



# Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products<sup>1</sup>

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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method is used to measure the index puncture resistance of geotextiles, 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—Geonets and geogrids cannot be tested using this test method.

1.3 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 *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 1776 Practice for Conditioning Textiles for Testing<sup>2</sup>

D 2905 Practice for Statements on Number of Specimens for Textiles<sup>3</sup>

D 4354 Practice for Sampling of Geosynthetics for Testing<sup>3</sup>

D 4439 Terminology for Geosynthetics<sup>3</sup>

## 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 *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 *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 used in this standard, refer to Terminology D 123.

3.3 For definitions of other terms relating to geotextiles used in this standard, refer to Terminology D 4439.

## 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, 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, 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

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

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.09.

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  $45 \pm 0.025$  mm ( $1.772 \pm 0.001$  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  $100 \pm 0.025$  mm ( $3.937 \pm 0.001$  in.). The diameter of the six holes

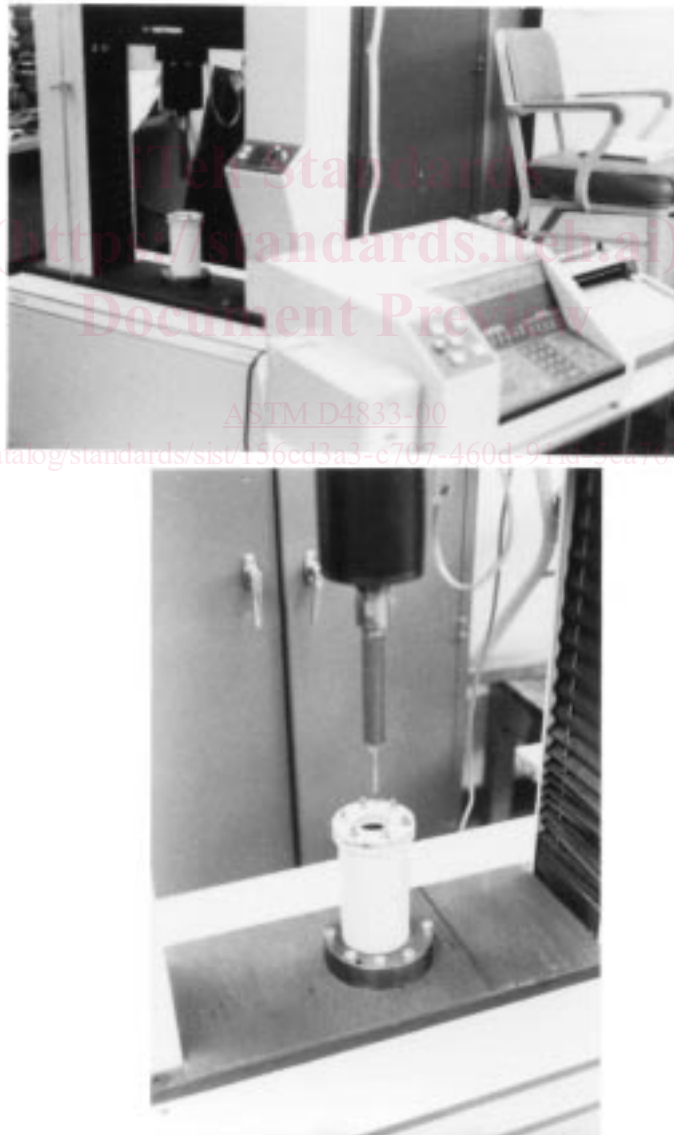
used for securing the ring clamp assembly is suggested to be 8 mm (0.135 in.) and equally spaced at a radius of 37 mm (2.95 in.). The surfaces of these plates can consist of grooves with O-rings or coarse sandpaper bonded onto opposing surfaces.

6.3 *Solid Steel Rod*, with a diameter of  $8 \pm 0.1$  mm ( $0.315 \pm 0.004$  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, 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



**FIG. 1 Photographs of Test Setup and Fixture**