



Designation: D8490 – 23a

Standard Test Method for Determining the Pore Size Characteristics of Geotextiles Using an Optical Method¹

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1. Scope

1.1 This test method covers the determination of the pore size characteristics of geotextiles using an optical method and image analysis.

1.2 This method has been developed for determination of the Image Opening Size (IOS) of knitted geotextiles by image analysis. Other properties may be obtained based on the pore size distribution.

1.3 The applicability of this test method must be assessed on a product-by-product basis, as it requires light to pass through its thickness to provide a useful observation. As a general rule, the tested product must be thin. Example of products which cannot be tested using this test method is thick needle-punched nonwoven and woven with a complex three-dimensional structure.

1.4 This test method shows 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.

1.5 *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.*

1.6 *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.*

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. Referenced Documents

2.1 ASTM Standards:²

D123 Terminology Relating to Textiles

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

D4439 Terminology for Geosynthetics

D4751 Test Methods for Determining Apparent Opening Size of a Geotextile

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

2.2 Other Standards:

ISO 12956 Geotextiles and Geotextile-Related Products—Determination of the Characteristic Opening Size³

CGSB 148.1 No. 10 Methods of Testing Geosynthetics Geotextiles—Filtration Opening Size⁴

3. Terminology

3.1 *Definitions*—For definitions of other textile terms used in this test method, refer to Terminology D123. For definitions of other terms relating to geosynthetics used in this test method, refer to Terminology D4439.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *circular knit, n*—a structure produced by interlooping one or more ends of yarn or comparable material in a continuously circular orientation around the fabric.

3.2.2 *ellipse diameter, n*—measured from the “best-fit” ellipse fitting inside a given opening.

3.2.2.1 *Discussion*—The minimum and maximum ellipse diameter are the smallest and largest diameter of the ellipse fitting the inside of an opening when varying the axis of the ellipse in the plane of observation (Fig. 1).

3.2.3 *Feret diameter, n*—distance between two parallel lines tangent to the silhouette of the opening.

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 Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from Canadian General Standards Board (CGSB), 11 Laurier St., Phase III, Place du Portage, Gatineau, Quebec K1A 0S5, Canada, <http://www.tpsgc-pwgsc.gc.ca/ongc-cgsb>.

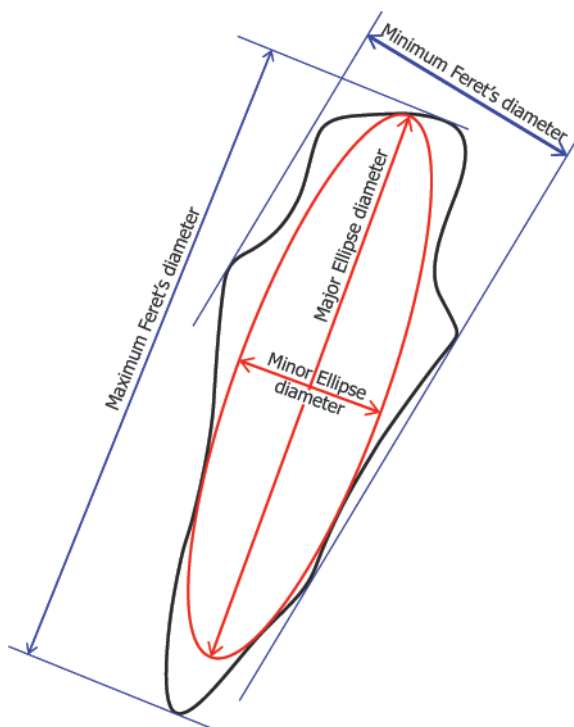


FIG. 1 Feret's and Ellipse Diameters

3.2.3.1 *Discussion*—The minimum and maximum Feret diameter are the smallest and largest distance between two parallel lines tangent to the opening's silhouette when varying the angle of these lines in the plane of observation (Fig. 1).

3.2.4 *image opening size (IOS), n*—for a knitted geotextile, a property that indicates the size of a soil particle which can be effectively expected to pass through the geotextile.

3.2.5 *opening, n*—surface with an irregular shape, through which the light can pass.

4. Summary of Test Method

4.1 For circular knit geotextiles, a specimen is placed in a frame where its circumference will be controlled to reflect the outside diameter of the pipe on which it will be installed. A stress is applied in the longitudinal direction to normalize the condition under which the product will be observed.

4.2 An image of the surface of the geotextile is captured. The image is processed to determine relevant properties of each opening, such as the minimum Feret diameter and the minimum ellipse diameter. A pore size distribution and a significant pore size defined as the image opening size, IOS, are defined based on these observations.

NOTE 1—The minimum size of the image function should be selected considering the size of the openings of the product to be tested. For knitted geotextile with openings up to 0.5 mm, an image 7.0 mm by 7.0 mm permitting the capture of 50 openings or more has been found satisfactory.

4.3 An equivalent Apparent Opening Size can be estimated based on the IOS.

5. Significance and Use

5.1 The significant opening size of geotextiles is usually determined using Test Method D4751, which involves sieving

calibrated beads through specimens of the geotextile being evaluated. However, Test Method D4751 includes many risks of errors due to static electricity, precision of the glass beads, among other issues.⁵ This risk of error is even higher with knitted geotextiles which exhibit a very low tensile modulus. This test method is proposed as an alternate to Test Method D4751 using a nondestructive technique, where the stress conditions are controlled without manipulation of the specimen.

5.2 This test method has been found to provide representative results for products exhibiting a planar structure, such as two-dimensional knits.

5.3 In case of a dispute arising from differences in reported test results when using ASTM D4751 Method A and this method, ASTM D4751 Method A shall be considered the referee method. However, data obtained using ASTM D4751 Method A should be reviewed considering the high risk of human error associated with the control of the stress condition of the geotextile.

5.4 Equivalency with the other pore opening size determined using other standards (for example, ISO 12956 and CGSB 148.1 No. 10) can also be considered using adequate correlations with test results obtained with these standards.

6. Apparatus

6.1 *Stretching Structure*—When testing circular knit geotextiles, a structure able to control the circumference of the specimen and to uniformly apply a tensile stress in the machine direction must be used. An example of such a structure is presented in Fig. 2. This structure is not necessary when testing planar geotextiles where no stress needs to be applied.

6.1.1 The structure permits clamping of the specimen on the upper end.

6.1.2 A free clamp is used on the bottom to apply a load using a dead weight.

6.1.3 Two vertical columns are installed to control the circumference of the specimen. The distance between these columns must be adjustable and should be approximately equal distance from the centerline of the image viewing area.

6.1.4 It must be possible to stop the geotextile from creeping after some time, using a secondary clamp fixed on the frame itself.

6.1.5 The edges must be rounded to avoid accidental tear of the specimen.

6.2 *Light Source*, attached to the stretching structure, offering a diffused light on a surface larger than the image captured.

NOTE 2—The NERLITE⁶ BL 50×200 LED Backlight was found to be satisfactory.

6.3 *Image Acquisition Device*, positioned with its axis perpendicular to the plane of the geotextile. The sensor and

⁵ Blond, E., Veermersch, O., Diederich, R., "A Comprehensive Analysis of the Measurement Techniques Used to Determine Geotextile Opening Size: AOS, FOS, O90, and Bubble Point," *Proceedings of Geosynthetics 2015*, Portland, OR, February 15–18, 2015.

⁶ NERLITE is a registered trademark of Microscan Systems, Inc., 700 SW 39th St. Renton, WA 98057.