



Standard Test Method for Measuring the Insulation Resistance of Sheathed Thermocouple Material at Room Temperature¹

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1. Scope

1.1 This test method covers the techniques and requirements for measuring the electrical insulation resistance at room temperature between the thermoelements and between each of the thermoelements and the metal sheath of compacted ceramic-insulated, sheathed thermocouple material. It may be used to measure the insulation resistance of bulk lengths of sheathed thermocouple material environmentally sealed at the time of manufacture. It may also be used for testing sheathed thermocouples with a Type U junction. This test method cannot be used for sheathed thermocouples with a Type G junction unless the junction is removed, prior to testing.

1.2 This test method applies to the testing of sheathed thermocouple materials that are suitable for use in air. It is also applicable for sheathed thermocouple materials whose sheath or thermoelements are composed of refractory metals and are tested in a dry and nonreactive environment.

1.3 This test method may be used for sheathed thermocouple material having an outside diameter of 1.0 mm or larger.

1.4 Since the insulation resistance at room temperature of sheathed thermocouple materials may change during shipment, storage and use, the results obtained by this test method may not be the same as insulation resistance values determined at some later time.

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 limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- E 235 Specification for Thermocouples, Sheathed, Type K, for Nuclear or for Other High-Reliability Applications²
- E 344 Terminology Relating to Thermometry and Hydrometry²

E 585 Specification for Sheathed Base-Metal Thermocouple Materials²

E 608 Specification for Metal-Sheathed Base-Metal Thermocouples²

3. Terminology

3.1 *Definitions*—The definitions given in Terminology E 344 shall apply to the terms used in this test method.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *bulk material length (BML), n*—a single length of thermocouple material (produced from the same raw material lot) after completion of fabrication resulting in sheathed thermocouple material.

3.2.2 *dry, adj*—a condition which does not exceed the equivalent of 50 % relative humidity at 22°C.

3.2.3 *nonreactive, adj*—a condition which will not produce a chemical transformation or change.

3.2.4 *test specimen, n*—a short length, at least 300 mm long, cut from the bulk material length.

4. Summary of Test Method

4.1 This test method involves measuring the d-c electrical resistance at normal room temperatures ($22 \pm 5^\circ\text{C}$) between the thermoelements and between each of the thermoelements and the metal sheath of a length of sheathed thermocouple material. The resistance measurements are made with an instrument such as a megohm bridge or megohmmeter. The instrument must be capable of determining values of resistance from $5 \times 10^4 \Omega$ to $1 \times 10^{12} \Omega$ with an uncertainty of not more than $\pm 10\%$. The applied voltage for the resistance measurement is 500 V d-c for sheathed thermocouple material having an outside diameter larger than 1.5 mm, and an applied voltage of 50 V d-c is recommended for smaller diameter sheathed thermocouple materials.

4.2 Special precautions must be exercised when preparing the sheathed thermocouple material for the resistance measurements to prevent the intrusion of moisture and other contaminants that might alter the insulation resistance. The repeatability of the test method depends primarily upon how well this is achieved. Preparation of the sheathed thermocouple material involves removing 5 to 30 mm of the metal sheath from the ends of the sheathed thermocouple material, heating the sheath

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

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² Annual Book of ASTM Standards, Vol 14.03.