

S.14: SPHERICAL BEARINGS

The term “bearing” in this case refers to a spherical bearing consists of a pair of matching concave and convex steel spherical backing plates with a low friction sliding interface in between thereby permitting rotation by in-curve sliding. The bearing shall cater for translation and/or rotation of the superstructure.

14.1. Scope of Work

The scope of work will include:

- i) Rendering necessary assistance/coordinate with the manufacturer with regard to placement/fixing of said bearings. The contractor shall ensure that these bearings are installed in accordance with the specification mentioned in these documents and approved method statement, so that the bearings perform in the desired manner, in accordance with the forces/ displacements/ rotations for which these bearings have been designed.
- ii) The contractor shall liaise with the agency and will be responsible for design etc.
- iii) The contractor shall furnish adequate and proper installation details for these bearings while submitting his design and detailed Engineering Drawings.
- iv) The design criteria, specifications etc. as mentioned in tender documents are mandatory and no deviation to the same shall be permitted unless otherwise directed by the Engineer.
- v) The contractor shall supply all the bearings in suitable packed condition (for its proper transportation and storage before placement in position) at project site to be identified by the Engineer.
- vi) Scope for lifting the superstructure for future replacement of bearings shall be provided for in the design of bearing. The scheme of lifting shall be indicated on the drawing to be submitted at the time of approval.
- vii) When requested by the engineer, the Contractor shall submit test certificates from the approved, independent testing authority to show that the respective materials comply with the specified requirements, or a certificate from the patent holder or designer certifying that the manufactured item complies in all respects with relevant product specifications.
- viii) The bearings shall be fabricated from only new and unused materials. Reclaimed materials are not acceptable.

14.2. Design

Design of the bearing and all accessories shall be the responsibility of the Contractor and got approved from the Employer's Representative.

Design of the Spherical Bearings shall confirm to the provisions of the Employer's requirement – Design and General planning criteria of this tender document.

The design, drawings and detailed method statements for installation and replaceability of the bearings shall be checked and certified by approved independent agency before submitting to the Engineer for approval.

14.3. Material Specifications

- i. All the materials to be used in Spherical Bearings shall confirm to clause No. 4 Materials of IRC 83: Part-IV 2014.
- ii. Steel for bearing main components shall be cast steel in accordance with IS: 1030 Grade 340-570W except for calotte which shall be only fine grain rolled steel conforming to IS:2062 Grade E 350 or above.

- iii. Equivalent or superior grades as per other national and international specification with proven performance and suitability to application requirements may also be acceptable, subject to the approval of Engineer-In-Charge.
- iv. Positive anchoring arrangement by way of Bolts passing through Bearing component and anchored to Dowels /Steel distribution plates shall be adopted for all Bearings. Bolts to be used for anchoring of the Bearings shall be of property class 8.8 or 10.9 in accordance with IS: 1367. Steel for Dowels shall be rolled steel in accordance with IS:2062 Grade E250 min. The anchor bolts and washers shall be galvanized.
- v. The corrosion protection of the exposed steel surfaces including backing, intermediate plates and welding zone etc. shall be achieved by a protective coating system in accordance with the Clause 4.10 of IRC-83-IV.
- vi. Low Friction Thermo-Plastic sliding material made of UHMWPE - Ultra high molecular weight polyethylene conforming to the provisions of IRC-83-IV, is only permitted for use as main sliding surface.
- vii. The entire curved surface of the convex steel plate mating with concave sliding surface shall be hard chromium plated only and conforming to the provisions of IRC-83-IV.
- viii. Silicone grease shall be used as lubricant for sliding surfaces. Physical and Chemical properties of silicon grease shall be as per Clause No.4.8 of IRC 83 Part-IV.
- ix. Care shall be taken to ensure that the adhesive is applied uniformly over the entire surface of the sliding material so as not to cause an uneven sliding surface that could lead to premature wear.

14.4. Manufacturing of Spherical Bearings

A. General

- i. Manufacturing of Spherical Bearings shall comply with Clause No.6 of IRC 83 Part-IV 2014.
- ii. The Contractor shall submit the Design & Fabrication drawings for the approval of Engineer at least 30 days prior to the start of bearing fabrication. This notification shall include all of the information shown on the shop drawings which are required as explained in subsequent section.
- iii. Protection Against Corrosion and Contamination: Shall conform to the provisions of Clause 6.9 of IRC-83-IV.
- iv. Manufacturing of Bearing shall be commenced only after the approval of Design and Fabrication drawings by the Engineer.
- v. **Movement indicators shall be provided for bearing with sliding assembly to facilitate routine inspection during service period.**

B. Shop Drawings

The Contractor shall submit shop drawings to the engineer for approval which shall include, but not limited to, the following information:

- i. Erection drawings, plan, elevations and complete details and sections showing all materials incorporated in the bearings.
- ii. Bearing pre-set details, if applicable.
- iii. Protective coating requirements.
- iv. A table containing maximum and minimum vertical and horizontal loads, design rotation requirements, and magnitudes and directions of movements.
- v. Bearing seat and all bearing connection and anchorage details.
- vi. Any special consideration such as earthquake requirements, uplift details, or temporary attachments.
- vii. The location of the top and bottom bearing adapter plates drawn in plan and in elevation on the deck soffit and on the support structures showing edge distances.
- viii. The bearing orientation (uni and multi directional bearings) with respect to the direction of Bridge / traffic movement.

- ix. The drawings and design calculations shall be duly signed & stamped by company seal.

C. Manufacturing Tolerances

- i. Manufacture tolerance shall conform to clause No.6 of IRC: 83 Part-IV.
- ii. All these measurements were taken using dial height gauges, vernier calliper, surface finish measurement instrument etc has to be arranged by manufacturer at the workshop.

14.5. Inspection and Acceptance Specification:

- i. Bearings shall be manufactured to high standards both in terms of material quality and workmanship. The manufacturer shall have requisite load test and NDT facilities required for process and acceptance control tests installed at his plant. The test facilities and their operation shall be open for inspection. For confirmatory tests on raw materials, tests shall be conducted at in-house facility of the manufacturer or at NABL accredited laboratory.
- ii. **Manufacturer's Internal Testing:** Shall comply with clause No. 7.3 of IRC 83-Part-IV 2014.
- iii. **Lot Classification:** Shall comply with clause No. 7.2 of IRC 83-Part-IV 2014.
- iv. **Acceptance Test by Inspecting Authority/Engineer:** Shall Comply with clause No 7.4 & 7.5 of IRC 83-Part-IV 2014. Acceptance testing shall commence with the prior submittal of testing program in form of Inspection and Test Plan (ITP) prepared by the manufacturer and approved by concerned authority, to the Engineer.
- v. **Inspection Report:** The details of the tests and inspection carried out both in house and in the presence of the Engineer shall be recorded in the standard testing formats along with their observations. These filled up formats along with the raw material test certificates, reports of the tests done in process e.g. welding (DPT), hard chromium plating (Ferroxyl Test), mating surface hardness test, ultrasonic test, S/S surface finish and Paint DPT etc. shall be compiled and submitted to the Inspecting/Acceptance Authority/Engineer as Test Reports.
- vi. **Certification:** The approving/accepting authority/Engineer after getting satisfied with the Quality of the Product manufactured shall issue Certificate of conformity of the product stating the conformity with the provisions of this Specification and clearance to the Manufacturer to effect the shipment of the Bearings to the job site.

14.6. Storage, Transportation and Handling:

A. Marking:

- a. Movement indicators shall be provided for bearing with sliding assembly to facilitate routine inspection during service period.
- b. All Bearings shall have suitable identification plates permanently affixed which shall be visible after installation, identifying the following information: -
 - i. Name of Manufacturer
 - ii. Month and Last two digits of the year in which the Bearing manufacturer(mm/yy)
 - iii. Serial Number of the Bearing
 - iv. Bearing Designation and Type
 - v. Design Performance parameters viz. Load, Movement etc.
- c. Besides this, the Bearing Top Surface shall also be marked with the following information to facilitate their correct installation at site:
 - i. Centerline Marking
 - ii. Bearing Designation and Type –
 - iii. Orientation Marking to facilitate correct placement on the Pedestal
 - iv. Direction of Major and Minor movement, as appropriate
 - v. Preset Marking, if applicable.
 - vi. -Location Number upon each support (If required)

- B. Packaging, Transport and Storage:** All the provisions of clause No.8 of IRC 83-Part-IV shall be complied.

14.7. Installation of Bearing:

- i. Install bearings in the structure as specified and shown on the drawings and directed by the bearing supplier. Installation procedure shall be subject to review and approval of the Method Statement by the engineer.
- ii. Bearing Installation Work shall be commenced only after the approval of Method Statement by the Engineer.
- iii. The manufacturer will have its technical representative present for the placement of the first few bearings unless the contractor gains confidence about the installation of the remaining Bearings.
- iv. At the instructions of the engineer, option of the manufacturer or the design engineer, the technical representative may be required to be present for the placement of any number of additional bearings.
- v. **Aspects Related to Bearing Performance and Installation:** Shall conform to the clause 9 of IRC:83-IV.
- vi. Bearings shall be set to the dimensions and offsets conforming to the requirements mentioned in the IRC:83-IV and the approved drawings.
- vii. When placed, bearings shall be dry, clean, and free from dirt, oil, grease, or other foreign substances.
- viii. They shall be adjusted as necessary to take into account the temperature at time of installation and future movements of the bridge due to temperature changes, release of false work and shortening due to prestressing.
- ix. Under no circumstances shall bearings be taken apart and reassembled on the site, except where it is an unavoidable feature, in which case the dismantling, installation and reassembly shall be under the supervision of the Manufacturer or his agent.
- x. Care shall be taken to ensure that no air pockets exist below the bearing bottom adapter plate after installation.
- xi. The bedding material i.e. High strength Non-Shrinkage Epoxy Mortar shall be capable of transmitting the applied load to the structure without damage. The cost of this epoxy mortar is included in the scope/BOQ Item and nothing extra is payable regarding this.
- xii. The bedding material thickness shall not be less than 20 mm.
- xiii. The bedding material shall extend beyond the bearing perimeter by at least 50 mm or twice the thickness of the bedding mortar; whichever is greater.
- xiv. Fall away (slope) the top surface of this bedding material extension from the bearing to prevent the collection of water around the bearing.
- xv. After installation leave bearings and their surrounding area clean. Remove temporary transit clamps at a time to be agreed upon by the supplier and the Consultant.
- xvi. Voids or hard spots after installation are not acceptable.
- xvii. Tighten threaded fixings uniformly to avoid overstressing any part of the bearing.
- xviii. Agree to the position of any temporary packing between the outer bearing plates and the structure with the Consultant.

14.8. Documentation to be Supplied with the Bearing:

The Contractor shall provide all necessary documentation for the long-term inspection, maintenance, and replacement of the bearings.

This shall include full documentation of the design, working drawings, a certificate of compliance from the supplier, third party testing certificates, welding certificates, documentation of the load tests, quality

records and as installed details, procedures for the inspection of the bearing, procedures for maintenance and a fully detailed method statement for the replacement of the bearings.

14.9. GUARANTEE

- i. The Contractor is to provide a written guarantee stating that the bearings have been fabricated such that they will perform satisfactorily within the design range of movement and under the design loads for a period of fifty years from the date of supply.
- ii. The Contractor shall indicate that they have reviewed the installation procedures and find it in accordance with the bearing recommendations.
- iii. Provide in the guarantee for the replacement (including supply and installation) of the bearing components or the bearing as a whole at no cost to the Owner in the event that the bearings do not perform satisfactorily within the design range of movement and under the design loads.
- iv. The Contractor shall submit from the bearings manufacturer the bearing technical approval document for Spherical Bearings with Special Sliding Material issued by MPA Stuttgart or equivalent approval bodies, which will indicate that the Manufacturer / their technology partner is allowed to design & produce the Bearings utilizing the special sliding material (MSM / UHMWPE) up to a diameter of 2500 mm and that the working / service life of the bearing shall not be not less than 50 years.
- v. Manufacturing or sourcing of the raw material or finished components of the Bearings or the Bearing as a whole from China is not permitted.

14.10. Measurement and Payment

- i. The bearings shall be measured and paid for per unit at the relevant price entered in the Bill of Quantities.
- ii. The tendered rate shall include full compensation for all engineering, labour, design, fabrication, installation and equipment necessary to complete the work, including all subsidiary and incidental items thereto for which separate payment is not elsewhere provided. Payment shall include supply of all materials, protection system, dust cover, all necessary bedding, anchor bolts, jacking plates (if required) and temporary works, etc., and shall include shop drawings, quality control, testing, supply and installation, storage, shipping and delivery.