Designation: D1970/D1970M – 15a

StandardSpecification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection[1]

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 reapproval. 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.

1.3 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 non-conformance with the standard.

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]

D228 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

D2523 Practice for Testing Load-Strain Properties of Roofing Membranes

D4073 Test Method for Tensile-Tear Strength of Bituminous Roofing Membranes

D5147 Test Methods for Sampling and Testing Modified Bituminous Sheet Material

D7349 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.

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

[1] This specification 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.

Current edition approved June 15, 2015. Published July 2015. Originally approved in 1990. Last previous edition approved in 2015 as D1970/D1970M – 15. DOI: 10.1520/D1970_D1970M-15A.

[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.

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.

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.

7. Test Methods

7.1 *Conditioning*—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.

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

7.3 *Maximum Load and Elongation at Break*—This test method covers the determination of the maximum load and elongation at break of the underlayment sheets, as set forth in Practice D2523 except as noted below.

7.3.1 *Specimens:*

7.3.1.1 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 the length of the sample may be reduced to 100 mm [4 in.] ±5 % if necessary to avoid limitations imposed by dimensions of the test machine.

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 temperature	–29°C	–20°F
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 after low temperature flexibility	pass	
Waterproof integrity of lap seam	pass	

7.3.2 *Procedure:*

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

7.3.2.2 Use a constant rate of elongation (CRE) tension testing machine, preferably with automatic load and strain recording equipment and clamps that permit a uniform clamping pressure on the specimen without slipping. 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].

7.3.2.3 Maintain a rate of separation of 50 mm [2 in.] ±3 % per min.

7.3.2.4 Record the percent elongation of each specimen at the visual break of the modified bitumen portion using an extensiometer, 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).

7.3.2.5 Record the maximum load attained by each specimen.

7.3.3 *Calculation:*

7.3.3.1 Determine the percent elongation at break of the modified bitumen portion obtained from the extensiometer 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.

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

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

7.3.4 *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*—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.

7.4.1 *Specimen Preparation:*

7.4.1.1 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 × 125 mm) [3 by 5 in.] to one piece of 6 mm [¼ in.] minimum thick plywood, APA Grade, Exposure 1, 75 by 150 mm [3 by 6 in.]. The plywood must not be reused for testing.

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

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

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

7.4.2 *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.

7.4.3 *Apparatus:*

7.4.3.1 Perform the test in a constant rate of extension type tester.

7.4.3.2 The rate of travel of the power-actuated grip shall be 50 mm [2 in.]/min ±3 %. This rate which provides a laminate separation rate of 25 mm [1 in.]/min ±3 % shall be uniform throughout the test.

7.4.4 *Procedure:*

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

7.4.4.2 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.

7.4.5 *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.

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

7.5.1 *Specimens:*

7.5.1.1 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 7.4.1) to one piece of 6 mm [¼-in.] minimum thick plywood, (APA Grade, Exposure 1) 150 ± 2 by 200 ± 2 mm [6 ± 0.125 by 8 ± 0.125 in.].

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

7.5.2 *Procedure:*

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

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

7.5.2.3 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.

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

7.6 *Flexibility Temperature*—This test method determines the low temperature flexibility of the underlayment sheets. For the sheet material to be given a *pass* rating in this test, the specimen must demonstrate either no visible signs of cracking in the sheet after bending at the test temperature through an angle of 180 ± 5° around a 25 mm [1 in.] ±5 % diameter mandrel in 2 ± 1 s, or minor surface cracking is observed in the sheet and the head of water test, performed on a sheet of material that has been subjected to this bending, yields a passing result.

7.6.1 *Specimens*—Prepare five specimens from each roll in both the longitudinal and transverse direction for each temperature to be tested. Specimens shall be 25 mm [1 in.] ±5 % wide by 150 mm [6 in.] ±5 % long. Remove the release liner from each specimen.

7.6.2 *Conditioning*—Test at the temperature specified for compliance in Table 1 (−29 ± 2°C [−20 ± 3.6°F]). Allow the refrigeration unit, mandrel and specimens to equilibrate for a minimum of 2 h.

7.6.3 *Procedure:*

7.6.3.1 After the specimens have 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 ± 5°. Repeat this procedure using a different specimen and bend with the weathering side down.

7.6.3.2 Remove the specimen from the refrigerated unit and immediately inspect for any signs of cracking.

7.6.3.3 Repeat the procedure for any remaining specimens. If the temperature of the refrigeration unit increases during testing, allow the refrigeration unit to equilibrate to test temperature prior to testing subsequent samples.

7.6.3.4 All specimens must pass at the test temperature of −29°C [−20°F]. Report as a pass if no cracking is visible. If cracking is visible on any specimen, performance of the Head of Water Test at Flexibility Temperature is required.

7.6.3.5 *Flexibility Temperature (Head of Water Test)*—If visible cracking is observed on one or more specimens from the Flexibility Temperature Test, the head of water test shall be performed.

(1) Apparatus—Water Column Container—A water impermeable cylinder with a minimum inside diameter of 100 mm [4