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An American National Standard

Standard Terminology Relating to Quality and Statistics[1]

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ε[1] NOTE—New terms were added and other terms were corrected editorially in May 2014.
ε[2] NOTE—New terms were added and other terms were corrected editorially in March 2015.
ε[3] NOTE—New terms were added and other terms were corrected editorially in April 2016.
ε[4] NOTE—New terms were added and other terms were corrected editorially in February 2017.

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:*[2]

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E105 Practice for Probability Sampling of Materials
E141 Practice for Acceptance of Evidence Based on the Results of Probability Sampling
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 Capability and Performance Measurement
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 Using Control Chart Techniques
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
E2709 Practice for Demonstrating Capability to Comply with an Acceptance Procedure
E2762 Practice for Sampling a Stream of Product by Variables Indexed by AQL
E2782 Guide for Measurement Systems Analysis (MSA)
E2819 Practice for Single- and Multi-Level Continuous Sampling of a Stream of Product by Attributes Indexed by AQL
E2935 Practice for Conducting Equivalence Testing in Laboratory Applications

[1] This terminology is under the jurisdiction of ASTM Committee E11 on Quality and Statistics and is the direct responsibility of Subcommittee E11.70 on Editorial/Terminology.

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

E3080 Practice for Regression Analysis

2.2 *ISO Standards:*[3]
ISO 3534 Statistics—Vocabulary and Symbols
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 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**

audit subsample, *n*—a small subsample of a sample selected for review of all sample selection and data collection procedures. **E141**

average outgoing quality (AOQ), *n*—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), *n*—the maximum of the AOQs for all possible incoming percentages defective for the process, for a given acceptance sampling plan. **E1994**

average quality protection, *n*—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), *n*—the average number of times that a process will have been sampled and evaluated before a shift in process level is signaled. **E2587**

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, λ, of blocks from the b blocks. **E1325**

bias, *n*—the difference between the expectation of the test results and an accepted reference value. **E177**

binary scale, *n*—nominal scale with only two possible categories. **E2282**

block factor, *n*—a factor that indexes division of experimental units into disjoint subsets. **E1325**

bulk sampling, *n*—sampling to prepare a portion of a mass of material that is representative of the whole. **E1402**

c chart, *n*—control chart that monitors the count of occurrences of an event in a defined increment of time or space. **E2587**

calibration, *n*—process of establishing a relationship between a measurement device and a known standard value(s). **E2782**

center line, *n*—line on a control chart depicting the average level of the statistic being monitored. **E2587**

chance cause, *n*—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 among the items. **E2282**

check sample, *n*—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 determination, *n*—square of the correlation coefficient, r. **E3080**

[3] Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, http://www.iso.org.

coefficient or variation (CV), *n*—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, *n*—see **chance cause**. **E2587**

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**

component of variance, *n*—a part of a total variance identified with a specified source of variability. **E1488**

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^n factorial (or its fraction). **E1325**

confidence bound, *n*—see **confidence limit**. **E2586**

confidence coefficient, *n*—see **confidence level**. **E2586**

confidence interval, *n*—an interval estimate [L, U] with the statistics L and U as limits for the parameter θ and with confidence level 1-α, where $Pr(L \leq \theta \leq U) \geq 1-\alpha$. **E2586**

confidence level, *n*—the value, 1-α, of the probability associated with a confidence interval, often expressed as a percentage. **E2586**

confidence limit, *n*—each of the limits, L and U, of a confidence interval, or the limit of a one-sided confidence interval. **E2586**

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**

continuous sampling inspection, *n*—a method of sampling a stream of product in order of production where the sampling frequency is adjusted based on ongoing inspection results. **E2819**

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**

correlation coeffecient, *n—for a population,* ρ, a dimensionless measure of association between two variables X and Y, equal to the covariance divided by the product of σ_X and times σ_Y. **E3080**

correlation coeffecient, *n—for a sample, r*, the estimate of the parameter ρ from the data. **E3080**

covariance, *n—of a population*, cov(X, Y), for two variables, X and Y, the expected value of $(X - \mu_X)(Y - \mu_Y)$. **E3080**

covariance, *n—of a sample*, the estimate of the parameter cov(X, Y) from the data. **E3080**

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**

degrees of freedom, *n*—the number of independent data points minus the number of parameters that have to be estimated before calculating the variance. **E2586**

dependent variable, *n*—a variable to be predicted using an equation. **E3080**

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

equal complete coverage result, *n*—the numerical characteristic of interest calculated from observations made by drawing randomly from the frame, all of the sampling units covered by the frame. E141

equivalence, *n*—condition that two population parameters differ by no more than predetermined limits. E2935

error of result, *n*—a test result minus the accepted reference value of the characteristic. E2655

estimate, *n*—sample statistic used to approximate a population parameter. E2586

evolutionary operation (EVOP), *n*—a sequential form of experimentation conducted in production facilities during regular production. E1325

EWMA chart, *n*—control chart that monitors the exponentially weighted moving averages of consecutive subgroups. E2587

EWMV chart, *n*—control chart that monitors the exponentially weighted moving variance. E2587

expanded uncertainty, U, *n*—uncertainty reported as a multiple of the standard uncertainty. E2655

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

exponentially weighted moving average (EWMA), *n*—weighted average of time-ordered data where the weights of past observations decrease geometrically with age. E2587

exponentially weighted moving variance (EWMV), *n*—weighted average of squared deviations of observations from their current estimate of the process average for time ordered observations, where the weights of past squared deviations decrease geometrically with age. E2587

factor, *n*—independent variable in an experimental design. 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^n 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

gage, *n*—device used as part of the measurement process to obtain a measurement result. E2782

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. **ISO 3534-1,** 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

independent variable, *n*—a variable used to predict another using an equation. E3080

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 nondefective, or the number of defects in the unit of product is counted, with respect to a given requirement or set of requirements. E2234

inspection by variables, *n*—inspection wherein the unit of product is measured on a continuous scale with respect to a given requirement or set of requirements. E2762

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

interaction, *n*—differences in responses to a factor among levels (versions) of other factors in the experiment. E1325

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

intermediate precision, *n*—the closeness of agreement between test results obtained under specified intermediate precision conditions. E177

intermediate precision conditions, *n*—conditions under which test results are obtained with the same test method using test units or test specimens (see Practice E691, 10.3) taken at random from a single quantity of material that is as nearly homogeneous as possible, and with changing conditions such as operator, measuring equipment, location within the laboratory, and time. **E177**

interquartile range (IQR), *n*—the 75th percentile (0.75 quantile) minus the 25th percentile (0.25 quantile), for a data set. **E2586**

interval scale, *n*—continuous scale or discrete scale with equal sized scale values and an arbitrary zero. **ISO 3534-2, E2282**

item, *n*—an object or quantity of material on which a set of observations can be made. **E2334**

judgment sampling, *n*—a procedure whereby enumerators select a few items of the population, based on visual, positional or other cues that are believed to be related to the variable of interest, so that the selected items appear to match the population. **E105**

kurtosis, γ_2, g_2, *n*—for a population or a sample, a measure of the weight of the tails of a distribution relative to the center, calculated as the ratio of the fourth central moment (empirical if a sample, theoretical if a population applies) to the standard deviation (sample, s, or population, σ) raised to the fourth power, minus 3 (also referred to as excess kurtosis). **E2586**

latin square, *n*—a factorial experiment having two block factors (rows and columns) and a treatment factor, with equal numbers of levels, and for which each treatment occurs once in each row and column. **E1325**

level (of a factor), *n*—a given value, a specification of procedure or a specific setting of a factor. **E1325**

life test, *n*—process of placing one or more units of product under a specified set of test conditions and measuring the time until failure for each unit. **E2696**

limiting quality level (LQL), *n*—quality level having a specified consumer's risk for a given sampling plan. **E2555**

long term standard deviation, σ_{LT}, *n*—sample standard deviation of all individual (observed) values taken over a long period of time. **E2281**

lot, *n*—a definite quantity of a product or material accumulated under conditions that are considered uniform for sampling purposes. **E2555**

lot quality protection, *n*—a type of protection in which there is prescribed some chosen value of limiting percent defective in a lot (lot tolerance percent defective (LTPD)) and also some chosen value for the probability (called the consumer's risk) of accepting a submitted lot that has a percent defective equal to the lot tolerance percent defective. **E1994**

lot tolerance percent defective (LTPD), *n*—for purposes of acceptance sampling, the percentage of defective units in a lot for which the consumer has a stated low probability of acceptance of the lot. **E1994**

lower control limit (LCL), *n*—minimum value of the control chart statistic that indicates statistical control. **E2587**

main effect, average effect, *n*—a term describing a measure for the comparison of the responses at each level (version) of a factor averaged over all levels (versions) of other factors in the experiment. **E1325**

major defect, *n*—a defect, other than critical, that is likely to result in failure, or to reduce materially the usability of the unit of product for its intended purpose. **E2234**

mean, *n*—*of a population*, μ, average or expected value of a characteristic in a population – *of a sample,* $\bar{x}$, sum of the observed values in the sample divided by the sample size. **E2586**

mean time to failure, θ, *n*—in life testing, the average length of life of items in a lot. **E2696**

measurement process, *n*—process used to assign a number to a property of an object or other physical entity. **E2782**

measurement result, *n*—number assigned to a property of an object or other physical entity being measured. **E2782**

measurement system, *n*—the collection of hardware, software, procedures and methods, human effort, environmental conditions, associated devices, and the objects that are measured for the purpose of producing a measurement. **E2782**

measurement systems analysis (MSA), *n*—any of a number of specialized methods useful for studying a measurement system and its properties. **E2782**

median, $\tilde{x}$, *n*—the 50th percentile in a population or sample. **E2586**

method of least squares, *n*—a technique of estimation of a parameter which minimizes $\sum e^2$, where e is the difference between the observed value and the predicted value derived from the assumed model. **E1325**

midrange, *n*—average of the minimum and maximum values in a sample. **E2586**

minor defect, *n*—a defect that is not likely to reduce materially the usability of the unit of product for its intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the unit. **E2234**

mixture design, *n*—a design in which two or more ingredients or components shall be mixed and the response is a property of the resulting mixture that does not depend upon the amount of the mixture. **E1325**

MR chart, *n*—control chart that monitors the moving range of consecutive individual subgroup observations. **E2587**

multiple sampling plan, *n*—a sampling plan in which successive samples from a lot are drawn and after each sample is inspected a decision is made to accept the lot, reject the lot,

or to take another sample, based on quality level of the combined samples. E2234

multiple stage acceptance procedure, *n*—a procedure that involves more than one stage of sampling and testing a given quality characteristic and one or more acceptance criteria per stage. E2709

multi-stage sampling, *n*—sampling in which the sample is selected by stages, the sampling units at each stage being selected from subunits of the larger sampling units chosen at the previous stage. E1402

nested experiment, *n*—an experiment to examine the effect of two or more factors in which the same level (version) of a factor cannot be used with all levels (versions) of other factors. Synonym **hierarchical experiment**. E1325

nested sampling, *n*—same as **multi-stage sampling**. E1402

nominal scale, *n*—scale with unordered labeled categories or ordered by convention. ISO 3534-2, E2282

non-conforming item, *n*—an item containing at least one non-conformity. ISO 3534-2, E2334

non-conformity, *n*—the non-fulfillment of a specified requirement. ISO 3534-2, E2334

number of failures, *n*—number of failures that have occurred at the time the decision as to lot acceptability is reached. E2696

observation, *n*—the process of obtaining information regarding the presence or absence of an attribute of a test specimen, or of making a reading on a characteristic or dimension of a test specimen. E2282

observed value, *n*—the value obtained by making an observation. E2282

operating characteristic, *n*—probability of acceptance using a specified acceptance sampling plan, as a function of parameters describing quality of the lot. E2234

order statistic $x_{(k)}$, *n*—value of the k^{th} observed value in a sample after sorting by order of magnitude. E2586

ordinal scale, *n*—scale with ordered labeled categories. ISO 3534-2, E2282

orthogonal array, *n*—a table of coefficients identifying the levels, or some weight associated with the levels, for each factor to be used in the analysis of specified effects, which are arranged in such a manner that each effect will be independent of the other effects. E1325

orthogonal contrasts, *n*—two contrasts are orthogonal if the contrast coefficients of the two sets satisfy the condition that, when multiplied in corresponding pairs, the sum of the products is equal to zero. See **contrast** and **contrast analysis.** E1325

outlier—see **outlying observation**. E178

outlying observation, *n*—an extreme observation in either direction that appears to deviate markedly in value from other members of the sample in which it appears. E178

p chart, *n*—control chart that monitors the fraction of occurrences of an event. E2587

parameter, *n*—see **population parameter**. E2586

partially balanced incomplete block design (PBIB), *n*—an incomplete block design in which each block contains the same number *k*, of different versions from the *t* versions of the principal factor. E1325

partially nested experiment, *n*—a nested experiment in which several factors may be crossed as in factorial experiments and other factors nested within the crossed combinations. E1325

percentile, *n*—quantile of a sample or a population, for which the fraction less than or equal to the value is expressed as a percentage. E2586

Plackett-Burman designs, *n*—a set of screening designs using orthogonal arrays that permit evaluation of the linear effects of up to $n = t - 1$ factors in a study of *t*, treatment combinations. E1325

population, *n*—the totality of items or units of material under consideration. E2586

population parameter, *n*—summary measure of the values of some characteristic of a population. ISO 3534, Part 2; E2586

precision, *n*—the closeness of agreement between independent test results obtained under stipulated conditions. E177

prediction interval, *n*—an interval for a future value or set of values, constructed from a current set of data, in a way that has a specified probability for the inclusion of the future value. E2586

primary sampling unit (PSU), *n*—the item, element, increment, segment or cluster selected at the first stage of the selection procedure from a population or universe. E1402

probability proportional to size sampling (PPS), *n*—probability sampling in which the probabilities of selection of sampling units are proportional, or nearly proportional, to a quantity (the "size") that is known for all sampling units. E1402

probability sample, *n*—a sample in which the sampling units are selected by a chance process such that a specified probability of selection can be attached to each possible sample that can be selected. E1402

probability sampling plan, *n*—a sampling plan which makes use of the theory of probability to combine a suitable procedure for selecting sample items with an appropriate procedure for summarizing the test results so that inferences may be drawn and risks calculated from the test results by the theory of probability. E105

process capability (PC), *n*—statistical estimate of the outcome of a characteristic from a process that has been demonstrated to be in a state of statistical control. E2281

process capability index, C_p, *n*—an index describing process capability in relation to specified tolerance. **E2281**

process performance (PP), *n*—statistical measure of the outcome of a characteristic from a process that may not have been demonstrated to be in a state of statistical control. **E2281**

process performance index, P_p, *n*—index describing process performance in relation to specified tolerance. **E2281**

producer's risk, α, *n*—probability that a lot having specified acceptable quality level will be rejected under a defined sampling plan. **E2696**

proficiency testing, *n*—determination of laboratory testing performance by means of interlaboratory comparisons. **E2489**

proportional sampling, *n*—a method of selection in stratified sampling such that the proportions of the sampling units (usually, psu's) selected for the sample from each stratum are equal. **E1402**

quota sampling, *n*—a method of selection similar to stratified sampling in which the numbers of units to be selected from each stratum is specified and the selection is done by trained enumerators but is not a probability sample. **E1402**

quantile, *n*—value such that a fraction of the sample or population is less than or equal to that value. **E2586**

R chart, *n*—control chart that monitors the range of observations within a subgroup. **E2587**

random error of result, *n*—a component of the error that, in the course of a number of test results for the same characteristic, varies in an unpredictable way. **E2655**

randomization, *n*—the procedure used to allot treatments at random to the experimental units so as to provide a high degree of independence in the contributions of experimental error to estimates of treatment effects. **E1325**

randomized block design, *n*—a design in which the experiment space is subdivided into blocks of experimental units, the units within each block being more homogeneous than units in different blocks. **E1325**

randomized block factorial design, *n*—a factorial experiment run in a randomized block design in which each block includes a complete set of factorial combinations. **E1325**

range, R, *n*—maximum value minus the minimum value in a sample. **E2586**

ratio scale, *n*—continuous scale with equal sized scale values and an absolute or natural zero point. **ISO 3534-2, E2282**

rational subgroup, *n*—subgroup chosen to minimize the variability within subgroups and maximize the variability between subgroups (see **subgroup**). **E2587**

regression, *n*—the process of estimating parameter(s) of an equation using a set of data. **E3080**

repeatability, *n*—precision under repeatability conditions. **E177**

repeatability conditions, *n*—conditions where independent test results are obtained with the same method on identical test items in the same laboratory by the same operator using the same equipment within short intervals of time. **E177**

repeatability limit r, *n*—the value below which the absolute difference between two individual test results obtained under repeatability conditions may be expected to occur with a probability of approximately 0.95 (95 %). **E177**

repeatability standard deviation, s_r, *n*—the standard deviation of test results obtained under repeatability conditions. **E177**

replicate subsamples, *n*—a number of disjoint samples, each one separately drawn from the frame in accord with the same probability sampling plan. **E141**

reproducibility, *n*—precision under reproducibility conditions. **E177**

reproducibility conditions, *n*—conditions where test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment. **E177**

reproducibility limit, *R*, *n*—the value below which the absolute difference between two test results obtained under reproducibility conditions may be expected to occur with a probability of approximately 0.95 (95 %). **E177**

reproducibility standard deviation, s_R, *n*—the standard deviation of test results obtained under reproducibility conditions. **E177**

residual, *n*—observed value minus fitted value, when a model is used. **E3080**

residual error, *n*—the difference between the observed result and the predicted value (estimated treatment response); Observed Result minus Predicted Value. **E1325**

response surface, *n*—the pattern of predicted responses based on the empirical model derived from the experiment observations. **E1325**

ruggedness, *n*—insensitivity of a test method to departures from specified test or environmental conditions. **E1169**

ruggedness test, *n*—a planned experiment in which environmental factors or test conditions are deliberately varied in order to evaluate the effects of such variation. **E1169**

s chart, *n*—control chart that monitors the standard deviations of subgroup observations. **E2587**

sample, *n*—a group of observations or test results, taken from a larger collection of observations or test results, which serves to provide information that may be used as a basis for making a decision concerning the larger collection. **E2586**

sample size, n, *n*—number of observed values in the sample. **E2586**

sample statistic, *n*—summary measure of the observed values of a sample. **E2586**

sampling fraction, f, *n*—the ratio of the number of sampling units selected for the sample to the number of sampling units available. **E1402**

sampling unit, *n*—an item, group of items, or segment of material that can be selected as part of a probability sampling plan. **E1402**

sampling with replacement, *n*—probability sampling in which a selected unit is replaced after any step in selection so that this sampling unit is available for selection again at the next step of selection, or at any other succeeding step of the sample selection procedure. **E1402**

sampling without replacement, *n*—probability sampling in which a selected sampling unit is set aside and cannot be selected at a later step of selection. **E1402**

scale, *n*—system of reference values for a characteristic. **ISO 3534-2, E2282**

screening design, *n*—a balanced design, requiring relatively minimal amount of experimentation, to evaluate the lower order effects of a relatively large number of factors in terms of contributions to variability or in terms of estimates of parameters for a model. **E1325**

sensitivity coefficient, *n*—differential effect of the change in a factor on the test result. **E2655**

sequential life test, *n*—life test sampling plan whereby neither the number of failures nor the time required to reach a decision are fixed in advance but instead decisions depend on the accumulated results of the life test. **E2696**

short term standard deviation, σ_{ST}, *n*—the inherent variation present when a process is operating in a state of statistical control, expressed in terms of standard deviation. **E2281**

significant digit, *n*—any of the figures 0 through 9 that is used with its place value to denote a numerical quantity to some desired approximation, excepting all leading zeros and some trailing zeros in numbers not represented with a decimal point. **E29**

simple random sample, *n*—*(without replacement)* probability sample of n sampling units from a population of N units selected in such a way that each of the $\frac{N!}{n!(N-n)!}$ subsets of n units is equally probable; *(with replacement)* a probability sample of n sampling units from a population of N units selected in such a way that, in order of selection, each of the N^n ordered sequences of units from the population is equally probable. **E1402**

skewness, γ_1, g_1, *n*—for population or sample, a measure of symmetry of a distribution, calculated as the ratio of the third central moment (empirical if a sample, and theoretical if a population applies) to the standard deviation (sample, s, or population, σ) raised to the third power. **E2586**

special cause, *n*—see **assignable cause**. **E2587**

stable process, *n*—process in a state of statistical control; process condition when all special causes of variation have been removed. **E2281**

staggered nested experiment, *n*—a nested experiment in which the nested factors are run within only a subset of the versions of the first or succeeding factors. **E1325**

standard deviation, *n*—*of a population*, σ, the square root of the average or expected value of the squared deviation of a variable from its mean;—*of a sample, s,* the square root of the sum of the squared deviations of the observed values in the sample from their mean divided by the sample size minus 1. **E2586**

standard error, *n*—standard deviation of the population of values of a sample statistic in repeated sampling, or an estimate of it. **E2586**

standard uncertainty, u, *n*—uncertainty reported as the standard deviation of the estimated value of the quantity subject to measurement. **E2655**

standardized chart, *n*—control chart that monitors a standardized statistic. **E2587**

state of statistical control, *n*—process condition when only common causes are operating on the process. **E2587**

statistic, *n*—see **sample statistic**. **E2586**

statistical procedures, *n*—the organized techniques and methods used to collect, analyze, and interpret data. **E1488**

statistical process control (SPC), *n*—set of techniques for improving the quality of process output by reducing variability through the use of one or more control charts and a corrective action strategy used to bring the process back into a state of statistical control. **E2587**

stratified sampling, *n*—sampling in which the population to be sampled is first divided into mutually exclusive subsets or strata, and independent samples taken within each stratum. **E1402**

subgroup, *n*—set of observations on outputs sampled from a process at a particular time. **E2587**

systematic error of result, *n*—a component of the error that, in the course of a number of test results for the same characteristic, remains constant or varies in a predictable way. **E2655**

systematic sampling, *n*—a sampling procedure in which evenly spaced sampling units are selected. **E1402**

test determination, *n*—the value of a characteristic or dimension of a single test specimen derived from one or more observed values. **E2282**

test method, *n*—a definitive procedure that produces a test result.
***Regulations Governing ASTM Technical Committees*,[4] 2.2.6; E2282**

[4] Available from ASTM International, http://www.astm.org/Regulations.html.

test observation, *n*—see **observation.** E2282

test result, *n*—the value of a characteristic obtained by carrying out a specified test method. **ISO 3534-2,** E2282

test specimen, *n*—the portion of a test unit needed to obtain a single test determination. E2282

test unit, *n*—the total quantity of material (containing one or more test specimens) needed to obtain a test result as specified in the test method. See **test result.** E2282

treatment, *n*—a combination of the levels (versions) of each of the factors assigned to an experimental unit, synonym **treatment combination.** E1325

treatment combination, *n*—see **treatment.** E1325

trueness, *n*—the closeness of agreement between the population mean of the measurements or test results and the accepted reference value. E177

u chart, *n*—control chart that monitors the count of occurrences of an event in variable intervals of time or space, or another continuum. E2587

uncertainty, *n*—an indication of the magnitude of error associated with a value that takes into account both systematic errors and random errors associated with the measurement or test process. E2655

uncertainty budget, *n*—a tabular listing of uncertainty components for a given measurement process giving the magnitudes of contributions to uncertainty of the result from those sources. E2655

uncertainty component, *n*—a source of error in a test result to which is attached a standard uncertainty. E2655

upper control limit (UCL), *n*—maximum value of the control chart statistic that indicates statistical control. E2587

variables data, *n*—observations or test results defined on a continuous scale. E2587

variance, σ^2, s^2, *n*—square of the standard deviation of the population or sample. E2586

waiting time, *n*—in life testing, the time elapsed from the start of testing until a decision is reached as to lot acceptability. E2696

warning limits, *n*—limits on a control chart that are two standard errors below and above the centerline. E2587

within-laboratory standard deviation, *n*—the standard deviation of test results obtained within a laboratory for a single material under conditions that may include such elements as different operators, equipment, and longer time intervals. E177

X-bar chart, *n*—control chart that monitors the average of observations within a subgroup. E2587

Youden square, *n*—a type of block design derived from certain Latin squares by deleting, or adding, rows (or columns) so that one block factor remains complete blocks and the second block factor constitutes balanced incomplete blocks. E1325

Z-score, *n*—observed value minus the sample mean divided by the sample standard deviation. E2586

4. Symbols

1–α—confidence level E2586

α—producer's risk E2696

C_p—process capability index E2281

f—sampling fraction E1402

γ_1, g_1—skewness of population, skewness of sample E2586

γ_2, g_2—kurtosis of population, kurtosis of sample E2586

μ—mean of a population E2586

n—sample size E2586

P_p—process performance index E2281

R—range E2586

r—repeatability limit E177

R—reproducibility limit E177

s_r—repeatability standard deviation E177

s_R—reproducibility standard deviation E177

σ_{ST}—short term standard deviation E2281

σ_{LT}—long term standard deviation E2281

σ, s—standard deviation of population, standard deviation of sample E2586

σ^2, s^2—population variance, sample variance E2586

Θ—mean time to failure (in life testing) E2696

Θ—a population parameter E2586

U—expanded uncertainty E2655

$x_{(k)}$—k^{th} ordered sample value E2586

$\tilde{x}$—sample or population median E2586

$\bar{x}$—sample mean E2586

5. Acronyms

AOQ, *n*—average outgoing quality E1994

AOQL, *n*—average outgoing quality limit E1994

AQL, *n*—acceptance quality limit E2234

ARL, *n*—average run length E2587

BIB, *n*—balanced incomplete block design E1325

CV, *n*—coefficient of variation E2586

EVOP, *n*—evolutionary operation E1325

EWMA, *n*—exponentially weighted moving average E2587

EWMV, *n*—exponentially weighted moving variance E2587

ILS, *n*—interlaboratory study **E691**

IQR, *n*—interquartile range **E2586**

LCL, *n*—lower control limit **E2587**

LQL, *n*—limiting quality level **E2555**

LTPD, *n*—lot tolerance percent defective **E1994**

MSA, *n*—measurement systems analysis **E2782**

PBIB, *n*—partially balanced incomplete block design **E1325**

PC, *n*—process capability **E2281**

PP, *n*—process performance **E2281**

PPS, *n*—probability proportional to size **E1402**

PSU, *n*—primary sampling unit **E1402**

SPC, *n*—statistical process control **E2587**

UCL, *n*—upper control limit **E2587**

6. Keywords

6.1 acceptance sampling terminology; quality control terminology; sampling terminology; specifications terminology; statistics terminology