



Standard Test Method for Ambient Temperature Fatigue Life of Metallic Bonded Resistance Strain Gages¹

This standard is issued under the fixed designation E1949; 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.

^{ε1} NOTE—Section 7.2.1 and Footnote 3 were editorially corrected in August 2014.

1. Scope

1.1 This test method covers a uniform procedure for the determination of strain gage fatigue life at ambient temperature. A suggested testing equipment design is included.

1.2 This test method does not apply to force transducers or extensometers that use bonded resistance strain gages as sensing elements.

1.3 Strain gages are part of a complex system that includes structure, adhesive, gage, lead wires, instrumentation, and (often) environmental protection. As a result, many things affect the performance of strain gages, including user technique. A further complication is that strain gages, once installed, normally cannot be reinstalled in another location. Therefore, it is not possible to calibrate individual strain gages; performance characteristics are normally presented on a statistical basis.

1.4 *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 its use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E1237 Guide for Installing Bonded Resistance Strain Gages

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *strain gage fatigue life, n*—the number of fully reversed strain cycles corresponding to the onset of degraded

gage performance, whether due to excessive zero shift or other detectable failure mode (see 9.6).

4. Significance and Use

4.1 Strain gages are the most widely used devices for measuring strains and for evaluating stresses in structures. In many applications there are often cyclic loads which can cause strain gage failure. Performance parameters of strain gages are affected by both the materials from which they are made and their geometric design.

4.2 The determination of most strain gage parameters requires mechanical testing that is destructive. Since gages tested for fatigue life cannot be used again, it is necessary to treat data statistically. In general, longer and wider gages with lower resistances will have greater fatigue life. Optional additions to gages (integral leads are an example) will often reduce fatigue life.

4.3 To be used, strain gages must be bonded to a structure. Good results, particularly in a fatigue environment, depend heavily on the materials used to clean the bonding surface, to bond the gage, and to provide a protective coating. Skill of the installer is another major factor in success. Finally, instrumentation systems must be carefully selected and calibrated to ensure that they do not unduly degrade the performance of the gages.

4.4 This test method encompasses only fully reversed strain cycles.

4.5 *Fatigue failure* of a strain gage may not involve visible cracking or fracture of the gage, but merely sufficient zero shift to compromise the accuracy of the gage output for static strain components.

5. Interferences

5.1 In order to ensure that strain gage test data are within a defined accuracy, the gages must be properly bonded and protected with acceptable materials. Aids in the strain gage installation and verification thereof can be found in Guide E1237. It is important to note that good performance in cyclic applications requires the best installations possible.

¹ This test method is under the jurisdiction of ASTM Committee E28 on Mechanical Testing and is the direct responsibility of Subcommittee E28.01 on Calibration of Mechanical Testing Machines and Apparatus.

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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.