Designation: D 7003 – 03

Standard Test Method for Strip Tensile Properties of Reinforced Geomembranes[1]

This standard is issued under the fixed designation D 7003; 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 measure the strip tensile properties of reinforced geomembranes.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

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

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 76 Specification for Tensile Testing Machines for Textiles

D 4354 Practice for Sampling of Geosynthetics

D 4439 Terminology for Geosynthetics

3. Terminology

3.1 *Definitions*—Definitions of terms applying to this test method appear in Terminology D 4439.

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

3.1.2 *reinforced geomembrane*, *n*—a geomembrane internally reinforced with a textile.

3.1.3 *yarn*, *n*—a generic term for a continuous strand of textile fibers, filaments or material in a form suitable for knitting, weaving or otherwise intertwining to form a textile fabric.

4. Significance and Use

4.1 This method evaluates strip tensile properties of reinforced geomembranes for the purposes of quality control, quality assurance and research. In order to evaluate the full contribution of the reinforcement, testing is performed parallel to the directions of reinforcement. This method is an index test and is not intended for design purposes.

5. Apparatus

5.1 *Tensile Testing Machine*—Constant Rate of Extension (CRE) equipment meeting the requirements of Specification D 76. The load cell shall be accurate to within ±1 % of the applied force. The drive mechanism shall be able to control the rate of extension to within ±1 % of the targeted rate.

5.2 *Grips*—One of the grips must be self aligning to compensate for uneven distribution of force across the specimen. The clamping force and the clamp surfaces shall hold the specimen firmly without causing damage. The clamps shall be capable of gripping a 25 mm (1 in.) by 25 mm (1 in.) area. This can be accomplished by either using 25 mm (1 in.) square clamp faces or by using clamps with dimensions of 25 mm (1 in.) by greater than 25 mm (1 in.) and crossing the clamps in the grips so that only a 25 mm (1 in.) by 25 mm (1 in.) area is gripped.

5.3 *Recording Mechanism*—The testing machine shall be equipped with equipment capable of producing a hard copy of the force versus displacement curve. Electronic data acquisition with printer capabilities or direct recording devices are acceptable.

6. Sampling and Test Specs and Units

6.1 *Lot Sample*—For the lot sample, take rolls of geomembrane per the applicable project specification, or as agreed upon between purchaser and supplier. Unless otherwise specified, refer to Practice D 4354.

6.2 *Laboratory Sample*—For the laboratory sample, take a full-width swatch approximately 1 m (3 ft) long by roll width for each roll in the lot sample. Take a sample that will exclude material from the outer wrap of the roll or the inner wrap around the core. In the case where the sample is taken at the production site, material from the outer wrap may be used if it is undamaged.

6.3 *Test Specimens*—Prepare five specimens with the length of the specimen parallel to the machine direction (MD) and five specimens with the length parallel to the transverse direction (TD) for materials with the reinforcement running in those directions. If the reinforcement is aligned in any direction other than the machine or transverse directions, specimens shall be cut parallel to those directions and so noted in the report. Cut

[1] 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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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at sevice@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

the specimens such that different reinforcing yarns or strands are tested in each specimen. Specimens may be taken from the selvage as long as there are not more yarns in the selvage than in the rest of the product.

6.4 The specimens shall be 25 mm (1 in.) wide by at least 150 mm (6 in.) long (test direction). Test specimens shall be cut parallel to the direction of reinforcement being tested. Reinforcement in the test direction should be continuous so the same strands of reinforcement can be gripped in both clamps. This is a critical point since the tensile strength is significantly reduced if the reinforcing yarns are not all continuous from one clamp to the other. Each specimen is to be inspected for cut test direction yarns. If it is not possible to prepare the specimens without cutting test direction yarns, it shall be so noted in the report.

7. Conditioning

7.1 *Conditioning*—Specimens may be tested once they have equilibrated at standard laboratory temperature. The time required to reach temperature equilibrium may vary according to the manufacturing process, material type and material thickness.

7.2 *Test Conditions*—Conduct tests at the standard atmosphere for testing geosynthetics, a temperature of 21 ± 2°C (70 ± 4°F) and a relative humidity between 50 to 70 %, unless otherwise specified.

8. Procedure

8.1 Set the distance between the gripping portion of the clamps 75 mm (3 in.) apart.

8.2 Clamp a specimen so that the specimen is centered in the clamps with the sides of the clamps being parallel to the tested reinforcement.

8.3 Elongate the specimen at a test speed of 300 mm/min (12 in./min) until both the reinforcement and the polymeric film or sheet has failed, recording the load-extension curve. If the specimen slips in the clamps, breaks in the clamps, breaks at the edges of the clamps, the scrim pulls out and does not break, or if for any reason attributable to faulty operation, the result falls markedly below the average for the set of specimens, discard the result and test an additional specimen.

8.4 Record peak load, grip separation at peak load, load at final break and grip separation at final break.

8.5 Repeat the procedure for the remaining specimens.

9. Calculation

9.1 Calculate peak strength in force per unit width, kN/m (lb/in.), by dividing the maximum load by the original width of the specimen.

9.2 Calculate elongation by dividing the grip movement by 75 mm (3 in.), multiplying by 100 % and reporting in percent.

9.3 Calculate the average and standard deviation for peak strength, elongation at peak strength, load at final break and elongation at final break. Calculate the results for each test direction separately.

10. Report

10.1 Report the following information:

10.1.1 Complete identification of the material tested,

10.1.2 The direction of testing if other than MD and TD,

10.1.3 Any deviation of the specified test procedure,

10.1.4 Any inability to prepare the tested specimens without cutting the reinforcing scrim in the test direction, and

10.1.5 The average and standard deviation for peak strength, elongation at peak strength, elongation at final break and strength at final break. Report each test direction results separately.

11. Precision and Bias

11.1 No precision and bias has been established yet for this test standard.

12. Keywords

12.1 geomembrane; reinforced; strip tensile; tensile