Designation: ~~C209 – 07a$^{\varepsilon 1}$~~ C209 – 12

Standard Test Methods for Cellulosic Fiber Insulating Board[1]

This standard is issued under the fixed designation C209; 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 («) indicates an editorial change since the last revision or reapproval.

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

~~[1] NOTE—Footnote 4 was editorially updated in August 2007.~~

1. Scope

1.1 These test methods cover those insulation products in specified Specification C208 ~~that are not singularly specified elsewhere as insulating formboard (see Specification . C532) and nail-base sheathing (see Specification D2277).~~ The requirements for the products' physical properties are specified in Specification C208. The methods for the general insulation products' physical properties are given as follows:

	Section
Thickness	7
Size of Finished Board	8
Thermal Conductivity	9
Transverse Strength	10
Deflection at Specified Minimum Load	11
Tensile Strength Parallel to Surface	12
Tensile Strength Perpendicular to Surface	13
Water Absorption	14
Linear Expansion	15
Water Vapor Transmission	16
Flame Spread Index	17
Moisture Content and Density	18
Compressive Strength	19

1.2 Reference is provided to an established source for nomenclature and definitions.

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.*

1.4 Several of the test methods contained in this document are referenced by material specifications other than cellulosic fiber insulating board. These include mineral fiber, perlite, polyisocyanurate, polystyrene and phenolic materials.

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

C208 Specification for Cellulosic Fiber Insulating Board

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

~~C532 Specification for Structural Insulating Formboard (Cellulosic Fiber) (Withdrawn 1992)[3]~~

C870 Practice for Conditioning of Thermal Insulating Materials

C1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions

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

[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.

Current edition approved ~~May 1, 2007~~Oct. 15, 2012. Published ~~June 2007~~January 2013. Originally approved in 1946. Last previous edition approved in 2007 as ~~C209 – 07.~~C209 – 07a[1]. DOI: ~~10.1520/C0209-07AE01.1~~0.1520/C0209-12.

[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.

D1037 Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
D1554 Terminology Relating to Wood-Base Fiber and Particle Panel Materials
~~D2277 Specification for Fiberboard Nail-Base Sheathing (Withdrawn 1992)[3]~~
E84 Test Method for Surface Burning Characteristics of Building Materials
E96/E96M Test Methods for Water Vapor Transmission of Materials

3. Terminology

3.1 *Definitions*—The definitions of terms used in these methods shall be in accordance with Definitions D1554 and Terminology C168.

3.2 *cellulosic fiber insulating board*—a fibrous-felted, homogeneous panel made from ligno-cellulosic fibers (usually wood ~~or cane)~~) and having a density of less than 31 lb/ft^3 (497 kg/m^3) but more than 10 lb/ft^3 (160 kg/m^3).

3.2.1 *Discussion*—

Cellulosic fiber insulating board. It is characterized by an integral bond that is produced by interfelting of the fibers, but which has not been consolidated under heat and pressure as a separate stage in manufacture. Other materials may be added during manufacture to improve certain properties.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *board*—refers to the material as received.

3.3.2 *sample*—refers to the 36 by 48-in. (0.9 by 1.2-m) piece cut from a board.

3.3.3 *test specimen*—refers to the test piece cut from a sample unless otherwise specified in the test method.

3.3.4 *sorption*—a general term in physical chemistry used to describe the combined processes of:

(*1*) *absorption*—refers to the taking up of matter in bulk by other matter, for example, the penetration of substances into the bulk of another solid or liquid.

(*2*) *adsorption*—refers to surface retention or adhesion of an extremely thin layer of molecules to the surfaces of solids or liquids with which they are in contact.

4. Significance and Use

4.1 The test methods contained in this document are intended for cellulosic fiber insulating board as described in Specification C208. These test methods examine mechanical, physical and thermal properties, properties related to water absorption and water vapor exposure, and flammability related properties.

4.2 The results of these tests may be used to describe the performance of insulating board and are suitable for use in material specifications.

NOTE 1—Committee C-16 is in the process of splitting this document into discrete test methods categorized by the nature of the test methods.

5. Sampling

5.1 *Selection of Boards*—Refer to Specification C208, Section 9 on Sampling.

5.2 *Size of Sample*— From each board a sample, 36 by 48 in. (0.9 by 1.2 m) shall be cut. When possible, the larger dimension of the sample shall be crosswise of the longer dimension of the board as it is usually obtained. When the individual boards are less than 36 by 48 in. (0.9 by 1.2 m) in size, enough material shall be taken to give the equivalent area.

6. Test Conditions

6.1 *Preconditioning*— Tests shall be made under prevailing atmospheric conditions except in the case of dispute. Tests then shall be made ~~in~~on specimens conditioned until equilibrium is obtained in accordance with Practice C870.

7. Thickness

7.1 *Apparatus*—An instrument such as a dial gage capable of measuring a 36 by 48 in. (0.9 by 12 m) sample, on which the contacting surfaces are flat and have a minimum diameter of ½ in. (13 mm) shall be used. Pressure on the contacting surfaces shall not be greater than 1 psi (6.9 kPa) nor less than 0.25 psi (1.7 kPa), and the instrument shall read to an accuracy of 0.001 in. (0.03 mm).

7.2 *Procedure*—Measure the thickness at five points, near each corner and near the center, to an accuracy of ±0.001 in. (±0.02 mm). Take care that the sample is not deformed when the thickness measurements are taken.

7.3 *Calculation and Report*—Report the average of the five measurements as the average thickness of the sample. Report as the average thickness of the sample, the average thickness of the lot, report thickness tolerance, as follows:

$$\text{Thickness tolerance} = \sim h_1 2 h_2 ! / h_1 \quad (1)$$

where:

h_1 = average thickness of lot, and
h_2 = average thickness of sample.

8. Size of Finished Board

8.1 *Procedure*—Obtain the average width of the finished board by measuring the width at each end and at the middle to an accuracy of ±0.3 % or 1⁄16 in. (2 mm), whichever is smaller, and averaging these readings. Obtain the average length of the finished board in a similar manner.

9. Thermal Conductivity

9.1 *Procedure*—Determine thermal conductivity in accordance with Test Method C177, or in accordance with Test Methods C518, C1045 or C1114. Test two specimens from one sample from one board.

10. Transverse Strength

10.1 *Apparatus:*

10.1.1 *Testing Machine*— Any standard mechanical or hydraulic testing machine capable of applying and measuring the required load within an accuracy of ±2 % may be used.

10.1.2 *Bearing Edges*— The bearing edges shall be rounded to a radius of ⅜ in. (10 mm) to prevent injury to the specimen. The bearing edges shall be straight and shall maintain full contact with the specimen throughout the test.

10.2 *Test Specimen*— The specimen shall be 3 by 15 in. (76 by 381 mm) and conditioned in accordance with 6.1. Three specimens from the long dimension of each sample from each board and three at right angles shall be tested. If the sample has a dimension less than 15 in. (381 mm), test only in that direction for which a 15 in. (381 mm) specimen can be obtained.

10.3 *Procedure*—Determine the transverse load by placing the specimen on horizontal bearing edges 12 in. (305 mm) apart and applying the load at midspan on a bearing parallel to the end supports, so that the head of the testing machines, through which the load is applied, moves at a rate of 6 ± 2 in./min (152 ± 51 mm/min) until failure occurs.

10.4 *Calculation and Report*—Report as the transverse load for specimen, the maximum load reached during the test. Report as the average transverse load in pounds-force (or Newtons) in each direction for a sample, the average of three specimens taken from that direction. Report as the total average transverse load in each direction, the average of all samples in that direction. Calculate modulus of rupture values in pounds-force per square inch (or megapascals) as follows:

$$MOR = 6P/t^2 \quad (2)$$

where:

MOR = Modulus of rupture, psi (MPa),
P = Transverse load, lbf (N), and
t = thickness, in. (mm).

10.5 *Precision and Bias*—See Section ~~19~~20.

11. Deflection at Specific Minimum Load

11.1 *Procedure*—Determine, to the nearest 0.01 in., (0.3 mm) the deflection at the corner of each specimen subjected to the minimum transverse load, by means of a suitable measuring device such as a dial gage under the specimen, a steel rule alongside the specimen, or measurement of the crosshead movement.

11.2 *Calculation and Report*—Report as the average deflection in each direction for a sample, the average of three specimens taken from that direction. Report as the total average deflection in each direction, the average of all samples in that direction.

11.3 *Precision and Bias*—See Section ~~19~~20.

12. Tensile Strength Parallel to Surface

12.1 *Apparatus*—Any standard mechanical or hydraulic testing machine capable of applying and measuring the required load within an accuracy of ±2 % may be used.

12.2 *Test Specimen*— Specimens shall be prepared in accordance with Fig. 1, and conditioned in accordance with 6.1. Three specimens from the long direction of each sample from each board and three at right angles thereto shall be tested.

12.3 *Procedure*—Set the testing machine for a rate of separation of the jaws of 2 ± ¼ in./min (51 ± 6 mm/min). Clamp the specimens in the jaws at a minimum distance of 6 in. (152 mm) apart. Specimens breaking within ½ in. (13 mm) of the jaws shall be disregarded. Measure the specimens, after breaking, for width and thickness at the break to the nearest 0.01 in. (0.3 mm).

12.4 *Calculation and Report*—Report as the average tensile strength in each direction for a sample, the average, in pounds-force per square inch (or kilopascals), of the three specimens taken from that direction. Report as the total average value in each direction, the average of all samples in that direction.