Designation: D 6364 – 99

Standard Test Method for Determining the Short–Term Compression Behavior of Geosynthetics[1]

This standard is issued under the fixed designation D 6364; 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 The test method establishes the procedures for evaluation of the deformations of a geosynthetic or combination of geosynthetics (that is, geocomposite (excluding geotextiles, geomembranes and geosynthetic clay liners)) under short-term compressive loading. This test method is strictly an index test method to be used to verify the compressive strength consistency of a given manufactured geosynthetic(s). Results from this test method should not be considered as an indication of actual or long-term performance of the geosynthetic(s) in field applications.

1.2 Since these geosynthetics may experience muti-directional compressive loadings in the field, this test method will not show actual field performance and should not be used for this specific objective. The evaluator of the results should also recognize that the determination of the short term single plane compressive behavior of geosynthetics does not reflect the installed performance of synthetic drainage systems and, therefore, should not be used as the only method of product specification or performance with respect to synthetic drainage systems.

1.3 *This standard does not purport to address all the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate health and safety practices and to determine the applicability of regulatory limitations prior to use.*

1.4 The values in SI units are to be regarded as the standard. Values in pound units are provided in parentheses for information.

2. Referenced Documents

2.1 *ASTM Standards:*

D 4354 Practice for Sampling of Geosynthetics for Testing[2]

D 4439 Terminology for Geotextiles[2]

D 4716 Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head[2]

D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes[2]

3. Terminology

3.1 *Definitions:*

3.1.1 *compressive deformation, [L], n*—the decrease in gage length produced in the test specimen by a compressive load.

3.1.2 *compressive strain, [nd], n*—the ratio of compressive deformation to the gage length of the test specimen.

3.1.3 *gage length, [L], n—in compression testing,* the measured thickness of the test specimen under specified compressional force, expressed in units of length prior to compressive loading. **(D 5199)**

3.1.4 *geocomposite, n*—a product fabricated from any combination of geosynthetics with geotechnical materials or other synthetics which is used in a geotechnical application.

3.1.5 *geosynthetic, n*—a planar product manufactured from polymeric material used with foundation, soil, rock, earth, or any other geotechnical engineering related material as an integral part of a man-made project, structure or system. **(D 4439)**

3.1.6 *index test, n*—a test procedure which may contain a known bias but which may be used to establish an order for a set of specimens with respect to the property of interest. **(D 4439)**

3.1.7 *yield point, n*—the first point on the load - deformation curve at which an increase in deformation occurs without a corresponding increase in load.

3.1.7.1 *Discussion*—Some geosynthetics do not exhibit an exact yield point. The tested geosynthetic may exhibit a less steep slope at yield. In addition, it should be stated that the yield point may also be the ultimate strength of the geosynthetic.

3.1.8 For definitions of terms relating to geotextiles, refer to Terminology D 4439

4. Summary of Test Method

4.1 Specimens are mounted between parallel plates in a load frame. Compressive loads are applied at a constant rate of crosshead movement. The deformations are recorded as a

[1] This test method is under the jurisdiction of ASTM Committee D-35 on Geosynthetics and is the direct responsibility of Subcommittee D35.01 on Mechanical Properties.

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

function of load. The compressive stress and strain are evaluated and plotted. The compressive yield point is evaluated from the stress/strain relationship for those materials that exhibit a detectable compressive yield point.

5. Significance and Use

5.1 The compression behavior test for geosynthetics is intended to be an index test. It is anticipated that the results of the compression behavior test will be used to evaluate product. The results of the analyses may also be used to compare the relative compressive yield points of materials that exhibit a detectable compressive yield point. It is anticipated that this test will be used for quality control testing to evaluate uniformity and consistency within a lot or between lots where sample geometry factors (for example, thickness) or materials may have changed.

NOTE 1—This is a one-dimensional test for compressive loading of a geosynthetic(s) in one plane.

5.1.1 The compressive yield point of geosynthetics may be evaluated from the stress/strain relationship. Many materials exhibit compressive deformation but may not show a distinct compressive yield point.

5.2 This test method can be used to evaluate the short-term stress/strain behavior of geosynthetics under compressive stress while loaded at a constant rate of deformation.

5.3 This test method may be used for acceptance testing of commercial shipments of geosynthetics but caution is advised because interlab testing is incomplete.

5.3.1 In the 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 statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, two parties should take a group of test specimens from material shipped to the project. 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 the 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 test results in the light of the known bias.

6. Apparatus

6.1 *Loading Mechanism*—The loading mechanism shall be capable of applying compressive loads at a constant rate of deformation of 10 % on the nominal thickness of the test specimen per minute or 1 mm/min, whichever is greater. The capacity of the load frame shall be at least two times greater than the compressive yield point of or the maximum load applied to the specimen.

NOTE 2—Some loading mechanisms, especially the older models, do not have the capability of adjusting the rate of deformation to the specific rate required. For these instruments, the user and producer should establish mutually agreed upon testing rates. However, the rate of deformation selected should not be greater than 10 % on the nominal thickness of the test specimen per minute or 1 mm/min, whichever is greater.

6.2 *Fixed Plate*—The fixed plate shall be larger than the specimen to be tested. It shall also be flat, smooth and completely and uniformly supported.

NOTE 3—It is recommended that the minimum fixed plate width be equal to the sample width plus twice the thickness of the test sample. This should support the sample through the range of deformation and prevent draping or flexing displacement.

6.3 *Movable Plate*—The movable plate shall be of sufficient thickness and strength to preclude any bending during loading. It shall be parallel to the fixed plate and attached to the compression mechanism. A spherical loading block of the suspended, self-aligning type is recommended. The dimensions and shape of the movable plate shall depend on the specimen dimensions and geometry. In general, both length and width of the movable plate should each be at least 20 % greater than the length and width of the specimens.

NOTE 4—Where the sample exhibits excessive surface irregularities or variation in thickness the plates may be modified to accommodate surface irregularities and thickness variations. This can be achieved by the insertion of a layer of hardening paste between the specimen and the plates. The surface of the specimen may require covering with a flexible film to inhibit the intrusion of the paste into the specimen. The hardened paste when fully cured must be well adhered to the loading plates and have compressive and shear strength properties at least a magnitude greater than the specimen to be tested.

6.4 *Variable Inclined Plates (Optional)*—Variable inclined plates or set angled blocks should be used to test the specimen under non-axial conditions. The test apparatus shall have one fixed plate and one movable plate. Fig. 1 shows set angled blocks with a movable base block with a roller system to allow lateral movement of the block during deformation (see 6.4.1). The base and top inclined plates can be adjustable angle plates. The inclined plates or set angled blocks must meet the requirements as stated in 6.3 of this test method. The base and top inclined plates or blocks must have a matched set of angles that differ by no more than 0.5 degrees. The incline plates or blocks shall be roughened or ribbed to keep specimen from sliding down the fixed plate or block during the test. The samples should be marked in regards to plates or blocks to check for slippage during the test. If mutual agreement is obtained between the manufacturer and user, other facings to the plates or blocks can be used. Allowable percent reduction in strength based on the load angle should also be agreed upon.

NOTE 5—The use of inclined plates or blocks may assist the manufacturer or user to evaluate the deformation of the geosynthetic(s) under loading at various angles. The use of inclined plates may not reflect the in-service performance of synthetic drainage systems.

6.4.1 **Warning**—The deformation of the geosynthetics within a testing apparatus may occur rapidly in a lateral direction (or not in the direction of loading) which could damage the testing apparatus. This is particularly true when the geosynthetic is tested using inclined plates. The user of this test method must be aware the testing apparatus' ability to handle a lateral movement of the geosynthetic or loading plate during the performance of this test.