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Standard Specification for Flexible Polypropylene Reinforced (fPP-R) and Nonreinforced (fPP) Geomembranes[1]

This standard is issued under the fixed designation D7613; 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.

1. Scope

1.1 This specification covers flexible polypropylene reinforced (fPP-R) and nonreinforced (fPP) geomembranes made from flexible polypropylene as the principal polymer prepared by the polymerization of propylene with or without other alpha olefin monomers.

1.2 The tests and property limits used to characterize the sheet are values intended to ensure minimum quality. In-place system design criteria, such as field-seaming strength and material compatibility among others, are factors that should be considered but are beyond the scope of this specification.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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]

D573 Test Method for Rubber—Deterioration in an Air Oven

D751 Test Methods for Coated Fabrics

D883 Terminology Relating to Plastics

D1004 Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting

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

D2136 Test Method for Coated Fabrics—Low-Temperature Bend Test

D4439 Terminology for Geosynthetics

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

D5199 Test Method for Measuring the Nominal Thickness of Geosynthetics

D5538 Practice for Thermoplastic Elastomers—Terminology and Abbreviations

D5884 Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes

D6636 Test Method for Determination of Ply Adhesion Strength of Reinforced Geomembranes

D6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

D7004 Test Method for Grab Tensile Properties of Reinforced Geomembranes

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

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminologies D883 and D4439 and Practice D5538.

4. Materials and Manufacture

4.1 The sheet shall be capable of being heat welded, fused, or adhesively bonded to itself for making watertight field splices and repairs.

4.2 Geomembrane can be nonreinforced or reinforced with fabric or scrim.

5. Chemical Composition

5.1 The geomembrane shall be formulated from virgin flexible polypropylene, in amounts greater than 85 %, by weight of the total polymer content. The remaining 15 % shall be comprised of compatible polymers or pigments or both, stabilizers, and colorants that are suitably compounded to

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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 specification's Document Summary page on the ASTM website.

satisfy the physical requirements in the specification (see Practice D5538 for definitions).

NOTE 1—The compound shall not contain postconsumer (PCR) components containing bitumen or any other ingredients that could interfere with the long-term stability of the geomembrane. No more than 10 % rework resin is allowed for the production of the membrane and shall be fully compatible with the parent material.

6. Physical Properties

6.1 Each sheet specimen shall meet or exceed 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 The tolerance for temperature conditions (aging and so forth) is ±2°C of the specified temperature, unless otherwise specified.

7. Dimensions, Mass, and Permissible Variations

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

7.2 The tolerance for both width and length shall be +3 %, -1 %.

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

8. Workmanship, Finish, and Appearance

8.1 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.

9. Test Methods

9.1 *Dimensions*—Test Methods , after permitting the sheet to relax at 23°C for 1 h.

9.2 *Thickness*—Test Method for reinforced and nonreinforced.

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

9.4 *Breaking Strength*—Test Method D7004.

9.5 *Tensile Strength*—Test Method D66933.

9.6 *Elongation at Break*—Test Method D7004.

9.7 *Ultimate Elongation %*—Test Method D6693.

9.8 *Tearing Strength*—Test Method D5884 for reinforced.

9.9 *Tear Resistance*—Test Method D1004 for nonreinforced.

9.10 *Low-Temperature Bend*—Test Method D2136 at -40°C.

9.11 *Heat Aging*—Test Method D573. Age sheet specimens for 670 h at 116°C. Specimens are then cut from the aged sheet for testing of breaking strength, elongation, and tearing strength. After exposure, the sheet specimens shall be removed from the oven; specimens cut from the aged sheet for testing of breaking strength, elongation, and tearing strength; and wrapped around a 75 mm diameter mandrel.

9.11.1 A specimen is rated "pass" if no cracks or crazing is observed using a 10× magnification.

TABLE 1 Physical Requirements

Physical Requirements	Method	fPP-R	fPP
Thickness, lowest individual reading, Reinforced	D5199	0.82 mm	
Thickness over scrim	Annex A1	0.305 mm	
Thickness, lowest individual reading, non-reinforced	D5199		0.68 mm
Breaking strength, minimum		980 N	
Tensile strength, kN/m			10.5 kN/m
Elongation at break, minimum %	D7004	15 %	
Ultimate elongation %	D6693		700 %
Tearing strength, minimum	D5884	244 N	
Tear resistance, minimum	D1004		45 N
Low-temperature bend		-40°C	-40°C
Properties after heat aging & Weathering	D573, G151, G154, G155		
Retention of breaking strength, minimum		85 %	
Retention of tensile strength			85 %
Retention of elongation at break, minimum		85 %	
Retention of ultimate elongation, %			85 %
Retention of tearing strength, minimum		60 %	
Retention of tear resistance, minimum			60 %
Visual inspection no cracks Pass Pass or crazing (10×)		Pass	Pass
Linear dimensional change, maximum change	D1204	1.0%	3%
Puncture resistance reinforced	D4833	330 N	
Puncture resistance non- reinforced			110 N
Factory prepared, ply adhesion strength, min	D6636	65 N	NA