



Standard Test Methods for Sheathed Thermocouples and Sheathed Thermocouple Material¹

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INTRODUCTION

Thermocouples are widely used in industry and they provide reliable service. However, if thermocouples fail in service, the results can range from negligible to life threatening. Often a loss of equipment, product, or operating time will result. The user should weigh the potential consequences of thermocouple failure when considering what tests should be performed. No tests are required by this document except those specifically ordered by the user. This document lists methods for testing sheathed thermocouples and thermocouple material but does not state criteria for acceptance. The acceptance criteria for the particular thermocouple, when subjected to the tests, are given in other ASTM standard specifications for that thermocouple. Examples from ASTM thermocouple specifications for acceptance criteria are given for many of the tests. These tabulated values are *not* necessarily those that would be required to meet these tests, but are given here as examples only.

1. Scope

1.1 These are test methods for sheathed thermocouple material and assemblies.

1.2 The tests are intended to ensure quality control and to evaluate the suitability of sheathed thermocouple material or assemblies for specific applications. Some alternative test methods to obtain the same information are given, since in a given situation an alternative test method may be more practical. Service conditions are widely variable and so it is unlikely that all the tests described will be appropriate for a given thermocouple application. A brief statement is made following each test description to indicate when it might be used.

1.3 The tests described herein include test methods to measure the following properties of sheathed thermocouple material and assemblies.

1.3.1 *Insulation Properties:*

1.3.1.1 Compaction

absorption method and tension method,

1.3.1.2 Thickness, and

1.3.1.3 Resistance—room temperature and elevated temperature.

1.3.2 *Sheath Properties:*

1.3.2.1 Integrity

water test (two test methods) and mass spectrometer,

1.3.2.2 Dimensions—length, diameter, and roundness,

1.3.2.3 Wall thickness,

1.3.2.4 Surface—gross visual, finish, defect detection by dye penetrant, and cold-lap detection by tension test,

1.3.2.5 Metallurgical structure, and

1.3.2.6 Ductility—bend test and tension test.

1.3.3 *Thermoelement Properties:*

1.3.3.1 Calibration,

1.3.3.2 Homogeneity,

1.3.3.3 Drift,

1.3.3.4 Thermoelement diameter, roundness, and surface appearance,

1.3.3.5 Thermoelement spacing,

1.3.3.6 Thermoelement ductility, and

1.3.3.7 Metallurgical structure.

1.3.4 *Thermocouple Assembly Properties:*

1.3.4.1 Dimensions

length, diameter, and roundness,

1.3.4.2 Surface—gross visual, finish, reference end seal, and defect detection by dye penetrant,

1.3.4.3 Electrical—continuity, loop resistance, and connector polarity,

1.3.4.4 Insulation resistance—room temperature, and elevated temperature,

1.3.4.5 Radiographic inspection,

1.3.4.6 Thermoelement diameter,

1.3.4.7 Thermal response time, and

¹ These test methods are under the jurisdiction of Committee E-20 on Temperature Measurement and are the direct responsibility of Subcommittee E20.04 on Thermocouples.

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