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.

Designation: D4830/D4830M – 98 (Reapproved 2021)

Standard Test Methods for Characterizing Thermoplastic Fabrics Used in Roofing and Waterproofing[1]

This standard is issued under the fixed designation D4830/D4830M; 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 These test methods cover the procedures for characterizing thermoplastic fabrics (for example polyester, polyamide, polypropylene, and so forth) used in prefabricated roofing and waterproofing membranes.

1.2 Procedures appear in the following order:

	Section
Unit Mass	3
Thickness	4
Breaking Load, Elongation, and Work-to-Break	5
Trapezoid Tearing Strength	6
Puncture Strength	7
Static Heat Stability	8
Dynamic Heat Stability	9

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 nonconformance 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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]

D76/D76M Specification for Tensile Testing Machines for Textiles

D123 Terminology Relating to Textiles

D885/D885M Test Methods for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made from Manufactured Organic-Base Fibers

D1117 Guide for Evaluating Nonwoven Fabrics (Withdrawn 2009)[3]

D1776/D1776M Practice for Conditioning and Testing Textiles

D4354 Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing

D5035 Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)

D5729 Test Method for Thickness of Nonwoven Fabrics (Withdrawn 2008)[3]

D5733 Test Method for Tearing Strength of Nonwoven Fabrics by the Trapezoid Procedure (Withdrawn 2008)[3]

E1 Specification for ASTM Liquid-in-Glass Thermometers

E18 Test Methods for Rockwell Hardness of Metallic Materials

3. Unit Mass

3.1 Determine the unit mass of the fabric using procedures described in Guide D1117. Report in g/m^2 or oz/yd^2.

4. Thickness

4.1 Determine fabric thickness following procedures described in Test Method D5729.

5. Breaking Load, Elongation, and Work-to-Break

5.1 Determine the breaking load and elongation by the cut strip method described in Test Method D5035 with the following exceptions:

[1] These test methods are under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and are the direct responsibility of Subcommittee D08.04 on Felts, Fabrics and Bituminous Sheet Materials.

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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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

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5.1.1 *Test Specimens*—Cut each specimen 51 ± 1 mm [2.0 ± 0.05 in.] wide and 203 ± 1 mm [8.0 ± 0.05 in.] long. The gauge length shall be 152 ± 1 mm [6.0 ± 0.05 in.].

5.1.2 *Apparatus*—The apparatus shall be a CRE (constant rate of extension) machine described in Specification D76/D76M. The machine will be set for an extension rate of 5 mm/s or 12 in./min.

5.2 *Calculation*—Report textile conditions and the average breaking load in N/m or lbf/in. and the elongation at break in percent.

5.3 *Work-to-Break*—The procedure and calculation shall be as described in Test Methods D885/D885M, with the exception that the load-elongation curve will be from specimens used in determining breaking load and elongation as described in 5.1 and 5.2.

6. Trapezoid Tearing Strength

6.1 Determine trapezoid tearing strength of the fabric following procedures described in Test Method D5733.

7. Puncture Strength

7.1 *Scope:*

7.1.1 This test method is used to measure the puncture strength of thermoplastic fabrics used in roofing.

7.1.2 This procedure is applicable to conditioned fabrics.

7.2 *Summary of Method:*

7.2.1 A specimen of the fabric is clamped without tension between grooved, circular plates of a ring clamp attachment secured in a tensile testing machine. A force is exerted against the center of the specimen by a solid steel rod attached to the load indicator until rupture occurs.

7.3 *Significance and Use:*

7.3.1 Puncture failures are recognized in the roofing industry. Puncture strength is felt to reflect the fabric's ability to withstand aggregate or ballast stone penetration. This test method is used to obtain the relative puncture resistance of various fabrics.

7.4 *Apparatus:*

7.4.1 *Tensile Testing Machine,* of the constant-rate-of-extension type (CRE), with autographic recorder conforming to the requirements of Specification D76/D76M.

7.4.2 *Ring Clamp Attachment,* consisting of concentric grooved plates with an internal diameter of 44.45 ± 0.025 mm [1.750 ± 0.001 in.], capable of clamping fabrics without slippage.

7.4.3 *Solid Steel Rod,* with a hardness in the range of Rockwell C (HRC) 50 to 60, with a diameter of 7.938 ± 0.013 mm [0.3125 ± 0.0005 in.] and a hemispherical end with a radius of 3.970 ± 0.013 mm [0.1563 ± 0.0005 in.] for contacting the fabric surface (see Fig. 1). The surface of the hemispherical end should be smooth and polished to a surface smoothness of RMS ≤ 8. (RMS is the root-mean-square method of describing surface smoothness.)[4]

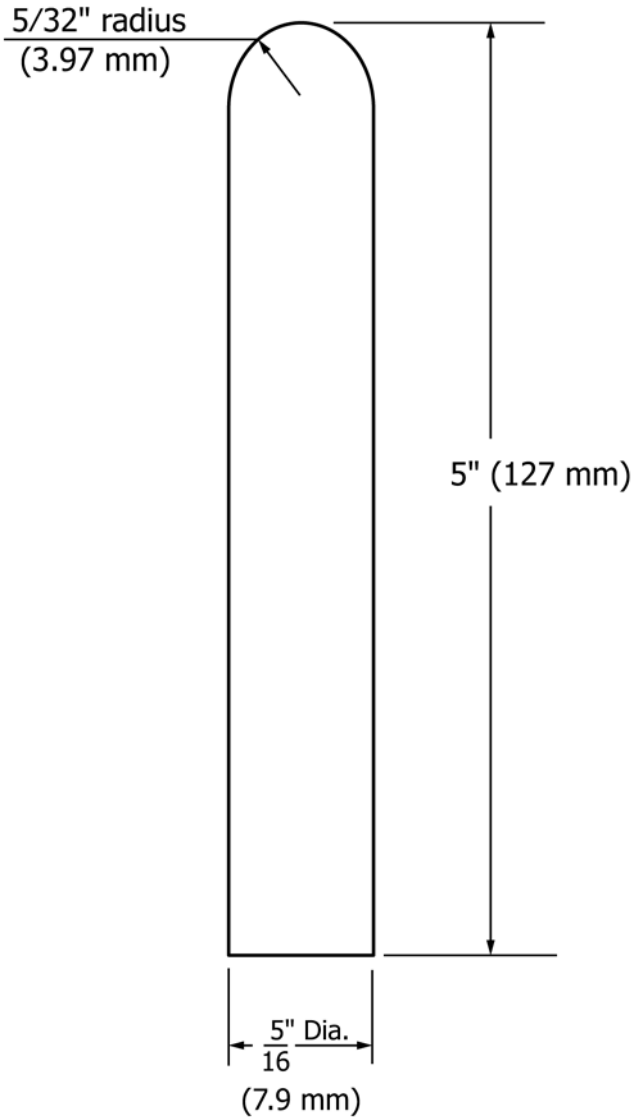

FIG. 1 Steel Rod

7.5 *Sampling, Number of Specimens, and Selection of Samples:*

7.5.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls of fabric directed in an applicable material specification or other agreement between the purchaser and the supplier, such as agreement to sample as directed in Practice D4354. Consider rolls of fabric to be the primary sampling units.

7.5.2 *Laboratory Sample*—Take, for the laboratory sample, a sample extending the width of the fabric and approximately 1.0 m [39 in.] along with the selvage from each roll in the lot sample. The sample may be taken from the end portion of a roll provided there is no evidence that it is distorted or different from other portions of the roll. In cases of dispute, take a sample that will exclude fabric from the outer wrap of the roll or the inner wrap around the core.

7.5.3 Unless otherwise agreed upon or specified in applicable material specifications, test a number of specimens from

[4] See *Machinery's Handbook*, 19th edition, Industrial Press, H. L. Horton, Ed.

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each laboratory sample that will give a precision of ±5 % at a probability level of 90 %, not to exceed ten specimens per sample.

7.6 *Preparation of Test Specimen:*

7.6.1 Each specimen shall be cut 76 by 76 mm [3.0 by 3.0 in.] to ensure proper clamping. Specimens should be taken on the diagonal across the sample so that no two specimens will contain the same machine direction and cross-machine direction yarns or fibers. Unless otherwise specified, no specimen should be taken within 51 mm [2.0 in.] of the selvage or edge.

7.7 *Conditioning:*

7.7.1 Condition the specimens as directed in Practice D1776/D1776M.

7.8 *Procedure:*

7.8.1 All testing must be conducted at standard textile laboratory conditions as required in Practice D1776/D1776M.

7.8.2 Select the load range of the tensile testing machine such that the rupture occurs between 15 and 85 % of the full-scale load.

7.8.3 Center and secure the specimen between the grooved plates, ensuring that the fabric extends beyond the outer edges of the plates.

7.8.4 *Measurement of Rupturing Load*—Test at a machine speed of 5 mm/s or 12 in./min until the puncture rod completely ruptures the specimen. Read the puncture strength as the greatest force in N [lbf] registered on the recording instrument during the test.

7.8.5 If the yarns or fibers fail to break due to the slippage of the specimen in the ring clamp or if the rod slips between the yarns or fibers without causing yarn or fiber breakage, discard the result and test another specimen.

7.9 *Calculation:*

7.9.1 Calculate the average of the rupturing load for all acceptable test results as read directly from the recording instrument.

7.10 *Report:*

7.10.1 Report all of the following:

7.10.1.1 Product(s) or material(s) sampled.

7.10.1.2 Test method used, identifying both the type of specimen and type of testing machine.

7.10.1.3 Sample conditioning.

7.10.1.4 Average puncture strength in N [lbf] of the specimens tested and number of specimens.

7.10.1.5 Variation, if any, from the described test method.

7.11 *Precision and Bias:*

7.11.1 *Precision*—The precision of the procedure in this test for measuring puncture strength is being determined.

7.11.2 *Bias*—Since there is no accepted reference material suitable for determining the bias for the procedure in this test for puncture strength, no statement on bias is being made.

8. Static Heat Stability

8.1 *Scope:*

8.1.1 This test method covers the determination of the heat stability of thermoplastic fabrics at typical asphalt application temperatures during manufacture of prefabricated membrane.

8.2 *Summary of Method:*

8.2.1 Fabric specimens are placed in an oven for a fixed amount of time at a specific temperature. The change in length of each specimen is recorded and expressed as a percentage of the original length.

8.2.2 This process is performed at four temperatures, and a plot can be made comparing the percent change in length versus temperature.

8.3 *Significance and Use:*

8.3.1 This test method is used to determine the comparative heat stability of thermoplastic fabrics, as received, at typical asphalt application temperatures.

8.4 *Apparatus:*

8.4.1 *Self-Supporting Aluminum Mounting Board*—Details on the construction and dimensions are described in Annex A1.

8.4.2 *Oven,* mechanical convection type, for controlled circulation of air. The oven must be capable of containing the mounting board, and shall be equipped with a temperature-control system designed to maintain oven temperatures at the levels specified in 8.7.1 with a precision of ±1 °C [±2 °F]. The oven should also be equipped with a visible thermometer which measures the inside oven temperature.

8.4.3 *Ruler,* graduated at 1.0 mm or 1/32 in. and at least 25 mm [1.0 in.] wide.

8.4.4 *Clips,* noninsulated alligator clips weighing no more than 1.4 g [0.05 oz] each.

8.4.5 *Timing Device,* reading in minutes with an audible alarm.

8.4.6 *Marking Pen,* indelible ink or felt-tip marker, capable of marking specimens.

8.5 *Preparation of Specimens:*

8.5.1 Take the specimens for the measurement of the static heat stability for the machine direction from different positions across the fabric and for the cross-machine direction from different positions along the length of the fabric.

8.5.2 Test specimens should be cut no closer than 51 mm [2.0 in.] from the selvage and no closer than 1 m [39 in.] from the end of the roll.

8.5.3 Each specimen should be 267 ± 3 mm [10.5 ± 1/8 in.] long and 25 ± 3 mm [1 ± 1/8 in.] wide.

8.5.4 Cut twelve specimens from the sample with their long dimension parallel to the machine direction. Label each specimen as a machine direction specimen.

8.5.5 Cut twelve specimens from the sample with their long dimension parallel to the cross-machine direction. Label each specimen as a cross-machine direction specimen.

8.5.6 *Marking the Specimens:*

8.5.6.1 Lay out a specimen fully extended on a flat, horizontal surface. Draw a line on the specimen 6 mm [1/4 in.] from the end, parallel to the short dimension (width). Draw a similar line on the other end of the specimen.

8.5.6.2 Prepare the other specimens as in 8.5.6.1.

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