Designation: D5641/D5641M – 16

Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber[1]

This standard is issued under the fixed designation D5641/D5641M; 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 practice covers procedures to perform nondestructive quality control testing described in Practice D4437/D4437M and Practice D4545 for evaluating the continuity of all types of geomembrane seams using the bubble emission or vacuum chamber method.

1.2 The technique described in this practice is intended for use on geomembrane seams, patches, and defects.

1.3 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 non-conformance with the standard.

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4437/D4437M Practice for Non-destructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes

D4439 Terminology for Geosynthetics

D4545 Practice for Determining the Integrity of Factory Seams Used in Joining Manufactured Flexible Sheet Geomembranes (Withdrawn 2008)[3]

E515 Practice for Leaks Using Bubble Emission Techniques

2.2 *E.P.A. Documents:*

EPA/530/SW-91/051 Inspection Techniques for the Fabrication of Geomembrane Field Seams[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *geomembrane, n*—an essentially impermeable geosynthetic composed of one or more synthetic sheets. (See Terminology D4439).

3.1.2 *seam, n*—the connection of two or more pieces of material by mechanical, chemical, or fusion methods to provide the integrity of a single piece of the material.

3.1.3 *vacuum chamber, n*—a device that allows a vacuum to be applied to a surface.

3.1.3.1 *Discussion*—In geomembranes, typical seams would include adhesive bonded, bodied chemical fusion welds; chemical fusion welds; dielectric; dual hot wedge; fillet extrusion; flat extrusion; hot air; single hot wedge; and ultrasonic. (See EPA/530/SW-91/051.)

NOTE 1—For definition of other terms used in this practice, refer to Terminology D4439.

4. Summary of Practice

4.1 The basic principle of this practice consists of creating a pressure differential across a seam and observing for bubbles in a film of foaming solution over the low pressure side, within the vacuum chamber. The vacuum chamber has a viewing port that allows observation of the seam area being tested. The foaming solution is applied to the surface to be tested and the vacuum chamber is placed over the test area. As the chamber is held firmly in place, vacuum is applied. Air leakage through flaws in the test area cause bubbles in the foaming solution that may be observed.

5. Significance and Use

5.1 This practice is a nondestructive evaluation intended to be used for quality control purposes during factory or field seaming of geomembranes.

5.2 This practice may also be used to evaluate geomembrane panels for holes that penetrate the entire thickness of

[1] This practice is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.10 on Geomembranes.

Current edition approved July 1, 2016. Published October 2016. Originally approved in 1994. Last previous edition approved in 2011 as D5641 – 94 (2011). DOI: 10.1520/D5641_D5641M-16.

[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] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from the U.S. Government Publishing Office, 732 N. Capitol St., NW, Washington, DC 20401-0001, http://www.gpo.gov.

material. Limitations on the test practice are that it may not be suitable for uneven or curved surfaces, thick seams, seams in corners, and thin extensible geomembranes.

6. Apparatus

6.1 *Vacuum Pump*—The vacuum pump shall be fuel or electric powered and capable of sustaining the required vacuum for the duration of the test.

6.2 *Vacuum Gauge*—The vacuum gauge shall be capable of registering, as a minimum, to 10 psi [70 kPa] in increments of ¾ psi [5 kpa].

6.3 *Calibration and Adjustment*—The calibration of the vacuum gauge shall be checked and adjusted periodically, and routinely at a minimum of once every twelve months.

6.4 *Foaming Solution*—The foaming solution shall be premixed with water at a ratio conducive to the formation of bubbles. It shall be dispensed by spray, brush, or any other convenient means. The foaming solution shall be compatible with the geomembrane.

NOTE 2—If the component to be tested has parts made of polyethylene or structural plastics, the test fluid must not promote environmental stress cracking (E.S.C.). (See Test Method E515.)

6.5 *Vacuum Chamber*—The vacuum chamber shall have an open bottom and a clear viewing panel on top. It shall be an appropriate and convenient size and shape, made of rigid materials and equipped with a vacuum gauge, valve, and soft pliable gasket around the periphery of the open bottom (see Fig. 1).

NOTE 3—Vacuum chamber equipment may be obtained from the suppliers given in Footnote 5.[5] These suppliers are cited only for convenience and no commercial endorsement is expressed or implied by incorporation into this practice.

[5] Series A100 Straight Seam Tester supplied by the American Parts and Service Company, 2201 West Commonwealth Avenue, P.O. Box 702, Alhambra, CA 91802. Vacuum Chamber Test System as supplied by Sinclair Equipment Company, 6686 A Merchandise Way, Diamond Springs, CA 95619. Columbine International, Ltd., 5441 Merchant Circle, Placerville, CA 95667.

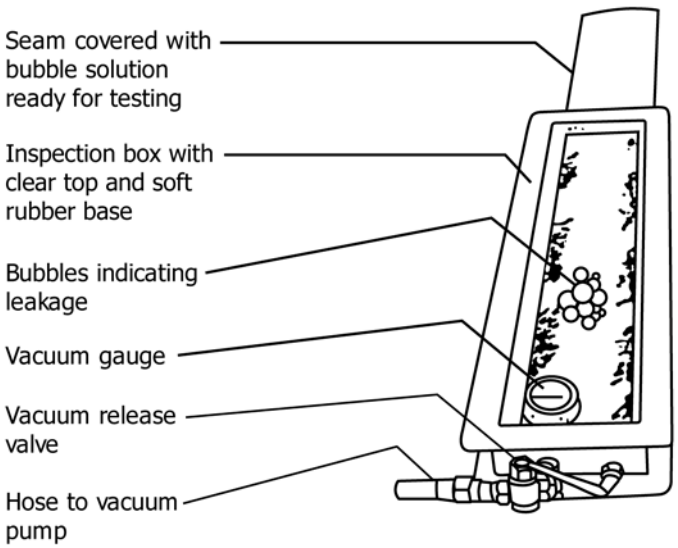

FIG. 1 Vacuum Chamber

7. Procedure

7.1 The area of the seam to be evaluated should be clean and free of soil or foreign objects that might prohibit a good seal from being formed between the vacuum chamber and the geomembrane.

7.2 Energize the vacuum pump.

7.3 Wet an area immediately adjacent to and including the geomembrane seam or test area measuring approximately twice the width and length of the vacuum chamber with a foaming solution.

7.4 Place the vacuum chamber over the wet area of the geomembrane such that the gasket is in complete contact with the geomembrane surface, and the test area is centered under the viewing port.

7.5 Apply a normal force to the top of the vacuum chamber to effect a seal and open the vacuum valve.

7.6 Ensure that a leak tight seal is created between the vacuum chamber gasket and the geomembrane material. For most cases, a minimum vacuum of 2 to 8 inches of mercury (1 to 4 psi) as registered on the vacuum gauge should be appropriate.

7.7 With the vacuum applied, maintain the normal force and observe the geomembrane seam or test area through the viewing port for bubbles resulting from the flow of air through defects in the seam. The vacuum should be held over the test site for a duration of not less than 10 s. If the vacuum cannot be held for the minimum 10 s, the test area shall be marked as untested. It is essential that the viewing port remain clean at all times to facilitate unobstructed viewing.

7.8 If bubbles appear on the geomembrane seam, turn the three-way vacuum valve to vent the chamber and remove the vacuum chamber from the seam. The defective area should then be marked for repair.

7.9 If bubbles do not appear through the geomembrane seam within the specified dwell time, turn the vacuum valve to vent the chamber and remove the chamber from the seam.

7.10 Move the vacuum chamber to the adjoining portion of the seam or test area overlapping the previously tested area by a distance no less than 10 % of the minimum chamber length or at least 2 in. [50 mm], whichever is the greater and repeat the procedure until the entire seam has been tested.

8. Report

8.1 Report the following information:

8.1.1 Identification of the geomembrane material, including type of polymer, source, thickness, reinforced or nonreinforced sheeting, seaming system used, ambient temperature, seam tested, seam width, date of seam fabrication, and date of seam evaluation, and results of seam evaluation,

NOTE 4—The intent of the form is not to imply that each VCT is to be recorded on said form.

8.1.2 Documentation of the typical vacuum pressure and hold duration and latest pressure gauge calibrations,

8.1.3 Identification of the location and approximate size of all defective areas, and

8.1.4 Identification of foaming solution used for the test and if different types were used, the location of use for each type.

9. Keywords

9.1 bubble emission testing; geomembrane; nondestructive testing; seam; testing; vacuum; vacuum chamber

APPENDIX

(Nonmandatory Information)

X1. Evaluation Form

Testing Agency: _____
Date of Test: _____ Operator: _____
Project Name: _____
Installer: _____
Job Number: _____ Geomembrane Type: _____
Manufacturer: _____ Fabricator: _____
Seam Width: _____ Geomembrane Thickness: _____

SEAM Factory_____ Field_____

Seam Type: Single Hot Wedge _____ Dual Hot Wedge _____ Hot Air _____
Flat Extrusion _____ Fillet Extrusion _____ Dielectric _____
Chemical/Adhesive _____

Vacuum Gauge Calibration Date:_____

Weather:_____ Ambient Temp._____

Seam Tested	Vacuum Applied	Hold Time Duration	Number of Defects Found	Number of Defects Repaired	Date Seam Accepted

Comments: _____
_____

Seams Accepted By: _____
Date: _____

FIG. X1.1 Evaluation Form