



Standard Test Method for Performance Validation of Thermomechanical Analyzers¹

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1. Scope

1.1 This test method provides procedures for validating temperature and length change measurements of thermomechanical analyzers (TMA) and analytical methods based upon the measurement of temperature and length change. Performance parameters include temperature repeatability, linearity and bias; and dimension change repeatability, detection limit, quantitation limit, linearity and bias.

1.2 Validation of apparatus performance and analytical methods is a necessary requirement for quality initiatives. Results may also be used for legal purposes.

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

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 use.*

2. Referenced Documents

2.1 ASTM Standards:²

[E473 Terminology Relating to Thermal Analysis and Rheology](#)

[E1142 Terminology Relating to Thermophysical Properties](#)

[E1363 Test Method for Temperature Calibration of Thermomechanical Analyzers](#)

[E1970 Practice for Statistical Treatment of Thermoanalytical Data](#)

[E2113 Test Method for Length Change Calibration of Thermomechanical Analyzers](#)

[E2161 Terminology Relating to Performance Validation in Thermal Analysis](#)

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. Terminology

3.1 Technical terms used in this test method are defined in Terminologies [E473](#), [E1142](#), and [E2161](#), including terms *analyte*, *bow*, *Celsius*, *coefficient of linear thermal expansion*, *detection limit*, *linearity*, *quantification limit*, *relative standard deviation*, *repeatability*, *standard deviation*, *thermodilatometry*, *thermomechanical analysis*, and *validation*.

4. Summary of Test Method

4.1 Temperature and time are the primary independent parameters and length change is the primary dependent experimental parameters provided by thermomechanical analysis.

4.2 Temperature, a measured value, is validated by performing a measurement of the penetration in sharply melting materials at three (or more) different known melting temperatures.

4.3 Length change, a measured value, is validated by performing a measurement of the linear thermal expansion for three (or more) test materials.

4.4 Validation of a thermomechanical test method based upon length change may be performed using the test specimen as the analyte.

4.5 The length change of three (or more) specimens (nominally representing the maximum, midpoint and minimum of the range of the test method) are measured in triplicate (or more). A fourth blank specimen, containing no analyte, is measured in triplicate (or more).

NOTE 1—Repeatability is determined by performing a sufficient number of determinations to calculate valid estimates of the standard deviation or relative standard deviation of the measurement.

4.5.1 Temperature and length change measurement linearity and bias are determined from the linear regression correlation of the results from measurements of the three (or more) specimens.

4.5.2 Length change detection limit and quantitation limit are determined from the standard deviation of the blank determination with no analyte present.

4.5.3 Temperature and length change repeatability are determined from the repeatability measurements of three (or more) specimens.