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Standard Practice for Preparation of Test Panels for Accelerated and Outdoor Weathering of Bituminous Coatings¹

This standard is issued under the fixed designation D1669/D1669M; 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 practice covers a procedure for the preparation of accelerated and outdoor weathering test panels of bituminous coatings. It is considered suitable for the preparation of film thicknesses in the range from 0.25 to 2.54 mm [0.010 to 0.100 in.].

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* (**Warning**—Mercury has been designated by EPA and many state agencies as a hazardous material that can cause central nervous system, kidney, and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury-containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website, <http://www.epa.gov/mercury/faq.htm>, for additional information. Users should be aware that selling mercury or mercury-containing products, or both, in your state may be prohibited by state law.)

1.4 *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.*

¹ This practice is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.02 on Steep Roofing Products and Assemblies.

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2. Referenced Documents

- 2.1 *ASTM Standards*:²
 - B209/B209M Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - D5/D5M Test Method for Penetration of Bituminous Materials
 - E1 Specification for ASTM Liquid-in-Glass Thermometers

3. Summary of Practice

3.1 Heated bituminous material is poured onto a clean, heated, and masked aluminum panel. Care is taken to remove air bubbles. The bitumen is leveled in a press before solidifying, and the coated panel is then cooled, cleaned, and measured for uniform thickness.

4. Significance and Use

4.1 This practice for preparation of test panels greatly increases the likelihood of achieving reproducible results in subsequent testing.

5. Apparatus

5.1 *Panel*—A supporting metal panel on which the bituminous coating is applied. It shall meet the following requirements:

5.1.1 *Metal, Aluminum or Aluminum Alloy*, as described in Table 2 of Specification B209/B209M under Alloy 3003-H14.³

5.1.2 *Finish*—Mill finish and process cleaned.

5.1.3 *Dimensions*:

5.1.3.1 *Thickness*—0.64 to 1.90 mm [0.025 to 0.075 in.].

5.1.3.2 *Width and Length*—70 by 150 mm [2¾ by 5⅞ in.] or of a size that will allow a minimum bitumen film area of 50 by 130 mm [2 by 5⅞ in.].

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.

³ The sole sources of supply of the apparatus (panels) known to the committee at this time are The Q-Panel Company, 26200 First St., Cleveland OH 44145; Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, IL 60613; Advanced Coating Technologies Inc., 273 Industrial Dr. (PO Box 401), Hillsdale MI 49242. 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.

5.1.4 *Flatness*—The maximum deviation from a true flat surface for either length or width shall not exceed 0.0005 times the dimension. Flatness shall be measured on a true flat surface employing a curling gauge equipped with a dial which reads in 0.025 mm [0.001 in.] and having a foot loading of approximately 100 g.⁴

5.1.5 *Edges*—The edges of the panels shall be free of burrs.

5.1.6 *Storage*—Panels shall be stored in a dry, well-ventilated place to prevent condensation and possible staining or corrosion.

5.2 *Press*—The press shall be capable of delivering a 4500 kg [10 000 lb] thrust and be equipped for using platens 152 by 152 mm [6 by 6 in.] or larger platens.⁵

5.3 *Platens*—The platens shall be 152 by 152 mm [6 by 6 in.] or larger in size and suitable for use with the press. (Platens can be purchased with the press.) It is preferable that both platens have thermostatically controlled units capable of heating them to temperatures up to 260 °C [500 °F].

5.4 *Metal Spacers*—The metal spacers shall be 13 mm [$\frac{1}{2}$ in.] wide and at least 152 mm [6 in.] long and of suitable thickness so that the proper thicknesses of bitumen films can be applied.⁶ To cover the range from 0.254 to 2.54 mm [0.010 to 0.100 in.], the following supply of metal spacers is adequate:

- 4–0.038 mm [0.0015 in.]
- 4–0.051 mm [0.002 in.]
- 4–0.076 mm [0.003 in.]
- 4–0.127 mm [0.005 in.]
- 4–0.229 mm [0.009 in.]
- 4–0.254 mm [0.010 in.]
- 4–0.305 mm [0.012 in.]
- 4–0.330 mm [0.013 in.]
- 4–0.081 mm [0.015 in.]

5.5 *Kraft Paper*—The kraft paper shall be from 64 to 191 μ m [0.0025 to 0.0075 in.] in thickness.

5.6 *Release Paper*—Silicone- or TFE-fluorocarbon-coated release paper shall be cut to a size large enough to cover the platens of the press. It must be easily removed at room temperature without damaging the bitumen film. (See **Note 1**.)

NOTE 1—Dextrin-coated paper is also allowed to be used as a release paper. It must not leave a residue that cannot be removed by water. A small tank through which lukewarm water (below 27 °C [80 °F]) is running

⁴ The sole source of supply of the apparatus (Model B-81) known to the committee at this time is Federal Products Corp., 1112 Eddy St., Providence, RI 02901. 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.

⁵ The sole source of supply of the apparatus (Laboratory Model Carver Press having a working range from 0 to 9000 kg [0 to 20 000 lb]) known to the committee at this time is Fred S. Carver, Inc., 1 Chatham Rd., Summit, NJ 07901. 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.

⁶ The sole source of supply of the apparatus (suitable spacers known as “shim” or “feeler” stock) known to the committee at this time is U.S. Gasket & Shim Co., 2743 Second St. (P.O. Box 360 A), Cuyahoga Falls, OH 44222. Suitable spacers are also available from many machine shops. 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.

shall be used for removing dextrin-coated paper from finished panels.

5.7 *Heating Equipment:*

5.7.1 One gas or electrically heated oven capable of warming the uncoated panels, thermostatically controlled so a temperature range from 93 to 204 °C [200 to 400 °F] can be maintained. A hot plate or any suitable plate-type heating unit capable of thermostatically controlling the temperature between 93 to 204 °C [200 and 400 °F] would be adequate.

5.7.2 One gas or electrically heated hot plate or oven for heating the bitumen, controlled so that container temperatures will not exceed 316 °C [600 °F].

5.8 *Melting Container*—A 17 kg [6 oz.] min. container of suitable size in which the bitumen can be melted, similar in type to that specified in Test Method **D5/D5M**.

5.9 *Thermometers:*

5.9.1 One ASTM partial immersion thermometer, having a range from –7 to 304 °C [20 to 580 °F] and conforming to the requirements for Thermometer 2C as prescribed in Specification **E1**, shall be used to determine the temperature of the oven used to warm the uncoated panel.

5.9.2 Two ASTM partial immersion thermometers, having a range from –7 to 304 °C [20 to 580 °F] and conforming to the requirements for Thermometer 3C as prescribed in Specification **E1**. One shall be used to determine the temperature of the bitumen sample. The other shall be used to determine the temperature of the oven or oil bath, if either of these is used.

5.9.3 As an alternative, any other thermometric device used shall be at least: (1) of equal accuracy to that of the thermometer specified in Specification **E1**, (2) capable of indicating temperature to within 1 °C [2 °F], and (3) stable to within 1 °C [2 °F] for the duration of the exposure.

5.10 *Water Bath*—A small tank through which lukewarm water is running shall be used for removing the dextrin-coated paper from finished panels when the bitumen has a softening point over 93 °C [200 °F]. For bitumens with lower softening points, the temperature of the water shall be below 27 °C [80 °F].

5.11 *Thickness Gauge*—A suitable hand micrometer, caliper, or dial-type thickness gauge reading in 25 μ m [0.001 in.] and having a foot of approximately 645 mm² [1 in.²] in area shall be used for calipering the panels.

5.12 *Masking Tape*—Pressure-sensitive paper or cloth tape, 13 to 25 mm [$\frac{1}{2}$ to 1 in.] in width.

6. Preparation of Metal Panels

6.1 *Handling*—Handle the panel by the edges only and do not allow fingers to contact the face to be coated. Do not unwrap the panels until the day on which they are to be coated. This is to prevent oxidation and contamination of the face. Do not reuse the test panels.

6.2 *Precalibration and Classification*—Measure the thickness of all panels at six representative points and classify them into groups of identical thickness.

6.3 *Marking*—Mark or drill the panels before or after coating, preferably afterwards. If marked or drilled before coating, take care to see that these operations do not alter the

flatness of the panel by distortion or by leaving burrs. (**Warning**—Stamping identification numbers by means of steel dies should be done with extreme caution to avoid distortion of the panel or shattering of the coating.) The preferred method of marking is by scratching the previously coated panel with a hardened steel stylus. It is permitted to mark either the back of the panel or on the face at one end. The masking tape surrounding the coated portion of the panel will leave a clean, uncoated area suitable for marking when the tape is stripped off.

6.4 *Mounting for Press*—On a two-tier rack, mask the panels so that the exposed bitumen is centered on the panel.

7. Preparation of Bitumen

7.1 Place the seamless tin container on the thermostatically controlled hot plate or in a forced-air oven and melt the bituminous coating in the container adding the coating in small increments as the melting proceeds. Stir the coating throughout the entire melting operation to prevent local overheating but not vigorously enough to whip air into the sample.

7.1.1 A suitable alternative method is to melt the bitumen in the inner container of an oil bath. This apparatus shall be heated on a thermostatically controlled hot plate. The outer container shall contain a low-viscosity, high-flash petroleum product or other suitable liquid, and it shall be maintained at a temperature slightly higher than the desired temperature of the sample bitumen in the inner container. A suitable ladle shall be used for transferring the bitumen from the inner container to the mounted panel.

7.1.2 In cases in which filled bitumen is used, make sure that the sample is mixed with a mechanical agitator to ensure proper dispersion of filler within the bitumen.

7.2 The viscosity of the molten coating shall be the basis for selection of the proper pouring temperature. That consistency shall be selected which previous experience has indicated will permit preparation of the coated panel. Since considerable leeway is permitted in selecting the pouring temperature, the temperature should be high enough to permit easy escape of occluded air, but, except with coatings of very high softening point, the temperature should not exceed 232 °C [450 °F]. It has been found that a viscosity of about 300 ± 200 cP is desirable.

8. Preparation of Press

8.1 Heat both top and bottom platens of the press to a temperature equal to the softening point of the bitumen +14 °C [+25 °F]. If only one of the platens can be heated, keep the press closed while heating one of the platens to a temperature equal to the softening point of the bitumen +14 °C [+25 °F]. This will allow both plates to become adequately heated to the desired temperature.

8.2 Open the press and place a set of spacers, equal in thickness to the aluminum panel and the desired thickness of

bituminous film, at each of two opposite sides of the lower platen of the press. Normally, it is necessary to use 76 to 127 μm [0.003 to 0.005 in.] of added spacer thickness to compensate for the contraction of the asphalt when it cools.

9. Procedure

9.1 Before using, place the mounted panel in the oven or on the hot plate. Maintain the oven or hot plate at 93 to 149 °C [200 to 300 °F] and heat the panel for a period of time sufficient to bring the panel to the desired temperature only, as prolonged heating may harm the masking tape and make it difficult to remove. Remove the panel from the oven or hot plate and place on a flat surface.

9.2 Immediately, pour approximately 1.25 times the bitumen needed onto the masked panel.

9.3 Tap the area around the panel to remove any air bubbles that may be present.

9.4 Then cover the bitumen surface with a sheet of release paper.

9.5 Place the panel in the press in such a manner that the spacers are not under the panel or masking tape. The spacers, however, must be under the kraft and dextrin-coated papers.

9.6 Immediately close the press with a thrust of 1600 to 4500 kg [3500 to 10 000 lb].

NOTE 2—This thrust is taken up by the spacers and is this high only to ensure the leveling of the bitumen before it has reached its solidifying point.

9.7 After 5 to 10 s, remove the panel from the press and allow it to cool to room temperature. Carefully peel the release paper off, ensuring that the bitumen film is not damaged. Remove the masking tape and the kraft paper. If dextrin-coated paper is used, place the panel into the water bath after removing it from the press. After the release paper floats free, remove the panel from the bath and wash thoroughly. Then strip the masking tape from the edges, remove the kraft paper, and dry the panel in air at room temperature.

9.8 Measure the thickness of the dry bitumen panel at six representative spots. Bitumen films of all thicknesses shall conform to a tolerance of ±51 μm [±0.002 in.] or be rejected. Slight adjustments may be made in the pouring temperature, handling time, or spacer thickness if the coating is not of the correct thickness.

9.9 Do not treat the bitumen on the panels after caliper. Warming on a hot plate or in an oven and flaming are considered objectionable. Discard the panels that show marked nonuniformity of surfaces.

9.10 Place the coated panels under test within 48 h after preparation.

10. Keywords

10.1 accelerated weathering; bituminous coatings; outdoor weathering; test panels