Designation: D6690 – 21

Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements[1]

This standard is issued under the fixed designation D6690; 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 joint and crack sealants of the hot-applied type intended for use in sealing joints and cracks in portland cement concrete and asphaltic concrete pavements.

1.2 This specification does not purport to cover the properties required of sealants for use in areas of portland cement concrete or asphaltic pavement subject to jet fuel or other fuel spillage such as vehicle and/or aircraft refuel and maintenance areas.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D36/D36M Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)

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

D5249 Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints

D5329 Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphalt Pavements and Portland Cement Concrete Pavements

3. General Requirements

3.1 The sealant shall be composed of a mixture of materials that will form a resilient and adhesive compound capable of effectively sealing joints and cracks in concrete and asphaltic pavements against the infiltration of moisture and foreign material throughout repeated cycles of expansion and contraction with temperature changes, and that will not, at ambient temperatures, flow from the joint or be picked up by vehicle tires. The material shall be capable of being brought to a uniform pouring consistency suitable for completely filling the joints without inclusion of large air holes or discontinuities and without damage to the material. It shall remain relatively unchanged in application characteristics for at least 6 h at the recommended application temperature in the field.

4. Classification

4.1 *Type I*—A joint and crack sealant capable of maintaining an effective seal in moderate climates. The material is tested for low-temperature performance at –18 °C using 50 % extension.

4.2 *Type II*—A joint and crack sealant capable of maintaining an effective seal in most climates. Material is tested for low-temperature performance at –29 °C using 50 % extension.

4.3 *Type III*—A joint and crack sealant capable of maintaining an effective seal in most climates. Material is tested for low-temperature performance at –29 °C using 50 % extension.

4.4 *Type IV*—A joint and crack sealant capable of maintaining an effective seal in climates experiencing very cold temperatures. Material is tested for low-temperature performance at –29 °C using 200 % extension.

NOTE 1—It is the responsibility of the user agency to determine which type is most applicable to their conditions.

[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] 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.

5. Physical Requirements

5.1 *Maximum Heating Temperature*—The maximum heating temperature is the highest temperature to which a sealant can be heated and still conform to all the requirements specified herein. For purposes of testing as specified hereinafter, the application temperature shall be the same as the maximum heating temperature. The maximum heating temperature shall be set forth by the manufacturer, shall be shown on all containers, and shall be provided to the testing agency before any laboratory tests are begun.

5.2 The sealant shall conform to the requirements prescribed in Table 1.

6. Sampling and Heating

6.1 *Sampling:*

6.1.1 Samples may be taken at the plant or warehouse prior to delivery or at the time of delivery, at the option of the purchaser. If sampling is done prior to shipment, the inspector representing the purchaser shall have free access to the material to be sampled. The inspector shall be afforded all reasonable facilities for inspection and sampling which shall be conducted so as not to interfere unnecessarily with the operation of the works.

6.1.2 Samples shall consist of one of the manufacturer's original sealed containers selected at random from the lot or batch of finished material. A batch or lot shall be considered as all finished material that was manufactured simultaneously or continuously as a unit between the time of compounding and the time of packaging or placing in shipping containers.

6.1.3 Obtain the sealant portion for testing from the selected manufacturer's original sealed container in accordance with Practice D5167. The sample portion added to and heated in the melter shall weigh 800 ± 50 g for Types I, II, IV, and 1600 ± 50 g for Type III. Both pots of the melter described in Practice D5167 shall be used for Type III.

6.2 *Heating*—Heat the material in accordance with Practice D5167.

6.2.1 The oil bath in the melter shall be heated to a temperature between the sealant's maximum heating temperature and 42 °C above the sealant's maximum heating temperature. (Never allow the oil temperature to exceed 288 °C.) Add the sealant to the melter according to the instructions in Practice D5167. After the sample has been added to the melter, regulate the oil temperature within the listed temperature limits while raising the sealant's temperature to manufacturer's recommended maximum heating temperature within the required 1 h of time, as stated in Practice D5167. Immediately upon reaching the maximum heating temperature, for Types I, II, and IV pour all specimens for testing directly including penetration, resilience, bond, softening point, and compatibility. Type III shall be heated for 3 h from the time of first addition to the melter before pouring all specimens.

7. Test Methods

7.1 *Specimen Conditioning*—Condition the penetration, resilience, bond to concrete, softening point, and compatibility specimens at standard laboratory conditions for 24 ± 4 h as specified in Test Methods D5329 prior to beginning any testing.

7.2 *Cone Penetration*—Determine cone penetration according to Test Methods D5329 for cone penetration, non-immersed.

7.3 *Softening Point*—Determine the softening point according to Test Method D36/D36M. USP glycerin shall be used for the liquid.

7.4 *Bond, Non-Immersed*—Determine the bond according to Test Methods D5329 for bond, non-immersed.

7.4.1 Immediately after conditioning the blocks as in Test Methods D5329, assemble the blocks with spacers as specified in Test Methods D5329 so the opening between the blocks will form a cured sealant block that is 25.0 ± 0.4 mm wide for Type I and 12.5 ± 0.2 mm wide for Type II, Type III, and Type IV.

7.4.2 After pouring material into the block opening, condition the specimen as in 7.1.

TABLE 1 Sealant Requirements

	Type I	Type II	Type III	Type IV
Cone Penetration at 25 °C	90 max.	90 max.	90 max.	90–150
Softening Point, °C	80 minimum	80 minimum	80 minimum	80 minimum
Bond, non-immersed	Two out of three 25 ± 0.4 mm specimens pass[A] 5 cycles at 50 % ext. at –18 °C	Three 12.5 ± 0.2 mm specimens pass[A] 3 cycles at 50 % ext. at –29 °C	Three 12.5 ± 0.2 mm specimens pass[A] 3 cycles at 50 % ext. at –29 °C	Three 12.5 ± 0.2 mm specimens pass[A] 3 cycles at 200 % ext. at –29 °C
Bond, water immersed	--	--	Three 12.5 ± 0.2 mm specimens pass[A] 3 cycles at 50 % ext. at –29 °C	--
Resilience, %	--	60 min.	60 min.	60 min.
Oven Aged Resilience, %	--	--	60 min.	--
Asphalt Compatibility	Pass[B]	Pass[B]	Pass[B]	Pass[B]

[A] The development at any time during the test procedure of a crack, separation, or other opening that at any point is over 6 mm deep in the sealant or between the sealant and concrete block shall constitute failure of the test specimen. The depth of the crack, separation, or other opening shall be measured perpendicular to the side of the sealant showing the defect.

[B] There shall be no failure in adhesion, formation of an oily exudate at the interface between the sealant and asphaltic concrete, or other deleterious effects on the asphaltic concrete or sealant when tested at 60 °C.

7.4.3 Re-compress and re-extend according to Test Methods D5329 for the total number of cycles prescribed in Table 1. The required cycles shall be completed within a five-day period from the time of pouring for Types II, III, and IV, and a seven-day period for Type I.

7.5 *Bond, Water Immersed, Type III Only*—Determine the bond according to Test Methods D5329. Prepare the specimens as in 7.4 except after conditioning, immerse in water for 96 h as described in Test Methods D5329. Testing shall be completed in five days from removal from the water for Type III.

7.6 *Resilience*—Use Test Methods D5329 for resilience.

7.7 *Oven Aged Resilience*—Age specimen at 70 °C for 168 h. Use Test Methods D5329.

7.8 *Asphalt Compatibility*—Test asphalt compatibility according to Test Methods D5329.

8. Packaging and Marking

8.1 The sealing compound shall be delivered in the manufacturer's original containers. Each container shall be legibly marked with the name of the manufacturer, the trade name of the sealant, the manufacturer's batch or lot number and specification number and type, the minimum application temperature, and the maximum heating temperature. The maximum heating temperature must be at least 11 °C higher than the minimum application temperature.

9. Keywords

9.1 hot applied; joint sealant

APPENDIX

(Nonmandatory Information)

X1. FIELD PRECAUTIONS

X1.1 Some, if not all, materials conforming to this specification may be damaged by heating to too high a temperature, reheating, or by heating for too long a time. Care should be exercised to secure equipment for heating and application that is suitable for the purpose and approved by the manufacturer of the material. The material should be heated in a kettle or melter constructed as a double boiler, with the space between the inner and outer shells filled with oil or other heat transfer medium. Thermostatic control for the heat transfer medium shall be provided and shall have sufficient sensitivity to maintain sealant temperature within the manufacturer's specified application temperature range. Temperature-indicating devices shall be calibrated as required to ensure accuracy. The melter shall have a continuous sealant agitation and mixing system to provide uniform viscosity and temperature of material being applied. If equipped with an application system to deliver sealant to the pavement, the melter shall incorporate a recirculation pump or other means of maintaining sealant temperature in the delivery system. Sealant that has been damaged due to overheating, reheating, or prolonged heating may experience poor adhesion, softening or bleeding, difficult application, or jelling in the melter. Direct heating must not be used.

X1.2 Pavement joints in new construction for application of material covered by this specification should be dry and 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 by use of the melter-applicator described in X1.1.

X1.3 When material covered by this specification is used for maintenance or resealing of joints that have contained either similar or dissimilar sealing material, it is recommended that the joint be dry and cleaned thoroughly with a plow, router, wire brush, concrete saw, or other suitable tool or tools designed for the purpose of neatly cleaning pavement joints. Loose material should be blown out. The sidewalls of the joint space to be sealed should be thoroughly sandblasted, blown free of loose sand with high-pressure air, and then sealed with material by use of the melter-applicator described in X1.1.

X1.4 The use of a backer material or bond breaker in the bottom of the joint to be filled with material covered by this specification is recommended to control the depth of the sealant and achieve the desired shape factor, and to support the sealant against indentation and sag. Backup materials and bond breakers should be compatible with the material. Due to the elevated temperatures of application of material covered by this specification, care should be exercised in the selection of the suitable backer materials. Refer to Specification D5249 for recommended backer materials.

X1.5 Care should be practiced in the application of material covered by this specification to avoid overfilling of the joint space. Joints should be filled in a neat, workmanlike manner from 3 to 6 mm below the adjacent pavement surface.