



Standard Specification for Iron-Nickel and Iron-Nickel-Cobalt Alloys for Low Thermal Expansion Applications¹

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1. Scope

1.1 This specification covers two iron-nickel alloys and one iron-nickel-cobalt alloy, for low thermal expansion applications. The two iron-nickel alloys, both containing nominally 36 % nickel and 64 % iron, with the conventional alloy designated by UNS No. K93603, and the free-machining alloy designated as UNS No. K93050. The iron-nickel-cobalt alloy, containing nominally 32 % nickel, 5 % cobalt and 63 % iron, is designated by UNS No. K93500. This specification defines the following product forms for UNS No. K93603 and UNS No. K93500: wire, rod, bar, strip, sheet plate, and tubing. The free-machining alloy, UNS No. K93050, is defined for bar products only. Unless otherwise indicated, all articles apply to all three alloys.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 This pertains only to the test method section, Section 13. *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:²

- D1971 Practices for Digestion of Water Samples for Determination of Metals by Flame Atomic Absorption, Graphite Furnace Atomic Absorption, Plasma Emission Spectroscopy, or Plasma Mass Spectrometry
- E8 Test Methods for Tension Testing of Metallic Materials
- E10 Test Method for Brinell Hardness of Metallic Materials
- E18 Test Methods for Rockwell Hardness of Metallic Materials
- E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E45 Test Methods for Determining the Inclusion Content of Steel
- E92 Test Methods for Vickers Hardness and Knoop Hardness of Metallic Materials
- E112 Test Methods for Determining Average Grain Size
- E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness
- E228 Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer
- E354 Test Methods for Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys
- E1019 Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques
- E1601 Practice for Conducting an Interlaboratory Study to Evaluate the Performance of an Analytical Method

¹ This specification is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.03 on Metallic Materials, Wire Bonding, and Flip Chip.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3. Ordering Information

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

- 3.1.1 Alloy, as indicated with UNS number,
- 3.1.2 Size,
- 3.1.3 Temper designation (Section 6),
- 3.1.4 Surface finish (Section 10),
- 3.1.5 Marking and packaging (Section 18), and
- 3.1.6 Certification, if required.

NOTE 1—Certification should include traceability of the heat to the original manufacturer.

4. Chemical Requirements

4.1 Each alloy shall conform to the requirements as to chemical composition prescribed in Table 1.

NOTE 2—Lower levels of phosphorus and sulfur may be required for certain welding applications. These lower levels shall be negotiated, as