Second edition
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Corrected version
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Sampling procedures for inspection by variables —

Part 2: General specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection of independent quality characteristics

Règles d'échantillonnage pour les contrôles par mesures —

Partie 2: Spécification générale pour les plans d'échantillonnage simples indexés d'après une limite de qualité acceptable (LQA) pour le contrôle lot par lot de caractéristiques-qualité indépendantes

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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. www.iso.org/directives

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

The committee responsible for this document is ISO/TC 69, *Application of statistical methods*, Subcommittee SC 5, *Acceptance sampling*.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: http://www.iso.org/iso/home/standards_development/resources-for-technical-work/foreword.htm

This second edition cancels and replaces the first edition (ISO 3951-2:2006), of which it constitutes a minor revision with the following changes:

— 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.

ISO 3951 consists of the following parts, under the general title *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*

— *Part 2: General specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection of independent quality characteristics*

— *Part 3: Double sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

— *Part 4: Procedures for assessment of declared quality levels*

— *Part 5: Sequential sampling plans indexed by acceptance quality limit (AQL) for inspection by variables (known standard deviation)*

This corrected version of ISO 3951-2:2013 incorporates the following corrections:

— Clause 1, letter f), points 2) and 3): "$x \geq U$" has been replaced with "$x \leq U$";

— Clause 4, process mean (6th line): "process mean" has been replaced with "unknown process mean";

— Clause 11, Note 1: reference to "ISO 16269-4" has been replaced with a reference to "ISO 5479";

— Clause 11, Note 2: reference to "Clause 2 of ISO 5725-2" has been replaced with a reference to "ISO 2854";

— 16.3.2.5, under "Information needed", last line: "(from Table G.1 as it is normal inspection)" has been replaced with "(from Table D.1, with 2,5 % AQL)", and the value "0,115 4" has been replaced with "0,064 66";

— 16.3.2.5, last line before the Note: "which is less than the acceptability constant p^*. The lot is therefore accepted." has been replaced with "which is greater than the acceptability constant p^*. The lot is therefore not accepted.";

— 18.2, second paragraph: "$\bar{x}_U$ $[=U-ks]$" has been replaced with "$\bar{x}_U$ $[=U-k\sigma]$";

— 18.2, Example, second paragraph, fourth line: ", it is seen that for an AQL of 1,0 %," has been replaced with ", it is seen that for an AQL of 0,65 %,";

— 18.3, Example: the sample size has been corrected to be "19" instead of "20" (several occurrences) and the value 488 Ω for the resistance has been deleted; under "Further information needed" and "Alternative further information needed", the values have been corrected accordingly;

— 20.2, paragraph below Table 4: reference to "Table G.1" has been replaced with a reference to "Table E.1";

— O.2: the acceptability constant k has been corrected from "1,962" to "1,963" and the example has been recalculated;

— P.4, last line before Figure P.1: "As $\bar{x} = 12{,}990 > 12{,}975$," has been replaced with "As $\bar{x} = 12{,}980 > 12{,}975$,";

— Bibliography: ISO 2854 and ISO 5479 have been added.

Introduction

This part of ISO 3951 specifies an acceptance sampling system of single sampling plans for inspection by variables. It is indexed in terms of the acceptance quality limit (AQL) and is of a technical nature, aimed at users who are already familiar with sampling by variables or who have complicated requirements. (A more introductory treatment is given in ISO 3951-1.)

The objectives of the methods laid down in this part of ISO 3951 are to ensure that lots of an 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) 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;

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 part of ISO 3951, the acceptability of a lot is either implicitly or explicitly determined from an estimate of the percentage of nonconforming items in the process, based on a random sample of items from the lot.

This part of ISO 3951 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 part of ISO 3951 is applied to each one separately.

This part of ISO 3951 is complementary to ISO 2859-1. When specified by the responsible authority, both this part of ISO 3951 and ISO 2859-1 may be referenced in a product specification, contract, inspection instructions, or other documents, and the provisions set forth therein govern. The responsible authority shall be designated in one of the above documents.

Caution — The procedures in this part of ISO 3951 are not suitable for application to lots that have been screened previously for nonconforming items.

Inspection by variables for percent nonconforming items, as described in this part of ISO 3951, 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 double specification limits with combined, separate, or complex control;

— univariate or multivariate cases;

— three inspection severities, namely normal inspection, tightened inspection, or reduced inspection.

Table 1 is intended to facilitate the use of this part of ISO 3951 by directing the user to the paragraphs and tables concerning any situation with which he may be confronted. Table 1 only deals with Clauses 15, 16, 17, 18, 19, 23, 24, and 25; in every case, it is necessary first of all to have read all the preceding clauses.

Table 1 — Summary table

	Single specification limit				Double specification limits with combined control			
	s-method		*σ*-method		*s*-method		*σ*-method	
	Clauses or sub-clauses	Tables/ Annexes	Clauses or sub-clauses	Tables/ Annexes	Clauses or sub-clauses	Tables	Clauses or sub-clauses	Tables/ Annexes
Normal inspection	16.1, 16.2, 16.3, 17,1, 17.2, 20 24.1	A.1, B.1	18.1, 18.2, 19, 20, 24.1	A.1, G.3	16.1, 16.3, 17.1,17.2, 20, 24.1 Annex L	A.1, D.1, Annex F (for n = 3), G.1	18.1, 18.3, 19, 20, 24.1	A.1, C.1, E.1
Switching between normal and tightened inspection	24.2, 24.3	B.1, B.2	24.2, 24.3	C.1, C.2	24.2, 24.3	D.1, D.2 F.1, F.2	24.2, 24.3	E.1 G.1, G.2
Switching between normal and reduced inspection	24.4, 24.5	B.1, B.3 J.1	24.4, 24.5	C.1, J.1	24.4, 24.5	D.1, D.3 F.1, F.3 J.1	24.4, 24.5	E.1 G.1, G.3 J.1
Switching between tightened and dis-continued inspection	22, 25	B.2	25	C.2	22, 25	D.2 F.2	25	E.1 G.2
Switching between the *s*-method and *σ*-method	26	I.1	26	K.2, I.1	26 L.2.1 L.3, L.4, L.5	I.1	26 L.2.2	K.2, I.1
Normal inspection	16.1, 17.1, 17.2, 20, 24.1, Annex L	A.1, D.1, Annex F (for n = 3), G.1	18.1, 18.2, 18.3, 19, 20, 24.1	Annex A, C.1, E.1	16.1, 16.3.4, 17.1, 17.2, 20, 24.1, Annex L	A.1, D.1, Annex F (for n = 3), G.1	18.1, 18.3, 19, 20, 24.1	A.1, C.1, E.1
Switching between normal and tightened inspection	24.2, 24.3	D.1, D.2, F.1, F.2	24.2, 24.3	E.1, E.2, G.2	24.2, 24.3	D.1, D.2, F.1, F.2	24.2, 24.3	E.1, E.2, G.3

	Single specification limit				Double specification limits with combined control			
	s-method		*σ*-method		*s*-method		*σ*-method	
	Clauses or sub-clauses	Tables/ Annexes	Clauses or sub-clauses	Tables/ Annexes	Clauses or sub-clauses	Tables	Clauses or sub-clauses	Tables/ Annexes
Switching between normal and reduced inspection	24.4, 24.5	D.1, D.3 F.1, F.3 J.1	24.4, 24.5	E.1, E.3, G.2, J.1	24.4, 24.5	D.1, D.3 F.1, F.3 J.1	24.4, 24.5	E.1, E.3, G.3, J.1
Switching between tightened and discontinued inspection	22, 25	D.2 F.2	25	E.2 G.2	22, 25	D.2 F.2	25	E.2 G.3
Switching between the *s*-method and *σ*-method	26 L.2.1 L.3, L.4, L.5	I.1	26 L.2.2	I.1, K.2	26 L.2.1 L.3, L.4, L.5	I.1	26 L.2.2	I.1, K.2

16 annexes are provided. Annexes A to J provide the tables needed to support the procedures. Annex K indicates how the sample standard deviation, *s*, and the presumed known value of the process standard deviation, *σ*, should be determined. Annex L provides formulae for the estimation of the process fraction nonconforming, together with a highly accurate approximation for use when the process standard deviation is unknown. Annex M provides formulae for the consumer's risk qualities, together with tables showing these quality levels for normal, tightened, and reduced inspection under the *s*-method and *σ*-method. Annex N provides similar information for the producer's risks. Annex O gives the general formula for the operating characteristic of the *σ*-method. Annex P provides procedures for accommodating measurement uncertainty.