Designation: D994/D994M − 11 (Reapproved 2016)

Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)[1]

This standard is issued under the fixed designation D994/D994M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers bituminous preformed expansion joint filler for use in concrete construction.

NOTE 1—Attention is called to ASTM Specifications D1751 and D1752.

1.2 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

D545 Test Methods for Preformed Expansion Joint Fillers for Concrete Construction (Nonextruding and Resilient Types)

D1751 Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

D1752 Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

3. Manufacture

3.1 This product shall consist of a bituminous (asphalt or tar) mastic composition, formed and encased between two layers of bituminous impregnated felt or two layers of glass-fiber felt. The mastic shall comprise mineral fillers and reinforcing fibers and may contain thin strips of reinforcing sheet material.

4. General Requirements

4.1 Preformed strips of expansion joint filler shall be of such character as not to be deformed or broken by ordinary handling when exposed to atmospheric conditions and shall not become brittle in cold weather. Pieces of the joint filler that have been damaged shall be rejected.

5. Properties

5.1 *Distortion at 50°C [125°F]*—The joint filler shall not show a deflection of more than 1 in. (25 mm) when tested in accordance with 8.2.1.

5.2 *Brittleness*—The joint filler shall not crack or shatter when tested in accordance with 8.2.2.

NOTE 2—Expansion joint filler having a nominal thickness of 5 mm [¼ in.] or less shall not be subject to a requirement for brittleness.

5.3 *Water Absorption*—The water absorption of the joint filler, when tested in accordance with 8.2.3, shall not exceed the following values:

Nominal Thickness of Joint, min, mm [in.]	Absorption, max, weight %
25 [1]	2.5
20 [¾]	3
15 [½]	4
10 [⅜]	5

NOTE 3—Expansion joint filler having a nominal thickness of less than 10 mm [⅜ in.] shall not be subject to a requirement for water absorption.

5.4 *Compression*—The load required to compress the test specimen to 50 % of its thickness before test shall not be less than nor more than the following values when the joint filler is tested in accordance with 8.2.4.

Nominal Thickness of Joint, mm [in.]	Load Requirements, min-max. kPa [psi]
25 [1]	700-5000 [100-754]
20 [¾]	700-6000 [100-841]
15 [½]	700-6500 [100-928]

NOTE 4—Expansion joint filler having a nominal thickness of less than 15 mm [½ in.] shall not be subject to a requirement for compression.

[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.

TABLE 1 Single-Operator Precision Statements SI Units Only[A]

Property	Property as a function of Nominal Thickness				
Thickness, Nominal, mm.	25.4	19.1	12.7	9.5	6.4
Distortion, max. mm.	25.4	25.4	25.4	25.4	25.4
Precision, max.accept.range.	2.93	2.30	5.92	6.03	6.84
Brittleness	Pass*	Pass*	Pass*	Pass*	- - - -
Precision, max.accept.range	**	**	**	**	- - - -
Water Absorption, wt % max.	2.5	3	4	5	- - - -
Precision, max.accept.range.	0.057	0.087	0.400	1.187	- - - -
Compression, kPa, min-max.	690–5200	690–5800	690–6400	- - - -	- - - -
Precision, max.accept.range.	204.2	180.1	416.5	- - - -	- - - -

NOTE—Precision, max.accept.range. Per Practice C670, Maximum acceptable range between high and low individual measurements.

Pass* Not crack or shatter.

** No precision statement is necessary for this attribute.

[A]All precision data was derived using inch-pound units.

6. Dimensions and Permissible Variations

6.1 The preformed strips shall conform to the dimensions specified or shown on the plans. Strips of the joint filler that do not conform to the specified dimensions within the permissible variations of ±1mm [1⁄16 in.] in thickness, ±2 mm [1⁄8 in.] in depth, and ±5 mm [1⁄4 in.] in length shall be rejected.

7. Sampling

7.1 *Size of Sample*—Each sample shall consist of sufficient material to provide at least three test specimens measuring 50 by 150 mm [2 by 6 in.] and at least one test specimen measuring 100 by 100 mm [4 by 4 in.].

7.2 *Number of Samples*—One representative sample shall be selected from each shipment of 100 m^2 [1000 ft^2], or fraction thereof, of each thickness ordered.

7.3 Samples shall be packed for transportation in such a manner that there will be no danger of distortion or breakage.

8. Test Methods

8.1 *Significance and Use:*

8.1.1 The distortion and brittleness tests are used to determine the handling characteristic of the material. The water absorption and compression tests are used to determine the suitability of the material as an expansion joint filler.

8.2 *Procedures:*

8.2.1 *Distortion at 50°C [125°F]*—Cut a test specimen 50 by 150 mm [2 by 6 in.], substantially flat and straight, with the 150-mm [6-in.] dimension parallel to the machine direction of the strip. Clamp the specimen between two blocks so that the expansion joint forms a cantilever of 90-mm [3½-in.] length. Place the clamp and joint assembly in a forced-draft oven maintained at 50 ± 1C [125 ± 2°F], with the specimen in a horizontal position, for 2 h. Measure the deflection of the specimen from the horizontal.

8.2.2 *Brittleness*—Cut a test specimen 50 by 150 mm [2 by 6 in.] with the 150-mm [6-in.] dimension parallel to the machine direction of the strip. Maintain the specimen at a temperature of 5 ± 1°C [39 to 43°F] in water for at least 2 h before testing. Clamp the specimen between two boards so that the expansion joint forms a cantilever of 90 mm [3½ in.] in length and hold in a horizontal position by a suitable rigid support. Suspend a spherical cast iron ball weighing 0.40 kg [0.95 lb] and having a diameter of 50 mm [17⁄8 in.] by a cord tied to an eyelet fastened to the ball. For specimens having a thickness of 15 mm [9⁄16 in.] or less, suspend the ball 300 mm [1 ft] above the center of the projecting portion of the specimen. For specimens over 15 mm [9⁄16 in.] in thickness, suspend the ball 600 mm [2 ft] above the specimen. Release the ball by burning the cord above the eyelet. Other suitable suspension-and-release devices may be used.

8.2.3 *Water Absorption*—Cut a test specimen 50 by 150 mm [2 by 6 in.] from the joint filler material in such a manner that all edges are freshly cut and weigh. Immerse the specimen horizontally under 25mm [1 in.] of distilled or deionized water at 25 ± 2°C [73.4 ± 3.6°F] for 24 h, remove, and wipe off the surface water with a slightly dampened cloth. Weigh the specimen quickly and calculate the gain in weight and express as weight percent of water absorbed.

8.2.4 *Compression*—Test the joint filler in accordance with the compression test outlined in Test Method D545, except make only a single application of the load required to compress the specimen to 50 % of its thickness before test, and do not measure the recovery.

8.3 *Precision and Bias:*

8.3.1 Precision statement for single operator was calculated per Practice C670. Maximum acceptable range of individual measurements. No precision statement is necessary for brittleness since this property is qualified as an attribute. Precision statements are listed in Table 1.

8.3.2 Since there is no accepted reference material suitable for determining the bias in this test method, no statement on bias is made.

9. Keywords

9.1 asphalt; bituminous; construction; expansion; joint; paving; preformed

APPENDIXES

(Nonmandatory Information)

X1. STANDARD TEST METHODS AND CONDITIONS

X1.1 *Size of Samples*—Sample sizes were used as required for each test property.

X1.2 *Number of Specimens*—For each test, three (3) specimens were used.

X1.3 *Test Conditions*—Standard test conditions were used as required in each test section and per Section 8.

X2. SINGLE-OPERATOR PRECISION STATEMENTS

X2.1 Practice C670, for Preparing Precision and Bias Statements for test methods for Construction Materials, was used to develop the single-operator precision statement.

X2.2 Windows 95 function categories were used to calculate the average (avg) values and the one-sigma (1s) limits. Data was graphed using Windows 95 Chart Wizard.

X2.3 Acceptance of individual measurement values was based on the calculated difference of two-sigma (d2s) limits as the appropriate index of test precision. Maximum acceptance range of the measurements was calculated per Practice C670, and for a given test the individual results of the measurements were accepted if the results were within the calculated maximum acceptable range.

X2.4 Single-Operator Precision was calculated per Practice C670. Results of three (3) specimens were used to calculate the average values and the one-sigma limits. From Practice C670, for the average of three (3) measurements, the multiplier is 5.7 for the maximum acceptable range of individual measurements. The precision statement then for a single-operator is calculated as follows:

$$\text{Precision Statement} = (1\,s) \times 5.7 \qquad (X2.1)$$

X2.5 Calculated precision statements for the various properties are given in Table 1.

X2.6 Single-Operator Precision for the average compression load values, for each thickness, is also presented in Graph I. (URL – Upper Range Limit, LRL – Lower Range Limit)

X3. COMPRESSION LOAD VALUES

X3.1 It was found that the compression load values are dependent on the thickness of the preformed expansion joint filler. As the thickness of the expansion filler increased the resultant compression load values decreased as shown in Fig. X3.1 and Fig. X3.2.

X3.2 Starting with the compression load value of 754 psi (5200 kPa) maximum for 1.0 in. (25.4 mm). thick joint filler, as a starting point, then by graphic analysis the maximum compression load values were plotted for each joint filler thickness as shown in Fig. X3.1 and as stated in Table 1.

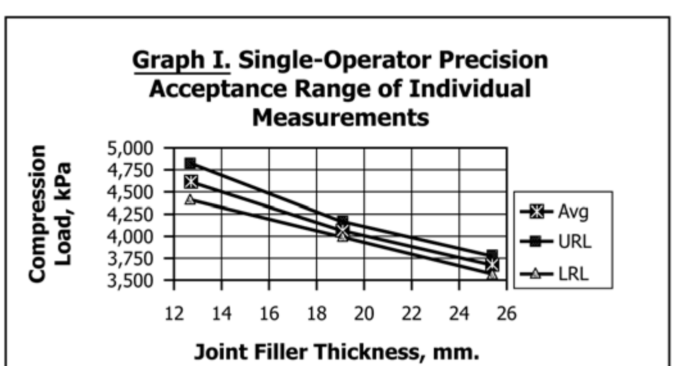

FIG. X3.1 Single–Operator Precision Acceptance Range of Individual Measurements

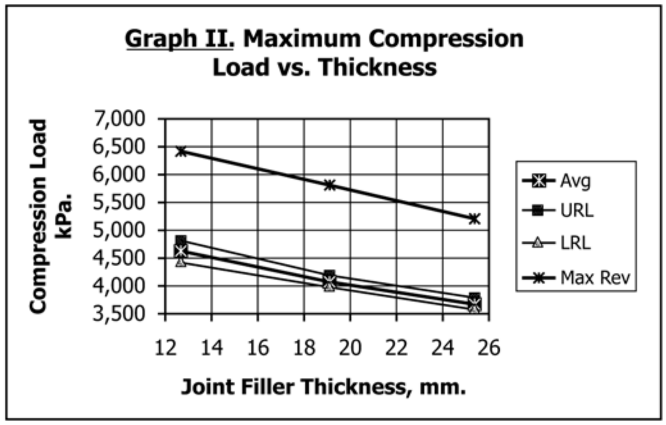

FIG. X3.2 Maximum Compression Load vs. Thickness

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