Designation: D 5212 – 03

Standard Specification for High Load Rotational Confined Elastomeric Bearings for Bridges and Structures[1]

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1. Scope

1.1 This specification covers bridge bearings which consist of a confined elastomeric element encased in steel (pot bearings) when the function of the bearing is to transfer loads or accommodate relative movement including rotation between a bridge superstructure and its supporting structure, or both.

1.2 This specification covers the requirements of pot bearings with standard horizontal loads (10 % of vertical).

1.3 The requirements stated in this specification are the minimums necessary for the manufacture of quality bearing devices. It may be necessary to increase these minimum values due to design conditions.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are for information only.

1.5 The following safety hazards caveat pertains only to the test method portion, Section 7, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

A 36/A 36M Specification for Carbon Structural Steel[2]

A 240/A 240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications[3]

A 572/A 572M Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel [2]

A 588/A 588M Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick[2]

A 709/A 709M Specification for Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates and Bars and Quenched and Tempered Alloy Structural Steel Plates for Bridges[2]

B 36/B 36M Specification for Brass Plate, Sheet, Strip, and Rolled Bar[4]

D 395 Test Methods for Rubber Property—Compression Set[5]

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension[5]

D 518 Test Method for Rubber Deterioration—Surface Cracking[5]

D 573 Test Method for Rubber—Deterioration in an Air Oven[5]

D 638 Test Method for Tensile Properties of Plastics[6]

D 746 Test Method for Brittleness Temperature of Plastics and Elastomers by Impact[6]

D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement[6]

D 1149 Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber[5]

D 4895 Specification for Polytetrafluoroethylene (PTFE) Resin Produced From Dispersion[7]

D 2240 Test for Rubber Property—Durometer Hardness[5]

2.2 *AWS Standards:*[8]

C.2.2–67 Metalizing with Aluminum and Zinc for Protection of Iron and Steel

D.1.5 Bridge Welding Code—AASHTO/AWS Welding Stainless

2.3 *Military Standard:*[9]

MIL-S-8660

3. Classification

3.1 The bearings are furnished in three types as follows:

3.1.1 *Fixed Pot Bearing*—Rotation only.

3.1.2 *Uni-Directional Sliding Pot Bearing*—Rotation plus movement in one direction.

[1] This specification is under the jurisdiction of ASTM Committee D0- on Road and Paving Materials and is the direct responsibility of Subcommittee D04.32 on Bridges and Structues.

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[2] *Annual Book of ASTM Standards*, Vol 01.04.

[3] *Annual Book of ASTM Standards*, Vol 01.03.

[4] *Annual Book of ASTM Standards*, Vol 02.01.

[5] *Annual Book of ASTM Standards*, Vol 09.01.

[6] *Annual Book of ASTM Standards*, Vol 08.01.

[7] *Annual Book of ASTM Standards*, Vol 08.03.

[8] Available from The American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126.

[9] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098

3.1.3 *Multi-Directional Sliding Pot Bearing*—Rotation plus movement in all directions.

3.2 The elastomer for the manufacture of the confined elastometric element is furnished in one of two materials as follows:

3.2.1 *Type CR*—Polychloroprene (neoprene) rubber.

3.2.2 *Type NR*—Polyisoprene (natural) rubber.

4. Material Specifications

4.1 *Steel*—Steel used for the confining base plates or pot, piston, and top or sole plates shall conform to Specifications A 36/A 36M, A 588/A 588M, A 572/A 572M or A 709/A 709M as required. All exposed surfaces shall be zinc metallized according to AWS C.2.2 (with no chipping) having a minimum thickness of 6 mil (0.152 mm), or treated with other approved coating systems such as coal tar epoxy or organic zinc. Internal surfaces shall not be coated.

4.2 *Stainless Steel*—Stainless steel used as the mating sliding surface to the PTFE in sliding pot bearing shall conform to Specification A 240/A 240M, Type 304, No. 8 mirror finish.

4.3 *Brass*—Flat brass sealing rings shall conform to the requirements of Specification B 36/B 36M half hard, alloy 260.

4.4 *Polytetrafluoroethylene (PTFE)*—The load bearing PTFE shall be resistant to acids, alkalis and petroleum products, and nonabsorbing of water. It shall be stable for temperatures up to 260°C (500°F) and shall be nonflammable. The PTFE shall be manufactured from pure virgin unfilled TFE resin conforming to Specification D 4895. The PTFE shall conform to the physical requirements listed in Table 1.

4.5 *Elastomer*—The elastomer portion of the elastomeric compound shall be 100 % virgin natural rubber or 100 % virgin polychloroprene with no reclaim or ground polymers reinforcement allowed. These compounds shall meet the physical property requirements listed in Table 2.

5. Design Requirements

5.1 *Steel Components*:

5.1.1 *Pot*—The pot shall consist of circular ring and a lower base plate. The plate and ring shall be fabricated from one piece of steel.

NOTE 1—Alternative methods of fabrication may be used provided the design is substantiated by calculations and other documentation.

5.1.1.1 Depth of the pot cavity shall be equal to or greater than: pot inside diameter/2 × 1.05 × (design rotation× 2) + piston face width + elastomeric pad thickness.

5.1.1.2 The inside diameter of the pot shall be nominally the same as the outside diameter of the elastomeric disc.

5.1.1.3 The thickness of the pot ring shall be designed to withstand the hydrostatic internal pressure caused by the elastomer considered as a fluid, and horizontal applied loads without consideration of the lower (base) plate.

5.1.1.4 The lower base plate shall be of sufficient thickness to ensure distribution of the bearing stress under full dead load applied at an eccentricity of 5 % of the inside diameter of the pot combined with a horizontal load amounting to 10 % of the total vertical load. The thickness of the lower base plate shall be at least 1/22 of the pot diameter but in no case less than ¾ in. (19 mm). If the lower base plate of the pot sits directly on concrete, then its thickness should be 0.06 times the pot diameter or ¾ in. (19 mm), whichever is greater.

5.1.1.5 Design calculations shall be submitted with shop drawings.

5.1.2 *Piston*—The piston shall be fully machined from a single piece of steel. Machining shall include profiling the side walls to allow 2 × design rotation and sufficient bearing area against the pot wall to carry maximum lateral loads at a stress not exceeding 0.8 Fy.

TABLE 1 Physical Property Requirements for PTFE

NOTE 1—15 % glass-filled PTFE may be used for guide bar surfaces (see Specification D 4895).

Physical Property	ASTM Test Method	Requirement Minimum
Ultimate tensile strength, psi, (MPa)	D 638	2800 (19.3)
Ultimate elongation, min, %	D 638	200
Specific gravity, min/max	D 792	2.12/2.19

TABLE 2 Physical Property Requirements for Pot Bearing Elastomer

NOTE 1—The elastomer meeting these requirements shall be plain, not laminated or fiber reinforced.

Physical Properties	ASTM Test Method	Requirements	
		Polychloroprene	Natural
Hardness, Shore A durometer (IRHD)	D 2240	50 ± 5	50 ± 5
Tensile strength, min, psi (mPa)	D 412	2250 (15.5)	2250 (15.5)
Ultimate elongation, min, %	D 412	400	400
Aged physicals after 70 h at 100°C (212°F)	D 573	. . .	. . .
Hardness change, max		0 to +15	. . .
Tensile strength change, max, %		−15	. . .
Elongation change, max, %		−40	. . .
Aged physicals after 168 h at 70°C (158°F)	D 573	. . .	. . .
Hardness, change, max		. . .	0 to +10
Tensile strength change, max, %		. . .	−25
Elongation change, max, %		. . .	−25
Compression set, 22 h Method B, max, %	D 395	. . .	. . .
at 100°C (212°F)		35	. . .
at 70°C (158°F)		. . .	25
Ozone resistance			
Mounting at 20 % strain	D 518 (Procedure A)	. . .	. . .
Exposure	D 1149	. . .	. . .
40 ±2°C (104°F)		. . .	. . .
100 h at 302 mPa ozone partial pressure		No cracks	. . .
100 h at 500 mPa ozone partial pressure		. . .	No cracks
		(Using 7× magnification lens)	
Low temperature brittleness at −40°C (−40°F)	D 746 (Procedure B)	No failure	. . .
		. . .	No failure