



# Standard Practice for Basic Statistics in Committee D-19 on Water <sup>1</sup>

This standard is issued under the fixed designation D 4375; 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 establishes a uniform standard for calculating, expressing, and symbolizing some basic statistical parameters.

## 2. Referenced Documents

- 2.1 *ASTM Standards*:  
D 1129 Terminology Relating to Water <sup>2</sup>  
E 456 Terminology Relating to Quality and Statistics <sup>3</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 *population*—the set of data that consists of all possible observations or values of a certain phenomenon.

3.1.2 *sample*—a set of data from the population.

3.1.3 *statistic*—an estimated quantity for a parameter calculated from a sample.

3.1.4 *parameter*—a measurable quantity characteristic of a population.

3.1.5 *observation*—a fact duly noted and recorded.

3.1.6 *sample or population size*—( $N$  may be finite or infinite, but  $N$  and  $n$  are finite for all calculations).

3.1.7 For definitions of related statistical terms, see Terminology E 456.

3.1.8 For definitions of other terms used in this practice, refer to Terminology D 1129.

### 3.2 Symbols for Sample and Population:

	Sample	Population
Observation	$x_i$	$X_i$
Sample or Population Size	$n$	$N$
Mean	$\bar{x}$	$\mu$
Variance	$s^2$	$\sigma^2$
Standard Deviation	$s$	$\sigma$
Standard Deviation of Mean	$s_{\bar{x}}$	$\sigma_{\mu}$
Relative Standard Deviation (%)	RSD	RSD <sub>p</sub>

## 4. Summary of Practices

4.1 Prior to performing many statistical procedures certain

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D-19 on Water and is the direct responsibility of Subcommittee D19.02 on General Specifications, Technical Resources, and Statistical Methods.

Current edition approved March 10, 1996. Published May 1996. Originally published as D 4375 – 84. Last previous edition D 4375 – 90.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 11.01.

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

variables need to be calculated. The technique for calculating these variables and presenting these results is developed in this practice.

## 5. Significance and Use

5.1 This practice assures the user that all calculations are performed in the same manner and that all results are presented consistently.

## 6. Calculation of Statistical Parameters

### 6.1 Mean:

$$\bar{x} = \sum_{i=1}^n x_i / n$$

$$\mu = \sum_{i=1}^N X_i / N$$

### 6.2 Variance:

$$s^2 = \sum_{i=1}^n (x_i - \bar{x})^2 / n - 1$$

$$\sigma^2 = \sum_{i=1}^N (X_i - \mu)^2 / N$$

### 6.3 Standard Deviation:

$$s = \sqrt{s^2}$$

$$\sigma = \sqrt{\sigma^2}$$

6.4 *Standard Deviation of the Mean*—(also known as standard error of the mean):

$$s_{\bar{x}} = \sqrt{s^2/n}$$

$$\sigma_{\mu} = \sqrt{\sigma^2/N}$$

6.5 *Relative Standard Deviation (%)*—(also known as coefficient of variation) expressed as a percentage:<sup>4</sup>

$$\text{RSD} = (100) s/\bar{x}$$

$$\text{RSD}_p = (100) \sigma/\mu$$

## 7. Keywords

7.1 notation; terminology; statistics

<sup>4</sup> *Manual on Presentation of Data and Control Chart Analysis*, 6th Edition, ASTM MNL 7, ASTM, 1990, p. 19.

 **D 4375**

*The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.*