

REVISION OF SPECIFICATION / STR

Ref: Draft Rev.2 to RDSO Spec. No. C-8527

Item Name: Specification for Direct Mounted Double Row Self-Aligning Spherical Roller Bearings for Use on ICF Type All-Coil Bogies for Passenger Coaches.

1. RDSO is reviewing the specification/STR to cater to the latest technological developments in the field, modify clauses not relevant in the present context and making them more enabling with focus on functional requirements.
2. It is requested that your comments / suggestions with regard to improvements / modifications in specification / STR of this item may be submitted in the following format alongwith the justification for the changes required.

Part A: Basic Information

SN	Particulars	Information
1	Name	
2	Designation	
3	Professional Qualification	
4	Organization / Firm's Name	
5	Address for Correspondence	
6	Contact No.	
7	Email ID	
8	<u>In case of Firm / Individual:</u> Manufacturing experience of item (or similar Item) on which comments are offered	
9	<u>Where relevant:</u> Whether any technical document to support suggested changes is available / enclosed for better appreciation	

Part B: Comments / suggestions on the specification

SN	Clause No. of RDSO STR / Spec	Clause, as exists in RDSO STR / Spec	Clause , as it should read after incorporation of comments / suggestions in the RDSO Spec / STR	Justification for changes

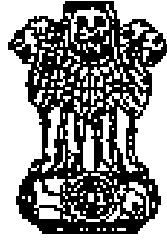
Comments may be sent to:

Joint Director/VDG/ Carriage
Research Designs and Standards Organization
Manak Nagar, Lucknow – 226011

Email: dirvdg1@rdso.railnet.gov.in OR dirvdg1@gmail.com

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INDIAN RAILWAYS



सत्यमेव जयते

SPECIFICATION FOR DIRECT MOUNTED DOUBLE ROW SELF-ALIGNING SPHERICAL ROLLER BEARINGS FOR USE ON ICF TYPE ALL-COIL BOGIES FOR PASSENGER COACHES

S. No.	Month/Year of Issue	Revision/ Amendment	Page No./ Clause No.	Reason for Amendment
1.	December- 85	-	-	First issue
2.	June - 2006	Revision-I	All	Life rating calculation, materials modified, Quality control requirements & test method included.
3.	Dec. - 2009	Amendment Slip No. 1	Clause No. 7.2 & Clause C-6 of Appendix "C"	Material specification of cages improved
4.	June - 2014	Amendment Slip No. 2	Clause No. 7.1 & 7.2	Material specification of rings, rollers and cages changed due to withdrawal of applicable DIN specification.
5.	Dec.- 2016	Amendment Slip No. 3	Clause No. 1	To include the ISO Document No: QO-D-7.1-11, New sub clause No. 1.3 has been added under clause No. 1 of Scope.
6.	October- 2018	Amendment Slip No. 4	Clause No. 13	Clause No. 13.1.3 is deleted and Clause No. 13.1 is modified.
7.	July - 2020	Revision - 2	All	Inspection & Testing parameters, Expansion Testing of IR to be as per EN 12080:2017 etc. included.

Issued By
Research Designs and Standards Organization
Manak Nagar, Lucknow - 226 011
(India)

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SPECIFICATION FOR DIRECT MOUNTED DOUBLE ROW SELF-ALIGNING SPHERICAL ROLLER BEARINGS FOR USE ON ICF TYPE ALL-COIL BOGIES FOR PASSENGER COACHES

1. SCOPE

- 1.1 This specification prescribes the conditions of supply, performance and design requirements and procedure for acceptance inspection of Direct Mounted Double Row Self Aligning Spherical Roller Bearings for use in axle boxes of passenger coaches on Indian Railways.
- 1.2 This specification is applicable to roller bearings for 20.32 t, 16.25 t and 10.25 t axle load applications.
- 1.3 All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-7.1-11 dated 19.07.2016 (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.

2. GENERAL

- 2.1 Tender offer along with the enclosures shall be submitted in TRIPLICATE.
- 2.2 In order to facilitate examination of tender offer, the same shall be accompanied by Clause by Clause comments on this specification, either confirming acceptance of the Clause and elaborating wherever necessary or indicating deviations there from.
- 2.3 The Tenderer shall strictly adhere to this specification. However, in the event of the Tenderer being unable to conform to any Clause of this specification, deviations from the same shall be clearly indicated.
- 2.4 In addition, the tenderer shall submit a consolidated statement of Deviations.
- 2.5 Tender offers shall be accompanied by information listed in Appendix 'A'.
- 2.6 Tenderer shall submit in triplicate, copies of English translation of standard other than those quoted in this specification and Indian Standard along with their offers.
- 2.7 Tender offers not accompanied by details indicated at Clauses 2.1 to 2.6 above are liable to be ignored without further reference.

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2.8 Research Designs & Standards Organisation, Lucknow-226 011 is hereinafter referred to as RDSO.

3. CONTRACTOR'S RESPONSIBILITY

3.1 The Contractor shall be completely responsible for execution of the contract in accordance with this specification and for the satisfactory and efficient performance of the Roller Bearings in service irrespective of-

- i) Any approval which the purchaser/ RDSO may have given for the design features; and
- ii) Tests/ inspection carried out by the purchaser / RDSO or his nominee.

3.2 The Contractor shall further, notwithstanding any exercise by the purchaser / RDSO of the power of superintendence, be responsible for sufficiency of packing, marking etc. of all the parts of the work to ensure their delivery without damage. The Contractor shall comply with the instructions of Purchaser/ RDSO or his nominee, if in his opinion, more precautions than those taken by the Contractor are necessary for the proper execution and safe delivery of all the parts of the work.

3.3 The contractor shall at his expenses, replace the roller bearings failing or proving unsatisfactory in service and attributed to defective/ faulty design, defective material or poor workmanship, within a period of 36 month or 4,00,000 kms from the date of commissioning into service whichever is later. The period of warranty shall stand extended by the duration for which the roller bearings remain inoperative under exercise of this Clause. In such cases, the period of 36 months or 4,00,000 kms would commence when the replaced bearing are commissioned in service. The sole judge in this case would be the purchaser. Further, should any design modification be made any part of the device as a result of any defects/fault/lacunae/shortcoming in the original design feature, the period of 36 months would commence from the date of modified part is commissioned into service.

4. APPROVAL OF DESIGN

4.1 The Contractor shall have a set of their/Collaborator's working drawing in metric units giving assembly and component details. The drawings shall be fully dimensioned with requisite tolerances etc. Other details such as material specification, surface finish of the bearing component shall also be indicated on the drawing. These drawings shall be made available whenever required by Inspecting Authority/ Purchaser/ RDSO.

4.2.1 Detailed material specification for each component shall be indicated on the relevant drawings.

4.3 Tests according to the standards/ specifications or as proposed by the Contractor to which the components and the assembly shall be subjected to by the Contractor at his

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works to establish the quality of the product and its satisfactory working shall be indicated in the drawings.

5. PERFORMANCE REQUIREMENTS

5.1 Bearings shall be used in axle boxes of two axle bogies of passenger coaches of Indian Railways. Axle Box arrangement on coaches on Indian Railways is as per drawings listed in Appendix 'B'.

5.2 Various operational parameters for these bearings are as under: -

S. No.	Axle Load	20.32t	16.25t	10.25t
1.	Weight of wheel set Assembly	1350 Kg	1070 Kg	600 Kg
2.	Maximum Operating Speed	120 kmph	160 kmph	120 kmph
3.	Vertical dynamic augment	30% for 10% of service period	30% for 10% of service period	30% for 10% of service period
		10% for 90% of service period	10% for 90% of service period	10% for 90% of service period
4.	Lateral Acceleration	0.3g	0.3g	0.3g
5.	Wheel Diameter (mm) (i) New (ii) Fully Worn	952	915	727
		865 857	843 825	635

5.3 Under the conditions given at Clause 5.2, the basic life ratings of bearings when calculated as per ISO 281-2007 shall be as under:

5.3.1 For 20.32t axle load application - 2.0×10^6 kms.

5.3.2 For 16.25t axle load application - 2.25×10^6 kms.

5.3.3 For 10.25t axle load application - 1.75×10^6 kms.

5.3.4 While calculating the basic life rating of bearing as per ISO: 281-2007.

The radial load F_r shall be calculated as under:

$$F_1 = [(W \times 1000 - W_1) / 2] \times 1.3 \times 9.81 \text{ for 10\% of service life in N}$$

$$F_2 = [(W \times 1000 - W_1) / 2] \times 1.1 \times 9.81 \text{ for 90\% of service life in N}$$

$$F_r = [0.1 \times (F_1)^{10/3} + 0.9 \times (F_2)^{10/3}]^{3/10}$$

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Where, W = Axle load in tonne

W_1 = Weight of one wheel set in Kg.

5.4 Tenderers should note that performance of bearings is evaluated periodically. For successful application of these bearings:

i) On 20.32t and 16.25t axle load application, the bearing failure rate should not exceed 0.5% during the first five years and 1% during 6th and 7th year of service.

ii) On 10.25t application, the failure rate should not exceed 0.5% during first two years and 1% during 3rd & 4th year of service.

This, however does not in any way affect Contractor's responsibility as indicated in Clause 3.3.

5.5 Indian Railway BG Mainline passenger coaches of ICF design of mail/express trains on an average run 300,000 kms. per year. Indian Railway other coaches of ICF design on an average run 200,000 kms. per year.

6. **PROVEN DESIGN**

6.1 The Bearings shall be of a design which is proven in service on Rolling Stock in a similar application.

7. **MATERIAL**

7.1 Rollers and rings shall be manufactured from Carbon Chromium Steel conforming to Grade Designation 103Cr2 of IS: 4398 –1972 or steel to SAE 52100. Alternatively, material grade SUJ2 to JIS G 4805 for rings and SUJ3 to JIS G 4805 for rollers may also be used. Rollers and rings shall also be manufactured from Carbon Chromium Steel conforming to grade designation 100Cr6 and 100CrMnSi6-4 of DIN ISO 683-17:2000. When steel to SAE 52100 or / JIS G 4805 or DIN ISO 683-17:2000 is used, other properties, e.g. inclusion rating and micro-structure must conform to requirements of IS: 4398-1972. Any other material of rollers and rings agreed between the bearing manufacturer and RDSO may also be used.

7.2 Bearings shall be fitted with machined brass cages. The material of cages shall be to designation CuZn40Pb2 of DIN EN 12164:2000 or CuZn39Pb1Al-C of DIN EN1982:2008. Alternatively, material grade HBsC1 to Japanese Specification No. JIS H 5102 for cages may also be used. Any other material specification of brass cage agreed between the bearing manufacturer & RDSO may also be used.

7.3 The steel employed for manufacture of bearings shall be free from defects such as pipes, seams, laminations, excessive inclusion of non-metallic impurities and such

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other internal defects as would render the material unsuitable for the purpose for which it is intended. On microscopic examination it shall show fine grain size and shall be free from signs of overheating.

- 7.4 In case the Bearings offered by the Tenderer have been executed using materials other than to standards given above, the Tenderer shall indicate details of the following:
- 7.4.1 Specification of materials (English translation of standards shall be submitted along with the offer).
- 7.4.2 Hardness of the component for which the steel to grade indicated at sub-clause 7.4.1 above is proposed to be used.
- 7.4.3 Inclusion rating and micro-structure of steel proposed to be used for manufacture of rings and rollers.
- 7.4.4 Drawing showing the constructional arrangement of the bearing.
- 7.4.5 Details of successful application of such bearings on Rolling Stock in the following format:
- i) Name of Railway System
 - ii) Year of supply.
 - iii) Number of roller bearings supplied.
 - iv) Designation of bearing supplied.
 - v) Axle load.
 - vi) Operating Speed.
 - vii) Report from the Railway System regarding the performance of the bearing.

8. BEARING DESIGN

- 8.1 Bearings shall be of double-row self-aligning spherical type and shall be with cylindrical bore.
- 8.2 Boundary dimensions (in mm) of Bearings for different axle load applications shall be as under:

	20.32t Axle Load	16.25t Axle Load	10.25t Axle Load
Bearing Outside dia.	300 ^{+0.0/-0.035}	280 ^{+0.0/-0.035}	215 ^{+0.0/-0.030}
Bearing bore dia.	140 ^{+0.0/-0.025}	130 ^{+0.0/-0.025}	100 ^{+0.0/-0.020}
Bearing (width)	102 ^{+0/-0.250}	93 ^{+0/-0.250}	73 ^{+0.0/-0.200}

- 8.3 ~~Radial internal clearances shall be as per Group 3 of Clause 4.3 (a) of IS: 5935-1970.~~

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Radial internal clearances shall be as per Group 3 of Clause 5.5 (Table 8) of ISO: 5753-1:2009.

8.4 Diameter (in mm) of axle-box housing bore and journal dia. on which these bearings shall be used shall be as under:

	20.32t Axle Load	16.25t Axle Load	10.25t Axle Load
Dia of Axle Box Housing bore	300 ^{+0.030/+0.052}	280 ^{+0.030/+0.052}	215 H7
Dia of journal	140 p6	130p6	100n6

8.5 The variation in dia. of rollers on one bearing shall not exceed 0.003 mm. The max. and min. clearance between cage and roller at the center be specified by the manufacturer.

8.6 Tolerance on the length of rollers shall be +0.015/-0.035 mm for 20.32t, 16.25t axle load bearings and +0.005/-0.010 mm for 10.25t axle load bearings.

8.7 ~~Variation in width of individual inner ring shall be as per Clause 5.1 of IS: 5692-1970.~~
Variation in width of individual inner ring shall be as per clause 5.2.1 of ISO:492:2014.

8.8 ~~Radial run-out of inner and outer ring shall be as per Clause 5.1 of IS: 5692-1970.~~
Radial run-out of inner and outer ring shall be as per clause 5.2.1 of ISO:492:2014.

8.9 Outer rings shall not have any holes.

9. SURFACE FINISH

9.1 Surface finish shall be checked in accordance with IS: 3073. In case manufacturer adopt any other standard, English translation of standard as per which surface finish is measured shall be supplied by the Contractor whenever required by Purchaser/RDSO /Inspecting Authority

10. HARDNESS

10.1 Tenderer shall, in his offer, indicate the hardness of inner & outer rings and rollers.

10.2 Hardness values measured, on one ring shall not differ by more than 3HRC units.

10.3 Hardness values measured on 3 rollers of one bearing shall not differ by more than 3 HRC units.

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11. WORKMANSHIP

- 11.1 The rolling elements shall be free from defects of workmanship and material which may affect their serviceability.
- 11.2 The surfaces of the bore, outside diameter, sides and load carrying areas shall be smooth and shall not show any damaged/corroded areas.

12. RETOUCHING

- 12.1 Retouching of the bearing or its components with or without the intention of concealing a defect is prohibited.

13. LUBRICATION

- 13.1 The bearing shall be suitable for lubrication with each of the following Lithium base greases:
- 13.1.1 Servogem-RR3 (M) of M/s Indian Oil Corporation.
- 13.1.2 Balmerol Multigrease LL3 of M/s Bamer Lawire & Co. Ltd.

The properties of these grease shall be as per RDSO specification No. WD-17-Misc.-92.

The bearing shall be suitable for lubrication with grease as per EN 12081:2017 as well.

- 13.2 In case the lubricants mentioned in Clause 13.1 are not suitable for the proposed bearing, the Tenderer shall make recommendations regarding the lubricants suitable for bearing offered. However, the lubricant recommended should normally be available in India.
- 13.3 The bearing shall be capable of working for a minimum period of 3 years or 4 lakh kms, whichever is earlier without any examination or grease change/topping.
- 13.4 If requirement at Clause 13.3 cannot be met, Tenderer shall make specific recommendations regarding minimum period for bearing examination. Tenderer shall note that bearings which require lesser maintenance shall be preferred.

14. MAINTENANCE

- 14.1 For every 500 bearings ordered, the Contractor shall supply one Maintenance Manual for guidance of Indian Railways Workshops/Maintenance Staff in maintenance of the bearings. However, the Contractors who are supplying bearings to Indian Railways first time shall supply 100 Maintenance Manual with first purchase order. The Manual shall be complete in respect of –

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- 14.1.1 Description of the bearing.
- 14.1.2 Procedure for initial mounting and lubrication of the bearing, indicating quantity of lubricant per box.
- 14.1.3 Maintenance checks in service such as frequency of grease topping, bearing examination, seal change and grease change etc. between major examinations.
- 14.1.4 Procedure for bearing extraction, examination and assembly, along with details of special tools required, if any, for this purpose.
- 14.1.5 Initial and condemning limits of clearances.
- 14.1.6 Details of other criteria for withdrawal of bearings from service.
- 14.2 New Contractor shall submit the draft of Maintenance Manual to purchaser/RDSO before its finalisation.

15. QUALITY ASSURANCE PROGRAMME

- 15.1 Contractor shall submit his Internal Quality Assurance programme in triplicate to the Purchaser/RDSO. In this, the frequency of various checks, details of nature of work involved in the checks and records maintained regarding these checks shall be indicated. The details of tools and gauges to be used during inspection of bearing /bearing components shall be also indicated in the QAP.
- 15.2 Contractor shall, on demand by purchaser or RDSO or Inspecting Authority nominated by Purchaser, make the records of checks carried out during Internal Quality Assurance available for scrutiny.
- 15.3 ~~Contractor should have the ISO 9001 2000 certification for manufacturer of roller bearing.~~
Contractor should have the ISO 9001 certification for manufacture of roller bearing.

16. ACCEPTANCE INSPECTION

16.1 General

- 16.1.1 Inspection shall be carried out by purchaser or Inspection Authority nominated by Purchaser.
- 16.1.2 Inspection of the bearings shall be carried out at the Contractor's premises.

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16.1.3 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, whether inspected at his own or his Sub-Contractor's Works.

16.2 Presentation of Delivery

16.2.1 On completion of manufacture including marking as per Clause 17 fully assembled bearings shall be presented for inspection in lots.

16.2.2 Bearings with the same designation, belonging to the same manufacturing batch and presented at the same time shall constitute a lot.

16.2.3 The bearings shall be in unlubricated and unpacked condition.
The bearings shall be lubricated and in unpacked condition.

16.3 Temperature

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

16.4 Gauges

16.4.1 Gauges operating by contact (Dial Gauges) shall be provided with a plunger contact of spherical form, having a minimum curvature radius of 2.5 mm.

16.4.2 The force exerted by the Dial Gauge Plunger on bearing shall not exceed 3.3N.

16.5 Reference Side

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

16.6 General Inspection

16.6.1 Inspection as per Clauses 16.6.2 to 16.6.6 shall be carried out on each of the bearing in the lot offered.

16.6.2 The diameter of bore of inner ring & outside diameter of outer ring shall be measured as per clause C-1 of Appendix 'C'.

16.6.3 Width of inner ring & outer ring shall be measured as per clause C-2 of Appendix 'C'.

16.6.4 Radial internal clearance of the bearing shall be measured as per clause C-3 of Appendix 'C'.

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- 16.6.5 Appearance of bearings shall be visually examined (without magnification). All essential portions of the roller bearings shall be clean and free from defects such as porosity, burrs, hardening cracks, grinding marks, indentations, rust marks etc., Surfaces other than
- those portions of the roller, which are not in contact with the ring ribs.
 - the roller chamfers, and
 - the reliefs at the ends of the outer and inner ring raceways shall be smooth.

16.6.6 Functioning of all bearings shall be checked, as per the method agreed between Contractor and Supplier.

16.6.7 Only those bearings of a lot which meet requirements in respect of Clauses 16.6.2 to 16.6.6 stipulated on approved drawings above shall form the lot for the purpose of Sampling Inspection as per Clause 16.7.

16.7 Sampling Inspection

16.7.1 Inspecting Authority shall select bearings at random from each lot presented for carrying out Sampling Inspection as per clauses 16.7.3 to 16.7.10. The size of sample to be selected for these tests shall be as indicated below:

No. of bearings in the lot	No. of sample bearings to be selected
Up to 100	2
101-250	3
Over 250	4

16.7.2 Sample bearings selected as per Clause 16.7.1 shall be indelibly marked.

16.7.3 Inner ring width variation on each of the sample bearing shall be checked as per clause C-4 of Appendix 'C'.

16.7.4 ~~Radial run-out of inner and outer rings in the assembled bearing.~~

~~Radial run-out of inner and outer rings of each sample bearing shall be checked as per clause C-5 of Appendix 'C'.~~

Measurement of radial run-out of individual inner and outer rings.

Radial run-out of inner and outer rings of each sample bearing shall be checked as per clause C-5 of Appendix 'C'.

16.7.5 The length and diameter of all rollers on each of sample bearings shall be measured and variation therein determined.

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16.7.6 ~~Magnetic Particle Test shall be carried out on both rings and 3 rollers of each sample bearing. 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 demagnetised.~~
Internal soundness inspection of rings shall be carried out on each sample bearing as per Annex A of EN 12080:2017. When tested, no ring shall exhibit defect indications on the raceway, or in a section of 4mm depth below the raceway, with the amplitude equal or greater than that observed with the master defect corresponding to the soundness class in question in accordance with Annex A of EN 12080:2017. Larger defects are tolerated deeper than this section, though the defect indications shall not be more than twice the amplitude of that observed with the master defect.

Magnetic Particle Test of rings shall be carried out on each sample bearing as per Annex B of EN 12080:2017. When tested, no evidence of defects shall be observed on any of the ring surfaces. Surface soundness inspection of rings can also be carried out with an approved equivalent, standardized inspection method, e.g. a calibration and test procedure analogous to the eddy current testing of rollers in Annex C of EN 12080:2017. Before & after the tests sample bearings shall be checked as per method agreed between Purchaser and Contractor for residual magnetism. The residual magnetism shall not exceed 0.5 mT.

Eddy current inspection of rollers shall be carried out on each sample bearing as per Annex C of EN 12080:2017. When tested, no roller shall exhibit defect indications on its raceway with amplitude equal to or greater than that observed with the master defect.

16.7.7 ~~Before and after the tests as per Clause 16.7.6 sample bearings shall be checked as per method, agreed between purchaser and Contractor for residual magnetism.~~
This clause to be deleted.

16.7.8 Hardness Testing:

Hardness of both rings and three rollers of each sample bearing shall be checked as per clause C-6 of Appendix 'C'.

16.7.9 ~~Expansion testing of inner ring of each of the sample bearing shall be carried out as per clause C-7 of Appendix 'C'.~~
"With the exception of case-hardened rings and bainite hardened rings, expansion testing of inner ring of each of the sample bearing shall be carried out as per clause C-7 of Appendix 'C'."

16.7.10 Surface finish of both rings and three rollers of sample bearings shall be checked in accordance with IS: 3073. However at the time of prototype bearing testing, surface finish of all rollers of sample bearings shall be checked.

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16.7.11 In case any of the sample bearings when tested as per Clauses 16.7.3 to 16.7.10 does not meet the requirements of this specification, the whole lot shall be rejected.

16.7.12 Bearings rejected as a result of tests in Clauses 16.7.3 to 16.7.10 may be re-offered for inspection. However, the numbers of bearing to be submitted for these further tests should be determined by special agreement between purchaser and Contractor.

16.8 Chemical Composition:

16.8.1 Manufacturer shall furnish ladle analysis, micro structure and inclusion rating of steel for each heat. This shall correspond to the stipulations in the approved drawings.

16.8.2 Manufacturer shall furnish actual chemical composition of cage material for each heat out of which cages on bearings in lot offered have been manufactured. This shall correspond to the stipulations in the approved drawings.

16.8.3 Inspector may order retest on rings, rollers and cage of one bearing out of every 1000 bearings inspected.

16.8.4 In Case the results of tests at Clause 16.8.3 or the analysis in Clauses 16.8.1 and 16.8.2 do not conform to stipulations on approved drawings, the whole lot of bearings shall be rejected.

16.9 Examination of Fracture Structure

16.9.1 This test shall be done on both the rings and 3 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. Fracture structure shall on visual examination not show any discontinuity, laminations, flaws, shrinkage cavities or other material defects.

16.10 Disposal of Rejected bearings

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

16.11 Rights of Purchaser/Inspecting Authority/RDSO

16.11.1 Purchaser/RDSO/Inspecting Authority shall adopt any means he may consider necessary to satisfy himself that all materials or components specified are actually used throughout the construction.

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- 16.11.2 Purchaser/RDSO/Inspecting Authority shall have right to visit at any reasonable time and without previous notice, either Contractor's Works or his Sub-Contractor's Works to inspect the manufacture and quality of work at any stage.
- 16.11.3 Purchaser/RDSO/Inspecting Authority shall have free and ready access to Contractor's Quality Assurance Records, Procedures etc.
- 16.11.4 Purchaser/RDSO/Inspecting Authority shall have to reject any material that do not conform to the relevant standard specifications or have not been manufactured in accordance with approved practices. The rejected materials shall be marked in a distinguishable manner and shall be disposed off in such a manner as specified in QAP.

17. MARKING

- 17.1 Each bearing shall carry on the side face of its inner ring visibly and indelibly the following markings:
- 17.1.1 Contractor's Name/Code/Trade mark.
- 17.1.2 Complete designation of the bearing.
- 17.1.3 Consecutive number of the bearing.
- 17.1.4 Month and year of manufacture.
- 17.2 Drawing showing the marking arrangement, proposed to be followed by the tenderer shall be submitted along with the offer.

18. PACKING

- 18.1 The bearing shall be packed as under:
- 18.1.1 Only one bearing shall be packed in a wooden/Carton box.
- 18.1.2 Plastic wedges and plastic straps shall be used to prevent damage during transit.
- 18.1.3 Rust preventive oil shall be used to cover all the surfaces.
- 18.1.4 ~~Bearing shall be suitably wrapped/packed in oil/grease resistant paper/polyethene before being packed in the box.~~
Bearing shall be suitably wrapped/packed in oil/grease resistant paper/polyethene (conform the statutory norms of Government of India) before being packed in the box.

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18.1.5 Bearing shall be finally packed in pallets or wooden cases depending upon mode of transport. These pallets are wooden boxes will be strapped with steel/nylon band and lead seal on wire, by inspecting authority before shipment.

19. Service Performance Testing: (New Clause Included)

Service Performance Testing of Bearings shall be carried out as per EN 12082:2017.

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Appendix "A"

INFORMATION TO BE SUBMITTED BY TENDERER ALONG WITH OFFER (See Clause 2.5)

1. Drawing of the bearing showing:
 - i) Boundary dimensions (width, outside diameter and bore diameter) along with tolerances.
 - ii) Material of rings, rollers and cage.
 - iii) Values of parameters necessary for calculation of life rating of the bearing as per ISO 281-2007 (i.e. number of rows of rollers per bearing, number of rollers per row, mean roller diameter, effective length of rollers, angle of contact and pitch circle diameter of rollers as defined in the ISO Standard).
2. Life rating calculations as per ISO 281-2007.
3. Confirmation that bearings are strictly in accordance with the specification. If there are deviations from any clause, they must be clearly listed clause wise.
4. Required frequency of maintenance of bearing. This is necessary to evaluate the bearings from maintenance requirements point of view.
5. Country of origin.
6. Details of extent to which bearings proposed to be offered are in use on rolling stock on other Railways. This information should include details of year wise supply to the Railway Systems and the numbers supplied in each year.

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Appendix "B"

LIST OF AXLE BOX ARRANGEMENT DRAWINGS

APPLICATION	DRAWING NUMBER
20.32 t Axle load	EMU/M-0-2-001
16.25 t Axle load	T-0-2-620
10.16 t Axle load	MG/T-0-2-011

Prints of these drawings if required can be obtained from Integral Coach Factory, Chennai - 600 038 India.

APPLICATION	DRAWING NUMBER
20.32 t Axle load	EMU/M-0-2-001 & EMU/M-0-2-016
16.25 t Axle load	WTAC-0-2-304
10.16 t Axle load	MG/T-0-2-011

Prints of these drawings if required can be obtained from Integral Coach Factory, Chennai - 600 038 India.

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Appendix “C”

C-1 Bore diameter ‘d’ (Cylindrical bore) and outer diameter ‘D’

For these measurements the bearing should preferably be placed on a substantially horizontal plane surface (see fig. 1 and 2)

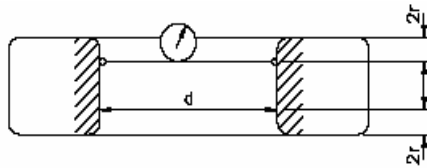


FIG.1

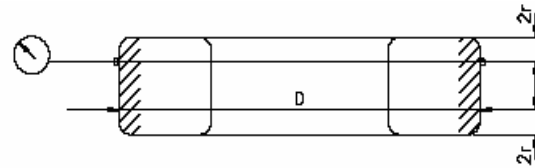


FIG.2

The measurements are made in two planes parallel to the sides and at a distance of 2r from the adjacent side (r = nominal ring chamfer dimension).

For both dimensions d and D, the smallest single diameter (d_{min} and D_{min}) and the largest single diameter (d_{max} and D_{max}) found in either of the two planes are determined, using a measuring instrument with two points of contact. The mean diameter (d_m and D_m) of a ring is the arithmetical mean value of the smallest and the largest single diameter.

$$d_m = \frac{d_{min} + d_{max}}{2} \quad D_m = \frac{D_{min} + D_{max}}{2}$$

C-2 Width of inner ring & outer ring

For both the rings, the distance between the side faces shall be checked using a measuring instrument with two points of contact. At every point the distance shall be within the stipulated limits.

C-3 Radial internal clearance

With the bearing standing on a reasonably horizontal plane surface, the clearance in the upper part of the bearing, between the two rollers adjacent to the vertical plane and either the outer ring or the inner ring as applicable, shall be measured with feeler gauges of known thickness (see fig. 3)



Fig-3

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Three measurements shall be carried out, the outer ring being rotated through 120° between measurements while the inner ring is kept stationary.

The bearing clearance is the arithmetical mean value of the clearances measured.

For double row roller bearings, these measurements are made on both rows.

C-4 Inner ring width variation:

The bearing shall be placed on three equidistant supports/flat plate, which are in contact only with the inner rings (see fig. 4)

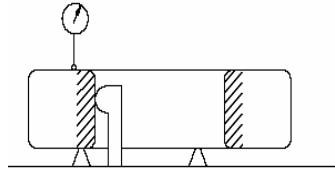


Fig-4

A dial gauge shall be applied to the middle of the inner ring side face directly above one of the supports/flat plate. A guide shall centre the bearing. The width variation is equal to the total variation of the dial gauge reading during one revolution of the inner ring.

C-5 Radial run out of inner and outer ring:

~~The bearing shall be mounted without clearance or deformation on a tapered * mandrel set horizontally between Centers (see fig.5)~~

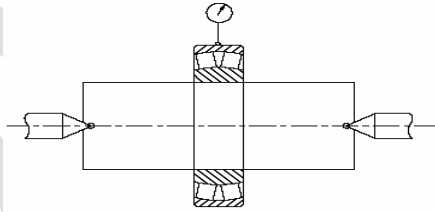


Fig-5

~~*Taper of about 0.03 mm on diameter per 100 mm length. If the bore is slightly tapered, its taper should be positioned in the same direction as that of the mandrel. Beforehand, the radial runout of the mandrel should be measured and located, and the readings of the dial gauge corrected, if necessary.~~

~~A dial gauge shall be placed in contact with the outer ring outside surface in the plane containing the middle of the raceway. The outer ring shall be guided laterally.~~

a) Radial runout of inner ring:

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~~The radial runout is equal to the difference between the maximum and the minimum reading of the dial gauge in contact with the outer ring, when rotating the mandrel and the inner ring through one revolution, the outer ring being stationary.~~

b) Radial runout of the outer ring:

~~The radial run out is equal to the difference between the maximum and the minimum reading of the dial gauge in contact with the outer ring, when rotating this ring through one revolution the inner ring being stationary.~~

c) Radial runout of inner and outer ring raceways:

The ring shall be placed on an inclined plane surface and shall be guided in its bore at two points situated in a plane parallel to the supporting surface and containing the middle of the roller raceway. A dial gauge shall be applied to the outside surface of the ring in line with one of the internal guides (see fig. 6). The radial runout is equal to the difference between the maximum and minimum reading of the dial gauge when rotating the ring through one revolution.

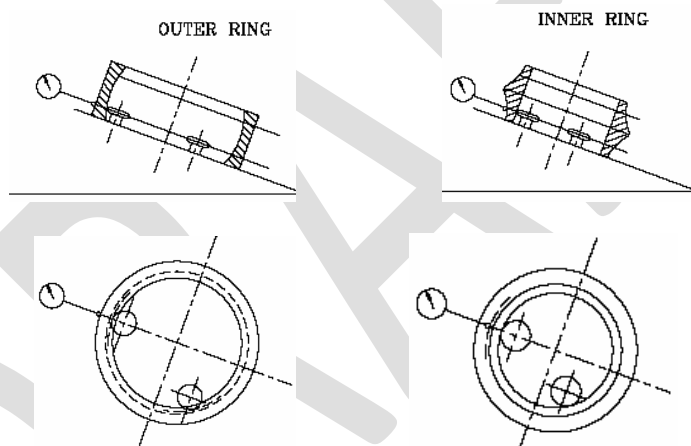


Fig-6

C-6 Hardness testing:

The test shall be carried out according to ISO 6508-1.

Rings:

The test shall be made on both rings of each bearing. The Rockwell hardness shall be measured on one of the side faces of the ring at the both ends of two diameters perpendicular to each other.

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In each of the four checked areas two measurements, giving compatible results, shall be made.

Rollers:

The test shall be made on three rollers of each bearing. The Rockwell hardness shall be measured at one point on the surface of one end of the roller.

In each checked area two measurements, giving compatible results, shall be made.

C-7 Expansion Testing of Inner Ring:

~~The test involves the expansion of the bore of the ring each of the sample bearing by means of a tapered mandrel. The expansion shall be such that the bore diameter increase is 0.0015 times the bore diameter.~~

~~The expansion shall be rapid. The use of an eccentric press is considered suitable and it is recommended that necessary precautions be taken during the test, since ejected fragments, if fracture occurs, may be dangerous.~~

~~Any equivalent method may be used.~~

~~After completion of the expansion test, inner rings shall be checked under Magnetic Particle Test as per Clause 16.7.6 and shall show no sign of fracture.~~

~~Any other method agreed between the bearing manufacturer & RDSO may be used to establish expandability of case hardened inner rings and Bainite hardened inner rings to ensure that the inner rings can withstand an increase of the bore diameter without causing fracture in service.~~

With the exception of case-hardened rings and bainite hardened rings, the test involves the expansion of the bore of the ring each of the sample bearing by means of a tapered mandrel. The expansion shall be such that the bore diameter increase is 0.0015 times the bore diameter.

The expansion shall be rapid. The use of an eccentric press is considered suitable and it is recommended that necessary precautions be taken during the test, since ejected fragments, if fracture occurs, may be dangerous.

Any equivalent method may be used.

After completion of the expansion test, inner rings shall be checked under Magnetic Particle Test as per Clause 16.7.6 and shall show no sign of fracture.

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