Designation: D2646 – 11

Standard Test Methods for Backing Fabric Characteristics of Pile Yarn Floor Coverings[1]

This standard is issued under the fixed designation D2646; 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 listed as follows for testing woven, knitted and nonwoven backing fabrics designed for use in the manufacture of pile yarn floor coverings. The procedures appear in the following order:

	Section
Bow and Skewness of Woven Fabrics	8
Breaking Force of Woven and Nonwoven Fabrics	15
Breaking Force After Tufting of Woven and Nonwoven Fabrics	16
Extractable Matter	9
Fabric Count of Woven Fabrics	12
Fabric Count of Knitted Fabrics	13
Length of Woven Fabrics	11
Mass per Unit Area (Weight) of Woven Fabrics	14
Shrinkage—Hot Wet Method	17
Shrinkage—Hot Dry Method	18
Width of Woven Fabrics	10

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered 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]

D123 Terminology Relating to Textiles
D1776 Practice for Conditioning and Testing Textiles
D2257 Test Method for Extractable Matter in Textiles
D3773 Test Methods for Length of Woven Fabric
D3774 Test Method for Width of Textile Fabric
D3775 Test Method for Warp (End) and Filling (Pick) Count of Woven Fabrics
D3776 Test Methods for Mass Per Unit Area (Weight) of Fabric
D3882 Test Method for Bow and Skew in Woven and Knitted Fabrics
D3887 Specification for Tolerances for Knitted Fabrics
D5034 Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
D5684 Terminology Relating to Pile Floor Coverings

3. Terminology

3.1 For definitions of terms relating to Pile Floor Coverings, D13.21, refer to Terminology D5684.

3.1.1 The following terms are relevant to this standard: backing fabric, carpet, dents per unit width, extractable matter, finished, finished pile yarn floor covering, floor covering, nonwoven fabric, pile, pile yarn floor covering, shrinkage, textile floor covering, tufted fabric, wale, wires per unit width.

3.2 For all other terminology related to textiles, refer to Terminology D123.

4. Summary of Test Methods, General

4.1 A summary of the directions prescribed for the determination of specific properties is stated in the appropriate sections of specific test methods.

5. Significance and Use

5.1 These test methods may be used for acceptance testing of commercial shipments; however, caution is advised because information about between interlaboratory precision is incomplete. Comparative tests as directed in 5.1.1 may be advisable.

5.1.1 If there are differences of practical significance between reported test results for two laboratories (or more), comparative tests should be performed to determine if there is statistical bias between them using competent statistical assistance. As a minimum, use test samples for such comparative tests that are as homogeneous as possible, drawn from the same lot of material as the samples that resulted in the disparate results during initial testing, and that are randomly assigned in equal numbers to each laboratory for testing. The test results from the laboratories should be compared using statistical test for unpaired data at a probability level chosen prior to the testing series. If a bias is found either its cause must be found and corrected, or future test results for that material must be adjusted in consideration of the known bias.

[1] These test methods are under the jurisdiction of ASTM Committee D13 on Textiles and are the direct responsibility of Subcommittee D13.21 on Pile Floor Coverings.

Current edition approved Aug. 1, 2011. Published September 2011. Originally approved in 1967. Last previous edition approved in 2005 as D2646 – 05. DOI: 10.1520/D2646-11.

[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.

5.2 These test methods are useful to evaluate quality and cost control during the manufacture of pile yarn floor covering.

5.3 The significance and uses of particular properties and test methods are discussed in the appropriate sections of the specified test methods.

6. Sampling

6.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls or pieces, as directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider the rolls or pieces of material to be the primary sampling units. In the absence of such agreement, take one roll or piece from the lot to be tested.

NOTE 1—An adequate specification or other agreement between the purchaser and the supplier requires taking into account the variability between rolls or pieces of floor covering and between specimens from a roll or pieces of floor covering to provide a sampling plan with a meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

6.2 *Laboratory Sample*—For acceptance testing, take a sample from a roll approximately 1.5 yd (1.5 m) long extending the width of the material from each roll or piece in the lot, unless otherwise specified in the specific test method. For rolls of floor covering, take a sample that will exclude fabric from the outer wrap of the roll or the inner wrap around the core.

6.3 *Test Specimens*—From each laboratory sampling unit, take three specimens with the longer direction parallel to the machine direction, unless otherwise specified in the specific test method. Consider the long direction as the direction of test.

7. Conditioning

7.1 Condition the specimens as directed in Practice D1776 D1776in the standard atmosphere for testing textiles, which is 21 ± 1°C (70 ± 2°F) and 65 ± 2 % relative humidity, for 24 h or until the specimen mass changes no more than 0.1 % in 2 h, except the specimens used for the determination of bow and skew (Section 8), width (Section 10), length (Section 11), and fabric count (Section 12), which may be tested without either preconditioning or conditioning. Specimens for the tests listed may be merely air-dried under prevailing room conditions.

NOTE 2—Using these conditions may not result in the product obtaining moisture and temperature equilibrium.

TEST METHODS

8. Bow and Skewness in Woven and Knitted Fabrics

8.1 Determine the bow and skewness of backing fabrics for pile yarn floor coverings as directed in Test Method D3882.

9. Extractable Matter

9.1 Determine the extractable matter that was added to the backing fabric for pile yarn floor covering as directed in Test Method D2257.

10. Width of Woven Fabrics

10.1 Determine the width of woven backing fabrics for pile yarn floor coverings as directed in Test Methods D3774. The choice of the test options of measurement in determining width shall be agreed upon between the purchaser and the supplier.

10.2 For knitted fabrics, refer to Test Method D3887.

11. Length of Woven Fabrics

11.1 Determine the length of woven fabrics used as backing fabrics in pile yarn floor coverings as directed in Test Methods D3773. The choice of the test options of measurement in determining the fabric length shall be agreed upon between the purchaser and the supplier.

11.2 For knitted fabrics, refer to Test Method D3887.

12. Fabric Count of Woven Fabrics

12.1 Determine the fabric count for woven backing fabrics for pile yarn floor coverings as directed in Test Method D3775.

13. Fabric Count of Knitted Fabrics

13.1 Determine the fabric count for knitted backing fabrics for pile yarn floor coverings as directed in Test Method D3887.

14. Mass Per Unit Area (Weight) of Woven Fabrics

14.1 Determine the mass per unit area (weight) of woven fabric for backing fabrics for pile yarn floor coverings as directed in Test Methods D3776.

14.2 For knitted fabrics, refer to Test Method D3887.

15. Breaking Force of Woven and Nonwoven Fabrics

15.1 Determine the breaking force of woven and nonwoven backing fabrics, of pile yarn floor coverings as directed in Test Methods D5034 using a constant-rate-of-extension (CRE) type tensile testing machine with the speed of the pulling jaw 12 ± 0.5 in./min (300 ± 10 mm/min).

16. Breaking Force After Tufting of Woven and Nonwoven Fabrics

16.1 Determine the breaking force of woven and nonwoven backing fabrics of pile yarn floor coverings as directed in Test Methods D5034 using a constant-rate-of-extension (CRE) type tensile testing machine with the speed of the pulling jaw 12 ± 0.5 in./min (300 ± 10 mm/min).

NOTE 3—The tuft conditions with respect to pile height, gage, stitches per inch (stitches per millimetre), pile yarn characteristics, and tufting needles style must be agreed upon by all parties concerned. Using agreed-upon conditions, tuft sufficient backing fabric to secure the required number of test specimens.

17. Shrinkage—Hot Wet Method

17.1 *Scope:*

17.1.1 This test method determines the shrinkage of woven, nonwoven, or knitted backing fabrics for pile yarn floor covering after exposure to hot wet conditions.

17.2 *Summary of Test Method:*

17.2.1 The backing fabric warp yarns and filling picks are first measured to a specific length. The fabric then is immersed in hot distilled or deionized water and remeasured. The shrinkage is calculated as the change in length expressed as a percentage of the length before immersion.

17.3 *Significance and Use:*

17.3.1 Test Methods D2646 for testing backing fabric shrinkage in hot wet conditions is considered satisfactory for acceptance testing of commercial shipments of fabric because the test method has been used extensively in the trade for that purpose.

17.4 *Apparatus:*

17.4.1 *Metal or Glass Pan,* approximately 13 by 13 in. (330 by 330 mm) by 1 in. (25 mm) deep.

17.4.2 *Circulating Air Oven,* controlled at 158 ± 4°F (70 ± 2°C).

17.4.3 *Staple Gun,* such as those used for stapling stationery or any other device that will produce a suitable waterproof mark.

17.4.4 *Reagent,* anionic wetting agent such as sodium lauryl sulphate.

17.5 *Number of Specimens:*

17.5.1 Take three specimens approximately 12 by 12 in. (300 by 300 mm). Take no specimen closer than 10 in. (250 mm) to the selvage and no closer than 1 yd (m) from the end of the roll. For woven fabrics take no specimen containing the same warp yarns or the same filling picks and cut all specimens parallel to the warp and the filling.

17.6 *Preparation of Specimens:*

17.6.1 Lay out the specimens without tension on a flat, horizontal surface, taking care that there are no wrinkles or creases. Place a staple in the specimen or a waterproof mark about 1 in. (25 mm) on it from one edge. Measure 10 ± 0.1 in. (250 ± 2 mm) directly along one principle direction of the specimen and place a second staple or mark. Repeat this procedure along the other principle direction.

17.7 *Procedure:*

17.7.1 Place the specimens in the pan and cover them with a solution of 0.1 % wetting agent in distilled or deionized water at 77 ± 2°C (170 ± 4°F) to a depth of approximately 1 in. (25 mm), and soak the specimens for 1 h.

17.7.2 Drain off the wetting solution. Place the specimens on paper towels or blotting paper to remove the excess solution. **Do not squeeze or press.**

17.7.3 Place the specimens flat on a screen and dry in an oven for at least 4 h at 70 ± 2°C (158 ± 4°F). Remove the specimens from the oven and recondition as directed in Practice D1776. Remeasure the specimens in both directions as directed in 22.1.

17.8 *Calculation:*

17.8.1 Average the measurements of the distance between the marks for each direction of the specimen before and after treatment. Calculate the shrinkage in percent by Eq 1 and Eq 2 as follows:

$$\text{Shrinkage, } \% = [(L_1 - L_f)/L_1] \times 100 \quad (1)$$

$$\text{Shrinkage, } \% = [(W_1 - W_f)/W_1] \times 100 \quad (2)$$

where:

L_1 = average original length,
L_f = average final length,
W_1 = average original width, and
W_f = average final width.

17.9 *Report:*

17.9.1 State that the tests were performed as directed in Test Methods D2646 for shrinkage to hot wet conditions and report the following information:

17.9.2 The shrinkage in the form of shrinkage or growth, and

17.9.3 The percent change in length and in width for each laboratory sample.

17.10 *Precision and Bias:*

17.10.1 *Precision*—Based on limited information from within (one) laboratory, two technicians, the repeatability standard deviation and the 95 % repeatability limits are approximately 0.153 and 0.429 respectively. The intermediate precision standard deviations and the 95 % intermediate precision limits are approximately 0.197 and 0.552 respectively.

17.10.2 *Bias*—The procedure for shrinkage—hot wet method for backing fabrics of pile yarn floor coverings has no known bias and may be used for referee purposes.

18. Shrinkage—Hot Dry Method

18.1 *Scope:*

18.1.1 This test method determines the shrinkage of woven, nonwoven, or knitted backing fabrics for pile yarn floor covering after exposure to hot dry conditions.

18.2 *Summary of Test Method:*

18.2.1 The backing fabric warp yarns and filling picks are first measured to a specific length. The fabric is then exposed to dry heat and remeasured. The shrinkage is calculated as the change in length expressed as a percentage of the length before exposure.

18.3 *Significance and Use:*

18.3.1 Test Methods D2646 for testing backing fabric shrinkage in hot dry conditions is considered satisfactory for acceptance testing of commercial shipments of fabric because the test method has been used extensively in the trade for that purpose.

18.4 *Apparatus:*

18.4.1 *Circulating Air Oven,* maintained at specified temperature within ± 2°C (± 4°F).

18.4.2 *Staple Gun,* such as those used for stapling stationery or any other device that will produce a suitable waterproof mark.

18.5 *Number of Specimens:*

18.5.1 Take three specimens as directed in 17.5.1.

18.6 *Preparation of Specimens:*

18.6.1 Prepare specimens as directed in 17.6.1.

18.7 *Procedure:*

18.7.1 Place the specimens on a perforated shelf in an oven controlled at a specified or agreed-upon temperature within ± 2°C (± 4°F) and heat for 15 min. In the absence of a specified or agreed-upon temperature, use 125 ± 2°C (257 ± 4°F).

18.7.2 Remove specimens from the oven and condition as directed in Test Method D1776.

18.7.3 Remeasure the specimens as directed in 17.6.1.

18.8 *Calculation:*

18.8.1 Calculate the results as directed in 17.8.1.

18.9 *Report:*

18.9.1 Report the information and results as directed in 17.9.

18.10 *Precision and Bias*[3]:

18.10.1 *Precision*—Based on limited information from three laboratories, one technician per laboratory, the repeatability standard deviation and the 95 % repeatability limits are 0.191 and 0.535 respectively. The reproducibility standard deviation and the 95 % reproducibility limits are 0.337 and 0.944.

18.10.2 *Bias*—The procedure for shrinkage—hot dry method for backing fabrics of pile yarn floor coverings has no known bias and may be used for referee purposes.

[3] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D13-1099.

19. Keywords

19.1 carpet; extractable matter; knitted fabric; nonwoven fabric; pile yarn floor covering; primary backing; secondary backing; shrinkage; woven fabric