Designation: C 764 – ~~99~~02

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

This standard is issued under the fixed designation C 764; 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 Department of Defense.

1. Scope

1.1 This specification covers the composition and physical properties of nodulated mineral fiber thermal insulation for use in attics or enclosed spaces in housing and other framed buildings.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are provided for information only.

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:*

B 152 Specification for Copper, Sheet, Strip, Plate, and Rolled Bar[2]

C 168 Terminology Relating to Thermal ~~Insulating Materials~~ Insulation[3]

C 177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus[3]

C ~~236 Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box~~[3]

~~C 390 Criteria~~ 390 Criteria for Sampling and Acceptance of Preformed Thermal Insulation Lots[3]

C 518 Test Method for Steady-State ~~Heat Flux Measurements and~~ Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus[3]

C 519 Test Method for Density of Fibrous Loose-Fill Building Insulations[3]

C 687 Practice for Determination of Thermal Resistance of Loose-Fill Type Building Insulation[3]

C 1104/C1104M Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation[3]

C 1304 Test Method for Assessing The Odor Emission of Thermal Insulation Materials[3]

C 1338 Test Method for Determining Fungi Resistance of Insulation Materials and Facings[3]

C 1363 Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus[3]

E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C[4]

E 970 Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Energy Heat Source[4]

G 1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens[5]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminology C 168.

4. Classification

4.1 The nodulated mineral fiber thermal insulation shall be of the following types and classes:

4.1.1 *Type I*—Pneumatic application.

4.1.2 *Type II*—Poured application.

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[1] This specification is under the jurisdiction of ASTM Committee C-16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.23 on Blanket and Loose Fill Insulation.

Current edition approved ~~December~~ Oct. 10, ~~1999.~~ 2002. Published ~~March 2000.~~ October 2002. Originally published as C 764 – 73. Last previous edition C 764 – ~~98~~9.

[2] *Annual Book of ASTM Standards*, Vol 02.01.

[3] *Annual Book of ASTM Standards*, Vol 04.06.

[4] *Annual Book of ASTM Standards*, Vol 04.07.

[5] *Annual Book of ASTM Standards*, Vol 03.02.

5. Ordering Information

5.1 Both types of nodulated mineral fiber thermal insulation are intended for use as thermal insulation in open spaces, such as attics and enclosed spaces, such as walls, in housing and buildings at ambient temperatures. Type I is used for pneumatic application (blown or conveyed by an air stream through a hose and discharged over the area to be insulated). Type II is used for application by pouring in place.

6. Materials and Manufacture

6.1 *Basic Material*—The basic material shall be fibers made from mineral substances such as rock, slag, or glass processed from the molten state into an incombustible fibrous form.

6.2 *Manufacture*—The fibers shall be mechanically processed into nodules, and may be treated to provide improved processing and handling characteristics suitable for installation by pouring or pneumatic applications.

7. Physical Properties

7.1 *Thermal Characteristics*—The standard thermal resistance values normally recommended for open application are: 11, 19, 22, 30, and 38 (1.9, 2.3, 3.3, 3.9, 5.3, and 6.7) and are expressed in °F·h·ft^2/Btu (K·m^2/W). The thermal resistance *R* for the average of any (four) randomly selected samples shall not be more than 5 % below the listed *R* value when tested in accordance with 12.2, nor shall any single specimen be more than 10 % below the listed *R* value. *R* values other than those listed shall be as agreed upon between the supplier and the purchaser.

7.2 *Critical Radiant Flux*—Mineral fiber loose fill when tested in accordance with 12.3 shall have a critical radiant flux-flame propagation resistance ≥0.12 W/cm^2 (.11 Btu/ft^2· s).

7.3 *Combustion Characteristics*—Mineral fiber loose fill when tested in accordance with 12.4 shall not have a recorded temperature rise of more than 54°F (30°C); shall have no flaming after the first 30 s; and, if the specimen weight loss exceeds 50 % during the test, the recorded temperature of the specimen during the test shall not rise above the furnace air temperature at the beginning of the test, and there shall be no flaming of the specimen.

7.4 *Water Vapor Sorption*—The water vapor sorption of the insulation shall not be more than 5 % by weight when tested in accordance with 12.5.

7.5 *Odor Emission*—A detectable odor of a strong objectionable nature recorded by more than two of the five panel members shall constitute rejection of the material when tested in accordance with 12.6.

7.6 *Corrosiveness*—When tested in accordance with 12.7, the metal plates that are in contact with the insulation shall show no corrosion greater than the comparative plates that are in contact with sterile cotton that has been tested in the same manner.

7.7 *Fungi Resistance*—When tested in accordance with 12.8, the insulation shall have growth no greater than that observed on the white birch tongue depressor comparative material.

8. Other Requirements

8.1 *Qualification Requirements*—The following requirements are generally emphasized for purposes of initial material product requirements:

8.1.1 Thermal resistance,
8.1.2 Critical radiant flux,
8.1.3 Combustion characteristics,
8.1.4 Water vapor sorption,
8.1.5 Odor emission,
8.1.6 Corrosiveness, and
~~8.1.6 Corrosiveness.~~
8.1.7 Fungi Resistance.

8.2 *Inspection Requirements*—The following requirements are generally emphasized for purposes of acceptance sampling of lots of qualified thermal insulation:

8.2.1 Minimum bag weight, and
8.2.2 Workmanship.

9. Workmanship

9.1 Mineral fiber nodulated insulation shall be free of foreign materials and shall be clean and dry. The insulation shall not have visible defects that will adversely affect the service quality.

10. Significance and Use

10.1 This specification covers products that are used in buildings. While products that comply with this specification may be used in various constructions, they are adaptable primarily, but not exclusively, to wood frame constructions.

11. Sampling

11.1 Sampling of the insulation shall be in accordance with Criteria C 390. Specific provisions for sampling shall be agreed upon between the purchaser and supplier.

12. Test Methods

12.1 *Density*—Prepare test samples in accordance with Test Method C 519. The density determined by Test Method C 519 shall be equal to or less than the design density of the manufacturer.

12.2 *Thermal Resistance*—Using samples prepared in accordance with 12.1 and adjusted to the design density, the thermal conductivity or thermal conductance shall be determined in accordance with Test Method C 518, Test Method C 177, or may be derived from measurements made by Test Method C ~~2~~1363. The mean temperature shall be 75°F (23.9°C) and the temperature difference shall be a minimum of 40°F (22°C). The thermal resistance shall then be calculated from the thermal conductance values using Practice C 687. See Note 1.

NOTE 1—The thermal resistance is a function of mean temperature. As an option, the thermal resistance may be determined at additional mean temperatures as agreed upon by the purchaser and the manufacturer.

12.3 *Critical Radiant Flux*—The critical radiant flux of the insulation shall be determined in accordance with Test Method E 970.

12.4 *Behavior of Materials in a Vertical Tube Furnace at 1382°F (750°C)*—The behavior of mineral fiber loose-fill insulation in a vertical tube furnace at 1382°F (750°C) shall be determined in accordance with Test Method E 136.

12.5 *Water Vapor Sorption*—The water vapor sorption of the test specimen shall be determined in accordance with Test Method C 1104/C 1104M.

12.6 *Odor Emission*—Determine the odor emission in accordance with Test Method C 1304.

12.7 *Corrosiveness*:

12.7.1 *Scope*—This test method provides a qualitative measure of the corrosiveness of mineral fiber insulation by comparison to a control.

12.7.2 *Summary of Test Method*:

12.7.2.1 Individually sandwich five each of specially cleaned steel, copper, and aluminum test plates between pieces of insulation. Hold the insulation uniformly against each side of the test plate with wire screens and rubber bands.

12.7.2.2 Sandwich an equal number of cleaned metal test plates between pieces of washed sterile cotton in an identical manner.

12.7.2.3 Vertically suspend the samples in a humidity test chamber at 95 ± 3 % relative humidity and temperature of 120 ± 3°F (49 ± 2°C) for time periods determined by the type of metal being tested. Steel is tested for 96 ± 2 h. Copper and aluminum are tested for 720 ± 5 h.

12.7.2.4 After the appropriate test period, compare the test plates exposed to the insulation to the control plates exposed to sterile cotton for severity of corrosion. The insulation is considered to have passed this test if the corrosion attributed to the insulation is not significantly worse than that of the washed sterile cotton controls. The criterion for acceptance is predetermined through the use of non-parametric statistics and a 90 % confidence level ($\alpha = 0.10$). ~~S~~ (see Note 2).

NOTE 2—Task Force C16.31 is developing a more quantitative insulation corrosiveness test method which will be considered for adoption in this standard when available.

12.7.3 *Significance and Use*:

12.7.3.1 The fiber composition and the type of binder used in the manufacture of mineral fiber insulation can sometimes create a potential for corrosion on certain metals in the presence of liquid water or water vapor.

12.7.3.2 This test method is used to determine the relative corrosion potential of mineral fiber insulation on specific metals under high humidity conditions.

12.7.4 *Materials*:

12.7.4.1 *Metal Test Plates*, with dimensions of 1 by 4 ± ¼ in. (25 by 100 mm). Steel plates shall be 0.02 ± 0.005 in. (0.5 mm) thick, bright No. 2 finish, cold-rolled low-carbon strip steel, quarter hard, temper No. 3. The aluminum plates shall be 0.025 ± 0.005 in. (0.6 mm) thick, type 3003-0. Copper plates shall be 0.032 ± 0.005 in. (0.8 mm) thick, in accordance with Specification B 152 type ETP, No. 110 soft copper.

12.7.4.2 *Woven Wire Screen*, 1½ ± ¼ by 4½ ± ¼ in. (114 by 38 mm), made of Type 304 stainless steel, 0.063 ± 0.005 in. (1.60 mm) wire, 7⁄16 ± 1⁄16 in. (11 mm) open-square grid.

12.7.4.3 *Rubber Bands*, No. 12.

12.7.4.4 *Humidity Test Chamber* clean, well maintained, and capable of controlling temperature at 120 ± 3°F (49 ± 2°C) and humidity at 95 ± 3 % relative humidity.

12.7.4.5 *Cheesecloth or Cotton Gauze*, cut into 6 by 10-in. (152 by 254-mm) pieces.

12.7.4.6 *Sample Preparation Fixture*, having a rectangular compartment or well with interior dimensions of 4½ by 1½ by 1½ in. (114 by 38 by 38 mm) with one 4½ by 1½ in. (114 by 38 mm) opening.

12.7.5 *Test Specimen*—A test specimen shall consist of a layer of loose-fill insulation held in place on each side of the metal test plate by a cheesecloth wrap. The loose-fill insulation is compressed uniformly against each side of the metal test plate using woven wire screening and a No. 12 rubber band at each end so that there is approximately a 4½ by 1½ by ½-in. (114- by 38- by 13-mm) thick layer of insulation on each side of the metal test plate.

12.7.6 *Test Method*:

12.7.6.1 Clean the metal test plates until the surface is free of water breaks. Clean the steel test plates first by 5 min of vapor

degreasing (using 1-1-1 trichlorethane or chloroprene). After degreasing, wipe residue from both sides of the coupons using paper laboratory wipes. Then immerse for 15 min in a hot caustic solution (15 % KOH by volume), rinse thoroughly in distilled water, and immediately dry using paper laboratory wipes. Degrease the copper plates in the same manner and then further clean in a hot acidic solution (10 % nitric acid by volume) for 15 min. Rinse the copper plates and dry immediately using paper laboratory wipes. Clean the aluminum plates with a 5 % solution all-purpose laboratory detergent and water, then rinse in distilled water and dry with laboratory wipes. Care should be taken to avoid excessive handling of the surfaces of the metal plates. They should not be touched after the final cleaning step. Plastic surgical gloves or their equivalent are recommended for handling of plates. Also clean the wire screens before use in the same manner as the aluminum plates (that is, wash in detergent, rinse in distilled water, and dry).

12.7.6.2 Build up the five test specimens as follows: place one woven wire screen in the compartment bottom, center and drop the cheesecloth over the compartment. Place a quantity of loose-fill insulation into the compartment and tamp the insulation to form a uniform pack 4½ by 1½ by ½ in. (114 by 38 by 13 mm) thick. Place a metal test plate over the insulation, adding more insulation over the metal test plate and tamp to achieve a uniform top layer 4½ by 1½ by ½–, in. (114 by 38 by 13 mm) thick. Fold the cheesecloth around this configuration. Place a woven wire screen on top of the assembly and secure the assembly at each end with a No. 12 rubber band.

12.7.6.3 Make five test specimens, each one consisting of one piece of metal placed between two pieces of insulation. Compress this assembly between two pieces of woven wire screen and secured near each end with a No. 12 rubber band. The compressed thickness of this assembly shall measure 1 ± ⅛ in. (25 ± 3 mm).

12.7.6.4 Assemble five control specimens, each consisting of one piece of metal placed between two 1½ by 4½ by ½ in. (38 by 114 by 13 mm) pieces of sterile cotton. Identify the outer surface of the cotton as rolled. After cleaning, the sterile cotton surface shall be the surface placed against the metal coupons in the same manner as the insulation specimen. The sterile cotton shall have previously been solvent extracted in reagent grade acetone[6] for 48 h, and then vacuum dried at low heat. Compress these specimens and secure in exactly the manner described in 12.7.6.2.

12.7.6.5 Suspend the five test specimens and five control specimens vertically in an atmosphere free of contaminants, having a relative humidity of 95 ± 3 %, and a temperature of 120 ± 3°F (49 ± 2°C) for the specified test period (96 ± 2 h for steel, 720 ± 5 h for copper and aluminum). If possible, the humidity chamber should remain closed for the entire test period. If the chamber must be opened, care should be taken to ensure that no condensation is within the chamber. At the conclusion of the test period, remove the specimens from the chamber, disassemble, and mark to distinguish individual plates.

12.7.6.6 Closely examine the surfaces of each of the test and control plates for the following characteristics:

(1) Steel—The presence and relative severity of red rust and pitting. Surface blush should not be weighed strongly.

(2) Aluminum—The presence and relative severity of pitting, scaling, or other evidence of attack. The generation of oxide is a protective mechanism of aluminum and should be disregarded. The oxide can be removed by scrubbing with a non-abrasive rubber implement under running water or immersion in a 70 % solution of nitric acid.

(3) Copper—Presence and relative severity of scaling, pitting, deposits, or encrustation, severe discolorations, or general uniform attack. Surface blush and slight discolorations should be ignored and can be removed by scrubbing with a non-abrasive rubber implement under running water or immersing into a 10 % solution of sulfuric acid.

NOTE 3—Additional guidance for evaluating the plates can be found in Practice G 1.

12.7.7 *Interpretation of Results*:

12.7.7.1 Because of the subjectivity inherent in the judging of these plates, nonparametric statistical methods are employed to identify those materials which are conclusively more corrosive than sterile cotton.

12.7.7.2 The ten metal plates (five test, five control), should be examined by at least four judges with experience in corrosion evaluation. Each judge should independently rank all ten plates in order from least severe corrosion to most severe corrosion. The judges should receive no indication as to which plates are control and which are test specimens. The judges' rankings should be based on their own best estimate of the severity of the corrosion visible on each plate.

12.7.7.3 Upon completion of the judges' ratings, the arithmetic sum of all of the rankings for each plate should be calculated. These sums should then be ranked from 1 (lowest total) to 10 (highest total) with any ties being assigned the arithmetic mean of the rankings involved (for example, two plates tied for third = (3 + 4)/2 = 3.5; three plates tied for fourth = (4 + 5 + 6)/3 = 5). The new rankings thus established should then be totaled for the control plates only; if this sum is less than 21, then the control plates are judged to be significantly better than the test plates and the insulation tested is considered to have *failed* the test. Any sum of the rankings for the five control plates greater than or equal to 21 indicates that there is no statistical difference between the control and test plates and the insulation *passes.*

12.7.8 *Precision and Bias*—Assuming that there is no bias involved in the judges' rankings, this test method will identify those materials which are significantly worse than sterile cotton with a statistical confidence of $\alpha = 0.10$. This means that a material which is judged to be more corrosive to a metal than sterile cotton has at most a 10 % chance of being incorrectly failed. This test

[6] *Reagent Chemicals, American Chemical Society Specifications,* American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals,* BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary,* U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

method can make no estimate of the probability that an insulation which is more corrosive than sterile cotton will not be identified as such.

12.8 *Fungi Resistance*—Determine fungi resistance in accordance with Test Method C 1338.

13. Inspection

13.1 Inspection of the insulation shall be made as agreed upon by the purchaser and the manufacturer as part of the purchase contract.

14. Packaging and Package Marking

14.1 *Packaging*—Unless otherwise specified, the insulation shall be packaged in the manufacturer's standard commercial containers.

14.2 *Package Marking*—Markings shall be clear and legible. Unless otherwise specified, each container shall be marked as follows:

14.2.1 Name of manufacturer,

14.2.2 Type of insulation,

14.2.3 Net weight of insulation per bag,

14.2.4 The manufacturer recommends that the insulation be installed at these minimum thicknesses, maximum coverages, to provide the levels of insulation thermal resistance (*R*-value) shown,

14.2.5 The filled-in coverage chart shall be based on the density determined in accordance with the manufacturer's design density and include information indicated in Table 1,

14.2.6 *Certification*—The certification shall state the following:

14.2.6.1 This insulation has been installed in conformance with the above recommendations to provide a value of *R*-_____ using _____ bags of this insulation to cover _____ square feet of area,

14.2.7 Place for builder's signature, company name, and date,

14.2.8 Place for applicator's signature, company, name, and date, and

NOTE 4—The requirements of 14.2.5, 14.2.6, 14.2.7, and 14.2.8 may be satisfied by a separate attic card containing the same information.

14.2.9 Where material is intended for both blowing or pouring application, the bag shall have a separate coverage chart for each type of application.

15. Keywords

15.1 loose-fill; mineral fiber; thermal insulation

TABLE 1 Coverage Chart

NOTE 1—Chart may be given in metric units.

R Value at 75°F Mean Temperature	Maximum Net Coverage		Minimum Thickness	Minimum Weight per ft^2
To obtain an insulation resistance (*R*) of:	Minimum bags per 1000 ft^2 of net area	Maximum ft^2 coverage per bag	Installed insulation should not be less than:	The weight per ft^2 of installed insulation should be not less than:
Attic:				
38	___bags/MSF	___feet^2	___in. thick	___lb/ft^2
30	___bags/MSF	___feet^2	___in. thick	___lb/ft^2
22	___bags/MSF	___feet^2	___in. thick	___lb/ft^2
19	___bags/MSF	___feet^2	___in. thick	___lb/ft^2
11	___bags/MSF	___feet^2	___in. thick	___lb/ft^2
Sidewalls[A]: *R*–	___bags/MSF	___feet^2	___in. thick	___lb/ft^2

[A] Optional information for products intended for sidewall application.