



Designation: D 6947 – 06

Standard Specification for Liquid Applied Moisture Cured Polyurethane Coating Used in Spray Polyurethane Foam Roofing System¹

This standard is issued under the fixed designation D 6947; 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 a single component, moisture cured, elastomeric urethane polymer coating used as a protective coating for spray polyurethane foam roofing systems.

1.2 This specification does not provide guidance for application.

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

1.4 The following precautionary caveat pertains only to the test method portions, Sections 5 and 6.

1.5 *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

D 16 Terminology for Paint, Related Coatings, Materials, and Applications

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D 471 Test Method for Rubber Property—Effect of Liquids

D 522 Test Methods for Mandrel Bend Test of Attached Organic Coatings

D 562 Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer

D 624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

D 903 Test Method for Peel or Stripping Strength of Adhesive Bonds

D 1079 Terminology Relating to Roofing and Waterproofing

D 1644 Test Methods for Nonvolatile Content of Varnishes

D 1653 Test Methods for Water Vapor Transmission of Organic Coating Films

D 2196 Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer

D 2697 Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings

D 4798 Practice for Accelerated Weathering Test Conditions and Procedures for Bituminous Materials (Xenon-Arc Method)

G 21 Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

3. Terminology

3.1 For definitions of terms specific to this standard, refer to Terminologies **D 16** and **D 1079**.

4. Materials and Manufacture

4.1 *Composition*—The product, as manufactured, shall be in liquid form for application to spray polyurethane foam (SPF) surfaces by brushing, rolling, or spraying. The product shall be composed of a solvent-borne moisture curing urethane elastomeric polymer, to which various pigments or other additives have been added to give the required physical properties.

4.2 *Physical Properties*—Although the product is supplied as a liquid, its performance is based on the functional properties of the dried material in film form. The coating is formed into a film fully adhered to the substrate surface.

5. Physical Properties

5.1 The liquid coating shall comply with physical property requirements in **Table 1**.

5.2 The film shall comply with physical property requirements in **Table 2**.

6. Sample and Test Methods

6.1 *Viscosity (Test Methods D 2196)*—Brookfield LVT Viscometer #4 Spindle, 6 RPM.

6.2 *Specimen Preparation (Dry Time)*—Films are prepared by applying two coats, with a minimum of an 8-h drying period between coats, to an FEB sheet substrate to give a total dry film thickness of 0.50 ± 0.5 mm (20 ± 2 mils). The film is allowed

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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 Liquid Property Requirements

Physical Properties	ASTM	Requirements
Viscosity	D 562 D 2196	90 to 110 KU 12 to 85 Pa·s
Volume Solids	D 2697	Greater than 65 %
Weight Solids	D 1644	As listed by Manufacturer

TABLE 2 Film Physical Property Requirements for Polyurethane Moisture Cured Coating for Use on Sprayed Polyurethane Foam

Physical Property	ASTM	Requirement
Initial Percent Elongation (break)	D 412	Minimum 350 %
Initial Tensile Strength (maximum stress)	D 412	Minimum 4.14 Mpa (600 psi)
Final Percent Elongation (break) after accelerated weathering after 1000 h	D 412	Minimum 350 %
Permeance	D 1653 Procedure B	Maximum Permeance 57 ng/[m ² · s · Pa] (1 grain/[ft ² · h · in.-Hg])
Water Absorption (Mass)	D 471	Maximum 3 %
Accelerated Weathering 1000 h	D 4798	No cracking or checking
Adhesion	D 903	Minimum 350 N/m (2.0 pli) Wet
Fungi Resistance	G 21	Zero Rating
Tear Resistance	D 624	Minimum 17.5 kN·m (100 pli)
Low Temperature Flexibility, 12.5 mm (½ in.)	D 522	Minimum pass mandrel -26°C (-15°F)

to thoroughly dry at $23 \pm 2^{\circ}\text{C}$ ($73.4 \pm 3.6^{\circ}\text{F}$) and $50 \pm 10\%$ relative humidity for 336 ± 12 h. The film shall be removed from the release paper and turned over after the first 168 ± 12 h to allow for complete curing.

6.3 Elongation and Tensile Strength (Test Methods D 412):

6.3.1 *Test Conditions:* $23 \pm 2^{\circ}\text{C}$ ($73 \pm 3.6^{\circ}\text{F}$) at $50 \pm 10\%$ relative humidity and $-18 \pm 2^{\circ}\text{C}$ ($0 \pm 3.6^{\circ}\text{F}$).

6.3.2 Cut specimen measuring 75 mm (3 in.) long by 13 mm (½ in.) $\pm 10\%$ wide.

6.3.3 Test type or functional equivalent:

Cross head speed	0.4 mm/s (1.0 in./min)
Gauge length	25 mm (1.0 in.)

6.4 Accelerated Weathering (Practice D 4798):

Cycle Employed	A
Uninsulated Black Panel Temperature	$63 \pm 3^{\circ}\text{C}$
Filter	Daylight
Radiant Exposure (Minimum)	1260 KJ/[m ² nm] @ 340 nm 151.2 MJ/m ² @ 300–400 nm

NOTE 1—Based on the irradiance level of $0.35 \text{ W}/(\text{m}^2 \cdot \text{nm})$ at 340 nm specified in Practice D 4798, the exposure time required to accumulate the radiant energy specified in 6.4 is 1000 h.

6.5 *Permeance (Test Methods D 1653, Procedure B)*—A 0.5 mm (20 mils) $\pm 10\%$ film shall be used.

6.5.1 *Test Conditions:* $23 \pm 2^{\circ}\text{C}$ ($73.4 \pm 3.6^{\circ}\text{F}$).

6.5.2 Test is run in the inverted position with water in contact with the film.

6.5.3 Value is reported in SI units.

6.6 *Water Absorption (Test Method D 471)*—The test shall be conducted at $23 \pm 2^{\circ}\text{C}$ ($73.4 \pm 3.6^{\circ}\text{F}$) using a 0.5 mm (20 mil) $\pm 10\%$ film immersed in distilled water for a period of 168 ± 4 h. At that time the weight is determined.

6.7 *Adhesion to Specified Substrate (Test Method D 903):*

6.7.1 Crosshead speed 0.8 mm/s (2 in./min).

6.7.2 Specimens are prepared by brush applying two coats to the specified substrate with the cloth strip (as described in Test Method D 903) embedded between the coats to give a total dry film thickness of 0.5 mm (20 mils) $\pm 10\%$. The panels are allowed to cure for 336 ± 12 h at $23 \pm 2^{\circ}\text{C}$ ($73.4 \pm 3.6^{\circ}\text{F}$) $50 \pm 10\%$ relative humidity prior to testing for wet adhesion. If a primer is specified, it shall be applied per the manufacturer's or supplier's direction.

6.7.3 Specimens shall be submerged for 168 ± 6 h in tap water at $23 \pm 2^{\circ}\text{C}$ ($73.4 \pm 3.6^{\circ}\text{F}$) prior to testing for wet adhesion. Samples are tested immediately after soaking.

6.8 *Tear Resistance (Test Method D 624)*—Die "C."

6.9 *Low Temperature Flexibility (Test Method D 522)*—Directly cast films to aluminum substrate to result in a dry film thickness of $0.36 \text{ mm} \pm 10\%$ (14 mil $\pm 10\%$) and allow to cure 72 h at $23 \pm 2^{\circ}\text{C}$ ($73.4 \pm 3.6^{\circ}\text{F}$) and $50 \pm 10\%$ relative humidity followed by 120 h at 50°C prior to testing.

7. Performance Requirements

7.1 Shipping containers shall be marked with the name of the material, the stock number, lot number, ASTM designation number and year of issue, quantity therein, shelf-life date, and the name of the manufacturer or supplier.

8. Inspection

8.1 Inspection requirements shall be determined by and as agreed upon between the purchaser and the supplier.

9. Rejection and Resubmittal

9.1 Failure to conform to any one of the requirements prescribed in this specification shall constitute grounds for rejection. The seller shall have the right to reinspect the rejected shipment and resubmit the lot after removal of those packages not conforming to the specified requirements.

10. Precision and Bias

10.1 The precision statements for the test methods included in this specification are under development.

11. Keywords

11.1 elastomeric coating; moisture cured; polyurethane coating; roof; spray polyurethane foam