This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D5793 – 18

Standard Test Method for Binding Sites per Unit Length or Width of Pile Yarn Floor Coverings[1]

This standard is issued under the fixed designation D5793; 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 describes the measurement of the number of binding sites per unit length or width of machine-made, woven, knitted, and tufted pile yarn floor covering both before and after adhesive backing application.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D123 Terminology Relating to Textiles

D1776 Practice for Conditioning and Testing Textiles

D1909 Standard Tables of Commercial Moisture Regains and Commercial Allowances for Textile Fibers

D2904 Practice for Interlaboratory Testing of a Textile Test Method that Produces Normally Distributed Data (Withdrawn 2008)[3]

D2906 Practice for Statements on Precision and Bias for Textiles (Withdrawn 2008)[3]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

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 terms relating to Pile Floor Coverings, D13.21, refer to Terminology D5684.

3.1.1 The following terms are relevant to this standard: back coating, backing, backing fabric, binding site, buried pile yarn, carpet, components, finished, finished pile yarn floor covering, floor covering, lengthwise direction, needles per unit width, pile, pile heights, pile yarn floor covering, pile yarn mass, pitch, stitches, stubble, textile floor covering, tuft, tufted fabric, widthwise direction.

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

4. Summary of Test Method

4.1 The length of pile floor covering containing 40 binding sites is measured in either the lengthwise or widthwise direction as required and the number of binding sites per unit length is calculated.

5. Significance and Use

5.1 This test method is useful in quality and cost control during manufacture. Both appearance and performance of pile yarn floor coverings can be affected by the number of binding sites per length and width.

5.2 This test method is considered satisfactory for acceptance testing of commercial shipments because current estimates of between-laboratory precision are acceptable and the method is used extensively in the trade for acceptance testing.

5.2.1 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 form the same lot of material as the samples that resulted in the disparate results during initial testing, and that are randomly assigned in

[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.

Current edition approved Jan. 1, 2018. Published February 2018. Originally approved in 1995. Last previous edition approved in 2013 as D5793 – 13. DOI: 10.1520/D5793-18.

[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.

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

equal numbers to each laboratory for testing. The test results from the 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 for that material must be adjusted in consideration of the know bias.

6. Apparatus

6.1 *Shears or Clippers,* capable of shearing close enough to the backing to leave a stubble of no more than 0.05 in. (1.3 mm).

6.2 *Scale or Tape,* metal, graduated in 0.05 in. (1 mm) and at least 10 % longer than the distance being measured.

6.3 *Location Markers,* two, such as straight pins.

7. Sampling Units and Test Specimens

7.1 *Sampling Units:*

7.1.1 *Uncoated Floor Covering*—The basic sampling unit of uncoated floor covering is a production roll.

7.1.2 *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.

7.2 Take a lot sample as directed in Practice E122 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 samples shall be in accordance with the manufacturer's quality control program or with the specification agreed to by the purchaser and the supplier.

7.3 A test sample 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 4 in. (100 mm) longer than the specimens required for the tests being conducted. Do not cut a test sample of coated floor covering from a seam end of a production roll.

7.4 *Test Specimens:*

7.4.1 The test specimens shall be large enough to include 44 binding sites in each direction.

7.4.2 This test method may be nondestructive since the measurements may be made on the test specimens without cutting the test specimens from the test sample.

7.4.3 A test specimen is a designated area of a test sample that may be marked on or cut from the test sample as directed in the test method. For test samples 120 in. (3000 mm) wide or wider, three test specimens are required, 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 test sample. For test samples at least 60 in. (1500 mm) wide but less 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 test samples less than 60 in. wide (1500 mm), take one specimen, from the middle.

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

7.4.5 When a full width test sample is not available, take a specimen as directed in 7.4.3 and state in the report the width available and the number of test specimens taken.

7.5 A test result is the average of the measurements made on a set of test specimens as described in 7.4.3, 7.4.4, or 7.4.5. In these methods, directions are given only for obtaining a test result from one test sample. The value representative of the lot being sampled will be the average of the test results for all the test samples in the lot sample.

8. Conditioning

8.1 Condition the test specimens or the test sample as specified in Practice D1776 in the standard atmosphere for testing textiles for 12 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 over 5 %, the specimen may be conditioned before measuring. Commercial moisture regains for textile fibers are listed in Table D1909.

9. Procedure

9.1 If the binding sites are visible from the back, place the test specimen face down on a flat surface; otherwise, place the test specimen back down and shear the pile close to the backing to reveal the binding sites. Select a line of binding sites in the direction to be counted.

9.1.1 Handle uncoated floor coverings carefully to avoid distortion of binding sites of coated floor covering after treating with reagents and removing the secondary backing.

9.2 Select a distinguishing feature found at each binding site.

NOTE 1—It is not necessary to define precisely the boundaries of a binding site; only to use the same distinguishing feature in every binding site being counted in a particular specimen. For tufted floor covering, a distinguishing feature is the needle hole separating two adjacent binding sites. For woven floor covering, it may be a filling yarn appearing once on the back for every binding site.

9.3 Locate the zero point at this distinguishing feature of one binding site with a marker.

9.4 Count 40 complete binding sites from this marker and insert another marker at this distinguishing feature of the 40th site.

NOTE 2—Some pile yarn floor coverings exhibit non-straight line binding sites; therefore, counting is facilitated by counting on the back side of the specimen.

9.5 Measure the length, L, between the marked binding sites with the graduated scale or tape, reading to the nearest 0.05 in. (1 mm).

9.6 Make one measurement on each of the test specimens or specimen areas.

10. Calculation

10.1 For each measurement calculate the number of binding sites per unit length (or width) to the nearest 0.1 sites/length (width) using Eq 1.

$$N = 40/L \quad (1)$$

where:

N = number of binding sites per unit length (or width) of floor covering, and

L = length measured as directed in in. (mm).

11. Report

11.1 State that the test sample was tested as directed in Test Method D5793 for determining the binding sites per unit length or width of pile floor covering. Describe the material or product sampled and the method of sampling used.

11.1.1 Report the average number of binding sites per unit length or width of pile yarn floor covering as agreed between the purchaser and the supplier. In the absence of such agreement, report the number of binding sites per unit length (width).

12. Precision and Bias

12.1 *Summary*—In comparing two averages, the differences should not exceed the single-operator precision values show in Tables 1-4 for the respective number of tests in 95 out of 100 cases when all the observations are all taken by the same well-trained operator using the same test method techniques and specimens randomly drawn from the sample of material. Larger differences are likely to occur under all other circumstances.

TABLE 1 Critical Length Differences for Two Averages for the Conditions Noted 95 % Probability Level, Units

Length	Single Material Comparisons		
Number of Test Results in Each Average	Single Operator Precision	Within Laboratory Precision	Between Laboratory Precision
1	0.14	0.14	0.35
2	0.10	0.10	0.34
4	0.07	0.07	0.33
8	0.05	0.05	0.33

TABLE 2 Critical Length Differences for Two Averages for the Conditions Noted 95 % Probability Level, Units

Length	Multi-Material Comparisons		
Number of Test Results in Each Average	Single Operator Precision	Within Laboratory Precision	Between Laboratory Precision
1	0.14	0.14	0.63
2	0.10	0.10	0.62
4	0.07	0.07	0.62
8	0.05	0.05	0.61

12.2 *Inter-laboratory Test Data*—An inter-laboratory test was run in 2001 in which randomly drawn samples of seven materials were tested in each of six laboratories. Each laboratory used one operator, and each operator tested two samples of each of the seven materials using Test Method D5793, recording results for stitches per inch in the length direction and stitches per inch in the width direction. One sample set (Material 7) was discarded after being flagged as a special case because of an obvious calculation error at one lab. Components of variance for length and width expressed as standard deviations were calculated to be the values listed in Tables 5 and 6. Analysis of the data was conducted using Practices D2904 and D2906. The material types were:

Material 1:	Tufted commercial loop pile carpet
Material 2:	Tufted commercial loop pile carpet
Material 3:	Tufted residential cut pile carpet
Material 4:	Tufted residential cut pile carpet
Material 5:	Tufted residential cut pile carpet
Material 6:	Tufted residential cut pile carpet
Material 7:	Tufted residential cut pile carpet

12.3 *Precision*—For the components of variance reported in Tables 5 and 6, 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 1-4.

12.4 *Bias*—The procedure in Test Method D5793 for determining the number of binding sites per unit length or width has no known bias and may be used as a referee method.

TABLE 3 Critical Width Differences for Two Averages for the Conditions Noted 95 % Probability Level, Units

Width	Single Material Comparisons		
Number of Test Results in Each Average	Single Operator Precision	Within Laboratory Precision	Between Laboratory Precision
1	0.16	0.16	0.76
2	0.11	0.11	0.75
4	0.08	0.08	0.75
8	0.06	0.06	0.75

TABLE 4 Critical Width Differences for Two Averages for the Conditions Noted 95 % Probability Level, Units

Width	Single Material Comparisons		
Number of Test Results in Each Average	Single Operator Precision	Within Laboratory Precision	Between Laboratory Precision
1	0.14	0.14	1.02
2	0.10	0.10	1.01
4	0.07	0.07	1.01
8	0.05	0.05	1.01

13. Keywords

13.1 binding sites; carpet; construction; floor covering; pile yarn

TABLE 5 Components of Variance Expressed as Standard Deviations[A] —Length

Variance Component	Single Material Comparisons	Multi-Material Comparisons
Single operator	0.050	0.050
Within laboratory	0	0
Between laboratory	0.119	0.221

[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.

TABLE 6 Components of Variance Expressed as Standard Deviations[A] —Width

Variance Component	Single Material Comparisons	Multi-Material Comparisons
Single operator	0.057	0.057
Within laboratory	0	0
Between laboratory	0.269	0.363

[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.

APPENDIX

(Nonmandatory Information)

X1. POPULAR TRADE TERMS

X1.1 The following are popular trade terms used to describe binding sites:

TABLE X1.1 Binding Site Types

Method of Manufacture	Binding Site Nomenclature
Woven	dents (width)
	pitch (width)
	wires (length)—for Wilton and velvet weaves
	rows (length)—for Axminster weaves
Tufted	gage, or gauge (width)
	needles (width)
	stitch (length)
Knitted	wales (width)
	courses (length)

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/