



## Standard Guide for Calculating and Reporting Measures of Precision Using Data from Interlaboratory Wear or Erosion Tests<sup>1</sup>

This standard is issued under the fixed designation G 117; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This guide offers direction on the handling of data from interlaboratory tests for wear or erosion. It describes a format for entering data and for subsequently reporting results on measures of precision in a Committee G-2 standard. It indicates methods for calculation of the needed statistical quantities.

1.2 The document offers guidance based on a Committee G-2 consensus, and exists for the purpose of emphasizing the need to use established statistical practices, and to introduce more uniformity in reporting interlaboratory test results in Committee G-2 standards.

1.3 An example of how the methods described in this guide may be applied is available in personal computer format (DOS type system) on floppy disk as a spreadsheet (LOTUS, rel. 4) file. The purpose is to facilitate use of the methods in this guide. The example file contains all needed equations in the recommended format and can be edited to accept new data. ASTM Headquarters or the Chairman of G-2 should be contacted for a copy of that computer file. The user must have spreadsheet software (for example, LOTUS or compatible) available.

1.4 The methods used in this document are consistent with Practices E 691 and E 177, and with the PC version of Practice E 691.<sup>2</sup>

### 2. Referenced Documents

#### 2.1 ASTM Standards:

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods<sup>3</sup>

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method<sup>3</sup>

G 65 Test Method for Measuring Abrasion Using the Dry Sand/Rubber Wheel Apparatus<sup>4</sup>

G 76 Practice for Conducting Erosion Tests by Solid Particle Impingement Using Gas Jets<sup>4</sup>

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee G-2 on Wear and Erosion and is the direct responsibility of Subcommittee G02.2 on Computerization in Wear and Erosion.

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<sup>2</sup> Available from ASTM Headquarters. Order PCN 12-506910-34.

<sup>3</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>4</sup> Annual Book of ASTM Standards, Vol 03.02.

G 77 Test Method for Ranking Resistance of Materials to Sliding Wear Using Block-on-Ring Wear Test<sup>4</sup>

### 3. Summary of Guide

3.1 Use of this guide in preparation of interlaboratory test results for inclusion in G-2 standards involves a sequence of steps. First the raw data from the individual laboratories are entered into a table of any suitable form that permits calculation of average values and standard deviations for each laboratory. Then those two measures are entered, for each laboratory, into a table such as that shown in Fig. 1. Then the steps described in this guide are carried out, leading to calculation of the precision measures that are to be used in the standard being prepared.

### 4. Significance and Use

4.1 This guide is intended to assist in developing statements of precision and supporting data that will be used in Committee G-2 standards. The methods and approach are drawn from Practice E 177 and E 691. It was felt that preparation of this guide and its use in Committee G-2 would lead to appropriate statistical analyses and more uniformity in G-2 standards regarding reporting of interlaboratory results and precision. The guide is not meant to substitute for possible use of Practices E 177 or E 691 in developing committee standards.

### 5. Procedure

5.1 An example of interlaboratory data analyzed and presented in the recommended format is shown in Fig. 1. The data were obtained from an interlaboratory series of solid particle erosion tests carried out in connection with Practice G 76. This table format can be used with either PC spreadsheet calculation or hand calculation.

5.2 Data tabulation and calculation can be carried out by use of a PC and numeric spreadsheet software (for example, LOTUS), as described in Table 1, or by any other appropriate means such as hand calculation (Table 2). The formulae were obtained from Practices E 177 or E 691 or from statistical analysis texts. Formulae that are used for calculation are given in Table 1 for spreadsheet calculation (for example, LOTUS) and in Table 2 for hand calculation.

5.3 The sequence of steps in assembling and handling the data is as follows (refer to the designated columns in Fig. 1):

5.3.1 Calculate the *average* value of the data for each of  $N$

