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भारत सरकार
रेल मंत्रालय

GOVERNMINT OF INDIA
MINISTRY OF RAILWAYS

बड़ी लाईन एवं एमजी डीज़ल लोकोमोटिव की कर्षण मोटर, कर्षण जेनरेटर, कर्षण अल्टरनेटर और डेमू के लिए रोलर बियरिंग की तकनीकि विशिष्टि

TECHNICAL SPECIFICATION FOR TRACTION MOTOR, TRACTION GENERATOR & TRACTION ALTERNATOR ROLLER BEARINGS USED ON BG & MG DE LOCOMOTIVES & DEMU's

विशिष्टि संख्या चा. श. – 0.2402.03 (संशोधन. 04)

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अनुसंधान अभिकल्प एवं मानक संगठन
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LIST OF AMENDMENTS

Sl. No.	Amendment date	Revision	Details
1	---	00	First Issue
2	January'1995	01	Second Issue
3	November'2007	02	Third Issue
4	April' 2011	03	Fourth Issue
5	April'2021	04	Fifth Issue
			Addition of list of Amendments
			Addition of Index
			Addition of clause no. 1.1 (Reference to Make In India)
			Addition of clause no. 1.2 (Vendor changes in approved status)
			Changes in Table-1 of Applicable documents
			Changes in Table-2: Make of TM, TA & TG is replaced by RDSO specification.
			Changes in Clause no 4.3.2
			Changes in Clause no. 4.7
			Changes in Clause no. 6.1
			Changes in Clause no. 6.2
			Change in Clause no. 6.3
			Changes in Clause no. 7
			Change in Cl. no.-9 for incorporation of Performance feedback format and reference of RDSO Document no. MP-M-8.1-1 for Qualifying Quantity and period for Field trials
			Changes in Cl. no.- 13.2, 18.4.2, 18.5.3 & Annexure-I

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TECHNICAL SPECIFICATION FOR TRACTION MOTOR, TRACTION GENERATOR & TRACTION ALTERNATOR ROLLER BEARINGS USED ON BG & MG DE LOCOMOTIVES & DEMU's

1.0 SCOPE:

a) This specification covers technical requirements for manufacture, supply and inspection of Cylindrical Roller Bearing fitted on traction motor, traction generator/ traction alternator of BG/MG Locomotives and DEMU's. This specifies technical requirements, relevant inspection procedures and acceptance standards.

b) The cylindrical roller bearings and its related components shall be suitable for fitment on series of traction machines as per **Annexure- I**.

c) This specification is a combined specification for cylindrical roller bearings fitted on traction motors, traction generator/traction alternator of BG/MG Locomotives and DEMU's.

d) This specification supersedes specification no. MP-0.2402.03 (Rev-03), April' 2011.

1.1 Preference to make in India: The Government of India policy on 'Make in India' shall apply.

1.2 Vendor changes in approved status: All the provisions contained in RDSO's ISO procedures laid down in document no. QO-D-8.1-11, dated 01.07.2020(Titled "Vendor –changes in approved status) and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways.

1.3 TERMINOLOGY:

As given in IS: 2399- 1988 'Glossary of terms relating to roller bearings'.

2 APPLICATION REQUIREMENTS:

The bearings shall be suitable for specific conditions as characterized below:

2.1 Extremely heavy impacts and vibrations emanating from the track, difficult operating environments and shock loads.

2.2 Varying loads and speeds both in direction and magnitude with top speed close to limiting speed for grease lubrication.

2.3 Limitation on maintenance during operation, hence long running period before inspection and re-lubrication.

2.4 Higher reliability in performance.

3 APPLICABLE DOCUMENTS:

The specification refers to the following standards:

TABLE –1

Sl. No.	Reference Document	Description
1	IS: 2399- 1988/ ISO: 5593- 1984	Rolling Bearings – Vocabulary (First Revision).
2	IS: 5669- 1987	General plan of boundary dimensions for radial rolling bearings (First revision).
3	IS: 5692- 1988	Rolling Bearings- Tolerances- Terms and Definitions
4	IS: 6453- 1984	Technical supply conditions for rolling bearings (First revision).
5	IS: 3073- 1967	Assessment of surface roughness.
6	IS: 5935- 1992 DIN: 620- (Pt.4)	Radial internal clearances in unloaded radial rolling bearings.
7	IS: 4398- 1994	Specification for carbon chromium steel for the manufacture of balls, rollers and bearing races (First revision).
8	IS: 9202- 1979	Specifications for Cylindrical rollers.
9	IS: 3823-1988/ ISO: 76 - 1987	Rolling Bearings- Static Load Ratings
10	IS: 3824- 2002/ ISO: 281 - 1990	Rolling Bearings- Dynamic Load Ratings and rating life (Second Revision)
11	DIN:5412 Part-6 & 8	Cylindrical roller bearings with lipped outer race, single row type.
12	DIN: 623- Part 1	Designations for rolling bearings; general, bearing series symbols relating to ball bearings, cylindrical roller bearings and self-aligning roller bearings.
13	DIN EN ISO 683-17: 2014	Heat-treated steels, alloy steels and free-cutting steels Part 17: Ball and roller bearings steels (ISO 683-17: 2014)

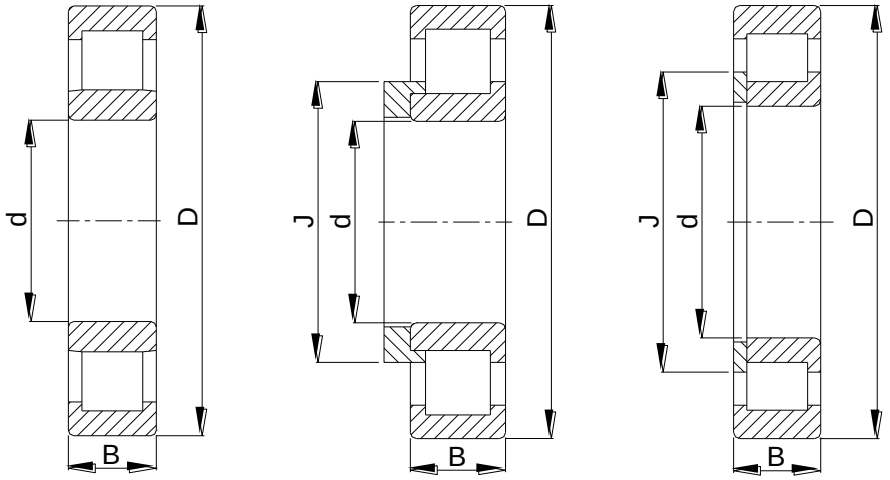
4 DIMENSION AND DESIGN:

4.1 DRAWINGS:

The Traction machine cylindrical roller bearings and its related components shall be suitable for mounting on the journal of armature shaft and housings of traction machines as per **Annexure-I**. The bearing shall also be of the designations as per Annexure- I to DIN 623.

4.2 BOUNDARY DIMENSIONS:

Boundary dimensions for cylindrical roller bearing shall conform to the dimension series 03 of IS: 5669- 1987 'General plan of boundary dimensions for radial rolling bearings (First Revision)'/Firm's approved drawing and QAP.



NU TYPE NH TYPE NUP TYPE

The cylindrical roller bearings shall be manufactured to designation and critical dimensions given in the table-2 below. However, the manufacturer shall got approved drawing before executing the order.

Table-2: (Details of bearings listed in Annexure- I)

Sl. No.	Description of Traction machine	Location	Bearing Design at-ion	Special Feature	ID (d)	OD (D)	Width (B)	Angle Ring (J)	Radial Clear a-nce
1	RDSO Spec. No. MP.0.2402.13 (Rev-03), March 13/(Latest) for Standard Motor & RDSO Spec no-MP.0.2402.19, Rev-01/(Latest) for TA of ALCo locomotives	PE	NU 330	Rivet less	150	320	65	--	C4
2		CE	NH 320	Rivet less	100	215	47	139.4	C4
3	RDSO Spec no. MP.0.2400.18 Jan'99 for 1400HP DEMU & Spec. No-MP.0.2434.07, Oct' 1992 / (Latest) for 700 HP DEMU	PE	NU 326	Rivet less	130	280	58	--	C4
4		CE	NUP 318	Rivet less	90	190	43	124	C4
5	RDSO Spec. No-MP.0.2402.12 (Rev-01), Jan.'02/(Latest) for Light Weight Motor	PE	NU 328	Rivet less	140	300	62	--	C4
6		CE	NH 318	Rivet less	90	190	43	124	C4

4.2.1 However, in case of any change in boundary dimensions of a new bearing for a new application or any change in bearing design feature, other than the ones shown above, drawings shall be got approved by RDSO.

4.3 TOLERANCE AND INTERCHANGEABILITY:

The Cylindrical roller bearings shall be produced to tolerance class 6 to IS: 5692-1988/ISO 492 (Latest) with the exceptions given in clause 4.3.1

4.3.1 The bearing bore diameter 'd' and bearing outside diameter 'D' shall conform to Normal class of tolerance to IS: 5692- 1988.

4.3.2 The inner rings and outer ring with cage assemblies shall be interchangeable meaning that even if rings from different bearings are mixed, the clearances shall remain within the specified range (It is applicable to new unused bearings only).

4.4 SURFACE FINISH:

Surface finish shall not exceed the following limits (in microns) when measured in accordance with IS: 3073- 1967 'Assessment of surface roughness' for inner and outer ring inner and outer surface with sides. The races and the rollers shall show characteristic polished or lapped surface. The surface shall be free from waves, grindings scratches, list, discoloration and other surface imperfections.

- Inner ring = 0.3 µm on raceway/ 0.8 µm on bore.
- Outer ring = 0.3 µm on raceway/ 0.8 µm on O.D.
- Sides of rings = 0.8 µm
- Rollers body = 0.2 µm
- Cage pockets and guides = 3.2 µm

4.4.1 Retouching of the bearing or its components for concealing a defect is prohibited.

4.5 RADIAL CLEARANCES:

The radial clearance shall be of 'C4' class conforming to DIN 620 part- 4 'Radial internal clearances in unloaded radial rolling bearings'.

4.6 ANGLE RING DIMENSIONS:

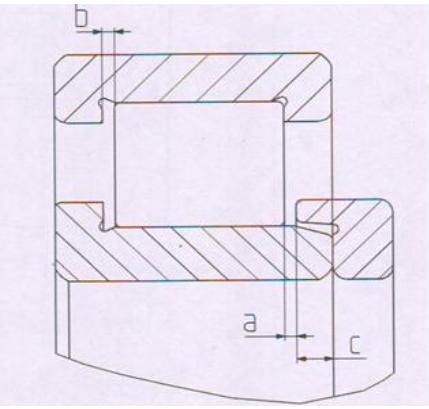
The dimensions and data for the angle ring shall conform to DIN 5412 (part- 6 & 8).

4.7 AXIAL INTERNAL CLEARANCE:

The total axial internal clearance in the NH type bearing shall correspond to the values given in Table-3 as under or as per firm's RDSO approved drawing and QAP:

Bearing Designation	a Axial internal clearance at inner ring (µm)		Total Axial Clearance a+b (µm)		c Tolerance on dimension (µm)	
	Min.	Max.	Min.	Max.	Under allowance	Over allowance
NH 320	180	300	210	395	-200	-155
NH 318	180	300	205	385	-200	-155

Read with the sketch given below-



4.8 The maximum axial displacement permissible for the shaft with inner rings is controlled by dimension 'a' as per clause 4.7. The axial displacement provided on NU type bearing shall be such that the roller is in full contact with the inner ring all the time relative to the outer rings or as per firm's RDSO approved drawing and QAP.

4.9 SPECIAL FEATURES:

4.9.1 Bearing with solid Rivet less brass cage and cylindrical cage pocket profile is mandatory.

4.9.2 The design of cage should be roller guided single piece or mixed guidance single piece.

4.9.3 A special logarithmic profile of the roller instead of straight, crowned or cylindrical/crowned profile is mandatory. The profile generation should be such that over the most of the contact length, the profile is practically straight but at the ends the deviations from a straight line can be considered without a sharp transition in profile. The details of the roller profile shall be submitted along with the offer.

4.9.4 Roller drop feature preferably be provided with suitable prongs on the cage pocket to eliminate the risk of roller coming out.

4.9.5 Uniform superior surface finish shall be obtained by grinding of track chamfers, honing of tracks and rollers.

4.9.6 Selection of rollers shall be done from a closely tolerated band such that the variation of roller diameter in a bearing is within 3 microns.

4.9.7 Radial Clearance variation should not be exceeding by 6 microns when measured on all the rollers of a bearing.

4.9.8 The bearing races shall maintain dimensional stability at least up to 120 degree centigrade bearing temperature.

5 GENERAL REQUIREMENTS:

Other requirements for the bearing shall conform to IS: 6453- 1984, 'Technical supply conditions for Rolling Bearing'.

6 MATERIAL:

6.1 Rollers and bearing races shall be manufactured from high carbon chromium bearing quality steel of grade designation as per Table-4 follows:

Rivetless Bearing Designation as per Table- 2 of para 4.2	**Recommended materials for bearing components**			
	Outer Ring	**Inner Ring**	**Rollers**	**Angle Ring/ Thrust Plate**
NU330, NU328 & NU326	104Cr6 of IS 4398-1994 (2nd. Rev.)/Latest or (100Cr6) / (100CrMnSi6-4) of DIN EN ISO 683-17:2014 or SUJ3 of JIS 4805/ 103Cr2Mn70 of IS 4398- 1994 or 100CrMo7 (ISO 683-17:2014/Latest)	104Cr6 of IS 4398-1994 (2nd. Rev.)/Latest or (100Cr6) / (100CrMnSi6-4) of DIN EN ISO 683-17:2014 or SUJ3 of JIS 4805/ 103Cr2Mn70 of IS 4398- 1994 or 100CrMo7 (ISO 683-17: 2014/Latest)	104Cr6 of IS 4398-1994 (2nd. Rev.)/Latest or (100Cr6) /(100CrMnSi6-4) of DIN EN ISO 683-17:2014 or SUJ3 of JIS 4805/ 103Cr2Mn70/ 100CrMn6 of IS 4398-1994 or 100CrMnSi6-4 (ISO 683-17:2014/Latest)	N/A
NH320, NH324, NH318 & NUP318	104Cr6 of IS 4398-1994 (2nd. Revision)/Latest or (100Cr6) / (100CrMnSi6-4) of DIN EN ISO 683-17:2014/Latest or SUJ2 of JIS 4805/ 103Cr2 of IS 4398,1972 or 100Cr6 (ISO 683-17: 2014/Latest)	104Cr6 of IS 4398-1994 (2nd. Revision)/Latest or (100Cr6)/ (100CrMnSi6-4) of DIN EN ISO 683-17:2014/Latest or SUJ2 of JIS 4805/103Cr2 of IS 4398, 1972 or 100Cr6 (ISO 683-17: 2014/Latest)	104Cr6 of IS 4398-1994 (2nd. Revision)/Latest or (100Cr6) / (100CrMnSi6-4) of DIN EN ISO 683-17:2014/Latest or SUJ2 of JIS 4805/ 103Cr2 of IS 4398,1972 or 100CrMnSi6-4 (ISO 683-17: 2014/Latest)	Manufacturer to declare to RDSO before executing the order

6.2 MATERIAL FOR CAGE (BRASS/BRONZE):

The bearing shall be fitted with cage manufactured from centrifugally cast solid Brass/Bronze confirming to:

i. Brass material grade CuZn39Pb1Al-C or Bronze material grade CuAl10Fe5Ni5-C-GZ or
ii. CuZn40Al1Pb or
iii. HBSC1 as per JIS5102

If the manufacturer wants to use any other material, sufficient information about the alternative material shall be furnished and the same shall be approved by RDSO. However, steel cages are not permissible.

6.3 The inclusion rating of the bearing steel shall be declared by the manufacturer and shall be in accordance with Table-3 of IS: 4398- 1994 or Table A.1 of ISO 683-17.

7. HEAT TREATMENT:

Armature temperature rise of traction machines may be referred as per governing specification given in Table-2 and Annexure-I.

7.1 HARDNESS:

Heat treatment process shall be such that uniform hardness is obtained as per the following limits:

a) Hardness of Inner ring, outer ring and rollers= 62$\pm$3 HRC shall conform to IS: 6453- 1984.The preferred range of hardness for rollers shall be 60 to 62 HRC and for rings shall be 59 to 62 HRC.
b) Cage hardness shall be 100 to 130 HB.

Actual hardness used, shall be indicated by the manufacturer.

8. LOAD RATING:

The load rating shall be computed in accordance with IS: 3823- 1988 'Method of evaluating static load rating of rolling bearings (First revision) and IS: 3824- 2002 'Method of evaluating dynamic load ratings of rolling Bearings (Second revision) and a copy of the calculations be submitted by the firm.

9. SPECIAL TESTS & FIELD TRIALS:

In case of development orders or if felt necessary by the RDSO, special tests shall be carried out by the manufacturer to establish the suitability of the bearing. The scope of the special test schedule shall be decided mutually between the RDSO and the manufacturer based on the list of tests given at **Annexure- II.**

9.1 A field trial on locomotives shall be done before clearing the bearing for regular use. The Quantity and Period for field trials shall be governed by RDSO Document no. MP-M-8.1-1.

9.2 Field trial of bearing shall be carried out and performance to be monitored as per following format:

S. No.	Loco No.	TM Make and Model No.	TM No./ Location	Date of fitment of TM in loco	Date of failure, if any	Remarks

10. PROTECTION AGAINST CORROSION:

The type of protection against corrosion shall be decided by the manufacturer depending on the packing material used. Under proper storage conditions the anti corrosive treatment shall be effective for at least 12 moths in order to ensure a satisfactory functioning of the rolling bearings, unless otherwise required by the RDSO.

11 PACKING:

The complete bearing assembly in unit shall be packed individually in suitable card board carton and several pieces may be packed together in suitable wooden containers depending on the size. The packing shall carry company's trademark, part number and Packaging date, and shall conform to international norms so as to protect the product during the transit handling and storage. In the event of supply to various sheds, the bulk packing must not be opened and bearings in multiple of bulk packing should only be supplied.

12 MARKING:

12.1 Packed containers shall be marked with the following.

a) Manufacturer's name or trade mark
b) Code or direct indication of month and year of manufacture.
c) Designation of the bearing defining the type and dimensions, radial internal clearance etc.
d) Quantity.

12.2 Each bearing shall carry on the side face of its inner and outer rings visibly and indelibly the following markings –

12.3

a) Manufacturer's name/ code/ trade mark.
b) Complete Designation of the bearing.
c) Date code of manufacturing of the production lot.

12.3 The manufacturer shall submit complete marking schemes and get it approved by RDSO. Drawing showing the marking arrangement proposed to be followed by the supplier shall be submitted along with the offer.

12.4 If the supplier proposes to use a code this shall be clearly indicated in the tender offer and duly incorporated in 'As Made Drawings' and Maintenance Manuals.

13 LUBRICATION:

13.1 The bearing shall be capable of working for a minimum period of 4 years without total change of grease. No attention (including grease topping) shall be required before 4 years.

13.2 The bearing shall be suitable for lubrication as recommended in Maintenance Instruction No. MP.MI-15 (Revision-12) January'19 or latest for recommended lubricant & coolant for diesel locomotives of RDSO.

14.0 ADDITIONAL REQUIREMENTS:

14.1 Life Expectancy:

The bearing shall have an average rated life expectancy equivalent to at least ten years working on both passenger and goods operation of Indian Railways for 90 % roller bearings calculated as per IS: 3824- 2002 (Second revision) or ISO-281-1990 ' Rolling bearings- Dynamic load ratings and rating life'.

15.0 TECHNICAL PARTICULARS TO BE FURNISHED BY THE SUPPLIER:

15.1 A complete set of detailed drawings of roller bearing showing overall dimensions, reference to IS specifications or equivalent standard specification for material of each component along with grades, classes etc. as applicable, mounting details and weight of each component shall be submitted to RDSO/ purchaser for prior approval and for the purpose of carrying out inspection accordingly.

15.2 Details of marking scheme on each individual component.

15.3 A copy of proposed maintenance manual incorporating the following minimum information –

a) Description of bearings.
b) Initial mounting and lubrication of the bearings.
c) Extraction and dismounting of bearing for overhaul and remounting.
d) Procedure of bearing examination (minimum period of 4 years).
e) Initial and condemning limits of dimensions of components and clearance.
f) Drawings for components and assembly.

15.4 Full calculation in support of the design capacity and life expectancy of the roller bearing offered including lateral thrust capacity. Although the gear drive is through spur gearing, thrust load is taken by the CE bearing due to axial movement of the armature.

15.5 Other information required as per this specification.

15.6 DEVIATION STATEMENT:

The supplier shall submit item wise deviation statement seeking approval for making deviation from the above drawings and specification. In case no relaxation is sought 'NIL' statement shall be submitted.

16. MAINTENANCE:

The supplier shall supply free copies of the approved maintenance manual for over haul purpose.

17. QUALITY ASSURANCE PLAN:

17.1 The firm shall prepare a Quality Assurance Plan (QAP) for all items for which approval is sought and submit the same as a part of compliance of this specification. The QAP shall be a comprehensive document covering the following aspects including all the parameters in accordance with ISO document no. **QM-RF-8.1.3 Ver-1.0 (or latest)** - Guidelines for preparing QAP during registration. In this, the frequency of various checks, details of nature of work involved in the checks and records maintained regarding these checks should be indicated.

17.2 Supplier shall on demand by RDSO/ Purchaser/ Inspecting authority nominated by RDSO/ Purchaser, make available the records of checks carried out during internal quality assurance for scrutiny.

18 INSPECTION:

18.1 The roller bearing shall be generally inspected at the manufacturer's premises in accordance with the procedure laid down in Para 18.3 of this specification.

18.2 The imported roller bearings shall also be inspected at the manufacturer's premises by Advisor to Railways (R.A) or any other authorized representative.

18.3 ACCEPTANCE INSPECTION:

18.3.1 GENERAL

a) Inspection shall be carried out by purchaser or inspection authority nominated by purchaser.

b) Inspection of the bearings shall be carried out at the contractor's premises.

c) For this purpose, the contractor shall provide, free of charge, labour and appliances required by inspecting officer for inspecting whole of the work under contract at the firm's premises.

18.3.2 PRESENTATION OF DELIVERY:

a) On completion of manufacture including marking as per clause 12.0 fully assembled bearings shall be presented for inspection in lots.

b) The bearings shall be in un-lubricated and unpacked condition.

c) In case of developmental order at least 5 bearings shall be presented for type tests inspection in un-assembled condition.

18.3.3 INSPECTION SCHEDULE FOR TYPE TESTS AND ROUTINE TESTS:

TYPE TESTS: Type tests shall be carried out by RDSO at firm's premises on newly developed bearings or bearings with existing approved design but developed by a new manufacturer.

ACCEPTANCE TESTS: Acceptance tests shall be carried by purchaser/ inspecting agency at firm's premises on the bearing which is already developed and type tested as per Table-6 below.

Table-6

S. No	Description	PINION END		COMMUTATOR END	
		Type Tests (Brg. in disassembled Condition)	Acceptance Test (Brg. in assembled Condition)	Type Tests (Brg. in disassembled Condition)	Acceptance Test (Brg. in assembled Condition)
1	**Outer Ring**				
	OD size	✔	✔	✔	✔
	OD roundness	✔	✔	✔	✔
	OD taper	✔	✔	✔	✔
	OD square ness w.r.t. face	✔	✔	✔	✔
	Width	✔	✔	✔	✔
	Face parallelism	✔	✔	✔	✔
	Face flatness	✔	✔	✔	✔
	Raceway/Track roundness	✔	X	✔	X
	Raceway/Track taper	✔	X	✔	X
	Eccentricity of OD w.r.t. Track	✔	X	✔	X
	Surface finish on track	✔	X	✔	X
	Surface finish on face	✔	✔	✔	✔
	Surface finish on OD	✔	✔	✔	✔
	Track width	✔	X	✔	X
	Hardness	✔	✔	✔	✔
	Corner/ Chordial distance Axial direction Radial direction	 ✔ ✔	 ✔ ✔	 ✔ ✔	 ✔ ✔
	Chemical composition, Microstructure, Inclusion rating	✔	X	✔	X
	MPI Test	✔	X	✔	X

S. No	Description	PINION END		COMMUTATOR END	
		Type Tests (Brg. in disassembled Condition)	**Acceptance Test (Brg. in assembled Condition)**	**Type Tests (Brg. in disassembled Condition)**	**Acceptance Test (Brg. in assembled Condition)**
	Thermal Stability Test	✔	**X**	✔	**X**
2	**Inner Ring**				
	Bore size	✔	✔	✔	✔
	Bore roundness	✔	✔	✔	✔
	Bore taper	✔	✔	✔	✔
	Bore square ness w.r.t. face	✔	✔	✔	✔
	Width	✔	✔	✔	✔
	Face parallelism	✔	✔	✔	✔
	Face flatness	✔	✔	✔	✔
	Track roundness	✔	✔	✔	✔
	Track taper	✔	✔	✔	✔
	Eccentricity of bore w.r.t. Track	✔	✔	✔	✔
	Surface finish on track	✔	✔	✔	✔
	Surface finish on face	✔	✔	✔	✔
	Surface finish on bore	✔	✔	✔	✔
	Hardness	✔	✔	✔	✔
	Corner/ Chordial distance Axial direction Radial direction	 ✔ ✔	 ✔ ✔	 ✔ ✔	 ✔ ✔
	Chemical composition, Microstructure, Inclusion rating	✔	**X**	✔	**X**
	MPI Test	✔	**X**	✔	**X**
	Thermal Stability Test	✔	**X**	✔	**X**
3	**Rollers**				
	OD size	✔	**X**	✔	**X**
	OD roundness	✔	**X**	✔	**X**

S. No	Description	PINION END		COMMUTATOR END	
		Type Tests (Brg. in disassembled Condition)	**Acceptance Test (Brg. in assembled Condition)**	**Type Tests (Brg. in disassembled Condition)**	**Acceptance Test (Brg. in assembled Condition)**
	Lot dia. variation in bearing	✔	X	✔	X
	Length	✔	X	✔	X
	Surface finish OD	✔	X	✔	X
	Hardness	✔	X	✔	X
	Chemical composition, Microstructure, Inclusion rating	✔	X	✔	X
	MPI Test	✔	X	✔	X
4	**Brass Cage**				
	Outer dia	✔	X	✔	X
	Inside dia.	✔	X	✔	X
	Width	✔	X	✔	X
	Pocket width	✔	X	✔	X
	Surface finish Pocket dia. Pocket face	✔	X	✔	X
	Hardness	✔	X	✔	X
	Chemical composition, Microstructure	✔	X	✔	X
5	**Bearing in assembled condition**				
	Radial clearance	✔	✔	✔	✔
	Radial clearance on all the rollers	✔	✔	✔	✔
	Radial run out- OR	✔	X	✔	X
	Radial run out- IR	✔	X	✔	X
	Interchangeability As per Para - 4.3.2	✔	✔	✔	✔
	Radial Run-out	✔	X	✔	X
6	**Angle Ring**				
	Bore dia. size	X	X	✔	✔
	Outer dia. size	X	X	✔	✔
	Width	X	X	✔	✔
	Surface finish- Face	X	X	✔	✔
	Hardness	X	X	✔	✔
	Flange depth	X	X	✔	✔

S. No	Description	PINION END		COMMUTATOR END	
		Type Tests (Brg. in disassembled Condition)	**Acceptance Test (Brg. in assembled Condition)**	**Type Tests (Brg. in disassembled Condition)**	**Acceptance Test (Brg. in assembled Condition)**
	Corner/ Chordial distance Axial direction Radial direction	 **X** **X**	 **X** **X**	 ✔ ✔	 ✔ ✔
	Chemical composition, Microstructure, Inclusion rating	**X**	**X**	✔	**X**
	MPI Test	**X**	**X**	✔	**X**

18.3.4 TEMPERATURE:

All measurement shall be carried out at ambient temperature. The gauges and measuring instruments and the parts to be inspected shall be stabilized at this temperature before any test is carried out.

18.3.5 REFERENCE SIDE:

The side face opposite the bearing designation marking shall be considered the reference side.

18.3.6 GENERAL INSPECTION:

a) Inspection as per clause 18.3.6(b) to 18.3.6(e) shall be carried out on each of the bearing in the lot offered.

b) Diameter of bore of inner ring and outer ring shall be measured.

c) Appearance of bearings shall be visually examined (without magnification). All essential portions of the cylindrical roller bearing shall be clean and free from defects such as porosity, burrs, hardening cracks, grinding marks, indentations and rust mark etc.

d) Functioning of all bearings shall be checked as per the method agreed between inspecting authority and supplier.

e) Only those bearings of a lot which meet requirements in respect of Para (b), (c) and (d) stipulated on approved drawings above shall form the lot for the purpose of sampling inspection as per clause 18.4.

18.4 SAMPLING INSPECTION:

18.4.1 Inspecting Authority shall select bearings at random from each lot presented for carrying inspection as per clause 18.4.2 to 18.4.9. The size of sample to be selected for these tests shall be as indicated in Table-7 below:

Table-7

Number of bearings in the lot offer for inspection	Number of sample bearings to be selected
Up to 100	2*
101 – 250	3
Over 250	4

***** The number of bearings to be selected from a lot equal to or less than 50 bearings is subject to agreement between customer and supplier. The bearings selected for sampling inspection shall be degreased, if necessary.

18.4.2 Radial run-out of inner ring and outer ring in the assembled bearings shall be checked - **Type test.**

18.4.3 The length and diameter of all rollers on each sample bearing shall be measured and variation therein determined (Refer Para **-** 4.9.6) - **Type Test**

18.4.4 Magnetic particle test shall be carried out on both rings and 3 rollers of each sample bearings. It shall be carried out as per procedure agreed upon between the purchaser/ RDSO and contractor. The rings and rollers should not show any signs of cracks or harmful defects. After this test, bearing components shall be demagnetized **- Type Test.**

18.4.5 Before and after the tests as per clause 18.4.4 sample bearings shall be checked as per method agreed between purchaser and contractor for residual magnetism **- Type Test.**

18.4.6 Hardness of inner ring, outer ring, three rollers and cage of each sample bearing shall be checked **- Type Test.**

18.4.7 Expansion testing of inner ring of each of the sample bearing shall be carried out. After completion of the expansion test, inner ring shall show no sign of fracture **- Type Test.**

18.4.8 Surface finish of inner ring, outer ring and all rollers of sample bearings shall be checked in accordance with para 4.4 of this specification.

18.4.9 In case any of the sample bearings when tested as per clauses 18.4.2 to 18.4.9 does not meet the requirements of this specification, the whole lot shall be rejected.

18.4.10 Bearing rejected as a result of tests in clause 18.4.2 to 18.4.8 may be re-offered for inspection as per agreement between purchaser and contractor.

18.5 CHEMICAL COMPOSITION:

18.5.1 Manufacturer shall furnish ladle analysis, micro structure and inclusion rating of steel for each heat. This shall correspond to the stipulations as per para 6.3 **- Type Test.**

18.5.2 Manufacturer shall furnish actual chemical composition of cage material for "each heat out" of which cages on bearing in lot offered have been manufactured. This shall correspond to the stipulations as per para 6.2 **- Type Test.**

18.5.3 Inspector may order retest on inner ring, outer ring, rollers and cage of one bearing out of every 1000 bearings inspected**.**

18.5.4 In case the results of tests at clause 18.5.3 or the analysis in clauses 18.5.1 and 18.5.2 do not conform, the whole lot of bearings shall be rejected **- Type Test.**

18.6 EXAMINATION OF FRACTURE STRUCTURE:

This test shall be done on both the rings (inner & outer) and three rollers of one bearing out of every 1000 bearings inspected. The rings and rollers shall be fractured by a method chosen by the contractor to show the structure of a brittle fracture. Fractured structure on visual examination should not show any discontinuity, laminations, flaws, shrinkage cavities or other material defects.

18.7 DISPOSAL OF REJECTED BEARINGS:

Bearings, which are finally rejected, shall be marked in a distinguishable manner and shall be disposed of in such a manner as the RDSO/ inspecting authority may direct.

18.8 Purchaser/ RDSO/ Inspecting Authority shall have power to visit at any reasonable time and without previous notice, to inspect the manufacturing and quality of work at any stage.

18.8.1 Purchaser/ RDSO/ Inspecting Authority shall have free and ready access to Manufacturer's quality assurance records and procedures etc.

ANNEXURE - I

List of Traction Machine with Cylindrical Roller Bearings

SL NO	Bearing Designation	Applicable Machine	Applicable on Loco/ DEMU	Location
1	NU 330	1. As per RDSO Spec. No. MP.0.2402.13 (Rev-03), March 13/ (Latest) for Standard Motor 2. As per RDSO Spec no. MP.0.2400.18 Jan'99/(Latest) for 1400HP DEMU, 3. As per RDSO Spec. No-MP.0.2434.07, Oct'1992/(Latest) for 700HP DEMU 4. As per RDSO Spec. No-MP.0.2402.12 (Rev-01), Jan.'02/(Latest) for Light Weight Motor, 5. As per RDSO Spec no-MP.0.2402.19, Rev-01/(Latest) for TA of ALCo locomotives.	WDM2 & WDM7 YDM4 WDM2 (AC-DC) WDM7 WDM2, WDM2C & WDG2	Armature Armature Non-Drive End Armature Armature Pinion End Pinion End Pinion End
2	NH 320		WDM2, WDM2C & WDG2 1400 HP DEMU	Comm. End Comm. End Comm. End
3	NU 326		YDM4 YDM4 700 HP DEMU 1400 HP DEMU	Pinion End Pinion End Pinion End Drive End
4	NUP 318		YDM4 YDM4 700 HP DEMU	Comm. End Comm. End Comm. End
5	NH 324		1400 HP DEMU	Non-Drive End
6	NU 328		1400 HP DEMU WDM2, WDM2C & WDG2 Std. Gauge	Pinion End Pinion End Pinion End Pinion End Pinion End
7	NH 318		WDM2, WDM2C & WDG2	Comm. End Comm. End

ANNEXURE - II

LIST OF SPECIAL TESTS FOR TRACTION MOTOR ROLLER BEARINGS

1. Bench test on no load and extended full load to establish/ determine -

   a) Running accuracy.

   b) Vibration and noise level – generally limited to 80 dB.

   c) Frequency spectrum generated by different elements of the bearing.

   d) Stability of dimensions especially radial run out and boundary dimensions after running.

2. Non - destructive tests on bearing components including all dimensions, run- outs, surface finish and hardness in accordance with this specification and ultrasonic examinations of bearing and rollers.

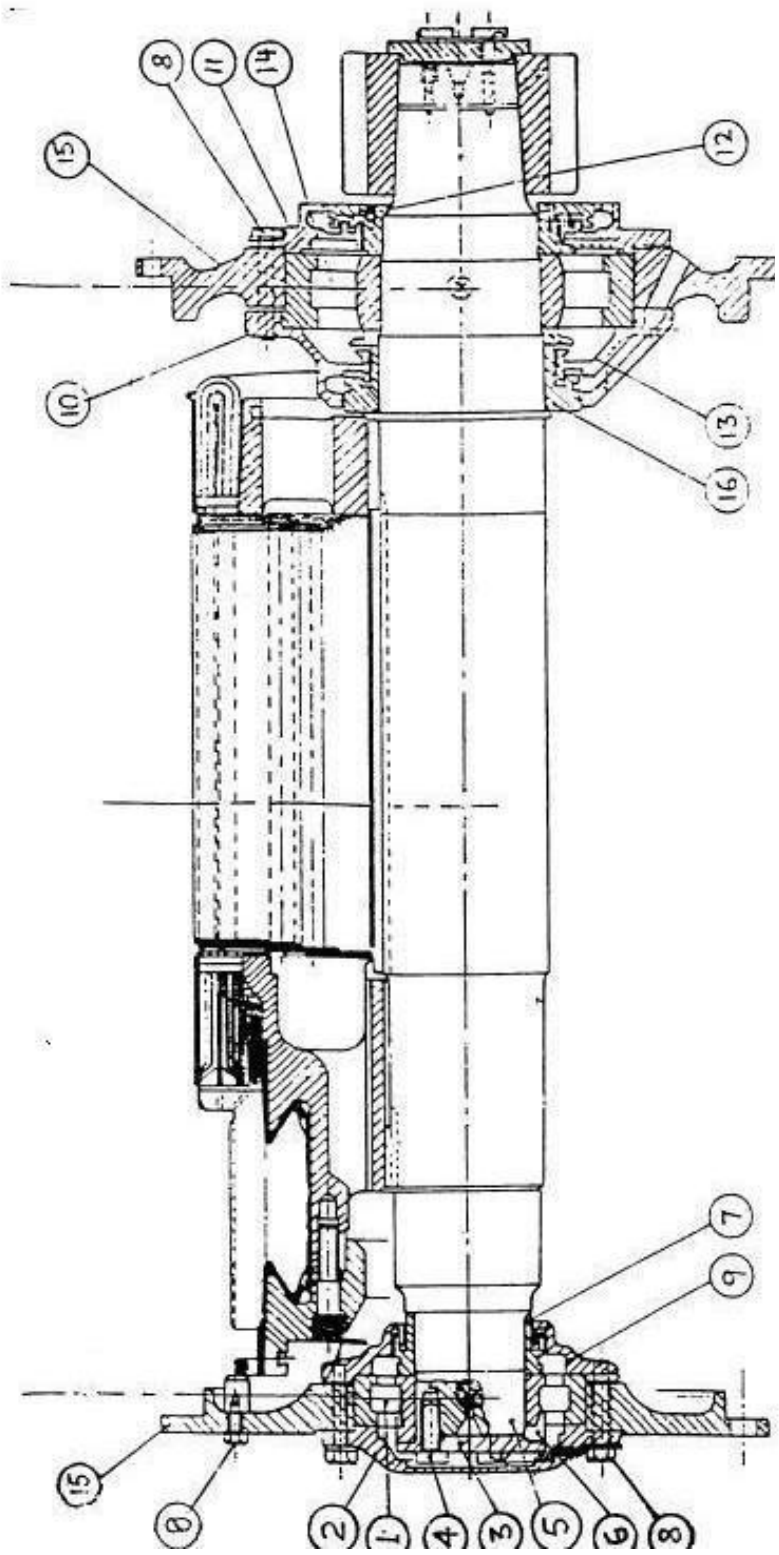
3. Destructive tests including chemical analysis of materials of different elements, hardness survey through the cross section of rings and rollers, microstructure of rings and rollers etc.

4. Endurance test to establish rated life.

5. Overspeed test at no load for limited period.

Refer armature assembly sketch No. 1, 2 & 3

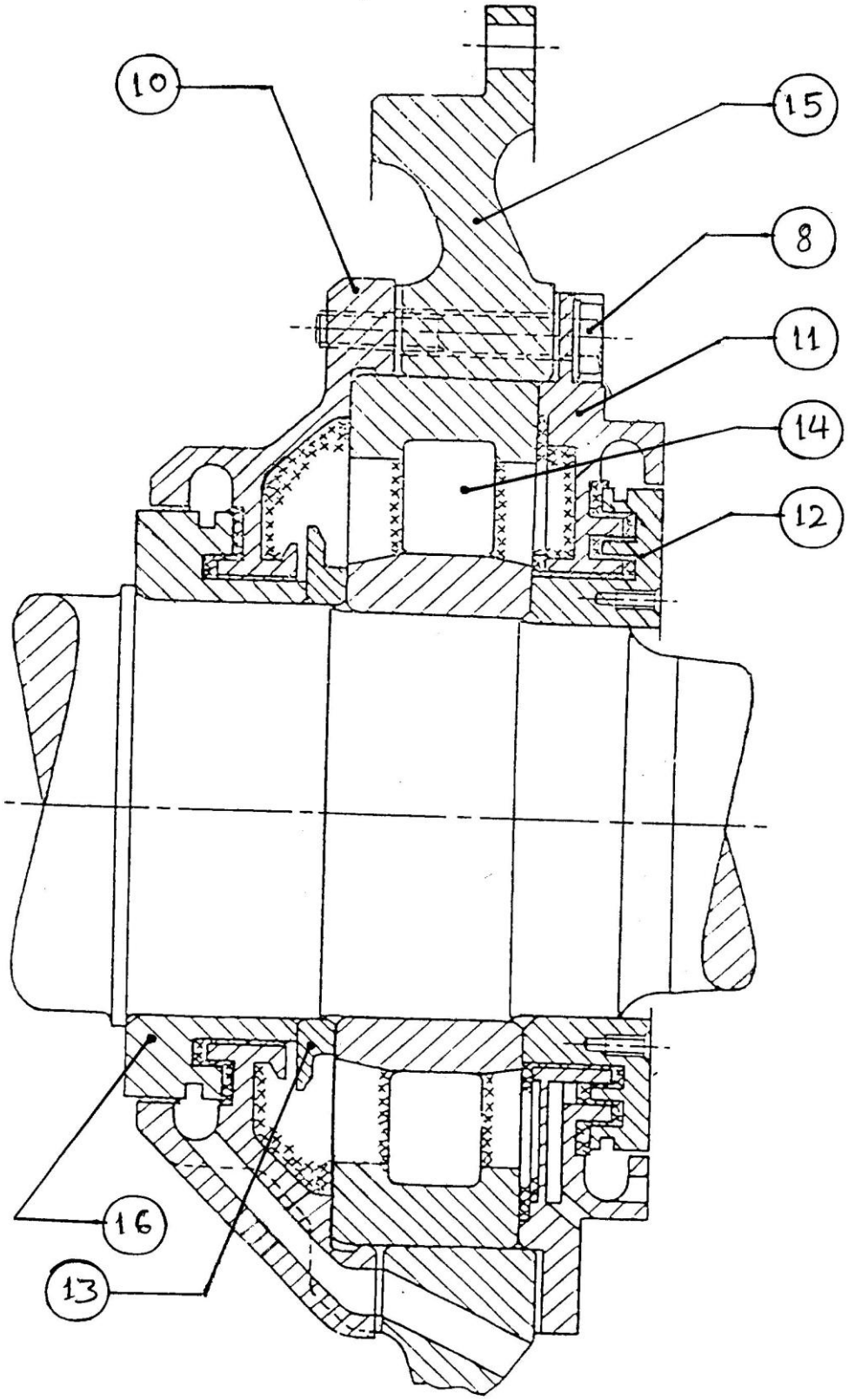
1. Armature bearing CE
2. Outer bearing cap CE
3. Bearing locking plate CE
4. Bearing locking bolt CE
5. Armature shaft
6. Bearing separate plate (Angle ring) CE
7. Bearing sleeve CE
8. Bolt
9. Inner bearing cap CE
10. End shield PE
11. Outer bearing cap PE
12. Bearing thrower PE
13. Flinger PE
14. Armature bearing PE
15. Magnet frame
16. Bearing sleeve PE



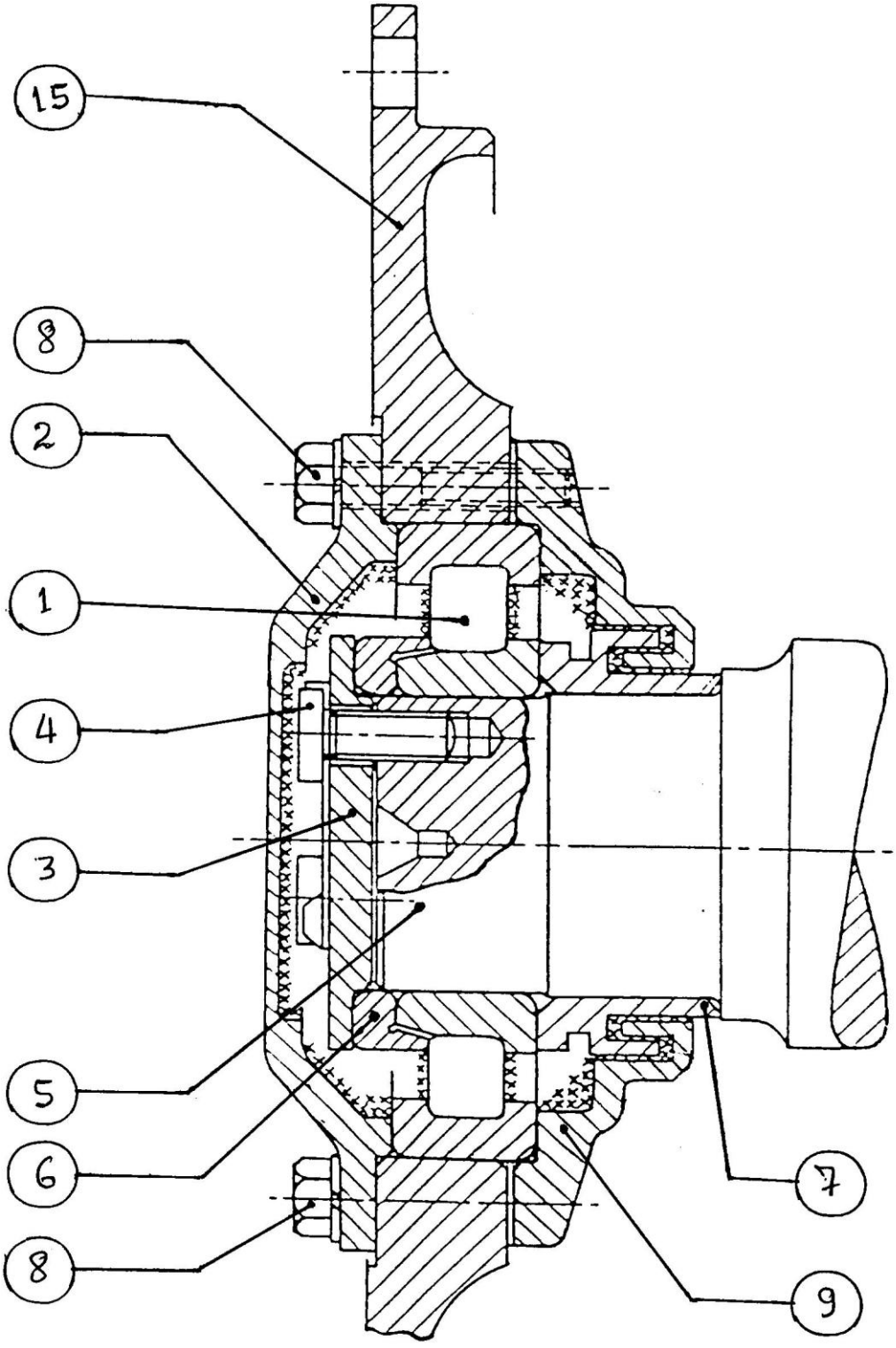
ARMATURE AND BEARING DETAILS

TM 4907 AZ / TM 4906 AZ / ~~TM 165/M~~

Sketch No. 1



PINION END ASSEMBLY
Sketch No. 2



COMMUTATOR END ASSEMBLY
Sketch No. 3