



Designation: D146/D146M – 04 (Reapproved 2012)^{ε1}

Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing¹

This standard is issued under the fixed designation D146/D146M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

^{ε1} NOTE—Units information was editorially corrected in June 2012.

1. Scope

1.1 These test methods cover the sampling and examination of felts or woven fabrics, saturated or impregnated but not coated with asphaltic or coal-tar materials, for use in waterproofing or for the construction of built-up roof coverings.

1.2 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.

1.3 *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:*²

[D95 Test Method for Water in Petroleum Products and Bituminous Materials by Distillation](#)

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.

Current edition approved May 1, 2012. Published June 2012. Originally approved in 1922. Last previous edition approved in 2004 as D146 – 04. DOI: 10.1520/D0146_D0146M-04R12E01.

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.

[D645/D645M Test Method for Thickness of Paper and Paperboard](#) (Withdrawn 2010)³

[D828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus](#) (Withdrawn 2009)³

[D1079 Terminology Relating to Roofing and Waterproofing](#)

[D1682 Test Method for Breaking Load and Elongation of Textile Fabric](#) (Withdrawn 1992)³

[D1910 Methods of Test for Construction Characteristics of Woven Fabrics; Replaced by D 3773, D 3774, D 3775, D 3776, D 3882, D 3883](#) (Withdrawn 1981)³

[D4072 Test Method for Toluene-Insoluble \(TI\) Content of Tar and Pitch](#)

[D4312 Test Method for Toluene-Insoluble \(TI\) Content of Tar and Pitch \(Short Method\)](#)

3. Sampling

3.1 From each shipment of the specified saturated felt or fabric, select at random a number of rolls equal to one half the cube root of the total number of rolls in the lot. If the specification requires sampling during manufacture, consider the lot to be the planned production quantity and select the rolls at uniformly spaced time intervals throughout the production period. The minimum sample shall consist of five rolls. If the calculated number is fractional, express it as the next highest whole number. For convenience, the following table, showing the number of rolls to be selected from lots of various sizes, is given:

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

| Number of Rolls in Shipment | Number of Rolls in Sample | $g/m^2 = A/BC(oz/yd^2 = 1728 A/BC)$ (2) |
|-----------------------------|---------------------------|---|
| Up to 1 000 | 5 | |
| 1 001 to 1 728 | 6 | |
| 1 729 to 2 744 | 7 | |
| 2 745 to 4 096 | 8 | |
| 4 097 to 5 832 | 9 | |
| 5 833 to 8 000 | 10 | |
| 8 001 to 10 648 | 11 | |
| 10 649 to 13 842 | 12 | |
| 13 843 to 17 576 | 13 | |
| 17 577 to 21 952 | 14 | |

The rolls so selected constitute the representative sample used for all subsequent observations and tests pertaining to the lot of material being examined. Identify each individual roll.

EXAMINATION OF REPRESENTATIVE SAMPLE

4. Gross Mass per Roll

4.1 Weigh each roll, intact, to the nearest 100 g [$\frac{1}{4}$ lb], and record each weight as the gross mass of that roll.

5. Mass of Wrapping Material and Mandrel (Core)

5.1 Strip each roll of its wrappings and weigh it to the nearest 100 g [$\frac{1}{4}$ lb]. If mandrels (cores) are used, collect them after the rolls are unwound and weigh them together, to the nearest 100 g [$\frac{1}{4}$ lb]. Calculate the average mass of the wrappings and mandrels per roll and record.

6. Mandrels (Cores)

6.1 Determine the shape of the cross section of the mandrels (cores) and report. If circular, measure the outside diameter to the nearest 1 mm [$\frac{1}{32}$ in.]. If square, measure each outside edge to the nearest 1 mm [$\frac{1}{32}$ in.]. Measure and report the length of the mandrel projecting beyond each end of each roll to the nearest 5 mm [$\frac{3}{16}$ in.].

7. Net Mass

7.1 Subtract the average mass of the wrappings and mandrels (Section 5) from the gross mass of each roll (Section 4) and record as the net mass of each roll. Calculate the average net mass per roll of the representative sample and record as the average for the lot.

8. Appearance and Dimensions of Rolls

8.1 Unwind the rolls. Observe the workmanship and finish, and record pertinent defects. Measure and record the length of each roll to the nearest 25 mm [1 in.] and its width to the nearest 1 mm [$\frac{1}{16}$ in.]. Calculate and record the area of material contained in each roll to the nearest 0.1 m² [1 ft²].

8.2 Measure and record the width of the selvage of each roll to the nearest 1 mm [$\frac{1}{16}$ in.].

9. Net Mass per Unit Area

9.1 From the net mass (Section 7) and the dimensions (Section 8), calculate the net mass per unit area for each roll, as follows:

For Felts:

$$g/m^2 = A/BC(lb/100 ft^2 = 1200 A/BC) \quad (1)$$

For Fabrics:

where:

A = net mass of rolls, kg [lb],

B = width of material, m [ft], and

C = length of material, m [ft].

Calculate the average net mass per unit area for the rolls in the representative sample and record it as the average for the lot.

10. Selecting a Representative Specimen

10.1 Examine in detail the roll having the unit net mass closest to the average unit net mass of the lot. Discard the outside convolution and cut a specimen the full width of the roll. Make the cuts perpendicular to the sides of the roll, straight and 750 mm [30 in.] apart, to the nearest 1 mm [$\frac{1}{32}$ in.]. Collect loose material, such as sand, if any, that may become detached from the specimen. Measure the width of the specimen to the nearest 2 mm [$\frac{1}{16}$ in.]. Weigh it, together with any detached surfacing, to the nearest 1 g. Calculate the net mass per unit area as follows:

For Felts:

$$g/m^2 = 1333.3D/E(lb/ft^2 = 1.0582 D/E) \quad (3)$$

For Fabrics:

$$g/m^2 = 1333.3D/E(oz/yd^2 = 1.5238 D/E) \quad (4)$$

where:

D = mass of the specimen, g, and

E = width of the specimen, mm [in.].

The mass so determined shall be within 1 % of the average net mass per unit area (Section 9). If the specimen so selected fails to conform to this requirement, cut additional specimens from the same roll until one of the proper mass is obtained. Use this specimen for further examination as described in Sections 11 – 16.

11. Detached Comminuted Surfacing

11.1 If the material is surfaced with sand or other finely comminuted material, sweep the detached surfacing from the representative specimen with an Osborn brush (or equivalent), brushing in one direction only. Combine the comminuted material thus removed with the loose material, collected as described in Section 10, and weigh both together to the nearest 1 g. Calculate this mass in g/m² [lb/100 ft²], record, and report as detached comminuted surfacing.

NOTE 1—The Osborn No. 322 Master Duster is the brush prescribed in Section 11. It is filled with Tampico fiber bristles projecting 73 mm [2.9 in.] from its holder.⁴

12. Moisture

12.1 From the representative specimen, cut four 50- by 460-mm [2- by 18-in.] test specimens, as shown in A-1 and A-2

⁴ The sole source of supply of the apparatus (Osborn No. 322 Master Duster) known to the committee at this time is Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland, OH 44114. (If required in less than dozen lots, the order must be marked "For ASTM Test.") If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

of Fig. 1. Cut them into 25-mm [1-in.] squares and select about 50 g, at random. Weigh to the nearest 0.1 g and distill with 100 mL of solvent as prescribed in Test Method D95. Read the volume of water collected in the trap and calculate to grams on the basis that 1 mL weighs 1 g. Calculate the moisture to the nearest 0.5 % of the mass of the specimen used (including the detached comminuted surfacing, if any) and report as moisture, percentage of net mass.

NOTE 2—Any sample taken for determination of moisture shall be protected from the time of sampling against change in moisture by enclosing it in a substantially moisture-proof container.

13. Strength

13.1 Felts:

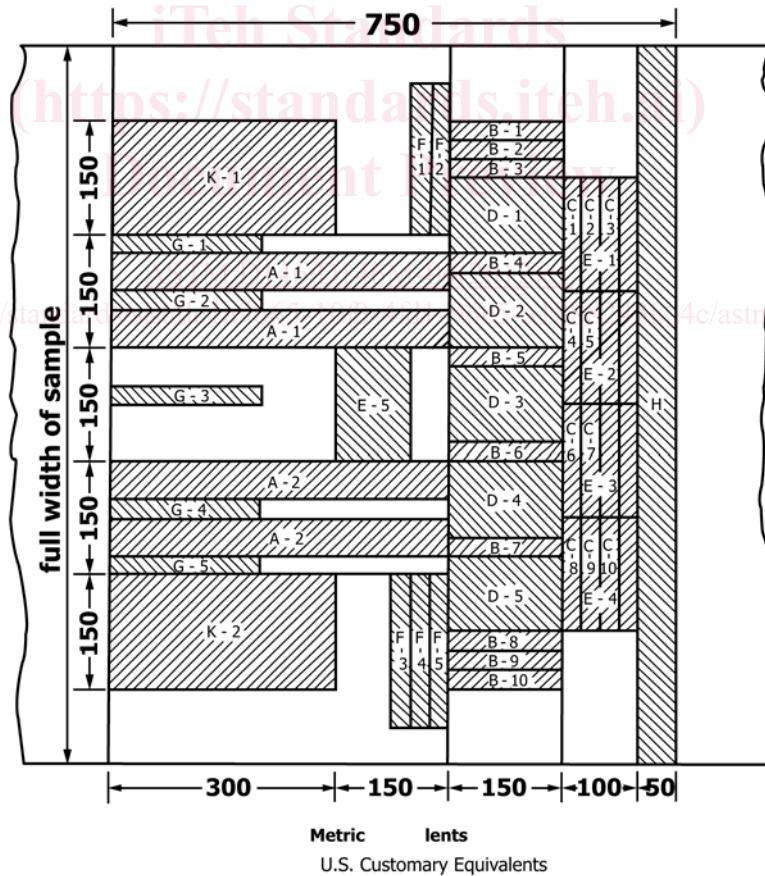
13.1.1 From the representative specimen, cut ten rectangular test strips, 25 by 150 mm [1 by 6 in.] with the fiber grain, as shown at B-1 to B-10 in Fig. 1, and ten strips across the grain, as shown at C-1 to C-10 in Fig. 1. Discard any specimens of perforated felt in which a perforation is within 1 mm [$1/32$ in.] of an edge. Condition both sets in air at $23 \pm 2^\circ\text{C}$ [$73.4 \pm 3.6^\circ\text{F}$] for at least 2 h, and test in a room maintained at the same temperature. In case of dispute, specimens shall also be conditioned in a controlled relative humidity of $50 \pm$

5 %. Determine the strength in accordance with Test Method D828, except as modified herein. At the start of the test, set apart the edges of the jaws of the clamps at 75 ± 3 mm [3.0 ± 0.1 in.]. Use a pendulum-type tensile tester with a driven clamp speed of 305 mm [12 in.]/min, or a load-cell-type tensile tester with a rate of jaw separation of 51 mm [2 in.]/min, and a response time of 1.25 s (or faster). Cut additional strips from adjacent areas of the representative specimen when needed because of discarded specimens or false breaks. False breaks occur within 1 in. of the clamping surfaces of the tensile tester jaws. Average the ten readings for each set and multiply by 0.04 to yield the strength in kN/m. Report to the nearest 0.1 kN/m for both with and across the fiber grain, respectively.

13.1.2 Precision⁵—The following data should be used for judging the acceptability of results (95 % probability) on samples from the same lot from the same supplier:

13.1.2.1 Repeatability—Duplicate results by the same operator should not be considered suspect unless they differ by more than the following amount:

⁵ Supporting data are available from ASTM International Headquarters. Request RR:D08-1005.



NOTE 1—All dimensions are in millimetres.

FIG. 1 Location of Test Pieces in Representative Specimen