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Designation: E 1319 – 98

Standard Guide for High-Temperature Static Strain Measurement[1]

This standard is issued under the fixed designation E 1319; 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 guide covers the selection and application of strain gages for the measurement of static strain up to and including the temperature range from 425 to 650°C (800 to 1200°F). This guide reflects some current state-of-the-art techniques in high temperature strain measurement, and will be expanded and updated as new technology develops.

1.2 This practice assumes that the user is familiar with the use of bonded strain gages and associated signal conditioning and instrumentation as discussed in Refs. **(1)** and **(2).**[2] The strain measuring systems described are those that have proven effective in the temperature range of interest and were available at the time of issue of this practice. It is not the intent of this practice to limit the user to one of the gage types described nor is it the intent to specify the type of system to be used for a specific application. However, in using any strain measuring system including those described, the proposer must be able to demonstrate the capability of the proposed system to meet the selection criteria provided in Section 5 and the needs of the specific application.

1.3 The devices and techniques described in this practice may be applicable at temperatures above and below the range noted, and for making dynamic strain measurements at high temperatures with proper precautions. The gage manufacturer should be consulted for recommendations and details of such applications.

1.4 The references are a part of this practice to the extent specified in the text.

1.5 The values stated in metric (SI) units are to be regarded as the standard. The values given in parentheses are for information purposes only.

1.6 *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.*

[1] This practice is under the jurisdiction of ASTM Committee E-28 on Mechanical Testing and is the direct responsibility of Subcommittee E28.14 on Strain Gages.

Current edition approved May 10, 1998. Published March 1999. Originally published as E 1319 - 89. Last previous edition E 1319 - 89 (1996)$^{\epsilon 1}$.

[2] The boldface numbers in parentheses refer to the list of references at the end of this practice.

2. Referenced Documents

2.1 *ASTM Standards:*

E 6 Terminology Relating to Methods of Mechanical Testing[3]

3. Terminology

3.1 *Definitions:*

3.1.1 Refer to Terminology E 6 for definitions of terms relating to stress and strain.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 Terms pertinent to this guide are described as follows:

3.2.2 *capacitive strain gage*—a strain gage whose response to strain is a change in electrical capacitance which is predictably related to that strain.

3.2.3 *conditioning circuit*—a circuit or instrument subsystem that applies excitation to a strain gage, detects an electrical change in the strain gage, and provides a means for converting this change to an output that is related to strain in the test article. The conditioning circuit may include one or more of the following: bridge completion circuit, signal amplification, zero adjustment, excitation adjustment, calibration, and gain (span) adjustment.

3.2.4 *compensating gage*—a gage element that is subject to the same environment as the active gage element, and which is placed in the adjacent leg of a Wheatstone bridge to provide thermal, pressure, or other compensation in the strain gage system.

3.2.5 *electrical simulation*—a method of calibration whereby a known voltage is generated at the input of an amplifier, equivalent to the voltage produced by a specific amount of strain.

3.2.6 *free filament gage*—a resistive strain gage made from a continuous wire or foil filament which is fixed to the test article along the entire length of the gage, and which is supplied without a permanent matrix.

3.2.7 *gage factor*—the ratio between the unit change of strain gage resistance due to strain and the measurement. The gage factor is dimensionless and is expressed as follows:

[3] *Annual Book of ASTM Standards*, Vol 03.01.

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