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Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation[1]

This standard is issued under the fixed designation C739; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers the composition and physical requirements of chemically treated, recycled cellulosic fiber loose-fill type thermal insulation for use in attics or enclosed spaces in housing, and other framed buildings within the ambient temperature range from −45 to 90°C by pneumatic or pouring application. While products that comply with this specification are used in various constructions, they are adaptable primarily, but not exclusively, to wood joist, rafters, and stud construction.

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

1.3 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B152/B152M Specification for Copper Sheet, Strip, Plate, and Rolled Bar

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

C687 Practice for Determination of Thermal Resistance of Loose-Fill Building Insulation

C1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus

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

C1363 Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

C1374 Test Method for Determination of Installed Thickness of Pneumatically Applied Loose-Fill Building Insulation

C1485 Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using an Electric Radiant Heat Energy Source

C1630 Guide for Development of Coverage Charts for Loose-Fill Thermal Building Insulations

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E970 Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, see Terminology C168.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *attic*—an enclosed space between the roof and ceiling of the occupied part of a building.

3.2.2 *critical radiant flux*—the level of incident radiant heat energy on the attic floor insulation system at the most distant flame-out point (W/cm^2).

4. Materials and Manufacture

4.1 The basic material shall be recycled cellulosic fiber made from selected paper, paperboard stock, or ground wood stock, excluding contaminated materials, which may reasonably be expected to be retained in the finished product. Suitable

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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.

chemicals are introduced to provide properties such as flame resistance, processing, and handling characteristics.

4.2 The basic material may be processed into a form suitable for installation by pneumatic or pouring methods.

5. Physical and Chemical Properties

5.1 *Design Density*—The design density shall be determined in accordance with Section 8. Report all units in kg/m^3.

5.1.1 Design density is not a basis for acceptance or rejection.

5.2 *Corrosiveness*—The loose-fill insulation material shall be tested for corrosiveness as specified in Section 9. The composition of the insulation material shall be such that after testing, no perforation of the 3-mil (76-µm) metal specimens shall be evident when the specimens are observed over a 40-W appliance light bulb. Notches extending into the coupon 3 mm or less from any edge shall be ignored.

5.3 *Critical Radiant Flux*—When tested in accordance with Section 10, the critical radiant flux shall be ≥ 0.12 W/cm^2. All values shall be reported to two significant digits.

5.4 *Fungi Resistance*—The loose-fill insulation material shall be tested and shall pass fungi resistance as specified in Section 11. If the growth on two or more of the replicate test items is greater than that on the comparative item, the test item shall be considered to fail.

NOTE 1—If the manufacturing claims the insulation kills or controls insects or rodents, or both, the product must be registered as a pesticide under the Federal Insecticide, Fungicide and Rodentic Act, as amended, and must also be registered in accordance with state pesticide statutes.

5.5 *Moisture Vapor Sorption*—Moisture gain in the insulation shall be no more than 15 % by weight when tested in accordance with Section 12.

5.6 *Odor Emission*—Any sample producing a detectable odor that is classified as objectionable and strong or very strong by more than two panel members shall be considered to have failed the test when tested in accordance with Section 13.

5.7 *Smoldering Combustion*—When tested in accordance with the smoldering combustion test method in Section 14, the insulation shall show no evidence of flaming and a weight loss no greater than 15 %.

5.8 *Thermal Resistance*—The standard thermal resistance values normally recommended for open application are: 2.3, 3.4., 3.9, 5.3, 6.7, and 8.6 and are expressed in K·m^2/W. The thermal resistance *R* for the average of any (four) randomly selected specimens shall not be more than 5 % below the listed *R* value when tested in accordance with Section 15. *R* values other than those listed shall be as agreed upon between the supplier and the purchaser.

6. Workmanship, Finish, and Appearance

6.1 The product shall be free of extraneous foreign materials such as metals and glass that will adversely affect the performance in service.

TEST METHODS

7. Summary

7.1 The following tests shall be conducted on loose-fill cellulosic insulation at the measured design density: moisture vapor sorption, smoldering combustion, and thermal resistance.

NOTE 2—The importance of an insulation's product to maintain its fire retardant characteristics is recognized. A task group in ASTM C16.31 is currently studying methods to ascertain if there is a long-term deterioration of fire performance characteristics of cellulose insulation. Should the need for a permanency test be determined by this task group and a test method be developed and finalized, it will become a part of this specification.

8. Design Density

8.1 *Scope*—This test method provides a basis for calculating the product coverage values and for conducting physical property tests requiring the use of design density for sample preparation.

8.2 *Significance and Use*—The design density is the approximate density expected after long-term attic application.

8.3 *Apparatus and Materials:*

8.3.1 *Insulation Specimen Container*—A beaker having a flat bottom and an inside diameter of 15.0 ± 1 cm, straight sides. The height of the beaker shall be such that the distance between the bottom of the cyclone and the top edge of the beaker is 8.50 ± 1.0 cm.

8.3.2 *Flat Rigid Disk,* having a total weight of 75 ± 5 g and of a suitable diameter to fit loosely into the specimen container. Weight may be added to the center of the disk to bring the total weight to the required 75 ± 5 g.

8.3.3 *Balance,* having a 2-kg capacity accurate to ±0.2 g.

8.3.4 *Blower Apparatus,* having two blower units (supply and overflow) meeting the following specifications:

8.3.4.1 Each blower apparatus shall be capable of blowing an average of 272.2 kg of insulation per hour.

8.3.4.2 Each blower apparatus shall have a nominal air flow velocity of 0.38 m/s.

8.3.4.3 Each blower apparatus shall have a nominal motor speed of 16 450 r/min at 115 V (a-c).

8.3.5 *Shaker Unit,* having a capability of shaking 4.5 kg of weight with a vertical motion of 0.5 g rms acceleration at an approximate frequency of 9 Hz and displacement of approximately 1.17 ± 0.08 cm.

8.3.6 *Fill Chamber,* having inside dimensions of 45.7 cm high by 38.1 cm wide by 38.1 cm deep, with covered openings that will allow a radiant panel tray to be slid through the chamber (see Fig. 1).

8.3.7 *Cyclone Receiver*—See Fig. 2.

8.3.8 *Hose*—Various lengths of nominal 5.08-cm diameter hose (see Fig. 1):

8.3.8.1 *Supply Source Hose,* 274.3 ± 5.1 cm.

8.3.8.2 *Cyclone Receiver Hose,* 182.9 ± 5.1 cm.

8.3.8.3 *Fill Chamber Exit Hose,* 91.4 ± 5.1 cm.

8.3.8.4 *Overflow Exhaust Hose,* length as needed.

8.3.9 *Blower Controls,* having capability of operating the two blowers at 40 V rms and 12 A.