



Standard Guide for Use of Thermocouples in Creep and Stress-Rupture Testing to 1800°F (1000°C) in Air¹

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INTRODUCTION

This guide provides basic information, options, and guidelines to enable the user to apply thermocouples, temperature measurement, and control equipment with sufficient accuracy to satisfy the temperature requirements for creep and stress-rupture testing of materials.

1. Scope*

1.1 This guide covers the use of ANSI thermocouple Types K, N, R, and S for creep and stress-rupture testing at temperatures up to 1800°F (1000°C) in air at one atmosphere of pressure. It does not cover the use of sheathed thermocouples.

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 establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- E6 Terminology Relating to Methods of Mechanical Testing
- E21 Test Methods for Elevated Temperature Tension Tests of Metallic Materials
- E139 Test Methods for Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
- E207 Test Method for Thermal EMF Test of Single Thermoelement Materials by Comparison with a Reference Thermoelement of Similar EMF-Temperature Properties
- E220 Test Method for Calibration of Thermocouples By Comparison Techniques

- E230 Specification and Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples
- E292 Test Methods for Conducting Time-for-Rupture Notch Tension Tests of Materials
- E344 Terminology Relating to Thermometry and Hydrometry
- E574 Specification for Duplex, Base Metal Thermocouple Wire With Glass Fiber or Silica Fiber Insulation
- E1129/E1129M Specification for Thermocouple Connectors
- E1684 Specification for Miniature Thermocouple Connectors

3. Terminology

3.1 *Definitions*—Unless otherwise indicated, the definitions given in Terminology E6 and E344 shall apply.

4. Classification

4.1 The following thermocouple types are identified in Tables E230:

- 4.1.1 *Type K*—Nickel—10 % chromium (+) versus nickel—5 % (aluminum, silicon) (–),
- 4.1.2 *Type N*—Nickel—14 % chromium, 1.5 % silicon (+) versus nickel—4.5 % silicon—0.1 % magnesium (–),
- 4.1.3 *Type R*—Platinum—13 % rhodium (+) versus platinum (–),
- 4.1.4 *Type S*—Platinum—10 % rhodium (+) versus platinum (–).

5. Summary of Guide

5.1 This guide will help the user to conduct a creep or stress-rupture test with the highest degree of temperature precision available. It provides information on the proper application of thermocouples that are used to measure and control the temperature of the test specimen. It also points out sources of error and suggests methods to eliminate them.

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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.