Designation: D8203 – 18 (Reapproved 2023)

Standard Test Method for Determination of the Horizontal Water Flow Rate of a Geosynthetic Screening Material, Product, or Device[1]

This standard is issued under the fixed designation D8203; 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 test procedures for determining the horizontal water flow rate through a geosynthetic or geosynthetic-enhanced screening device, such as a sediment retention device (SRD), under a constant-head pressure. The test is conducted with potable water.

1.2 This test is intended to be used for quality control and product development efforts, but should not be considered a performance test.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information purposes 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]

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

D4439 Terminology for Geosynthetics

D5819 Guide for Selecting Test Methods for Experimental Evaluation of Geosynthetic Durability

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of common technical terms used in this standard, refer to Terminology D4439.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *geosynthetic screening device, n*—geosynthetic or geosynthetic-enhanced materials, products, or devices that primarily provide the screening function, such as a sediment retention device (SRD).

3.2.2 *screening*—a geosynthetic, placed across the path of a flowing fluid (ground water, surface water, wind), carrying particles in suspension, provides screening when it retains some or all fine soil particles while allowing the fluid to pass through. After some period of time, particles accumulate against the screen, which requires that the screen be able to withstand pressures generated by the accumulated particles and the increasing pressure from accumulated fluid. (See Guide D5819.)

3.2.3 *sediment retention device (SRD), n*—a material, product, or device designed to intercept sediment-laden flow, screening out suspended solids and reducing the velocity of the flow, causing transported sediments to settle out. Typical SRDs include silt fences, as well as natural or manmade materials encapsulated in geosynthetic fabrics, meshes, or nettings such as wattles, filter logs, fiber filtration tubes, fiber rolls, and compost socks.

4. Summary of Test Method

4.1 A test specimen is positioned vertically across the mouth of a "box" reservoir, and potable water is introduced upstream and maintained at a predetermined constant head as the water is allowed to seep through the specimen. Once a steady-state flow condition is established, a discharge volume and the associated time are measured.

5. Significance and Use

5.1 The test method simulates the flow conditions (without sediment) applicable to sediment retention devices exposed to sheet-flow runoff. Horizontal flow rate is an inherent (index) property of sediment retention devices (SRDs), and can be used to control quality and to assess the effects of product changes.

[1] This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.05 on Geosynthetic Erosion Control.

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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.

6. Apparatus

6.1 *Upper "Box" Reservoir,* constructed from marine-grade plywood, plexiglas, aluminum, or other material. The box should be watertight and constructed as shown in Fig. 1.

NOTE 1—The box end opening is approximately the size of a straw bale. A typical upper box reservoir is 122 cm (48 in.) wide by 244 cm (96 in.) long by 61 cm (24 in.) deep.

6.2 *Lower "Receiving" Reservoir,* constructed from marine-grade plywood, plexiglas, aluminum, or other material. The flume should be watertight and constructed as shown in Fig. 1.

NOTE 2—The lower receiving reservoir is much larger than the upper reservoir. A typical receiving reservoir is at least 122 cm (48 in.) wide by 600 cm (20 ft) long by 122 cm (48 in.) deep. This size reservoir facilitates a relatively stable water surface at a height that allows for ease of measuring the depth of the collected volume.

6.3 *Water Recirculation System:*

6.3.1 *Potable Water,* also known as drinking water, containing no flocculent agents or anything in suspension that could alter the flow characteristics of the product(s) being tested.

6.3.2 *High-Capacity Gravity Flow or Pumping/Piping System,* with sufficient capacity to maintain a constant head behind the product(s) being tested. Recirculation of water from the lower reservoir to the upper reservoir may be used.

6.4 *"Floating" Calibrated Container,* approximately 75 L (20 gal), plastic or nonmetallic.

6.5 *Stopwatch,* for measuring the time associated with the collected volume.

6.6 *Ruler,* for measuring the depth of the collected volume.

7. Sampling

7.1 *Lot Sample*—Divide the product into lots and take the lot sample as directed in Practice D4354.

7.2 *Laboratory Sample*—Cut off sufficient length of the sediment retention device to obtain the appropriate size of test specimen. If holes or damaged areas are evident, then damaged material should be discarded and additional material sampled.

7.3 *Test Specimen*—Cut the desired number of specimens to be tested from the laboratory sample. Each test specimen should be cut to fit the box end opening.

FIG. 1 Horizontal Flow Test Apparatus

8. Procedure

8.1 *Test Setup and Installation of Sediment Retention Device:*

8.1.1 *SRD Installation*—The sediment retention device (SRD) is installed across the open end of the upper box, using any effective sealing material to seal the bottom and ends against the box bottom and walls. The SRD rests against a mesh on the downstream side that provides horizontal support against deformation during testing.

8.1.2 A "door" is placed across the downstream opening of the box to minimize box discharge during initial filling, which permits the water to penetrate and surround the SRD prior to it experiencing seepage forces.

8.1.3 Clear water is then allowed to flow or pumped into the upstream side of the box at a rate necessary to raise the water level to the desired level. As the water level approaches the desired level, the door is removed and seepage through the SRD is allowed and balanced with increased flow/pumping into the upstream side of the SRD until steady-state, constant-head flow is achieved. Testing shall be done at a minimum of three depths, such as approximately 25 %, 50 %, and 75 % of the SRD's maximum height.

8.1.4 A schematic is shown in Fig. 2.

8.2 *Test Procedure:*

8.2.1 Once steady-state, constant-head conditions are achieved, slide a floating calibrated container under the flow while starting a stopwatch.

8.2.2 After allowing discharge collection between one-third and two-thirds of the depth of the tub, slide the tub back out from under the flow and stop the stopwatch.

8.2.3 The collected volume is allowed to calm and the tub is held in a level position while water depth measurements are made in the tub. Depth and time measurements are recorded, and the discharge collection is repeated a total of five times.

8.2.4 The water level behind the SRD is then adjusted and steps 8.1.2, 8.1.3, and 8.2.1 – 8.2.3 are repeated. Measurements are taken at least three different upstream (constant) water levels for each specimen to enable a determination of a flow rate versus depth relationship for the product. Pictures of the test procedure are shown in Appendix X1.

9. Calculation

9.1 *Collected Volume*—From the depth of the collected flow, derive the collected volume.

9.2 *Volumetric Flow Rate*—From the collected volume and collection time measurements, volumetric flow rate is calculated.

9.3 *Volumetric Flow Rate per Unit Length and per Unit Area*—Volumetric flow rate per length and per area are further calculated using the box width and constant head water depth. This water depth is considered a conservative "effective" height for surface area calculations.

10. Report

10.1 State that the specimens were tested as directed in Test Method D8203, and describe the material or product sampled and the method of sampling used.

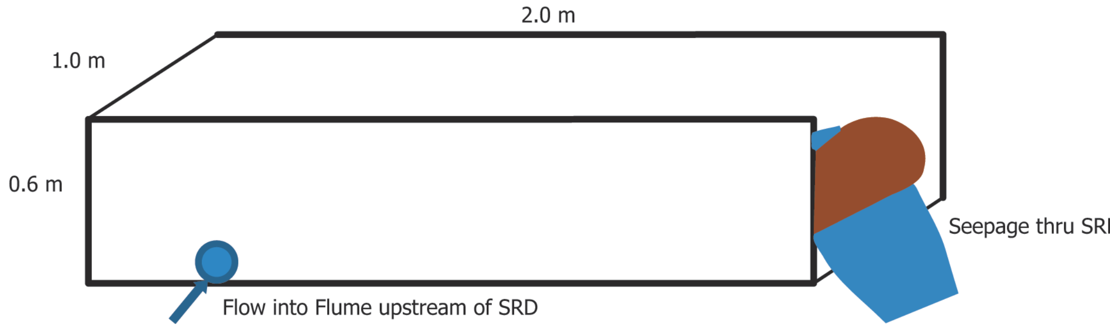

FIG. 2 Schematic of Horizontal Flow Test

10.2 Report the following for each laboratory sample:

10.2.1 The volumetric flow, volumetric flow per unit length, and volumetric flow per unit area at each depth tested for each material tested.

10.2.2 The volumetric flow versus depth equation for the "best fit" regression for each material tested.

10.2.3 The flow at the maximum theoretical impoundment depth.

11. Precision and Bias

11.1 *Precision*—The precision of the procedure in this test method for measuring the horizontal flow rate of a vertical sediment retention device is being established.

11.2 *Bias*—The procedure in this test method for measuring the horizontal flow rate of a vertical sediment retention device has no bias because the values of those properties can be defined only in terms of a test method.

12. Keywords

12.1 horizontal permeability; sediment control product; sediment retention device

APPENDIX

(Nonmandatory Information)

X1. PHOTOGRAPHS OF THE TEST PROCEDURE

X1.1 Figs. X1.1-X1.5 show the typical setup and procedures used during testing and a typical data plot.

FIG. X1.1 Typical Seepage Collection