SERVICE DEPARTMENT

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

M.I. 3950-2
*Rev. B

Maintenance Instruction

TRACTION MOTOR OVERHAUL

Traction motor overhaul instructions are presented in seven sections, each under separate cover, and contain detailed instructions to completely disassemble, inspect, overhaul, assemble, and test the traction motor. Refer to Maintenance Instruction 3900 for general or "running" maintenance of the traction motor and also for procedures to remove the traction motor from the locomotive truck. These instructions apply to Models D37, D47, D57, D67, D75, and D77 traction motors unless specifically identified.

SECTION 2
BEARING COMPONENT INSPECTION

INTRODUCTION

This section contains inspection procedures and condemning limits of bearing components. 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. Stoddards Solvent or similar non-corrosive solvent having a flash point of 46° C (115° F) can be used.

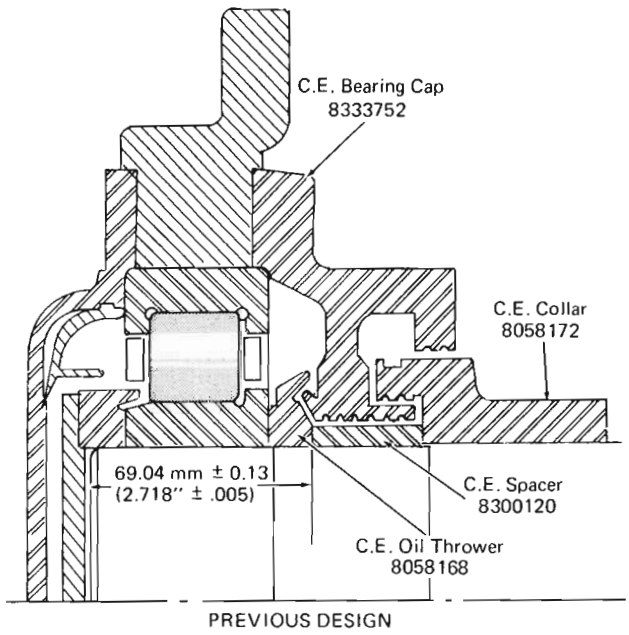
CAUTION: Do not wash bearing housing assembly in caustic or submit to cob blast.

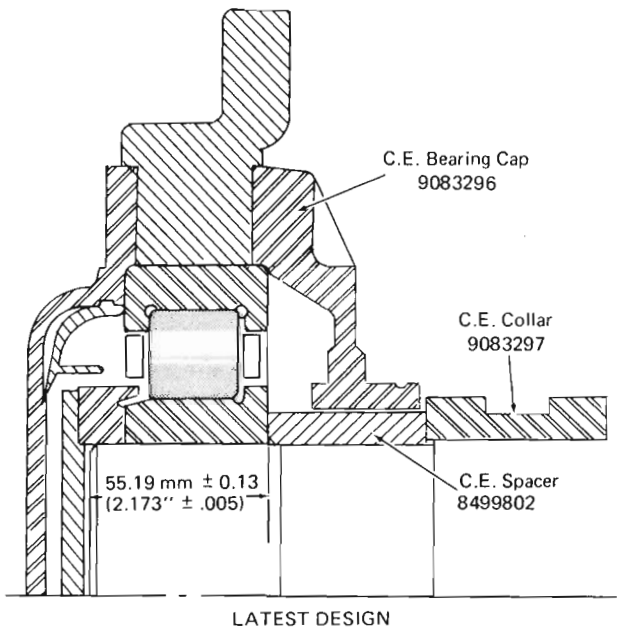
A clean brush or lintless cloth can be used to facilitate cleaning. Gasket surfaces should be given special attention to remove all traces of remaining gasket material.

CURRENT MODEL D77 BEARING SEAL PARTS

D77 traction motor bearing assemblies are currently modified by the removal of unnecessary oil slingers and the redesign of other bearing parts. The modified arrangement is designed specifically for current grease lubricated motors. Refer to Figs. 1 and 2.

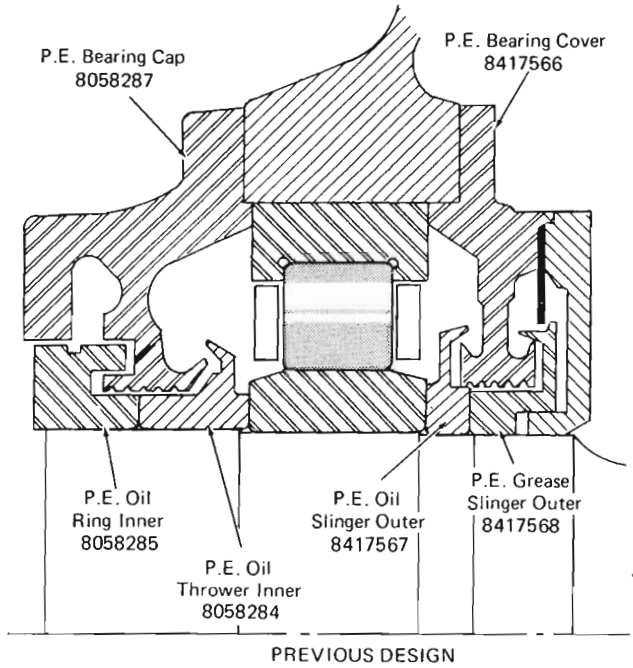
*This bulletin is revised and supersedes previous issues of this number.

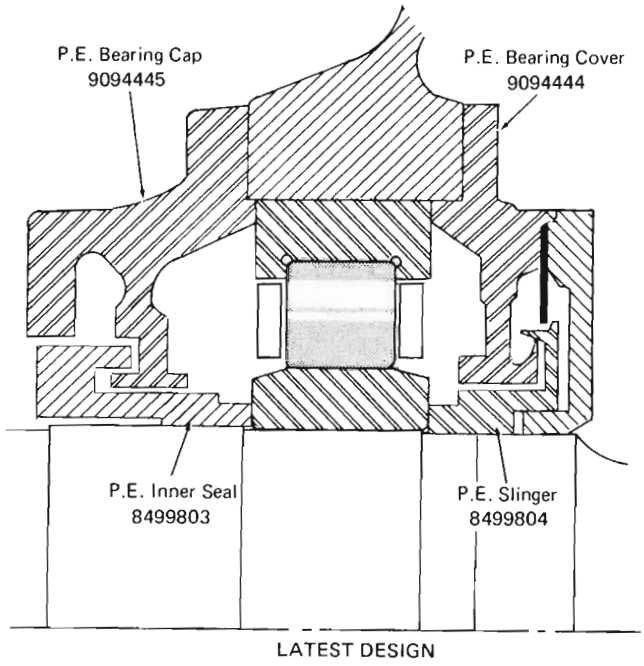




22459

Fig. 1 - Commutator End Seal Arrangement





22460

Fig. 2 - Pinion End Seal Arrangement

The redesigned bearing parts are available for motor rebuild, however, the modification of motors in service is not recommended as no performance increase will result.

Inspection of the model "E" pinion end bearing parts shall conform with the limits provided for the model "B" parts.

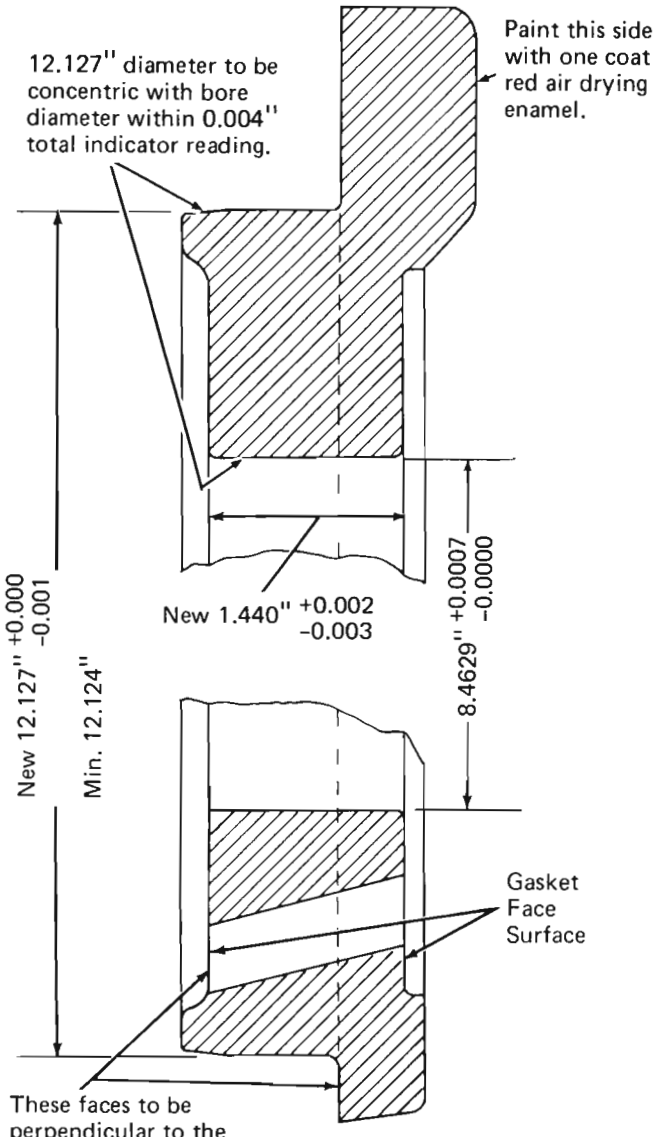
BEARING ASSOCIATED COMPONENTS

COMMUTATOR END BEARING HOUSING

1. Check bearing bore diameter, Fig. 3. The bore diameter should be 214.958 mm +0.018 mm, -0.000 (8.4629" +.0007, -.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 (1/4") wide and 0.4 mm (1/64") 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 discoloration caused by fretting is permitted in the entire bore if a good bearing surface remains.
3. Check pilot diameter. Condemning limit is 307.95 mm (12.124").
4. Bearing housing mounting surface and bearing bore faces should be square with the bore within 0.08 mm (.003") total indicator reading.
5. The 308.03 mm (12.127") outer diameter to be concentric with the bore diameter within 0.10 mm (.004") total indicator reading.
6. The six bearing cap holes should be 18 mm (23/32") or be enlarged to 18 mm (23/32").
7. Check the threads of the eight 3/4"-10 UNC tapped mounting holes. The threads should be class 2B.
8. 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 CAP

NOTE: Commutator end bearing cap 8333752 is replaced by bearing cap 9083296 in current model D77 motors. Refer to Fig. 1.

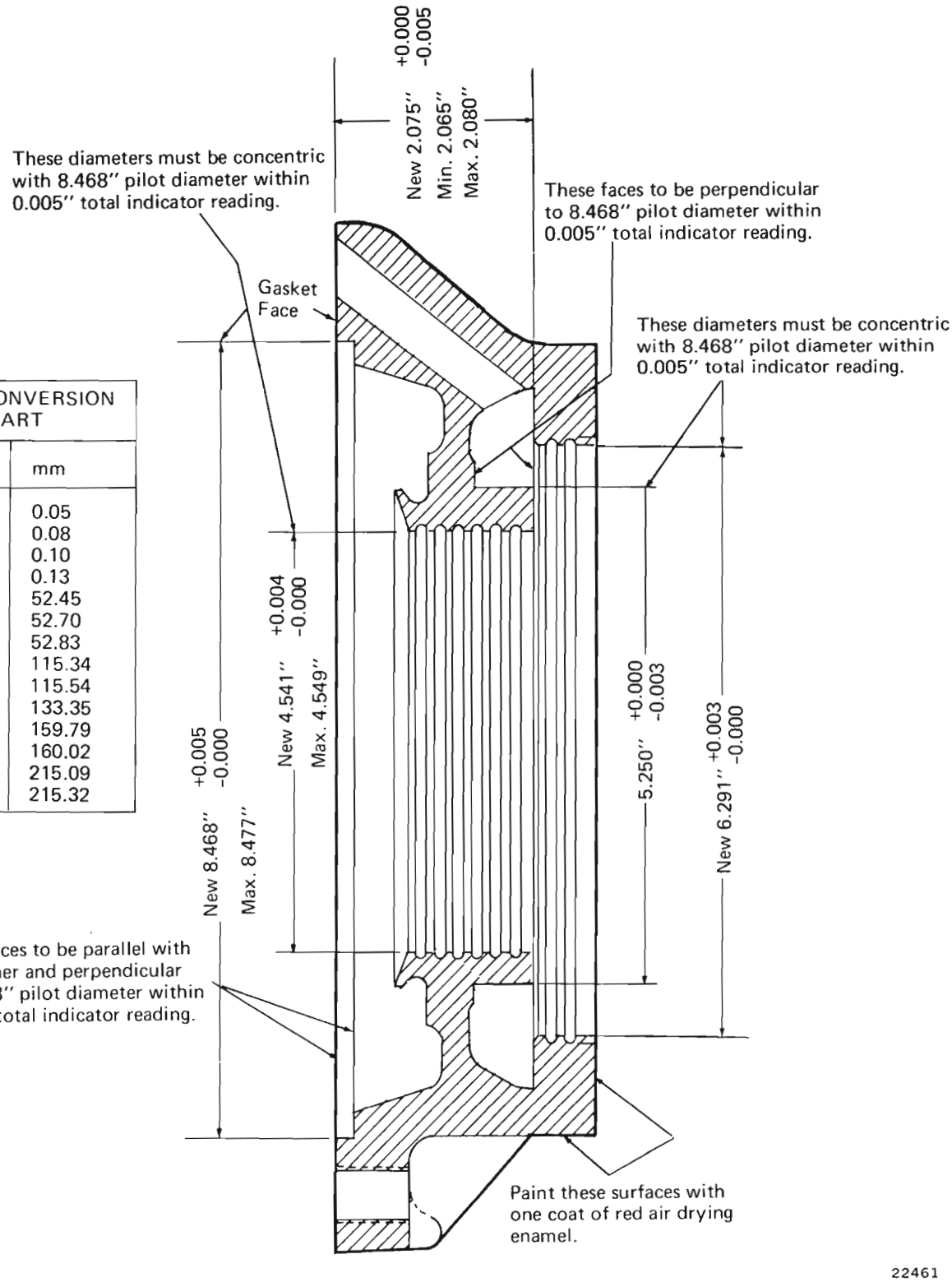


METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.0007	0.018	1.440	36.58
0.001	0.03	8.4629	214.958
0.002	0.05	12.124	307.95
0.003	0.08	12.127	308.03
0.004	0.10		

21907

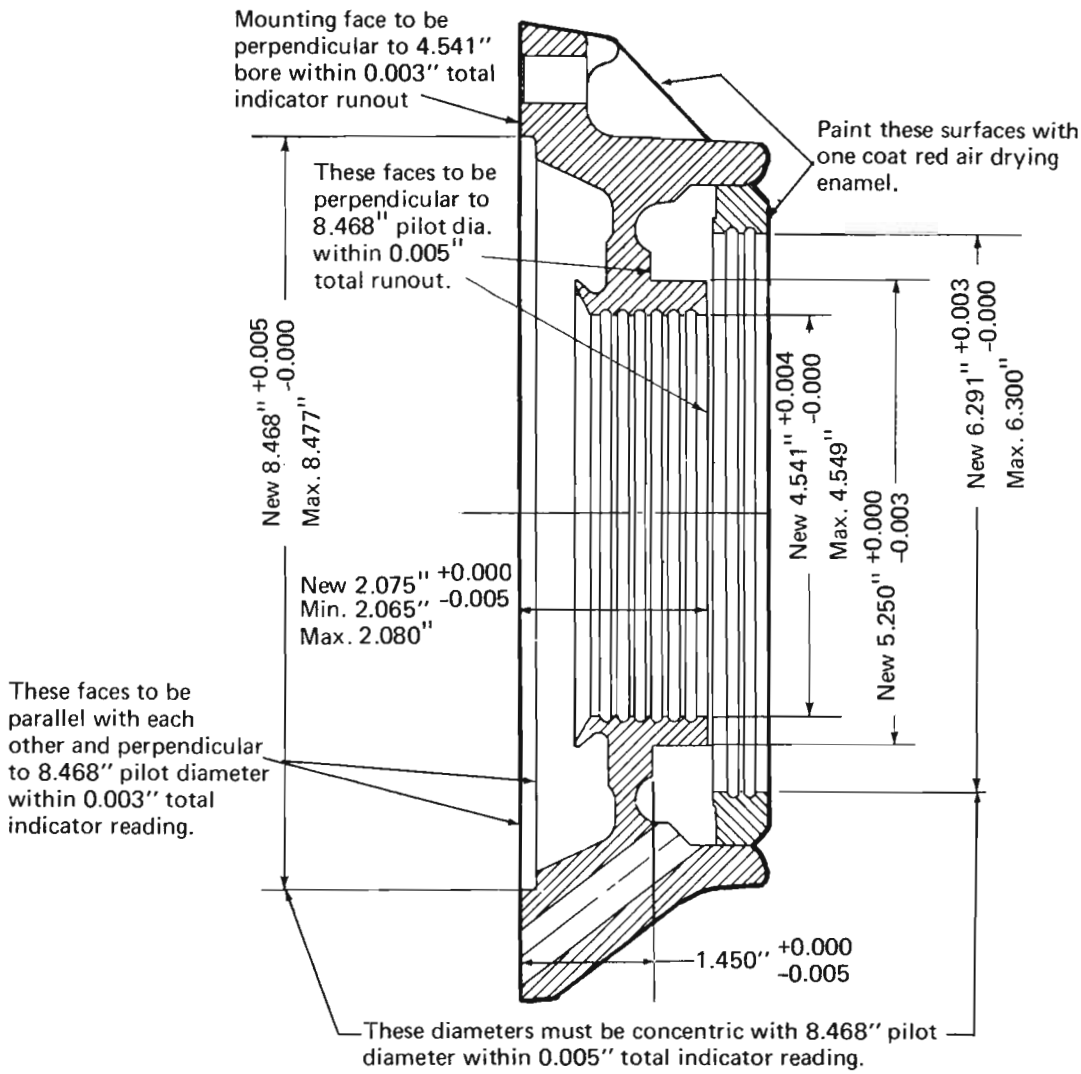
Fig. 3 – Commutator End Bearing Housing

1. Check the inner labyrinth diameter (small diameter of caps 8333752 and 8058171), Figs. 4, 5, or 6. The diameter should be minimum of 115.34 mm (4.541") and a maximum of 115.54 mm (4.549").



METRIC CONVERSION CHART	
(inch)	mm
0.002	0.05
0.003	0.08
0.004	0.10
0.005	0.13
2.065	52.45
2.075	52.70
2.080	52.83
4.541	115.34
4.549	115.54
5.250	133.35
6.291	159.79
6.300	160.02
8.468	215.09
8.477	215.32

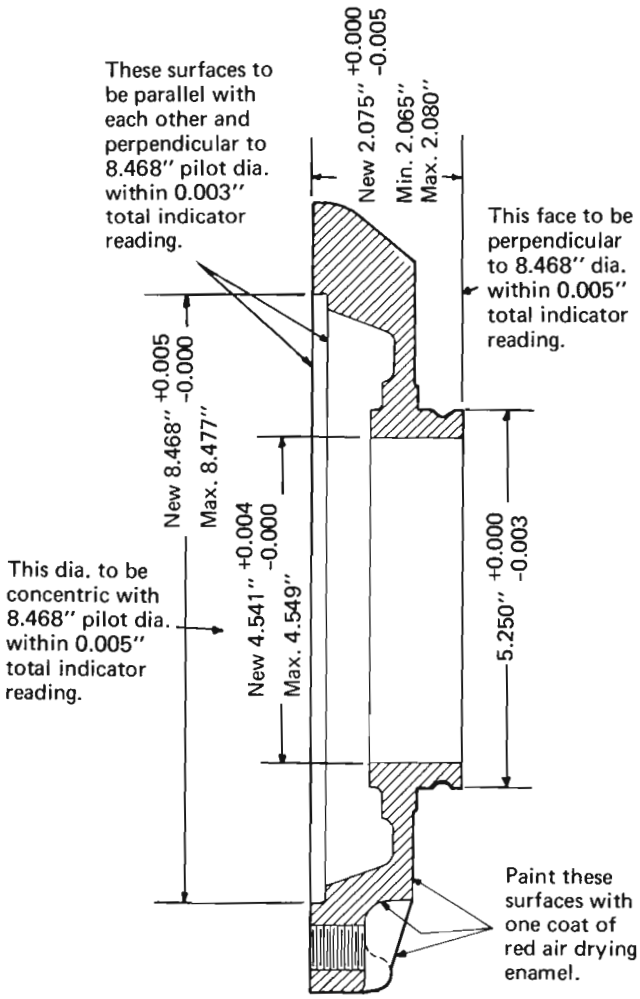
Fig. 4 - Models D67 And D77 Commutator End Bearing Cap 8333752



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.003	0.08	4.541	115.34
0.004	0.10	4.549	115.54
0.005	0.13	5.250	133.35
1.450	36.83	6.291	159.79
2.065	52.45	6.300	160.02
2.075	52.71	8.468	215.09
2.080	52.83	8.477	215.32

21908

Fig. 5 - Models D37, D47, And D57 Commutator End Bearing Cap 8058171



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.002	0.05	4.549	115.54
0.003	0.08	5.250	133.35
0.004	0.10	8.468	215.09
0.005	0.13	8.477	215.32
4.541	115.34		

22462

Fig. 6 – Model D77 Commutator End Bearing Cap 9083296

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

2. Check the outer labyrinth diameter (large diameter of caps 8333752 and 8085171). The diameter should be a minimum of 159.79 mm (6.291") and a maximum of 160.02 mm (6.300"). This diameter does not apply to bearing cap 9083296.

3. Check the dimension from the gasket face surface to the back face of the inner labyrinth. This dimension should be a minimum of 52.45 mm (2.065") and a maximum of 52.83 mm (2.080").

4. Check the pilot bore diameter of the cap into which the outer race of the bearing fits. This diameter should be a minimum of 215.09 mm (8.468") and a maximum of 215.32 mm (8.477").

5. The cap to housing mounting face to be perpendicular to the bore within 0.08 mm (.003").

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

7. Model D37, D47, and D57 bearing caps, Fig. 5, should be machined to receive a nylon anti-churn insert for sealed grease application as shown in Fig. 7.

8. Bearing caps with nylon anti-churn insert should have the insert removed, the cover thoroughly cleaned, and a new insert installed.

NOTE: An oil baffle was used on early model D37, D47, and D57 caps. The baffle must be removed before the cap can be used for sealed grease application.

COMMUTATOR END OIL THROWER

NOTE: Commutator end oil thrower 8058168 and spacer 8300120 are replaced by spacer 8499802 in current model D77 motors. Refer to Fig. 1.

1. Check the oil thrower bore diameter, Fig. 8. The diameter should be a minimum of 100.41 mm (3.953") to a maximum of 100.444 mm (3.9545").

2. Check the dimension (thickness) between faces. The dimension should be a minimum of 13.79 mm (.543") to a maximum of 13.87 mm (.546").

3. Bore diameter out-of-round is acceptable from 100.36 mm to 100.46 mm (3.951" to 3.955").

4. Oil thrower faces to be square with the bore within 0.03 mm (.001") and parallel within 0.013 mm (.0005"). .

5. Inspect flanges of oil thrower for damage. If broken, do not reuse the oil thrower. Small nicks or imperfections on the flanges are permissible, but any raised edges must be removed.

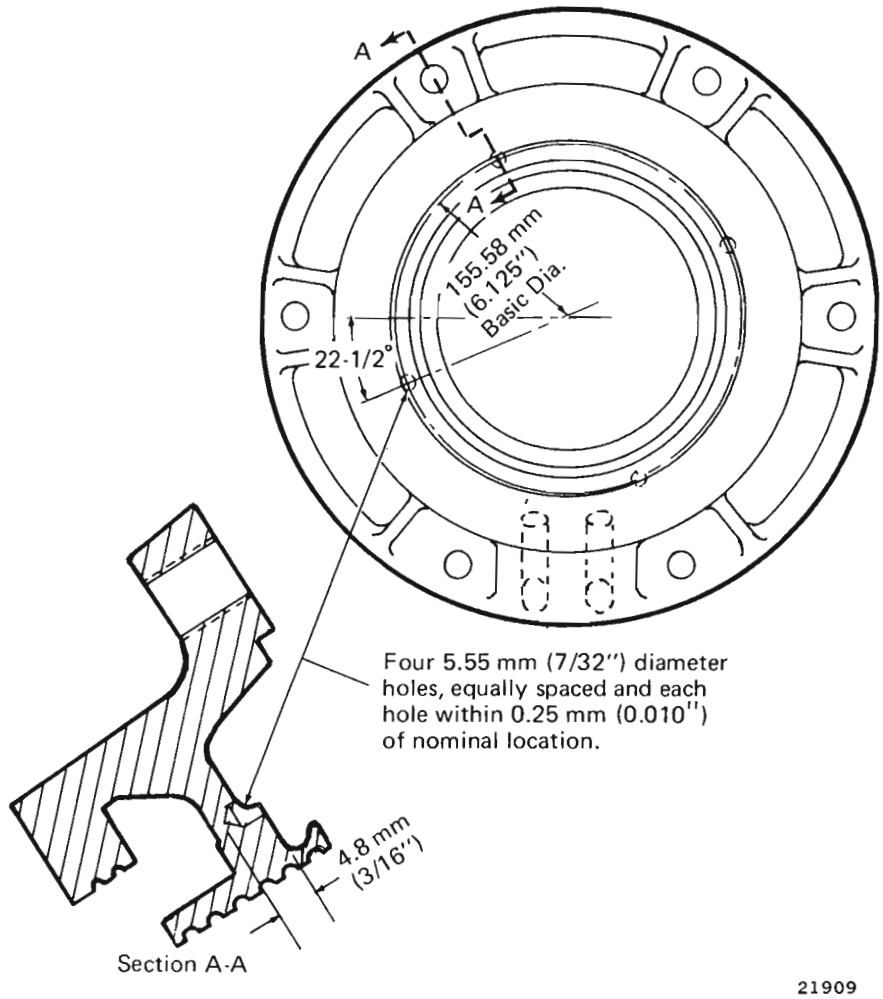
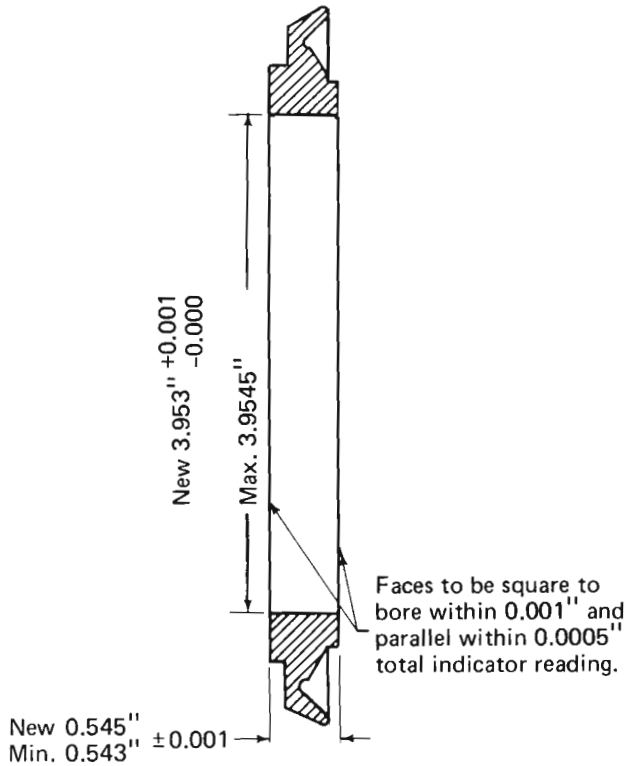


Fig. 7 - Commutator End Bearing Cap Modification



METRIC CONVERSION CHART	
(inch)	mm
0.0005	0.013
0.001	0.03
0.543	13.79
0.545	13.84
3.9545	100.444
3.953	100.41

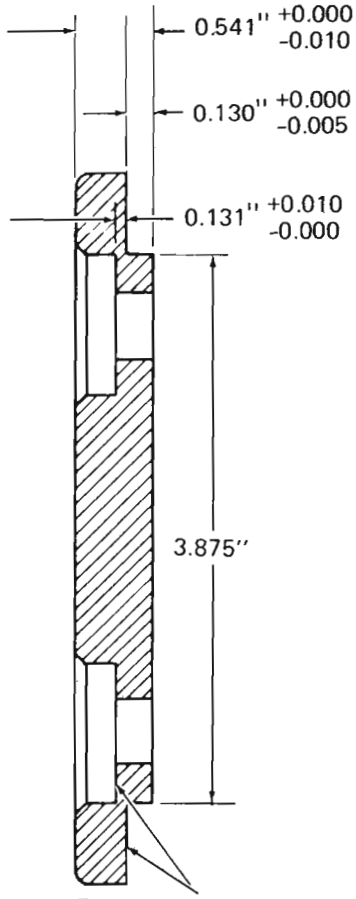
Fig. 8 - Commutator End Oil Thrower

COMMUTATOR END BEARING RETAINER

1. The bearing retainer, Fig. 9, must be flat within 0.013 mm (0.005").

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

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



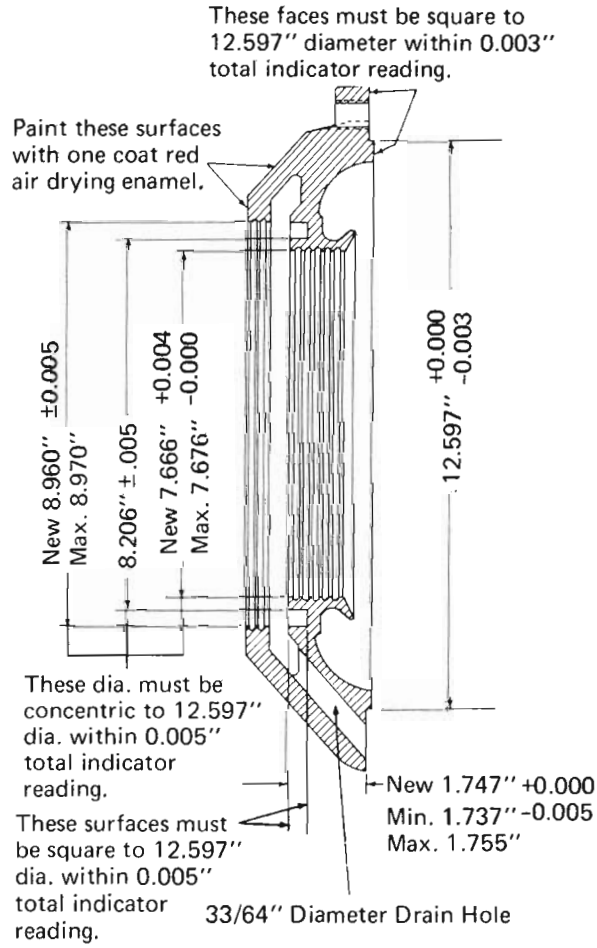
METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.005	0.13	0.131	3.33
0.010	0.25	0.541	13.74
0.130	3.30	3.875	98.42

21911

Fig. 9 - Commutator End Bearing Retainer

PINION END BEARING CAP

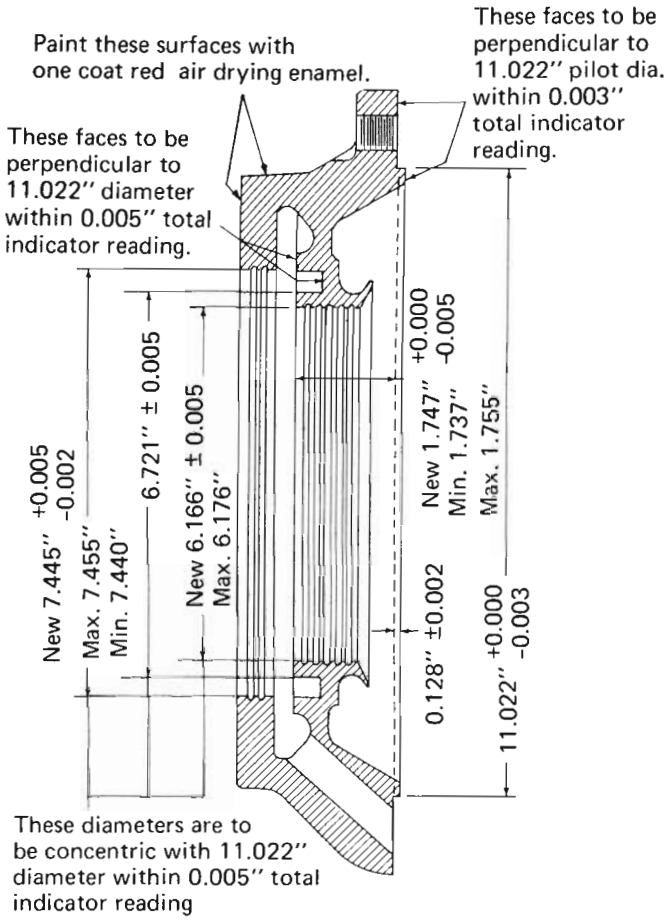
NOTE: Pinion end bearing cap 8058287 is replaced by bearing cap 9094445 in current model D77 motors. Refer to Fig. 2.



METRIC CONVERSION CHART			
(inch)	(mm)	(inch)	mm
0.002	0.05	1.755	44.58
0.003	0.08	7.666	194.72
0.004	0.10	7.676	194.97
0.005	0.13	8.206	208.43
0.5156	13.1	8.960	227.59
1.737	44.12	8.970	227.84
1.747	44.37	12.597	319.96

21972

Fig. 10 - "E" Model Pinion End Bearing Cap



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.002	0.05	1.755	44.58
0.003	0.08	6.166	156.62
0.005	0.13	6.176	156.87
0.008	0.20	6.721	170.71
0.128	3.25	7.440	188.98
1.737	44.12	7.445	189.10
1.747	44.37	7.455	189.36
		11.022	279.96

22463

Fig. 11 - Model D37-D77 Pinion End Bearing Cap 8058287

1. Check the inner labyrinth diameter (small diameter). The E model bearing cap, Fig. 10, diameter should be a minimum of 194.72 mm (7.666") and a maximum of 194.97 (7.676"). The bearing cap diameter of other models, Fig. 11, should be a minimum of 156.49 mm (6.161") and a maximum of 156.87 mm (6.176").

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

2. Check the outer labyrinth diameter (large diameter). The E model diameter should be a minimum of 227.46 mm (8.955") and a maximum of 227.84 mm (8.970"). The diameter of other models should be a minimum of 188.98 mm (7.440") and a maximum of 189.36 mm (7.455").

3. Check the dimension from the gasket face to the back face of the inner labyrinth. This dimension should be a minimum of 44.12 mm (1.737") and a maximum of 44.58 mm (1.755").

4. The pilot face surface and the gasket face surface are to be perpendicular to the 319.96 mm (12.597") pilot diameter of E models and the 279.96 mm (11.022") pilot diameter of other models within 0.08 mm (.003") total indicator reading.

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

6. Paint the outside of the bearing cap with one coat of red air drying enamel.

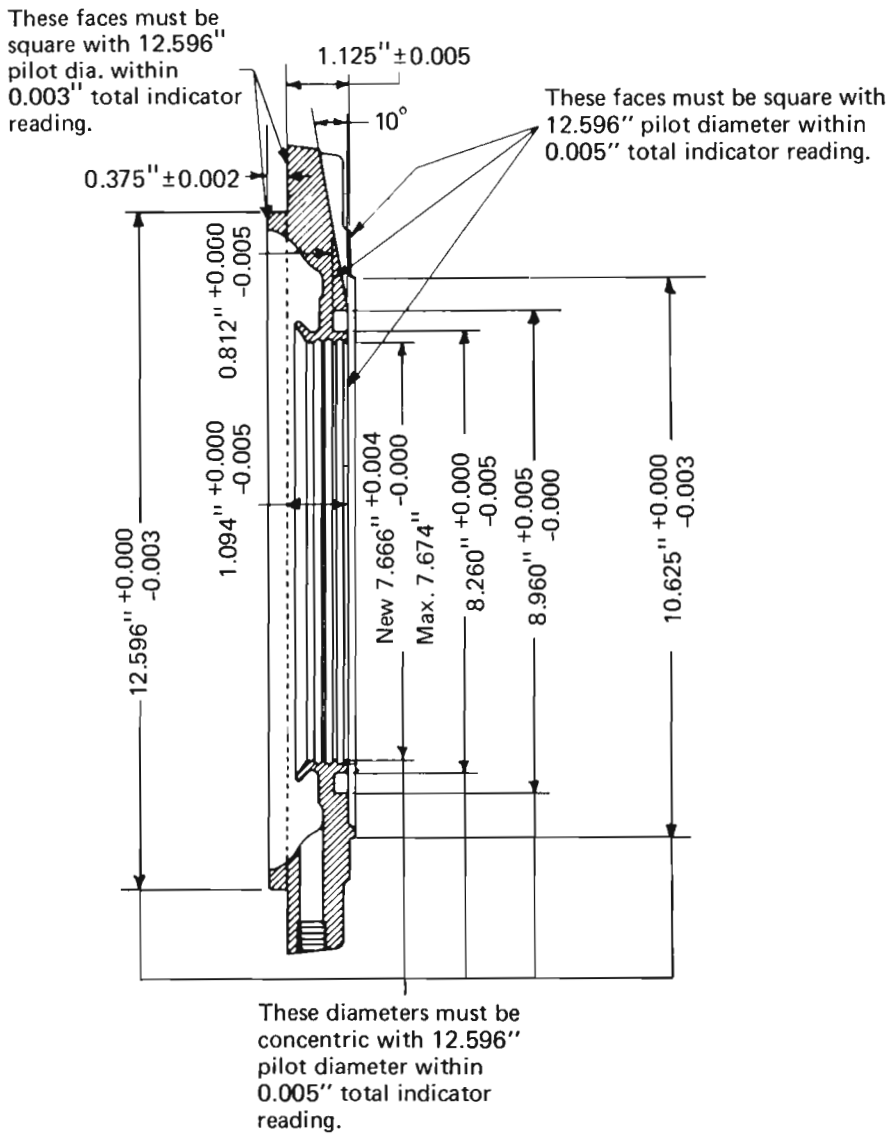
NOTE: Bearing caps equipped with oil baffle must have the baffle removed if the cap is to be used for sealed grease lubrication. The 13.1 mm (33/64") drain holes must also be enlarged to 15.9 mm (5/8").

PINION END BEARING COVER

(Models D37, D47, D57, D67)

1. Check labyrinth diameter. The E model bearing cover, Fig. 12, diameter should be a minimum of 194.72 mm (7.666") and a maximum of 194.92 mm (7.674"). The bearing cover diameter of models D37, D47, D57, and D67, Fig. 13, should be a minimum of 156.62 mm (6.166") and a maximum of 156.85 mm (6.175").

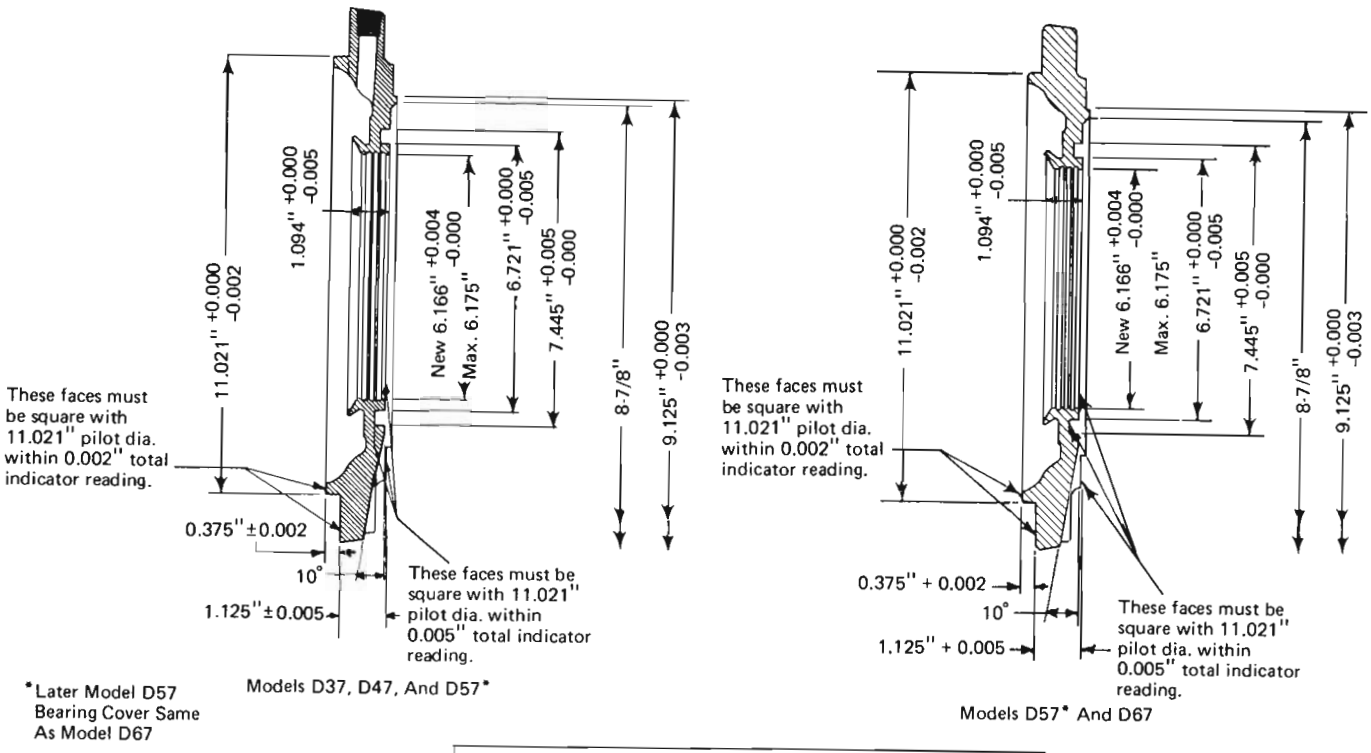
NOTE: The bearing cover bore diameter should be checked dimensionally and not rejected for evidence of rubbing or wear.



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.002	0.05	1.125	28.58
0.003	0.08	7.666	194.72
0.004	0.10	7.674	194.92
0.005	0.13	8.206	208.43
0.375	9.52	8.960	227.58
0.812	20.62	10.625	269.88
1.094	27.79	12.596	319.94

21914

Fig. 12 – "E" Model Pinion End Bearing Cover



METRIC CONVERSION CHART					
(inch)	mm	(inch)	mm	(inch)	mm
0.002	0.05	1.094	27.79	7.445	189.10
0.003	0.08	1.125	28.58	8-7/8	225.43
0.004	0.10	6.166	156.62	9.125	231.78
0.005	0.13	6.175	156.85	11.021	279.93
0.375	9.53	6.721	170.71		

21913

Fig. 13 - Pinion End Bearing Cover

2. The pilot face surface and gasket face surface are to be perpendicular to the 319.93 mm (12.596") pilot diameter of E models and 279.93 mm (11.021") pilot diameter of other models within 0.05 mm (.002") total indicator reading.

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

4. Model D37, D47, and D57 bearing covers without nylon anti-churn insert should be machined to receive insert for sealed grease application as shown in Fig. 14.

5. Bearing covers with nylon anti-churn insert should have the insert removed, the cover thoroughly cleaned, and a new insert installed.

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. Refer to Fig. 15 for condemning limits.

2. Check outer diameter. Wear and rubbing is acceptable if there are no depressions greater than 0.25 mm (0.010") deep. Remove any sharp edges or nicks.

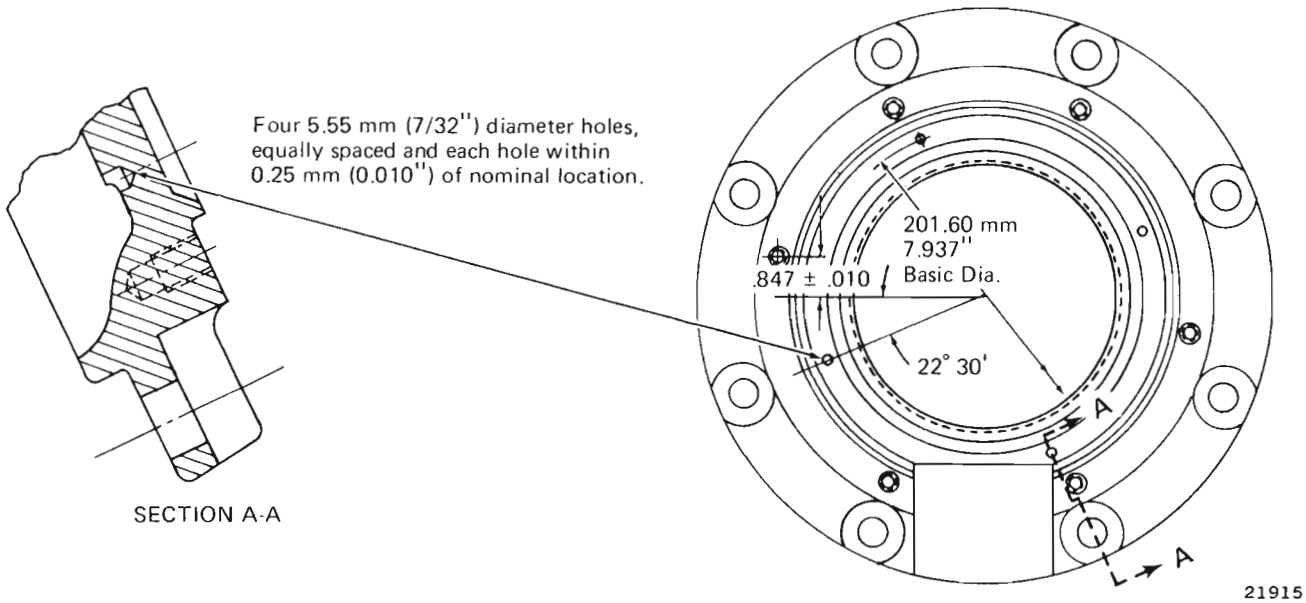
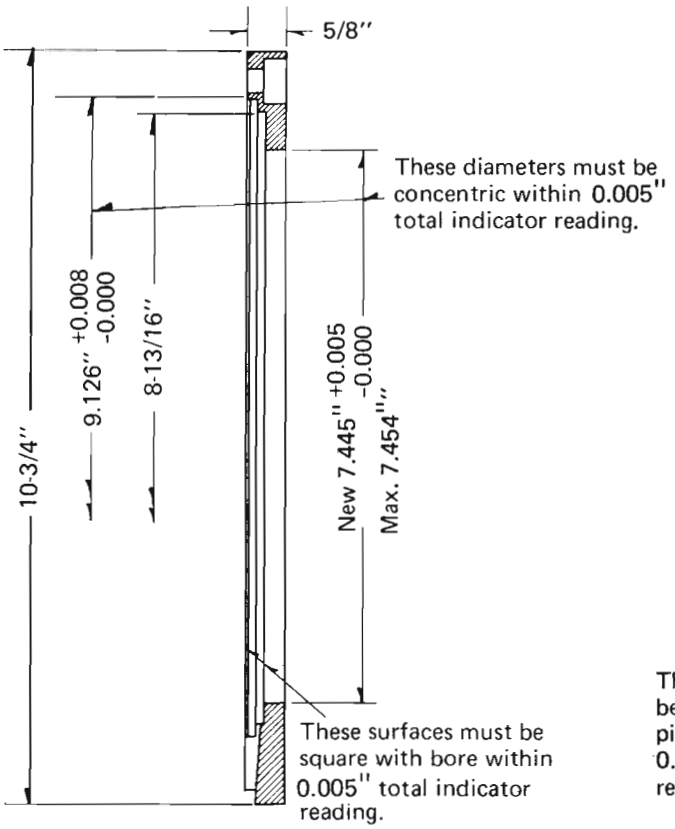
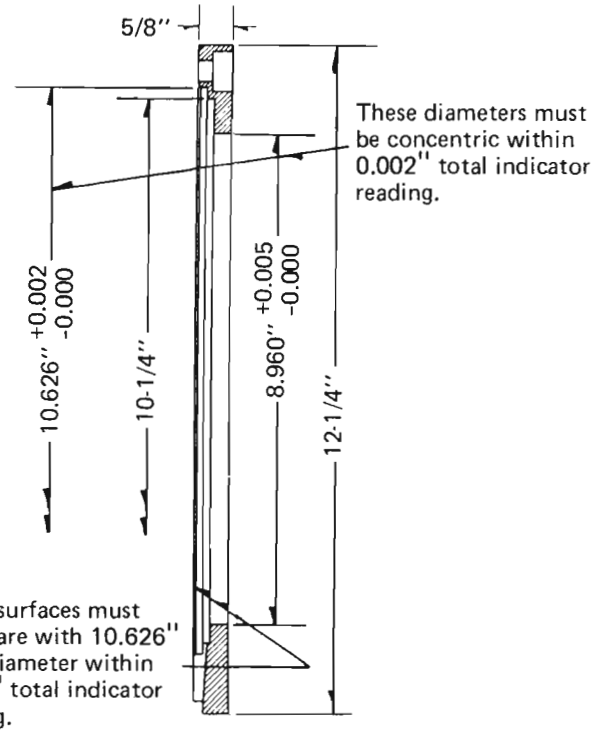


Fig. 14 - Pinion End Bearing Cover Modification





METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.002	0.05	8.960	227.58
0.005	0.13	9.126	231.80
5/8	15.8	10-1/4	260.4
7.445	189.10	10.626	269.90
7.454	189.33	10-3/4	273.05
8-13/16	223.8	12-1/4	311.15

Fig. 15 - Pinion End Outer Oil Seal

PINION END BEARING HOUSING

1. Check bearing housing to frame pilot diameter, Fig. 16. Wear limits for standard size and oversize bearing housing pilot diameters are as follows.

Bearing Housing	Pilot Diameter New +0.03 mm, -0.00 mm (+.001", -.000")	Diameter Limit
Standard Size	581.13 mm (22.879")	581.00 mm (22.874")
0.8 mm (1/32")	581.91 mm (22.910")	581.84 mm (22.907")
2.4 mm (1/16")	582.80 mm (22.945")	582.73 mm (22.942")
1.6 mm (3/32")	583.57 mm (22.975")	583.49 mm (22.972")
3.2 mm (1/8")	584.33 mm (23.005")	584.25 mm (23.002")

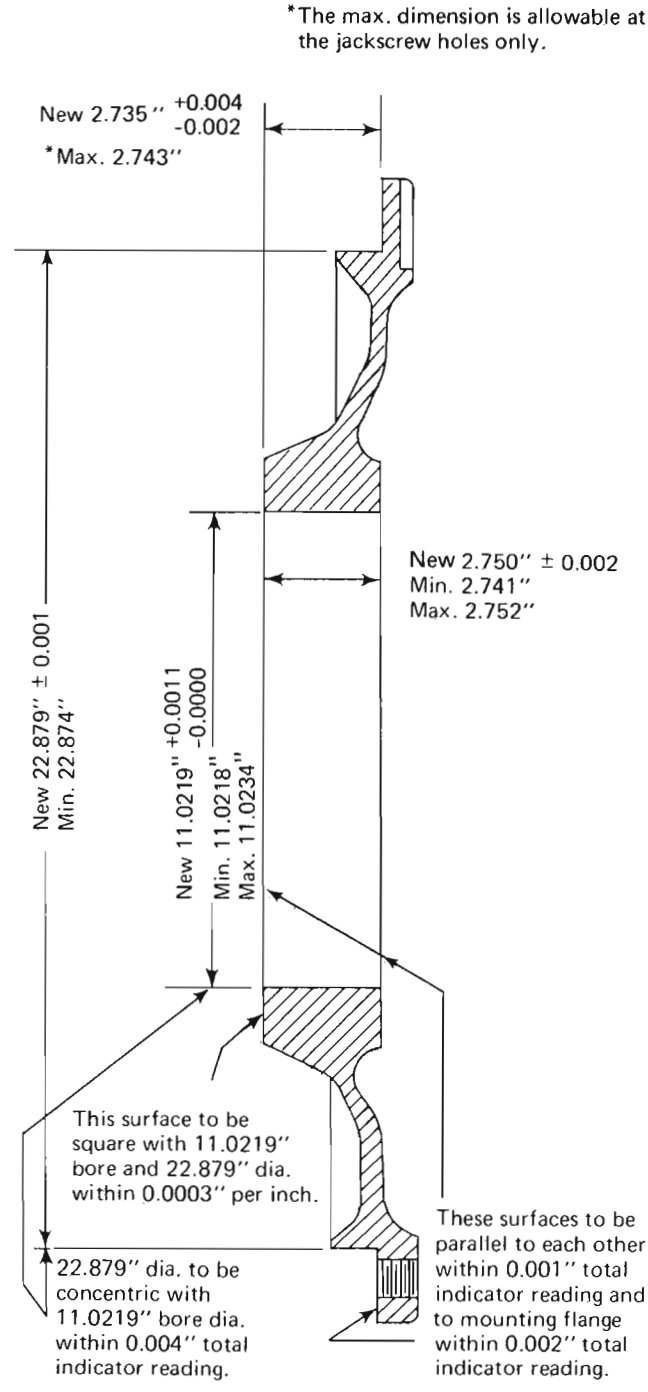
NOTE: The frame pilot diameter may be reworked by iron, chrome, or nickel plating.

2. Check bearing housing bore diameter. On E models the diameter should be a minimum of 319.951 mm (12.5965") and a maximum of 320.004 mm (12.5986"). The diameter of other models should be a minimum of 279.954 mm (11.0218") and a maximum of 279.994 mm (11.0234").

3. Inspect the housing for warping and distortion. The frame mounting surface to the inside bearing bore face shall not exceed 69.67 mm (2.743") at the three jackscrew holes, 70.87 mm (2.790") at the outer flange area within 51 mm (2") on either side of the jackscrew holes, and 70.61 mm (2.780") at all other outer flange areas.

4. Check the thickness at the bore. The thickness should be a minimum of 69.62 mm (2.741").

5. The mounting surface to the inside bore face should be 69.47 mm (+0.10, -0.05 (2.735" +.004, -.002). Rework of the frame mounting dimension may be accomplished by machining the 69.85 mm (2.750") dimension up to 69.62 mm (2.741") and machining the mounting face a corresponding amount to obtain the 69.47 mm (2.735").



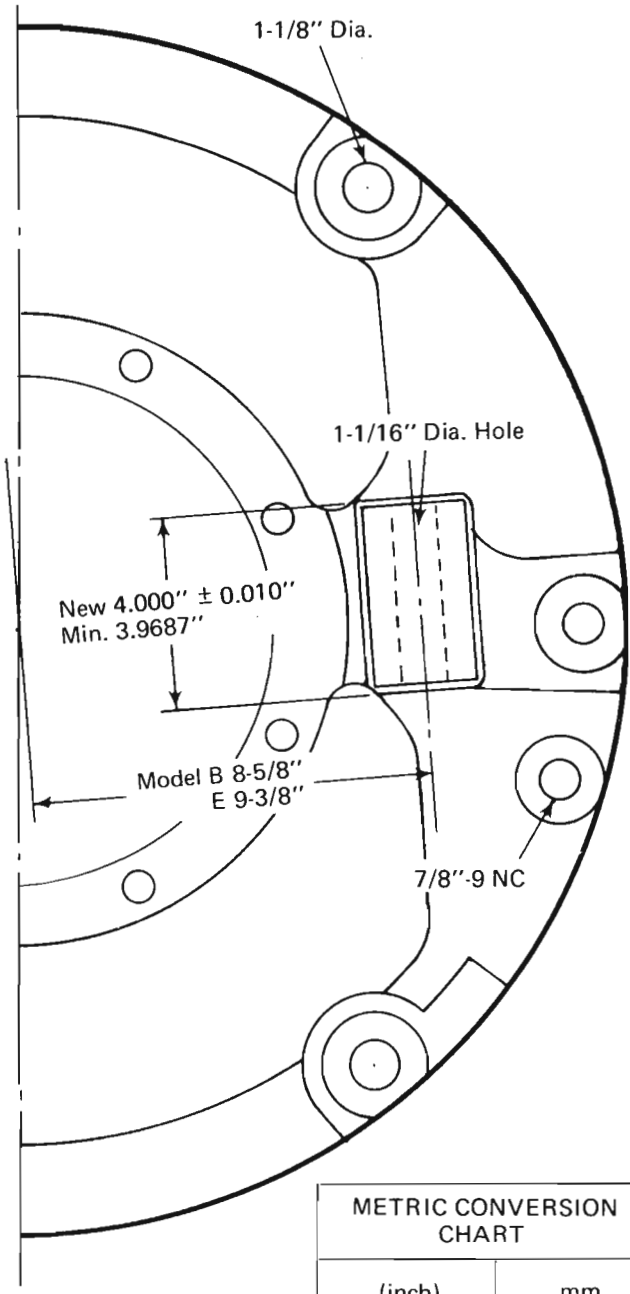
METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.001	0.03	2.750	69.85
0.0011	0.028	2.752	69.90
0.002	0.05	11.0218	279.954
0.004	0.10	11.0219	279.956
2.735	69.47	11.0234	279.994
2.741	69.62	22.874	581.00
2.743	69.67	22.879	581.13

22465

Fig. 16 – Pinion End Bearing Housing, Cross-Section

GEAR CASE SUPPORT ASSEMBLY
(Pinion End Bearing Housing)

1. Magnaflux the weld joining the arm to the housing, Fig. 17. No crack is permissable. If crack is found, bearing housing is to be scrapped.



METRIC CONVERSION CHART	
(inch)	mm
0.010	0.25
1-1/16	27
1-1/8	28.6
3.9687	100.805
4.000	101.60
8-5/8	219.1
9-3/8	238.1

22466

Fig. 17 – Pinion End Bearing Housing, Front View

2. Check the arm thickness. The thickness should be a minimum of 100.805 mm (3.9687") and a maximum of 101.854 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. Gear case support assemblies with seven 27 mm (1-1/16") diameter bolt holes should have bolt holes enlarged to 29 mm (1-1/8") diameter.

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

PINION END INNER OIL RING (8058285)

NOTE: Pinion end inner oil ring 8058285 and pinion end inner oil thrower 8058284 are replaced by inner seal 8499803 in current model D77 motors. Refer to Fig. 2.

1. Check inner oil ring bore diameter, Fig. 18. The oil ring bore diameter should be a minimum of 131.763 mm (5.1875") and a maximum of 131.80 mm (5.189"). Bore out-of-round acceptable from 131.70 mm to 131.85 mm (5.185" to 5.191").

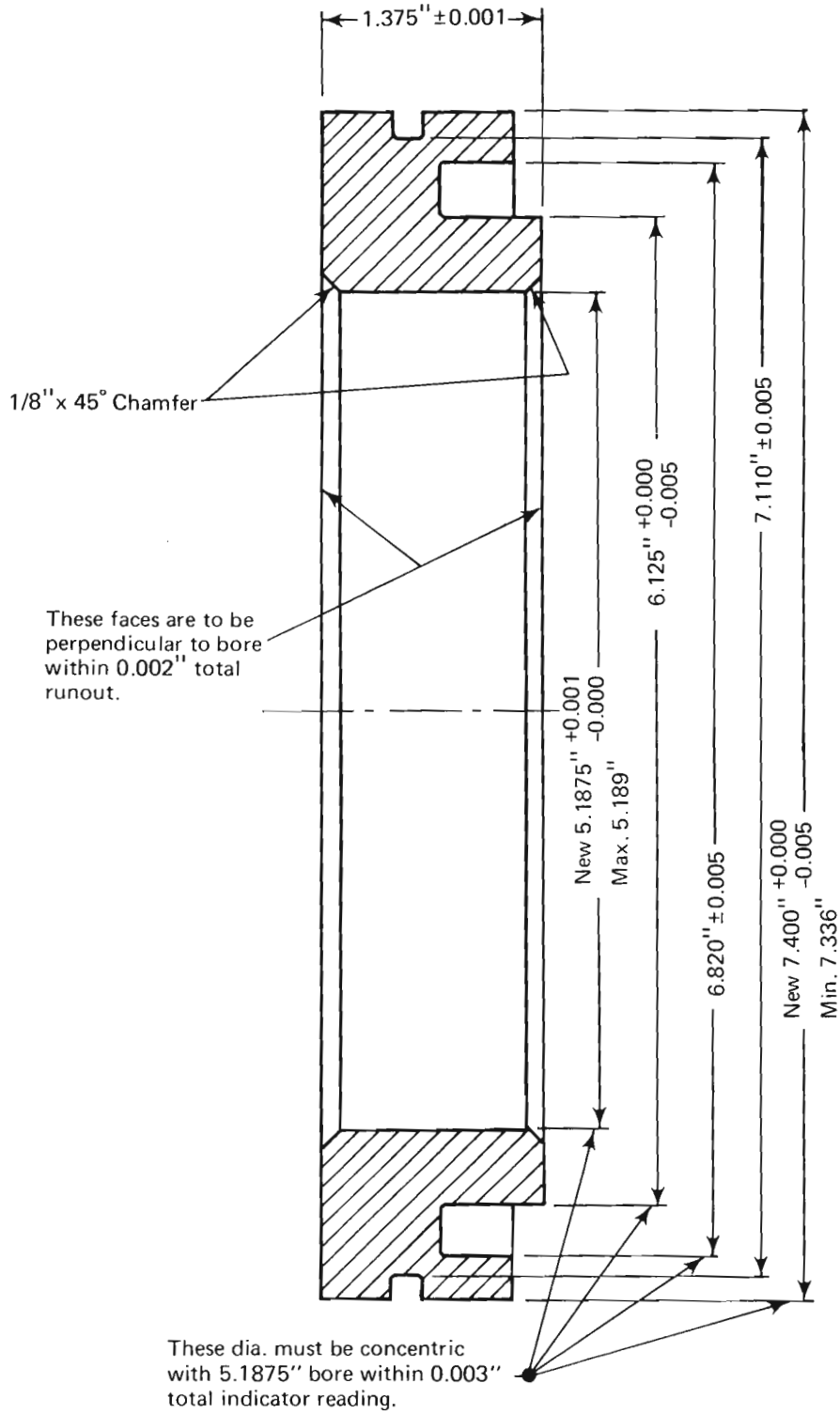
2. Check inner oil ring outer diameter. The outer diameter should be a minimum of 186.334 mm (7.336") and a maximum of 187.96 mm (7.400"). Rubbing is permitted on outer diameter if there are no depressions greater than 0.13 mm (.005").

NOTE: Oil rings with 186.59 mm (7.346") outer diameter must be replaced with a ring having 187.96 mm (7.400") diameter.

3. Bore faces must be square with bore within 0.05 mm (.002") on oil ring 8058285.

4. Bore face must be square with bore within 0.03 mm (.001") on oil ring 8499803.

5. Ring diameters must be concentric with bore within 0.08 mm (.003").



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.001	0.03	5.1890	131.801
0.002	0.05	6.125	155.58
0.003	0.08	6.820	173.23
0.005	0.13	7.110	180.59
1.375	34.93	7.336	186.33
5.1875	131.763	7.400	187.96

21918

Fig. 18 – Pinion End Inner Oil Ring

PINION END INNER OIL THROWER
(8058284)

NOTE: Pinion end inner oil thrower 8058284 and pinion end inner oil ring 8058285 are replaced by inner seal 8499803 in current model D77 motors. Refer to Fig. 2.

1. Check inner oil thrower bore diameter, Fig. 19. The oil thrower bore diameter should be a minimum of 131.763 mm (5.1875") and a maximum of 131.80 mm (5.189"). Bore out-of-round acceptable from 131.70 mm to 131.85 mm (5.185" to 5.191").

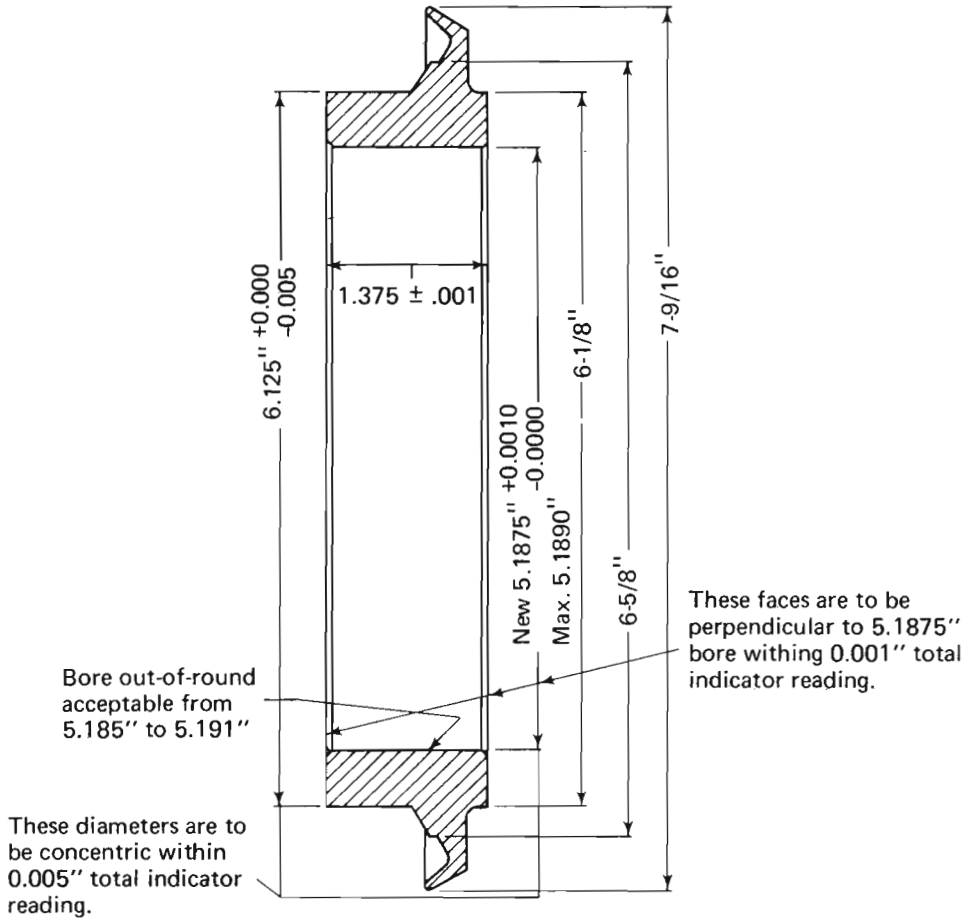
2. Oil thrower bore faces to be square with bore within 0.03 mm (.001").

3. Rubbing is permitted on the outer diameter provided that the 155.78 mm +0.00, -0.13 (6.125" +.000, -.005) is within tolerance.

PINION END OUTER OIL THROWER
(Models D37, D47, D57)

1. Check oil thrower bore diameter, Fig. 20. Oil thrower bore diameter should be a minimum of 129.39 mm (5.094") and a maximum of 129.426 mm (5.0955"). Bore out-of-round acceptable from 129.31 mm to 129.46 mm (5.091" to 5.097").

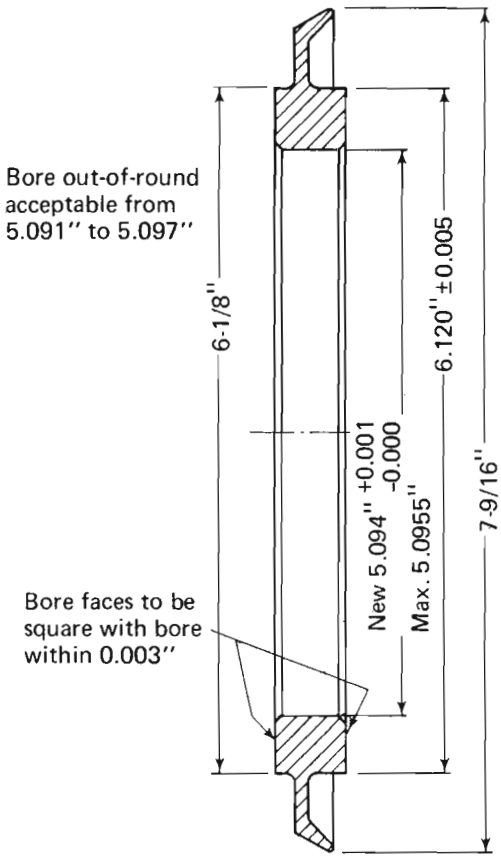
2. Oil thrower bore faces to be square with bore within 0.08 mm (.003").



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.0010	0.025	6.125	155.58
0.005	0.13	6-1/8	155.6
1.375	34.92	6-5/8	168.3
5.185	131.70	7-9/16	192.1

21919

Fig. 19 – Pinion End Inner Oil Thrower



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.001	0.03	5.097	129.46
0.002	0.05	5.0940	129.388
0.003	0.08	5.0955	129.426
0.005	0.13	6.120	155.45
5.091	129.31	6-1/8	155.6
		7-9/16	192.1

21920

Fig. 20 - Pinion End Outer Oil Thrower

3. All nicks and raised edges to be removed or blended smooth.

PINION END OUTER OIL RING
(Models D37, D47, D57)

1. Check oil ring bore diameter, Fig. 21. Oil ring bore diameter should be a minimum of 128.588 mm (5.0625") and a maximum of 128.600 mm (5.0630"). Bore out-of-round acceptable from 128.562 mm to 128.626 mm (5.0615" to 5.0640").

2. Check both seal diameters. Seal diameters should be a minimum of 187.83 mm (7.395") and a maximum of 188.09 mm (7.405").

3. Check the 158.58 mm (6.125") diameter. The diameter should be a minimum of 155.32 mm (6.115").

4. Check the dimension from the inner bore face to the mounting flange. The dimension should be a minimum of 24.2 mm (61/64") and a maximum of 25.4 mm (1").

5. Bore faces to be square with bore within 0.08 mm (.003").

6. All diameters to be concentric with bore within 0.13 mm (.005") total indicator reading.

7. Check the threads of the three 3/8"-16 tapped holes. The threads to be class 2B.

COMMUTATOR END COLLAR (8058172)

NOTE: Commutator end collar 8058172 is replaced by collar 9083297 in current model D77 motors. Refer to Fig. 1.

1. Check collar bore diameter, Fig. 22. The collar bore diameter should be a minimum of 100.79 mm (3.968") and a maximum of 100.851 mm (3.9705").

2. Check collar outer diameter. Outer diameter should be a minimum of 158.50 mm (6.240") and a maximum of 158.75 mm (6.250").

3. Check bore labyrinth diameter. Labyrinth diameter should be a minimum of 134.39 mm (5.291") and a maximum of 134.62 mm (5.300").

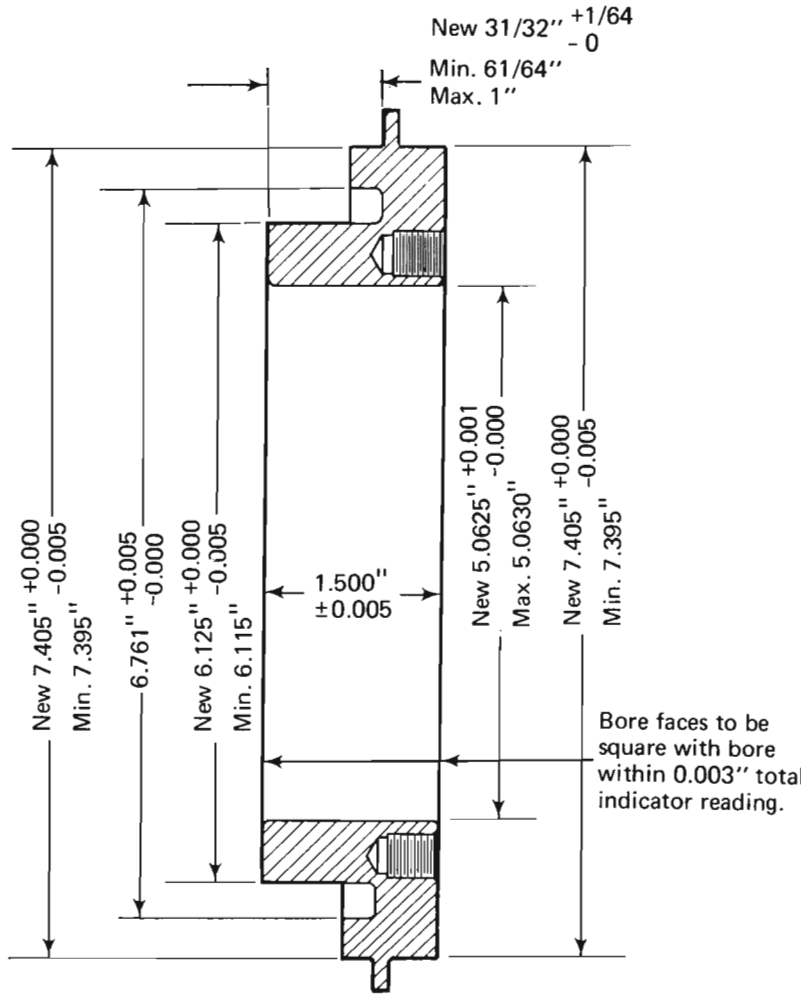
4. Bore faces to be square with the bore within 0.05 mm (.002") total indicator reading.

COMMUTATOR END COLLAR (9083297)

NOTE: Commutator end collar 9083297 replaces collar 8058172 in current model D77 motors. Refer to Fig. 1.

1. Check collar bore diameter, Fig. 23. The collar bore diameter should be a minimum of 100.79 mm (3.968") and a maximum of 100.851 mm (3.9705").

2. Bore faces to be square with bore within 0.05 mm (.002") total indicator reading.



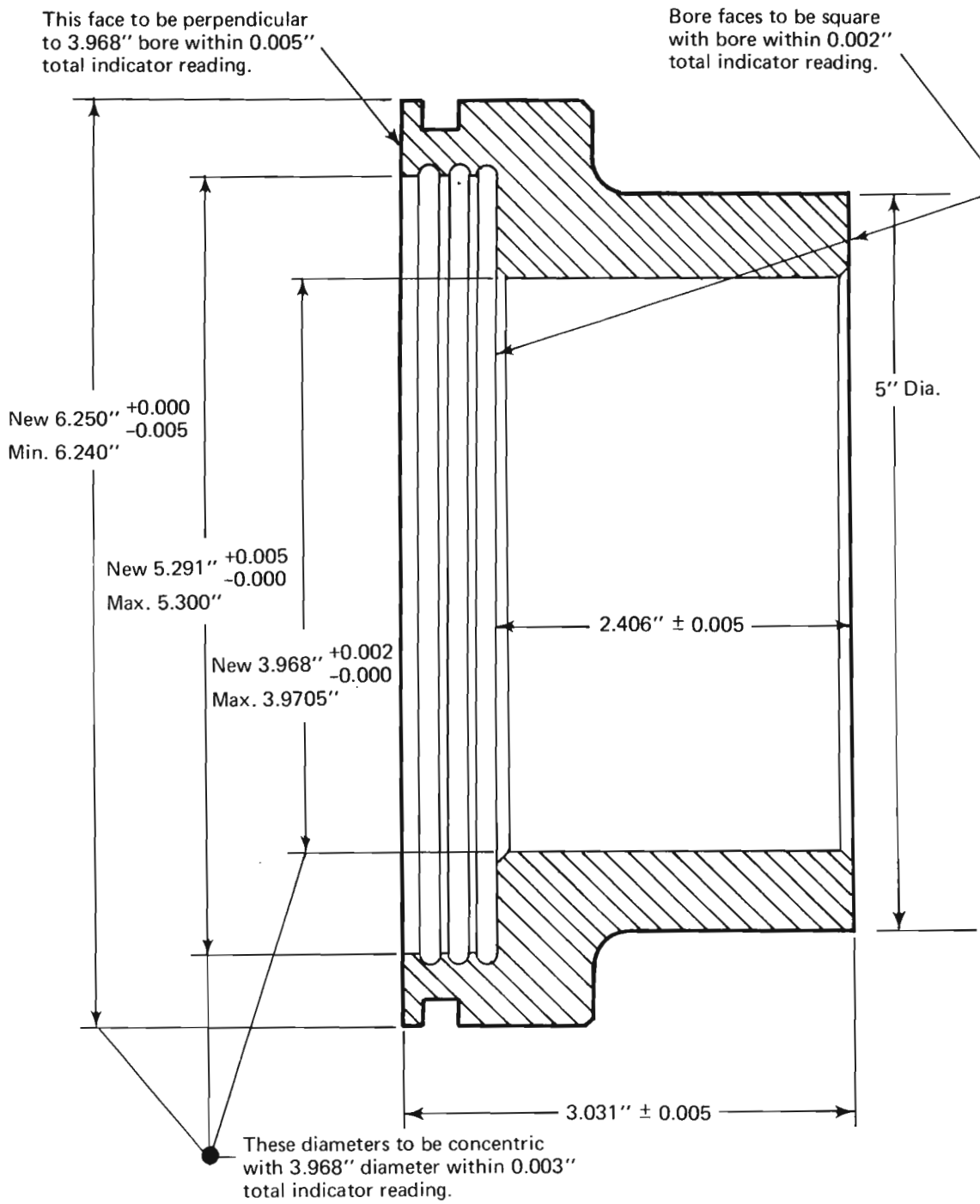
NOTES:

1. All diameters to be concentric with bore within 0.005" total indicator reading.
2. Bore out-of-round acceptable from 5.0615" to 5.0640".

METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.001	0.03	5.0625	128.588
0.003	0.08	5.0630	128.600
0.005	0.13	5.0640	128.626
1/64	0.4	6.115	155.32
61/64	24.2	6.125	155.58
31/32	24.6	7.761	197.13
1	25.4	7.395	187.83
1.500	38.10	7.405	188.09
5.0615	128.562		

21922

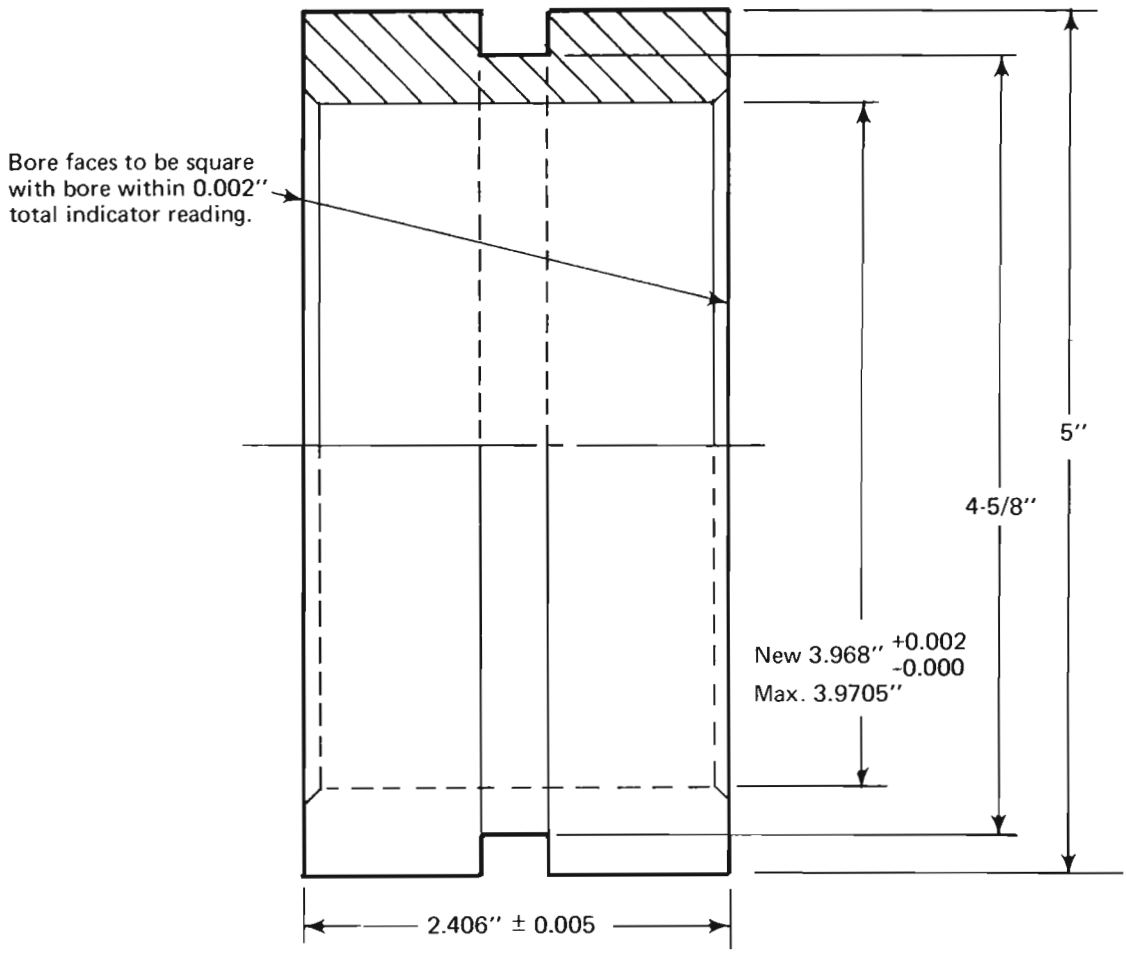
Fig. 21 – Pinion End Outer Oil Ring



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.002	0.05	3.9705	100.851
0.005	0.13	5	127
1-3/4	44.4	5.291	134.39
2.406	61.11	5.300	134.62
3.031	76.99	6.240	158.50
3.968	100.79	6.250	158.75

22467

Fig. 22 – Commutator End Collar 8058172



METRIC CONVERSION CHART	
(inch)	mm
0.002	0.05
0.005	0.13
2.406	61.11
3.968	100.79
3.9705	100.851
4-5/8	117.5
5	127

22468

Fig. 23 - Commutator End Collar 9083297

COMMUTATOR END BEARING COVER

1. Check depth of grease pocket, Fig. 24. Minimum depth over the entire area shall not be less than 30 mm (1-3/16") when measured from the gasket surface.

2. Bearing cover outer wall to be flat within 1.6 mm (1/16").

3. Bearing covers not equipped with nylon anti-churn insert should be machined to receive the insert as shown in Fig. 24.

4. Bearing covers with the nylon anti-churn insert should have the insert removed, the cover thoroughly cleaned, and a new insert installed.

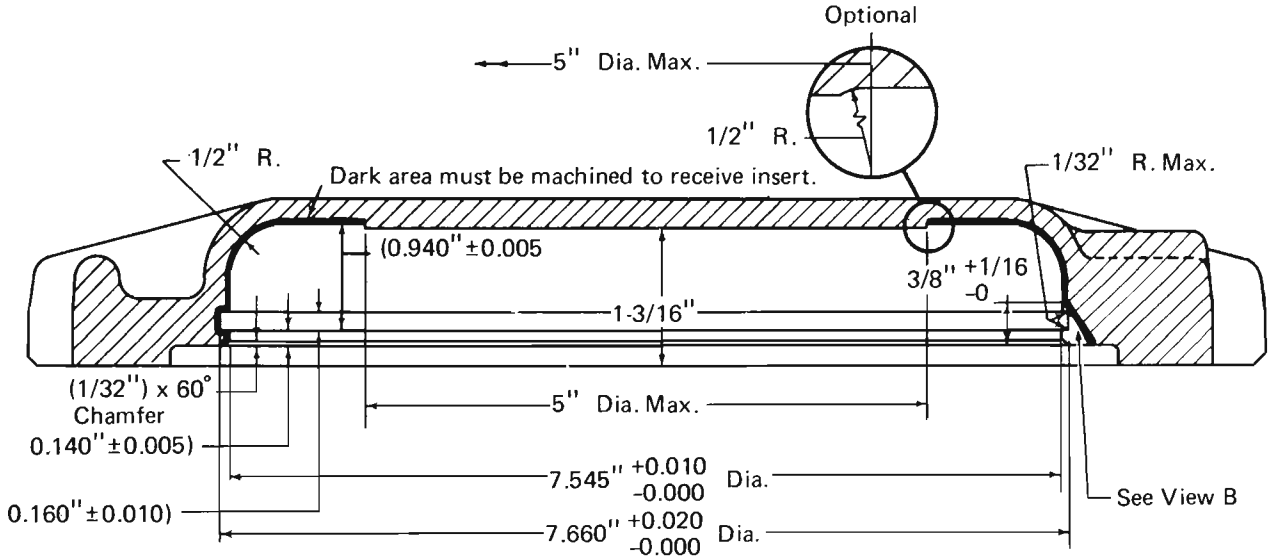
CAUTION: When performing rework of bearing cover, minimum outer wall thickness is 2.79 mm (.110").

PINION END BEARING COVER

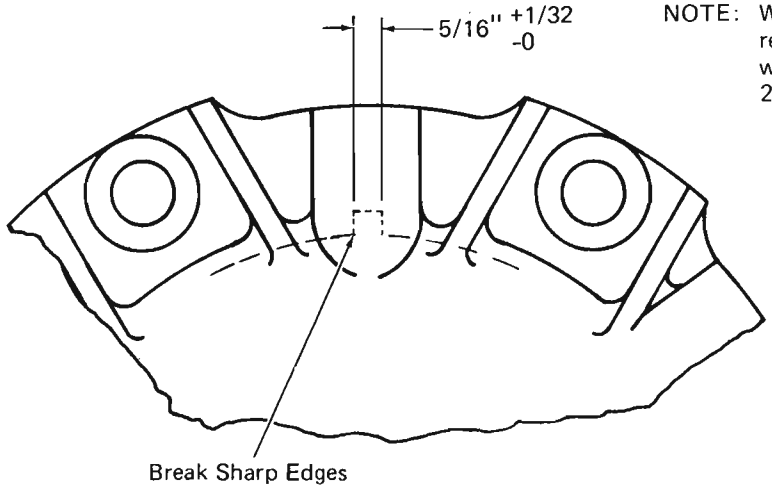
(9094444 and 8417566)

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

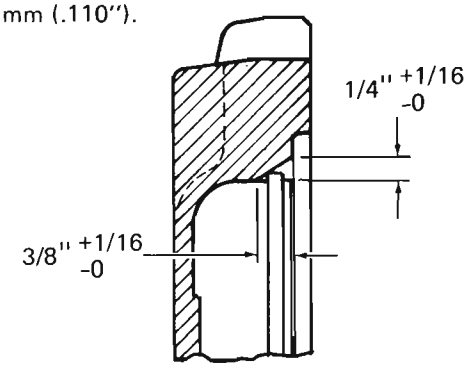
VIEW A - MACHINING ANTI-CHURN INSERT CLEARANCE



VIEW B - MACHINING ANTI-CHURN INSERT NOTCH

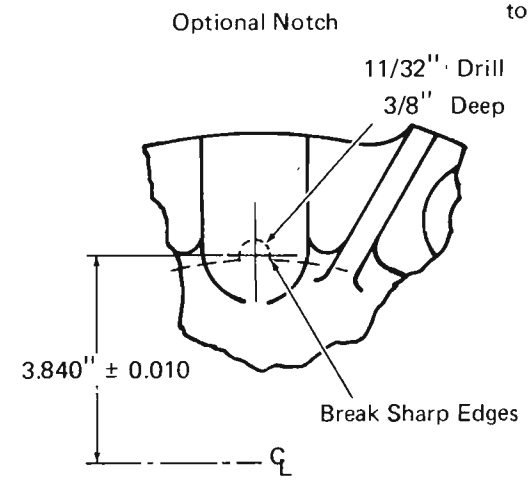


NOTE: When performing rework, minimum outer wall thickness is 2.79 mm (.110").



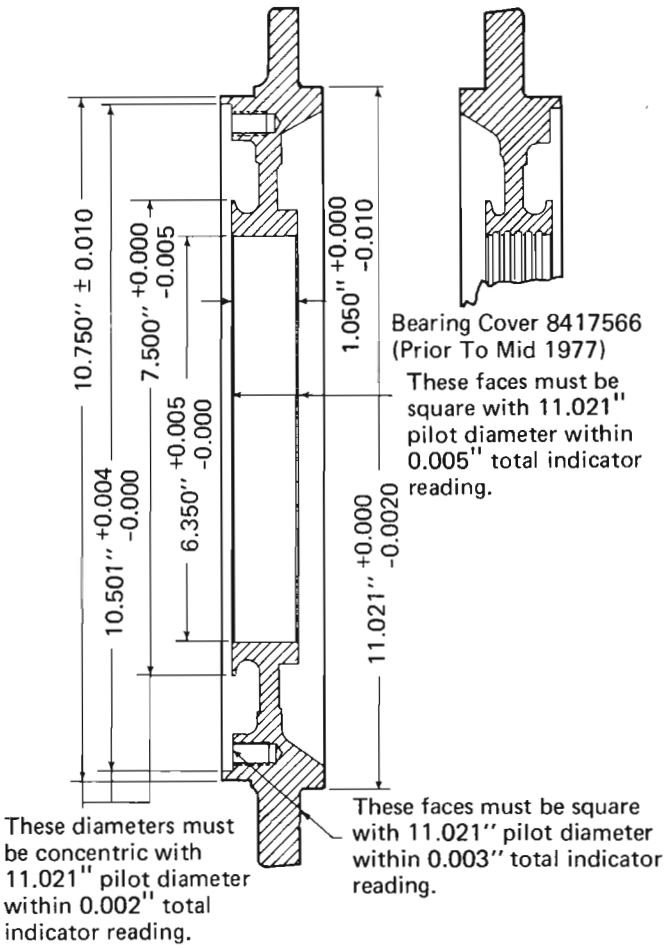
NOTE: Notch must be cut at the top center of the cover to properly position the insert to prevent insert from turning.

METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.005	0.13	11/32	9
0.010	0.25	3/8	9.5
0.020	0.51	1/2	13
1/32	0.8	0.940	23.88
1/16	1.6	1-3/16	30.2
0.110	2.79	3.840	97.54
0.140	3.56	5	127
0.160	4.06	7.545	191.64
1/4	6.4	7.660	194.56
5/16	8		



21906

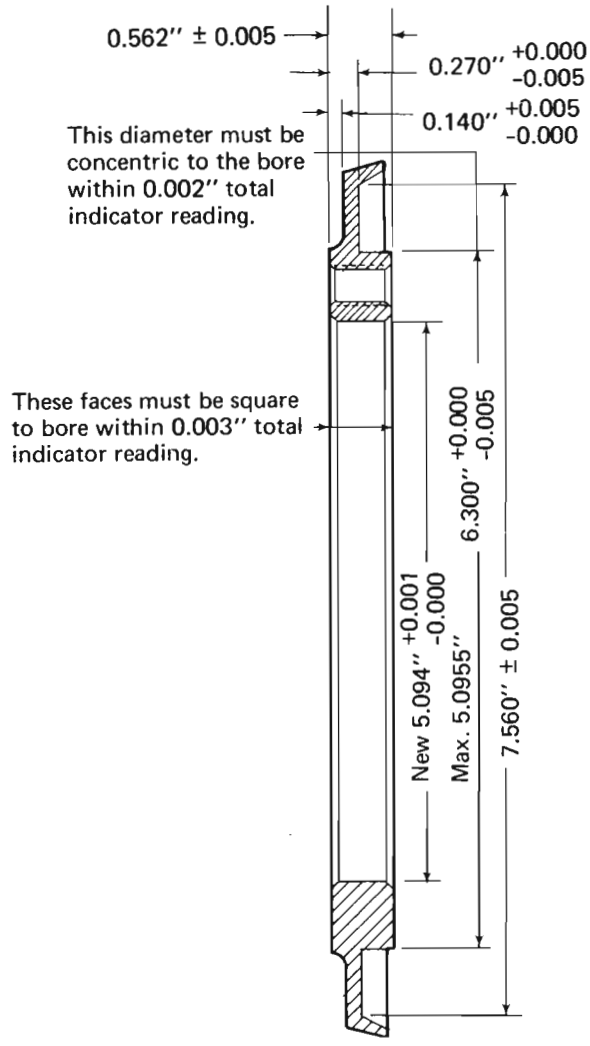
Fig. 24 – Commutator End Bearing Cover



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.002	0.05	7.500	190.50
0.004	0.10	10.021	254.53
0.005	0.13	10.501	266.73
0.010	0.25	10.750	273.05
1.050	26.67	11.021	279.93
6.350	161.29		

22469

Fig. 25 – Model D77 Pinion End Bearing Cover (9094444 And 8417566)



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.001	0.03	0.562	14.27
0.002	0.05	5.094	129.39
0.003	0.08	5.0955	129.426
0.005	0.13	6.300	160.02
0.140	3.56	7.560	192.02
0.270	6.86		

22470

Fig. 26 – Model D77 Pinion End Outer Oil Slinger (8417567)

1. Check bearing cover bore diameter. The diameter, Fig. 25, should be a minimum of 161.29 mm (6.350") and a maximum of 161.54 mm (6.360").

2. Bearing cover mounting face and the 266.73 mm (10.501") pilot diameter face to be perpendicular within 0.08 mm (.003").

3. Check threads of the six 3/8"-16 UNC and the four 5/8"-11 UNC tapped holes. The threads should be class 2B.

PINION END OUTER OIL SLINGER (8417567)

NOTE: Pinion end outer oil slinger 8417567 and pinion end outer grease slinger 8417568 are replaced by slinger 8499804 in current model D77 motors. Refer to Fig. 2.

1. Check outer oil slinger bore diameter. The diameter, Fig. 26, should be a minimum of 129.39 mm (5.094") and a maximum of 129.426 mm (5.0955").

2. Oil slinger out-of-round is acceptable from 129.31 mm to 129.46 mm (5.091" to 5.097").

3. Oil slinger bore faces to be perpendicular to the bore within 0.08 mm (.003").

4. All nicks and raised edges must be removed or blended smooth.

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

PINION END OUTER GREASE SLINGER (8417568)

NOTE: Pinion end outer grease slinger 8417568 and pinion end outer oil slinger 8417567 are replaced by slinger 8499804 in current model D77 motors. Refer to Fig. 2.

1. Check outer grease slinger bore diameter. The diameter, Fig. 27, should be a minimum of 128.575 mm (5.0620") and a maximum of 128.577 mm (5.0630").

2. Grease slinger out-of-round condition acceptable from 128.562 mm to 128.626 mm (5.0615" to 5.0640").

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

4. Check the 160.27 mm (6.310") diameter. The diameter should be a minimum of 160.02 mm (6.300") and a maximum of 160.27 mm (6.310").

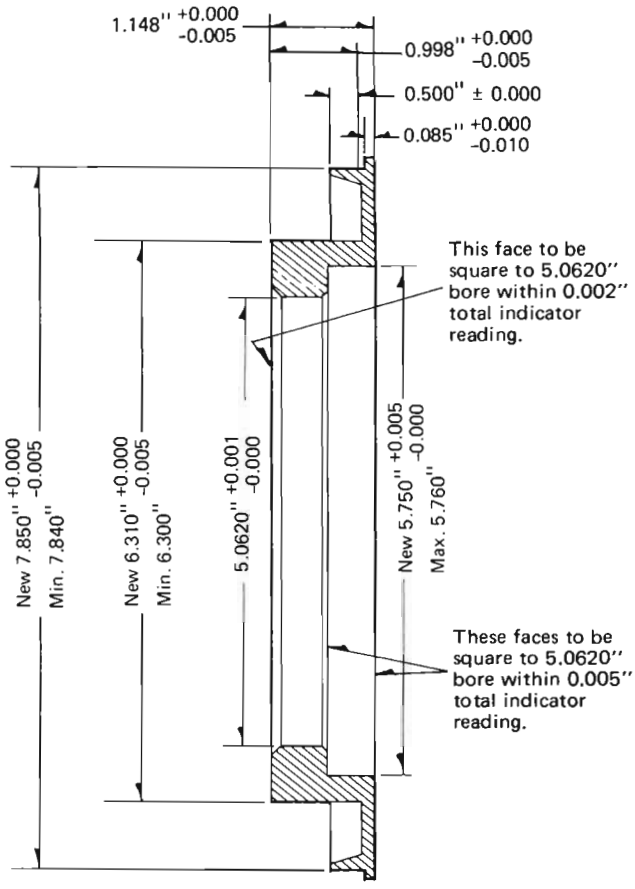
5. Check the 146.05 mm (5.750") diameter. The diameter should be a minimum of 146.05 mm (5.750") and a maximum of 146.30 mm (5.760").

6. All diameters are to be concentric to the bore within 0.13 mm (.005") total indicator reading.

7. Outer slinger face surface to be perpendicular to the bore within 0.13 mm (.005") total indicator reading.

PINION END PARTITION PLATE (8417569)

1. The partition plate should conform to the limits of Fig. 28.



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.001	0.03	5.0620	128.575
0.002	0.05	5.750	146.05
0.005	0.13	5.760	146.30
0.010	0.25	6.300	160.02
0.085	2.16	6.310	160.27
0.500	12.70	7.560	192.02
0.625	15.88	7.840	199.14
0.998	25.35	7.850	199.39
1.148	29.16		

21921

Fig. 27 - Model D77 Pinion End Outer Grease Slinger (8417568)

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 (.005").

PINION END SLINGER (8499804)

NOTE: Slinger 8499804 replaces pinion end outer grease slinger 8417568 and outer oil slinger 8417567 in current model D77 motors. Refer to Fig. 2.

1. Check slinger bore diameter. The diameter, Fig. 29, 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").

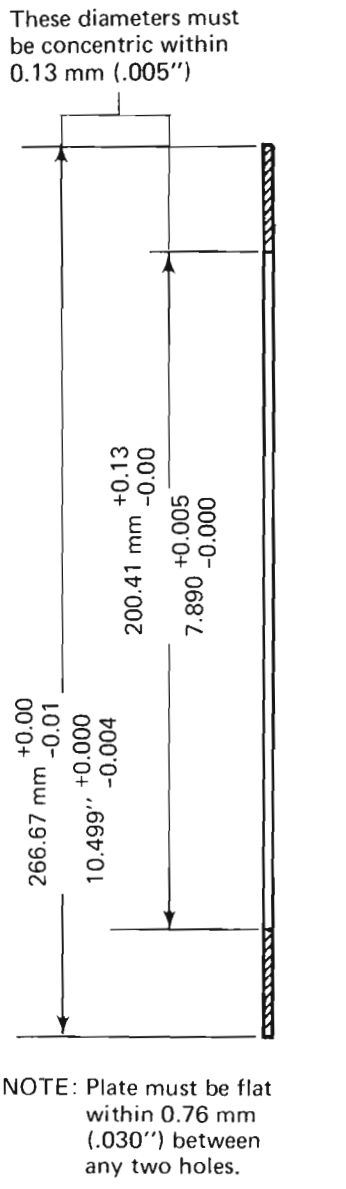
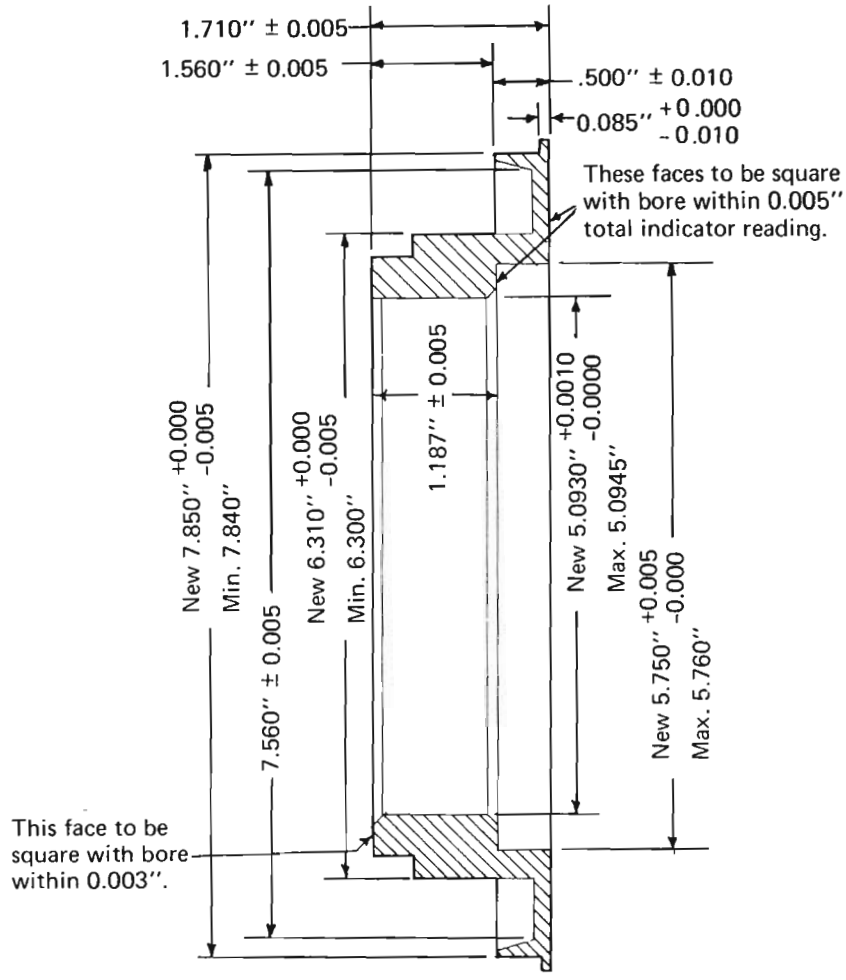


Fig. 28 – Model D77 Pinion End Partition Plate (8417569)



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.0010	0.025	5.0945	129.400
0.005	0.13	5.750	146.05
0.010	0.25	5.760	146.30
0.085	2.16	5-7/8	149.2
0.500	12.70	6.300	160.02
1.187	30.15	6.310	160.27
1.560	39.62	7.560	192.02
1.710	43.43	7.840	199.14
5.0930	129.362	7.850	199.39

Fig. 29 – Model D77 Pinion End Slinger (8499804)

2. The 149.22 mm (5-7/8") bore face to be perpendicular to the bore within 0.08 mm (.003").

3. All diameters are to be concentric with the bore within 0.13 mm (.005") total indicator reading.

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 160.02 mm (6.300") 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 146.05 mm (5.750") and a maximum of 146.30 mm (5.760").

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 noncorrosive solvent with flash point of 46° C (115° F) 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, 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 smoothedged 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 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 sometimes bright. This is caused by advanced fatiguing beyond the pitting stage, in which large sections of the surface are freed by extensive subsurface 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.

CAUTION: Traction motors built since January 1, 1971 are equipped with an offset crown inner race type bearing at the pinion end. When replacing bearing parts, be careful not to mix component parts. Refer to Section 3, Assembly And Test, of this Maintenance Instruction for additional information.

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° 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:

PINION END BEARING

Inner race inside diameter 129.974 mm to 129.999 mm (5.1171" to 5.1181"). See Fig. 30. Inner race inside diameter of E model is 169.974 mm to 169.976 mm (6.6919" to 6.6920").

Outer race outside diameter 279.981 mm to 279.999 mm (11.0229" to 11.0236"). See Fig. 31. Outer race outside diameter of E model is 319.974 mm to 319.999 mm (12.5974" to 12.5984").

COMMUTATOR END BEARING

Inner race inside diameter 99.979 mm to 99.999 mm (3.9362" to 3.9370"). See Fig. 32.

Outer race outside diameter 214.983 mm to 215.000 mm (8.4639" to 8.4646"). See Fig. 33.

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 0.163 mm to 0.208 mm (.0064" to .0082"). Pinion end bearing of E model is 0.198 mm to 0.244 mm (.0078" to .0096").

Commutator end 0.1397 mm to 0.185 mm (.0055" to .0073").

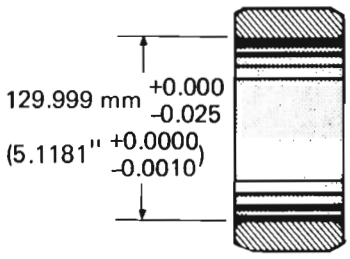


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Fig. 30 - Pinion End Inner Race

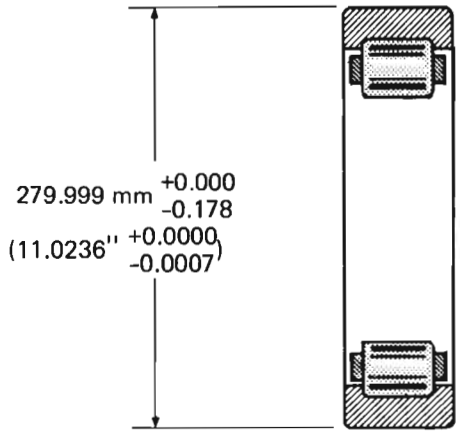

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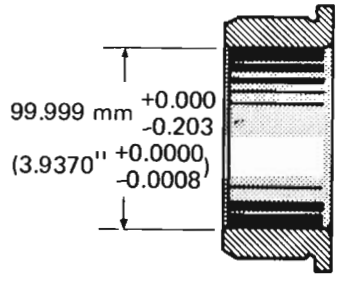
Fig. 31 - Pinion End Outer Race And Roller



22529

Fig. 32 - Commutator End Inner Race

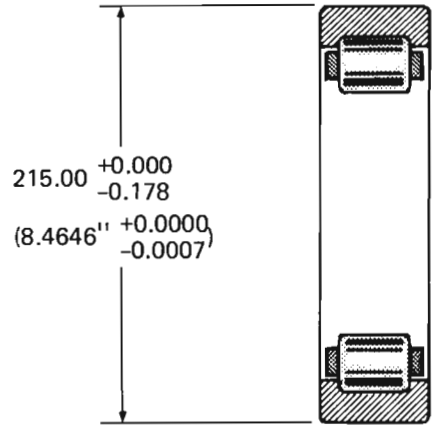


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Fig. 33 - Commutator End Outer Race And Roller

Litho in U.S.A.