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Light density open cell semi-rigid spray polyurethane foam – Material Specification

1. Scope

This document specifies the material property requirements for open cell spray-applied semi-rigid polyurethane foam, used as an air barrier and as thermal insulation. The document includes the test methods used to determine these properties.

The supplier produces a liquid “resin” component and supplies the corresponding polymeric isocyanate which, when mixed together on a fixed ratio basis, produce the material with the material properties listed in this document. This final material is manufactured on-site by the installer.

This material is installed on the interior of a building between framing members. This material is not designed to be in contact with water, perform as a vapor retarder, or support compression or tensile loads.

This document does not cover either one component or two component sealant foams.

The test methods listed in this document are used to determine the values for the material properties. These values are intended to be used to evaluate materials and for quality control. They are not intended to predict end-use material performance.

This material is limited to continuous service temperature of any substrate within the range of -60 to +80 °C (-76 to 176 °F).

The testing and evaluation of a material against this document may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this document has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any existing applicable regulatory requirements prior to its use.

2. Referenced documents

The documents shown below are referenced in the text of this document. Unless otherwise stated elsewhere in this Document such reference shall be considered to indicate the edition and/or revisions of the document available at the date on which the Committee approved this document.

Air Barrier Association of America, Inc.
1600 Boston Providence Hwy
Walpole MA 02081 USA
Telephone: (866) 956-5888 Fax: (866) 956-5819
www.airbarrier.org

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ABAA 0004, Standard Test Method for Determining Gap Bridging Ability of Air and Water Resistive Barrier Material

Documents Published by the American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 U.S.A.
Telephone: (610) 832-9585 Fax: (610) 832-9555
www.astm.org

ASTM C390, Standard Criteria for Sampling and Acceptance of Preformed Thermal Insulation Lots

ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

ASTM C1338, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings

ASTM D618, Standard Practice for Conditioning Plastics for Testing

ASTM D1622, Test Method for Apparent Density of Rigid Cellular Plastics

ASTM D2126, Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging

ASTM D6226, Standard Test Method for Open-Cell Content of Rigid Cellular Plastics

ASTM E84, Standard test method for surface burning characteristics of building materials

ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials

ASTM E2178, Standard Test Methods for Air Permeance of Building Materials

ASTM E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

3. Terminology

light density, open cell spray applied semi-rigid polyurethane foam (material)

semi-rigid cellular plastic material that is formed in place by the catalyzed reaction of polymeric isocyanate and polyhydroxyl compounds, expanded with non-captive blowing agents and producing an open-cell material with a minimum of 80 % open cell content that has a density between 6.8 and 12 kg/m³ (0.43 and 0.75 lb/ft³).

spray polyurethane foam system supplier (supplier)

manufacturer or distributor responsible for the liquid chemical system (resin and polymeric isocyanate) which is designed to be mixed and sprayed to form spray polyurethane foam material in-situ

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4. Requirements

4.1 General

The material shall be site manufactured /installed in accordance with the manufacturer's instructions.

The liquid components (resin and polymeric isocyanate) shall be stored in accordance with the manufacturer's instructions and installed before the "expiry" date.

4.2 Detailed requirements

The material shall meet the required material performance specified in Table 1.

5. Sampling

The testing laboratory conducting the testing shall be responsible for the random sampling of the resin containers and polymeric isocyanate containers. Sampling shall be performed in accordance with the principles of ASTM C 390.

Unless otherwise specified in the appropriate test method, the number of sample panels shall be left to the discretion of the organization determining compliance with this Document.

6. Sample panels

The sample panels shall be prepared in accordance with the manufacturer's instructions such that they are representative of the end product.

All sample panels shall be prepared from the same open-cell formulation and documented. This can be accomplished by one of the following methods:

- a. A single batch (lot) of liquid components shall be used to produce a complete set of sample panels required to produce individual specimens in the size and number required to conduct all the tests included in this document for a single occasion which has been formulated and sprayed in order to represent the minimum foam density required by the manufacturer.
- b. Sample panels are made using a witnessed formulation for the resin. The witnessing agent shall be from a 3rd party accredited agency and shall verify that all sample panels used to conduct all the tests included in this document were made from the same chemical formulation.
- c. Manufacturer is under a 3rd party quality control system that verifies the sample panels used to conduct all the tests included in this document were made from the same chemical formulation.

Except for the sample panel required to create the air leakage test specimen, the sample panels shall be made by spraying on a 12 mm (½ in.) nominal thick plywood substrate.

Unless specified by the test method, the size of the sample panels shall be a minimum of 1.0 m x 1.0 m (39 in. x 39 in.) nominal. The material shall uniformly fill a cavity 140 mm (5.5 in.) in height and shall not contain any voids. Excess material above the 140 mm (5.5 in.) nominal framing

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member shall be trimmed so that it is flush to the top of the wooden framing member prior to conditioning.

The ambient temperature (in the area where the sample panels are produced) and the substrate temperature shall be $23 \pm 5 \text{ }^\circ\text{C}$ ($74 \pm 10 \text{ }^\circ\text{F}$) and the ambient relative humidity (RH) shall not exceed 80 %, unless otherwise specified and so reported.

7. Conditioning of sample panels

Unless otherwise specified, sample panels shall be conditioned in accordance with ASTM D 618, (Procedure A) i.e., 88 h at $23 \pm 2 \text{ }^\circ\text{C}$ ($74 \pm 5 \text{ }^\circ\text{F}$), $50 \pm 5 \text{ } \%$ RH prior to cutting the specimens.

8. Preparation of specimens

Unless otherwise specified in the test method, the specimens shall be cut to the required size from the sample panels using a band saw or other suitable equipment. Unless specified otherwise, specimens shall be 100 mm (4 in.) thick and shall be taken 25 mm (1 in.) from the substrate to represent core specimens with no skins remaining on the specimens.

9. Test methods

9.1 Air leakage rate - material

The air leakage rate shall be determined in accordance with ASTM E2178 using five specimens (Figure 1). The specimens shall be prepared by constructing a rectangular wood frame 1.0 m x 1.0 m (39 in. x 39 in.) inside dimensions. The height shall be equal to the thickness of the material being tested. Wood fiberboard or other similar material is to be attached to one side of the frame. The liquid components shall be sprayed into the frame and shall have a height greater than the frame. The material above the open top of the frame shall be cut flush with the frame. The wood fiberboard shall be cut from the frame/material and removed. A wire mesh shall be installed on both sides of the wood frame, holding the material in place. The corners of the wood frame shall be sealed. The specimen shall be installed into the testing apparatus outlined in ASTM E 2178. The mean value of the specimens shall be reported to at least four decimal places and a value of zero is an invalid test. The thickness of the material tested shall be reported.

9.2 Apparent core density

The apparent core density shall be determined in accordance with ASTM D 1622 using five core specimens measuring 100 mm x 100 mm x 100 mm (4 in. x 4 in. x 4 in.). The average of the five specimens shall be reported.

9.3 Dimensional stability

The dimensional stability shall be determined in accordance with ASTM D 2126, except that the specimen conditioning time before testing shall be 14 d at $23 \pm 2 \text{ }^\circ\text{C}$ ($74 \pm 5 \text{ }^\circ\text{F}$) and $50 \pm 5 \text{ } \%$ RH.

Three specimens (without substrate) measuring 100 mm x 100 mm x 25 mm (4 in. x 4 in. x 1 in.) thick (direction parallel to rise) that has been cut from the sample panels shall be used. The dimensional changes are to be measured after the specimens have been exposed to the following conditions, using at least:

- a. 28 d at $-20 \pm 2 \text{ }^\circ\text{C}$ ($-4 \pm 5 \text{ }^\circ\text{F}$), ambient humidity;

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- b. 28 d at 80 ± 2 °C (176 ± 5 °F), ambient humidity; and
- c. 28 d at 70 ± 2 °C (158 ± 5 °F), 97 ± 3 % RH

Determine the dimensions of the three principal axes to the nearest ± 0.1 %. Make three measurements per dimension at the approximate top, bottom and center of each face. Report the distorting of the specimens under the specified aging conditions.

The average percentage volumetric change obtained is to be reported for each exposure. The results are to be expressed as a “plus %” when there has been expansion and as a “minus %” when there has been shrinkage.

9.4 Fungi resistance

The fungi resistance shall be determined in accordance with ASTM C 1338 using three specimens measuring 150 mm x 150 mm x 25 mm (6 in. x 6 in. x 1 in.).

9.5 Gap bridging

The gap bridging shall be determined in accordance with ABAA 0004 using three specimens. The gap to be used is a Class 4, a 6 mm (3/16 inch). The test temperature shall be Type B temperatures -26 ± 2 °C (-15 ± 4 °F)

9.6 Open-cell content volume

The open-cell content volume shall be determined in accordance with ASTM D 6226 Procedure 2 using three 25 mm x 25 mm x 25 mm (1 in. x 1 in. x 1 in.) specimens. The results shall be expressed as an average of the three specimens.

9.7 Surface burning characteristics

The surface burning characteristics shall be determined in accordance with ASTM E84. The flame-spread rating and smoke development shall be determined on the basis of two tests each meeting the requirements, not averaged together. The specimens shall be prepared in accordance with the ASTM E84 test method.

9.8 Tensile strength

The tensile strength shall be determined in accordance with ASTM D1623 using 3 Type B specimens. The results shall be reported as the average of the three specimens.

9.9 Thermal resistance

The thermal resistance shall be determined in accordance with ASTM C518 at a standard mean temperature of 24 °C (75 °F) and a temperature differential of 22 ± 2 °C (40 ± 4 °F). Three specimens shall be tested which measure 300 mm x 300 mm x 90 mm thick, (12 in. x 12 in. x 3.5 in.) cut in direction of rise and cut from core. The specimens tested shall be conditioned at 60 ± 2 °C (140 ± 4 °F) and 50 ± 5 % RH for 90 d from the time of sample panel preparation. Report the mean value and the average value of the specimens. The average value shall be used as the value of the material.

9.10 Water vapor transmission rate

The water vapor transmission rate shall be determined in accordance with ASTM E96 at a temperature of 23 ± 2 °C (73 ± 4 °F) for both the water method and the desiccant method using

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three 100 mm thick specimens. The average value of the specimens, as outlined in ASTM E96, shall be reported.

10. Reporting requirements

The reported values for the material requirements shall be the average value resulting from testing the number of specimens required by the specified test method.

Test data shall be reported in the form of a table with property, result and pass/fail columns including results for all properties listed in this document followed by a statement on whether the material met the requirements of this document.

In addition to the information specified in the individual test methods, the report showing conformance to this document shall include the following information:

- a. manufacturer's name, address, production facility address and product designation;
- b. type and name of the material and other material description;
- c. lot number and manufactured date and expiry date;
- d. sampling information;
- e. name and location of laboratory performing the tests and the accreditation agency for the laboratory for each specific test;
- f. size of specimens used for each test;
- g. description of the thermal resistance test apparatus, calibration standards used and their source;
- h. report of the average of all test results and report the apparent core density of the material used for each the tests;
- i. report of all test results according to the test methods;
 - i.1 ABAA 0004 Section 8
 - i.2 ASTM C518 Section 9
 - i.3 ASTM C1338 Section 8
 - i.4 ASTM D1622 Section 11
 - i.5 ASTM D1623 Section 11
 - i.6 ASTM D2126 Section10
 - i.7 ASTM D6226 Section 11
 - i.8 ASTM E84 Section 11
 - i.9 ASTM E96 Section 14
 - i.10 ASTM E2178 Section 10
 - i.11 ASTM E2357 Section 11
- j. summary of measured results compared to the requirements of this document and when applicable an indication that the property has passed/failed;
- k. declaration of conformity with this document;
- l. when follow-up testing is required, the agency conducting the sampling shall be identified and if the sampling was unannounced and at random;
- m. appendix to the report shall contain the data used to generate the above items; and

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11. Packaging and labelling

11.1 Packaging

Unless otherwise specified, the liquid components shall be packaged in the manufacturer's standard containers. When liquid components are transported in bulk, the labelling requirements shall be met by supplying a written report containing all of the information required in Clause 12.

12. Labelling

Each liquid component container shall be clearly identified as either polymeric isocyanate component or resin component. Unless otherwise specified, each container shall be marked with the following information:

- a. manufacturer's name;
- b. material name;
- c. component name;
- d. type of material (e.g. light density, open cell);
- e. net mass of the contents of the packaged liquid components;
- f. country of manufacturer;
- g. lot number;
- h. manufacturer and/or expiry date; and
- i. reference to this document

13. Manufacturer's documentation

The manufacturer shall provide upon request;

- a. description of the liquid components;
- b. safety data sheet for each liquid component;
- c. instructions for safe handling, use and disposal of the liquid components;
- d. physical properties of the liquid components; and
- e. shelf life of the liquid components.

14. Verification requirements

The manufacturer's compliance to this document shall be by testing and reporting the results of the tests as required in the reporting section.

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TABLE 1
REQUIREMENTS FOR MATERIAL PROPERTIES

Property	Unit	Requirements		Test Method
		Min.	Max.	
air leakage rate – material (declare thickness tested)	L/(s·m ²) @ 75 Pa (CFM/ft ² @ 1.57 psf)	-	0.0200 (0.00400)	ASTM E2178
apparent core density	Kg/m ³ lb/ft ³	6.80 0.43	12.00 0.75	ASTM D1622
dimensional stability -20°C +80°C +70°C, 97 ±3 % R.H.	%	- - -	Shrinkage/growth -1/+10 -15/+10 -15/+14	ASTM D2126
fungi resistant	-	no growth	-	ASTM C1338
gap bridging	visual	no cracking	-	ABAA T0003
open-cell content volume	%	80	-	ASTM D6226
surface burning characteristics – flame spread	-	-	75	ASTM E84
surface burning characteristics – smoke development	-	-	450	
Tensile strength	psi kPa	1 7	-	ASTM D1623
thermal resistance	W·m ² ·K F·ft ² ·h/Btu	report		ASTMC518
water absorption	%	-	5	ASTM D2842
water vapor transmission at 100 mm (4 in.) thick	ng/Pa·s·m ² (US Perms)	declare both water and desiccant methods		ASTM E96