Designation: D5884 – 04a

# Standard Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes[1]

This standard is issued under the fixed designation D5884; 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.

## 1. Scope

1.1 This test method covers a uniform procedure for determining the tear strength of flexible geomembranes internally reinforced with a textile, using the tongue tear method.

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

1.3 *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]

D4354 Practice for Sampling of Geosynthetics for Testing

D4439 Terminology for Geosynthetics

D4533 Test Method for Trapezoid Tearing Strength of Geotextiles

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *atmosphere for testing geosynthetics*, *n*—air maintained at a relative humidity between 50 to 70 % and a temperature of 21 ± 2°C (70 ± 4°F). (See Terminology D4439.)

3.1.2 *geomembrane*, *n*—an essentially impermeable geosynthetic composed of one or more synthetic sheets. (See Terminology D4439.)

3.1.3 *reinforced geomembrane*—a geomembrane internally reinforced with a textile.

3.1.4 *tearing strength, (F, (F), kN)*, *n*—the force required either to start or to continue or propagate a tear in a fabric under specified conditions. (See Terminology D4439 and Test Method D4533.)

## 4. Summary of Test Method

4.1 The tensile tear strength of a membrane in both machine and cross-machine directions is determined by measuring the maximum load when cut specimens of specific dimensions are tested to failure, by tearing, at a fixed testing displacement rate.

## 5. Significance and Use

5.1 Since tear resistance may be affected to a large degree by mechanical fibering of the membrane under stress, as well as by stress distribution, strain rate, and size of specimen, the results obtained in a tear resistance test can only be regarded as a measure of the resistance under the conditions of that particular test and not necessarily as having any direct relation to service value. This test method measures the force required to tear a reinforced geomembrane along a reasonably defined course such as that the tear propagates across the width of the specimen. The values may vary between types of reinforcement used within a geomembrane.

5.2 The tongue tear method is useful for estimating the relative tear resistance of different reinforcing textiles or different directions in the same reinforcing textiles.

5.3 *Disputes*—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 difference between their laboratories.

## 6. Apparatus

6.1 The machine shall consist of three main parts:

6.1.1 *Straining Mechanism*—A machine wherein the specimen is held between the two clamps and strained by a uniform movement of the pulling clamp shall be used. Unless otherwise

[1] This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.10 on Geomembranes.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact 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.

specified in the material specification, the machine shall be adjusted so that the pulling clamp shall have a uniform speed of 50 ± 2 mm/min (2 ± 0.1 in./min).

6.1.2 *Clamps for Holding Specimen*—The clamps for holding a reinforced flexible geomembrane specimen shall have metallic gripping surfaces sufficiently smooth, flat, and parallel as to prevent the test specimen from slipping or moving between the gripping surfaces when held under the pressure normal to operation. The dimension of all gripping surfaces shall measure 25 by 50 mm (1 by 2 in.) or more with the long dimension perpendicular to this direction of application of the load. All edges that might cause a cutting action shall be rounded to a radius of not over 0.4 mm (1⁄64 in.). The design of the clamp shall be such that one gripping surface shall be an integral part of the rigid frame of the clamp while the other shall be on a part hinged or swiveled to the movable member of the clamp. The pressure between the gripping surfaces, sufficient to clamp the specimen firmly before testing load is applied and to prevent slippage during the progress of the test, shall be secured by any suitably constructed mechanical device operating on the movable member of the clamp. The distance between the clamps at the start of the test shall be 75 mm (3 in.).

6.1.3 *Load and Elongation Recording Mechanism(s)*—Calibrated dial, scale, or chart to indicate applied load and elongation. Unless otherwise specified for load determination, the machine shall be adjusted or set so that the load required to tear the specimen will remain indicated on the calibrated dial or scale after the test specimen has ruptured.

6.2 *Capacity*—Machine shall be of such capacity that the maximum load required to break the specimen shall not be greater than 85 % or less than 15 % of the rated capacity.

6.3 *Testing Machine Accuracy*—The error of the machine shall not exceed 2 % up to and including a 200-N (50-lbf) force and 1 % over 200 N and 1 % at any reading within its loading range.

NOTE 1—As a practical method of determining the degree of width and alignment (in parallel) of the assembled clamp mechanism, it is recommended that a sheet of this white paper, between two thin sheets of carbon paper, be placed between the gripping surfaces, and the jaws then brought together with a light pressure.

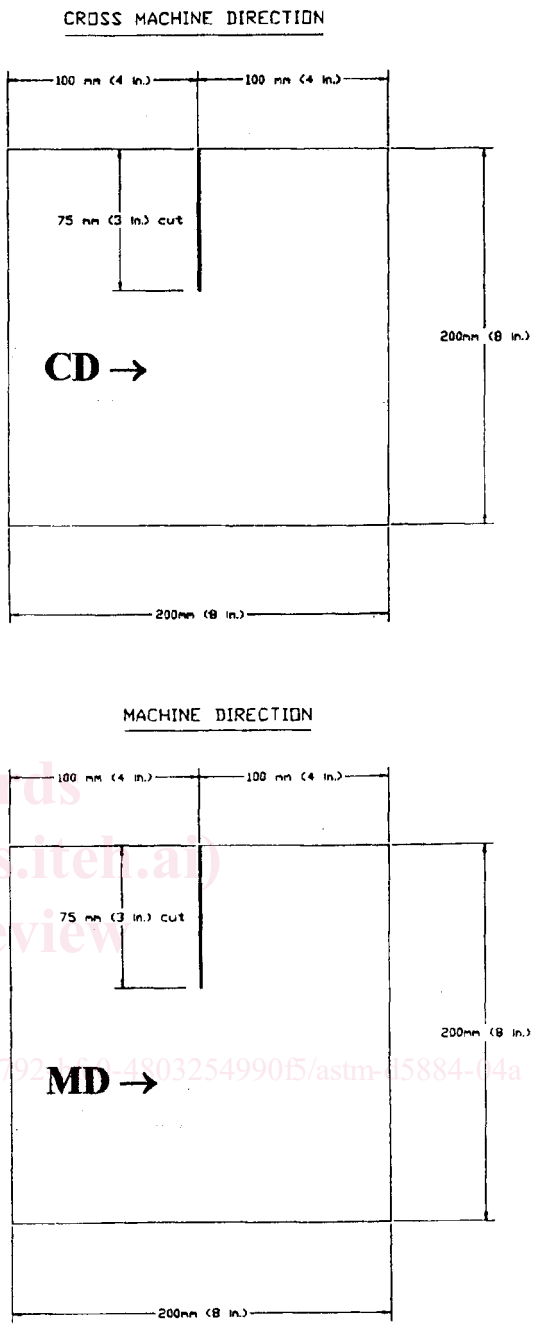
## 7. Test Specimen

7.1 Obtain samples for specimen removal from the geomembranes in accordance with Practice D4354.

7.2 Each specimen shall be a square of 200 by 200-mm (8 by 8-in.) internally reinforced geomembrane (see Fig. 1). Two sets of five specimens each will be required, one set for the machine and one set for cross-machine directions shall be tested. No two specimens for machine direction tests shall contain the same warp yarns or fibers, nor shall any two specimens for the cross-machine tests contain the same filling yarns or fibers. Using a precision template, a 75-mm (3-in.) cut shall be made at the center of the specimen forming the tongues or cut strips as shown in Fig. 1.

## 8. Conditioning

8.1 *Conditioning*—Condition the test specimens at 21 ± 2°C (70 ± 4°F) and 50 to 70 % relative humidity for not less than 40 h prior to test. In cases of disagreement, the tolerances shall be ±1°C (±1.8°F) and ±2 % relative humidity.




NOTE 1—Testing for the machine direction and cross direction tears the machine direction and cross direction fibers, respectively. (The cross direction test tears in the machine direction).

**FIG. 1 Tongue Tear Specimen**

8.2 *Test Conditions*—Conduct tests in a standard laboratory atmosphere in accordance with Terminology D4439, that calls for air maintained at a relative humidity between 50 to 70 % and a temperature of 21 ± 2°C (70 ± 4°F).

8.3 *Moisture Equilibrium*—It shall be considered that moisture equilibrium is reached when, after free exposure to air in