



Standard Practice for Statistical Treatment of Thermoanalytical Data¹

This standard is issued under the fixed designation E1970; 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 practice details the statistical data treatment used in some thermal analysis methods.

1.2 The method describes the commonly encountered statistical tools of the mean, standard deviation, relative standard deviation, pooled standard deviation, pooled relative standard deviation, the best fit to a (linear regression of a) straight line, and propagation of uncertainties for all calculations encountered in thermal analysis methods (see Practice E2586).

1.3 Some thermal analysis methods derive the analytical value from the slope or intercept of a linear regression straight line assigned to three or more sets of data pairs. Such methods may require an estimation of the precision in the determined slope or intercept. The determination of this precision is not a common statistical tool. This practice details the process for obtaining such information about precision.

1.4 There are no ISO methods equivalent to this practice.

2. Referenced Documents

2.1 ASTM Standards:²

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E456 Terminology Relating to Quality and Statistics

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E2161 Terminology Relating to Performance Validation in Thermal Analysis and Rheology

E2586 Practice for Calculating and Using Basic Statistics

F1469 Guide for Conducting a Repeatability and Reproducibility Study on Test Equipment for Nondestructive Testing

¹ This practice 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.

Current edition approved April 1, 2016. Published April 2016. Originally approved in 1998. Last previous edition approved in 2011 as E1970 – 11. DOI: 10.1520/E1970-16.

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 *Definitions*—The technical terms used in this practice are defined in Practice E177 and Terminologies E456 and E2161 including *precision*, *relative standard deviation*, *repeatability*, *reproducibility*, *slope*, *standard deviation*, *thermoanalytical*, and *variance*.

3.2 Symbols (1):³

m	= slope
b	= intercept
n	= number of data sets (that is, x_i , y_i)
x_i	= an individual independent variable observation
y_i	= an individual dependent variable observation
Σ	= mathematical operation which means “the sum of all” for the term(s) following the operator
$\bar{X}$	= mean value
s	= standard deviation
s_{pooled}	= pooled standard deviation
s_b	= standard deviation of the line intercept
s_m	= standard deviation of the slope of a line
s_y	= standard deviation of Y values
RSD	= relative standard deviation
δy_i	= variance in y parameter
r	= correlation coefficient
R	= gage reproducibility and repeatability (see Guide F1469) an estimation of the combined variation of repeatability and reproducibility (2)
s_r	= within laboratory repeatability standard deviation (see Practice E691)
s_R	= between laboratory repeatability standard deviation (see Practice E691)
s_i	= standard deviation of the “ i th” measurement

4. Summary of Practice

4.1 The result of a series of replicate measurements of a value are typically reported as the mean value plus some estimation of the precision in the mean value. The standard deviation is the most commonly encountered tool for estimating precision, but other tools, such as relative standard deviation or pooled standard deviation, also may be encountered in specific thermoanalytical test methods. This practice describes

³ The boldface numbers in parentheses refer to a list of references at the end of this standard.