



Designation: D 5329 – 96

Standard Test Methods for Sealants and Fillers, Hot-Applied, For Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements¹

This standard is issued under the fixed designation D 5329; 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 These test methods cover tests for hot-applied types of joint and crack sealants and fillers for portland cement concrete and asphaltic concrete pavements. There are numerous standard material specifications that use these test methods. Refer to the respective standard material specification of interest to determine which of the following test methods to use. For sample melting and concrete block preparation see their respective standard practices.

1.2 The test methods appear in the following sections:

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Bond, Water-Immersed	10
Cone Penetration, Non-Immersed	6
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Flexibility	18
Flow	8
Resilience	12
Resilience, Oven-Aged	13
Solubility (Change in Weight)	17
Tensile Adhesion	16

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 limitations prior to use.*

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

2. Referenced Documents

2.1 ASTM Standards:

D 5 Test Method for Penetration of Bituminous Materials²

¹ These test methods are under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and are 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 04.03.

D 217 Test Methods for Cone Penetration of Lubricating Grease³

D 471 Test Method for Rubber Property-Effect of Liquids⁴

D 1074 Test Method for Compressive Strength of Bituminous Mixtures²

D 1190 Specification for Concrete Joint Sealer, Hot-Poured Elastic Type²

D 1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus²

D 1561 Practice for Preparation of Bituminous Mixture Test Specimens by Means of California Kneading Compactor²

D 1985 Practice for Preparing Concrete Blocks for Testing Sealants, for Joints and Cracks²

D 3381 Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction²

D 3405 Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements²

D 5167 Practice for Melting of Hot-Applied Joint and Crack Sealant for Evaluation²

E 145 Specification for Gravity-Convection and Forced-Ventilation Ovens⁵

E 171 Specification for Standard Atmospheres for Conditioning and Testing Materials⁶

G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Material⁵

3. Significance and Use

3.1 These test methods describe procedures for determining specification conformance for hot-applied, field-molded joint and crack sealants and fillers.

4. Sample Melting

4.1 See Practice D 5167.

³ *Annual Book of ASTM Standards*, Vol 05.01.

⁴ *Annual Book of ASTM Standards*, Vol 09.01.

⁵ *Annual Book of ASTM Standards*, Vol 14.02.

⁶ *Annual Book of ASTM Standards*, Vol 15.09.

5. Standard Conditions

5.1 The laboratory atmospheric conditions, hereinafter referred to as standard conditions, shall be in accordance with Specification E 171 ($73.4 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$)).

6. Cone Penetration, Non-Immersed

6.1 *Apparatus*—Conduct this test using the apparatus described in Test Method D 5, except as specified herein. Use a penetration cone in place of the standard penetration needle. The cone shall conform to the requirements given in Test Methods D 217, except that the interior construction may be modified as desired. The total moving weight of the cone and attachments shall be 150.0 ± 0.1 g.

6.2 *Specimen Preparation*—Pour a portion of the sample prepared in accordance with Practice D 5167 into one 6 oz (177 mL) tin measuring approximately 2.76 in. in diameter and 1.77 in. in depth and fill flush with the rim of the tin. Allow the specimen to cure under standard conditions as specified in its respective material specification.

6.3 *Procedure*—Place the specimen in a water bath maintained at $77 \pm 0.2^\circ\text{F}$ ($25 \pm 0.1^\circ\text{C}$) for 2 h immediately before testing. Remove the specimen from the bath and dry the surface. Using the apparatus described in 6.1, make determinations at three locations on 120° radii, and halfway between the center and outside of the specimen. Take care to ensure the cone point is placed on a point in the specimen that is representative of the material itself and is free of dust, water, bubbles or other foreign material. Clean and dry the cone point after each determination.

6.4 *Report*—Average the three results and record the value as the penetration of the specimen in $1/10$ mm units.

7. Cone Penetration, Fuel-Immersed

7.1 *Apparatus*—Same as described in 6.1.

7.2 *Specimen Preparation*—Pour a portion of the sample prepared in accordance with Practice D 5167 into one 6 oz tin, then proceed as in 6.2.

7.3 *Specimen Preparation*—Immerse the specimen prepared as described in 6.2 for 24 h in approximately 0.53 qt (500 mL) to provide a minimum of 0.50 in. cover of clean test fuel conforming to the requirements of Reference Fuel B of Test Method D 471, maintained in a water bath at a constant temperature of $120 \pm 2^\circ\text{F}$ ($40 \pm 1^\circ\text{C}$). Discard the test fuel after each specimen immersion. After the 24 h immersion, dry the specimen under a draft of an approximately 12 in. (30.5 mm) diameter electric fan at standard conditions for 1 h. The placement of the fan shall be such as to maintain air velocity of 150 to 500 ft/min (0.76 to 2.54 m/s) over the sample.

7.4 *Procedure*—Test as described in 6.3.

7.5 *Report*—Record as described in 6.4.

8. Flow

8.1 *Apparatus*:

8.1.1 *Mold*—Construct a mold (see Note 1) 1.57 in. wide by 2.36 in. long by 0.125 in. deep (40 by 60 by 3.2 mm) and place it on a bright tin panel. The tin plate must be free of dirt, oil, etc. and be between 0.010 and 0.025 in. in thickness (0.25 to 0.64 mm).

NOTE 1—A release agent should be used to coat molds and spacers to prevent them from bonding to the sealants. Extreme care should be exercised to avoid contaminating the area where the joint sealant makes contact with the blocks. A non-toxic release agent is recommended for this purpose. Two examples that have been found suitable for this purpose are KY jelly (available at drug stores) and a release agent prepared by grinding a mixture of approximately 50 % talc, 35 % glycerine, and 15 % by weight, of a water-soluble medical lubricant into a smooth paste.

8.1.2 *Oven*—Forced draft type conforming to Specification E 145 and capable of controlling its temperature $\pm 2^\circ\text{F}$.

8.2 *Specimen Preparation*—Pour a portion of the sample prepared in accordance with Practice D 5167 for melting samples into the mold described in 8.1. Fill the mold with an excess of material. Allow the test specimen to cool at standard conditions for at least $1/2$ h, then trim the specimen flush with the face of the mold with a heated metal knife or spatula and remove the mold. Allow the specimen to cure under standard conditions as specified in its respective material specification.

8.3 *Procedure*—Mark reference lines on the panel at the bottom edge of the sealant. Then place the panel containing the sample in a forced-draft oven maintained for the time and at the temperature specified in its respective material specification. During the test, mount the panel so that the longitudinal axis of the specimen is at an angle of $75 \pm 1^\circ$ with the horizontal, and the transverse axis is horizontal. After the specified test period, remove the panel from the oven and measure the movement of the specimen below the reference lines in millimeters.

8.4 *Report*—Report the measurement obtained in 8.3 in millimeters.

9. Bond, Non-Immersed

9.1 *Apparatus*:

9.1.1 *Extension Machine*—The extension machine used in the bond test shall be so designed that the specimen can be extended a minimum of 0.50 in. (12.7 mm) at a uniform rate of $1/8 \pm 0.010$ in. (3.2 ± 0.26 mm) per hour. It shall consist essentially of one or more screws rotated by an electric motor through suitable gear reductions. Self aligning plates or grips, one fixed and the other carried by the rotating screw or screws, shall be provided for holding the test specimen in position during the test.⁷

9.1.2 *Cold Chamber*—The cold chamber shall be capable of maintaining the required cold test temperature within $\pm 2^\circ\text{F}$.

9.2 *Concrete-Block Preparation*:

9.2.1 The concrete blocks shall be prepared in accordance with Practice D 1985.

9.3 *Specimen Preparation*:

9.3.1 Prepare three test specimens (3 specimens \times 2 = 6 blocks) as follows: On removal from the storage water, again scrub the 2 by 3-in. (50 by 75-mm) saw-cut faces of the blocks under running water. When this operation is completed on individual blocks, again place them under clean, fresh water until all blocks to be used are prepared. When all blocks are scrubbed, remove them from the water and lightly blot them with an oil-free, soft, absorbent cloth or paper to remove all

⁷ A machine suitable for testing a minimum of three specimens simultaneously can be obtained from such sources as Applied Test Systems of Butler, PA.

free surface water and condition them according to their respective material specification.

9.3.2 Take these blocks and mold the test specimen between them as follows (see Fig. 1): Place four treated (see Note 1) brass or TFE-fluorocarbon spacer strips, approximately 1/4 in. (6.4 mm) thick, on a treated metal plate base to enclose an open space according to the width specified in the respective material specification by 2 in. (50 mm) long. Place the blocks on the spacer strips and space them the required width ± 0.005 in. (± 0.13 mm) apart by means of other treated brass or TFE-fluorocarbon spacer strips, of the required width placed at such distances from the ends that an opening is of the required width ± 0.005 in. by 2.000 ± 0.005 in. by 2.000 ± 0.005 in. (required width by 50.80 ± 0.13 mm by 50.80 ± 0.13 mm) is formed between the blocks with a 1/4-in. (6.4-mm) opening below the blocks.

9.3.3 Rubber bands, clamps, or similar suitable means may be used to hold the blocks in position. Place treated brass or TFE-fluorocarbon spacer strip side walls 1 in. (25 mm) high on top of the blocks. Pour material prepared in accordance with Practice D 5167 into the space between the blocks in sufficient quantity to bring flush with the top of the side walls. After the specimen has cooled for at least 2 h, remove the excess material protruding beyond the top and bottom of the blocks by cutting it off with a heated metal knife or spatula. Use extreme care when removing the spacers so as not to damage the sealant. If this spacer removal caused defects, if shrinkage of the material upon cooling reduces its level below the top of the concrete blocks, or if other casting defects are apparent, the specimen shall be discarded. The finished specimen should resemble Fig. 2.

9.4 *Extension at Low Temperature*—Place test specimens, prepared as described in 9.3, in a cold cabinet as described in 9.1.2 for not less than 4 h; then remove the treated spacer blocks and mount the specimens immediately in the self-aligning clamps of the extension machine. Extend the specimens as required by the respective material specification at a uniform rate of $1/8 \pm 0.010$ in. (3.2 ± 0.26 mm) per hour. During this period, maintain the atmosphere surrounding the test specimens at the temperature specified in the respective material specification. The specimen shall be removed from the test device within 30 min after completing the extension.

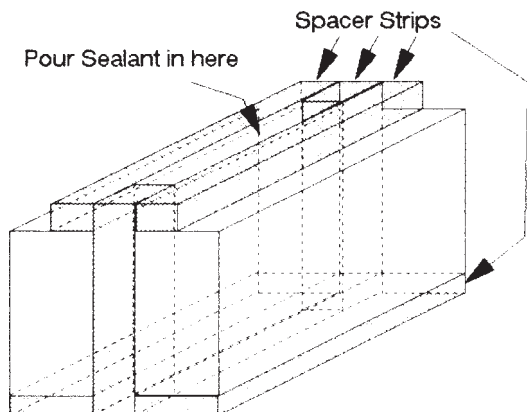


FIG. 1 Concrete Block Mold

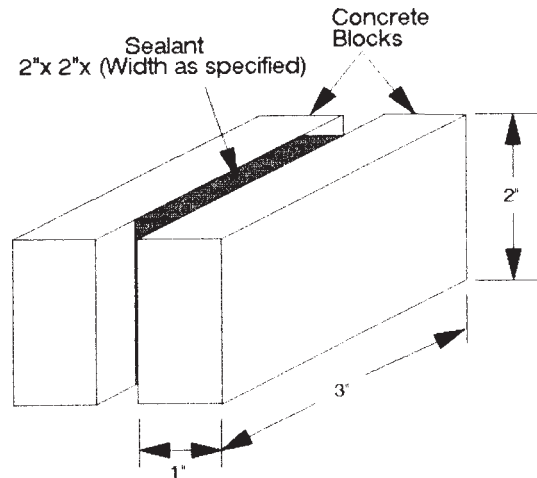


FIG. 2 Concrete Block Test Specimen

9.5 *Recompression*—After extension as described in 9.4, remove the specimens from the extension machine and immediately examine the specimens for obvious separations within the sealant and between the sealant and the blocks, without distorting or manually causing extension of the specimens. After inspection replace the spacer strips, return to storage at room temperature for 2 h and rest each specimen on one concrete block so that the weight of the top block recompresses the joint sealant.

9.6 *Reextension at Low Temperature and Recompression*—After recompression repeat the procedure described in 9.4 and 9.5 to complete the number of cycles of extension and recompression as specified in the respective material specification.

9.7 *Evaluation of Bond-Test Results*—Within 30 min after the last required extension remove the bond test specimens from the extension machine. Immediately examine the specimens, while still frozen, for obvious separations within the sealant and between the sealant and the blocks, without distorting or manually causing extension of the specimens. Determine conformance to the respective material specification.

10. Bond, Water-Immersed

10.1 Apparatus:

10.1.1 *Extension Machine*, as described in 9.1.1.

10.1.2 *Cold Chamber*, as described in 9.1.2.

10.2 Concrete-Block Preparation:

10.2.1 The concrete blocks shall be prepared in accordance with Practice D 1985.

10.3 *Specimen Preparation*—Prepare three specimens as described in 9.3, replacing the thicker brass or TFE-fluorocarbon spacers with thinner spacers between the concrete blocks so that an opening of not less than 0.25 by 0.50 by 2 in. (6.4 by 12.7 by 50.8 mm) will be produced and maintained between the spacers and the sealant. Then immerse the specimens in suitable covered containers to provide at least a 0.50-in. (12.7-mm) water cover for 96 h in 0.53 qt (500 mL) of distilled or deionized water per specimen and store under standard conditions. Place the specimens in the containers with the concrete blocks in the horizontal position, resting on the