



Designation: D 5141 – 96 (Reapproved 1999)

Standard Test Method for Determining Filtering Efficiency and Flow Rate of a Geotextile for Silt Fence Application Using Site-Specific Soil¹

This standard is issued under the fixed designation D 5141; 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 is used to determine the filtering efficiency and the flow rate of a geotextile used exclusively in silt fence or silt barrier application.

NOTE 1—The terms silt fence and silt barrier are used synonymously.

1.1.1 The results are shown as a percentage for filtering efficiency and cubic metres per square metre per minute ($\text{m}^3/\text{m}^2/\text{min}$) or gallons per square foot per minute ($\text{gal}/\text{ft}^2/\text{min}$) for flow rate.

1.1.2 The filtering efficiency indicates the percent of sediment removed from sediment-laden water.

1.1.3 The flow rate is the average rate of passage of the sediment-laden water through the geotextile.

1.2 This test method requires several specialized pieces of equipment, such as an integrated water sampler and an analytical balance, and site specific soil from the construction project.

1.3 The values stated in SI units are the standard, while the inch-pound units are provided for information. The values expressed in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

D 123 Terminology Relating to Textile Materials²

D 653 Terminology Relating to Soil, Rock, and Contained Fluids³

D 4439 Terminology for Geosynthetics⁴

D 4354 Practice for Sampling of Geosynthetics for Testing⁴

D 4759 Practice for Determining the Specification Conformance of Geosynthetics⁴

2.2 *American Public Health Association (APHA) Standard: 208D Total Nonfiltrable Residue Dried at 103–105°C (Total Suspended Matter)⁵*

3. Terminology

3.1 Definitions:

3.1.1 *filtration*—See *filter*.

3.1.2 *filter*—See Terminology D 653.

3.1.3 *geosynthetic, n*—a planar product manufactured from polymeric material used with foundation soil, rock, earth, or any other geotechnical engineering related material as an integral part of a man-made project, structure, or system. (See Practice D 4759.)

3.1.4 *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 man-made project, structure, or system.

3.1.5 *performance property, n*—a result obtained by conducting a performance test.

3.1.6 *performance test, n*—in *geosynthetics*, a laboratory procedure which simulates selected field conditions which can be used in design.

3.1.7 For definitions of other terms relating to geosynthetics, refer to Terminology D 4439. For definitions of textile terms, refer to Terminology D 123. For definitions of soil terms, refer to Terminology D 653.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *filtering efficiency, FE, n*—in *geosynthetics*, the percent of sediment removed from sediment-laden water by a geotextile over a specified period of time.

3.2.2 *flow rate, FR* [$L^3L^{-2}T^{-1}$], *n*—in *geosynthetics*, the volume of fluid per unit time, expressed as an average, which passes through a cross-sectional plane perpendicular to the fluid flow.

¹ This test method is under the jurisdiction of ASTM Committee D-35 Geosynthetics and is the direct responsibility of Subcommittee D35.03 on Permeability and Filtration.

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² *Annual Book of ASTM Standards*, Vol 07.01.

³ *Annual Book of ASTM Standards*, Vol 04.08.

⁴ *Annual Book of ASTM Standards*, Vol 04.13.

⁵ Available from American Public Health Association (APHA), 1015 Eighteenth St. NW, Washington, DC 20036.



3.2.3 *flume, n*—an apparatus that carries a liquid to an outlet.

3.2.4 *silt fence, n*—in *geosynthetics*, a temporary sediment control measure used to remove soil from runoff.

4. Summary of Test Method

4.1 A geotextile specimen is placed across a flume while sediment-laden water is passed through the specimen.

4.1.1 The time that water flows through the geotextile and the amount of soil passed by the geotextile are measured. The amount of soil retained, filtering efficiency, and flow rate are calculated from these measured values.

4.2 Soil from the construction project should be used in this test method.

5. Significance and Use

5.1 This test method is used to determine the filtering efficiency and flow rate of a geotextile used in a silt fence or silt barrier installation for specific soil conditions.

5.2 This test method may be used for the design of a silt fence or silt barrier to meet requirements of regulatory agencies in filtering efficiency or flow rate for specific soil conditions.

5.2.1 The designer can use this test method to determine the spacing between silt fences or silt barriers.

5.3 This test method is intended for performance evaluation, as the results will depend on the specific soil evaluated. It is recommended that the user or representative perform the test to pre-approved products, as geotextile manufacturers are not typically equipped to handle or test soil requirements.

5.4 This test method provides a means of evaluating geotextiles with different soils under various conditions that simulate the conditions that exist in a silt fence or silt barrier installation. This test method may be used to simulate several storm events on the same geotextile specimen. Therefore, the number of times this test is repeated per specimen is dependent upon the user and the site conditions.

6. Apparatus

6.1 *Flume*, constructed from marine-grade plywood, plexiglas, aluminum, or other material. The flume should be watertight and constructed as shown in Fig. 1.

NOTE 2—Metal flumes should be mounted on a wood frame. The flume opening is the standard length of a straw bale. With a standard length flume of 122 cm (48 in.), the height of the back of the flume would be elevated 10 cm (3⁷/₈ in.).

6.2 *Sample Cutter*, appropriate to prepare test specimens.

6.3 *Integrated Water Sampler*,⁶ a 500-mL (0.13-gal) device used to collect integrated samples of water.

6.4 *Two Containers*, 75-L (20-gal), plastic or nonmetallic.

6.5 *Stopwatch*.

6.6 *Stirrer*, such as a stirring rod on a portable electric drill.

6.7 *Sediment-Free Water*, containing no flocculent agents.

NOTE 3—Flocculent agents used in water treatment may cause erroneous results by affecting the settling rate of soil particles in the water.

6.8 *Soil*, site-specific.

6.9 *Gooch Crucible*.

6.10 *Membrane Filter Apparatus*.

6.11 *Vacuum Pump*.

6.12 *Planchet*, aluminum or stainless steel.

6.13 *Desiccator*.

6.14 *Analytical Balance*, sensitivity of 0.00001 g.

7. Sampling

7.1 *Geotextile*:

7.1.1 *Lot Sample*—Divide the product into lots and take the lot sample as directed in Practice D 4354.

7.1.2 *Laboratory Sample*—After first discarding a minimum of 1 m (3.3 ft) of geotextile from the end of the roll, cut off sufficient length of the roll to get the appropriate number of test specimens. If holes or damaged areas are evident, then damaged material should be discarded and additional material sampled.

7.1.3 *Test Specimens*—Cut the appropriate number of specimens to be tested from the machine direction of the laboratory sample by a random method. Each test specimen should be cut (1 m long by 0.3 m wide (3.3 ft long by 12 in. wide)) to fit the flume.

NOTE 4—No specimen should be within 0.2 m (6 in.) of a selvage.

7.2 *Soil*—Obtain representative samples of the site-specific soil that is significant to the design of the silt barriers or silt fences on the construction project. The size and type of sample required is dependent upon the number of tests to be performed and the percent of coarse particles in the sample.

8. Procedure

8.1 Place the geotextile tautly across the flume opening and fasten securely in place to ensure that the test specimen has no wrinkles or loose sections.

8.2 Elevate the back of the flume to an 8 % slope. (See Fig. 1.)

8.3 Pre-wet the geotextile by running one test with 50 L (13.3 gal) of sediment-free water. Record the temperature of the water.

8.4 Mix 0.15 kg (0.33 lb) of air-dried site-specific soil in 50 L (13.3 gal) of untreated water placed in a 75-L (20-gal) container. These soil particles are smaller than 2 mm, the opening size of a No. 10 sieve. Thoroughly agitate the solution with a stirrer for 1 min to obtain a uniform mix.

8.5 While continuing to mix the solution, release the sediment-laden water at the upper end of the flume. Release of the solution should take less than 10 s. Start the timer at release.

8.6 Rinse the mixing container with no more than 2 L (0.5 gal) of additional water and release into the flume.

8.7 Time the flow of water through the geotextile until no water remains behind the geotextile or 25 min has elapsed. If

⁶ The US DH-48 integrated water sampler has been found to be satisfactory. It is available from the Federal Inter-Agency Sedimentation Project, St. Anthony Falls Hydraulic Laboratory, 3rd Avenue S.E., Minneapolis, MN 55414.