



Designation: D7176 – 06

Standard Specification for Non-Reinforced Polyvinyl Chloride (PVC) Geomembranes Used in Buried Applications¹

This standard is issued under the fixed designation D7176; 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 specification covers polyvinyl chloride (PVC) flexible sheeting which is used for construction of concealed containment-membranes. Examples are ponds and lakes, canals, reservoirs, landfill liners, covers and closures or similar installations where the membrane is inaccessible once the construction is complete. Included are requirements for materials and sheeting, test methods, workmanship criteria and methods of marking. This Specification covers un-reinforced flexible sheet made from polyvinyl chloride (PVC) resin as the primary polymer intended for use in geomembranes. This specification covers PVC sheet 0.25 mm through 1.5 mm thickness (0.010 in. through 0.060 in.)—typically used for geomembrane linings.

1.2 Reworked materials may be used in this product in accordance with the requirements in Section 5.

1.3 The tests are intended to ensure quality and performance and are not intended for design purposes. Tests have been selected to be conducted primarily with liquids that simulate the environment to which the membrane will be subjected during actual use. The test and property limits used to characterize the sheet are values intended to ensure minimum quality for the intended purpose. In place design criteria such as material compatibility, chemical resistance, among others, are factors that shall be considered but are beyond the scope of this specification.

1.4 The values stated in metric units are to be regarded as the standard. The values stated in parentheses (English) are for information only.

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 appro-*

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

2. Referenced Documents

2.1 ASTM Standards:²

- D751 Test Methods for Coated Fabrics
- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D882 Test Method for Tensile Properties of Thin Plastic Sheeting
- D1004 Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
- D1203 Test Methods for Volatile Loss From Plastics Using Activated Carbon Methods
- D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
- D1239 Test Method for Resistance of Plastic Films to Extraction by Chemicals
- D1243 Test Method for Dilute Solution Viscosity of Vinyl Chloride Polymers
- D1790 Test Method for Brittleness Temperature of Plastic Sheeting by Impact
- D2124 Test Method for Analysis of Components in Poly-(Vinyl Chloride) Compounds Using an Infrared Spectrophotometric Technique
- D4439 Terminology for Geosynthetics
- D5033 Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics³
- D5199 Test Method for Measuring the Nominal Thickness of Geosynthetics

¹ This specification 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 Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

D5747 Practice for Tests to Evaluate the Chemical Resistance of Geomembranes to Liquids

G160 Practice for Evaluating Microbial Susceptibility of Nonmetallic Materials by Laboratory Soil Burial

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology **D4439** unless otherwise indicated.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *fabricator, n*—a company that converts geomembrane rolls into panels.

3.2.2 *homogeneous sheeting, n*—sheeting that is of uniform composition throughout its thickness.

3.2.3 *manufacturer, n*—a company that processes raw materials into geomembrane rolls.

3.2.4 *panel, n*—a series of geomembrane sheets fabricated together to make a larger unit, as supplied by a fabricator usually folded onto a pallet or folded then rolled on a core.

3.2.5 *roll, n*—a quantity of geomembrane rolled up to form a single package as supplied from the manufacturer.

3.2.6 *roll width, n*—the width of a roll as supplied from the manufacturer, (typically 1.5 to 2.5 m) (60 to 96 in.).

3.2.7 *sheet, n*—a part of the manufactured geomembrane material cut from the roll.

4. Classification

4.1 The sheeting will be subdivided by grades based on thickness:

4.1.1 *PVC10*—0.254 mm (0.010 in.).

4.1.2 *PVC20*—0.508 mm (0.020 in.).

4.1.3 *PVC30*—0.762 mm (0.030 in.).

4.1.4 *PVC40*—1.016 mm (0.040 in.).

4.1.5 *PVC50*—1.270 mm (0.050 in.).

4.1.6 *PVC60*—1.524 mm (0.060 in.).

5. Materials and Manufacture

5.1 This specification covers polyvinyl chloride (PVC) containment membrane formulated from PVC materials meeting the following requirements:

5.2 The geomembrane sheet shall consist of polyvinyl chloride (PVC) resin in amounts greater than 50 % of the total weight suitably compounded with plasticizers, stabilizers, additives, and pigments, to satisfy the physical property requirements.

5.3 A PVC resin with an inherent viscosity (logarithmic viscosity number) of not less than 0.92 as determined by Test Method **D1243**.

5.4 Reworked materials, as defined in Guide **D5033**, may be used in this product if all the requirements in Sections 3, 5, and 6 are met by the reworked material. A maximum of up to 10 % reworked material shall be permitted.

6. Physical Properties and Requirements

6.1 The sheeting shall conform to the physical requirements prescribed in **Tables 1 and 2**.

6.2 Sheeting shall be compounded so that bonds between sheets used in fabrication of large geomembrane panels can be accomplished in the factory or field without reducing the overall resistance of the membrane to permeation or leakage or significantly reducing the sheeting's physical strength. The manufacturer shall specify recommended bonding procedures in its product literature.

6.3 The sheeting shall be colored as agreed upon between the purchaser and the seller as part of the purchase contract.

6.4 The sheeting shall be monolithic and homogeneous.

6.5 Metric values are converted from U.S. values and are rounded to the available significant digits.

6.6 *Manufacturing Certified Properties*—Certified properties are tested based on a quantity of material produced. Certified properties are tested once per lot, or once every 18 000 kg of material (40 000 lb), whichever is more frequent. The certification properties include thickness, tensile break strength, elongation at break, modulus at 100 % strain, tear resistance, dimensional stability, and low temperature impact. Thickness is to be tested once per roll unless automatic thickness measuring equipment is installed on the production

TABLE 1 Certified Properties

Certified Properties	ASTM	PVC 10	PVC 20	PVC 30	PVC 40	PVC 50	PVC 60
Thickness ±	D5199	0.254 ± 0.013 mm (0.010 ± 0.0005 in.)	0.508 ± 0.030 mm (0.020 ± 0.0010 in.)	0.762 ± 0.040 mm (0.030 ± 0.0015 in.)	1.016 ± 0.050 mm (0.040 ± 0.0020 in.)	1.270 ± 0.060 mm (0.050 ± 0.0025 in.)	1.524 ± 0.080 mm (0.060 ± 0.0030 in.)
Tensile Properties	D882						
Strength at Break	Min	4.2 kN/m (24 lb/in.)	8.4 kN/m (48 lb/in.)	12.8 kN/m (73 lb/in.)	17.0 kN/m (97 lb/in.)	20.3 kN/m (116 lb/in.)	24.0 kN/m (137 lb/in.)
Elongation	Min	250 %	360 %	380 %	430 %	430 %	450 %
Modulus at 100 %	Min	1.8 kN/m (10 lb/in.)	3.6 kN/m (20 lb/in.)	5.4 kN/m (30 lb/in.)	7.2 kN/m (40 lb/in.)	9.0 kN/m (50 lb/in.)	10.8 kN/m (60 lb/in.)
Tear Strength	D1004 Min	11 N (2.5 lb)	27 N (6 lb)	35 N (8 lb)	44 N (10 lb)	58 N (13 lb)	67 N (15 lb)
Dimensional Stability	D1204 Max Change	4 %	4 %	3 %	3 %	3 %	3 %
Low Temperature Impact	D1790 Pass	-23°C (-10°F)	-26°C (-15°F)	-29°C (-20°F)	-29°C (-20°F)	-29°C (-20°F)	-29°C (-20°F)