



Designation: D5329 – 09

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 D5329; 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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Cone Penetration, Non-Immersed	6
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1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information purposes only.

1.4 *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:²

D5 Test Method for Penetration of Bituminous Materials

¹ These test methods are under the jurisdiction of ASTM Committee D04 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 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.

D217 Test Methods for Cone Penetration of Lubricating Grease

D471 Test Method for Rubber Property—Effect of Liquids

D1074 Test Method for Compressive Strength of Bituminous Mixtures

D1561 Practice for Preparation of Bituminous Mixture Test Specimens by Means of California Kneading Compactor

D1985 Practice for Preparing Concrete Blocks for Testing Sealants, for Joints and Cracks

D3381 Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction

D5167 Practice for Melting of Hot-Applied Joint and Crack Sealant and Filler for Evaluation

D6690 Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

E145 Specification for Gravity-Convection and Forced-Ventilation Ovens

E171 Practice for Conditioning and Testing Flexible Barrier Packaging

G151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources

G154 Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

G155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

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 **D5167**.

5. Standard Conditions

5.1 The laboratory atmospheric conditions, hereinafter referred to as standard conditions, shall be in accordance with Specification **E171** ($23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$)).

6. Cone Penetration, Non-Immersed

6.1 *Scope*—This test method covers determination of cone penetration of bituminous joint and crack sealers and fillers.

6.2 Significance and Use—The cone penetration, non-immersed is a measure of consistency. Higher values indicate a softer consistency.

6.3 Apparatus—Conduct this test using the apparatus described in Test Method **D5**, 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 **D217**, 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.

6.4 Specimen Preparation—Pour a portion of the sample prepared in accordance with Practice **D5167** into one 177 mL (6 oz) tin measuring approximately 70 mm in diameter and 45 mm 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.

6.5 Procedure—Place the specimen in a water bath maintained at $25 \pm 0.1^\circ\text{C}$ ($77 \pm 0.2^\circ\text{F}$) for 2 h immediately before testing. Remove the specimen from the bath and dry the surface. Using the apparatus described in **6.3**, 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.

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

6.7 Precision and Bias:

6.7.1 For Specification **D6690** Type I materials, the following precision statement is based on an interlaboratory study of 12 laboratories that tested five different Specification **D6690** Type I materials.

6.7.1.1 Within Tin—Single-Operator Precision (for penetration between 40 and 80): The single-operator deviation has been found to be 0.994. Therefore, results of two properly conducted tests by the same operator should not differ by more than three penetration units.

6.7.1.2 Within and Between Laboratories—Single-Operator Precision (penetrations 40 to 80): The single-operator standard deviation of a single test (test result is defined as the average of three penetrations) has been found to be 0.924. Therefore, the results of two properly conducted tests by the same operator on the same material should not differ by more than three penetration units.

6.7.1.3 Multilaboratory Precision—(penetration 40 to 80): The multilaboratory standard deviation of a single test (test result is defined as the average of three penetrations) has been found to be 3.249. Therefore, the results of two properly conducted tests in different laboratories should not differ by more than nine penetration units.

6.7.2 For Specification **D6690** Type II materials, the following precision statement is based on an interlaboratory study of eleven laboratories that tested six different Specification **D6690** Type II materials.

6.7.2.1 Within Tin—Single-Operator Precision (for penetration between 55 and 85): The single-operator deviation has

been found to be 0.974. Therefore, results of two properly conducted tests by the same operator should not differ by more than three penetration units.

6.7.2.2 Within and Between Laboratories—Single-Operator Precision (penetrations 50 to 70): The single-operator standard deviation of a single test (test result is defined as the average of three penetrations) has been found to be 1.0865. Therefore, the results of two properly conducted tests by the same operator on the same material should not differ by more than three penetration units.

6.7.2.3 Single-Operator Precision—(penetrations 71 to 85): The single-operator standard deviation of a single test (test result is defined as the average of three penetrations) has been found to be 2.237. Therefore, the results of two properly conducted tests by the same operator on the same material should not differ by more than six penetration units.

6.7.2.4 Multilaboratory Precision—(penetration 50 to 70): The multilaboratory standard deviation of a single test (test result is defined as the average of three penetrations) has been found to be 5.2609. Therefore, the results of two properly conducted tests in different laboratories should not differ by more than 15 penetration units.

6.7.2.5 Multilaboratory Precision—(penetration 71 to 85): The multilaboratory standard deviation of a single test (test result is defined as the average of three penetrations) has been found to be 16.8831. Therefore, the results of two properly conducted tests in different laboratories should not differ by more than 48 penetration units.

7. Cone Penetration, Fuel-Immersed

7.1 Scope—This test method covers the determination of cone penetration after immersion in reference fuel.

7.2 Significance and Use—The cone penetration is a measure of consistency of the material. Higher penetration values indicate a softer consistency. Large changes in penetration from the cone penetration, non-immersed value indicate a significant effect of the reference fuel on the sealant.

7.3 Apparatus—Same as described in **6.3**.

7.4 Specimen Preparation—Pour a portion of the sample prepared in accordance with Practice **D5167** into one 177 mL (6 oz) tin, then proceed as in **6.4**.

7.5 Specimen Preparation—Immerse the specimen prepared as described in **6.4** for 24 h in approximately 500 mL (0.53 qt) to provide a minimum of 12 mm cover of clean test fuel conforming to the requirements of Reference Fuel B of Test Method **D471**, maintained in a water bath at a constant temperature of $40 \pm 1^\circ\text{C}$ ($120 \pm 2^\circ\text{F}$). Discard the test fuel after each specimen immersion. After the 24 h immersion, dry the specimen under a draft of an approximately 300 mm (12 in.) diameter electric fan at standard conditions for 1 h. The placement of the fan shall be such as to maintain air velocity of 0.75 to 2.50 m/s (150 to 500 ft/min) over the sample.

7.6 Procedure—Test as described in **6.5**.

7.7 Report—Record as described in **6.6**.

7.8 Precision and Bias—The precision and bias of this test method for measuring cone penetration are as specified in Section **6**.

8. Flow

8.1 *Scope*—This test method measures the amount of flow of bituminous joint and crack sealants when held at a 75° angle at elevated temperatures.

8.2 *Significance and Use*—This test method is a means of measuring the ability of a sealant to resist flow from the joint or crack at high ambient temperatures.

8.3 Apparatus:

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

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.

8.3.2 *Oven*—Forced draft type conforming to Specification **E145** and capable of controlling its temperature $\pm 1^\circ\text{C}$.

8.4 *Specimen Preparation*—Pour a portion of the sample prepared in accordance with Practice **D5167** for melting samples into the mold described in **8.3**. Fill the mold with an excess of material. Allow the test specimen to cool at standard conditions for at least $\frac{1}{2}$ 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.

8.5 *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 millimetres.

8.6 *Report*—Report the measurement obtained in **8.5** in millimetres.

8.7 Precision and Bias:

8.7.1 For Specification **D6690** Type I materials, the following precision statement is based on an interlaboratory study of 12 laboratories that tested five different Specification **D6690** Type I materials.

8.7.1.1 *Single-Operator Precision (flow 0 to 5)*—The single-operator standard deviation has been found to be 0.255. Therefore, the results of two properly conducted tests by the same operator should not differ by more than one flow unit.

8.7.1.2 *Single-Operator Precision (flow 5 to 10)*—The single-operator standard deviation has been found to be 1.024. Therefore, the results of two properly conducted tests by the same operator should not differ by more than three flow units.

8.7.1.3 *Multilaboratory Precision (flow 0 to 5)*—The multi-laboratory standard deviation has been found to be 4.256. Therefore, the results of two properly conducted tests in different laboratories should not differ by more than 12 flow units.

8.7.1.4 *Multilaboratory Precision (flow 5 to 10)*—The multi-laboratory standard deviation has been found to be 5.326. Therefore, the results of two properly conducted tests in different laboratories should not differ by more than 15 flow units.

8.7.2 For Specification **D6690** Type II materials, the following precision statement is based on an interlaboratory study of eleven laboratories that tested six different Specification **D6690** Type II materials.

8.7.2.1 *Single-Operator Precision (flow 0 to 1)*—The single-operator standard deviation has been found to be 0.2494. Therefore, the results of two properly conducted tests by the same operator should not differ by more than one flow unit.

8.7.2.2 *Single-Operator Precision (flow 1.1 to 4)*—The single-operator standard deviation has been found to be 0.7616. Therefore, the results of two properly conducted tests by the same operator should not differ by more than three flow units.

8.7.2.3 *Multilaboratory Precision (flow 0 to 1)*—The multi-laboratory standard deviation has been found to be 0.5644. Therefore, the results of two properly conducted tests in different laboratories should not differ by more than three flow units.

8.7.2.4 *Multilaboratory Precision (flow 1.1 to 4)*—The multi-laboratory standard deviation has been found to be 2.3508. Therefore, the results of two properly conducted tests in different laboratories should not differ by more than seven flow units.

9. Bond, Non-Immersed

9.1 *Scope*—This test method is used to evaluate the bond to concrete.

9.2 *Significance and Use*—Bond to concrete is necessary for a sealant to maintain proper field performance.

9.3 Apparatus:

9.3.1 *Extension Machine*—The extension machine used in the bond test shall be so designed that the specimen can be extended a minimum of 12.5 mm (0.5 in.) at a uniform rate of 3.1 ± 0.3 mm (0.125 ± 0.010 in.) 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.³

9.3.2 *Cold Chamber*—The cold chamber shall be capable of maintaining the required cold test temperature within $\pm 1^\circ\text{C}$.

9.4 Concrete-Block Preparation:

³ The sole source of supply of the apparatus known to the committee at this time is Applied Test Systems of Butler, PA. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.