Designation: D4869/D4869M – 16a

Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing[1]

This standard is issued under the fixed designation D4869/D4869M; 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 asphalt-saturated organic felt for use as an underlayment with steep slope roofing.

1.2 The objective of this specification is to provide a finished product that will lie flat and resist wrinkling, puckering, and shrinking when left exposed to the sun, rain, frost, or dew for a period of two weeks after application.

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 The following safety hazards caveat pertains only to the test method portion, Section 8, of this specification: *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]

D70 Test Method for Density of Semi-Solid Bituminous Materials (Pycnometer Method)

D146/D146M Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing

D1079 Terminology Relating to Roofing and Waterproofing

D1922 Test Method for Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method

D6136/D6136M Test Method for Kerosine Number of Unsaturated (Dry) Felt by Vacuum Method

F1087 Test Method for Linear Dimensional Stability of a Gasket Material to Moisture

3. Terminology

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

4. Classification

4.1 Asphalt-saturated felts covered by this specification are of four types:

4.1.1 *Type I*—#8 Underlayment,

4.1.2 *Type II*—#13 Underlayment,

4.1.3 *Type III*—#20 Underlayment, and

4.1.4 *Type IV*—#26 Underlayment.

5. Materials and Manufacture

5.1 In the process of manufacture, a single thickness of organic dry felt shall be uniformly saturated with an asphaltic saturant.

5.2 The felt shall be produced principally from organic fibers. The surface of the felt shall be uniform and relatively smooth. Upon splitting or tearing on the bias, the felt shall appear free of lumps or particles of foreign substances.

6. Physical Requirements

6.1 The material shall conform to the physical requirements in accordance with Table 1 and the dimensions and masses in accordance with Table 2.

6.2 The finished product shall not crack nor be so sticky as to cause tearing or other damage upon being unrolled at temperatures between 0 and 60°C [32 and 140°F].

6.3 The finished product shall pass the water shower exposure test in accordance with 8.6, indicating resistance to liquid water transmission.

7. Workmanship, Finish, and Appearance

7.1 The felt shall be thoroughly and uniformly saturated, and shall show no unsaturated spots at any point upon cutting

[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.

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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.

TABLE 1 Physical Requirements

	Type I	Type II	Type III	Type IV
Tear strength, 23 ± 2°C [73 ± 4°F] min, N [lbf] (both cross and with direction of sheet)	2.0 [0.45]	2.0 [0.45]	4.0 [0.90]	4.0 [0.90]
Pliability at 23 ± 2°C [73 ± 4°F]. Ten strips tested shall not crack when bent 90° at a uniform speed over a rounded corner of radius in table for each type.	12.7 mm [0.50 in.]	12.7 mm [0.50 in.]	19.1 mm [0.75 in.]	19.1 mm [0.75 in.]
Loss on heating at 105°C [221°F] for 5 h max, %	6	6	6	6
Liquid water transmission test	Pass	Pass	Pass	Pass
MD breaking strength at 23 ± 2°C [73 ± 4°F], kN/m [lbf/in.], min	5.3 [30]	5.3 [30]	7.0 [40]	7.0 [40]
CD breaking strength at 23 ± 2°C [73 ± 4°F], kN/m [lbf/in.], min	2.6 [15]	2.6 [15]	3.5 [20]	3.5 [20]
Dimensional stability, max, % (MD and CD,[A] from Low Humidity to High Humidity)	2.00	2.00	1.75	1.75

[A] MD is Machine Direction and CD is Cross Machine Direction.

TABLE 2 Dimensions and Masses

	Type I	Type II	Type III	Type IV
Width of the roll, mm [in.][A]	914 [36] ± 0.7 %	914 [36] ± 0.7 %	914 [36] ± 0.7 %	914 [36] ± 0.7 %
Area of the roll, m^2 [ft^2],[A] min	40.13 [432]	40.13 [432]	20.07 [216]	20.07 [216]
Net mass of saturated felt, g/m^2 [$lb/100\ ft^2$], min	390 [8.0]	635 [13.0]	976 [20]	1270 [26]
Net mass of saturant, g/m^2 [$lb/100\ ft^2$], min	195 [4.0]	293 [6.0]	615 [12.6]	732 [15.0]
Net mass of desaturated felt, g/m^2 [$lb/100\ ft^2$], min	195 [4.0]	244 [5.0]	439 [9.0]	488 [10.0]
Saturation, % by wt., min	100	120	140	150
Moisture, % by wt.[B], min	2.0	2.0	2.0	2.0
Saturating efficiency, % by wt., min	75.0	70.0	70.0	70.0

[A] Other areas and widths can be provided as agreed upon by purchaser and seller.
[B] At time of manufacture.

50-mm [2-in.] wide strips at random across the entire sheet and splitting them open for their full length.

7.2 The saturated felt may be surfaced lightly on one side with talc or other finely comminuted mineral material to prevent sticking in the roll.

7.3 The finished material shall be free of visible external defects, such as holes, ragged or untrue edges, breaks, cracks, tears, protuberances, and indentations.

8. Sampling and Test Methods

8.1 Sample the material in accordance with Test Method D146/D146M and determine the properties enumerated in this specification in accordance with Test Methods D146/D146M, D1922, D6136/D6136M, and F1087 as specified below.

8.2 Determine the saturation percent of the felt in accordance with Test Method D146/D146M, Section 19 (Bituminous Saturant), and the saturating efficiency of the desaturated (dry) felt by the following method:

8.2.1 Calculate the percent of asphalt saturation by dividing the mass of the asphalt saturant by the mass of the desaturated (dry) felt and multiply the result by 100.

8.2.2 Determine the kerosine number of the desaturated (dry) felt in accordance with Test Method D6136/D6136M.

8.2.3 Calculate the saturation efficiency of the felt by dividing the percent saturation of the asphalt saturated felt by the kerosine number times the specific gravity of the saturant and multiply the result by 100. A suitable method for determining the specific gravity of the bitumen is Test Method D70.

8.2.4 The precision and bias of this method for measuring kerosine value are as specified in Test Method D6136/D6136M, Section 12 (Precision and Bias).

8.3 Determine the tear strength according to Test Method D1922 modified to use rectangular samples that measure 76 by 63 mm [3 by 2.5 in.] ± 3 %. Condition specimens at 23 ± 2°C [73 ± 4°F] for at least 2 h prior to testing and conduct tests at 23 ± 2°C [73 ± 4°F]. Use an Elmendorf Tear Strength Tester with a 1600 g full scale capacity.

8.4 Determine the pliability in accordance with Test Method D146/D146M, Section 14.

8.5 Determine the loss on heating of felt in accordance with Test Method D146/D146M, Section 15.

8.6 Determine the resistance to liquid water transmission by the following test method:

8.6.1 *Scope*—The purpose of this test method is to indicate the resistance of the material to transmission of liquid water and visible deterioration by observation of the material after a water shower is impinged for 4 h on an inclined plane typical of the lowest acceptable steep slope roof deck.

8.6.2 *Significance and Use*—This test method measures the ability of the underlayment to resist the transmission of liquid water and visible deterioration by the action of water and,

hence, function as intended. A function of underlayment is to provide secondary protection to the deck and underlying structure by shielding these components from rain water that may be driven under the shingles by wind. Knowledge of the resistance of underlayment to liquid water transmission is important to the assessment of its suitability for use as a secondary protective layer beneath any steep slope roofing.

8.6.3 *Apparatus*—The water exposure tester consists of the following components (see Fig. 1):

8.6.3.1 *One Head,* mounted above sink. The head should be capable of providing a heavy shower as described below.

8.6.3.2 *Cold, 5 to 27°C [40 to 80°F], Tap Water* supply to the shower and appropriate sink and drain to collect water run off.

8.6.3.3 Stopwatch, 20-L [5-gal] pail, and volumetric measuring vessel.

8.6.3.4 *Plywood, ⅜-in.,* 380 by 760 mm [15 by 30 in.], for test specimen support.

8.6.4 *Procedure:*

8.6.4.1 Mount each single thickness sheet specimen on a plywood board by overlapping and folding over all edges and stapling the specimen on the back of the board. Take care to ensure that the staples do not protrude at the front surface of the plywood board so as not to puncture the test specimen.

8.6.4.2 After sample preparation, condition the board at 21 to 27°C [70 to 80°F] and 30 to 55 % relative humidity for 24 h before testing.

8.6.4.3 Position the test board in the sink at a 14° incline with the shower head directly overhead and 460 mm [18 in.] above the center of the test board. The shower should impinge an area of approximately 250 to 300 mm [10 to 12 in.] in diameter.

8.6.4.4 Open the water supply to the shower head and adjust the flow regulator to provide a flow of 42 to 44 cm^3/s [40 to 42 gal/h]. Calibrate the volume of water by collecting the shower output in a 20-L [5-gal] pail for 1 min and then measure in a measuring vessel. Run the water shower for 4 h.

8.6.4.5 At the end of the test period, shut off the water supply and wipe the surface and edges of the test board free of excess dripping water.

8.6.4.6 Using a sharp knife, carefully cut the three edges of the specimen on the board to avoid accidental wetting of the back surface of the test specimen. Then turn over the specimen and inspect for any sign of wetness on the underside. Also inspect the top of the plywood board for wetness. Inspect the specimen for any visible signs of deterioration by the action of water.

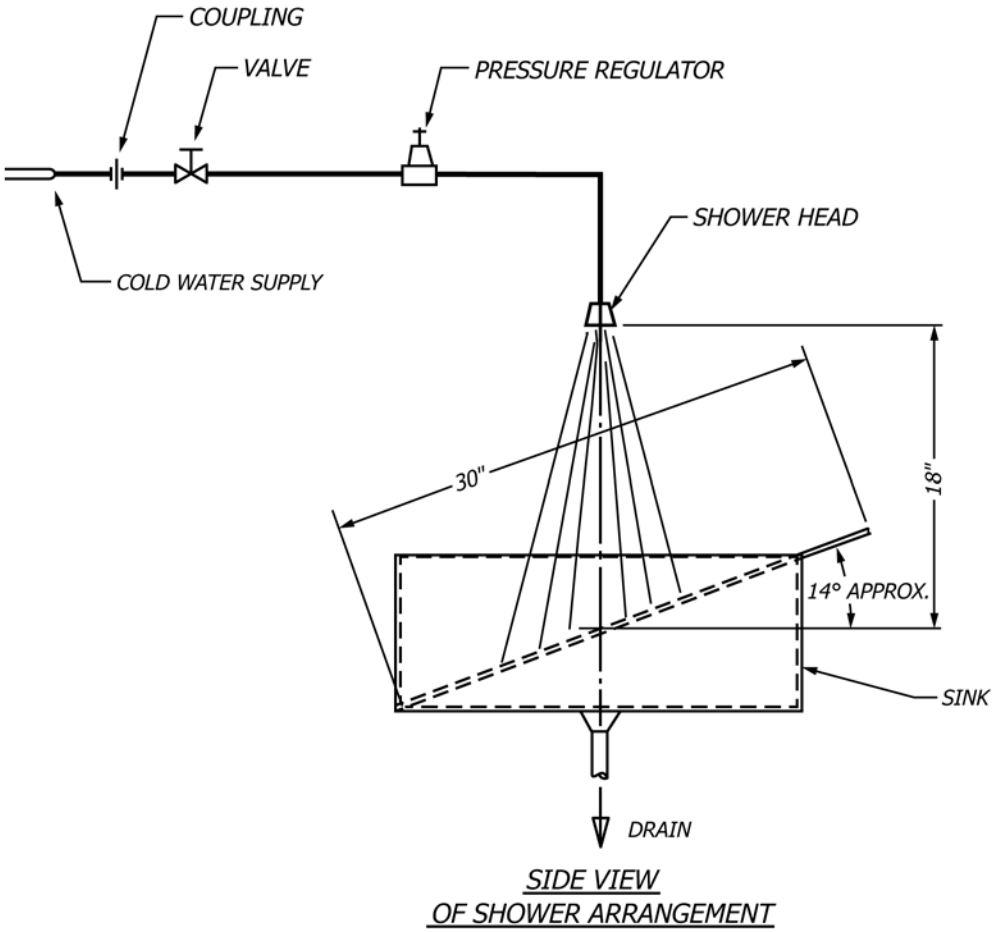

FIG. 1 Water Shower Exposure Test for Underlayment

8.6.4.7 Test two specimens from each roll of product as above to determine compliance with this test requirement.

8.6.5 *Results*—Liquid water transmission, the lack of transmission, or evidence of visible deterioration in this test is expressed as follows:

P A S S	No sign of any liquid water wetness on either specimen underside or top of plywood support or visible deterioration of the specimen.
F A I L	Any sign of liquid water wetness on either specimen underside or top of plywood support or visible deterioration of the specimen.

8.6.6 *Precision and Bias*—No statement is made about either the precision or bias of this test method for measuring resistance to liquid water transmission since the result merely states whether there is conformance to the criteria for success as specified in the procedure.

8.7 Determine the breaking strength in accordance with Test Method D146/D146M, Section 13 for Strength.

8.8 Testing of the material for Dimensional Stability shall be done in accordance with Test Method F1087 except as modified here.

8.8.1 Three specimens shall be dried per Section 7.2 of Test Method F1087 for Dimensional Stability to Low Humidity. Record the length of the specimens after drying as the low-humidity length of the specimens.

8.8.2 The specimens are then tested according to Section 7.3 of Test Method F1087 for Dimensional Stability to High Humidity. Measure the specimens in the same place as previously measured and record as high humidity length.

8.8.3 Report the results as percent dimensional change from low humidity to high humidity calculated using the following equation:

8.8.3.1 Low humidity to high humidity:

$$\Delta L_{\%} = \frac{L_h - L_l}{L_l} \times 100$$

where:

L_l = low humidity length of specimen,
L_h = high humidity length of specimen, and
$\Delta L_{\%}$ = the percent change in length from low to high humidity.

8.8.4 Calculate and report the average percent change in length of the three individual specimens. The change reported is the change from low humidity to high humidity.

9. Inspection

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

10. Rejection and Resubmittal

10.1 Failure to conform to any of the requirements prescribed in this specification shall 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.

11. Packaging and Marking

11.1 The rolls shall be securely wrapped or banded with material that completely encircles the roll in a manner that will prevent slipping.

11.2 No roll shall contain more than two pieces, and no more than 3 % of the rolls in any lot shall contain two pieces.

11.3 Unless otherwise specified, each package shall be plainly marked with the manufacturer's name, brand name, ASTM designation, and type of underlayment.

12. Keywords

12.1 asphalt-saturated felt; roofing; steep slope; underlayment