Designation: D 4886 – 88 (Reapproved 1995)ε1

Standard Test Method for Abrasion Resistance of Geotextiles (Sand Paper/Sliding Block Method)[1]

This standard is issued under the fixed designation D 4886; 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.

ε[1] NOTE—Paragraph 3.1.1 was corrected.

1. Scope

1.1 This test method covers the determination of resistance of geotextiles to abrasion using an abrasion tester. This test method at this point has only been evaluated for geotextiles—not geomembranes, grids, etc. Therefore, the test method is designated for geotextiles, not geosynthetics, as all products may not lend themselves to this test method for abrasion. If later developments indicate a wider scope for this test method, appropriate changes will be made.

1.2 The values stated in SI units are to be regarded as standard. The values given in inch-pound units are provided as 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:*

D 123 Terminology Relating to Textiles[2]

D 1682 Test Methods for Breaking Load and Elongation of Textile Fabrics[3]

D 1776 Practice for Conditioning Textiles for Testing[2]

D 4354 Practice for Sampling of Geosynthetics for Testing[4]

D 4439 Terminology for Geosynthetics[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *atmosphere for testing geotextiles*, *n*—air maintained at a relative humidity of 65 ± 5 % and a temperature of 21 ± 2°C (70 ± 4°F). **D 4439**

3.1.2 *abrasion*, *n*—the wearing away of any part of a material by rubbing against another surface. **D 123**

3.1.3 *geotextiles*, *n*—any permeable textile used with foundation, soil, rock, earth, or any other geotechnical engineering related material as an integral part of a man-made project, structure, or system. **D 4439**

3.1.4 For definitions of other terms used in this test method, refer to Terminologies D 123 or D 4439.

4. Summary of Test Method

4.1 A test specimen, mounted on a stationary platform is rubbed by an abradant with specified surface characteristics. Under controlled conditions of pressure and abrasive action, the abradant is rubbed on a horizontal axis using a uniaxional motion. Resistance to abrasions is expressed as a percentage of original strength before abrading.

5. Significance and Use

5.1 This test method may be used for acceptance testing of commercial shipments of geotextiles, but caution is advised since information on the precision of the test is lacking. Comparative testing as directed in 5.1.1 may be advisable.

5.1.1 In case of a dispute arising from differences in reported test results when using this test method, the purchaser and the 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 that are as homogeneous as possible and that 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 is begun. If a bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results in light of the known bias.

5.2 The resistance of abrasion is also greatly affected by the conditions of the tests, such as the nature of abradant, variable action of the abradant over the area of specimen abraded, the tension of the specimen, the pressure between the specimen and abradant, and the dimensional changes in the specimens.

5.3 The resistance of geotextile materials to abrasion as measured on a testing machine in the laboratory is generally

[1] This test method is under the jurisdiction of ASTM Committee D-35 on Geosynthetics and is the direct responsibility of Subcommittee D35.02 on Endurance Properties.

Current edition approved Nov. 25, 1988. Published January 1989.

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

[3] Discontinued—See 1991 *Annual Book of ASTM Standards*, Vol 07.01.

[4] *Annual Book of ASTM Standards*, Vol 04.09.

only one of several factors contributing to performance or durability as experienced in the actual use of the material. While "abrasion resistance" and" durability" are frequently related, the relationship varies with different end uses, and different factors may be necessary in any calculation of predicted durability from specific abrasion data. Laboratory tests may be reliable as an indication of relative end-use performance in cases where the difference in abrasion resistance of various materials is large, but they should not be relied upon for prediction of actual in-situation life in specific end uses unless there are data showing the specific relationship between laboratory abrasion tests and actual in-situation life in the intended end-use.

5.4 These general observations apply to all types of fabrics, including woven, nonwoven, and knit fabrics.

5.5 If there is a disagreement arising from differences in values reported by the purchaser and the seller when using this test method for acceptance testing, the statistical bias, if any, between the laboratory of the purchaser and the laboratory of the seller should be determined with each comparison being based on testing specimens randomly drawn from one sampling unit of material of the type being evaluated.

6. Apparatus

6.1 *Abrasion Tester,*[5] having the following essential parts:

6.1.1 *Balanced Head and Block Assembly*—The assembly should be two parallel, smooth plates, one of which makes a reciprocating motion. The speed of the reciprocating plate should be adjustable between 10 and 115 double strokes per minute. The stroke length should be 25 mm (1 in.). The second plate is rigidly supported by a double-lever assembly to provide free movement in a direction perpendicular to the reciprocating plate. This plate is stationary during the test and must be well balanced so that a vertical load can be maintained by means of dead weights. Both plates are equipped with clamps at each end to hold the test sample and the abrading medium. The clamps have gripping surfaces adequate to prevent slippage of the specimen or the abrading material during the test.

6.1.2 *Indicator*—Means should be provided for indicating the number of cycles (1 cycle = 1 double stroke).

6.1.3 *Weights*—Weights should be provided for applying a vertical load to the specimen.

7. Sampling

7.1 *Lot Sample*—As a lot sample for acceptance testing, or routine product evaluation, take at random the number of rolls of fabric directed in an applicable material specification or other agreement between the purchaser and the supplier, such as agreement to use Practice D 4354. Consider rolls of fabric to be the primary sampling unit.

NOTE 1—Abrasion testing is a nonroutine quality control test for geotextiles and will not normally be performed on every lot by the manufacturer or supplier. When testing for abrasion is performed, however, the sampling should be as described in Section 7.

[5] An abrasion tester, available from Custom Scientific Instrument Inc., 13 Wing Drive, Cedar Knolls, NJ 07927, or its equivalent, has been found satisfactory for this purpose.

7.2 *Laboratory Sample*—Take for the laboratory sample, a swatch extending the width of the fabric and approximately 1 m (39 in.) along the selvage from each roll in the lot sample. The swatch may be taken from the end portion of a roll provided there is no evidence that it is distorted or different from other portions of the roll. In cases of dispute, take a swatch that will exclude fabric from the outer wrap of the roll or the inner wrap around the core.

7.3 *Test Specimens*—From each swatch in the laboratory sample, prepare two sets of specimens each containing five specimens. Cut rectangular specimens 75 by 200 ± 1 mm (3 by 8 ± 1/16 in.). Cut the set of specimens to be tested in the machine direction with the longer dimension parallel to the machine direction and the set of specimens to be tested in the cross-machine direction with the longer dimension in the cross-machine direction. Take each set of specimens from a swatch along a diagonal so that they will be taken from different positions across the length and width of the swatch. Take no specimens nearer to the selvage than 1/20th of the fabric width or 150 mm (6 in.), whichever is the smaller.

8. Conditioning

8.1 Bring the specimens to moisture equilibrium in the atmosphere for testing geotextiles. Equilibrium is considered to have been reached when the increase in mass of the specimen in successive weighings made at intervals of not less than 2 h does not exceed 0.1 % of the mass of the specimen.

NOTE 2—It is recognized that in practice geotextile materials are frequently not weighed to determine when moisture equilibrium has been reached. While such a procedure cannot be accepted in cases of dispute, it may be sufficient in routine testing to expose the material to the standard atmosphere for testing for a reasonable period of time before the specimens are tested. A time of at least 24 h has been found acceptable in most cases. However, certain fibers may show slow equalization rates when they are received on the wet side of equilibrium. When it is known that a fiber loses moisture slowly when approaching equilibrium from the wet side, a preconditioning cycle, as described in Method D 1776, may be agreed upon between contractual parties.

8.2 Immerse specimens to be tested in the wet condition in water, maintained at a temperature of 21 ± 2°C (70 ± 4°F). The time of immersion must be sufficient to wet-out the specimens thoroughly, as indicated by no significant change in strength or elongation following a longer period of immersion, and at least 2 min. To obtain thorough wetting, it may be necessary or advisable to add not more than 0.05 % of a nonionic neutral wetting agent to the water.

9. Procedure

9.1 Test the conditioned specimen in the standard atmosphere for testing geotextiles, as described in Section 8 of this test method.

9.2 Place the specimen to be tested in the upper (stationary) plate and secure it by means of the clamp at each end of the plate. Place the abrading medium on the lower (reciprocating) plate and secure it by means of the clamp at each end of the plate. Use Emory cloth equal to 100-grit as the abrading medium unless specified otherwise by a material specification.

NOTE 3—When testing nonwoven geotextiles, secure the edges of the test specimen to the stationary plate by using double-back tape or some

other type adhesive. This prevents deformation ("neckdown") of the specimen during the abrasion test.

9.3 Lower the top plate onto the bottom plate by releasing the support pin for the top plate. Be sure the abrading medium and the specimen are properly aligned.

9.4 Load the pressure (top) plate with a 1-kg load unless specified otherwise by a material specification.

9.5 Start the tester and operate at a speed of 30 cpm unless specified otherwise in an applicable material specification.

9.6 Operate the tester at the specified speed for 250 cycles or as agreed upon in an applicable materials specification or until the specimen ruptures.

NOTE 4—If a specimen ruptures before the specified number of cycles is reached, report that the specimen ruptured and the number of cycles completed at the time of rupture.

9.7 If the specimen or the abrading material slips in the clamps, discard the specimen and test another specimen after adjustments are made.

9.8 Check the abrading medium for wear after each test. Replace every 1250 cycles (5 specimens) or as needed to accommodate wear.

9.9 Determine the end point by the following method:

9.9.1 *Percentage Loss in Breaking Load*—Abrade the specimen a specified number of cycles, after which determine the breaking load using the 50-mm (2-in.) raveled-strip or cut-strip procedure in Test Methods D 1682, with the exception of a gage length of 100 mm (4 in.) and an extension rate of 300 mm (12 in.)/min. The abraded area of the specimen should be placed midway between the clamps of the machine. Compare this breaking load with the breaking load determined under the same conditions on an unabraded portion of the sample. Calculate the loss in breaking load and report to the nearest 1.0 % using Eq 1:

$$\text{loss on breaking load, \%} = 100\,(A - B)/A \quad (1)$$

where:

A = breaking load before abrasion, and
B = breaking load, after abrasion.

10. Report

10.1 Report that the tests were performed as directed in Test Method D 4886. Describe the material(s) or product(s) sampled and the method of sampling used.

10.2 Report the following applicable items:

10.2.1 Average of the loss in breaking load, in percent, for each direction,

10.2.2 Test conditions if different from those specified in this test method,

10.2.3 Number of specimens tested for each direction,

10.2.4 Number of specimens which ruptured, if any, before the specified number of cycles was reached and the number of cycles completed before rupture, and

10.2.5 Any modification of test specimens as manufactured, or test method as described.

11. Precision and Bias

11.1 *Precision*—The precision of this test method is being established.

11.2 *Bias*—The procedure in this test method has no bias because the value of that property can be defined only in terms of a test method.