Designation: D7425/D7425M – 13

Standard Specification for Spray Polyurethane Foam Used for Roofing Applications[1]

This standard is issued under the fixed designation D7425/D7425M; 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 the types and physical properties of spray polyurethane foam (SPF) for use in SPF roofing applications.

1.2 This specification does not provide guidance for application.

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]

C165 Test Method for Measuring Compressive Properties of Thermal Insulations
C168 Terminology Relating to Thermal Insulation
C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
C1363 Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
D1079 Terminology Relating to Roofing and Waterproofing
D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
D1622 Test Method for Apparent Density of Rigid Cellular Plastics
D1623 Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
D2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
D2842 Test Method for Water Absorption of Rigid Cellular Plastics
D6226 Test Method for Open Cell Content of Rigid Cellular Plastics
E96/E96M Test Methods for Water Vapor Transmission of Materials

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminologies D1079 and C168.

3.1.1 *knit line*—also called lift line. They are interchangeable terms describing the adhesion plane where one pass is sprayed over another.

4. Significance and Use

4.1 This specification covers spray polyurethane foam (SPF) that is used as part of a SPF roofing system.

5. Classification

5.1 This specification covers SPF currently commercially available as described by the physical property requirements in Table 1.

6. Ordering Information

6.1 Orders for materials purchased under this specification shall include the following:

6.1.1 ASTM designation, year of issue, and title.
6.1.2 Type.
6.1.3 Sampling, if different (see Section 9).
6.1.4 If packaging is other than specified (see 13.1).
6.1.5 If marking is other than specified (see 13.4).

7. Materials and Manufacture

7.1 SPF is produced by the catalyzed polymerization of polyisocyanates in the presence of polyhydroxyl compounds, with the addition of other compounds such as stabilizers and blowing agents.

[1] This specification is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.06 on Spray Polyurethane Foam Roof Systems.

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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 Property

Property	Units	Requirements
Thermal resistance of 25 mm [1.0 in.] thickness aged at mean temperature 24°C [75°F] for 180 days or at mean temperature 60°C [140°F] for 90 days.	K·m^2/W [°F·ft ^{2}·h/Btu]	0.98 [5.6], min
Compressive strength, at yield or 10 % deformation	KPa [psi]	276 [40], min
Density	Kg/m^3 [lb/ft^3]	40 [2.5], min
Water absorption	volume %	5, max
Tensile strength	KPa [psi]	276 [40], min
Dimensional stability, 70°C, 97 % RH, 2 weeks	linear change %	+6, max
Closed cell content	%	90, min
Water vapor permeability	ng/Pa·s·[perm-in.]	4.47 [3.02], max

NOTE 1—Thermal Resistance of SPF for roofing application varies significantly depending on formulations, but shall have a minimum value of 0.98 K·m^2/W [5.6°F·ft^2/Btu] per 25.4 mm [1 in.].

7.2 The materials shall be capable of being mixed and applied using commercially available polyurethane spray equipment.

8. Physical Requirements

8.1 SPF used in roofing applications shall meet the minimum physical property values as shown in Table 1.

8.2 Other physical properties may be required, as agreed upon by the purchaser and the manufacturer.

9. Sampling

9.1 Sampling for inspection tests, if required, shall be for properties agreed upon between the manufacturer and the purchaser.

10. Test Specimen Preparation

10.1 Finished SPF test panels shall be made by spray application consistent with the manufacturer's recommendations including temperatures of the liquid components, ambient temperature, temperature and type of substrate, type and operation settings of spray equipment, and thickness of SPF per pass. Unless otherwise specified and reported, the ambient and substrate temperature shall be 24 ± 3ºC [75 ± 5ºF] and relative humidity must not exceed 80 %. The test panels shall be of a sufficient quantity and size to satisfy test requirements.

10.2 The test panels shall be allowed to cure for at least 72 h at 24 ± 3ºC [75 ± 5ºF] and 50 ± 5 % relative humidity before cutting or testing for additional physical properties.

10.3 Core specimens, when required, shall be obtained by removing both the external skin and the boundary skin found at the substrate/SPF interface. A trim cut on each face to a depth of 3 to 6 mm [⅛ to ¼ in.] is sufficient

10.4 Sample preparation method for determining response to thermal and humid aging in accordance with Test Method D2126. The samples are spray applied to exterior CDX grade 19 mm [¾ in.] plywood (unfinished on both sides), which is 610 by 610 mm [2 by 2 ft]. The maximum height of the applied foam shall be 50 mm [2 in.] above the substrate with a minimum of two passes and a maximum of three. A sample of 305 by 305 mm [12 by 12 in.] is cut from the center of the plywood foam sample as the test specimen. The specimen and plywood will be cut in such a manner that it will have a knit line. The cut foam height will be 25.4 mm [1 in.] from the plywood surface. The test specimen will have smooth edges free of cracks. All faces shall be flat. Dust shall be blown off the sample. Two specimens shall be used for test exposure per test. In addition, one sample of the plywood will also be cut to these dimensions as a control.

11. Test Methods

11.1 Determine thermal resistance in accordance with Test Method C177, Test Method C1363, or Test Method C518 at a mean temperature of 24 ± 1ºC [75 ± 2ºF] and 22ºC [40ºF] minimum temperature gradient. These core specimens shall be conditioned 24 ± 1ºC [75 ± 2ºF] and 50 ± 5 % relative humidity for 180 days. Size of specimens shall be 305 by 305 by 2.5 mm [12 by 12 by 1 in.].

11.2 Determine compressive strength in accordance with Test Method C165, Procedure A, at a crosshead speed of 2.54 mm/min [0.1 in./min] per 25.4 mm [1 in.] of thickness, at yield or 10 % deformation, whichever comes first, or in accordance with Test Method D1621, Procedure A. The loading force shall be applied parallel to the normal thickness dimension of the SPF.

11.3 Determine water absorption in accordance with Test Method D2842.

11.4 Determine tensile strength in accordance with Test Method D1623.

11.5 Determine the response to thermal and humid aging in accordance with Test Method D2126. Expose 305 by 305 by 25 mm [12 by 12 by 1 in.] specimens adhered to 19 mm [¾ in.] exterior grade plywood to 70 ± 2ºC [158 ± 4ºF] and 97 ± 3 % relative humidity for 168 ± 2 h. Measure after 24 ± ½ h and 168 ± 2 h.

11.6 Determine core density in accordance with Test Method D1622.

11.7 Determine water vapor permeability in accordance with Test Method E96/E96M, Procedure B. The test specimen shall be flat and without external skin. The number of knit lines shall be reported.

11.8 Determine the closed cell content in accordance with Test Method D6226.

12. Rejection, Rehearing, and Resubmittal

12.1 Finished SPF test panels that fail to conform to the requirements of this specification are grounds for rejection of the liquid components. Rejection should be reported to the

manufacturer promptly and in writing. In case of disagreement with the results of any test, the manufacturer may make a claim for a rehearing. In case of rejection the manufacturer shall have the right to reinspect the rejected shipment and resubmit the lot after removal of that portion not conforming to requirements.

13. Packaging and Package Marking

13.1 Unless otherwise specified or agreed upon between the manufacturer and the purchaser, the liquid components shall be packaged in the manufacturer's standard commercial containers.

13.2 Each package shall be blanketed with dry air or nitrogen and tightly sealed.

13.3 Each container shall be clearly identified as either polyisocyanate ("A" component) or resin ("B" component).

13.4 Each container shall also be marked with the following information:

13.4.1 Name of the manufacturer.

13.4.2 Manufacturer's product designation.

13.4.3 Manufacturer's lot or date of manufacturer or both.

13.4.4 Net weight of the contents and gross weight of the container and contents.

13.4.5 Instructions for safe handling and recommended storage temperatures.

13.4.6 Mixing instructions.

13.4.7 Listing agency label if applicable.

14. Keywords

14.1 insulation; roofing; SPF—spray polyurethane foam

APPENDIX

(Nonmandatory Information)

X1. General Information

X1.1 The properties of spray-applied polyurethane foam (SPF) may vary depending on such factors as the thickness of the SPF, the temperature and type of substrate, the ambient temperature and humidity, the number of spray passes, and the output of the equipment. The properties may also vary depending on different manufacturer's liquid components.

X1.2 SPF generally exhibits its highest thermal resistance at the time of manufacture. The thermal resistance may be significantly influenced by installation and service-related variables such as age, foam thickness, type of coating, environmental conditions and mechanical abuse. These variables may cause the thermal resistance to be reduced from measured initial values.

X1.3 Rigid-cellular polyurethane thermal insulation is combustible to varying degrees when exposed to an ignition source or high temperatures, or both.

X1.4 Consult local building and fire code regulations, insurance requirements, and the manufacturer's specifications and application instructions for each specific installation. Detailed information concerning the application of SPF and fire safety can be obtained from the SPFA (Spray Polyurethane Foam Alliance)