



Standard Guide for Testing Sheathed Thermocouples, Thermocouples Assemblies, and Connecting Wires Prior to, and After Installation or Service¹

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INTRODUCTION

Thermocouples are widely used in industry and provide reliable service when used within their specified temperature range. However, if thermocouples fail in service the consequences can range from insignificant to life-threatening. Often, a costly loss of equipment, product, or operating time will result. The user should weigh the potential consequences of thermocouple failure when considering which tests should be performed either prior to, during, or after installation.

This standard is a guide for the field testing of thermocouples, thermocouple assemblies, and their connecting wires to ensure that they were not damaged during storage, installation, or use rather than being a guide for acceptance testing of thermocouples as delivered from the vendor. The test methods range from basic tests to verify that the thermocouple was properly installed to tests necessary for failure analysis. Thermocouple tests such as homogeneity, capacitance, and loop-current step-response require elaborate equipment and sophisticated analysis and are not included in this guide.

Faulty installation practices and in-service operation beyond prescribed limits are frequently the cause of failure in properly made sheathed thermocouples. Many of the most common types of these application errors may be identified through use of the test methods described in this document. For further information, the reader is directed to MNL 12, Manual on the Use of Thermocouples in Temperature Measurement,² which is an excellent reference document on metal sheathed thermocouples.

1. Scope

1.1 This guide covers methods for users to test metal sheathed thermocouple assemblies, including the extension wires just prior to and after installation or some period of service.

1.2 The tests are intended to ensure that the thermocouple assemblies have not been damaged during storage or installation, to ensure that the extension wires have been attached to connectors and terminals with the correct polarity, and to provide benchmark data for later reference when testing to assess possible damage of the thermocouple assembly after operation. Some of these tests may not be appropriate for

thermocouples that have been exposed to temperatures higher than the recommended limits for the particular type.

1.3 The tests described herein include methods to measure the following characteristics of installed sheathed thermocouple assemblies and to provide benchmark data for determining if the thermocouple assembly has been subsequently damaged in operation:

1.3.1 *Loop Resistance:*

1.3.1.1 Thermoelements,

1.3.1.2 Combined extension wires and thermoelements.

1.3.2 *Insulation Resistance:*

1.3.2.1 Insulation, thermocouple assembly,

1.3.2.2 Insulation, thermocouple assembly and extension wires.

1.3.3 *Seebeck Voltage:*

1.3.3.1 Thermoelements,

1.3.3.2 Combined extension wires and thermocouple assembly.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the*

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*, MNL 12, ASTM. Available from ASTM International, www.astm.org.