Technical Pre-qualifying Criteria for "Spherical/Taper Roller Bearings" (Type 2310/C3, 639/632 & 45290/45220)

The pre-qualification criteria for "spherical/taper roller bearings" are as under :-

1) Supplier to confirm manufacturing of spherical/taper roller bearings as per BHEL drawing no. C450069 items-1, 2 & 3 and to furnish technical data as per C450067 (Sheet-1).

2) Supplier should be original manufacturer of the referred bearings & not a trader.

3) Supplier to furnish details of material specification and grade used for bearing cage, race and rollers along with source of procurement of raw material.

4) Supplier to furnish flowchart of the activities performed during manufacturing of the bearing.

5) Supplier to furnish different parameters and stages of quality inspection followed while manufacturing.

6) The acceptable country of manufacturing of bearings shall be USA, Europe or Japan only. Supplier to confirm the above & specify the country of manufacturing.

7) Supplier to furnish names of customers (Original Equipment Manufacturer of Traction machines or Railways) with details of supply (along with quantity) of "spherical/taper roller bearings" as per BHEL drawing in the last 3 years and the details of the machines in which these bearings have been used.

8) Supplier to furnish clausewise details of the bearings offered by it for Traction applications as per attached **annexure-1**.

9) Supplier to confirm to provide replacement warranty of 3 years for the bearings offered from the date of execution of PO or 2 years from the date of commissioning whichever is later in case of procurement of bearings first time against development PO's by BHEL.

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Annexure: 1

1.0 TRACTION APPLICATION REQUIREMENTS:

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

1.1 Extremely heavy impacts and vibrations emanating from the track, difficult operating environments and shock loads.
1.2 Varying loads and speeds, both in direction and magnitude with top speed close to limiting speed for grease lubrication.
1.3 Limitation on maintenance during operation, hence long running period before inspection and re-lubrication.
1.4 Higher reliability in performance.

2.0 APPLICABLE SPECIFICATIONS:

The traction machine bearings generally refer 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 for radial rolling bearings.
4	IS: 6453- 1984	Definitions Technical supply conditions for rolling bearings (First revision).
5	IS: 3073- 1967	Assessment of surface roughness.
6	IS: 4398- 1994	Specification for carbon chromium steel for the manufacture of balls, rollers and bearing races (First revision).
7	IS: 3823-1988/ ISO: 76 - 1987	Rolling Bearings- Static Load Ratings
8	IS: 3824- 2002/ ISO: 281 - 1990	Rolling Bearings- Dynamic Load Ratings and rating life (Second Revision)

9	DIN: 17230	Ball and roller bearing steels technical conditions of delivery.
10	DIN: 623- Part 1	Designations for rolling bearings; general, bearing series symbols relating to ball bearings, cylindrical roller bearings and self-aligning roller bearings.

3.0 TOLERANCE & INTERCHANGEABILITY:

The roller bearings shall be produced to tolerance class 6 as stipulated in IS: 5692- 1988.

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

3.2 The inner rings with cage assemblies and outer rings shall be interchangeable, meaning thereby that even if rings from different bearings are mixed; the clearances shall remain within the specified range.

4.1 Surface finish:

Surface roughness shall not be in excess of the following limits (in microns) when measured in accordance with IS: 3073- 1967 'Assessment of surface roughnesses' 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

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

4.2 Radial clearances:

The radial clearance for the bearings shall be as per the requirements of the drawing.

4.3 Special features:

4.3.1 Two window type steel cages ,flangeless inner ring and guide ring centered on the inner ring.

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

4.3.3 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.

4.3.4 Radial Clearance variation shall not exceed 6 microns when measured on all the rollers of a bearing.

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

5.0 GENERAL REQUIREMENTS:

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

6.0 MATERIAL:

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

Recommended materials for bearing components:

Outer Ring	Inner Ring	Rollers/balls
104Cr6 of IS 4398- 1994 (2nd. Rev.) or 1.3505 (100Cr6) of DIN 17230 or SUJ3 of JIS 4805/ 103Cr2Mn70 of IS 4398, 1972. or 100CrMo7 (ISO 683-17: 1999) Steel Type B5	104Cr6 of IS 4398- 1994 (2nd. Rev.) or 1.3505 (100Cr6) of DIN 17230 or SUJ3 of JIS 4805/ 103Cr2Mn70 of IS 4398,1972. or 100CrMo7 (ISO 683-17: 1999) Steel Type B5	104Cr6 of IS 4398- 1994 (2nd. Rev.) or 1.3505 (100Cr6) of DIN 17230 or SUJ3 of JIS 4805/ 103Cr2Mn70 of IS 4398,1972. or 100CrMo7 (ISO 683-17: 1999) Steel Type B5

6.2 The inclusion rating of the bearing steel shall be declared by the manufacturer and shall be in accordance with IS: 4398- 1994', which shall not be more than 1 ½ A, 1 B, ½ C and 1 D for both thick and thin series.

7.0 HEAT TREATMENT:

Shall conform to 1.3520 of DIN 17230.

Hardness:

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

- Inner ring, outer ring and rollers- 62+3 HRC shall conform to IS 6453- 1984. The preferred range shall be 60 to 62 HRC for rollers and 59 to 62 HRC for rings.
- Cage hardness- 100 to 130 HB. Actual hardness used, shall be indicated by the manufacturer.

8.0 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 shall be submitted by the tenderer.

9.0 SPECIAL TESTS & FIELD TRAILS:

In case of development orders, special tests shall be carried out by the manufacturer to establish the suitability of the bearing. The scope of the special test shall be decided based on the list of tests given at **Annexure- A.**

10.0 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 months in order to ensure a satisfactory functioning of the rolling bearings.

11.0 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 & 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 shall not be opened and bearings in multiple of bulk packing shall only be supplied.

12.0 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:

a) Manufacturer's name/ code/ trade mark.

b) Complete Designation of the bearing.

c) Date code of manufacturing of the production lot.

d) Clearance classes shall be etched on each individual bearing.

12.3 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.

13.0 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 with SHELL Cyprina RA grease of M/s IOCL.

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 goods operation of traction applications 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 BHEL for prior approval and for the purpose of carrying out inspection accordingly.

15.2 Details 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 (After minimum period of 4 years).

e) Initial and condemning limits of dimensions of components and clearance.

15.4 Full calculation in support of the design capacity and life expectancy of the roller bearing offered including lateral thrust capacity.

15.5 Other information required as per this specification.

16.0 QUALITY ASSURANCE PROGRAMME:

16.1 Supplier shall have quality assurance programme as per international standards and submit its internal quality assurance programme. 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.

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

Annexure- A

LIST OF SPECIAL TESTS ON BEARINGS FOR TRACTION APPLICATIONS.

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 specially radial run out and boundary dimensions after running.

2. Non-destructive tests on bearing components including all dimensions, runouts, 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. Over speed test at no load for limited period.