



Designation: E 1970 – 00

Standard Practice for Statistical Treatment of Thermoanalytical Data¹

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1. Scope

1.1 This practice details the statistical data treatment used in some methods based upon thermal analysis.

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 and the best fit to a straight line, all calculations encountered in thermal analysis methods.

1.3 Some thermal analysis methods derive the analytical value from the slope or intercept of a best fit 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 Computer or electronic-based instruments, techniques or data treatment equivalent to this practice may also be used.

NOTE 1—Users of this practice are expressly advised that some such instruments or techniques may not be equivalent. It is the responsibility of the user of this standard to determine the necessary equivalency prior to use.

1.5 The values stated in SI units are to be regarded as the standard.

1.6 There are no ISO methods equivalent to this practice.

2. Referenced Documents

2.1 ASTM Standards:

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods²

E 456 Terminology Relating to Quality and Statistics²

3. Terminology

3.1 **Definitions**—The technical terms used in this practice are defined in Practice E 177 and Terminology E 456.

3.2 Symbols: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

4. Summary of Practice

4.1 The result of a series of replicate measurements of a value is reported typically 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 the mathematical process of achieving mean value, standard deviation, relative standard deviation and pooled standard deviation.

4.2 In some thermal analysis experiments, a linear, that is, a straight line, response is assumed and desired values are obtained from the slope or intercept of the straight line through the experimental data. In any practical experiment, however, there will be some uncertainty in the data so that results are scattered about such a straight line. The least squares method is an objective tool for determining the “best fit” straight line drawn through a set of experimental results and for obtaining information concerning the precision of determined values.

4.2.1 For the purposes of this practice, it is assumed that the physical behavior, which the experimental results approximate, are linear with respect to the controlled value, and may be represented by the algebraic function:

$$y = mx + b \quad (1)$$

4.2.2 Experimental results are gathered in pairs, that is, for every corresponding x_i (controlled) value, there is a corresponding y_i (response) value.

¹ This practice is under the jurisdiction of ASTM Committee E-37 on Thermal Measurements and is the direct responsibility of Subcommittee E37.01 on Thermal Analysis Methods.

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² *Annual Book of ASTM Standards*, Vol 14.02.

³ Taylor, J.K., *Handbook for SRM Users*, Publication 260-100, National Institute of Standards and Technology, Gaithersburg, MD, 1993.