



Standard Guide for Temperature Electromotive Force (emf) Tables for Non- Letter Designated Thermocouple Combinations¹

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1. Scope

1.1 This guide consists of reference tables that give temperature-electromotive force (emf) relationships for special purpose, limited use, thermocouple combinations that do not have a letter designation.

1.2 Extension wire or compensating extension wires are not covered by this guide. ASTM MNL 12² or thermocouple alloy suppliers should be consulted.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

2. Referenced Documents

2.1 *ASTM Standards*:³

E344 Terminology Relating to Thermometry and Hydrometry

E696 Specification for Tungsten-Rhenium Alloy Thermocouple Wire

3. Terminology

3.1 *Definitions*:

3.1.1 For definitions of terms used in this guide see Terminology E344.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *matched pairs, n*—a set of positive and negative thermoelements chosen so that a thermocouple fabricated from these thermoelements will match a specified temperature-

electromotive force relationship to within a specified tolerance, at the time of first use.

4. Source of Data

4.1 The data in these tables are based on the SI Volt and the International Temperature Scale of 1990.

4.2 All temperature-electromotive force data in Tables 1-20 have been developed from NIST, NRC, and wire manufacturers' data.

4.3 Tables 1-16 give emf values in millivolts to three decimal places (1 μ V) at 1°C or 1°F intervals. Tables 17-20 give emf values in microvolts to one decimal place (0.1 μ V) at 1°C or 1°F intervals. If greater precision is required, refer to the equation and coefficients listed for each thermocouple alloy.

5. Significance and Use

5.1 These thermocouple combinations have been developed for specific applications by the wire manufacturer(s). If additional information is required, consult ASTM MNL 12 or the wire manufacturer.

6. Thermocouple Types

6.1 Letter symbols have not been assigned. Identification is made by alloy composition with the thermoelectrically positive material listed first.

6.1.1 Tungsten versus tungsten-26 % rhenium.

6.1.2 Tungsten-3 % rhenium versus tungsten-25 % rhenium.

6.1.3 Platinel II.⁴

6.1.4 KP versus gold-0.07 % iron.⁵

6.1.5 Platinum-5 % molybdenum versus platinum-0.1 % molybdenum.

6.1.6 Platinum-40 % rhodium versus platinum-20 % rhodium.

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

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² "Manual on the Use of Thermocouples in Temperature Measurement," ASTM Manual, 12, ASTM, 1993.

³ 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.

⁴ Trademark of Engelhard Corp., Specialty Metals Division.

⁵ Alloy compositions are expressed in percentages by mass, except for the gold-0.07 % iron alloy, which is given in atomic percent.