



Standard Test Method for Electrical Resistivity of Manufactured Carbon and Graphite Articles at Room Temperature¹

This standard is issued under the fixed designation C611; 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.

ϵ^1 NOTE—Editorial changes were made to Figure 3 in May 2005.

—Updated units throughout the standard editorially May 2010.

1. Scope

1.1 This test method covers the determination of the electrical resistivity of manufactured carbon and graphite articles at room temperature.

1.2 The values stated in SI units are to be regarded as the standard.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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. Terminology

2.1 Definition:

2.1.1 *resistivity*—the property of a material that determines its resistance to the flow of an electrical current. It is defined as the value of ρ , in milliohm metres, as follows:

$$\rho = (R \cdot A) / L$$

where:

R = resistance of a specimen of the material of uniform cross section, ohms,

A = uniform cross section, mm², and

L = distance between potential contacts, mm.

2.1.1.1 In cases where resistivity is requested in ohm-inches, multiply ρ in milliohm metres by 0.03937.

3. Significance and Use

3.1 This test method provides a means of determining the electrical resistivity of carbon or graphite specimens. The use of specimens that do not conform to the specimen size limitations described in the test method may result in an alteration of test method accuracy.

4. Apparatus

4.1 The means for applying current and potential terminals to the specimen is specified in 5.2.3.1. A typical specimen holder is shown in Fig. 1.

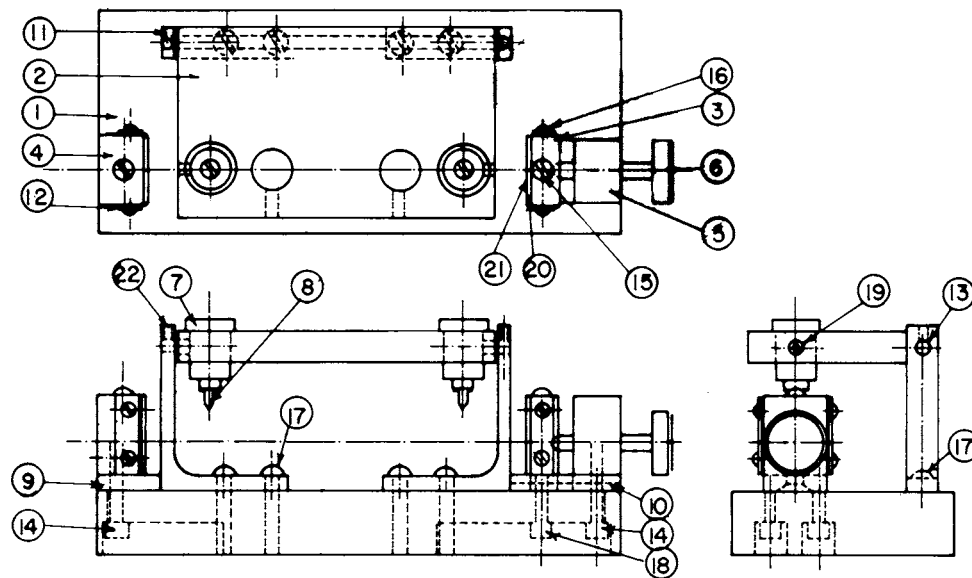
4.2 *Bridge, Potentiometer, or Suitable Digital Voltmeter*, with necessary accessories for making resistance measurements with a limit of error of less than 0.5 %. Fig. 2 schematically depicts two wiring diagrams that have been found satisfactory for this purpose.

4.3 The means for measuring the dimensions of the specimen should be adequate to determine its gage length and its mean area of cross section, each within 0.5 %.

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.F0 on Manufactured Carbon and Graphite Products.

Current edition approved May 1, 2005. Published May 2005. Originally approved in 1969. Last previous edition approved in 1998 as C611-98. DOI: 10.1520/C0611-98R05E01 on Petroleum Products and Lubricants.

Current edition approved May 1, 2010. Published May 2010. Originally approved in 1969. Last previous edition approved in 2005 as C611-98 (2005)^{\epsilon}1. DOI: 10.1520/C0611-98R10E01.



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|----------------------------|----------------------|
| 1—Base block | 12—Wire gauze holder |
| 2—Pivot block | 13—Pivot red |
| 3—Current block adjustable | 14—Screw: sockethead |
| 4—Current block stationary | 15—Roundhead screw |
| 5—Clamp block | 16—Roundhead screw |
| 6—Clamp screw | 17—Roundhead screw |
| 7—Brush holder | 18—Screw, sockethead |
| 8—Contacts | 19—Set screw |
| 9—Current block support | 20—Neoprene |
| 10—Current block guide | 21—Wire gauze |
| 11—Pivot bracket | 22—Set screw |

NOTE—Contacts for the voltage and current probes may be made through channels drilled in the brush holders (7) and the current blocks (3 and 4), respectively.

FIG. 1 Typical Test Apparatus

5. Test Specimen

5.1 The test specimen may be in the form of a strip, rod, bar, or tube.

5.2 In order to determine the resistivity, each specimen shall conform to the following:

5.2.1 The cross-sectional area shall be uniform within 0.75 %. In general, the diameter of circular cross section, or the thickness and width of a strip specimen shall be determined by micrometer measurements, and a sufficient number of measurements shall be made to obtain a mean cross-sectional area to within 0.5 %. The test specimen shall be machined to yield planar and parallel end faces. These faces shall be perpendicular to the specimen length to within 0.001 mm/mm. All surfaces shall have a surface finish visually comparable to 0.8 μm (32 $\mu\text{in.}$) rms. Reasonable care should be exercised to assure that all edges are sharp and without chips or other flaws.

5.2.2 The test specimen shall show no defects observable with normal vision and shall be free of surface deposits.

5.2.3 The minimum ratio of specimen length to maximum cross-sectional dimension (width or diameter) shall be 6 : 1.

5.2.3.1 The gage length may be measured by any scale that will give an accuracy of $\pm 0.5\%$ in the length measured. In the direction of the length of the specimen, the dimension of each potential contact shall be not more than 0.5 % of the distance between the potential contacts. The minimum distance between each potential contact and the adjacent current contact shall be the maximum cross-sectional dimension (width or diameter) of the specimen. If knife edges are used, they shall be parallel to each other and perpendicular to the longitudinal direction of the sample. The minimum ratio of gage length to maximum cross-sectional dimension (width or diameter) shall be 4 : 1.

5.2.4 No dimension shall be smaller than five times the length of the largest visible particle.

5.2.5 No joints or splices are permissible, unless this is the variable under study.

6. Conditioning

6.1 The specimen shall be dried for a minimum of 2 h at 110°C, cooled to room temperature in a desiccator, and stored in a desiccator until tested.

7. Procedure

7.1 *Resistance Measurement*—Measure resistance with instruments accurate to $\pm 0.5\%$ or less (see Note 1). To ensure a correct reading, the reference standard and the test specimen must be allowed to come to the same temperature as the surrounding medium.