

CHAPTER 65 — TAIL ROTOR DRIVE SYSTEM

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TAIL ROTOR DRIVE SYSTEM

65-1. TAIL ROTOR DRIVE SYSTEM.

This chapter contains maintenance information on tail rotor driveshafts, couplings and hanger assemblies, intermediate (42°) gearbox, and tail rotor (90°) gearbox.

65-2. TROUBLESHOOTING.

Refer to table 65-1 for troubleshooting tail rotor drive system problems.

Table 65-1. Troubleshooting - tail rotor drive system

INDICATION OF TROUBLE		
INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Vibration believed to be originating in tail rotor drive system.	Bolts in V-band couplings loose.	Inspect all V-band clamps for loose bolts. Tighten or replace as required.
	Broken hanger or hanger support.	Inspect hangers and supports for cracks. Replace defective parts.
	Tail rotor driveshaft out of balance.	Verify driveshaft balance weights are secure. The balance weights are small metal strips bonded to driveshaft (one empty bonded space should be open where a bonded test strip was removed during manufacture). If more than one space is open, a balance weight is missing. Replace driveshaft.
Visual overheat indicator stripe(s) on hanger shows discoloration (from green to brown).	Shaft hanger bearings rough or overheating.	Check for signs of overheated bearings. If no sign of overheating is noted, recheck after five hours of operation.
		Replace bearings if overheating is evident. Replace bearings, if rough, after five hours of operation, whether or not overheating.
Excessive loss of grease from hanger bearings.	Misalignment of bearing in hanger.	Check and correct alignment of bearings.

Table 65-1. Troubleshooting - tail rotor drive system (Cont)

INDICATION OF	TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Binding or roughness when rotor and tail rotor driveshaft is turned by hand.		Dry or faulty hanger bearings.	Lubricate bearings.
		Faulty tail rotor gearbox.	Inspect electric chip detectors in intermediate and tail rotor gearboxes for evidence of internal failure. Replace defective gearbox.

TAIL ROTOR DRIVESHAFTS AND HANGERS

65-3. TAIL ROTOR DRIVESHAFTS AND HANGERS.

Five of the six tail rotor driveshafts are of the same length. Number two shaft, located below engine tailpipe area, is shorter. Each shaft is an anodized aluminum alloy tube with face-splined couplings riveted on both ends, and is dynamically balanced by metal strips bonded on each end of tube. Hinged covers with cowl-fasteners provide access to shafts along tailboom and on the vertical fin.

Tail rotor driveshaft hanger assemblies are mounted on three supports on the tailboom and one support on the engine deck (figure 65-1). Each consists of a flexible and a nonflexible coupling attached on a splined shaft mounted through a sealed single-row bearing in a ring-shaped hanger. The hanger has two mounting lugs and is attached to hanger fittings with bolts. Hanger fittings are prealigned with permanent shims on tailboom structure.

65-4. TAIL ROTOR DRIVESHAFTS.

65-5. Removal.

1. Open hinged covers along top of tailboom and on front of vertical fin. Open engine cowling.



DO NOT DISPLACE EITHER END OF SHAFT FROM MATING COUPLING UNLESS CLAMP SET IS REMOVED FROM BOTH ENDS OF SHAFT.

DO NOT INTERMIX PARTS OF CLAMP SETS.

2. Remove clamp sets (8, figure 65-1) at both ends of each shaft (1 or 3). Reassemble clamp set to prevent intermixing of parts.

3. Push shaft (1 or 3) against spring-loaded flexible coupling to disengage opposite end. Remove shaft.

65-6. Cleaning.

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specification and source.

NUMBER	NOMENCLATURE
C-304	Solvent

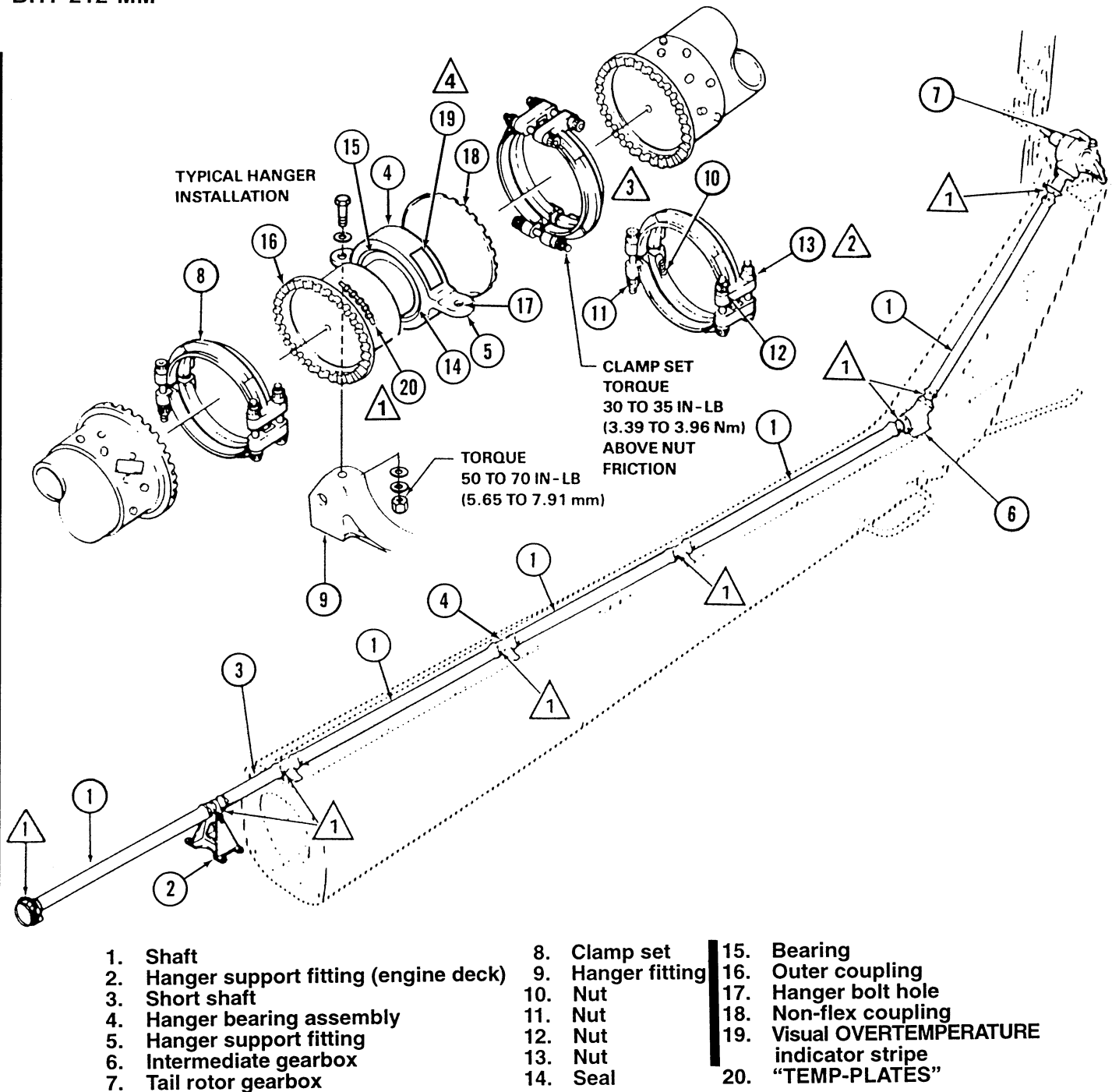


DO NOT ALLOW SOLVENT TO SATURATE DRIVESHAFT.

1. Clean driveshaft with clean, lint-free cloth dampened in solvent (C-304).
2. Dry with filter, compressed air.

65-7. Inspection.

1. Inspect driveshafts in accordance with figure 65-2.
2. Check two water drain holes are not clogged on contoured surface of curvic coupling.
3. Inspect curvic coupling splines on face of shaft coupling. There shall be no radial play or backlash between mating couplings when fully meshed without clamps.
4. Inspect shaft for distortion (figure 65-2).
5. Inspect balance weights for security. Any weights found debonded may be rebonded. If weight is missing, replace driveshaft.
6. Inspect clamp sets for cracks, worn bolt holes, and distortion. Damage which can be



NOTES

- 1** Location of temperature indicator TEMP-PLATES on outer couplings. (BHT-212-CR&O, Chapter 65)
- 2** Torquing sequence is as follows: 10, 12, 13, and 11.
- 3** Clamp halves shall be kept together as a set.
- 4** Location of hanger bearing assembly visual overtemperature indicator stripe. (BHT-212-CR&O, Chapter 65)

212-M-65-1

Figure 65-1. Tail rotor driveshaft and hangers

detected visually requires replacement of clamp set.

7. Inspect clamp sets for gouges or wear pattern extending into fillet radius at bottom of internal groove. Damage which can be detected visually requires replacement of clamp set.

8. Inspect clamp sets for mechanical damage on spot face, lug fillets, and internal groove. Damage not exceeding 0.008 in. (0.203 mm) is acceptable without repair. Damage exceeding this limit is not acceptable and shall be repaired or entire clamp set replaced. Inspect remaining surfaces of clamp set for mechanical damage. Damage not exceeding 0.010 in. (0.254 mm) is acceptable without repair. Damage exceeding this limit is not acceptable and shall be repaired or clamp set replaced.

65-8. Repair.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-100	Chemical Film Material
C-202	Primer
C-305	Aliphatic Naphtha
C-317	Adhesive
C-423	Abrasive Cloth or Paper



DO NOT USE GRINDING WHEEL
TO REMOVE DAMAGE.

DRIVESHAFT SHALL BE CHECKED
AND REBALANCED AS REQUIRED
IF REWORKED AREA IS 8.0 SQ.
IN. (51.6 SQ. CM) MORE ON ONE
SIDE THAN THE OTHER.

1. Polish out mechanical and corrosion damage from driveshaft within limits (figure 65-2) using 400 to 600 grit abrasive cloth or paper (C-423).

2. Radius in reworked area shall be 0.50 in. (12.7 mm) or greater. Surface finish shall be 32 RMS or better. When surface rework is complete, verify damage limits are not exceeded.

3. Treat repaired areas with chemical film material (C-100) (BHT-ALL-SPM).

4. Apply one coat of primer (C-202).

5. Touch up paint to match surrounding area.

6. Rebond loose balance strip as follows:

a. Clean balance weight and shaft in area where weight will be bonded by abrading lightly with 400 grit abrasive cloth or paper (C-423).

b. Remove sanding residue with a clean, lint-free cloth dampened with aliphatic naphtha (C-305).

c. Mix adhesive (C-317) 33 parts B to 100 parts A. Mix parts thoroughly. (Pot life is 30 to 50 minutes after mixing.)

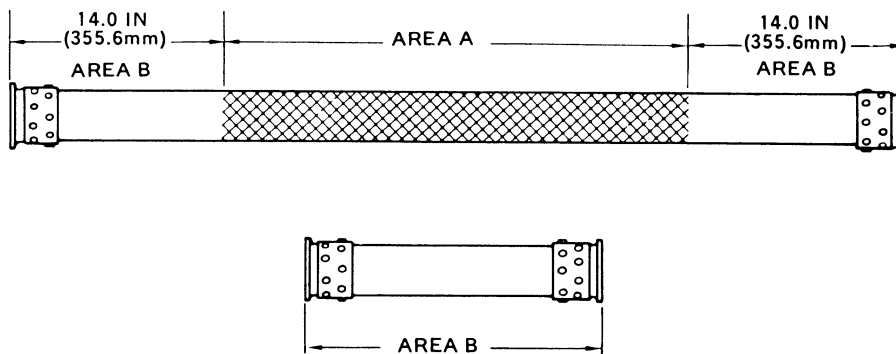
d. Apply a thin coat of adhesive to balance weight and shaft in area where weight will be bonded.

e. Place a 6 to 10 mil thread in adhesive on balance weight to act as a spacer and control bondline thickness.

f. Position weight on shaft. Maintain approximately 10 psi pressure on weight using rubber bands or equivalent.

g. Allow adhesive to cure at 70 to 95°F (21 to 35°C) for 24 hours. Accelerated cure may be accomplished by heating area to 175 to 190°F (79 to 88°C) for 60 minutes.

h. Apply chemical film material (C-100) to balance weight and apply touch up paint, if required.



DAMAGE LOCATION SYMBOLS



AREA A



AREA B

TYPE OF DAMAGE

MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED
AFTER POLISHING OUT

CRACKS ALLOWED	See Note 6	See Note 6
NICKS AND SCRATCHES	0.008 Inch (0.203 mm)	0.012 Inch (0.304 mm)
SHARP DENTS	0.010 Inch (0.254 mm)	0.015 Inch (0.381 mm)
NONSHARP DENTS	0.020 Inch (0.508 mm)	0.030 Inch (0.762 mm)

NOTES

- Damage defined on the chart above is acceptable if repaired as follows:
 - Damage is polished out with fine abrasive cloth with minimum radius of 0.5 inch (12.70 millimeters) and with surface finish of 32 RMS or better.
 - Maximum depth after rework does not exceed limits shown in chart.
 - Reworked area is treated for corrosion prevention.
 - If rework area is eight square inches more on one side than the other, shaft balance must be checked.
- Loss of one or more balance weights is cause to replace driveshaft. One empty bonding space should be open where bond test coupon was removed. If more than one empty space is observed, replace driveshaft.
- Damaged curvic coupling splines that result in radial play and/or backlash between assembled couplings when fully meshed without clamps are not acceptable.

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Figure 65-2. Damage limits - tail rotor driveshaft (sheet 1 of 2)

4. Grooves worn on shaft coupling by clamp to extent that wear prevents proper clamping are cause to replace driveshaft.
5. If tail rotor driveshaft distortion is suspected, support driveshaft on "V" blocks and measure run out. Maximum acceptable total indicator reading on long shafts is 0.050 inch (1.27 millimeters). Maximum acceptable total indicator reading on short shaft is 0.020 inch (0.508 millimeters). Do not attempt to straighten driveshaft.
6. Any crack in a driveshaft is cause to replace the affected driveshaft except cracks in rivet heads are acceptable if they do not exceed the following limits:
 - a. Cracks are approximately radial when viewing top of shop head.
 - b. No crack extends into an area with a diameter less than 1.25 diameters of rivet shank.
 - c. Cracks do not intersect.
 - d. The minimum distance between cracks is less than one shank diameter.
 - e. A maximum of 3 such cracks.
 - f. Crack width does not exceed 0.06 inches (1.52 millimeters) times rivet shank diameter.
 - g. Maximum of ten percent of rivet shop heads may have cracks within above limits.

212-M-65-2-2

Figure 65-2. Damage limit - tail rotor driveshaft (sheet 2)

65-9. Installation.**NOTE**

Tail rotor driveshaft clamps (8, figure 65-1) are matched sets. Keep in sets after removal to maintain balance. If it is necessary to replace one clamp half, or if clamp halves are intermixed, each shall be rematched with one of equal weight within one gram.

1. Position each shaft (1 or 3, figure 65-1) between mating couplings of hangers (4) and gearboxes.
2. Install matched clamp sets (8) on couplings, with bolt heads to direction of rotation and clamp joints indexed 90° to those of adjacent clamps for balance in operation.

NOTE

All nuts used on a clamp must be of the same type and style.

Adjust clamp set halves to obtain equal gaps at both ends within 0.030 in. (0.732 mm).

3. Tighten clamp bolts evenly, torque 30 to 35 in.lbs. (3.39 to 3.95 Nm) above nut friction. Driveshaft clamp nuts are self-locking and shall not be reused unless tare torque is a minimum of 3.5 in.lbs. (0.395 Nm). Torque sequence is as follows: 10, 12, 13, and 11 (figure 65-1). Tap lightly around outer surface to seat clamp, and recheck torque.
4. Close covers and cowling.

65-10. DRIVESHAFT HANGERS.**65-11. Removal.**

DO NOT DISPLACE EITHER END OF DRIVESHAFT FROM MATING COUPLING UNLESS CLAMP SET IS REMOVED FROM BOTH ENDS OF SHAFT. FAILURE TO COMPLY MAY RESULT IN DAMAGE TO HANGER BEARING AND/OR CURVIC COUPLING.

1. Remove tail rotor driveshafts from each end of hanger to be removed (paragraph 65-5).
2. Remove two bolts (19, figure 65-3), washers (20, 22, 23, and 25), and nuts (26). Remove hanger assembly from support (17).
3. Remove two bolts (27) and washers (28). Remove hanger assembly (5) from fitting (16).
4. Remove hanger assembly (9) same as previous step.

65-12. Cleaning.**MATERIALS REQUIRED**

Refer to BHT-ALL-SPM for specification and source.

NUMBER	NOMENCLATURE
C-304	Solvent

NOTE

These instructions are applicable to assembled tail rotor driveshaft hanger(s) only. Refer to BHT-212-CR&O for instructions to clean disassembled hanger(s).



DO NOT IMMERSE HANGER ASSEMBLY IN SOLVENT.

Clean external surfaces of hanger assembly with a clean, lint-free cloth dampened with solvent (C-304). Do not allow solvent to contact internal surfaces of hanger assemblies.

65-13. Inspection.**MATERIALS REQUIRED**

Refer to BHT-ALL-SPM for specification and source.

NUMBER	NOMENCLATURE
C-454	India Stone

1. Inspect hanger bearing (4, figure 65-1) for cracks, elongated bolt holes, or other visible damage.
2. Inspect outer coupling (16) temperature indicator "TEMP-PLATES" (20) as follows:

NOTE

Overtemperature indicator dots on "TEMP-PLATES" are white or light gray color and turn black when exposed to an overtemperature condition. Chemical contamination can also cause indicator DOTS to turn black.

a. Temperature indicator "TEMP-PLATES" must not show evidence of overtemperature, deterioration, debonding, or discoloration of the epoxy coating that prevents interpretation of the indicating DOTS. If any of these conditions exist, proceed to step b.

b. If one "TEMP-PLATE" is missing, and no DOT on the other "TEMP-PLATE" (on the same coupling) is discolored or shows mechanical damage or degradation of the

epoxy overcoating, the helicopter may be returned to service.

c. The discrepant "TEMP-PLATE" in step b. should be replaced as soon as practical. If any indicator DOT on "TEMP-PLATE" has changed color to black, see figure 65-4A for probable cause and required corrective action.

2a. Inspect hanger bearing assembly visual overheat indicator stripes (19, figure 65-1) for discoloration and overheat condition. A change in color of indicator stripe(s) (from green to brown) indicates a possible overheat condition and/or component degradation. Cause of discoloration shall be determined and corrected prior to continued operation (BHT-212-CR&O)

3. Inspect nonflexible couplings for nicks, dents, and cracks. Minor damage which can be polished out with fine India stone (C-464) is acceptable.

4. Inspect outer coupling (16) for nicks, dents, and cracks. Minor damage which can be polished out with fine India stone (C-464) is acceptable.

5. Inspect seal (14) for protrusions, leakage, cuts, tears, and deterioration. Replace unserviceable seals (BHT-212-CR&O).

NOTE

Inspect hanger bearing for movement of grease shields, indicated by breakage of witness marks. Remove any bearing from service whose witness marks indicate that the grease shield has moved.

6. Inspect bearing (15) in hanger support fitting (5) and outer coupling (16) for grease leakage. Grease leakage of adjacent areas by grease is cause for replacement with the following exception: A small amount of grease expelled from around tip of bearing seals indicates a slight overlubrication and is not cause for hanger replacement. If leakage is detected, perform an evaluation of grease leakage as follows:



DO NOT CLEAN OR SPRAY BEARING HANGER ASSEMBLY WITH ANY TYPE OF SOLVENT DURING INSPECTION. USE CLEAN CLOTH TO CLEAN EXTERIOR OF HANGER ASSEMBLIES.

a. Wipe grease from outer coupling (16), and bearing (15) in hanger support fitting (5).

b. Record which bearing is leaking and monitor bearing condition for the next ten flight hours.

c. If the amount of grease expelled from bearing seal does not decrease after this period of time, replace hanger assembly.

7. Inspect bearing (15) in hanger support fitting for wear, roughness and binding as follows:

a. Remove driveshaft from each side of hanger bearing assembly.

b. Rotate bearing while pressing in axially on nonflexible coupling and at hanger bearing assembly. Bearing may feel smooth when turned with no load, but rough when loaded by pressing in with hand. Obvious roughness, catching, or binding when turned, by hand, is cause for replacement of hanger bearing assembly.

8. Inspect engine deck hanger, support fittings and hanger support fitting for mechanical and corrosion damage. Mechanical damage in excess of superficial and corrosion damage which can be detected visually is not acceptable.

9. Replace driveshaft hanger assemblies for the following conditions:

a. Bearing is rough, binds when rotated, or shows excessive wear.

b. Hanger bearing assembly (15) is excessively worn or cracked.

c. Curvic face of couplings are excessively worn.

d. Couplings show signs of overheating, or being run without lubricant.

e. Hanger support fitting shows signs of overheating.

f. Hanger support fitting shows signs of metal particles and/or rust colored fretting debris near bearing.

10. Lubricate hanger bearing assemblies as required (paragraph 65-14).

65-14. Lubrication.

1. Remove tail rotor driveshaft sections attached to hanger bearings assemblies to be lubricated (paragraph 65-5).

2. Remove tail rotor driveshaft hanger assemblies (paragraph 65-11).

3. Clean tail rotor driveshaft hanger assemblies (paragraph 65-12).

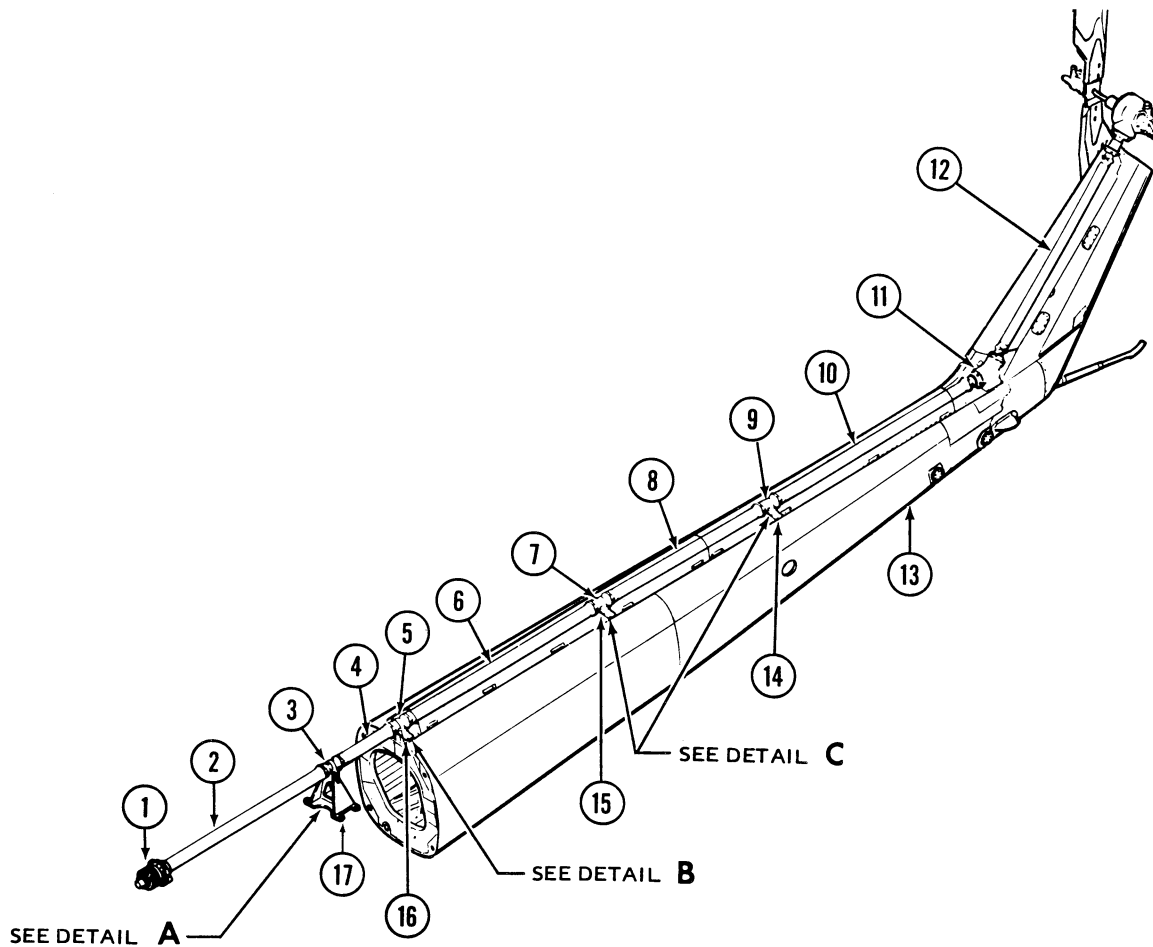
4. Disassemble, lubricate, and re-assemble tail rotor driveshaft hanger assemblies (BHT-212-CR&O).

5. Install tail rotor driveshaft hanger assemblies (paragraph 65-15).

NOTE

Ground run and leak check must be performed following installation of new, repaired, or relubricated flexible couplings.

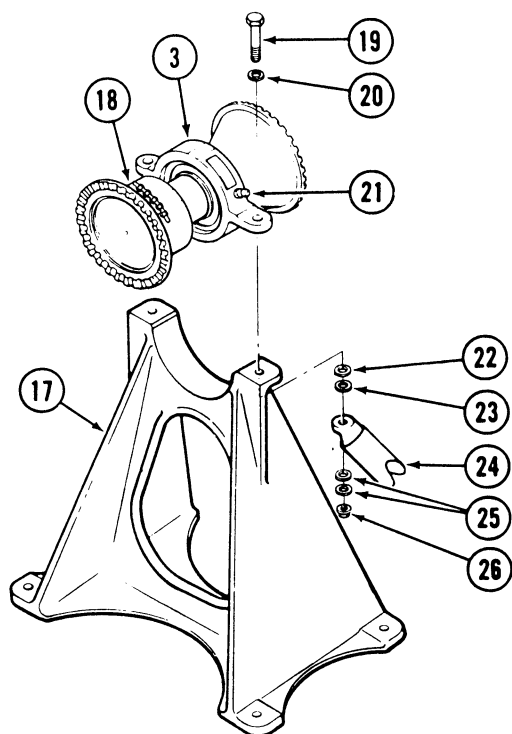
6. Make an entry in helicopter log and in flex couplings lubrication log of date lubricated, date grease manufactured and helicopter hours (Chapter 12).



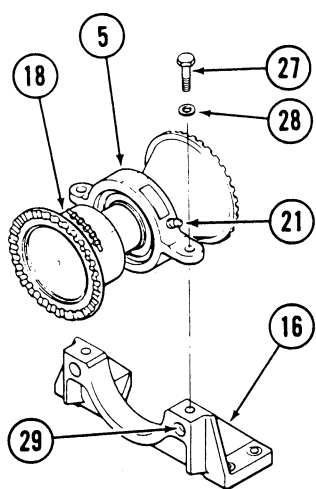
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|-----------------------------------|-----------------------|-----------------------|
| 1. Drive quill (transmission) | 13. Tailboom | 25. Steel washer |
| 2. Tail rotor driveshaft | 14. Fitting | 26. Nut |
| 3. Hanger assembly | 15. Fitting | 27. Bolt |
| 4. Tail rotor driveshaft | 16. Fitting | 28. Thin steel washer |
| 5. Hanger assembly | 17. Support | 29. Barrel nut |
| 6. Tail rotor driveshaft | 18. Flexible coupling | 30. Bolt |
| 7. Hanger assembly | 19. Bolt | 31. Thin steel washer |
| 8. Tail rotor driveshaft | 20. Steel washer | 32. Aluminum washer |
| 9. Hanger assembly | 21. Grease fitting | 33. Thin steel washer |
| 10. Tail rotor driveshaft | 22. Aluminum washer | 34. Nut |
| 11. Intermediate gearbox assembly | 23. Steel washer | |
| 12. Tail rotor driveshaft | 24. Brace assembly | |

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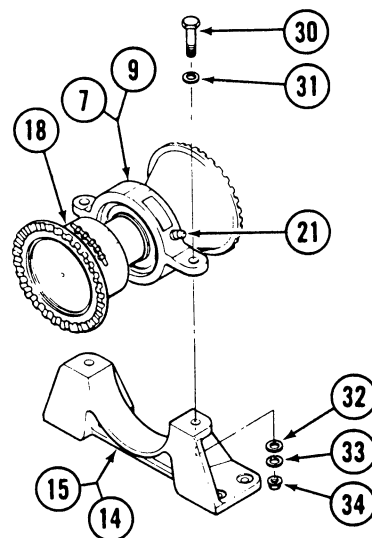
Figure 65-3. Tail rotor driveshaft hanger assemblies (sheet 1 of 2)



DETAIL A



DETAIL B



DETAIL C

212-M-65-3-2

Figure 65-3. Tail rotor driveshaft hanger assemblies (sheet 2)

65-15. Installation.

1. Position hanger assembly (3, figure 65-3) on support (17) with flexible coupling (18) forward. Install washers (22 and 23) between support (17) and brace assembly (24) on each side. Install bolts (19) with washers (20) through hanger assembly (3), support (17), and brace assembly (24). Install washers (25) and nuts (26).

2. Position hanger assembly (5) on fitting (16) with flexible coupling (18) forward. Ensure barrel nuts (29) are aligned on each side. Install two bolts (27) and washers (28).

NOTE

Use additional washers (33) if necessary to obtain proper bolt thread engagement.

3. Position hanger assembly (7) on fitting (15) with flexible coupling (18) forward. Install bolts (30) and washers (31) through hanger assembly (7) and fittings (15). Install washer (32) next to fitting (15), washer (33), and nut (34).

4. Install hanger assembly (9) on fitting (14) using procedures in previous step.

5. Install tail rotor driveshafts.

212-M-65-4

Figure 65-4. Deleted

ONE RED TEMP-PLATE	OTHER RED TEMP-PLATE	PROBLEM CAUSE	SEE NOTE
Black	Good	Defect/Instl	1
Black	Black	Overtemp	2
Part Black	Good	Chem Contamination	1
Missing	Good	Defect/Instl	1
Missing	Missing	Possible Overtemp	2

NOTES

1. Resume operation. Defective TEMP-PLATE or improper installation, replace defective TEMP-PLATE as soon as practical (BHT-212-CR&O).
2. Coupling overtemp condition is very likely. Remove driveshaft or coupling assembly and perform overtemp inspection in accordance with BHT-212-CR&O and the following instructions. Scrap affected male and female couplings if any of the conditions listed below exist or if required by BHT-212-CR&O inspection criteria.
 - a. Cadmium plating on outer coupling is discolored (circumferential tan or light brown band) or blistered.
 - b. Gear teeth of either coupling are discolored (brown or blue) in normally bright contact patterns.
 - c. Under 5x or 10x magnification, surfaces of gear teeth of either inner or outer coupling exhibit signs of metal smearing or tearing in contact patterns.
 - d. Grease is very viscous (thick) and has a strong pungent order.

NOTE

If NONE of the above conditions exist, coupling may be reassembled in accordance with BHT-212-CR&O and return to service following replacement of TEMP-PLATES.

212-M-65-4A

Figure 65-4A. Tail rotor driveshaft coupling TEMP-PLATE condition and correction

6. Operate helicopter (BHT-212-FM) for 5 minutes at 100% Nr.

7. Shut down engine and inspect coupling(s) and surrounding structure for evidence of grease leakage. If there is evidence of grease leakage, remove hanger assembly and replace defective parts.

8. Inspect hangers overheat indicator stripes for discoloration and overheat condition. A change in color of indicator stripe (from green to brown) indicates a possible overheat condition and/or component degradation. Cause of indicator stripe discoloration shall be determined and corrected prior to continued operation (BHT-212-CR&O). Inspect flexible couplings temperature indicator "TEMP-PLATES". Refer to paragraph 65-13.

65-16. ALIGNMENT — TAIL ROTOR DRIVE SYSTEM.

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specification and source.

NUMBER	NOMENCLATURE
C-001	Grease
C-305	Aliphatic Naphtha
C-309	Methyl-Ethyl-Ketone (MEK)
C-317	Adhesive
C-508	Lockwire

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T103226-101	Tail rotor gearbox simulator
T103224-101	Intermediate gearbox simulator
T103335-119	Alignment plate
T103225-109	Bushing

SPECIAL TOOLS REQUIRED (CONT)

NUMBER	NOMENCLATURE
412-240-033-101	Hanger simulator (2)
412-240-034-101	Hanger simulator
412-240-035-101	Hanger simulator

1. A tail rotor drive system alignment check shall be made whenever driveshaft misalignment is suspected, when damage to airframe structure in area of driveshaft hangers requires structural repair or parts replacement, when major structural repairs are performed in any area of tailboom or in aft section of forward fuselage, or when original intermediate gearbox is replaced with a gearbox of a different part number. Alignment of driveshaft hanger supports and intermediate gearbox shall be accomplished as follows:

a. Open tail rotor driveshaft covers and intermediate gearbox cover.

b. Remove tail rotor driveshafts and hangers (paragraphs 65-4 and 65-10).

NOTE

Do not remove driveshaft hanger support assemblies from tailboom or forward fuselage.

c. Remove intermediate gearbox (paragraph 65-28). Ensure any shims between gearbox and tailboom remain in their original locations on tailboom.

d. Remove tail rotor gearbox (paragraph 65-54).

e. Remove tailboom from helicopter and place in suitable support cradle (Chapter 53).

f. Clean surfaces on tailboom and hanger supports where hangers and gearboxes were removed of primer and sealant. Use a plastic scraper and a clean cloth moistened with MEK (C-309) or aliphatic naphtha (C-305).

g. Install alignment plate, T103225-119 with T103225-117 bushing for left hand position of plate (looking aft) (figure 65-5, view A, detail A), on forward tailboom bulkhead using AN8-31A bolt or equivalent with AN960-816 washer under bolt head.

h. Install tail rotor/90° gearbox simulator T103226-101 on top of vertical fin.



MAKE SURE THREE LEVELING SCREWS IN INTERMEDIATE GEARBOX SIMULATOR ARE BACKED OFF SO THEY DO NOT PROJECT BELOW THE MOUNTING SURFACE OF THE SIMULATOR BEFORE PROCEEDING.

i. Install intermediate gearbox simulator T103224-101 using AN4-13A bolts and sufficient number of AN960-416 and AN960-416L washers under heads of bolts so bolt grips do not bottom out in mating tailboom nutplates.



VERIFY TAIL ROTOR GEARBOX SIMULATOR, T103226-101 AND BULKHEAD ALIGNMENT PLATE, T103225-119 ARE SECURED BEFORE PROCEEDING.

j. Install unkinked 0.020 inch lockwire (C-508) in hole of tail rotor gearbox simulator, T103226-101. Secure end of wire on upper side of plate.

k. Pass other end of wire through hole in top of plate of intermediate gearbox simulator, T103224-101, around "V" groove in pin and out through hole of forward (vertical) end plate (figure 65-5, view E).

l. Pass wire through hole in tailboom bulkhead alignment plate, T103225-119 and tighten wire until all slack is removed and secure end of wire. Secure end of wire with

safety wire spinner pliers or other positive locking pliers.

NOTE

Ensure wire is still unkinked and is still positioned in "V" groove in the pin in intermediate gearbox simulator T103224-101.

m. Check for alignment of intermediate gearbox by confirming wire clears the edges of holes in top and forward end plates by at least 0.005 inch (0.127 mm). See view B. If alignment is not acceptable, proceed directly to step m(1). Pluck wire and check to see if the wire continues to vibrate. If vibration continues, wire clearance is sufficient to proceed.

If alignment is acceptable loosen 0.020 diameter alignment wire and remove intermediate gearbox simulator T103224-101. Install the P/N 212-040-003 intermediate gearbox and then verify that a minimum of 0.030 inch (0.762 mm) clearance exists between lower surfaces of gearbox (other than four mounting pads) and underlying surfaces of tailboom. If sufficient clearance exists, proceed directly to step n. If sufficient clearance does not exist, add shims (equal amounts at all four mounting pads) as required to achieve clearance required, then proceed directly to step m (2).

(1) Loosen 0.020 inch diameter alignment wire and remove intermediate gearbox simulator T103224-101.

(2) Remove all shims on tailboom at intermediate gearbox location, note thickness of shim-stacks removed. Using a plastic scraper and a cloth moistened with MEK (C-309) remove any adhesive or sealant residue around gearbox mounting hole locations on tailboom.

(3) Adjust three leveling screws on intermediate gearbox simulator T103224-101 so they project below mounting surface an amount approximately equal to thickness of shim-stack established in step m(2) at corresponding mounting bolt location.



WHEN GEARBOX SIMULATOR T103224-101 IS SUPPORTED ON ITS THREE LEVELING SCREWS. TIGHTEN 4 SIMULATOR MOUNTING BOLTS TO 20 TO 30 INCH- LB. (2.26 TO 3.39 Nm).

(4) Install intermediate gearbox simulator T103224-101 on tailboom in accordance with step i. and reinstall alignment wire in accordance with steps k. and l. Ensure alignment wire is positioned in "V" groove in simulator pin.

(5) Loosen or tighten each of four simulator mounting bolts while adjusting each of three levelling bolts until an acceptable simulator position is obtained. See step m.

(6) Ensure simulator mounting bolts are torqued to only 20 to 30 inch-lb. (2.26 to 3.39 Nm); then using a thickness gage, measure and record gaps between lower surface of simulator and tailboom at each of the mounting bolt locations.

(7) Size thickness of shim-stacks for each simulator mounting bolt location equal to the respective gaps measured in step m(6).

(8) Loosen alignment wire and remove intermediate gearbox simulator T103224-101. Retract each of three leveling bolts so it does not project below lower surface of simulator. Install tail rotor gearbox using shim-stacks manufactured in step m(7), then verify that a minimum of 0.030 inch (0.762 mm) clearance exists between lower surfaces of gearbox (other than the four mounting pads). If sufficient clearance exists, proceed directly to next step. If sufficient clearance does not exist, add equal amounts of shims at all four mounting bolt locations as required to achieve clearance required and repeat steps m(2) thru this step except in step m(3) adjust simulator leveling screws such that they project below mounting surface equal to total shim thickness established above in this step.

(9) Reinstall simulator in accordance with step i using shim-stacks manufactured in

step m(7) and reinstall alignment wire in accordance with steps k and l. Tighten simulator mounting bolts 50 to 70 inch-lb. (5.65 to 7.91 Nm) and confirm satisfactory wire positions in holes in top and forward end plates of simulator in accordance with step m. If wire placement is satisfactory proceed to step (10) otherwise repeat steps m(1) through m(9) until satisfactory alignment is obtained.

(10) Loosen alignment wire and remove intermediate gearbox simulator T103224-101. Measure and record final thickness of shims at each of four mounting bolt locations.

(11) Clean shim contact areas on tailboom using aliphatic naphtha (C-305). Apply a light coat of adhesive (C-317) to bottom surface of each of four shim-stacks. Avoid placing adhesive within 0.25 inch (6.35 mm) of bolt holes.

(12) Install shim-stacks, adhesive side down, in their original locations on tailboom.

NOTE

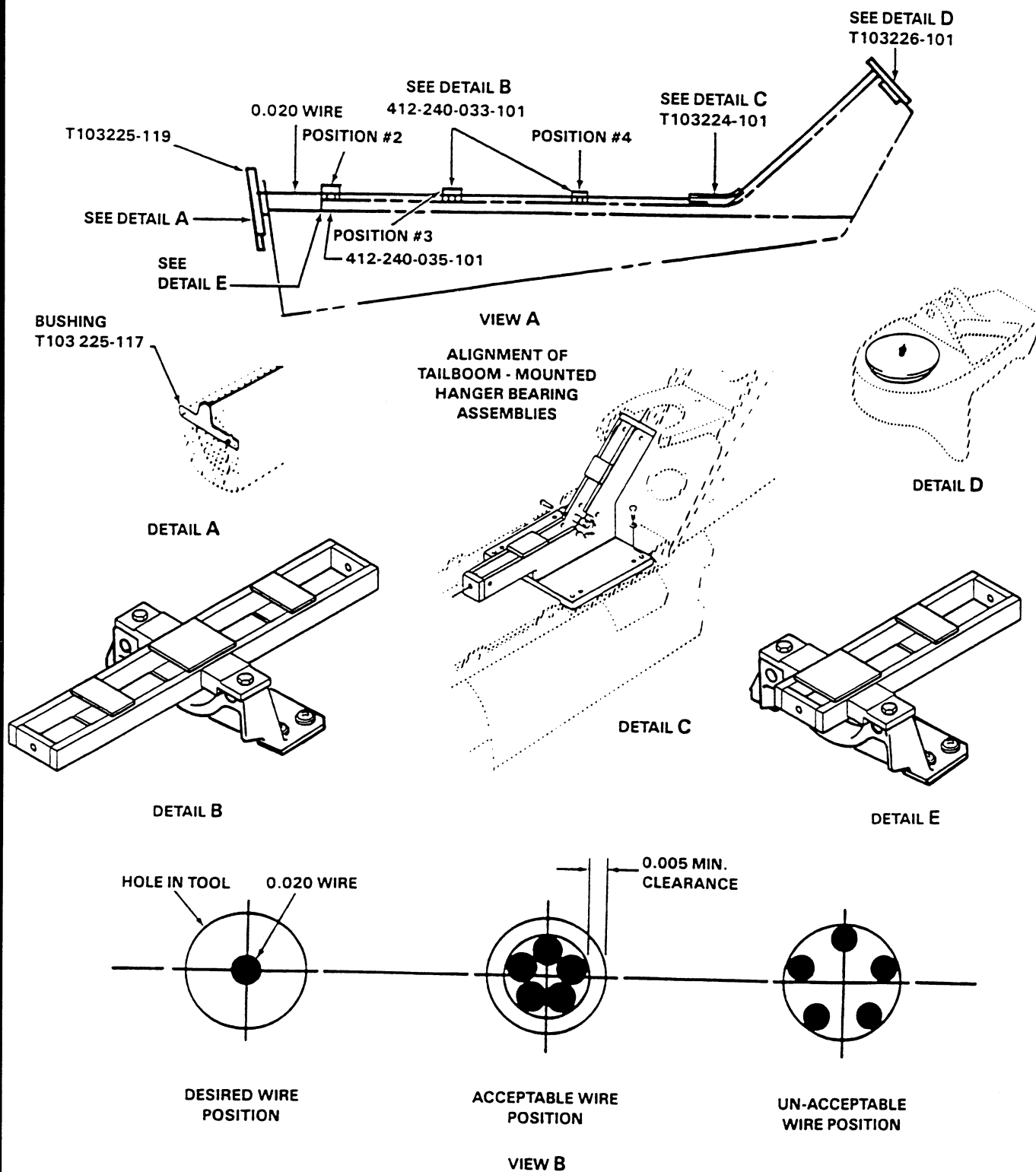
Coat bottom surface of intermediate gearbox simulator T103224-101 and the threads and shank of each simulator mounting bolt with a very light coat of petroleum jelly or grease (C-001) prior to installation.

(13) Reinstall intermediate gearbox simulator and tighten four mounting bolts 50 to 70 inch-lb. (5.65 to 7.91 Nm). Do not remove simulator until shim adhesive has set.

(14) Reinstall alignment wire in accordance with steps k and l and confirm satisfactory wire positions in holes in top and forward end plates of simulator in accordance with step m.

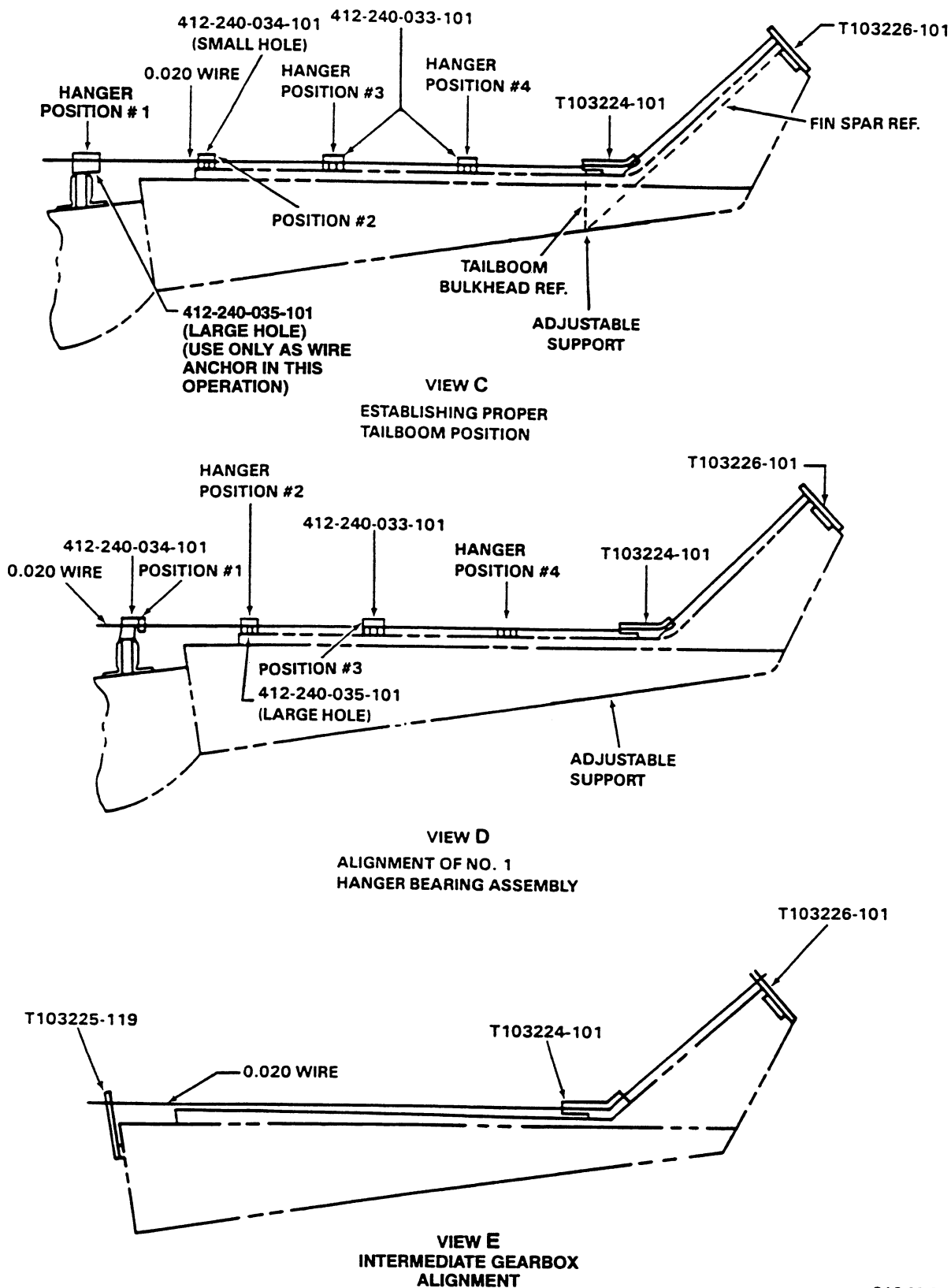
n. Remove alignment wire from alignment plate T103225-119 and thread wire through forward and aft holes of a hanger simulator 412-240-033-101.

o. Install hanger simulator 412-240-033-101 at number four location on tailboom using two AN4-10A bolts, two MS35650-3252 nuts and sufficient number of AN960-416L



212-M-65-5-1

Figure 65-5. Tail rotor driveshaft alignment (sheet 1 of 2)



212-M-65-5-2

Figure 65-5. Tail rotor driveshaft alignment (sheet 2)

washers under nut to keep nut from bottoming out in bolt grip, see detail B. Leave fasteners slightly loose at this point.

p. Using uniform hand pressure on extreme aft end of simulator, push hanger simulator forward and hold in this position while tightening the two bolts.

q. Tighten alignment wire in accordance with steps k and l. Ensure alignment wire is positioned in "V" groove in the intermediate gearbox simulator T103224-101 pin.

r. Verify acceptable alignment of hanger simulator 412-240-033-101 by confirming alignment wire clears edges of holes in forward and aft end plates of simulator by at least 0.005 inch (0.127 mm), see view B. Pluck wire and watch wire closely to see if the wire continues to vibrate. If vibration continues, wire clearance in holes is sufficient to proceed. Also verify alignment wire is in acceptable positions in holes in forward and top end plates of intermediate gearbox simulator T103224-101. If alignment of hanger simulator is acceptable proceed directly to step s; otherwise proceed as follows:

CAUTION

DO NOT LOOSEN HANGER
SUPPORT TO AIRFRAME BOLTS
ONCE "YAW" ADJUSTMENTS
HAVE BEEN MADE.

(1) If hanger simulator 412-240-033-101 position error is in "yaw", loosen four bolts securing hanger support to tailboom and shift support to obtain acceptable alignment. Retighten bolts and verify acceptable alignment in accordance with step r.

(2) If hanger simulator error is in "pitch" direction, remove four bolts securing hanger support to tailboom. To adjust hanger simulator "pitch" forward, add equal shims under both aft support mounting pads and remove same thickness of shims from under

both forward mounting pads. Do the opposite to adjust hanger simulator "pitch" aft. Install four mounting bolts and verify acceptable alignment in accordance with step r. It will likely be necessary to perform step r(1) to achieve acceptable "yaw" alignment.

(3) If a "lateral position" error exists at any hanger simulator (not simply a "yaw" error) remove alignment wire and hanger simulator. Remove four bolts securing hanger support to tail boom and remove support. Rework only the problem support in accordance with figure 65-5. Following rework, reinstall support. Reinstall hanger simulator and alignment wire in accordance with steps n thru q. Loosen four bolts slightly and adjust lateral position of support so as to obtain satisfactory lateral alignment of simulator. Verify acceptable alignment in accordance with step r. It will likely be necessary to perform step r (1) to restore acceptable "yaw" alignment.

(4) If hanger simulator position error is in "elevation" (vertical position), remove four bolts securing hanger support to tailboom and add or remove same thickness of shims under each of four support mounting pads. Install four mounting bolts and verify acceptable hanger simulator alignment in accordance with step r. It will likely be necessary to perform step r(1) and (3) to achieve acceptable "yaw" and "lateral position" alignment. If lateral position is acceptable proceed to step s.

NOTE

Ensure alignment wire remains free of kinks and is seated in "V" groove in intermediate gearbox simulator pin in the following operations.

s. Remove hanger simulator 412-240-033-101 from number four hanger location and install at location three. Perform steps o thru r.

(1) Loosen the alignment wire and remove hanger simulator 412-240-033 from hanger location three.

NOTE

Hanger simulators 412-240-035 and 412-240-034 are very similar in appearance. Confirm the correct simulator is installed in the following operation.

(2) Install hanger simulator 412-240-035-101 at hanger location two using two AN4H7A bolts and a sufficient number of AN960-416L washers to keep the bolts from bottoming out in the bolt grip. Leave fasteners slightly loose at this point. Perform steps p thru r, except, in step r the hanger simulator will be the 412-240-035-101.

t. Tail rotor driveshaft hanger assembly alignment on tailboom is now complete. Remove tailboom bulkhead alignment plate T103225-119, alignment wire, and hanger simulator 412-240-035-101.

u. Install tailboom on helicopter (Chapter 53).



THE FOLLOWING PROCEDURES FOR ALIGNMENT OF HANGER BEARING ASSEMBLY AT HANGER POSITION NUMBER ONE MUST BE PERFORMED USING A TAILBOOM KNOWN TO HAVE ACCEPTABLE TAIL ROTOR DRIVE SYSTEM ALIGNMENT.

v. Install hanger simulators as follows:

(1) Install hanger simulator 412-240-034-101 at number two hanger location in accordance with step s(2) for the 412-240-035-101 hanger simulator except perform only referenced step p. See view C.

(2) Install hanger simulator 412-340-033-101 at number three and number four hanger locations in accordance with steps o & p. See view C.

(3) Install hanger simulator 412-340-035-101 at number one hanger position in

accordance with instructions given for 412-340-033-101 hanger simulator in step o & p. See view C.

NOTE

In steps w, x, and y, the 412-240-035-101 hanger simulator at hanger number one location is used as a wire anchor. Alignment of the number one hanger support is accomplished per steps z thru ab.



DO NOT LOOSEN BOLTS SECURING ANY HANGER SUPPORT TO TAILBOOM IN AN EFFORT TO ACHIEVE SATISFACTORY ALIGNMENT IN STEPS W THROUGH AB.

w. Install a length of unkinked 0.020 inch diameter wire in accordance with steps j and k. Route wire through each of three hanger simulators. Tighten wire until all slack is removed. Secure wire at forward end of hanger simulator 421-240-034-101 at number one hanger location. Secure end of wire with safety-wire spinner pliers or other positive-locking pliers.

NOTE

A stable cushion such as shot bags or a sand bag should be placed between tailboom skin and support so as to distribute the load and prevent damage to tailboom structure. Tension on alignment wire may require adjustment during tailboom positioning operation to prevent wire sag.

x. Position an adjustable support under tailboom. This support should be located at a point approximately 12 inches (30.48 cm) forward of intermediate gearbox location where extension of canted vertical fin spar approaches adjacent tailboom bulkhead at lower surface of tailboom, see view C. Slowly

adjust elevation of support as required to position alignment wire within acceptable limits in each of three hanger simulators, see view B. Once this position is obtained do not reposition helicopter or readjust tailboom support until tail rotor drive system alignment is complete.

y. Remove alignment wire and hanger simulator 412-240-035-101 from the number one hanger location. Reposition hanger simulator 412-240-034-101 from number two hanger location to number one location on forward fuselage. Install hanger simulator 421-240-034-101 in accordance with steps o and p, except use AN4-7A bolts. See view D.

z. Remove hanger simulator 412-240-033-101 from number four hanger location. Install hanger simulator 412-240-035-101 at number two hanger location in accordance with step s(2).

aa. Install a new length of unkinked 0.020 inch diameter wire in accordance with steps j and k. Route wire through hanger simulators at number three, two and one hanger locations. Tighten wire until all slack is removed and secure wire at the forward end of hanger simulator 412-240-034-101 at number one hanger location. Secure end of wire with safety-wire spinner pliers or other positive-locking pliers. Ensure alignment wire is seated in "V" groove in intermediate gearbox simulator T103224-101 pin.

NOTE

As an alternate procedure the alignment wire may be anchored at forward face of hanger simulator 412-240-034-101 and tension/clamped at top end plate of intermediate gearbox simulator T103224-101.

bb. Verify acceptable alignment of hanger simulator by confirming alignment wire clears edges of holes in forward and aft end plates of hanger simulators on tailboom, in aft end plate of hanger simulator at number one hanger location and in forward and top end plates of intermediate gearbox simulator. See view B. If alignment of hanger simulator 412-

240-034-101 is acceptable proceed directly to step ac; otherwise proceed as follows:

NOTE

Elongation of the four mounting holes in the No. 1 hanger support is not permitted.

(1) If hanger simulator error is in "yaw" direction, loosen four bolts securing hanger support to airframe and shift support to obtain acceptable alignment. Tighten four bolts and verify acceptable alignment in accordance with step ab.

(2) If hanger simulator error is in "pitch" position, relax tension on alignment wire and remove four bolts securing hanger support to airframe. To "pitch" hanger simulator forward add equal shims under both aft support mounting pads and remove same thickness of shims from under both forward mounting pads. Do just the opposite to "pitch" support aft. Install four support mounting bolts, tighten alignment wire and verify acceptable hanger simulator alignment in accordance with step ab. It may be necessary to perform step ab(1) to achieve acceptable "yaw" alignment.

(3) If hanger simulator error is in "elevation" position (alignment wire hits top or bottom of holes in hanger simulator at number two hanger location), relax tension on alignment wire and remove four bolts securing hanger support to airframe. Add or remove equal shim thickness under each of four support mounting pads to obtain required elevation. Install four mounting bolts and verify acceptable hanger simulator alignment in accordance with step ab. It may be necessary to repeat step ab(1) to achieve acceptable "yaw" alignment.

cc. Tail rotor drive system alignment is complete. Remove all alignment tools and tailboom support. Verify bolts securing hanger supports to forward fuselage and to tailboom are properly torqued. Remove any grease remaining on uppermost shim at intermediate gearbox location.

2. Install tail rotor gearbox (paragraph 65-58).

- 3.** Install intermediate gearbox (paragraph 65-33).
- 4.** Install tail rotor hangers and tail rotor driveshafts (paragraphs 65-14 and 65-8).

- 5.** Close and secure tail rotor driveshaft covers.

65-17. DELETED.

INTERMEDIATE GEARBOX

65-18. INTERMEDIATE (42°) GEARBOX.

The intermediate gearbox is installed on the tailboom forward of the vertical fin. The gearbox is aligned by use of shims between gearbox and tailboom (paragraph 65-16). An electrical chip detector and an oil level sight gage are located on the right side. A vented filler plug is installed on top of the case. Both the input and output quills have flexible, crown-toothed couplings for attachment of driveshafts. A cover with cowl fasteners provides access to the gearbox.

65-19. MAINTENANCE.

The following maintenance procedures consists of troubleshooting, inspection (while still installed), removal, cleaning, limited repair, and installation.

NOTE

When any doubt exists as to the serviceability of a gearbox, perform serviceability checks defined in Chapter 63.

65-20. Troubleshooting.

Table 65-2. Troubleshooting - intermediate gearbox

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
CHIP 42/90 BOX caution segment illuminated.	Metal chips have accumulated on chip detector.	Remove and inspect electric chip detector. If chips are found, retain in a clean container for subsequent investigation.
	Faulty wiring or faulty chip detector.	Inspect wiring to chip detector for continuity and grounding (Chapter 98). Repair wiring or replace defective chip detector as required.
Oil leakage from intermediate gearbox.	Faulty seals, packings, or wear sleeves.	Clean gearbox and recheck for oil leak both static and dynamic (engine operating). Measure and record rate of leakage. Maximum allowable static or dynamic leakage at any single source is two drops per minute. Total allowable leakage from all sources on gearbox is six drops per minute.

Table 65-2. Troubleshooting - intermediate gearbox (Cont)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
		Replace gearbox seals, packings, or wear sleeves if maximum allowable leakage rate is exceeded (BHT-212-CR&O).
	Cracked gearbox housing.	Inspect gearbox for cracks in housing. Replace gearbox if cracks are found.

65-21. Inspection (installed).

- 1. Open tail rotor driveshaft covers and remove intermediate gearbox cover.
- 2. Shake gearbox (9, figure 65-6) and check for looseness on tailboom. No looseness is acceptable.
- 3. Check for evidence of fretting corrosion at mating surface between gearbox and tailboom which could be caused by movement of gearbox on tailboom. A gray residue is an indication of fretting corrosion. If residue is present, remove and inspect gearbox (BHT-212-CR&O).

NOTE

Inspection steps 4. through 10. are not applicable if gearbox is removed at step 3.

- 4. Inspect four bolts (2) for correct torque and correct thread engagement.
- 5. Inspect couplings (8 and 10) for grease leakage and for overheating evidenced by discoloration of temperature indicator TEMP-PLATES (11) from white or light gray to black. A change in color indicates a possible overheat and /or component degradation.

Cause of TEMP-PLATE discoloration shall be determined and corrected prior to continued operation. Refer to paragraph 65-13 for coupling TEMP-PLATE inspection.

- 6. Deleted.
- 7. Inspect oil filler cap (paragraph 65-39).
- 8. Inspect oil sight glass for correct oil level. Inspect sight glass and indicator for staining and/or cracks and crazing. Damage which could cause oil leakage or make oil level difficult to determine is not acceptable.
- 9. Inspect electrical chip detector for metal particles. Refer to Chapter 63, Serviceability Checks if metal particles are found.

65-22. Removal.

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
DB3703-30	Drain line

- 1. When intermediate gearbox is to be replaced, unless conditions prevent operation, perform a ten minute ground runup and drain

operation oil using drain line DB3703-30. If runup is not practical, remove intermediate (42°) gearbox and flush with new lubricating oil (Chapter 12) of same type being used in gearbox. Attach tag to intermediate gearbox stating: "PRESERVED WITH OPERATING LUBRICANT."

2. Open tail rotor driveshaft covers and remove intermediate gearbox cover.
3. Remove tail rotor driveshafts (1 and 7, figure 65-6) (paragraph 65-5).
4. Remove chip detector (paragraph 65-34).
5. Remove four bolts (3).
6. Remove gearbox (9). Inspect shims (6) for secure installation on tailboom. If shims (6) are not bonded to tailboom, index the shims for installation in same location.

65-23. Cleaning.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-304	Solvent

1. Clean gearbox with clean, lint-free cloth dampened with solvent (C-304).



DO NOT FORCE SOLVENT AND/OR DIRT INTO FLEXIBLE COUPLING WHEN USING COMPRESSED AIR.

2. Dry with filtered, compressed air.

65-24. Inspection (removed from helicopter).

Refer to BHT-212-CR&O manual.

65-25. Inspection (special/conditional).

NOTE

Special/conditional inspections of intermediate gearbox are required after tail rotor drive system overtorque, sudden stoppage, compressor stall, etc. (Chapter 5).

65-26. Repair.

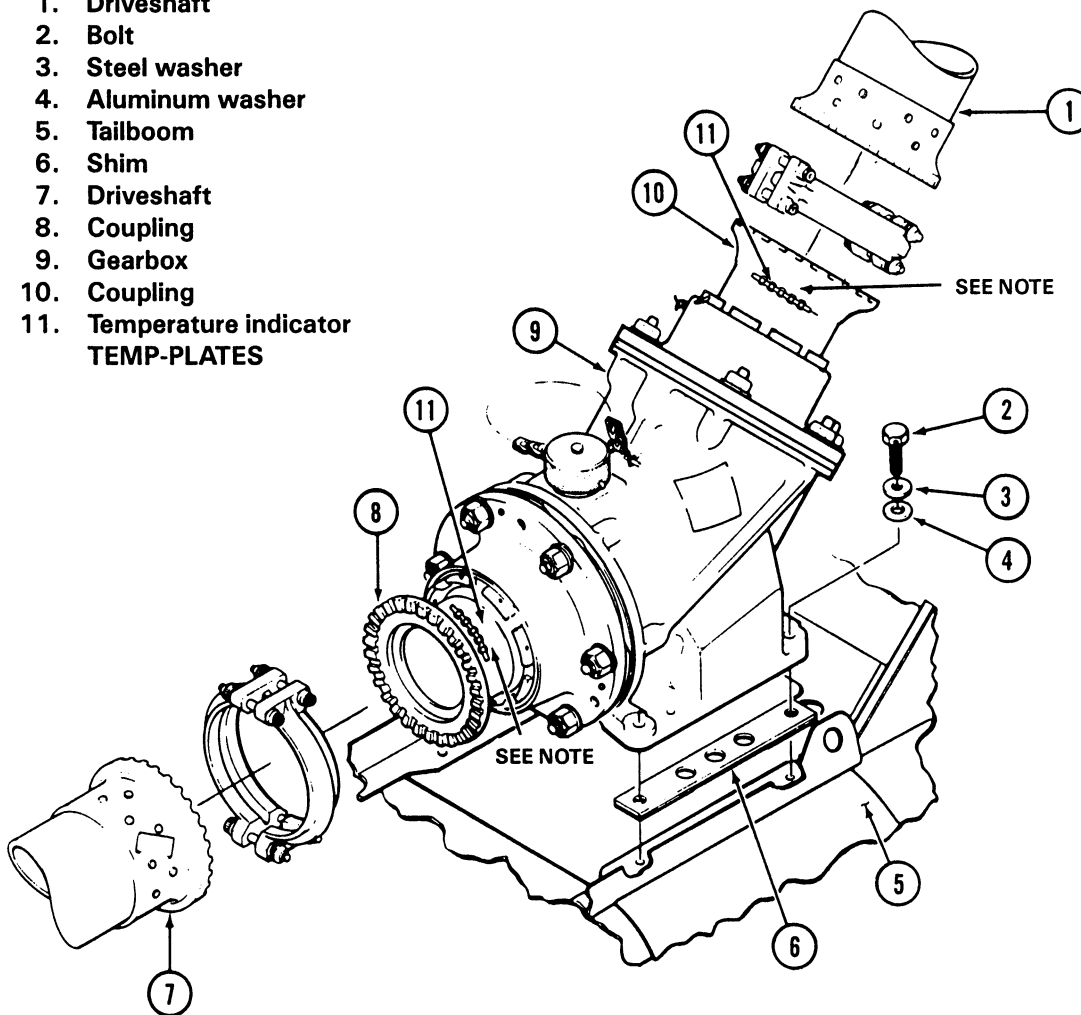
1. Repair intermediate gearbox (BHT-212-CR&O).
2. Repair faulty filler cap by same procedure outlined for tail rotor gearbox filler cap (paragraph 65-64).
3. Replace sight glass (3, figure 65-7) and/or indicator (4) that fails to pass inspection (paragraph 65-31).
4. Replace chip detector and/or self-closing valve that fails to pass inspection (paragraph 65-35).
5. Deleted.

65-27. Installation.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-201	Primer
C-204	Primer
C-405	Lockwire

1. Driveshaft
2. Bolt
3. Steel washer
4. Aluminum washer
5. Tailboom
6. Shim
7. Driveshaft
8. Coupling
9. Gearbox
10. Coupling
11. Temperature indicator
TEMP-PLATES



NOTE

Refer to BHT-212-CR&O for TEMP-PLATES installation procedure.

212-M-65-6

Figure 65-6. Intermediate gearbox



PRIOR TO INSTALLATION OF INTERMEDIATE (42) GEARBOX, ACCOMPLISH THE FOLLOWING:

ENSURE FLEXIBLE COUPLINGS ON INPUT AND OUTPUT QUILLS ARE PROPERLY LUBRICATED (PARAGRAPH 65-42).

ROTATE FLEXIBLE COUPLING ON INPUT QUILL AND CHECK FOR BINDING AND FOR EXISTENCE OF BACKLASH BETWEEN PINION ON INPUT QUILL AND GEAR ON OUTPUT QUILL.

DRAIN OIL FROM GEARBOX AND SERVICE WITH GEARBOX OIL (CHAPTER 12).

SHIMS (6, FIGURE 65-6) SHOULD BE BONDED TO TAILBOOM. IF SHIMS ARE NOT BONDED TO TAILBOOM, ENSURE SAME SHIMS WHICH WERE REMOVED, OR SHIMS OF IDENTICAL THICKNESS, ARE INSTALLED. FAILURE TO COMPLY COULD CAUSE MISALIGNMENT AND FAILURE OF TAIL ROTOR DRIVE COMPONENTS.

1. Clean mating surfaces of gearbox (9, figure 65-6) and tailboom (5).
2. Position gearbox on tailboom.
3. Check gearbox for contact with shim (6) at four points where bolts (2) are to be installed. Maximum acceptable gap at any of the four points is 0.001 inch (0.025 mm).
4. Remove gearbox and coat all faying surfaces, bolts, and bolt holes with unreduced primer (C-201) or primer (C-204).

NOTE

Complete driveshaft alignment and gearbox shimming (paragraph 65-16) before proceeding with this step.

5. Position gearbox on tailboom and install four bolts (2) with steel washers (3) next to bolt head and aluminum washer (4) next to gearbox. Bottoming of bolt grip is to be determined as follows:

NOTE

One aluminum washer and one steel washer is normally required at each bolt location, however, additional washers may be required at each location if bolt grip bottoms in airframe prior to securing gearbox.

- a. Torque each bolt 30 to 40 inch-lbs and check the washers under bolt heads for looseness. If any of the washers are loose add washers, as required at each bolt location, to ensure no looseness is apparent when above stated procedure is repeated.
- b. After completion of bolt -grip-bottoming test, retorque bolts 50 to 70 inch-lbs. (5.7 to 5.9 Nm). Secure bolts in pairs at each side with lockwire (C-405). Additional washers (3) may be required if bolt grip bottoms out on nut plate.
6. Install driveshafts (1 and 7) (paragraph 65-15).
7. Verify actual presence of oil in sight gage and check oil level to full mark on indicator.
8. Install chip detector (paragraph 65-36). Connect wiring.
9. If gearbox has not previously been qualified on run-in test stand, accomplish alternate run-in and test (paragraph 65-28).
10. Install intermediate gearbox cover and close tail rotor driveshaft covers.
11. Perform alternate run-in test (paragraph 65-28).

65-28. Alternate run-in test.**NOTE**

It is desirable that intermediate gearbox, after overhaul, be test run and inspected in accordance with publication(s) furnished with run-in stand for qualification for flight. In the event a run-in stand is not available, the following functional test may be accomplished as a minimum acceptable alternate test.

1. Install sufficient ballast in cabin to obtain maximum allowable gross weight (BHT-212-FM).
2. Verify helicopter is properly serviced and lubricated.
3. Start power sections (BHT-212-FM) and operate at 60% rpm for five minutes.
4. Gradually increase rpm to 88% a rate of 7% each six minutes.
5. Hold at 88% for two minutes with collective pitch applied to maximum which can be maintained without becoming airborne, or exceeding 100% torque.
6. Shut down engine (BHT-212-FM) and check electrical chip detector for foreign material or chips.
7. Clean and install chip detector.
8. Start engine (BHT-212-FM) and gradually increase to 88%. Run at 88% for six minutes.
9. Apply collective pitch to maximum position which can be maintained without becoming airborne or exceeding 100% torque.
10. At a rate of 3% each six minutes, gradually increase rpm to 100% without becoming airborne or exceeding 100% torque.
11. Run at 100% rpm for 30 minutes with collective pitch in maximum up position which can be maintained without becoming airborne or exceeding 100% torque.
12. Shut down engine (BHT-212-FM) and drain oil from gearbox. Check gearbox oil and chip detector for an excessive amount of metal particles indicating internal failure.
13. Inspect input and output quill couplings and surrounding area for evidence of grease leakage. If there is evidence of grease

leakage, remove couplings and replace defective parts. Repeat test run.

14. Check temperature indicator "TEMP-PLATES" (11, figure 65-6) for discoloration and overheat condition. A change in color of "TEMP-PLATES" from white or light gray to black indicates a possible overheat condition and/or component degradation. Cause of discoloration shall be determined and corrected prior to continued operation. Refer to paragraph 65-13 for inspection procedure.

15. Install chip detector and fill gearbox to specified level with approved lubricating oil (Chapter 12).

65-29. SIGHT GLASS.**65-30. Removal.****SPECIAL TOOLS REQUIRED**

NUMBER	NOMENCLATURE
DB3703-30	Drain line

1. Remove chip detector (paragraph 65-34).
2. Insert one end of DB3703-30 drain line into container. Insert other end in hole where detector was installed. Oil will automatically drain.
3. Remove ring (1, figure 65-7).
4. Remove glass (3) and packing (2).
5. Remove indicator (4).
6. Remove DB3703-30 drain line.
7. Install chip detector (paragraph 65-36).

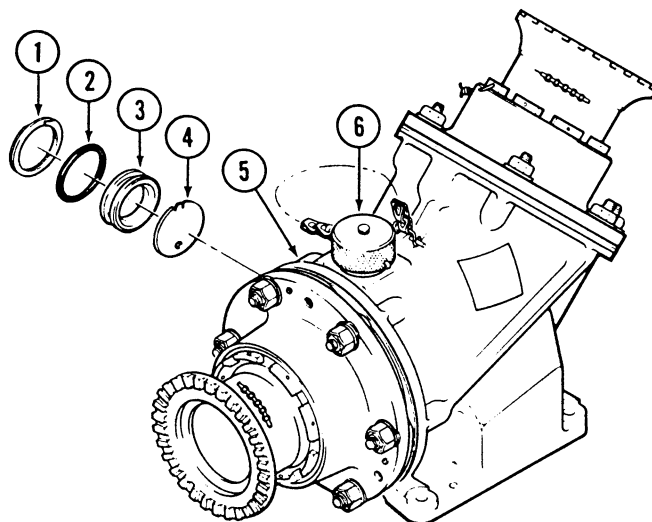
65-31. Inspection and repair.

Inspect sight glass for cracking and crazing. Replace glass if cracked or if crazed or discolored to the extent that accurate indication of oil level cannot be determined.

65-32. Installation.

1. Install indicator (4, figure 65-7).
2. Install packing (2) on glass (3). Coat packing (3) with oil used in gearbox (Chapter 12). Install glass (3) in gearbox port.
3. Install ring (1).

1. Retaining ring
2. Packing
3. Sight glass
4. Oil level indicator
5. Gearbox
6. Cap assembly



212-M-65-7

Figure 65-7. Intermediate gearbox sight glass

65-33. CHIP DETECTOR.

65-34. Removal.

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
DB3703-30	Drain line

NOTE

Electrical chip detector element (3, figure 65-8) may be removed for inspection without draining gearbox oil.

1. Move nipple (8) back on electrical wire (2) to expose nut (1). Remove nut (1) and electrical wire (2).

2. Press in on knurled body of electrical chip detector (3), turn counterclockwise to

disengage locking detent and withdraw electrical chip detector (3) from self-closing valve (5). Inspect chip detector (3) for presence of metal particles. If any metal particles are detected, refer to Chapter 63.

NOTE

If self-closing valve (5) is to be removed, install DB3703-30 oil draining line in self-closing valve (5) and allow oil to drain from gearbox.

3. Remove self-closing valve (5) from gearbox (7). Remove gasket (6) from self-closing valve (5). Discard gasket.

65-35. Inspection and repair.

1. Inspect chip detector for damage (figure 65-9).

2. Repair of the electrical chip detector is restricted to replacement of defective parts.

65-36. Installation.**MATERIALS REQUIRED**

NUMBER	NOMENCLATURE
C-405	Lockwire

1. Lubricate new gasket (6, figure 65-8) with lubricating oil used in gearbox and install gasket on valve (5).

2. Install self-closing valve (5) on gearbox case (7). Torque valve (5) 120 to 150 in.lbs. (14 to 17 Nm). Secure valve (5) to gearbox case (7) with lockwire (C-405).



ENSURE PROPER PACKING (4) IS INSTALLED ON CHIP DETECTOR (3). THE WRONG PACKING MAY NOT ALLOW CAUTION SEGMENT TO ILLUMINATE AND MAY RESTRICT OPERATION OF SELF-CLOSING VALVE.

3. Lubricate new packing (4) with lubricating oil used in gearbox and install packing on chip detector (3). Insert chip detector (3) into valve (5). Push and twist clockwise to engage locking detents.

4. Position electrical wire (2) on chip detector (3) and install nut (1). Do not exceed 4 in.lbs. (0.45 Nm) torque on nut. Position nipple (8) over nut (1).

65-37. OIL FILLER CAP.**65-38. Removal.**

1. Push down on cap (6, figure 65-10) and twist to disengage pin (7) from gearbox (4).

2. Unsnap pin (1) from gearbox (4).

65-39. Inspection.

1. Inspect filler cap for distortion of pin (7, figure 65-10) or other damage which would affect function.

NOTE

Some cap assemblies have a stainless steel mesh plug installed instead of aluminum wool. The spring-back check is not required for these cap assemblies.

2. For cap assemblies with aluminum wool installed, invert filler cap to expose washer (11). Press washer in to cap approximately 0.06 in. (1.5 mm) and release. Washer should spring back against ring (12). If washer does not immediately spring back into position aluminum wool packing (10) is dirty or an insufficient amount is installed.

65-40. Repair.

1. Repair intermediate gearbox filler cap assembly by same procedure outlined for tail rotor gearbox filler cap (paragraph 65-64).

65-41. Installation.**NOTE**

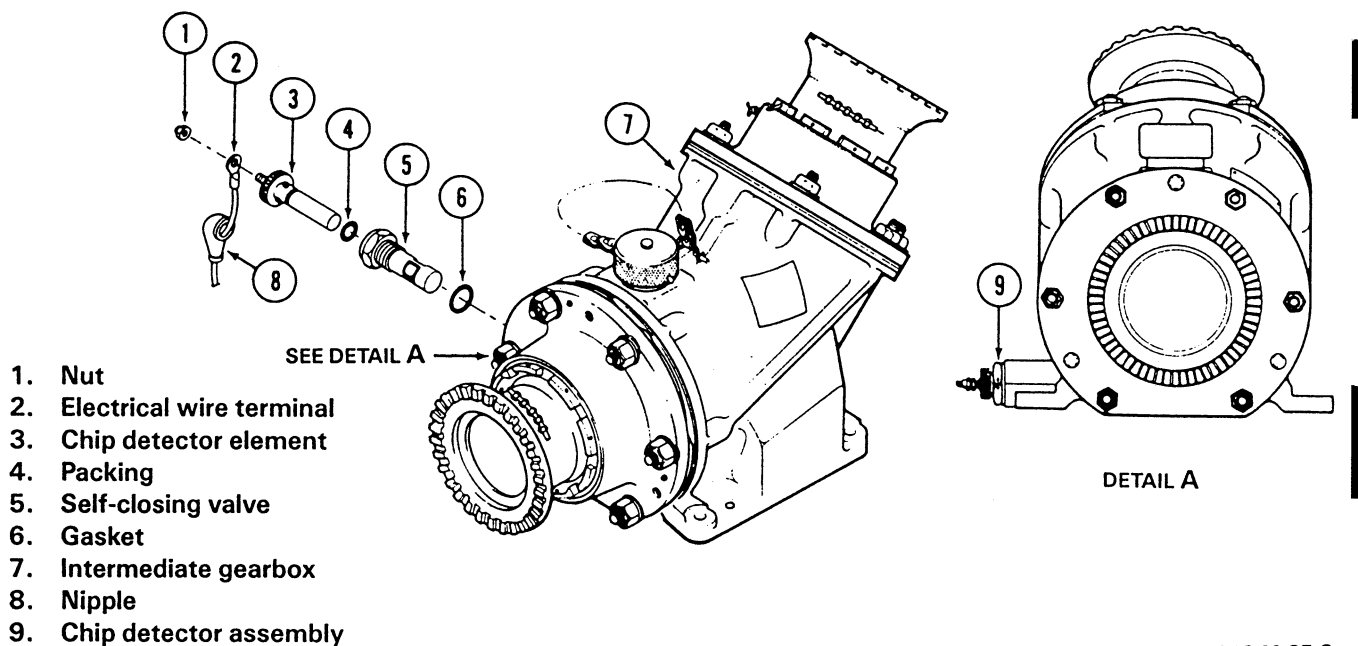
Ensure replacement cap is a breather type.

1. Position cap assembly on gearbox (4, figure 65-10). Push down on cap (6) and twist clockwise to engage pin (7) in slots in gearbox adapter.

2. Secure chain (3) to gearbox (4) with safety pin (1).

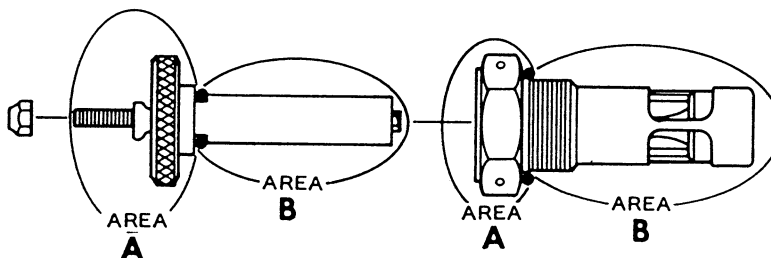
65-42. FLEXIBLE COUPLINGS.**65-43. Lubrication.**

For lubrication of input and output flexible couplings, refer to paragraph 65-14.



212-M-65-8

Figure 65-8. Chip detector



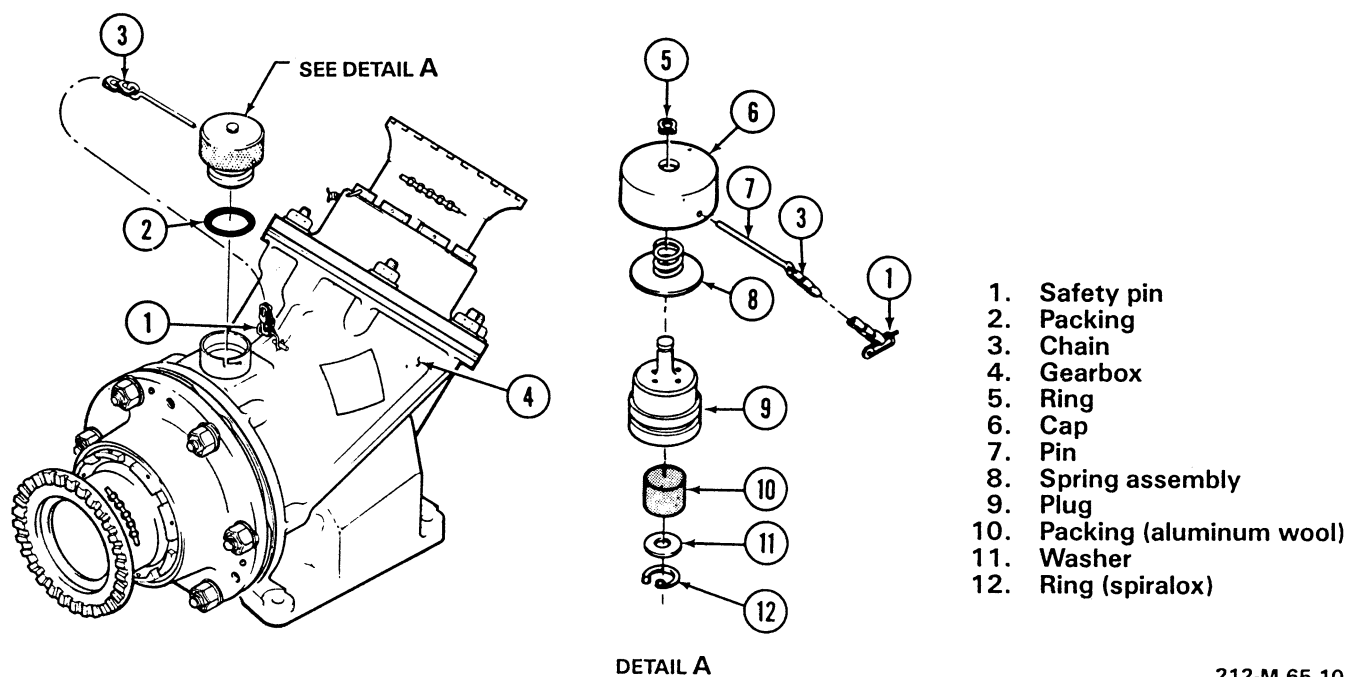
AREA

LIMITS

- All No cracks allowed.
- A Maximum depth of pitting is 0.030 inch (0.762 millimeter) with no more than 40 percent of any 1.0 inch (25.4 millimeters) square or 20 percent of total area of any surface to be pitted.
- B Maximum depth of pitting is 0.020 inch (0.508 millimeter) with no more than 40 percent of any 1.0 inch (25.4 millimeters) square or 20 percent of total area of any surface to be pitted. Thread damage is not permitted.

212-M-65-9

Figure 65-9. Chip detector damage limits



212-M-65-10

Figure 65-10. Oil filler cap

TAIL ROTOR GEARBOX

65-44. TAIL ROTOR (90°) GEARBOX.

65-45. REMOVAL.

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
DB3703-30	Drain line
T101264-103	Pusher set

1. When tail rotor (90°) gearbox is to be replaced, unless conditions prevent operation, perform a ten minute ground run. Drain operating oil using DB3703-30 drain line. If run up is not practical, remove tail rotor gearbox and flush with new lubricating oil of same type being used in gearbox. Attach tag to tail rotor gearbox stating: "PRESERVED WITH OPERATING LUBRICANT".

2. Remove tail rotor hub and blade assembly (Chapter 64).

3. Remove bolt (7, figure 65-11) and disconnect link (8) from lever (3).

4. Disconnect electrical wire and remove chip detector (paragraph 65-57).

5. Open vertical fin cover (12) and remove intermediate gearbox fairing.



REMOVE CLAMP SET FROM BOTH ENDS OF DRIVESHAFT (13) BEFORE REMOVING EITHER END OF SHAFT FROM CURVIC COUPLINGS OR SUPPORT UNATTACHED END OF SHAFT TO HOLD SHAFT ALIGNED IN NORMAL OPERATING POSITION WHILE GEARBOX IS REMOVED.

6. Remove driveshaft (13) (paragraph 65-5).

7. Remove six nuts (11) with steel washers (10).

8. Remove gearbox (1) from support fitting (14) using T101264-103 tailrotor gearbox pusher (figure 65-12).

NOTE

Install two spacers (15, figure 65-11), nut (11) with steel washer (10) on gearbox studs (17) to hold input quill in gearbox (1) while gearbox is removed from helicopter.

65-46. Cleaning.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-304	Solvent

1. Clean gearbox with clean cloth dampened in solvent (C-304).



DO NOT FORCE SOLVENT AND/OR DIRT INTO FLEXIBLE COUPLING WHEN USING COMPRESSED AIR.

DO NOT IMMERSE GEARBOX IN SOLVENT.

2. Dry with filtered, compressed air.

65-47. Inspection (installed).

1. Open vertical fin cover (12, figure 65-11).

2. Shake gearbox (1) and check for looseness on tail rotor gearbox support fitting (14).

3. Inspect for evidence of fretting corrosion at mating surface between gearbox (1) and tail rotor gearbox support fitting (14), which could be caused by movement of gearbox on support. A gray residue is an indication of fretting-corrosion. If residue is present, remove gearbox and inspect in accordance with [BHT-212-CR&O](#) and inspect tail rotor gearbox support fitting in accordance with [Chapter 53](#).

NOTE

Step 4 through step 9 are not applicable if gearbox is removed at step 3.

Oil leaks shall not exceed two drops per minute from any single source and shall not exceed a total of six drops per minute from all sources on gearbox.

4. Inspect gearbox for cracks and external damage, oil leaks, and unserviceable fittings.

5. Inspect six nuts (11) for correct torque and correct thread engagement ([paragraph 65-50](#)).

6. Inspect link assembly (8) and lever (3) for secure installation.

7. Inspect coupling (16) for grease leakage and outer coupling temperature indicator TEMP-PLATES for discoloration and overheat condition. A change in color of TEMP-PLATES (from white or light gray to black) will indicate a possible overheat condition and/or component degradation. The cause of discoloration shall be determined prior to continued operation. Refer to [paragraph 65-13](#) for inspection procedure.

8. Inspect oil sight glass for correct oil level. Inspect sight glass and indicator for damage and discoloration ([paragraph 65-54](#)).

9. Inspect electrical chip detector for metal particles and damage ([paragraph 65-58](#)). Refer to [Chapter 63](#) for metal particle identification and required maintenance actions.

65-48. Inspection (Off Helicopter)

Inspect gearbox and historical records for evidence gearbox has been involved in an accident or incident

requiring special or conditional inspection ([Chapter 5](#) and [BHT-212-CR&O](#)).

65-49. Repair

1. Polish out mechanical and corrosion damage within limits ([BHT-212-CR&O](#)).

2. Repair faulty oil filler cap ([paragraph 65-61](#)).

3. Replace faulty sight glass ([paragraph 65-52](#)).

4. Replace chip detector and/or self-closing valve that fails to pass inspection ([paragraph 65-56](#)).

5. Replace temperature indicator TEMP-PLATES ([Figure 65-11](#)). Refer to [BHT-212-CR&O](#) for installation procedures.

65-50. INSTALLATION

MATERIALS REQUIRED

Refer to [BHT-ALL-SPM](#) for specifications.

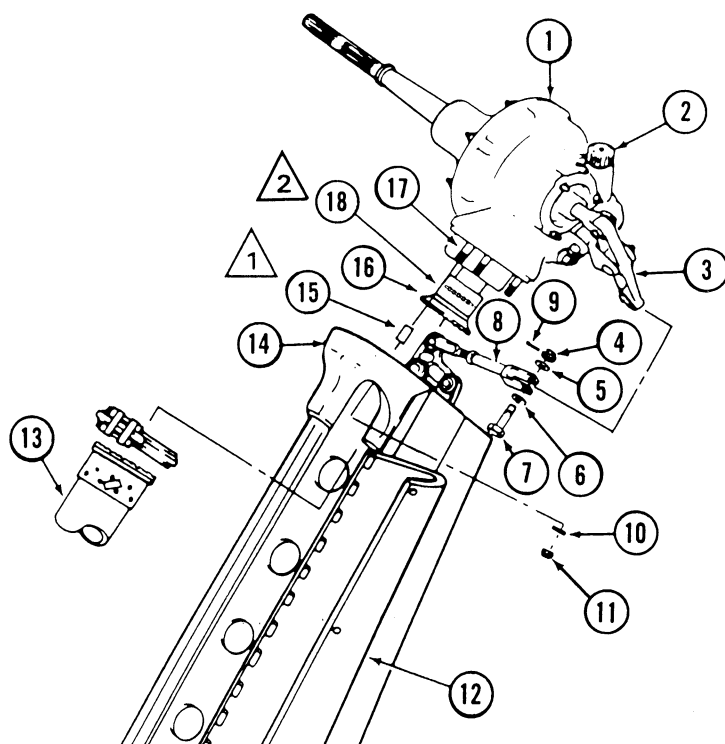
NUMBER	NOMENCLATURE
C-204	Epoxy Polyamide Primer
C-309	MEK

CAUTION

PRIOR TO INSTALLATION OF TAIL ROTOR GEARBOX, ACCOMPLISH THE FOLLOWING:

ENSURE GEARBOX FLEXIBLE COUPLING IS PROPERLY LUBRICATED ([PARAGRAPH 65-42](#)).

ROTATE FLEXIBLE COUPLING AND CHECK FOR BINDING AND FOR EXISTENCE OF BACKLASH BETWEEN PINION ON INPUT QUILL AND GEAR ON OUTPUT



NOTES

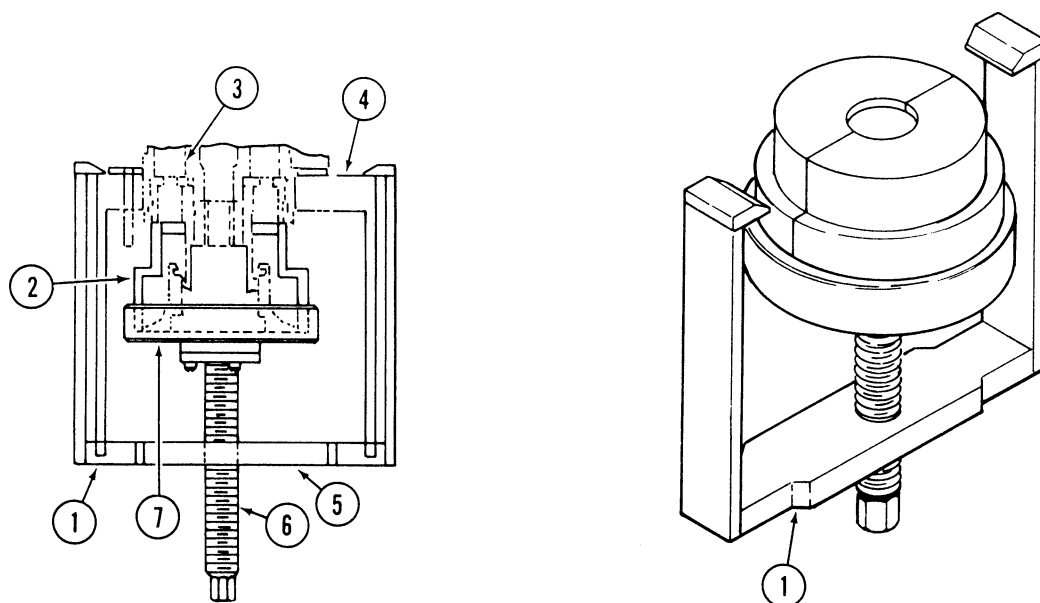
1 Shipping spacer is removed from gearbox prior to installation.

2 Refer to BHT-212-CR&O for TEMP-PLATE installation procedure.

1. Tail rotor gearbox
2. Cap assembly
3. Lever
4. Nut
5. Washer
6. Washer
7. Bolt
8. Link assembly
9. Cotter pin
10. Thin steel washer
11. Nut
12. Vertical fin cover
13. Driveshaft
14. Support fitting
15. Spacer (NAS43DD6-49) (2)
16. Coupling
17. Stud
18. Temperature indicator TEMP-PLATE

212-M-65-11

Figure 65-11. Tail rotor gearbox



1. Tail rotor gearbox pusher (T101264-103)
2. Adapter assembly (T101264-109)
3. Tail rotor gearbox assembly
4. Tail rotor gearbox support
5. Clamp assembly (T101264-107)
6. Screw Assembly (T101264-105)
7. Adapter retainer (T101264-121)

NOTES

1. If not previously accomplished, thread screw assembly (6) into clamp assembly (5). Allow sufficient clearance for positioning on support (4) and adapter assembly (2).
2. Position both halves of adapter assembly (2) on tail rotor gearbox (3) against input quill as shown.
3. Position tail rotor gearbox pusher (1) on gearbox and support with hooks of clamp assembly (5) centered securely over shoulders of support (4) and adapter retainer (7) over both halves of adapter assembly (2).
4. Tighten screw assembly (6) clockwise with a suitable wrench until tail rotor gearbox (3) separates from support (4). Remove tools and lift gearbox from support.

212-M-65-12

Figure 65-12. Tail rotor gearbox pusher T101264-103 tool application

SHAFT.

DRAIN PRESERVATIVE OIL (IF ANY) FROM GEARBOX AND SERVICE WITH GEARBOX OIL (CHAPTER 12).

1. Check mounting flange of gearbox (1, figure 65-11) for sealant protruding from the three jackscrew holes. Trim off sealant flush (using a sharp, non-metallic scraper) to allow proper seating of tail rotor gearbox (1) flange on support fitting (14).
2. Remove nuts (11), spacers (15), and washers (10) from studs (17) around input drive quill.
3. Using MEK (C-309) and a non-metallic scraper, clean mating surfaces of gearbox and tailboom support fitting.
4. Coat all faying surfaces of gearbox, studs, tailboom mount fitting, holes for studs in mount and washers with primer (C-204). Install gearbox while primer is wet.



ENSURE A MINIMUM OF TWO THREAD PITCHES, INCLUDING CHAMFER, EXTEND THROUGH NUTS (11). ENSURE NUTS DO NOT BOTTOM ON GRIP PORTION OF STUDS. USE ADDITIONAL THIN STEEL WASHERS (10) IF REQUIRED.

SHIPPING SPACERS (15) ARE FOR SHIPMENT OF GEARBOX ONLY, DO NOT INSTALL SPACERS.

NOTE

Perform special inspection (Chapter 5) after installation of tail rotor gearbox.

5. Position tail rotor gearbox (1) on support fitting (14) with coupling (16) and studs (17) through holes in support fitting (14).

6. Install six thin steel washers (10) and nuts (11).

7. Torque nuts evenly in a star pattern 200 to 235 in.lbs. (22.6 to 26.5 Nm). Repeat torque pattern until all nuts retain torque initially applied to first nut in pattern. Torque value of first nut will decrease as other nuts are torqued.

8. Use a 0.005 in. (0.127 mm) feeler gage to ensure no gap exists between gearbox input quill and gearbox shim.

9. Install driveshaft (13) (paragraph 65-8).

NOTE

Additional washers (5) may be used to align nut (4) for cotter pin installation.

10. Connect link (8) to lever (3). Install bolt (7) with one steel washer (6) under bolthead and one steel washer (5) under nut (4). Install cotter pin (9).

11. Install chip detector (paragraph 65-60).

12. Verify actual presence of oil in sight gage and check oil level to full mark on indicator.

13. Close vertical fin cover (12) and install intermediate gearbox fairing.

14. Install and rig tail rotor hub and blade assembly and controls (Chapter 64 and 67).

15. If gearbox has not previously been qualified on run-in test stand, accomplish alternate run-in and test (paragraph 65-51).

65-51. Alternate run-in test.**NOTE**

It is desirable that tail rotor gearbox, after overhaul, be test run and inspected in accordance with publication(s) furnished with run-in stand for qualification for flight. In the event a run-in stand is not

available, the following function test may be accomplished as a minimum acceptable alternate test.

Perform alternate run-in test for tail rotor gearbox per paragraph 65-28.

65-52. SIGHT GLASS.

65-53. Removal.

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
DB3703-30	Drain line

1. Remove chip detector (6, figure 65-13) (paragraph 65-57).

2. Insert one end of DB3703-30 drain line into container. Insert other end in hole where detector was installed. Oil will automatically drain.

3. Remove ring (5).

4. Remove glass (4) and packing (3). Discard packing.

5. Remove indicator (2).

6. Remove DB3703-30 drain line.

7. Install chip detector (paragraph 65-60).

65-54. Inspection and repair.

Inspect sight glass for crazing and discoloration. Inspect indicator for discoloration or any markings which would impair determination of oil level. Replace defective parts.

65-55. Installation.

1. Install indicator (2, figure 65-13).

2. Install new packing (3) on glass (4). Coat packing (3) with oil used in gearbox (Chapter 12). Install glass (4) in gearbox port.

3. Install ring (5).

4. Service gearbox to specified level (Chapter 12).

65-56. CHIP DETECTOR.

65-57. Removal.

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
DB3703-30	Drain line

NOTE

Electrical chip detector element (5, figure 65-14) may be removed for inspection without draining gearbox oil.

1. Move nipple (8) back on electrical wire (6) to expose nut (7). Remove nut (7) and wire (6).

2. Press in on knurled body of chip detector (5), turn counterclockwise to disengage locking mechanism, and withdraw element (5) from self-closing valve (3).

NOTE

If self-closing valve (3) is to be removed, drain gearbox oil into container with DB3703-30 drain line installed in valve (3).

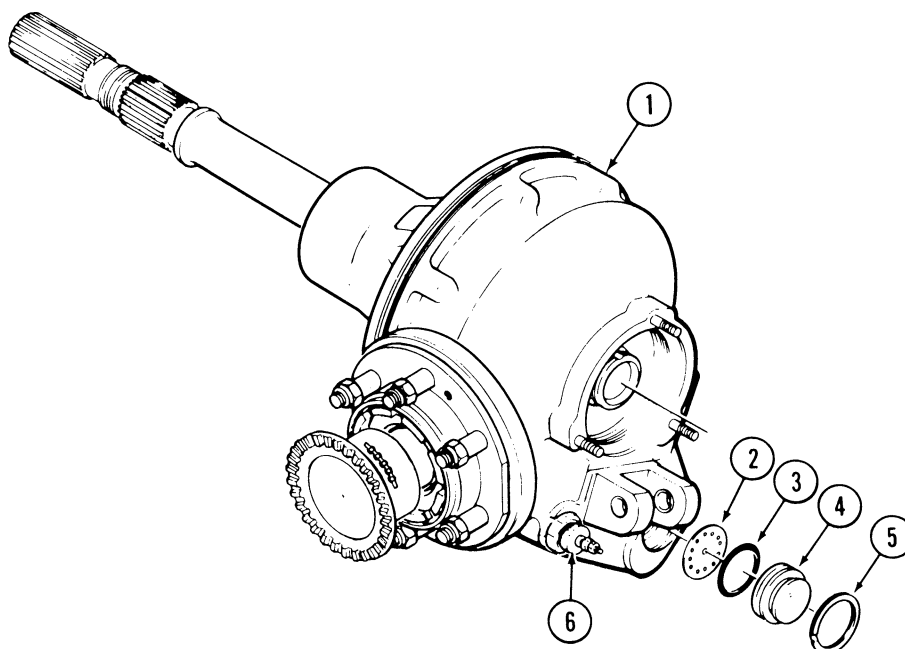
3. Remove valve (3). Remove packing (2) from valve (3). Discard packing.

65-58. Inspection.

1. Inspect electrical chip detector element (5, figure 65-14) for metal particles. Refer to Chapter 63 for metal particle determination and maintenance action required.

2. Inspect electrical chip detector components for damage (figure 65-15).

1. Tail rotor gearbox
2. Oil level indicator
3. Packing
4. Sight glass
5. Retaining ring
6. Electrical chip detector



212-M-65-13

Figure 65-13. Sight glass

65-59. Repair.

Repair of the electrical chip detector is restricted to replacement of defective parts.

65-60. Installation.**MATERIALS REQUIRED**

NUMBER	NOMENCLATURE
C-405	Lockwire

1. Lubricate new packing (2, figure 65-14) with lubricating oil used in gearbox and install packing on self-closing valve (3).

2. Install self-closing valve (3) on gearbox (1). Torque valve (3) 120 to 150 in.lbs. (14 to 17 Nm). Secure valve (3) to gearbox (1) with lockwire (C-405).

3. Lubricate new packing (4) with lubricating oil used in gearbox and install packing on

chip detector element (5). Insert element (5) into self-closing valve (3). Push down and twist element until locking detents engage.

4. Position electrical wire (6) on element (5) and install nut (7). Do not exceed 4 in.lbs. (0.45 Nm) torque on nut. Position nipple (8) over nut (7).

5. Service gearbox to specified level with approved lubricating oil if self-closing valve (3) was removed (Chapter 12).

65-61. OIL FILLER CAP.**65-62. Removal.**

1. Push down on cap assembly (6, figure 65-16) and twist to disengage pin (7) from gearbox (1).

2. Unsnap safety pin (4) from gearbox (1).

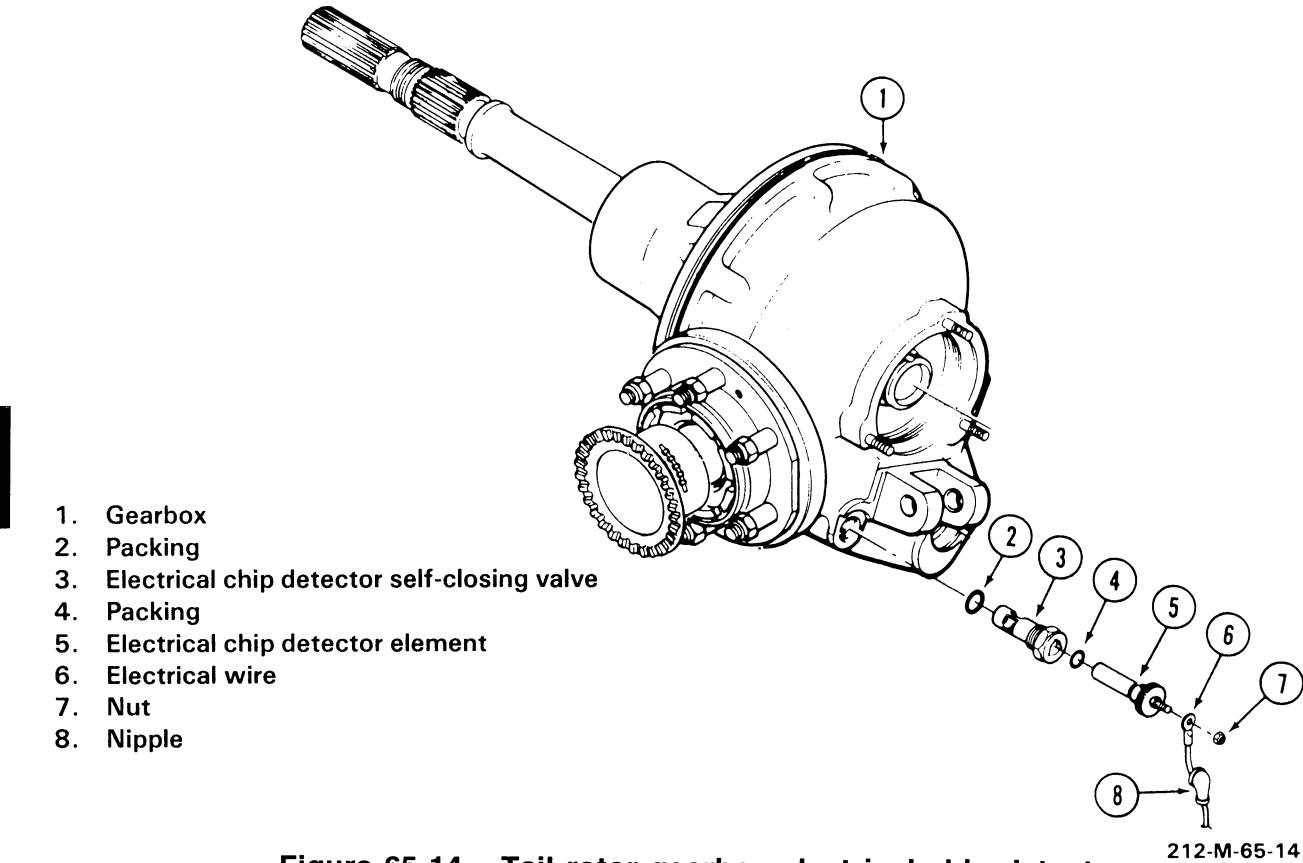


Figure 65-14. Tail rotor gearbox electrical chip detector

65-63. Inspection.

- 1. Inspect filler cap for distortion of pin (7, figure 65-16) or other damage which would affect function.

NOTE

Some cap assemblies have a stainless steel mesh plug installed in lieu of aluminum wool. The spring-back check is not required when stainless steel mesh plug is installed.

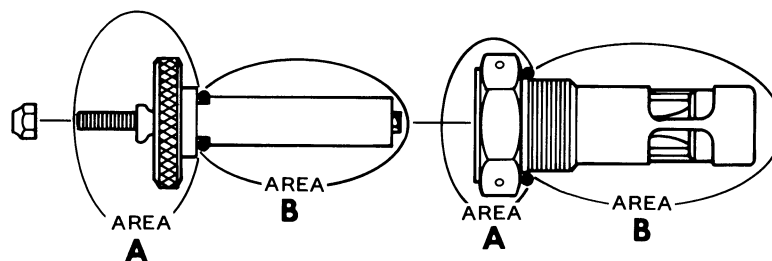
- 2. Invert the filler cap to expose washer (9).
- 3. Press washer approximately 0.06 in, (1.5 mm) and release. The washer should spring back against ring (8). If washer does not spring back, aluminum wool packing (10) is dirty or an insufficient amount is installed.

65-64. Repair.

MATERIALS REQUIRED

NUMBER	NOMENCLATURE
C-304	Solvent
C-422	Aluminum Wool

- 1. Repair is restricted to replacement of aluminum wool packing (10, figure 65-16) as outlined in steps 2. through 10.
- 2. Remove pin (7).
- 3. Remove ring (5), cap (6), and spring assembly (12) from plug (11).
- 4. Remove ring (8) and washer (9).
- 5. If installed, remove aluminum wool packing (10) and discard.
- 6. Clean parts with solvent (C-304).



AREA	LIMITS
All	No cracks allowed.
A	Maximum depth of pitting is 0.030 inch (0.762 millimeter) with no more than 40 percent of any 1.0 inch (25.4 millimeters) square or 20 percent of total area of any pitted surface.
B	Maximum depth of pitting is 0.020 inch (0.508 millimeter) with no more than 40 percent of any 1.0 inch (25.5 millimeters) square or 20 percent of total area of any pitted surface. Thread damage is not permitted.

212-M-65-15

Figure 65-15. Tail rotor gearbox electrical chip detector damage limits

7. For filler caps which are filled with aluminum wool, fill plug (11) with new aluminum wool (C-422) until washer (9) will spring back to original position after being pressed in 0.06 in. (1.5 millimeters). Add or remove aluminum wool as required.

8. Install washer (9) and ring (8).

9. Ensure packing (3) is in place and install spring assembly (12), cap (6), and ring (5) on plug (11).

10. Insert pin (7) through cap (6). Bend end of pin to secure.

65-65. Installation.

1. Position cap assembly on gearbox (1, figure 65-16). Push down on cap (6) and

twist clockwise to engage pin (7) in gearbox adapter.

2. Secure chain (2) to gearbox (1) with safety pin (4).

65-66. TAIL ROTOR GEARBOX FLEXIBLE COUPLING.

65-67. LUBRICATION.

For lubrication of input flexible coupling, refer to paragraph 65-14.

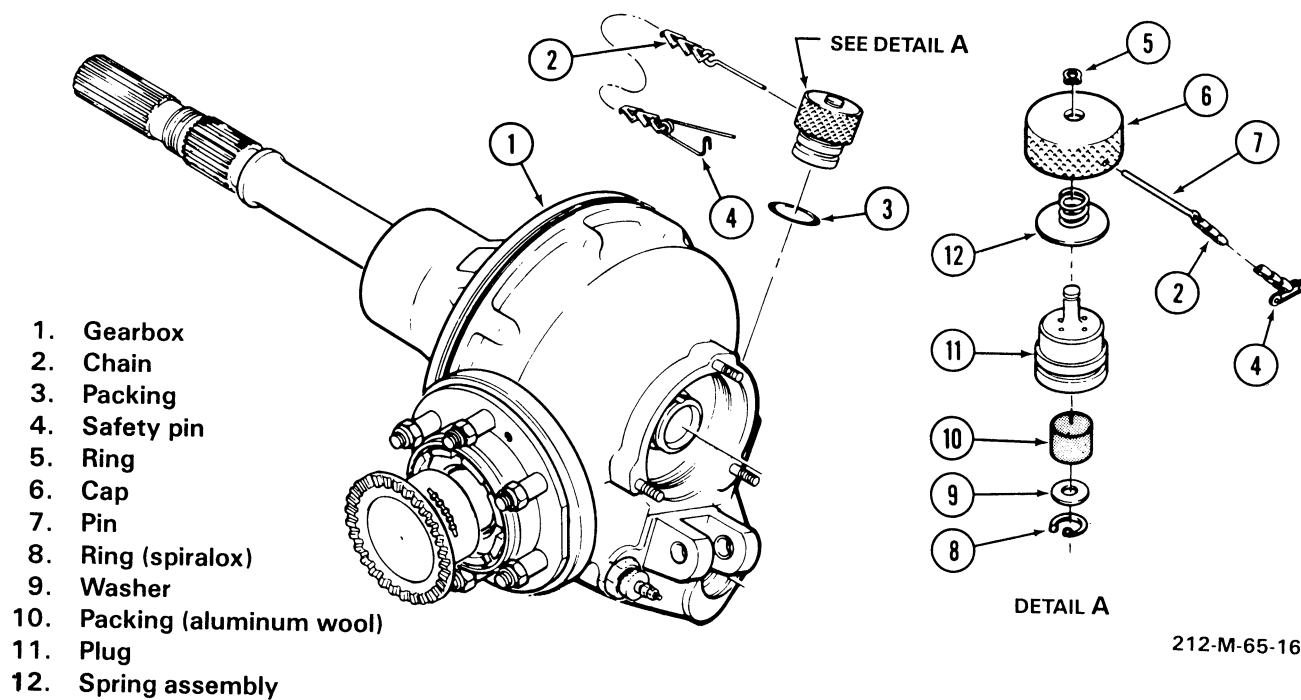


Figure 65-16. Tail rotor gearbox oil filler cap