



Standard Test Method for Thermal Conductivity of Refractories by Hot Wire (Platinum Resistance Thermometer Technique)¹

This standard is issued under the fixed designation C1113/C1113M; 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 the determination of thermal conductivity of non-carbonaceous, dielectric refractories.

1.2 Applicable refractories include refractory brick, refractory castables, plastic refractories, ramming mixes, powdered materials, granular materials, and refractory fibers.

1.3 Thermal conductivity k -values can be determined from room temperature to 1500°C [2732°F], or the maximum service limit of the refractory, or to the temperature at which the refractory is no longer dielectric.

1.4 This test method is applicable to refractories with k -values less than 15 W/m·K [100 Btu·in./h·ft²·°F].

1.5 In general it is difficult to make accurate measurements of anisotropic materials, particularly those containing fibers, and the use of this test method for such materials should be agreed between the parties concerned.

1.6 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.7 *This standard does not purport to address 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

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.

C134 Test Methods for Size, Dimensional Measurements, and Bulk Density of Refractory Brick and Insulating Firebrick

C201 Test Method for Thermal Conductivity of Refractories
C865 Practice for Firing Refractory Concrete Specimens
E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 ISO Standard:

DIS*8894-2 Refractory Materials - Determination of Thermal Conductivity up to 1250°C of Dense and Insulating Refractory Products According to the Hot Wire Parallel Method³

3. Terminology

3.1 Symbols:

3.1.1 R_T —hot wire resistance at any temperature, ohms.

3.1.2 R_0 —hot wire resistance at 0°C [32°F] (from an ice bath), ohms.

3.1.3 L —hot wire length, cm.

3.1.4 T —sample test temperature, °C.

3.1.5 V —average voltage drop across hot wire, volts.

3.1.6 V_s —average voltage drop across standard resistor, volts.

3.1.7 R_s —average resistance of standard resistor, ohms.

3.1.8 I —average current through hot wire (V_s/R_s), amperes.

3.1.9 Q —average power input to hot wire ($I \cdot V \cdot 100/L$) during test, watts/m.

3.1.10 t —time, min.

3.1.11 B —slope of linear region in R_T vs. $\ln(t)$ plot.

3.1.12 k —thermal conductivity, W/m·K.

3.1.13 a , b , c —coefficients of a second degree polynomial equation relating hot wire resistance and temperature.

3.1.14 V , I , and Q are preferably measured in the linear region of the R_T versus $\ln(t)$ plot for maximum data accuracy.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.