



Designation: D4751 – 12

Standard Test Method for Determining Apparent Opening Size of a Geotextile¹

This standard is issued under the fixed designation D4751; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method covers the determination the apparent opening size (AOS) of a geotextile by sieving glass beads through a geotextile.

1.2 This test method shows the values in both SI units and inch-pound units. SI units is the technically correct name for the system of metric units known as the International System of Units. Inch-pound units is the technically correct name for the customary units used in the United States. The values in inch-pound units are provided 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 requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

D1776 Practice for Conditioning and Testing Textiles

D4238 Test Method for Electrostatic Propensity of Textiles (Withdrawn 1996)³

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

D4439 Terminology for Geosynthetics

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 *Definitions:* For general geosynthetics terms used in this standard, refer to Terminology D4439.

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.

³ The last approved version of this historical standard is referenced on www.astm.org.

3.2 Definitions:

3.2.1 *apparent opening size (AOS), $O_{95, n}$ —for a geotextile,* a property that indicates the approximate largest particle that would effectively pass through the geotextile.

4. Summary of Test Method

4.1 A geotextile specimen is placed in a sieve frame, and sized glass beads are placed on the geotextile surface. The geotextile and frame are shaken laterally so that the jarring motion will induce the beads to pass through the test specimen. The procedure is repeated on the same specimen with various size glass beads until its apparent opening size has been determined.

5. Significance and Use

5.1 Using a geotextile as a medium to retain soil particles necessitates compatibility between it and the adjacent soil. This test method is used to indicate the apparent opening size in a geotextile, which reflects the approximate largest opening dimension available for soil to pass through.

5.2 Test Method D4751 for the determination of opening size of geotextiles is acceptable for testing of commercial shipments of geotextiles. Current estimates of precision, between laboratories, are being established.

5.2.1 In case of a dispute arising from differences in reported test results when using Test Method D4751 for acceptance testing of commercial shipments, the purchaser and the supplier should conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens that are homogeneous as possible and that are from a lot of material of the type in question. The test specimens should then be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using Students *t*-test for unpaired data and an acceptable probability level chosen by the two parties before the testing is begun. If a bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results in the light of the known bias.

TABLE 1 Glass Bead Sizes

Bead Size Range					
Passing		Retained		Bead Size Designation ^A	
mm	Sieve Number ^B	mm	Sieve Number ^B	mm	Sieve Number
2.0	10	1.70	12	1.7	12
1.4	14	1.18	16	1.18	16
1.00	18	0.850	20	0.850	20
0.710	25	0.600	30	0.600	30
0.500	35	0.425	40	0.425	40
0.355	45	0.300	50	0.300	50
0.250	60	0.212	70	0.212	70
0.180	80	0.150	100	0.150	100
0.125	120	0.106	140	0.106	140
0.090	170	0.075	200	0.075	200

^A The designated bead size is the “retained on” size of the sieve pair used to size the beads. For example, beads designated No. 40 are beads that pass the No. 35 sieve and are retained on the No. 40 sieve. These beads are typically sold as 35-40 beads.

^B See Specification E11.

6. Apparatus

6.1 *Mechanical Sieve Shaker*—A mechanical sieve shaker, which imparts lateral and vertical motion to the sieve, causing the particles thereon to bounce and turn so as to present different orientations to the sieving surface, should be used. The sieve shaker should be a constant frequency device utilizing a tapping *arm* to impart the proper motion to the glass beads.⁴

NOTE 1—Care should be given to the cork or rubber contact point on shakers when the vertical motion comes from an arm striking the cork or rubber. Excessive wear on the cork or rubber could affect the motion imparted to the glass beads and, therefore, the test result.

6.2 *Pan, Cover, and 200-mm (8-in.) Diameter Sieves.*

6.3 *Spherical Glass Beads*,⁵ in size fractions in accordance with Table 1. It is only necessary to have on hand the bead size fractions necessary for the range of geotextiles for which testing is anticipated. The sizing of all beads shall be verified prior to each use by sieving on the pairs of sieves shown in Table 1. Prepare at least 50 g of each size fraction to be used prior to beginning the test. Bead sizes to be used in this test method are shown in Table 1.

6.4 *Balance*, having a capacity adequate for the mass of samples anticipated and accurate to ± 0.05 g.

6.5 *Static Elimination*, to prevent the accumulation of static electricity when the beads are shaken on the surface of geotextile.⁶ Commercially available devices or anti-static sprays are acceptable.

6.6 *Pan*, for collecting sieved beads.

⁴ A sieve shaker of this type is available from W. S. Tyler, Inc., 8200 Tyler Blvd., Mentor, OH 44060.

⁵ Glass beads available from Cataphote Division, Ferro Corporation, P.O. Box 2369, Jackson, MS 39205, or Potters Industries, Inc., 377-T, Route 17, Hasbrouck Heights, NJ 07604, or beads of equal quality have been found satisfactory for this purpose.

⁶ Static Eliminators available from Staticmaster Ionizing Units, Model #2U500, Nuclear Products Co., P.O. Box 5178, El Monte, CA 91733, or Western Static Eliminators Co., 215-219 S. Western Avenue, Chicago, IL 60612, have been found satisfactory for this purpose. For other availability addresses, see Footnote 7 of Test Method D4238.

6.7 *Flexible Rubber Template*, Either a square shaped flexible rubber template with a 203mm(8 in) diameter hole cut in it, or a 203 mm (8 in) diameter template, constructed from a durable, yet flexible material such as rubber or neoprene. This template is used to trace the 203 mm (8 in) diameter circles on the geotextile fabric for mounting into the sieves described in 6.2. (See Fig. 1)

7. Sampling

7.1 Sampling of Planar Geotextiles

7.1.1 *Lot Sample*—For routine quality control testing, divide the product into lots and take the lot sample as directed in Practice D4354, Section 7 Procedure B Sampling for Quality Assurance Testing. For Specification Conformance testing, sample as directed in Practice D4354, Section 6 Procedure A—Sampling for Specification Conformance.

7.1.2 *Laboratory Sample*—As a laboratory sample for acceptance testing, take a full width swatch 1-m (1-yd) long from the end of each roll of fabric in the lot sample, after first discarding a minimum of 1 m (1 yd) of fabric from the very outside of the roll.

7.1.3 *Test Specimens*—Cut five specimens from each swatch in the laboratory sample with each specimen being cut to fit the appropriate sieve pan. Cut the specimens from a single swatch spaced along a diagonal line on the swatch.

7.2 Sampling of Circular-Knitted Sock Geotextiles

7.2.1 *Lot Sample* for manufacturers quality control (MQC) testing - Divide rolls of sock covered perforated pipe Circular-Knitted Sock Geotextile Fabric into lots and take the lot sample as directed in Practice D4354, Section 7, Procedure B Sampling for Quality Assurance Testing.

7.2.2 *Laboratory Sample*—To obtain a laboratory sample for MQC testing of the Circular-Knitted Sock Geotextile, follow the procedure below.

7.2.2.1 Apply the knitted sock Geotextile sample over the outside of the corresponding diameter of a 406 mm (16 in) length of perforated tubing or reasonable facsimile.

7.2.2.2 Tie a knot in each end of the fabric so as to fully encase the pipe in the fabric.

7.2.2.3 Using the knot from one end of the fabric, suspend the geotextiles encased pipe vertically. Gently suspend a 1.13 kg (2.5 lb) weight from the bottom to ensure intimate contact with the perforated pipe. See Fig. 2.

NOTE 2—Pipes with diameters larger than 75 mm – 150 mm(3 in – 6 in) may require heavier weights to ensure intimate contact between the pipe and sock material.

Allow the suspended pipe with weight to hang for 2 minutes.

7.2.2.4 Using a flexible 203 mm (8 in) diameter round template as a guide, trace a circle on the surface of the fabric using an indelible marker. See Fig. 2.

7.2.2.5 Remove the fabric from the pipe section by untying or cutting off the knots at one or both ends in the fabric. Cut the fabric tube in a lengthwise direction at a position opposing the drawn circle, taking care to not cut the fabric within the circle. If so desired, the length of the specimen may be shortened by cutting the fabric in a cross wise direction, taking care not to cut the fabric closer than 75 mm (3 in) from the outside of the

DETERMINATION OF APPARENT
OPENING SIZE OF GEOTEXTILE

DATE: _____
TEST BY: _____
COMP BY: _____
CHECK BY: _____

Range (mm) US Std Mesh	Minimum Dia. (mm)	Wt. F+G* W/ Beads	Wt. F+G	Wt. Beads	% Retained	Wt. Pan W/ Beads	Wt. Pan	Wt. Beads	% Passing	Wt. F+G Before	Wt. F+G After	Wt. Retained in Geotextile	% Retained in Geotextile
2.0 - 1.70	1.70												
1.4 - 1.18	1.18												
1.0 - .850	.850												
.710 - .60	.600												
.50 - .425	.425												
.355 - .30	.300												
.25 - .212	.212												
.18 - .15	.150												
.125 - .106	.106												
.09 - .075	.075												

GEOTEXTILE DESCRIPTION: _____

* F=FRAME
G=GEOTEXTILE

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<https://standards.itech.ai/catalog/standards/sist/ed47d6a2-c472-477b-904a-a5dca9f14789/astm-d4751-12>

FIG. 1 Sample Worksheet

circle. The result will be a planar specimen of more or less rectangular shape with a circle drawn approximately in its center.

7.3 Lot Sample for Specification Conformance Testing—Sample as directed in Practice D4354 Section 8, Procedure C—Sampling for Specification Conformance.

7.3.1 Laboratory Sample—To obtain a laboratory sample of the Circular Knitted Geotextile Fabric for acceptance testing of each lot of pipe, follow the procedure below.

7.3.1.1 Select a 3m (10 ft) section on each lot of the sock covered pipe to be tested.

7.3.2 Using a length of string, twine or cord, secure the fabric to the pipe at each end of the 3m (10 ft) pipe section that was chosen in 7.3.3.1 in order to prevent the sock fabric from contracting lengthwise when the sock covered pipe sample is removed from the roll or pipe section. Remove the 3m (10 ft) sock covered pipe section from the roll or pipe section by cutting the pipe at each end of the 3 m (10 ft) sample, outside of the ties.

7.3.3 Test Specimens—With the fabric still secured to the pipe sample, use the flexible rubber template, to draw five 2003

m (8 in) diameter circles at various locations around the circumference of each laboratory sample, equally spaced along its length and not closer than 100 mm (4 in) from either end of the pipe sample.

7.3.3.1 Remove the ties from the laboratory sample and remove the fabric from the pipe.

7.3.3.2 When securing specimens by wedging between two sieve frames cut the laboratory specimen in a cross wise direction to create 5 specimens taking care not to make these cuts closer than 75mm (3 in) from the outside of the circle. Continue to prepare the specimens by cutting the fabric in a lengthwise direction at a position opposing the circle. Care must be taken not to cut through the circle. The result will be the creation of 5 planar fabric specimens of more or less a rectangular shape with a circle drawn at its center.

8. Specimen Preparation

8.1 Weigh the specimens and then submerge them in distilled water for 1 h at the standard atmosphere for testing. Bring the specimens to moisture equilibrium in the atmosphere for testing geosynthetics. Equilibrium is considered to have been