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Sampling procedures for inspection by variables —

Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL

Règles d'échantillonnage pour les contrôles par mesures —

Partie 1: Spécification pour les plans d'échantillonnage simples indexés d'après un niveau de qualité acceptable (NQA) pour un contrôle lot par lot pour une caractéristique qualité unique et un NQA unique



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Contents

	Page
Foreword.....	v
Introduction.....	vi
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	2
4 Symbols.....	6
5 Choice of a sampling plan.....	7
5.1 Choice between variables and attributes.....	7
5.2 General.....	8
5.3 Choice between the s -method and σ -method.....	8
5.4 Choice of inspection level and AQL.....	9
6 Standard procedures for the s-method.....	10
6.1 General.....	10
6.2 Single specification limits.....	10
6.3 Double specification limits.....	11
7 Standard procedures for the σ-method.....	11
7.1 General.....	11
7.2 Single specification limits.....	11
7.3 Double specification limits.....	12
8 The p^*-method.....	12
9 Switching between inspection severities.....	13
9.1 Rules for switching between inspection severities.....	14
9.2 Records for switching between inspection severities.....	15
10 Relation to ISO 2859-1.....	15
10.1 Similarities.....	15
10.2 Differences.....	16
11 Allowing for measurement uncertainty.....	17
12 Normality, data transformations and outliers.....	17
12.1 Normality.....	17
12.2 Data transformations.....	17
12.3 Outliers.....	18
13 Monitoring and recording of inspection results.....	18
13.1 Monitoring of inspection results.....	18
13.2 Process capability and performance assessment.....	18
13.3 Monitoring of process parameters.....	18
14 Tables.....	19
14.1 Form k for single sampling plans: s -method.....	19
14.2 Form k for single sampling plans: σ -method.....	26
14.3 Form p^* single sampling plans.....	33
14.4 Values of f_σ for maximum process standard deviation (MPSD).....	40
14.5 Supplementary acceptance constants for qualifying towards reduced inspection.....	40
15 Examples.....	41
15.1 General.....	41
15.2 Examples for the s -method.....	41
15.3 Examples for the σ -method.....	48
15.4 Examples for the p^* -method.....	52
Annex A (informative) Procedures for obtaining s and σ.....	55

This is a preview of "ISO 3951-1:2022". [Click here to purchase the full version from the ANSI store.](#)

Annex B (informative) Accommodating measurement variability	58
Annex C (informative) Sampling strategies	63
Annex D (informative) Operating characteristics for the σ-method	65
Annex E (informative) Operating characteristic for the s-method – tabulated values for single sampling plans, normal inspection	66
Annex F (informative) Consumer’s risk qualities	75
Annex G (informative) Producer’s risks	82
Annex H (informative) Construction of acceptance diagrams for double specification limits	90
Annex I (informative) Use of the underlying software	101
Bibliography	106

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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*.

This third edition cancels and replaces the second edition (ISO 3591-1:2013), which has been technically revised.

The main changes are as follows:

- procedures have been introduced to accommodate measurement uncertainty;
- many of the sampling plans have been adjusted to improve the match between their operating characteristic curves and the operating characteristic curves of the corresponding plans for single sampling by attributes in ISO 2859-1.

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 acceptance quality limit (AQL). A more comprehensive and technical treatment of the AQL scheme is given in ISO 3951-2. This document is complementary to ISO 2859-1.

The objectives of the methods laid down in this document are to ensure that lots of acceptable quality have a high probability of acceptance and that the probability of not accepting inferior lots is as high as practicable. This is achieved by means of the switching rules, which provide the following:

- a) an automatic protection to the consumer (by means of a switch to tightened inspection or discontinuation of sampling inspection) should a deterioration in quality be detected; and
- b) an incentive (at the discretion of the responsible authority) to reduce inspection costs (by means of a switch to a smaller sample size) should consistently good quality be achieved.

In this document, the acceptance of a lot is implicitly determined from an estimate of the percentage of nonconforming items in the process, based on a random sample of items from the lot.

This document is intended for application to a continuing series of lots of discrete products all supplied by one producer using one production process. If there are different producers or production processes, this document is applied to each one separately.

This document is intended for application to a single quality characteristic that is measurable on a continuous scale and is normally distributed. For two or more such quality characteristics, see ISO 3951-2. For information on normality and data transformations, see [Clause 12](#).

It is assumed in the body of this document that measurement error is negligible (see ISO 10576-1:2003). For information on allowing for measurement error, see [Annex B](#).

For double specification limits, this document covers combined control. For other types of control, refer to ISO 3951-2.

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 may appear quite complex to the user:

- unknown standard deviation, or originally unknown then estimated with fair precision, or known since the start of inspection;
- a single specification limit, or combined control of double specification limits;
- normal inspection, tightened inspection, or reduced inspection.

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](#) of this document is intended to help those responsible for specifying sampling plans in making this choice. They suggest the considerations that should be kept in mind when deciding whether a variables plan is suitable and the choices to be made when selecting an appropriate standard plan.

The basic definitions and notations are provided in [Clauses 3](#) and [4](#). The basic operational rules are contained in [Clauses 5](#) through [9](#). [Clause 10](#) informs about the relations between this document and the attributes sampling standard ISO 2859-1. [Clauses 11](#), [12](#) and [13](#) provide background on accounting for measurement uncertainty, the normality assumption, and monitoring of inspection results and the underlying process. All tables needed for the sampling procedure can be found in [Clause 14](#) and examples for the s -method and the σ -method for both one and two specification limits can be found in [Clause 15](#).

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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 characteristic of the σ -method and provides tables with values of the operating characteristics of single sampling plans with known σ . [Annex E](#) gives the general formula for the operating characteristic of the s -method and provides tables with values of the operating characteristics of single sampling plans with unknown σ . [Annex F](#) provides the statistical theory underlying the calculation of the consumer's risk qualities, together with tables showing these quality levels for normal, tightened, and reduced inspection, as well as for the s -method and σ -method. [Annex G](#) provides similar information for the producer's risks. [Annex H](#) give details of how Acceptance diagrams for double specification limits are constructed, [Annex I](#) shows the use of the underlying software (R package to support implementation of this document).