INTERNATIONAL

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Standard Test Method for Thermoelectric Power of Electrical-Resistance Alloys[1]

This standard is issued under the fixed designation B77; 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 test method covers the determination of the thermoelectric power of a metal or alloy with respect to copper when the temperatures of the junctions lie between 0 and 100°C.

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 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 become familiar with all hazards including those identified in the appropriate Safety Data Sheet (SDS) for this product/material as provided by the manufacturer, to establish appropriate safety, health, and environmental practices, and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B3 Specification for Soft or Annealed Copper Wire

3. Terminology

3.1 *thermoelectric power, Q, n*—the electromotive force in an electric circuit consisting of two metals when the junctions between them have a difference in temperature of 1°C.

3.1.1 *Discussion*—Experimentally, it has been found that the thermoelectric power of two metals is not a constant but depends on the mean temperature of the junctions. However, over a range of temperature from 0 to 100°C it is usually sufficient to assume that the thermoelectric power is independent of temperature so that for this range of temperature:

$$Q = E/(t' - t)$$

where:

E = the electromotive force developed in the circuit,
t' = the higher temperature at one junction, °C, and
t = the lower temperature at the other junction, °C.

4. Significance and Use

4.1 The purpose of this method is to determine the suitability of different metals for use in resistance apparatus in which a low thermoelectric power is desired. As most electric circuits are largely composed of copper, the thermoelectric power of a resistance metal will generally be measured against copper.

5. Test Specimen

5.1 The metal or alloy to be tested shall be in the form of sheet, ribbon, or wire and the test specimen shall be of such length that the two ends can be readily maintained at different temperatures. At each end of the specimen a copper lead of convenient size shall be fastened. These leads shall make good electrical contact with the specimen, such as that obtained by welding, brazing, or soldering. Slight impurities in the copper have a negligible effect on the thermoelectric power.

NOTE 1—When necessary to specify the quality of the copper leads, reference should be made to Specification B3.

6. Procedure

6.1 *Measurement of Temperature*—As a matter of precaution, the average temperature used in determining the thermoelectric power shall be approximately the same as that to which the material will be subjected in practice, and in no case shall the temperature difference between the two junctions be less than 20°C. The temperature at each of two junctions shall be measured by a device that is sufficiently accurate to determine the temperature difference within 5 %. A convenient method for determining the temperatures of the junctions is to immerse each junction in separate oil baths maintained at the desired temperatures. Baths that are stirred and the temperatures of which are thermostatically controlled are to be

[1] This test method is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.10 on Thermostat Metals and Electrical Resistance Heating Materials.

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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.