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Standard Test Method for Resistivity of Metallically Conducting Resistance and Contact Materials [1]

This standard is issued under the fixed designation B 63; 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—Section 14 was added editorially in June 1995.

1. Scope

1.1 This test method covers the determination, to a precision of 2 %, of the electrical resistivity of materials used in resistors, heating elements, and electrical contacts, as well as products of powder metallurgy processes which are used for other purposes.

NOTE 1—For determining the resistivity of electrical conductors, see Test Method B 193.

1.2 *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:*

B 193 Test Method for Resistivity of Electrical Conductor Materials[2]

3. Terminology

3.1 *Definitions:*

3.1.1 *resistivity*—that property of a material which determines its resistance to the flow of an electric current, expressed as:

$$\rho = RA/L \quad (1)$$

where R is the resistance in ohms of a specimen of the material of uniform cross section A and of a length L. In reporting values of resistivity under this test A shall be expressed in square centimetres and L in centimetres.

4. Significance and Use

4.1 In the case of materials for resistors and heating elements, a knowledge of resistivity is important in determining whether wire or strip of a specified area of cross section and length will have a required resistance. It serves as one basis for the selection of materials for specific applications and its measurement is a necessary acceptance test for resistance materials.

4.2 In the case of materials for electrical contacts, the measurement of resistivity can serve as a test for uniformity of materials of nominally the same composition and structure.

5. Apparatus

5.1 Means for applying current and voltage terminals to the specimen are specified in Section 9. An optional suitable specimen holder for nonductile materials is shown in Fig. 1.

5.2 A suitable bridge, potentiometer, digital ohmmeter, or equivalent, with necessary accessories for making resistance measurements with a limit of error of less than 0.5 %.

5.3 Means for measuring the dimensions of the specimen, adequate to determine its length and its mean area of cross section, each within 0.5 %.

6. Test Specimen

6.1 *Ductile Materials*—The test specimen for ductile materials, including those used for contacts, shall be in the form of a wire or a strip. In order to determine the resistivity with a precision of 2 %, it is necessary that the resistance, cross-sectional area, and length shall be measured with a limit of error within 0.5 %. To ensure this limit of error each test specimen shall conform to the following:

6.1.1 It shall have a length of at least 30 cm (1 ft),

6.1.2 It shall have a resistance of at least 0.001 Ω,

6.1.3 If the cross section is to be determined by direct measurement, the diameter of a wire specimen or the thickness of a strip specimen shall not be less than the limits defined by the 0.5 % criteria of 6.1, and this dimension throughout the length of the specimen shall not vary by more than 3 %, and

6.1.4 It shall show no surface cracks or other defects observable with normal vision, and shall be free from surface oxide.

6.2 *Nonductile Materials*—The test specimen for nonductile materials shall be made in accordance with Fig. 2 if the material is readily machinable. For materials which are not readily machinable, such as those containing graphite, a flat strip may be used as a test specimen. In order to determine the resistivity with a precision of 2 %, each specimen shall

[1] This test method is under the jurisdiction of ASTM Committee B-4 on Metallic Materials for Thermostats and for Electrical Resistance, Heating, and Contacts and is the direct responsibility of Subcommittee B04.01 on Electrical Heating and Resistance.

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[2] *Annual Book of ASTM Standards*, Vol 02.03.

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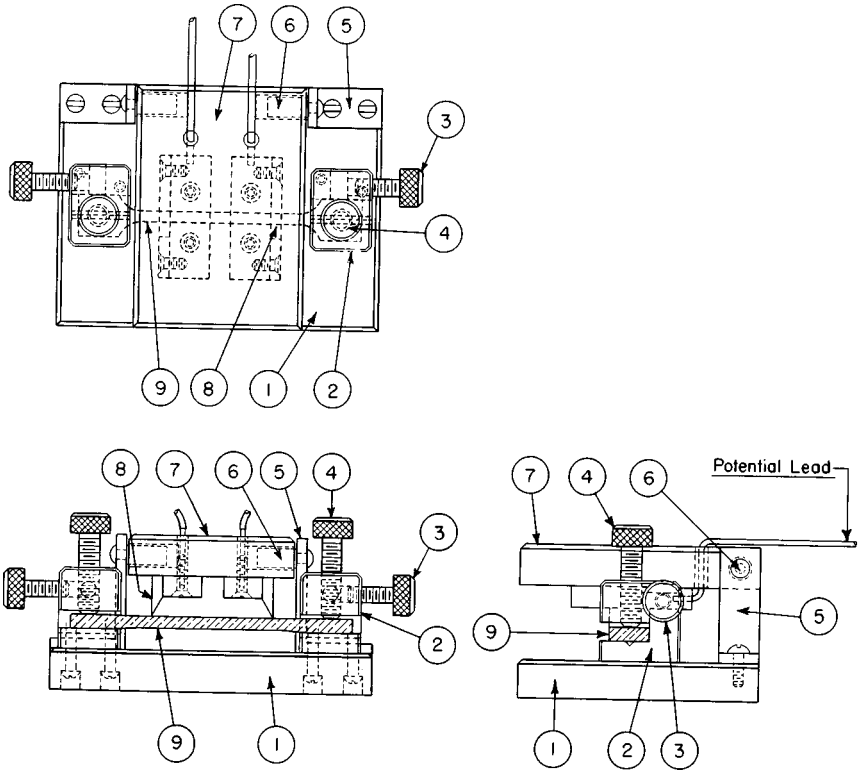


Item	Description	Dimensions, in. (mm)	Material	Number Required
1	Base block	½ by 3 by 4 (12.7 by 76.2 by 101.6)	micarta	1
2	Clamp block	¾ by 1 by 1 (19.0 by 25.4 by 25.4)	copper	2
3	Current lead clamp screw, knurled head	10/32 by 3/16	brass	2
4	Specimen clamp screw, knurled head	¼ in. by 40 by 1 in.	brass	2
5	Pivot bracket	½ by 15/16 by 1 7/16 (12.7 by 23.8 by 36.5)	steel	2
6	Pivot	...	steel	2
7	Pivot block	½ by 2 3/32 by 3 (12.7 by 53.2 by 76.2)	micarta	1
8	Potential knife-edge	...	steel	2 sets
9	Specimen being tested	...	...	...

NOTE 1—Contact surfaces must be clean and free of visible oxide.

FIG. 1 Specimen Holder for Nonductile Materials

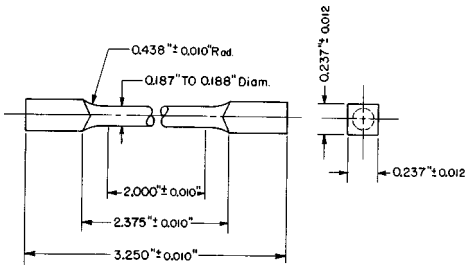
conform to the following:

6.2.1 The diameter of a specimen (Fig. 2), or the thickness and width of a strip specimen, shall be uniform within 1 %, and

6.2.2 It shall show no surface cracks or other defects observable with normal vision, and shall be free from surface oxide.

7. Length Measurements

7.1 The length may be measured by any scale which will give an accuracy of 0.5 % in the length measured. In case potential leads are used, the length shall be taken between the potential contacts. In the direction of the length of specimen, the dimension of each potential contact, including soldering surface or clamp contact area, shall not be more than 0.5 % of the distance between the potential contacts. In the case of the specimen holder for nonductile materials shown in Fig. 1, the distance between the potential contacts may be found by measuring from the outside flat of one potential knife edge to the outside flat of the other. A micrometer shall be used for



NOTE—Metric equivalents are as follows.

in.	mm	in.	mm
0.010	0.25	0.438	11.12
0.012	0.30	2.000	50.80
0.187	4.75	2.375	60.32
0.188	4.78	3.250	82.55
0.237	6.01		

FIG. 2 Resistivity Test Specimen for Machinable Nonductile Materials

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