Designation: D8172/D8172M – 18 (Reapproved 2023)ε1

Standard Test Method for Shear and Peel Strength of Solvent-Welded Seams with Nonreinforced Geomembranes[1]

This standard is issued under the fixed designation D8172/D8172M; 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.

ε1 NOTE—Editorially updated designation in May 2023.

1. Scope

1.1 This test method describes destructive quality control and quality assurance tests used to determine the integrity of geomembrane seams produced by adhesive and chemical fusion methods. These test procedures are intended for nonreinforced geomembranes only. This test method utilizes two sampling techniques; Method A is for seams produced without a testing flap, while Method B is for seams that produce a testing flap.

1.2 The rationale behind the two methods is that most seaming processes produce some type of flap on the back side or front side, or both, of the seam to perform peel testing. However, there are some processes in the industry that do not produce any type of flap to perform seam peel testing, and this is where the additional method is needed.

1.3 This method is intended for use with polyvinyl chloride (PVC)-based material seams, but is not limited to PVC.

1.4 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.5 *Hazardous Materials*—Always consult the proper Material Safety Data Sheets for any hazardous materials used for proper ventilation and protection.

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

1.7 *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

D4439 Terminology for Geosynthetics

3. Terminology

3.1 Refer to Terminology D4439 for definitions of terms applying to this test method.

3.2 *Definitions:*

3.2.1 *adhesive, n*—seams are typically produced by applying an adhesive to both sides of the sheet to be bonded, and then pressure is applied to the top sheet with the bottom sheet supported by a flat, firm surface.

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

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

3.2.3 *bodied chemical fusion seams, n*—use of a bodied chemical agent to dissolve the surfaces of the geomembranes for bonding.

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

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

4. Significance and Use

4.1 The use of nonreinforced geomembranes as barrier materials has created a need for a test method to evaluate the

[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.

quality of chemical fusion seams produced by methods other than thermal fusion. This test method is used for quality control purposes and is intended to provide quality control and quality assurance personnel with a method to evaluate seam quality.

4.2 This test method utilizes two methods of sampling and specimen preparation for the purpose of providing a method of specimen preparation when overlapping of the seam does or does not produce a flap suitable for testing purposes.

5. Apparatus

5.1 *Tensile Testing Machine*—Constant rate of extension (CRE) equipment meeting the requirements of Specification D76/D76M. The load cell shall be accurate to within 1 % of the applied force used. The drive mechanism shall be able to control the rate of extension to within 1 % of the targeted rate. The maximum allowable error in recorded grip displacement shall be 1 % of the recorded values. The maximum allowable variation in nominal gage length on repeated return of the clamps to their starting position shall be less than 0.25 mm [0.01 in.].

5.2 *Grip Faces*—The clamping force and the clamp surfaces shall hold the specimen firmly without causing damage. One of the grips shall be self aligning to compensate for uneven distribution of force across the specimen.

5.3 Clamp faces shall be adequate to grip the specimen in the dimension parallel to the direction of test and wide enough to grip the full width of the specimen.

6. Sampling, Test Specimens, and Test Units

6.1 *Method A*—Use this method when overlapping of the geomembrane material during the seaming process does not produce a flap suitable for peel testing across the seam. Seams tested using this procedure should have a minimum seam width of 1 in. for testing. If the seams to be tested are less than 1 in. in width, further calculations may be required as noted in 10.2.

6.1.1 *Seam Samples – Method A*—Cut the sample. Approximately a 760 mm [30 in.] length of seam shall be cut out with a minimum of 102 mm [4 in.] of material on either side of the seam for shear testing.

6.1.2 *Peel Specimen Preparation*—Place two cuts across the seam and initiate a peel in both directions of the cut and on the two ends of the sample a minimum of 25.4 mm [1 in.], parallel with the seam, so that you have five locations that a peel has been initiated. (See Fig. 1.)

NOTE 1—This process should take place immediately during or after production of the seam, as the setup times for various seaming methods differ for the various methods, processes, and materials.

NOTE 2—Placing tape or other suitable bond-breaking materials in the seam overlap can be used to create a flap suitable for peel testing.

6.1.3 Peel specimens are cut in the length of the seam. A specimen width of 25.4 mm [nominal 1.0 in.] cut within the outer boundaries of the seam and a minimum of 50 mm [2 in.] in the length of bonded seam shall be tested, but not more than 55 mm [2.125 in.]. This can be obtained by either trimming the specimen to the specified length or by setting the testing machine to stop the test after testing 50 mm [2 in.] of seam peel. (See Fig. 1.)

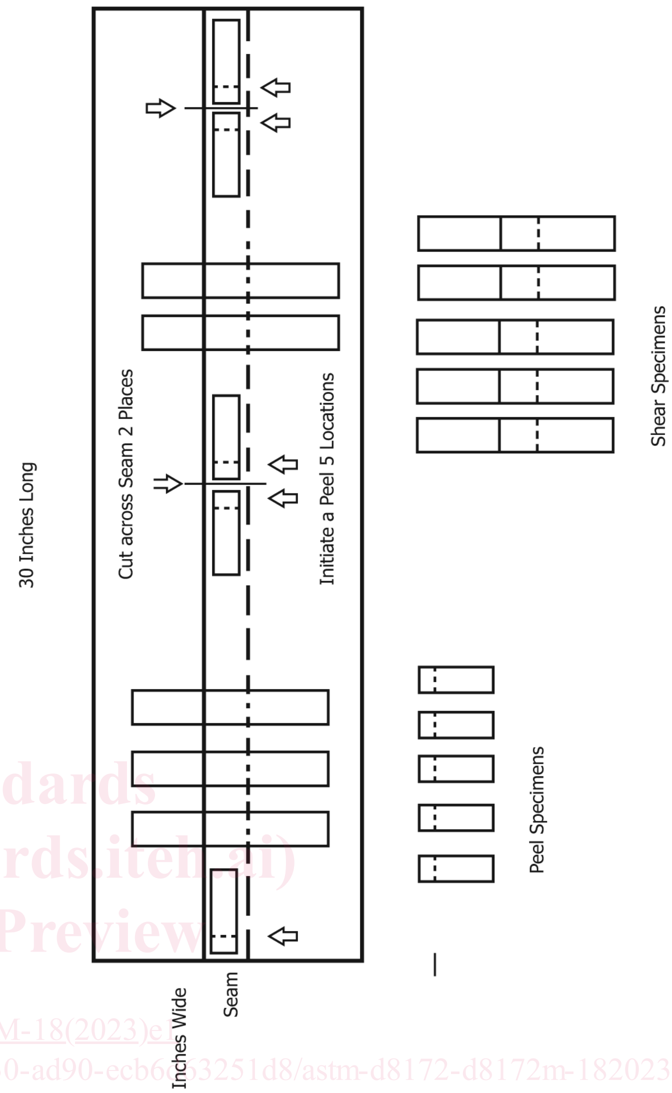

FIG. 1 Specimen Cutout Diagram – Method A

6.1.4 *Shear Specimen Preparation*—Cut five shear specimens from the remaining portion of the sample across the seam as shown in Fig. 1. Cut to produce a specimen 25 mm [nominal 1.0 in.] wide by a minimum of 150 mm [nominal 6 in.] long.

6.2 *Method B*—Use this method when overlapping of the geomembrane material during the seaming process does produce a flap suitable for peel testing.

6.2.1 *Seam Samples – Method B*—Cut the sample. Approximately a 760 mm [30 in.] length of seam shall be cut out with a minimum of 102 mm [4 in.] of material on either side of the seam.

6.2.2 *Specimen Preparation*—Ten specimens shall be cut from the sample submittal. The specimens shall be cut to produce ten specimens 25 mm [nominal 1 in.] wide by a minimum of 150 mm [nominal 6 in.] long. Depending on the width of the seam, at least 50 mm [2 in.] of unbounded material on each side of the bonded seam is required for testing.

6.2.3 Specimens that will be subjected to peel and shear tests shall be selected alternately from such so that the seam is

as shown in Fig. 2. Specimens shall be cut such that the seam is perpendicular to the longer dimension of the strip specimen.

7. Conditioning

7.1 *Conditioning and Curing*—With chemical or adhesive-type seams, these seams normally require a period of time for the seam to set up or cure. The sample should be cured for a minimum of 40 h from the time of the actual fabrication before testing. Note on the paperwork the date and time of actual fabrication. Samples or specimens shall be conditioned and cured at standard laboratory test conditions.

7.2 *Test Conditions*—Conduct tests and conditioning at the standard atmosphere for testing geosynthetics, a temperature of 21.1 °C ± 1 °C [70 °F ± 2 °F], unless otherwise specified.

NOTE 3—If samples are sent to the laboratory and testing is performed before the required aging period, then this shall be noted on the sample results.

8. Destructive Test Methods

8.1 *Peel Testing*—Subject five specimens to the 90° "T-Peel" test (see Fig. 3). Fully grip the test specimen across the width of the specimen. Grip the peel specimen by securing grips 12.5 mm [0.5 in.] on each side of the start of the seam bond at a constant machine crosshead speed of 508 mm/min [20 in./min]. The test is complete when the specimen ruptures.

8.2 *Shear Testing*—Subject five specimens to the shear test (see Fig. 4). Fully support the test specimen within the grips across the width of the specimen. Secure the grips 25 mm [1 in.] on each side of the start of the seam bond at a constant machine crosshead speed of 508 mm/min [20 in.]/min. The test is complete when the specimen ruptures.

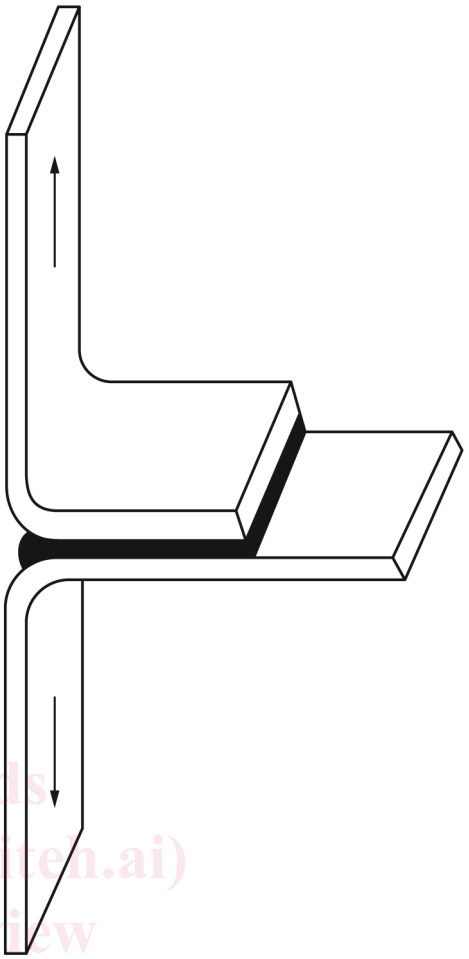

FIG. 3 Example of T-Peel Test

9. Procedure

9.1 *Shear Test:*

9.1.1 Set the grip separation equal to the width of the seam plus 50.4 mm [2.00 in.]. Set the crosshead speed to 508 mm/min [20 in./min].

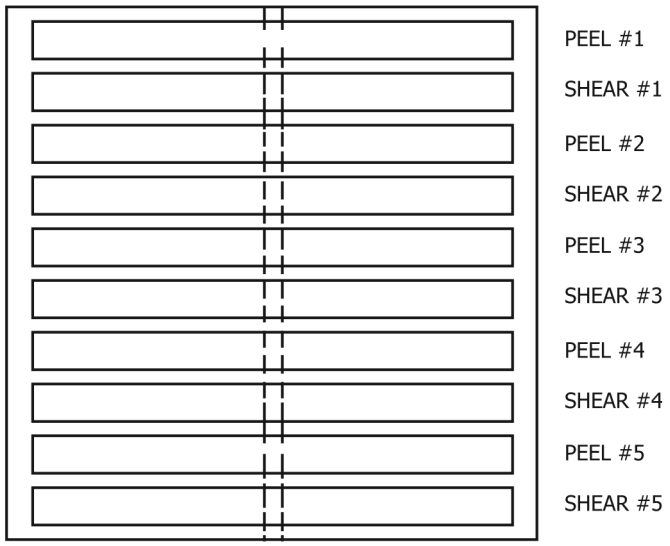

FIG. 2 Specimen Cutout Diagram – Method B

9.1.2 Place the specimen symmetrically in the clamps so the weld will experience shear force (Fig. 4). Center the seam vertically between the grips.

9.1.3 Elongate the specimen until rupture.

9.1.4 Record the load at peak and break code (Fig. 5).

9.2 *Peel Test:*

9.2.1 Set the grip separation to a minimum of 12.7 mm/min [0.50 in./min].

9.2.2 Set the crosshead speed to 508 mm/min [20.00 in./min].

9.2.3 Place the specimen in the clamps in a "T" configuration (Fig. 3). If there is enough material, center the seam vertically between the grips.

9.2.4 Elongate the specimen until rupture or separation of weld has occurred across the entire weld.

9.2.5 If a specimen slips between the clamps, discard the individual result and test another specimen if the minimum strength requirement has not been met.

9.2.6 Record the load at peak and break code (see Fig. 5).

10. Calculation

10.1 *Seam Shear Strength*—Divide the peak load by the width of the specimen to obtain results in N/mm [lb/in.].