Designation: D6283 – 12

Standard Test Method for Tuft Element Length of Uncoated Pile Yarn Floor Coverings[1]

This standard is issued under the fixed designation D6283; 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 measurement of tuft length and pile yarn length of uncoated pile floor coverings.

1.2 Usually the tuft elements measured as directed in this test method will each be bound at only one binding site, but this test method also may be used for tuft elements bound at more than one binding site, provided that every tuft element measured is bound at the same number of binding sites.

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 practice 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 practice 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

D2904 Practice for Interlaboratory Testing of a Textile Test Method that Produces Normally Distributed Data (Withdrawn 2008)[3]

D2906 Practice for Statements on Precision and Bias for Textiles (Withdrawn 2008)[3]

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: carpet, cut pile yarn floor covering, finished, finished pile yarn floor covering, floor covering, loop pile yarn floor covering, pile, pile yarn floor covering, textile floor covering, tuft, tuft element, tuft leg, tuft length, tufted fabric.

3.2 For definitions of other terms related to textiles, refer to Terminology D123.

4. Summary of Test Method

4.1 The individual tuft elements of like character (cut or loop, and height) are removed from the test sample and placed, one at a time, in a grooved holder that maintains the tuft fibers in a straight line while the length of the tuft element is measured with a graduated scale and a magnifying glass.

4.2 In loop pile yarn floor covering, adjacent elements are first separated by cutting the connecting loops at the midpoint of the bend with sharp scissors before the tuft elements are withdrawn from the backing fabric.

5. Significance and Use

5.1 The determination of the tuft length of pile yarn floor covering is useful in quality and cost control during the manufacture of pile yarn floor covering. Both appearance and performance can be affected by changes in this characteristic.

5.2 In case there are disputable differences between reported test results for two or more laboratories, comparative tests should be performed to determine if there is a statistical bias between them, using competent statistical assistance. At a minimum, test samples should be used that are as homogeneous as possible, that are drawn from the material from which disputable test results were obtained, and that are assigned randomly in equal numbers to each laboratory for testing. The test results from the two laboratories should be compared using a 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 must be adjusted in consideration of the known bias.

6. Apparatus

6.1 *Grooved Specimen Holders*—The holder shall be of a length at least 10 % longer than the longest tuft element to be measured. A 4 in. (100 mm) length normally will be adequate.

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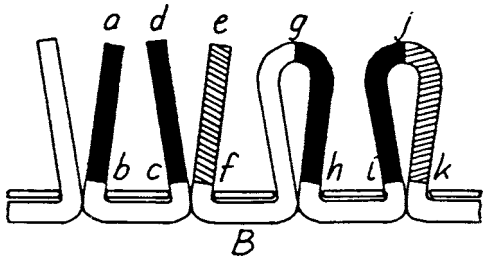
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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



ad = cut pile tuft element
gj = loop pile tuft element
ab, cd, ef, gh, ij, jk = tuft legs
cd, ef = cut pile tuft leg pair
ij, jk = loop pile tuft leg pair, a loop
B = one binding site

FIG. 1 Cross-Section of Tufted Pile Yarn Floor Covering

6.1.1 The grooves shall be a V-shaped cross-section with a 1.05 rad (60°) angle at the bottom. The depth of the grooves and width across the top of the grooves should accommodate a variety of yarns according to the following example:

Yarns	Groove Widths, in. (mm)
Coarse	0.18 (4.6)
Medium	0.13 (3.3)
Fine	0.08 (2.0)

6.1.2 Additional grooves of intermediate width also may be used.

6.2 *Scale,* at least 4 in. (100 mm) long, graduated in 0.10-in. (2 mm) divisions.

6.2.1 If the scale is not transparent, it shall be no thicker than 0.04 in. (1 mm).

6.3 *Cover Plate,* clear plastic to be used when nontransparent scale is used.

6.4 *Magnifying Glass,* 2× to 5×, mounted above the holder to permit centering the glass immediately above the cut ends of the tuft to avoid parallax in reading the scale.

6.5 *Scissors,* with sharp points.

7. Sampling

7.1 The basic sampling unit of uncoated pile yarn floor covering is a production roll.

7.2 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls, or pieces, of pile yarn floor covering as directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider the rolls, or pieces, of pile yarn floor covering 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 agreement between the purchaser and supplier requires taking into account the variability between rolls or pieces of pile yarn floor covering and between specimens from a roll or pieces of pile yarn floor covering to provide a sampling plan with a meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

7.3 *Test Sample*—The test sample shall consist of a full width section of pile yarn floor covering cut from one end of each roll in the lot sample and shall be at least 4 in. (100 mm) longer than the specimens required for the tests being conducted. Do not cut any laboratory sample from the seam end of the production roll.

7.4 *Test Sample Area*—The test sample area(s) is designated on the laboratory sample as follows.

7.4.1 For laboratory samples 120 in. (3000 mm) wide or wider, designate three test sample areas, one from each edge portion, no nearer to the edge than 5 % of the pile yarn floor covering width and one from the center portion.

7.4.2 For laboratory samples less than 120 in. (3000 mm) and at least 60 in. (1500 mm) wide, designate two test sample areas, one from each edge portion no nearer to the edge than 5 % of the pile yarn floor covering width.

7.4.3 For laboratory samples less than 60 in. (1500 mm) wide, or when a full width is not available, designate one test sample area that includes the entire piece except no nearer to either edge than 5 % of the width of the pile yarn floor covering width.

7.5 *Test Specimens*—For each like characteristic, cut pile, loop pile, and each tuft height of interest randomly select ten test specimens from the laboratory sample as directed in Section 9. A test specimen is one tuft element.

7.5.1 A test result is the average of the measurements made on a set of ten test specimens for a given characteristic. For test sample areas described in 7.4.1, three sets of ten measurements are averaged to represent the laboratory sample. For the test sample area described in 7.4.2, two sets of ten measurements are averaged to represent the laboratory sample. For the test sample area described in 7.4.3, one set of ten measurements is averaged to represent the laboratory sample.

8. Conditioning

8.1 Bring the test sample to moisture equilibrium for testing in standard atmosphere for testing textiles approaching equilibrium from the dry side without heat. Determine that moisture equilibrium for testing has been attained as directed in Practice D1776.

9. Tuft Element Selection

9.1 For each characteristic of interest, select at random ten test specimens from each test sample area as described in 9.2-9.4.

9.2 For laboratory samples having three sample test areas, select at random four tuft elements from the middle test sample area and three tuft elements from each of the two edge test sample areas.

9.3 For laboratory samples having two sample test areas, select at random five tuft elements from each edge test sample area.

9.4 For laboratory samples having one sample test area, select at random ten tuft elements from the test sample piece.

10. Procedure

10.1 Select the groove appropriate to the tuft element yarn.

NOTE 2—The groove width is of appropriate yarn size if the bend in the middle of the tuft element is removed substantially when the cover plate is placed over the yarn in the groove. The groove is too small if the fibers of the tuft element spread beyond the edge of the groove and hold the cover plate above the holder surface. A deflection of the tuft element from straightness of as much as 0.04 in. (1 mm) will not significantly affect the measured tuft length.

10.2 Place the extended tuft element in the groove.

10.3 If clear graduated scale is used, cover the groove with the graduations directly over the yarn in the groove and align the zero of the scale with one end of the tuft element.

10.3.1 If the tuft element is not cut squarely, visually select a location midway between the extremes of the cut.

10.4 If a nontransparent scale is used, place the scale along one edge of the groove and the clear cover plate above the groove abutting the scale. Align the zero of the scale with one end of the test specimen (see 10.3.1).

10.5 Center the magnifying glass immediately above one end of the tuft element to avoid parallax, and read the scale at the end of the tuft element to the nearest 0.02 in. (0.5 mm).

10.6 Record the length of the tuft element.

10.7 Test the remaining tuft elements.

11. Calculation

11.1 Average the lengths for each group of ten tuft elements of like character in each laboratory sampling unit to the nearest 0.01 in. (0.25 mm).

12. Report

12.1 State that the samples are tested as directed in Test Method D6283, for determining tuft element length. Describe the material sampled and the method of sampling used.

12.2 Report the following information:

12.2.1 Whether the tuft elements are removed from cut pile or loop pile areas of the pile yarn floor covering and in the case of multilevel pile yarn floor covering, also state from which level of pile the tuft elements are removed.

12.2.2 The average tuft element length for each like character group in each sample.

13. Precision and Bias

13.1 *Summary*—In comparing two averages, the differences should not exceed the single-operator precision values shown in Tables 1 and 2 for the respective number of tests in 95 out of 100 cases when all the observations are taken by the same well trained operator using the same test method techniques and specimens drawn randomly from the sample of material. Larger differences are likely to occur under all other circumstances.

TABLE 1 Critical Differences for Two Averages for the Conditions Noted

Number of Test Results in Each Average	95 % Probability Level, cms Single Material Comparisons		
	Single Operator Precision	Within-Laboratory Precision	Between-Laboratory Precision
1	0.12	0.23	0.23
5	0.06	0.20	0.20
10	0.04	0.20	0.20

TABLE 2 Critical Differences for Two Averages for the Conditions Noted

Number of Test Results in Each Average	95 % Probability Level, cms Multi-Material Comparisons		
	Single Operator Precision	Within-Laboratory Precision	Between-Laboratory Precision
1	0.15	0.24	0.28
5	0.10	0.22	0.26
10	0.09	0.21	0.25
15	0.09	0.21	0.25

13.2 *Interlaboratory Test Data*—An interlaboratory test was run in 1997 in which randomly-drawn samples of four materials were tested in each of two laboratories. Each laboratory used two operators, each of whom tested two specimens of each material using Test Method D6283. The components of variance for tuft element length expressed as standard deviations were calculated to be the values listed in Table 3. Analysis of the data was conducted using Practices D2904, and D2906 and the adjunct "Tex-Pac". The material types that were used are as follows:

Material 1: Tufted/straight saxony carpet.
Material 2: Tufted/straight loop carpet.
Material 3: Tufted/shifted loop carpet.
Material 4: Tufted/shifted saxony carpet.

13.3 *Precision*—For the components of variance reported in Table 1, two averages of observed values should be considered significantly different at the 95 % probability level if the difference equals or exceeds the critical differences listed in Tables 1 and 2.

NOTE 3—The tabulated values of the critical differences should be considered to be a general statement, particularly with respect to between-laboratory precision.

NOTE 4—Because the interlaboratory test included less than five laboratories, estimates of between-laboratory precision may be either underestimated or overestimated to a considerable extent and should be used with special caution.

13.4 *Bias*—The value of tuft element length of pile floor coverings can be defined only in terms of a test method. Within this limitation, Test Method D6283 has no known bias.

14. Keywords

14.1 carpet; pile yarn floor covering; textile floor covering

TABLE 3 Components of Variance Expressed as Standard Deviations[A]

Variance Component	Single Material Comparisons	Multi-material Comparisons
Single Operator	0.04	0.04+0.03
Within Laboratory	0.07	0.07
Between Laboratory	0	0.05

[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.