



Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement¹

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1. Scope

1.1 This specification covers mineral fiber (rock or slag) insulating and finishing cement shipped in dry-mix form, including hydraulic-setting binder, which, when mixed with water and applied in accordance with the manufacturer's directions, affords a smooth surface as a final finish for heated surfaces up to 1200 °F (649 °C) for specific applications. The actual temperature limit shall be agreed upon between the purchaser and the manufacturer.

NOTE 1—Precautionary measures should be taken with this material as with other hydraulic-setting mixtures. This material should be used within the time period recommended by the manufacturer.

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 The following safety hazards caveat pertains only to the test method (Section 10) described in this specification: *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 When the installation or use of thermal insulation materials, accessories, and systems pose safety or health problems, the manufacturer shall provide the user with appropriate current information regarding any known problems associated with the recommended use of the company's products and shall also recommend protective measures to be employed in their safe utilization. The user shall establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.

¹ This specification is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.20 on Homogeneous Inorganic Thermal Insulations.

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2. Referenced Documents

2.1 *ASTM Standards*:²

- C163 Practice for Mixing Thermal Insulating Cement Samples
- C166 Test Method for Covering Capacity and Volume Change Upon Drying of Thermal Insulating Cement
- 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
- C356 Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat
- C390 Practice for Sampling and Acceptance of Thermal Insulation Lots
- C411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
- C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- C795 Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
- C1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions
- C1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation
- C1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus
- E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C

3. Terminology

3.1 *Definitions*—Definitions found in Terminology C168 shall be considered as applying to the terms used in this specification.

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. Materials and Manufacture

4.1 Mineral fiber insulating and finishing cement shall be composed of mineral fiber and suitable inorganic fillers, premixed with a hydraulic setting binder such that when mixed with clean, fresh water, the cement will attain its initial set in approximately 2 to 4 h as usually applied.

4.2 The mineral fiber shall consist of rock or slag or glass processed from a molten state into fibrous form.

4.3 Asbestos shall not be used as an ingredient or component part in the manufacture of this product.

4.4 Ceramic fiber shall not be used as an ingredient or component part in the manufacture of this product.

Warning—In the presence of moisture or water, a hydraulic-setting binder, usually portland cement, will chemically react with aluminum-containing materials such as aluminum lagging and powdered aluminum pigmented paints or coatings.

5. Other Requirements

5.1 The cement shall conform to the requirements given in **Table 1**. Conformance shall be based on results of tests on specimens prepared in accordance with **9.1**.

5.2 *Maximum Use Temperature*—When tested in accordance with **10.5**, the dried cement shall not warp, flame, or glow during hot surface exposure. No evidence of melting or fiber degradation shall be evident upon post-test inspection.

5.3 *Non-combustibility*—When tested in accordance with **10.6**, the dried cement specimen, shall conform to the requirements of Test Method **E136**.

5.4 When the cement is to be used in contact with austenitic stainless steel, distilled or demineralized water shall be used for mixing. The cured and dried product, processed in accordance with Section **9** on Specimen Preparation, shall conform to the requirements of Specification **C795**.

6. Qualification Requirements

6.1 The following requirements are employed for purposes of initial material or product qualifications:

- 6.1.1 Dry covering capacity,
- 6.1.2 Volume change upon drying,
- 6.1.3 Linear shrinkage, and
- 6.1.4 Apparent thermal conductivity.

7. Sampling

7.1 The cement shall be sampled for acceptance tests in accordance with **Table 1** (Sampling Plan and Acceptance

Criteria for Inspection Requirements) of Practice **C390**, with each bag representing a shipping unit.

7.2 The test specimen shall be taken from the middle of a bag, so as to be representative of material from the entire bag. A “grain thief” or equivalent shall be used to obtain the specimen from the bag.

8. Number of Tests and Retests

8.1 The number of tests shall be as required in **7.1** or as otherwise agreed to between the manufacturer and the user.

8.2 If the average of the test data obtained on the required number of specimens fails to comply with the requirements of **Table 1**, the lot shall be resampled and retested. The results of the retest shall be averaged with the results of the original tests to determine compliance with this specification.

9. Specimen Preparation

9.1 Allow dry cement to expand/swell by standing for at least 15 min. then mix cement with water, and mold, cure, dry and cut in accordance with Practice **C163**, to produce the appropriate size and shape specimens, for testing as specified below.

10. Test Methods

10.1 *Dry Covering Capacity*—Test Method **C166**.

10.2 *Volume Change Upon Drying*—Test Method **C166**.

10.3 *Linear Shrinkage*—Test Method **C356**.

10.4 *Apparent Thermal Conductivity*

10.4.1 The thermal conductivity as a function of temperature for the representative specimens shall be determined with data obtained from a series of thermal tests utilizing Test Methods **C177**, **C518**, or **C1114** as appropriate for the material under study. Specimen shall be tested at a maximum thickness of 2 in. (51 mm).

10.4.1.1 Test Method **C518** shall not be used at temperatures or resistances other than those in the range of the calibration.

10.4.1.2 Test Method **C1114** shall not be used at temperatures or resistance ranges other than those with comparable results to Test Method **C177**.

10.4.2 The test method selected shall have proven correlation with Test Method **C177** over the temperature range of conditions used. In cases of dispute, Test Method **C177** shall be considered as the final authority for material having flat geometry.

10.4.3 Practice **C1058** shall be used to obtain recommended test temperature combinations for testing purposes.

10.4.4 As specified in Practice **C1045**, the range of test conditions must include at least one test where the hot surface temperature is greater than, or equal to, the hot limit of the temperature range of desired data and at least one test where the cold surface temperature is less than, or equal to, the cold limit of the temperature range desired. Additional tests, at least two, shall be distributed somewhat evenly over the rest of the temperature range.

TABLE 1 Physical Requirements

Dry covering capacity min ft ² @ 1 in. thickness per 100 lb of dry cement (m ² @ 1 cm thickness per 100 kg of dry cement)	24 (12.5)
Volume change (shrinkage) upon drying, max %	10.0
Linear shrinkage (length) after 24 h heat soak at 1200°F (649°C), max %	5.0
Apparent thermal conductivity, max Btu-in./h-ft ² -°F (W/m-K):	
Mean temperature° F (°C),	
75 (24)	0.95 (0.137)
200 (93)	1.00 (0.144)
400 (204)	1.10 (0.159)
700 (371)	1.30 (0.188)

10.4.5 Conduct the final analysis of the thermal data in accordance with Practice **C1045** to generate a thermal conductivity versus temperature relationship for the specimen.

10.4.6 The final step of Practice **C1045** analysis is to calculate the thermal conductivity using the equations generated at a set of mean temperatures for comparison to the specification.

NOTE 2—Caution: While it is recommended that the specification data be presented as conductivity versus temperature, several existing specifications may contain mean temperature data from tests conducted at specific hot and cold surface temperatures. In these cases, the conductivity as a function of temperature from the Practice **C1045** analysis may provide different results. To insure that the data is compatible, a Practice **C680** analysis, using the conductivity versus temperature relationship from Practice **C1045** and the specific hot and cold surface temperatures, is required to determine the effective conductivity for comparison to the specification requirements.

10.5 *Maximum Use Temperature*—Shall be tested, in accordance with Test Method **C411** at the insulation's maximum use temperature and at the manufacturer's maximum recommended thickness at that temperature. No special requirements for heat up of material shall be specified by the manufacturer.

10.6 *Non-combustibility*—Test Method **E136**.

11. Inspection

11.1 The following requirements are employed for purposes of acceptance sampling of lots or shipments of qualified cement:

11.1.1 Dry covering capacity.

11.1.2 Volume change upon drying.

12. Rejection and Rehearing

12.1 Failure to conform to the requirements in this specification shall constitute cause for rejection. Rejection shall be reported to the producer or supplier promptly and in writing.

12.2 In case of rejection, the manufacturer or supplier shall have the right to reinspect the rejected shipment and resubmit the lot after removal of that portion not conforming to the specified requirements.

13. Certification

13.1 When specified in the purchase order or contract, the purchaser shall be furnished with certification that samples representing each lot have been either tested or inspected as directed in this specification, and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

14. Packaging

14.1 Unless otherwise specified or agreed upon by the purchaser and the manufacturer or supplier, the cement shall be packaged in the manufacturer's standard commercial containers.

15. Keywords

15.1 cement; finishing; hydraulic-setting; insulating; mineral fiber; thermal; thermal conductivity

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