Designation: ~~C1763 – 14~~ C1763 – 16

Standard Test Method for Water Absorption by Immersion of Thermal Insulation Materials[1]

This standard is issued under the fixed designation C1763; 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 test method determines the amount of water retained (excluding surface water) by flat specimens of thermal insulations after these materials have been fully immersed in liquid water for a prescribed time interval under isothermal conditions. This test method is intended to be used for the characterization of materials in the laboratory. It is not intended to simulate any particular environmental condition potentially encountered in building construction applications.

1.2 This test method does not address all the possible mechanisms of water intake and retention and related phenomena for thermal insulations. It relates only to those conditions outlined in 1.1. Determination of moisture accumulation in thermal insulations due to partial immersion, water vapor transmission, internal condensation, freeze-thaw cycling, or a combination of these effects requires different test procedures.

1.3 This test method does not address or attempt to quantify the drainage characteristics of materials.

1.4 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.

1.5 *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. Material And Specimen Characteristics that can Influence Results

2.1 The apparent water absorption measured by this test method is dependent on the surface to volume ratio of the sample and time of immersion. As such, comparisons between Procedures A, B, and, C cannot be made. Cracks in the specimens and rough surfaces can increase the apparent water absorption.

2.2 Some materials tend to collect water on surfaces or to trap water in corners and, if not removed, will give incorrect results.

2.3 Materials that change or react with water can have increased (or decreased) apparent water absorption and are not suitable for use with this method. ~~12.5.1~~13.5.1 provides a method for ensuring the specimen has not been physically or chemically altered in a way that would invalidate the measurement. Use this method in cases of dispute.

3. Referenced Documents

3.1 *ASTM Standards:*[2]

C168 Terminology Relating to Thermal Insulation
C303 Test Method for Dimensions and Density of Preformed Block and Board–Type Thermal Insulation
C870 Practice for Conditioning of Thermal Insulating Materials
C1134 Test Method for Water Retention of Rigid Thermal Insulations Following Partial Immersion
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

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[1] This test method is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.33 on Insulation Finishes and Moisture.

Current edition approved ~~May 1, 2014~~March 1, 2016. Published ~~July 2014~~July 2016. Originally approved in 2014. Last previous edition approved in 2014 as C1763 – 14. DOI: ~~10.1520/C1763–14.~~10.1520/C1763-16.

[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.

4. Terminology

4.1 *Definitions*—Terminology C168 applies to terms used in this test method.

5. Summary of Test Method

5.1 Test specimens are conditioned and then immersed in water for a prescribed amount of time. The amount of water absorbed is determined by the weight increase in the specimens.

6. Significance and Use

6.1 This test method provides a means of measuring the water absorption of flat specimens of thermal insulation materials under isothermal conditions as a result of direct immersion in liquid water. It is intended for quality control and product and material specifications.

6.2 The procedure to be used: A, B, or C as well as any exceptions shall be noted in material specifications citing this test method.

6.3 Repeatability has been established only for one type and size of material at one immersion duration.

NOTE 1—Specifications referring to this test method are encouraged to establish repeatability for specific materials, immersion duration, and dimensions for inclusion in this test method.

7. Apparatus

7.1 *Temperature measuring device*—Such as a thermometer, graduated in Celsius or Fahrenheit degrees with at least 1ºC (2ºF) sensitivity.

7.2 *Balance,* accurate to 0.1g.

7.3 *Immersion Pan*—A pan or vessel of width and length at least 50 mm (2 in.) larger than the dimensions of the specimen width and length, and of a depth at least 50 mm (2 in.) greater than the specimen thickness.

7.4 *Timing device,* such as stopwatch or timer capable of ±1% of the required immersion duration.

7.4.1 *Specimen Supports and Constraints*—Included in the construction of the immersion pan shall be a means for securing the specimens in a level position, that is, a noncorrosive support for the bottom surface of the specimens and a similar constraining device for the top surface for buoyant materials. The support and constraining devices shall not contact more than 15 % of the specimen surfaces. The space between the support and the bottom of the pan shall be not less than 5 mm (0.2 in.). The pressure exerted on the specimens by the constraining device for the top surface shall be limited to that required to counteract any buoyant force exerted by the specimens at the beginning of the test. Stainless steel is an acceptable support and weight material. An example of a suitable constraining device is a 6.4 mm. (0.25 in.) mesh rigid stainless steel screen.

8. Sampling, Test Specimens, and Test Units

8.1 Number of specimens, dimensions, and dimension tolerance of the test specimen or specimens shall be stated in the material specification to follow one of the following procedures:

8.2 *Procedure A:*

8.2.1 Test specimens shall be 152 ± 3 mm long, 89 ± 3 mm wide, and 51 ± 3 mm thick (6 ± ⅛ in. long, 3½ ± ⅛ in. wide, and 2 ± ⅛ in. thick)

8.2.2 A minimum of two test specimens are required.

8.2.3 Immersion time shall be a minimum of 48 h.

8.2.4 The specimen shall be weighed immediately after the removal of surface water.

8.3 *Procedure B:*

8.3.1 Test specimens shall be 305 ± 3 by 305 ± 3 mm (12 by 12 in.) with all four edges trimmed square and thickness representative of manufactured product.

8.3.2 One specimen from each of three boards shall be tested.

8.3.3 Immersion time shall be 2 h.

8.3.4 The specimen shall be drained by placing on end for 10 min.

8.4 *Procedure C:*

8.4.1 Test specimens shall be 305 ± 3 by 305 ± 3 mm by 25 mm thick. (12 by 12 in. by 1 in. thick.)

8.4.2 Three specimens shall be tested.

8.4.3 Immersion time shall be 24 h.

8.4.4 The specimen shall be shaken vigorously then weighed immediately after the removal of surface water.

NOTE 2—Procedure A is typically used for perlite block insulation.

NOTE 3—Procedure B is typically used for cellulosic fiber insulating board and polyisocyanurate thermal insulation board.

NOTE 4—Procedure C is typically used for polystyrene thermal insulation board.

9. Precision and Bias[3]

9.1 The precision of this test method is based on an interlaboratory study of Test Method C1763 conducted in 2015. Each of ten laboratories tested three different insulating materials. Every "test result" represents an individual determination, and all participants reported triplicate test results. Practice E691 was followed for the design and analysis of the data.

9.1.1 *Repeatability (r)*—The difference between repetitive results obtained by the same operator in a given laboratory applying the same test method with the same apparatus under constant operating conditions on identical test material within short intervals of time would in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

9.1.1.1 Repeatability can be interpreted as maximum difference between two results, obtained under repeatability conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

9.1.1.2 Repeatability limits are listed in Table 1 and Table 2.

9.1.2 *Reproducibility (R)*—The difference between two single and independent results obtained by different operators applying the same test method in different laboratories using different apparatus on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

9.1.2.1 Reproducibility can be interpreted as maximum difference between two results, obtained under reproducibility conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

9.1.2.2 Reproducibility limits are listed in Table 1 and Table 2.

9.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E177.

9.1.4 Any judgment in accordance with statements 9.1.1 and 9.1.2 would have an approximate 95 % probability of being correct.

9.2 *Bias*—At the time of the study, there was no accepted reference material suitable for determining the bias for this test method, therefore no statement on bias is being made.

9.3 The precision statement was determined through statistical examination of all reported results, from ten laboratories, three insulating materials.

9.4 To judge the equivalency of two test results, it is recommended to choose the material closest in characteristics to the test material.

10. Preparation of Apparatus

10.1 Fill the immersion pan with distilled, deionized water sufficient to maintain a 25 mm (1 in.) head of water over the sample surface at all times during the test.

10.2 Allow the water to reach a steady temperature of 23 ± 1°C (73 ± 2°F).

11. Calibration and Standardization

11.1 All measuring equipment shall have calibration certificates that are current at the time of use of the equipment.

12. Conditioning

12.1 Pre-condition per Test Method C870. Additional conditioning, such as heat-soaking, shall be performed as required by the material specification.

13. Procedure

13.1 Measure test specimen dimensions and calculate density per Test Method C303. Weigh each specimen to the nearest 0.1 g. This weight is the pre-immersion weight, W_1.

13.2 The selection of Procedure A, B, or C, including their proscribed sample size and duration of immersion, shall be stated in the material or product specification.

[3] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report ~~RR:C16-1042~~RR:C16-1046. Contact ASTM Customer Service at service@astm.org.

TABLE 1 Water Absorbed by Weight (%)

Material	Average[A]	Repeatability Standard Deviation	Reproducibility Standard Deviation	Repeatability Limit	Reproducibility Limit
	$\bar{x}$	s_r	s_R	r	R
Procedure A: Perlite block insulation	43.89	2.93	3.91	8.19	10.96

[A] The average of the laboratories' calculated averages.