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.

INTERNATIONAL

Designation: D7406 – 20

Standard Test Method for Time-Dependent Compressive Deformation Under Constant Pressure for Geosynthetic Drainage Products[1]

This standard is issued under the fixed designation D7406; 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 is used to determine the unconfined compressive deformation (consolidation) characteristics of drainage geotextiles, geocomposites, geonets, or any other geosynthetic associated with drainage at a constant temperature, when subjected to a constant compressive stress.

1.2 This test method is intended for use as an unconfined compressive performance deformation test only. For a detailed procedure on how to establish an index test, see EN ISO 25619-1. For performance tests, the specimen shall be subjected to the site-specific liquid, the site-specific stress (normal and potentially a tangential stress on the upper and parallel loading platen), or both.

NOTE 1—Results achieved from unconfined compressive performance deformation testing may differ from testing performed under confined conditions.

1.3 Because of the changing nature of the geosynthetic industry and the wide variety of products already available, this particular test method may have to be slightly modified for unconfined compression deformation testing of some products.

1.4 The values given in SI units are to be considered as the standard. The values given in parentheses are 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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A1030/A1030M Practice for Measuring Flatness Characteristics of Steel Sheet Products

D2990 Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics

D4439 Terminology for Geosynthetics

D5199 Test Method for Measuring the Nominal Thickness of Geosynthetics

D5261 Test Method for Measuring Mass per Unit Area of Geotextiles

D6364 Test Method for Determining Short-Term Compression Behavior of Geosynthetics

2.2 *ISO Standard:*[3]

EN ISO 25619-1 Geosynthetics—Determination of Compression Behavior—Part 1: Compressive Creep Properties

3. Terminology

3.1 For definitions related to geosynthetics, see Terminology D4439.

4. Summary of Test Method

4.1 In this performance test method, a geosynthetic drainage product is subjected to a sustained normal and potentially tangential stress. Deformations of the specimen are recorded at designated time intervals, and a graph is drawn.

4.2 The specimen may be immersed in a site-specific water or permeant, to simulate actual field conditions.

4.3 For long-term testing, it is recommended that the test be run for at least 1000 h. Seating times up to 10 000 h have been used, if that longer time data is required.

4.4 Deformation load (normal as well as potentially tangential) should reflect the actual field conditions.

4.5 The test will be conducted at site-specific temperatures.

---

[1] This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.02 on Endurance Properties.

Current edition approved Jan. 1, 2020. Published January 2020. Originally approved in 2007. Last previous edition approved in 2012 as D7406 – 07 (2012). DOI: 10.1520/D7406-20.

[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 International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

5. Significance and Use

5.1 The performance characteristics of a drainage geosynthetic are directly related to the integrity under compressive loading. If the product is sensitive to compressive deformation, its flow capacity could be greatly reduced or even shut off completely.

5.2 The deformation sensitivity of a candidate geosynthetic can be tested at field-simulated normal stress and potential tangential stresses.

5.3 This test method does not evaluate the effect of deformation of a geotextile filter or adjacent membrane.

5.4 Compression deformation, as it relates to reduction in flow capacity of a geosynthetic drainage product, is manufacturer and product specific. For example, a 10 % reduction in original thickness of a geonet made by Manufacturer A does not necessarily equal the same reduction in flow capacity as a 10 % reduction in thickness of the same or another type of geonet made by Manufacturer B.

5.5 This deformation data has merit directly to the end user, because it can be easily interpreted to result in a reduction factor for compressive deformation.[4] The reduction factor can then be used to derive an allowable flow rate.[5]

6. Apparatus

6.1 *Overall System*—Fig. 1 shows a compression deformation test setup. It consists of a loading platen, a normal stress assembly, potentially a tangential load assembly (not shown in Fig. 1), potentially a specimen container, and three gauges (one dial gauge shown in Fig. 1).

6.2 *Specimen Container*—The specimen container shall have a flat, rigid surface on which the base platen is placed. The container shall be deep enough to allow the test specimen to be completely immersed during testing. The container shall be large enough to hold a minimum specimen size of 150 by 150 mm (6.0 by 6.0 in.), but can have size of 300 by 300 mm (12.0 by 12.0 in.) or larger to ensure the test setup remains unconfined.

6.3 *Base Platen*—The base platen shall be rigid enough to resist bending and, in turn, support a uniform normal stress. A thick steel plate is advisable; steel is preferable given potential rusting once immersed in site-specific liquid. The base platen shall be placed in the specimen container to support the tested specimen. Practice A1030/A1030M provides a standard practice for measuring the flatness characteristics of steel sheet products, which is applicable here. When a tangential stress is applied, it is necessary to avoid any slippage of the tested specimen with the base platen (rough surfaces on the platen are recommended). Ideally, the base platen will be larger than the specimen size to support the specimen during draping and flexing under the stress assembly.

6.4 *Loading Platen*—The loading platen shall be rigid enough to resist bending and, in turn, apply a uniform normal stress. Planarity and maintaining flatness of the loading platen are important as well, especially when the normal stress is applied via a point load. Practice A1030/A1030M provides a practice of how to measure the flatness. When tangential stress is applied, it is necessary to avoid slippage of the tested specimen with the loading platen (rough surfaces on the platen are recommended). The loading platen shall be slightly larger than the specimen to provide even compression during the entire duration of the test. In addition, the loading platen will be attached to the stress assembly in such a way that no stress is placed on the specimen until the commencement of the test and the weight of which is included in the measurement of the applied stress when appropriate for the loading system used.

6.5 *Gauges*—At least three gauges accurate to 0.01 mm (0.0005 in.) shall be used to measure specimen deformation for the normal stress assembly. Alternatively, any device that can measure deformations to an accuracy of 0.01 mm (0.0005 in.) may be substituted for a gauge (for example, a linear variable differential transformer (LVDT)). If a tangential stress assembly is used, one digital gauge shall be used to measure the tangential deformation.

[4] Giroud, J.-P., Zhao, A., and Richardson, G. N., "Effect of Thickness Reduction on Geosynthetic Hydraulic Transmissivity," *Geosynthetics International*, Vol 7, Nos. 4–6, 2000, pp. 433–452.

[5] GRI GC-8 standard, "Standard Guide for Determination of the Allowable Flow Rate of a Drainage Geocomposite," 2001.

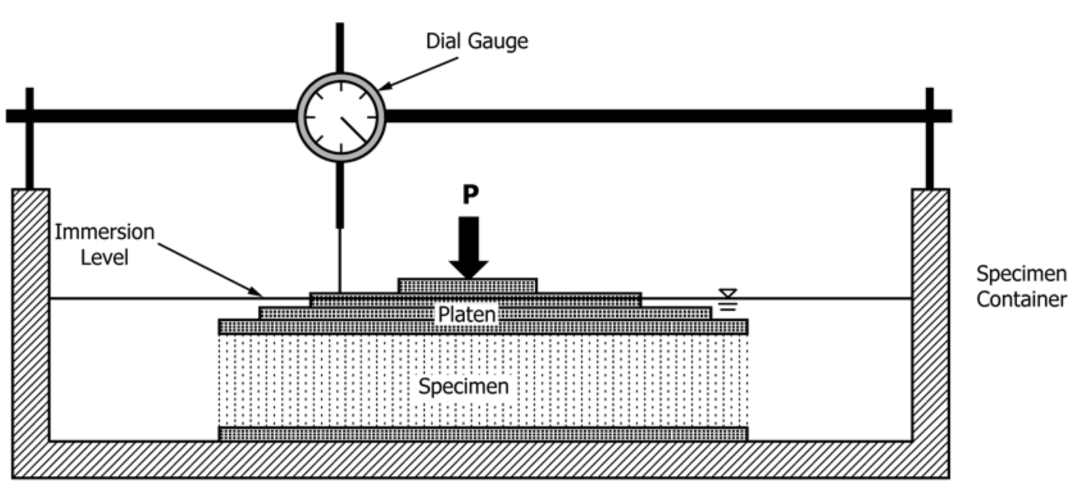

FIG. 1 Conceptual Apparatus Cross Section