C.M.I. 3954-2

CLYDE MAINTENANCE INSTRUCTION

D43 TRACTION MOTOR OVERHAUL

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SECTION 2
BEARING COMPONENT INSPECTION

NOTE

This D43 Traction Motor overhaul instruction is presented in seven sections, each under separate cover, and contains detailed instructions to completely disassemble, inspect, overhaul, assemble, and test the traction motor.

Refer to Maintenance Instruction, CMI 3901, for general or"running" maintenance of the traction motor and also for procedures to remove the traction motor from the locomotive truck.

Section No.	Title
1	Disassembly
2	**Bearing Component Inspection**
3	Stator Inspection and Reconditioning - Mechanical
4	Stator Inspection and Reconditioning - Electrical
5	Armature Inspection and Reconditioning
6	Armature Overhaul
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1.RETAINER
2.BEARING COLLAR
3.BEARING COVER
4.BEARING HOUSING
5.BEARING OUTER RACE
6.COLLAR
7.SEAL
8.BEARING INNER RACE
9.SPIDER-COMMUTATOR

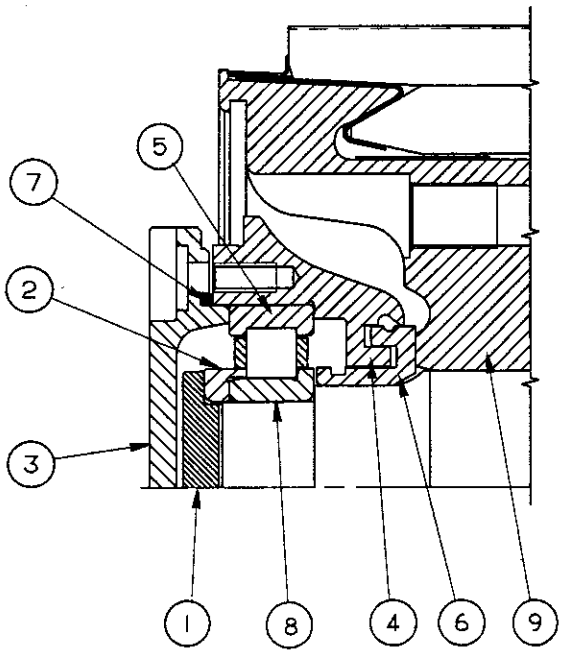

Fig. 1 - Commutator End Bearing Arrangement

1. INNER OIL SEAL
2. HOUSING BEARING
3. BEARING OUTER RACE
4. BEARING COVER
5. OUTER OIL SEAL
6. PARTITION PLATE
7. OUTER GREASE SLINGER
8. BEARING INNER RACE

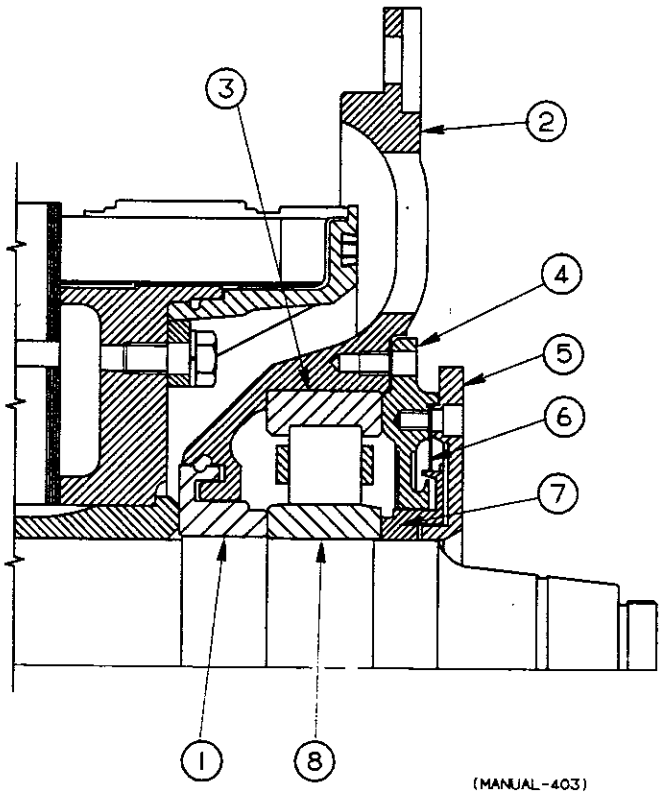

Fig. 2 - Pinion End Bearing Arrangement

BEARING COMPONENT INSPECTION

INTRODUCTION

This section contains inspection procedures and condemning limits of bearing components Figs. 1 & 2.

The condemning limit is given on the illustration as a minimum or maximum dimension along with the manufacturing tolerance for the dimension. The condemning limits are given only where wear or distortion is permitted. Any bearing component which does not meet the limits of this Maintenance Instruction should be replaced with a new bearing component.

Bearing parts should also be thoroughly inspected for possible evidence of impending failure. Any part which shows signs of distress should be replaced with a new part.

The armature bearings are critical components of the traction motor and should be given most careful handling and a thorough inspection.

CLEANING

Components associated with the bearing assembly, such as housing, cap, cover and seals should be thoroughly cleaned prior to inspection to remove all dirt, grease, and other foreign materials. Shellsol 1626 Solvent or similar non-corrosive solvent having a flash point of 40° C can be used.

CAUTION :
Do not wash bearing housing assembly in caustic or submit to cob blast.

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.

BEARING ASSOCIATED COMPONENTS

COMMUTATOR END BEARING HOUSING

NOTE: The bearing housing bore diameters should be checked dimensionally and not rejected for evidence of rubbing or wear.

1. Check bearing bore diameter, Fig. 3. The bore diameter should be 159.96mm +0.015 mm, -0.00 (6.2976" +.0006, -.0000). When bore diameter is beyond acceptable limits and all other dimensions are within tolerance, the bore may be restored by iron, nickel, or chrome plating and remachined to new bore tolerance.

2. Scoring up to 6.4 mm (.25") wide and 0.4mm (.015") deep is permitted in the bearing bore surface, provided raised edges of the score marks are removed and the total area does not exceed 25% of the bore surface. Fretting or discolouration caused by fretting is permitted in the entire bore if a good bearing surface remains.

3. Check pilot diameter. Condemning limit is 212.75mm(8.376").

4. Bearing housing mounting surface and bearing bore faces should be square with the bore within 0.05 mm T.I.R.

5. The pilot diameter is to be concentric with the bore diameter within 0.10 mm T.I.R.

6. The six bearing cap holes should be 18 mm or be enlarged to 18 mm.

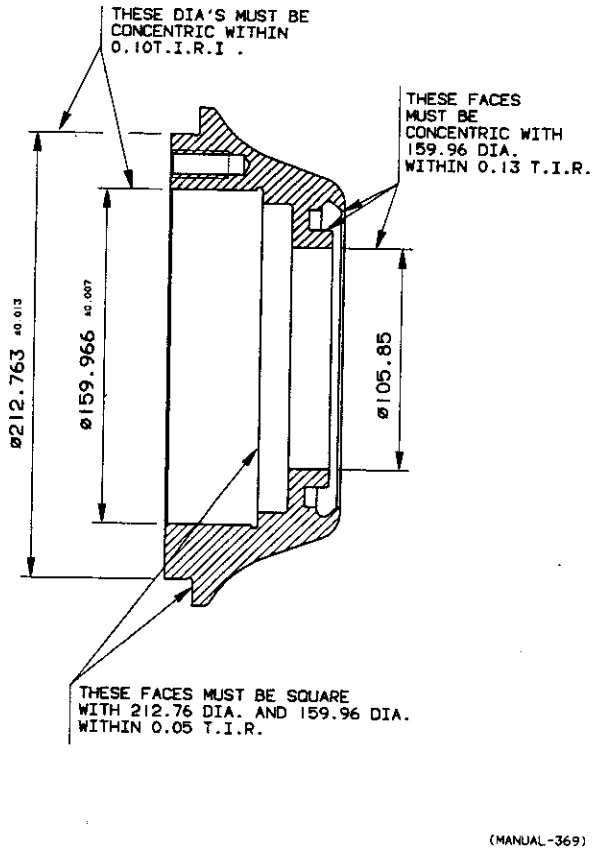

Fig. 3 - Commutator End Bearing Housing

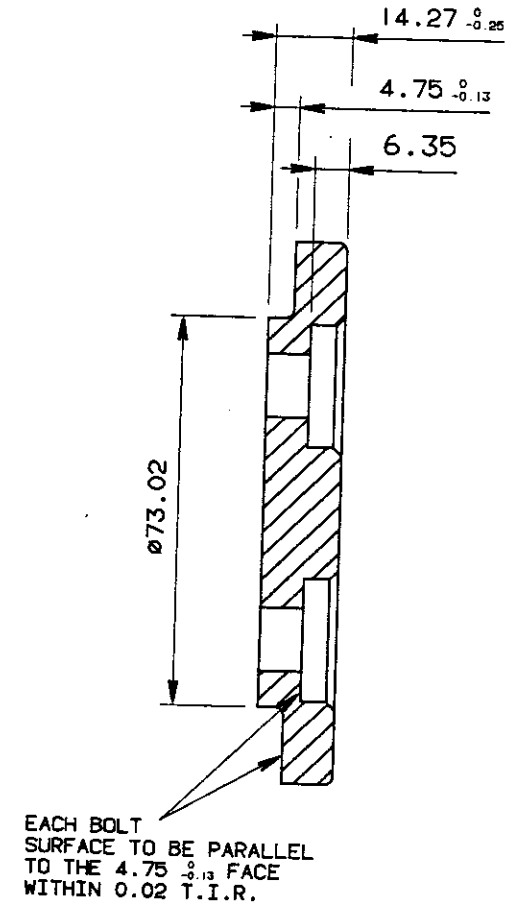

Fig. 4 - Commutator End Bearing Retainer

7. Check the threads of the eight 1/2"-13 UNC tapped mounting holes. The threads should be class 2B.

8. Check the inner diameter Fig. 3. the diameter should be 105.8mm +0.12mm -0.00mm,(4.165" +0.005" - 0.00").

9. The housing to collar mounting faces are to be concentric with the bore diameter within 0.13 mm T.I.R.

10. After inspecting the bearing housing, paint the back side with one coat of red air drying enamel. Keep enamel off machined faces, fits and bearing bore.

COMMUTATOR END BEARING RETAINER

1. The bearing retainer, Fig. 4, must be flat within 0.013 mm T.I.R..

2. Retainer must not be damaged. No tears or gouges are acceptable.

3. Bolt surface finish acceptable to 200 micro-inches.

COMMUTATOR END COLLAR

1. Check collar bore diameter, Fig.5. The collar bore diameter should be a minimum of 88.90 mm (3.500") and a maximum of 88.93 mm (3.501").

2. Indicated faces to be square with bore within 0.13 mm T.I.R..

3. Indicated diameters must be concentric with the bore diameter within 0.13 mm T.I.R..

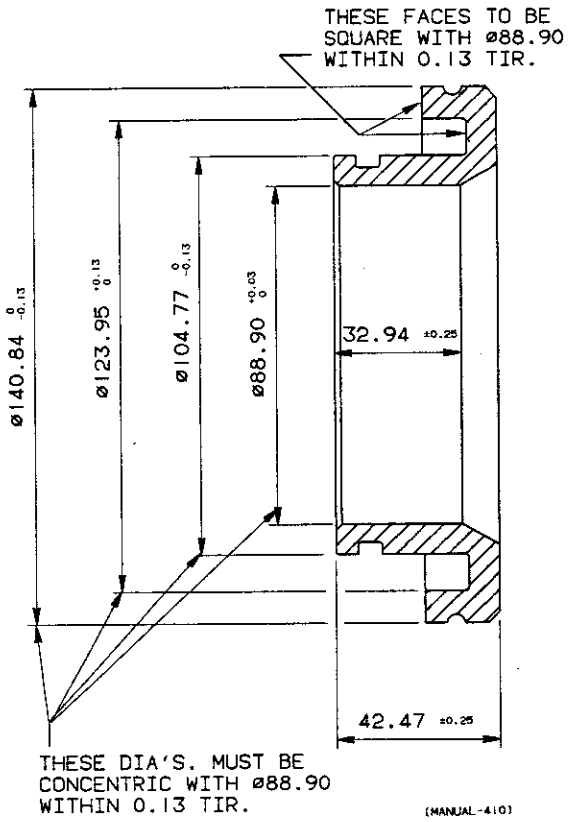

Fig. 5 - Commutator End Collar

COMMUTATOR END BEARING COVER

1. Check depth of grease pocket, Fig.6. Minimum depth over the entire area shall not be less than 23.8 mm (0.937"). Paint inner surface with one coat of red air drying enamel.

2. Indicated surfaces to be perpendicular to the bore diameter within 0.05 T.I.R..

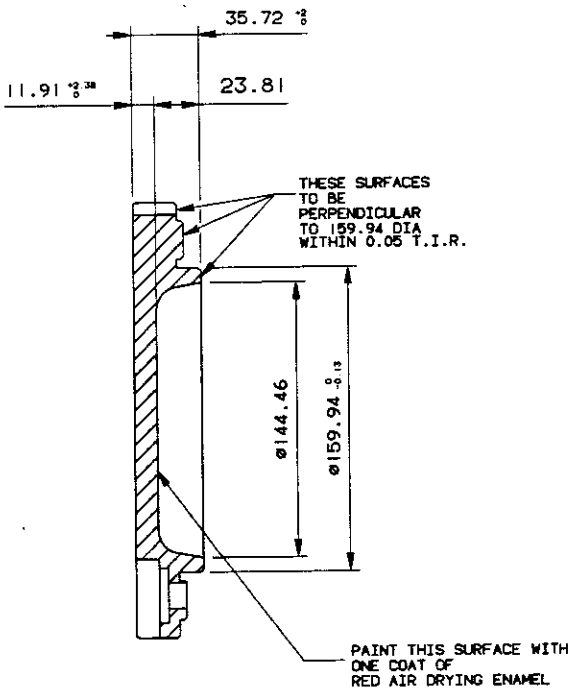

Fig. 6 - Commutator End Bearing Cover

PINION END BEARING HOUSING

1. Check the small diameter. The bearing cap diameter Fig. 7, should be a minimum of 168.27mm (6.625") and a maximum of 168.40 mm (6.630").

NOTE: The bearing housing bore diameters should be checked dimensionally and not rejected for evidence of rubbing or wear.

2. Check the inner diameter. The diameter should be a minimum of 204.22 mm (8.040") and a maximum of 204.35 mm (8.045").

3. Check the threads of the eight 5/8"-11 UNC tapped holes. The threads should be class 2B.

4. The bore diameter and mounting flange diameter are to be concentric within 0.1 mm T.I.R..

5. Check bearing housing bore diameter, should be a minimum of 279.95mm (11.02") and a maximum of 279.98mm (11.023").

6. Inspect the housing for warping and distortion. The frame mounting surface to the inside face shall not exceed 100.79 mm at the three jackscrew holes.

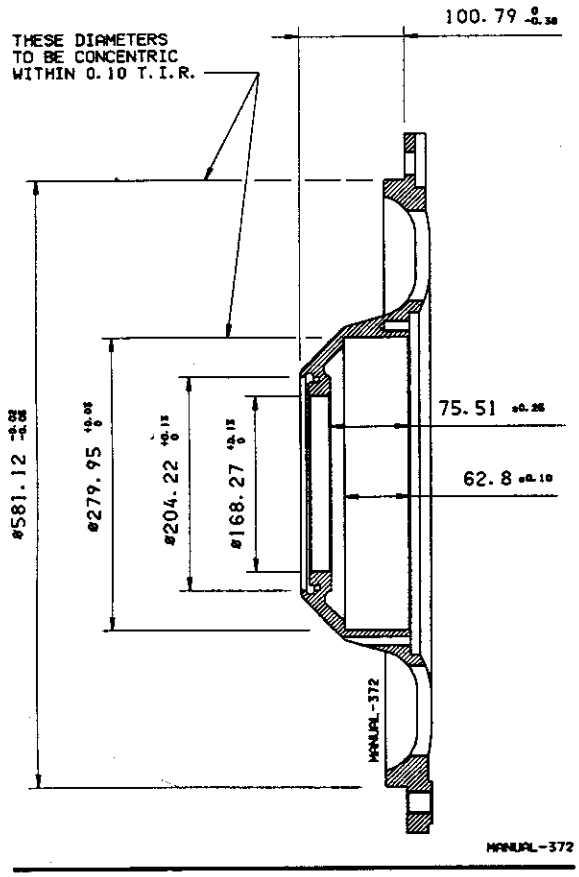

Fig. 7 - Pinion End Bearing Housing Cross Section

7. Check the thickness at the bore. The thickness should be a minimum of 62.70 mm (2.44").

8. Paint the outside of the bearing housing with one coat of red air drying enamel.

GEAR CASE SUPPORT ASSEMBLY

(Pinion end bearing housing)

1. Magnaflux the weld joining the arm to the housing, Fig. 8. No crack is permissable. If crack is found, bearing housing is to be scrapped .

2. Check the arm thickness. The thickness should be a minimum of 101.4mm (3.99") and a maximum of 101.9 mm (4.010"). When this dimension is at the condemning limit, the surface may be built up with weld by depositing one bead around the 27 mm (1-1/16") diameter hole of the support arm starting at the open end of the arm and parallel to the long side. Deposit beads of weld to the required height to the remainder of the surface to be built up. Machine support arm to"new" dimension.

3. Check the three 7/8"-9 N.C. threaded bolt holes. The threads are to be class 3.

PINION END BEARING COVER

NOTE: The bearing cover bore diameter should be checked dimensionally and not rejected for evidence of rubbing or wear.

1. The indicated mounting faces Fig.9, must be square with the pilot diameter within 0.05 mm T.I.R..

2. The indicated bore faces must be square with the pilot diameter within 0.13 mm T.I.R..

3. The indicated diameters must be concentric with the pilot diameter within 0.05 mm T.I.R..

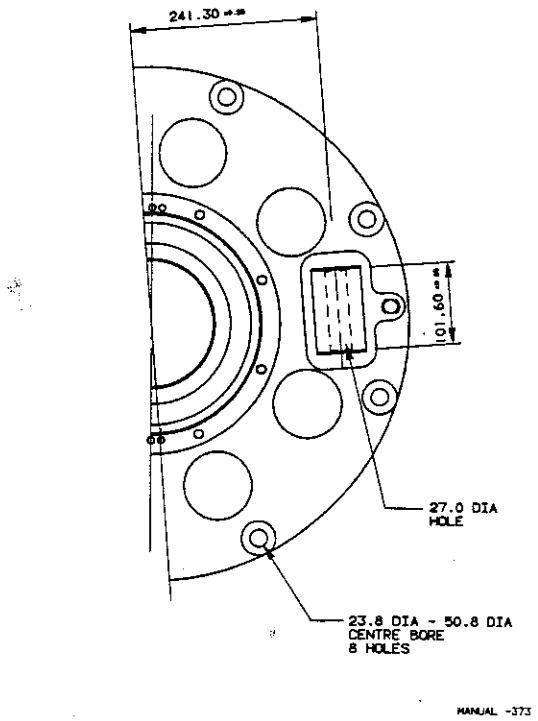

Fig. 8 - Pinion End Bearing Housing Front View

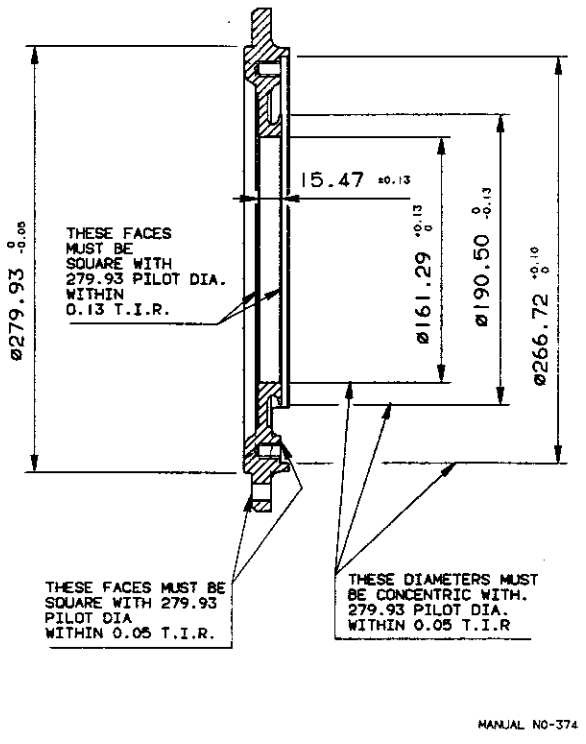

Fig. 9 - Pinion End Bearing Cover

4. Check the threads of the six 3/8"-16 UNC tapped holes. The threads are to be class 2B.

PINION END OUTER OIL SEAL

NOTE: The outer oil seal bore diameter should be checked dimensionally and not rejected for evidence of rubbing or wear.

1. Check outer oil seal bore diameter, Fig.10. Diameter should be 130.48mm (5.137") minimum and 130.6mm (5.142") maximum.

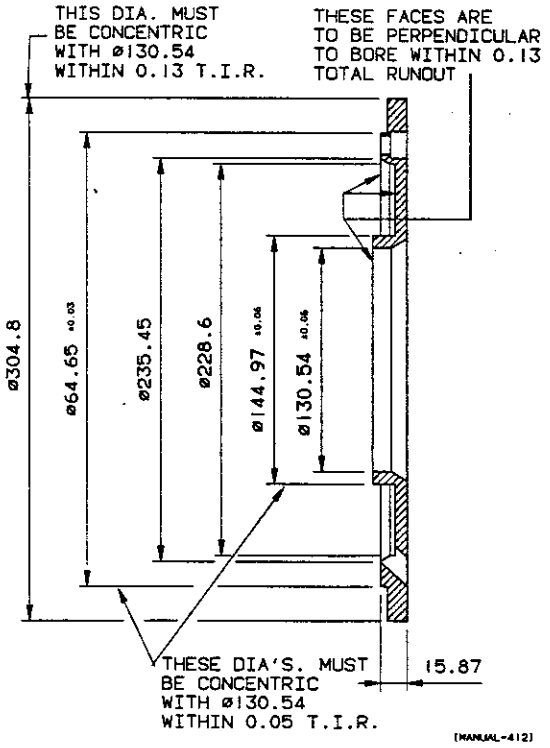

Fig. 10 - Pinion End Outer Oil Seal

2. Check outer diameter. Wear and rubbing is acceptable if there are no depressions greater than .25mm (0.010") deep. Remove any sharp edges or nicks.

PINION END INNER OIL RING

1. Check inner oil ring bore diameter, Fig.11. The diameter should be a minimum of 131.76mm (5.187") and a

maximum of 131.79mm (5.189"). Bore out-of-round acceptable from 131.70mm to 131.85mm (5.185" to 5.191").

2. Check inner oil ring outer diameter. The outer diameter should be a minimum of 203.07mm (7.995") and a maximum of 203.2mm (8.00"). Rubbing is permitted on outer diameter if there are no depressions greater than 0.13mm (.005").

3. Bore faces must be square with the bore within 0.03 mm T.I.R..

4. Indicated diameters must be concentric with the bore diameter within 0.08 mm T.I.R.

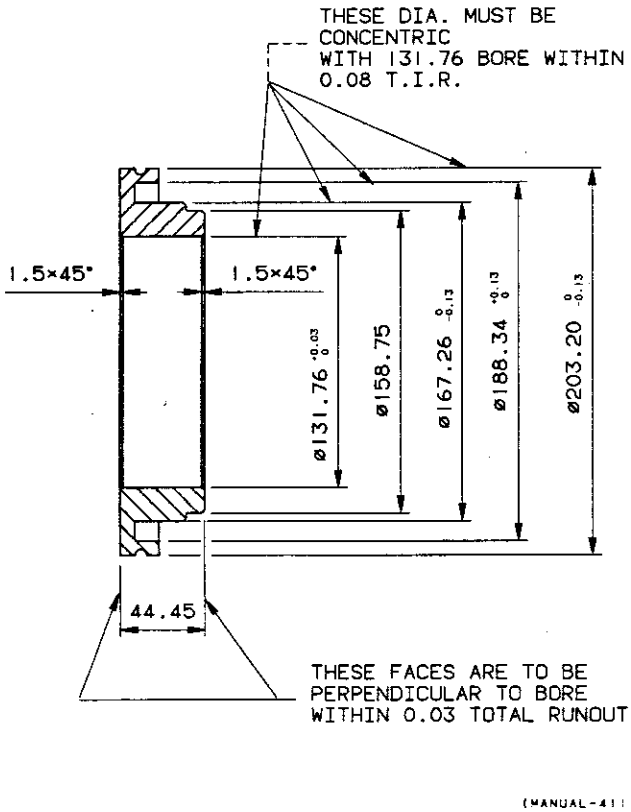

Fig. 11 - Pinion End Inner Oil Seal

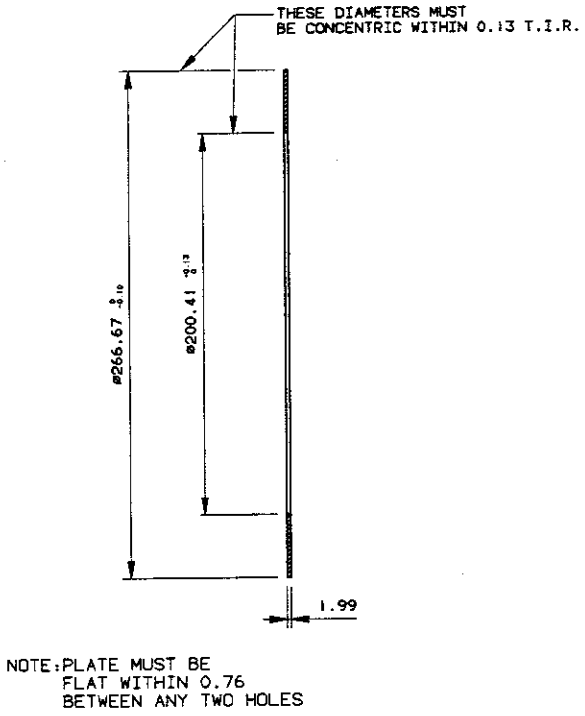

Fig. 12 - Pinion End Partition Plate

PINION END PARTITION PLATE

1. The partition plate should conform to the limits of Fig.12.

2. The plate must be flat within 0.76 mm, (.030") between any two holes.

3. The plate inner and outer diameters must be concentric to within 0.13 mm T.I.R..

PINION END SLINGER

1. Check slinger bore diameter. The diameter, Fig.13, should be a maximum of 129.400 mm (5.0945"). Bore out-of-round acceptable from 129.29 to 129.44 mm (5.090 to 5.096").

2. The 146.05 mm (5-3/4") bore face to be perpendicular to the bore within 0.08 mm T.I.R.

3. All diameters are to be concentric with the bore within 0.13 mm T.I.R..

4. Check the 199.39 mm (7.850") diameter. The diameter should be a minimum of 199.14 mm (7.840) and a maximum of 199.39 mm (7.850").

5. Check the 160.27 mm (6.310") diameter. The diameter should be a minimum of 160.14 mm (6.305") and a maximum of 160.27 mm (6.310").

6. Check the 146.05 mm (5.750") diameter. The diameter should be a minimum of 145.92 mm (5.745") and a maximum of 146.05 mm (5.75").

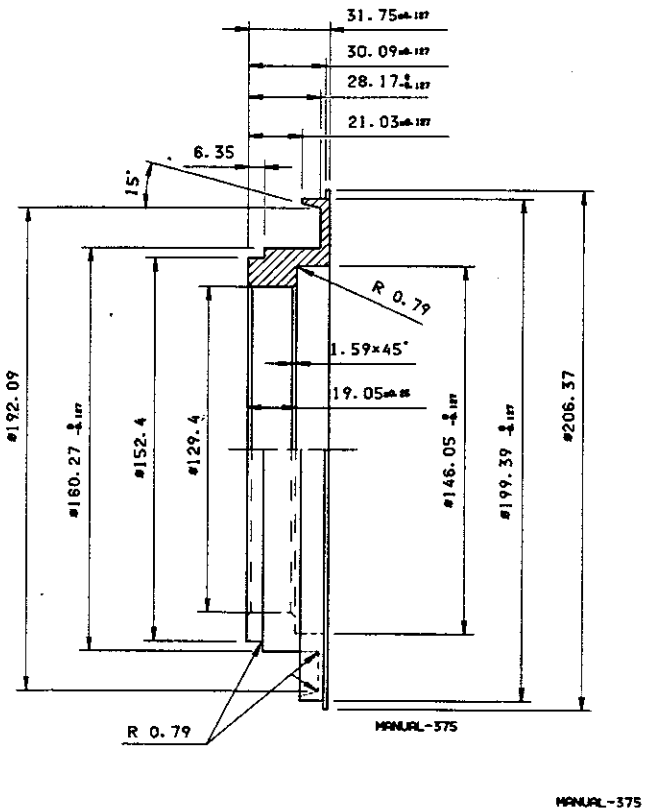

Fig. 13 - Pinion End - Slinger

BEARING ASSEMBLIES

CLEANING

When the traction motor is disassembled, the armature bearings should be kept together as an assembly and protected from dirt and damage by wrapping in clean non-corrosive paper. During cleaning and inspection, every care should be taken to keep bearings clean and to handle them carefully.

Bearings may be washed using clean Stoddards Solvent or some similar non-corrosive solvent withflash point of 46° C, or higher. Apply solvent with a brush or rag, being careful that bristles and threads do not come loose in bearing.Cotton waste should never be used. A tank with a small motor driven pump with hose and nozzle connection will be found advantageous in reaching inaccessible spots in the bearing.

INSPECTION PROCEDURE

Roller bearing assemblies should be carefully inspected with the aid of adequate light and a magnifying glass of two power (2X). Bearings should be handled with clean hands adequately protected by lanolin to prevent staining and corrosion.

In order to keep the details of each inspection as clear and concise as possible, a glossary of terms follows.

GLOSSARY OF TERMS

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

Craters - Small deformities in the normal surface with ragged edges, molten, discoloured, 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 smooth-edged 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 deformations 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 with 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 accompanied 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 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 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 some-times bright. This is

caused by advanced fatiguing beyond the pitting stage, in which large sections of the surface are freed by extensive sub-surface cracking.

GENERAL

On all bearings which have seen 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. Remember that all questions of doubt should be settled on the safe side.

In general, scrapped parts may be replaced with new ones. It must be remembered that if one part of an assembly was under any extended or excessive stressing which resulted in a visible defect severe enough to scrap it, then the rest of the assembly requires a cautious and detailed inspection and evaluation before use.

This inspection procedure is divided into four parts as follows: (1) Operating Surfaces, (2) Non-operating Surfaces, (3) Cages, and (4) Dimensional.

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 may be reduced to the normal surface by light circumferential honing with Arkansas stone or grade 240 cloth. Likewise, the sharp edges may 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 of 2.38 mm (3/32") or more in length, or more than hairline width.
4. Scores or deep scratches which extend more than 19 mm (3/4") the length of the operating surface and are inclined at less than 10 degrees to the axis.
5. Corrosion pits of 0.8 mm (1/32") or more in diameter.
6. Craters or pits from electrical arcing of 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.)

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.

Overheating - Reject bearing.

CAGES

Cages must be inspected to ensure that they are free from cracks and burrs and have no loose or missing rivets.

DIMENSIONAL

Bearing parts must be checked dimensionally so as to maintain the proper fits and to determine the change in internal clearance due to wear.

The following tolerances must be held on the diameters of the races:

COMMUTATOR END BEARING

Inner race inside diameter 74.85 mm to 75.00 mm (2.948" to 2.953"). See Fig.14.

Outer race outside diameter 159.89 mm to 159.90 mm (6.294" to 6.295"). See Fig.15.

PINION END BEARING

Inner race inside diameter 129.97 mm to 129.9 mm (5.117" to 5.118"). See Fig.16.
Outer race outside diameter 279.98 mm to 279.9 mm (11.023" to 11.024"). See Fig.17.

Pinion end inner races must be measured to assure that no race, with a roller path diameter deviating 0.03 mm (.001") or more from the normal unworn surface, will be used. Races with such a deviation are to be scrapped because of the possibility of being assembled so that the rollers will run on the ridge rather than on the worn circumference.

The internal radial clearance is checked by hanging the assembled bearing by its inner race and passing a feeler gauge between each roller and race on the unloaded side for limits to be maintained. Clearance between race and rollers of bearings not installed in motors is as follows:

Pinion end bearing 0.16 mm to 0.21 mm (.006" to .008").

Commutator end 0.14 mm to 0.19 mm (.006" to.007").

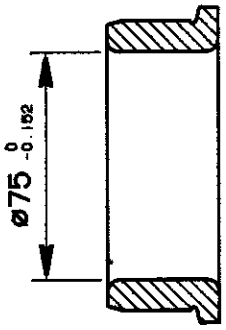

Fig. 14 - Commutator End Inner Race

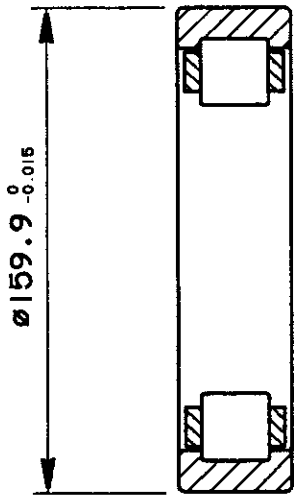

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Fig. 15 - Commutator End Outer Race & Roller

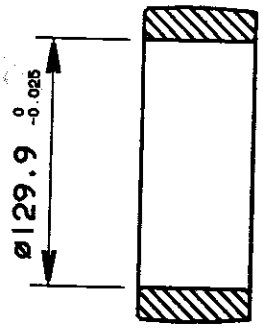

Fig. 16 - Pinion End Inner Race

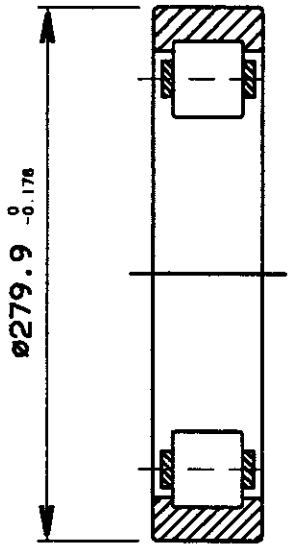

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Fig. 17 - Pinion End Outer Race & Roller