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Standard Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings[1]

This standard is issued under the fixed designation D6859; 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 This test method covers the determination of pile thickness of finished level pile yarn floor covering using a thickness measuring instrument having a stationary surface (platen), a circular pressure foot under specified force, and capable of being moved vertically above the platen.

~~1.2This test method is applicable only to finished level loop and cut pile constructions with tuft heights less than 6 mm (0.25 in.).~~

1.2 This test method is applicable only to finished level loop, cutpile and cut & loop constructions with tuft heights less than 0.25 in. (6 mm).

NOTE 1—Determination of pile thickness of finished level pile yarn floor coverings was previously contained within Test Methods D418. For user convenience, Subcommittee D13.21 subdivided Test Methods D418 into separate standards of which this test method is one.

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1.3 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.

1.4 *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 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

D418 Test Methods of Testing Pile Yarn Floor Covering Construction

D1776 Practice for Conditioning and Testing Textiles

D5684 Terminology Relating to Pile Floor Coverings

D5823 Test Method for Tuft Height of Pile Floor Coverings

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

3. Terminology

3.1 For definitions of terms relating to Pile Floor Coverings, D13.21, refer to Terminology D5684. See also Annex A1.

3.1.1 The following terms are relevant to this standard: carpet, finished, finished pile yarn floor covering, floor covering, pile, pile thickness, pile yarn floor covering, pitch. primary backing, shorn pile, stubble, stubble height, textile floor covering, tufted fabric.

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

4. Summary of Test Method

4.1 The total thickness of an unsheared strip specimen is measured as the distance between two parallel plates exerting a specified pressure on the test specimen. The pile yarn of the strip specimen is sheared down to a stubble. The backing thickness of the sheared strip specimen is measured as the distance between two parallel plates exerting a different specified pressure on the sheared strip specimen. The difference between the two measurements is the pile thickness.

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[1] 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.

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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.

5. Significance and Use

5.1 The determination of pile thickness of level pile yarn floor covering is useful in quality and cost control during the manufacture of pile yarn floor covering. The appearance and performance may be affected by changes in pile thickness of pile yarn floor coverings. 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.

5.2 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 a statistical bias between them, using competent statistical assistance. As a minimum, use the samples for such comparative tests that are as homogenous as possible, drawn from the same lot of material as the samples that resulted in disparate results during initial testing and randomly assigned in equal numbers to each laboratory. The test results from the laboratories involved should be compared using a statistical test for unpaired data, 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 Units and Test Specimens

6.1 *Sampling Units*:

6.1.1 *Coated Floor Covering*—The basic sampling unit of coated floor covering is a shipping roll. The number of shipping rolls obtained from each production roll ranges from one to over ten.

6.2 *Lot Sample*—Take a lot sample as directed in Practice E122 when statistical knowledge of the product variability and test method precision is available, and a decision has been made on the maximum deviation that can be tolerated between the estimate to be made from the sample and the result that would be obtained by measuring every sampling unit of the lot. Otherwise the number of sampling units in a lot sample and the use of the test results obtained from the individual test samples shall be in accordance with the manufacturer's quality control program or with the specification agreed upon between the purchaser and supplier.

6.3 *Laboratory Sampling Unit*—A laboratory sampling unit shall consist of a full width section of floor covering cut from one end of each roll in the lot sample and shall be at least ~~100 mm (4 in.)~~4 in. (100 mm) longer than the specimens required for the tests being conducted. Do not cut a laboratory sampling unit of coated floor covering from a seam end of a production roll.

6.4 *Test Specimens*:

6.4.1 A test specimen is a designated area cut from a laboratory sampling unit. For laboratory sampling units ~~3000 mm (120 in.)~~120 in. (3000 mm) wide or wider, three test specimens are required for a test method, one at each edge no nearer to the edge than 5 % of the total floor covering width and one in the middle portion of laboratory sampling unit. For laboratory sampling units at least ~~1500 mm (60 in.)~~60 in. (1500 mm) wide but less than ~~3000 mm (120 in.),~~120 in. (3000 mm), take two test specimens, one at each edge no nearer to the edge than 5 % of the total floor covering width. For laboratory sampling units less than ~~1500 mm (120 in.)~~60 in. (1500 mm) wide, take one test specimen from the middle.

6.4.2 Where it is known that systematic variations in a floor covering characteristic may occur in bands ~~460 mm (18 in.)~~18 in. (460 mm) or more in width, as with a modular pattern device having separate controls or adjustments for each module, take test specimens from the middle of each band.

6.4.3 When a full-width laboratory sampling unit is not available, take test specimens as directed in 6.4, and state in the report the width available and the number of test specimens taken.

7. Apparatus

7.1 *Shear or Clipper*, capable of shearing close enough to the backing to leave a stubble of no more than ~~1.3 mm (0.05 in.).~~ 0.05 in. (1.3 mm).

7.2 *Thickness Measuring Instrument*:

7.2.1 Having a stationary surface (plate) on which to place the specimen, and a presser foot capable of being moved vertically above the plate, at least ~~25 mm (1 in.)~~1 in. (25 mm) from the plate.

7.2.2 Having two interchangeable presser feet; one ~~25.40~~1.000 ± ~~0.03 mm (1.000~~0.001 in. (25.40 ± ~~0.001 in.)~~0.03 mm) diameter, the other ~~57.15~~2.250 ± ~~0.003 mm (2.250~~0.001 in. (57.15 ± ~~0.001 in.)~~0.003 mm) in diameter.

7.2.3 Having means for indicating the vertical distance between the presser foot and the plate to the nearest ~~0.03 mm (0.001 in.)~~0.001 in. (0.03 mm) and capable of developing and indicating a force up to ~~2.77 n (0.6 lbf)~~0.6 lbf (2.77 n) between the presser foot and the plate.

8. Conditioning

8.1 Condition the test sample or test specimens in the standard atmosphere for testing textiles, that is ~~21~~70 ± ~~1°C (70~~2°F (21 ± ~~2°F)~~1°C) at 65 ± 2 % relative humidity, 12 h or until the mass changes no more than 0.1 % in 2 h as directed in Practice D1776.

9. Procedure

9.1 *Total Thickness*:

9.1.1 Select the number and location of the test specimens as directed in Section 6. Prepare the test specimens according to the procedures listed in Section 8. The test specimens shall be ~~250~~10.0 ± ~~3 mm (10.0~~0.1 in. (250 ± ~~0.1 in.)~~3 mm) in the lengthwise

direction and ~~320~~12.5 ± ~~3 mm (12.5~~0.1 in. (320 ± ~~0.1 in.)~~3 mm) in the widthwise direction. The test specimens may be prepared according to the examples in Appendix X1.

9.1.2 Select a strip specimen from each of the test specimens. The strip specimens shall be ~~250~~10.0 ± ~~3 mm (10.0~~0.1 in. (250 ± ~~0.1 in.)~~3 mm) in the lengthwise direction and ~~64~~2.5 ± ~~3 mm (2.5~~0.1 in. (64 ± ~~0.1 in.)~~3 mm) in the widthwise direction and shall be conditioned as directed in Section 8.

9.1.3 Attach the ~~57.15 mm (2.250 in.)~~2.250 in. (57.15 mm) diameter presser foot loosely to the moveable stem or head of the instrument and bring the diameter presser foot into firm contact with the plate. Tighten the presser foot on the stem.

9.1.4 Check the instrument zero by lowering the presser foot into contact with the plate until the indicated pressure increases to the pressure to be used in measuring the indicated distance between the foot and the plate, which must read 0 ± ~~0.03 mm~~0.001 in. (± ~~0.001 in.)~~.0.03 mm). If the reading is not within this range, make an adjustment appropriate to the type of instrument being used. Verify the instrument with calibrated thickness blocks.

9.1.5 For each strip specimen, raise the presser foot and center the specimen, pile face up, on the plate under the foot. Lower the presser foot slowly (take about 5 s to apply full load) onto the pile surface until a pressure of ~~689~~0.100 ± ~~21 Pa (0.100~~0.003 psi (689 ± ~~0.003 psi)~~21 Pa) is exerted on the specimen. Read the distance between the presser foot and the plate to the nearest ~~0.03 mm (0.001 in.),~~0.001 in. (0.03 mm), determine the total thickness in three different areas for each strip specimen and record the average as the total thickness, *T*.

9.1.6 Shear the pile on the strip specimen down to a stubble measuring approximately ~~1.3 mm (0.05 in.).~~ 0.05 in. (1.3 mm).

NOTE 2—Both adhesive projections and a fiber layer needle punched to the surface of the backing can interfere with shearing the pile down to a stubble of ~~1.3 mm (0.05 in.).~~0.05 in. (1.3 mm). Therefore, a seven and one half fold increase in pressure in measuring the thickness of the stubble specimen is used to level out minor variations in stubble height.

9.2 *Backing Thickness*:

9.2.1 Attach the ~~25.40 mm (1.000 in.)~~1.000 in. (25.40 mm) diameter presser foot loosely to the stem and bring the presser foot into firm contact with the plate. Tighten the presser foot on the stem. Check the instrument zero as directed in 9.1.4.

9.2.2 For each stubble specimen, raise the presser foot and center the specimen, stubble side up, on the plate. Lower the presser foot onto the stubble surface until a pressure of ~~517~~0.75 ± ~~69 Pa (0.75~~0.01 psi (5170 ± ~~0.01 psi)~~69 Pa) is exerted on the stubble specimen. Read the distance between the presser foot and the plate to the nearest ~~0.03 mm (0.01 in.),~~0.01 in. (0.03 mm), determine the backing thickness in three different areas for of each strip specimen and record the average as the backing thickness, *B*.

10. Calculation

10.1 A test result is the average of the measurements made on a set of test specimens described in 6.4. In this method, directions are given only for obtaining a test result from one test specimen. The value representative of the lot being sampled will be the average of the test results from each laboratory sampling unit.

10.2 For each strip specimen calculate the pile thickness using Eq 1.

$$P = T - B \quad (1)$$

where:

P = ~~pile thickness, mm (in.),~~ pile thickness, in. (mm),
T = ~~average total thickness, mm (in.), and~~ average total thickness, in. (mm), and
B = ~~average backing thickness, mm (in.).~~average backing thickness, in. (mm).

10.2.1 Calculate the average values of pile thickness and total thickness from average values obtained on individual strip specimens to the nearest ~~0.03 mm (0.01 in.)~~0.01 in. (0.03 mm) for each laboratory sampling unit.

10.3 Calculate the average values of pile thickness and total thickness for the lot from average values obtained from all laboratory sampling units in the lot to the nearest ~~0.3 mm (0.01 in.).~~ 0.01 in. (0.3 mm).

11. Report

11.1 State the test sample was tested as directed in Test Method D6859 for determining the pile thickness of level pile yarn floor covering. Describe the material or product sampled and the method of sampling used.

11.2 Report the average pile thickness and when required, total thickness, for each laboratory sampling unit and for the lot.

TABLE 1 Components of Variance Expressed as Standard Deviations[A]

Variance Component	Single Material Comparisons for Loop Pile Carpet	Single Material Comparisons for Cut Pile Carpet
Within Laboratory	0.002	0.005
Between Laboratory	0.011	0.006

[A] The square roots of the components of variance are being reported to express the variability in the appropriate units of measure rather than as the squares of those units of measure.