



Standard Test Method for Distortion of Yarn in Woven Fabrics¹

This standard is issued under the fixed designation D 1336; 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 yarn distortion of one set of yarns over the other in woven cloth following the application of surface friction. This test method especially is applicable to open-weave fabrics, such as nettings, marquissettes, gauzes, chiffons, and heavier fabrics made from slippery surface yarns.

NOTE 1—For the determination of yarn slippage in woven fabrics, refer to Test Method D 434.

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are provided for information only.

1.3 *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 123 Terminology Relating to Textiles²

D 434 Test Method for Resistance of Slippage of Yarns in Woven Fabrics Using a Standard Seam²

D 1776 Practice for Conditioning Textiles for Testing²

2.2 Federal Standard:

Federal Test Method Standard 191—Method 5410 Slippage Resistance of Yarns in Cloth, Yarn Distortion Method³

3. Terminology

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

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *yarn distortion, n—in woven fabrics*, a condition in which the symmetrical surface appearance of a fabric is altered by the shifting or sliding of warp or filling yarns.

4. Summary of Test Method

4.1 A specimen is subjected to a specified shearing force acting in the plane of the fabric. The degree to which the force causes yarns to shift distorting the original symmetry of the weave is taken as a measure of ease of yarn distortion in the fabric. The degree of distortion is reported in terms of the widest opening, measured in hundredths of an inch.

5. Significance and Use

5.1 This test method is considered satisfactory for acceptance testing of commercial shipments because current estimates of between-laboratory precision are acceptable and the method has been used extensively in the trade for acceptance testing.

5.2 In cases of dispute, the statistical bias, if any, between the laboratory of the purchaser and the laboratory of the seller should be determined, with each comparison being based on testing randomized specimens from one sample of fabric.

5.3 This test method is used as an indication of the propensity of yarns to shift or distort in a fabric. Such distortions are objectionable due to the resulting changes in appearance. These appearance changes are sometimes referred to as “finger marks” or “shift marks.”

5.4 It is recommended that fabrics be tested in their original condition and also after laundering or drycleaning, or both, depending upon the intended use of the material.

6. Apparatus

6.1 *Fabric Shift Tester*,⁴, as shown in Fig. 1, including:

6.1.1 *Cylindrical Rubber Friction Drums*, consisting of a pair of rubber drums mounted one above the other on the tester in such a way that the specimen may be inserted between their two circular contacting surfaces. Each drum shall be 19 mm (0.75 in.) in diameter and have a Shore Durometer hardness of 55 to 60 (A scale). The lower drum shall be 51 mm (2 in.) in length, fastened to the platform of the apparatus. Facilities shall

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

Current edition approved Sept. 10, 1997. Published June 1998. Originally published as D 1336 – 54T. Discontinued November 1995 and reinstated as D 1336 – 98.

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

³ Available from General Services Administrations, Specification and Consumer Information and Distribution Section (WFSIS), Washington, Navy Yard, Building 197, Washington, DC 20407.

⁴ The United States Testing Company, Inc., 1415 Park Ave., Hoboken, NJ 07030. The apparatus is described in Federal Test Method Standard 191-Method 5410.

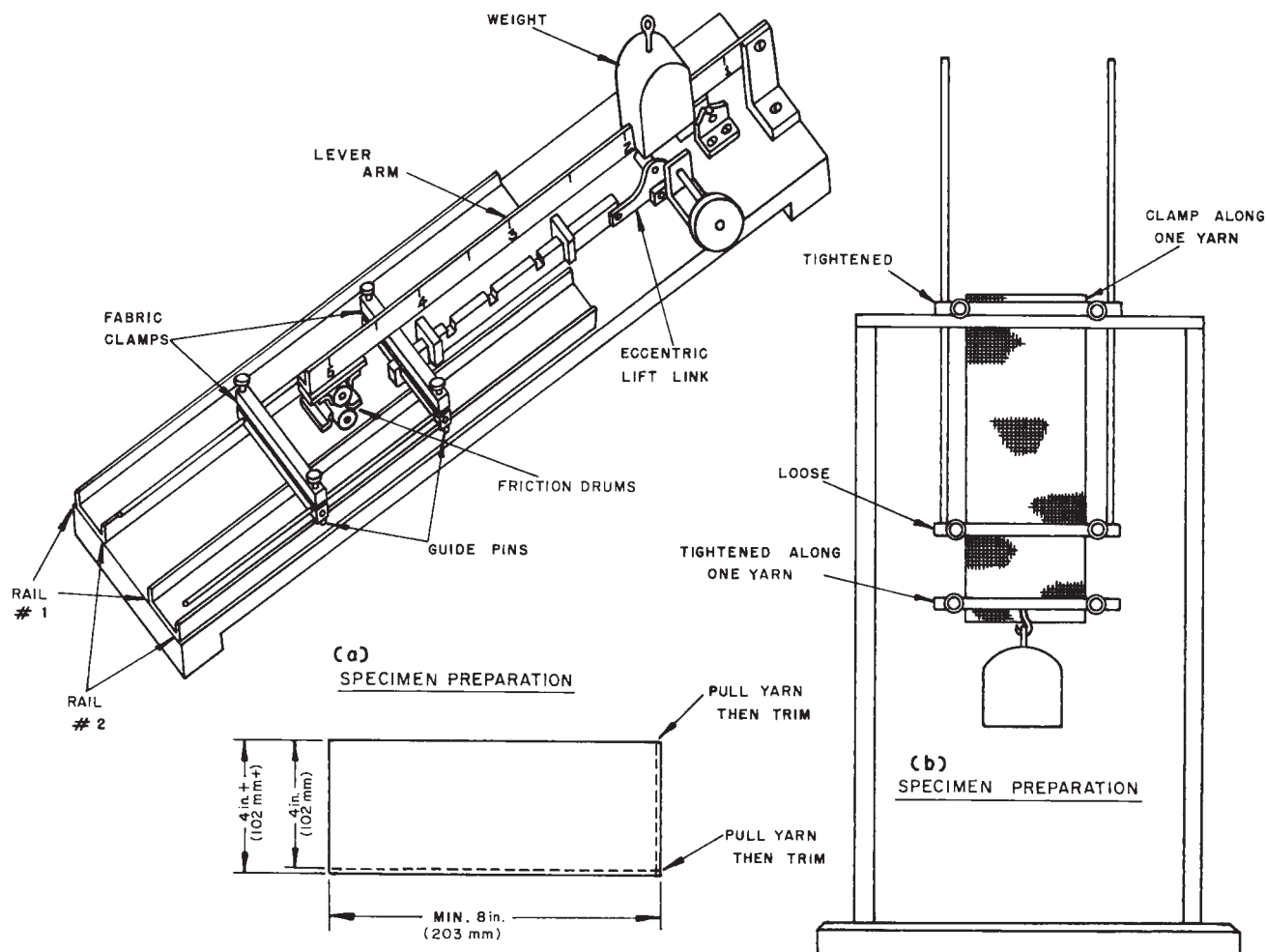


FIG. 1 Fabric Shift Tester

be provided for rotation of the drums in the mounting frame between tests. The upper drum shall be 25 mm (1 in.) in length, have the same provisions for rotation as the lower one, and shall be so mounted that a total force of 4.5 to 18 N (1 to 4 lbf) can be exerted upon the specimen by means of a lever arm and movable weight.

NOTE 2—The term “weight” is used temporarily in this test method because of established trade usage. The word weight is used to mean both “force” and “mass,” and care must be taken to determine which is meant in each case (SI unit for force = newton and for mass = kilogram).

6.1.2 *Mounting Frame or Bracket*, designed to hold the specimen under uniform tension. The frame shall consist of a rectangle whose inside dimensions are 102 by 153 mm (4 by 6 in.). The 153-mm (4-in.) sides shall be rectangular screw clamps 10 mm (0.375 in.) wide, with the gripping surfaces suitably grooved, taped, or otherwise designed or modified to minimize slipping of the specimen in the clamps during the test. The frame, when placed in the test position on the rails, shall be free to slide as a carriage in a plane perpendicular to the plane of the areas of the friction drums.

6.1.3 *Hand-Crank Arrangement*, for 25 mm (1 in.) reciprocating motion of the carriage. This device, or reciprocating arm, shall have a cam attachment that lifts the upper drum in the return motion.

6.1.4 *Rails*, two sets, fixed and spaced on the platform of the tester, for supporting the carriage.

6.2 *Jig*, for mounting the specimen in the frame under tension of 22.2 ± 0.22 N (5 ± 0.05 lbf). A suitable device consists of a clamp and weight (Fig. 1) having a total mass of 2.3 kg (5 lb).

6.3 *Steel Scale*, graduated in a 0.2 mm (0.01 in.).

6.4 *Dividers*.

6.5 *Magnifying Device*, 5× power.

7. Sampling, Selection and Number of Specimens

7.1 Take a lot sample and a laboratory sample as directed in the applicable material specification or as agreed upon by the purchaser and the supplier. In the absence of such a specification or agreement, take one representative sample from each lot of rolls, pieces, or consumer items.

NOTE 3—A realistic specification or other agreement between the purchaser and the supplier requires taking into account the variability between primary sampling units and within primary sampling units so as to provide a sampling plan, which has a meaningful producer’s risk, consumer’s risk, acceptable quality level, and limiting quality level. A lot sample normally consists of a very small fraction of the total primary sampling units.



7.2 Take five specimens from each laboratory sampling unit (roll, piece, or consumer item) with the long dimension parallel to the yarns that have the greater resistance to shifting and take them from undisturbed portions of the fabric.

7.3 Whenever possible, take specimens such that no two specimens are taken from the same warp yarns or filling bobbins and at such places that no specimen is nearer to the selvage than one-tenth the width of the fabric.

7.4 Designate as “warp specimens” those specimens cut with their long dimension parallel with the filling, and as “filling specimens” those cut with their long dimension parallel with the warp.

7.5 When testing after laundering or drycleaning, prepare a separate set of specimens from a swatch of fabric from the laboratory sample.

7.5.1 Because of the many end-uses and means of refurbishing, the procedure used for laundering or drycleaning must be agreed upon by the purchaser and the supplier.

8. Conditioning

8.1 Condition samples for testing as directed in Practice D 1776, except that preconditioning is not necessary.

9. Preparation of Specimens

9.1 *Preliminary Test (Thumb and Finger Test)*—With the thumb and forefinger touching opposite surfaces of the fabric, exert a shearing motion to produce a frictional force that is high enough to produce a shift mark and estimate the direction of least resistance to yarn shifting. Where insufficient evidence of the direction of least resistance is noted by the thumb and finger test, cut one specimen in each direction and determine the resistance mechanically as directed in Section 10.

9.2 From each sample cut five specimens 102 by 203 ± 2 mm (4 by 8 ± 0.1 in.) with the longer dimension parallel to the set of yarns having the greater resistance to shifting as determined by the preliminary test.

9.3 Pull a yarn at the edge of the specimen in both the warp and filling directions to aid in aligning the specimen in the mounting frame of the tester.

10. Procedure

10.1 Verify and establish the weight location on the moment arm of the tester using a calibrated spring scale, or equivalent, and adjust the weight position as needed to provide the required force.

NOTE 4—Some instruments may not provide the designated force at the manufacturer’s marked location.

10.2 Test the specimens in the standard atmosphere for testing textiles.

10.3 Place the specimen vertically in the frame with the warp or filling yarns parallel to the sides of the frame. Clamp one 102-mm (4-in.) end of the specimen to one end of the frame. Apply the 2.3-kg (5-lb) weight across the opposite 102-mm (4-in.) width of the specimen and fasten the second clamp securely. Remove the weight and clamp.

10.4 Raise the upper friction drum on its weighted lever and place the frame between the drums, positioning it at the extreme end of its travel on the rails.

10.5 Adjust the weight of the upper friction drum to provide the force specified in the material specification and lower the lever arm gently so that the drum rests on the specimen. In the absence of such a specification use the force described in Table 1.

10.6 Make two rotations on the hand crank at a speed of approximately 30 rpm to slide the carriage back and forth over a distance of 25 mm (1 in.), causing the cloth to slip twice between the friction drums. Locate the area of friction on the specimen centrally between the clamps, approximately 13 mm (0.5 in.) from one edge of the specimen.

10.7 Transfer the carriage to the second pair of rails and repeat the test to cause another area of friction 13 mm (0.5 in.) from the other long edge of the specimen.

10.8 Turn the rubber surfaces of the friction drums in their clamps to present a new surface after every 40 rubbing cycles. Replace the drums after each complete revolution in their clamps. When not in use, keep the friction drums from coming in contact with each other.

10.9 Remove the carriage from the rails, and remove the specimen carefully from the frame and tape it without tension on a flat, smooth surface having a contrasting color.

10.10 Allow the specimen to relax for 15 min after removal from the frame. Measure the widest opening of each shift mark, or distorted yarn group, as illustrated in Fig. 2 to the nearest 0.2 mm (0.01 in.). Make the measurement under magnification, using a pair of dividers and graduated scale.

10.11 The width of the shifted area should measure 25.4 mm (1 in.). If it is less than 25.4 mm (1 in.), the test should be discarded as it indicates that the test was either run improperly or the apparatus is out of adjustment.

11. Calculation

11.1 Calculate the individual specimen average opening width from the two two-stroke shift marks to the nearest 0.2 mm (0.01 in.).

11.2 Calculate the average slippage of the five tested specimens to the nearest 0.2 mm (0.01 in.).

11.3 Consider test results that show unshifted or nonaligned yarns as illustrated in Fig. 2 as unmeasurable. The nonaligned condition may be corrected by proper alignment of the specimen as provided in 10.1.

12. Report

12.1 State that the specimens were tested as directed in Test Method D 1336. Describe the material or product sampled, and the method of sampling used.

12.2 Report the following information:

12.2.1 The yarn distortion for each laboratory sampling unit and for the lot,

TABLE 1 Force to Be Applied to Fabric

Force N (lbf)	Type of Fabric
4.4 (1)	blouse, dress, scarf, and window curtain
8.9 (2)	bathrobe, beachwear, bedspread, drapery, dressing gown, decorative pillow, lining, rapery, necktie, shirting, sleepwear, tablecloth, and underwear
18.0 (4)	coat, comforter, sportswear, suiting, umbrella, and uniform

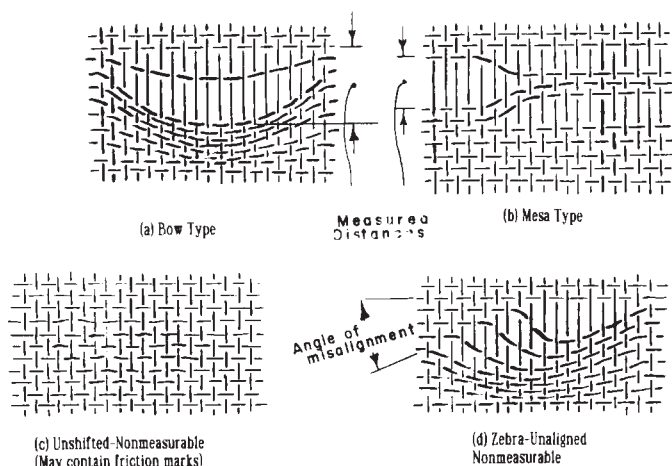


FIG. 2 Shift Openings

- 12.2.2 The number of specimens tested,
- 12.2.3 The drycleaning or laundering procedure used, if any,
- 12.2.4 The force used,
- 12.2.5 Whether the warp or the filling yarns were distorted, and,
- 12.2.6 For any test result considered unmeasurable, report the nature of the resistance and the direction.

13. Precision and Bias

13.1 *Interlaboratory Test*⁵—An interlaboratory test was run in 1970 in which four laboratories each tested ten specimens from each of five materials. Each laboratory had one operator test each material. All 40 specimens of each material came from the same sample. The components of variance for yarn distortion expressed as standard deviations were calculated to be:

	mm (in.)
Single-material comparisons	
Single-operator component	6.35 (0.25)
Within-laboratory component	0.00 (0.00)
Between-laboratory component	0.00 (0.00)
Multi-material comparisons	

Single-operator component	0.00 (0.00)
Within-laboratory component	0.00 (0.00)
Between-laboratory component	2.03 (0.08)

NOTE 5—Where separate components of variance are shown for multi-material components, (1) the multi-material, single-operator component is due to an operator times material (within-laboratories) interaction and is combined with the single-material, single-operator component in calculating critical differences, and (2) any increase in the multi-material, between-laboratory component is due to a material times laboratory interaction.

13.2 *Precision*—For the components of variance reported in 13.1, two averages of observed values should be considered significantly different at the 95 % probability level if the difference equals or exceeds the critical differences for yarn distortion listed below:

Number of Observations in Each Average	Critical Differences ⁴ mm (in.), for the Conditions Noted	
	Single-Operator Precision	Between-Laboratory Precision
	Single-material Comparisons	
	mm (in.)	mm (in.)
1	17.5 (0.69)	17.5 (0.69)
2	12.4 (0.49)	12.4 (0.49)
5	7.9 (0.31)	7.9 (0.31)
10	5.6 (0.22)	5.6 (0.22)
	Multi-material Comparisons	
	mm (in.)	mm (in.)
1	17.5 (0.69)	18.5 (0.73)
2	12.4 (0.49)	13.7 (0.54)
5	7.9 (0.31)	9.7 (0.38)
10	5.6 (0.22)	2.6 (0.32)

⁴ The critical differences were calculated using $t = 1.960$, which is based on infinite degrees of freedom.

NOTE 6—This is 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 randomized specimens from one sample of the material to be tested.

13.3 *Bias*—No justifiable statement on the bias of Test Method D 1336 for yarn distortion can be made since the value of the property cannot be established by an accepted referee method.

14. Keywords

14.1 woven fabric; yarn

⁵ Supporting data available from ASTM Headquarters. Request Research Report No. D-13-1027.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).