Designation: D4355 – 07

StandardTest Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus[1]

This standard is issued under the fixed designation D4355; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the determination of the deterioration in tensile strength of geotextiles by exposure to xenon arc radiation, moisture, and heat.

1.2 The light and water exposure apparatus employs a xenon-arc light source.

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]

D123 Terminology Relating to Textiles
D1898 Practice for Sampling of Plastics
D4439 Terminology for Geosynthetics
D5035 Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
G113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials
G141 Guide for Addressing Variability in Exposure Testing of Nonmetallic Materials
G151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources
G155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *geotextile*—any permeable textile material used with foundation, soil, rock, earth, or any other geotechnical engineering related material that is an integral part of a man-made product, structure, or system.

3.2 *Definitions:*

3.2.1 For definitions of other textile terms used in this test method, refer to Terminology D123, for geotextile terms refer to Terminology D4439.

3.2.2 The definitions given in Terminology G113 are applicable to this standard.

4. Summary of Test Method

4.1 Five specimens of a geotextile for the machine direction and for the cross machine direction are exposed in a xenon arc device for each of the following times: 0 (control specimens), for 150, 300, and 500 h. The exposure consists of 120-min cycles as follows: 90 min of light only at 65 ± 3°C uninsulated black panel temperature and 50 ± 5% relative humidity, followed by 30 min of light plus water spray.

4.2 After each exposure period, the specimens are subjected to a cut or ravel strip tensile test. The average breaking strength in each direction is compared with the average breaking strength in each direction of the control specimens. The percent strength retained is plotted versus exposure period to produce a degradation curve for the specimens from each direction.

5. Significance and Use

5.1 This method is intended to induce property changes associated with end use conditions, including the effects of solar radiation, moisture and heat. The exposure used is not intended to simulate the deterioration caused by localized weather phenomena such as atmospheric pollution, biological attack, and salt water exposure.

5.2 The relation between time to failure in an exposure conducted in accordance with this test method, and service life in a specific outdoor environment requires determination of an acceleration factor as defined in Terminology G113. The acceleration factor is material-dependent and is only valid if it is based on data from a sufficient number of separate exterior

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

Current edition approved April 1, 2007. Published May 2007. Originally approved in 1984. Last previous edition approved in 2005 as D4355 – 05. DOI: 10.1520/D4355-07.

[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.

and laboratory-accelerated exposures so that the results used to relate times to failure in each exposure can be analyzed using statistical methods.

NOTE 1—An example of a statistical analysis using multiple laboratory and exterior exposures to calculate an acceleration factor is described by J. A. Simms.[3] See Practice G151 for more information and additional cautions about the use of acceleration factors.

5.2.1 The deterioration curve obtained from the results of this test method enables the user to determine the tendency of a geotextile to deteriorate when exposed to xenon arc radiation, water and heat.

5.3 Variation in results may be expected when operating conditions are varied within the accepted limits of this test method. Its intended use is as a qualitative assessment of the presence of ultraviolet inhibitors, and comparison of that influence between products. However, no inference to the time of stability should be implied by the test results to the relation between time duration and outdoor exposure.

NOTE 2—Information on sources of variability and on strategies for addressing variability in the design, execution and data analysis of laboratory accelerated exposure tests is found in Guide G141.

5.3.1 If it becomes necessary for the purchaser and seller to use this test method for acceptance testing, the statistical bias, if any, between the purchaser's and seller's laboratories should be determined. Such comparison is to based on specimens randomly drawn from the sample of geotextile being evaluated.

5.3.2 In such cases, 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 started. 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 the light of the known bias.

6. Apparatus

6.1 *Xenon-Arc Apparatus,* with daylight filters conforming to Practices G151 and G155.

NOTE 3—Previous versions of this standard referenced in Practice G26which describes specific equipment designs of xenon arc devices. Practice G26 has been replaced by Practice G151, which gives performance criteria for all devices that use laboratory light sources, plus Practice G155, which gives requirements for exposure of nonmetallic materials in xenon arc devices.

6.1.1 The apparatus must be capable of exposing the specimens to cycles of light only, followed by light and moisture as water spray.

6.2 *Strength Testing Apparatus* , conforming to that described for a 2-in. cut or ravel strip test, as described in Test Methods D5035.

7. Sampling

7.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls of fabric directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider rolls of fabric to be the primary sampling units. If the specification requires sampling during manufacture, select the rolls for the lot sample at uniformly spaced time intervals throughout the production period.

NOTE 4—An adequate specification or other agreement between the purchaser and the supplier requires taking into account the variability between rolls of fabric, and between specimens from a swatch from a roll of fabric, so as to provide a sampling plan with a meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

7.2 *Laboratory Sample*—Take for the laboratory sample a sample extending the full width of the fabric of sufficient length along the selvage from each sample roll such that the requirements of 8.1 are met. The sample shall exclude material from the outer wrap of the roll or the inner wrap around the core unless the sample is taken at the production site, at which point inner and outer wrap material may be used.

8. Specimen Preparation

8.1 Take two, one-metre square portions from the laboratory sample. Each shall be no closer to the selvage than 1/10 the sample width. One is to be used for machine direction specimens, the other for cross machine direction specimens.

NOTE 5—Since the thickness of a specimen may markedly affect test results, thickness of the replicate specimens shall be within ± 10% of the nominal dimensions. This is especially important when mechanical properties are being investigated.

8.2 Use template illustrated in Fig. 1 to identify potential specimens from which the actual specimens are drawn. To select these actual specimens randomly draw 20 specimens from both the machine and cross directions measuring 50 by 150 mm (2 by 6 in.) from the one-metre square portions of each laboratory sample as directed in Practice D1898.

NOTE 6—In the event that roller grips are used to hold the specimens in the tensile testing machine, specimens must be longer than the 150 mm

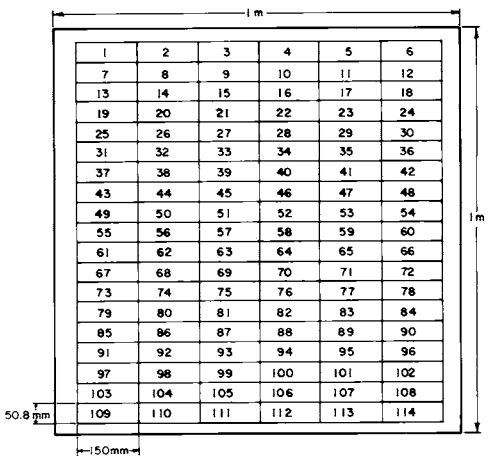

FIG. 1 Specimen Selection Template

[3] Simms, J.A., *The Journal of Coatings Technology*, Vol 50, 1987, pp. 45-53.