



Standard Test Method for Thermal Conductivity of Carbon Refractories¹

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1. Scope

1.1 This test method supplements Test Method C201, and shall be used in conjunction with that procedure to determine the thermal conductivity of carbon or carbon-bearing refractories. This test method is designed for refractories having a conductivity factor of not more than 200 Btu-in./h-ft²·°F (28.8 W/m·K).

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 *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

- C155 Classification of Insulating Firebrick
- C201 Test Method for Thermal Conductivity of Refractories
- E220 Test Method for Calibration of Thermocouples By Comparison Techniques

3. Significance and Use

3.1 The thermal conductivity of carbon refractories is a property required for selecting their thermal transmission characteristics. Users select carbon refractories to provide specified conditions of heat loss and cold face temperature, without exceeding the temperature limitation of the carbon refractory. This test method establishes placement of thermocouples and positioning of test specimens in the calorimeter.

¹ This test method is under the jurisdiction of ASTM Committee C08 on Refractories and is the direct responsibility of Subcommittee C08.02 on Thermal Properties.

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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.

3.2 This procedure must be used with Test Method C201 and requires a large thermal gradient and steady state conditions. The results are based upon a mean temperature.

3.3 The data from this test method is suitable for specification acceptance, estimating heat loss and surface temperature, and the design of multi-layer refractory construction.

3.4 The use of these data requires consideration of the actual application environment and conditions.

4. Apparatus

4.1 The apparatus shall be in accordance with Test Method C201 with the addition of thermocouples, back-up insulation, and refractory fiber paper as described in Section 5 of this test method.

5. Test Specimen and Preparation

5.1 Select the test specimen and prepare in accordance with Test Method C201.

5.2 *Thermocouples*—Embed calibrated thermocouples³ in the test specimen at two points for measuring temperature. Thermocouples⁴ sheathed with material having low reactivity with carbon must be used. Use the top thermocouple for one test only.

5.3 *Installation of Thermocouples*—Place the hot junction of the thermocouples in the center of each 9 by 4½-in. (228 by 114-mm) face and just below the surface of the test specimen. Cut grooves to receive the wire in each 9 by 4½-in. face of the brick to a depth necessary to embed the thermocouple just beneath the surface by means of an abrasive wheel. The layout for the grooves allows all of the cold-junction ends of the wires to extend from one end of the brick. Cut a groove in the center of each 9 by 4½-in. face along the 9-in. dimension and end ¼ in. (6 mm) beyond the center. Before cementing⁵ the thermocouples in place, take measurements to obtain, within ±0.01 in. (±0.3 mm), the eventual distance between the center lines of the thermocouple junctions. Do this by measuring the 2½-in. (64-mm) dimension of the brick at the location for the

³ Method E220 specifies calibration procedures for thermocouples.

⁴ Claud S. Gordon Co., 5710 Kenosha St., Richmond, IL 60071, ¼-in. (2-mm) sheathed Xactpak thermocouple, Cat. No. 401-2104 or equivalent.

⁵ Alundum Cement RA 562 supplied by the Norton Co., One New Bond St., Worcester, MA 01606, is satisfactory for this purpose.