



## Standard Specification for Compacted Mineral-Insulated, Metal-Sheathed, Noble Metal Thermocouples and Thermocouple Cable<sup>1</sup>

This standard is issued under the fixed designation E 2181/E 2181M; 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.

### 1. Scope

1.1 This specification establishes dimensional and material requirements for compacted, mineral-insulated, metal-sheathed, Type S (platinum-10 % rhodium versus platinum), Type R (platinum-13 % rhodium versus platinum), and Type B (platinum-30 % rhodium versus platinum-6 % rhodium) noble metal thermocouples. This specification also establishes dimensional and material requirements for compacted, mineral-insulated, metal-sheathed cable with at least one noble metal thermoelement pair.

1.2 This specification describes both the required processing and testing requirements and also the optional supplementary testing and quality assurance requirements.

1.3 Provisions are made for selecting the type of noble metal thermocouple or thermoelements, either magnesia (MgO) or alumina (Al<sub>2</sub>O<sub>3</sub>) insulation, and a noble metal alloy or other alternate heat-resistant sheath material. Provisions are also made for selecting a thermocouple measuring junction configuration and for a transition or termination.

1.4 The values stated in inch-pound units or SI (metric) units may be regarded separately as standard. The values stated in each system are not the exact equivalents, and each system shall be used independently of the other.

1.5 *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 requirements prior to use.*

### 2. Referenced Documents

2.1 The following documents of the latest issue form a part of this specification to the extent specified herein. In the event of a conflict between this specification and other specifications referenced herein, this specification shall take precedence.

#### 2.2 ASTM Standards:

A 213/A 213M Specification for Seamless Ferritic and Aus-

tenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes<sup>2</sup>

A 249/A 249M Specification for Welded Austenitic Steel Boiler, Superheater, Heat-Exchanger, and Condenser Tubes<sup>2</sup>

A 269 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service<sup>2</sup>

A 632 Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service<sup>2</sup>

B 163 Specification for Seamless Nickel and Nickel Alloy Condenser and Heat-Exchanger Tubes<sup>3</sup>

B 167 Specification for Nickel-Chromium-Iron Alloy (UNS N06600, N06601, and N06690) Seamless Pipe and Tube<sup>3</sup>

B 516 Specification for Welded Nickel-Chromium-Iron Alloy (UNS N06600, UNS N06603, UNS N06025, and UNS N06045) Tubes<sup>3</sup>

E 165 Test Method for Liquid Penetrant Examination<sup>4</sup>

E 220 Method for Calibration of Thermocouples by Comparison Techniques<sup>5</sup>

E 230 Specification for Temperature—Electromotive Force (EMF) Tables for Standardized Thermocouples<sup>5</sup>

E 344 Terminology Relating to Thermometry and Hydrometry<sup>5</sup>

E 608/E 608M Specification for Mineral-Insulated, Metal-Sheathed Base Metal Thermocouples<sup>5</sup>

E 839 Test Methods for Sheathed Thermocouples and Sheathed Thermocouple Material<sup>5</sup>

E 1652 Specification for Magnesium Oxide and Aluminum Oxide Powder and Crushable Insulators Used in the Manufacture of Metal-Sheathed Platinum Resistance Thermometers, Base Metal Thermocouples, and Noble Metal Thermocouples<sup>5</sup>

E 1751 Guide for Temperature-Electromotive Force (EMF) Tables for Non-Letter Designated Thermocouple Combinations<sup>5</sup>

#### 2.3 ANSI Standard:

<sup>1</sup> This specification 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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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 02.04.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 03.03.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 14.03.