

# Standard Practice for Verification and Classification of Extensometer Systems<sup>1</sup>

This standard is issued under the fixed designation E83; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

## 1. Scope

1.1 This practice covers procedures for the verification and classification of extensometer systems, but it is not intended to be a complete purchase specification. The practice is applicable only to instruments that indicate or record values that are proportional to changes in length corresponding to either tensile or compressive strain. Extensometer systems are classified on the basis of the magnitude of their errors.

1.2 Because strain is a dimensionless quantity, this document can be used for extensometers based on either SI or US customary units of displacement.

**Note 1**—Bonded resistance strain gauges directly bonded to a specimen cannot be calibrated or verified with the apparatus described in this practice for the verification of extensometers having definite gauge points. (See procedures as described in Test Methods E251.)

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<sup>2</sup>

- E6 Terminology Relating to Methods of Mechanical Testing
- E21 Test Methods for Elevated Temperature Tension Tests of Metallic Materials
- E251 Test Methods for Performance Characteristics of Metallic Bonded Resistance Strain Gauges

## 3. Terminology

3.1 **Definitions:** In addition to the terms listed, see Terminology E6.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E29 on Mechanical Testing and is the direct responsibility of Subcommittee E29.01 on Calibration of Mechanical Testing Machines and Apparatus.

<sup>2</sup> Current edition approved June 1, 2010. Published July 2010. Originally approved in 1956. Last previous edition approved in 2010 as E83 – 10 (D01) in 1529 (2009)–10a.

<sup>3</sup> 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.

3.1.1 **calibration**—a determination of the calibration factor for a system using established procedures.

3.1.2 **calibration factor**—the factor by which the change in extensometer reading must be multiplied to obtain the equivalent strain.

3.1.2.1 **Discussion**—For any extensometer, the calibration factor is equal to the ratio of change in length to the product of the gauge length and the change in the extensometer reading. For direct-reading extensometers the calibration factor is unity.

3.1.3 **compressometer**—a specialized extensometer used for sensing negative or compressive strain.

3.1.4 **deflectometer**—a specialized extensometer used for sensing of extension or motion, usually without reference to a specific gauge length.

3.1.5 **error in extensometer system**—the value obtained by subtracting the correct value of the strain from the indicated value given by the extensometer system.

3.1.6 **extensometer** *n*—a device for sensing strain.

3.1.7 **extensometer system**—a system for sensing and indicating strain.

3.1.7.1 **Discussion**—The system will normally include an extensometer, conditioning electronics and auxiliary device (recorder, digital readout, computer, etc.). However, completely self-contained mechanical devices are permitted. An extensometer system may be one of three types.

3.1.8 **Type 1 extensometer system, *n***—an extensometer system which both defines gauge length and senses extension, for example, a clip-on strain gauge type with conditioning electronics.

3.1.9 **Type 2 extensometer system, *n***—an extensometer which senses extension and the gauge length is defined by specimen geometry or specimen features such as ridges or notches.

3.1.9.1 **Discussion**—A Type 2 extensometer is used where the extensometer gauge length is determined by features on the specimen, for example, ridges, notches, or overall height (in case of compression test piece). The precision associated with gauge length setting for a Type 2 extensometer should be specified in relevant test method or product standard. The position readout on a testing machine is not recommended for use in a Type 2 extensometer system.

# Astm E83 Calibration Verification And Validation

**Marco Casella**



## **Astm E83 Calibration Verification And Validation:**

**Standards and Practices for Instrumentation** Instrument Society of America, 1980 Prepared by the Instrument Society of America **Index of Specifications and Standards**, 2005 *Polymer Matrix Composites: Guidelines for Characterization of Structural Materials* Composite Materials Handbook - 17 (CMH-17), 2012-07-11 Volume 1 of this six volume compendium contains guidelines for determining the properties of polymer matrix composite material systems and their constituents as well as the properties of generic structural elements including test planning test matrices sampling conditioning test procedure selection data reporting data reduction statistical analysis and other related topics Special attention is given to the statistical treatment and analysis of data Volume 1 contains guidelines for general development of material characterization data as well as specific requirements for publication of material data in CMH 17 The Composite Materials Handbook referred to by industry groups as CMH 17 is a six volume engineering reference tool that contains over 1 000 records of the latest test data for polymer matrix metal matrix ceramic matrix and structural sandwich composites CMH 17 provides information and guidance necessary to design and fabricate end items from composite materials It includes properties of composite materials that meet specific data requirements as well as guidelines for design analysis material selection manufacturing quality control and repair The primary purpose of the handbook is to standardize engineering methodologies related to testing data reduction and reporting of property data for current and emerging composite materials It is used by engineers worldwide in designing and fabricating products made from composite materials *Annual Book of ASTM Standards* American Society for Testing and Materials, 1978 **Book of ASTM Standards, with Related Material** American Society for Testing and Materials, 1976 Materials Metrology and Standards for Structural Performance B.F. Dyson, S. Loveday, Mark Gee, 1995 Materials metrology is the measurement science used for determining materials property data An essential element is the symbiosis between the understanding of materials behaviour and the development of suitable measurement techniques which through the provision of standards enable design engineers and plant operators to acquire materials data of appropriate precision This book is concerned only with those aspects of materials metrology and standards that relate to the design and performance in service of structures and consumer products It does not consider their important role in the processing of materials The editors are grateful for the commitment and patience of the experts who contributed the various chapters In addition help from staff in the Division of Materials Metrology National Physical Laboratory in assisting with the task of refereeing the chapters is gratefully acknowledged The production of this book was carried out as part of the Materials Measurement Programme of underpinning research financed by the United Kingdom Department of Trade and Industry Brian F Dyson Malcolm S Loveday Mark G Gee Division of Materials Metrology National Physical Laboratory Teddington TW11 0LW UK CHAPTER 1 Materials metrology and standards an introduction B F Dyson M S Loveday and M G Gee 1 1 MATERIALS ASPECTS OF STRUCTURAL DESIGN Knowledge concerning the behaviour of

materials has always been vital for the success of manufactured products but never more so than at the present time

Commerce Business Daily ,2000-03 *Proceedings of the Annual Meeting* American Society for Testing and Materials,1964 Vol 12 includes under the same cover the society s year book for 1912 Proceedings - American Society for Testing and Materials American Society for Testing and Materials,1962 Vols 61 66 include technical papers Index and Directory of U.S. Industry Standards ,1987 **Practical Aspects of Dynamic Verification of Extensometers** FJ.

Albright,J. Annala,1994 Material property studies frequently require the measurement of load and strain Accurate measurement of both parameters is essential Methods for accurate static calibration and verification of load transducers and extensometers are well established More recently standard practices have been developed for the dynamic calibration of load transducers Still in its infancy is a standard method for dynamic verification of extensometers **Report on calibration**

**verification** H. W. Hinds,1994 **Statistical Considerations of Calibration Verification** William Henry,2003

Standard Practice of Calibration of Force-measuring Instruments for Verifying the Force Indication of Testing Machines ASTM Committee E28 on Mechanical Testing,2013 Standard Practices for Calibration and Verification for

Force-Measuring Instruments , **The Scratch Test** N. M. Jennett,S. Owen-Jones,2002 *Standard Practices for Force Calibration and Verification of Testing Machines* , **Instrument Calibration Verification** John R. Olvera,1993 *Cost Effective Automatic Test Equipment Calibration/verification Solution* Edgar N. Chung,2000 **Direct Reading Particle**

**Counters** ,2015 We examined the calibration records of two direct reading instruments designated as condensation particle counters in order to determine the number of times they were found to be out of tolerance at annual manufacturer s recalibration For both instruments were found to be out of tolerance more times than within tolerance And it was concluded that annual calibration alone was insufficient to provide operational confidence in an instrument s response Thus a method based on subsequent agreement with data gathered from a newly calibrated instrument was developed to confirm operational readiness between annual calibrations hereafter referred to as bump testing The method consists of measuring source particles produced by a gas grille spark igniter in a gallon size jar Sampling from this chamber with a newly calibrated instrument to determine the calibrated response over the particle concentration range of interest serves as a reference Agreement between this reference response and subsequent responses at later dates implies that the instrument is performing as it was at the time of calibration Side by side sampling allows the level of agreement between two or more instruments to be determined This is useful when simultaneously collected data are compared for differences i e background with process aerosol concentrations A reference set of data was obtained using the spark igniter The generation system was found to be reproducible and suitable to form the basis of calibration verification Finally the bump test is simple enough to be performed periodically throughout the calibration year or prior to field monitoring

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