



Designation: ~~D4833-00~~^{ε1} Designation: D 4833 – 07

Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, Geomembranes and Related Products¹

This standard is issued under the fixed designation D 4833; 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.

This standard has been approved for use by agencies of the Department of Defense.

~~^{ε1}Note—Table 1 was editorially corrected from a one-sided table to a two-sided table in April 2002.~~

1. Scope

1.1 This test method is used to measure the index puncture resistance of ~~geotextiles, geomembranes, geomembranes and~~ related products.

1.2 The use of Test Method D 4833 may be inappropriate for testing some woven geotextiles or related products which have large openings (Note 1):

~~Note 1—Geonet openings, such as geonets and geogrids.~~

1.3 It is recommended that ~~geotextile and geotextile related products~~ be tested using ~~this test method.~~ Test Method D6241.

~~1.3.1~~ 1.4 The values stated in SI units are to be regarded as the standard. The values provided in inch-pound units are for information only.

~~1.4.1.5~~ *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:*²

D 76 Specification for Tensile Testing Machines for Textiles ~~D123~~ Terminology Relating to Textiles²

~~D1776~~ Practice for Conditioning and Testing Textiles²

~~D2905~~ Practice for Statements on Number of Specimens for Textiles² 123 Terminology Relating to Textiles

D 1776 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 Geosynthetics³ Terminology for Geosynthetics

D 6241 Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

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 *geomembrane, n*—very low permeability synthetic membrane liners or barriers used with any geotechnical engineering related material so as to control fluid migration in a man-made project, structure, or system.

3.1.3 *geotextile, n*—any permeable textile used with foundations, soil, rock, earth, or any other geotechnical material as an integral part of man-made project, structure, or system.

~~3.1.4~~ 3.1.4 *index test, n*—a test procedure which may contain a known bias but which may be used to establish an order for a set of specimens with respect to the property of interest.

~~3.1.5~~

¹ This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.01 on Mechanical Properties. Current edition approved March 21, 2002. Published May 2000. Originally published as D4833-88. Last previous edition D4833-88(96).

Current edition approved Dec. 1, 2007. Published January 2008. Originally approved in 1988. Last previous edition approved in 2000 as D4 833-00.^{ε1}

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* Volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.4 *puncture resistance* (F), n —the inherent resisting mechanism of the test specimen to the failure by a penetrating or puncturing object.

3.2 For definitions of other ~~textile~~ terms relating to geosynthetics used in this standard, refer to Terminology D123D 4439.

3.3 ~~For definitions of other terms relating to geotextiles used in this standard, refer to Terminology D4439.~~

4. Summary of Test Method

4.1 A test specimen is clamped without tension between circular plates of a ring clamp attachment secured in a tensile testing machine. A force is exerted against the center of the unsupported portion of the test specimen by a solid steel rod attached to the load indicator until rupture of the specimen occurs. The maximum force recorded is the value of puncture resistance of the specimen.

5. Significance and Use

5.1 This test method is an index test for determining the puncture resistance of ~~geotextiles, geomembranes, geomembranes~~ and related products. The use of this test method is to establish an index value by providing standard criteria and a basis for uniform reporting.

5.2 This test method is considered satisfactory for acceptance testing of commercial shipments of ~~geotextiles, geomembranes, geomembranes~~ and related materials since the test method has been used extensively in the trade for acceptance testing.

5.2.1 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 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 the 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. Apparatus

6.1 *Tensile/Compression Testing Machine*, of the constant-rate-of extension (CRE) type, with autographic recorder conforming to the requirements of Specification D 76. See Fig. 1.

6.2 *Ring Clamp Attachment*, consisting of concentric plates with an open internal diameter of 45 ± 0.025 mm (1.772 ± 0.001 in.), capable of clamping the test specimen without slippage. A suggested clamping arrangement is shown in Fig. 1 and Fig. 2. The external diameter is suggested to be 100 ± 0.025 mm minimum of 100 (3.937 ± 0.001 in.). The diameter of the six holes used for securing the ring clamp assembly is suggested to be 8 mm (0.135 in.) and equally spaced at a radius of 37 mm (2.95 in.). The surfaces of these plates can consist of grooves with O-rings or coarse sandpaper bonded onto opposing surfaces.

6.3 *Solid Steel Rod*, with a diameter of 8 ± 0.1 mm (0.315 ± 0.004 in.) having a flat end with a $45^\circ = 0.8$ mm (0.315 in.) chamfered edge contacting the test specimen's surface. See Fig. 1 and Fig. 3.

7. Sampling

7.1 *Lot Sample*—Divide the product into lots and take the lot sample as directed in Practice D 4354.

7.2 *Laboratory Sample*—For the laboratory sample, take a swatch extending the full width of the ~~geotextile~~ and of sufficient length along the selvage, from each sample roll so that the requirements of 7.3 and 8.1 can be met. Take a sample that will exclude material from the outer wrap and inner wrap around the core unless the sample is taken at the production site, then inner and outer wrap material may be used.

7.3 *Test Specimens*—Select from the laboratory sample the number of specimens directed in Section 8. Minimum specimen diameter is 100 mm (4 in.) to facilitate clamping. Space the specimens along a diagonal on the unit of the laboratory sample. Take no specimens nearer the selvage or edge of the geotextile sample than $1/10$ the width of the geotextile sample.

8. Number of Specimens

8.1 *Reliable Estimate of v* —When there is a reliable estimate of v based on extensive past records for similar materials tested in the user's laboratory, calculate the number of specimens per unit in the laboratory sample using Eq 1:

$$n = (tv/a)^2 = (tv)^2/36 \quad (1)$$