



Designation: D1777 – 96 (Reapproved 2015)

## Standard Test Method for Thickness of Textile Materials<sup>1</sup>

This standard is issued under the fixed designation D1777; 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.

### 1. Scope

1.1 This test method covers the measurement of the thickness of most textile materials.

1.2 This test method applies to most fabrics including woven fabrics, air bag fabrics, blankets, napped fabrics, knitted fabrics, layered fabrics, and pile fabrics. The fabrics may be untreated, heavily sized, coated, resin-treated, or otherwise treated. Instructions are provided for testing thickness, except as provided for in another standard such as listed in Section 2.

1.3 The values stated in SI units are to be regarded as the standard. The values stated in inch-pound may be approximate.

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

D2904 Practice for Interlaboratory Testing of a Textile Test Method that Produces Normally Distributed Data (Withdrawn 2008)<sup>3</sup>

D2906 Practice for Statements on Precision and Bias for Textiles (Withdrawn 2008)<sup>3</sup>

2.2 *ASTM Adjuncts:*

TEX-PAC<sup>4</sup>

<sup>1</sup> 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.

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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.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> A PC program on floppy disk for analyzing Committee D13 interlaboratory data are available from ASTM Headquarters. For a 3½-in. disk, request PCN:12-429040-18. For a 5¼-in. disk, request PCN:12-429041-18.

### 3. Terminology

3.1 *Definitions*—For definitions of textile terms used in this test method, see Terminology D123.

3.1.1 The following terms are relevant to this standard: cross-machine direction, machine direction, pressure, and thickness.

### 4. Summary of Test Method

4.1 A specimen is placed on the base of a thickness gauge and a weighted presser foot lowered. The displacement between the base and the presser foot is measured as the thickness of the specimen.

### 5. Significance and Use

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

5.1.1 In case of a dispute arising from differences in reported test results when using this test method for acceptance testing of commercial shipments, 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 specimens that are as homogeneous as possible and that are from a lot of material of the type in question. Test specimens then should be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using the appropriate statistical analysis 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.

5.2 Thickness is one of the basic physical properties of textile materials. In certain industrial applications, the thickness may require rigid control within specified limits. Bulk and warmth properties of textile materials are often estimated from their thickness values, and thickness is also useful in measuring some performance characteristics, such as before and after abrasion and shrinkage.

5.3 The thickness value of most textile materials will vary considerably depending on the pressure applied to the specimen at the time the thickness measurement is taken. In all cases, the apparent thickness varies inversely with the pressure applied. For this reason, it is essential that the pressure be specified when discussing or listing any thickness value.

5.4 When using this test method for measuring the thickness of textile materials, the primary method for the specific material such as listed in the Referenced Document section shall take precedence over the directions described in this test method, unless specifically provided for in that test method. This test method is used in its entirety when no test method for measuring thickness is available for the specific material to be tested or unless otherwise specified in a material specification or contract order.

## 6. Apparatus

6.1 *Thickness Gauge*, having dimensions appropriate to the material to be tested as specified in **Table 1**, unless otherwise specified in a material specification or contract order. A circular presser foot commonly is used for most materials; however, for certain materials, such as narrow tapes, a rectangular foot is more appropriate when agreed upon between the purchaser and the supplier.

6.1.1 *Automatic Microprocessor Data Gathering Systems*, optional.

6.1.2 *Spring Force or Compression Test Apparatus*, may be substituted for the dead-weight-type thickness gauge providing they meet the specified conditions cited in **Table 1**.

6.2 *Cutting Dies or Templates*, to cut specimens having minimum dimensions at least 20 % greater than any dimension of the presser foot to be used in measuring the thickness (optional).

## 7. Sampling and Test Specimens

7.1 *Lot Sample*—As a lot sample for acceptance testing, randomly select the number of rolls or pieces of fabric directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider the rolls or pieces of fabric to be the primary sampling units. In the absence of such an agreement, take the number of fabric rolls specified in **Table 2**.

NOTE 1—An adequate specification or other agreement between the purchaser and the supplier requires taking into account the variability between rolls or pieces of fabric and between specimens from a swatch from a roll or piece of fabric 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 swatch extending the width of the fabric and approximately 1 m (1 yd) along the machine direction from each roll or piece in the lot sample. For rolls of fabric, take a sample that will exclude fabric from the outer wrap of the roll or the inner wrap around the core of the roll of fabric. For finished garments, take a piece of sufficient size to provide the number of specimens required in **7.3**.

7.3 *Test Specimens*—From each laboratory sampling unit, take ten specimens. Use the cutting die or template described in **6.2**. It is permissible to make thickness tests of a textile material without cutting, providing it can be maintained without distortion in a plane parallel to the presser foot and anvil while making measurements.

7.3.1 *Cutting Test Specimens*—When cutting specimens, cut having minimum dimensions at least 20 % greater than any dimension of the presser foot to be used. Label to maintain specimen identity.

7.3.1.1 Take specimens, representing a broad distribution across the width and length, and preferably along the diagonal,

**TABLE 1 Designated Gauges and Gauge Specifications for Measuring Thickness of Textiles**

Testing Option <sup>A</sup>	Material Type	Gauge Type <sup>B</sup>	Presser Foot Diameter	Anvil	Anvil/Foot Parallelism	Foot to Anvil Surface Parallelism	Applied Pressure	Readability
1	Woven fabrics Knitted fabrics Textured fabrics	dead-weight	28.7 ± 0.02 mm (1.129 ± 0.001 in.)	38 mm D, or greater (1.629 in. D, or greater)	0.01 mm (0.0005 in.)	0.002 mm (0.0001 in.)	4.14 ± 0.21 kPa (0.60 ± 0.03 psi)	0.02 mm (0.001 in.)
2	Coated fabrics Narrow fabrics Webbings Tapes Ribbons Braids	dead-weight	9.5 ± 0.02 mm (0.375 ± 0.001 in.)	38 mm D, or greater (1.629 in. D, or greater)	0.01 mm (0.0005 in.)	0.002 mm (0.0001 in.)	23.4 ± 0.7 kPa (3.4 ± 0.1 psi)	0.02 mm (0.001 in.)
3	Films Glass cloths Glass tapes	dead-weight	6.3 ± 0.02 mm (0.250 ± 0.001 in.)	19 mm D, or greater (0.750 in. D, or greater)	0.002 mm (0.0001 in.)	0.002 mm (0.0001 in.)	172 ± 14 kPa (25 ± 2 psi)	0.002 mm (0.0001 in.)
4	Glass fiber mat	dead-weight	(2.25 ± 0.001 in.)	(2.75 in. D, or greater)	0.01 mm (0.0005 in.)	0.002 mm (0.0001 in.)	18.9 ± 0.7 kPa (2.75 ± 0.1 psi)	0.02 mm (0.001 in.)
5	Blankets Pile fabrics Napped fabrics	dead-weight	28.7 ± 0.02 mm (1.129 ± 0.001 in.)	38 mm D, or greater (1.629 in. D, or greater)	0.01 mm (0.0005 in.)	0.002 mm (0.0001 in.)	0.7 ± 0.07 kPa (0.1 ± 0.01 psi) also 7.58 ± 0.21 kPa (1.1 ± 0.03 psi)	0.02 mm (0.001 in.)

<sup>A</sup> When testing fabrics made with textured yarns or open-end spun yarns, primary consideration should be given to the pressure applied in Option 1, with respect to the size of the presser foot used.

<sup>B</sup> Other spring force or compression test apparatus that meet the stated specifications can be used.