



Standard Specification for Drawn or Rolled Nickel-Chromium and Nickel-Chromium- Iron Alloys for Electrical Heating Elements¹

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1. Scope

1.1 This specification covers annealed, drawn, or rolled shapes for electrical heating purposes, of alloys having the nominal compositions of 80 % nickel and 20 % chromium; 60 % nickel, 16 % chromium, and remainder iron; and 35 % nickel, 20 % chromium, and remainder iron.

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.

2. Referenced Documents

2.1 ASTM Standards:

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products²

B 63 Test Method for Resistivity of Metallically Conducting Resistance and Contact Materials³

B 70 Test Method for Change of Resistance with Temperature of Metallic Materials for Electrical Heating³

B 76 Test Method of Accelerated Life Test of Nickel-Chromium and Nickel-Chromium-Iron Alloys for Electrical Heating³

3. Significance and Use

3.1 This specification on nickel-chromium and nickel-chromium-iron alloys contains the requirements for chemistry, electrical resistance, mechanical properties, and packaging.

4. Chemical Requirements

4.1 The alloys shall conform to the requirements as to chemical composition prescribed in Table 1.

4.2 *Samples for Chemical Analysis*—Specimens for chemical analysis may be taken from either the melt or from a sample of finished wire that is representative of the lot.

4.2.1 The lot size for determining compliance with the requirements of this specification shall be one heat.

4.3 *Chemical Analysis*—The chemical analysis shall be made in accordance with Test Methods A 751, or by other analytical methods approved by the purchaser.

4.4 Actual chemical analysis is not required for routine acceptance.

5. Physical Requirements

5.1 The material shall be thoroughly and uniformly annealed.

5.2 Wire shall conform to the following elongation requirements:

Size	Elongation in 10 in., min, %
0.0035 in. (0.0889 mm) (No. 39 Awg) and larger	20
0.0031 in. (0.0787 mm) to 0.002 in. (0.0508 mm) (Nos. 40 to 44 Awg)	10

5.3 Determination is not required for routine acceptance.

6. Nominal Resistivity

6.1 The nominal resistivity (Note 1) shall be the resistivity of the wire as quenched from a temperature above 1450°F (788°C). The numerical value of the nominal resistivity shall be as shown in Table 2.

6.2 Determination is not required for routine acceptance.

NOTE 1—The characteristics of these alloys are such that the actual resistivity of annealed wire may be as much as 6 % higher than the nominal, depending on its method of manufacture.

7. Test for Resistivity

7.1 The resistivity shall be determined in accordance with Test Method B 63.

7.2 Determination is not required for routine acceptance.

8. Nominal Electrical Resistance for Unit Length

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

NOTE 2—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

¹ This test method is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.08 on Electrical Resistance Heating Materials.

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² *Annual Book of ASTM Standards*, Vol 01.03.

³ *Annual Book of ASTM Standards*, Vol 03.04.