RJ Watson Inc

# Disk Bearings - Railway
## Contract Specifications

1.0 DESIGN

1.1 Scope of Work

1.1.1 This work shall consist of furnishing Multi-Rotational, High Load Disk Bearings and installing Disk Bearing Assemblies at the locations shown on the plans in accordance with these specifications and the *AREMA Manual for Railway Engineering (MRE).* Bearing assemblies shall include bearings device, distribution plates, distribution pads, and connection hardware.

1.1.2 Disk bearings shall consist of a polyether urethane structural element (disk) confined by upper and lower steel bearing plates. The bearing shall be equipped with a shear restriction mechanism to prevent lateral movement of the disk. Bearings shall adequately provide for the thermal expansion and contraction, rotation, camber changes, and creep and shrinkage of structural members, where applicable.

1.1.3 Disk bearings shall be supplied as fixed bearings; guided expansion bearings; and non-guided expansion bearings as designated by the contract documents. Disk bearings can be used as an alternate to a spherical bearing.

1.1.4 Due to concerns over large cyclical live load deformations and rotations, pot bearings are not recommended for support of railroad bridges. In addition, pot bearings should not be used when the minimum vertical load is less than 20% of the bearing vertical design load. Pot bearings will not be allowed.

1.2 Qualification Requirements:
Disk bearings and the bearing supplier shall be subject to the qualification requirements for acceptance listed below. The following supplier has displayed the capability of supplying disk bearings with characteristics that conform to the requirements of these contract specifications.

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1.2.1 Disk bearings shall be designed and constructed in accordance with *AREMA MRE; Chapter 15, Sections 5.7 and 5.13.*

1.2.2 The bearing supplier shall show previous history in the design and fabrication of disk bearings. Documentation showing a minimum of five years' experience, and ten bridge installations shall be provided to the engineer.

1.2.3 If uplift or vertical movement restraint is required, per *AREMA MRE Chapter 15 Section 5.1.2d*, the supplier shall show previous history in the design, fabrication, and testing of disk bearings with uplift restraint. Documentation shall include at least one previous project with static uplift testing completed on a full-size disk bearing. Static uplift test results shall be provided to the engineer. If seismic uplift restraint is required, documentation of previous shake table testing of disk bearing with uplift restraint shall be provided.

1.3 Shop Drawings

The contractor shall submit drawings to the engineer for approval and shall have received said approval prior to the construction of the beam seats and fabrication of disk bearings. These drawings shall include, but not be limited to, the following information.

(1) Plan and elevation of each disk bearing size
(2) Complete details and sections showing all materials (with ASTM or other designations) incorporated in the disk bearings.
(3) Vertical and horizontal load capacities.
(4) Bearing seat and all bearing connection details.
(5) Design calculations verifying compliance with AREMA standards.

The shop drawings and design calculations shall be stamped by a professional engineer employed by the bearing supplier with at least five years of documented history of disk bearing design experience.

## 2.0 CONSTRUCTION

2.1 All materials shall be new and unused, with no reclaimed material incorporated in the finished bearing.

2.2 The physical properties of the polyether urethane elements shall conform to *AREMA MRE; Chapter 15, Section 5.7.2d.*

2.3 All steel except stainless steel components of the bearing shall conform to the requirements of the type of steel designated on the contract plans.

2.4 Stainless steel plates shall conform to the requirements of ASTM A240 – Type 304. Higher grades of stainless are permissible. Stainless steel in contact with PTFE shall be polished to a No. 8 bright mirror finish. The minimum thickness of the stainless-steel sheet shall be 12 gage.

2.5 Polytetrafluoroethylene (PTFE) sheet shall be manufactured from pure virgin (not re-processed) PTFE resin. PTFE sheet shall meet the applicable material requirements of *AREMA MRE; Chapter 15, Section 10.5.2.1.* The minimum thickness of the PTFE sheet shall be 0.25 inches. Alternative low coefficient of friction material may be considered for use on bother the guide bars and horizontal sliding surface. Alternative materials shall be more durable than PTFE with a similar coefficient of friction.

2.6 Elastomeric rotational element shall be molded as a single piece, separate layers are not allowed.

2.7 Fabrication Details

2.7.1 The contractor shall provide the engineer with written notification prior to the start of bearing fabrication. This notification shall include all of the information required by Sections 1.2 and 1.3. The bearing fabricator shall be certified by the American Institute of Steel Construction (AISC) for Simple Steel Bridges Category. Bearings shall be fabricated at facilities owned and operated by the supplier.

2.7.2 All steel surfaces exposed to the atmosphere, except stainless steel surfaces and metal surfaces to be welded, shall be shop coated in accordance with the contract plans. Prior to coating, the exposed steel surfaces shall be cleaned in accordance with the recommendations of the coating's manufacturer.

2.7.3 Stainless steel sheet shall be attached to its steel substrate with a continuous seal weld.

2.7.4 All welding shall conform to, and all welders shall be qualified in accordance with, the requirements of the American Welding Society (AWS).

2.7.5 Except as noted all bearing surfaces of steel plates shall be finished or machined flat within 0.010 inches per foot. Out-of-flatness greater than 0.010 inches per foot on any plate shall be cause for rejection. The bottom surfaces of lower bearing plates (masonry plates) designed to rest on bearing pads shall not exceed an out-of-flatness value of 0.0625 inches per foot. Oxygen cut surfaces shall not exceed a surface roughness value of 1000 micro-inches as defined by ANSI B46.1.

2.7.6 Every bearing shall have an individual bearing number indelibly marked with ink.

2.7.7 After assembly including sole plates and masonry plates, bearing components shall be held together with steel strapping or other means, to prevent disassembly until the time of installation. Packaging shall be adequate to prevent damage from impact as well as from dust and moisture contamination during shipping and storage.

2.8 Production Bearing Sampling and Testing

2.8.1 Production bearing sampling and testing shall be performed in accordance with *AREMA MRE; Chapter 15, Section 5.13.4.*

2.8.2 Each bearing shall be visually examined both during and after testing. Any resultant defects, such as bond failure, physical destruction, or cold flow of PTFE to the point of debonding, shall be cause for rejection. Defects such as extruded or deformed elastomer or cracked steel shall also be cause for rejection. Minor deformations in the elastomer are allowed.

2.8.3 Bearings shall be tested at a facility owned and operated by the supplier. Bearings shall be tested in a machine with force measuring equipment that is calibrated based on standards that are traceable to NIST. Calibration certificates shall be provided to the engineer.

## 3.0 INSTALLATION

3.1 Bearings delivered to the bridge site shall be stored under cover on a platform above the ground surface. Do not stack bearings. Bearings shall be protected at all times from damage. When placed, bearings shall be dry, clean, and free from dirt, oil, grease, or other foreign substances.

3.2 Bearing devices shall not be disassembled unless otherwise permitted by the bearing supplier.

3.3 Bearings shall be installed in accordance with the alignment plan and installation scheme as shown in the contract plans. Upon final installation of the bearings, the engineer, in the presence of the manufacturer's representative if required, shall inspect the bearing components to assure that they are level and parallel to with ± 0.005 radians. Any deviations in excess of the allowed tolerances shall be corrected.

3.4 Bearings assemblies shall be handled by their bottom surfaces only unless specifically designed lifting brackets are used. Do not lift bearings by their tops, sides and/or shipping bands. Lifting brackets shall be approved by bearing supplier prior to use.

3.5 Caution shall be taken to ensure that the steel temperature directly adjacent to the polyether urethane rotational element does not exceed 225°F. The polyether urethane disk must not be exposed to direct flame or sparks.

## 4.0 MAINTENANCE

4.1 Biennial bearing inspection is recommended to ensure proper bearing performance.

4.2 Protective coatings shall be repaired in accordance with project specifications.

4.3 Do not apply protective coatings to PTFE and/or stainless-steel sliding surfaces as it may impede the proper function of expansion bearings.

## 5.0 CERTIFICATE OF COMPLIANCE

5.1 In addition to records of test results, the contractor's disk bearing supplier shall submit Certificates of Compliance for the disk bearings indicating the materials, fabrication, testing, and installation are as specified herein.

## 6.0 INSURANCE

6.1 The bearing supplier shall hold a current policy with the following limits:

- Commercial General Liability
  - Each Occurrence: $2,000,000 limit
  - General Aggregate: $4,000,000 limit
  - Products/Completed Operations Aggregate: $4,000,000 limit
  - Personal and Advertising Injury Limit: $2,000,000 limit
- Umbrella/Excess Liability
  - Each Occurrence: $4,000,000
  - Aggregate: $4,000,000