Designation: D 1970 – 01

Standard Specification 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 D 1970; 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 SI units are to be regarded as standard.

1.4 The following safety hazards caveat pertains to the test methods portion, Section 7, of this standard. *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:*

D 228 Test Methods for Asphalt Roll Roofing, Cap Sheets, and Shingles[2]

D 903 Test Method for Peel or Stripping Strength of Adhesive Bonds[3]

D 1079 Terminology Relating to Roofing, Waterproofing, and Bituminous Materials[2]

D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature[4]

D 2523 Practice for Testing Load-Strain Properties of Roofing Membranes[2]

D 4073 Test Method for Tensile-Tear Strength of Bituminous Roofing Membranes[2]

D 5147 Test Methods for Sampling and Testing Modified Bituminous Sheet Material[2]

E 96 Test Methods for Water Vapor Transmission of Materials[5]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminology D 1079.

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

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[2] *Annual Book of ASTM Standards*, Vol 04.04.

[3] *Annual Book of ASTM Standards*, Vol 15.06.

[4] *Annual Book of ASTM Standards*, Vol 08.01.

[5] *Annual Book of ASTM Standards*, Vol 04.06.

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
Slip resistance		Greater than asphalt saturated felt when tested under the same conditions of temperature and wetness (see Note 1)

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 D 228.

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 shingle underlayment in accordance with Test Methods D 5147.

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 D 2523 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.

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 D 903 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*—Testing is to be performed at two temperatures, 23.9 ± 1.1°C (75 ± 2°F) and 4.4 ± 1.1°C (40 ± 2°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 D 1204, 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 7.4.2.1) to one piece of ¼-in. 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 *Low Temperature Flexibility*—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.

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.

7.6.2 *Conditioning*—Test at the temperature specified for compliance in Table 1 (−29°C (−20°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. The temperature of the refrigeration unit may increase during testing. Allow 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).

7.6.3.5 To ensure that the material will perform its intended function, the head of water test (7.10) shall be performed on at least one specimen that has been flexed and judged to pass the flexibility test at the test temperature and that specimen shall also pass the head of water test.

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

7.7 *Tear Resistance*—This test method covers the determination of the tear resistance of the underlayment sheets as set forth in Test Method D 4073 except as noted below.

7.7.1 *Procedure*—Test procedure shall be in accordance with Test Method D 4073 except that the rate of jaw separation shall be 50 mm (2.0 in.)/min ±3 %.

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

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

7.8 *Moisture Vapor Permeability*—Sample the underlayment sheet and determine the moisture vapor transmission in accordance with Test Methods E 96.

7.9 *Self Sealability (Head of Water Test)*

7.9.1 This test method will determine the ability of the underlayment sheet to seal around a roofing nail and prevent standing water from leaking through to the underside of the sheet.

7.9.1.1 This test method will also determine the waterproof integrity of the sheet after performing the low temperature flexibility test (7.6).

7.9.1.2 This test method will also determine the waterproof integrity of lap seems formed according to the manufacturers' instructions or rolled as described in 7.4.1.2 at 23 ± 2°C (73.4 ± 3.6°F). A larger diameter container than specified in 7.9.3.3 may be required to accommodate the full width of the specified lap seam centered across a diameter of the open (bottom) end of the container (the diameter should be at least 2× the width of the lap).

7.9.2 *Specimens*:

7.9.2.1 The test specimen shall consist of one piece of underlayment sheet 300 by 300 mm (12 by 12 in.) ±5 % centered on a piece of 10-mm (⅜-in.) minimum thick (APA Grade, Exposure 1) plywood, of the same dimensions.

7.9.2.2 At least two specimens shall be tested for each sample roll.

7.9.3 *Procedure*:

7.9.3.1 At room temperature (23 ± 2°C (73.4± 3.6°F)) peel the release paper or film off the self stick underlayment sheet and lightly place the sheet on the plywood. Press down the edges of the sheet just hard enough to keep them from lifting. Roll membrane as specified in 7.4.1.2.

7.9.3.2 With two pieces of lumber placed underneath the plywood for support, drive two 32-mm (1.25-in.) galvanized roofing nails, 25 to 51 mm (1 to 2 in.) apart, near the center of the plywood so that the nail heads are flush with the surface of the sheet. Tap the pointed ends of the nails to raise the nail heads approximately 6 mm (0.25 in.) off the surface of the sheet.

7.9.3.3 Cut the bottom out of a 4-L (1-gal) can with a can opener and center it, bottom side down, on the membrane. Apply a 6-mm (0.25-in.) bead of silicone sealant completely around the outside rim of the can to bond it to the membrane. Allow 2 h for the sealant to set, then apply another bead around the inside rim of the can.

7.9.3.4 After waiting 24 h at ambient temperature the sealant to cure, place this assembly atop another 1-gal can which has the lid removed and the bottom intact. Fill the upper can to a depth of 127 mm (5 in.) with deionized or distilled water. Place the entire assembly in a refrigeration unit maintained at 4 ± 2°C (40 ± 5°F) for a period of three days.

7.9.3.5 At the conclusion of the test, remove the top can and plywood and note any water in the bottom can, on the shanks of the nails, or on the underside of the plywood. Pour the water from the top can and blot the inside dry. Peel the top can from the underlayment sheet then peel the sheet back to the nails and inspect the underside for any signs of water.

7.9.3.6 When using this procedure to determine the waterproof integrity of specimens after the low temperature flexibility test or to determine the integrity of laps seams, proceed as above, substituting those specimens for the nailed specimen, and inspect the underside for any signs of water after the test.

7.9.4 *Report*—Observe and report whether or not water is found in the bottom can, on the nail shanks, on the underside of the plywood, or between the plywood and the underlayment sheet. Report as a *failure* if water is present in any of these areas, or as a *pass* if dry.

8. Precision and Bias

8.1 The precision statements for the test methods included in this specification are under development.

9. Inspection

9.1 Inspection of the material shall be agreed upon between the purchaser and the manufacturer/supplier as part of the purchase contract.

10. Rejection and Rehearing

10.1 Failure to conform to any of the requirements prescribed in this specification will constitute grounds for rejection. In case of rejection, the seller shall have the right to reinspect the rejected material and resubmit the lot after removal of those packages not conforming to the requirements. Alternative arrangements for replacement of defective material may be agreed upon between the purchaser and supplier as part of the purchase contract.

11. Packaging and Package Marking

11.1 The area per roll and packaging shall be as agreed upon by the purchaser and the seller.

11.2 Unless otherwise specified, each package shall be plainly marked with the manufacturer's name, brand name, area of the roll, and the ASTM designation.

11.3 The rolls shall be securely wrapped or banded in a substantial manner to prevent shifting of material and to permit normal handling.

12. Keywords

12.1 ice dam protection; polymer-modified; self-adhering; steep roofing; underlayment