Designation: D5848 – 10$^{\varepsilon 1}$

Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings[1]

This standard is issued under the fixed designation D5848; 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.

ε[1] NOTE—Section references were corrected in the Scope in September 2010.

1. Scope

1.1 This test method covers the measurement of mass per unit area of machine-made woven, knitted, and tufted pile yarn floor covering both before and after an adhesive-back coating application.

1.2 This test method encompasses three techniques for determination of mass per unit area as applicable:

1.2.1 Section 7, for determining total mass per unit area, applies to both coated and uncoated (unfinished) pile floor coverings.

1.2.2 Section 8, for determining component mass per unit area, applies only to uncoated (unfinished) pile yarn floor coverings.

1.2.3 Section 9, for determining pile yarn mass per unit area, applies only to back-coated, or finished, pile yarn floor coverings.

1.3 Determination of mass per unit area of pile yarn floor coverings was previously contained within Test Methods D418. For user convenience, Subcommittee D 13.21 subdivided Test Methods D418 into separate standards, of which this test method is one.

1.4 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.

1.5 *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. Specific precautionary statements are given in 9.5.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D123 Terminology Relating to Textiles

D418 Test Method for Testing Pile Yarn Floor Covering Construction (Withdrawn 1998)[3]

D1193 Specification for Reagent Water

D1776 Practice for Conditioning and Testing Textiles

D1909 Standard Table of Commercial Moisture Regains for Textile Fibers

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

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]

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: back coating, backing, backing fabric, binding sites, buried pile yarn, carpet, components, extractable matter, finished, finished pile yarn floor covering, floor covering, multilevel pile, pile, pile yarn floor covering, pile yarn mass, pitch, primary backing, secondary backing, stubble, textile floor covering, total mass, tufted fabric.

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

[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.

4. Significance and Use

4.1 The determination of the mass per unit area of pile yarn floor covering is useful in quality and cost control during the manufacture of pile floor covering. Both appearance and performance may be affected by changes in mass per unit area.

4.2 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 supplier should conduct comparison testing 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 that are from a lot of material of the type in question. The test specimens should then be randomly assigned 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 prior to testing. If a bias is found, either its cause must be found and corrected or the purchaser and supplier must agree to interpret future test results with consideration to the known bias.

5. Test Specimen

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 Practice E122 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 *Laboratory Sampling Unit*—A laboratory sampling unit 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 laboratory sampling unit of coated floor covering from a seam end of a production roll.

5.4 *Test Specimens:*

5.4.1 A test specimen is a designated area of a test sample cut from the test sample. For test samples 120 in. (3000 mm) 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 60 in. (1500 mm) wide but less than 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. (1500 mm) wide, take one specimen from the middle.

5.4.2 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 a modular pattern device having separate controls or adjustments for each module, take test specimens from the middle of each band.

5.4.3 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.

5.5 A test result is the average of the measurements made on a set of test specimens as described in 5.4. 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 specimens or the test sample in the standard atmosphere for testing textiles, that is 70 ± 2°F (21 ± 1°C) at 65 ± 2 % relative humidity, for 12 h or until the mass changes no more than 0.1 % in 2 h.

6.2 If the fiber in any layer of the backing has a commercial regain of over 5 %, the specimen shall be conditioned before measuring. Commercial moisture regains for textile fibers are listed in Table 1 in D1909.

7. Total Mass Per Unit Area

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

7.2 *Summary of Test Method*—Test specimens are cut from a conditioned test sample and then measured, or are cut from an unconditioned test sample and then conditioned before measuring, so that the area of each test specimen is measured after conditioning. Each conditioned test specimen is weighed and the mass per unit area is calculated.

7.3 *Apparatus:*

7.3.1 *Balance,* having a capacity and sensitivity to weigh to the nearest 0.1 % of the test specimen mass or to the nearest 0.01 g, whichever is larger.

NOTE 1—Weighing to the nearest 0.1 % means weighing to the nearest 0.01 g for test specimens weighing 10 to 100 g, to the nearest 0.1 g for 100 to 1000 g, and to the nearest 1 g for more than 1000 g. A 100-g, 10.0 × 10.0-in. (254 × 254-mm) test specimen has a mass per unit area of 457 oz/yd^2 (1550 g/m^2) while a 1000-g, 18.0 × 18.0-in. (457 × 457-mm) test specimen has a mass per unit area of 141.1 oz/yd^2 (4784 g/m^2).

7.3.2 *Device for Cutting and Measuring Test Specimens,* as directed for the procedure selected in Annex A1.

7.4 *Conditioning*— Condition the test specimens as directed in Section 1.2.3 before measuring and weighing. For Annex A1 Procedures 2 and 3, condition the test sample before cutting the test specimens.

7.5 *Sample and Test Specimens*—Take the test sample and the test specimens as directed in Section 1.2.2.

7.5.1 For level pile floor covering, the test specimens shall be at least 10.0 × 10.0 ± 0.2 in. (250 × 250 ± 5 mm).

7.5.2 For multilevel pile floor covering the test specimens shall comprise a full pattern repeat or a whole number multiple of a full pattern repeat in each direction, but no less than as directed in 7.5.1. If the pattern repeat is not known and cannot be determined readily, use 18.0 × 18.0 ± 0.2 in. (460 × 460 ± 5 mm) for the test specimen dimensions.

7.6 *Procedure:*

7.6.1 *Preparation of Specimens*—Follow the selected procedure of Annex A1.

7.6.2 *Test Specimen Mass*—Weigh each test specimen to the nearest 0.1 % (or less) of the test specimen mass, *M* (Note 1).

7.7 *Calculation:*

7.7.1 *Test Specimen Total Mass Per Unit Area*—Calculate the total mass per unit area for each test specimen to the nearest 0.01 oz/yd^2 (0.3 g/m^2) using Eq 1.

$$W = M \times K/(B \times L) \quad (1)$$

where:

W = total mass per unit area of the test specimen, oz/yd^2 (g/m^2),
M = mass of the test specimen, oz(g),
K = appropriate conversion factor in Table 1,
B = average width of the test specimen to the nearest 0.01 in. (0.3 mm), and
L = average length of the test specimen to the nearest 0.01 in. (0.3 mm).

NOTE 2—When the template or clicking die procedure of Annex A1 is used, a standard area value for $B \times L$ may be used in place of values of B and L determined by direct measurement of the specimens. Round this standard area value to the nearest 0.1 in.^{2} (65 mm^2).

7.7.2 Calculate the average total mass per unit area for all test specimens of the test sample to the nearest 0.1 oz/yd^2 (3 g/m^2).

7.8 *Report:*

7.8.1 State the test sample was tested as directed in Test Method D5848 for determining total mass per unit area. Describe the material or product sampled and the method of sampling used.

7.8.2 Report the average total mass per unit area for each test sample.

7.9 *Precision and Bias:*

7.9.1 *Precision*—The precision of the procedure in Test Method D5848 for determining total mass per unit area is being established.

7.9.2 *Bias*—The procedure in Test Method D5848 for determining total mass per unit area has no known bias and may be used as a referee method.

TABLE 1 Conversion Factors for Mass Per Unit Area

From	To	
	g/m^2	oz/yd^2
oz/in.^{2}	43 940	1296.0
oz/mm^2	28.350 × 10^4	836 100
g/in.^{2}	1550.0	45.72
g/mm^2	10^4	29 490

8. Component Masses Per Unit Area

8.1 *Scope*—This test method applies only to uncoated floor covering.

8.2 *Summary of Test Method*—The test specimens used for determining the total mass per unit area as directed in Section 1.3 are dissected into the component parts, separating the pile yarn from the backing fabric, and, if required, separating the yarns composing the backing fabric one from the other. Each component is weighed separately and the component mass per unit area calculated.

8.3 *Apparatus*—Balance, see 7.3.1.

8.4 Condition the test specimens as directed in Section 1.2.3 before measuring.

8.5 *Test Specimens*—Use the test specimens prepared for determining total mass per unit area as directed in Section 1.3 or prepare test specimens as directed in 7.5 and 7.6.

8.6 *Procedure:*

8.6.1 Manually separate the pile yarn from the backing fabric in each test specimen.

8.6.2 In the case of woven and knitted floor covering also separate the backing yarns, if required.

8.6.3 Weigh each component to the nearest 0.1 % of the component mass, *M*.

8.7 *Calculation:*

8.7.1 For each component calculate the component mass per unit area for each test specimen to the nearest 0.01 oz/yd^2 (0.3 g/m^2), using Eq 2.

$$C = M \times K/(B \times L) \quad (2)$$

where:

C = component mass per unit area for the test specimen, oz/yd^2 (g/m^2),
M = mass of the component removed from the test specimen, oz (g),
K = appropriate conversion factor in Table 1,
B = average width of the test specimen, in. (mm), and
L = average length of the test specimen, in. (mm).

8.7.2 Calculate the average component mass per unit area for each component to the nearest 0.1 oz/yd^2 (3 g/m^2) for all test specimens in the test sample.

8.8 *Report:*

8.8.1 State the test sample was tested as directed in Test Method D5848 for determining component masses per unit area. Describe the material or product sampled and the method of sampling used:

8.8.2 Report the average component mass per unit area for each component for the test sample, using component names in common usage.

8.9 *Precision and Bias:*

8.9.1 *Precision*—The precision of the procedure in Test Method D5848 for determining component masses per unit area is being established.

8.9.2 *Bias*—The procedure in Test Method D5848 for determining component masses per unit area has no known bias and may be used as a referee method.

9. Pile Yarn Mass Per Unit Area

9.1 *Scope*—This test method applies only to coated pile yarn floor coverings.

9.2 *Summary of Test Method*—One or two strip specimens are taken as directed in 9.7.2 from each test specimen such that the combined mass per unit area of the strip specimen(s) is within 1 % of the mass per unit area of the test specimen. The total mass of the selected strip specimens taken from all test specimens of the test sample is designated *M*. Most of the pile is shear from the strip specimens and discarded, leaving stubble specimens whose total mass is designated *S*. The buried pile yarn in the stubble specimens along with adhering coating material is manually removed from the backing fabric with the assistance of a solvent that dissolves or softens the coating material. Most of the adhering coating material is cleaned from the fiber of this buried pile yarn by further soaking in solvent and by abrasion. There are three different options to accomplish the cleaning of the buried pile. The total mass of this partially cleaned fiber from all the strip specimens is designated *C*. The amount of residual coating material on this fiber is determined by dissolving the partially cleaned pile fibers, leaving a residue of coating material. The mass of the residue is designated *R*. The mass of the pile yarn in the strip specimens equals the mass sheared from the strip specimens, *(M − S),* plus the mass of the pile yarn buried in the backing, *(C − R).*

9.3 *Apparatus:*

9.3.1 *Balance,* see 7.3.1.

9.3.2 *Shear or Clipper,* capable of shearing close enough to the backing so as to leave stubble of approximately 0.05 in. (1.3 mm).[4]

9.3.3 *Means for Cutting and Measuring Test Specimens,* as directed for the procedure selected in Annex A1.

9.3.4 *Means for Abrading Buried Pile Yarn in Solvent Manual Option:*

9.3.4.1 *16-Mesh Screen,* with rim, approximately 8 in. (200 mm) in diameter.[5]

9.3.4.2 *Receiver Pan,* approximately 4 in. (100 mm) deep and 12 in. (305 mm) in diameter, large enough to hold 16-mesh screen.

9.3.4.3 *Presser,* having a flat, firm surface approximately 1.5 in. (38 mm) wide.

9.3.5 *Means for Abrading Buried Pile Yarn in Solvent—Mechanical Option:*

9.3.5.1 *Stainless Steel, Industrial Grade Blender,* minimum of two speeds (speed range 15 000 to 20 000 rpm), stainless steel 2 qt container (see photograph 1).

9.3.5.2 *Container,* polyethylene or stainless steel, approximately minimum dimension 6 in. (150 mm) square at top and 5 in. (130 mm) square at bottom and 7 in. (180 mm) deep.

9.3.5.3 *Wire Mesh Screen Basket,* 16–mesh, approximately 4.5 in. (114 mm) square at top and 4 in. (100 mm) square at bottom and 5 in. (130 mm) deep.

9.3.5.4 *Mesh Wire mesh Screen Basket,* 4.5 in. (114 mm) square at top and 4 in. (100 mm) square at bottom and 5 in. (130 mm) deep.

9.3.5.5 *Spacer,* polyethylene ring, approximately 5 in. (130 mm) outside diameter and 2 in. (50 mm) high to fit bottom of the polyethylene container and support the screen basket.

9.3.5.6 *Laboratory Stirrer.*[6]

9.3.5.7 *Shallow Tray,* of glass, aluminum, or plastic, must be resistant to solvent used in testing.

9.3.6 *Spatula.*

9.3.7 *Tweezers.*

9.3.8 *Laboratory Forced Air Oven,* capable of maintaining a temperature range of 221 ± 5°F (105 ± 2°C).

9.3.9 *Tea Strainer,* or similar sieve.

9.3.10 *Wire Mesh Screen,* 100-mesh, approximately 4 × 4 in. (100 × 100 mm).

9.3.11 *Gloves,* chemical-resistant.

9.3.12 *Brush,* steel.

9.3.13 *Steam Table.*

9.4 *Reagents*—All technical grade unless otherwise specified.

9.4.1 *Acetone.*

9.4.2 *Ammonium Thiocyanate,* 70.

9.4.3 *γ-Butyrolactone.*

9.4.4 *Chloroform.*

9.4.5 *m-Cresol,* clear.

9.4.6 *Decalin.*

9.4.7 *Dimethylacetamide.*

9.4.8 *Dimethylformamide.*

9.4.9 *Formic Acid,* 90 %.

9.4.10 *Hexafluorisopropanol.*

9.4.11 *Hydrochloric Acid,* approximately 6 *N*. Carefully add 1 volume of concentrated hydrochloric acid (sp gr 1.19) to 1 volume of water.

9.4.12 *Methyl Chloroform,* aerosol grade.

9.4.13 *Methylene Chloride.*

9.4.14 *Phenol,* 88 %.

9.4.15 *Sodium Hydroxide,* 5 ± 0.5 %. Dissolve 5.0 ± 0.5 g of reagent grade sodium hydroxide (NaOH) in water and dilute to 100 mL.

9.4.16 *Tetrachloroethane.*

9.4.17 *Tetrahydrofuran.*

9.4.18 *Water,* Type IV grade of reagent water conforming to Specification D1193.

9.4.19 *Xylene,* boiling point between 275 and 284°F (135 and 140°C).

9.5 *Precaution*—In addition to other precautions, the reagents cited in 9.4 can cause damage to health and property if not used with proper precautions. Some are flammable. Some are corrosive. Some are known or suspected to be toxic, carcinogenic, mutagenic, teratogenic, or otherwise harmful to

[4] Sunbeam Model 510 Clipmaster with EA-1 SUR bottom blade, or equivalent. Available from most agricultural supply sources.

[5] Standard sieve screen, Tyler Screen Scale: 16 mesh. U.S. Standard Sieve Series: 1 mm. Available from most laboratory or scientific supply sources.

[6] The sole source of supply of the Lightning Mixer Model G3-U-05, variable speed, 180–2300 rpm, or equivalent known to the committee at this time is Mixing Equipment Co., 135 Mount Read Blvd., Rochester, NY 14611. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

people. Table 2 lists the boiling point, flashpoint, and the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for each reagent. The threshold limits are subject to change and precautions should be adjusted accordingly.

9.5.1 Use hoods, gloves, and safety goggles according to the hazard presented by each reagent.

9.5.2 Always refer to the manufacturer material safety data sheet for recommendations on handling, use, storage, and disposal for each chemical reagent.

9.5.3 *It is the responsibility of the user of this test method to establish appropriate safety practices and to determine the applicability of regulatory limitations prior to use.*

9.6 Condition the test specimens and strip specimens as directed in Section 1.2.3 before weighing.

9.7 *Specimens:*

9.7.1 *Test Specimens:*

9.7.1.1 For level pile floor covering, the test specimens shall be at least 10.0 × 12.5 in. (250 × 320 mm).

9.7.1.2 For multilevel pile floor covering, the test specimens shall comprise a full pattern repeat or a whole number multiple of a full pattern repeat in each direction, but no less than as directed in 9.7.1.2. If the pattern repeat is not known and cannot be determined readily, use test specimens at least 18.0 × 18.0 in. (460 × 460 mm) in size.

NOTE 3—Before selecting test specimens, examine the back of the test sample for signs of variation in the amount of back coating. As far as possible, take test specimens at locations having neither high nor low amounts of back coating.

9.7.2 *Strip Specimens:*

9.7.2.1 Strip specimens shall be 10.0 ± 0.1 in. (250 ± 3 mm) in the lengthwise direction and 2.5 ± 0.1 in. (64 ± 3 mm) in the widthwise direction.

NOTE 4—The actual dimensions of a specimen are not critical as long as the area has been measured accurately.

9.7.2.2 Take one strip specimen from each test specimen for routine quality control and acceptance testing.

9.7.2.3 Take two strip specimens from each test specimen for referee testing, and for acceptance testing when the pile yarn mass per unit area is close to a minimum standard to be met or exceeded.

NOTE 5—Two strip specimens may be taken from each test specimen either as a pair at the same time or as directed in 9.7.2.2 on two separate occasions. In the latter case, two sets of analyses are performed but the masses obtained from each set, at each stage of the analysis, are combined as though the two strip specimens had been taken as a pair.

9.8 *Procedure:*

9.8.1 *Preparation of Specimens*—Follow the selected procedure in Annex A1.

9.8.1.1 Combination templates or clicking dies may be used to cut the strip specimens together with the test specimens.

TABLE 2 Reagent Hazard Characteristics[A]

Reagent			Characteristics				
Common Name	Formal Name[B]	Number[B]	Boiling Point,[C] °F (°C)	Flash Point,[C] °F (°C)	Exposure Limits, TWA[D] ppm	Exposure Limits, TWA[D] mg/m³	Dominant Hazard(s)[E,F]
Acetone	2-propanone	67-64-1	133 (56)	1.4 (–17)	750	1780	e, f
Ammonium thiocyanate	thiocyanic acid, ammonium salt	1762-94-4	338 (170) (decomposes)	. . . (. . .)	. . .	. . .	d
Chloroform	methane, trichloro-	67-66-3	142 (61)	. . . (. . .)	10	49	a, c, h, t
m -Cresol	phenol 3-methyl-	108-39-4	396 (202)	187 (86)	5	22	i, k, s
Decalin	naphthalene, deca-hydro-	91-17-8	378 (192)	136 (58)	. . .	. . .	i
Dimethylformamide	formamide, *N,N*-dimethyl-	68-12-2	307 (153)	136 (58)	10	30	g, i, s, t
Formic acid	formic acid	64-18-6	226 (108)	185 (85)	5	9	i, k
Hydrochloric acid	hydrochloric acid	7647-01-0	228 (109)	. . . (. . .)	5	7	i, k
Methyl chloroform	ethane,1,1,1-trichloro-	71-55-6	165 (74)	. . . (. . .)	350	1910	a, h
Methylene chloride	methane, dichloro-	75-09-2	104 (40)	. . . (. . .)	50	174	a, h, z
Phenol	phenol	108-95-2	359 (182)	174 (79)	5	19	g, i, k, s
Sodium hydroxide	sodium hydroxide	1310-73-2	216 (102)	. . . (. . .)	. . .	2	i, k
Sodium hypochlorite	sodium hypochlorite	7681	232 (111)	. . . (. . .)	. . .	. . .	l, k
Tetrachloroethane	ethane,1,1,2,2-tetrachloro-	79-34-5	295 (146)	()	1	6.9	a, g, h, s
Tetrahydrofuran	furan, tetrahydro-	109-99-9	151 (66)	6 (–14)	200	590	c, e, f, m, t
Xylene	benzene, dimethyl-	1330-20-7	282 (139)	84 (29)	100	435	f

[A] The information in this table is provided to alert users to the hazards accompanying the use of these reagents. Each user must make his own decisions regarding the kind and extent of risk involved and what protective measures to enforce.
[B] Toxic Substances Control Act Chemical Substance Inventory, *Initial Inventory,* Vol 1, May 1979.
[C] Approximate values from various sources.
[D] ACGIH-TLVs (trademarked) *Threshold Limit Values for Chemical Substances and Physical Agents* adopted by American Conference of Governmental Industrial Hygienist, TWA = time weighted average.
[E] Sources include: *Documentation of the Threshold Limit Values,* 1992–1993 edition, ACGIH, Cincinnati, OH.
[F] This listing of dominant hazards is indicative, not exhaustive. Suspected as well as confirmed hazards are included in some cases.

Legend:

a=	anesthetic, narcotic	i=	irritating
c=	carcinogenic	k=	corrosive
d=	forms cyanide fumes on decomposition or contact with acids	m=	mutagenic
e=	explosive	s=	skin penetrating
f=	flammable	t=	teratogenic, embryotoxic
g=	gastrointestinal	v=	very
h=	hepatoxic-liver	z=	carbon monoxide in blood

When a standard size test specimen template or clicking die is used on multilevel pile floor covering, the template or die may be designed to cut as many strip specimens from the test specimen as possible to provide extra strip specimens, if needed.

9.8.1.2 For floor coverings having gages 5⁄16 in. (8 mm) or greater and essentially straight lengthwise lines of binding sites (less than one-half gage lateral deviation from a straight line), angle the 10 ± 0.1-in. (250 ± 3-mm) specimen dimension approximately 14° (0.24 rad) to the lengthwise direction of the floor covering. The diagonal of the 2.5 by 10.0 ± 0.1-in. (64 by 250 ± 3-mm) specimen has this angle to the 10.0 ± 0.1 in. (250 ± 3-mm) side.

NOTE 6—With coarse gages and straight lengthwise lines of binding sites it is possible to lose a whole row of tufts by a small lateral shift in the location of the strip specimen location when the long dimension is parallel to the line of binding sites. Angling the strip specimen avoids this problem.

9.8.2 *Equivalent Mass for s Strip Specimens:*

9.8.2.1 Determine the total mass per unit area of each test specimen as directed in Section 1.3. Convert this to an equivalent mass for *s* strip specimen using Eq 3.

$$E_i = AsW_i/K \quad (3)$$

where:

- i = numerical designation of an individual test specimen (1, 2, . . . n; where n = number of test specimens),
- E_i = equivalent mass of the s strip specimen(s) for the ith test specimen, g,
- A = nominal area of one strip specimen, 25 in.^{2} (16 000 mm^2),
- s = number of strip specimens taken from each test specimen, 1 or 2,
- W_i = total mass per unit area of the ith test specimen, oz/yd^2 (g/m^2), and
- K = appropriate conversion factor from Table 1, converting g/in.^{2} (g/mm^2) to the units of W_i.

9.8.2.2 Calculate 1 % limiting values for acceptable masses for *s* strip specimens using Eq 4 and 5:

$$Upper\,Limit = 1.01\,E_i \quad (4)$$

$$Lower\,Limit = 0.99\,E_i \quad (5)$$

9.8.3 *Strip Specimen Selection*—Weigh the strip specimen(s) from each test specimen to the nearest 0.01 g. Select *s* strip specimen(s) from each test specimen whose combined mass is between the upper and lower 1 % limiting values calculated in 9.8.2.2 for that test specimen. Cut additional strip specimens, if necessary. Record the total mass of all selected strip specimens from all test specimens as *M*.

9.8.4 *Stubble Specimens:*

9.8.4.1 Shear the pile yarn on the selected strip specimens down to a stubble of approximately 0.05 in. (1.3 mm), removing and discarding all loose pile fiber.

NOTE 7—When shearing, avoid including back coating projections or fiber from fiber layers needle-punched into the backing fabric with the pile fiber of the tufted floor covering, or both. Stop shearing before this occurs even if the pile stubble has not been reduced to 0.05 in. (1.3 mm). In subsequent steps, care must be exercised to keep the layer fiber separate from the pile fiber.

9.8.4.2 Weigh all the stubble specimens from all test specimens together to the nearest 0.01 g and record as the stubble specimen mass, *S*.

NOTE 8—When separate pile yarn mass per unit area estimates are required for individual test specimens, weigh the stubble specimen(s) from each test specimen separately and conduct the subsequent steps of the procedure treating the stubble specimens from each test specimen separately. When individual stubble specimen weighings are required, as for the pile thickness determination on multilevel pile yarn floor covering, add the masses obtained for all stubble specimens together to obtain the value of *S*.

9.8.5 *Separation of Buried Pile Yarn from Backing*—The objective of this operation is to separate the buried pile yarn of each selected stubble specimen from the backing fabric(s) and some of the back coating materials. The steps to be followed will vary with the type of floor covering construction: tufted, woven, or knitted; the type of backing fabric: jute, woven polypropylene, with or without needle-punched fiber, and nonwoven polypropylene; and the type of back coating: latex, hot melt, polyurethane, poly(vinyl chloride), and rubber foam. Variations of composition within each type of coating will require variations in treatment, as well. Frequently used procedures are detailed in 9.8.5.1-9.8.5.8.

9.8.5.1 First remove most of any attached cushion manually by slicing with a knife and by abrasion with the steel brush, taking care not to remove pile fiber from the yarn in the backing.

9.8.5.2 Remove the backcoating material as directed in 9.8.5.3 for poly(vinyl chloride) coatings, 9.8.5.4 for hot-melt coatings, and 9.8.5.5 for latex coatings. See 9.5 and Table 2 for safety precaution information.

9.8.5.3 *Poly(Vinyl Chloride) Coatings*—Remove poly(vinyl chloride) coatings by placing the stubble specimen in a beaker containing tetrahydrofuran at room temperature. Use a spatula to scrape off the softened PVC coating. Proceed to 9.8.5.8.

9.8.5.4 *Hot-Melt Coatings*—Remove hot-melt coatings with methyl chloroform; warm as necessary. If there is a secondary backing, proceed to 9.8.5.6, otherwise to 9.8.5.7 and 9.8.5.8.

9.8.5.5 *Latex Coatings*—Soften the latex of a latex coated, tufted floor covering by placing the buried pile yarn specimen in ether, chloroform, methyl chloroform, or methylene chloride for approximately 10 min at room temperature. Proceed to 9.8.5.6-9.8.5.8.

NOTE 9—A woven polypropylene primary backing often can be mechanically stripped from the rest of the backing of a tufted floor covering with little or no solvent treatment.

9.8.5.6 Peel the secondary backing from the primary backing, repeating the solvent immersion, if necessary.

9.8.5.7 Scrape buried yarn, together with any coating material adhering to the yarn from the primary backing or the secondary backing, or both, with a spatula. Tweezers may be necessary in some instances.

9.8.5.8 Accumulate the separated buried pile yarn in a beaker and cover it with solvent. Combine the buried yarn from all of the selected stubble specimens for the remaining steps of the procedure.

9.8.6 *Cleaning of Buried Pile Yarn*—The objective of this step is to accurately determine the mass of the buried pile yarn

without the adhesive coating. There are three different procedures that can be used. Each uses a solvent to aid in dissolving the adhesive and an abrasive action to help break down and separate the adhesive from the fiber. Choose only one method from the procedures described below:

9.8.6.1 *Manual Option*—Remove the adhesive coating material from the buried pile yarn by immersing the yarn in the solvent and abrading the yarn. After 10 to 60 min of immersion in the solvent, place the buried yarn on the 16-mesh screen in the flat tray and abrade the coated particles with the presser tool. Apply just enough force to pass the adhesive material through the screen while retaining the buried yarn fibers on the screen surface.

(1) Use of Cleaning Solvent—Repeat the cleaning process until the buried pile yarn has been separated into individual fibers which are visually clean of adhesive coating particles. Periodically transfer the fiber to fresh solvent with a tea strainer or sieve. Pour the spent solvent through the strainer to catch any remaining fiber. If the sieve contains coating particles, inspect them for trapped fiber. Discard all particles that are free of fiber and continue to clean the particles with embedded fiber. With some coating formulations; rice-like particles will persist even after repeated abrading. When the quantity stabilizes, proceed to 9.8.6.7.

9.8.6.2 *Mechanical Option*—Remove the adhesive coating material from the buried pile yarn by immersing the yarn in the solvent and abrading the yarn. Place the buried pile yarn in the 16-mesh screen basket and put the basket in the square polyethylene container filled with solvent. Subject the yarn to power stirring for approximately 30 min. The yarn should circulate vertically while stirring. Adjust the amount of yarn per batch as needed to obtain proper circulation.

(1) Use of Cleaning Solvent—Repeat the cleaning process until the buried pile yarn has been separated into individual fibers which are visually clean of adhesive coating particles. Periodically transfer the fiber to fresh solvent with a tea strainer or sieve. Pour the spent solvent through the strainer to catch any remaining fiber. If the sieve contains coating particles, inspect them for trapped fiber. Discard all particles that are free of fiber and continue to clean the particles with embedded fiber. With some coating formulations, rice-like particles will persist even after repeated abrading. When the quantity stabilizes, proceed to 9.8.6.7.

9.8.6.3 *Blender Option*—This option is designed for textile floor coverings that use latex compounds as an adhesive binder. The option uses chloroform as a solvent to remove the adhesive from the carpet fiber (this option does not require a fiber dissolving step). The method relies on a vigorous separation of the fiber from the latex adhesive compound. The separation of the latex from the fiber is caused by placing the buried yarn from step 9.8.5.8 into a high speed blender with chloroform. The chloroform in conjunction with the chopping action of the blender allows the latex to go into solution, the filler (heavy particles) settles to the bottom of the blender, and the fibers migrate to the top of the blender. The method has been proven to produce statistically equal results when compared to the other cleaning options outlined in 9.8.6.1 and 9.8.6.2 without using the dissolving part of the method.

NOTE 10—Chloroform is used in this method as a solvent to remove the latex from the fiber and put it into solution. Other solvents that produce the same result can be substituted.

(1) Use of Blender and Solvent—Place the buried yarn from step 9.8.5.8 in an industrial grade blender (see Fig. 1). If specimen has a large amount of buried yarn, the specimen should be divided into two separate treatments. Dividing the sample will avoid a build-up of fiber in the blender.

(2) Pour chloroform into the blender until the specimen is covered (see Fig. 3) (adding too much solvent to the blender will cause the solvent to be forced out of the blender). Cover the blender and use a pulsation action to the cycle and break up large particulate. Remove the cover and rinse the sides of the blender with chloroform. Replace cover and run on low speed for 1 to 2 min. Fiber and latex adhesive compound will separate (fiber floating to the top and solubles and insolubles falling to the bottom). (See Fig. 4.)

(3) Carefully separate the fiber/residue mixture from the chloroform by pouring solution from the blender through a 100 mesh sieve into a shallow pan. Observe the color of the chloroform. If the poured chloroform is white/cloudy color, this indicates that latex adhesive is still present in the sample. Therefore, an additional cleaning is needed, (see Fig. 5). If the color is clear or similar to virgin chloroform, no latex is present and cleaning is complete (see Fig. 6), proceed to step four.

(4) If fibers or large particles are caught in the sieve while pouring out the chloroform, use a presser tool and chloroform to try to break up the pieces (see Fig. 7). Return all fibers or particles, or both, that may have fiber in them back to the blender.

(5) If additional cleaning is needed, rinse the inner walls of the blender with fresh chloroform to move all the fiber and residuals back to the bottom of the blender. Repeat step two.

(6) Pour the blender's contents into the sieve. Using the "Presser Tool," push the fibers to one side of sieve and rinse any fibers attached to tool (using chloroform from a plastic squirt bottle) onto the sieve. Carefully rinse the inside surface of the blender. Swirl the contents to aid in removal of residue from the blender. Pour the contents through the uncovered part

FIG. 1 Two Quart Blender Typically Used to Mechanically Separate Buried Yarn from the Latex Compound

FIG. 2 Buried Yarn in Blender (Before Chloroform Addition)

FIG. 3 Buried Yarn with Chloroform, Before Mechanical/Blender Separation

FIG. 4 Yarn Separated from the Latex Compound

of the sieve. Repeat this procedure until the inside of the blender is visually clean of residue. Do not pour the blender's contents on top of the fiber sitting in the sieve, as this will add error to the weight of the fiber.

FIG. 5 Separation of Solvent from Fiber (Note Milky Solvent Color Indicates Latex is Still Present in the Specimen)

FIG. 6 Separation of Latex from Fiber with Solvent (Note Clear Solvent Color Indicates No Latex is Present in the Specimen)

(7) Rinse the fiber with solvent, carefully looking for residue caught in the fiber mass. Remove any residue found in the uncovered area of the sieve (see Fig. 8). Allow most of the solvent to evaporate from the fiber in a hood, either at room temperature or on a steam table.

(8) Place the rinsed fiber (substantially free of solvent) on a heat-resistant surface and place in an oven at 221°F (105°C) for at least 60 min to evaporate the solvent. Remove the specimen from the oven.

(9) Condition the fiber/residue in the sieve for at least 4 h in the standard atmosphere for testing textiles.

(10) Carefully separate the fiber from the residue. Place the fibers and residue into separate containers of known weight. Pre-weighed coffee filters are useful containers for the separation. Visually inspect the residue for any additional fibers and return the fibers to the fiber container. Separately, weigh the residue/container and fiber/container specimens to the nearest 0.01 g, Fig. 9 and Fig. 10. Calculate the weight of the residue by subtracting the container weight from the total weight. The weight of the residue should be less than 1.0 g if a thorough separation of the fiber and latex has occurred. If the residue

FIG. 7 Using Presser Tool and Chloroform to Break Up Hard Pieces of Buried Fiber

FIG. 8 Cleaning the Blender Out by Pouring Residue Into Clear Area of the Sieve

FIG. 9 Buried Fiber After Separation from Latex Compound, Placed on Pre-Weighed Paper

amount is greater than 1 g, additional separation of the fiber and residue is needed. Once the residue weight is less than 1.0 g, go to 9.9 (see Note 11).

FIG. 10 Residual Compound Held in Sieve and Placed on Pre-Weighed Paper

NOTE 11—In this option, the residue weight is not used in the final calculation. Use $R = 0$ regardless of the residue weight. The residue weight is used to assess if adequate cleaning has been performed.

9.8.6.4 *Other Options*—As new back coatings are developed, other solvents and procedures may be required to remove the bulk of the back coating material from the fiber. The loss in fiber mass shall be less than 0.1 % when the new procedure is applied to fiber alone, without back coating.

9.8.6.5 Use 9.8.6.1 when 9.8.6.2 or 9.8.6.3 does not provide sufficient cleaning.

9.8.6.6 Rinse fiber with solvent and allow most of the solvent to evaporate from the fiber in a hood either at room temperature or on a steam table.

NOTE 12—This step is not necessary if a properly ventilated explosion-proof oven is used for the next step.

9.8.6.7 Place the rinsed fiber (substantially free of solvent) on a heat-resistant surface in an oven at 221°F (105°C) for at least 60 min to complete the solvent vaporization.

9.8.6.8 Check fiber for tackiness and subject the fiber to further abrasive immersion if tackiness is found.

9.8.6.9 Condition tack-free fiber for at least 4 h in the standard atmosphere for testing textiles.

9.8.6.10 Weigh conditioned fiber to the nearest 0.01 g and record as buried pile yarn mass, *C*.

9.8.7 *Fiber Dissolving (Not necessary if using the Blender Option.):*

9.8.7.1 Select the appropriate fiber solvent and dissolving conditions from Table 3. Place the cleaned fiber in a beaker and cover with the selected solvent. Follow the specified dissolving conditions. See 9.5 and Table 2 for safety precaution information.

NOTE 13—As new back coatings are used in pile yarn floor covering it may be necessary to use special techniques involving other reagents to accomplish the final separation of fiber from back coating materials. When this is the case, test to determine whether the fiber-dissolving reagent, as used, dissolves the back coating material appreciably. The loss in back coating mass shall be less than 1 % when the fiber-dissolving solvent is applied to back coating material in the absence of fiber.

9.8.7.2 Collect the residue on the 100-mesh screen and rinse with water for aqueous solvents and with acetone for organic solvents.

TABLE 3 Solvents for Dissolving Pile Fibers[A]

Fiber Type	Solvent	Procedure
Acrylic	70 % ammonium thiocyanate solution	15 min @ boil
	dimethylformamide	15 min @ 77°F (25°C), then bring to boil
Modacrylic	acetone	15 min @ 104 to 122°F (40 to 50°C)
	dimethylformamide	15 min @ 77°F (25°C)
Nylon	*m*-cresol	15 min @ 203°F (95°C)
	formic acid, 90 %	15 min @ 77°F (25°C)
	hydrochloric acid, 6*N*	15 min @ 77°F (25°C)
Polyester	*m*-cresol	15 min @ boil
Polypropylene	xylene	15 min @ boil
	decalin	15 min @ 275°F (135°C)
Wool	sodium hydroxide, 5 %	15 min @ boil
	sodium hypochlorite	30 min @ 77°F (25°C) (stir)

[A] Different varieties of the generic fiber types may respond differently to the same solvent. The best combination of solvent and dissolving conditions often must be found by trial and error. As new back coatings are developed, new solvents and dissolving conditions may be required to avoid dissolving the back coating while dissolving the fiber.

9.8.7.3 Examine residue for presence of pile fibers and subject the residue to the above dissolving procedure until all signs of fiber are gone.

9.8.7.4 For nonaqueous solvents allow most of the solvent to evaporate from the rinsed residue in a hood, either at room temperature or on a steam table (see Note 9).

9.8.7.5 Place the residue in an oven at 221°F (105°C) for 60 min to remove the remaining solvent.

9.8.7.6 Condition dried residue for at least 4 h in the standard atmosphere for testing textiles.

9.8.7.7 Weigh residue to the nearest 0.01 g and record as coating residue, *R*.

9.9 *Calculations:*

9.9.1 Calculate the average pile yarn mass per unit area to the nearest 0.1 oz/yd^2 (3 g/m^2) using Eq 6:

$$P = K(M - S + C - R)/A \quad (6)$$

where:

P = average pile yarn mass per unit area, oz/yd^2 (g/m^2),
K = dimensional conversion factor from Table 1, converting from g/in.^{2} (g/mm^2) to required reporting units,
M = total mass of the selected strip specimens from all test specimens, g,
S = total mass of all stubble specimens, g,
C = mass of cleaned buried yarn, g,
R = mass of coating residue, g, R = 0 if Cleaning Option 3 is used, and
A = combined measured area of all strip specimens, in.^{2} (mm^2).

NOTE 14—When separate estimates are required for individual test specimens, record the mass of the strip specimen(s) selected from each test specimen as M_i and obtain values of S_i, C_i, and R_i for each test specimen as directed in Note 7. A value of the pile yarn mass per unit area for each test specimen can then be calculated by substituting M_i, S_i, C_i, and R_i for *M, S, C,* and *R,* respectively, in Eq 6 and using the measured area of the strip specimens of each test specimen for *A*.

9.9.2 An example of a typical calculation is presented in Annex A2.

9.10 *Report:*

9.10.1 State the test sample was tested as directed in Test Method D5848 for determining pile yarn mass per unit area. Describe the material or product sampled and the method of sampling used.

9.10.2 Report the number of strip specimens taken from each test specimen. Report the average pile yarn mass per unit area.

10. Precision and Bias

10.1 *Summary*—In comparing two averages, the differences should not exceed the single-operator precision values shown in Tables 4 and 5 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 randomly drawn from the sample of material. Larger differences are likely to occur under all other circumstances.

TABLE 4 Critical Differences for Two Averages for the Conditions Noted 95 % Probability Level,[A] Ounces per Square Yard Material 1[B]

Number of Test Results in each Average	Single Operator Precision	Within-Laboratory Precision	Between-Laboratory Precision
1	1.25	1.25	1.67
3	.72	.72	1.32
6	.51	.51	1.22
8	.44	.44	1.19

[A] The critical differences stated in Tables 4 and 5 were calculated using *t = 1.960,* which is based on infinite degrees of freedom.
[B] This data represents a large percentage of the carpets manufactured to date. Other carpet weight ranges and variations in construction materials may not present the same precision values.

10.2 *Interlaboratory Test Data*—An interlaboratory test was run in 1995 in which randomly-drawn samples of two 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 D5848 – 95, "Mass per Unit Area of Pile Yarn Floor Coverings." The components of variance for pile yarn mass per unit area expressed as standard deviations were calculated to be the values listed in Table 6. Analysis of

TABLE 5 Critical Differences for Two Averages for the Conditions Noted 95 % Probability Level,[A] , Ounces per Square Yard Material 2[B]

Number of Test Results in each Average	Single Operator Precision	Within-Laboratory Precision	Between-Laboratory Precision
1	.17	.34	.58
3	.10	.31	.56
6	.07	.30	.56
8	.06	.29	.56

[A] The critical differences stated in Tables 4 and 5 were calculated using *t = 1.960,* which is based on infinite degrees of freedom.
[B] This data represents a large percentage of the carpets manufactured to date. Other carpet weight ranges and variations in construction materials may not present the same precision values.

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

Variance Component	Material 1	Material 2
Within Laboratory	.45	.17
Single Operator	0	.13
Between Laboratory	.45	.06

[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.

the data was conducted using Practice D2904, Practice D2906 and the Adjunct "Tex-Pac." The material types were:

Material 1: Tufted coated loop pile nylon carpet (SBR latex w/woven synthetic back) (Nominal 20 ozs./yd^2)

Material 2: Tufted coated cut pile nylon carpet (SBR latex w/woven synthetic back) (Nominal 24 ozs./yd^2)

10.3 *Precision*—For the components of variance reported in Table 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 4 and 5. There were sufficient differences related to the material type and structure to warrant listing the components of variance and the critical differences separately. Consequently, no multi-material comparisons are shown.

NOTE 15—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.

NOTE 16—The tabulated values of the critical differences should be considered to be a general statement, particularly with respect to between laboratory precision. Before a meaningful statement can be made about two specific laboratories, the amount of statistical bias, if any, between them must be established, with each comparison being based on recent data obtained on specimens taken from a lot of material to the type being evaluated so as to be as nearly homogeneous as possible and then randomly assigned in equal numbers to each of the laboratories.

10.4 *Bias*—The value of pile yarn mass per unit area can only be defined in terms of a test method. Within this limitation, Test Method D5848 has no known bias.

11. Keywords

11.1 carpet; construction; floor covering; mass per unit area; pile yarn

ANNEXES

(Mandatory Information)

A1. PREPARING SPECIMENS OF MEASURED AREA

A1.1 In this test method, specimens of measured area are required for mass per unit area determinations. It is important to recognize that just as much care is needed in measuring the area of the specimen as in measuring its mass. The actual dimensions of a specimen are not critical as long as the area has been measured accurately.

A1.2 Any procedure for obtaining a pile yarn floor covering specimen of measured area must also have the objective of retaining with the specimen all tuft legs attached to binding sites included in the measured area.

A1.3 Three procedures for obtaining specimens of measured area may be used. These are distinguished by the apparatus employed. The choice of procedure depends primarily on the cost of preparing specimens. Each procedure must be capable of producing specimens having straight sides and right angle corners, 1.57 ± 0.03 rad (90 ± 2°). The adequacy of the cutting method chosen can be checked by measuring the two diagonals of a test specimen. On a 10-in. (250-mm) square test specimen the diagonals will differ no more than 0.49 in. (12 mm) when the angles are between 1.54 and 1.61 rad (88 and 92°). In general, the allowable difference is 0.0494 times the length of the side of the square. For a rectangular specimen, the difference between the squares of the diagonals shall be no greater than 0.14 times the product of the length and width of the specimen. For the 64 × 250-mm (2.5 × 10-in.) strip specimen, the allowable difference between the squares of the diagonals is 3.5 in.^{2} (2260 mm^2) and the allowable difference between the diagonals is 0.17 in. (4.3 mm).

A1.4 Before following any of the following procedures, remove all loose fiber and foreign matter from the face and back of the area of floor covering from which the specimen is to be cut.

A1.5 *Procedure 1:*

A1.5.1 *Apparatus:*

A1.5.1.1 *Scale or Tape,* metal, graduated in 0.01 in. (2 mm), and at least 10 % longer than the test specimen dimensions.

A1.5.1.2 *Pen,* felt tip.

A1.5.1.3 *Straightedge,* steel, 0.06 in. to 0.08 in. (1.5 to 2.0 mm) thick, at least 10 % longer than the test specimen dimensions, and having a row of pins projecting approximately 0.15 in. (3.8 mm) from one face at intervals of approximately 2 in. (50 mm) along its centerline.

A1.5.1.4 *Razor Knife,* having a blade about 0.02 in. (0.5 mm) thick.

A1.5.1.5 *Scissors,* sharp.

A1.5.2 *Test Specimen Cutting:*

A1.5.2.1 Place the test sample pile down on a flat surface.

A1.5.2.2 Measure and mark the boundaries of the test specimens on the back using the scale, straightedge, and pen.

A1.5.2.3 Cut just through the backing with the razor knife guided by the straightedge, following the ink markings. Hold the plane of the razor knife perpendicular to the back of the test sample.

A1.5.2.4 Separate each test specimen from the test sample using scissors to cut any loops connected to the remainder of the test sample.

A1.5.3 *Test Specimen Dimensions*—Measure each dimension of each conditioned test specimen three times with the graduated metal scale or tape to the nearest 0.01 in. (0.3 mm); once approximately in the middle and once each about 1 in. (25 mm) from each side. Calculate areas to the nearest 0.01 in.^{2} (65 mm^2).

A1.6 *Procedure 2:*

A1.5.4 *Apparatus:*

A1.5.4.1 *Template,* steel, 0.06 to 0.08 in. (1.5 to 2.0 mm) thick, having dimensions 0.02 in. (0.5 mm) less than the test specimen dimensions specified in the test method, and having a pin projecting approximately 0.15 in. (4.0 mm) from one face in each corner about 0.25 in. (6 mm) in from the sides of the corner. Two such templates are illustrated in Figs. A1.1 and A1.2.

NOTE A1.1—For multilevel floor covering a standard size template or clicking die may be used if the pattern area is within 2 % of the standard area.

A1.5.4.2 *Razor Knife,* having a blade about 0.02 in. (0.5 mm) thick.

A1.5.4.3 *Scissors,* sharp.

A1.5.5 *Test Specimen Cutting:*

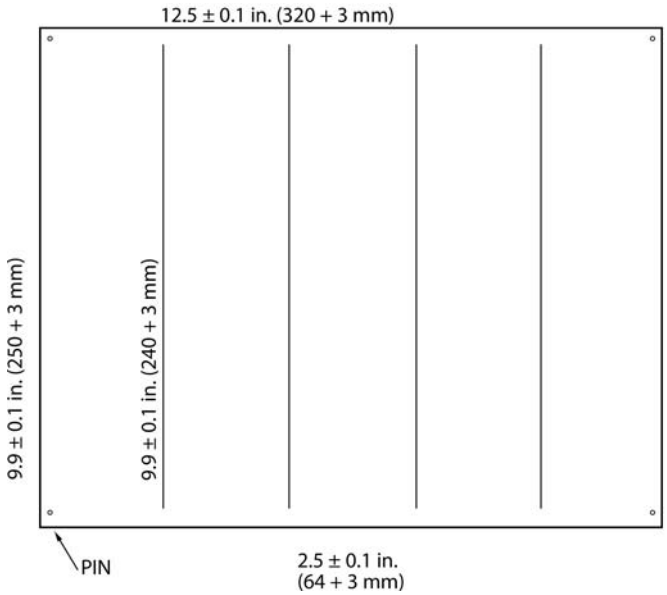

FIG. A1.1 Template for 9.9 × 12.5-in. (250 × 320-mm) Specimen

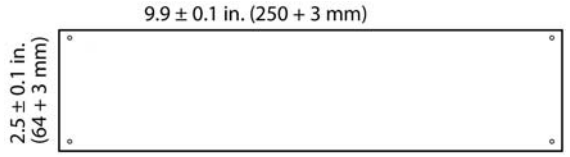

FIG. A1.2 Template for 2.5 × 9.9-in. (64 × 250-mm) Specimen

A1.5.5.1 Place the conditioned test sample pile down on a flat surface.

A1.5.5.2 Place the template on the back of the test sample.

A1.5.5.3 Cut just through the backing with the razor knife guided by the edges of the template. Hold the plane of the razor knife perpendicular to the back of the test sample.

A1.5.5.4 Separate the test specimen from the test sample. Use scissors to cut any loops connecting the test specimen to the remainder of the test sample.

A1.5.6 *Calibration of Template*—Periodically measure a set of three specimens as directed in A1.5.3. The areas computed from these dimensions should be within 1 % of the area specified in the test method.

A1.7 *Procedure 3:*

A1.5.7 *Apparatus:*

A1.5.7.1 *Clicking Die,* steel, having dimensions specified in the test method.

A1.5.7.2 *Clicking Machine or Hand Mallet and Cutting Block.*

NOTE A1.2—A hand die may be used when the perimeter of the specimen is 30 in. (760 mm) or less.

A1.5.8 *Calibration of Clicking Die*—After each sharpening, die-cut a piece of cardboard and measure the dimensions of the specimen as directed in A1.5.3. The area computed from these dimensions should be within 1 % of the area specified in the test method.

A1.5.9 *Test Specimen Cutting:*

A1.5.9.1 Place the test sample pile up on the cutting block of the clicking machine.

A1.5.9.2 Brush pile surface by hand toward the middle of the area to be included in the specimen, or

A1.5.9.3 When the floor covering exhibits a strong pile lay, brush the pile surface in the direction of the pile lay to make the surface more uniform.

A1.5.9.4 Place the die on the face of the test sample with the longer sides parallel to the lengthwise direction of the floor covering unless otherwise specified in the test method.

A1.5.9.5 Activate clicking machine and remove the test sample remnant from around the die.

A1.5.9.6 If the brushing method of A1.5.9.2 was used, remove the specimen from the die and discard any loose fiber.

A1.5.9.7 If the specimen was brushed (A1.5.9.3), carefully remove and retain for weighing with the specimen all loose yarn and fiber from around the inside perimeter of the die.

A2. TYPICAL CALCULATION FOR PILE YARN MASS PER UNIT AREA (SECTION 1.5)

A2.1 *Equivalent Mass for s Strip Specimens and 1 % Limiting Values*—Three 18 × 18-in. (460 × 460-mm) test specimens were taken from one test sample. The total mass per unit area of each test specimen in is given in Table A2.1 along with the corresponding equivalent strip specimen masses and 1 % upper and lower limits for both one and two strip specimens per test specimen.

A2.2 *Selection of Strip Specimens for Analysis*—While it may normally be unnecessary to cut five strip specimens from each test specimen, the masses of this number of strip specimens are shown in Table A2.2. Those marked with an asterisk (*) fall outside the single strip specimen 1 % limits given in Table A2.1 and could not be used for analysis. As pairs, obviously, any of those within 1 % as individuals could be used together. In addition, some of those rejected as singles could be used in pairs. For this example there are seven acceptable pairs in each test specimen ranging in mass from 61.93 to 62.96 g for No. 1; 62.90 to 63.85 g for No. 2; and 64.50 to 65.5 g for No. 3. The masses of the pairs taken for further analysis are shown at the bottom of Table A2.2.

TABLE A2.1 Test Specimen Data

	Test Specimen Number *(i)*		
	1	2	3
Total mass per unit area, g/m^2	1939.4	1969.9	2017.4
E_i (one strip specimen), g	31.277	31.769	32.535
E_i (two strip specimens), g	62.555	63.539	65.070
1 % limits (one)			
Upper	31.59	32.09	32.86
Lower	30.96	31.45	32.21
1 % Limits (two)			
Upper	63.18	64.17	65.72
Lower	61.93	62.90	64.42

TABLE A2.2 Strip Specimen Data

Strip Specimen	Test Specimen Number *(i)*		
	1	2	3
1	30.30*	31.55	31.90*
2	31.28	32.20*	32.60
3	31.63*	31.20*	32.25
4	31.04	31.35*	32.40
5	31.33	31.65	32.40
Selected	31.28	31.55	32.25
Pairs	31.04	31.65	32.40
Sum	62.32	63.20	64.65

A2.3 *Average Pile Yarn Mass Per Unit Area*—The total mass, *M,* of the selected strip specimen pair was 190.17 g. The stubble specimen mass, *S,* was 116.20 g; the buried pile yarn, *C,* 11.53 g; and the coating residue mass, *R,* 0.050 g. The combined area of the six strip specimens was 150.6 in.^{2} (.097 m^2). The average pile yarn mass per unit area is obtained by substituting these values in Eq A2.1:

$$P = M - S + C - R/A \quad \text{(A2.1)}$$

$$= 190.17 - 116.20 + 11.53 - 0.050/.097$$

$$= 25.9\, oz/yd^2 \ (879.5\, g/m^{\,2})$$