Designation: C 1559 – 04

Standard Test Method for Determining Wicking of Fibrous Glass Blanket Insulation (Aircraft Type)[1]

This standard is issued under the fixed designation C 1559; 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 covers a laboratory procedure for evaluating the tendency of, aircraft type, fibrous glass blanket insulation to wick water.

1.2 The wicking characteristics of materials may be affected by environmental conditions such as temperature and humidity. Values obtained as a result of this test method may not adequately describe the wicking characteristics of materials subject to conditions other than those indicated in the test method. (See Specification C 800.)

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]

C 168 Terminology Relating to Thermal Insulation

C 390 Practice for Sampling and Acceptance of Preformed Insulation Lots

C 800 Specification for Fibrous Glass Blanket Insulation (Aircraft Type)

3. Terminology

3.1 *Definitions*—Terminology C 168 shall be considered as applying to the terms used in this specification.

3.1.1 *wicking*—the infiltration of a wetting liquid into a fibrous glass blanket by capillary attraction.

4. Summary of Test Method

4.1 The insulation is suspended in de-ionized or distilled water so that the bottom of the specimen is submerged to one inch below the water surface; distance of wicking is noted every 24 h for 96 h and then again at the end of 168 h.

5. Significance and Use

5.1 The tendency of the insulation toward wicking can result in an increase in weight and a resultant potential degradation in the properties of the insulation.

6. Apparatus

6.1 As described in the Procedure section of this test method.

6.2 *Steel Rule*, accurate to ± 0.05 in. (1 mm).

7. Sampling, Test Specimens, and Test Units

7.1 Six specimens shall be tested for each procedure, cut with the axis parallel to the length and six cut with the axis perpendicular to the length from a representative package.(See Practice C 390.)

7.2 The specimens shall be 1- by 6-in. (25.4- by 152.4-mm) by full sample thickness.

7.3 The insulation shall be tested without facing or jacketing.

8. Conditioning

8.1 As described in the Procedure section of this test method.

9. Procedure A—Wicking as Received

9.1 Condition specimens for at least 24 h at 73 ± 4°F (23 ± 2°C) and 50 ± 5 % relative humidity.

9.2 With fine wire, fasten loosely six specimens (three cut with the axis parallel to the length and three cut with the axis perpendicular to the length)[3] to a grease-free 0.025 to 0.035 in. (0.64 to 0.89 mm) 8 by 8 mesh stainless steel wire screen. Position this assembly in an upright position so the ends of the specimens touch the bottom of the container. The 6-in. sample

[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 Sept. 1. 2004. Published October 2004. Originally approved in 2003. Last previous edition approved in 2003 as C1559–03.

[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] An alternative attachment method would be to attach the specimens to the wire mesh using a hot melt adhesive (at approximately ½ in. below and above the water line, and approximately ½ in. from the top of the specimen).

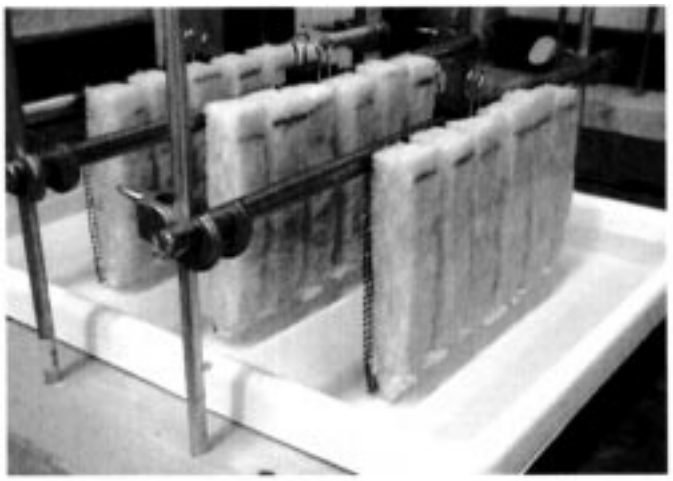

FIG. 1 Typical Specimen Mounting for Wicking Test

dimension is in a perpendicular direction to the water surface. The specimens must not touch each other or the sides of the container (Fig. 1).

9.3 Pour de-ionized (or distilled) water into the container to a height of 1-in. (25-mm) (Optional: add dye[4] to the water—1 to 2 drops per liter to the water to facilitate marking the extent of wicking). The water shall be at 68 ± 4°F (20 ± 2°C).

9.4 Position the remaining six specimens similarly in another container. Pour de-ionized (or distilled) water into this container to a height of 1-in. (25-mm), again adding dye. Maintain the temperature of this water at 120 ± 5°F (50 ± 2°C) by using a hot plate.

9.5 Note distance of wicking above water surface with steel rule every 24 h in each container for the first 96 h. Then note again after 168 h. Replenish the water daily to maintain water level.

10. Procedure B—Wicking after Aging

10.1 Condition a sample of insulation 8- by 14-in. (203- by 356-mm) in a forced air circulating oven at 160 ± 5°F (71 ± 3°C) for two weeks or at least 336 h. The aged specimen shall be tested according to procedure outlined in 9.2-9.5.

11. Procedure C—Wicking after Leaching

11.1 Condition a sample of insulation 8- by 14-in. (203- by 356-mm) by submerging in an immersion tank of de-ionized (or distilled) water maintained at a temperature of 80 to 85°F (27 to 29°C) for a period of at least 24 h. The tank shall be of such a shape and size that the specimen can be submerged therein with all surfaces of the specimen having full access to the water. Ratio of specimen to water shall not be less than 1 to 100 by weight. A continuous flow of water shall be supplied to the bottom of the container at the above temperature at a rate of five changes per hour. At the end of the leaching period, the specimen shall be removed from the water, air dried to a constant weight and weighed. The leached specimen shall be tested according to procedure outlined in 9.2-9.5.

12. Calculation or Interpretation of Results

12.1 Determine the amount of wicking by measurement with a steel rule as described in 6.2.

12.2 Wetting of the submerged portion of the wicking specimens is permissible. Wicking is the distance of wetting above the water surface (average value of center-point measurements of three sides of the wicking specimen-side adjacent to screen surface should not be measured).

12.3 Beads of water are not to be construed as a condition of wetting. The formation of beads of water on the insulation surface indicates water repellency.

12.4 Surface wetting is not considered wicking, but cannot be greater than 1 in. (25.4 mm) when measured from the water line.

13. Report

13.1 The report shall include the following:

13.1.1 Name and any additional identification of the material tested,

13.1.2 Thickness of the material,

13.1.3 Number of specimens tested, and

13.1.4 The average wicking height according to each condition.

14. Precision and Bias

14.1 *Inter-laboratory Test Program*—An inter-laboratory study was run in which randomly selected test specimens of one material (0.42 pcf by 1 in.) were tested for wicking in each of five laboratories with each laboratory testing three specimens per configuration. Practice E 691 was followed for the design and analysis of the data. A single laboratory provided all of the test specimens. The details are given in ASTM Research Report RR:C16-1028 [5].

14.2 *Test Result*—The precision information shown below in units of measurement noted is for the comparison of one material and based on an average of 3 tests.

14.3 *Precision*—See Table 1.

TABLE 1 Water Repellency Round Robin Statistical Results Using Standard E 691

Cell Average	Standard Deviation of the Cell Averages	Repeatability Standard Deviation	Reproducibility Standard Deviation	Repeatability Limit[A]	Reproducibility Limit[B]
$\bar{X}$ bar	S_x	S_r	S_R	r	R
0.22 in.	0.11	0.07	0.11	0.18	0.30

[A] 95 % confidence = 2.8 · S_r
[B] 95 % confidence = 2.8 · S_R

14.4 *Bias*—No information can be presented on the bias of the procedure in Test Method C 1159 for measuring wicking, because no material having an accepted reference value is available.

[4] Dye such as "Key Acid Blue" distributed by Chem Central Corporation. Dye should be tested to insure that the surface tension of water is not reduced (approximately 72 dynes/ cm).

[5] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: C16-1028.

15. Keywords

15.1 aircraft; aircraft insulation; fibrous glass insulation; wicking