Designation: C831 – 98 (Reapproved 2013)

Standard Test Methods for Residual Carbon, Apparent Residual Carbon, and Apparent Carbon Yield in Coked Carbon-Containing Brick and Shapes [1]

This standard is issued under the fixed designation C831; 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 These test methods cover the determination of residual carbon content in carbon-bearing brick and shapes after a prescribed coking treatment. They provide two procedures. The first procedure is based on the combustion of carbon and its measurement as carbon dioxide. However, when using the first procedure for articles that contain silicon carbide or other carbides, no distinction will be made between carbon present in the form of a carbide and carbon present as elemental carbon. The second procedure provides a method for calculating apparent residual carbon (on the basis of weight loss after igniting the coked specimens), apparent carbonaceous material content, and apparent carbon yield. If the second procedure is used for brick or shapes that contain metallic additives or carbides, it must be recognized that there will be a weight gain associated with the oxidation of the metals, or carbides, or both. Such a weight gain can change the results substantially and this must be kept in mind when interpreting the data.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are 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:*[2]

C571 Methods for Chemical Analysis of Carbon and Carbon-Ceramic Refractories (Withdrawn 1995)[3]

D2906 Practice for Statements on Precision and Bias for Textiles (Withdrawn 2008)[3]

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Significance and Use

3.1 These test methods are designed for use with carbon-containing products. The residual carbon content of a coked carbon containing brick or shape is an indication of how much carbon may be available, in service, to resist slag attack on, or oxidation loss of, that body. Apparent carbon yield gives an estimate of the relative efficiency of the total carbonaceous matter to be retained as residual carbon.

3.2 Residual carbon has a direct bearing on several properties of a pitch or resin containing refractory such as ignited porosity, density, strength, and thermal conductivity.

3.3 These test methods are suitable for product development, manufacturing control and specification acceptance.

3.4 These test methods are very sensitive to specimen size, coking rates, etc.; therefore, strict compliance with these test methods is critical.

3.5 Appreciable amounts of reducible components, such as Fe_2O_3, will have a noticeable effect on the results. Thus, values obtained by these test methods will be different when brick removed from service is tested. This must be kept in mind when attempting to use these test methods in an absolute sense.

3.6 Oxidizable components such as metals and carbides can have a noticeable effect on the results. This must be kept in mind when using the second procedure, which is based on measuring weight loss after igniting the coked specimens.

3.7 Testing of brick or shapes that contain magnesium metal presents special problems since this metal is highly volatile and substantial amounts of the magnesium can be lost from the sample during the coking procedure. This must be kept in mind when interpreting the results of testing of brick that contain

[1] These test methods are under the jurisdiction of ASTM Committee C08 on Refractories and are the direct responsibility of Subcommittee C08.04 on Chemical Behaviors.

Current edition approved April 1, 2013. Published August 2013. Originally approved in 1976. Last previous edition approved in 2008 as C831 – 98 (2008). DOI: 10.1520/C0831-98R13.

[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] The last approved version of this historical standard is referenced on www.astm.org.

magnesium. In addition, magnesium can react readily with atmospheric humidity. This must be kept in mind when storing brick that contain magnesium.

4. Apparatus

4.1 *For Coking:*

4.1.1 *Gas or Electric Furnace* with heating chamber capable of receiving the coking box shown in Fig. 1.

NOTE 1—Samples should not be subjected to thermal gradients greater than 40°F (22°C) during heatup. In electric furnaces with silicon carbide heating elements, the length of the box should be parallel to these elements.

4.1.2 *Inner and Outer Box,* stainless steel (or equivalent alloy), as shown in Figs. 1-3.

4.2 *For CO_2 Absorption:*

4.2.1 *Laboratory Pulverizer*[4] designed to provide a sealed, dustproof grinding chamber, and having a capacity of at least 50 g of sample.

4.2.2 *Combustion-Tube Furnace* capable of operating at 183°F (1000°C)

4.2.3 *CO_2-Absorption Train* as described in Fig. 4 and in Method

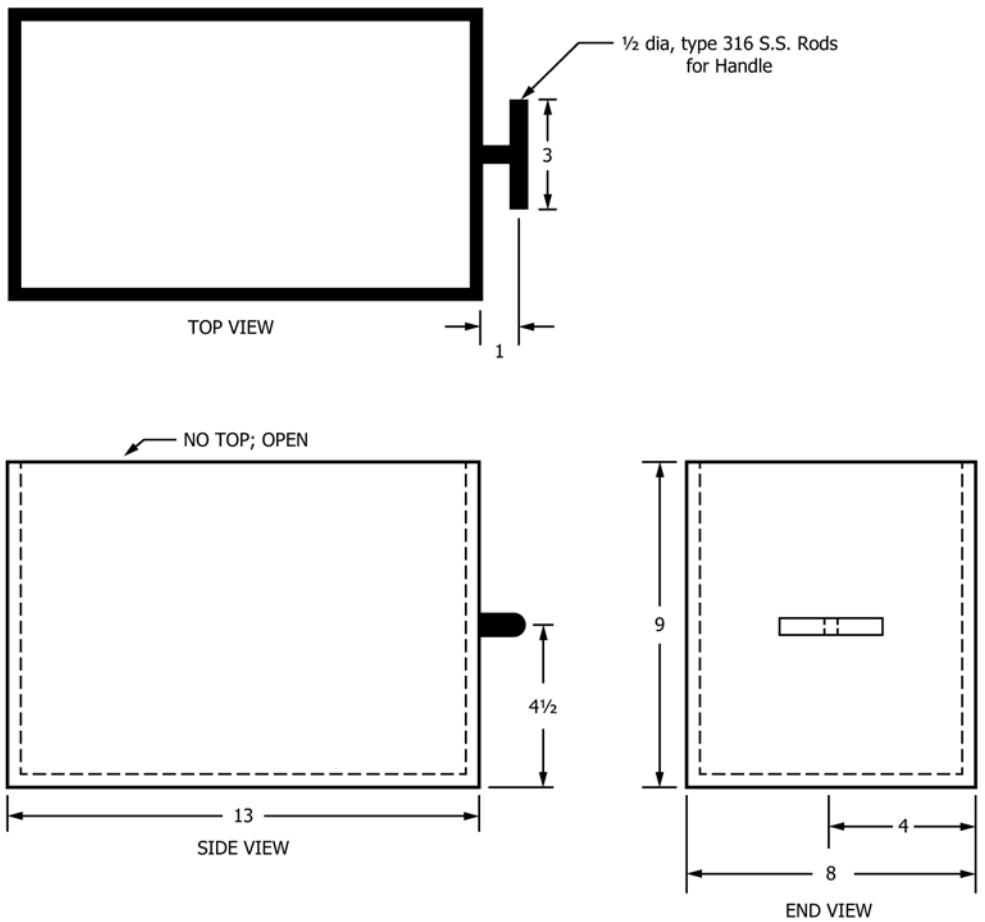
NOTE 2—Commercial automatic and semi-automatic carbon determinators may replace the apparatus described in 4.2.2 and 4.2.3.

4.3 The precision obtained with these instruments shall meet the requirements specified in Section 10.

5. Preparation of Test Specimens

5.1 This method assumes that the number of specimens tested will be a statistically valid sample of the entire lot of

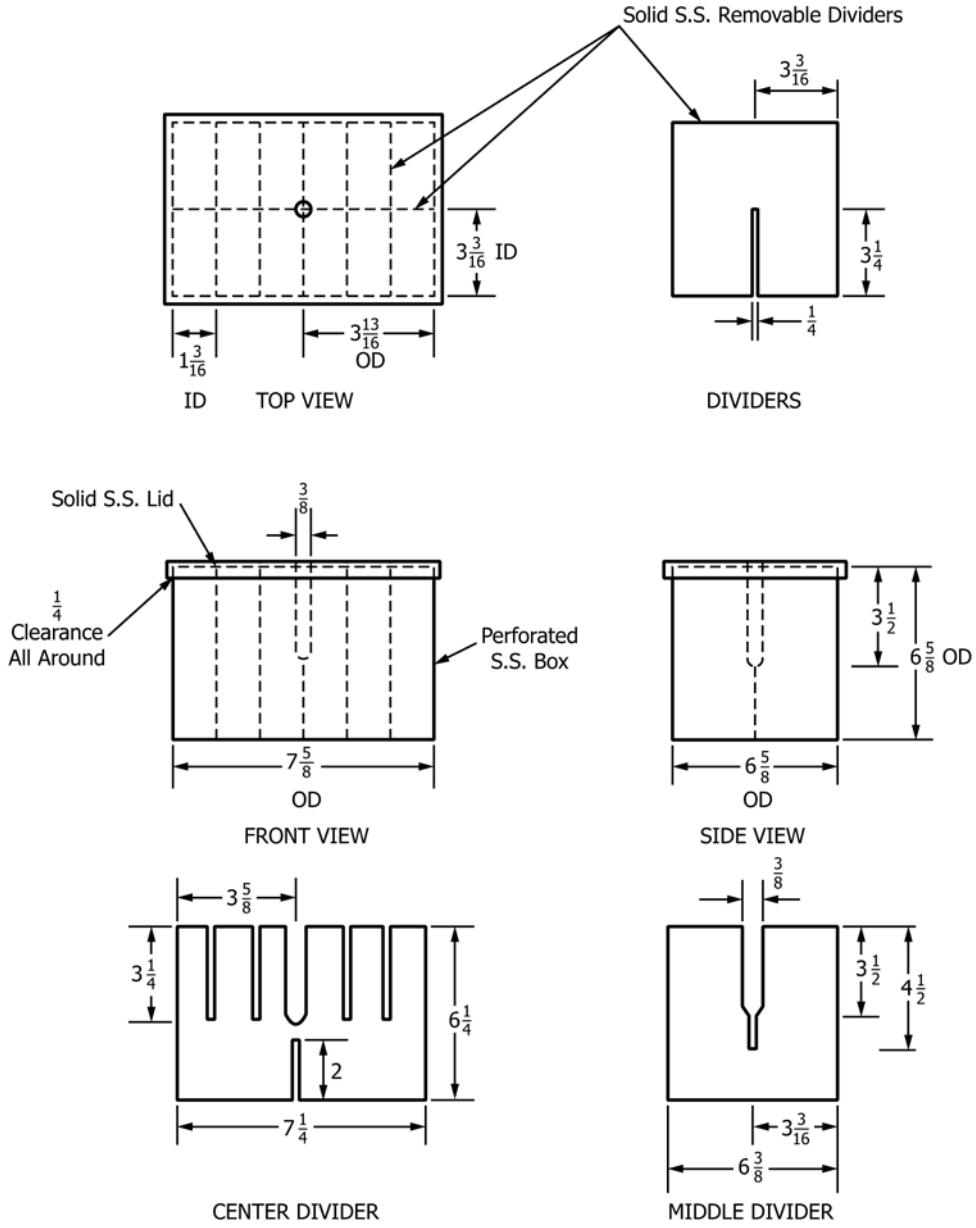
[4] Typical grinders are: Blueler Mill, Applied Research Laboratories, Sunland, CA; Laboratory Disc Mill, Angstrom, Inc., Bellville, MI; and Shatter Box, Spex Industries, Inc., Metuchen, NJ.



NOTE 1—Material specified is type 316 stainless steel (S.S.) or other suitable alloy (¼ in. (6 mm) recommended).
NOTE 2—All dimensions minimum outside diameter.

	Metric Equivalents							
in.	½	1	3	4	4½	8	9	13
mm	13	25	76	102	114	203	229	330

FIG. 1 Outer Coking Box (Dimensions are in Inches)



NOTE 1—Type 316 stainless steel (S.S.) or other suitable alloy, 14 gage (1.984 mm). Perforated S.S.: 14 gage. 3/16-in. (5-mm) diameter perforations, 1/2-in. (13-mm) centers, 11% open.

NOTE 2—Dimensions are in inches.

Metric Equivalents

in.	¼	⅜	1 3/16	2	3 3/16	3¼	3½	3⅝	3 13/16	4½	6¼	6⅜	6⅝	7¼	7⅝
mm	6	10	30	51	81	83	89	92	97	114	159	162	168	184	194

FIG. 2 Inner Coking Box

brick or shapes being evaluated. The exact number is usually arrived at by mutual agreement between parties concerned.

5.2 Although sample brick from either the 4½-in. (114-mm) or the 6-in. (152-mm) series may be tested, it is preferable to use the larger size for the test. Cut slices 1 ± 1/32 in. (25 ± 0.8 mm) in thickness perpendicular to the length at the mid-section of each sample brick or shape. As shown in Fig. 5, the nominal size of each slice shall be 1 by 3 by 6 in. (25 by 76 by 152 mm). The two 1 by 3-in. faces and the two 1 by 6-in. faces must be original surfaces.

5.3 Test specimens may be cut wet or dry except for products capable of hydration, such as dolomite brick, which must be cut dry and stored in a dry container prior to coking.