



## Standard Test Methods for Length of Woven Fabric<sup>1</sup>

This standard is issued under the fixed designation D3773/D3773M; 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 ( $\epsilon$ ) 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 These test methods cover four options for measuring fabric length and are applicable to full rolls or bolts of materials.

1.2 There are four approved options of measuring length as follows:

- 1.2.1 *Option A*—Hand (Section 6).
- 1.2.2 *Option B*—Drum (Section 7).
- 1.2.3 *Option C*—Clock (Section 8).
- 1.2.4 *Option D*—Folding (Section 9).

1.3 The values stated in either SI units or in U.S. customary units shall be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

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:*<sup>2</sup>
  - D123 Terminology Relating to Textiles
  - D1776 Practice for Conditioning and Testing Textiles
  - D4850 Terminology Relating to Fabrics and Fabric Test Methods
  - E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee D13 on Textiles and are the direct responsibility of Subcommittee D13.60 on Fabric Test Methods, Specific.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto: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 relating to D13.60, Fabric Test Methods, Specific, refer to Terminology D4850.

3.1.1 The following terms are relevant to this standard: length, stable fabric, woven fabric

3.2 For definitions of other textile terms used in this test method, refer to Terminology D123.

### 4. Summary of Test Methods

4.1 The length is measured from one end of the fabric to the other, using a suitable graduated device, or apparatus as described in the option used.

### 5. Conditioning

5.1 Condition the specimens as directed in Practice D1776.

5.2 When full rolls or bolts of fabric cannot be properly conditioned in a reasonable time with available facilities, perform the tests without conditioning and report the actual conditions prevailing at the time of the test. Such results may not correspond with the results obtained after testing in the standard atmosphere for testing textiles.

### 6. Option A—Hand

6.1 *Significance and Use*—The hand method specifies that the length of a fabric be measured in a relaxed tension-free manner. This test method is the referee method to which all other test methods shall be compared for the establishment of their accuracy. This test method can be used for acceptance testing, although it is not used as a general practice because it is too time consuming.

6.1.1 In case of a dispute arising from differences in reported test values when using Test Methods D3773 for acceptance testing of commercial shipments, the purchaser and 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 specimens which are as homogeneous as possible and which are from a lot of material of the type in question. The test specimens should then be randomly assigned in equal numbers 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 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 in the light of the known bias.

#### 6.2 Apparatus:

6.2.1 *Flat Horizontal Surface*, at least 3 m [3 yd] long and having a width equal to or greater than the widest fabric to be measured.

6.2.2 *Length-Measuring Device, metal rule or steel tape*, 1 m [1 yd] minimum length graduated in 1 mm [ $\frac{1}{16}$  in.] units, and

6.2.3 *Pins*, suitable for use as markers.

6.3 *Sampling*—Take a lot sample as directed in the material specification or as agreed upon by the purchaser and seller. In the absence of such specification or agreement, all rolls or pieces shall be measured. Consider rolls or bolts of fabric as the primary sampling units. The lot sample also serves as the laboratory sample and as the test specimens.

#### 6.4 Procedure:

6.4.1 Lay the fabric on a smooth horizontal surface. Fabric must lay flat, without tension, and free from wrinkles and folds.

6.4.2 Using a minimum number of increments, measure successive lengths of fabric parallel to the selvage to the nearest 1 mm [ $\frac{1}{16}$  in.], marking each length with pins.

6.4.3 Add the measurements to determine the length of the fabric.

### 7. Option B—Drum

7.1 *Significance and Use*—The drum option may be used for measuring the length of a fabric for the purpose of acceptance testing, provided the user's laboratory verifies for the specific weave and construction of interest that results obtained by this test method agree within  $\pm 0.5\%$  of those obtained by the hand option. In cases of dispute the hand option shall be used.

#### 7.2 Apparatus:

7.2.1 *Motor-Driven Measuring Drum*<sup>3</sup>, equipped with a dial or counter geared to the drum. The measuring drum is usually covered with fabric or cork. Synchronize the counting mechanism with the drum to read in metres [or yards].

7.2.2 *Standard Roll*, the length of which has been determined by the hand method.

7.3 *Sampling*—Sample as directed in 6.3.

#### 7.4 Procedure:

7.4.1 Run the fabric over the measuring drum, face side up, with sufficient tension to keep the fabric running flat and true to prevent any slippage. Eliminate any observed slippage by adjusting one or two free running guide rollers to increase the arc of contact between the fabric and the drum when necessary. The rollers should not touch the fabric in contact with the drum.

7.4.2 Read the length from the dial or counter geared to the drum. This reading represents the length measured under the tension existing while the fabric is running.

7.4.3 Calculate the average length for the lot.

### 8. Option C—Clock

8.1 *Significance and Use*—The clock option may be used for measuring the length of a fabric for the purpose of acceptance testing, provided the user's laboratory verifies for the specific weave and construction of interest that results obtained by this test method agree within  $\pm 0.5\%$  of those obtained by the hand method. Use the device on any machine equipped to handle continuous lengths of fabric. In cases of dispute, the hand option shall be used.

#### 8.2 Apparatus:

8.2.1 *Measuring Device*<sup>3</sup>, consisting of a pair of identical wheels, mounted 75 to 100 mm [3 to 4 in.] apart on a free-running common axle connected to a counting mechanism graduated to read in metres or decimetres [yards and eighths of a yard]. The surfaces of the wheels are approximately 10 mm [ $\frac{1}{2}$  in.] wide and should be covered with cork or other suitable friction material ground to a known circumference. Synchronize the counting mechanism to this circumference so that it will read in metres [yards].

8.2.2 *Standard Roll*, the length of which has been determined by the hand option.

8.3 *Sampling*—Sample as directed in 6.3.

#### 8.4 Procedure:

8.4.1 Mount the measuring device in such a way that the movement of the fabric through the machine will turn the wheels.

8.4.2 Run the fabric through the measuring device. Read the length of fabric directly from the counter. This reading represents the length measured under the tension existing while the fabric is running.

8.4.3 Calculate the average length for the lot.

### 9. Option D—Folding

9.1 *Significance and Use*—The machine folding option is generally applicable for measuring the length of soft uncoated fabrics weighing 200 g/m<sup>2</sup> [6 oz/yd<sup>2</sup>] or less. However, the test method may be used with any fabric for the purpose of acceptance testing provided the user's laboratory verifies that results obtained by this test method agree within  $\pm 0.5\%$  of those obtained by the hand option for the specific weave or construction of interest.

#### 9.2 Apparatus:

9.2.1 *Mechanical Device*<sup>3</sup>, that folds a known length of fabric at each stroke.

9.2.2 *Rigid Measuring Device*, such as a metre stick graduated in 1-mm units or a yard stick graduated in  $\frac{1}{16}$ -in. units.

9.3 *Sampling*—Sample as directed in 6.3.

#### 9.4 Procedure:

9.4.1 Run the fabric through the folding device and record the length of five or more folds drawn at random intervals with the metre stick [yard] stick.

<sup>3</sup> Apparatus is commercially available.

9.4.2 Calculate the average length of a fold to the nearest 1 mm [ $\frac{1}{16}$  in.].

9.4.3 Calculate the length of the fabric as the product of the number of strokes required to fold the piece, times the average length of the folds, plus any partial fold, in metres [yards].

## 10. Report

10.1 State that the specimens were tested as directed in Test Methods D3773. Describe the material or product sampled and the method of sampling used.

10.2 Report the following information:

10.2.1 Option used to measure fabric length.

10.2.2 Fabric length for each roll or bolt.

10.2.3 The atmospheric conditions under which the tests were conducted if not standard, and if the specimens were conditioned as directed in Practice D1776.

## 11. Precision and Bias<sup>4</sup>

11.1 *Precision*—The precision of this test method is based on an interlaboratory study of D3773 - Standard Test Methods for Length of Woven Fabric, conducted in 1996. Three laboratories participated in the metal rule/steel tape portion of the study (Option A in D3773), while nine laboratories participated in the motor-drive drum against back of fabric analysis (Option B in D3773). Each of the labs reported duplicate test results for 16 different upholstery fabrics. Every “test result” reported represents an individual determination. Except for the use of data from only three laboratories for the metal rule/steel tape analysis, Practice E691 was followed for the design and analysis of the data.

11.1.1 *Repeatability limit (r)*— Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the “r” value for that material; “r” is the interval representing the critical difference between two test

results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory.

11.1.1.1 Repeatability limits are listed in Table 1 and Table 2 below.

11.1.2 *Reproducibility limit (R)*— Two test results shall be judged not equivalent if they differ by more than the “R” value for that material; “R” is the interval representing the critical difference between two test results for the same material, obtained by different operators using different equipment in different laboratories.

Reproducibility limits are listed in Table 1 and Table 2 below.

11.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E177.

11.1.4 Any judgment in accordance with statement 11.1.2 would normally have an approximate 95% probability of being correct, however the precision statistics for the metal rule/steel tape analysis obtained in this ILS must not be treated as exact mathematical quantities which are applicable to all circumstances and uses. The limited number of laboratories reporting results guarantees that there will be times when differences greater than predicted by the ILS results will arise, sometimes with considerably greater or smaller frequency than the 95% probability limit would imply. The reproducibility limit should be considered as a general guide, and the associated probability of 95% as only a rough indicator of what can be expected.

11.2 *Bias*—At the time of the study, there was no accepted reference material suitable for determining the bias for this test method, therefore no statement on bias is being made.

11.3 The precision statement was determined through statistical examination of 384 results, from nine laboratories, on 16 different upholstery fabrics.

## 12. Keywords

12.1 fabric; length; woven

**TABLE 1 Metal Rule/Steel Tape [Yards]**

Material	Average <sup>A</sup>		Repeatability Standard Deviation	Reproducibility Standard Deviation	Repeatability Limit	Reproducibility Limit
	x	Sx	s <sub>r</sub>	s <sub>R</sub>	r	R
Roll A	42.333	0.416	0.125	0.425	0.350	1.191
Roll B	41.521	0.425	0.051	0.427	0.143	1.195
Roll C	53.792	0.722	0.102	0.725	0.286	2.031
Roll D	58.333	0.402	0.204	0.427	0.572	1.195
Roll E	45.792	0.753	0.177	0.764	0.495	2.139
Roll F	53.854	0.567	0.561	0.692	1.572	1.938
Roll G	54.833	0.524	0.072	0.527	0.202	1.475
Roll H	53.542	0.416	0.191	0.438	0.535	1.225
Roll I	51.083	1.035	0.473	1.088	1.325	3.046
Roll J	58.125	0.758	0.260	0.780	0.729	2.183
Roll K	55.396	0.505	0.265	0.539	0.742	1.509
Roll L	61.958	0.532	0.462	0.624	1.294	1.747
Roll M	44.208	0.473	0.204	0.495	0.572	1.385
Roll N	53.750	0.556	0.072	0.558	0.202	1.562
Roll O	40.197	0.753	0.177	0.764	0.495	2.139
Roll P	54.146	0.532	0.051	0.533	0.143	1.492

<sup>A</sup>Average of Laboratories calculated averages

**TABLE 2 Motor-Driven Measuring Drum Against Back of Fabric [Yards]**

Material	Average <sup>A</sup>		Repeatability Standard Deviation	Reproducibility Standard Deviation	Repeatability Limit	Reproducibility Limit
	x	Sx	s <sub>r</sub>	s <sub>R</sub>	r	R
Roll A	42.361	0.253	0.083	0.260	0.233	0.729
Roll B	41.701	0.227	0.114	0.241	0.320	0.675
Roll C	54.208	0.465	0.273	0.503	0.765	1.409
Roll D	58.160	0.183	0.098	0.195	0.274	0.546
Roll E	45.563	0.998	0.273	1.017	0.765	2.847
Roll F	53.750	0.309	0.156	0.328	0.437	0.920
Roll G	55.042	0.367	0.228	0.401	0.639	1.123
Roll H	53.903	0.264	0.144	0.283	0.404	0.791
Roll I	50.792	0.475	0.393	0.550	1.101	1.541
Roll J	58.208	0.436	0.093	0.441	0.261	1.236
Roll K	55.694	0.307	0.102	0.315	0.286	0.883
Roll L	62.410	0.248	0.147	0.269	0.412	0.754
Roll M	43.722	1.303	0.125	1.306	0.350	3.656
Roll N	53.743	0.472	0.206	0.494	0.577	1.384
Roll O	40.632	0.734	0.141	0.741	0.396	2.074
Roll P	53.868	0.584	0.141	0.593	0.396	1.659

<sup>A</sup>Average of Laboratories calculated averages

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