SERVICE DEPARTMENT

Electro-Motive Division
Of General Motors
La Grange, Illinois 60525

Maintenance Instruction

AR6-D14 TRACTION GENERATOR

AR6-D14 traction generator maintenance and overhaul instructions are presented in six sections, each under separate cover. General maintenance instructions are included for the AR6-D14 combination. In addition, detailed instructions to completely disassemble, inspect, recondition, assemble, and test the AR6 traction generator are included. Performance of a specific procedure may require, as a prerequisite, the completion of a procedure contained in another section. In each case this procedure will be referenced.

Section No.	Title
1	Maintenance And Disassembly
▶2	Bearing Component Maintenance And Inspection
3	Stator Inspection, Reconditioning, And Test
4	Rotor Inspection, Reconditioning, And Test
5	Rectifier Bank Assemblies And Suppression Circuits
6	Assembly And Test

SECTION 2
BEARING COMPONENT MAINTENANCE AND INSPECTION

INTRODUCTION

Traction generator bearings have been designed to withstand rigorous conditions encountered in normal operation. They are manufactured to exacting tolerances necessary for this vital area of the generator.

In consideration of their importance, bearing components should be given the most careful handling and thorough inspection possible to qualify them for further use. No doubt should exist as to their ability to function until the next overhaul period. For this reason all questionable parts should either be repaired or renewed.

The bearing cover and exposed portions of the bearing when the cover is removed, require lubrication at intervals recommended in the Scheduled Maintenance Program. These parts can be lubricated while the generator is in place. Refer to Bearing Maintenance.

BEARING MAINTENANCE

Other than recommendations in the Scheduled Maintenance Program, no additional bearing lubrication is necessary. The following bearing lubrication procedure may be performed while the generator is in place.

1. Perform Procedure A under Generator Disassembly section in M.I. 3323-1.

2. Inspect grease in the bearing cover and inspect exposed side of bearing. Look for metal particles in the grease, excessive wear, fatigue damage on the rollers or roller path, or evidence of overheating. If any of the above conditions exist, all bearing components should be removed and and inspected. Refer to Bearing Component Inspection paragraphs.

3. If no distress is found, thoroughly clean bearing cover.

4. Fill labyrinth grooves in bearing cover with unweighed Shell Cyprina RA Grade 3 grease.

CAUTION: Shell Cyprina RA grease must be used exclusively, not mixed with other lubricants. Adequate lubrication depends upon precise weight of grease. Too much grease is as detrimental to life of bearing as too little.

5. Weigh piece of paper that will be used in handling grease to fill bearing cover. Weight of paper must be compensated for when weighing grease.

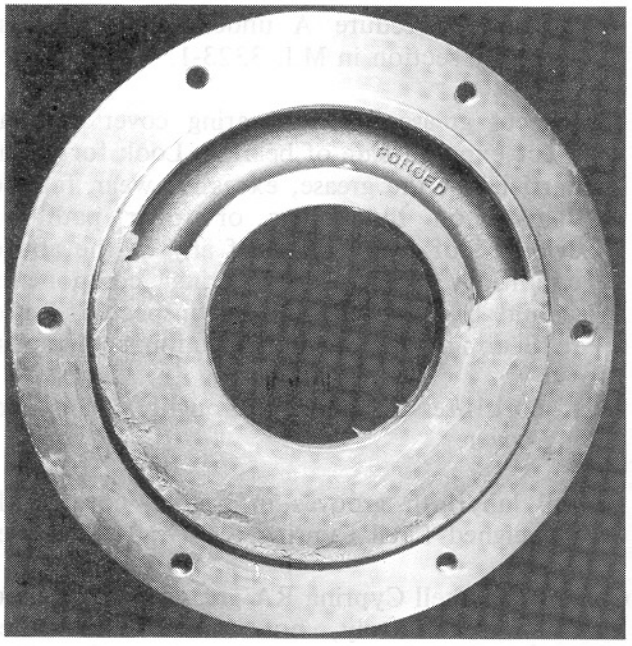
6. Carefully weigh amount of grease needed to fill bearing cover. Refer to Service Data for proper quantity and type of grease.

7. Pack grease into bearing cover groove. Leave a space free of grease at the top of the bearing cover. This will limit churning and liquefaction of the grease. Form grease to proper contour as shown in Fig. 1.

8. Remove old grease from exposed side of bearing and as much as possible from between the rollers and cage. Use only a putty knife and fingers. Do not use a solvent. Be careful not to introduce dirt or any other foreign substance into the bearing. Repack all spaces on the exposed side of the bearing with grease.

BEARING COMPONENT INSPECTION

Bearing parts should be thoroughly inspected for possible evidence of impending failure. If components show signs of distress or do not conform to dimensional checks, they should be renewed. The following items are helpful in inspecting bearing parts.



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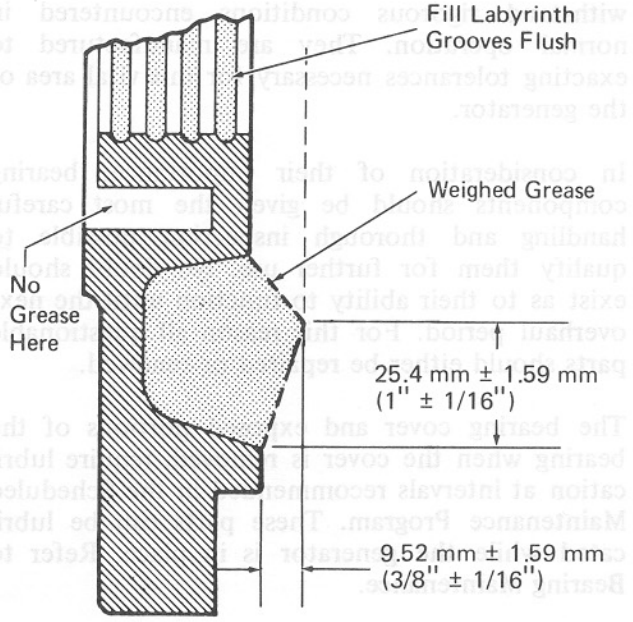

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Fig. 1 – Application Of Grease To Bearing Cover

CLEANING

Before attempting to make any inspection, the bearing components must be thoroughly cleaned. Stoddards Solvent (ASTM-D474-40) or similar noncorrosive solvent having a flash point of 46° C (115° F) or higher may be used.

A clean brush or lintless cloth can be used to facilitate cleaning. Gasket surfaces should be given special attention to remove all traces of remaining gasket material.

NOTE: If bearing components are not to be used immediately after inspection they should be coated with Shell Cyprina RA grease to prevent corrosion while in storage.

DIMENSIONAL CHECKS

BEARING HOUSING

1. Check inside diameter of bearing bore, Fig. 2.

2. Check housing to frame pilot diameter.

3. Check that insulation around housing diameter is not cracked, gouged, or damaged in any way.

BEARING CAP

1. Check pilot diameter, Fig. 3.

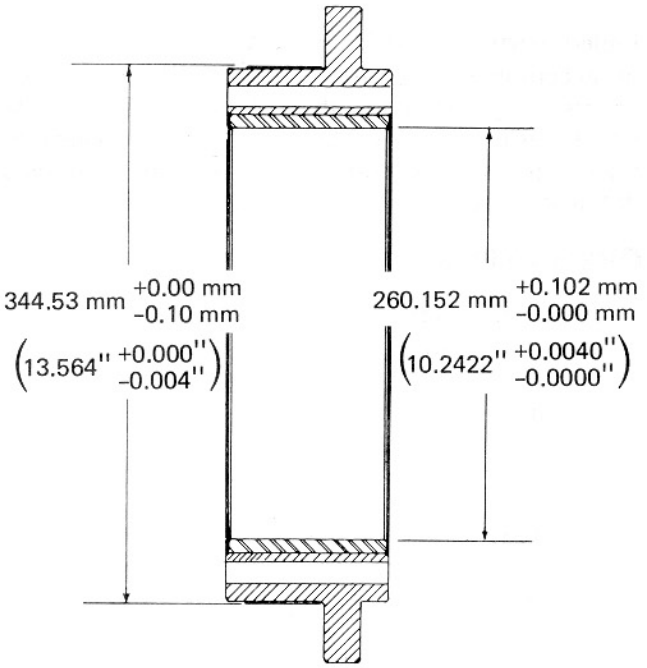

Fig. 2 – Bearing Housing Inspection

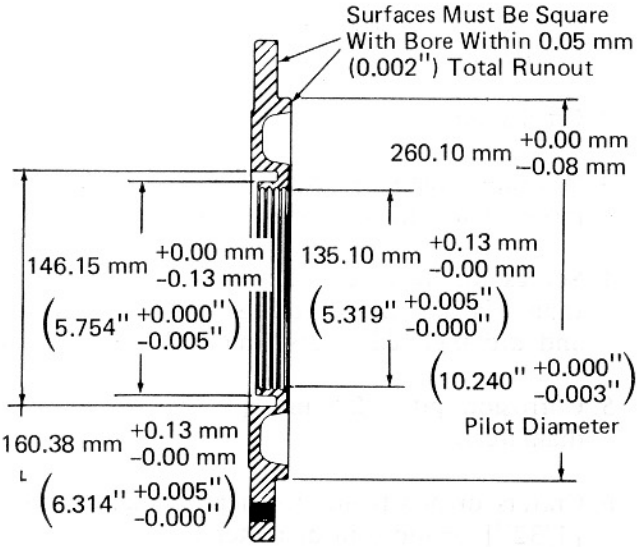

Fig. 3 – Bearing Cap Inspection

2. Check counterbore inside and outside diameters.

3. Check labyrinth bore diameter.

4. Inspect labyrinth lands for wear and broken lands. Small nicks should be blended.

BEARING COVER

1. Check pilot diameter, Fig. 4.

2. Check counterbore inside and outside diameters.

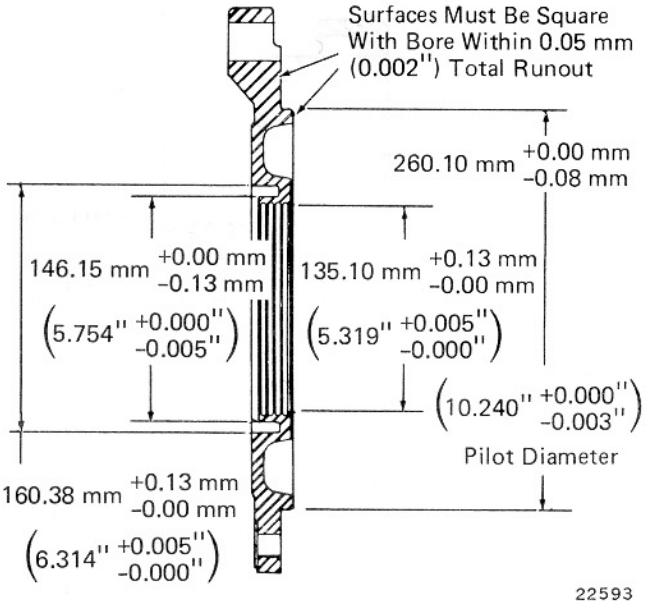

Fig. 4 – Bearing Cover Inspection

3. Check labyrinth bore diameter.

4. Inspect labyrinth lands for wear and broken lands. Small nicks should be blended.

INNER AND OUTER SEAL

1. Inspect bore diameter of both the inner and outer seals, Figs. 5 and 6.

2. Inspect all diameters for wear and rubbing.

3. Check that surfaces indicated in Figs. 5 and 6 are square with the bore.

BEARING

The inner and outer bearing races, Fig. 7, should be dimensionally checked to ensure proper fits and to determine internal clearance due to wear.

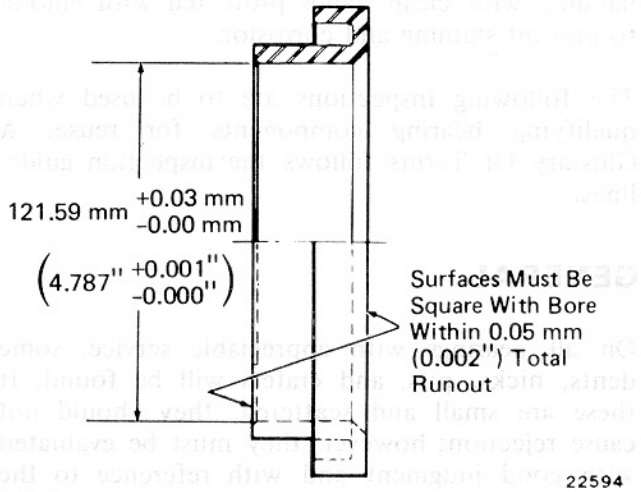

Fig. 5 – Inner Seal Inspection

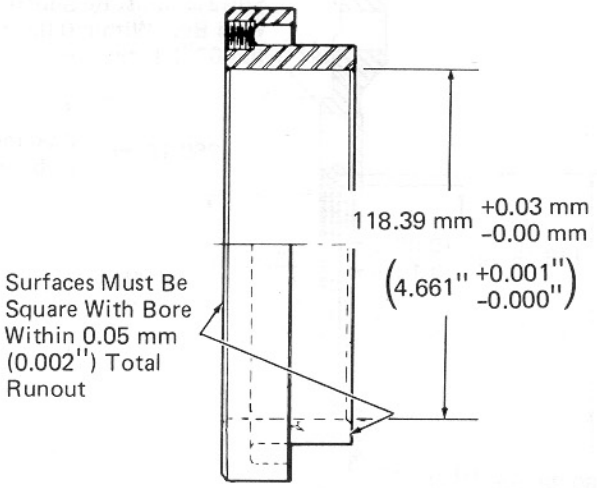

Fig. 6 – Outer Seal Inspection 22595

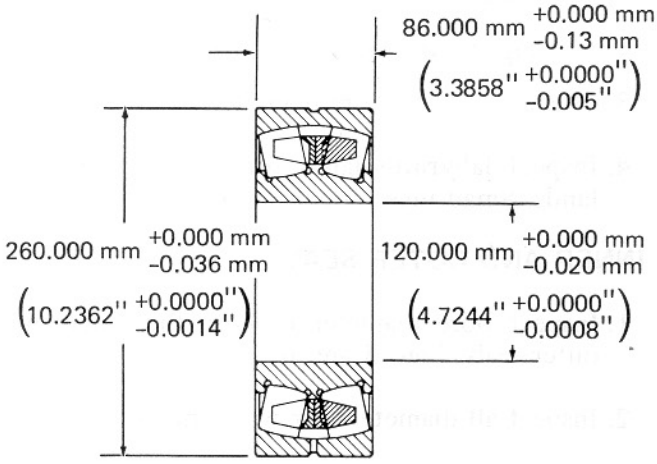

Fig. 7 – Bearing Inspection 22596

VISUAL INSPECTION

Bearing components should be carefully inspected with the aid of adequate light and a magnifying glass, to prevent eye strain. Bearings should be handled with clean hands protected with lanolin to prevent staining and corrosion.

The following inspections are to be used when qualifying bearing components for reuse. A Glossary Of Terms follows the inspection guidelines.

GENERAL

On all bearings with appreciable service, some dents, nicks, pits, and craters will be found. If these are small and scattered, they should not cause rejection; however, they must be evaluated with good judgment and with reference to the overall condition of the bearing. All doubtful parts should be discarded.

Failed parts should be replaced with either new or acceptable reconditioned parts. If one part of an assembly has been subjected to excessive stress which results in a visible defect severe enough to reject the part, the rest of the assembly requires a detailed inspection and evaluation before use.

OPERATING SURFACES

All exposed operating surfaces must be inspected visually to ensure that they contain none of the following defects which will be cause for rejection:

1. Protrusions above the normal surface.

NOTE: Protrusions should be reduced to the normal surface by light circumferential honing with Arkansas stone (novaculite) or grade 240 abrasive cloth. Likewise, the sharp edges should be smoothed. Care must be taken to work down to the normal surface only, to prevent reduction of contact area, and to work circumferentially so as to prevent the formation of flats.

2. Cracks and flats.
3. Ruptures, tears or seams (2.4 mm [3/32"] or more in length, or more than hairline width).
4. Scores, or deep scratches which extend more than 3/4 the length of the operating surface and are inclined at less than 10° to the axis.
5. Corrosion pits. (0.8 mm [1/32"] or more in diameter.)
6. Craters or pits from electrical arcing. (0.8 mm [1/32"] or more in diameter.)
7. Profuse denting or cratering.
8. Overheating.
9. Circumferential pattern of pits or dents at the ends of the roller path.
10. Fatigue pits, flaking, shelling or galling.

NON-OPERATING SURFACES

All non-operating surfaces are to be visually inspected for:

Rust – Remove by rubbing with a grade 240 abrasive cloth. If rust pits of great depth are encountered they must be cleaned.

Galling -- Smooth down by rubbing with a grade 240 abrasive cloth. Care must be taken not to reduce the normal surface. (See Dimensional Checks.)

Cracks – Reject bearing.

Severe Physical Abuse – Evaluate to determine whether it is heavy enough to affect the operating surfaces. In addition, each such location must be reduced by light honing with an Arkansas stone (novaculite).

Overheating – Reject bearing.

CAGES

Cages must be inspected to ensure that they are free from cracks and burrs.

GLOSSARY OF TERMS

Cracks -- Separations of the bearing material resulting in jagged dark lines or chasms, caused by material defects, severe mishandling, overheating, overstressing, or fatiguing.

Craters -- Small deformities in the normal surface with ragged edges, molten, discolored, bright bottoms, and a contrasting edge. They are formed by the passage of electrical currents through the bearing and are dangerous when the area is large enough to increase the unit load, or when the depth indicates a large electrical discharge and subsequent tempering of the bearing metal.

Dents -- Shallow deformations in the normal surface. They are caused by smoothedge particles being forced or rolled into the surface. If severe, they may rupture the surface, cause a protrusion, or if large, act as a flat.

Flaking – Small areas of the normal surface where the steel has been freed, revealing a "fish-scale" appearance. Flaking is usually the next stage after pitting (but sometimes is the first apparent indication of fatigue) which has developed from a pit formed since the last inspection.

Flats -- Sections of the normal surface with bright bottoms which have been reduced from the original diameter. They can be caused by grinding, severe denting due to handling, skidding of a roller when held in the loaded area, by faulty reduction of a protrusion, and by severe denting from static load (brinnelling). Flats cause the bearing parts to be stressed abnormally.

Galling – Transfer of metal from one part onto another. This is caused by relative motion under extremely high pressures without lubrication, generally accompanied by heating.

Nicks – Sharp-bottomed deformation in normal surface of some depth, but relatively little width. They are caused by a sharp edge being forced into the surface. If severe, they may rupture the surface or cause a protrusion.

Operating Surfaces -- The areas of the rollers and races which contact each other under load.

Pits – Small holes in the normal surface with ragged edges and dark bottoms. They are caused by extended corrosion, fatigue cracking, and minute flaking. Those due to fatiguing will generally be accomplished by indentation or imprinting of the material freed from the surface and then rolled between the rollers and races. Those due to corrosion will be localized to those sections originally stained or etched. It can be seen that fatigue pits are the initial signal of failure and the end of useful life, and therefore demand scrapping of the parts involved. Corrosion pits, if isolated and arrested in growth, are dangerous only in that they reduce the contact area and increase the unit load, thereby increasing the rate at which the part is fatiguing.

Protrusions – Metal displaced above normal surface. On operating surfaces, this results in stress concentrations at protrusions and hastens fatigue. They are found around some dents, nicks, scratches, scores, and craters.

Roller Path -- That section of the race which the rollers contacted in service. This can be detected from the normal surface by the wearing of the original grinding nap.

Ruptures -- Separations of the normal surface generally leaving sharp corners, jagged edges, or cracked sections at their bottoms. They are found in some dents, scratches, nicks, and scores. Ruptures are the focal points for fatigue stresses and so can be the origin of the cracks, pits, flaking, spalling, and the ultimate failure.

Scores -- Axial deformations of heavy character with a rough or torn bottom. They are caused by gouging a bearing surface while forcing a roller over a race under load and while slightly cocked.

Scratches – Deformations of the normal surface with bright bottoms caused by forcing hard sharp

objects over the surface in long, narrow, sharp-bottomed gouges. Scratches are generally of little danger so long as they have no protruding edges, do not rupture the normal surface, and do not constitute a flat.

Seams – Inclusions of foreign material in the bearing metal which are exposed on the normal surface. They are harmful only when too large or numerous.

Shelling – Areas on the normal surface where the material has broken loose, leaving jagged edges with a rough "washboard" bottom which is sometimes bright. This is caused by advanced fatiguing beyond the pitting state, in which large sections of the surface are freed by extensive subsurface cracking.

GREASE APPLICATION

The final step before assembling the bearing components to the generator is lubrication. When assembling sealed lubricated bearings, Shell Cyprina RA Grade 3 grease should be used exclusively. The importance of following the recommended procedure can be emphasized by a description of how the grease lubricates the bearing during operation.

Fundamentally, lubrication is accomplished in the following way:

1. When applied as recommended, oil bleeds into the required areas by contact with that area. Intimate cage and roller end grease contact softens a small amount of grease, gradually releasing the oil lubricant.

2. Solidly packed grease within the contact area forces the released oil into the bearing.

3. Proper quantities of grease spread on the roller cage assembly (ID and OD) prevent roller skidding and scuffing.

4. By purposely leaving a space free of grease at the top of the bearing cap and cover churning and liquefaction is limited.

Particular care and attention should be given to the proper application of grease lubricant to The bearings. The precautions listed below should be observed.

1. All assembly parts must be thoroughly cleaned of all foreign material and previous lubricant. All cleaning solvents must be removed, and all parts perfectly dry before applying grease. Keep new or remanufactured bearings in their wrapping until application of grease. The lubricant applied to these bearings, when packaged, is compatible with Cyprina RA-3 grease, therefore, if kept clean, the bearings need not be washed.

2. Cyprina RA-3 grease must be used exclusively, and not mixed with other lubricants.

3. Adequate lubrication depends upon precise weight of grease as determined by an accurate scale. Too much grease is as detrimental to the service life of the bearing as too little.

4. Cleanliness can be ensured by obtaining grease direct from covered containers by use of a hand or motor driven pump, of a type that will not soften or harden (± 5 ASTM penetration) the grease during handling. If a pump is not used, extra precaution must be used to prevent contamination of the grease in the pail or drum. Grease should be handled on a clean piece of oil proof paper.

5. A clean steel-bladed spatula or putty knife should be used during intermediate handling of the grease, and for greasing the bearing parts. Use of bare hands should be avoided, wherever possible, to prevent accidental inclusion of dirt or other contaminants.

PROCEDURE

1. After thorough cleaning and inspection of all bearing parts, fill the labyrinth grooves in the bearing cap and cover flush with unweighed grease, Fig. 8.

CAUTION: Shell Cyprina RA grease must be used exclusively, not mixed with other lubricants. Adequate lubrication depends upon precise weight of grease. Too much grease is as detrimental to life of bearing as too little.

2. Weigh piece of paper that will be used in handling grease. Weight of paper must be compensated for when weighing grease.

3. Carefully weigh grease for the specified bearing part to be greased. See Service Data for proper quantities of grease.

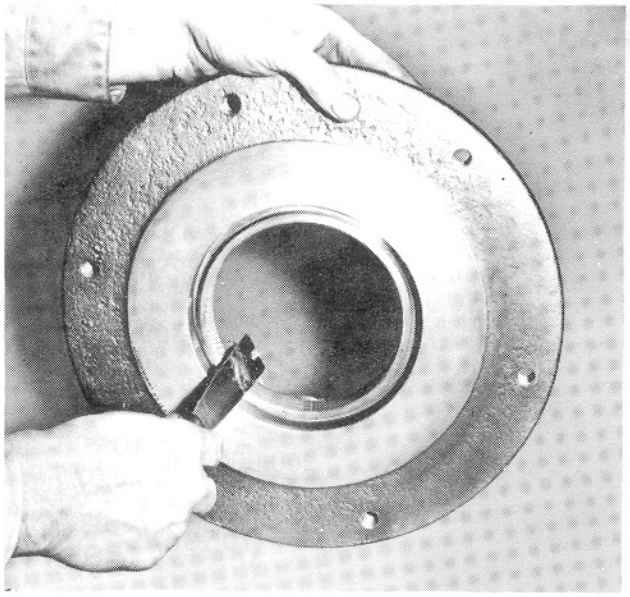

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Fig. 8 – Grease Application To Labyrinth Grooves

4. Pack bearing rollers and space between rollers with measured grease. Use unweighed grease to pack groove in bearing outer race.

5. Grease application to bearing cap and cover.

   a. After weighing, use spatula or putty knife to apply grease to cap or cover. Roughly form grease, as shown in Fig. 9, into approximate desired contour.

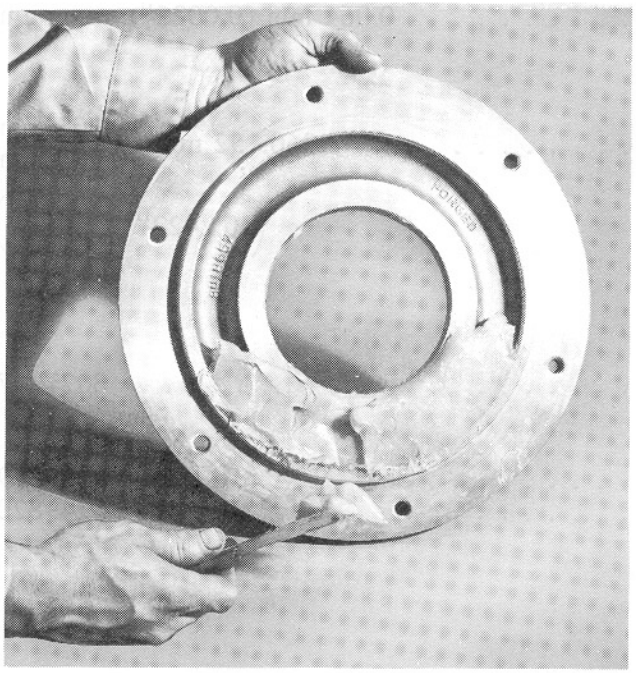

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Fig. 9 – Roughly Formed Grease Contour

   b. Grease should be solidly packed only into lower 180° to 240° (dependent on the part and specified quantity) of the cap or cover keeping the ungreased portion at the top, Fig. 10.

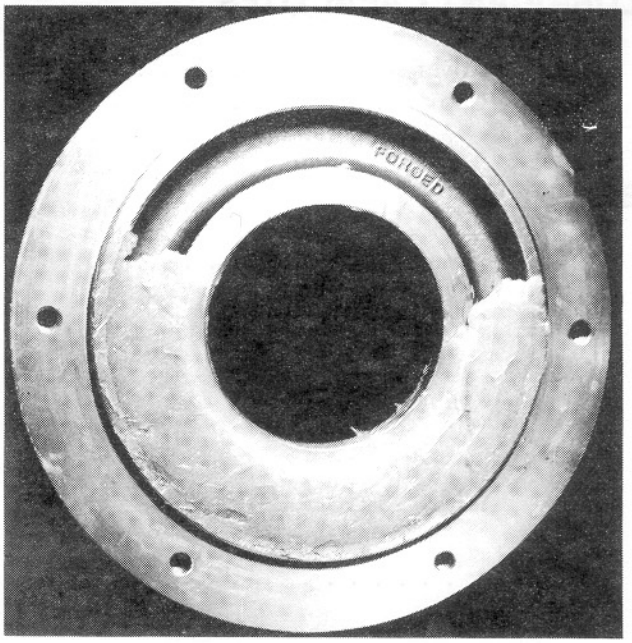

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Fig. 10 – Grease Position

   c. Form grease to proper contour, Fig. 11.

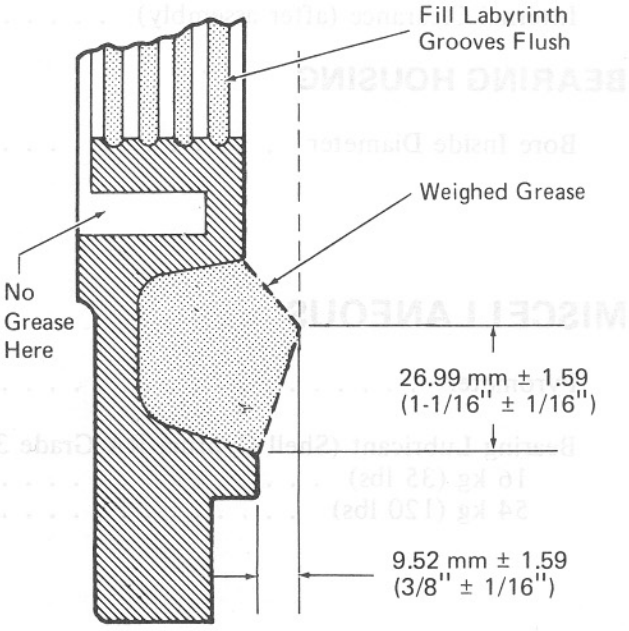

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Fig. 11 – Application Of Grease To Bearing Cap And Cover

SERVICE DATA

SPECIFICATIONS

LUBRICANT CAPACITIES

Bearing Cover	284 g (10 ozs)
Bearing Cap	284 g (10 ozs)
Bearing	369 g (13 ozs)

BEARING

Outer Diameter	260.000 mm $^{+0.000\ mm}_{-0.036\ mm}$
	$\left(10.2362'' \ ^{+0.0000''}_{-0.0014''}\right)$
Bore	120.000 mm $^{+0.000\ mm}_{-0.020\ mm}$
	$\left(4.7244'' \ ^{+0.0000''}_{-0.0008''}\right)$
Width	86.000 mm $^{+0.00mm}_{-0.13\ mm}$
	$\left(3.3858'' \ ^{+0.000''}_{-0.005''}\right)$
Internal Clearance (before assembly)	0.104 mm to 0.150 mm (0.0041" to 0.0059")
Internal Clearance (after assembly)	0.064 mm (0.0025") minimum

BEARING HOUSING

Bore Inside Diameter	260.152 mm $^{+0.102\ mm}_{-0.000\ mm}$
	$\left(10.2422'' \ ^{+0.0040''}_{-0.0000''}\right)$

MISCELLANEOUS

Pyrometer	8027937
Bearing Lubricant (Shell Cyprina RA Grade 3)	
16 kg (35 lbs)	8249819
54 kg (120 lbs)	8249820

Litho in U.S.A.