



Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials¹

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

1. Scope *

1.1 This practice supplements Practice E 177, in order to provide guidance in preparing precision and bias statements for ASTM test methods pertaining to certain construction materials (Note 1). Recommended forms for precision and bias statements are included. A discussion of the purpose and significance of these statements for the users of those test methods is also provided.

NOTE 1—Although under the jurisdiction of Committee C-9, this practice was developed jointly by Committees C-1, D-4, and C-9, and has been endorsed by all three committees. It has subsequently been adopted for use by Committee D-18.

2. Referenced Documents

2.1 ASTM Standards:

C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)²

C 802 Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction Materials³

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods⁴

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.2 *one-sigma limit (1s)*—the fundamental statistic underlying all indexes of precision is the standard deviation of the population of measurements characteristic of the test method when the latter is applied under specifically prescribed conditions (a given system of causes). The terminology “one-sigma limit” (abbreviated (1s)) is used in Practice E 177 to denote the estimate of the standard deviation or sigma that is characteristic

of the total statistical population. The one-sigma limit is an indication of the variability (as measured by the deviations above and below the average) of a large group of individual test results obtained under similar conditions.

3.2.1 *single-operator one-sigma limit*—the one-sigma limit for single-operator precision is a quantitative estimate of the variability of a large group of individual test results when the tests have been made on the same material by a single operator using the same apparatus in the same laboratory over a relatively short period of time. This statistic is the basic one used to calculate the single-operator index of precision given in the precision statement for guidance of the operator.

3.2.2 *multilaboratory one-sigma limit*—the one-sigma limit for multilaboratory precision is a quantitative estimate of the variability of a large group of individual test results when each test has been made in a different laboratory and every effort has been made to make the test portions of the material as nearly identical as possible. Under normal circumstances the estimates of one-sigma limit for multilaboratory precision are larger than those for single-operator precision, because different operators and different apparatus are being used in different laboratories for which the environment may be different.

3.2.3 *one-sigma limit in percent (1s%)*—in some cases the coefficient of variation is used in place of the standard deviation as the fundamental statistic. This statistic is termed the “one-sigma limit in percent” (abbreviated (1s%)) and is the appropriate standard deviation (1s) divided by the average of the measurements and expressed as a percent. When it is appropriate to use (1s%) in place of (1s) is discussed in Section 6.

3.3 Acceptable Range of Results:

3.3.1 *acceptable difference between two results*—the “difference two-sigma limit (d2s)” or “difference two-sigma limit in percent (d2s%),” as defined in Practice E 177, has been selected as the appropriate index of precision in most precision statements. These indexes indicate a maximum acceptable difference between two results obtained on test portions of the same material under the applicable system of causes described in 4.1.1 and 4.1.2 (or whatever other system of causes is appropriate). The (d2s) index is the difference between two individual test results that would be equaled or exceeded in the

¹ This practice is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.94 on Evaluation of Data.

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² *Annual Book of ASTM Standards*, Vol 04.01.

³ *Annual Book of ASTM Standards*, Vol 04.02.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

