



Standard Test Method for Large Scale Hydrostatic Puncture Testing of Geosynthetics¹

This standard is issued under the fixed designation D 5514; 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 evaluates the stress/time properties of geosynthetics by using hydrostatic pressure to compress the geosynthetic over synthetic or natural test bases consisting of manufactured test pyramids/cones, rocks, soil or voids.

1.2 This test method allows the user to determine the relative failure mode, points of failure for geosynthetics, or both.

1.3 This test method offers two distinct procedures.

1.3.1 Procedure A incorporates manufactured test pyramids or cones as the base of the testing apparatus. Procedure A is intended to create comparable data between laboratories, and can be used as a guide for routine acceptance test for various materials.

1.3.2 Procedure B incorporates site specific soil or other material selected by the user as the test base of the testing apparatus. Procedure B is a method for geosynthetic design for a specific site.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

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:

D 136 Method for Sieve Analysis of Fine and Coarse Aggregates²

D 751 Method of Testing Coated Fabrics³

D 4439 Terminology for Geotextiles⁴

D 4885 Test Method for Determining Performance Strength of Geomembranes Using Wide Strip Testing⁴

D 5199 Test Method for Measuring Nominal Thickness of Geotextiles⁴

E 11 Specification for Wire-Cloth Sieves for Testing Purposes⁵

3. Terminology

3.1 Definitions:

3.1.1 *atmosphere for testing geomembranes, n*—air maintained at a relative humidity of 50 to 70 % and a temperature of $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$).

3.1.2 *critical height (ch), n*—the maximum exposed height of a cone or pyramid that will not cause a puncture failure of a geosynthetic at a specified hydrostatic pressure for a given period of time.

3.1.3 *failure, n*—in testing geosynthetics, water or air pressure in the test vessel at failure of the geosynthetic.

3.1.4 *hydrostatic pressure, n*—a state of stress in which all the principal stresses are equal (and there is no shear stress), as in a liquid at rest; induced artificially by means of a gaged pressure system; the product of the unit weight of the liquid and the difference in elevation between the given point and the free water elevation.

4. Significance and Use

4.1 Procedure A:

This procedure is an index type test which can be used as a guide for acceptance of commercial shipments of geosynthetics. The standard cone and pyramid test fixtures can establish critical height (ch) consistency with similar material from previous lots or different suppliers, as well as testing from other laboratories. However, due to the time required to perform tests, it is generally not recommended for routine acceptance testing.

4.2 Procedure B:

This procedure is a performance test intended as a design aid used to simulate the in-situ behavior of geosynthetics under hydrostatic compression. This test method may assist a design engineer in comparing the ability of several candidate geosynthetic materials to conform to a site specific subgrade under specified use and conditions.

5. Apparatus

5.1 For safe operation, the test vessel should have an appropriate ASME pressure rating. The maximum pressure rating of the vessel is dependent on the material being tested

¹ This test method is under the jurisdiction of ASTM Committee D-35 on Geosynthetics and is the direct responsibility of Subcommittee D35.10 on Geomembranes.

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² Discontinued—Replaced by C117.

³ Annual Book of ASTM Standards, Vol 09.02.

⁴ Annual Book of ASTM Standards, Vol 04.09.

⁵ Annual Book of ASTM Standards, Vol 14.02.