Item No. 438S
Elastomeric Materials

438S.1 Description

This item shall govern the materials, testing, fabrication and placement of elastomeric materials, except as otherwise covered in other specifications or on the Drawings.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

438S.2 Submittals

The submittal requirements of this specification item include:

A. Type and Manufacturer of proposed products.

B. Certification that proposed products meet the requirements of this section.

438S.3 Materials

(1) Elastomeric Bearings

When specified on the Drawings, structural members shall be seated on elastomeric bearings.

These bearings may be either "plain" (consisting of elastomer only) or "laminated" (consisting of alternating individual layers of elastomer and nonelastic laminates) as indicated. Elastomeric bearings shall be specified on the Drawings by hardness (durometer), size and configuration and, in the case of laminated bearings, by the thickness of the individual layers of elastomer and the size and position of special connection members, if any, required to be vulcanized with the bearing.

(a) General

Unless otherwise indicated, the elastomer for bearings shall be formulated from previously unvulcanized 100 percent virgin polychloroprene or 100 percent virgin polyisoprene rubber polymers. Rubber-like polymers employed in the elastomer formulation shall be exclusively of the polychloroprene or natural polyisoprene type. Bearings will not be acceptable if the elastomer employed contains previously vulcanized rubber (natural of synthetic) or other synthetic rubber-like polymers.

Nonelastic laminates shall be 1/16 inch (1.6 mm) [-0 inch, +1/16 inch (0 mm, + 1.6 mm)] thick steel strip or sheet. Metal for special connections shall conform to ASTM A 36, unless otherwise shown on the plans.

(b) Physical Properties of the Elastomer

Elastomer formulated from polychloroprene shall meet the requirements shown in Table A. Elastomer formulated from polyisoprene shall meet the requirements of Table B. Material tests shall be made in accordance with

the test methods stipulated except that all tests shall be made on the finished product and standard laboratory test slabs will not be utilized for this purpose. The values shown in Tables A and pertain to performed on samples taken from the finished product. The apparatus employed in preparing test specimens from the finished product shall be in accordance with ASTM Designation: D 3183, "Standard Practice for Rubber-Preparation of Pieces for Test Purposes from Products".

Compression set test specimens shall be taken from the finished product. In bearing thicknesses exceeding 1/2 inch (12.7 mm) or elastomer layers in laminated bearings exceeding 1/2 inch (12.7mm), the full thickness of the bearing of elastomer layer shall be utilized. The 25 percent compression shall be employed and obtained through the utilization of appropriate thickness of space bar and/or shims.

Beveled or wedge shaped bearings of elastomer layers in laminated bearings shall have the compression set specimens selected from sections of the bearings or layers which have been properly cut or ground so that the top and bottom surfaces of the circular compression set specimens will have essentially parallel surfaces. The maximum permissible thickness of such bearings or layers, after rendering the upper and lower surfaces parallel, will be used as a source for the cutting of the cylindrical test specimens employed in the compression set test in accordance with ASTM D 395, "Standard Test Methods for Rubber Property-Compression Test", as modified herein.

(c) Formulation Prequalification and Certification

All bearings furnished by the Contractor shall be produced by a bearing manufacturer who has previously submitted the required prequalification test samples and certification and whose elastomer formulation has been initially approved for use by the Engineer or designated representative. Each elastomer formulation produced by a manufacturer must be approved by the Engineer or designated representative prior to its first use on Department projects. To prequalify and obtain initial approval of a particular formulation, the bearing manufacturer shall submit to the Engineer or designated representative, well in advance of anticipated use of the manufacturer’s product, certified test results of actual test values obtained when the physical properties of the elastomer to be furnished were tested for compliance with the pertinent specifications.

The bearings manufacturer shall certify that all of the samples submitted are of the same basic elastomer formulation and of equivalent cure to that used in the finished products to be furnished on City projects.

The Producer may be required to perform the complete prequalification testing procedure again during later production should the Engineer or designated representative require such retesting.

(d) Manufacturing Requirements

All components of a "laminated" bearing shall be molded together to form an integral unit free of voids or separations in the elastomer or between the

elastomer and the nonelastic laminates or special connections unless specifically required or permitted by the plans or these specifications. The elastomer between laminates or special connections and on the outer surfaces of the bearing shall be well vulcanized, uniform and integral such that it is incapable of being separated by any mechanical means into separate, definite, well-defined elastometric layers. Evidence of this layered construction, either at the outersurfaces or within the bearing, shall be cause for rejection of such laminated bearing shipments.

All edges of nonelastic laminates shall be covered by a minimum of 1/8 inch (3.2 mm) of elastomer, except that exposure of the laminates will be permitted at approved laminate restraining devices and around holes that will be entirely enclosed in the finished structure. Unless otherwise indicated, all laminates shall be parallel with the bottom surface of the bearing, subject to the tolerances that follow.

Plain bearings may be molded individually, cut from previously molded strips or slabs, molded to the full thickness of the finished bearings or extruded and cut to length. The finished bearings shall have no voids or separations detectable either at the bearing surfaces or within the bearing unless specifically required or permitted by the Drawings or these specifications. Plain elastomeric bearings shall be well vulcanized, uniform and integral units of construction such that the bearing is incapable of being separated by any mechanical means into separate, definite and well-defined elastomeric layers.

Evidence of layered construction, either at the outer surfaces or within the bearing, shall be cause for rejection of such bearing shipments.

TABLE A
Interpolate Between Values Shown for Other Hardness Values

Hardness	**50**	**60**	**70**	**80**	**90**
ORIGINAL PHYSICAL PROPERTIES Hardness ASTM D 2240, Type A Durometer Tensile Strength, Minimum psi (mPa) ASTM D 412 Elongation at Break, minimum percent	 50+5 2250 (15.5) 450	 60+5 2250 (15.5) 360	 70+5 2250 (15.5) 270	 80+5 1800 (12.4) 135	 90+5 1800 (12.4) 90
ACCELERATED TESTS TO DETERMINE LONG TERM AGING CHARACTERISTICS, OVEN AGED 70 HR at 212 F (100 C) ASTM D 573; Hardness points change, maximum Tensile Strength, % change maximum Elongation at Break, % change maximum	 0 to +15 -15 40	 0 to +15 -15 40	 0 to +15 -15 40	 0 to +15 -15 40	 0 to +15 -15 40
OZONE: 100 PPHM IN AIR BY VOLUME; 20% STRAIN AT 100 +2 F (38 + -17 C)-- ASTM D 1149*, 100 hours	No Cracks	No Cracks	No Cracks	No Cracks	No Cracks
COMPRESSION SET-22 HRS AT 158 F (70 C) ASTM D 395(Method B)**, % Maximum	25	25	25	25	25

LOW TEMPERATURE RESISTANCE ASTM D 746 PROCEDURE B, Brittleness at -14.8 F (-26 C)	No Failure	No Failure	No Failure	No Failure	No Failure

ADHESION (PREQUALIFICATION ONLY)
For laminated bearings, bond between the elastomer and laminates will be qualitatively evaluated by the procedure outlined in the TxDOT Manual of Testing Procedures, Test Method Tex-601-J.

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* Samples to be solvent wiped before test to remove traces of surface impurities.
** Modified in that test is performed on specimens of essentially full bearing or layer thickness with the 25 percent compression obtained through the use of appropriate spacer bars and/or shims.

TABLE B
Interpolate Between Values Shown for Other Hardness Values

Hardness	**50**	**60**	**70**	**80**	**90**
ORIGINAL PHYSICAL PROPERTIES Hardness ASTM D 2240, Type A Durometer Tensile Strength, Minimum psi (mPa) ASTM D 412 Elongation at Break, minimum percent	 50+5 2250 (15.5) 405	 60+5 2250 (15.5) 360	 70+5 2250 (15.5) 270	 80+5 1800 (12.4) 135	 90+5 1800 (12.4) 90
ACCELERATED TESTS TO DETERMINE LONG TERM AGING CHARACTERISTICS, OVEN AGED 70 HR at 212 F (100 C)ASTM D 573; Hardness points change, maximum Tensile Strength, % change maximum Elongation at Break, % change maximum	 0 to +10 -25 -25	 0 to +10 -25 -25	 0 to +10 -25 -25	 0 to +10 -25 -25	 0 to +10 -25 -25
OZONE: 25 PPHM IN AIR BY VOLUME; 20% STRAIN AT 100 +2 F (38 + -17 C)-- ASTM D 1149*, 48 hours	No Cracks	No Cracks	No Cracks	No Cracks	No Cracks
COMPRESSION SET-22 HRS AT 158 F (70 C) ASTM D 395(Method B)**, % Maximum	25	25	25	25	25
LOW TEMPERATURE RESISTANCE ASTM D 746 PROCEDURE B, Brittleness at -14.8 F (-26 C)	No Failure	No Failure	No Failure	No Failure	No Failure

ADHESION (PREQUALIFICATION ONLY)
For laminated bearings, bond between the elastomer and laminates will be qualitatively evaluated by the procedure outlined in the TxDOT Manual of Testing Procedures, Test Method Tex-601-J.

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* Samples to be solvent wiped before test to remove traces of surface impurities.

** Modified in that test is performed on specimens of essentially full bearing or layer thickness with the 25 percent compression obtained through the use of appropriate spacer bars and/or shims.

The finish of cut surfaces shall be ANSI Number 250 or smoother. The batch or lot number and the dimensions or piece mark shall be marked on each bearing and they shall remain legible until placement in the structure.

(e) Appearance and Dimensions

Flash tolerance, finish and appearance shall meet the requirements of the latest edition of the Rubber Handbook as published by the Rubber Manufacturers Association, Inc.; MA-F3-T.063 for molded bearings and RMA-F2 for extruded bearings.

For both plain and laminated bearings, the permissible variation from the dimensions and configuration required by the plans and these specifications shall be as follows:

1. Overall Vertical Dimensions:
   Average Total Thickness 1 1/4 inch (31.8 mm) or less ..... -0,+1/8 inch (3.2 mm)
   Average Total Thickness Over 1 1/4 inch (31.8 mm) ..... -0,+1/4 inch (6.4 mm)
2. Overall Horizontal Dimensions ..... -0,+1/4 inch (6.4 mm)
3. Thickness of Individual Layers of Elastomer
   (Laminated Bearings Only) ..... +1/8 inch (+3.2 mm)
4. Variation from a Plane Parallel to the Theoretical Surface:

   Top ..... 1/8 inch (3.2 mm)
   Sides .....1/4 inch (6.4 mm)
   Individual Nonelastic Laminates..... 1/8 inch (3.2 mm)
   (As determined by measurements at the edges of the bearing)
5. Position of Exposed Connection Member.....1/8 inch (3.2 mm)
6. Edge Cover of Embedded Laminates or Connection members . 0,+1/8 inch (3.2 mm)
7. Size of Holes, Slots or Inserts ..... 0,+1/8 inch (3.2 mm)
8. Position of Holes, Slots or Inserts..... 0,+1/8 inch (3.2 mm)
9. Thickness of Nonelastic Laminates ..... 0,+1/16 inch (1.6 mm)

(f) Routine Inspection, Sampling and Testing

After prequalification approval, the inspection, sampling and testing of actual bearing production will be as outlined below:

Plain Bearings

A minimum of one plain bearing will be taken by a representative of the Engineer from each project or from each batch or lot in case the same batch or lot is used for more than one project.

Routine tests for compliance with the requirements of Table A or Table B, whichever is applicable, will be performed by the Engineer or designated representative. Samples will not be returned.

Laminated Bearings

Each laminated bearing shall be subjected, by the manufacturer, to an average compression of 1,000 psi (6.9 mPa) or to lower average compression if so indicated in the plans or approved by the Engineer or designated representative. This compression test will be performed in the presence of a representative of the Engineer or designated representative who will perform visual inspections and accept or reject the bearings at that time. The performance of each bearing will be considered satisfactory, provided there is no visible evidence of bond failure or other damage to the bearing because of this loading and provided the finished bearing meets all other pertinent portions of this specification. Samples of laminated bearings may be taken if the quality of the plant production becomes questionable. If samples are taken, they shall be taken and tested as outlined for plain bearings.

The manufacturer shall furnish certified laboratory test results on the elastomer properties of each batch or lot of compound used in the manufacture of bearings, both plain and laminated.

(2) Waterstops

Waterstops shall be furnished and installed in accordance with the details indicated. Except where otherwise indicated on the plans, waterstops may be manufactured from either natural (plain) or synthetic rubber or from polyvinyl chloride (PVC) as specified below:

(a) Materials

1. Natural (plain) rubber waterstops shall be manufactured from a stock composed of a high-grade compound made exclusively from new plantation rubber, reinforcing carbon black, zinc oxide, accelerators, antioxidants and softeners. This compound shall contain not less than 72 percent by volume of new plantation rubber.

2. Synthetic rubber waterstops shall be manufactured from a compound made exclusively from neoprene or GRS, reinforcing carbon black, zinc oxide, polymerization agents and softeners. This compound shall contain not less than 70 percent by volume of neoprene or GRS.

3. Physical properties of natural or synthetic rubbers for waterstops shall be as shown in Table C below:

TABLE C: Physical Properties for Rubber for Waterstops

	Natural (Plain) Rubber	Synthetic (Neoprene GRS) Rubber

Original Physical Properties: Hardness-ASTM D 2240 (Durometer) Tensile Strength, Minimum psi (mPa) ASTM D 412 Elongation at Break, Minimum percent	 60 + 05 3500 (24.1) 550	 55 + 5 2500 (17.2) 425
Accelerated Tests to Determine Long-term Aging Characteristics: either- after 7 days in air at 158° (+2°) F (70° + -7° C) (ASTM D 573)or - after 48 hours in oxygen (ASTM D 572) at 158° (+2°)F (70° + -7° C) and 300 psi (2.1 mPa) pressure Tensile Strength, %change, Maximum Elongation, % change, Maximum	 35 35	 35 ----

4. Polyvinyl Chloride (PVC). Unless otherwise specified on the plans, the material shall conform to the Corps of Engineers Specification Number, CRD-C-572-60, "Polyvinylchloride Waterstop".

(b) Manufacturer's Certification

The manufacturer shall furnish certified test results indicating compliance with this specification for each batch or lot of waterstop furnished under this contract. In case of doubt of the quality furnished, the burden of proof shall be on the manufacturer and the decision of the Engineer or designated representative shall be final.

(c) Manufacturer's Requirements

1. Rubber Waterstops

Waterstops shall be manufactured with an integral cross section which shall be uniform within + 1/8 inch (3.2 mm) in width and the web thickness or bulb diameter, within + 1/16 and - 1/32 inch (+ 1.6 and -0.8 mm). No splices will be permitted in straight strips. Strips and special connection pieces shall be well cured so that any cross sections shall be dense, homogeneous and free from all porosity. All junctions in the special connection pieces shall be full-molded. During the vulcanizing period, the joint shall be securely held by suitable clamps.

2. PVC Waterstops

Requirements shall be as in 1 above for rubber waterstops, except that splicing of PVC shall be done by heat sealing the adjacent surfaces in accordance with the manufacturer's recommendations. A thermostatically controlled electric source of heat shall be used to make all splices. The heat shall be sufficient to melt but not to char the plastic.

3. Elastomeric Pads

When so specified on the plans, rail posts, rail members, metal shoes or minor structural members shall be insulated, leveled, shimmed or otherwise protected by elastomeric pads, sheets or washers.

Such bearings may be any elastomeric material, plain, fibered or laminated, having a hardness(durometer) between 70 and 100 as certified by the manufacturer to the Engineer.

Acceptance testing will not be required.

4. Other Elastomeric Products

Other elastomeric products shall be in accordance with the requirements on the plans.

438S.4 Construction Methods

Elastomeric Bearings

Unless otherwise indicated, concrete bearing seats shall be float finished to the required elevation. Variation from a level plane shall not exceed 1/16 inch (1.6 mm) within the limits of the bearing.

After erection of members on steel structures only, the horizontal distortion of the bearings shall be measured, corrected for temperature and adjusted if necessary, so that the horizontal displacement between top and bottom of bearings at 70° F (21°C) does not exceed 15 percent of the elastomer thickness.

Welding in the vicinity of the bearings shall be done with care to avoid injury to the elastomer.

Waterstops

Waterstops shall be installed as indicated, to prohibit the flow of liquid through a joint in the concrete.

Field splices shall be either vulcanized, mechanical, using stainless steel parts or made with a rubber splicing union of the same stock as the waterstop, at the option of the Contractor. All finished splices shall have a tensile strength not less than 50 percent of the unspliced material.

438S.4 Measurement

Elastomeric bearings or waterstops used with concrete units will not be measured for payment but will be included in the unit price bid for the item of construction in which these activities are used.

End

SPECIFIC CROSS REFERENCE MATERIALS

Specification Item No. 438S, "Elastomeric Materials"

American Society for Testing and Materials, ASTM

Designation	Description
ASTM C 36	Standard Specification for Carbon Structural Steel
ASTM D 395	Standard Test Methods for Rubber Property-Compression Test
ASTM D 412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers- Tension
ASTM D 572	Standard Test Method for Rubber- Deterioration by Heat and Oxygen
ASTM D 573	Standard Test Method for Rubber-Deterioration in an Air Oven
ASTM D 746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 1149	Standard Test Method for Rubber Deterioration-Surface Ozone Cracking in a Chamber
ASTM D 2240	Standard Test Method for Rubber Property- Durometer Hardness
ASTM D 3183	Standard Practice for Rubber-Preparation of Pieces for Test Purposes from Products

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-601-J	Adhesion and Chlorinated Compound Testing of Elastomeric Bridge Bearings

American National Standards Institute, ANSI

Corp of Engineers

Designation	Description
CRD-C-572-6D	Polyvinylchloride Waterstop

Rubber Manufacturer's Association, The RMA Rubber Handbook

Designation	Description
MA-F3-T.063	Molded Bearings
RMA-F2	Extruded Bearings

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item 438S, "Elastomeric Materials"

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item 360	Concrete Pavement
Item 420	Concrete Structures
Item 434	Sliding Elastomeric Bearings
Item 435	Elastomeric Material

City of Austin Standard Specifications

Designation	Description
Item No. 360	Concrete Pavement
Item No. 408S	Concrete Joint Materials

Item No. 410S	Concrete Structures
Item No. 416S	Waterstops