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: D5493 – 23

Standard Test Method for Permittivity of Geotextiles Under Load[1]

This standard is issued under the fixed designation D5493; 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 the determination of the water permittivity behavior of geotextiles in a direction normal to the plane of the geotextile when subjected to specific normal compressive loads.

1.2 Use of this test method is limited to geotextiles. This test method is not intended for application with geotextile-related products such as geogrids, geonets, geomembranes, and other geocomposites.

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

1.4 *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]

D123 Terminology Relating to Textiles

D653 Terminology Relating to Soil, Rock, and Contained Fluids

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

D4716/D4716M Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 *Definitions:*

3.1.1 *geotextile, n*—any permeable textile material used with foundation, soil, rock, earth, or any other geotechnical engineering related material as an integral part of a manmade project, structure, or system (see Terminology D4439).

3.1.2 *hydraulic gradient, i, n*—the loss of hydraulic head per unit distance of flow, dh/dL (see Test Method D4716/D4716M).

3.1.3 *permittivity, (ψ), (T^{-1}), n*—of geotextiles, the volumetric flow rate of water per unit cross-sectional area per unit head under laminar flow conditions, in the normal direction through a geotextile (see Terminology D4439).

3.2 For the definitions of other terms relating to geotextiles, refer to Terminology D4439. For the definitions of textile terms, refer to Terminology D123. For the definitions of coefficient of permeability, refer to Terminology D653.

4. Summary of Test Method

4.1 This test method provides a procedure for measuring the water flow, in the normal direction, through a known cross section of a single layer of a geotextile at a predetermined constant hydraulic head over a range of applied normal compressive stresses.

4.2 The permittivity of a geotextile, ψ, can be determined by measuring the flow rate of water, in the normal direction, through a known cross section of a geotextile at a predetermined constant water head.

4.3 Water flow through geotextiles can be laminar, transient, or turbulent, and therefore permittivity cannot be taken as a constant.

5. Significance and Use

5.1 The thickness of a geotextile decreases with increase in the normal compressive stress. This decrease in thickness may

[1] This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.03 on Permeability and Filtration.

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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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result in the partial closing or the opening of the voids of geotextile depending on its initial structure and the boundary conditions.

5.2 This test method measures the permittivity due to a change of void structure of a geotextile as a result of an applied compressive stress.

6. Apparatus

6.1 The apparatus is a constant head permeameter. General guidance on the hydraulic design of a constant head permeameter can be found in Test Methods D4491/D4491M.

6.2 The components installed around the test specimen are designed in such a way that a normal load can be applied uniformly on the entire flow surface without significantly restraining the flow rate. The permittivity of the apparatus, calculated using the calibration curve established in Section 10, shall be at least ten times greater than the permittivity of the test specimen under the hydraulic conditions prevailing during a given test. However, the central deflection of the loading mechanism on the plane of the geotextile shall not exceed 0.25 mm while subjected to the maximum normal load applied during the test.

6.3 The recommended apparatus configuration for applying the compressive stress is shown in Fig. 1.

6.3.1 Stopwatch accurate to 0.1 s.

6.3.2 Water volume container accurate to 2 %.

6.3.3 An optimum flow diameter has been found to be 50 mm to minimize hydraulic side effects while ensuring an optimum rigidity of the loading mechanism.

6.3.4 A wire meshes, 1.0 mm in opening, complying with Specification E11 is installed as the contact surface on both sides of the test specimen.

6.3.5 Two rigid metallic plates with the geometry shown in Fig. 1 act as a structural component on both sides of the wire meshes. The lower one is supported by the apparatus, while the upper one can move freely but is adjusted to the diameter of the flow channel.

6.3.6 The upper metallic plate is connected to a device capable of applying the requested normal load on the test specimen (dead loads, air piston, or any suitable device). The mechanical connection between the upper metallic plate and the loading mechanism consists of four rods, 3 mm in diameter, distributed on a circle approximately 30 mm in diameter.

6.3.7 A dial or digital indicator can be connected to the loading mechanism to monitor the specimen thickness during the test.

6.4 A de-airing system that may be a commercially available system, or one consisting of a vacuum pump capable of removing a minimum of 150 L/min of air in connection with a non-collapsible storage tank with a large enough storage capacity for the test series, or at least one specimen at a time. Allow the de-aired water to stand in closed storage under a slight vacuum until room temperature is attained.

6.5 Thermometer or digital temperature sensor with a resolution of 0.1 °C.

7. Sampling

7.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls of geotextile directed in an applicable material specification and the supplier (for example, Practice D4354) or other agreement between the purchaser and the supplier. Consider rolls of geotextile to be the primary sampling units. If the specification requires sampling during

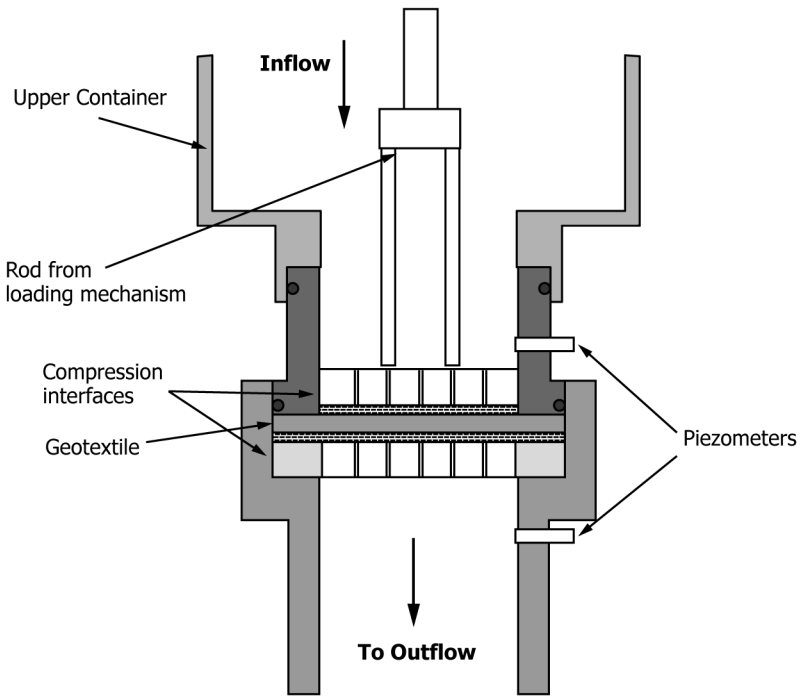

FIG. 1 Specimen Holder and Loading Mechanism