



Standard Specification for Asphaltic Plug Joints for Bridges¹

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1. Scope

1.1 This specification covers the material, testing and application requirements for a field molded asphaltic plug joint (APJ) used in expansion joint sealing on asphalt concrete overlay and portland cement concrete decks. The scope of this specification is limited to field molded APJ. This molded element can consist of multilayer, or single layer, or both, application systems depending upon individual manufacturing requirements. The details of this specification are limited to the materials used in the application of APJ. It is recommended that a practical means of testing the watertightness aspects of the individual systems, either in the field or at the testing laboratory, be developed. When used on highway bridges, limits on maximum joint movements shall be specifically identified for each type of APJ. APJs should not be used for movement applications exceeding ± 25 mm from the installation width.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

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.*

2. Referenced Documents

2.1 ASTM Standards:²

- A36/A36M Specification for Carbon Structural Steel
- D5 Test Method for Penetration of Bituminous Materials
- D36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
- D113 Test Method for Ductility of Bituminous Materials

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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

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 Asphaltic and Portland Cement Concrete Pavements

3. Terminology

3.1 Acronyms:

3.1.1 APJ—Asphaltic Plug Joint.

3.1.2 AB—Asphaltic Binder.

4. Material

4.1 The AB shall be a thermoplastic polymeric-modified asphalt conforming to the physical properties in Table 1.

4.2 Type of aggregate shall be one of the following: granite, basalt, gabbro, porphyry or gritstones. The specified aggregate shall be crushed, washed, and dried. Specific size and gradations of aggregate shall be agreed upon by the purchaser and APJ manufacturer. The aggregate shall be preweighed and packaged to avoid confusion on the jobsite. It shall be noted that specific sizes of aggregate may be proprietary to certain manufacturers.

4.3 The closed cell foam expansion joint filler shall be nongassing and capable of withstanding the elevated installation temperature (199°C) of the AB and meet Specification D5249.

4.4 The steel bridging plate shall conform to Specification A36/A36M for mild steel.

5. Physical Properties

5.1 The thermoplastic polymeric modified asphalt samples shall be melted for sample preparation in accordance to Practice D5167.

5.2 The thermoplastic polymeric modified asphalt shall conform to the physical properties prescribed in Table 1.

TABLE 1 Physical Properties

	ASTM Standards	Required Physical Properties
Softening point, min	D36	83°C
Tensile adhesion, min	D5329	700 %
Ductility, min at 25°C (77°F)	D113	400 mm
Penetration	D5329	
Max at 25°C (77°F) 150 g, 5 s		75 units
Low temperature penetration	9.1	
Min at -18°C (0°F) 200 g, 60 s		10 units
Flow, max 5 h at 60°C (140°F)	D5329	3.0 mm
Resiliency, min - max at 25°C (77°F)	D5329	40 - 70 %
Asphalt compatibility	D5329	Pass
Recommended application heating Temperature range		182°C - 199°C
Bond 3 Cycles at -7°C (+20°F), 100 % Elongation	D5329	Pass
Flexibility, at -23°C (-10°F)	9.2	Pass

6. Dimensions and Tolerances

6.1 The size, shape, and dimensional tolerance shall be agreed upon by the purchaser and the producer or supplier. These tolerances shall be in compliance with the field construction specifications. The standard minimum blockout dimensions are 50 × 500 mm; however, it should be noted that values fluctuate depending on existing field conditions.

7. Procedure

7.1 The AB shall be heated to a temperature as specified by the manufacturer. The melter must be supplied with a continuous agitation system and calibrated thermometers.

7.2 The specified aggregate shall be heated to the manufacturer's prescribed temperature in a manufacturer's recommended mixer. The temperature of the specified aggregate shall be controlled by a digital temperature sensor.

7.3 The AB shall be blended with the heated aggregate at a ratio of aggregate to AB as specified by the manufacturer. The blend tolerance shall be $\pm 5\%$ by weight. The minimum aggregate content shall be 68 % by weight.

7.4 Alternately, the AB and specified aggregate can be pre-measured and pre-packaged, heated on site in a manufacturer's recommended mixing unit.

7.5 The specified aggregate shall be coated completely with binder prior to placement in the blockout.

7.6 The closed cell, foam expansion joint filler shall be placed into the expansion gap at a depth of not greater than the width of the gap. Where the gap is greater than 25 mm, the minimum depth shall be 25 mm. The joint opening shall then be filled with AB until it runs into the corresponding blockout to ensure a water-tight joint below the bridging plate.

7.7 The bridging plate shall be mild steel or aluminum a minimum of 6-mm thick and 200-mm wide, cut in minimum 1.2-m lengths, centered over the entire length of the expansion joint gap when specified. When specified, the bridging plate shall have pre-drilled holes at 300-mm on center for the locating pins.

7.8 The blended heated AB and heated specified aggregate shall be placed in a prepared blockout in accordance with the manufacturer's recommended installation procedures.

7.9 When specified, the locating spikes used to position the bridging plate, shall be galvanized 16 d column nails or larger.

7.10 The blended heated AB and heated coated specified aggregate shall be compacted longitudinal and transverse to the joint using a roller or plate compactor, which delivers a minimum centrifugal force of 15 kN.

7.11 Where an antiskid/antitracking surface is required, the surface of the APJ shall be heated prior to broadcasting the antiskid material in accordance with the manufacturers written instructions.

8. Sampling

8.1 Samples of the thermoplastic polymeric modified asphalt shall be taken at random prior to the shipment of material. If the shipment consists of more than one batch, a sample from each batch shall be taken.

8.2 A minimum of 1.4 kg of the thermoplastic polymeric modified asphalt taken from the manufacturer's facility shall constitute one sample for testing purposes.

8.3 Samples of the specified aggregate shall be taken at random from each shipment of material. If the shipment consists of more than one batch, a sample from each batch shall be taken.

8.4 A minimum of 23 kg of the specified aggregate shall constitute one sample for size and gradation analysis.

8.5 A minimum of 300 mm of the closed cell, foam expansion joint filler constitute one sample for testing purposes.

9. Test Methods

9.1 Low Temperature Cone Penetration, Non-immersed:

9.1.1 Apparatus:

9.1.1.1 *Penetrometer/Cone*—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 the interior construction may be modified as desired. The total moving weight of the cone and attachments shall be 150.0 ± 0.1 g.

9.1.1.2 *Cold Chamber*—The cold chamber shall be capable of maintaining the required cold test temperature within $\pm 1.1^\circ\text{C}$.

9.1.2 *Specimen Preparation*—Pour a portion of the AB prepared in accordance with Practice D5167 into three 177-mL tins measuring approximately 69-mm diameter and 44 mm in depth and fill flush to the rim of each tin. Allow the test specimens to cure under the standard conditions as specified in its respective material specification.

9.1.3 *Procedure*—Place the three test specimens and three cones in cold chamber at $18 \pm 0^\circ\text{C}$ for no less the 4h. Remove one sample and core from the cold chamber and using the apparatus described in 9.1.1, immediately make a determination at a location on 120° radii, and halfway between the center

and outside of the test specimen. Take care to ensure the cone point is placed on a point in the test specimen that is representative of the material itself and is free of dust, water, bubbles or other foreign material. Follow the above procedure for the second and third samples.

9.1.4 Report—Average the three results to the nearest whole unit and record the value as the low temperature penetration of the specimen.

9.2 Flexibility:

9.2.1 Scope—This method measures the ability of a sealant to be bent around a mandrel when exposed to cold temperatures. Conduct this test and prepare samples as described in Section 18 of Test Method **D5329** except as specified herein.

9.2.2 Apparatus:

9.2.2.1 Cold Chamber—The cold chamber shall be capable of maintaining the required test temperature within $\pm 1.1^\circ\text{C}$.

9.2.3 Specimen Conditioning—Place three test specimens and the test mandrel in the cold chamber at -23°C for no less than 4 h to condition samples prior to testing.

9.2.4 Procedure—After the specimens and test mandrel have been conditioned for the required conditioning time period and while keeping both the specimens and the mandrel in the cold chamber slowly bend the sample over a 6.4 mm (0.25 in.) diameter mandrel producing a 90° bend in the sample plate with a maximum radius at the bend of 3.2 mm (0.125 in.). Locate the bend so that it is approximate midpoint in the 60 mm (2.36 in.) dimension of the specimen.

9.2.5 Reporting—Report results as pass or fail. A passing result will be no cracking or minimal cracking that does not expose the metal substrate. A failing result will be loss of adhesion to the metal substrate or cracking that exposes the metal substrate.

10. Precision and Bias

10.1 The precision of the procedure in Test Method **D5** for determining penetration as modified in **9.1** is being determined.

11. Keywords

11.1 asphaltic plug; bridging plate; closed cell foam; expansion joint; polymeric; thermoplastic

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