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AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
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Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material[1]

This standard is issued under the fixed designation D 5147; 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 procedures for sampling and testing prefabricated, reinforced, polymer modified bituminous sheet materials designed for single or multiple ply application in roofing and waterproofing membranes. These products may employ various surfacing materials on one side.

1.2 These test methods appear in the following order:

1.3 *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 95 Test Method for Water in Petroleum Products and Bituminous Materials by Distillation[2]

D 228 Test Methods for Asphalt Roll Roofing, Cap Sheets, and Shingles[3]

D 573 Test Method for Rubber—Deterioration in an Air Oven[4]

D 751 Test Methods for Coated Fabrics[5]

D 1079 Terminology Relating to Roofing, Waterproofing, and Bituminous Materials[3]

D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting at Elevated Temperature[6]

D 4073 Test Method for Tensile-Tear Strength of Bituminous Roofing Membranes[3]

D 4798 Test Method for Accelerated Weathering Test Conditions and Procedures for Bituminous Materials (Xenon-Arc Method)[3]

D 4977 Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion[3]

3. Sampling

3.1 From each shipment or fraction thereof, select at random a number of rolls equal to one-half (½) the cube root of the total number of rolls in the lot. If the calculated number is fractional, express it as the next highest whole number. For convenience, a table showing the number of rolls to be selected from the lots of various sizes, is given in Test Methods D 228. When mutually agreed upon by the concerned parties, other sampling frequencies may be used and reported within the framework of these procedures. The minimum sample shall consist of five (5) rolls. The rolls so selected constitute the representative sample used for all subsequent observations and tests pertaining to the lot of material being examined.

4. Conditioning

4.1 Unless otherwise specified, condition test specimens for a minimum of 4 h at 73.4 ± 3.6°F (23 ± 3°C) and 50 ± 5 % relative humidity prior to testing.

5. Thickness

5.1 Sheet materials shall be checked at five points across the roll width, to include the weathering surface. Measurements shall be made at two points, each being 6 ± 0.5 in. (150 ± 15 mm) from each edge, and at three points equally spaced between these two points. Compute the average thickness and the standard deviation of the thicknesses based on the total number of point measurements from all of the rolls taken in accordance with Section 3.

5.2 Report the individual point measurements, average, and estimated standard deviation.

6. Load Strain Properties

6.1 This test method covers the determination of the load-strain (tensile-elongation, and strain energy) properties of

[1] These test methods are under the jurisdiction of ASTM Committee D-8 on Roofing, Waterproofing, and Bituminous materials, and are the direct responsibility of Subcommittee D08.04 on Fabrics for Bituminous Roofing and Waterproofing.

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[2] *Annual Book of ASTM Standards*, Vol 05.01.

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

[4] *Annual Book of ASTM Standards*, Vol 09.01.

[5] *Annual Book of ASTM Standards*, Vol 09.02.

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

polymer modified bituminous sheets.

6.1.1 *Specimens*—Prepare five specimens from each sample roll in both the longitudinal and transverse directions for each temperature to be tested. Specimens shall be 1.0 in. (25 mm) wide by a minimum of 6.0 in. (150 mm) long for sheet materials having an ultimate elongation of 75 % or less at 0°F (−18°C). Specimens shall be 0.5 in. (12.5 mm) wide by a minimum of 4.0 in. (100 mm) long for materials having an ultimate elongation of greater than 75 % at 0°F (−18°C).

6.1.2 *Procedure*:

6.1.2.1 Condition each specimen at least 2 h at the selected test temperature. If conditioning is done outside the machine clamps, allow the specimen to equilibrate at the testing temperature for at least 15 min before the testing force is applied.

6.1.2.2 Test specimens at both 73.4 ± 3.6°F (23 ± 3°C) and 0 ± 3.6°F (−18 ± 3°C).

6.1.2.3 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 3.0 ± 0.125 in. (75± 2 mm) for sheet materials having an ultimate elongation of 75 % or less at 0°F (−18°C), and 2.0 ± 0.125 in. (50 ± 2 mm) for sheet materials having an ultimate elongation greater than 75 % at 0°F (−18°C).

6.1.2.4 Maintain a rate of separation of 2.0 in./min± 3 % (50 mm/min ± 3 %) for specimens tested at 73.4 ± 3.6°F and a rate of separation of 0.08 in./min ± 3 % (2.0 mm/min ± 3 %) for specimens tested at 0 ± 3.6°F.

6.1.2.5 Record the percent elongation of each specimen at specimen break and also at maximum load using an extensiometer, or calculate the percent elongation at specimen break and also at maximum load from the chart of the stress versus time knowing the speed of the chart drive and the jaw separation rate.

6.1.2.6 Record the breaking load and maximum load of each specimen.

6.1.3 *Calculation*:

6.1.3.1 Determine the percent elongation at break obtained from the extensiometer in accordance with the manufacturer's instructions, or read directly, calculate the percent elongation determined from the chart, without an extensiometer, as follows:

$$\text{Percent elongation} = \frac{a - b}{b} \times 100 \text{ at break.} \quad (1)$$

where:

a = jaw separation at specimen break
$= \frac{\text{maximum extension on chart} \times \text{jaw separation rate}}{\text{chart speed}}$

b = initial jaw separation.

6.1.3.2 Determine the average percent elongation at break in each direction and the standard deviation of percent elongation at break in each direction based on the total number of measurements taken.

6.1.3.3 Calculate the percent elongation at maximum load obtained from the extensiometer in accordance with the manufacturer's instructions, or read directly, calculate the strain at maximum load determined from the chart, without an extensiometer, as follows:

$$\text{percent elongation} = \frac{c - d}{b} \times 100 \text{ at maximum load} \quad (2)$$

where:

c = jaw separation at maximum load
$= \frac{\text{maximum extension on chart} \times \text{jaw separation rate}}{\text{chart speed}}$

b = initial jaw separation.

6.1.3.4 Calculate the average percent elongation at maximum load in each direction and the standard deviation of percent elongation at maximum load in each direction based on the total number of measurements taken.

6.1.3.5 Calculate the average breaking load in each direction and the standard deviation of the breaking loads in each direction based on the total number of measurements taken.

6.1.3.6 Calculate the average maximum load in each direction and the standard deviation of the maximum loads in each direction based on the total number of measurements taken.

6.1.3.7 If the load elongation curve is not available, estimate the strain energy. The strain energy should be reported as either measured, or estimated.[7]

6.1.3.8 Calculate the average strain energy at maximum load and at break in each direction and the standard deviation of the strain energies in each direction based on the total number of measurements taken.

6.1.4 *Report*:

6.1.4.1 For each specimen in each direction, record the temperature of the test, specimen size, and individual measurements of maximum load in lbf/in. (kN/m), percent elongation at maximum load, breaking load in lbf/in. (kN/m), percent elongation at break, method of determining elongation, strain energy in inch-pound/in.^{2} (kNm/m^2) at maximum load, strain energy in inch-pound/in.^{2} (kNm/m^2) at break, and method of determining elongation.

6.1.4.2 Report the average and the standard deviation in each direction based on the total measurements taken of maximum load in lbf/in. (kN/m), breaking load in lbf/in. (kN/m), percent elongation at maximum load percent elongation at break, strain energy in inch-pound/in.^{2}(kNm/m^2) at maximum load and strain energy in inch-pound/in.^{2}(kNm/m^2) at break.

7. Tear Strength

7.1 This test method determines the tensile-tear strength of

[7] The estimation technique requires knowledge of the maximum tensile strength and elongation values of the test specimen. This technique can only be used for fibrous glass reinforced specimens. If the values generated by this technique are in question, verification must be made by analysis of the load-elongation curve. Strain energy for fibrous glass reinforced specimens is estimated by:

$$\text{se} = \frac{[1/2 \times \text{maximum load (lbf)} \times \text{elongation (in)}]}{1 \text{ in.} \times \text{gage length (in)}}$$

where 1 in. = sample width.

Strain energy represented as the area under the load-elongation curve may also be calculated by direct computer integration, or analog techniques such as, the trapezoidal rule, use of planimeter, or gravimetrical analysis.