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Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection¹

This standard is issued under the fixed designation D1970/D1970M; 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 approval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers polymer modified bituminous sheet materials intended for use as underlayment on roof eaves, or valleys, or both, to prevent leakage of shingle, tile, or metal roofs from water back-up due to ice dams.

1.2 These underlayment sheets have a sticky adhesive layer which is exposed by removal of a protective sheet. The top surface is suitable to work on during the application of the exposed roofing.

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1.4 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.

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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

- D228/D228M Test Methods for Sampling, Testing, and Analysis of Asphalt Roll Roofing, Cap Sheets, and Shingles Used in Roofing and Waterproofing
- D903 Test Method for Peel or Stripping Strength of Adhesive Bonds
- D1079 Terminology Relating to Roofing and Waterproofing
- D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
- D4073/D4073M Test Method for Tensile-Tear Strength of Bituminous Roofing Membranes
- D5147/D5147M Test Methods for Sampling and Testing Modified Bituminous Sheet Material
- D7349/D7349M Test Method for Determining the Capability of Roofing and Waterproofing Materials to Seal Around Fasteners
- E96/E96M Test Methods for Water Vapor Transmission of Materials

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminology D1079.

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.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *lot*—for the purpose of sampling, a lot shall consist of all material manufactured in one production run (not to exceed 24 h) using the same source of raw materials.

4. Workmanship, Finish, and Appearance

4.1 The underlayment sheet shall be supplied in roll form.

4.2 The underlayment sheet shall be substantially uniform in thickness and appearance. It shall be free of visible defects such as holes, ragged or untrue edges, breaks, cracks, tears, protuberances, and indentations, except for those perforations or protuberances which are intentional.

4.3 The surface of the underlayment sheet shall be designed to provide traction and slip resistance to the applicator.

NOTE 1—The intent of 4.3 is to recognize that surface slipperiness is important when working on a roof and, while no test method is specified in this standard, several methods for assessing the relative slipperiness of surfaces are available. It is the further intent of this paragraph to ensure that, whatever method is used, the friction coefficient or resistance to slipping of the surface of these products should be at least as great as asphalt-saturated felt shingle underlayment tested under the same conditions of temperature and wetness as agreed between purchaser and seller.

4.4 Sheet sections shall be suitable for joining by the manufacturer's recommended procedure. The entire lower surface of the underlayment sheet shall be capable of being fully adhered to the roof deck.

5. Physical Requirements

5.1 The underlayment sheet shall conform to the physical requirements prescribed in Table 1.

5.2 The underlayment sheet shall not crack nor be so sticky as to cause tearing or other damage upon being unrolled at material temperatures between 4.4 and 60 °C [40 and 140 °F].

6. Sampling

6.1 From each lot of underlayment sheet, select sample rolls in accordance with Test Methods D228/D228M.

6.2 The rolls so selected shall constitute the representative sample used for all subsequent observations and tests pertaining to the lot of material being examined.

TABLE 1 Physical Requirements of Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

Property	SI	Inch-Pound
Thickness, min	1.0 mm	40 mils
Maximum load, min		
Longitudinal	4.4 kN/m	25 lbf/in.
Transverse	4.4 kN/m	25 lbf/in.
Elongation at break, min of modified bitumen portion		10 %
Adhesion to plywood, min at 40 °F	0.92 kgf/30.5 cm	2.0 lbf/ft width
Adhesion to plywood, min at 75 °F	5.44 kgf/30.5 cm	12.0 lbf/ft width
Thermal stability, max	3 mm	0.1 in.
Flexibility at -29 °C [-20 °F]		pass
Tear resistance		
Longitudinal, min	89 N	20 lbf
Transverse, min	89 N	20 lbf
Moisture vapor permeance, max	5.7 ng/Pa.S.M. ²	0.1 U.S. Perms
Sealability around nail		pass
Waterproof integrity of lap seam		pass

7. Test Methods

7.1 Conditioning:

7.1.1 Unless otherwise specified, condition test specimens for at least 4 h at 23 ± 2 °C [73.4 ± 3.6 °F] and 50 ± 5 % relative humidity prior to testing.

7.2 Thickness:

7.2.1 Measure the thickness of the roofing underlayment in accordance with Test Methods D5147/D5147M.

7.2.2 Report the number of measurements, the average, and standard deviation across the sheet.

7.3 Maximum Load and Elongation at Break:

7.3.1 This test method covers the determination of the maximum load and elongation at break of the underlayment sheets, as set forth in the Load Strain Properties section of Test Methods D5147/D5147M, except as noted below.

7.3.2 *Specimens*—Prepare five specimens from each sample roll in both the longitudinal and transverse directions. Specimens shall be 25 mm [1 in.] ± 5 % wide by a minimum of 150 mm [6 in.] ± 5 % long. For materials with high elongation, it is permitted to reduce the length of the specimen to 100 mm [4 in.] ± 5 % if necessary to avoid limitations imposed by dimensions of the test machine.

7.3.3 Procedure—Perform the following procedure.

7.3.3.1 Condition each specimen at least 2 h at 23 ± 2 °C [73.4 ± 3.6 °F].

7.3.3.2 The initial clamp separation shall be a minimum of 75 mm [3 in.] ± 5 % for sheets having an ultimate elongation of 75 % or less at 23.9 °C [75 °F] and 50 mm [2 in.] ± 5 % for sheets having an ultimate elongation greater than 75 % at 23.9 °C [75 °F].

7.3.3.3 Record the percent elongation of each specimen at the visual break of the modified bitumen portion using an extensometer, or mark the extension at visual break of the modified bitumen portion from the chart of the stress versus time (knowing the speed of the chart drive and the jaw separation rate).

7.3.3.4 Record the maximum load attained by each specimen.

7.3.4 *Calculation*—Determine the percent elongation at break of the modified bitumen portion obtained from the extensometer in accordance with the manufacturer's instructions, or read directly. Calculate the percent elongation from the chart as follows:

$$\% \text{ Elongation} = \frac{a}{b} \times 100 \% \quad (1)$$

where:

a = extension at modified bitumen break (extension at break on chart × jaw separation rate divided by chart speed), and

b = initial jaw separation.

7.3.4.1 Determine the average percent elongation at break of the modified bitumen portion in each direction.

7.3.4.2 Calculate the average *maximum load* in each direction.

7.3.5 *Report*—For each set of five specimens in each direction report the individual measurements, the average and

standard deviation for the size of specimen (initial length between jaws), maximum load in kN/m [lbf/in.], percent elongation at modified bitumen break, and method of determining elongation.

7.4 Adhesion to Plywood:

7.4.1 This test method covers the determination of the adhesive properties of the underlayment sheets to plywood, as set forth in Test Method **D903** except as noted below.

7.4.2 *Specimen Preparation*—Prepare test specimens as described.

7.4.2.1 The test specimen shall consist of one piece of underlayment sheet, 75 ± 2 by 200 ± 2 mm [3 ± 0.125 by 8 ± 0.125 in.], bonded for 15 in.^2 (75 by 125 mm) [3 by 5 in.] to one piece of 6 mm [$\frac{1}{4}$ in.] minimum thick plywood, APA Grade, Exposure 1, 75 by 150 mm [3 by 6 in.]. The plywood must not be reused for testing.

7.4.2.2 Roll test specimen three times back and forth with a roller which has a mass of 11.8 kg [26 lb] $\pm 0.5 \%$, diameter of 125 mm [5 in.] $\pm 5 \%$, and width of 125 mm [5 in.] $\pm 5 \%$ (2 to 3 s per cycle).

7.4.2.3 At least five specimens shall be tested for each test temperature.

7.4.2.4 It is recommended that specimens be assembled individually. Cutting specimens to size after assembly may influence the test results.

7.4.3 *Conditioning*—The test shall be performed at 23 ± 2 °C [73.4 ± 3.6 °F] and 4 ± 2 °C [39.2 ± 3.6 °F]. Materials used to construct test specimens and the roller must be conditioned at the test temperature for at least 4 h prior to assembly. Similarly, test specimens must be conditioned at the test temperatures for at least 1 h prior to testing.

NOTE 2—Adhesion to other potential wood deck materials may be determined by this test method, but it has been observed that substrates such as APA-approved nonveneer sheets typically give greater adhesion values than the minimum specified in this standard for plywood.

7.4.4 *Apparatus*—Perform the test in a constant rate of extension type tester. The rate of travel of the power-actuated grip shall be 50 mm [2 in.]/min $\pm 3 \%$. This rate which provides a laminate separation rate of 25 mm [1 in.]/min $\pm 3 \%$ shall be uniform throughout the test.

7.4.5 *Procedure*—Perform the following procedure.

7.4.5.1 Conduct the test after the test specimens have been conditioned at the test temperature (in the environmental chamber) for 15 min.

7.4.5.2 Separate the free end of the underlayment sheet from the plywood for a distance of about 50 mm [2 in.] leaving about 75 mm [3 in.] of bonded length. Place the specimen in the testing machine by clamping the free end of the plywood in one grip, turning back the free end of the sheet, and clamping it in the other grip. Maintain the specimen in the approximate plane of the clamps during the test. Peel at least three quarters of the bonded area, even though a peel or stripping value may be indicated before this point.

7.4.6 *Calculation*—Determine the peel strength on the chart as the average load line that will visually accommodate the recorded curve. Record the load so indicated, corrected for tare.

7.4.7 *Reporting*—For each series of tests, report the number of measurements, the average, and the standard deviation of all the test values in kg/30.5 cm width [lb/ft of width].

7.5 Thermal Stability:

7.5.1 This test method determines the thermal stability of the underlayment sheets as set forth in Test Method **D1204**, except as noted below.

7.5.2 *Specimens*—Prepare test specimens as described.

7.5.2.1 The test specimen shall consist of one piece of underlayment sheet, 100 ± 2 by 100 ± 2 mm [4 ± 0.125 by 4 ± 0.125 in.], centered and bonded (as described in **7.4.2.2**) to one piece of 6 mm [$\frac{1}{4}$ in.] minimum thick plywood, (APA Grade, Exposure 1) 150 ± 2 by 200 ± 2 mm [6 ± 0.125 by 8 ± 0.125 in.].

7.5.2.2 At least five specimens shall be tested for each sample roll.

7.5.3 *Procedure*—Perform the following procedure.

7.5.3.1 Set specimens at a 45° angle in a hot air circulating oven maintained at 70 ± 2 °C [158 ± 4 °F] for 14 days.

7.5.3.2 At the end of the oven-exposure period, allow specimens to equilibrate to 23.9 ± 1.1 °C [75 ± 2 °F] and $50 \pm 5 \%$ relative humidity for at least 4 h.

7.5.3.3 From the lower edge of the sheet measure to the nearest 2.5 mm [0.1 in.] the furthest point of modified bitumen flow. Estimate the average flow across the entire lower edge of the sample.

7.5.4 *Report*—Report the individual specimen values, the average, and the standard deviation.

7.6 Flexibility at -29 °C [-20 °F]:

7.6.1 *Scope*—This test method is a qualitative procedure performed in a laboratory that determines the low temperature flexibility of the underlayment sheets. For the sheet material to be given a *pass* rating in this test, the material must demonstrate either no visible signs of cracking after bending at the test temperature through an angle of $180 \pm 5^\circ$ around a 25 mm [1 in.] $\pm 5 \%$ diameter mandrel in 2 ± 1 s, or cracking is visible in one or more specimens that have been bent over the mandrel and a head of water confirmation, performed on a sheet of material that has been subjected to this bending, yields a passing result.

7.6.2 *Significance and Use*—Ice dam protective sheet materials are expected to accommodate some reasonable amount of strain. This test method establishes a threshold expectation by screening for flexibility at -29 °C [-20 °F].

7.6.3 *Specimens*—Prepare five specimens from each roll in both the longitudinal and transverse direction. Specimens shall be 25 mm [1 in.] $\pm 5 \%$ wide by 150 mm [6 in.] $\pm 5 \%$ long. Remove the release liner from each specimen.

7.6.4 *Conditioning*—Condition specimens and mandrel in a refrigeration unit for a minimum of 2 h at -29 ± 2 °C [-20 ± 3.6 °F].

7.6.5 *Procedure*—Perform the following procedure.

7.6.5.1 After the specimens have been conditioned, conduct the test at -29 ± 2 °C [-20 ± 3.6 °F]. Complete the entire procedure inside the refrigeration unit. Position the center of the specimen firmly on the mandrel with the weathering side up. Bend the projecting ends without exerting any stress other than that required to keep the specimen in contact with the

mandrel. Bend the specimen through an arc of $180 \pm 5^\circ$ within 2 ± 1 s until the projecting ends of the specimen are parallel to each other while keeping the bottom surface in contact with the mandrel. Repeat this procedure using a different specimen and bend with the weathering side down.

7.6.5.2 Remove the specimen from the refrigerated unit and immediately inspect for visible cracking.

7.6.5.3 Repeat the procedure for any remaining specimens, testing half the specimens with the weathering side up and half the specimens with the weathering side down. If the temperature of the refrigeration unit increases during testing, allow the refrigeration unit to equilibrate to test temperature prior to testing subsequent samples.

7.6.5.4 All specimens must pass at the test temperature of $-29 \pm 2^\circ\text{C}$ [$-20 \pm 3.6^\circ\text{F}$]. Report as a pass if no cracking is visible on any specimen. If cracking is visible on any specimen, performance of a head of water confirmation is required.

7.6.5.5 *Head of Water Confirmation*—If visible cracking is observed on one or more specimens that have been bent over the mandrel during the first portion of the Flexibility at -29°C [-20°F] Test, the head of water confirmation shall be performed.

(1) *Apparatus—Water Column Container*—A water-impermeable cylinder with a minimum inside diameter of 100 mm [4 in.] and a minimum depth of 150 mm [6 in.] suitable for erecting a water column on the underlayment test specimen assembly.

(2) *Specimen*—At least one specimen shall be tested. The test specimen shall consist of one piece of underlayment sheet 180 by 180 mm [7 by 7 in.] or larger in size. Remove the release liner from the specimen.

(3) *Conditioning*—Condition specimens and mandrel in a refrigeration unit for a minimum of 2 h at $-29 \pm 2^\circ\text{C}$ [$-20 \pm 3.6^\circ\text{F}$].

(4) *Procedure*—(a) After the specimen has been conditioned, position the center of the specimen firmly on the mandrel with the weathering side up. Bend the projecting ends without exerting any stress other than that required to keep the specimen in contact with the mandrel. Complete the entire procedure inside the refrigerated unit within 2 ± 1 s. Bend the specimen until the projecting ends of the specimen are parallel to each other, keeping the bottom surface in contact with the mandrel through an arc of $180 \pm 5^\circ$. (b) Place the sample in a refrigeration unit maintained at $4 \pm 2^\circ\text{C}$ [$40 \pm 5^\circ\text{F}$]. Carefully return the specimen to a flat condition and place it on a piece of plywood. (c) In the refrigeration unit, center the water column container over the area of the specimen that was bent. Apply a 6-mm [0.25-in.] bead of sealant completely around the outside rim of the water column container to bond it to the specimen. Allow 2 h for the sealant to set, then apply another bead around the inside rim of the water column container. (See Note 3.) (d) After waiting 24 h for the sealant to cure, place this assembly over a container capable of catching all the water in case there is a leak. Fill the water column container to a depth of 125 mm [5 in.] + 5 % with deionized or distilled water. Keep the entire assembly in the refrigeration unit maintained at $4 \pm 2^\circ\text{C}$ [$40 \pm 5^\circ\text{F}$] for a

period of 72 h. (e) At the conclusion of the 72-h period, remove the water column container, specimen, and plywood and note any water in the bottom container. Pour the water from the water column container and blot the inside dry. Remove the underlayment sheet and the water column container and examine the area of the plywood under the underlayment sheet for any sign of water. (f) Observe whether or not water is found between the plywood and the underlayment sheet. Report as a *failure* if water is present in this area, or as a *pass* if dry.

NOTE 3—Silicone sealant has been found to work well for this purpose, especially those varieties designed for use at cold temperatures. However, use of any sealant that does not interact with the underlayment sheet is acceptable.

7.6.6 *Report*—Report whether the material passes or fails at the specified temperature.

7.6.7 *Precision and Bias*—No information is presented about either the precision or bias of the test method for measuring Flexibility at -29°C [-20°F] since the test result is nonquantitative.

7.7 Tear Resistance:

7.7.1 This test method covers the determination of the tear resistance of the underlayment sheets as set forth in Test Method **D4073/D4073M** except as noted below.

7.7.2 *Procedure*—Test procedure shall be in accordance with Test Method **D4073/D4073M** except that the rate of jaw separation shall be 50 mm [2.0 in.]/min $\pm 3\%$.

7.7.3 *Calculation*—Calculate the average tear strength in each direction.

7.7.4 *Report*—Report the individual specimen values, the average, and standard deviation in each direction.

7.8 Moisture Vapor Permeability:

7.8.1 Sample the underlayment sheet and determine the moisture vapor transmission in accordance with Test Methods **E96/E96M**.

7.9 Capability to Seal Around Nail (Head of Water Test):

7.9.1 Perform Test Method **D7349/D7349M**, Protocol 4, with the following modifications:

7.9.1.1 Collect sample rolls in accordance with Specification D1970/D1970M rather than following the sample collection procedure referenced in Test Method **D7349/D7349M**.

7.9.1.2 Evaluate two specimens per sample roll.

7.9.1.3 For each test specimen, penetrate the test material and intervening material with two fasteners spaced 25 to 51 mm [1 to 2 in.] apart.

NOTE 4—Test Method **D7349/D7349M**, Protocol 4, prescribes the use of a shingle as an intervening material because the majority of steep roof installations use asphalt shingles as the roof cover. The scope of Specification D1970/D1970M includes shingle, tile, and metal roofs, and therefore, it is not prohibited to use other roof covers as intervening materials for research or investigative purposes.

7.9.2 *Report*—Report as a *pass* if all specimens evaluated by Test Method **D7349/D7349M** yield a passing result. Report as a *failure* if one or more specimens evaluated by Test Method **D7349/D7349M** do not yield a passing result.

7.10 *Waterproof Integrity of Side Lap Seam (Head of Water Test):*