



Designation: B 452 – 93 (Reapproved 1998)^{ε1}

Standard Specification for Copper-Clad Steel Wire for Electronic Application¹

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This standard has been approved for use by agencies of the Department of Defense.

^{ε1} NOTE—Editorial changes were made throughout in March 1998.

1. Scope

1.1 This specification covers bare round copper-clad steel wire for electronic application.

1.2 Four classes of copper-clad steel wire are covered as follows:

1.2.1 *Class 30HS*—Nominal 30 % conductivity hard-drawn,

1.2.2 *Class 30A*—Nominal 30 % conductivity annealed,

1.2.3 *Class 40HS*—Nominal 40 % conductivity hard-drawn, and

1.2.4 *Class 40A*—Nominal 40 % conductivity annealed.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are in SI units.

2. Referenced Documents

2.1 The following documents of the issue in effect on the date of material purchase form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards*:

B 193 Test Method for Resistivity of Electrical Conductor Materials²

B 258 Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors²

2.3 *National Institute of Standards and Technology*:

NBS *Handbook 100—Copper Wire Tables*³

3. Ordering Information

3.1 Orders for material under this specification shall include the following information:

3.1.1 Quantity of each size and class,

3.1.2 Wire size, diameter in inches (see 5.3 and Table 1),

3.1.3 Class of wire (see 1.2 and Table 1),

3.1.4 Packaging and shipping (Section 10),

3.1.5 If inspection is required (see 6.3.3), and

3.1.6 Place of inspection (see 6.1).

4. Material

4.1 The wire shall consist of a core of homogeneous open-hearth, electric-furnace, or basic-oxygen steel with a continuous outer cladding of copper thoroughly bonded to the core throughout and shall be of such quality as to meet the requirements of this specification (Note 1).

NOTE 1—The copper-clad steel wire provides a high-strength conductor for use in wire and cable where greater strength is required and a lower conductivity can be tolerated. At high frequencies the reduced conductivity is less pronounced due to concentration of the current in the outer periphery of the wire. Minimum thickness of 6 % and 10 % of the radius for 30 and 40 % conductivity material, respectively, has been established to facilitate the inspection of thickness on fine wires.

5. General Requirements

5.1 *Tensile Strength and Elongation*—The copper-clad steel wire shall conform to the tensile strength and elongation requirements of Table 1. For intermediate sizes not listed in Table 1, the elongation requirements of the next smaller size shall apply; in the case of tensile strength, the requirements of the next larger size shall apply.

5.2 *Resistivity*—The electrical resistivity at a temperature of 20°C shall not exceed the values prescribed in Table 2. See Note 2 for calculating electrical resistance.

NOTE 2—Relationships which may be useful in connection with the values of electrical resistivity prescribed in this specification are shown in Table 3. Resistivity units are based on the International Annealed Copper Standard (IACS) adopted by IEC in 1913, which is $\frac{1}{58} \Omega \cdot \text{mm}^2/\text{m}$ at 20°C for 100 % conductivity. The value of $0.017241 \Omega \cdot \text{mm}^2/\text{m}$ and the value of $0.15328 \Omega \cdot \text{g}/\text{m}^2$ at 20°C are respectively the international equivalent of volume and weight resistivity of annealed copper equal to 100 % conductivity. The latter term means that a copper wire 1 in. in length and weighing 1 g would have a resistance of 0.15328Ω . This is equivalent to a resistivity value of $875.20 \Omega \cdot \text{lb}/\text{mile}^2$, which signifies the resistance of a copper wire 1 mile in length weighing 1 lb. It is also equivalent, for example, to $1.7241 \mu\Omega/\text{cm}$ of length of a copper bar 1 cm^2 in cross section. A complete discussion of this subject is contained in *NBS Handbook 100*. The use of five significant figures in expressing resistivity does not imply

¹ This specification is under the jurisdiction of ASTM Committee B-1 on Electrical Conductors and is the direct responsibility of Subcommittee B01.06 on Composite Conductors.

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

³ Available from the National Institute of Standards and Technology (NIST), Gaithersburg, MD 20899.