



Designation: D7983 – 17

# Standard Test Method for Shrinkage of Carpet Backing Fabrics<sup>1</sup>

This standard is issued under the fixed designation D7983; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers the procedure for evaluating shrinkage, in both wet and dry conditions, of woven, knitted and nonwoven backing fabrics designed for use in the manufacture of pile yarn floor coverings. Determination of carpet backing shrinkage was previously contained within Test Methods [D2646](#). For consistency, Subcommittee D13.21 extracted this portion and created a separate test method.

1.2 The values stated in inch-pound units are to be regarded as the 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:*<sup>2</sup>

[D123 Terminology Relating to Textiles](#)

[D1776 Practice for Conditioning and Testing Textiles](#)

[D2646 Test Methods for Backing Fabric Characteristics of Pile Yarn Floor Coverings](#)

[D5684 Terminology Relating to Pile Floor Coverings](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

## 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, nonwoven fabric, shrinkage.

3.1.2 For all other terminology related to textiles, refer to Terminology [D123](#).

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee [D13](#) on Textiles and is the direct responsibility of Subcommittee [D13.21](#) on Pile Floor Coverings. Current edition approved March 1, 2017. Published March 2017. DOI: 10.1520/D7983-17

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

## 4. Summary of Test Method

4.1 *HOT WET Procedure*—The backing fabric is first measured to a specific length in each principle direction. The fabric then is immersed in hot distilled or deionized water, dried, and remeasured. The shrinkage is calculated as the change in length expressed as a percentage of the length before immersion.

4.2 *HOT DRY Procedure*—The backing fabric is first measured to a specific length in each principle direction. 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.

## 5. Significance and Use

5.1 This test method can be useful in characterizing and comparing shrinkage properties of both primary and secondary backing fabrics. This test method is considered satisfactory for acceptance testing of commercial shipments because current estimates of between-laboratory precision are acceptable, and this test method is commonly used in the trade for acceptance testing.

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.

## 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. 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 as described in 8.2.1.

**7. Conditioning**

7.1 Condition the specimens as directed in Practice D1776 in the standard atmosphere for testing textiles.

**8. Procedure—Option 1: Hot Water Method**

8.1 *Apparatus:*

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

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

8.1.3 *Waterproof Marker, or Staple Gun*, or any other device that will produce a suitable waterproof mark.

8.1.4 *Reagent*, sodium lauryl sulfate.

8.1.5 *Ruler or Digital Measurement Device*, capable of measuring to 0.1 in. (2 mm).

8.2 *Number of Specimens:*

8.2.1 From the 1.5 yd (1.5 m) fabric sample, cut three specimens approximately 12 by 12 in. (30 by 30 cm) each, spaced across the width 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. Take no specimen closer than 10 in. (25 cm) to the selvage and no closer than 1 yd (1 m) from the end of the roll. Identify the principle directions of each specimen if necessary.

8.3 *Preparation of Specimens:*

8.3.1 Lay out the specimens without tension on a flat, horizontal surface, taking care that there are no wrinkles or creases. Using a ruler or a suitable template, place waterproof marks at locations along each specimen such that two equidistant spans measuring 10 ± 0.1 in. (250 ± 2 mm) are marked in each principle direction. Within each specimen, the marked spans should be located at positions 1 in. (25 mm) from each ledge (see Fig. 1). Identify the principle directions of the material if necessary and mark a corner as a starting place.

8.3.2 Using a ruler or measurement device, begin at the starting corner and measure the two marked spans in each principle direction to the nearest 0.1 in. (2 mm). Avoid stretching or applying excessive tension to the fabric during measurement. Record these measurements as original lengths.

8.4 *Procedure:*

8.4.1 Place the specimens in the pan and cover them to a depth of approximately 1 in. (25 mm) with a solution of 0.1 % wetting agent in tap water brought to an initial temperature of 170 ± 4 °F (77 ± 2 °C). Soak the specimen for 1 h.

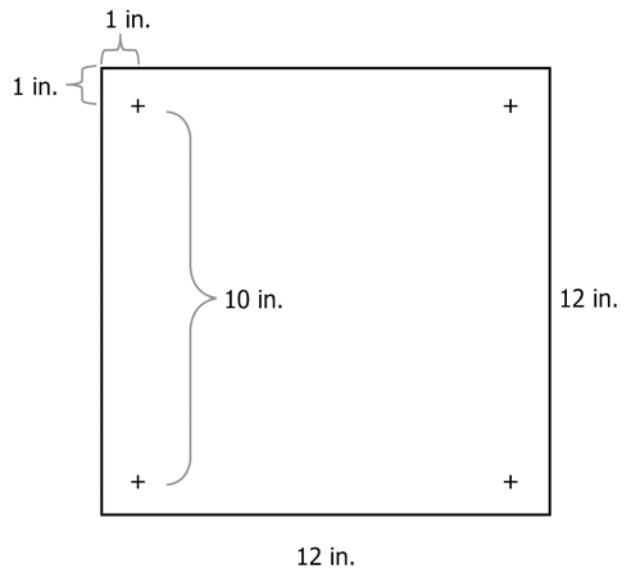


FIG. 1 Diagram for Marking

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

8.4.3 Place the specimens flat on a screen and dry in an oven for at least 4 h at 158 ± 4 °F (70 ± 2 °C). Remove the specimens from the oven and allow them to return to ambient room conditions.

8.4.4 Re-measure the marked spans of the specimens in both directions as directed in 8.3.2, and record the measurements as final lengths.

8.5 *Calculation:*

8.5.1 For each principle direction, average the measurements of the distance between the marks of the specimen before and after treatment. For each specimen, calculate the shrinkage in percent by Eq 1 as follows:

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

where:

$L_1$  = average original length, and

$L_f$  = average final length.

8.6 *Report:*

8.6.1 State that the tests were performed as directed in Test Method D7983 Option 1, for shrinkage to hot water conditions and report the following information:

8.6.2 The dimensional change in the form of shrinkage or growth,

8.6.3 The percent change, to the nearest 0.1 %, in each principle fabric direction for each laboratory sample (average of three specimens), and

8.6.4 Any deviations from the recommended durations or conditions.

**9. Procedure—Option 2: Dry Oven Method**

9.1 *Apparatus:*

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

9.1.2 *Marker, or Staple Gun*, or any other device that will produce a suitable permanent mark.

9.2 *Number of Specimens:*

9.2.1 Take three specimens as directed in 8.2.

9.3 *Preparation of Specimens:*

9.3.1 Prepare specimens as directed in 8.3.

9.4 *Procedure:*

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

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

9.4.3 Re-measure the specimens as directed in 8.4.4, stating that the test was performed as directed according to Option 2, dry oven method.

9.5 *Calculation:*

9.5.1 Calculate the results as directed in 8.5.

9.6 *Report:*

9.6.1 Report the information and results as directed in 8.6.

10. Precision and Bias

10.1 The precision of this test method is based on an interlaboratory study of WK33654, New Standard Test Method for Shrinkage of Carpet Backing Fabrics, conducted in 2013. Six laboratories participated in this study. Each of the six laboratories was asked to report triplicate results for three different materials being tested for shrinkage in two directions. Every “test result” reported represents an individual determination. Practice E691 was followed for the design and analysis of the data; the details are given in an ASTM Research Report.<sup>3</sup>

10.1.1 *Repeatability (r)*—The difference between repetitive results obtained by the same operator in a given laboratory applying the same test method with the same apparatus under constant operating conditions on identical test material within short intervals of time would in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

10.1.1.1 Repeatability can be interpreted as the maximum difference between two results, obtained under repeatability conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

10.1.1.2 Repeatability limits are listed in Tables 1-4.

10.1.2 *Reproducibility (R)*—The difference between two single and independent results obtained by different operators applying the same test method in different laboratories using different apparatus on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

10.1.2.1 Reproducibility can be interpreted as the maximum difference between two results, obtained under reproducibility

<sup>3</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D13-1144. Contact ASTM Customer Service at service@astm.org.

TABLE 1 Percent Fabric Shrinkage, Wet (machine-direction)

	Average <sup>A</sup> $\bar{x}$	Repeat- ability Standard Deviation $s_r$	Repro- ducibility Standard Deviation $s_R$	Repeat- ability Limit $r$	Repro- ducibility Limit $R$
Woven polypropylene 18-pick primary	0.49	0.22	0.31	0.61	0.86
Woven polypropylene 5-pick secondary	1.25	0.36	0.69	1.02	1.93
Woven polypropylene 12-pick secondary	1.42	0.20	0.36	0.55	1.01

<sup>A</sup> The average of the laboratories' calculated averages.

TABLE 2 Percent Fabric Shrinkage, Dry (machine-direction)

	Average <sup>A</sup> $\bar{x}$	Repeat- ability Standard Deviation $s_r$	Repro- ducibility Standard Deviation $s_R$	Repeat- ability Limit $r$	Repro- ducibility Limit $R$
Woven polypropylene 18-pick primary	2.06	0.25	0.71	0.70	1.98
Nonwoven polyester primary	1.31	0.17	0.30	0.48	0.83
Woven polypropylene 12-pick secondary	4.14	0.53	1.65	1.49	4.61

<sup>A</sup> The average of the laboratories' calculated averages.

TABLE 3 Percent Fabric Shrinkage, Wet (cross machine-direction)

	Average <sup>A</sup> $\bar{x}$	Repeat- ability Standard Deviation $s_r$	Repro- ducibility Standard Deviation $s_R$	Repeat- ability Limit $r$	Repro- ducibility Limit $R$
Woven polypropylene 18-pick primary	0.21	0.09	0.25	0.26	0.70
Woven polypropylene 5-pick secondary	1.86	0.37	0.46	1.04	1.30
Woven polypropylene 12-pick secondary	1.64	0.19	0.38	0.53	1.08

<sup>A</sup> The average of the laboratories' calculated averages.

conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

10.1.2.2 Reproducibility limits are listed in Tables 1-4.

**TABLE 4 Percent Fabric Shrinkage, Dry (cross machine-direction)**

	Average <sup>A</sup> $\bar{x}$	Repeat- ability Standard Deviation $s_r$	Repro- ducibility Standard Deviation $s_R$	Repeat- ability Limit $r$	Repro- ducibility Limit $R$
Woven polypropylene 18-pick primary	1.11	0.26	0.47	0.73	1.31
Nonwoven polyester primary	0.33	0.12	0.23	0.34	0.65
Woven polypropylene 8-pick secondary	3.85	0.68	1.23	1.90	3.43

<sup>A</sup> The average of the laboratories' calculated averages.

10.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E177.

10.1.4 Any judgment in accordance with 10.1.1 and 10.1.2 would have an approximate 95 % probability of being correct.

10.2 *Bias*—At the time of this study, there was no accepted reference material suitable for determining the bias for this test method, therefore no statement on bias is being made.

10.3 The precision statement was determined through statistical examination of 216 results, from six laboratories, on three materials.

NOTE 2—To judge the equivalency of two test results, it is recommended to choose the sample type closest in characteristics to your test material.

## 11. Keywords

11.1 carpet; knitted fabric; nonwoven fabric; pile yarn floor covering; primary backing; secondary backing; shrinkage; woven fabric

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