Designation: D 5823 – ~~95~~00

Standard Test Method for Tuft Height of Pile Floor Coverings[1]

This standard is issued under the fixed designation D 5823; 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 tuft height using a grooved specimen holder. It applies to cut-pile and loop-pile floor covering after adhesive backing has been applied to bond the pile yarn to the backing fabric.

1.2 The values stated in SI units are to be regarded as the standard for all measurements. The inch-pound values are provided for information purposes only.

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:*

[1] This test method is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.21 on Pile Floor Coverings. Current edition approved ~~Oct.~~ Sept. 10, ~~1995.~~ 2000. Published ~~February 1996.~~ October 2000. Originally published as D 5823–95. Last previous edition D 5823–96.

D 123 Terminology Relating to Textile Materials[2]
D 1909 Table of Commercial Moisture Regains for Textile Fibers[2]
E 122 Practice for Choice of Sample Size to Estimate a Measure of Quality for a Lot or Process[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *tuft height, n*—for pile yarn floor covering, the length of a tuft leg.

3.1.1.1 *Discussion*—The terms tuft height, pile height, and pile thickness are often confused due to the similarity of the terminology. Procedures for measurement of these properties are distinctly different and should not be interchanged. See Annex A1 for an explanation of the differences.

3.1.2 *tuft leg, n*—for pile yarn floor covering, one of the two portions of a tuft element that projects above the backing fabric on the pile side of the floor covering (see Fig. 1).

3.1.3 For definitions of other textile terms used in this test method, refer to Terminology D 123.

4. Summary of Test Method

4.1 For cut pile floor covering, individual tuft leg specimens of like character (either cut or loop and of uniform height) are cut as closely as possible to the surface of the backing of a pile floor covering sample and placed, one at a time, in a grooved specimen holder that maintains the tuft yarn in a straight line while the length of the tuft leg is measured using a graduated scale and a magnifying glass.

4.2 For loop pile floor covering, the two tuft legs forming the loop are each severed from the adjacent binding sites at the backing surface to provide a specimen of twice the tuft height and the length measured as in 4.1.

5. Significance and Use

5.1 This test method 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 the tuft height.

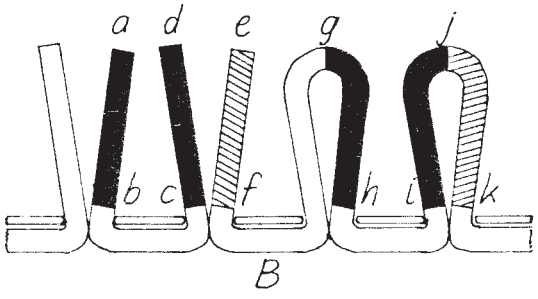
5.1.1 In case of a dispute arising from differences in reported test results when using this test method for acceptance testing of commercial shipments, the purchaser and the supplier should conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens that are as homogeneous as possible and are from a lot of material of the type in question. The test specimens should then be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using Student's *t*-test for unpaired data and an acceptable probability level chosen by the two parties before testing is begun. If a bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results in view of the known bias.

6. Apparatus

6.1 *Grooved Specimen Holder*, having a length at least 10 % longer than the longest tuft element to be measured.

6.1.1 *Specimen Holder*, 100-mm (4-in.) long, has been found satisfactory for this purpose.

[2] *Annual Book of ASTM Standards*, Vol 07.01.
[3] *Annual Book of ASTM Standards*, Vol 14.02.



ad = cutpile 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

6.1.2 The grooves shall have a V-shaped cross-section with a 1.05 rad (60°) angle at the bottom and widths across the top to accommodate several size yarns as follows:

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

6.1.3 Additional grooves of intermediate width may also be used.

6.2 *Tuft Cutting Device*, angled flush wire cutter,[4] having blades approximately 10-mm (⅜-in.) long, angled 0.44 to 0.61 rad (25 to 35°) to the plane of the handles and ground flush so as to permit cutting at the back surface.

6.3 *Graduated Scale*, clear or opaque, measuring to the nearest 0.5 mm (0.01 in.).

6.4 *Magnifying Glass*, 5× magnification.

6.5 *Cover Plates*, clear plastic or glass.

7. Sampling

7.1 *Lot Sample*—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 more than ten.

7.1.1 Take a lot sample as directed in Practice E 122 when statistical knowledge of the product variability and test method precision is available, and 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 sample shall be in accordance with the manufacturer's quality control program or with the specification agreed to by the purchaser and the supplier.

7.2 *Laboratory Sample*—For acceptance testing, take a sample from each laboratory sampling unit that is full width by at least 100 mm (4 in.) longer than the strip samples required for the test. Do not cut a lab sample of coated floor covering from a seam end of a production roll.

7.3 *Test Sample*— A test sample is a designated area of a lab sample that may be marked on or cut from the lab sample. For lab samples 3 m (10 ft) wide or wider, take three test samples, one at each edge no nearer to the edge than 5 % of the total floor covering width, and one in the middle portion of the lab sample. For lab samples at least 1.5 m (5 ft) wide but less than 3 m (10 ft), take two test samples, one at each edge no nearer to the edge than 5 % of the total floor covering width. For lab samples less than 1.5 m (5 ft) wide, only one test sample in the middle of the width is required.

7.3.1 Where it is known that systematic variations in a floor covering characteristic may occur in bands 0.5 m (18 in.) or more in width, as with modular pattern devices having separate controls or adjustments for each module, or individual needle control, take test samples from the middle of each band and in the same area of the pattern.

7.3.2 When a full width lab sample is not available, take a test sample as directed in 7.3 and state in the report the width available and the number of test specimens taken.

7.4 *Strip Sample*— From each test sample, take a strip sample approximately 63 by 250 mm (2.5 by 10 in.), with the longer dimension parallel to the manufacturing direction.

7.5 *Test Specimens*— Test 10 tufts from each strip sample.

8. Conditioning

8.1 Condition and maintain the strip samples in the standard atmosphere for testing textiles, 21 ± 1°C (70 ± 2°F) and 65 ± 2 % relative humidity, for 4 h or until the mass changes no more than 0.1 % in 2 h.

8.2 If the fiber in any layer of the backing has a commercial regain of more than 5 %, the strip sample shall be conditioned before measuring. Commercial moisture regains for textile fibers are listed in the Table in D 1909.

9. Procedure

9.1 Cut ten tuft legs of each kind of tuft, cut or loop, to be measured from the strip samples. Choose the tuft legs to take a nearly equal number of tuft legs of each kind from each strip sample. Sever the leg of each selected tuft leg or loop as close to the backing surface as possible with the angled flush wire cutter.

9.2 Select the groove of the specimen holder appropriate to the tuft element yarn diameter.

9.2.1 The groove is of appropriate size if the bend in the middle of the tuft element is substantially removed when the graduated scale or 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 specimen holder surface. A deflection of the tuft element from straightness of as much as 1 mm (0.04 in.) will not significantly affect the measured tuft length.

9.3 Place the extended tuft element in the groove.

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

[4] Jensen Tools and Alloys Angled Flush Cutter, Type GA65, has been found satisfactory for this purpose.

9.3.1.1 If the end of the tuft element is not cut squarely, visually select a location for measuring that is midway between the extremes of the cut.

9.3.2 If an opaque 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 graduation with one end of the tuft element.

9.4 Center the magnifying glass immediately above the tuft element to avoid parallax. Read the graduated scale at the opposite end of the tuft element and record to the nearest 0.5 mm (0.01 in.).

9.5 Repeat 9.3-9.5 for the remaining tuft elements taken from the strip sample.

10. Calculations

10.1 For each tuft leg, determine the difference between the two readings made in Section 9 to obtain the length of the individual tuft legs.

10.2 Average the lengths of each group of ten tuft legs of like character to the nearest 0.5 mm (0.01 in.) for each strip sample. For cut-pile floor covering, record this as the tuft height.

10.2.1 For loop pile floor covering, divide the average tuft leg length obtained in 10.2 by 2, rounding to the nearest 0.5 mm (0.01 in.) and record this as the tuft height.

10.3 Calculate the average tuft height of like character for each laboratory sampling unit and for the lot.

11. Report

11.1 State that the material was tested as directed in ASTM Test Method D 5823 for determining tuft height. Describe the material sampled and the method of sampling used.

11.2 Report the following information:

11.2.1 Whether the tuft elements were removed from cut pile or loop pile areas of the floor covering, and, in the case of multilevel floor covering, state from which level of pile the tuft elements were removed,

11.2.2 The average tuft height for each like character for each strip sample, laboratory sampling unit, and for the lot.

12. Precision and Bias

12.1 *Precision*—The precision of the procedure in Test Method D 5823 for measuring tuft height is being established.

12.2 *Bias*—The procedure in Test Method D 5823 for measuring tuft height has no known bias and may be used as a referee method.

13. Keywords

13.1 carpet; construction; pile yarn floor covering; tuft height

ANNEX

(Mandatory Information)

A1. CLARIFICATION OF ~~TUFT HEIGHT,~~ PILE HEIGHT, ~~AND~~ PILE THICKNESS, AND TUFT HEIGHT

A1.1 Introduction

A1.1.1 Confusion sometimes arises in specifying and testing pile yarn floor coverings due to the similarity of the terminology describing th~~r~~ese distinctly different methods of measuring the height of the pile in relation to the backing. Each method has a specific purpose and yields different data. They cannot be compared or interchanged. Problems occur when specifications are written using pile height and the testing laboratory reports pile thickness or tuft height, which may be more appropriate for the particular product. Measuring pile thickness or tuft height of a typical loop pile carpet by either procedure will yield a difference in the range of 30 to 40 % from the pile height measurement.

A1.2 Pile Height

A1.2.1 Pile height is typically used generically by the layman and by manufacturing personnel in setting machinery.

~~A1.1.1.1 Pile~~

A1.2.2 Pile height is measured by inserting a small graduated ruler into the pile down to the backing and reading the overall height of the pile. This procedure is subject to significant variability between technicians and is therefore used only for rough field work and in machinery settings during the manufacturing process.

A1.3 Pile Thickness

A1.~~2~~3.1 Pile thickness is a technical term used to describe the measurement of thickness of pile yarn which can be sheared from the backing of a carpet.

A1.~~1~~3.~~2~~.~~1~~ Pile thickness is the preferred procedure for precision measurement of loop pile carpets and~~,~~ of cut pile carpets with

a tuft height of less than 6.4 mm (0.25in.). Although it is more complex, it is very repeatable between different technicians and laboratories. It involves the use of a thickness measuring instrument which measures thickness of materials between a platen and a circular foot of specified area under a specified force. In measuring carpet with this device, the total thickness of pile and backing is measured, the pile sheared away, and the backing only measured. Pile thickness is the difference between the two values. The procedure is complicated by remaining pile stubble which cannot be sheared. Refer to ASTM Test Method D 5823.

~~A1.1.3 Tuft height is a procedure of measuring the length of tufts that are cut or sliced from a carpet sample. This technique is most often used for cut pile constructions.~~

~~A1.1.3.1 Tuft~~

A1.4 Tuft Height

A1.4.1 Tuft height, as described in this test method, is a laboratory procedure which is very repeatable. Ten tufts are severed from the backing with a cutting device, placed into a V-shaped groove in a specimen holder, covered with a clear plate, and measured using a precision scale.

A1.4.2 Tuft height is not applicable to cut pile constructions with tuft heights less than 6.4 mm (0.25 in.) due to the problems associated with mounting a tuft of this length in the grooved specimen holder. For this construction, pile thickness must be performed.