



**Designation: D4533-91 (Reapproved 1996) Designation: D 4533 – 04 (Reapproved 2009)**

## Standard Test Method for Trapezoid Tearing Strength of Geotextiles<sup>1</sup>

This standard is issued under the fixed designation D 4533; 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 Department of Defense.*

### 1. Scope

1.1 This test method is an index test used to measure the force required to continue or propagate a tear in woven or non-woven geotextiles by the trapezoid method. While useful for quality control and acceptance testing, the trapezoid tear test does not provide all the information needed for all design applications and other test methods should be used.

1.2 This test method is applicable to most geotextiles that include woven fabrics, nonwoven fabrics, layered fabrics, knit fabrics, and felts that are used for geotextile applications.

~~1.3 The values stated in SI units are to be regarded as the standard.~~

1.3 The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

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>

D 76 [Specification for Tensile Testing Machines for Textiles](#)

D 123 [Terminology Relating to Textiles](#)

D 1776 ~~[Practice for Conditioning Textiles for Testing](#)~~<sup>2</sup> [Practice for Conditioning and Testing Textiles](#)

D 2905 [Practice for Statements on Number of Specimens for Textiles](#)

D 4354 [Practice for Sampling of Geosynthetics for Testing](#)

D 4439 ~~[Terminology for Relating to Geosynthetics](#)~~<sup>3</sup> [Terminology for Geosynthetics](#)

### 3. Terminology

3.1 *Definitions:*

3.1.1 *atmosphere for testing geotextiles, n*—air maintained at a relative humidity of  $65 \pm 5\%$  and a temperature of  $21 \pm 2^\circ\text{C}$  ( $70 \pm 4^\circ\text{F}$ ).

3.1.2 *geotextile, n*—any permeable textile material used with foundation, soil, rock, earth, or any other geotechnical engineering related material as an integral part of a man-made product, structure, or system.

3.1.3 *tearing strength, n*—the force required to either (1) start, or (2) continue or propagate a tear in a fabric under specified conditions.

3.1.3.1 *Discussion*—This test method uses the maximum value of the tearing force as the tearing strength.

3.1.4 For definitions of other terms used in this test method, refer to Terminology D 123 or Terminology D 4439.

### 4. Summary of Test Method

4.1 An outline of an isosceles trapezoid is marked on a rectangular specimen cut for the determination of tearing strength (see Fig. 1), and the nonparallel sides of the trapezoid marked on the specimen are clamped in parallel jaws of a tensile testing machine. The separation of the jaws is continuously increased so the tear propagates across the specimen. At the same time, the force developed is recorded. The tearing strength, which is the maximum value of the tearing force, is obtained from the autographic force – extension curve (see Fig. 2).

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee [D-35 D35](#) on Geosynthetics and is the direct responsibility of Subcommittee [D35.01](#) on Mechanical Properties.

Current edition approved Aug. 15, 1991. Published December 1991.

Current edition approved June 1, 2009. Published July 2009. Originally approved in 1991. Last previous edition approved in 2004 as D 4533 – 04.

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

<sup>3</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.

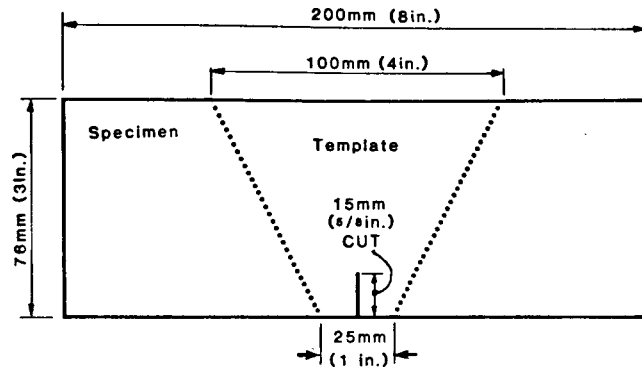


FIG. 1 Trapezoidal Template for Trapezoid Tearing Strength Test

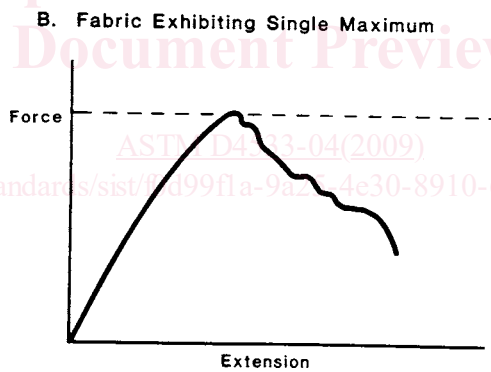
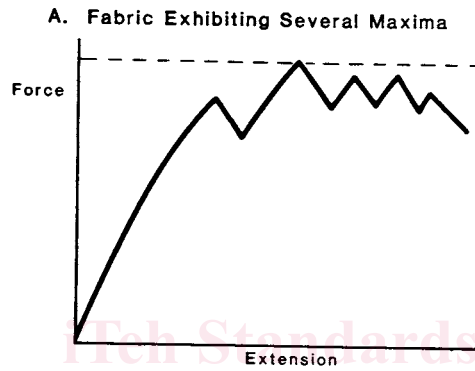


FIG. 2 Typical Tearing Force – Extension Curves for Individual Test Specimens

## 5. Significance and Use

5.1 The trapezoid tear method is a test that produces tension along a reasonably defined course such that the tear propagates across the width of the specimen. The trapezoid tearing strength for woven fabrics is determined primarily by the properties of the yarns that are gripped in the clamps. In nonwoven fabrics, because the individual fibers are more or less randomly oriented and capable of some reorientation in the direction of the applied load, the maximum trapezoid tearing strength is reached when the resistance to further reorientation is greater than the force required to rupture one or more fibers simultaneously.

5.2 The trapezoid tearing strength method is useful for estimating the relative tear resistance of different fabrics or different directions in the same fabric.

5.3 This test method may be used for acceptance testing of commercial shipments; however, caution is advised since information about between-laboratory precision is incomplete. Comparative tests as directed in 5.3.1 may be advisable.

5.3.1 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 should then be randomly assigned in equal numbers to each laboratory for testing. The average results