



Designation: E 1223 – 87 (Reapproved 1996)^{ε1}

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
Reprinted from the Annual Book of ASTM Standards. Copyright ASTM

Standard Specification for Type N Thermocouple Wire¹

This standard is issued under the fixed designation E 1223; 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.

^{ε1} NOTE—Keywords were added and editorial changes were made throughout in November 1996.

1. Scope

1.1 This specification covers the requirements for bare, solid conductor, ISA Type N, base metal thermocouple wire, NiCrSi-NiSi. Nominal composition is 14.2 % Cr, 1.4 % Si, balance Ni for the positive leg (ISA Type NP) and 4.4 % Si, 0.1 % Mg, balance Ni for the negative leg (ISA Type NN). These thermoelements, when fabricated and applied properly, are suitable for use either as bare wire thermocouples in oxidizing or inert atmosphere, or with proper care in metal sheathed, compacted-ceramic-insulated thermocouples.

1.2 The Type N alloys were developed to specifically overcome some of the drawbacks of the Type K thermoelements and are intended for generally the same applications. The particular alloy compositions selected are intended to greatly reduce the gradual and generally cumulative drift in thermal emf resulting from long term exposure in air, at high temperature (1000°C), to lengthen the wire oxidation life in air, and to reduce the reversible change in thermal emf on heating to 250 to 600°C related to atomic ordering of the positive leg of a Type K thermocouple. These improvements are demonstrated by the ability of Type N thermoelements to meet the requirements of 5.3.4.1-5.3.4.3. No effort was made to eliminate other application problems such as sulfur attack, cold work effects on emf, selective oxidation, etc. The emf-temperature curve is different from that for Type K and requires its own extension wire, scales, chart paper, or instruments for proper use. For greater detail, see the references in Section 2.²

2. Referenced Documents

2.1 ASTM Standards:

- E 207 Method of Thermal EMF Test of Single Thermoelement Materials by Comparison with a Secondary Standard of Similar EMF-Temperature Properties³
- E 220 Test Method for Calibration of Thermocouples by Comparison Techniques³

¹ This specification is under the jurisdiction of ASTM Committee E-20 on Temperature Measurement and is the direct responsibility of Subcommittee E20.04 on Thermocouples.

Current edition approved Dec. 31, 1987. Published February 1988. Originally published as E 1223 – 87. Discontinued February 1996 and reinstated as E 1223 – 87 (1996)^{ε1}.

² Additional information is available from ASTM Headquarters. Request RR: E20 – 1001.

³ Annual Book of ASTM Standards, Vol 14.03.

E 230 Specification for Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples³

E 344 Terminology Relating to Thermometry and Hydrometry³

E 601 Test Method for Comparing EMF Stability of Single Element Base-Metal Thermocouple Materials in Air³

3. Terminology

3.1 Definitions in accordance with Terminology E 344 shall apply to this specification.

4. Ordering Information

4.1 The purchase order documents shall specify the following information:

4.1.1 Wire size by stating one of the following: the AWG gage size, wire diameter, or the resistance in ohms per unit length at 25°C. Tolerance should also be specified. Vendor practices vary. Check before ordering.

4.1.2 Weight, spool size, or length desired.

4.1.3 The initial calibration tolerance:

4.1.3.1 *Standard*, $\pm 2.2^\circ\text{C}$ or $\pm 0.75\%$, whichever is greater, or,

4.1.3.2 *Special*, $\pm 1.1^\circ\text{C}$ or $\pm 0.4\%$, whichever is greater.

NOTE 1—If no initial calibration tolerance is specified, standard tolerance shall be used.

4.1.4 The tolerance for any listed physical parameters (see 5.2.3) if required. Contact vendor before setting a tolerance.

4.1.5 Tests listed under 5.3.4, if required.

4.1.6 Certification of actual chemical and physical properties is optional.

5. Materials and Manufacture

5.1 Thermocouple Wire, General:

5.1.1 *Nominal Composition*—The positive thermoelement shall be 14.2 % chromium, 1.4 % silicon, balance nickel. The negative thermoelement shall be 4.4 % silicon, 0.1 % magnesium, balance nickel.

NOTE 2—Trace elements are often added by the wire vendor to control the emf output over the entire use range. This is permissible so long as no deviation from, or deterioration of, the herein specified properties occurred.

5.2 Physical Properties:

5.2.1 The diameter of the wire shall be to the nominal value