



Designation: D5994/D5994M – 10 (Reapproved 2021)

## Standard Test Method for Measuring Core Thickness of Textured Geomembranes<sup>1</sup>

This standard is issued under the fixed designation D5994/D5994M; 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 ( $\epsilon$ ) 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.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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

1.5 *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.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

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

D4439 Terminology for Geosynthetics

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E2554 Practice for Estimating and Monitoring the Uncer-

tainty of Test Results of a Test Method Using Control Chart Techniques

### 3. Terminology

3.1 For definitions of other terms relating to geomembranes used in this test method, refer to Terminology D4439.

#### 3.2 Definitions:

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

3.2.2 *geomembrane,  $n$* —an essentially impermeable geosynthetic composed of one or more synthetic sheets. D4439

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

3.2.4 *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.

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

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

### 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 gauge points. The opposing thickness gauge points are manufactured to a defined geometry, with a specified force of  $0.56 \pm 0.05$  N [ $2.0 \pm 0.2$  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

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.10 on Geomembranes.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

specimen during measurement. To reduce variation in measurements and the chance of unrealistically low values due to excessively high pressures, a specific gauge 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 Gauge*—The thickness gauge shall be of the dead-weight type capable of measuring to an accuracy of at least  $\pm 0.01$  mm [ $0.0004$  in.]. The gauge shall be constructed to permit application of a specific force of  $0.56 \pm 0.05$  N [ $2.0 \pm 0.2$  oz]. The gauge 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 gauge points. An underlying support system may be necessary to support large test specimens.

6.2 *Thickness Gauge Points*—The gauge 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  $0.8 \pm 0.1$  mm [ $0.031 \pm 0.004$  in.]. Fig. 1 shows the critical dimensions.

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

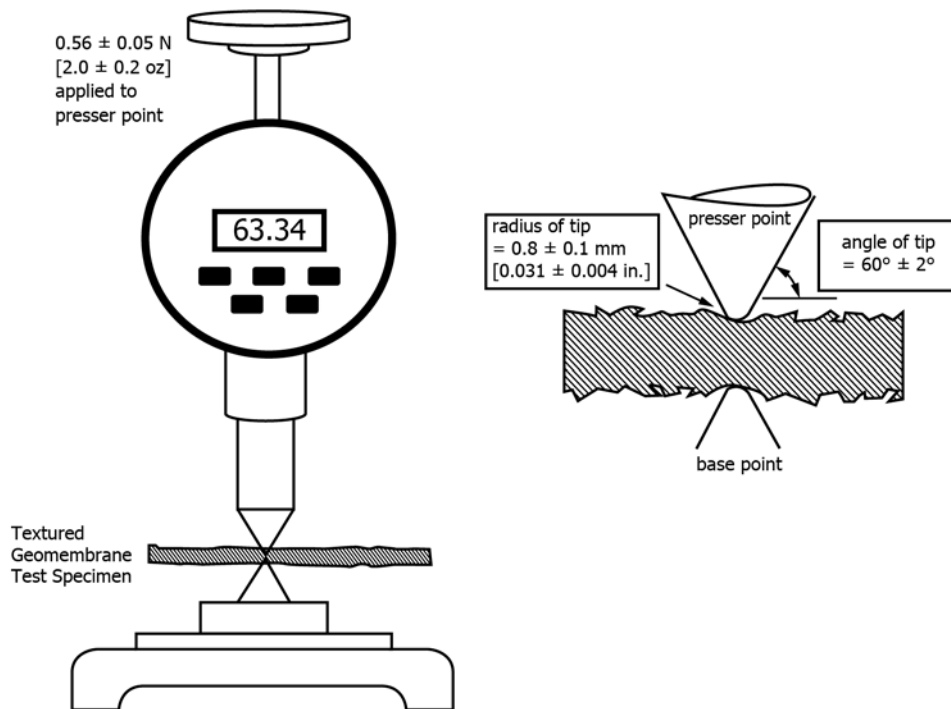
7.4 *Number of Specimens*—Unless otherwise agreed upon, as when provided in an applicable material specification, take a number of test specimens per sample such that the user may expect, at the 95 % probability level, that the test result is not more than 5 % of the average above or below the true average 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 Practice D4354), a 95 % probability level, and the degrees of freedom associated with the estimate of  $v$ ,



**FIG. 1 Dead-Weight Thickness Measurement Device for Textured Geomembranes**