Designation: D6637/D6637M – 15 (Reapproved 2023)

Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method[1]

This standard is issued under the fixed designation D6637/D6637M; 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 determination of the tensile strength properties of geogrids by subjecting strips of varying width to tensile loading.

1.2 Three alternative procedures are provided to determine the tensile strength, as follows:

1.2.1 *Method A*—Testing a single geogrid rib in tension (N or lbf).

1.2.2 *Method B*—Testing multiple geogrid ribs in tension (kN/m or lbf/ft).

1.2.3 *Method C*—Testing multiple layers of multiple geogrid ribs in tension (kN/m or lbf/ft).

1.3 This test method is intended for quality control and conformance testing of geogrids.

1.4 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.

1.5 *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]

D76/D76M Specification for Tensile Testing Machines for Textiles

D123 Terminology Relating to Textiles

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

D4439 Terminology for Geosynthetics

D5262 Test Method for Determining the Unconfined Tension Creep and Creep Rupture Behavior of Planar Geosynthetics Used for Reinforcement Purposes

3. Terminology

3.1 *Definitions:*

3.1.1 *atmosphere for testing geosynthetics, n*—air maintained at a relative humidity of 50 to 70 % and a temperature of 21 ± 2 °C [70 ± 4 °F].

3.1.2 *breaking force, (F), n*—the force at failure.

3.1.3 *corresponding force, n*—synonym for force at specified elongation.

3.1.4 *force at specified elongation, FASE, n*—a force associated with a specific elongation on the force-elongation curve (synonym for corresponding force).

3.1.5 *force-elongation curve, n*—in a tensile test, a graphical representation of the relationship between the magnitude of an externally applied force and the change in length of the specimen in the direction of the applied force (synonym for stress-strain curve).

3.1.6 *geogrid, n*—a geosynthetic formed by a regular network of integrally connected elements with apertures greater than 6.35 mm [¼ in.] to allow interlocking with surrounding soil, rock, earth, and other surrounding materials to primarily function as reinforcement. **D5262**

3.1.7 *geosynthetic, n*—a product manufactured from polymeric material used with soil, rock, earth, or other geotechnical

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

Current edition approved Nov. 15, 2023. Published November 2023. Originally approved in 2001. Last previous edition approved in 2015 as D6637/D6637M – 15. DOI: 10.1520/D6637_D6637M-15R23.

[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.

engineering related material as an integral part of a man-made project, structure, or system.

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

3.1.9 *integral, adj*—in geosynthetics, forming a necessary part of the whole; a constituent.

3.1.10 *junction, n*—the point where geogrid ribs are interconnected to provide structure and dimensional stability.

3.1.11 *rib, n*—for geogrids, the continuous elements of a geogrid which are interconnected to a node or junction.

3.1.12 *rupture, n*—for geogrids, the breaking or tearing apart of ribs.

3.1.13 *tensile, adj*—capable of tensions, or relating to tension of a material.

3.1.14 *tensile strength, (α_f), n*—for geogrids the maximum resistance to deformation developed for a specific material when subjected to tension by an external force. Tensile strength of geogrids is the characteristic of a sample as distinct from a specimen and is expressed in force per unit width.

3.1.15 *tensile test, n*—for geosynthetics, a test in which a material is stretched uniaxially to determine the force-elongation characteristics, the breaking force, or the breaking elongation.

3.1.16 *tension, n*—the force that produces a specified elongation.

3.2 For definitions of other terms used in this test method, refer to Terminologies D123 and D4439.

4. Summary of Test Method

4.1 *Method A*—In this method, a single representative rib specimen of a geogrid is clamped and placed under a tensile force using a constant rate of extension testing machine. The tensile force required to fail (rupture) the specimen is recorded. The ultimate single rib tensile strength (N or lbf) is then determined based on the average of six single rib tensile tests.

4.2 *Method B*—A relatively wide specimen is gripped across its entire width in the clamps of a constant rate of extension type tensile testing machine operated at a prescribed rate of extension, applying a uniaxial load to the specimen until the specimen ruptures. Tensile strength (kN/m or lbf/ft), elongation, and secant modulus of the test specimen can be calculated from machine scales, dials, recording charts, or an interfaced computer.

4.3 *Method C*—A relatively wide, multiple layered specimen is gripped across its entire width in the clamps of a constant rate of extension type tensile testing machine operated at a prescribed rate of extension, applying a uniaxial load to the specimen until the specimen ruptures. Tensile strength (kN/m or lbf/ft), elongation, and secant modulus of the test specimen can be calculated from machine scales, dials recording charts, or an interfaced computer.

5. Significance and Use

5.1 The determination of the tensile force-elongation values of geogrids provides index property values. This test method shall be used for quality control and acceptance testing of commercial shipments of geogrids.

5.2 In cases of dispute arising from differences in reported test results when using this test method for acceptance testing of commercial shipments, the purchaser and supplier should conduct comparative tests to determine if there is 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 which are as homogeneous as possible and which are from a lot of material of the type in question. 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 Student's t-test for unpaired data and an acceptable probability level chosen by the two parties before the testing began. If a bias is found, either its cause must be found and corrected or the purchaser and supplier must agree to interpret future test results in light of the known bias.

5.3 All geogrids can be tested by any of these methods. Some modification of techniques may be necessary for a given geogrid depending upon its physical makeup. Special adaptations may be necessary with strong geogrids, multiple layered geogrids, or geogrids that tend to slip in the clamps or those which tend to be damaged by the clamps.

6. Apparatus

6.1 *Testing Clamps*—The clamps shall be sufficiently wide to grip the entire width of the specimen (as determined by the test method) and with appropriate clamping power to prevent slipping or crushing (damage). For a given product, the same clamps shall be used in testing Methods A, B, and C prior to making any comparison between results.

6.1.1 *Size of Jaw Faces*—Each clamp shall have jaw faces measuring wider than the width of the specimen.

6.2 *Tensile Testing Machine*—A testing machine of the constant rate of extension type as described in Specification D76/D76M shall be used. The machine shall be equipped with a device for recording the tensile force and the amount of separation of the grips. Both of these measuring systems shall be accurate to ±1.0 % and, preferably, shall be external to the testing machine. The rate of separation shall be uniform and capable of adjustment within the range of the test.

6.3 *Distilled Water and Nonionic Wetting Agent,* shall be used for wet specimens only.

6.4 *Extensometer*—When required by the method, a device capable of measuring the distance between two reference points on the specimen without any damage to the specimen or slippage, care being taken to ensure that the measurement represents the true movement of the reference points. Examples of extensometers include mechanical, optical, infrared, or electrical devices.

7. Sampling

7.1 *Lot Sample*—Divide the product into lots and take the lot sample as directed in Practice D4354.