STRUCTURAL BEARING ASSEMBLIES

GENERAL REQUIREMENTS

A. Description. This work shall consist of designing, manufacturing, and installing pot style bearings in accordance with, and at the locations shown, on the plans. The pot bearings shall be Versiflex™ HLMR Bearings supplied by The D. S. Brown Company, 300 E. Cherry Street, North Baltimore, Ohio, 45872, Phone (419) 257-3561.

The manufacturer shall demonstrate a minimum of 5 years experience in the design and manufacture of pot 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.

MATERIALS

Materials shall conform to the following standards:

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

B. Stainless Steel: ASTM A240, Type 304, no. 8 finish.

C. Brass for Sealing Rings: ASTM B36, half-hard alloy 260.

D. Polytetrafluoroethylene (PTFE). PTFE shall be manufactured from pure virgin unfilled TFE resin conforming to ASTM D1457. PTFE shall be resistant to acids, alkalis and petroleum products; non-absorbing of water; stable from -360°F to +500°F; and non-flammable. It shall meet the following test requirements:

Physical Property	**ASTM Test Method**	**Requirement (min.)**
Ultimate tensile strength	D1457	2800 psi
Ultimate elongation	D1457	200%
Specific Gravity	D792	2.12

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

F. Elastomer. The pot bearing elastomer shall be 100% virgin polychloroprene (neoprene). The elastomer shall be plain, not laminated or fiber reinforced. It shall meet the following test requirements:

Physical Property	**ASTM Test Method**	**Requirement**
Hardness, Shore A durometer	D2240	50 ± 5
Tensile strength, min. p.s.i.	D412	2250
Ultimate elongation, min.	D412	400%
Aged properties after 70 hrs.	D573	
Temperature		212°F
Hardness change, max.		+15
Tensile strength change, max.		- 15%
Ultimate elongation change, max.		- 40%
Compression set after 22 hrs.	D395 (method B)	
Temperature		212°F
Compression set, max.		35%

DESIGN REQUIREMENTS

Bearings shall be designed for the loads and movements given on the Project Plans. Bearing design shall include a minimum rotation of 0.02 radians, which includes rotations due to all applicable service loads and movements, maximum rotations caused by fabrication and installation tolerances, and allowance for uncertainty. Designs shall assume that vertical and horizontal loads occur simultaneously.

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

A. Steel Rotational Elements.

1.) Pots. The pot shall be machined from a single piece of steel. The inside diameter of the pot cavity shall be nominally equal to the diameter of the elastomeric pad. The pot shall be deep enough to permit the seal and piston rim to remain in full contact with the vertical face of the pot wall under all design loads, movements, and rotations. Contact between metal components shall not prevent further displacements or rotation.

The pot walls shall be designed to withstand both the internal pressures caused by the vertical loads (considering the elastomer to behave as a fluid) and the design lateral loads.

2.) Pistons. The piston shall be machined from a single piece of steel. When at maximum rotation, the piston thickness shall be sufficient to provide at least 0.125 inch vertical clearance between rotating and non-rotating components of the bearing assembly.

The outside diameter of the piston shall be at least 0.04 inches less than the inside diameter of the pot.

For bearings carrying horizontal loads, the piston face width shall be designed assuming a contact area with the pot wall of one-third the pot circumference and allowable compressive stress not exceeding $0.8 \times Fy$.

B. Sole and Masonry Plates. The sole and masonry plates shall be designed to distribute the bearing loads into the surrounding substructure and/or superstructure. The allowable bending stress in sole and masonry plates shall be $0.63 \times Fy$, but thickness shall not be less than 0.75 inch. 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. Guide Bars. When necessary, guide bars shall be welded to the slide plates. Guide bars shall be designed for the specified horizontal loads, but not less than 10 percent 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, $\pm$ 1/32 inch.

D. Finish of Steel Components. All steel surfaces in contact with elastomer, PTFE, or other steel surfaces, shall be finished to a smoothness of 125 micro-inch (rms) or less.

E. Stainless Steel Sheet. 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. The attachment of stainless steel sheets to their backing plates shall be capable of resisting the frictional force set up in the bearing. Welding shall be in accordance with AWS D1.5. 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. It is essential that stainless steel sheets remain in contact with base metal throughout their service life such that interface corrosion cannot occur.

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

F. Brass Sealing Rings for Pot Bearings. Flat brass sealing rings shall have a minimum width of 0.375 inch. The thickness of the rings shall be a minimum of 0.09375 inches. The number of rings shall be a minimum of 3 depending on the design load of the bearing. The rings shall be finished to a smoothness of 63 micro-inch (rms) or less.

The gap between the ring and the wall shall nowhere exceed 0.01 inches. Each ring shall have one vertical cut at 45° to the tangent with a maximum gap of 0.05 inches. The gaps shall be staggered a minimum of 90° relative to one another when the rings are in place.

G. PTFE Sheets. 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.

Allowable pressures on Unfilled PTFE sheets on primary sliding surfaces (excluding guide bars) shall be as follows:

Design Load Effect	**Allowable Contact Pressure**
Avg. Stress (All Loads)	4500 psi
Edge Stress (All Loads)	5500 psi

The allowable average stress on Unfilled PTFE on guide bar surfaces shall be 4500 psi. The use of alternative low coefficient of friction material shall be allowed for guide bar surfaces.

H. Elastomeric Disc for Pot Bearings. All elastomeric discs shall be individually molded in one-piece. No layering or stacking of discs will be permitted. Cuts, gouges or nicks from machine cutting or flash trimming will be cause for rejection.

The sealing groove shall be molded integrally. It shall be square to the pad top surface and the same nominal dimensions as the brass sealing rings.

The area of the pad shall be designed to limit the average bearing pressure on the pad to 3500 psi under the design loads.

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 straightedge.

3.) Flatness is acceptable if the feeler does not pass under the straightedge.

4.) Flatness tolerances are arranged in the following classes:
- Class A: 0.001" x "Nominal Dimension"
- Class B: 0.002" x "Nominal Dimension"
- Class C: 0.005" x "Nominal Dimension"

5.) "Nominal Dimension" shall be interpreted as the actual dimension of the plate, in inches, under the straightedge.

B. Rotational Elements

1.) The inside diameter of pots shall be machined to a tolerance of ± 0.003. The tolerance on the depth of pot cavity shall be $+0.025$", -0". The tolerance on the thickness of the pot base shall be ± 0.025", -0".

2.) The underside of pots shall be machined parallel to the inside and to a class "C" tolerance.

3.) Elastomeric disc tolerances shall be:
- Diameters, -1/16", + 0.0"
- Thickness, -0", + 1/8"

4.) Piston tolerances shall be:
- Diameters, ± 0.003"
- Thickness + 0.025", - 0"
- Sliding side, Class "C" tolerance; elastomer side, Class "C" tolerance. Piston flanges (if any): thickness + 1/8", -1/32"; diameter + 1/8", -1/32".

C. Non-Rotational Elements

1.) Masonry and distribution plate tolerances shall be:
- Plan dimensions, ±0.25"
- Thickness tolerance shall be ±0.0625"
- 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, ±0.25"
- Center line thickness, ±0.063"
- 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, + 0.030", -0.0" and ±0.005 radians out of parallel.

4.) Overall bearing height shall not vary from nominal height dimension by + 0.25", -0.0".

PAINTING OR METALIZING

The bearing assemblies shall be painted or zinc metalized in accordance with AWS C2.18 -93. Galvanizing will not be permitted. The surfaces to be painted or metalized are shown in the working drawings. The pot cavity and all surfaces covered by stainless steel or PTFE sheet are not painted or metalized.

SAMPLING, TESTING, AND INSPECTION

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. Two separate tests can be performed. The first test will be conducted on all bearing types (fixed, mobile and guided) with the bearing loaded to 150 percent of the vertical design capacity at the design rotation. The second test will measure the coefficient of friction on a representative sliding bearing (mobile and guided). During this test, the bearing should be loaded to 100 percent of the vertical design capacity while measuring the coefficient of friction. Finally, the third test will be conducted on fixed and guided bearing assemblies to verify the horizontal load carrying capacity. During this test, the bearing should be loaded to 100 percent of the vertical design capacity while a horizontal load equal to 150 percent of the horizontal load capacity is applied to the assembly.

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 - All bearings, whether in the fabrication shop or an independent warehouse shall be stored in a clean, dry, covered facility. When in storage the bearings will be kept banded, wrapped, and secured in a condition suitable for shipment.

INSTALLATION

Bearings shall be installed in strict accordance with the manufacturer's instructions, as approved by the design engineer. The manufacturer will have its technical representative present for the placement of the first bearing. At the 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. Measures shall be taken to limit the rotation of the bearing to maximum design rotation during construction.