



Designation: D1335 – 21

Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings¹

This standard is issued under the fixed designation D1335; 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 U.S. Department of Defense.

1. Scope

1.1 This test method covers the measurement of force required to pull or break a tuft from a pile floor covering sample.

1.2 This test method is applicable to both cut and loop pile yarn floor covering.

1.3 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.

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

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

2. Referenced Documents

2.1 *ASTM Standards:*²

[D76 Specification for Tensile Testing Machines for Textiles](#)

[D123 Terminology Relating to Textiles](#)

[D1776 Practice for Conditioning and Testing Textiles](#)

[D5684 Terminology Relating to Pile Floor Coverings](#)

[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

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. Terminology

3.1 For all terminology related to Pile Floor Coverings, D13.21, refer to Terminology [D5684](#).

3.1.1 The following terms are relevant to this standard: carpet, constant-rate-of-extension, cut pile yarn floor covering, finished, finished pile yarn floor covering, floor covering, loop pile yarn floor covering, pile, pile yarn floor covering, textile floor covering, tuft, tuft bind, tuft leg, tufted fabric.

3.2 For all other terminology related to textiles see Terminology [D123](#).

4. Summary of Method

4.1 A test sample is mounted on a metal cylindrical sample holder in a clamping fixture to the base of a tensile testing machine. A hook (for loops specimen) or a tuft clamp (for cut pile specimen) are used to remove a specimen from the sample. The force to pull the specimen free from the test sample is measured as the tuft bind.

5. Significance and Use

5.1 Test Method D1335 for tuft bind of pile yarn floor coverings is being used for acceptance testing of commercial shipments. Comparative tests as directed in [5.1.1](#) may be advisable.

5.1.1 In case of a dispute arising from differences in reported test results using this test method, the purchaser and the supplier should conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended from the investigation of bias. As a minimum, the two parties should take a group of test samples that are homogeneous as possible and are from a lot of material of the type in question. The test samples should then be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using appropriate statistical analysis, and a probability level chosen by the two parties before testing begun. If a bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results with consideration to the known bias.

5.2 The satisfactory performance of a pile yarn floor covering depends to a considerable extent on the maintenance of its original appearance. In a cut pile yarn floor covering an

inadequate tuft bind may result in complete loss of pile in areas exposed to severe wear. In a looped pile yarn floor covering with inadequate tuft bind the pile loops may be pulled out to form unsightly long loops which may be hazardous.

6. Apparatus

6.1 *Tensile Testing Machine*, Constant-rate-of-extension (CRE) type, conforming to Specification D76, with a capacity selected such that the force required to complete the test falls within 15 to 85 % of full scale. A full scale ranging from 1 to 25 lbf (4.45 to 111 N) is generally adequate. For constant-rate-of-extension (CRE) type and constant-rate-of-traverse (CRT) type machines, the rate is 12 ± 0.5 in./min (300 ± 12 mm/min). In case of controversy the CRE type tensile testing machine shall prevail.

NOTE 1—The test results obtained with different types of testing machines is not always the same.

6.2 *Clamps and Jaw Faces*—The use of hydraulic or pneumatic clamping systems with a minimum of 1 by 3 in. (25 by 76 mm) serrated or padded faces designed to minimize slippage in the clamps during testing is recommended. Manual clamping is permitted providing no slippage of the specimen is observed. The faces shall be parallel and have matching centers with respect to one another in the same clamp and to the corresponding jaw face of the other clamp.

6.3 *Metal Cylindrical Sample Holder*, 6.0 ± 0.5 in. (152 ± 12 mm) long made from 1.5 ± 0.06 in. (38 ± 1.5 mm) outside diameter tubing with a section 2.0 ± 0.2 in. (50 ± 5.0 mm) long and 1.5 ± 0.2 in. (38 ± 5 mm) wide cut away from the center portion of the tubing. See Fig. 1 and Fig. 2. The sample holder should be constructed in a manner that will permit clamping the test sample in the non-measuring clamp of the tensile testing machine or replacement of the non-measuring clamp by the sample holder.

6.4 *Tuft Clamp*, for use with a cut pile specimen. The clamp is a tweezer-like device that can be used to grip a single tuft tightly enough to ensure removal from the sample without slippage. The gripping of the tuft by the tuft clamp is shown in Fig. 3. Alternatively, a hemostat³ can be used.

6.5 *Loop Hook*, for use with loop pile specimen. The hook should be designed to readily pass through a tufted loop. The hook should be made of steel wire having a diameter of at least $1/32$ in. (0.8 mm). The wire must be constructed so that it can be hooked into the test specimen and then clamped/attached to, or replace, the measuring clamp of the test machine. (See Fig. 4).

7. Sampling

7.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls, or pieces, of pile yarn floor covering as directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider the rolls, or pieces, of pile yarn floor covering to be the primary sampling units. In the absence of such agreement, take one roll or piece from the lot to be tested.

³ Hemostats suitable for this purpose can be obtained from many laboratory equipment suppliers.

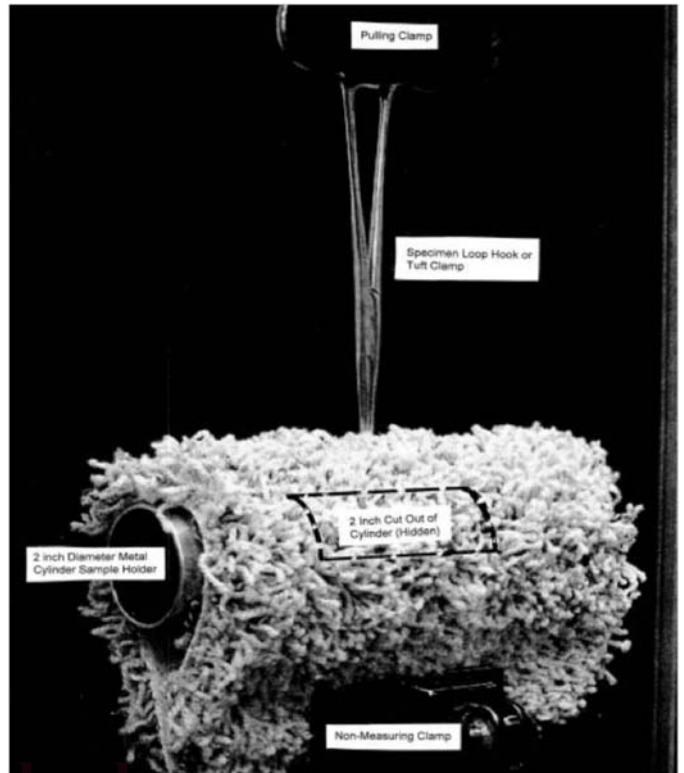


FIG. 1 Relative Position of Cylinder Opening, Cylinder, the Cylinder, Hook or Tuft Clamp and the Carpet Sample

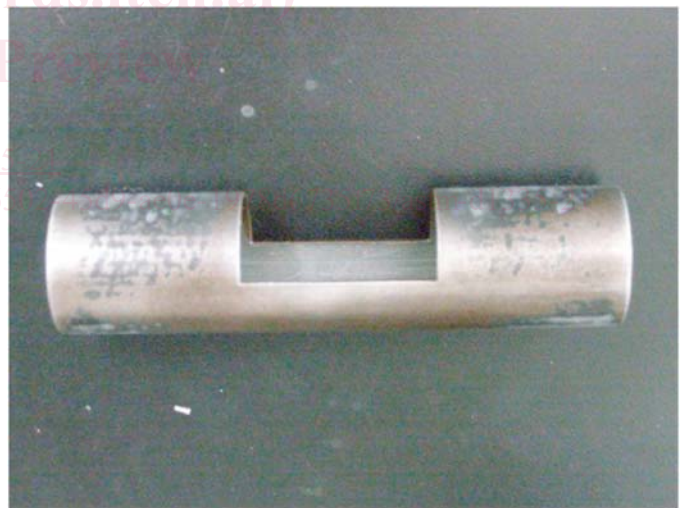


FIG. 2 Cylinder Configuration

NOTE 2—An adequate specification or other agreement between the purchaser and supplier requires taking into account the variability between rolls or pieces of pile yarn floor covering and between specimens from a roll or pieces of pile yarn floor covering to provide a sampling plan with a meaningful producer’s risk, consumer’s risk, acceptable quality level, and limiting quality level.

7.2 *Laboratory Sample*—For acceptance testing, cut a section extending the full width of the pile yarn floor covering and at least 4 in. (100 mm) longer than the test sample requested in 7.3, from each roll, or piece, in the lot. For rolls of pile floor covering, take a sample that will exclude fabric with visible damage.



FIG. 3 Tuft Clamp Device Gripping Tuft Leg



FIG. 4 Loop Hook Secured in the Upper Clamp (Note the hook has been passed through the loop)

7.3 *Test Sample*—From each laboratory sampling unit, cut five test samples with the longer direction parallel to the machine direction. Consider the long direction as the direction of test. Cut each test sample 6 by 8 in. (150 by 200 mm). The test sample should be taken no nearer to the edge than 5 % of the pile yarn floor covering width.

7.3.1 If the pile floor covering is back coated only, exercise care in handling the sample to prevent breaking, or otherwise disturbing, the back coating.

7.4 *Test Specimens*—Test three specimens from each test sample. A specimen is a tuft leg or loop. In cases where a pile yarn floor covering contains both cut and uncut pile, test only the uncut (loop).

NOTE 3—If the uncut (loop) is satisfactory, the cut pile will be adequate.

7.5 *Test Result*—The test result is the average for the three specimens in a test sample.

8. Preparation and Verification of Apparatus

8.1 *Tensile Testing Machine*, A constant-rate-of extension (CRE) type conforming to Specification D76 with a constant rate-of-traverse of 12 ± 0.5 in./min (300 ± 12 mm/min) is preferred. A constant-rate-of-traverse (CRT) type tensile testing machine conforming to Specification D76 and operated at the same speed is permitted.

8.2 If required, replace the nonmeasuring clamp of the test machine with the sample holder described in 6.3.

8.3 Replace the measuring clamp of the test machine with, or attach to the measuring clamp of the test machine, the tuft clamp described in 6.4 or the loop-hook described in 6.5 depending on which is required for the type of pile yarn floor covering under test (Note 3).

8.3.1 Because the tuft clamp or loop hook is attached to, or replaces, the usual measuring clamp of the test machine, compensate for the effect of the altered mass of the clamp to retain the previous verification of the testing machine.

9. Conditioning

9.1 Condition the specimen in the standard atmosphere for testing textiles in accordance with Practice D1776.

10. Procedure

10.1 *Cut Pile Yarn Floor Covering*:

10.1.1 Test the conditioned specimens in the standard atmosphere for testing textiles.

10.1.2 Mount the test sample on the sample holder and place in the stationary clamp jaws with the rows of tufts (machine direction) at right angles to the long axis of the holder in such a position that the tuft to be tested is approximately centered over the cut away portion of the holder. The tension on the test sample should be uniform across the clamp width so that the sample presents an undistorted cylindrical surface over the cut away section of the sample holder. Locate a tuft or loop to be pulled out directly below the center of the pulling clamp or hook (see Fig. 1).

10.1.3 Select only one specimen for testing from any one row and allow at least 1.0 in. (25 mm) between any tuft tested and the edge of the sample.

10.1.4 Using the tuft clamp grip one tuft leg (Fig. 3). Make certain that all fibers forming the tuft leg are securely gripped by the tuft clamp. If multiple, single yarn ends form a leg, combine all the yarn ends, and test as one end. Take care not to