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# Standard Guide for the Selection of Test Methods for Flexible Polypropylene (fPP) Geomembranes<sup>1</sup>

This standard is issued under the fixed designation D6434; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This guide covers recommendations for the selection of appropriate test methods for flexible polypropylene sheet used in geomembrane applications to provide consistency in data reporting.

1.2 This guide includes test methods for three types of flexible polypropylene geomembranes including smooth non-reinforced sheet, textured nonreinforced sheet, and scrim-reinforced sheet.

1.3 This guide is intended to aid all personnel involved in the selection, manufacture, installation, or evaluation of flexible polypropylene geomembrane sheet.

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:*<sup>2</sup>

- D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- D413 Test Methods for Rubber Property—Adhesion to Flexible Substrate
- D471 Test Method for Rubber Property—Effect of Liquids
- D573 Test Method for Rubber—Deterioration in an Air Oven
- D618 Practice for Conditioning Plastics for Testing
- D696 Test Method for Coefficient of Linear Thermal Expansion of Plastics Between  $-30^{\circ}\text{C}$  and  $30^{\circ}\text{C}$  with a Vitreous Silica Dilatometer
- D746 Test Method for Brittleness Temperature of Plastics

- and Elastomers by Impact
- D751 Test Methods for Coated Fabrics
- D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- 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
- D1149 Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment
- D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
- D1238 Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
- D1505 Test Method for Density of Plastics by the Density-Gradient Technique
- D1603 Test Method for Carbon Black Content in Olefin Plastics
- D2136 Test Method for Coated Fabrics—Low-Temperature Bend Test
- D2137 Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics
- D3389 Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader)
- D3417 Test Method for Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry (DSC) (Withdrawn 2004)<sup>3</sup>
- D4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique
- D4364 Practice for Performing Outdoor Accelerated Weathering Tests of Plastics Using Concentrated Sunlight
- D4437 Practice for Non-destructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes

<sup>1</sup> This guide 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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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

- D4439 Terminology for Geosynthetics
- D4545 Practice for Determining the Integrity of Factory Seams Used in Joining Manufactured Flexible Sheet Geomembranes (Withdrawn 2008)<sup>3</sup>
- D4833 Test Method for Index Puncture Resistance of Geomembranes and Related Products
- D5199 Test Method for Measuring the Nominal Thickness of Geosynthetics
- D5321 Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
- D5323 Practice for Determination of 2 % Secant Modulus for Polyethylene Geomembranes
- D5397 Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
- D5514 Test Method for Large Scale Hydrostatic Puncture Testing of Geosynthetics
- D5617 Test Method for Multi-Axial Tension Test for Geosynthetics
- D5721 Practice for Air-Oven Aging of Polyolefin Geomembranes
- D5747 Practice for Tests to Evaluate the Chemical Resistance of Geomembranes to Liquids
- D5884 Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes
- D5994 Test Method for Measuring Core Thickness of Textured Geomembranes
- D6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
- D7003 Test Method for Strip Tensile Properties of Reinforced Geomembranes
- E96/E96M Test Methods for Water Vapor Transmission of Materials
- F1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
- G26 Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure

of Nonmetallic Materials (Discontinued 2001) (Withdrawn 2000)<sup>3</sup>

- G151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources
  - G154 Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
  - G155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
- 2.2 *Federal Test Method Standards*:<sup>4</sup>  
 FTMS 101C–2031 Puncture Resistance

**3. Terminology**

3.1 *Definitions*—For definitions of geosynthetics terms used in this guide, refer to Terminology D4439.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *flexible polypropylene, n*—a material having a 2 % secant modulus of less than 300 MPa (42 850 psi) as determined by Practice D5323 produced by polymerization of propylene with or without other alpha olefin monomers.

**4. Significance and Use**

4.1 To evaluate flexible polypropylene properly, tests must be performed according to specific test methods and procedures. Failure to follow this guide can result in data not representative of the material’s characteristics and performance.

**5. Test Methods**

5.1 Recommended test methods for flexible polypropylene sheet are listed in tables as follows:

- 5.1.1 **Table 1**—Flexible Polypropylene (fPP) Sheet Manufacturing Quality Control Tests;
- 5.1.2 **Table 2**—Optional Performance Tests for Flexible Polypropylene (fPP) Sheet; and,
- 5.1.3 **Table 3**—Tests for Field and Factory Prepared Seams of Flexible Polypropylene (fPP) Sheet.

<sup>4</sup> Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

**TABLE 1 Flexible Polypropylene (fPP) Sheet Manufacturing Quality Control Tests**

Sheet Type	Reinforced Sheet	Smooth Nonreinforced Sheet	Textured Sheet	Conditions
General:				
Terminology	D4439	D4439	D4439	
Conditioning	D618	D618	D618	
Physical Properties:				
Thickness	D5199	D5199	D5994	
Ultimate tensile strength and elongation	D7003	D6693	D6693	Type IV, no extensometer grip separation = 63.5 mm (2.50 in.), strain rate = 509 mm/min (20 in./min)
	D412, Die C	D412, Die C	D412, Die C	
	D882	D882	D882	D882 for thickness < 1 mm (0.040 in.)
Tear resistance	D7003	D1004	D1004	
	D5884			
Puncture resistance	D7003			
	D4833	D4833	D4833	
	FTMS 101C–2031			
Ply adhesion	D413	—	—	