



Standard Test Method for Length Change Calibration of Thermomechanical Analyzers¹

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1. Scope

1.1 This test method describes calibration of the length change (deflection) measurement or thermal expansion of thermomechanical analyzers (TMAs) within the temperature range from -150 to 1000°C using the thermal expansion of a suitable reference material.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 This test method differs from ISO 11359-1 by providing an alternative calibration procedure.

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 whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

E473 Terminology Relating to Thermal Analysis and Rheology

E831 Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis

E1142 Terminology Relating to Thermophysical Properties

E1363 Test Method for Temperature Calibration of Thermomechanical Analyzers

E2161 Terminology Relating to Performance Validation in Thermal Analysis

2.2 Other Standards:

ISO 11359-1 Plastics—Thermomechanical analysis (TMA)—Part 1: General principles³

¹ This test method is under the jurisdiction of ASTM Committee E37 on Thermal Measurements and is the direct responsibility of Subcommittee E37.10 on Fundamental, Statistical and Mechanical Properties.

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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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

3. Terminology

3.1 Specific technical terms used in this test method are described in Terminologies E473, E1142, and E2161 include calibration, Celsius, coefficient of linear thermal expansion, Kelvin, reference material, repeatability, reproducibility and thermomechanical analysis.

4. Summary of Test Method

4.1 Thermomechanical analyzers (TMAs) or related devices are commonly used to determine coefficient of linear thermal expansion of solid materials (for example, Test Method E831). The test specimen is heated at a linear rate over the temperature range of interest and the change in length (dimension) is electronically recorded.

4.2 Performance verification or calibration of the length change measurement is needed to obtain accurate coefficient of thermal expansion data.

4.3 The thermal expansion of a reference material is recorded using a thermomechanical analyzer. The recorded thermal expansion is compared to the known value of the reference material. The resultant ratio, a calibration coefficient, may then be applied to the determination of unknown specimens to obtain accurate results.

5. Significance and Use

5.1 Performance verification or calibration is essential to the accurate determination of quantitative dimension change measurements.

5.2 This test method may be used for instrument performance validation, regulatory compliance, research and development and quality assurance purposes.

6. Apparatus

6.1 *Thermomechanical Analyzer (TMA)*—The essential instrumentation required to provide the minimum thermomechanical analytical or thermomechanical capability for this test method includes:

6.1.1 *A Rigid Specimen Holder*, of inert, low expansivity material [$<0.5 \mu\text{m m}^{-1} \text{K}^{-1}$] to center the specimen in the furnace and to fix the specimen to mechanical ground.

6.1.2 *A Rigid Expansion Probe*, of inert, low expansivity material [$<0.5 \mu\text{m m}^{-1} \text{K}^{-1}$] which contacts the specimen with an applicable compressive or tensile force.