Designation: ~~C831 – 98 (Reapproved 2013)~~ C831 – 98 (Reapproved 2017)

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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C571 ~~Methods~~ Test Method for Chemical Analysis of Carbon and Carbon-Ceramic Refractories ~~(Withdrawn 1995)~~[3] (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

[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~~Nov. 1, 2017. Published ~~August 2013~~November 2017. Originally approved in 1976. Last previous edition approved in ~~2008~~2013 as C831 – 98 ~~(2008).~~(2013). DOI: ~~10.1520/C0831-98R13.~~10.1520/C0831-98R17.

[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.

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

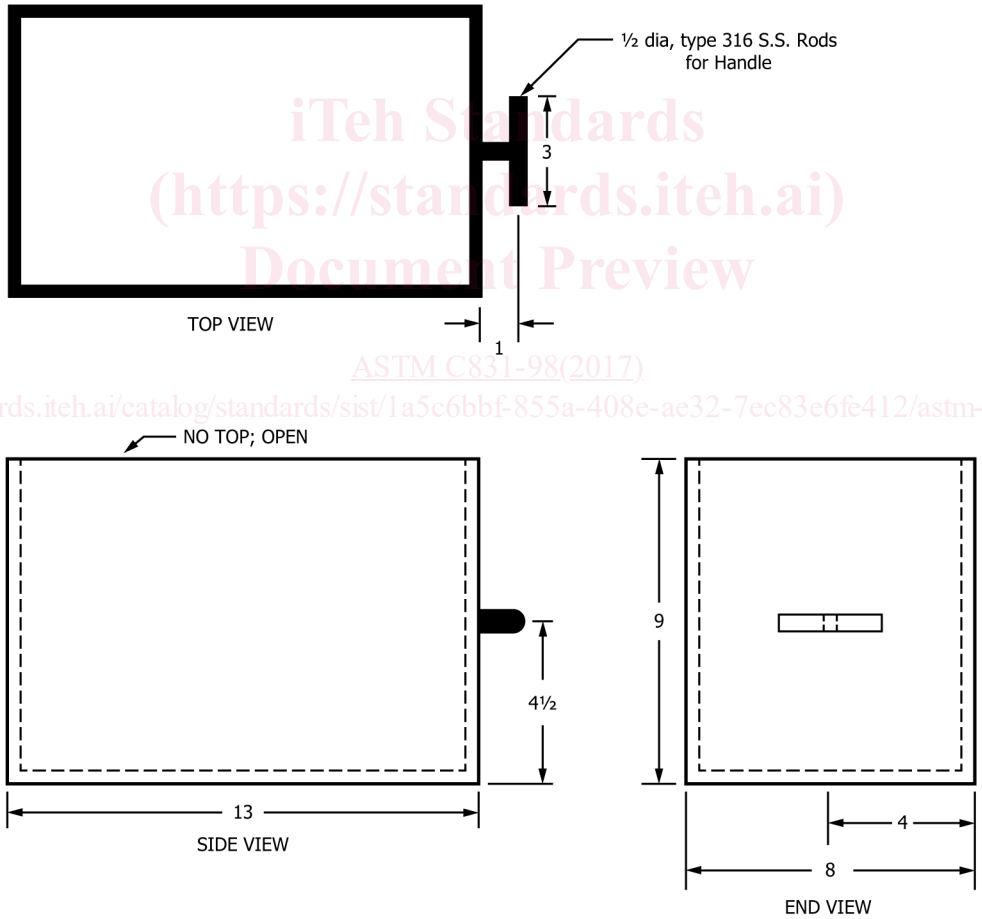
4. Apparatus

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)~~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.

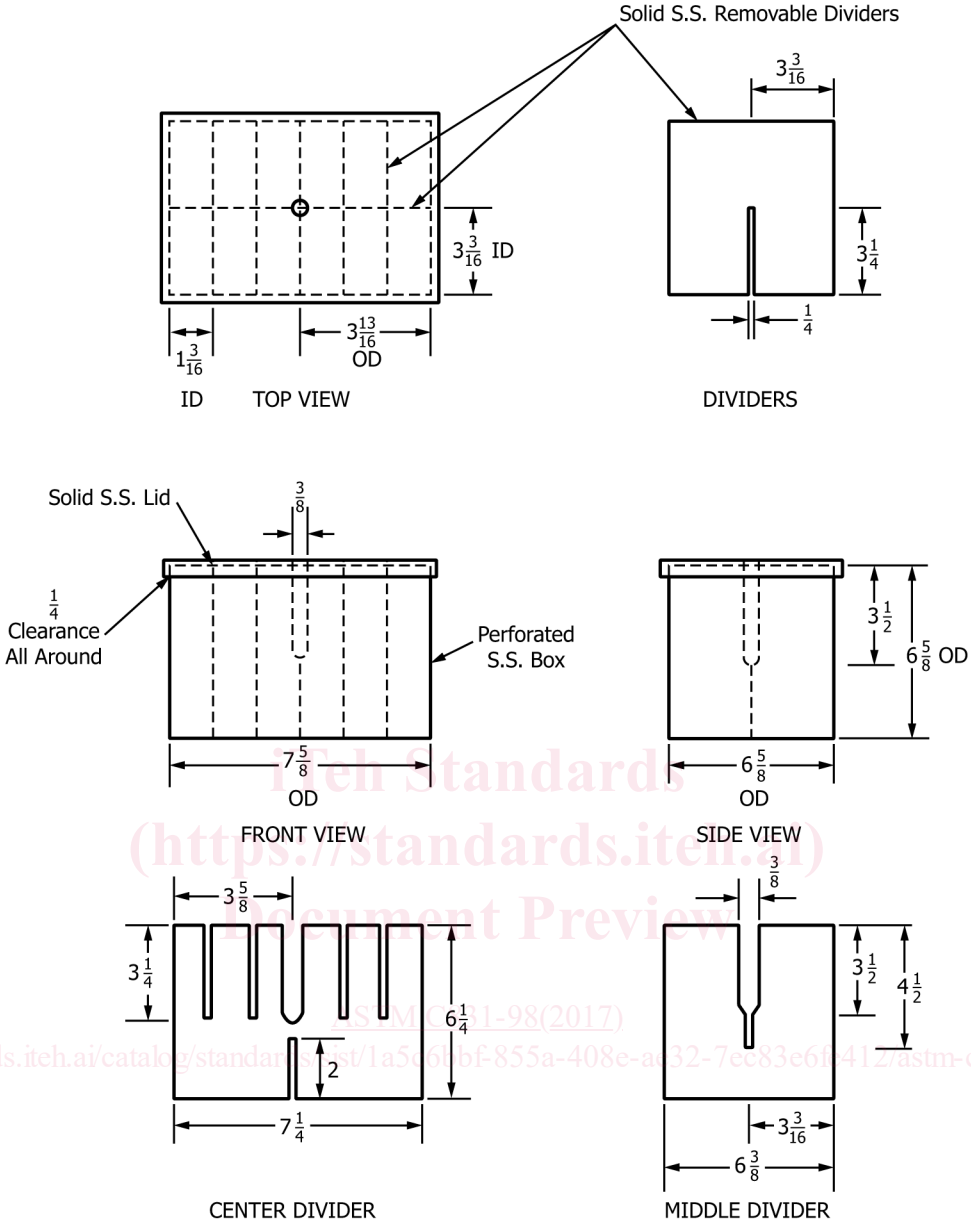
4.1.2 *Inner and Outer Box,* stainless steel (or equivalent alloy), as shown in Figs. 1-3.



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

4.2 *For CO_2 Absorption:*

4.2.1 *Laboratory Pulverizer,*[4] ~~designed~~ 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)~~183 °F (1000 °C)

4.2.3 *CO_2 ~~Absorption Train~~ Absorption Train,* as described in Fig. 4 and in Test Method C571.

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

[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.

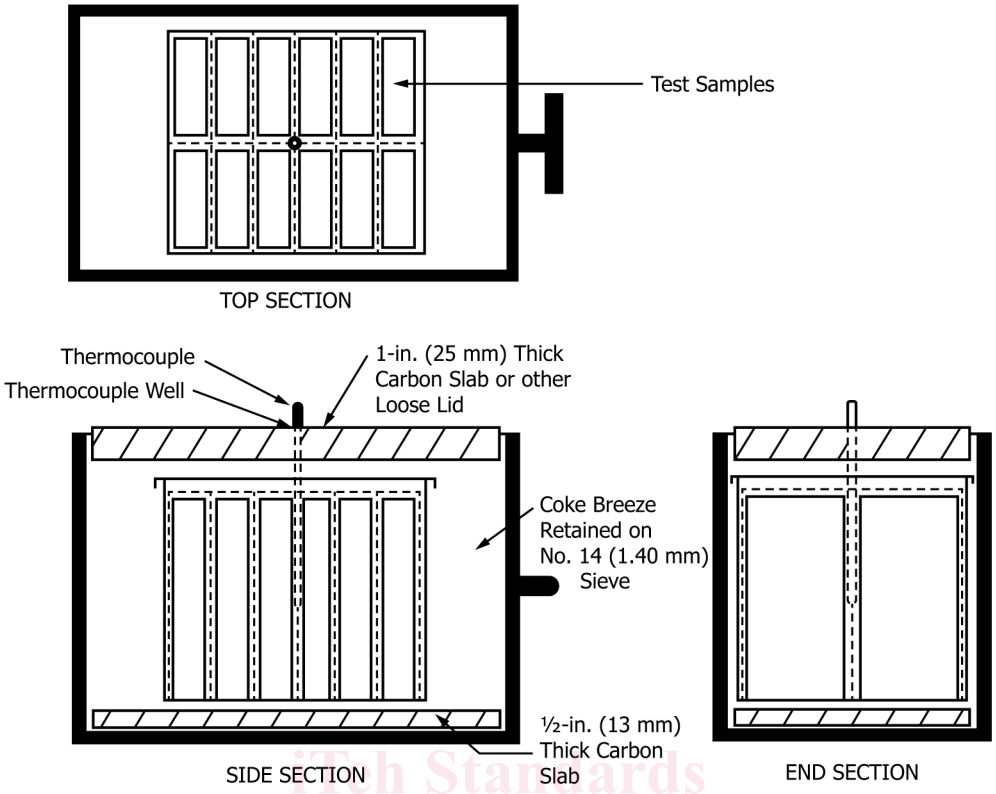
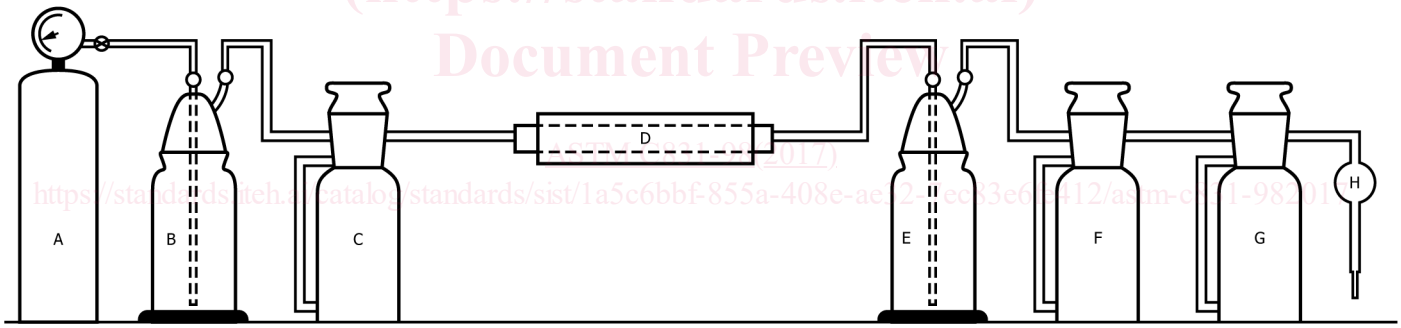


FIG. 3 Coking Box Arrangement



Key

[A] Oxygen supply with gages and needle-valve control.
[B] Drechsel bottle containing KOH solution (757 g/litre) for bubble count and removal of CO_2.
[C] Nesbitt absorption bulb containing anhydrous magnesium perchlorate ($Mg(ClO_4)_2$).
[D] Gastight combustion tube of porcelain, sillimanite, fused quartz, or zircon.
[E] Drechsel bottle with $KMnO_4$ solution (50 g/litre) to remove SO_2.
[F] Nesbitt absorption bulb containing anhydrous $Mg(ClO_4)_2$.
[G] Nesbitt absorption bulb containing indicating soda-asbestos to absorb CO_2 liberated by the sample in combustion tube.
[H] Drying tube filled one half with indicating soda-asbestos and one half with anhydrous $Mg(ClO_4)_2$ (to protect CO_2-absorption bulb from the atmosphere).

NOTE—Plug the absorption bulbs containing dry reagents with glass wool at both ends. The KOH solution should be replaced daily with fresh reagent.

FIG. 4 CO_2-~~Absorption~~ Absorption Train

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