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# Standard Test Method for Tensile Strength of Geosynthetic Clay Liners[1]

This standard is issued under the fixed designation D6768/D6768M; 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 establishes the procedures for the measurement of tensile strength of a geosynthetic clay liner (GCL). This test method is strictly an index test method to be used to verify the tensile strength of GCLs. Results from this test method should not be considered as an indication of actual or long-term performance of the geosynthetic(s) in field applications.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D76/D76M Specification for Tensile Testing Machines for Textiles
D123 Terminology Relating to Textiles
D4439 Terminology for Geosynthetics
D5889/D5889M Practice for Quality Control of Geosynthetic Clay Liners
D6072/D6072M Practice for Obtaining Samples of Geosynthetic Clay Liners



## 3. Terminology

~~3.1 *geosynthetic clay liner, n*—a manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetic material(s). **D4439**~~

3.1 *Definitions:*

3.1.1 *geosynthetic clay liner, n*—a manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetic material(s). **D4439**

3.2 For terminology of other terms used in this test method, refer to Terminologies D123 and D4439.

## 4. Summary of Test Method

4.1 A 100-mm [4-in.] wide specimen is gripped across its entire width in the clamps of a constant rate of extension (CRE) type tensile testing machine operated at a prescribed rate of extension, applying a longitudinal force to the specimen until the specimen ruptures.

## 5. Significance and Use

5.1 This test method may be used for the acceptance testing of commercial shipments of GCLs, but caution is advised since information about between-laboratory precision is incomplete. Comparative tests as directed in 5.1.1 may be advisable.

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[1] This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.04 on Geosynthetic Clay Liners.

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[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.

5.1.1 In cases of a dispute arising from differences in reported test results when using this test method for acceptance of shipments, the purchaser and the supplier should conduct comparative tests to determine if there is a statistical bias. The two parties should take a group of test samples that are as homogeneous as possible and which are from the lot of material in question.

5.2 Some modification of clamping techniques may be necessary for a given GCL, depending upon its structure. Specimen clamping may be modified as required at the discretion of the individual laboratory, provided a representative tensile strength is obtained. In any event, the procedure described in Section 10 of this test method for obtaining tensile strength must be maintained.

5.3 This test method is applicable for testing GCLs as received. It is used with a constant rate of extension type tension apparatus.

## 6. Atmospheric Conditions

6.1 *Atmospheric Conditions:*

6.1.1 The atmospheric conditions of the laboratory determining tensile strength of geosynthetic clay liners shall be: relative humidity between 50 to 70 % and a temperature of 21 ± 2 °C [70 ± 4 °F].

## 7. Apparatus

7.1 *Tensile Testing Machine*—A constant rate of extension (CRE) type of testing machine described in Specification D76/D76M shall be used with a minimum precision measuring capability of 0.1 N/m [$5.71 \times 10^{-4}$ lbf/in.].

7.2 *Clamps*—The clamps shall be a minimum 25 by 100 mm [1 by 4 in.] and with appropriate clamping power to prevent slipping or crushing (damage).

7.3 *Die or Template,* 100 by 200 mm (±1 mm) [4 by 8 in. (±0.04 in.)].

7.4 *Miscellaneous*—Knives, razor, etc., as required.

## 8. ~~Sampling~~ Sampling, Test Specimens, and Test ~~Specimens~~Units

8.1 *Lot Sample*—For the lot sample, take rolls of GCLs as directed in an applicable material specification, Practice D5889/D5889M, or as agreed upon between the purchaser and the supplier.

8.2 *Laboratory Sample*—For the laboratory sample, sample shall be taken in accordance with Practice D6072/D6072M. The sample received at the testing laboratory should be in satisfactory condition and representative of the product manufactured or delivered to a site, or both.

8.3 *Test Specimens*—A minimum of five test specimens shall be taken in the machine direction from each swatch in the laboratory sample. Take specimens from the laboratory sample, with those for the measurement of the machine direction tensile properties from different positions across the GCL width. No specimens shall be taken within 10 cm [4 in.] of the selvage or edge of the GCL.

8.4 The size of the die or template for cutting specimens is 100 by 200 mm (minimum) [4 by 8 in.].

8.5 The loss of clay during the specimen cutting process should have no bearing on the results of the test.



## 9. Conditioning

9.1 The test specimen shall be tested as received.

## 10. Procedure

10.1 *Obtain Specimens*—Using the die, or template and razor, and other necessary apparatus, carefully cut from the laboratory sample five (5) test specimens. The five specimens should be randomly selected from locations on the sample, but should be distributed across the sample. All specimens should be cut parallel to the machine direction.

10.2 *Machine Setup Conditions*—Adjust the distance between the clamps at the start of the test to 100 ± 3 mm [4 ± 0.1 in.]. Set the CRE at 300 mm/min [12 in./min].

10.3 *Insertion of Specimen in Clamps*—Mount the specimen centrally in the clamps. The specimen must be visually observed 25 mm [1 in.] extended past the clamp. The specimen length in the machine direction must be parallel to the direction of application of force.

10.4 *Measurement of Tensile Strength*—Start the tensile testing machine.

10.4.1 Continue testing the specimen until complete rupture and record the maximum tensile force of the GCL.

NOTE 1—In some instances, it may be required to determine elongation. In these cases, the user should indicate the criteria at which elongation is required.

10.4.2 Readings of force and time shall be taken at a minimum rate of 20 readings per second.

10.4.3 If a specimen slips in the jaws, or if for any reason attributable to faulty operation the results fall significantly below the average for the set of specimens, discard the results and test another specimen. Continue until the required number of readings has been taken.

## 11. Calculation

11.1 *Tensile Strength*—Calculate the tensile strength as read directly from the test instrument expressed in N/m [lbf/in.] of width, using the following equation: