



Designation: **D7465/D7465M – 15** **D7465/D7465M – 15**^{ε1}

Standard Specification for Ethylene Propylene Diene Terpolymer (EPDM) Sheet Used In Geomembrane Applications¹

This standard is issued under the fixed designation D7465/D7465M; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

^{ε1} NOTE—Section 9 was editorially corrected in July 2015.

1. Scope

1.1 This specification covers flexible sheet made from ethylene propylene diene terpolymer (EPDM) geomembrane intended for use in geotechnical and geoenvironmental applications. The tests and property limits used to characterize the sheet are values to ensure minimum quality for the intended use. The vulcanized rubber sheet may be non-reinforced, fabric or scrim reinforced.

1.2 In place geomembrane design criteria, such as field seaming strength, and material compatibility, among others, are factors that must be considered but are beyond the scope of this specification.

1.3 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.

1.4 *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:*²

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D471 Test Method for Rubber Property—Effect of Liquids

D518 Test Method for Rubber Deterioration—Surface Cracking (Withdrawn 2007)³

D573 Test Method for Rubber—Deterioration in an Air Oven

D624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

D751 Test Methods for Coated Fabrics

D1149 Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment

D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheet or Film at Elevated Temperature

D1418 Practice for Rubber and Rubber Latices—Nomenclature

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

D4439 Terminology for Geosynthetics

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

D5884 Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes

D7004/D7004M Test Method for Grab Tensile Properties of Reinforced Geomembranes

D7635/D7635M Test Method for Measurement of Thickness of Coatings Over Fabric Reinforcement

G151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources

G155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of other geosynthetic terms used in this guide, refer to Terminology D4439.

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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 The last approved version of this historical standard is referenced on www.astm.org.

3.1.2 *composite, n*—factory laminated non-woven geotextile and EPDM.

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

4. Classification

4.1 Types describe the sheet construction:

4.1.1 *Type I*—Non-reinforced.

4.1.2 *Type II*—Scrim (or fabric) internally reinforced.

5. Materials and Manufacture

5.1 The sheet shall be formulated from EPDM polymers and other compounding ingredients. EPDM shall be the principal polymer used in the sheet and shall be greater than 95 % of the total polymer content.

5.2 To make seams and repairs, the sheet shall be capable of being bonded watertight to itself and the supplier or fabricator shall recommend suitable methods.

TABLE 1 Physical Requirements for EPDM Sheet

Property	ASTM	Nominal Sheet Thickness	Type I	Type II
Thickness, min, mm [in.]: Sheet-overall	D412		1.14 [0.045]	
	D751		1.52 [0.060]	1.14 [0.045] 1.52 [0.060]
Coating over scrim or fabric	D7635/D7635M	1.14 [0.045] 1.52 [0.060]	...	0.38 [0.015] 0.59 [0.022]
Breaking Strength, min, N [lbf]	D7004/D7004M Grab Method	1.14 [0.045] 1.52 [0.060]	...	400 [90] 400 [90]
Tensile strength, min, MPa [psi]	D412 Die C	1.14 [0.045] 1.52 [0.060]	9.0 [1305] 9.0 [1305]	...
Puncture Resistance N [lbs] Min.	D4833/D4833M	1.14 [0.045] 1.52 [0.060]	133 [30] 178 [40]	270 [60] 350 [80]
Elongation, ultimate, min %	D412 Die C	1.14 [0.045] 1.52 [0.060]	300 300	250 ^A 250 ^A
Elongation @ fabric break, ultimate, min, % Machine direction	D7004/D7004M , Grab Method, 50 mm [2 in.] per minute jaw separation rate	1.14 [0.045]		15
		1.52 [0.060]		15
Cross direction	D7465/D7465M	1.14 [0.045]		15
Tensile set, max	D412 Method A, Die C	1.52 [0.060]	10	15
		1.14 [0.045]	10	...
Tear resistance, min, kN/m [lbf/in.]	D624 Die C	1.14 [0.045]	26.27 [150]	...
		1.52 [0.060]	40.28 [230]	...
Tearing strength, min, N [lbf]	D5884	1.14 [0.045]	...	580 [130]
		1.52 [0.060]	...	750 [170]
Brittleness point, max °C [°F]	D2137	1.14 [0.045]	-45 [-49]	-45 [-49]
		1.52 [0.060]	-45 [-49]	-45 [-49]
Ozone resistance, no cracks	D1149	1.14 [0.045]	pass	pass
		1.52 [0.060]	pass	pass
Heat Aging:	D573			
Breaking strength, min, N [lbf]	D7004/D7004M	1.14 [0.045]		356 [80]
		1.52 [0.060]		888 [200]
Tensile strength, min, MPa [psi]	D412 Method A, Die C	1.14 [0.045]	8.3 [1205]	...
		1.52 [0.060]	8.3 [1205]	...
Elongation, ultimate, min, %	D412 Die C	1.14 [0.045]	200	200 ^A
		1.52 [0.060]	200	200 ^A
Tear resistance, min, kN/m [lbf/in.]	D624 Die C	1.14 [0.045]	21.9 [125]	...
		1.52 [0.060]	37.3 [213]	...
Linear dimensional change, max, %	D1204	1.14 [0.045]	±1	±1
		1.52 [0.060]	±1	±1
Water absorption, max, mass, %	D471	1.14 [0.045]	±8, -2	±8, -2 ^A
		1.52 [0.060]	±8, -2	±8, -2 ^A
Laboratory Accelerated Weathering:	G151 and G155			
Visual Inspection	D518	1.14 [0.045]	No cracks	No cracks
		1.52 [0.060]	No cracks	No cracks
PRFSE, min, %		1.14 [0.045]	30	...
Elongation, ultimate, min, %		1.52 [0.060]	30	...
		1.14 [0.045]	200	...
		1.52 [0.060]	200	...

^A Specimens to be prepared from coating rubber compound, vulcanized in a similar method to the reinforced products.

6. Physical Properties and Requirements

6.1 The sheet shall conform to the physical requirements prescribed in **Table 1**.

6.2 The tolerance for time conditions (aging, weathering, and so forth) is ± 15 min or ± 1 % of the period; whichever is greater, unless otherwise specified.

6.3 Tolerances for temperature shall be $\pm 2^\circ\text{C}$ [$\pm 4^\circ\text{F}$].

7. Dimensions

7.1 The width and length of the sheet shall be agreed upon between the purchaser and the supplier.

7.1.1 The width and length tolerance shall be +3 %, -0 %.

7.2 The thickness tolerance shall be +15 %, -10 % of the thickness agreed upon between the purchaser and supplier, but in no case shall the thickness be less than the minimum listed in **Table 1**.

8. Workmanship, Finish, and Appearance

8.1 The sheet, including the full width of factory seams if present, shall be fully adhered, watertight, and visibly free of pinholes, particles of foreign matter, undispersed raw material or other manufacturing defects that might affect serviceability. If the number of irregularities in the form of pockmarks (see **Note 1**) appear excessive on the sheet (or portion thereof), then its rejection shall be negotiated between involved parties.

NOTE 1—Pockmarks are oblong depressions, cavities or craters on the surface of the sheet that have an approximate surface dimension of 3.2 by 1.6 mm [$1/8$ by $1/16$ in.], and have a maximum depth approaching one half of the sheet thickness.

8.2 Edges of the sheets shall be straight and flat so that they may be seamed to one another without fishmouthing.

9. Test Methods

9.1 *Dimensions*—Test Methods **D751**, after permitting the sheet to relax at $23 \pm 2^\circ\text{C}$ [$73.4 \pm 4^\circ\text{F}$] for $1 \text{ h} \pm 15$ min.

9.2 *Thickness, Sheet Overall*—From across the full width of the unbuffered sheet, take three samples, 300 by 300 mm [1 by 1 ft]. Measure the thickness of each corner. Refer to Test Methods **D412** for Type I sheet and Test Methods **D751** for Type II sheet.

9.3 *Thickness of Coating Over Scrim (Reinforcing Fabric)—Optical Method*—see **Annex A1**.

9.4 *Breaking Strength*—Test Methods **D751**, Grab Method.

9.5 *Tensile Strength*—Test Methods **D412**, Die C.

9.6 *Puncture Resistance*—Test Method **D4833/D4833M**.

9.7 *Elongation, Ultimate*—Test Methods **D412**, Die C.

9.8 *Elongation at Fabric Break, Ultimate*—Test Methods **D751**, Grab Method, 50 mm [2 in.] per minute jaw separation rate.

9.9 *Tensile Set*—Test Methods **D412**, Method A, Die C, 50 % elongation.

9.10 *Tear Resistance*—Test Method **D624**, Die C.

9.11 *Tearing Strength*—Test Methods **D751**, B-Tongue Tear.

9.12 *Brittleness Point*—Test Methods **D2137**.

9.13 *Ozone Resistance*—Test Methods **D1149**, Terminology **D4439**. Inspect at $7\times$ magnification on specimens exposed to 100 mPa [1×10^{-5} psi] ozone in air at $40 \pm 2^\circ\text{C}$ [$104 \pm 4^\circ\text{F}$]. Elongate Type I specimens 50 % for 166 ± 1.66 h exposure. And Type II specimens must be wrapped around a 75 mm [3 in.] diameter mandrel for 166 ± 1.66 h exposure. The required specimen width is 25 mm [1 in.].

9.14 *Heat Aging*—Test Method **D573**. Age sheet at $116 \pm 2^\circ\text{C}$ [$240 \pm 4^\circ\text{F}$] for 670 ± 6.7 h. Specimens are then cut from the aged sheet for testing of breaking strength, tensile strength, elongation and tear resistance.

9.15 *Linear Dimensional Change*—Test Method **D1204**.

9.16 *Water Absorption*—Test Method **D471**, at $70 \pm 2^\circ\text{C}$ [$158 \pm 4^\circ\text{F}$] for 166 ± 1.66 h.

9.17 *Laboratory Accelerated Weathering*—Accelerated weathering tests shall be performed in accordance with Practices **G151** and **G155**. These tests are performed on the intact sheet with the weathering side facing the lamps. Mount specimens for exposure under no strain. After exposure the specimens shall be removed and inspected immediately for cracks and crazing at 10 % strain in the bent loop configuration in accordance with Test Method **D518** under $7 \times$ magnifications. A specimen is rated “pass” if no cracks or crazing are observed. In addition, for Type I sheet, determine tensile strength and ultimate elongation after exposure to laboratory accelerated weathering. Calculate the specimen percent retained fractional strain energy (PRFSE):

$$PRFSE = \frac{(\text{Tensile Strength} \times \text{Elongation})_{\text{aged}}}{(\text{Tensile Strength} \times \text{Elongation})_{\text{original}}} \times 100$$