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Standard Guide for Selection of Test Methods for Ethylene Propylene Diene Terpolymer (EPDM) Geomembranes[1]

This standard is issued under the fixed designation D7106/D7106M; 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, and editorial changes were made throughout in June 2015.

1. Scope

1.1 This guide covers and provides recommendations for the selection of appropriate test methods for Ethylene Propylene Diene Terpolymer (EPDM) geomembranes used in geotechnical and geoenvironmental applications.

1.2 This guide includes test methods for three different types of EPDM geomembranes including; scrim-reinforced membranes, composite membranes and smooth, non-reinforced membranes.

1.3 The test methods are divided into three categories including manufacturing quality control, optional performance tests and seam testing.

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 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.

1.5 *This standard does not purport to address all of the safety problems, 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]

D297 Test Methods for Rubber Products—Chemical Analysis

D413 Test Methods for Rubber Property—Adhesion to Flexible Substrate

D471 Test Method for Rubber Property—Effect of Liquids

D618 Practice for Conditioning Plastics for Testing

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

D1418 Practice for Rubber and Rubber Latices—Nomenclature

D1434 Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting

D2137 Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics

D2240 Test Method for Rubber Property—Durometer Hardness

D4355/D4355M Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

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

D4439 Terminology for Geosynthetics

D4637/D4637M Specification for EPDM Sheet Used In Single-Ply Roof Membrane

D4833/D4833M Test Method for Index Puncture Resistance of Geomembranes and Related Products

D5199 Test Method for Measuring the Nominal Thickness of Geosynthetics

D5321/D5321M Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear

D5514/D5514M Test Method for Large Scale Hydrostatic Puncture Testing of Geosynthetics

D5617 Test Method for Multi-Axial Tension Test for Geosynthetics

[1] 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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[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.

D5721 Practice for Air-Oven Aging of Polyolefin Geomembranes
D5747/D5747M Practice for Tests to Evaluate the Chemical Resistance of Geomembranes to Liquids
D5884/D5884M Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes
D7004/D7004M Test Method for Grab Tensile Properties of Reinforced Geomembranes
E96/E96M Test Methods for Water Vapor Transmission of Materials

3. Terminology

3.1 *Definitions:*

3.1.1 *composite membrane, n*—factory laminated nonwoven geotextile and EPDM

3.1.2 *EPDM, n*—terpolymer of ethylene, propylene, and diene with the residual unsaturated portion of the diene in the side chain. **D1418**

3.1.3 For definitions of other geosynthetic terms used in this guide, refer to D4439 Standard Terminology for Geosynthetics.

4. Significance and Use

4.1 This standard provides guidance to obtain data that is the most representative of the material's characteristics and performance. To properly evaluate EPDM, tests should be performed in accordance with specific test methods and procedures.

5. Test Methods

5.1 The recommended test methods for EPDM sheet are listed in tables under the following categories:

Table 1: Test Methods for Manufacturing Quality Control of EPDM Sheet

Table 2: Performance Test Methods for EPDM Sheet

Table 3: Test Methods for Seams of EPDM Sheet

6. Keywords

6.1 EPDM; geomembrane; sheet

TABLE 1 Test Methods for Manufacturing Quality Control of EPDM Sheet

Test Title	Sheet Type			Conditions:
	Reinforced	Composite	Smooth Non-Reinforced	
General:				
Terminology	D4439	D4439	D4439	
Conditioning	D618	D618	D618	
Physical Properties:				
Thickness	D5199	D5199	D5199	
Thickness of Coating over Scrim	D4637/D4637M	D4637/D4637M		Optical Method, Annex A1
Density	D297	D297	D297	
Durometer Hardness	D2240[A]	D2240[A]	D2240	Shore A
Mechanical Properties:				
Ultimate Tensile Strength and Elongation			D882	Strip width = 25 mm [1.0 in.]; Strain rate 500 mm [≈20 in.]/min
Breaking Strength	D7004/D7004M	D7004/D7004M		Grab Test Method
Tear Resistance			D1004	
Tear Strength	D5884/D5884M	D5884/D5884M		
Puncture Strength	D4833/D4833M	D4833/D4833M	D4833/D4833M	
Ply Adhesion	D413			
Fabric Adhesion	D413			

[A] Test specimens should be prepared from the coating compound, vulcanized in a similar manner to the scrim-reinforced and composite products

TABLE 2 Performance Test Methods for EPDM Sheet

Test Title	Sheet Type			Test Parameters
	Reinforced	Composite	Smooth Nonreinforced	
Physical Properties:				
Water Vapor Transmission	E96/E96M[A]	E96/E96M[A]	E96/E96M	23°C [73°F]/50 % RH
Gas Transmission	D1434[A]	D1434[A]	D1434	70°C [158°F]/160 h
Water Absorption	D471[A]	D471[A]	D471	70°C [158°F]/160 h
Mechanical Properties:				
Hydrostatic Resistance	D5514/D5514M	D5514/D5514M	D5514/D5514M	
Multi-Axial Tensile	D5617	D5617	D5617	
Direct Shear	D5321/D5321M	D5321/D5321M	D5321/D5321M	
Thermal Properties:				
Dimensional Stability	D1204	D1204	D1204	115°C [239°F]/670 h
Brittleness Point	D2137	D2137	D2137	
Endurance Properties:				
Resistance to Artificial Weathering	D4355/D4355M	D4355/D4355M	D4355/D4355M	As per this test standard
Ozone Resistance	D1149	D1149	D1149	
Oven Aging	D5721	D5721	D5721	115°C [239°F]/670 h
Chemical Resistance	D5747/D5747M	D5747/D5747M	D5747/D5747M	As agreed to by manufacturer and end user

[A] Test specimens should be prepared from the coating compound, vulcanized in a similar manner to the scrim-reinforced and composite products.

TABLE 3 Test Methods for Seam *Testing* of EPDM Sheet

Seam Properties:	Test Method:	Comments:
Peel Adhesion – Seam *Testing*	D4437	Strip width: 25 mm [1.0 in.] Grip Separation: 50 mm [2.0 in.] + Seam Width Strain rate = 500 mm [20 in.]/min Maximum test strain: 200 %
Shear Strength – Seam *Testing*	D4437	Strip width: 25 mm [1.0 in.] Grip Separation: 50 mm [2.0 in.] + Seam Width Strain rate = 500 mm [20 in.]/min Maximum test strain: 200 %
Non-destructive Test of Seam *Testing* using Air Lance	D4437	