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Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints[1]

This standard is issued under the fixed designation D 5249; 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 backer material for cold- and hot-applied joint sealant for use in portland-cement concrete or asphalt-pavement joints.

1.2 This specification establishes basic requirements for sealant-backer material either in rod or strip form, that can withstand the temperature of hot- or cold-applied sealants without excessive deformation.

1.3 Sealant backer material serves one or more of the following purposes:

1.3.1 Limits the amount and depth of sealant applied to a joint,

1.3.2 Acts as a barrier interface to prevent backside adhesion (bondbreaker), and

1.3.3 Provides a form to assist the sealant in developing a shape factor.

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

1.5 The following safety hazards caveat pertains only to the test methods described in 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:*

C 670 Practice for Preparing Precision and Bias Statements for Test Methods of Construction Materials[2]

C 1016 Test Method for Determination of Water Absorption of Sealant Backing (Joint Filler) Material[3]

C 1253 Test Method for Determining the Outgassing Potential of Sealant Backing[3]

D 545 Test Methods for Preformed Expansion Joint Fillers for Concrete Construction (Nonextruding and Resilient Types)[4]

D 1622 Test Method for Apparent Density of Rigid Cellular Plastics[5]

D 1623 Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics[5]

D 5535 Terminology Relating to Formed-in-Place Sealants for Joints and Cracks in Pavement[4]

E 1 Specification for ASTM Thermometers[6]

3. Terminology

3.1 For definitions, refer to Terminology D 5535.

4. Classification

4.1 Sealant backer material is available in three types:

4.1.1 *Type 1*, shall be round rods of various diameters intended for use with cold- and hot-applied sealants.

4.1.2 *Type 2*, shall be sheets or strips of various thicknesses, laminated or skived by the manufacturer but capable of being field laminated and used with cold- and hot-applied sealants.

4.1.3 *Type 3*, shall be round rods of various diameters limited for use with cold-applied sealants.

4.2 Type 1 and Type 3 rod materials are intended for use primarily where there is a reservoir, either already existing or formed, such as a contraction joint, where the rod will limit the sealant depth and prevent the sealant from bonding to the bottom of the joint reservoir (bond-breaker) thus eliminating bottom-side adhesion.

4.3 Type 2 strip material is intended primarily for use where there is an opening the full depth of the pavement, such as an expansion joint for which it is desirable to have a filler material completely fill the opening and prevent or minimize the accumulation of water or incompressible materials below the sealant.

5. Ordering Information

5.1 Types 1, 2, and 3 backer material are available in a range of sizes, lengths, and diameters; they are available on reels, in coils, or in straight lengths. Consult the manufacturer for information on how to order.

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[1] This specification is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.33 on Formed-In-Place Sealants for Joints and Cracks in Pavements.

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[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 04.07.

[4] *Annual Book of ASTM Standards*, Vol 04.03.

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

[6] *Annual Book of ASTM Standards*, Vol 14.03.

5.2 Backer material must be ordered by diameter or size in relation to the joint opening, usually 25 to 35 % larger than the joint width.

6. Materials

6.1 Sealant backer material shall be easily compressed and installed in the joint reservoir. This material shall be heat resistant when used with hot-applied sealants.

7. Physical Properties

7.1 Physical properties of the sealant backer material shall conform to the requirements of Table 1.

8. Workmanship, Finish, and Appearance

8.1 The product shall be clean, free of scale or foreign matter, oil, or water which could wipe off on a joint sidewall and interfere with the proper cure or adhesion of the sealant.

9. Test Methods

9.1 *Water Absorption*— Tests for water absorption of the Types 1 and 3 backing material shall be made in accordance with Test Method C 1016, Procedure B. Type 2 material shall be tested in accordance with Test Method D 545.

9.1.1 For Type 2 material:

$$WA = \frac{W \times 100}{262t} \quad (1)$$

where:

WA = water absorption by volume, %,
W = weight of water absorbed, from tests made according to Test Methods D 545, g, and
t = thickness of 4 in. by 4 in. specimen, inches.

9.1.2 For the purposes of this calculation, 1 g of water occupies 0.061 $in.^3$ at test conditions.

9.2 *Density*—Tests for density of Types 1 and 3 materials shall be made in accordance with Test Method D 1622. Tests for density of Type 2 material shall be made in accordance with Test Methods D 545.

9.3 *Tensile Strength*— Tests for tensile strength of Types 1 and 3 materials shall be made in accordance with Test Method D 1623.

9.4 *Compression Deflection and Recovery*—Type 2 material shall be tested in accordance with Test Methods D 545. Type 1 and 3 materials shall be tested in accordance with the following procedure.

9.4.1 *Significance and Use*—This test method covers a procedure for measuring the force necessary to compress the backer material, and the percentage recovery of original dimensions after removal of the compression load.

TABLE 1 Physical Property Requirements

Property	Type 1	Type 2	Type 3
Density, lb/ft^3(kg/m^3), max	6 (96.1)	4 (64.1)	6 (96.1)
Tensile strength, psi (kgf/cm^2), min	20 (1.41)	N/A	20 (1.41)
Water absorption, by volume, %, max	0.5	0.5	0.5
25 % Compression deflection force, psi (kgf/cm^2), max	15 (1.06)	15 (1.06)	15 (1.06)
Compression recovery, %, min	90	90	90
Heat resistance, °F	392 ± 5	392± 5	N/A
°C	200 ± 2.8	200 ± 2.8	N/A
Maximum shrinkage, %	10 %	10 %	N/A

9.4.2 *Apparatus*:

9.4.2.1 An apparatus shall be provided having a flat compression plate larger than the specimen to be tested, connected to a force measuring device, and mounted in such a manner that the specimen can be deflected (compressed) at a speed of 0.5 to 2 in./min. The apparatus shall be arranged to support the specimen on a level horizontal plate. The apparatus shall be capable of measuring the distance between the movable plate and the stationary plate.

9.4.2.2 *Calipers*, capable of measuring 0.001 in.[7]

9.4.3 *Test Specimens*:

9.4.3.1 Test specimens shall be 6 ± 0.125 in. lengths of the backer material.

9.4.3.2 Each test requires a minimum effective area of 3.0 $in.^2$ When the effective area of a single length is less than 3 $in.^2$, multiple lengths shall be used in a single test. When rod-shaped backer material is less than ¾in. in diameter, multiple lengths are required for each test (see Table 2).

TABLE 2 Multiple Specimen Requirements for Rod-Shaped Backer Materials for Compression Recovery Testing

Rod Diameter	Specimens Required for Each Test
¾ in. or larger	1
⅜ to ⅝ in.	2
< ⅜ in.	3

9.4.4 *Number of Test Specimens*—Test three specimens for each sample. The values reported shall be the mean of those observed.

9.4.5 *Procedure*:

9.4.5.1 Place the test specimen in the center of the supporting plate of the apparatus. Materials that are supplied in coils often have a tendency to curl. Place these samples between the plates in such a manner that the arc formed by the sample is in the vertical plane.

9.4.5.2 Bring the compression plate into contact with the specimen so that the entire length of the test specimen is in contact with both plates. No light should be visible anywhere between the rod and the plate, except within ½ in. of the end of the sample.

9.4.5.3 Measure the original diameter of the rod by measuring the separation of the plates of the apparatus with the calipers. Compress the rod 25 ± 0.5 % of this thickness at 0.5 in./min. Record the reading of the load immediately.

9.4.5.4 Hold the specimen at the specified deflection for 30 s.

9.4.5.5 Remove the load at a rate of 0.5 in./min. Carefully observe the specimen during the last 10 % of plate travel. Stop plate when contact is not maintained with the specimens. This may be observed when, except within ½ in. of the ends, light is visible along the length of the rod. Immediately measure and record the loss in diameter.

[7] Brown and Sharp Model 579-1 or equivalent has been found suitable.

9.4.6 *Calculation*:

9.4.6.1 Calculate the 25 % compression deflection force, *CD*, per unit area of specimen, expressed in pounds force per square inch (kilograms of force per centimeter square) as follows:

$$CD = F/A \tag{2}$$

where:

F = force required to compress the specimen 25 % as measured in 9.4.5.3, lbf (kgf), and

A = effective area of specimen compression contact surface, in.^{2}, (cm^2).

For rods:

$$A = 0.66\,dl \tag{3}$$

where:

d = diameter of rod, in. (cm), and

l = length of the sample, in. (cm).

9.4.6.2 Calculate the compression recovery, *CR*, as a percentage of the original diameter of thickness as follows:

$$CR = (d_o = \Delta_d)/d_o \times 100 \tag{4}$$

where:

d_o = original diameter, in. (cm), and,

Δ_d = loss in diameter, in. (cm).

9.4.7 *Report*:

9.4.7.1 Report the average compression deflection for the three specimens tested in pounds force per square inch (kilograms of force per square centimeter).

9.4.7.2 Report the average compression recovery for the three specimens tested in percent.

9.4.8 *Precision and Bias*—Precision and bias statements are being prepared. They will be added to this specification when completed (see Practice C 670).

9.5 *Heat Resistance for Types 1 and 2 Backer Material*:

9.5.1 *Significance and Use*—This test method is used to determine the heat resistance of backer material.

9.5.2 *Apparatus*:

9.5.2.1 *Insulated Oil Bath*, capable of maintaining a uniform and homogeneous temperature of 392± 9°F. Any commercial deep-fryer is sufficient.

9.5.2.2 *Thermometer*, having a range from 170 to 500°F (77 to 260°C) and conforming to the requirements of Specification E 1. (For example, ASTM 11C Thermometer or ASTM 11F Thermometer.)

9.5.2.3 *Drainage Pan or Absorbent Towel*.

9.5.2.4 *Stop Watch or Timer*, that reads out in seconds.

9.5.2.5 *Silicone Fluid*, [8] 100 cSt viscosity, or equivalent.

9.5.2.6 *Calipers*, capable of measuring 0.001 in.

9.5.2.7 *Rule*, capable of measuring 0.01 in. (1 mm).

9.5.3 *Test Specimens*:

9.5.3.1 Test specimens of the rod material shall be cut 10 to 12 in. long. (Types 1 and 3.)

9.5.3.2 Test specimens of the slab or sheet material shall be cut 4 by 4 in. ± 1⁄16 (102 by 102 mm) (Type 2).

9.5.4 *Procedure*:

9.5.4.1 Measure the original diameter of the rod with the calipers. Measure the thickness of the slab or sheet with the ruler.

9.5.4.2 Fill insulated oil bath to a minimum depth of 3 in. with silicone fluid.[8] Heat fluid to 392 ± 5°F.

9.5.4.3 Holding the specimen vertically over the oil bath, immerse approximately 2 in. of the specimen in the hot oil.

9.5.4.4 Begin the dwell-time count upon immersion and leave the specimen immersed for the period of time designated in Table 3.

9.5.4.5 Remove the specimen at the end of the dwell-time period and allow it to cool in the drain pan or on absorbent towels for 1 min.

9.5.4.6 Measure the diameter of the rod or thickness of the slab after immersion. Record the change in dimensions.

9.5.4.7 Calculate the percent shrinkage as follows:

$$S = \frac{t - t_1}{t} \times 100 \tag{5}$$

where:

t = original diameter or thickness of specimen, and

t_1 = diameter or thickness after immersion.

9.5.4.8 The specimen is sufficiently heat resistant if the shrinkage is less than 10 % of the original diameter or original thickness.

9.5.5 *Precision and Bias*—Precision and bias statements are being prepared. They will be added to this specification when they are completed.

10. Rejection

10.1 Material that fails to conform to the requirements of this specification shall be rejected. Rejection shall be reported to the manufacturer or supplier promptly and in writing. In the case of dissatisfaction with the test results, the manufacturer or supplier may request retesting.

11. Package Marking

11.1 Packages shall be marked with the following information:

11.1.1 Name, brand, or trademark of the manufacturer,

11.1.2 Quantity and size,

11.1.3 ASTM designation, and

11.1.4 Any other information that the manufacturer requires.

TABLE 3 Specimen Dwell Time

Specimen Diameter or Thickness	Dwell Time, s
Less than 3⁄16 in.	2
Equal to or greater than 3⁄16 to less than 7⁄16 in.	3
Equal to or greater than 7⁄16 to less than 15⁄16 in.	5
Equal to or greater than 15⁄16 to less than 1 1⁄8 in.	8
Equal to or greater than 1 1⁄8 to less than 1 3⁄8 in.	10
Equal to or greater than 1 3⁄8 to less than 1 3⁄4 in.	15
Equal to or greater than 1 3⁄4 in.	20

[8] Dow Corning 200 has been found suitable.

APPENDIX

(Nonmandatory Information)

X1. PRECAUTIONS ON USE AND APPLICATION

X1.1 Some of the conditions that have been identified to influence bubble formation in the sealant include a combination of high moisture content in the concrete and high pavement surface temperatures, damaged or melted backer material, or air entrapment due to application equipment malfunctions.

X1.2 The use of a back-up material or bond breaker in the bottom of the joint covered by this specification is recommended to control the depth of sealant and achieve the desired shape factor, and to support the sealant against identation and sag. Back-up materials and bond breakers should be compatible with the material. Due to the elevated temperatures of application of material, care should be exercised in the selection of suitable back-up materials.

X1.3 Pavement joints should be dry, clean of all scale, dirt, dust, curing compound, and other foreign matter. The sidewalls of the joint space to be sealed should then be thoroughly sandblasted, blown clean of loose sand by high-pressure air, and sealed. If joints are cleaned by jet waterblasting, the jet waterblast machine shall be capable of discharging water up to 10 000 psi (69 MPa) pressure and 22 gal of water/min. Joints shall be thoroughly dry before installation of bond breaker or joint sealant material is applied.

X1.4 The backer material is used as a base to gun and/or tool the sealant against, thus ensuring proper wetting of the joint side walls. Joint widths may vary because of spalls, ravels, and locked joints. Therefore, backer material sizing is important and project specific. Backing material should easily conform to joint irregularities to ensure contact with the joint side wall, thereby preventing the sealant from flowing to the base of the pavement.

X1.5 Tests for outgassing of cold applied sealants shall be made in accordance with Test Method C 1253.