



## Standard Terminology Relating to Quality and Statistics<sup>1</sup>

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

<sup>e1</sup> NOTE—New terms were added and other terms corrected editorially in January 2009.

<sup>e2</sup> NOTE—New terms were added and other terms corrected editorially in May 2010.

### 1. Scope

1.1 This standard is the general terminology standard for terms defined in the standards of Committee E11 on Quality and Statistics.

1.2 A term in this standard which lists an attribution to an E11 technical standard indicates that the standard is normative for that term. Any changes in the term definition in the normative standard will be editorially changed in this standard. Any terms added to an E11 standard will be editorially added to this standard with an attribution to that standard.

1.3 Term definitions that are similar to **ISO 3534** will be noted in this standard, but **ISO 3534** will not be considered normative for any E11 terms.

### 2. Referenced Documents

2.1 *ASTM E11 Standards with Terms in This Standard:*<sup>2</sup>

**E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

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

**E178** Practice for Dealing With Outlying Observations

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

**E1169** Practice for Conducting Ruggedness Tests

**E1325** Terminology Relating to Design of Experiments

**E1402** Guide for Sampling Design

**E1488** Guide for Statistical Procedures to Use in Developing and Applying Test Methods

**E1994** Practice for Use of Process Oriented AOQL and LTPD Sampling Plans

**E2234** Practice for Sampling a Stream of Product by Attributes Indexed by AQL

**E2281** Practice for Process and Measurement Capability Indices

**E2282** Guide for Defining the Test Result of a Test Method

**E2334** Practice for Setting an Upper Confidence Bound For a Fraction or Number of Non-Conforming items, or a Rate of Occurrence for Non-conformities, Using Attribute Data, When There is a Zero Response in the Sample

**E2489** Practice for Statistical Analysis of One-Sample and Two-Sample Interlaboratory Proficiency Testing Programs

**E2554** Practice for Estimating and Monitoring the Uncertainty of Test Results of a Test Method in a Single Laboratory Using a Control Sample Program

**E2555** Practice for Factors and Procedures for Applying the MIL-STD-105 Plans in Life and Reliability Inspection

**E2586** Practice for Calculating and Using Basic Statistics

**E2587** Practice for Use of Control Charts in Statistical Process Control

**E2655** Guide for Reporting Uncertainty of Test Results and Use of the Term Measurement Uncertainty in ASTM Test Methods

**E2696** Practice for Life and Reliability Testing Based on the Exponential Distribution

2.2 *ISO Standards:*

**ISO 3534** Statistics-Vocabulary and Symbols

**Part 1** Probability and General Statistical Terms

**Part 2** Applied Statistics

### 3. Terminology

**acceptance quality limit, AQL,  $n$** —quality limit that is the worst tolerable process average when a continuing series of lots is submitted for acceptance sampling. **E2234**

**accepted reference value,  $n$** —a value that serves as an agreed-upon reference for comparison, and which is derived as: (1) a theoretical or established value, based on scientific principles, (2) an assigned or certified value, based on experimental work of some national or international organization, or (3) a consensus or certified value, based on collaborative experimental work under the auspices of a

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- scientific or engineering group. **E177**
- accuracy**, *n*—the closeness of agreement between a test result and an accepted reference value. **E177**
- aliases**, *n*—in a fractional factorial design, two or more effects which are estimated by the same contrast and which, therefore, cannot be estimated separately. **E1325**
- area sampling**, *n*—probability sampling in which a map, rather than a tabulation of sampling units, serves as the sampling frame. **E1402**
- assignable cause**, *n*—factor that contributes to variation in a process or product output that is feasible to detect and identify (see **special cause**). **E2587**
- attributes data**, *n*—observed values or test results that indicate the presence or absence of specific characteristics or counts of occurrences of events in time or space. **E2587**
- attributes, method of**, *n*—measurement of quality by the method of attributes consists of noting the presence (or absence) of some characteristic or attribute in each of the units in the group under consideration, and counting how many units do (or do not) possess the quality attribute, or how many such events occur in the unit, group, or area. **E2334**
- average outgoing quality (AOQ)**—the average percent defective of outgoing product including all accepted lots or batches, after any defective units found in them are replaced by acceptable units, plus all lots or batches which are not accepted after such lots or batches have been effectively 100 % inspected and all defective units replaced by acceptable units. **E1994**
- average outgoing quality limit (AOQL)**—the maximum of the AOQs for all possible incoming percentages defective for the process, for a given acceptance sampling plan. **E1994**
- average quality protection**—a type of protection in which there is prescribed some chosen value of average percent defective in the product after inspection (average outgoing quality limit (AOQL), that shall not be exceeded in the long run no matter what may be the level of percent defective in the product submitted to the inspector. **E1994**
- average run length (ARL)**—the average number of times that a process will have been sampled and evaluated before a shift in process level is signaled. **E2587**
- average standard deviation**,  $\bar{s}$ , *n*—arithmetic average of sample standard deviations. **E2281**
- balanced incomplete block design (BIB)**, *n*—an incomplete block design in which each block contains the same number *k* of different versions from the *t* versions of a single principal factor arranged so that every pair of versions occurs together in the same number,  $\lambda$ , of blocks from the *b* blocks. **E1325**
- bias**, *n*—the difference between the expectation of the test results and an accepted reference value. **E177**
- bulk sampling**, *n*—sampling to prepare a portion of a mass of material that is representative of the whole. **E1402**
- c chart**—control chart that monitors the count of occurrences of an event in a defined increment of time or space. **E2587**
- center line**—line on a control chart depicting the average level of the statistic being monitored. **E2587**
- chance cause**—source of inherent random variation in a process which is predictable within statistical limits (see **common cause**). **E2587**
- characteristic**, *n*—a property of items in a sample or population which, when measured, counted or otherwise observed, helps to distinguish between the items. **E2282**
- check sample**—see **control sample**. **E2554**
- classification of defects**, *n*—the enumeration of possible defects of the unit of product arranged according to their seriousness, that is, critical, major, or minor defect. **E2234**
- cluster sampling**, *n*—sampling in which the sampling unit consists of a group of subunits, all of which are measured for sampled clusters. **E1402**
- coefficient of variation, CV**—for a nonnegative characteristic, the ratio of the standard deviation to the mean for a population or sample. **E2586**
- collaborative study**, *n*—interlaboratory study in which each laboratory uses the defined method of analysis to analyze identical portions of homogeneous materials to assess the performance characteristics obtained for that method of analysis. **E2489**
- collaborative trial**, *n*—see **collaborative study**. **E2489**
- common cause**—see **chance cause**. **E2587**
- component of variance**, *n*—a part of a total variance identified with a specified source of variability. **E1488**
- completely randomized design**, *n*—a design in which the treatments are assigned at random to the full set of experimental units. **E1325**
- completely randomized factorial design**, *n*—a factorial experiment (including all replications) run in a completely randomized design. **E1325**
- composite design**, *n*—a design developed specifically for fitting second order response surfaces to study curvature, constructed by adding further selected treatments to those obtained from a 2<sup>n</sup> factorial (or its fraction). **E1325**
- confidence bound**, *n*—see **confidence limit**. **E2334**
- confidence coefficient**, *n*—the value, *C*, of the probability associated with a confidence interval or statistical coverage interval. It is often expressed as a percentage. **ISO 3534 Part 1 E2334**
- confidence interval**, *n*—an interval estimate of a population parameter, calculated such that there is a given long-run probability that the parameter is included in the interval. **E2334**
- confidence level**, *n*—see **confidence coefficient**. **E2334**
- confidence limit**, *n*—the upper or lower limit of a confidence interval for a population parameter. **E2334**
- confounded factorial design**, *n*—a factorial experiment in which only a fraction of the treatment combinations are run in each block and where the selection of the treatment combinations assigned to each block is arranged so that one or more prescribed effects is (are) confounded with the block effect(s), while the other effects remain free from confounding. **E1325**
- confounding**, *n*—combining indistinguishably the main effect of a factor or a differential effect between factors (interactions) with the effect of other factor(s), block factor(s) or

- interactions(s). **E1325**
- consumer's risk**, *n*—probability that a lot having specified rejectable quality level will be accepted under a defined sampling plan. **E2555**
- contrast**, *n*—a linear function of the observations for which the sum of the coefficients is zero. **E1325**
- contrast analysis**, *n*—a technique for estimating the parameters of a model and making hypothesis tests on preselected linear combinations of the treatments (contrasts). **E1325**
- control chart**, *n*—chart on which are plotted a statistical measure of a subgroup versus time of sampling along with limits based on the statistical distribution of that measure so as to indicate how much common, or chance, cause variation is inherent in the process or product. **E2587**
- control chart factor**, *n*—a tabulated constant, depending on sample size, used to convert specified statistics or parameters into a central line value or control limit appropriate to the control chart. **E2587**
- control limits**, *n*—limits on a control chart that are used as criteria for signaling the need for action or judging whether a set of data does or does not indicate a state of statistical control based on a prescribed degree of risk. **E2587**
- control sample**, *n*—sample taken from a stable, homogeneous material for the purposes of monitoring the performance of a test method in a laboratory. **E2554**
- critical defect**, *n*—a defect that judgment and experience indicate would result in hazardous or unsafe conditions for individuals using, maintaining, or depending upon the product, or a defect that judgment and experience indicate is likely to prevent performance of the function of a major end item. **E2234**
- defect**, *n*—any nonconformance of the unit of product with specified requirements. **E2234**
- dependent variable**, *n*—see **response variable**. **E1325**
- design of experiments**, *n*—the arrangement in which an experimental program is to be conducted, and the selection of the levels (versions) of one or more factors or factor combinations to be included in the experiment. Synonyms include *experiment design* and **experimental design**. **E1325**
- double sampling plan**, *n*—a multiple sampling plan in which up to two samplings can be taken and evaluated to accept or reject a lot. **E2234**
- empirical percentile**, *n*—estimate of a population percentile using the sample data. This is a sample value such that a percentage *p* of the sample is less than that value. **E2586**
- error of result**, *n*—a test result minus the accepted reference value of the characteristic. **E2655**
- expanded uncertainty**, **U**, *n*—uncertainty reported as a multiple of the standard uncertainty. **E2655**
- evolutionary operation (EVOP)**, *n*—a sequential form of experimentation conducted in production facilities during regular production. **E1325**
- experimental design**, *n*—see **design of experiments**. **E1325**
- experimental unit**, *n*—a portion of the experiment space to which a treatment is applied or assigned in the experiment. **E1325**
- experiment space**, *n*—the materials, equipment, environmental conditions and so forth that are available for conducting an experiment. **E1325**
- factorial experiment (general)**, *n*—in general, an experiment in which all possible treatments formed from two or more factors, each being studied at two or more levels (versions) are examined so that interactions (differential effects) as well as main effects can be estimated. **E1325**
- 2<sup>n</sup> factorial experiment**, *n*—a factorial experiment in which *n* factors are studied, each of them in two levels (versions). **E1325**
- fractional factorial design**, *n*—a factorial experiment in which only an adequately chosen fraction of the treatments required for the complete factorial experiment is selected to be run. **E1325**
- frame**, *n*—a list, compiled for sampling purposes, which designates all of the sampling units (items or groups) of a population or universe to be considered in a specific study. **E1402**
- fully nested experiment**, *n*—a nested experiment in which the second factor is nested within levels (versions) of the first factor and each succeeding factor is nested within versions of the previous factor. **E1325**
- hierarchical experiment**, *n*—see **nested experiment**. **E1325**
- histogram**, *n*—graphical representation of the frequency distribution of a characteristic consisting of a set of rectangles with area proportional to the frequency. **E2586**
- I chart**, *n*—control chart that monitors the individual subgroup observations. **E2587**
- incomplete block design**, *n*—a design in which the experiment space is subdivided into blocks in which there are insufficient experimental units available to run a complete set of treatments or replicate of the experiment. **E1325**
- inspection**, *n*—the process of measuring, examining, testing, or otherwise comparing the unit of product with the requirements. **E2234**
- inspection by attributes**, *n*—inspection whereby either the unit of product is classified simply as defective or non-defective, or the number of defects in the unit of product is counted, with respect to a given requirement or set of requirements. **E2234**
- inspection lot**, *n*—a collection of units of product produced under conditions that are considered uniform and from which a sample is drawn and inspected. **E2234**
- interlaboratory comparison**, *n*—organization, performance, and evaluation of tests on the same or similar test items by two or more laboratories in accordance with predetermined conditions. **E2489**
- interlaboratory study (ILS)**, *n*—a designed procedure for obtaining a precision statement for a test method, involving multiple laboratories, each generating replicate test results on one or more materials. **E691**
- interquartile range, IQR**, *n*—the 75<sup>th</sup> percentile (0.75 quantile) minus the 25<sup>th</sup> percentile (0.25 quantile), for a data set. **E2586**
- intermediate precision**, *n*—the closeness of agreement between test results obtained under specified intermediate