Designation: C240 – 08$^{\varepsilon 1}$

StandardTest Methods of Testing Cellular Glass Insulation Block[1]

This standard is issued under the fixed designation C240; 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.

ε^1 NOTE—Units of measure were updated in March 2009.

1. Scope

1.1 These test methods cover the testing of cellular glass insulation block for density, water absorption, compressive strength, flexural strength at ambient temperature; preparation for chemical analysis; and thermal conductivity measurements.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered 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 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

C203 Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation

C303 Test Method for Dimensions and Density of Preformed Block and Board–Type Thermal Insulation

C390 Practice for Sampling and Acceptance of Thermal Insulation Lots

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

C871 Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions

C226 Specification for Air-Entraining Additions for Use in the Manufacture of Air-Entraining Hydraulic Cement

2.2 *ISO Standard:*

ISO 3951 Sampling Procedure and Charts for Inspection by Variables for Percent Nonconforming[3]

2.3 *Military Standard:*

MIL-I-24244 Specification Insulation Materials with Special Corrosion, Chloride, and Fluoride Requirements[4]

2.4 *Other Standard:*

NRC 1.36 Nonmetallic Thermal Insulation for Austenitic Stainless Steel[5]

3. Terminology

3.1 *Definitions*—Terminology C168 shall be considered as applying to the terms considered in these test methods.

4. Significance and Use

4.1 From a general standpoint, these test methods outline the particular points which have to be taken into account when applying ASTM standard test methods to the case of cellular glass insulating block.

5. Test Methods

5.1 *General Sample Preparation*—All tests have to be run on dry specimens. In case of need, the sample must be unpacked and stored in a dry place in such a way that all surfaces are exposed to the ambient air for a minimum of 24 hours before testing.

5.2 *Density*—Determine the density in accordance with Test Method C303. Preferably, the density shall be measured on a full block, 18 by 24 in. (450 by 600 mm) by full thickness.

[1] These test methods are under the jurisdiction of ASTM Committee C16 on Thermal Insulation and are the direct responsibility of Subcommittee C16.32 on Mechanical Properties.

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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.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from Standardization Documents Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094.

[5] Available from Director of Regulatory Standards, US Atomic Energy Commission, Washington, DC 20545.

5.2.1 It shall be noted that density is interesting as such for calculation of insulated equipment load and because it has influence on the other important properties of cellular glass. But it shall not be considered in itself as a criterion for acceptance in the case of cellular glass.

5.3 *Water Absorption:*

5.3.1 *Scope*—This test method covers the determination of water absorption of cellular glass insulating blocks by measuring the amount of water retained as a result of complete immersion for a prescribed time interval. Surface blotting is used to correct for the water absorbed on the cut surface cells.

5.3.2 *Significance and Use*—This test method provides a means of measuring the water absorption of cellular glass insulating blocks under isothermal conditions as a result of direct immersion in liquid water. It is intended for use in product evaluation and quality control.

5.3.3 *Equipment and Materials:*

5.3.3.1 *Balance,* minimum 1500 g capacity and 0.1 g or greater sensitivity.

5.3.3.2 *Immersion Tank,* equipped with inert specimen supports and top surface weights such as stainless steel.

5.3.3.3 *Synthetic Sponge,* 4 by 7 by 1.5 in. (100 by 180 by 40 mm) or larger. Sponges found acceptable to use include cellulosic sponges and fine-pored absorbent synthetic plastic sponges.

5.3.3.4 *Test Room,* with temperature of 70 ± 5°F (21 ± 3°C) and relative humidity of 50 ± 10 %.

5.3.3.5 *Distilled Water.*

5.3.4 *Procedure:*

5.3.4.1 Carefully measure the thickness, width, and length to the nearest 1 mm of a cellular glass block, preferably 2 by 12 by 18 in. (50 by 300 by 450 mm) and calculate the volume and exposed surface area.

5.3.4.2 Weigh the specimen to the nearest 0.1 g (W_1), then submerge it horizontally under 25 mm (1 in.) of water maintained at 70 ± 5°F (21 ± 3°C). Inert top surface weights are required to keep it submerged. After submerging it for 2 h, set the specimen on end on a damp cotton bath towel to drain for 10 min. After the 10 min, remove the excess surface water by hand with a damp sponge for 1 min per large face and 1 min for the four sides. Wring out the sponge before and once in between for each face and pass a minimum of two times on each surface. Blot each face of the specimen equally by compressing the sponge by a minimum of 10 % of its thickness. Weigh the specimen immediately (W_2) to the nearest 0.1 g.

5.3.5 *Calculation of Results*—Calculate the weight of water absorbed ($W_2 - W_1$) and express it as a function of the exterior surface of the sample (g/cm ^{2}). Water absorption is also be expressed as a function of volume percent, absorbed water volume divided by specimen volume; or as a function of weight percent, weight of water absorbed ($W_2 - W_1$) divided by the dry specimen weight (W_1). Such ways of expressing the results shall be strictly limited to direct comparison of results on specimens of identical sizes.

5.3.6 *Precision and Bias*—The precision as determined in inter-laboratory tests is given in Research Report RR C16-1007.[6] The repeatability or single-laboratory operator precision is ±0.00060 g/cm^2 or ±0.030 volume % (±1S). The reproducibility or multilaboratory operator precision is ±0.00071 g/cm^2 or ±0.035 volume %. Due to a lack of a standard, no statement is made regarding bias.

5.4 *Compressive Strength*—Determine the compressive strength in accordance with Test Method C165 Procedure A, with the following test parameters and specimen preparation techniques:

5.4.1 Each of the two parallel bearing surfaces of the specimens shall be plane. When required, rub them on a suitable abrasive surface to produce the required flat surface.

5.4.2 The test specimens shall preferably be one half block 12 by 18 in. (300 by 450 mm) by nominal received thickness. Alternates include a quadrant 9 by 12 in. 225 by 300 mm() or a full block 18 by 24 in.(450 by 600 mm) by nominal received thickness. A quadrant specimen shall be taken from any one of four equal area quadrants of the preformed block. The minimum acceptable specimen size is 8 by 8 in. (200 by 200 mm). The report shall include the specimen size.

5.4.3 Cap both bearing surfaces of the specimens as follows: Coat one surface with molten Type III or Type IV asphalt (350, + 50, – 25°F (preheated to 177, + 28, – 14°C)), completely filling the surface cells with a small excess. Such a coating application rate is approximately 0.20 lb/ft^2 (1.0 kg/m^2) ± 25%. Immediately press the hot coated block onto a precut piece of felt or paper laying on a flat surface. This is to prevent the asphalt surface from sticking to the compression platten during the test. A lightweight kraft paper is suitable, although traditionally a Type 1 roofing felt paper, commonly called a No. 15 asphalt felt, per Specification C226 has been used.

NOTE 1—A hot asphalt capping is used to simulate field applied systems, which require a high load bearing insulation product, ranging from roof applications to cryogenic storage tank base applications. Uncapped material or different cappings will give different values.

Properly capped surfaces shall be approximately plane and parallel. Set the specimens on edge, exposing both capped surfaces to room temperature for a minimum of 15 min to allow the asphalt to harden before testing.

5.4.4 The number of specimens to be tested and the sampling plan shall conform to Practice C390 where applicable. For the purpose of inspection by user's representative or independent third party, the number of specimens shall conform to ISO 3951 inspection level S-4, 10.0 % AQL using the S method.

5.4.5 Compress the specimen until failure. The deformation at failure will vary, depending on the thickness of insulation and the thickness of the capping materials. Record the loads at the failure point or definite yield point. The compressive strength is calculated from this load divided by the specimen cross sectional area in accordance with Test Method C165.

5.4.6 The rate of loading will depend on the type of equipment used. With a hydraulic test machine use a constant load rate of 500 lbf/s (2200 N/s) for half block specimen. With a screw driven machine use a crosshead speed of 0.01 in./min.

[6] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: C16 – 1007.