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.

Designation: D5494 – 93 (Reapproved 2018)

Standard Test Method for the Determination of Pyramid Puncture Resistance of Unprotected and Protected Geomembranes[1]

This standard is issued under the fixed designation D5494; 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 The test method is to be used as an index test to determine the pyramid puncture resistance of geomembranes and, or both, geomembranes protected by nonwoven geotextiles and other puncture-protective geosynthetics.

1.2 The test method measures the increase of the pyramid puncture resistance due to the use of protective nonwoven geotextiles with geomembranes.

1.3 The values stated in SI units are to be regarded as the standard value. The values stated in parentheses are provided 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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

D4354 Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing

D4439 Terminology for Geosynthetics

D4491/D4491M Test Methods for Water Permeability of Geotextiles by Permittivity

3. Terminology

3.1 *Definitions:*

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).

3.1.2 *geomembrane, n*—an essentially impermeable geosynthetic composed of one or more synthetic sheets.

3.1.2.1 *Discussion*—In geotechnical engineering, "essentially impermeable" means that no measurable liquid flows through a geosynthetic when tested in accordance with Test Methods D4491/D4491M.

3.1.3 *geotextile, n*—a permeable geosynthetic comprised solely of textiles.

3.1.3.1 *Discussion*—Current manufacturing techniques produce nonwoven fabrics, knitted (non-tubular) fabrics, and woven fabrics.

3.1.4 For other terms, see 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 compression press or tensile testing machine. A force is exerted against the center of the unsupported or supported portion of the test specimen by a solid steel pyramid attached to a load indicator until rupture of the specimen occurs. The maximum load and elongation recorded is the value of the puncture resistance of the specimen.

5. Significance and Use

5.1 The pyramid method of puncture resistance is an index test for the determination of the puncture resistance of unprotected geomembranes or geomembranes protected with nonwoven geotextiles and other puncture-protective geosynthetics.

5.1.1 The purpose of this test method is to establish an index value of puncture resistance by providing standard criteria and a basis for uniform reporting.

5.2 This test method may be used for acceptance testing of commercial shipments of geomembranes and geomembranes protected with nonwoven geotextiles; however, caution is advised since information about between-laboratory precision is incomplete.

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

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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.

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