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Standard Specification for Preformed Thermoplastic Vulcanizate Elastomeric Joint Seals for Bridges[1]

This standard is issued under the fixed designation D6924; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers the material requirements for preformed thermoplastic vulcanizate (TPV) elastomeric joint seals for bridges. The seal consists of a multiple-web design composed of a TPV and functions only by compression of the seal between the faces of the joint with the seal folding inward at the top to facilitate compression. The seal is installed with a lubricant adhesive and is designed to seal the joint and reject incompressibles.

NOTE 1—This specification may not be applicable for seals whose height is less than 90 % of its nominal width.

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

1.3 *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 requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D395 Test Methods for Rubber Property—Compression Set

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D518 Test Method for Rubber Deterioration—Surface Cracking (Withdrawn 2007)[3]

D573 Test Method for Rubber—Deterioration in an Air Oven

D575 Test Methods for Rubber Properties in Compression

D1149 Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment

D2240 Test Method for Rubber Property—Durometer Hardness

D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries

D6338 Classification System for Highly Crosslinked Thermoplastic Vulcanizates (HCTPVs) Based on ASTM Standard Test Methods

3. Marking and Ordering Information

3.1 Each lot of seal shall be marked with characters of not less than 0.25 in. (6.35 mm) in height on the top of the seal at a maximum of 4 ft (1.22 m) intervals showing the lot number, date of manufacture, and the manufacturing seal designation.

3.2 The purchaser shall specify the anticipated required minimum acceptable joint movement, and either the minimum joint opening, or the nominal width of seal.

4. Materials and Manufacture

4.1 The seals shall be preformed, and the material shall be vulcanized elastomeric compound using a thermoplastic vulcanizate as the compound. A thermoplastic vulcanizate is a blend of a crosslinked rubber and a thermoplastic polymer that can be processed on conventional thermoplastic processing machinery and has the properties of a crosslinked elastomer. Highly crosslinked thermoplastic elastomers are classified according to Classification System D6338. TPV materials are made in the dynamic vulcanization process. One example of a typical TPV is crosslinked ethylene propylene diene rubber blended with polypropylene. The TPV material can also contain processing oils, antioxidants, fillers, or other additives.

5. Physical Requirements

5.1 The materials shall conform to the physical properties prescribed in Table 1.

5.2 In the applicable requirements of Table 1 and the test methods, all deflection shall be based on the nominal width.

6. Dimensions and Working Parameters

6.1 The size, shape and dimensional tolerances shall be as outlined in 6.1.1.

[1] This specification is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.34 on Preformed Joint Fillers, Sealers and Sealing Systems.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

TABLE 1 Physical Requirements for Preformed Elastomeric Joint Seals

	Requirements	ASTM Test Method
Tensile strength, min, psi (MPa)	730 (4.4)	D412
Elongation at break, min, %	300	D412
Hardness, Type A durometer, points	50 to 70	D2240 (modified)[A]
Oven aging, 168 h at 212°F (100°C)		
Tensile strength, max, % loss	10	
Elongation, max, % loss	10	
Hardness, Type A durometer, points change	0 to 5	
Ozone resistance[B] 20 % strain, 300 pphm in air, 70 h, at 104°F (40°C) (wiped with toluene to remove surface contamination)	no cracks	D1149[C]
Low-temperature recovery, 72 h at 14°F (-10°C), 50 %:		
Deflection, min, %	80	Section 7[D]
Low-temperature recovery, 22 h at -20°F (-29°C), 50 %:		
Deflection, min, %	70	Section 7[D]
High-temperature recovery, 70 h, at 212°F (100°C), 50 %:		
Deflection, min, %	75	Section 7[D]
Compression-deflection properties:		
LC min in. (mm)	9.3	D575 Method A (modified)[E]
LC max in. (mm)	9.3	
Movement range, in. (mm)	9.3	

[A] The term "modified" in the table relates to the specimen preparation. The use of the joint seal as the specimen source requires that more plies than specified in either of the modified test procedures be used. Such specimen modification shall be agreed upon between the purchaser and the supplier prior to testing. The hardness test shall be made with the durometer in a durometer stand as recommended in Test Method D2240.
[B] Sample prepared in accordance with Method A of Test Method D518.
[C] Cracking, splitting, or sticking of a specimen during a recovery test shall mean that the specimen has failed the test.
[D] The reference section and subsections are those of this specification. The values found in 6.2.2, 6.2.3, and 6.2.4 shall be within the range specified by the purchaser in 3.2.
[E] Speed of testing shall be 0.5 ± 0.05 in. (13 ± 1.3 mm), min at room temperature of 73 ± 4°F (23 ± 2.2°C). The sheets of sandpaper are not used.

6.1.1 Measurements used for laboratory testing shall be taken to the nearest 0.01 in. (0.3 mm) and reported/recorded to the nearest 0.1 in. (3 mm) as the average of three measurements. The measured width shall be greater than or equal to the nominal width. The seal height shall not be less than 90 % of the nominal width unless joint recess dimensions or special design considerations dictate the geometry.

6.2 *Compression Deflection Properties*—The contact pressure expressed in pounds-force per square inch (or pascals) when the seal is compressed to any particular width indicates the stress-strain relationship that exists in the seal. This relationship is dependent on both the properties of the elastomer and the cross-sectional configuration of the seal. Therefore, for a predetermined allowable pressure, a definitive relationship will exist and the working limits of the seal may be defined.

6.2.1 The working limits (minimum and maximum degrees of compression) of the seal shall be determined on the basis of the minimum and maximum limits of compressibility (LC min and LC max), and the movement range as specified herein. Seals with nominal width differing from that specified are acceptable, providing the compressed width at LC max is less than the minimum anticipated joint opening, and the movement range requirement is met.

6.2.2 The minimum limit of compressibility (LC min) is defined as the compressed width (expressed in terms of percent of nominal width) corresponding to a contact pressure of 3 psi (20.68 kPa). The LC min shall be determined in accordance with 9.3. For the purpose of calculating movement range, a value at 85 % of nominal width shall be used for LC min when the measured value of LC min exceeds 85 %.

NOTE 2—If the seal generates a pressure of 3 psi at 90 % of nominal width, LC min equals 85 %. However, if the seal generates 3 psi at 70 % of nominal width, the LC min equals 70 %.

6.2.3 The maximum limit of compressibility (LC max) is defined as the compressed width (expressed in terms of percent of nominal width) corresponding to a contact pressure of 35 psi (241.32 kPa). The LC max shall be determined in accordance with 9.3. LC max has been designated at 35 psi (241.32 kPa) in order to mitigate the tendencies toward pressure decay of the seal during use. A reading of 35 psi is considered an absolute maximum pressure which should not be exceeded.

6.2.4 The movement range of the seal is defined as the numerical difference between the LC min and the LC max expressed in inches (mm). For the purpose of calculating the movement range, a value at 85 % shall be used for LC min when the measured value of LC min exceeds 85 %. For purposes of acceptance testing, the calculated movement range of the seal shall not be less than the specified value.

7. Sampling

7.1 A lot shall consist of the quantity for each cross section agreed upon between the purchaser and the supplier.

7.2 Samples shall be taken at random from each shipment of material. If the shipment consists of more than one lot, each lot shall be sampled.

7.3 The minimum lengths of samples for testing purposes shall be as prescribed by the purchaser or as prescribed in Table 2.

8. Specimen Preparation

8.1 All test specimens shall be cut, buffed, or both from the sample of preformed seal. Care should be taken not to overheat the test specimen during buffing. The cut shall be square to within 2° and smooth, with no roughness visible to the naked eye. The use of a tooth blade device or a guillotine-type cutter, or both, is not acceptable. This process will eliminate irregularities.

8.2 Specimens for determining tensile strength and elongation (Test Methods D412) shall be prepared using Die C when possible. Die D may be used when the flat sections of a seal are too small for Die C. However, the requirement of Table 1 shall

TABLE 2 Minimum Lengths of Seal Samples

Seal Size, in. (mm)	Length of Sample, in. (m)
Less than 2 (51)	96 (2.44)
2 (51) to less than 3 (76)	72 (1.83)
3 (76) and larger	60 (1.52)