



Designation: D 2261 – 96 (Reapproved 2002)

## Standard Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine)<sup>1</sup>

This standard is issued under the fixed designation D 2261; 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 tearing strength of textile fabrics by the tongue (single rip) procedure using a recording constant-rate-of-extension-type (CRE) tensile testing machine.

1.1.1 The CRE-type tensile testing machine has become the preferred test apparatus for determining tongue tearing strength. It is recognized that some constant-rate-of-traverse-type (CRT) tensile testing machines continue to be used. As a consequence, these test instruments may be used when agreed upon between the purchaser and the supplier. The conditions for use of the CRT-type tensile tester are included in **Appendix X1**.

1.2 This test method applies to most fabrics including woven fabrics, air bag fabrics, blankets, napped fabrics, knit fabrics, layered fabrics, pile fabrics. The fabrics may be untreated, heavily sized, coated, resin-treated, or otherwise treated. Instructions are provided for testing specimens with or without wetting.

1.3 Tear strength, as measured in this test method, requires that the tear be initiated before testing. The reported value obtained is not directly related to the force required to initiate or start a tear.

1.4 Two calculations for tongue tearing strength are provided: the single-peak force and the average of five highest peak forces.

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

1.6 *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 Textiles<sup>2</sup>

**D 123** Terminology Relating to Textiles<sup>2</sup>

**D 629** Test Methods for Quantitative Analysis of Textiles<sup>2</sup>

**D 1776** Practice for Conditioning Textiles for Testing<sup>2</sup>

**D 2904** Practice for Interlaboratory Testing of a Textile Test Method That Produces Normally Distributed Data<sup>2</sup>

**D 2906** Practice for Statements on Precision and Bias for Textiles<sup>2</sup>

**D 4848** Terminology of Force, Deformation and Related Properties of Textiles<sup>3</sup>

2.2 *ASTM Adjuncts:*

TEX-PAC<sup>4</sup>

### 3. Terminology

3.1 *Definitions*—For definitions of other textile terms used in this test method, refer to Terminology **D 123**. For definitions of other terms related to force and deformation in textiles, refer to Terminology **D 4848**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cross-machine direction, CD, n*—the direction in the plane of the fabric perpendicular to the direction of manufacture.

3.2.1.1 *Discussion*—This term is used to refer to the direction analogous to crosswise or filling direction in woven fabrics.

3.2.2 *fabric, in textiles, n*—a planar structure consisting of yarns or fibers.

3.2.3 *machine direction, MD, n*—the direction in the plane of the fabric parallel to the direction of manufacture.

3.2.3.1 *Discussion*—This term is used to refer to the direction analogous to lengthwise or warp direction in woven fabrics.

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

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 07.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 07.02.

<sup>4</sup> A PC program on floppy disk for analyzing Committee D-13 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.

3.2.4 *peak force, in tear testing of fabrics, n*—the maximum force required to break one or more yarn components in a woven or knitted fabric specimen, or break the fiber, the fiber bonds, or fiber interlocks in other manufactured fabric forms.

3.2.4.1 *Discussion*—The peak force may consist of a single peak or a series of peaks depending upon the nature of the fabric. Typically for woven fabrics, if a small decrease in force occurs at a time when the force is increasing, it is not considered to peak unless the indicated force exceeds the force required to break a yarn. Lower shifts corresponding to yarn movement do not qualify as peaks since no yarns are broken.

3.2.5 *tearing force, in fabric, n*—the force required to propagate a tear initiated under specified conditions.

3.2.5.1 *Discussion*—The tongue tearing force may be calculated from a single-peak or a multiple-peak force-extension curve.

3.2.6 *tearing strength, in fabrics, n*—the capacity of a fabric to withstand the tearing force required to propagate a tear after its initiation.

#### 4. Summary of Test Method

4.1 A rectangular specimen, cut in the center of a short edge to form a two-tongued (trouser shaped) specimen, in which one tongue of the specimen is gripped in the upper jaw and the other tongue is gripped in the lower jaw of a tensile testing machine. The separation of the jaws is continuously increased to apply a force to propagate the tear. At the same time, the force developed is recorded. The force to continue the tear is calculated from autographic chart recorders or microprocessor data collection systems.

#### 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 the 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 fabric 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 The force registered in a tear test is irregular, and as a consequence, empirical methods have had to be developed to obtain usable values related to tear strength. In spite of the empirical nature of the reported values, the values are considered to reflect comparative performance of similar fabrics tested and measured in the same way. No known procedure is

available that can be used with all fabrics to determine the minimum tearing strength.

5.3 Depending on the nature of the specimen, the data recording devices will show the tearing force in the form of a peak or peaks. The highest peaks appear to reflect the strength of the yarn components, fiber bonds, or fiber interlocks, individually or in combination, needed to stop a tear in a fabric of the same construction. The valleys recorded between the peaks have no specific significance. The minimum tearing force, however, is indicated to be above the lowest valleys.

5.4 Most textile fabrics can be tested by this test method. Some modification of clamping techniques may be necessary for a given fabric due to its structure. Strong fabrics or fabrics made from glass fibers usually require special adaptation to prevent them from slipping in the clamps or being damaged as a result of being gripped in the clamps.

5.5 The CRE-type is the preferred tensile testing machine. This test method allows the use of the CRT-type tensile machine when agreed upon between the purchaser and the supplier. There may be no overall correlation, however, between the results obtained with the CRT-type machine and the CRE-type machine. Consequently, these two tensile testers cannot be used interchangeably unless the degree of quantitative correlation has been established between the purchaser and the supplier. In any event, the CRE-type machine shall prevail.

#### 6. Apparatus

6.1 *Tensile Testing Machine*, of the CRE-type conforming to the requirements of Specification **D 76** with autographic recorder, or automatic microprocessor data gathering system.

6.2 *Clamps*, having all jaw surfaces parallel, flat, and capable of preventing slipping of the specimen during a test, and measuring at least 25 by 75 mm (1 by 3 in.) with the longer dimension perpendicular to the direction of application of the force.

6.2.1 The use of hydraulic pneumatic clamping systems with a minimum of 50 by 75-mm (2 by 3-in.) serrated or rubber jaw faces having a clamping force at the grip faces of 13 to 14 kN (2900 to 3111 lbf) is recommended. Manual clamping is permitted providing no slippage of the specimen is observed.

6.2.2 For some materials, to prevent slippage when using jaw faces other than serrated, such as rubber-faced jaws, the jaw faces may be covered with a No. 80 to 120 medium-grit emery cloth. Secure the emery cloth to the jaw faces with pressure-sensitive tape.

6.3 *Cutting Die or Template*, having essentially the shape and dimensions shown in **Fig. 1**.

#### 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 1**.

NOTE 1—An adequate specification or other agreement between the purchaser and the supplier requires taking into account the variability