture, approximately 35% by volume will produce a sprayable consistency.

7. Apply a light mist coat of epoxy polyamide primer (C-204) and allow to dry 1 hour minimum to 8 hours maximum.

8. Apply first coat of lacquer to match original color, to touchup areas of blade. Allow 1 hour minimum drying time, then apply second coat. Allow 1 hour minimum drying time before putting any other paint over second coat. Spray only repaired areas. If required, apply polyurethane coating (C-245), color No. 13538, to blade tip.

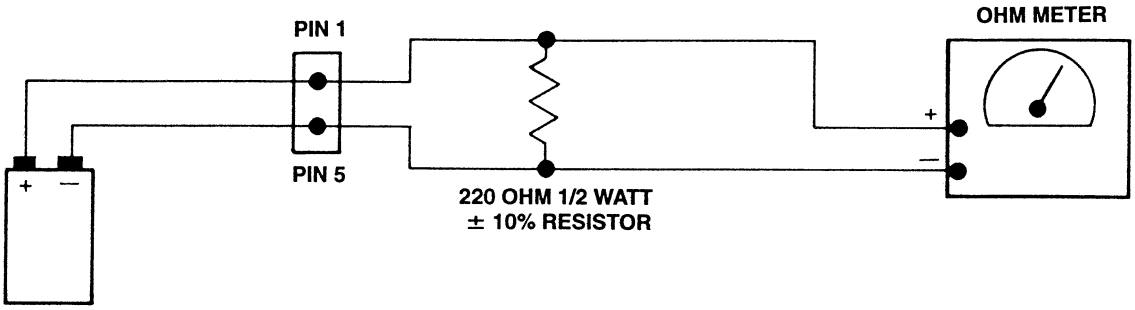

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Figure 62-7. Battery Tester

62-16. MAIN ROTOR BLADE TRIM TAB — REPLACEMENT

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-100	Chemical Film Material
C-309	MEK
C-313	Adhesive
C-423	Abrasive Paper

1. Trim tab replacement will be required if crack indications, separations, or a trailing edge of the tab that cannot be straightened, is noted.

2. Should trim tab replacement be required for any reason, it may be accomplished as follows:

a. Remove the old tab by cutting the portion of tab that extends beyond the trailing edge of the blade (approximately 0.125 inch (3.175 mm) beyond trailing edge of blade).

b. Drill out rivets if any exist.

c. Peel tab spanwise, starting at outer corner of tab, one side at a time. Apply heat (200°F (93°C) maximum) using a heat gun, to aid in trim tab removal.

3. Cleanup.

a. Mask off the tab area of the blade, allowing a 0.5 inch (12.7 mm) border for adhesive squeeze-out.

b. Drill trim tab that is used on main rotor blade as shown in Figure 62-8.

NOTE

If the removed tab had rivets installed, use reverse rivet pattern (Figure 62-8). Top rivet pattern should be on the bottom surface and old rivet holes should be filled with adhesive (C-313).

c. Remove old adhesive in the masked area by sanding spanwise with progressively finer abrasive paper (C-423) to include all traces of corrosion.

d. Wipe clean with cloths dampened with MEK (C-309) and dry with a clean cloth.

e. Install replacement tab and use it as a template to locate holes to be drilled into the blade.

NOTE

Use a stop on the drill to provide maximum drill depth of 0.125 inch (3.175 mm).

f. Remove trim tab and deburr all holes on the blade and trim tab.

g. Clean the blade trim tab area by wiping with cloths dampened with MEK (C-309) and dry with a clean cloth.

h. Sand the trim tab on the inside of both surfaces with medium grit (200 or finer) abrasive paper (C-423) until surfaces are bright. Wipe clean with cloths dampened with MEK (C-309) and dry with a clean cloth.

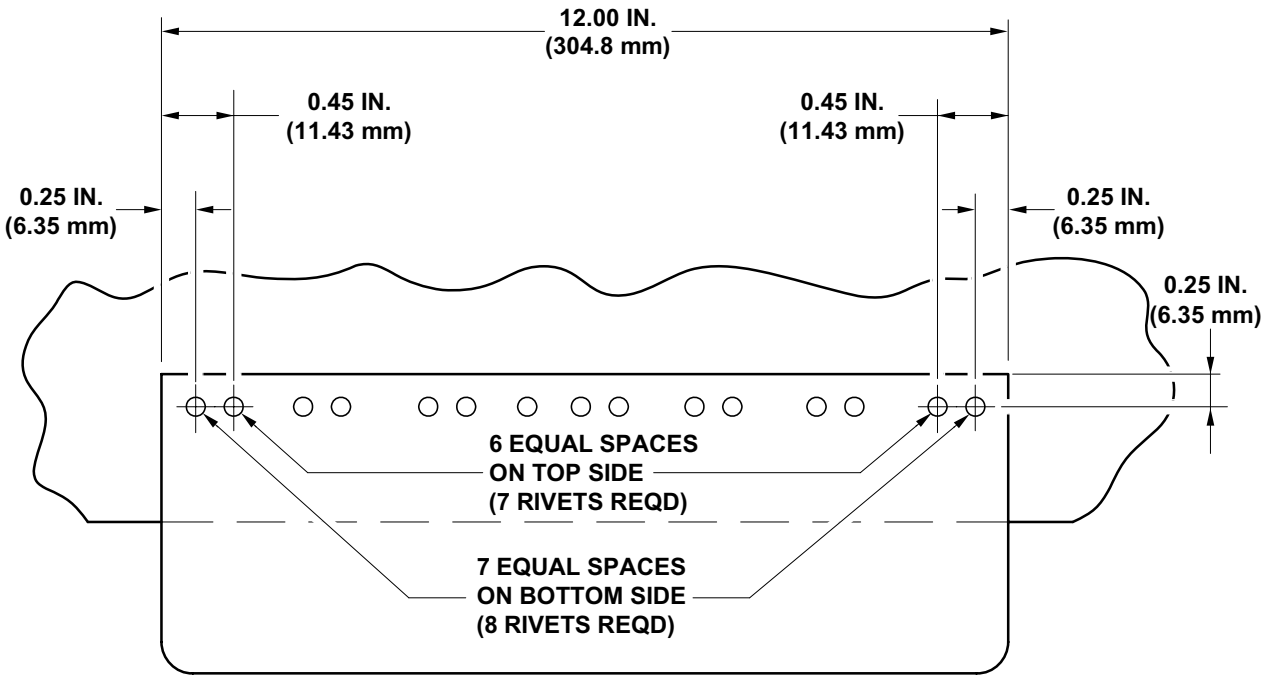
4. Thoroughly mix adhesive (C-313) in a one to one mixing ratio by weight or volume, and apply without delay.

5. Apply adhesive to masked area of blade and interior of replacement trim tab.

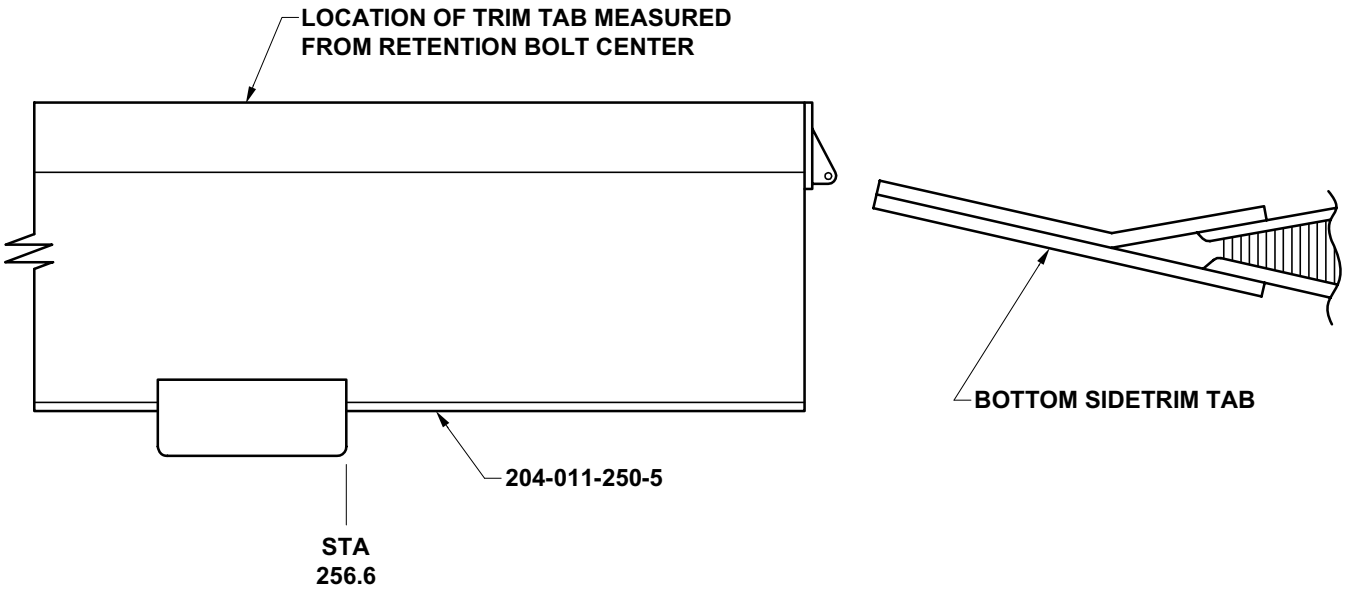
6. Install trim tab as follows:

a. Install replacement tab, locating as shown in Figure 62-8 (fair in squeeze-out). Cover tab with cellophane, allowing a border of at least 1 inch (25.4 mm). Tape cellophane to blade.

b. Dip rivets in adhesive (C-313) prior to installing, to obtain seal.



MAIN ROTOR BLADE TRIM TAB INSTALLATION INSTRUCTIONS:
DRILL 0.129 TO 0.132 IN. (3.28 TO 3.35 mm) DIAMETER USING NO. 30
DRILL 15 PLACES (7 ON TOP, 8 ON BOTTOM).
DEBURR ALL HOLES



212_MM_62_0006

Figure 62-8. Trim Tab Replacement

NOTE

Rivets should be installed prior to complete cure of adhesive previously applied to blade and interior of tab.

c. Install CR2263-4-1 Cherrylock rivets universal head using rivet gun P/N G-15 and pulling head No. H615A-4U or equivalent.

d. Apply 2 to 10 PSI (13.8 to 68.9 kPa) pressure to tab to ensure contact. “C” clamps and wood blocks approximately the size of the tabs may be used as a pressure device. A hard rubber pad 1/16 inch thick should be used to distribute the clamping load evenly. Clamps should be tightened snug, but not tight. Pressure period is a minimum of 24 hours at 70 to 90°F (21 to 32°C). Cure may be accelerated by applying heat (145 to 155°F (63 to 68°C)) for approximately 30 minutes. Apply heat until adhesive is completely firm (squeeze-out will resist fingernail penetration).

7. Final blade cleanup.

a. At the end of the pressure period, remove the pressure pads and cellophane. Smooth the squeeze-out with sandpaper, taking care not to damage skins.

b. Wipe blade in area of tab with MEK (C-309) and dry. Rinse with water.

c. Apply chemical film material (C-100) to reworked area (BHT-ALL-SPM).

d. Wipe with MEK (C-309) and dry with clean cloth.

8. Refinish repaired area (paragraph 62-15).

62-17. MAIN ROTOR HUB

The main rotor hub attaches main rotor blades to mast through a trunnion to provide rotor tilt through pillow block bearings. Blade grips rotate on yoke spindles to provide pitch change of blades.

62-18. Main Rotor Hub Grip Oil Reservoir Seals — Replacement

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire

1. Remove bolt (1, Figure 62-9), washers (2, 3, and 4), and packing (5) to detach cover (6), sight glass (8), and packings from plate assembly (11) on hub grip.

2. Inspect sight glass for transparency and damage. Replace if unserviceable. Replace packings at reassembly.

3. Place two spring lockwashers (2), a thin steel washer (3), an aluminum alloy washer (4), and a packing (5) on bolt (1). Assemble sight glass (8), two packings (7), and cover (6) on hub grip plate assembly (11). Insert bolt through cover into boss on plate. Tighten bolt until spring washers are fully compressed, then back off bolt 1 full turn (6 ±1/2 wrench flats).

4. Remove filler plug (9) and packing (10) from reservoir cover. Service with oil (Chapter 12) until reservoir is 1/2 full. Install plug with new packing. Secure plug to boltheads with lockwire (C-405).

62-19. Main Rotor Hub Pillow Block Reservoir Seals — Replacement

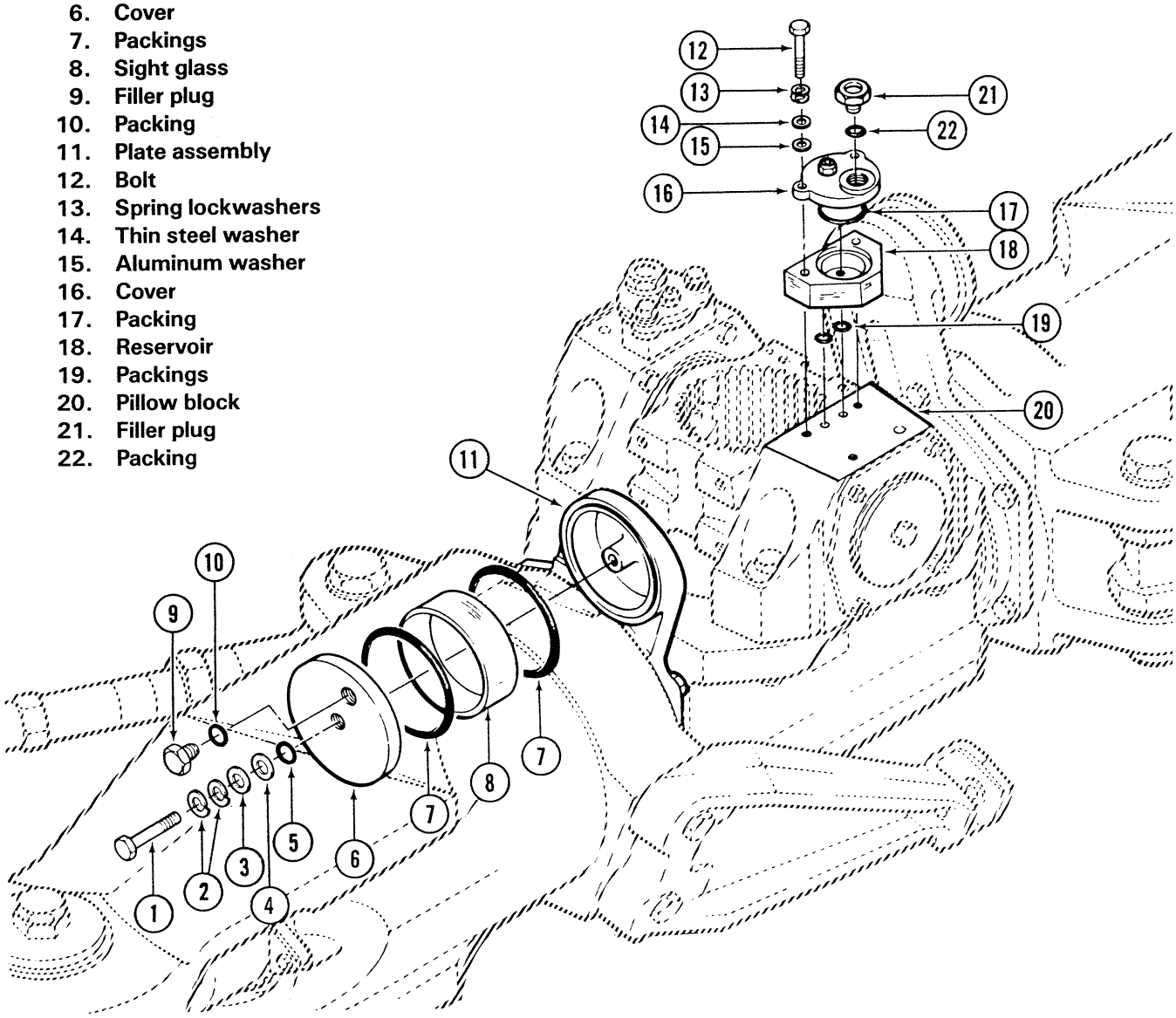
MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire

1. Remove two bolts (12, Figure 62-9), with washers (13, 14, and 15), to detach cover (16) and reservoir (18) with packings (17 and 19) from hub pillow block (20). Discard packings.

1. Bolt
2. Spring lockwashers
3. Thin steel washer
4. Aluminum washer
5. Packing
6. Cover
7. Packings
8. Sight glass
9. Filler plug
10. Packing
11. Plate assembly
12. Bolt
13. Spring lockwashers
14. Thin steel washer
15. Aluminum washer
16. Cover
17. Packing
18. Reservoir
19. Packings
20. Pillow block
21. Filler plug
22. Packing



212-M-62-8

Figure 62-9. Main Rotor Oil Reservoirs

2. Inspect reservoir for transparency and damage. Replace if unserviceable.

3. Assemble two packings (19), reservoir (18), packing (17), and cover (16) on pillow block (20).

4. On each of two bolts (12), place two spring lockwashers (13), thin steel washer (14) and aluminum washer (15). Insert bolts through cover and reservoir into mounting holes in pillow block. Tighten each bolt until spring washers are fully compressed, then back off 1 full turn (6 ±1/2 wrench flats).

5. Remove filler plug (21) with packing (22) from reservoir cover. Service with oil (Chapter 12), until reservoir is 1/2 full. Install plug with new packing. Secure plug to boltheads with lockwire (C-405).

62-20. Main Rotor Hub Grip — Ultrasonic Inspection

NOTE

Individuals performing this inspection shall be qualified and certified UT Level II or Level III per ATA Specification 105 (or equivalent) or Level I Special. Level I Special inspectors will have successfully completed the approved Bell Helicopter training (main rotor grip in section training or NDI training course) and examination. Refer to Information Letter 212-02-48 for additional information. Verify with local regulatory authorities for recertification requirements of Level I Special certification, as there may be a requirement for periodic recurrent training.

NOTE

Level I Special inspectors must use the special tools listed to perform this inspection. Level II or Level III qualified and certified inspectors may develop and obtain local approval for an alternate procedure utilizing other ultrasonic test equipment, however the UT-010-057 calibration standard shall be used.

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
USM22B or USMXB (1)	Ultrasonic Test Set
UT-010-057 (2)	Calibration Standard
118-140-012 (1)	Cable
362-001-210 (1)	Wedge
389-025-070 (1)	Transducer

NOTES:

(1) Manufactured by Krautkramer.

(2) Manufactured by Bell Helicopter.

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
118-300-500	Couplant
C-407	Abrasive Pad

NOTE

Disassembly or removal of the main rotor hub from the helicopter is not necessary.

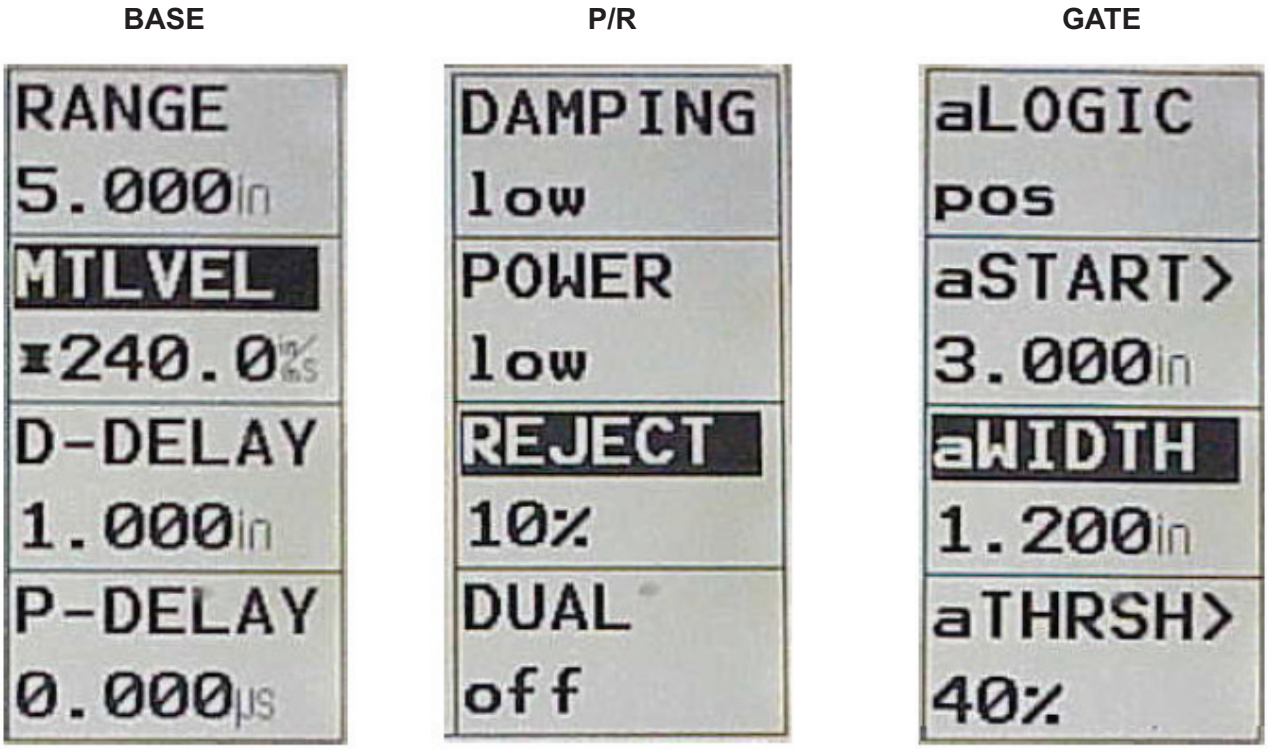
1. Clean lower grip tang surfaces to remove any grease or other contamination.

2. Calibrate the ultrasonic test set as follows:

a. Install the transducer (Figure 62-11, View A) into the 23° wedge and connect to the ultrasonic test set with the cable.

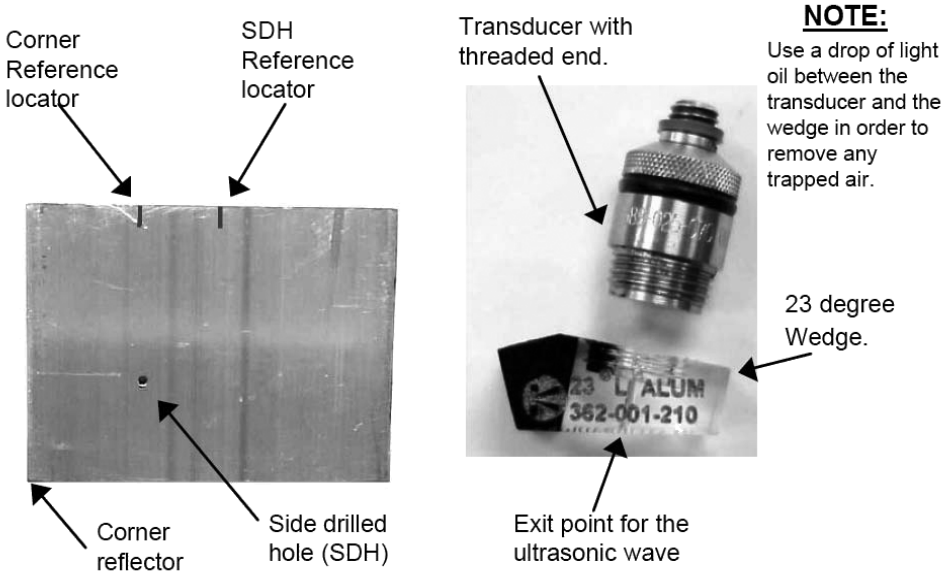
b. The initial equipment setup shall be done in accordance with Table 62-2 and Figure 62-10.

c. Place a layer of couplant on the top of reference standard. Smooth the couplant over the surface using your finger.

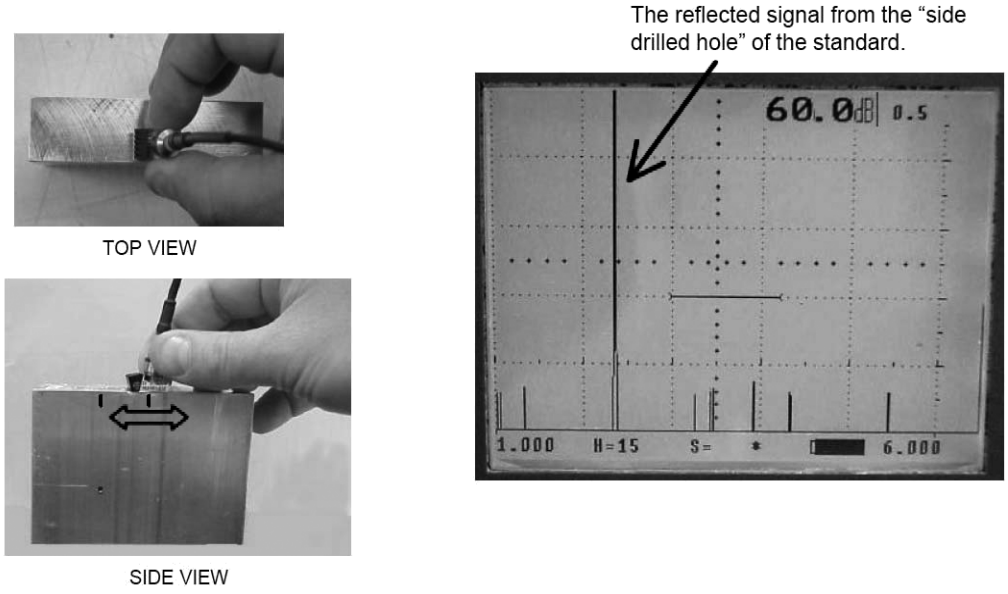


212_MM_62_0001

Figure 62-10. Ultrasonic Test Equipment Initial Setup



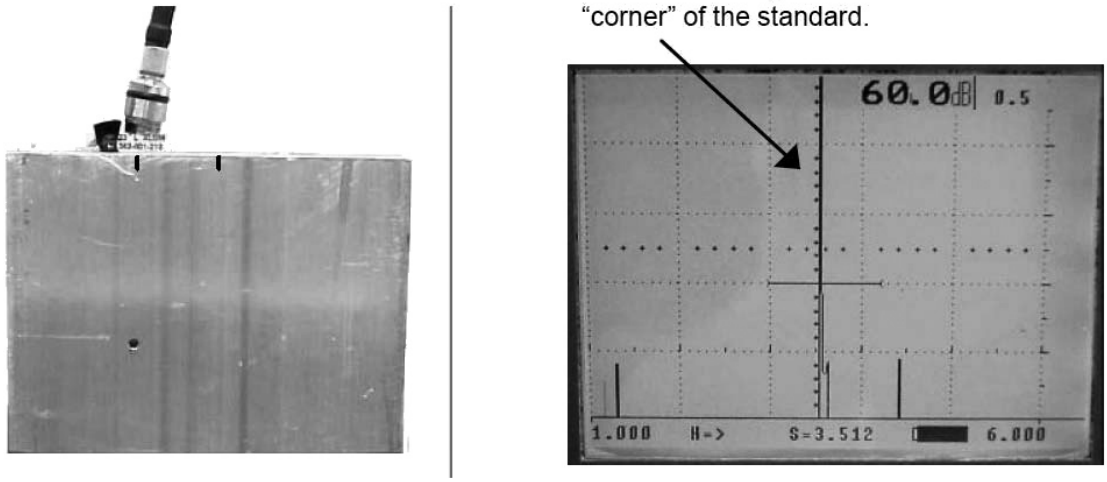
VIEW A



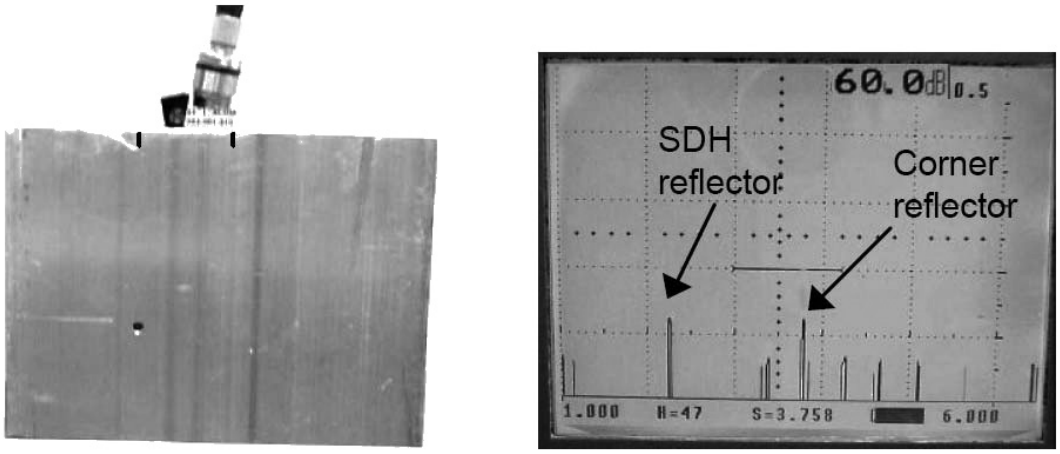
VIEW B

212_MM_62_0002

Figure 62-11. Ultrasonic Test Equipment Calibration (Sheet 1 of 2)



VIEW C



VIEW D

212_MM_62_0003

Figure 62-11. Ultrasonic Test Equipment Calibration (Sheet 2 of 2)

Table 62-2. Ultrasonic Test Set — Initial Setup

DELAY: 1.000 INCH	REJECT: 10%
RANGE: 5.0 INCH	RECTIFIER: FULL WAVE
VELOCITY: LONG. = 2.40 IN. SEC. X 10^5	GATE START: 3.00 INCH
DAMPENING: 50 OHM	GATE LENGTH: 1.20 INCH
REP-RATE: LOW	GATE THRESHOLD: 40%
FREQUENCY: 10.0 MHZ	

d. On the ultrasonic test set, adjust the gain to an initial setting of 60.0 dB.

e. Position the transducer with the 23° wedge on the reference standard Side Drilled Hole (SDH) reference locator as shown in Figure 62-11, View B, and direct the sound beam toward the SDH.

f. Slide the transducer slowly back and forth to obtain a maximum response from the SDH as displayed on the screen (View B).

g. Slide the transducer to the corner reference locator (View C) and aim the sound beam toward the corner of the standard.

h. Slide the transducer slowly back and forth to obtain a maximum response from the corner reflector as displayed on the screen (View C).

i. Slide the transducer between the reference locators on the standard until both reflectors are displayed on the screen (View D).

j. Manipulate the transducer so that the amplitude from both signals (SDH and the corner) is displayed equally. Using the rotary knob on the left side of the ultrasonic test set, adjust the height of the signals to achieve a 30% amplitude signal as displayed on the screen (View D).

k. Verify the ALARM GATE is located as shown in View B, View C, and View D.

3. Ultrasonically inspect the main rotor lower grip tangs as follows:

a. The surface condition of the grip in the area to be inspected should be relatively smooth. An abrasive pad (C-407) may be used to remove rough or raised contamination areas where necessary.

NOTE

Only inspect the lower grip tang in the areas described in Figure 62-12. Scanning outside this area may result in false or irrelevant signal response.

b. Place a layer of couplant on area of lower grip tang to be inspected. Smooth the couplant over the surface using your finger.

c. Using the setup described in step 2, perform multiple pass inspection of the grip lug as follows.

NOTE

The transducer will not sit solidly on the grip due to the surface curvature of the grip tangs. Keep the exit point (as marked on the transducer wedge) against the surface of the grip tang to maximize detection capability.

(1) Inspect Area A as shown in Figure 62-12. Scan the grip tang from the top edge to the bottom edge in the scan direction shown. Move the transducer over 1/2 inch and scan again. Continue until the complete area from the 1 o'clock to 9 o'clock position has been checked.

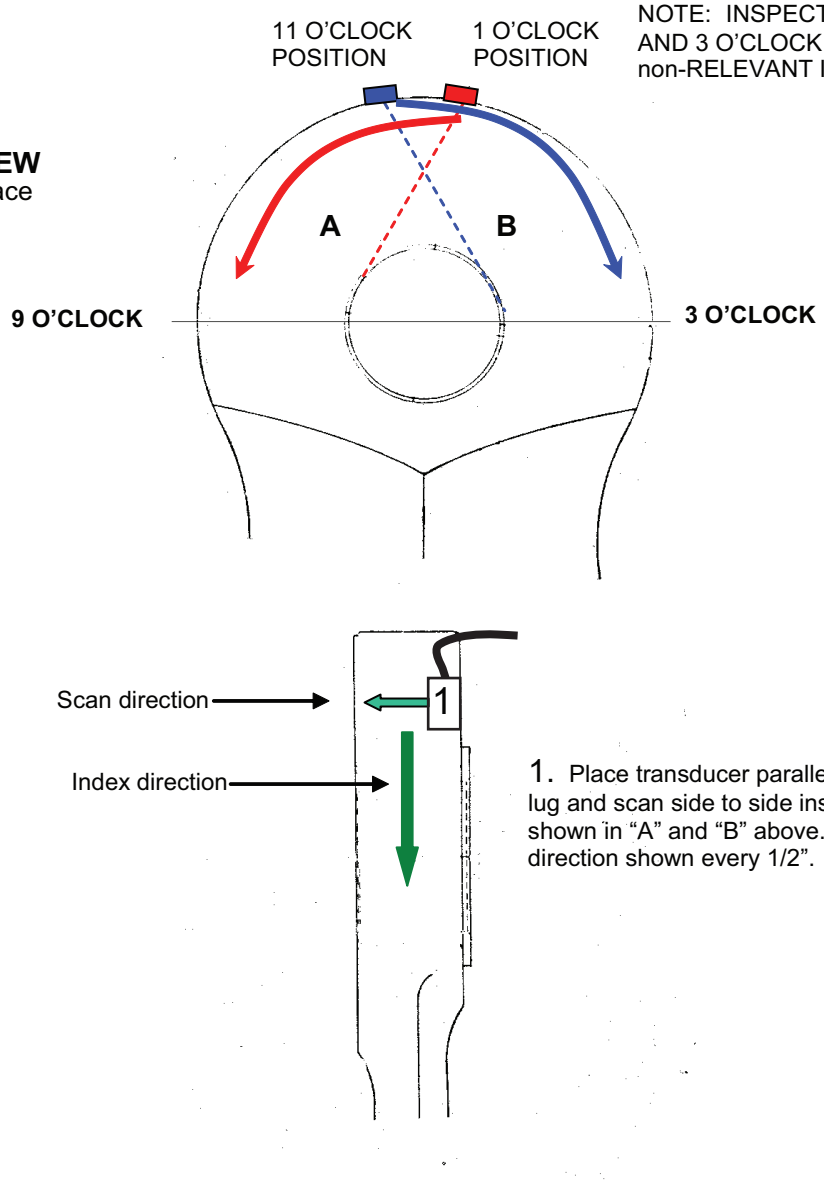
(2) Inspect Area B in the same manner as Area A.

d. A relevant signal response should appear as shown in Figure 62-13 and will require further investigation.

AREA "A" - PLACE THE TRANSDUCER IN THE 1 O'CLOCK POSITION AT THE EDGE OPPOSITE THE BLADE AND INSPECT TOWARD THE 9 O'CLOCK POSITION. INDEX THE TRANSDUCER AS DESCRIBED BELOW. THIS INSPECTION COVERAGE WILL BE THE SAME FOR EACH TECHNIQUE DESCRIBED IN THE SIDE VIEW BELOW.

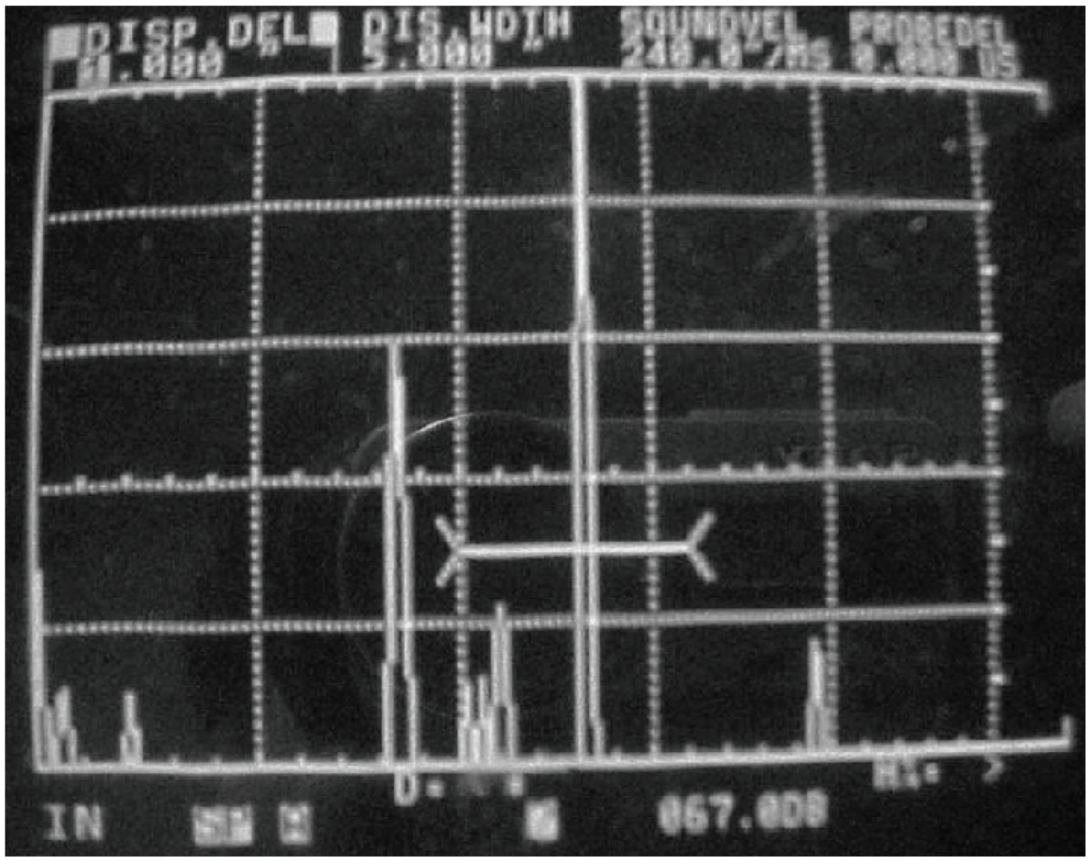
AREA "B" THE SAME AS DESCRIBED FOR AREA "A" EXCEPT INSPECT FROM THE 11 O'CLOCK POSITION TOWARD THE 3 O'CLOCK POSITION.

NOTE: INSPECTING BEYOND THE 9 O'CLOCK AND 3 O'CLOCK POSITIONS MAY PRODUCE non-RELEVANT INDICATIONS.



212_MM_62_0004

Figure 62-12. Main Rotor Grip Ultrasonic Inspection Method



NOTES

1. **Any response similar to that shown above that is within the GATE is cause for rejection.**
2. **The signal that appears to the left of the GATE will be displayed throughout the inspection; it is not considered relevant.**

212_MM_62_0005

Figure 62-13. Ultrasonic Equipment Display

e. Any indication of a crack will require the grip to be removed from service. If the grip was inspected by a Level I Special inspector the unserviceable grip shall be sent to a facility that has Level II or Level III ultrasonic inspection capability for further investigation.

f. All grips inspected by a Level II or Level III qualified inspector that have a crack indication are to be sent to Bell Helicopter for further investigation. Contact Product Support Engineering for shipping instructions.

MAIN ROTOR CONTROLS

62-21. MAIN ROTOR CONTROLS

The main rotor controls consist of pitch change links, stabilizer bar, stabilizer bar dampers, swashplate and support, and scissors and sleeve.

62-22. PITCH CHANGE LINK

The pitch change link connects pitch horn on blade grip to mixing lever of stabilizer bar.

62-23. Pitch Change Link — Removal

1. Disconnect pitch change link (13, Figure 62-14) from main rotor pitch horn.

2. Disconnect pitch change link from mixing lever (1), and remove pitch change link.

62-24. Pitch Change Link — Inspection

1. Check universal bearings for a maximum looseness of 0.017 inch (0.4318 mm) axial and 0.0085 inch (0.2159 mm) radial (BHT-ALL-SPM).

2. Check rod end bearings for a maximum looseness of 0.010 inch (0.254 mm) axial and radial. The 0.010 inch (0.254 mm) can be extended to 0.020 inch (0.508 mm), provided excessive vertical vibration does not occur in main rotor operation.

3. Inspect pitch change link for corrosion, cracks, nicks, and scratches (BHT-212-CR&O).

4. Inspect thread and shoulder area of clevis for cracks using a 5X magnifying glass. Any suspected crack indication requires magnetic particle inspection (BHT-212-CR&O and BHT-ALL-SPM).

5. Inspect for any bent, dented, or distorted link parts, or any parts with cracks.

62-25. Pitch Change Link — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound
C-104	Corrosion Preventive Compound

1. If installing a new pitch change link, adjust length of new link to same length of removed link or adjust both pitch change links to length (Figure 62-15).

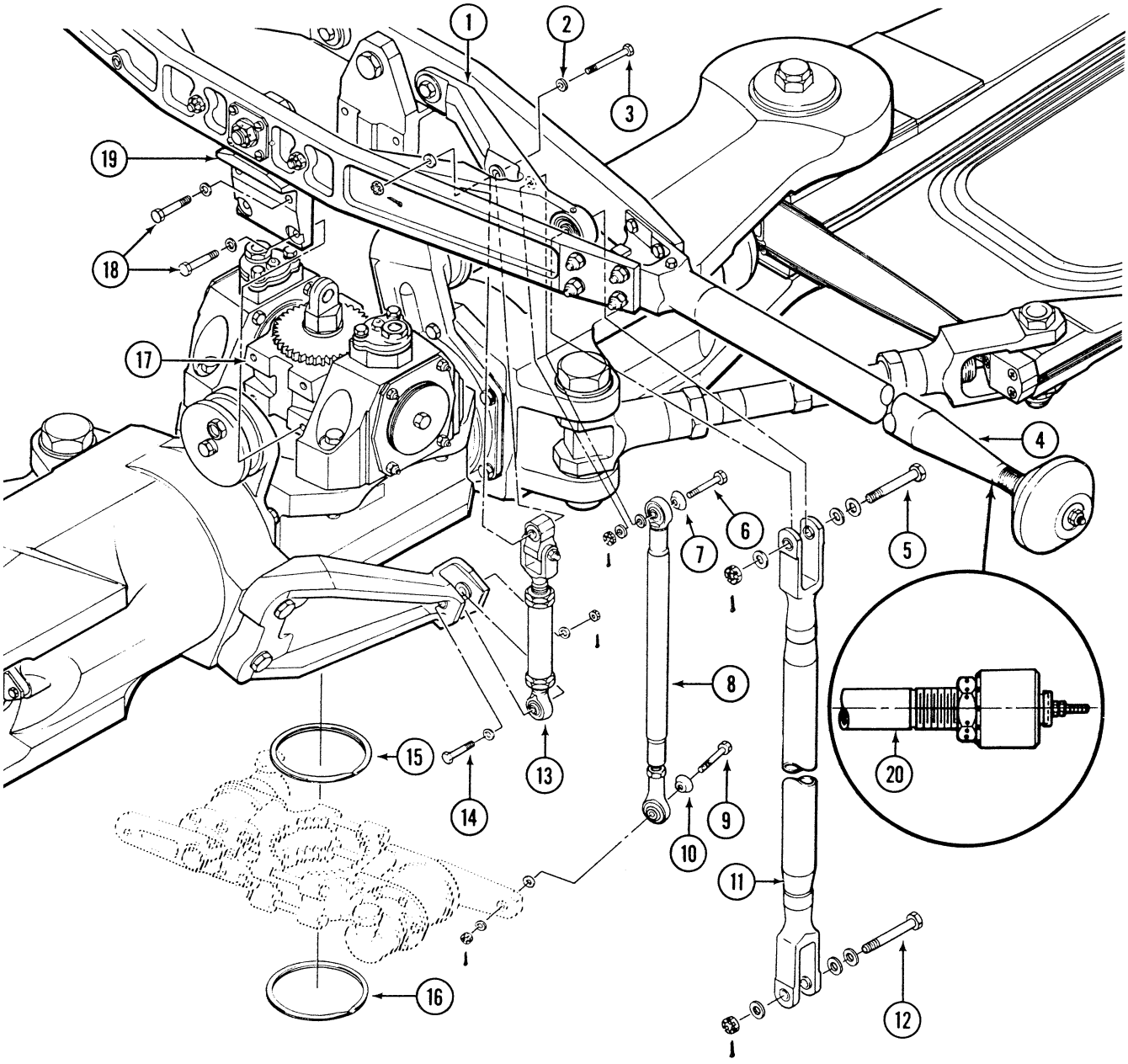
2. Coat shanks and threads of control bolts (3 and 14, Figure 62-14) with corrosion preventive compound (C-104).

3. Place countersunk washer (2) on bolt (3), with countersink toward bolthead, and insert through mixing lever (1) and pitch change link (13). Install washer and nut. Torque nut 200 to 250 inch-pounds (22.60 to 28.25 Nm) and secure with cotter pin.

4. Insert bolt (14), with nut end toward direction of rotation, through pitch horn and pitch change link. Install washer and nut. Torque nut 200 to 250 inch-pounds (22.60 to 28.25 Nm) and secure with cotter pin.

5. Coat nuts, washers, boltheads, and lockwire with corrosion preventive compound (C-101).

6. Perform main rotor operational check (paragraph 62-4).



1. Mixing Lever
2. Washer
3. Bolt
4. Stabilizer Bar 204-011-326
5. Bolt
6. Bolt
7. Special Washer
8. Damper Link Tube
9. Bolt
10. Special Washer
11. Control Tube
12. Bolt
13. Pitch Change Link
14. Bolt
15. Retainer Ring
16. Retainer Ring
17. Main Rotor Trunnion
18. Bolts
19. Stabilizer Support
20. Stabilizer Bar 212-010-300

212-M-62-9

Figure 62-14. Rotating Control Tubes

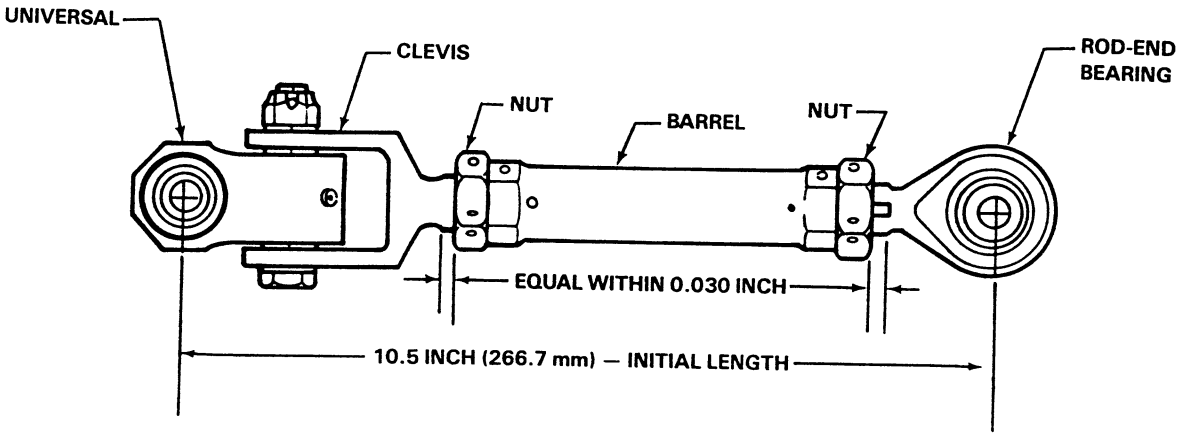


Figure 62-15. Pitch Change Link

62-26. STABILIZER BAR

The stabilizer bar is attached to mast at main rotor hub trunnion. The bar is connected into main rotor system in such a manner that inherent inertia and gyroscopic action of the bar is induced into rotor system and provides a measure of stability for all flight conditions. The relative movement between bar and mast causes hub and blade assembly to feather and return rotor to near its original plane of rotation. If the bar were completely unrestrained it would remain in its original plane of rotation and would induce stability to the point of removing all control from the pilot. Due to restraining and damping action, the bar possesses a mast following characteristic. This following time is regulated by two hydraulic dampers connected to the bar in such a manner that movement of mast is transmitted to the bar through dampers at a rate determined by internal adjustment of the dampers. A compromise is met to which the bar provides desired amount of stability and still allows pilot complete responsive control of helicopter.

62-27. Stabilizer Bar — Removal

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T101402	Grip Positioning Links (Qty 2)

CAUTION

GRIP POSITIONING LINKS SHALL BE INSTALLED TO PREVENT DAMAGE TO MAIN ROTOR STRAP ASSEMBLIES. IF GRIP/YOKE ROTATES MORE THAN 80°, REPLACE MAIN ROTOR STRAP.

1. Disconnect pitch change links (13, Figure 62-14) from main rotor pitch horns and install T101402 grip positioning links (Figure 62-16) to hold blades in normal position.

2. Verify that assembly is color coded.

3. Disconnect control tubes (11, Figure 62-14) from scissor levers, and damper link tubes (8) from damper levers. Pad stabilizer bar outer tube to protect control tubes and secure control tubes to bar with tape.

4. Detach each stabilizer support (19) from main rotor trunnion by removing lockwire and four bolts.

5. Remove stabilizer bar assembly.

62-28. Stabilizer Bar — Inspection

NOTE

Inspect assembly for evidence of foreign object damage.

1. Visually inspect stabilizer bar tube assembly for cracks, paying particular attention to inboard 6 inches (15.24 cm) of tube.

2. Check stabilizer bar centerframe and pivot bearings for general condition and freedom of movement.

3. Inspect mixing lever (1, Figure 62-14) and bearings for general condition.

4. Inspect main rotor pitch change links (13) and bearings for general condition and looseness.

5. Inspect stabilizer bar damper link tubes (8) for foreign object damage and bearings for looseness.

6. Inspect control tube (11) for foreign object damage and adequate bolt shank clearance at scissor arm attachment point. See Figure 62-17 for damage and repair limits for control tube (11).

7. Inspect stabilizer bar support for condition and security.

8. Allowable wear limits for the damper control tube bearings permit a maximum of 0.012 inch (0.305 mm) radial play and 0.030 inch (0.762 mm) axial play (BHT-ALL-SPM). Replace bearing/control tube that exceeds allowable bearing wear limits.

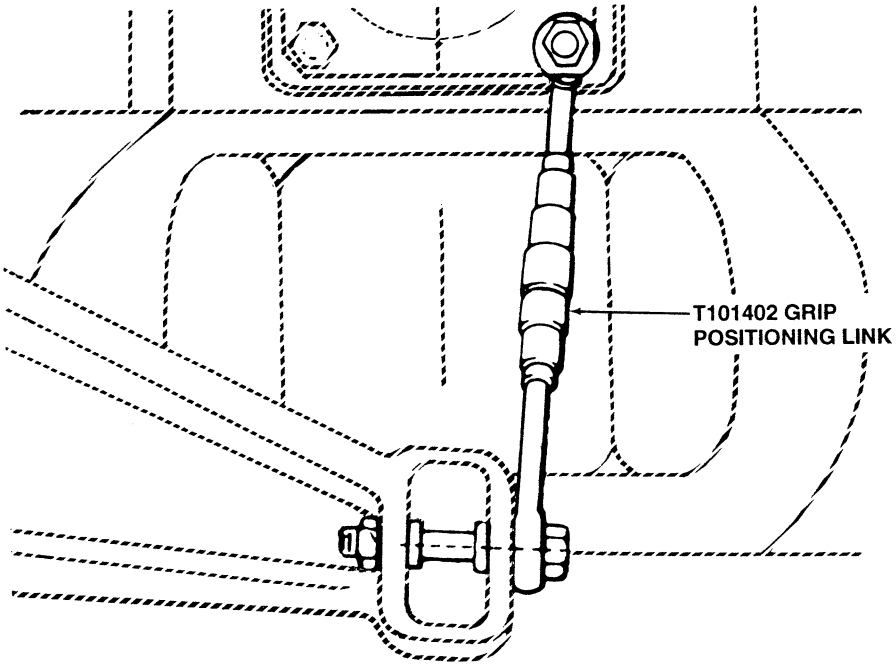
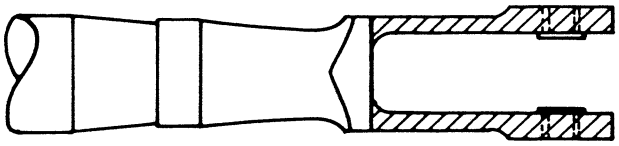


Figure 62-16. T101402 Grip Positioning Link Application



DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
NICKS AND DENTS	0.005 IN. (0.127 mm)	0.010 IN. (0.254 mm)
CORROSION	0.0025 IN. (0.0635 mm)	0.005 IN. (0.127 mm)
AREA OF FULL DEPTH REPAIR	0.10 SQ. IN. (64.52 Sq. cm)	Not Critical
NUMBER OF REPAIR AREAS	One Per Lug	Not Critical
EDGE CHAMFER	0.020 IN. (0.508 mm)	0.040 IN. (1.016 mm)
BORE DAMAGE	0.001 For 1/4 Circumference	

NOTE

The width of repair at any section of tube should not exceed one-third of the circumference.

212-M-62-12

Figure 62-17. Stabilizer Bar Control Tube Damage and Repair Limits

62-29. Stabilizer Bar — Repair or Replace

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-100	Chemical Film Material
C-204	Epoxy Polyamide Primer

1. Replace parts that are not acceptable for continued usage.

2. Polish out mechanical and corrosion damage.

3. Touchup bare areas on aluminum surfaces with chemical film material (C-100).

4. Touchup bare areas where cadmium plating is removed with epoxy polyamide primer (C-204).

62-30. Stabilizer Bar — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound
C-104	Corrosion Preventive Compound
C-308	Sealant
C-405	Lockwire

1. Observing color code, position stabilizer bar over main rotor trunnion. Attach each stabilizer support (19, Figure 62-14) with four bolts (18) and washers. Assemble washers on bolts. Short bolts go in lower holes. Secure bolts in vertical pairs with lockwire (C-405).

2. Connect control tubes (11) to scissor levers with bolts (12). Use two washers under bolthead. Torque nuts 120 to 145 inch-pounds (13.56 to 16.38 Nm). Secure with cotter pins.

3. Remove grip positioning links and connect pitch change links (13) to main rotor pitch horns. Coat bolt shanks with corrosion preventive compound (C-104). Install bolt with head inside of pitch horns. Torque nut 200 to 250 inch-pounds (22.60 to 28.25 Nm). Secure with cotter pins.

4. Connect damper link tube (8) to stabilizer bar frame assembly by placing special washer (7) on bolt (6). Coat bolt shank with corrosion preventive compound (C-104). Install bolt (6) through rod end bearing and stabilizer bar frame assembly with one steel washer between bushing in frame assembly, and rod end bearing and one aluminum washer between frame assembly and nut. Torque 30 to 40 inch-pounds (3.39 to 4.52 Nm). Secure with cotter pin.

5. Place special washer (10) on bolt (9). Coat bolt shanks with corrosion preventive compound (C-104). Install bolt (9) through rod end bearing and lever with one steel washer between bushing in lever and rod end bearing, and one aluminum washer between lever and nut. Torque 25 to 45 inch-pounds (2.82 to 5.08 Nm). Secure with cotter pin.

6. Coat boltheads, nuts, washer and cotter pins with corrosion preventive compound (C-101).

7. To prevent chafing between control tube and mixing lever, install a bumper washer between mixing lever and push-pull tube clevis on side where heavy contact is noted; allowable cleanup is 0.005 inch (0.127 mm) to leading edge of mixing lever and 0.015 inch (0.381 mm) to trailing edge side. The bumper washer may be locally fabricated from approximately 0.031 inch (0.787 mm) rubber sheet with a 1.5 inches (38.1 mm) O.D. and a 0.5625 inch (14.2875 mm) I.D. Bond bumper washer with sealant (C-308). Ensure no sealant contaminates bearing. The bond shall be located at the outer edge of the bearing stake area.

62-31. STABILIZER BAR DAMPERS

The double action dampers are bolted to a frame that is secured to the mast by a split-splined clamp. Adjustment of dampers determine the following time of stabilizer bar in relation to mast inclination for purposes of maneuvering. In order for the pilot to experience maneuverability of the helicopter, such as

rolling from one turn to another, the stabilizer bar must follow and become perpendicular to mast within a reasonable period of time. Should dampers become maladjusted and give inadequate damping to the stabilizer bar, control response is slow. Should dampers become maladjusted to give excessive damping to the stabilizer bar, control response would be rapid and stability of helicopter jeopardized.

62-32. Stabilizer Bar Dampers — Removal

1. Disconnect damper link tubes (8, Figure 62-14) from lever arms (6, Figure 62-18) and lift top retainer ring (3) from mast splines.

2. Remove four nuts, washers, and adapter bolts (2). Remove damper assembly (1) and adapter (4) from mast. Remove lower retainer ring (3).

3. Remove four nuts, washers, and dampter mounting bolts (5) to separate dampers from adapter.

CAUTION

DO NOT HEAT ABOVE 200°F (93°C).

4. Remove nut, washers, and retaining bolt (8). Heat joint of lever arm (6) and shaft to 160°F (71°C). Tap lever arm lightly to remove from damper.

62-33. Stabilizer Bar Dampers — Inspection and Repair

1. Inspect lever arm (6, Figure 62-18) for scratches, nicks, dents, and corrosion (BHT-212-CR&O).

2. Inspect adapters (4) and damper assembly (1) for scratches, nicks, dents, and corrosion (BHT-212-CR&O).

3. Replace dampers that show indications of leakage beyond recommended rates.

62-34. Stabilizer Bar Dampers — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound
C-304	Drycleaning Solvent
C-313	Adhesive

1. Install lever arm, if removed, on stabilizer bar damper as follows:

a. Clean stabilizer bar damper shaft splines and lever arm splines with drycleaning solvent (C-304).

b. Apply adhesive (C-313) to splines of stabilizer bar damper shaft and lever arm (6, Figure 62-18).

CAUTION

INCORRECT TORQUE OF RETAINING BOLT (8) WILL CAUSE WEAR, FRETTING, OR SHEARING OF SHAFT SPLINES.

c. Install lever arm (6) on shaft with wingshaft notch aligned with slot in lever. Install retaining bolt (8) with washer under bolthead and nut. Torque nut 60 inch-pounds (6.78 Nm).

d. Allow adhesive to cure at room temperature for 24 hours or at 150°F (66°C) for 1 hour plus an additional 2 hours at room temperature before operating damper assembly.

e. Position dampers (1) on adapters (4), with wingshafts toward direction of rotation, and install two bolts in each adapter with washer under each head and nut. Torque 60 inch-pounds (6.78 Nm).

2. Clean mast splines and adapter (4) splines with drycleaning solvent (C-304). Coat mast splines with corrosion preventive compound (C-101).

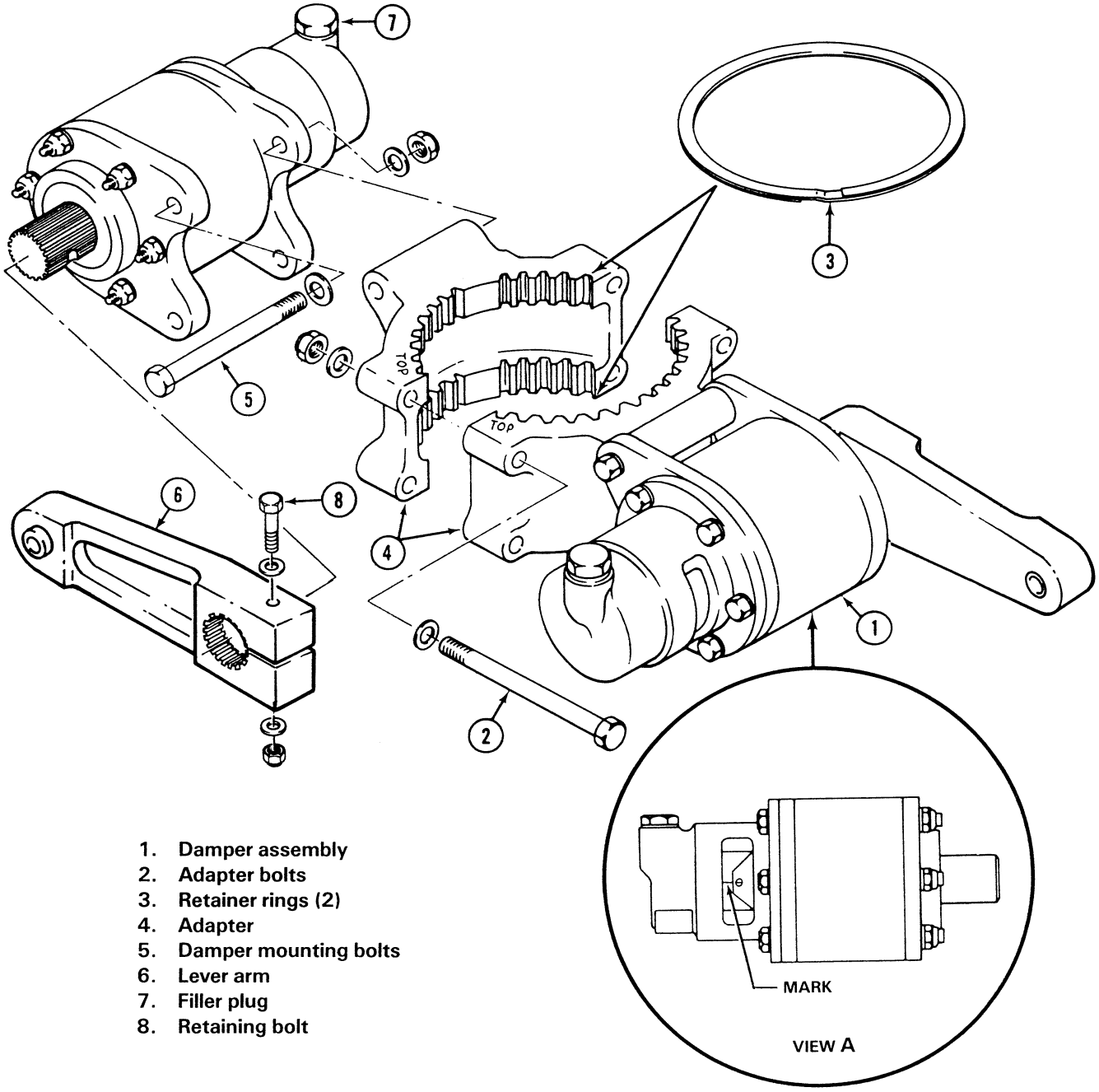


Figure 62-18. Stabilizer Bar Dampers

3. Install spiral retaining ring (3) in lower groove of mast splines. Align adapter halves with etched word "TOP" facing upward. Position adapters according to master splines and slide onto mast.

CAUTION

DO NOT ATTEMPT TO PULL ADAPTERS INTO MAST SPLINES BY MEANS OF THE ATTACHING BOLTS. THIS MAY RESULT IN CHIPPING OR FRACTURING THE SUPPORT SPLINES, BOLT LUGS, AND/OR ENTIRE ADAPTER.

USE ALTERNATING PROCEDURE TO DRAW FOUR NUTS DOWN EVENLY. TORQUE EACH NUT IN INCREMENTS OF 10 INCH-POUNDS (1.13 NM) UNTIL A TORQUE VALUE OF 60 INCH-POUNDS (6.78 NM) IS ATTAINED.

4. Install four adapter bolts (2) with one washer under boltheads and nuts, and torque evenly. Install retainer ring in groove of mast splines above adapter set.

5. Adjust and connect damper link tube (8, Figure 62-14) (paragraph 62-35).

62-35. Damper Link Tube — Adjustment

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-104	Corrosion Preventive Compound

1. Disconnect damper link tube (8, Figure 62-14) from lever arm (6, Figure 62-18).

2. Position stabilizer bar perpendicular to mast. Adjust damper link tube (8, Figure 62-14), as required, to connect to lever arm with pin lined up with mark on cam as seen through damper window (Figure 62-18, View A).

3. Place special washer (10, Figure 62-14) on bolt (9). Coat bolt shank with corrosion preventive compound (C-104). Install bolt (9) through rod end bearing and lever with one steel washer between bushing in lever and rod end bearing, and one aluminum washer between lever and nut. Torque to 25 to 45 inch-pounds (2.80 to 5.08 Nm). Secure with cotter pin.

4. Repeat procedure for opposite damper.

5. Position stabilizer bar (4) against stop. While observing pin in damper window, rapidly return stabilizer bar to neutral and check time required for pin to return to mark on cam. Time required should be 5 ±1 seconds. If limit is not met, replace damper.

6. Check stabilizer bar for contact between centerframe and stop surface on support. If center frame does not contact stop in either or both directions proceed as follows:

a. Disconnect both damper link tubes (8) at lever arm and move bar up to contact support. Adjust rod end to align with lever arm, then lengthen 1/2 turn.

b. Accomplish preceding step 6 and recheck stop contact.

c. Repeat adjustment on opposite damper.

d. If centerframe still fails to contact stop, repeat adjustment with stabilizer bar and lever arm in down position.

e. If above adjustment is required, pin will not be in line with mark on cam when stabilizer bar is square to mast. Pin may be off mark on cam 0.100 inch (2.54 mm) maximum.

62-36. Stabilizer Bar Dampers — Servicing

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-002	Hydraulic Fluid

1. If damper shows signs of fluid leakage or if level can be seen slightly below top of window, remove filler

plug, fill damper with hydraulic fluid (C-002) and install plug. Check damper frequently for further leakage.

2. If fluid level falls more than 1/8 inch (3.175 mm) below top of window, satisfactory filling without trapped air may not be possible and replacement of damper may be necessary.

3. Check damper timing, as required, to determine serviceability.

62-37. SCISSORS AND SLEEVE

The scissors and sleeve assembly consists of two scissor levers and a rotating hub splined to the mast and mounted through ball thrust bearings on the upper end of the non-rotating collective sleeve. The collective sleeve operates between the swashplate support and mast and is actuated by collective levers attached to the lower end. The outboard ends of scissors are connected to swashplate outer ring by two drive links. The inboard ends of scissors are indirectly connected to the pitch horns by two control tubes which transmit collective and cyclic control motions to mixing levers in stabilizer bar.

62-38. Scissors and Sleeve — Removal

1. Open or remove transmission cowling.

2. Remove stabilizer bar (paragraph 62-27).

3. Remove main rotor hub and blade (paragraph 62-7).

4. Remove stabilizer bar dampers and adapters (paragraph 62-32).

5. Remove lockwire around mast dust boot, and remove boot and spacer.

6. Remove bolts (30, Figure 62-19) and disconnect scissors link (4) from trunnion (15).

7. Check spline wear on drive plate (3) by attaching dial indicator to mast with indicator probe in contact with a flat of bolthead (flange attaching bolthead). Move hub assembly back and forth and measure amount of play present. Maximum radial play allowed between mast (6) and drive plate (3) is 0.040 inch (1.016 mm) at point of measurement.

8. Remove bolt (17) and disconnect collective control tube (16) from trunnion assembly (27).

9. Remove bolts (11, 25 and 26) to detach and remove parts of collective lever (21). Keep all parts together, including shims (18 and 20) for reassembly.

10. Remove lockwire and four screws (22) to detach each bearing and liner assembly (23) from lower end of scissors and sleeve assembly (5).

11. Disconnect two scissor links (4) from swashplate trunnions (15) by removing cotter pin, nuts, washers and bolts (30).

12. Remove scissors and sleeve.

62-39. Scissors and Sleeve — Inspection and Repair

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-204	Epoxy Polyamide Primer
C-406	Abrasive Cloth

1. Inspect bearing liner assembly (23, Figure 62-19) for mechanical and corrosion damage. Maximum damage is 0.010 inch (0.254 mm) depth with an area not to exceed 0.010 square inch (0.065 cm^2).

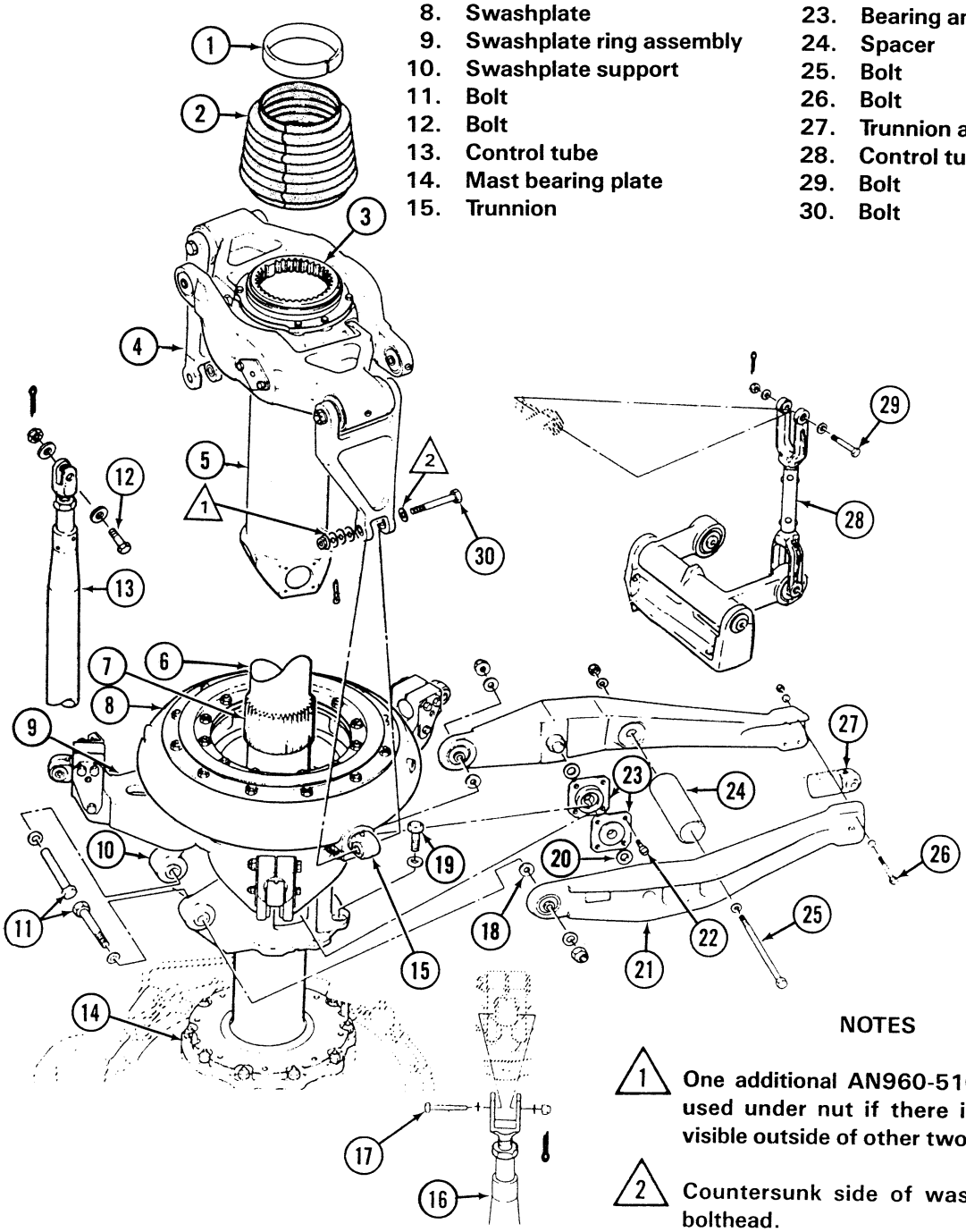
2. Remove no more material than necessary, using fine to medium grades of abrasive cloth (C-406).

3. Touchup repaired areas with epoxy polyamide primer (C-204).

4. Inspect bearing for excessive looseness and damage (BHT-ALL-SPM).

5. Refer to BHT-212-CR&O for inspection and repair of other scissors and sleeve parts.

1. Spacer
2. Dust boot
3. Drive plate
4. Scissors link
5. Scissors and sleeve assembly
6. Mast
7. Mast splines
8. Swashplate
9. Swashplate ring assembly
10. Swashplate support
11. Bolt
12. Bolt
13. Control tube
14. Mast bearing plate
15. Trunnion
16. Control tube
17. Bolt
18. Shim
19. Bolt
20. Shim
21. Collective lever
22. Screw
23. Bearing and liner assemblies
24. Spacer
25. Bolt
26. Bolt
27. Trunnion assembly
28. Control tube
29. Bolt
30. Bolt



NOTES

1. One additional AN960-516 washer may be used under nut if there is any bolt shank visible outside of other two washers.

2. Countersunk side of washer goes toward bolthead.

212-M-62-14

Figure 62-19. Scissors and Sleeve, Swashplate and Collective Lever

62-40. Scissors and Sleeve — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-007	Bearing Grease
C-101	Corrosion Preventive Compound
C-104	Corrosion Preventive Compound
C-405	Lockwire

NOTE

Apply corrosion preventive compound (C-104) to all bolt shanks at installation and apply corrosion preventive compound (C-101) to bolt heads, nuts, washers and cotter pins (lockwire) after installation.

1. Lubricate mast splines and collective sleeve splines with bearing grease (C-007). Lower scissors and sleeve assembly (5, Figure 62-19) carefully over mast and into swashplate support.

NOTE

One additional AN960-516 washer may be used under nut if there is any bolt shank visible outside other two washers.

2. Attach scissor links (4) to trunnion (15) bearings on swashplate outer ring, with boltheads toward rotation with steel washer under bolthead and a minimum of two steel washers under nut. End play between scissor and drive link should be divided equally on both sides of scissors with total end play of 0.038 to 0.090 inch (0.965 to 2.286 mm). Torque nuts 120 to 145 inch-pounds (13.56 to 16.38 Nm). Install cotter pins.

3. Assemble collective lever (21) halves on swashplate support (10) with pins inserted into bearings (23) on sleeve, and with trunnion (27) and spacer (24) in place. Torque nuts on trunnion retaining bolts (26) to 60 inch-pounds (6.78 Nm), and nut on bolt (25) through spacer to 175 inch-pounds (19.77 Nm).

4. At pivot end of lever, install bolts (11) with washers under boltheads and nuts, and with shims (4, Figure 62-20) between support and lever as required to give 0.000 to 0.005 inch (0.000 to 0.127 mm) interference fit at each side, keeping shims equal within 0.005 inch (0.127 Nm). Torque nuts on bolts 290 to 410 inch-pounds (32.76 to 46.32 Nm).

5. Use feeler gauge to measure clearance between inner race of bearings (3) and shoulder of pins (2) on lever on each side. Prepare two shims (1), equal within 0.005 inch (0.127 mm), and of total thickness required to provide 0.000 to 0.002 inch (0.000 to 0.057 mm) clamp up on bearings. Disassemble lever enough to install shims on pins, and reassemble as in step 3 and step 4. Move lever to check for freedom of operation.

6. Connect collective pitch control tube (16, Figure 62-19) to trunnion assembly (27).

7. Slide dust boot (2) down under flange at top of sleeve assembly and secure with lockwire (C-405). Position spacer (1) around mast, under top edge of boot, and secure with lockwire (C-405). For replacement of split boot, refer to paragraph 62-42.

NOTE

To prevent possible damage to dust boot during operation, maintain a distance of 10.25 to 10.75 inches (260.35 to 273.05 mm) between top of boot and lower surface of damper support frame. Position of collective stick will not affect dimension.

8. Install stabilizer bar damper and adapter (paragraph 62-34).

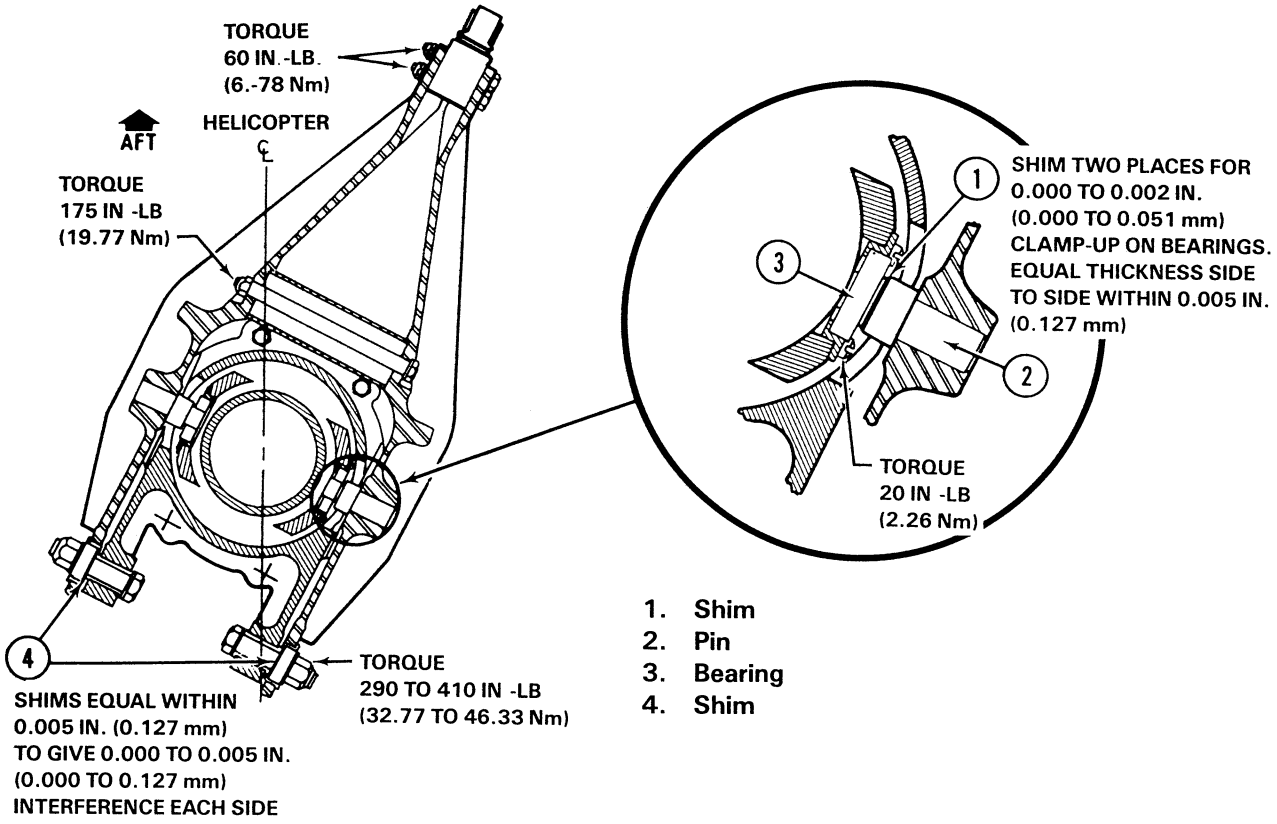
9. Install main rotor hub and blade (paragraph 62-9).

10. Install stabilizer bar (paragraph 62-30).

11. Check for looseness between collective lever pin (2, Figure 62-20) and bearing (3), as follows:

a. Station a person to attempt to rotate a main rotor blade on pitch change axis.

b. Feel with fingers at bearings (3) on collective sleeve and lever pins (2).



212-M-62-15

Figure 62-20. Collective Lever Shimming

c. Any movement, indicating end play, between lever pins and bearing is cause to recheck and correct shims (1).

12. Install and close transmission cowling.

13. Perform an operational check of main rotor assembly.

62-41. DUST BOOT (SCISSORS AND SLEEVE)

62-42. Dust Boot — Replacement

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-324	Adhesive
C-325	Adhesive
C-405	Lockwire

NOTE

If replacement of dust boot is to be accomplished without removing rotor, follow this procedure.

1. Cut lockwire at each end of dust boot (2, Figure 62-19) and split boot to remove from mast.

2. Coat inner faces of flap and mating surfaces of new dust boot with adhesive (C-324) or adhesive (C-325).

3. Allow sufficient time for adhesive to become tacky, then apply a light second coat. Immediately install dust boot (2) around mast (6) and insert edge of boot into flap. Form into proper shape and expel any trapped air by pressing on external mating surfaces with a small round tool.

NOTE

To prevent possible damage to the dust boot during operation, maintain a distance of 10.25 to 10.75 inches (260.35 to 273.05 mm) between top of boot and lower surface of damper support frame.

4. After adhesive is cured, slide dust boot (2) down over flange at top of sleeve assembly and secure bottom end of boot with lockwire (C-405). Position spacer (1) around mast, under top edge of boot, and secure with lockwire (C-405).

62-43. SWASHPLATE AND SUPPORT

The swashplate and support assembly consists of an outer rotating ring mounted through a duplex bearing set on the inner non-rotating ring. The inner ring is connected to the swashplate support by a gimbal ring assembly. Control rods connect to two trunnions on inner ring assembly, to tilt ring in the desired direction. The outer ring assembly tilts with inner ring assembly, but rotates independently with mast and rotor.

62-44. Swashplate and Support — Removal

1. Open or remove transmission cowling.

2. Remove stabilizer bar (paragraph 62-30).

3. Remove main rotor hub and blade (paragraph 62-7).

4. Remove stabilizer bar dampers and adapters (paragraph 62-32).

5. Remove scissors and sleeve assembly (paragraph 62-38).

6. Remove bolt (12, Figure 62-19) and disconnect cyclic control tube (13) from swashplate ring assembly (9).

7. Disconnect elevator control tube (28) from trunnion on swashplate (8). Insert a piece of folded paper or cardboard into each of four gimbal support clevises to prevent damage in handling.

8. Remove eight bolts that secure swashplate support to mast bearing plate (14) on transmission.

9. Carefully lift swashplate and support from mast.

62-45. Swashplate and Support — Inspection and Repair

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-007	Bearing Grease
C-100	Chemical Film Material
C-108	Cadmium Plating Solution
C-406	Abrasive Cloth
C-464	India Stone
C-500	Crocus Cloth

1. Check trunnions (15, Figure 62-19) as follows:

a. Rotate trunnion bearing and apply slight outward pressure to determine trunnion bearing position where maximum axial looseness can be felt.

NOTE

The trunnion bearings are different from other bearings, which normally can be feel-checked for roughness and ease of rotation. The trunnion bearings are preloaded into the cylinder portion of the trunnion with a 0.0005 inch (0.0127 mm) tight to 0.0005 inch (0.0127 mm) loose tolerance. The feeling of roughness is due to the preload and the angular faces of inner and outer races.

b. Use a dial indicator and determine actual amount of axial play. Maximum amount of axial play allowed is 0.020 inch (0.508 mm). Trunnion bearings which have axial play in excess of 0.020 inch (0.508 mm) are non-repairable and non-airworthy and require replacement.

c. Lubricate trunnion bearings with bearing grease (C-007) while rotating trunnion (Chapter 12).

2. Check gimbal bearings for looseness and roughness in operation.

3. Inspect and repair mechanical and corrosion damage on swashplate and support (BHT-212-CR&O).

4. Score marks on inside surface of holes or bushings may be polished out, if not more than 0.002 inch (0.051 mm) deep.

CAUTION

DO NOT USE GRINDING WHEEL TO REMOVE SURFACE BLEMISHES.

5. Remove no more material than necessary, using fine to medium grades of abrasive cloth (C-406) or fine India stone (C-464) and polish to a smooth scratch-free surface with crocus cloth (C-500).

6. Polish out corrosion damage to twice depth of pit (within repairable limits), on aluminum parts only. Polish out mechanical damage only deep enough to remove traces of damage (BHT-212-CR&O).

7. Where anodize surface is removed, restore finish with chemical film material (C-100). Anodize part if more than 10% of surface area was removed (BHT-ALL-SPM).

8. Where cadmium plating is removed, restore finish with cadmium plating solution (C-108) (BHT-ALL-SPM).

62-46. Swashplate and Support — Installation

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-007	Bearing Grease
C-101	Corrosion Preventive Compound
C-104	Corrosion Preventive Compound
C-405	Lockwire

1. Apply corrosion preventive compound (C-104) to shanks of all bolts at installation.

2. Carefully lower assembly over mast until swashplate support rests on mast bearing plate (14, Figure 62-19).

3. Align holes and install eight bolts with aluminum alloy washers under heads, through flange of support into cap. Use two longest bolts between pivots of collective lever. Torque bolts 120 inch-pounds (13.56 Nm) and lockwire (C-405) boltheads in pairs.

4. Lubricate mast splines and collective sleeve splines with bearing grease (C-007). Lower scissors and sleeve (5) carefully over mast and into swashplate support. Install and tighten four screws to secure each bearing and liner assembly (23). Secure screws in pairs with lockwire (C-405).

5. Attach scissor links (4) to trunnion bearings (15) on swashplate outer ring, with boltheads toward rotation with steel washer under bolthead and nut. End play between scissors and drive link should be divided equally on both sides of scissors with total end play not to exceed 0.090 inch (2.286 mm). Replace thrust washers if exceeded. Torque nuts 120 to 145 inch-pounds (13.56 to 16.38 Nm). Install cotter pins.

NOTE

Maximum allowable looseness of bearing (23) is 0.005 inch (0.127 mm) axial and radial.

6. Assemble collective lever (21) halves on swashplate support (10), with pins inserted into bearings (23) on sleeve and with trunnion (27) and spacer (24) in place. Torque nuts on trunnion retaining bolts to 60 inch-pounds (6.78 Nm) and nut on bolt through spacer to 175 inch-pounds (19.77 Nm).

7. At pivot end of lever, install bolts with washers under boltheads and nuts, and with shims (4, Figure 62-20) between support and lever as required to give 0.000 to 0.005 inch (0.000 to 0.0127 mm) interference fit at each side, shims equal within 0.005 inch (0.0127 mm). Torque nuts on bolts 290 to 410 inch- pounds (32.76 to 46.32 Nm).

8. Use feeler gauge to measure clearance between inner race of bearings (3) and shoulder of pins (2) on lever on each side. Prepare two shims (1), equal within 0.005 inch (0.0127 mm) and of total thickness required to provide 0.000 to 0.002 inch (0.000 to 0.051 mm) clamp up on bearings. Disassemble lever enough to install shims on pins, and reassemble as in step 6 and step 7. Move lever to check for freedom of operation.

9. Apply corrosion preventive compound (C-101) to all boltheads, washers, nuts and lockwire (cotter pins) after torque is applied.

10. Connect collective pitch control tube (16, Figure 62-19) to trunnion assembly (27).

11. Slide dust boot (2) down under flange at top of sleeve assembly and secure with lockwire (C-405). Position spacer (1) around mast, under top edge of boot, and secure with lockwire (C-405). For replacement of split boot, refer to paragraph 62-42.

NOTE

To prevent possible damage to dust boot during operation, maintain a distance of 10.25 to 10.75 inches (260.35 to 273.05 mm) between top of boot and lower surface of damper support frame. Position of collective stick will not affect dimension.

12. Connect cyclic and elevator control tubes to swashplate trunnions.

13. Install stabilizer bar damper and adapter (paragraph 62-34).

14. Install main rotor hub and blade (paragraph 62-9).

15. Install stabilizer bar (paragraph 62-30).

16. Check for looseness between collective lever pin (2, Figure 62-20) and bearing (3), as follows:

a. Station a person to attempt to rotate a main rotor blade on pitch change axis.

b. Check for movement between bearings (3) on collective sleeve and lever pins (2).

c. Any movement indicating end play between lever pins and bearing is cause to recheck and correct shims (1).

17. Install and close transmission cowling.

18. Perform an operational check of main rotor assembly (paragraph 62-4).