



Designation: D5641/D5641M – 25

Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber¹

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](#) 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 This practice can only be used when the seam to be tested is at the edge or covering the edge of the welded material, enabling a vacuum to be created.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.5 *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.*

1.6 *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

[D4437/D4437M Practice for Nondestructive Testing \(NDT\) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes](#)

[D4439 Terminology for Geosynthetics](#)

[E515 Practice for Leaks Using Bubble Emission Techniques](#)

2.2 *EPA Documents:*³

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

3. Terminology

3.1 Definitions of terms applying to this test method appear in Terminology [D4439](#).

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

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 causes 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 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.

¹ This practice 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 www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from the U.S. Government Publishing Office, 732 N. Capitol St., NW, Washington, DC 20401-0001, <http://www.gpo.gov>.

6.2 Vacuum Gauge—The vacuum gauge shall be capable of registering, as a minimum, to 10 psi [70 kPa] in increments of $\frac{3}{4}$ 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 should be pre-mixed with water at a ratio conducive to the formation of bubbles. It should be dispensed by spray, brush, or any other convenient means. The foaming solution shall be compatible with the geomembrane.

NOTE 1—If the component to be tested has parts made of polyethylene or structural plastics, the test fluid shall not promote environmental stress cracking (E.S.C.). (See Practice 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).

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.

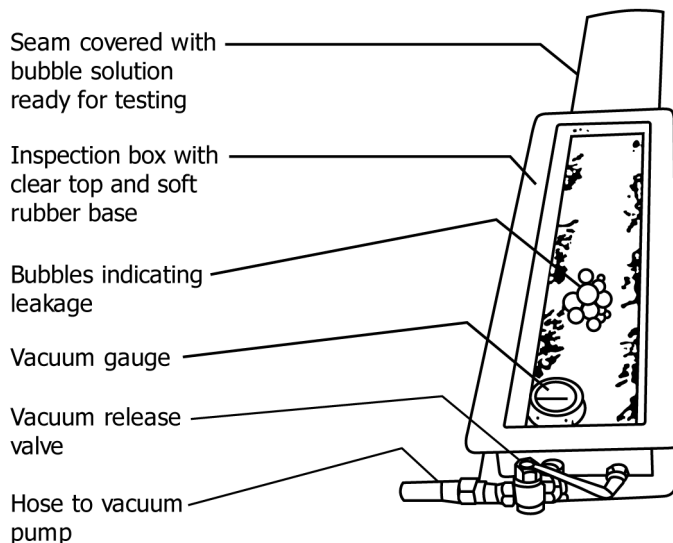


FIG. 1 Vacuum Chamber

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 in. to 8 in. [51 mm to 203 mm] of mercury (1 psi to 4 psi [7 kPa to 27.5 kPa]) 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. Vacuum pressure should be adjusted according to membrane thickness so that the pressure applied does not create a situation whereas the membrane is forced against the viewing glass of the vacuum testing apparatus. If the membrane is pressed against the viewing glass, bubbles cannot be seen.

7.8 If bubbles appear on the geomembrane seam, vent the chamber of vacuum pressure 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, vent the chamber of vacuum pressure and remove the chamber from the seam.

7.10 Move the vacuum chamber to the adjoining portion of the seam or test area, ensuring it overlaps the previously tested area by at least 10 % of the minimum chamber area viewed by the operator or at least 2 in. [50 mm], whichever is the greater. Repeat the procedure until the entire seam has been tested.

7.11 The vacuum pump shall run for the entire duration of the test. It is not the intention that the vacuum testing device hold the vacuum once the vacuum pump has been switched off.

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, date of seam evaluation, and results of seam evaluation;

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