Designation: D5199 – 11

Standard Test Method for Measuring the Nominal Thickness of Geosynthetics[1]

This standard is issued under the fixed designation D5199; 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 the measurement of the nominal thickness of geotextiles, smooth surfaced geomembranes, geonets, and geocomposite drainage products.

1.2 This test method does not provide thickness values for geosynthetics under variable normal compressive stresses. This test method determines nominal thickness, not necessarily minimum thickness.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information 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 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
D1776 Practice for Conditioning and Testing Textiles
D2905 Practice for Statements on Number of Specimens for Textiles[3]
D4354 Practice for Sampling of Geosynthetics for Testing
D4439 Terminology for Geosynthetics
D5199 Test Method for Measuring the Nominal Thickness of Geosynthetics
E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 For definitions of other terms relating to geotextiles and geomembranes used in this standard, refer to Terminology D4439. For definition of other textile terms used in this standard, refer to Terminology D123.

3.2 *Definitions:*

3.2.1 *pressure*, *n*—the force or load per unit area.

3.2.2 *thickness*—(1) the distance between one planar surface and its opposite parallel and planar surface; (2) in the textiles the distance between the upper and lower surfaces of the material, measured under a specified pressure and time.

4. Summary of Test Method

4.1 The nominal thicknesses of geosynthetics is determined by observing the perpendicular distance that a movable plane is displaced from a parallel surface by the geotextile or geomembrane material while under a specified pressure (2 kPa for geotextiles and 20 kPa for geomembranes for 5 s).

5. Significance and Use

5.1 Thickness is one of the basic physical properties used to control the quality of many geosynthetics. Thickness values are required in calculation of some geotextile and geomembrane parameters such as permeability coefficients, tensile stress (index), and the like thickness is not indicative of field performance and therefore is not recommended for specifications.

5.2 The thickness of geotextiles and geomembranes may vary considerably depending on the pressure applied to the specimen during measurement. Where observed changes occur, thickness decreases when applied pressure is increased. To minimize variation, specific sample size and applied pressure are indicated in this method to ensure all results are comparable.

5.3 To determine the effect of difference pressure loadings on the measure thickness of geotextiles and geomembranes, use this test method.

5.4 This test method may be used for acceptance testing of commercial shipments of geotextiles and geomembranes, but caution is advised since information on between-laboratory precision is incomplete. Comparative tests, as directed in 5.4.1 may be advisable.

5.4.1 In case of a dispute arising from differences in reported test results when using this test method for acceptance testing of commercial shipments, the purchaser and the supplier should conduct comparative tests to determine if there is

[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.

Current edition approved Feb. 1, 2011. Published March 2011. Originally approved in 1991. Last previous edition approved in 2006 as D5199 – 01(2006). DOI: 10.1520/D5199-11.

[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] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

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 as homogeneous as possible and that are formed from a lot of material of the type in question. The test specimens should be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using Student's *t*-test for unpaired data and an acceptable probability level chosen by the two parties before the testing is begun. If bias is found, either its cause must be found and corrected or the purchaser and supplier must agree to interpret future tests in the light of the known bias.

NOTE 1—The user should be aware that the compressibility of the materials, their rebound characteristics, and the like will also affect the thickness of the geotextiles and geomembranes following the time when they are rolled up on rolls shipped and stored.

6. Apparatus

6.1 *Thickness Testing Instrument* —The thickness gauge shall have a base (or anvil) and a free moving presser foot plate whose planar faces are parallel to each other to <0.01 mm. A gauge with a 56.4 mm (2.22 in.) diameter presser foot, the base shall extend at least 10 mm in all directions further than the edge of the 2500 mm^2 circular pressor foot, shall be used for measurements of geotextiles, geocomposite drainage materials, and geonets. A gauge with a 6.35 mm (0.250 in.) diameter pressor foot shall be used for laboratory measurements of geomembranes. A gauge with 6.35 mm (0.250 in.) diameter pressor foot and base may be used for field measurements of geomembrane thickness. The instruments must be capable of measuring a maximum thickness of at least 10 mm to an accuracy of at least ±0.02 mm. The gauges shall be constructed to permit gradual application of pressure to a specific force of 2 ± 0.02 kPa (0.29 ± 0.003 psi) for geotextiles and 20 ± 0.2 kPa (2.9 ± 0.03 psi) for geomembranes. Dead-weight loading may be used.

6.1.1 The specified force of 20 kPa may be inadequate for some HDPE geomembranes. A pressure in the range of 50 to 200 kPa is recommended for HDPE geomembranes if fictitiously high readings are suspected using the 20 kPa pressure.

NOTE 2—(Appendix X1) lists some of the suppliers of apparatus for thickness measurement.

6.2 *Cutting Dies*—Dies to cut specimens should have dimensions at least as large as a circle of 75 mm (3 in.) diameter.

NOTE 3—Due to compressibility of many geotextiles and geomembranes the cutting and handling preparation may change the thickness. Care should be exercised to minimize these effects.

7. Sampling

7.1 *Lot Sample*—In the absence of other guidelines divide the product into lots and take lot samples as specified in Practice D4354.

7.2 *Laboratory Sample*—Consider the units in the lot sample as the units in the laboratory sample. For the laboratory sample, take a full width sample of sufficient length along the selvage or edge of the roll so that the requirements of 7.3-7.5.2 can be met. Exclude the inner and outer wraps of the roll or any material containing folds, crushed areas or other distortions not representative of the sampled lot.

7.3 Remove test specimens from the laboratory sample in a randomly distributed pattern across the width with no specimen taken nearer than 100 mm (4 in.) from the selvage or roll edge, unless otherwise specified. For geomembranes include at least one specimen taken no more than 152 mm (6 in.) from the edge. Since seams are an important part of geomembrane applications, thickness readings within 152 mm (6 in.) of each edge is appropriate.

7.4 *Test Specimens*—From each unit in the laboratory sample, remove the specimens so that the edge of the specimen will extend beyond the edge of the pressor foot by 10 mm (0.39 in.) in all directions (that is, at least a circle of 75 mm (3 in.) in diameter).

7.5 *Number of Specimens*—Unless otherwise agreed upon, as when provided in an applicable material specifications, take a number of test specimens per laboratory sample such that the user may expect at the 95 % probability level that the test result is not more than 6.0 % of the average above or below the true average of the sample. Determine the number of specimens per sample as follows:

7.5.1 *Reliable Estimate of v*—When there is a reliable estimate of v based upon extensive part records for similar materials tested in the user's laboratory as directed in the method, calculate the required number of specimens for the machine and cross-machine directions as follows:

$$n = (tv / A)^2$$

where:
n = number of test specimens (rounded upward to a whole number),
v = reliable estimate of the coefficient of variation of individual observations on similar materials in the user's laboratory under conditions of single-operation precision, %,
t = the value of Student's t for two-sided limits (see Table 1), a 95 % probability level, and the degrees of freedom associated with the estimate of v, and
A = 5.0 % of the average, the value of the allowable variation.

TABLE 1 Values of Student's *t* for Two-Sided Limits and the 95 % Probability[A]

df	t.025	df	t.025	df	t.025
1	12.706	11	2.201	21	2.080
2	4.303	12	2.179	22	2.074
3	3.182	13	2.160	23	2.069
4	2.776	14	2.145	24	2.064
5	2.571	15	2.131	25	2.060
6	2.447	16	2.120	26	2.056
7	2.365	17	2.110	27	2.052
8	2.306	18	2.101	28	2.048
9	2.262	19	2.093	29	2.045
10	2.228	20	2.086	inf.	1.960

[A] Values in this table were calculated using Hewlett Packard HP 67/97 Users' Library Programs 03848D, "One-Sided and Two-Sided Critical Values of Student's *t*" and 00350D, "Improved Normal and Inverse Distribution." For values at other than the 95 % probability level, see published tables of critical values of Student's *t* in any standard statistical text. Further use of this table is defined in Practice D2905.