Designation: D 6214 – 98 (Reapproved 2003)

Standard Test Method for Determining the Integrity of Field Seams Used in Joining Geomembranes by Chemical Fusion Methods[1]

This standard is issued under the fixed designation D 6214; 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 an accelerated, destructive test method for geomembranes in a geotechnical application.

1.2 This test is applicable to field fabricated geomembranes that are scrim reinforced or non reinforced.

1.3 This test method is applicable for field seaming processes that use a chemical fusion agent or bodied chemical fusion agent, as the seaming mechanism.

1.4 Subsequent decisions as to seam acceptance criteria are made according to the site-specific contract plans, specification and CQC/CQA documents.

1.5 The values stated in both inch-pound and SI units are to be regarded separately as the standard. The values given in parentheses are for information only.

1.6 *Hazardous Materials*—Always consult the proper Material Safety Data Sheets for any Hazardous materials used for proper ventilation and protection. The use of the oven in this test method may accelerate fume production from the test specimen.

1.7 *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 applicable of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 413 Test Methods for Rubber Property—Adhesion to Flexible Substrate

D 638 Test Method for Tensile Properties of Plastics

D 751 Test Method for Coated Fabrics

D 882 Test Methods for Tensile Properties of Thin Plastic Sheeting

D 4439 Terminology for Geosynthetics

2.2 *ANSI/NSF Standard:*

ANSI/NSF Standard 54[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *bodied chemical agent, n*—a chemical fluid containing a portion of the parent geomembrane polymer, that dissolves the surface of the geomembrane to be bonded.

3.1.2 *bodied-chemical fusion seams, n*—use of a bodied chemical agent to dissolve the surfaces of the geomembrane for bonding.

3.1.2.1 *Discussion*—Heat and pressure are commonly used as part of the bodied chemical fusion process.

3.1.3 *chemical agent, n*—a chemical fluid that dissolves the surface of the geomembrane to be bonded.

3.1.4 *chemical fusion seams, n*—use of a chemical agent to dissolve the surface of the geomembrane for bonding.

3.1.4.1 *Discussion*—Heat and pressure are commonly used as part of the chemical fusion process.

4. Significance and Use

4.1 *Significance*— The increased use of geomembranes as barrier materials to restrict fluid migration from one location to another in various applications, and the various types of seaming methods used in joining geomembrane sheets, has created a need to standardize tests by which the various seams can be compared and the quality of the seam systems can be evaluated. This test method is intended to meet such a need.

4.2 *Use*—Accelerated seam test provides information as to the status of the field seam. Data obtained by this test method should be used with site-specific contract plans, specification and CQC/CQA documents. This test method is useful for specification testing and for comparative purposes, but does not necessarily measure the ultimate strength that the seam may acquire.

[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 service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

5. Apparatus

5.1 A testing machine of the constant-rate-of-cross head-movement type comprising essentially of the following:

5.1.1 *Fixed Member*— A fixed or essentially stationary member carrying one grip.

5.1.2 *Movable Member*— A movable member carrying a second grip.

5.1.3 *Grips*—Grips for holding the test specimen between the fixed member and the movable member and minimizes both slippage and uneven stress distribution. The grips shall be self-aligning so that they shall be attached to the fixed and movable member, respectively, in such a manner that they will move freely into alingment as soon as any load is applied, so that the long axis of the test specimen will coincide with the direction of the applied pull through the center line of the grip assembly.

NOTE 1—Grips lined with thin rubber, crocus-cloth or pressure-sensitive tape as well as file-faced or serrated grips have been successfully used for many materials. The choice of grip surface will depend on the manterial tested, thickness, etc.

5.1.4 *Drive Mechanism*— A drive mechanism for imparting to the movable member in uniform, controlled velocity with respect to the stationary member. Unless otherwise specified in the material specification, the mechanism shall be capable of and adjusted so that the movable member shall have a uniform speed of 50 mm/min, (2 in. min), 300 mm/min (12 in./min), and 500 mm/min (20 in./min.)

5.1.5 *Load Indicator*— A suitable load-indicating mechanism capable of showing the total tensile load carried by the test specimen when held by the grips. This mechanism shall be essentially free of inertia lag at the specified rate of testing and shall indicate the load with an accuracy of ± 1 % of the indicated value or better.

5.1.6 *Extension Indicator (Extensometer) (If Employed)*—A suitable instrument shall be used for determining the distance between two designated points within the gage length of the test specimen as the specimen is stretched and shall conform to requirements specified in Test Method D 638.

5.2 *Oven*—An oven of sufficient size to hold a rack containing at least three 30 cm (12 in.) wide test strip samples for accelerated curing is necessary. The oven should be a forced convection oven and must be capable of maintaining a temperature of 50°C (122°F) ± 3°C (6°F) for at least 16 h.

5.3 *Rock*—A rack for holding and positioning the test strip horizontally or vertically in an oven is necessary. The samples must be separated from one another so that the air is free to move completely around the samples without obstruction to allow for dissipation of vapors.

6. Materials

6.1 The geomembrane material (reinforced or non reinforced) shall be capable of being bonded to itself by one of the methods described in Section 3 according to the geomembrane manufacturers' recommendations and instructions.

7. Sampling, Test Specimens, and Test Units

7.1 *Trial Seam Sample*—A representative seam from each seaming crew, fabricated from the same sheet material, and using the same seaming methods as those recommended by the geomembrane frabricator, installer or sheet manufacturer, or all of these, will be used for this test method.

7.1.1 The trial seam sample shall be no loss than 3 m (10 ft) in length for this method.

7.1.2 For non reinforced geomembranes, cut five, 1 in. (25 mm) wide specimens for shear and five, 1 in. (25 mm) wide specimens for peel testing from the trial seam sample after the sample has been cured in accordance with Section 8.

7.1.3 For reinforced geomembranes, cut five, 4 in. (100 mm) wide specimens for shear and five, in in. (25 mm) wide specimens for peel testing from the trial seam sample after the sample has been cured in accordance with Section 8.

7.1.4 Frequency of trial seams and sampling locations within trial seams should be determined in accordance with the site-specific contract documents.

7.2 *Field Seam Sample*—Cut a 300 mm (12 in.) long non reinforced or a 1200 mm (48 in.) long reinforced section of the fabricated seam from the installed lining for this test method.

7.2.1 For non reinforced geomembranes cut five, 1 in. (25 mm) wide specimens for shear and five, 1 in. (25 mm) wide specimens for peel testing from the field seam sample after the sample is cured in accordance with Section 8.

7.2.2 For reinforced geomembranes cut five, 4 in. (100 mm) wide specimens for shear and five, 1 in. (25 mm) wide specimens for peel testing from the field seam sample after the samples is cured in accordance with Section 8.

NOTE 2—Specimens that will be subjected to peel and shear test shall be alternately selected from the sample and labeled ash show in Fig. 1.

7.3 The field seam sample should be wide enough (approximately 12 in.) (30 cm) to accomodate peel and shear testing as in 9.1 and 9.2.

7.4 Allow the field seam sample to cure or age properly (see Section 8) before testing.

7.5 Field seam sample sizes may be modified according to the site-specific contract plans, specification and CQC/CQA documents.

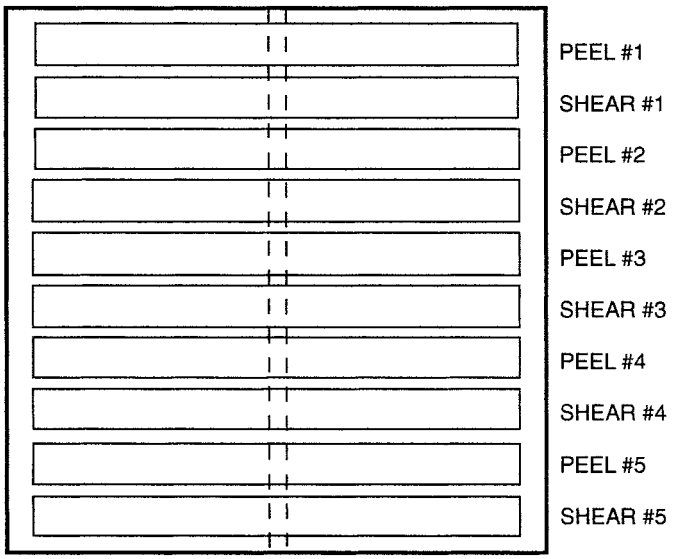

FIG. 1 Seam Sample

7.6 Location, frequency and patching requirements for field scam sample areas are determined in accordance with site-specific contract documents.

7.7 *Values, n*—The values stated in SI units are to be regarded as standard. The inch-pound units given in parentheses are for information only.

8. Conditioning and Curing

8.1 *Test Method A: Standard Curing*—For lab curing, samples are to be conditioned for a minimum of 40 h at standard atmosphere for testing geosynthetics of a relative humidity between 50 to 70 % and a temperature of 21° ± 2°C (70 ± 4°F). For field testing applications the ambient temperature and humidity shall be recorded, conditioning and test shall be performed at a minimum of 18°C (65°F) air temperature.

8.2 *Test Method B: Accelerated Curing*—Samples are to be quick cured by placing the samples into an air oven at 50 ± 2°C (122°F ± 4°F) for 16 ± 2h. Samples to be conditioned at ambient temperatures for approximately 1 h prior to placing in oven.

8.3 *Test Method C: Accelerated Curing*—Samples are to be quick cured by placing the samples into an air oven at 70 ± 2°C (158 ± 4°F)for 4 h minimum (5 h maximum). Samples to be conditioned at ambient temperature for approximately 1 h prior to placing in oven.

NOTE 3—Heavier gages of material (that is, 60 mil and up) may require longr time frames to quick cure. User should evaluate the results to ensure a proper weld is achieved. If not, this test method is not to be used and refer to Test Method B.

NOTE 4—Method of curing shall be chosen in accordance with the site-specific contract documents.

8.4 The samples are placed either horizontally on racks or vertically suspended so that the strips are supported in a manner where the air is free to move completely around the samples without obstruction.

9. Destructive Test Methods

9.1 *Peel Testing*— Use Method A of Test Method D 413 using a minimum of five 25 mm (1 in.) wide specimens, with the grips positioned no less than 13 mm (0.5 in) on either side of the start of seam bond, and a constant cross head speed of 50 mm/min (2 in./min). The seams overlap length shall be as fabricated in the field. Fully support the test specimen within the grips across the width of the specimen.

9.2 *Shear Testing*:

9.2.1 *Non Reinforced Sheet Materials*—Follow Test Method D 882 using a minimum of five 25 mm (1 in.) wide specimens for non reinforced materials. Grip separation at the beginning of the test should be 50 mm (2 in.) plus the seam width. The seam is to be centered between the clamps, and cross head speed shall be 500 ± 0.2 mm/m (20 ± 0.5 in./min).

9.2.2 *Reinforced Sheet Materials*—The following procedure as outlined in Test Method D 751 and modified in ANSI/NSF Standard 54 shall be used: prepare a minimum of 5 to 100 mm (4 in.) wide specimens for reinforced sheet materials with the field seams at the center of the test specimen and perpendicular to the center line. Grip separation at the beginning of the test shall be 150 mm (6 in.) plus the seam width. The seam is to be centered between the clamps. Cross head speed should be 300 ± 0.2 mm/min (12± 0.5 in/min). The clamped width for each grip should be 25.4 mm (1 in.).

9.3 Record the maximum load applied to the specimen at break or separation.

NOTE 5—The term at break in reinforced materials applies to the point at which scrim is visible across the specimen.

10. Procedure

10.1 *Sample Preparation and Incubation*:

10.1.1 Obtain sample in accordance with Section 7.

10.1.2 If using accelerated curing methods, place sample(s) into oven (oven requirements in accordance with Section 8).

10.1.3 Remove sample(s) from oven, condition sample(s) at ambient temperature of field conditions for 30 min. (See Note 4.)

10.1.4 Cut specimens from samples in accordance with Section 7.

10.1.5 Test specimens in accordance with Section 9.

NOTE 6—Ambient temperatures may vary in field applications. All variances should be recorded on final records or per job specification. Decisions of variance are made according to the site-specific contract plans, specification and CQC/CQA documents.

11. Report

11.1 *Report at a minimum the following information*:

11.1.1 Complete identification of the geomembrane system, including type of polymer, and thickness, reinforced or non-reinforced sheeting, sample location, sample identification, seaming method, ambient and membrane temperatures.

11.2 *Suggested other parameters to be included in the report*:

11.2.1 Complete identification of the sampling procedure and conditioning method but not limited to the sample type, sample location, sample identification, seaming technique, seam width, and date of fabrication of field seams, fabricator identification, and curing method used.

11.2.2 Type of tensile machine used, grip separation, cross head speed, grip surface texture, grip dimensions, and grip pressure.

11.2.3 Type of failure in the peel and shear tests, that is, within the chemical fusion system, within the sheet material, clamp edge, or seam edge, for each individual specimen.

12. Precision and Bias

12.1 No statement is made about either the precision or bias of this test method since it merely refers to available destructive test methods that could be used in determining the quality of bonded seams. Precision should be based on the respective test method used.