Designation: D5101 – 01(Reapproved 2006)

Standard Test Method for Measuring the Soil-Geotextile System Clogging Potential by the Gradient Ratio[1]

This standard is issued under the fixed designation D5101; 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 performance test applicable for determining the soil-geotextile system permeability and clogging behavior for cohesionless soils under unidirectional flow conditions.

1.2 The values stated in SI units are to be regarded as standard. The values 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]

D123 Terminology Relating to Textiles
D653 Terminology Relating to Soil, Rock, and Contained Fluids
D737 Test Method for Air Permeability of Textile Fabrics
D4354 Practice for Sampling of Geosynthetics for Testing
D4439 Terminology for Geosynthetics

3. Terminology

3.1 *Definitions:*

3.1.1 *clogging potential, n— in geotextiles*, the tendency for a given fabric to lose permeability due to soil particles that have either lodged in the fabric openings or have built up a restrictive layer on the surface of the fabric.

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

3.1.3 *gradient ratio, n— in geotextiles*, the ratio of the hydraulic gradient through a soil-geotextile system to the hydraulic gradient through the soil alone.

3.1.4 *hydraulic gradient, i, s (D)*—the loss of hydraulic head per unit distance of flow, dH/dL.

3.1.5 For definitions of other textile terms, refer to Terminology D123. For definitions of other terms related to geotextiles, refer to Terminology D4439 and Terminology D653.

3.2 *Symbols and Acronyms:*

3.2.1 CO_2—the chemical formula for carbon dioxide gas.

3.2.2 *CHD*—the acronym for constant head device.

4. Summary of Test Method

4.1 This test method requires setting up a cylindrical, clear plastic permeameter (see Fig. 1 and Fig. 2) with a geotextile and soil, and passing water through this system by applying various differential heads. Measurements of differential heads and flow rates are taken at different time intervals to determine hydraulic gradients. The following test procedure describes equipment needed, the testing procedures, and calculations.

5. Significance and Use

5.1 This test method is recommended for evaluating the performance of various soil-geotextile systems under controlled test conditions. Gradient ratio values obtained may be plotted and used as an indication of the soil-geotextile system clogging potential and permeability. This test method is not appropriate for initial comparison or acceptance testing of various geotextiles. The test method is intended to evaluate geotextile performance with specific on-site soils. It is improper to utilize the test results for job specifications or manufacturers' certifications.

5.2 It is important to note the changes in gradient ratio values with time versus the different system hydraulic gradients, and the changes in the rate of flow through the system (see Section 11 and Annex A1.).

6. Apparatus and Supplies

6.1 *Soil-Geotextile Permeameter*—(three-piece unit) equipped with support stand, soil-geotextile support screen,

[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.

piping barriers (caulk), clamping brackets, and plastic tubing

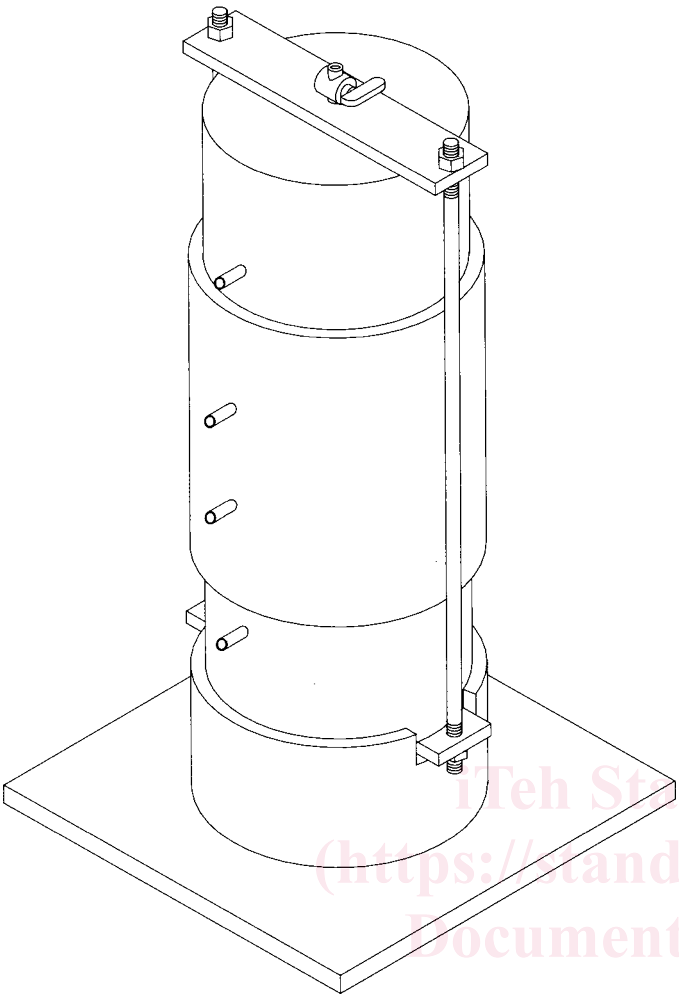

FIG. 1 Geotextile Permeameter

(see Fig. 2). Both 100-mm (4-in.) and 150-mm (6-in.) diameter permeameters are described.

6.2 *Two Constant Water Head Devices* , one mounted on a jack stand (adjustable) and one stationary (Fig. 3).

6.3 *Soil Leveling Device* (Fig. 4).

6.4 *Manometer Board,* of parallel glass tubes and measuring rulers.

6.5 *Two Soil Support Screens,* of approximately 5 mm (No. 4) mesh.

6.6 *Soil Support Cloth,* of 150 µm (No. 100) mesh, or equivalent geotextile.

6.7 *Thermometer* (0 to 50 ± 1°C).

6.8 *Graduated Cylinder,* 100 ± 1 cm^3 capacity.

6.9 *Stopwatch.*

6.10 *Balance,* or scale of at least 2-kg capacity and accurate to ±1 g.

6.11 *Carbon Dioxide,* (CO_2), gas supply and regulator.

6.12 *Geotextile.*

6.13 *Water Recirculation System* .

6.14 *Water Dearing System,* with a capacity of approximately 1700 L/day (500 gal/day).

6.15 *Algae Inhibitor,* or micro screen.

6.16 *150-µm Mesh Screen, (No. 100),* or equivalent geotextile for manometer ports.

6.17 *Soil Sample Splitter (optional)* .

6.18 *Pan,* for drying soil.

6.19 *Mortar and Pestle,* for pulverizing soil.

6.20 *Wooden rod,* 20-mm (¾ – in.) diameter by 150 mm (6 in.) long.

7. Sampling and Test Specimens

7.1 *Lot Sample and Laboratory Sample—* Take a lot sample and laboratory samples as directed in Practice D4354. For laboratory samples, take a full width swatch of geotextile from each roll of material in the lot sample at least 1 m (3 ft) long cut from the end of the roll after discarding the first metre of material from the outside of the roll.

7.2 *Test Specimen—*Cut one circular specimen from each swatch in the laboratory sample with the specimen having a diameter of 110 mm (4.33 in.) or 165 mm (6.50 in.). Take the specimen from the center of the swatch.

8. Conditioning

8.1 *Test Water Preparation:*

8.1.1 Test water should be maintained at room temperature about 16 to 27°C (60 to 80°F), and deaired to a dissolved oxygen content of 6 ppm or less before introducing it to permeameter system. This will reduce or eliminate the problems associated with air bubbles forming within the test apparatus.

8.1.2 An algae inhibitor or micro screen should be used to eliminate any algae buildup in the system.

8.2 *Specimen Conditions:*

8.2.1 Condition the specimen by soaking it in a container of deaired water for a period of 2 h. Dry the surface of the specimen by blotting prior to inserting in the permeameter.

9. Procedure

9.1 *Preparation of Apparatus:*

9.1.1 Thoroughly clean and dry permeameter sections.

9.1.2 Close all valves and cover the inside openings of all manometer ports with fine wire mesh or lightweight nonwoven fabric (the equivalent of No. 100 mesh).

9.1.3 Lubricate all O-ring gaskets.

9.2 *Permeameter Preassembly:*

9.2.1 Stand center section of the permeameter on end and place a soil support cloth 110 mm (4.33 in.) or 165 mm (6.5 in.) in diameter on recessed permeameter flanges.

9.2.2 Insert the support screen 110 mm (4.33 in.) or 165 mm (6.5 in.) in diameter on top of the support cloth with the mesh side against the cloth.

9.2.3 Align and insert top section of the permeameter into center section and press until there is a tight fit to secure the support cloth and screen in place. Ensure that all gasket edges

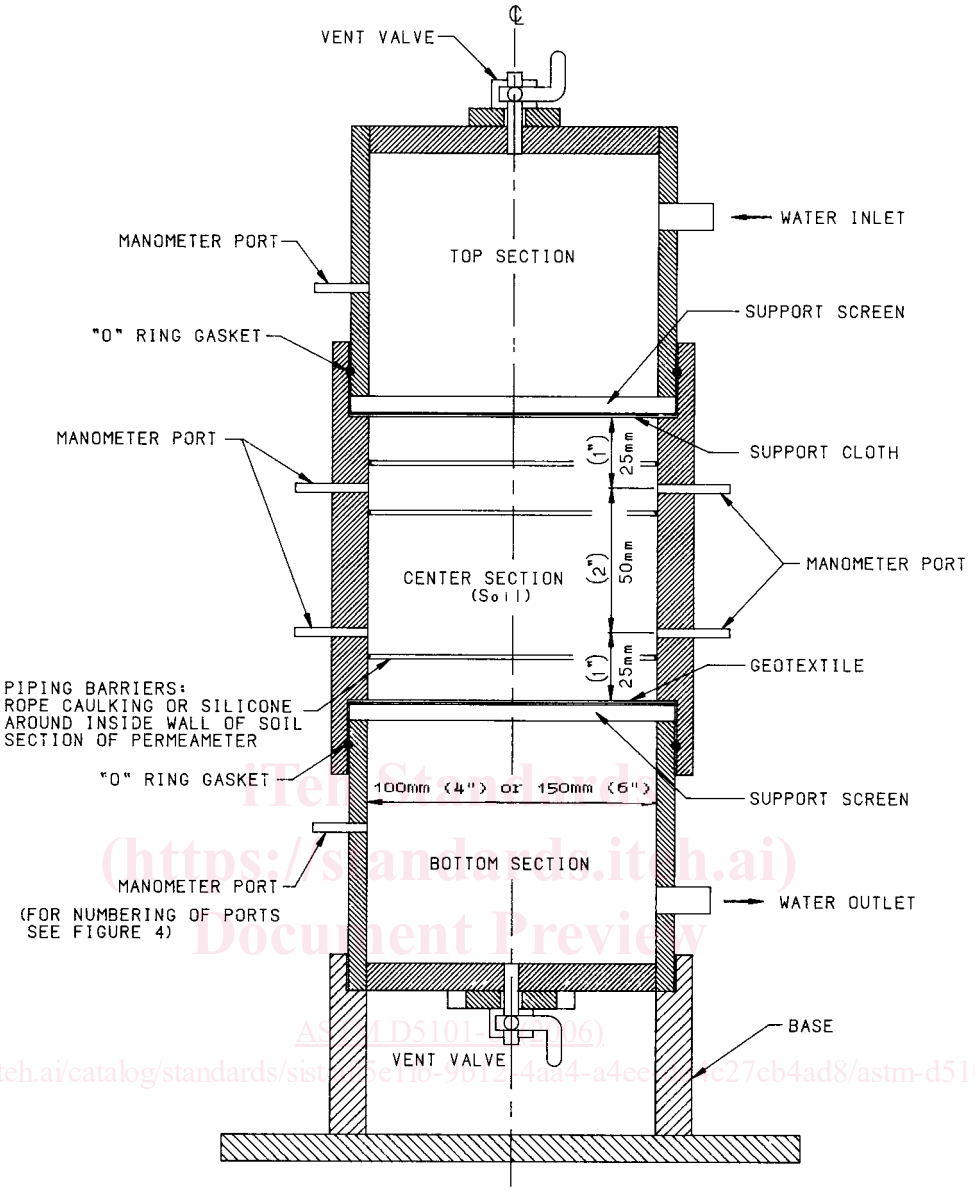

FIG. 2 Section—Geotextile Permeameter

secure against the support cloth, support bracket, and between the center and top permeameter sections.

9.2.4 Invert and place permeameter into holding stand.

9.3 *Process Soil:* The test is to be performed on −10 mm (−⅜ in.) material. The material passing the 10 mm (⅜ in.) and retained on the No. 10 sieve is subject to a second round of grinding to ensure that the sample has been broken down into individual grains.

9.3.1 Thoroughly air dry the soil sample as received from the field. This shall be done for a minimum of three days. Grind the sample in a mortar with a rubber-tipped pestle (or in some other way that does not cause breakdown of individual grains), to reduce the particle size to a maximum of 10 mm (⅜ in.). Select a representative sample of the amount required, approximately 1350 g (or 3000 g for the 150-mm (6-in.) diameter), to perform the test by the method of quartering or by the use of a soil splitter.

9.3.2 Select that portion of the air-dried sample selected for purpose of tests and record the mass as the mass of the total test sample uncorrected for hygroscopic moisture. Separate the test sample by sieving with a 2-mm (No. 10) sieve. Grind that fraction retained on the 2-mm (No. 10) sieve in a mortar with a rubber-covered pestle until the aggregations of soil particles are broken up into the separate grains.

9.3.3 Mix the fractions passing the 2-mm (No. 10) sieve along with the portion that was retained on the 2-mm (No. 10) sieve to form the test soil. All particles larger than 10 mm (⅜ in.) should be eliminated.

9.4 *Soil Placement*— The following procedures offer two options to the user. The first is a "standard" placement while the second is a "field condition" placement. The placement procedure is a critical aspect of the test and may significantly influence the test results.

9.4.1 *Standard Placement Method:*