



Designation: D 4434 – 06

## Standard Specification for Poly(Vinyl Chloride) Sheet Roofing<sup>1</sup>

This standard is issued under the fixed designation D 4434; 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.

*This standard has been approved for use by agencies of the Department of Defense.*

### 1. Scope

1.1 This specification covers flexible sheet made from poly(vinyl chloride) resin as the primary polymer intended for use in single-ply roofing membranes exposed to the weather. The sheet shall contain reinforcing fibers or reinforcing fabrics.

1.2 The tests and property limits used to characterize the sheet are values intended to ensure minimum quality for the intended purpose. In-place roof system design criteria, such as fire resistance, material compatibility, wind uplift resistance, in-situ shrinkage, among others, are factors that must be considered but are beyond the scope of this specification.

1.3 The values stated in SI units are to be regarded as the standard. The values stated in parentheses are for information only.

1.4 *This standard may involve hazardous materials, operations, and equipment. 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 limitation prior to use.*

### 2. Referenced Documents

- 2.1 *ASTM Standards:*<sup>2</sup>
- D 570 Test Method for Water Absorption of Plastics
  - D 638 Test Method for Tensile Properties of Plastics
  - D 751 Test Methods for Coated Fabrics
  - D 1004 Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
  - D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.18 on Nonbituminous Organic Roof Coverings.

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<sup>2</sup> 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.

- D 2136 Test Method for Coated Fabrics—Low-Temperature Bend Test
- D 3045 Practice for Heat Aging of Plastics Without Load
- D 5602 Test Method for Static Puncture Resistance of Roofing Membrane Specimens
- D 5635 Test Method for Dynamic Puncture Resistance of Roofing Membrane Specimens
- G 151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources
- G 154 Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- G 155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

### 3. Classification

#### 3.1 Type II:

3.1.1 *Grade 1*—Reinforced sheet in which fibers are incorporated into a production process, for example as a carrier, without appreciably affecting such physical property characteristics of the finished product as tensile strength or ultimate elongation, but may provide other desirable characteristics, such as dimensional stability.

3.1.2 *Grade 2*—Externally reinforced sheet utilizing a fabric backing.

3.2 *Type III*—Sheet that is internally reinforced with fabric and which may also have a fabric backing.

3.3 *Type IV*—Sheet that is internally reinforced with fabric and which may also have a fabric backing with minimum thickness of 0.91 mm (0.036 in.).

### 4. Materials and Manufacture

4.1 The sheet shall consist of poly(vinyl chloride) resin in amounts greater than 50 % of the total polymer content suitably compounded with plasticizers, stabilizers, fillers, pigments, and other ingredients to satisfy the physical property requirements and accelerated durability tests.

4.2 To make seams and repairs, the sheet shall be capable of being bonded watertight to itself during the design service life of the sheets. The manufacturer shall recommend a suitable method. Design service life is defined as the designated time period of intended system performance.

## 5. Physical Requirements Physical Requirements

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

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

5.3 The tolerance for temperature conditions (aging, weathering, and so forth) is  $\pm 2^\circ\text{C}$  ( $\pm 4^\circ\text{F}$ ) of the specified temperature, unless otherwise specified.

## 6. Dimensions

6.1 The width and length of the sheet shall be agreed upon between the purchaser and the supplier as part of the purchase contract. The width and length tolerance shall be  $+3$  %,  $-0$  % after permitting the sheet to relax for 1 h at  $21 \pm 3^\circ\text{C}$  ( $70 \pm 5^\circ\text{F}$ ).

6.2 The thickness tolerance shall be  $\pm 10$  % of the thickness agreed upon by the purchaser and supplier, but in no case shall the thickness be less than the minimum in **Table 1**.

6.3 The sheet shall have a minimum coating or laminant thickness of 0.40 mm (0.016 in.) above the cross points of any fabric or fiber and the surface exposed to the weather.

## 7. Workmanship, Finish, and Appearance

7.1 The sheet and any factory seams shall be watertight. It shall be visually free of pinholes, particles of foreign matter, undispersed raw material, protruding fibers or reinforcement, or other manufacturing defects that might affect serviceability.

7.2 The sheet shall be visually free of nicks and cuts, voids, thin areas, delaminations, or other defects.

7.3 The sheet shall lay straight and flat to permit seaming without fishmouths.

## 8. Test Methods

8.1 *Conditioning*—Condition the test specimens in accordance with the individual test methods.

8.2 *Overall Thickness*—Test Method **D 638** for Type II, Grade 1 and Test Method **D 751** for Type II, Grade 2, Type III, and Type IV.

8.3 *Tensile Strength at Break*—Test Method **D 638** for Type II, Grade 1.

8.4 *Breaking Strength*—Test Methods **D 751**, A—Grab Method, for Type II, Grade 2, Type III and Type IV.

8.5 *Elongation at Break*—Test Method **D 638** for Type II, Grade 1 and Test Methods **D 751**, A-Grab Method, for Type II, Grade 2, Type III and Type IV.

8.6 *Seam Strength*—Test Method **D 638** for Type II, Grade 1 and Test Methods **D 751**, A-Grab Method, for Type II, Grade 2, Type III and Type IV. All testing shall be performed on seamed specimens with the passing criteria specified as a percent of either unseamed sample tensile strength at break or unseamed sample breaking strength, dependent on type.

8.7 *Heat Aging*—Practice **D 3045** at  $80 \pm 1^\circ\text{C}$  ( $176 \pm 2^\circ\text{F}$ ) for 56 days  $\pm 1$  h.

8.8 *Tear Resistance*—Test Method **D 1004**, for Type II, Grade 1.

8.9 *Tearing Strength*—Test Methods **D 751**, B-Tongue Tear Method, for Type II, Grade 2, Type III, and Type IV. Specimen size shall be  $200 \times 200$  mm ( $8 \times 8$  in.).

8.10 *Low Temperature Bend Test*—Test Method **D 2136**, at  $-40^\circ\text{C}$  ( $-40^\circ\text{F}$ ).

8.11 *Accelerated Weathering*—Perform accelerated weathering for 5000 h using the exposure described either in **8.11.1** or **8.11.2**. Choice of apparatus and exposure conditions selected shall be by mutual agreement among the interested

**TABLE 1 Physical Requirements for Poly(Vinyl Chloride) Sheet**

Property	Type II		Type III	Type IV
	Grade 1	Grade 2		
Overall thickness of PVC sheet, min, mm (in.)	1.14 (0.045)	1.14 (0.045)	1.14 (0.045)	0.91 (0.036)
Thickness over scrim, min, mm (in.) <sup>A</sup>	0.40 (0.016)	0.40 (0.016)	0.40 (0.016)	0.40 (0.016)
Tensile strength at break, min, MPa (psi):				
Machine direction	10.3 (1500)	...	...	...
Cross-machine direction	10.4 (1500)	...	...	...
Breaking strength, min, kN/m (lbf/in.)	...	35 (200)	35 (200)	48 (275)
Elongation at break, min, %:				
Machine direction	250	15	15 <sup>B</sup>	25 <sup>B</sup>
Cross-machine direction	220	15	15 <sup>B</sup>	25 <sup>B</sup>
Seam strength, min, % of tensile or breaking strength	75	75	75	75
Retention of properties after heat aging:				
Tensile strength, min, % of original	90	...	...	...
Breaking strength, min, % of original	...	90	90	90
Elongation, min, % of original	90	90	90	90
Tear resistance, min, N (lbf)	45.0 (10.0)	...	...	...
Tearing strength, min, N (lbf)	...	200 (45.0)	200 (45.0)	400 (90.0)
Low temperature bend	pass	pass	pass	pass
Accelerated weathering test:				
Cracking (7 $\times$ magnification)	none	none	none	none
Crazing (7 $\times$ magnification)	none	none	none	none
Linear dimensional change, max, %	0.1	0.1	0.5	0.5
Change in weight after immersion in water, max, %	$\pm 3.0$	$\pm 3.0$	$\pm 3.0$	$\pm 3.0$
Static Puncture Resistance	pass	pass	pass	pass
Dynamic Puncture Resistance	pass <sup>C</sup>	pass <sup>C</sup>	pass <sup>C</sup>	pass <sup>C</sup>

<sup>A</sup> Above the cross points of any fabric or fiber and the surface exposed to the weather.

<sup>B</sup> For reinforcing fabric only; elongation of PVC material shall be the same as Type II, Grade 1.

<sup>C</sup> For Type II, Grade 1 products, dynamic puncture shall be evaluated at an energy level of 10 J min. For Type II, Grade 2 and Type III products, dynamic puncture shall be evaluated at an energy level of 20 J min.