Structural Bearing Assemblies

Versiflex™ HLMR Disc Bearing Assemblies

SECTION I – General Requirements

A. **Description.** This work shall consist of designing, manufacturing and installing disc style bearings in accordance with, and at the locations shown, on the plans. The disc bearings shall be Versiflex™ HLMR Bearings supplied by

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The manufacturer shall demonstrate a minimum of five (5) years experience in the design and manufacture of disc style bearings and be certified under the AISC Quality Certification Program - Simple Steel Bridges. Bearings shall be fabricated at facilities owned and operated by the manufacturer; the manufacturer being the single entity that designs, fabricates and supervises the installation of the bearing assemblies.

B. **Submittals.** Prior to fabrication of the bearing assemblies, the manufacturer shall submit the following items to the design engineer for review and approval:

1. Shop drawings for all components and assemblies, including general arrangements and large scale details. The shop drawings shall include tables showing load capacity and movement rating, if applicable, of each bearing, including initial offset required at various ambient temperatures.
2. Calculations showing conformance of the bearings to the design loadings, movements and other specified requirements
3. Weld procedures

C. **Shop Inspection.** The engineer reserves the right to visit the manufacturer's fabrication shop for purposes of inspecting the manufacturing, assembly, testing and painting of the bearings.

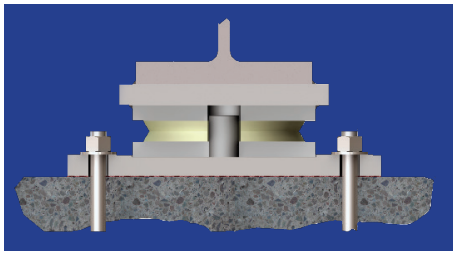
SECTION II – Materials

Materials shall conform to the following standards:

A. **Steel Plate:** ASTM A36, A588 or A572

B. **Stainless Steel:** ASTM A240, Type 304, with a minimum No. 8 mirror finish

C. **Polytetrafluoroethylene** (PTFE). PTFE sheet shall be manufactured from pure virgin unfilled TFE resin conforming to the material requirements of AASHTO LRFD Bridge Construction Specification, Section 18.8.2. PTFE shall be resistant to acids, alkalis and petroleum products, non-absorbing of water, stable from -360°F to +500°F and non-flammable.



D. **Adhesive.** Adhesive used for bonding sheet PTFE shall be an epoxy material stable from -100°F to +250°F.

E. **Polyether Urethane:** Polyether urethane shall conform to Section 18.3.2.8 and Table 18.3.2.8-1 of the AASHTO LRFD Bridge Construction Specification.

SECTION III – Design Requirements

Bearings shall be designed based on the current AASHTO LRFD Bridge Design Specification using the loads, rotations and movements given on the project plans. Designs shall assume that vertical and horizontal loads occur simultaneously.

The design of the bearings shall meet the following additional requirements:

A. The bearing assembly shall be removable and replaceable by raising the bridge superstructure 0.375 inch maximum. This requires the fabrication of a minimum of a four plate system including a masonry plate, lower bearing plate, upper bearing plate and sole plate.

B. The sole and masonry plates shall be designed to distribute the bearing loads into the surrounding substructure

and/or superstructure. Service or installation considerations specified by the design engineer, such as weldability and bearing height, may require thicker masonry and sole plates than are required due to strength considerations alone.

C. When necessary, guide bars shall be welded to the slide plates or integrally machined into a larger plate. Guide bars shall be designed for the specified horizontal loads, but not less than 10% of the vertical capacity of the bearing. Guided members must have their contact area within the guide bars in all operating positions. The total clearance between guide bars and the guided member shall be 1/16 inch, ±1/32 inch.

D. The polyether urethane disc shall be designed for a maximum average compressive stress of 5000 psi. If the outer surface of the disc is not vertical, the stress shall be computed using the smallest plan diameter of the disc, excluding the area of any holes.

E. The shear restriction mechanism shall be designed to allow free rotation and withstand the specified horizontal forces. The mechanism shall be designed to withstand the design forces on the bearing without exceeding the allowable shear, bending and bearing capacities. Shear resistance of the urethane disc shall not be included.

F. All steel surfaces in contact with PTFE, or other steel surfaces, shall be finished to a smoothness of 125 micro-inches (rms) or less.

G. Stainless steel sheets shall be of 16 gauge minimum thickness and shall be attached to their backing plates by continuous fillet welding along their edges. Bonding and/or mechanical fastening of sheets will not be permitted. Welding shall be in accordance with AWS D1.6. The backing plates shall extend beyond the edge of the stainless steel sheets to accommodate the welds and the welds shall not protrude above the stainless steel sheets.

The stainless steel sheets shall face downward and shall completely cover the PTFE sheets in all operating positions, plus two additional inches in the direction(s) of movement. The surfaces in contact with the PTFE shall be finished to a smoothness of 20 micro-inches (rms) or less.

H. PTFE sheets shall be a minimum of 0.125 inch thick, epoxy-bonded into a square-edged recess of a depth equal to one-half the PTFE sheet thickness. The shoulders of the recesses shall be sharp and square. After completion of the bonding operation, the PTFE surfaces shall be smooth and free from blisters and bubbles. Alternative low coefficient of friction materials shall be considered for use on both the guide bars and horizontal sliding surface. Materials used on the horizontal sliding surfaces shall be more durable than PTFE with a coefficient of friction similar to PTFE.

SECTION IV – Fabrication Tolerances

A. **Determination of Flatness and Tolerances**

Flatness of bearings after welding and fabrication shall be determined by the following method:

1. A precision straight edge that is longer than the nominal dimension to be measured shall be placed in contact with the plate surface to be measured.
2. Select a feeler gauge with a thickness corresponding to the flatness tolerances in item 4 below, and having a tolerance of ±0.001” and attempt to insert it under the straight edge.
3. Flatness is acceptable if the feeler does not pass under the straight edge.
4. Flatness tolerances are arranged in the following classes:
   - **Class A:** 0.0005” x “Nominal Dimension”
   - **Class B:** 0.001” x “Nominal Dimension”
   - **Class C:** 0.002” x “Nominal Dimension”
5. “Nominal Dimension” shall be interpreted as the actual dimension of the plate, in inches, under the straight edge.

B. **Rotational Elements**

1. Upper and lower bearing plate tolerances shall be:
   - Plan dimensions under 30”: -0”, +3/16”
   - Plan dimensions over 30”: -0”, +1/4”
   - Thickness tolerance shall be: -0”, +1/16”
   - Bevel (if required): ±0.002 radians
   - Class “B” tolerance for the side in contact with the urethane disc and Class “A” tolerance for the side in contact with other bearing components
2. The tolerance on the diameter of the shear restricting pin shall be –0”, +1/16” and the tolerance on the diameter of the receiving hole shall be –0”, +3/32”.
3. Urethane disc tolerances shall be:
   - Diameters greater than 20”: -3/32”, +3/32”
   - Diameters less than 20”: -1/16”, +1/16”
   - Thickness: -0”, +1/8”

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C. **Non-Rotational Elements**

1. Masonry and distribution plate tolerances shall be:
   - Plan dimensions under 30": -0", +3/16"
   - Plan dimensions over 30": -0", +1/4"
   - Thickness tolerance shall be: –1/32", +1/16"
   - Class "C" tolerance for the underside and Class "A" tolerance for the upper side in contact with other bearing components
2. Sole plates shall conform to:
   - Plan dimensions under 30": -0", +3/16"
   - Plan dimensions over 30": -0", +1/4"
   - Center line thickness: -1/32", +1/8"
   - Bevel (if required): ±0.002 radians
   - Class "B" tolerance for the upper side and Class "A" tolerance for underside (i.e., side contacting stainless sliding surface) in contact with other bearing components
3. Guide bar tolerances shall be:
   - Length: ±1/8"
   - Section dimensions: ±1/16"
   - Flatness where it bears on another plate Class "A"
   - Bar-to-bar, nominal dimension, ±1/16" and not more than 1/16" out of parallel
4. Overall bearing height shall not vary from nominal height dimension by more than +1/4" or less than -1/16".

SECTION V – Painting or Metalizing

A. The bearing assemblies shall be shop painted in accordance with the paint manufacturer's recommendations or zinc metalized in accordance with AWS C2.18-93. Galvanizing and field painting will not be permitted. The surfaces to be painted or metalized are shown in the working drawings. All surfaces covered by stainless steel or PTFE sheet are not painted or metalized.

SECTION VI – Sampling, Testing and Inspection

A. Sampling, testing and inspection shall be performed on a number of bearings consistent with the applicable governing agency's sampling requirements. All testing shall be performed in the presence of a representative of the applicable governing agency or its designated inspection agency in accordance with Section 18.1.5 of the AASHTO LRFD Bridge Construction Specification. Five separate tests can be performed depending on the type of bearings required for the project. The first three tests shall be conducted on all bearing types (fixed, mobile and guided) and include a dimensional check (Section 18.1.5.2.4), clearance test (Section 18.1.5.2.5) and a short-term compressive proof load test. The short-term compressive proof load test shall consist of loading the bearing to 150 percent of the vertical design capacity at the design rotation. During the test or upon disassembly, the bearing shall show no signs of permanent deformation of the elastomer or PTFE. The fourth test will measure the coefficient of friction on a representative sliding bearing (mobile and guided) following the provisions in Section 18.1.5.2.6. The fifth test will be conducted on fixed and guided bearing assemblies to verify the horizontal load carrying capacity following the provisions in Section 18.1.5.2.8. Long-term deterioration tests are not required for sampled bearings.

SECTION VII – Identification, Storage and Handling

A. **Identification** - Each bearing shall be stamped with the manufacturer's name, bearing type or model number, bearing number and the installed location. The stamp shall be on a surface visible after installation.

B. **Storage** - When in storage the bearings will be kept banded, wrapped and secured in a condition suitable for shipment.

SECTION VIII – Installation

A. Bearings shall be installed in strict accordance with the manufacturer's instructions, as approved by the design engineer.

B. Bearing devices shall not be disassembled unless otherwise permitted by the engineer or manufacturer.

C. Caution shall be taken to ensure that the steel temperature directly adjacent to the urethane rotational element does not exceed 200°F. The urethane disc shall not be exposed to direct flame or sparks. In addition, no weld current shall pass between bearing plates on either side of the urethane disc.

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