



Designation: ~~D7177/D7177M—05 (Reapproved 2015)~~^{ε1} D7177/D7177M – 21

Standard Specification for Air Channel Evaluation of Polyvinyl Chloride (PVC) Dual Track Seamed Geomembranes¹

This standard is issued under the fixed designation D7177/D7177M; 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—Designation was changed to dual and units information was corrected editorially in June 2015.

1. Scope

1.1 This specification covers a nondestructive evaluation of the strength and continuity of parallel PVC geomembrane seams separated by an unwelded air channel. The unwelded air channel between the two distinct seamed regions is sealed and inflated with air to a predetermined pressure. Long lengths of seam can be evaluated by this specification more quickly than by other common nondestructive tests.

1.2 This specification can be used as a substitute for destructive testing or used in conjunction with destructive testing.

1.3 This specification covers PVC sheet 0.760 mm [~~0.030 in.~~] [0.030 in.] and thicker.

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

D4439 Terminology for Geosynthetics

3. Terminology

3.1 *Definitions:*

¹ This specification is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.06 on Geosynthetic Specifications.

Current edition approved May 1, 2015Jan. 1, 2021. Published June 2015January 2021. Originally approved in 2005. Last previous edition approved in 20102015 as D7177-05(2010);D7177/D7177M – 05 (2015)^{ε1}. DOI: 10.1520/D7177-D7177M-05R15E01-10.1520/D7177_D7177M-21.

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.

3.1.1 *dual seam, n*—a geomembrane seam with two parallel welded zones separated by an unwelded air space.

3.1.1.1 *Discussion*—

The dual seam itself can be made by a number of methods; hot wedge, hot air, and ultrasonic bonding are all typical techniques.

3.1.2 *geomembrane, n*—an essentially impermeable ~~geo-synthetic~~geosynthetic composed of one or more synthetic sheets.

3.1.3 *seam, n*—a permanent joining of two or more materials.

3.2 For definitions of other terms, see Terminology [D4439](#).

4. Summary of Specification

4.1 This specification utilizes a dual seam where an air channel exists between the two welded zones. Both ends of the air channel are sealed and then a pressure gauge is attached to the air space. Air pressure is applied and the gauge is monitored.

4.2 Air pressures used in this specification are related to the ambient temperature of the PVC geomembrane and can be used for thickness 0.760 mm [0.030 in.] and thicker PVC geomembrane. The air pressure is not dependant on thickness of the PVC geomembrane being tested.

4.3 The minimum monitoring time is recommended to be ~~1/2-min~~ min (30 s) following stabilization of the pressure.

5. Significance and Use

5.1 The increased use of geomembranes as barrier materials to restrict liquid or gas movement, and the common use of dual track seams in joining these sheets, has created a need for a standard nondestructive test by which the quality of the seams can be assessed for continuity, ~~water tightness, watertightness,~~ and strength. The test is also intended to provide an indication of the physical peel strength of the PVC seam.

5.2 This specification recommends an air pressure test within the channel created between dual seamed tracks whereby the presence of un-bonded sections or channels, voids, discontinuities, foreign objects, and the like, in the seamed region can be identified.

5.3 This technique is intended for use on seams of PVC ~~Geomembrane~~geomembrane sheets 0.760 mm [0.030 in.] and thicker formulated from the appropriate polymers and compounding ingredients to form a polyvinyl chloride sheet material that meets all specified requirements for the end use of the product.

5.4 This test is used to ~~assure~~ensure minimum peel strengths are met through the entire seam area.

5.5 This test measures the seam strength to 2.6 kN/m [~~15~~15 lb ~~lb/in.~~lb/in.] width minimum peel strengths.

5.6 This procedure is based on an air channel width of 15.87 ± 3.17 mm [0.625 ± 0.125 in.]. ~~For air channels greater or lesser in lay flat width use the formula below to calculate hoop stress:~~

~~5.7 Hoop Stress (Barlow's Formula)—The stress in a channel wall acting circumferentially in a plane perpendicular to the longitudinal axis of the channel and produced by the pressure of the air in the channel.~~

~~5.7.1 Hoop Stress Calculation:~~

$$S = \frac{PD}{2t} \quad (1)$$

where:

S = hoop stress, psi;

P = internal pressure,
 D = outside diameter of the channel, in., and
 t = normal wall thickness, in.

6. Equipment

- 6.1 *Sealing Equipment*, appropriate to seal the two ends of the air channel.
- 6.2 A device is necessary to insert air into the open channel and allow monitoring its pressure. This device is unique to each user.
- 6.3 *Air Pump or Air Pressure Supply*, capable of generating up to 517 kPa [75 psi] pressure is necessary.
- 6.4 *Pressure Gauge*, capable of indicating the air pressure in 7 kPa [1 psi] increments within the test range.
- 6.5 Any equipment used on the geomembrane must be placed on an adequate cushion to preclude damage to the geomembrane.
- 6.6 *Flexible Hose*, used to connect the air supply to the air pressure device.
- 6.7 *Knife or Scissors*, capable of cutting or trimming the liner material.
- 6.8 *Infrared or ~~Probe-Type~~ Probe-Type Thermometer*, able to measure the sheet temperature to an accuracy of $\pm 1.1^{\circ}\text{C}$ [$\pm 2^{\circ}\text{F}$]; $\pm 1.1^{\circ}\text{C}$ [$\pm 2^{\circ}\text{F}$].

Note 1—All gauges should be calibrated as specified by the manufacturer, or at a frequency of at least once per year.

6.9 All gauges should be calibrated as specified by the manufacturer, or at a frequency of at least once per year.

Note 2—A change of 1°F equals a change of $\frac{5}{9} = 0.56^{\circ}\text{C}$.

6.10 A change of 1 °F equals a change of $\frac{5}{9} = 0.56^{\circ}\text{C}$.

7. Procedure

- 7.1 After the dual track seam is fabricated and the length of seam that is to be evaluated is determined, seal one end of the continuous air channel with a clamp.
- 7.2 Connect the pressure gauge and air insertion tool directly into the air channel.
- 7.3 ~~Connect~~ For seams made with a standard air channel width of 15.87 ± 3.17 mm [0.625 ± 0.125 in.], connect an air supply to the pressure gauge and insertion tool and pressurize the air channel to the pressure appropriate for the PVC geomembrane sheet temperature. (Refer to [Table 1](#).)
- 7.4 For seams made with an air channel width other than 15.87 ± 3.17 mm [0.625 ± 0.125 in.], calculate the appropriate pressure to be used in the air channel by multiplying the air pressure below by 15.87 ± 3.17 mm [0.625 ± 0.125 in.] and dividing by the width of the air channel.
- 7.5 Maintain the minimum pressure from the source for a minimum of 30 s.
- 7.6 Inspect the seam from the clamped end for complete inflation. If the seam completely inflates and there is no audible or visible evidence of air leakage, the seam passes the test.
- 7.7 If the channel will not pressurize there is a leak in the seam, provided air is not leaking at the clamp or air supply tool.
- 7.8 Inspect the seam from the clamped end and locate the leak area. Because of the flexibility and elongation factors of a PVC