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Standard Specification for Mineral Fiber Thermal Insulating Cement[1]

This standard is issued under the fixed designation C195; 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 mineral fiber thermal insulating materials in the form of dry cement, which, when mixed with a suitable proportion of water, applied as a plastic mass, and dried in place, affords resistance to heat transmission on surfaces operating at temperatures between 250 and 1900°F (about 121 and 1038°C).

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 methods section of 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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

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

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

4. Materials and Manufacture

4.1 Mineral fiber thermal insulating cement shall be composed of mineral fiber and inorganic fillers, with a suitable proportion of heat-resistant binder.

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

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

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 shall conform to the requirements of Test Method E136.

[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] 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.

TABLE 1 Physical Requirements

Dry covering capacity, min, ft^2, 1 in. in thickness per 100 lb of dry cement (m^2, 1 cm in thickness per 100 kg of dry cement)	30 (15.6)
Volume change (shrinkage) upon drying, max, %	35 (35)
Linear shrinkage (length) after heat soaking at 1600°F (871°C) max, %	5 (5)
Apparent thermal conductivity, max, Btu·in./h·ft^2·°F (W/m·K):[A]	
At mean temperature of 200°F (93°C)	0.70 (0.101)
At mean temperature of 500°F (260°C)	0.85 (0.123)
At mean temperature of 700°F (371°C)	0.95 (0.137)
At mean temperature of 900°F (482°C)	1.2 (0.173)

[A] The user is advised that some applications could require the knowledge of the thermal conductivity of the insulating cement at mean temperatures above those shown. Consult the manufacturer for data at mean temperatures exceeding those listed.

6. Qualification Requirements

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

6.1.1 Linear shrinkage, and

6.1.2 Dry adhesion to steel.

7. Sampling

7.1 The cement shall be sampled, for the purpose of tests, using one of the following procedures. Unless otherwise specified or agreed upon between the purchaser and the manufacturer or supplier, the cement shall be sampled using the manufacturer's standard procedure.

7.1.1 Use Criteria C390. Each bag shall represent a unit.

7.1.1.1 In a single sampling plan by attributes the acceptability of a lot will be determined by the number of units of product in the sample that do not conform to the specifications. The acceptable quality level (AQL) and limiting quality level (LQL) of an acceptance sampling plan, expressed as percentages of the units nonconforming, are characteristics of the sampling plan and are not to be viewed as product specifications.

7.1.2 Use the average of the test data from the number of test specimens required by the appropriate test method to represent the average for the entire lot.

7.2 The specimen for test is to be taken from the middle of a bag, so as to be representative of material from the entire bag.

8. Number of Tests and Retests

8.1 If the average of the test data obtained using 7.1.2 fails to conform to the requirements of this specification, a second sample shall be taken from the lot. Average the results of the retest with the results of the original test to determine compliance with this specification.

9. Specimen Preparation

9.1 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 1½ in. (38 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.

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. **Warning—**While it is recommended that the specification data be presented as thermal 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 thermal 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 thermal conductivity versus temperature relationship from Practice C1045 and the specific hot and cold surface temperatures, is required to determine the effective thermal conductivity for comparison to the specification requirements.

10.5 *Maximum Use Temperature*—Test Method C411, at the insulation's maximum use temperature and at the manufacturer's maximum recommended thickness at that temperature. The test surface shall be at the intended surface temperature when test begins. No special requirements for heat up 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 manufacturer 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 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 insulating cement; mineral fiber; thermal insulation