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Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing¹

This standard is issued under the fixed designation D6878/D6878M; 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. ~~ε¹Note—Subsection 7.13.2 was editorially corrected in January 2009.~~

1. Scope

1.1 This specification covers flexible sheet made from thermoplastic polyolefin (TPO) as the principal polymer, intended for use in single-ply roofing membranes exposed to the weather. The sheet shall contain reinforcing fabrics or scrims.

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, field seaming strength, material compatibility, and uplift resistance, among others, are factors which should 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.~~

1.3 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 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 requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D471 Test Method for Rubber Property Effect of Liquids

D573 Test Method for Rubber Deterioration in an Air Oven

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 Sheeting or Film at Elevated Temperature

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

D5538 Practice for Thermoplastic Elastomers Terminology and Abbreviations

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. Materials and Manufacture

3.1 The sheet shall be formulated from ethylene and higher alpha-olefin polymers, copolymers, and mixtures thereof, in amounts greater than 50 %, by weight of the total polymer content suitably compounded to satisfy the physical requirements in the specification (see Practice D5538).

3.2 The sheet shall be capable of being heat welded, fused, or adhesively bonded to itself for making watertight field splices and repairs, and the supplier or fabricator shall recommend suitable methods and materials.

3.3 Sheet shall be reinforced with fabric or scrim.

4. Physical Properties and Tolerances

4.1 Each sheet specimen shall meet or exceed the physical requirements prescribed in Table 1.

¹ 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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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.

TABLE 1 Physical Requirements for TPO Sheet

Thickness, min, mm (in.)	
Thickness, min, mm [in.]	
—Sheet overall	1.0 (0.039)
Sheet overall	1.0 [0.039]
—Coating over fabric or scrim, weathering side only	0.305 (0.012)
Coating over fabric or scrim, weathering side only	0.305 [0.012]
Breaking strength, min, N (lbf)	976 (220)
Breaking strength, min, N [lbf]	976 [220]
Elongation at reinforcement break, min, %	15
Tearing strength, min, N (lbf)	245 (55)
Tearing strength, min, N [lbf]	245 [55]
Brittleness point, max, °C (°F)	-40 (-40)
Brittleness point, max, °C [°F]	-40 [-40]
Ozone resistance, no cracks	Pass
Properties after heat aging: (retained values)	
Breaking strength, % min	90
Elongation at reinforcement break, % min	90
Tearing strength, % min	60
Weight change (mass), max %	±1
Linear dimensional change, max, %	±1
Water absorption, max, mass %	±3.0 ^A
Factory seam strength, min, N (lbf)	290 (66)
Factory seam strength, min, N [lbf]	290 [66]
Weather resistance:	
Visual inspection	Pass

^A Test performed on top coating material only. (Use Test Method D471, Procedure for Change in Mass.)

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

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

5. Dimensions and Permissible Variations

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

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

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

6. Workmanship, Finish, and Appearance

6.1 The sheet, including factory seams, if present, shall be watertight and free of pinholes, particles of foreign matter, protruding fibers or reinforcement, undispersed raw material, nicks and cuts, voids, thin areas, delaminations or other manufacturing defects that might adversely affect serviceability.

6.2 Edges of the sheets shall be capable of being seamed to one another without fishmouthing.

7. Test Methods

7.1 *Dimensions*—Test Methods D751, after permitting the sheet to relax at 23°C (73°F) [73°F] for 1 h.

7.2 *Thickness, Sheet Overall*—Refer to Test Methods D751 for ~~Type I.~~

7.3 *Thickness of Coating Over Scrim (Reinforcing Fabric)*—Optical Method described in Annex A1.

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

7.5 *Elongation at Break*—Test Methods D751, Grab Method.

7.6 *Tearing Strength*—Test Methods D751, 2 in./min jaw speed. (~~8 [8 by 8 in. sample size]-size~~).

7.7 *Brittleness Point*—Test Methods D2137, Method B.

7.8 *Ozone Resistance*—Test Method D1149. Inspect at $7\times$ magnification on specimens exposed to 100 mPa (1×10^{-5} psi) psi] ozone in air at 40°C (104°F) [104°F]. Specimens shall be wrapped around a 75-mm (~~3-in.~~) [3-in.] diameter mandrel for 166 h exposure. Specimen shall be wrapped around the same size mandrel for inspection. The required specimen width is 25 mm (~~1.0 in.~~) [1.0 in.].

7.9 *Heat Aging*—Test Method D573. Age sheet specimens for ~~6705376 h~~ (224 days or 32 weeks) at 116°C (240°F) [240°F]. Specimens are then cut from the aged sheet for testing of breaking strength, elongation, and so forth.

7.10 *Linear Dimensional Change*—Test Method D1204. Age specimen for 6 h at 70°C (158°F) [158°F] or 1 h at 100°C (212°F) [212°F].

7.11 *Water Absorption*—Test Method D471 for 166 h at 70°C (158°F) [158°F]. Test performed on top coating material only. (Use Test Method D471, Procedure for Change in Mass.)

7.12 *Factory Seam Strength*—Test Methods D751, Grab Method. Modify procedure by cutting a 25 mm (~~1.0 in.~~) [1.0 in.] wide by 300 mm (~~12 in.~~) [12 in.] long sample across the lap seam. Place in jaws approximately 50 mm (~~2.0 in.~~) [2.0 in.] from edges of