



Designation: D 5793 – 9503

## Standard Test Method for Binding Sites ~~Per~~ per Unit Length or Width of Pile Yarn Floor Coverings<sup>1</sup>

This standard is issued under the fixed designation D 5793; 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 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 SI units are to be regarded as the standard for all measurements. The inch-pound values ~~are~~ provided are for information purposes only.

1.3 Determination of the number of binding sites per unit length or width of pile ~~yarn~~ floor covering previously was contained within Test Methods D 418.

NOTE 1—For user convenience, Subcommittee D13.21 has subdivided Test Methods D 418 into separate standards, of which this test method is one.

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.*

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<sup>1</sup> 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 Yarn Floor Coverings

Current edition approved Oct. 1, 2003. Published November 2003. Originally approved in 1995. Last previous edition approved in 1995 as D 5793 – 95.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

D 123 Terminology Relating to Textiles

D 418 Test Methods of Testing Pile Yarn Floor Covering Construction

D 1909 Table of Commercial Moisture Regains 1776 Practice for Textile Fibers<sup>2</sup> Conditioning and Testing Textiles

D 1909 Table of Commercial Moisture Regains for Textile Fibers

D 2904 Practice for Interlaboratory Testing of a Textile Test Method that Produces Normally Distributed Data

D 2906 Practice for Statements of Precision and Bias of Textiles

D 5684 Terminology Relating to Pile Yarn Floor Coverings

E 122 Practice for Choice of Calculating Sample Size to Estimate With a Specified Tolerable Error, the Average Quality Characteristic of a Lot Process

## 3. Terminology

### 3.1 Definitions:

3.1.1 *binding site, n*—for pile yarn floor covering, a location at which the pile yarn is, or can be, bound to the backing fabric.

3.1.1.1 *Discussion*—In any machine-made pile yarn floor covering, the binding sites occur in an orderly and repetitive array at uniform intervals in both lengthwise and widthwise directions

3.1 For definitions of the floor covering. Among woven, knitted and tufted floor coverings, binding sites differ. For example, the binding site of a woven floor covering consists of one or more filling shots under which the face yarn passes, while the binding site of a tufted floor covering consists of the section of backing fabric between two adjacent needle holes in the lengthwise direction. The number of pile yarn strands that can be fastened at one binding site can vary from one to several, according to design.

3.1.2 *components, n*—for pile yarn floor covering, the individual yarn or fabric elements into which a pile yarn floor covering can be dissected.

3.1.2.1 *Discussion*—The major components of uncoated pile yarn covering are the pile yarn and the backing fabric. For woven and knitted floor covering, the backing fabric may be further dissected into component yarns.

3.1.3 *tuft, n*—in pile fabrics, those cut or uncut loops which form part of the fabric face that are attached to the backing fabric at binding sites.

3.1.3.1 *Discussion*—A tuft may consist of one or more tuft elements.

3.2 For definitions of other terms related to pile floor coverings, terms used in this test method, refer to Terminology D 5684.

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

## 4. Summary of Test Method

4.1 The length of pile floor covering containing 40 binding sites is measured in either the lengthwise or the 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 changes in bindings the number of binding sites per unit length or and width.

5.2 Although this

5.2 This test method is useful considered satisfactory for acceptance testing of commercial shipments as the best available method, because current estimates of between-laboratory precision has not yet been determined.

5.2.1 In case of a dispute from differences 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 when using this test method the purchaser and the supplier should conduct for two laboratories (or more), comparative tests should be performed to determine if there is statistical bias between their laboratories. Competent them using competent statistical assistance is recommended for the investigation of bias assistance. As a minimum, the two parties should take a group of use test specimens which samples for such comparative tests that are as homogeneous as possible and which are from a possible, drawn from the same lot of material of as the type samples that resulted in question. The test specimens should then be the disparate results during initial testing, and that are randomly assigned in equal numbers to each laboratory for testing. The average test results from the two laboratories w should be compared using Student's *t*-test a statistical test for unpaired data and an acceptable at a probability level chosen by prior to the two parties before testing is begun series. 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 with for that material must be adjusted in consideration to known of the know bias.

<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, Vol 07.01, volume information, refer to the standard's Document Summary page on the ASTM website.

## 6. Apparatus

- 6.1 *Shears or Clipper*, capable of shearing close enough to the backing to leave a stubble of no more than 1.3 mm (0.05 in.).
- 6.2 *Scale or Tape*, metal, graduated in 1 mm (0.05 in.); 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 Recommended 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 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 100 mm (4 in.) 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 3000 mm (118 in.) 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 1500 mm (60 in.) wide but less than 3000 mm (118 in.), 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 1500 mm wide (60 in.), 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 460 mm (18 in.) 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 directed in Practice D 1776 in the at standard atmosphere for testing textiles ( $21 \pm 1^\circ\text{C}$  ( $70 \pm 2^\circ\text{F}$ ) at  $65 \pm 2\%$  relative humidity) 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 ~~shall~~ may be conditioned before measuring. Commercial moisture regains for textile fibers are listed in Table D 1909.

## 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 ~~distorting the test specimen dimensions. Do not measure the number~~ 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 ~~precisely~~ precisely define 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 ~~the~~ 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 1 mm (0.05 in.).

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.

$$N = 40/L \tag{1}$$

where:

- $N$  = number of binding sites per unit length (or width) of floor covering, and
- $L$  = length measured as directed in ~~10.5~~, 9.5, mm (in.).

**11. Report**

11.1 State that the test sample was tested as directed in Test Method D 5793; for determining number of the binding sites per unit length or width of pile yarn 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 ~~seller~~, supplier. In the absence of such agreement, report the number of binding sites per unit length (width).

**12. Precision and Bias**

12.1 ~~Precision—The precision of~~Summary—In comparing two averages, the differences should not exceed the single-operator precision values show in Test Method D 5793 Tables 1-4 for determining the respective number of binding sites per unit length or width is being established. 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.

12.2 ~~Bias—The procedure~~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 D 5793, recording results for determining the number of binding sites stitches per u inch in the length or width has no known bias direction and may be used stitches per inch in the width direction. One sample set (Material 7) was discarded after being flagged as a referee method.

**13. Keywords**

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

**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

**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

**APPENDIX**

**(Nonmandatory Information)**

**X1. DESCRIPTION OF BINDING SITE TYPES**

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

be the values listed in Tables 5 and 6. Analysis of the data was conducted using Practices D 2904 and D 2906. The material types were:

**Table X1—Binding Site Types**

Method of Manufacture	Binding-Site-Nomenclature
Woven	dents (width)
Woven Material 1:	Tufted commercial loop pile carpet
Material 2:	pitch (width)
Material 3:	Tufted commercial loop pile carpet
Material 4:	wires (length)—for Wilton and velvet weaves
Tufted	Tufted residential cut pile carpet
Material 5:	rows (length)—for Axminster weaves
Material 6:	Tufted residential cut pile carpet
Material 7:	gage, or gauge (width)
Knitted	Tufted residential cut pile carpet
	needles (width)
	Tufted residential cut pile carpet
	stitch (length)
	stitch (length)
	wales (width)
	courses (length)
	courses (length) 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 D 5793 for determining the number of binding sites per unit length or width has no known bias and may be used as a referee method.

**13. Keywords**

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

**TABLE 5 Components of Variance Expressed as Standard Deviations<sup>A</sup>—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

<sup>A</sup> 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<sup>A</sup>—Width**

<u>Variance Component</u>	<u>Single Material Comparisons</u>	<u>Multi-Material Comparisons</u>
<u>Single operator</u>	<u>0.057</u>	<u>0.057</u>
<u>Within laboratory</u>	<u>0</u>	<u>0</u>
<u>Between laboratory</u>	<u>0.269</u>	<u>0.363</u>

<sup>A</sup> 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**

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

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