Designation: D 6818 – 02

Standard Test Method for Ultimate Tensile Properties of Turf Reinforcement Mats[1]

This standard is issued under the fixed designation D 6818; 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 strip test procedures for determining the tensile properties of Turf Reinforcement Mats (TRM).

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

1.3 This standard does not apply to TRM's made of composite materials where the component providing the reinforcement cannot be tested for tensile strength with the procedure herein described. In this case, the established ASTM testing method, which is most appropriate for that material, shall be used instead.

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

2. Referenced Documents

2.1 *ASTM Standards:*

D 76 Specification for Tensile Testing Machines for Textile[2]

D 123 Terminology Relating to Textiles[2]

D 1776 Practice for Conditioning Textiles for Testing[2]

D 4439 Terminology for Geosynthetics[3]

D 5035 Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Force)[4]

3. Terminology

3.1 *Definitions:*

3.1.1 *breaking load, n*—the maximum force applied to a specimen in a tensile test carried to rupture.

3.1.1.1 *Discussion*—Materials that are brittle usually rupture at the maximum force. Materials that are ductile usually experience a maximum force before rupturing.

3.1.2 *constant rate of extension (CRE) tensile testing machine*—a testing machine in which the rate of increase of specimen length is uniform with time.

3.1.3 *elongation, n*—the ratio of the extension of a material to the length of the material prior to stretching. (Compare *extension*.)

3.1.4 *extension, n*—the change in length of a material due to stretching. (Compare *elongation*.)

3.1.5 *rupture, v*—the act of bursting.

3.1.6 *strip test, n*—in TRM testing, a tensile test in which the full width of the specimen is gripped in the clamps.

3.1.7 *tensile test, n*—in geosynthetics, a test in which a geosynthetic material is stretched in one direction to determine the force - elongation characteristics, the breaking force, or the breaking elongation.

4. Summary of Test Method

4.1 A test specimen is clamped in a tensile testing machine and a force applied to the specimen until it breaks. Values for the breaking force and elongation of the test specimen are obtained from machine scales, dials, autographic recording charts, or a computer interfaced with the testing machine. Also, points along the stress/strain curve can be reported.

5. Significance and Use

5.1 The strip test in this test method is considered satisfactory for acceptance testing of commercial shipments of Turf Reinforcement Mats since the method has been used extensively in the trade for acceptance testing.

5.1.1 In case of disagreement arising from differences in reported test values 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, the two parties should take a group of test specimen which are as homogeneous as possible and are from a lot of material of the type in question. The test specimen 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 testing is begun. If bias is found, either its cause must be found

[1] This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.05 on Geosynthetic Erosion Control.

Current edition approved July 10, 2002. Published October 2002.

[2] *Annual Book of ASTM Standards*, Vol 07.01.

[3] *Annual Book of ASTM Standards*, Vol04.13.

[4] *Annual Book of ASTM Standards*, Vol 07.02

and corrected, or the purchaser and the supplier must agree to interpret future results in the light of the known bias.

6. Apparatus

6.1 *Tensile Testing Machine*, of the Constant Rate of Extension (CRE) type conforming to Specification D 76, with respect to force indication, working range, capacity, and elongation indicator and designed for operation at a speed of 300 ± 10 mm/min (12 ± 0.5 in./min).

6.2 *Clamps and Jaw Faces*—Each jaw face shall be smooth, flat, and with a metallic or other agreed upon surface. The faces shall be parallel and have machining centers with respect to one another in the same clamp and to the corresponding jaw face of the other clamp. The jaw faces shall measure at least 10 mm (0.5 in.) wider than the specimen being tested and at least 25 mm (1.0 in.) in height.

7. Sampling

7.1 *Lot Sample*—Take a lot sample as directed in the applicable material specifications.

7.2 *Laboratory Sample*—From each roll or piece of TRM taken from the lot sample, cut at least one laboratory sample the full width of the TRM and 1 m (1 yd) along the edge in the machine direction.

7.3 *Test Specimen*—From each laboratory sample, take five specimens from each direction for each test.

7.4 Cut specimens with their long dimension parallel either to the machine direction or to the cross machine direction, or cut specimens for testing both directions as required. Unless otherwise specified, take specimens no nearer to the machine direction edge of the TRM than one tenth of the width of the TRM.

7.5 Cut each specimen 100 mm (4 in.) wide, by at least 150 mm (6 in.) long.

NOTE 1—The length of the specimen depends on the type of clamps being used. The specimen should be long enough to extend through the clamps and project at least 12.5 mm (½ in.) at each end and provide a gage length of 75 mm.

8. Conditioning

8.1 Bring the specimens to the moisture and temperature equilibrium in the atmosphere for testing TRM's, that is a temperature of 21 ± 2°C (70 ± 4°F) and a relative humidity of 60 ± 10 %.

9. Procedure

9.1 Set gage length to 75 mm.

9.2 Mount the specimen securely in the clamp of the testing machine. Take care that the specimen is centrally located and that the long dimension is as nearly parallel as possible to the direction of force application. Be sure that the tension on the specimen is uniform across the clamped width. Clamps which are too tight will produce breaks at the clamp line; clamps which are too loose will cause slippage.

9.3 Operate the machine and break the specimen. The rate of extension should be 300 ± 10 mm/min.

9.4 Read the breaking force and elongation, from the mechanism provided for such purpose. Record machine and cross machine direction results separately. If desired, additional points along the stress/strain curve can be recorded as well.

9.5 For some machines, data may be obtained using an interfaced computer.

9.6 If a specimen slips in the jaws, or breaks at the edge of or in the jaws, or if for any reason the results falls markedly below the average of the set of specimens, discard the result and take another specimen. Continue this until the required numbers of breaks have been obtained.

NOTE 2—It is difficult to determine the precise reason that certain specimens break near the edge of the jaws. If such a break is by damage to the specimen by the jaws, then the results should be discarded. If, however, the break is merely due to randomly distributed weak places, it is a legitimate result. In some cases, it may also be caused by a concentration of stress in the area adjacent to the jaws because the jaws prevent the specimen from contracting in the width as the force is applied. In such cases, a break near the edge of the jaw is inevitable and should be accepted as a characteristic of the particular method of test.

10. Calculation

10.1 *Breaking Force per Unit Width*—For each laboratory sample, calculate the average of the breaking force observed for all acceptable specimens, that is, the maximum force exerted on the specimen as read directly from the testing machine indicating mechanism and divide this force by the width of the strip. The resulting value is expressed in Kilo Newtons/Meter.

10.2 *Elongation*—For each laboratory sample, calculate the average of the elongation observed for all acceptable specimens, that is, the elongation that corresponds to the maximum force as stated above, as read directly from the testing machine indicating mechanism. The elongation is expressed in percent.

11. Report

11.1 State that the specimens were tested as directed in Test Method D 6818. Describe the material or product sampled and the method of sampling used.

11.2 Report the following for each laboratory sample:

11.2.1 The average breaking force per unit width of acceptable specimens for each test.

11.2.2 The average elongation at break of acceptable specimens for each test.

11.2.3 Number of specimens tested in each direction.

11.2.4 Size of jaw faces used.

12. Precision and Bias

12.1 *Precision*—The precision of the strip tensile test procedure of this test method is being established.

12.2 *Bias*—The true value of the breaking force and elongation of fabric can be defined only in terms of specific test methods. Within this limitation, the procedure in this test method has no known bias.

13. Keywords

13.1 breaking force; elongation; turf reinforcement mat