Designation: ~~D6818 – 17~~ D6818 – 18

Standard Test Method for Ultimate Tensile Properties of Rolled Erosion Control Products[1]

This standard is issued under the fixed designation D6818; 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 rolled erosion control products (RECPs).

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 RECPs 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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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

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

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

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.

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[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.

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[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.

3.1.6 *strip test, n*—in RECP 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 rolled erosion control products 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~~At a minimum, the two parties should take a group of test specimens which are as homogeneous as possible and 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 testing is begun. If bias is found, either its cause must be found 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 D76/D76M, 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*—In the absence of other guidelines, divide the product into lots and take lot samples in accordance with Practice D4354.

7.2 *Laboratory Sample*—For the laboratory sample, take a full-width sample of sufficient length in the machine direction so that the required size and number of specimens can be obtained. Exclude the inner and outer layers or wraps of the roll or any material containing folds, crushed areas, or other distortions not representative of the sampled lot.

7.3 Remove test specimens from the laboratory sample so that each specimen will contain different machine and cross-machine elements with no specimen taken nearer than 100 mm (4 in.) from the roll sides or ends, unless otherwise specified.

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 RECP than one-tenth of the width of the RECP. 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 (0.5 in.) at each end and provide a gage length of 75 mm (3.0 in.).

7.5 *Number of Specimens*—Unless otherwise agreed upon, as when provided in an applicable material specification, take the number of test specimens per laboratory sample as follows:

7.5.1 *Reliable Estimate of* v—When there is a reliable estimate of *v* based upon extensive part records for similar materials tested in the user's laboratory as directed in this test method, calculate the required number of specimens as follows so that the user may expect at the 95 % probability level that the test result is not more than 5.0 % of the average above or below the average of the sample:

$$n = (t\ v/A)^2 \tag{1}$$

where:

n = number of test specimens (rounded upward to a whole number),
v = ~~coefficient of variation of individual observations on similar materials in the user's laboratory under conditions of single operation precision, %,~~

v = coefficient of variation of individual observations on similar materials in the user's laboratory under conditions of single-operator precision, %,
t = value of Student's t for one-sided limits, a 95 % probability level, and the degrees of freedom associated with the estimate of v (see Table 1), and
A = 5.0 % of the average, the value of the allowable variation.

7.5.2 *No Reliable Estimate of* v—When there is no reliable estimate of v for the user's laboratory, measurements shall be made on a minimum of five (5) specimens per laboratory sample.

8. Conditioning

8.1 Bring the specimens to the moisture and temperature equilibrium in the atmosphere for testing rolled erosion control products, 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 of the gage length should be 300 ± 10 mm/min (12 ± 0.5 in./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~~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 result 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~~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 kilonewtons/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 as a percentage.

11. Report

11.1 State that the specimens were tested as directed in Test Method D6818. Describe the material or product sampled and the method of sampling used.

TABLE 1 Values of Student's *t* for One-Sided Limits and the 95 % Probability

df	One-Sided	df	One-Sided	df	One-Sided
1	6.314	11	1.796	22	1.717
2	2.920	12	1.782	24	1.711
3	2.353	13	1.771	26	1.706
4	2.132	14	1.761	28	1.701
5	2.015	15	1.753	30	1.697
6	1.943	16	1.746	40	1.684
7	1.895	17	1.740	50	1.676
8	1.860	18	1.734	60	1.671
9	1.833	19	1.729	120	1.658
10	1.812	20	1.725	∞	1.645