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Sampling procedures for inspection by variables —

Part 6: Specification for single sampling plans for isolated lot inspection indexed by limiting quality (LQ)

Règles d'échantillonnage pour les contrôles par mesures —

Partie 6: Spécification pour les plans d'échantillonnage simples pour les contrôles de lots isolés, indexés d'après la qualité limite (QL)

Reference number
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC *69, Applications of statistical methods,* Subcommittee SC 5, *Acceptance sampling*.

A list of all parts in the ISO 3951 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document specifies an acceptance sampling system of single sampling plans for inspection by variables. It is indexed in terms of the limiting quality (LQ) for the inspection of lots where switching rules as used in ISO 3951-1 are not applicable. These switching rules provide protection to the consumer (by the prospect of switching to tightened inspection and discontinuation) and also provide an incentive to the supplier to improve the quality level. However, there are various cases where the switching rules of ISO 3951-1 are not applicable, such as isolated lots or a short series of lots.

This document is designed for the inspection of a single quality characteristic that is measurable on a continuous scale and is normally distributed, under conditions where ISO 3951-1 is not applicable, and is complementary to the attributes standard ISO 2859-2. The operating characteristic curves (OC curves) of the variables plans in this document are similar but not identical to those of the corresponding attributes plans in ISO 2859-2. The OC curves have been matched by minimizing the difference of the OC curves on condition of getting a comprehensible sample size structure (see Clause 9).

In this document, the acceptance of a lot is implicitly determined from an estimate of the fraction of nonconforming items in the process, based on a random sample of items from the lot. The objectives of the methods laid down in this document are to ensure that lots of limiting quality have a probability of acceptance about 10 % and that the probability of accepting lots with good quality is as high as practicable.

It is assumed in the main body of this document that measurement error is negligible. For information on accommodating measurement error, see Annex B, which was derived from References [24], [29] and [30].

CAUTION — The procedures in this document are not suitable for application to lots that have been screened for nonconforming items.

Inspection by variables for nonconforming items, as described in this document, includes several possible modes, the combination of which leads to a presentation that can appear quite complex to the user:

— unknown standard deviation, or known since the start of inspection;

— a single specification limit, or combined control of double specification limits.

The choice of the most suitable variables plan, if one exists, requires experience, judgement, and some knowledge of both statistics and the product to be inspected. Clause 5 is intended to help those responsible for specifying sampling plans in making this choice. It suggests the considerations that should be borne in mind when deciding whether a variables plan would be suitable and the choices to be made when selecting an appropriate standard plan.

The basic definitions and notations are provided by Clauses 3 and 4. The basic operational rules are contained in Clauses 5 through 8. Clause 9 informs about the relations between this document and the attributes sampling standard ISO 2859-2. Clauses 10 and 11 provide background on accounting for measurement uncertainty and the underlying normality assumption. All tables needed for the sampling procedure can be found in Clause 12, and examples for the s–method and the σ–method for both single and double specification limits can be found in Clause 13.

Nine annexes are provided. Annex A indicates how the sample standard deviation, s, and the presumed known value of the process standard deviation, σ, should be determined. Annex B provides procedures for accommodating measurement uncertainty. Annex C shows five different sampling strategies. Annex D gives the general formula for the operating characteristics of the s–method. Annex E gives the general formula for the operating characteristics of the σ–method. Annex F gives the theory underlying the calculation of consumer's risks. Annex G gives the theory underlying the calculation of producer's risk quality. Annex H gives details of how acceptance diagrams for double specification limits are constructed. Annex I gives a description of the use of the underlying software, R package ISO 3951, to support implementation of this document.

Sampling procedures for inspection by variables —

Part 6: Specification for single sampling plans for isolated lot inspection indexed by limiting quality (LQ)

1 Scope

This document specifies an acceptance sampling system of single sampling plans for inspection by variables, primarily designed for use under the following conditions:

a) where the inspection procedure is applied to an isolated lot of discrete products all supplied by one producer using one production process;

b) where only a single quality characteristic, x, of this process is taken into consideration, which is measurable on a continuous scale;

c) where the quality characteristic, x, is distributed according to a normal distribution or a close approximation to a normal distribution;

d) where the quality characteristic can be measured without error or with moderate measurement error;

e) where a contract or standard defines a lower specification limit, L, an upper specification limit, U, or both; an item is qualified as conforming if and only if its measured quality characteristic, x, satisfies the appropriate one of the following inequalities:

   1) $x \geq L$ (i.e. the lower specification limit is not violated);

   2) $x \leq U$ (i.e. the upper specification limit is not violated);

   3) $x \geq L$ and $x \leq U$ (i.e. neither the lower nor the upper specification limit is violated).

Inequalities 1) and 2) are cases with a single specification limit, whereas inequality 3) is a case with double specification limits.

Where double specification limits apply, it is assumed in this document that conformance to both specification limits is equally important to the integrity of the product. In such cases, it is appropriate to apply a single LQ to the combined fraction of a product outside the two specification limits. This is referred to as combined control.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 2859-2, *Sampling procedures for inspection by attributes — Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection*

ISO 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

ISO 3534-2, *Statistics — Vocabulary and symbols — Part 2: Applied statistics*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2859-1, ISO 2859-2, ISO 3534-1, and ISO 3534-2 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
inspection by variables
inspection by measuring the magnitude of a characteristic of an item

[SOURCE: ISO 3534-2:2006, 4.1.4, modified — "the magnitude(s) of the characteristic(s)" replaced with "the magnitude of a characteristic".]

3.2
sampling inspection
inspection of selected items in the group under consideration

[SOURCE: ISO 3534-2:2006, 4.1.6]

3.3
acceptance sampling inspection
acceptance sampling
sampling inspection (3.2) to determine whether or not to accept a lot or other amount of product, material, or service

[SOURCE: ISO 3534-2:2006, 4.1.8, modified — "acceptance sampling" added as second preferred term; original definition, "acceptance inspection where the acceptability is determined by means of sampling inspection" replaced with the current one.]

3.4
acceptance sampling inspection by variables
acceptance sampling inspection (3.3) in which the acceptance of a lot is determined statistically from measurements on specified quality characteristics of each item in a sample from a lot

[SOURCE: ISO 3534-2:2006, 4.2.11, modified — “the process” replaced by “a lot”, and “on specified quality characteristics of each item in a sample from a lot” has been replaced by “from inspection by variables”]

3.5
process fraction nonconforming
rate at which nonconforming items are generated by a process

Note 1 to entry: It is expressed as a proportion.

3.6
quality level
quality expressed as the fraction nonconforming