



Designation: D 418 – 93

Standard Test Methods for Testing Pile Yarn Floor Covering Construction¹

This standard is issued under the fixed designation D 418; 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.

This standard has been approved for use by agencies of the Department of Defense.

¹ NOTE—This standard was corrected editorially in June 1993. The 1992 edition was incorrect. The current test methods contained in the document will eventually be balloted as individual standards.

1. Scope

1.1 These test methods cover the construction testing of machine-made woven, knitted, and tufted pile yarn floor covering both before and after an adhesive back coating, which bonds the pile yarn to the backing fabric, has been applied.

1.2 This standard includes the following test methods:

	Section
Component Masses ² per Unit Area	8
Number of Binding Sites per Unit Length or Width of Floor Covering	16
Number of Binding Sites per Unit Length or Width of Pile Floor Covering	21
Pile Thickness—Level Pile	10
Pile Thickness—Multilevel Pile	11
Pile Yarn Length per Unit Length of Floor Covering	14
Pile Yarn Length per Unit Length of Floor Covering	20
Pile Yarn Mass per Unit Area	9
Total Mass per Unit Area	7
Tuft and Yarn Length of Uncoated Floor Covering	18
Tuft Length	12
Tuft Length	19
Tuft Length for Level Loop Pile Floor Covering	15
Tuft Height	13

1.2.1 Specimen preparation procedures common to Sections 7-11 are presented in **Annex A1**, Preparing Specimens of Measured Area. **Annex A2** and **Annex A3** give examples of typical calculations for Sections 9-11.

1.3 The values stated in inch-pound units are to be regarded as the standard for all measurements except mass. The SI (metric) values for all measurements except mass are provided for information purposes only.

1.4 *This standard may involve the use of hazardous materials, operations and equipment. It is the responsibility of the user of this standard to establish appropriate safety practices and to determine the applicability of regulatory limitations prior to use.*

¹ These methods are under the jurisdiction of ASTM Committee D-13 on Textiles and are the direct responsibility of Subcommittee D13.21 on Pile Floor Coverings.

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² The technically correct term “mass” is used throughout this standard in place of “weight,” the term in common usage. The buoyancy effect of the displaced air is considered negligible for the test methods in this standard, so that apparent mass and mass are the same within the limits of precision and accuracy achieved (see section 3.4.1 of E 380E 380).

2. Referenced Documents

2.1 *ASTM Standards:*

D 123 Terminology Relating to Textiles³

D 861 Practice for Use of the Tex System to Designate Linear Density of Fibers, Yarn Intermediates, and Yarns³

D 1193 Specification for Reagent Water⁴

D 1909 Table of Commercial Moisture Regains for Textile Fibers³

E 122 Recommended Practice for Choice of Sample Size to Estimate the Average Quality of a Lot or Process⁵

E 380 Standard for Metric Practice⁶

3. Terminology

3.1 *Definitions:*

3.1.1 *back coating, n—in textiles*, an adhesive-type substance applied to the back of a fabric for such purposes as locking pile yarn tufts into a carpet backing, bonding a secondary backing to a primary backing, or increasing fabric body or stiffness.

3.1.2 *backing, n—for pile yarn floor covering*, all materials in a pile yarn floor covering other than pile yarn.

3.1.3 *backing fabric, n—in textiles, (1)* a fabric into which a pile yarn is inserted, or *(2)* a reinforcing layer adhered to the reverse side of a fabric.

3.1.3.1 *Discussion*—In woven and knitted pile yarn floor coverings the backing fabric is created at the same time the pile yarn is bound to the backing fabric but in tufted pile yarn floor coverings the backing fabric is made prior to the operation in which the pile yarn is fastened to the backing fabric.

3.1.4 *backing, primary, n—for tufted pile yarn floor covering*, the fabric through which the pile yarn is carried by needles to form tufts: the backing fabric.

3.1.5 *backing, secondary, n—for pile yarn floor covering*, a material adhered to the backing fabric side of a pile yarn floor covering.

³ Annual Book of ASTM Standards, Vol 07.01.

⁴ Annual Book of ASTM Standards, Vol 11.01.

⁵ Annual Book of ASTM Standards, Vol 14.02.

⁶ Excerpts appear in Annual Book of ASTM Standards, Vol 07.01.

3.1.5.1 *Discussion*—The secondary backing may be a textile layer, a solid plastic layer, a rubber sponge, or an elastomeric foam.

3.1.6 *binding site, n.*—for pile yarn floor covering, a place at which the pile yarn is, or can be, bound to the backing fabric. See Fig. 1.

3.1.6.1 *Discussion*—In any machine-made pile yarn floor covering the binding sites occur in an orderly and repetitive array at uniform intervals in both the lengthwise and widthwise directions of the floor covering. The nature of the binding site differs among woven, knitted, and tufted floor coverings. 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.

3.1.6.2 The number of pile yarn strands that can be fastened at one binding site can vary from none to several, according to design.

3.1.7 *carpet, n.*—all textile floor coverings not designated as rugs.

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

3.1.8.1 *Discussion*—The major components of uncoated pile yarn floor 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.

3.1.9 *dents per unit width, n.*—for woven pile yarn floor covering, the number of binding sites per unit width; dents being the reed spaces through which the warp yarns pass in the loom or the metal strips in the reed which form these spaces.

3.1.10 *direction, lengthwise, n.*—in textiles, the direction in a machine-made fabric parallel to the direction of movement of the fabric followed in the manufacturing machine. (*Syn. machine direction and wrapwise.*)

3.1.11 *direction, widthwise, n.*—in textiles, the direction in a machine-made fabric perpendicular to the direction of movement of the fabric followed in the manufacturing machine. (*Syn. cross machine direction, weftwise, and fillingwise.*)

3.1.12 *floor covering, n.*—an essentially planar material, having a relatively small thickness in comparison to its length

or width, which is laid on a floor to enhance the beauty, comfort, and utility of the floor.

3.1.12.1 *Discussion*—It is customary to distinguish between hard or resilient floor coverings and soft or textile floor coverings. Textile floor coverings are further subdivided into pile floor coverings and nonpile floor coverings such as braided rugs or flat, nonwoven barb needlepunched felt. There are two types of pile floor coverings: pile yarn and pile fiber. Typical examples of pile fiber floor coverings are flocked floor covering and fork needlepunched nonwoven floor covering.

3.1.12.2 Textile floor coverings are also classified as *carpets* or *rugs*.

3.1.13 *floor covering, pile yarn, n.*—a textile product in which yarn or yarn segments are attached intermittently to a backing fabric so as to project above the backing fabric to form a pile; the yarn entering the backing fabric substantially perpendicular to the plane of the backing fabric.

3.1.13.1 Pile yarn floor covering is distinguished from flannel, fork needlepunched, and flocked products in that the latter have a nap or pile formed of individual fibers rather than of yarn.

3.1.13.2 Pile yarn upholstery fabrics are sometimes distinguishable from pile yarn floor covering only in that they having backings that are not as stiff as for pile yarn floor covering.

3.1.14 *gage, n.*—of tufted pile yarn floor covering, the average distance between adjacent binding sites in the widthwise direction.

3.1.15 *gage, n.*—of a tufting machine, the average centerline distance between the needles.

3.1.16 *needles per unit width, n.*—for tufted pile yarn floor covering, the number of binding sites per unit of floor covering width; needles being the means of inserting the pile yarn into the backing fabric.

3.1.17 *pile, n.*—for pile yarn floor covering, the texture surface composed of many tuft legs bound to a backing fabric in an orderly and repetitive array.

3.1.17.1 *Discussion*—A particular floor covering may be all cut pile, or all loop pile and in either case the pile may be of essentially one pile level or multilevel. A particular floor covering may also contain both cut pile areas and loop pile areas which may be of the same pile level or different pile levels. Areas of intermingled cut and loop pile or intermingled high- and low-level pile may also occur.

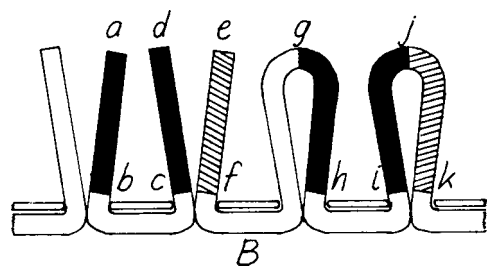
3.1.18 *pile, cut, n.*—for pile yarn floor covering, pile in which the legs of any one tuft element are not connected to the legs of any other tuft element.

3.1.19 *pile, level, n.*—for pile yarn floor covering, pile in which all tuft legs are of substantially the same length.

3.1.20 *pile, loop, n.*—for pile yarn floor covering, pile in which, for each loop, a tuft leg of one tuft element is connected to a tuft leg of another tuft element at another binding site so as to form a loop which projects above the backing fabric between the binding sites of the connected tuft elements.

3.1.21 *pile, multilevel, n.*—for pile yarn floor covering, pile in which some tuft legs are substantially longer than others.

3.1.22 *pile yarn, buried, n.*—for coated pile yarn floor covering, that portion of the pile tuft elements which remains after the tuft legs have been removed by shearing.



ad = cutpile tuft element
 gj = loop pile tuft element
 ab, cd, ef, gh, ij, jk = tuft legs
 cd, ef = cut pike 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

3.1.22.1 *Discussion*—The buried pile yarn is composed of the pile yarn in the backing and a short stubble of yarn projecting above the backing.

3.1.23 *pitch, n*—for woven pile yarn floor covering, the number of binding sites in 27 in. (686 mm) of width.

3.1.24 *rug, n*—a textile floor covering of limited area which is complete in itself and is intended for use as a partial covering of a floor or another floor covering.

3.1.25 *tuft, n*—in pile fabrics, those cut or uncut loops which are attached to the backing fabric at one binding site and which form part of the fabric face.

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

3.1.26 *tuft element, n*—for pile yarn floor covering, a segment of yarn bound to a backing fabric at a binding site so that two portions (legs) of the yarn project above the backing fabric, one portion on each side of the binding site. See Fig. 1.

3.1.26.1 *Discussion*—In loop pile floor covering, the tuft element extends from the midpoint of the loop on one side of the binding site to the midpoint of the loop on the other side of the binding site.

3.1.26.2 In most pile yarn floor coverings both legs of the tuft element are immediately adjacent to the same binding site. In some pile yarn floor coverings the yarn segment extends from one leg past a number of binding sites before the second leg of the tuft element projects above the backing fabric.

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

3.1.28 *tuft leg, n*—for pile yarn floor covering, one of the two portions of a tuft element that project above the backing fabric on the pile side of the floor covering. See Fig. 1.

3.1.29 *tuft length, n*—for pile yarn floor covering, the length of a tuft element measured while extended in a straight line under zero tension.

3.1.30 *wires per unit length, n*—for woven pile yarn floor covering, the number of binding sites per unit of floor covering length; wires in the widthwise direction being the usual means of forming the pile.

3.1.31 For the definition of other textile terms used in these methods, refer to Terminology D 123D 123.

4. Significance and Use

4.1 The characteristics that can be determined by these test methods are useful in quality and cost control during the manufacture of pile yarn floor covering. Both appearance and performance can be affected by changes in these characteristics.

4.2 Although these test methods are useful for acceptance testing of commercial shipments as the best available methods, between-laboratory precision has not yet been determined. If there is a disagreement arising from differences in values reported by the purchaser and the supplier when using the methods of this standard for acceptance testing, the statistical bias, if any, between the laboratory of the purchaser and the laboratory of the supplier should be determined with each comparison of test results being based on adjacent test samples cut from one shipping roll of the floor covering.

5. Sampling Units and Test Specimens

5.1 Sampling Units:

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

5.1.2 *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.

5.2 *Lot Sample*—Take a lot sample as directed in Recommended Practice E 122E 122 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 the supplier.

5.3 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.

5.4 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 a test method. For test samples 305 cm (120 in.) 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 the test sample. For test samples at least 152 cm (60 in.) wide but less than 305 cm, two 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. For test samples less than 152 cm wide, only one specimen, in the middle of the width, is required for a test method.

5.5 Where it is known that systematic variations in a floor covering characteristic may occur in bands 46 cm (18 in.) 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.

5.6 When a full width test sample is not available, take specimens as directed in 5.4 and state in the report the width available and the number of test specimens taken.

5.7 A test result is the average of the measurements made on a set of test specimens as described in 5.4, 5.5, or 5.6. 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.

6. Conditioning

6.1 When required, condition the test specimens or the test sample in the 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.

7. Total Mass per Unit Area

7.1 *Scope*—This method applies to both uncoated and coated floor covering.