



Designation: D 5994 – 98

Standard Test Method for Measuring Core Thickness of Textured Geomembrane¹

This standard is issued under the fixed designation D 5994; 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 approval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a procedure to measure the core thickness of textured geomembranes.

1.2 This test method does not provide thickness values for geomembranes under variable normal stresses.

2. Referenced Documents

2.1 *ASTM Standards:*

D 4354 Practice for Sampling of Geosynthetics for Testing²

D 4439 Terminology for Geosynthetics²

3. Terminology

3.1 *Definitions:*

3.1.1 *core thickness, n*—the average thickness of a textured geomembrane as measured using this particular test method.

3.1.2 *geomembrane, n*—an essentially impermeable geosynthetic composed of one or more synthetic sheets. (**D 4439**)

3.1.3 *thickness gage points, n*—the tips of a thickness gage which contact the upper and lower geomembrane surfaces, and between which the thickness is measured.

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

3.1.5 *textured geomembrane, n*—a geomembrane having one or both surfaces intentionally manufactured with projections or indentations, most commonly for the purpose of providing increased shear strength against adjacent materials.

3.1.6 *thickness, n*—the perpendicular distance between one surface and its opposite.

3.1.7 For definitions of other terms relating to geomembranes used in this test method, refer to the Terminology D 4439.

4. Summary of Test Method

4.1 The core thickness of a textured geomembrane is calculated as the average value of measurements taken on replicate specimens of the sample under investigation. The thickness of each specimen is measured at a specific location as

the distance between two gage points. The opposing thickness gage points are manufactured to a defined geometry, with a specified force of $0.56 \pm 0.05 N$ (2.0 ± 0.2 oz) applied along their axis.

5. Significance and Use

5.1 Thickness is one of the basic index properties used to control and track the quality of many geomembranes. Additionally, many mechanical properties (for example, tensile yield strength, puncture strength, etc.) can be related to core thickness. Core thickness values may also be required in calculation of some parameters such as diffusion coefficients or tensile stresses.

5.2 The measured core thickness of geomembranes may vary considerably depending on the pressure applied to the specimen during measurement. To reduce variation in measurements and the chance of unrealistically low values due to excessively high pressures, a specific gage point geometry and applied force are prescribed in this test method.

5.3 The test method is applicable to all commonly available textured geomembranes that are deployed as manufactured geomembrane sheets.

6. Apparatus

6.1 *Thickness Gage*—The thickness gage shall be of the dead-weight type capable of measuring to an accuracy of at least ± 0.01 mm (0.0004 in.). The gage shall be constructed to permit application of a specific force of $0.56 \pm 0.05 N$ (2.0 ± 0.2 oz). The gage shall have a base point (or anvil) and a free-moving presser point whose axes are aligned to each other.

NOTE 1—The geomembrane specimen being measured should be maintained perpendicular to the axes of the opposing gage points. An underlying support system may be necessary to support large test specimens.

6.2 *Thickness Gage Points*—The gage points shall be made of hardened steel. The points shall be tapered at an angle of $60 \pm 2^\circ$ to the horizontal with the tip rounded to a radius of 0.8 ± 0.1 mm (0.031 ± 0.004 in.). Fig. 1 shows the critical dimensions.

NOTE 2—The gage and points can be calibrated using standard thickness blocks. Frequent use and rough use of the gage can dull the gage

¹ This test method is under the jurisdiction of ASTM Committee D-35 on Geosynthetics and is the direct responsibility of Subcommittee D35.10 on Geomembranes.

Current edition approved May 10, 1998. Published January 1999. Last previous edition D 5994 – 96

² *Annual Book of ASTM Standards*, Vol 04.13.

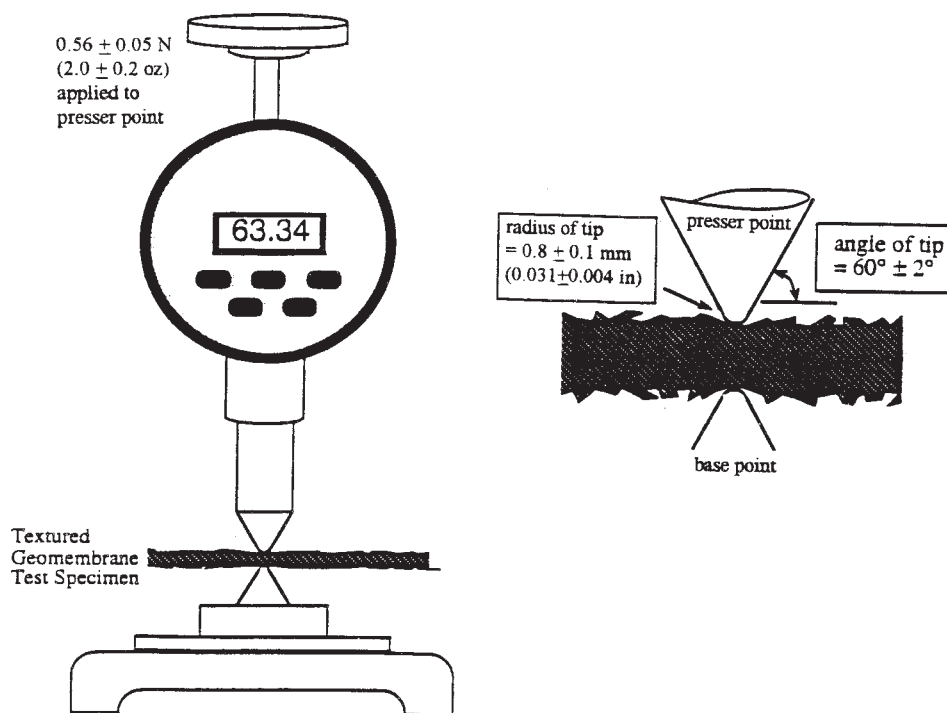


FIG. 1 Dead Weight Thickness Measurement Device for Textured Geomembranes

points and cause misalignment, both of which will cause incorrect readings. These problems can be detected by frequent calibration.

7. Sampling

7.1 *Sample*—For the sample, take a full width sample of sufficient length so that the requirements of 7.2 through 7.4.2 can be met. Exclude the inner and outer wraps of the roll or any material not representative of the sample (see Note 1).

7.2 Remove test specimens from the sample in a randomly distributed pattern across the width. The thickness readings must include measurements within 15 cm (6 in.) of both edges of the geomembrane roll.

7.3 *Test Specimens*—From each unit in the sample, remove the specimens so that the edge of the specimen will extend beyond the edge of the gage points by 10 mm (0.4 in.) in all directions. It is recommended to use circular test specimens of approximately 75 mm (3 in.) diameter.

7.4 *Number of Specimens*—Unless otherwise agreed upon, as when provided in an applicable material specification, take a number of test specimens per sample such that the user may expect, at the 95 % probability level, that the test result is not more than 5 % of the average above or below the true average of the sample. Determine the number of specimens per sample as follows:

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

$$n = (tv/A)^2 \quad (1)$$

where:

n = number of test specimens (rounded upward to a whole number),

t = the value of Student's "t" for one-sided limits (see Table 1 in Test Method D 4354), a 95 % probability level, and the degrees of freedom associated with the estimate of v ,

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, %, and

A = 5 % of the average, the value of the allowable variation.

7.4.2 *No Reliable Estimate of v* —When there is no reliable estimate of v for the user's laboratory, Eq 1 should not be used directly. Instead, specify the fixed number ten of specimens. The number of specimens is calculated using $v = 9.5$ % of the average. These values for v are somewhat larger than usually found in practice. When a reliable estimate of v for the user's laboratory becomes available, Eq 1 will usually require fewer than the fixed number of specimens.

8. Conditioning

8.1 Bring the specimens to a temperature equilibrium of $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$) and a relative humidity of 60 ± 10 %.

9. Procedure

9.1 Test the conditioned specimens in the standard laboratory atmosphere specified in 8.1.

9.2 With the specified force applied to the presser point on the base point (that is, no specimen present), zero the measuring scale or record the initial non-zero reading.

9.3 Lift the presser point and insert the test specimen. While allowing the presser point to come slowly into contact with the test specimen, adjust the test specimen to locate the gage points in the “low spots” or “valleys,” in between the projections, or into the indentations, of the textured surface(s) to obtain the local minimum thickness reading. Repeat the above so that a total of three measurement readings are obtained for each specimen. Record only the lowest value of the three readings to the nearest 0.025 mm or 0.001 in. as the thickness for that specimen.

9.4 Allow the full dead weight pressure to be applied for 5 s, and record the thickness value to the accuracy of the gage.

9.5 Repeat the method for each of the remaining specimens.

10. Calculation

10.1 Calculate the average thickness of the sample from the individual specimen results and record to the nearest 0.025 mm or 0.001 in.

11. Report

11.1 Report the following information for the average thickness:

11.1.1 Project, type of geomembrane tested, and method of sampling.

11.1.2 Name or description of thickness apparatus used for testing.

11.1.3 Dimensions of the gage points (if different than this standard).

11.1.4 Dimensions of the sample and test specimens (if different than this standard).

11.1.5 Loading time interval.

11.1.6 Number of specimens.

11.1.7 Report the individual specimen thickness measurements to the nearest 0.025 mm or 0.001 in.

11.1.8 Report the average thickness of the individual measurements to the nearest 0.025 mm or 0.001 in.

11.1.9 Coefficient of variation of the individual measurements of the sample, in percent (optional).

11.1.10 Any unusual or out-of-standard conditions or observations made during the tests.

12. Precision and Bias

12.1 *Precision*—The precision of this test method procedure is being established.

12.2 *Bias*—The procedure in this test method has no bias because the value of average thickness can be defined only in terms of this test method.

13. Keywords

13.1 geosynthetics; geomembrane; textured geomembrane; thickness

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).