AMERICAN NATIONAL STANDARD

SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY ATTRIBUTES

AMERICAN SOCIETY FOR QUALITY
600 NORTH PLANKINTON AVENUE
MILWAUKEE, WISCONSIN 53203

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Sampling Procedures and Tables for Inspection by Attributes

Prepared by
The Statistics Subcommittee of the Accredited
Standards Committee Z1 on Quality, Environment,
Dependability and Statistics

Secretariat
American Society for Quality

Abstract
Sampling Procedures and Tables for Inspection by Attributes is an acceptance sampling system to be used with switching rules on a continuing stream of lots for AQL specified. It provides tightened, normal, and reduced plans to be applied for attributes inspection for percent nonconforming or nonconformities per 100 units.

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Foreword

(This foreword is not a part of the American National Standard—*Sampling Procedures and Tables for Inspection by Attributes*, Z1.4-2003)

This standard is a revision of ANSI/ASQC Z1.4-1993, "Sampling Procedures and Tables for Inspection by Attributes." Beyond editorial refinements, only the following eight changes have been made:

1) Acceptable Quality Level (AQL) has been changed to Acceptance Quality Limit (AQL). See Clause 4.

2) The definition and explanation of AQL have been changed. See Clauses 4.2 and 4.3.

3) The Discontinuation of Inspection rule has been changed. See Clause 8.4.

4) ANSI/ASQC A2-1987 has been changed to ANSI/ASQ A3534-2-1993. See Clauses 2 and 7.2.

5) ANSI/ASQC Q3 has been changed to ASQC Q3-1988. See Clause 11.6.3.

6) The connected arrows in Table II-A, III-A, III-C, IV-A, and IV-C have been separated.

7) In Tables III-A, III-B, and III-C and for clarification of instructions, the * footnote has changed and the + footnote added.

8) In Tables IV-A, IV-B, and IV-C and for clarification of instructions, the footnotes * and ++ have changed and the footnote ## added.

Note 1: Other than 3), 7), and 8) above, all tables, table numbers and procedures used in MIL-STD-105E (which was cancelled in 1995) have been retained.

Note 2: A compatible and interchangeable standard for variables inspection is ANSI/ASQC Z1.9-2003.

Suggestions for improvement of this standard are welcomed. Send your comments to the sponsor, ASQ, 600 North Plankinton Avenue, Milwaukee, WI 53203.

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SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY ATTRIBUTES

1. SCOPE

1.1 PURPOSE. This publication establishes sampling plans and procedures for inspection by attributes. When specified by the responsible authority, this publication shall be referenced in the specification, contract, inspection instructions, or other documents and the provisions set forth herein shall govern. The "responsible authority" shall be designated in one of the above documents, as agreed to by the purchaser and seller or producer and user.

1.2 APPLICATION. Sampling plans designated in this publication are applicable, but not limited, to inspection of the following:

a. End items.

b. Components and raw materials.

c. Operations.

d. Materials in process.

e. Supplies in storage.

f. Maintenance operations.

g. Data or records.

h. Administrative procedures.

These plans are intended primarily to be used for a continuing series of lots or batches. The plans may also be used for the inspection of isolated lots or batches, but, in this latter case, the user is cautioned to consult the operating characteristic curves to find a plan which will yield the desired protection (see 11.6).

1.3 INSPECTION. Inspection is the process of measuring, examining, testing, or otherwise comparing the unit of product (see 1.5) with the requirements.

1.4 INSPECTION BY ATTRIBUTES. Inspection by attributes is inspection whereby either the unit of product is classified simply as conforming or nonconforming, or the number of nonconformities in the unit of products is counted, with respect to a given requirement or set of requirements.

1.5 UNIT OF PRODUCT. The unit of product is the unit inspected in order to determine its classification as conforming or nonconforming or to count the number of nonconformities. It may be a single article, a pair, a set, a length, an area, an operation, a volume, a component of an end product, or the end product itself. The unit of product may or may not be the same as the unit of purchase, supply, production, or shipment.

2. DEFINITIONS AND TERMINOLOGY

The definitions and terminology employed in this standard are in accord with ANSI/ASQ A3534-2-1993 (Terms, Symbols, and Definitions for Acceptance Sampling). The following two definitions are particularly important in applying the standard.

DEFECT: A departure of a quality characteristic from its intended level or state that occurs with a severity sufficient to cause an associated product or service not to satisfy intended normal, or foreseeable, usage requirements.

NONCONFORMITY: A departure of a quality characteristic from its intended level or state that occurs with severity sufficient to cause an associated product or service not to meet a specification requirement.

These acceptance sampling plans for attributes are given in terms of the percent or proportion of product in a lot or batch that depart from some requirement. The general terminology used within the document will be given in terms of percent of nonconforming units or number of nonconformities, since these terms are likely to constitute the most widely used criteria for acceptance sampling.

In the use of this standard it is helpful to distinguish between:

a. an individual sampling plan—a specific plan that states the sample size or sizes to be used, and the associated acceptance criteria.

b. a sampling scheme—a combination of sampling plans with switching rules and possibly a provision for discontinuance of inspection. In this standard the terms “sampling scheme” and “scheme performance” will be used in the restricted sense described in Sec. 11.1.

c. a sampling system—a collection of sampling schemes. This standard is a sampling system indexed by lot-size ranges, inspection levels, and AQLs.

3. PERCENT NONCONFORMING AND NONCONFORMITIES PER HUNDRED UNITS

3.1 EXPRESSION OF NONCONFORMANCE. The extent of nonconformance of product shall be expressed either in terms of percent nonconforming or in terms of nonconformities per hundred units.

3.2 PERCENT NONCONFORMING. The percent nonconforming of any given quantity of units of product is one hundred times the number of nonconforming units divided by the total number of units of product, i.e.:

$$\text{Percent nonconforming} = \frac{\text{Number nonconforming}}{\text{Number of units inspected}} \times 100$$

3.3 NONCONFORMITIES PER HUNDRED UNITS. The number of nonconformities per hundred units of any given quantity of units of product is one hundred times the number of nonconformities contained therein (one or more nonconformities being possible in any unit of product) divided by the total number of units of product, i.e.:

$$\text{Nonconformities per hundred units} = \frac{\text{Number of nonconformities}}{\text{Number of units inspected}} \times 100$$

It is assumed that nonconformities occur randomly and with statistical independence within and between units.

4. ACCEPTANCE QUALITY LIMIT (AQL)

4.1 USE. The AQL together with the Sample Size Code Letter, is used for indexing the sampling plans provided herein.

4.2 DEFINITION. The AQL is the quality level that is the worst tolerable process average when a continuing series of lots is submitted for acceptance sampling.

Note: The use of the abbreviation AQL to mean Acceptable Quality Level is no longer recommended.

4.3 NOTE ON THE MEANING OF AQL. The concept of AQL only applies when an acceptance sampling scheme with rules for switching between normal, tightened and reduced inspection and discontinuance of sampling inspection is used. These rules are designed to encourage suppliers to have process averages consistently better than the AQL. If suppliers fail to do so, there is a high probability of being switched from normal inspection to tightened inspection where lot acceptance becomes more difficult. Once on tightened inspection, unless corrective action is taken to improve product quality, it is very likely that the rule requiring discontinuance of sampling inspection will be invoked.

Although individual lots with quality as bad as the AQL can be accepted with fairly high probability, the designation of an AQL does not suggest that this is necessarily a desirable quality level. The AQL is a parameter of the sampling scheme and should not be confused with a process average which describes the operating level of a manufacturing process. It is expected that the product quality level will be less than the AQL to avoid excessive non-accepted lots.

The sampling plans in this standard are so arranged that the probability of lot acceptance at the designated AQL depends upon sample size, being generally higher for large samples than for small samples for a given AQL. To determine the specific protection to the consumer at a given AQL, it is necessary to refer to the operating characteristic curves (which are provided in this standard) of the corresponding scheme and its constituent plans.

The AQL alone does not describe the protection to the consumer for individual lots or batches, but more directly relates to what is expected from a series of lots or batches provided the provisions of this standard are satisfied.

4.4 LIMITATION. The designation of an AQL shall not imply that the supplier has the right to knowingly supply any nonconforming unit of product.

4.5 SPECIFYING AQLs. The AQL to be used will be designated in the contract or by the responsible authority. Different AQLs may be designated for groups of nonconformities considered collectively, or for individual nonconformities. For example, Group A may include nonconformities of a type felt to be of the highest concern for the product or service and therefore be assigned a small AQL value; Group B may include nonconformities of the next higher degree of concern and therefore be assigned a larger AQL value than for Group A and smaller than that of Group C, etc. The classification into groups should be appropriate to the quality