



Standard Test Method for Resistance to Yarn Slippage at the Sewn Seam in Woven Upholstery Fabrics¹

This standard is issued under the fixed designation D 4034; 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 slippage of warp yarns or filling yarns in woven upholstery fabrics, when testing for yarn slippage at the seam.

NOTE 1—This test method is derived from Test Method D 434, from which appropriate changes have been made to make the method more applicable for upholstery fabrics.

1.2 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the inch-pound units are shown in brackets. 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.

1.3 *This standard does not purport to address all of the safety problems, 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 434 Test Method for Resistance to Slippage of Yarns in Woven Fabrics Using a Standard Seam²

D 1776 Practice for Conditioning Textiles for Testing²

2.2 Federal Standard:

Fed. Std. No. 751a Stitches, Seams, and Stitching³

3. Terminology

3.1 Definitions:

3.1.1 *direction of slippage, n—at the seam*, the line of

movement parallel to either the filling or the warp on a woven fabric in which minimum force is required to produce yarn slippage.

3.1.1.1 *Discussion*—The fabric may be pulled in both directions in many cases.

3.1.2 *resistance to yarn slippage, n—at the seam*, the force required to displace one or more yarns in a fabric from the original position, causing differences in alignment or spacing, or both.

3.1.3 *sewn seam, n—in sewn fabrics*, a juncture at which two or more planar structures such as textile fabrics, are joined by sewing, usually near the edge.

3.1.4 *yarn slippage, n—at the seam in sewn fabrics*, the displacement of one or more yarns from the original position, causing differences in alignment or spacing, or both.

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

4. Summary of Test Method

4.1 Resistance to yarn slippage is determined on a specimen made from pieces of the same fabric that have been stitched together in a specified manner (see 9.3). First, tension is applied to the unseamed part of the specimen using a constant rate-of-extension or a constant rate-of-traverse type machine and the curve recorded. Next, tension is applied across the seam and results are recorded on the same chart. The distance between the recorded force-extension curves is measured from the point where slippage began (see 12.1).

5. Significance and Use

5.1 Test Method D 4034 for measuring the resistance to yarn slippage at the sewn seam is considered satisfactory for acceptance testing of woven upholstery fabrics.

5.1.1 In case of disagreement arising from differences in values reported by the purchaser and the supplier when using this test method for acceptance testing, the statistical bias, if any, between the laboratory of the supplier and the laboratory of the purchaser should be determined with comparisons being based on the testing of specimens taken from a lot of material of the type evaluated to be as nearly homogeneous as possible and then randomly assigned in equal numbers to each of the laboratories.

¹ This test method is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.59 on Fabric Test Methods, General.

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

³ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, Pa. 19111-5094, Attn: NPODS.

5.2 This test method is intended to measure yarn slippage at the sewn seam in upholstery fabrics under controlled conditions. This test method may not indicate actual field performance.

5.3 Fabrics that do not meet the requirements agreed upon between the purchaser and supplier should be classified as “delicate in seam slippage resistance” and the purchaser and furniture manufacturer so notified.

6. Apparatus

6.1 *Tensile Testing Machine*—A constant rate-of-traverse (CRT) or constant rate-of-extension (CRE) type machine conforming to the requirements of Specification D 76. The machine shall be equipped with an autographic recording device and with clamps having front jaws 25 mm (1 in.) in width with back jaws of 50 mm (2 in.) or more in width, except as otherwise provided (Note 2). The clamps shall be set 76 mm (3 in.) apart. The speed of the pulling clamp shall be 5.0 ± 0.2 mm/s (12.0 ± 0.5 in./min).

NOTE 2—In comparing results with those from another laboratory, both laboratories should use the same type of tensile testing machine, or have established the relationship between test results obtained using a CRT machine and those obtained using a CRE machine when testing fabrics of the type being evaluated.

6.1.1 *Tensile Testing Machine (Other)*—A tensile testing machine other than a CRT or CRE type that conforms to the requirements of Specification D 76 and gives results that correlate with those for CRT or CRE testers. The machine must be acceptable to both the purchaser and supplier if the results are to be used for acceptance testing of commercial shipments.

6.2 *Needle*—Size 22 ball point needle.⁴

6.3 *Sewing Thread*, 100 % nylon bonded monocord thread. The needle thread shall have a minimum breaking strength of 35 N (8 lbf) and the bobbin thread shall have a minimum breaking strength of 23 N (5 lbf).⁵

6.4 *Dividers*—One pair.

6.5 *Metal Clamp*—An auxiliary clamp weighing 170 g (6 oz.) and having anvils at least 100 mm (4 in.) in width.⁶

7. Sampling

7.1 *Lot Sample*—For acceptance testing, take at random the number of rolls of fabric directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider rolls of fabric to be the primary sampling units.

7.2 *Laboratory Sample*—Take a full width swatch 1 m (1 yd) long from the end of each roll of fabric in the lot sample, after first discarding a minimum of 1 m (1 yd) from the outside of the roll.

7.3 *Test Specimens*—For preliminary testing, two specimens are required, one with the long dimension parallel to the

warp and one with the long dimension parallel to the filling. Preliminary tests are not necessary if the direction with the lower resistance to yarn slippage is known.

7.3.1 For final testing, five specimens in the direction of the greater slippage are required.

8. Number of Specimens

8.1 For preliminary testing, two specimens are required, one with the long dimension parallel to the warp and one with the long dimension parallel to the filling. Preliminary tests are not required if the direction with the lower resistance to yarn slippage is known.

8.2 For final testing, five specimens in the direction of the greater slippage are required.

9. Preparation of Specimen

9.1 Cut two pieces of fabric, one 100 by 100 mm (4 by 4 in.) and one 100 by 250 mm (4 by 10 in.) from both warp and filling directions. When testing resistance to warp yarn slippage, the long dimension should be parallel to the warp yarns (see Fig. 1). When testing filling yarn slippage over the warp yarn, the long dimension is parallel to the filling yarns (see Fig. 2).

9.2 Place the 100 by 100-mm (4 by 4-in.) piece on top of the 100 by 250-mm (4 by 10-in.) piece, face to face, with one end even with the end of the 100 by 250-mm piece. For testing resistance to warp yarn slippage, the warp yarn in both pieces should be lengthwise or perpendicular to the seam, and for testing resistance to filling yarn slippage, the filling yarn should run lengthwise in both pieces, perpendicular to the seam.

9.3 Stitch a seam across the short dimension of the specimens, placing the seam 12 mm (0.5 in.) from the edge of the specimen, using 7 ± 0.5 stitches per 25 mm (1 in.) and a plain lockstitch.

9.3.1 The plain lockstitch shall conform to Type No. 301 of Federal Standard No. 751a. This type of stitch shall be formed with two threads. A loop of one thread shall be passed through the material where it shall be entered by the mass supply of the other thread. The loop of the first thread then shall be drawn into the material to the extent that the concatenation is approximately halfway between the two surfaces of the material. These operations are repeated to form a sequence of stitches (see Fig. 3).

9.4 It is important that the stitches be made under uniform tension and that the seam be perpendicular to the filling or warp yarns.

9.5 Draw a line 35 mm (1.5 in.) from the edge parallel to the long direction to aid in the placement of the specimen in the testing machine.

10. Conditioning

10.1 Condition all specimens for at least 4 h in the standard atmosphere for testing textiles from the dry side as directed in

⁴ Singer 135 × 17, size 22 light ball point or Schmetz NM 140 light ball point, or equivalent, have been found to be satisfactory.

⁵ Belding Corticelli Thread identified as NYMO-EX-HR size 8 needle thread and NYMO-EX ready wound size 5 bobbin thread have been found to be satisfactory. They can be obtained from Belding Corticelli Thread Co., 1430 Broadway, New York, N. Y. 10018.

⁶ This clamp can be obtained from Custom Scientific Instruments Inc., P. O. Box A, Whippany, N.J. 07981.

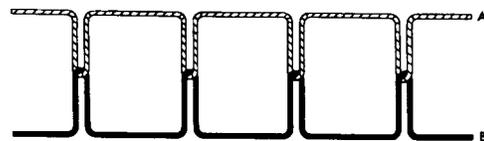
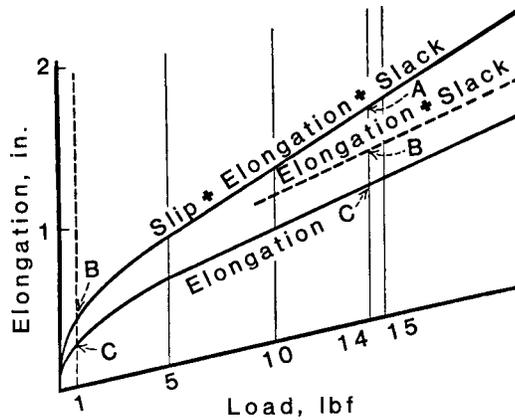


FIG. 1 Sequence of Stitches



SI Units	Inch-Pound Equivalents
25 mm	1 in.
51 mm	2 in.
4.45 N	1 lbf
22 N	5 lbf
44.5 N	10 lbf
62.3 N	14 lbf
66.7 N	15 lbf

FIG. 2 Slippage Chart

Practice D 1776. Specimens used in preliminary tests need not be conditioned.

11. Procedure

11.1 In all tests, place one end of a specimen squarely between the jaws of the upper clamp and grip the specimen securely. Then place the other end of the specimen between the jaws of the lower clamp and attach the auxiliary clamp, below the lower clamp, in order to achieve a uniform and even tension. When correct alignment and tension are achieved, tighten the lower clamp and remove the auxiliary clamp.

11.2 *Force-Extension Curve for Fabric*—Grip the 100 by 250-mm (4 by 10-in.) part of the specimen in the clamps of the testing machine (see 6.1), the end opposite the seam being placed in the upper clamp. Place the pen of the recording device on the zero ordinate and any convenient abscissa. Start the machine and record the force-extension curve for the fabric.

11.3 *Force-Extension Curve for Fabric With Seam*—Grip the specimen in the clamps of the machine (see 6.1) with the seam located midway between the upper and lower clamps. Place the pen of the recording device on the zero ordinate and on the same abscissa that was used to record the force-extension curve for the base fabric. Start the machine and record the force-extension curve for the fabric with the sewn seam.

11.4 Record the force-extension curves for each of the five specimens, starting each pair of curves at a different point on the zero vertical ordinate.

12. Calculation

12.1 To measure 6-mm (¼-in.) yarn slippage, set the dividers at one quarter the distance of chart travel for 25 mm

(1 in.) of lower jaw travel. Gear-driven recorders may exhibit odd ratios of actual magnification.

NOTE 3—Example—Set dividers at 7 mm (⅜ in.) for a 1.125:1 ratio; at 6 mm (¼ in.) for a 1:1 ratio; at 14 mm (⅞ in.) for a 2.25:1 ratio.

12.2 Add to this the seam extension compensation, which is the distance between the force-extension curves of the specimen with and without the seam at the 4.5-N (1-lbf) ordinate (Point B to C, Fig. 4).

12.3 With the dividers set as in 12.2 follow the force-extension curve for the fabric without seam with one point of the divider until the other point of the divider meets the force-extension curve of the fabric with seam and both points rest on the same ordinate. Mark the ordinate.

12.4 Record the force in newtons (or pounds-force) to the nearest 2 N (0.5 lbf) at this ordinate. Subtract the 4.5-N (1-lbf) compensation and record the result as resistance to slippage. If the force-extension curves do not exhibit a separation equal to the predetermined distance plus compensation, record the seam strength if less than the capacity of the testing machine, and note that the fabric or the thread breaks, or both; or record that the seam strength exceeds the capacity of the testing machine with less than 6-mm (¼-in.) yarn slippage.

12.5 Repeat 12.1-12.4 for the additional four pairs of force-extension curves developed in 11.2 and 11.3.

12.6 Calculate the average force observed for the five specimens. Determine the average resistance to yarn slippage to the nearest 2 N (0.5 lbf).

13. Report

13.1 State that specimens were tested as directed in Test Method D 4034, and state the material or product sampled and the method of sampling used.

13.2 Report the following information:

13.2.1 Force required to produce slippage of the warp yarns in newtons (or pounds-force), or,

13.2.2 Force required to produce slippage of the filling yarns in newtons (or pounds-force).

13.2.3 Type of tensile testing machine used.

13.2.4 Resistance to slippage to the nearest 2 N (0.5 lbf) or other end point, for example, fabric breaks, thread breaks, or loads exceeding the capacity of the testing machine.

14. Precision and Bias

14.1 *Precision*—The precision of Test Method D 4034 for measuring the resistance to yarn slippage at the sewn seam in woven upholstery fabrics is being established.

14.2 *Bias*—The true value of Test Method D 4034 for measuring the resistance to yarn slippage in sewn seams made from upholstery fabrics can be defined only in terms of a specific test method. Within this limitation, Test Method D 4034 has no known bias.

15. Keywords

15.1 seam strength; upholstery; woven fabric; yarn slippage

 **D 4034**

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