



## **Standard Specification for Wire for Use In Wire-Wound Resistors <sup>1</sup>**

This standard is issued under the fixed designation B 267; 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<sup>1</sup> NOTE—Section 18 was added editorially in June 1995.

### **1. Scope**

1.1 This specification covers round wire and ribbon with controlled electrical properties for use in wire-wound resistance units and similar applications, but not for use as electrical heating elements.

### **2. Referenced Documents**

#### **2.1 ASTM Standards:**

B 63 Test Method for Resistivity of Metallically Conducting Resistance and Contact Materials <sup>2</sup>

B 77 Test Method for Thermoelectric Power of Electrical-Resistance Alloys <sup>2</sup>

B 84 Test Method for Temperature-Resistance Constants of Alloy Wires for Precision Resistors <sup>2</sup>

### **3. Significance and Use**

3.1 This specification on wire and ribbon contains the generic chemistry and requirements for resistivity, temperature coefficient of resistance, thermal emf versus copper resistance tolerances, and mechanical properties of bare wire, as well as the wire enamels and insulations of alloys normally used in the manufacture of wound resistors.

### **4. Alloy Classes**

4.1 Fifteen classes of alloys are covered by this specification as listed in Table 1.

### **5. Elongation**

5.1 The wire shall conform to the requirements for elongation as prescribed in Table 1, when tested on a 10-in. (254-mm) length.

### **6. Resistivity**

6.1 The bare wire shall conform to the requirements for nominal resistivity as prescribed in Table 1.

6.2 Actual resistivity shall not vary from nominal resistivity by more than ±5 % for Alloy Classes 1 to 4 inclusive, and

±10 % for Alloy Classes 5 to 11 inclusive.

### **7. Nominal Electrical Resistance per Unit Length**

7.1 The nominal resistance per unit length for round wire shall be calculated from the nominal resistivity and the nominal cross-sectional area.

NOTE 1—When ribbon or flat wire is produced by rolling from round wire, the cross section departs from that of a true rectangle by an amount depending on the width-to-thickness ratio and the specific manufacturing practice. The conventional formula for computing ohms per foot and feet per pound is to consider the cross section as 17 % less than a true rectangle when width is more than 15 times the thickness and 6 % less than a true rectangle in other cases. This is not valid in view of modern rolling equipment and practices, but still is widely used as a basis of description. Ribbon actually is made to a specified resistance per foot, and no tolerance is specified for thickness. An alternative and a closer approximation would be that for ribbon rolled round wire, the electrical resistance would be calculated on a cross 6 % less than a true rectangle.

### **8. Temperature Coefficient of Resistance**

8.1 The change in resistance with change in temperature, expressed as the mean temperature coefficient of resistance based on the reference temperature of 25°C, shall be within the limits specified in Table 1, Columns 4 and 6, over the corresponding temperature ranges specified in Columns 5 and 7. The mean temperature coefficient of resistance referred to 25°C is defined as the slope of a chord of an arc. This slope is determined from the following equation:

$$\alpha_m = (\Delta R/R_{25}\Delta T) \times 10^6$$

where:

$\alpha_m$  = mean temperature coefficient of resistance, ppm/°C, Table 1, Columns 4 and 6,

$\Delta R$  = change in resistance over temperature range indicated in Table 1, Columns 5 and 7,

$R_{25}$  = resistance at 25°C,

$\Delta T$  = temperature range indicated in Table 1, Columns 5 and 7.

8.2 For Alloy Classes 1, 2, and 5, the temperature coefficient as specified in Table 1 of any 10-ft (3-m) length shall not vary more than 3 ppm/°C from that of any other 10-ft length on the same spool or coil.

### **9. Thermal EMF with Respect to Copper**

9.1 The thermal electromotive force (emf) with respect to copper shall fall within the limits shown in Table 1, in the

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<sup>2</sup> Annual Book of ASTM Standards, Vol 03.04.