



Designation: D 3936 – 02

Standard Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering¹

This standard is issued under the fixed designation D 3936; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the measurement of the resistance to delamination of the secondary backing applied to some pile yarn floor coverings.

1.2 This test method is applicable to all backings including natural manufactured fibers or attached cushion.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as the standard. Within the text the inch-pound units are shown in parentheses. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification. In case of referee decisions, the SI units shall prevail.

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.*

2. Referenced Documents

2.1 ASTM Standards:

D 76 Specification for Tensile Testing Machines for Textiles²

D 123 Terminology Relating to Textiles²

D 1776 Practice for Conditioning Textiles for Testing²

D 2904 Practice for Interlaboratory Testing of a Textile Test Method That Produces Normally Distributed Data²

D 2906 Practice for Statements on Precision and Bias for Textiles²

D 4697 Guide for Maintaining Test Methods in the User's Laboratory³

D 5684 Terminology Relating to Pile Floor Coverings³

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminologies D 123 and D 5684.

4. Summary of Test Method

4.1 A specimen is separated manually for a distance of about 38 mm (1.5 in.). Each layer then is placed in opposing clamps of a tensile tester, and the force to continue the separation for a specified distance is recorded. The peak forces in specified length intervals are averaged and the resistance to delamination calculated.

5. Significance and Use

5.1 This test method is used for acceptance testing of commercial shipments. Comparative tests as directed in 5.2 may be advisable.

5.2 In a case of a dispute arising from differences in reported test results when 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 for the investigation of bias. As a minimum, the two parties should take a group of test samples that are as homogenous as possible and are from a lot of material of the type in question. The test samples then should be assigned randomly in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using a statistical test for unpaired data and an acceptable probability level chosen by the two parties before testing is 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.

5.3 This test method is useful to evaluate quality and cost control during the manufacture of pile yarn floor covering. Both appearance and performance of the pile floor covering can be affected by delamination of the secondary backing.

6. Apparatus

6.1 *Tensile Testing Machine*—A constant-rate-of extension (CRE) type conforming to Specification D 76 with a constant rate of speed of 300 ± 10 mm/min (12 ± 0.5 in./min) is

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² *Annual Book of ASTM Standards*, Vol 07.01.

³ *Annual Book of ASTM Standards*, Vol 07.02.

preferred. A constant-rate-of-traverse (CRT) type tensile testing machine conforming to Specification D 76 and operated at the same speed is permitted. There may be no overall correlation with CRE-type and CRT-type testing machines. Consequently, the two machines cannot be used interchangeably. In case of controversy, the CRE-type testing machine shall prevail.

6.2 Clamps and Jaw Faces—The use of hydraulic or pneumatic clamping systems with a minimum of 25 mm × 75 mm (1 in. × 3 in.) 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 Tape, self adhering, cloth reinforced tape has been found suitable.

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 an agreement, take one roll or piece from the lot to be tested.

NOTE 1—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, take a laboratory sampling unit that is a minimum of 460 mm (18 in.) in the machine direction by full width (cross machine direction) from each roll or piece in the lot sample.

7.3 Test Specimens—From each laboratory sampling unit, cut three specimens with the longer direction parallel to the machine direction. Consider the long dimension as the direction of the test.

7.3.1 Secondary Back of Textile Construction—Cut the specimens 75 ± 2 mm by at least 150 mm (3 ± 0.08 in. by at least 6 in.).

7.3.2 Attached Cushion Construction—Cut the specimens 50 ± 2 mm by at least 150 mm (2 ± 0.08 in. by at least 6 in.).

7.3.3 Specimen Sampling and Labelling—Take specimens, representing a broad distribution along the length and across the width of each laboratory sampling unit. Take one specimen near each edge of the laboratory sampling unit but no nearer the extreme edge than 5 % of its width, and take one specimen from the center area. Ensure that specimens are free of folds, creases or wrinkles. Avoid getting oil, water, grease, etc., on the specimens when handling. Label to maintain specimen identity.

8. Conditioning

8.1 Bring the specimen to moisture equilibrium for testing in the standard atmosphere for testing textiles, approaching equilibrium from the dry side without heat. Determine that

moisture equilibrium for testing has been attained as directed in Practice D 1776.

9. Preparation of Specimens

9.1 At one end of the specimen, manually separate the secondary backing from the pile yarn floor covering for approximately 38 mm (1.5 in.).

9.2 Cover the attached cushion side of each specimen with self-adhering cloth reinforced tape. At one end of the specimen, manually separate the attached cushion from the test sample for approximately 75 mm (3 in.).

10. Preparation and Verification of Apparatus Systems

10.1 Preparation of Tensile Testing Machine:

10.1.1 Prepare the machine according to the manufacturer's instructions and using the conditions given in 10.1.2-10.2.2.

10.1.2 Set the distances between the clamps at 25 ± 1 mm (10 ± 0.05 in.). Select the full-scale force range of the testing machine such that the maximum force occurs between 15 and 85 % of full-scale force. Verify the testing machine for this range.

10.1.3 Select the testing machine speed of 300 ± 10 mm/min (12 ± 0.5 in.)/min.

10.1.4 When using a microprocessor automatic data gathering system, set the appropriate parameters as defined in the manufacturer's instructions.

10.2 Verification of the Total Operating System of the Apparatus:

10.2.1 Verify the total operating system, for example, loading, clamping, and recording or data collection, whenever there are changes in the loading system, especially an increase, or clamping mechanism by testing a control material.

10.2.2 Compare the data with the previous data, if the average is outside the tolerances established, and recheck the total system to locate the cause of the deviation (see Guide D 4697).

11. Procedure

11.1 Mount the loose end of the secondary backing or attached cushion, as applicable, in the stationary clamp jaws and the other loose end of the specimen in the movable clamp. Apply uniform tension across the clamp width of the specimen (see Fig. 1).

11.2 Start the machine and autographic recording device. If the attached cushion breaks, record that the resistance to delamination exceeds the breaking force of the cushion.

11.3 A trace from the recording device consisting of a series of peaks, each representing the force at which the layers have separated, and troughs corresponding to the fall back of the force will be generated. After the initial peak is recorded and an additional 75 mm (3 in.) of the specimen has been delaminated, (this represents approximately 150 mm (6.0 in.) of jaw separation), stop the machine, and return the crosshead to the start position.

11.4 Remove the delaminated specimen from the clamps, and test the remaining specimens.

12. Calculation

12.1 From the recording device, determine the value of the highest peak in each 12 mm (0.5-in.) interval of delamination,

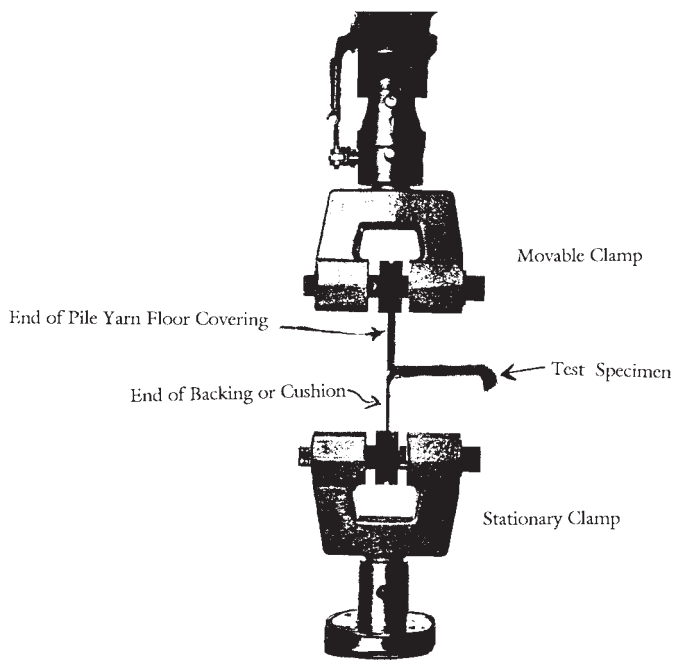


FIG. 1 Specimen Mounted in Clamps

ignoring the initial peak force (which represents approximately 24 mm (1.0 in.) of jaw separation). Average these five peak forces for each specimen to the nearest 0.5 N (0.1 lbf) (see Fig. 2).

12.2 Calculate the resistance to delamination for each specimen to the nearest 0.5 N (0.1 lbf)/unit width, using the following equation:

$$D = F/W \quad (1)$$

where:

- D = resistance to delamination, N/mm (lbf/in.),
- F = average peak force for the specimen, N (lbf), and
- W = specimen width, 75 mm (3 in.).

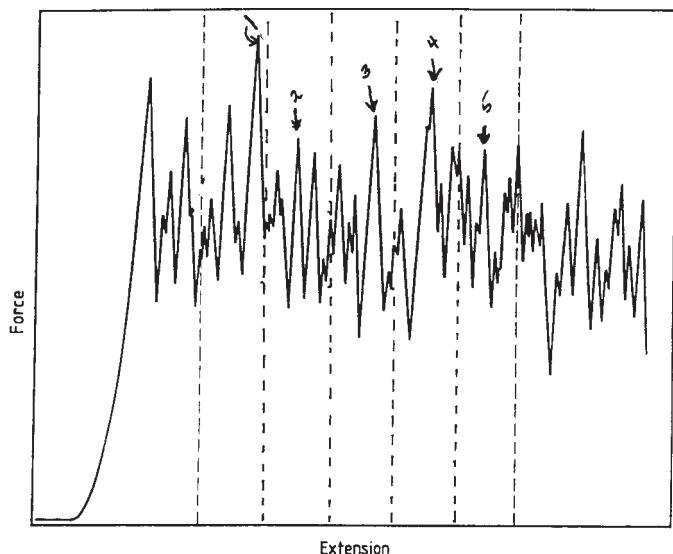


FIG. 2 Typical Autographic Trace Showing Highest Peaks in 6 Length Intervals

12.3 Calculate the average resistance to delamination for each laboratory sampling unit and for the lot, or both.

12.4 Calculate the standard deviation or coefficient of variation, or both, if requested.

13. Report

13.1 State that the resistance to delamination was determined as directed in Test Method D 3936. Describe the material or product sampled and the method of sampling used.

13.2 Report the following information:

13.2.1 The resistance to delamination for each specimen and laboratory sampling unit and for the lot.

13.2.2 On attached cushion specimens, if the cushion breaks, report the peak force and note that the resistance to delamination exceeds the breaking force of the cushion.

TABLE 1 Critical Differences for Two Averages for the Conditions Noted

Number of Test Results in Each Average	95 % Probability Level, lbs/in. Single Material Comparisons		Between-Laboratory Precision
	Single Operator Precision	Within-Laboratory Precision	
1	.67	.83	1.32
3	.38	.63	1.21
6	.27	.55	1.18
8	.24	.55	1.17

TABLE 2 Critical Differences for Two Averages for the Conditions Noted

Number of Test Results in Each Average	95 % Probability Level, lbs/in. Multi-Material Comparisons		Between-Laboratory Precision
	Single Operator Precision	Within-Laboratory Precision	
1	.68	.84	1.34
3	.40	.64	1.21
6	.30	.58	1.18
8	.27	.57	1.18

TABLE 3 Components of Variance Expressed as Standard Deviations^A

Variance Component	Single-Material Comparisons	Multi-Material Comparisons
Within-laboratory	.37	.37 + .044
Single-operator	.18	.18
Between-laboratory	.24	.38

^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.

13.2.3 If calculated, the standard deviation, or coefficient of variation, or both.

13.2.4 Record the type of testing machine.

14. Precision and Bias

14.1 *Summary*—In comparing two averages, the differences should not exceed the single-operator precision values shown in Tables 1 and 2 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 drawn randomly from the sample of material. Larger differences are likely to occur under all other circumstances.

14.2 *Interlaboratory Test Data*—An interlaboratory test was run in 1996 in which randomly-drawn samples of four materials were tested in each of two laboratories. Each laboratory used two operators, each of whom tested two specimens of each material using this test method. The components of variance for resistance to delamination expressed as standard deviations were calculated to be the values listed in Table 3. The material types were:

Material 1	Tufted loop pile carpet (SBR latex with woven synthetic back) (Nominal 28 oz/yd ²)
Material 2	Tufted cut pile carpet (SBR latex with woven synthetic back) (Nominal 32 oz/yd ²)
Material 3	Tufted cut pile carpet (SBR latex with woven synthetic back) (Nominal 46 oz/yd ²)
Material 4	Tufted loop pile carpet (SBR latex with woven synthetic back) (Nominal 32 oz/yd ²)

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14.3 *Precision*—For the components of variance reported in Table 3, 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 and 2.

NOTE 2—The tabulated values of the critical differences should be considered to be a general statement, particularly with respect to between-laboratory precision.

14.4 *Bias*—The value of resistance to delamination of secondary backings only can be defined in terms of a test method. Within this limitation, Test Method D 3936 has no known bias.

15. Keywords

15.1 carpet; peel; pile yarn floor covering; strength delamination; textile floor covering