



BSI Standards Publication

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

National foreword

This British Standard is the UK implementation of ISO 3951-1:2022. It supersedes BS ISO 3951-1:2013, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee SS/5, Acceptance sampling schemes.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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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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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](#).

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).

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

1 Scope

This document specifies single sampling plans for lot-by-lot inspection under the following conditions:

- a) where the inspection procedure is applied to a continuing series of lots of discrete products, all supplied by one producer using one production process;
- b) where only a single quality characteristic, x , of these products is taken into consideration, which is measurable on a continuous scale;
- c) where production is under statistical control and the quality characteristic, x , is distributed according to a normal distribution or a close approximation to the normal distribution;
- d) 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 its measured quality characteristic, x , satisfies as 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, and 3) is a case with double specification limits.

Where double specification limits apply, it is assumed in this document that conformity to both specification limits is equally important to the integrity of the product. In such cases, it is appropriate to apply a single AQL to the combined percentage 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 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*

ISO 3951-2, *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*

3 Terms and definitions

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

ISO and IEC maintain terminological 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(s) of a characteristic(s) of an item

[SOURCE: ISO 3534-2:2006, 4.1.4]

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 inspection where the acceptability is determined by means of *sampling inspection* (3.2)

[SOURCE: ISO 3534-2:2006, 4.1.8]

3.4 acceptance sampling inspection by variables

acceptance sampling inspection (3.3) in which the acceptance of the process is determined statistically from measurements from *inspection by variables* (3.1)

[SOURCE: ISO 3534-2:2006, 4.2.11 modified — “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 acceptance quality limit

AQL
(acceptance sampling) worst tolerable *quality level* (3.7)

Note 1 to entry: This concept only applies when an acceptance sampling scheme with rules for switching and for discontinuation, such as ISO 2859-1 and ISO 3951, is used.

Note 2 to entry: See 5.4.

[SOURCE: ISO 3534-2:2006, 4.6.15 modified — Notes 2 to 4 to entry have been deleted and Note 1 to entry has been added.]

3.7**quality level**

quality expressed as the fraction nonconforming

[SOURCE: ISO 3534-2:2006, 4.6.16 modified — “or rate of number of nonconformities” has been removed”.]

3.8**limiting quality****LQ**

quality level (3.7), when a lot is considered in isolation, which, for the purposes of *acceptance sampling inspection* (3.3), is limited to a low probability of acceptance

Note 1 to entry: In this document: 10 %.

[SOURCE: ISO 3534-2:2006, 4.6.13, modified — Note 1 to entry has been added.]

3.9**nonconformity**

non-fulfilment of a requirement

[SOURCE: ISO 3534-2:2006, 3.1.11]

3.10**nonconforming unit**

unit with one or more nonconformities

[SOURCE: ISO 3534-2:2006, 1.2.15]

3.11***p**-method acceptance sampling plan**

acceptance sampling (3.3) plan by variables where the the estimated fraction nonconforming $\hat{p}$ is compared to the maximum acceptable value p^* .

Note 1 to entry: The method is applicable to both the *s-method* (3.12) and the *σ-method* (3.13) and gives equivalent results. It has the advantage that it deals directly with the fraction nonconforming.

3.12***s*-method acceptance sampling plan**

acceptance sampling (3.3) plan by variables using the sample standard deviation

Note 1 to entry: See [Clause 6](#).

[SOURCE: ISO 3534-2:2006, 4.3.10 modified — “s method” has been replaced by “s-method” and “acceptance sampling plan” has been added]

3.13***σ*-method acceptance sampling plan**

acceptance sampling (3.3) plan by variables using the presumed value of the process standard deviation

Note 1 to entry: See [Clause 7](#).

[SOURCE: ISO 3534-2:2006, 4.3.9 modified — “sigma method” has been replaced by “σ-method” and “acceptance sampling plan” has been added]

3.14**specification limit**

conformance boundary specified for a characteristic

[SOURCE: ISO 3534-2:2006, 3.1.3, modified — “limiting value stated” has been replaced with “conformance boundary specified”.]

3.15

lower specification limit

L

specification limit (3.14) that defines the lower conformance boundary

[SOURCE: ISO 3534 2:2006, 3.1.5, modified — "limiting value" has been replaced with "conformance boundary".]

3.16

upper specification limit

U

specification limit (3.14) that defines the upper conformance boundary

[SOURCE: ISO 3534-2:2006, 3.1.4, modified — "limiting value" has been replaced with "conformance boundary".]

3.17

combined control

requirement when both upper and lower limits are specified for the quality characteristic and an *AQL* (3.6) that applies to the combined percent nonconforming beyond the two limits is given

Note 1 to entry: See 5.4.

Note 2 to entry: The use of combined control implies that nonconformity beyond either *specification limit* (3.14) is believed to be of equal, or at least roughly equal, importance to the lack of integrity of the product.

3.18

form *k* acceptance constant

k

constant depending on the specified value of the *acceptance quality limit* (3.6) and the sample size, used in the criteria for accepting the lot in an *acceptance sampling* (3.3) plan by variables

Note 1 to entry: See Clause 6 and Clause 7.

[SOURCE: ISO 3534-2:2006, 4.4.4, modified — "acceptability constant" has been replaced with "acceptance constant". The original Note 1 to entry has been deleted, a new Note 1 to entry has been added.]

3.19

form *p** acceptance constant

*p**

constant depending on the specified value of the *acceptance quality limit* (3.6) and the sample size, used in the criteria for accepting the lot in an *acceptance sampling* (3.3) plan by variables

[SOURCE: ISO 3534-2:2006, 4.4.4, modified — "acceptability constant" has been replaced with "acceptance constant". The original Note 1 to entry has been deleted, a new Note 1 to entry has been added.]

3.20

quality statistic

Q

function of the *specification limit* (3.14), the sample mean and the sample or process standard deviation, used in assessing the acceptance of a lot

Note 1 to entry: For the case of a single specification limit, the lot can be accepted or rejected on the result of comparing *Q* with the *form k acceptance constant* (3.18).

Note 2 to entry: See Clause 6 and Clause 7.

[SOURCE: ISO 3534-2:2006, 4.4.9, modified — In the Note 1 to entry, "may be sentenced" has been replaced with "can be accepted or rejected". Note 2 to entry has been added.]

3.21**lower quality statistic** Q_L

function of the *lower specification limit* (3.15), the sample mean, and the sample or process standard deviation

Note 1 to entry: For a single lower specification limit, the lot can be accepted or rejected on the result of comparing Q_L with the *form k acceptance constant* (3.18).

Note 2 to entry: See [Clause 4](#), [Clause 6](#), and [Clause 7](#).

[SOURCE: ISO 3534-2:2006, 4.4.11, modified — Note 2 to entry has been added.]

3.22**upper quality statistic** Q_U

function of the *upper specification limit* (3.16), the sample mean, and the sample or process standard deviation

Note 1 to entry: For a single upper specification limit, the lot can be accepted or rejected on the result of comparing Q_U with the *form k acceptance constant* (3.18).

Note 2 to entry: See [Clause 4](#), [Clause 6](#), and [Clause 7](#).

[SOURCE: ISO 3534-2:2006, 4.4.10, modified — Note 2 to entry has been added.]

3.23**maximum process standard deviation****MPSD** $\sigma_{\max}$

largest process standard deviation for a given sample size code letter and *AQL* (3.6) for which it is possible to satisfy the acceptance criterion for a double specification limit under all inspection severities (i.e. normal, tightened and reduced) when the process variability is known

Note 1 to entry: The MPSD depends on whether the double specification limits are combined, separate or complex, but does not depend on the inspection severity.

Note 2 to entry: See [5.2](#).

[SOURCE: ISO 3534-2:2006, 4.4.8, modified — Note 2 to entry has been added.]

3.24**switching rule**

instruction within an *acceptance sampling* (3.3) scheme for changing from one acceptance sampling plan to another of greater or lesser severity based on demonstrated quality history

Note 1 to entry: Normal, tightened, or reduced inspection or discontinuation of inspection are examples of 'severity of sampling'.

Note 2 to entry: See [Clause 9](#).

[SOURCE: ISO 3534-2:2006, 4.3.4, modified — Note 2 to entry has been added.]

3.25**measurement**

set of operations to determine the value of some quantity

[SOURCE: ISO 3534-2:2006, 3.2.1, modified — "having the object of determining a value of a quantity" has been replaced with "to determine the value of some quantity". Notes 1 and 2 to entry have been deleted.]

4 Symbols

f_{σ}	factor that relates the maximum process standard deviation to the difference between U and L (see 14.5)
$F_{BETA(\alpha,\beta)}(x)$	the distribution of the standard beta distribution with parameters α and β . In this document $\alpha = \beta = n/2 - 1$ throughout.
$F_{t(v,\delta)}(x)$	the distribution function of the non-central t -distribution with v degrees of freedom and non-centrality parameter δ
K_p	the upper p -quantile of the standardized normal distribution i.e. x such that $1 - \Phi(x) = p$, which corresponds to the process fraction nonconforming p
k	form k acceptance constant for use with a single quality characteristic and a single specification limit (see 14.1 for the s -method acceptance sampling plan or 14.2 for the σ -method acceptance sampling plan)
L	lower specification limit (as a subscript to a variable, it denotes its value at L)
M	unknown process mean
N	lot size (number of items in a lot)
n	sample size (number of items in a sample)
$\hat{p}$	estimate of the process fraction nonconforming
$\hat{p}_L$	estimate of the process fraction nonconforming below the lower specification limit
$\hat{p}_U$	estimate of the process fraction nonconforming above the upper specification limit
p^*	form p^* acceptance constant i.e. the maximum acceptable value for the estimate of the process fraction nonconforming
P_a	probability of acceptance
$\Phi(x)$	the distribution function of the standardized normal distribution
Q	quality statistic
Q_L	lower quality statistic NOTE Q_L is defined as $(\bar{x} - L)/s$ when the process standard deviation is unknown, and as $(\bar{x} - L)/\sigma$ when it is presumed to be known.
Q_U	upper quality statistic NOTE Q_U is defined as $(U - \bar{x})/s$ when the process standard deviation is unknown, and as $(U - \bar{x})/\sigma$ when it is presumed to be known.
S	sample standard deviation of the measured values of the quality characteristic (also an estimate of the standard deviation of the process), i.e.

$$s = \sqrt{\frac{\sum_{j=1}^n (x_j - \bar{x})^2}{n-1}}$$

(See [Annex A](#).)

σ	process standard deviation NOTE σ^2 , the square of the process standard deviation, is known as the process variance.
$\sigma_{\max}$	maximum process standard deviation (MPSD)
σ_{root}	weighted root mean square of s
U	upper specification limit (as a suffix to a variable, it denotes its value at U)
x_j	measured value of the quality characteristic for the j^{th} item of the sample
$\bar{x}$	the arithmetic mean of the measured values of the quality characteristic in the sample, i.e.

$$\bar{x} = \frac{\sum_{j=1}^n x_j}{n}$$

5 Choice of a sampling plan

5.1 Choice between variables and attributes

The first question to consider is whether it is desirable to inspect variables rather than attributes. The following points should be taken into account.

- a) In terms of economics, it is necessary to compare the total cost of the relatively simple inspection of a larger number of items by means of an attributes scheme with the generally more elaborate procedure required by a variables scheme, which is usually more time-consuming and costly per item.
- b) In terms of the knowledge gained, the advantage lies with inspection by variables as the information obtained indicates more precisely the quality of the product. Therefore, earlier warning can be given if the quality is slipping.
- c) An attributes scheme can be more readily understood and accepted. For example, two phenomena of variables sampling are difficult to understand:
 - 1) lots containing 100 % conforming items can be rejected, occasionally even with a high probability (see example 3 in [15.1](#));
 - 2) there are cases of larger AQL and smaller lot size where lots containing 100 % nonconforming items are accepted.
- d) From a comparison of the size of the samples required for the same AQL from standard plans for inspection by attributes, such as from ISO 2859-1, and the standard plans in this document, the smallest samples are generally required by the σ -method (used when the process standard deviation is presumed to be known). The sample sizes for the s -method (used when the process standard deviation is presumed to be unknown) are larger than for the σ -method but are, in general, substantially smaller than for sampling by attributes.
- e) Inspection by variables is particularly appropriate in conjunction with the use of control charts for variables.
- f) Variables sampling has a substantial advantage when the inspection process is expensive, for example, in the case of destructive testing.
- g) A variables scheme becomes relatively more complicated to operate as the number of measurements to be taken on each item increases.

NOTE For two or more quality characteristics, that need to be treated together using a single AQL, this document does not apply. See ISO 3951-2 for details.

5.2 General

The sampling schemes found in this document, with their rules for switching and for discontinuation of sampling inspection, are designed to encourage suppliers to keep the process fraction nonconforming consistently better than the respective AQLs.

Otherwise, there is a high risk that the inspection severity be switched to tightened inspection, under which the criteria for lot acceptance become more demanding. Once on tightened inspection, unless action is taken to improve the process, it is very likely that the rule requiring discontinuation of sampling inspection be invoked pending such improvement.

The following procedures shall be followed before starting an inspection by variables:

- a) check that an AQL has been designated, and that it is one of the preferred AQLs for use with this document (see [Clause 5](#)). If it is not, then the sampling tables of this document are not applicable;

NOTE If an AQL other than a preferred AQL is designated, then this document is only applicable under the advice of a statistical expert.

- b) check that the inspection level to be used has been designated. If none has been given, the inspection level II shall be used (see [5.4](#));

- c) determine the quality characteristic x and an upper limit U and/or a lower limit L for x ;

- d) for a quality characteristic with double specification limits, check that nonconformities beyond each limit are of equal importance. If this is not the case, refer to ISO 3951-2;

NOTE If the lot size, the inspection level, U , L or the AQL change during the process, the user might need to stop and begin again with [5.1](#).

- e) check whether the s -method ([Clause 6](#)) is to be used initially or whether the standard deviation is stable and known, in which case the σ -method ([Clause 7](#)) should be used (see [5.3](#));

- f) for the σ -method and a quality characteristic with double specification limits, a process capability study in the following sense should be done:

- 1) enter [Table 11](#) in [14.4](#) with the AQL to determine the value of the factor f_σ ;
- 2) calculate the maximum allowable value of the process standard deviation using the formula $\sigma_{\max} = (U - L)f_\sigma$;
- 3) If σ exceeds $\sigma_{\max}$, the process is not capable and sampling inspection is pointless until it is demonstrated that the process variability has been adequately reduced.

- g) obtain the sample size code letter with the inspection limit (normally level II) and the lot size from [Table 1](#).

5.3 Choice between the s -method and σ -method

If the inspection by variables method as proposed in this document is chosen, the decision shall be made whether to use the s -method or the σ -method. The σ -method is the more economical in terms of sample size, but before this method can be applied, it is necessary to have a reliable value of σ , usually obtained from previous process analyses.

In the case that no reliable assumptions on the value of σ can be made, it shall be necessary to begin with the s -method, but subject to the agreement of the responsible authority and provided the quality remains satisfactory, the operational rules of this document permit a change to the σ -method and consequently the use of a smaller sample size.

If the variability is under control, a reliable estimation for the process standard deviation can be made from the observed data, in which case it may be economical to change to the σ -method. The size of the sample is generally smaller and the acceptance criterion is simpler using the σ -method (see [Clause 7](#)).

On the other hand, it shall still be necessary to calculate the sample standard deviation, s , for record and continued monitoring purposes of the product quality and to keep the pattern or control charts up to date (see [Clause 13](#)). Methods of determining s and σ are given in [Annex A](#).

In case of using the σ -method, it is recommended to perform, periodically and systematically, comparisons of observed data, i.e. observed process standard deviations with the assumption made on σ . In the framework of continued monitoring, this can be done in several ways:

- use of descriptive, graphical methods, e.g. pattern charts;
- use of statistical control charts;
- descriptive numerical analysis; or
- statistical tests, e.g. Bartlett's test for the comparison of variances.

If based on these analyses there is doubt in the reliability of the assumptions made on σ , it can be necessary to switch to the s -method.

5.4 Choice of inspection level and AQL

The AQL is the quality level that is the worst tolerable nonconforming process fraction when a continuing series of lots is submitted for acceptance sampling. Although individual lots determined to be of "bad" quality may be accepted by the AQL with fairly high probability, the designation of an AQL does not suggest that this is a desirable quality level.

The AQL, together with the sample size code letter, is used to index the sampling plans in this document. For a standard sampling plan, the inspection level, in conjunction with the size of the lots and the AQL, determines the size of the sample to be taken and governs the severity of the inspection. The appropriate operating characteristic from [Annex E](#) shows the extent of the risk that is involved in such a plan.

The 16 AQLs given in this document, ranging in value from 0,01 % to 10 % nonconforming, are described as "preferred AQLs". They are only preferred in the sense that they are the AQL values used in the tabulations and charts. It follows that, if for any product or service, an AQL other than a preferred AQL is designated, then this document is only applicable under the advice of a statistical expert.

The AQL to be used shall be designated in the product specification or in the contract, or by the responsible authority. Where both upper and lower specification limits are given, this document addresses only the case of an overall AQL applying to the combined percent nonconforming beyond the two limits; this is known as "combined control." (See ISO 3951-2 for "separate" and "complex" control of double specification limits.)

From the definition of the AQL, it follows that the desired protection can only be ensured when a continuing series of lots is provided for inspection.

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

The choice of inspection level and AQL is governed by a number of factors but is mainly a balance between the total cost of inspection and the consequences of nonconforming items passing into service.

Three inspection levels, I, II, and III, are given in [Table 1](#) for general use. Inspection level II shall be used unless special circumstances indicate that another level is more appropriate. Level I may be used when less discrimination is needed, and level III when greater discrimination is required. Four additional special levels, S-1, S-2, S-3, and S-4, are also given in [Table 1](#) and may be used when relatively small sample sizes are necessary and larger sampling risks can be tolerated, or when very high process capability has been demonstrated.

Table 1 — Sample size code letters and inspection levels

Lot or batch size	Special inspection levels				General inspection levels		
	S-1	S-2	S-3	S-4	I	II	III
2 to 8	B	B	B	B	B	B	B
9 to 15	B	B	B	B	B	B	C
16 to 25	B	B	B	B	B	C	D
26 to 50	B	B	B	C	C	D	E
51 to 90	B	B	C	C	C	E	F
91 to 150	B	B	C	D	D	F	G
151 to 280	B	C	D	E	E	G	H
281 to 500	B	C	D	E	F	H	J
501 to 1 200	C	C	E	F	G	J	K
1 201 to 3 200	C	D	E	G	H	K	L
3 201 to 10 000	C	D	F	G	J	L	M
10 001 to 35 000	C	D	F	H	K	M	N
35 001 to 150 000	D	E	G	J	L	N	P
150 000 to 500 000	D	E	G	J	M	P	Q
500 000 and over	D	E	H	K	N	Q	R
NOTE The sample size code letters and inspection levels in this document correspond to those given in ISO 2859-1 and ISO 3951-2.							

6 Standard procedures for the s-method

6.1 General

The *s*-method shall be used if information about the process standard deviation is missing or unreliable. Using the *s*-method, the standard deviation is estimated directly from each sample. As soon as the conditions for the use of the σ -method are warranted, one may switch from the *s*-method to the σ -method (see 5.3).

6.2 Single specification limits

Before starting the inspection by variables, see [Clause 5](#).

The procedure for a single specification limit is as follows.

- Enter [Table 2](#), [Table 3](#), or [Table 4](#), as appropriate, with the code letter and the AQL to obtain the sample size, n , and the acceptance constant, k .
- Take a random sample of size n , measure the characteristic x in each item, and then calculate $\bar{x}$, the sample mean, and s , the sample standard deviation (see [Annex A](#)).

NOTE Some sampling strategies are provided in [Annex C](#).

- Calculate the quality statistic $Q_U = (U - \bar{x})/s$ or $Q_L = (\bar{x} - L)/s$ and compare it with the acceptance constant k . The lot is accepted if $Q_U \geq k$ or $Q_L \geq k$; or rejected if $Q_U < k$ or $Q_L < k$.
- Proceed with [Clause 9](#).

For examples of single lower and upper specification limits using the *s*-method, see Example 1 and Example 2 in [15.1](#).

6.3 Double specification limits

Before starting the inspection by variables, see [Clause 5](#).

The procedure for double specification limits for the s -method is as follows.

- a) Enter [Table 2](#), [Table 3](#), or [Table 4](#), as appropriate, with the code letter and the AQL to obtain the sample size, n , and the acceptance constant, k .
- b) Take a random sample of size, n , measure the characteristic x in each item, and then calculate $\bar{x}$, the sample mean, and s , the sample standard deviation (see [Annex A](#)).

NOTE Some sampling strategies are provided in [Annex C](#).

- c) Determination of acceptance.
 - 1) If $\bar{x} < L$ or $\bar{x} > U$, reject the lot; or continue with the next step.
 - 2) Plot $(s, \bar{x})$ on the acceptance diagram, which can be obtained using the accCurve function in the underlying software (see [L.5](#)).

NOTE The standardized values $(s_S, \bar{x}_S)$ where $s_S = \frac{s}{U-L}$ and $\bar{x}_S = \frac{\bar{x}-L}{U-L}$ may be used in which case $(s_S, \bar{x}_S)$ is plotted on the standardized acceptance diagram, which can be obtained using the accCurve function in the underlying software without providing the standardized lower and upper specification limits $L = 0, U = 1$ (see [L.5](#)).

- 3). If the plotted point is outside the acceptance region the lot is rejected; otherwise the lot is accepted.
- d) Proceed with [Clause 9](#).

For examples of combined control of double specification limits using the s -method, see Example 3 to Example 6 in [15.2](#).

7 Standard procedures for the σ -method

7.1 General

The σ -method shall only be used when there is valid evidence that the standard deviation σ of the process can be considered constant with a known value.

7.2 Single specification limits

Before starting the inspection by variables, see [Clause 5](#).

The procedure for a single specification limit is as follows.

- a) Enter [Table 5](#), [Table 6](#), or [Table 7](#), as appropriate, with the code letter and the AQL and obtain the sample size, n , and the acceptance constant, k .
- b) Take a random sample of size n , measure the characteristic x in each item, and then calculate $\bar{x}$, the sample mean, and s , the sample standard deviation (see [Annex A](#)).

NOTE 1 Some sampling strategies are provided in [Annex C](#).

NOTE 2 The sample standard deviation is needed for the records (see [Clause 13](#)).

- c) Calculate the quality statistic $Q_U = (U - \bar{x})/\sigma$ or $Q_L = (\bar{x} - L)/\sigma$ and compare it with the acceptance constant k . The lot is accepted if $Q_U \geq k$ or $Q_L \geq k$; or rejected if $Q_U < k$ or $Q_L < k$.

For examples of single lower and upper specification limits using the σ -method, see Example 1 and Example 2 in [15.2](#).

7.3 Double specification limits

Before starting the inspection by variables, see [Clause 5](#).

The procedure for double specification limits is as follows.

- a) Enter [Table 2](#), [Table 3](#), or [Table 4](#), as appropriate, with the code letter and the AQL and obtain the sample size, n , and the acceptance constant, k .
- b) Take a random sample of size n , measure the characteristic x in each item, and then calculate $\bar{x}$, the sample mean, and s , the sample standard deviation (see [Annex A](#)).

NOTE 1 Some sampling strategies are provided in [Annex C](#).

NOTE 2 The sample standard deviation is needed for the records (see [Clause 13](#)).

- c) Determination of acceptance.
 - 1) If $\bar{x} < L$ or $\bar{x} > U$, reject the lot; or continue with the next step.
 - 2) Calculate the quality statistics $Q_L = (\bar{x} - L) / \sigma$ and $Q_U = (U - \bar{x}) / \sigma$. If $Q_L < k$ or $Q_U < k$, reject the lot; or continue with the next step.
 - 3) If $\sigma \leq 0,75 \sigma_{\max}$ accept the lot; otherwise continue with the next step.
 - 4) If neither Q_L or Q_U are close to k accept the lot; otherwise use the p^* -method in [Clause 8](#).
- d) Proceed with [Clause 9](#).

For an example of combined control of double specification limits using the σ -method, see Example 3 in [15.2](#).

8 The p^* -method

The p^* -method acceptance sampling plan is an alternative to the standard procedures in [Clause 6](#) and [Clause 7](#). For the application of this method, distribution functions are calculated.

Before starting the inspection by variables, see [Clause 5](#).

The procedure for the p^* -method for a single limit and double limits is as follows.

- a) Enter [Tables 8, 9](#) or [10](#) in [14.3](#) with the code letter and the AQL, to obtain the sample size, where $n=n_s$ is the sample size for the s -method, and $n = n_\sigma$ is the sample size for the σ -method, and to obtain the acceptance constant, i.e. the maximum fraction nonconforming, p^* .
- b) Take a random sample of size n , measure the characteristic x in each item, and then calculate $\bar{x}$, the sample mean, and s , the sample standard deviation (see [Annex A](#)).

NOTE 1 Some sampling strategies are provided in [Annex C](#).

NOTE 2 In the case of known standard deviation, σ , the sample standard deviation is needed for the records (see [Clause 13](#)).

- c) Estimated fraction nonconforming:
 - 1) **unknown standard deviation:** For a lower specification limit, calculate $\hat{p}_L$, for an upper limit, calculate $\hat{p}_U$, and for two specification limits, calculate both,

$$\hat{p}_L = F_{BETA\left(\frac{n-1}{2}, \frac{n-1}{2}\right)}\left(\max\left\{0, \frac{1}{2} - \frac{1}{2} \frac{\bar{x} - L}{s} \frac{\sqrt{n}}{n-1}\right\}\right) = F_{BETA\left(\frac{n-1}{2}, \frac{n-1}{2}\right)}\left(\max\left\{0, \frac{1}{2} \left[1 - Q_L \frac{\sqrt{n}}{n-1}\right]\right\}\right)$$

$$\hat{p}_U = F_{BETA\left(\frac{n-1}{2}, \frac{n-1}{2}\right)}\left(\max\left\{0, \frac{1}{2} - \frac{1}{2} \frac{U - \bar{x}}{s} \frac{\sqrt{n}}{n-1}\right\}\right) = F_{BETA\left(\frac{n-1}{2}, \frac{n-1}{2}\right)}\left(\max\left\{0, \frac{1}{2} \left[1 - Q_U \frac{\sqrt{n}}{n-1}\right]\right\}\right)$$

- 2) **known standard deviation:** For a lower specification limit, calculate $\hat{p}_L$, for an upper limit, calculate $\hat{p}_U$, and for two specification limits, calculate both,

$$\hat{p}_L = \Phi\left(\frac{L - \bar{x}}{\sigma} \sqrt{\frac{n}{n-1}}\right) = \Phi\left(-Q_L \sqrt{\frac{n}{n-1}}\right)$$

$$\hat{p}_U = \Phi\left(\frac{\bar{x} - U}{\sigma} \sqrt{\frac{n}{n-1}}\right) = \Phi\left(-Q_U \sqrt{\frac{n}{n-1}}\right)$$

NOTE The fraction nonconforming can be calculated with the R package, see [Annex I](#).

- d) Acceptance criteria:

- 1) **single limit:** A lot shall be accepted if $\hat{p}_L \leq p^*$ for a lower limit, and if $\hat{p}_U \leq p^*$ for an upper limit; if $\hat{p}_L > p^*$ or $\hat{p}_U > p^*$ respectively, the lot is rejected;
- 2) **double limits:** A lot shall be accepted if $\hat{p}_L + \hat{p}_U \leq p^*$; if $\hat{p}_L + \hat{p}_U > p^*$, the lot is rejected;

- e) Proceed with [Clause 9](#).

For examples of single specification limits see Example 1 and Example 3 in [15.3](#). For examples of combined control of double specification limits see Example 2 and Example 4 in [15.3](#).

9 Switching between inspection severities

Switching rules discourage the producer from operating at a quality level that is worse than the AQL. This document prescribes a switch to tightened inspection when inspection results indicate that the AQL is being exceeded. It further prescribes a discontinuation of sampling inspection altogether if tightened inspection fails to stimulate the producer into rapidly improving this production process.

Tightened inspection and the discontinuation rule are integral and, therefore, obligatory procedures of this document if the protection implied by the AQL is to be maintained.

This document also provides the possibility of switching to reduced inspection when inspection results indicate that the quality level is stable and reliable at a level better than the AQL. This practice is, however, optional (at the discretion of the responsible authority).

When it has been necessary to discontinue acceptance sampling inspection, inspection as outlined by this document shall not be resumed until action has been taken by the producer to improve the quality of the submitted product.

The sampling system specified by this document can only work efficiently if the switching rules in [9.1](#) are obeyed (see also [Figure 1](#)), and therefore records of some values of the inspection plan need to be kept (see [9.2](#)).

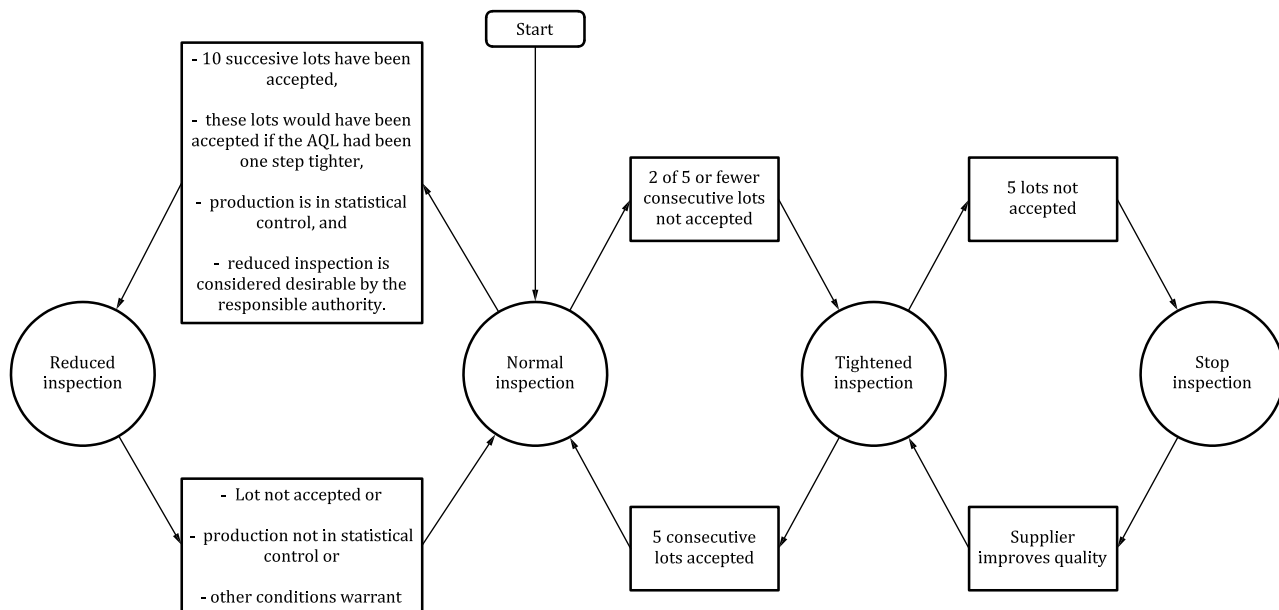


Figure 1 — Outline of the switching rules

9.1 Rules for switching between inspection severities

Normal inspection is used at the start of inspection (unless otherwise designated). It shall be used during inspection until tightened inspection becomes necessary or reduced inspection is allowed. For further information about the three inspection severities see [5.4](#).

This document prescribes a switch to tightened inspection when inspection results indicate that the AQL is being exceeded, and also provides the possibility of switching to reduced inspection when inspection results indicate that the quality level is stable and reliable at a level better than the AQL. The switch to reduced inspection is, however, optional (at the discretion of the responsible authority).

The standard switching rules are as follows.

a) Within normal inspection:

- 1) when two lots are rejected within any five or fewer successive lots, tightened inspection shall be instituted;

NOTE Tightened inspection is generally achieved by increasing the value of the acceptance constant k . The values are tabulated in [Table 3](#) for the s -method and in [Table 6](#) for the σ -method.

- 2) after 10 successive lots have been accepted, reduced inspection may be instituted, provided that

- i) these lots would have been accepted if the AQL had been one step tighter (e.g. 0,65 % instead of 1,0 %),

NOTE 1 To determine this, it is useful to keep a record of the values of Q_U or Q_L , respectively. Next, follow the procedures in [Clause 6](#) or [Clause 7](#) respectively, with the sample size code letter, the new AQL, the values of Q_U or Q_L and the last 10 values of $\bar{x}$ and s .

NOTE 2 If a value of k for the tighter AQL is not given in [Table 2](#) (s -method) or [Table 6](#) (σ -method), refer to the supplementary acceptance constants provided in Table 13.

- ii) production is in statistical control (see [5.3](#)), and
- iii) reduced inspection is considered desirable by the responsible authority.

NOTE 1 When the previous 10 lots have been accepted under original inspection, reduced inspection can be instituted without the condition that these lots would have been accepted if the AQL had been one step tighter, subject to the approval of the responsible authority.

NOTE 2 Reduced inspection is conducted on a much smaller sample than normal inspection and the value of the acceptance constant is also decreased. The values of n and k for reduced inspection are given in [Table 4](#) for the s -method and [Table 7](#) for the σ -method.

- b) Within reduced inspection: Normal inspection shall be reinstated if at least one of the following occur:
 - 1) a lot is rejected;
 - 2) production is no longer in statistical control or is delayed; or
 - 3) reduced inspection is no longer considered desirable by the responsible authority.
- c) Within tightened inspection:
 - 1) when five successive lots have been accepted, normal inspection shall be reinstated;
 - 2) if the cumulative number of lots rejected in a sequence of consecutive lots on original tightened inspection reaches five, the acceptance procedures of this document shall be discontinued.

Inspection under the provisions of this document shall not be resumed until action has been taken by the supplier to improve the quality of the submitted product or service and the responsible authority has agreed that this action is likely to be effective. Tightened inspection shall then be used again.

9.2 Records for switching between inspection severities

As a variables sampling inspection plan can only operate efficiently if records are kept, this is an important part of the inspection. For further information about the advantages of keeping records, and control charts especially, see [Clause 13](#). In particular, the following values should be kept:

- a) the values of $\bar{x}$ and s , the lot size, the inspection level, the inspection severity, the code letter, U , L and the AQL (especially when they changed since the last inspection);

When one of the prescribed values changes, apart from the inspection severity, one needs to start again with [Clause 5](#).

- b) whether the lot was accepted;

Any lot rejected by the sampling plan shall not be resubmitted either in whole or in part without the permission of the responsible authority.

- c) if the lot has been accepted; the values of Q_U and Q_L , if they have been evaluated.

NOTE These values are important for switching to reduced inspection.

10 Relation to ISO 2859-1

10.1 Similarities

The similarities are as follows.

- a) This document is complementary to ISO 2859-1; the two documents share a common principle and, as far as possible, their procedures and vocabulary are the same.
- b) Both use the AQL to index the sampling plans, and the preferred values used in this document are identical to those given for percent nonconforming in ISO 2859-1 (i.e. from 0,01 % to 10 %).

- c) In both this document and in ISO 2859-1, lot size and inspection level (inspection level II) determine a sample size code letter. General tables give the sample size to be taken and the acceptance criterion, indexed by the sample size code letter and the AQL. Separate tables are given for the s -method and σ -method, and for normal, tightened, and reduced inspection.
- d) The switching rules are essentially equivalent.

10.2 Differences

- a) **Determination of acceptance.** In ISO 2859-1, acceptance for an attributes sampling plan for percent nonconforming is determined by the number of nonconforming items found in the sample. Acceptance for a plan for inspection by variables is based on the distance of the estimated value of the process mean from the specification limit(s) in terms of the estimated or presumed value of the process standard deviation. In this document, two methods are considered: the s -method, for use when the process standard deviation, σ , is unknown, and the σ -method, for use when σ is presumed to be known.
- b) **Normality.** In ISO 2859-1, there is no requirement relating to the distribution of the characteristics. However, in this document, it is necessary for the efficient operation of the plans that the measurements be distributed according to a normal distribution (see [12.1](#)), or a close approximation to a normal distribution, or that the data is appropriately transformed to a normal distribution (see [12.2](#)).

- c) **Operating characteristic curves (OC curves).** The OC curves of the variables plans in this document are not identical to those of the corresponding attributes plans in ISO 2859-1. The curves for s -method plans have been matched by minimizing the area between the curves representing the squares of the OC values, which gives greater emphasis to the match at the top of the OC curves. In most cases, the resulting match between the OC curves is so close that, for most practical purposes, the attributes and variables of OC curves may be considered to be identical.

NOTE The σ -method plans are derived by minimizing the area between the squared OC functions subject to keeping the same Form p^* acceptance constant as for the corresponding s -method plan, i.e. only the sample size is open to choice, so the match is, in general, less perfect.

- d) **Producer's risk.** For process quality precisely at the AQL, the producer's risk that a lot not be accepted tends to decrease with increments in sample size coupled with decrements in AQL, as visible down the 'right' diagonals of the master tables, i.e., the tables in [Clause 14](#), running from top right to bottom left. The progressions of probabilities are similar, but not identical, to those in ISO 2859-1.

NOTE The producer's risks of the plans are given in [Annex G](#).

- e) **Sample sizes.** The variables sample sizes for given combinations of sample size code letter and AQL are usually smaller than the corresponding attributes sample sizes. This is particularly true for the σ -method. Moreover, due to the method by which the variables plans were derived, their sample sizes vary over AQL for a given sample size code letter.
- f) **Double sampling plans.** Double sampling plans by variables are presented separately in ISO 3951-3.
- g) **Multiple sampling plans.** There are no multiple sampling plans by variables in any part of ISO 3951 series.
- h) **Average outgoing quality limit (AOQL).** The AOQL concept is mainly of value when 100 % inspection and rectification is feasible for non-accepted lots. It follows that the AOQL concept cannot be applied under destructive or expensive testing. As variables plans shall generally be used under these circumstances, no tables of AOQL have been included in this document.

11 Allowing for measurement uncertainty

The master tables, i.e. the tables in [Clause 14](#), are based on the assumption that the quality characteristic, x , of the items in the lots is normally distributed with unknown process mean, μ , and either known or unknown process standard deviation, σ . The assumption is also made that x can be measured without measurement error, i.e. that measurement of an item with the true value, x_i , results in the value x_i . However, the tables in [Clause 14](#) can also be used, with appropriate adjustments, in the result of measurement error.

Ideally, as a prerequisite for the application of the proposed sampling schemes, the measurement uncertainty, i.e. the measurement standard deviation, is determined by a structured measurement analysis followed by a measurement system capability assessment. If the measurement standard deviation is not higher than 10 % of the process standard deviation, the measurement system can be considered as capable and no further adjustments on sample sizes are required.

For measurement standard deviation higher than 10 % of the process standard deviation, the sample size needs to be increased, although the acceptance constant remains the same. Moreover, if neither the measurement standard deviation nor the process standard deviation is known, more than one measurement needs to be made on each sampled item and the total variability of the measurements needs to be separated into the components.

Details are provided in [Annex B](#).

12 Normality, data transformations and outliers

12.1 Normality

The assumption of a normal distribution for the inspected quality characteristic x is the fundamental requirement for the application of the proposed variables sampling plans. Therefore, it is essential to assess the data normality before applying the sampling plans, which can be done by several approaches:

- a) assessment based on practical, engineering experience and expertise;
- b) assessment based on graphical, descriptive methods, such as histograms, quantile/quantile or normal probability plots (see ISO 5479); or
- c) statistical tests for departure from normality, such as those given in ISO 5479 or in ISO 5725-2:2019, Clause 2.

12.2 Data transformations

For non-normal distributed data, the first approach is usually to try to find a suitable transformation f of the observed data x , so that $Z = f(x)$ now follows an (approximate) normal distribution. The most commonly used data transformations are (see ISO 16269):

- power transformations;
- Box-Cox transformations;
- Johnson transformations;
- transformations using Pearson functions.

For the transformed data, the goodness of fit to a normal distribution can be assessed using normal probability plots and/or statistical tests for normality. For subsequent capability analyses and assessments, the targets and specification limits of the quality characteristic x have to be transformed in the same way as the observed process data.

12.3 Outliers

An outlier (or an outlying observation) is one that appears to deviate markedly from other observations in the sample in which it occurs. A single outlier, even when it lies within specification limits, increase variability, changes the mean, and may consequently lead to non-acceptance of the lot (see ISO 16269-4).

Generally, outliers can be a result of

- a) (unexpectedly high) natural process variability, and/or
- b) presence of special causes not representing the controlled and capable process status.

For case b), it might be considered to exclude the outlying observations for the quality assessment, whereas for case a), these values have to be considered in the analysis. Nevertheless, a sensitivity analysis including and excluding the outliers can help to assess the impact of these values on the decision on lot acceptance.

When outliers are detected, the disposition of the lot should be a matter for the responsible authority and may involve negotiation between the vendor and the vendee.

13 Monitoring and recording of inspection results

13.1 Monitoring of inspection results

The results of the quality assessment using the inspection by variables sampling plans proposed in the corresponding tables should be monitored continuously. The monitoring results should be analysed to detect changes or trends in the quality level of the product, so that warning can be given before an unacceptable quality level is reached. The adequate data recording of quality assessment results is a necessary prerequisite for monitoring.

Independent of the performed inspection, continuous monitoring should serve to assess the inherent product and process quality level of the production. Monitoring allows the user of this document to obtain a long-term view of the production quality in addition to the information on lot-by-lot decisions.

13.2 Process capability and performance assessment

Before implementing this document, it is recommended to assess the process capability, i.e. the ability of the production process to fulfil predefined quality requirements. These assessments shall be done in a scientifically planned manner or performance study. Several methods for estimating process capability or performance depending on the assumed process data distribution model are provided in ISO 22514-2.

13.3 Monitoring of process parameters

For variable inspection procedures, monitoring of product and process quality mainly focuses on process mean and process standard deviation. Whatever method used, s -method or σ -method, records should be kept of the values of $\bar{x}$ and s , preferably in the form of pattern or control charts.

An introduction to the use of control charts is given in ISO 7870, and special control chart applications for assessing process means and standard deviations can be found for standard Shewhart control charts in ISO 7870-2 or ISO 8258 and, for more complex CUSUM (cumulated sum) charts, in ISO 7870-4.

The process standard deviation should be monitored particularly when using the σ -method in order to verify that the values of s obtained from the samples fall within the limits of the prescribed value of σ . With the s -method, the standard deviation shall be monitored to indicate whether a switch to the σ -method is possible. In particular, the values of s or σ , respectively, and whether they exceed their control limit should be kept.

14 Tables

14.1 Form k for single sampling plans: s -method

Table 2 — Single sampling plans of form *k* for normal inspection: *s*-method

Code letter	Acceptance quality limit (in percent nonconforming)															
	0,01	0,015	0,025	0,04	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>
B														3	4	4
C													4	0,950	0,735	0,586
D												6	1,242	1,061	0,939	5
E											9	1,476	1,323	1,218	0,887	7
F										11	1,696	1,569	1,475	1,190	0,869	9
G									15	1,889	1,769	1,682	1,426	1,147	0,935	14
H								18	2,079	2,22	2,3	2,18	2,0	2,21	2,21	21
I								2,254	2,153	2,079	1,862	1,636	1,471	1,225	0,945	0,724
J							23	36	38	31	37	41	46	49	52	53
K						28	44	47	40	48	54	63	69	75	79	82
L						2,580	2,493	2,428	2,237	2,043	1,904	1,702	1,552	1,377	1,195	0,946
M						34	54	58	61	71	84	94	105	115	124	
N						2,737	2,653	2,592	2,230	2,101	1,914	1,777	1,619	1,456	1,239	
P						40	69	60	89	108	124	143	159	178		
Q						2,882	2,722	2,573	2,279	2,104	1,977	1,832	1,683	1,488		
						47	71	93	137	159	186	213	247			
						3,023	2,728	2,564	2,285	2,166	2,031	1,894	1,716			
						55	112	134	202	239	277	332				
						3,161	2,723	2,614	2,347	2,220	2,092	1,928				
						101	159	207	293	348	424					
						3,288	2,762	2,615	2,388	2,268	2,114					

NOTE The sample size code letters in this document correspond to those given in ISO 2859-1 and ISO 3951-2 in all cases where a correspondence can reasonably be considered.

Table 2 (continued)

Code letter	Acceptance quality limit (in percent nonconforming)															
	0,01	0,015	0,025	0,04	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>
R	116 3,351	127 3,301	120 3,156	155 3,012	189 2,912	247 2,771	298 2,670	362 2,556	438 2,443	541 2,298						
Key	There is no suitable plan in this area; use the first sampling plan in the appropriate column. If the sample size equals or exceeds the lot size, carry out 100 % inspection.															
	There is no suitable plan in this area; use the last sampling plan in the appropriate column.															
NOTE The sample size code letters in this document correspond to those given in ISO 2859-1 and ISO 3951-2 in all cases where a correspondence can reasonably be considered.																

Table 3 — Single sampling plans of form *k* for tightened inspection: *s*-method

Code letter	Acceptance quality limit (in percent nonconforming)															
	0,01	0,015	0,025	0,04	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
B	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>
C																
D																
E																
F																
G																
H																
J																
K																
L																
M																
N																
P																
Q																

NOTE The sample size code letters in this document correspond to those given in ISO 2859-1 and ISO 3951-2 in all cases where a correspondence can reasonably be considered.

Table 3 (continued)

Acceptance quality limit (in percent nonconforming)																
Code letter	0,01	0,015	0,025	0,04	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>
	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>
R	90	116	127	120	155	189	247	320	398	498						
	3,408	3,351	3,301	3,156	3,012	2,912	2,771	2,628	2,495	2,354						
Key	There is no suitable plan in this area; use the first sampling plan in the appropriate column. If the sample size equals or exceeds the lot size, carry out 100 % inspection.															
	There is no suitable plan in this area; use the last sampling plan in the appropriate column.															
NOTE The sample size code letters in this document correspond to those given in ISO 2859-1 and ISO 3951-2 in all cases where a correspondence can reasonably be considered.																

Table 4 — Single sampling plans of form k for reduced inspection: s-method

Code letter	Acceptance quality limit (in percent nonconforming)															
	0,01	0,015	0,025	0,04	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>	<i>n</i> <i>k</i>
B-D												3	4	4	4	7
E											4	6	6	6	5	9
F											1,242	1,155	1,061	0,939	0,550	0,162
G									9	11	13	13	9	9	9	12
H								11	15	17	18	13	14	14	14	13
J							15	19	22	23	18	20	21	21	21	21
K						18	24	28	30	24	27	30	32	33	33	33
L					23	30	36	38	31	37	41	46	48	50	52	
M				28	37	44	47	40	48	54	63	66	71	75	1,120	
N			34	44	54	58	50	61	71	84	90	99	105	1,377		
P		40	52	64	69	60	76	89	108	117	131	143				
Q	47	2,882	2,848	2,802	2,744	2,573	2,400	2,279	2,104	2,037	1,924	1,832				
R	3,032	2,991	2,948	2,892	2,728	2,564	2,449	2,285	2,222	2,117	2,031					
	71	88	96	86	112	134	171	187	214	239						
	3,131	3,089	3,036	2,879	2,723	2,614	2,459	2,399	2,300	2,220						
Key	There is no suitable plan in this area; use the first sampling plan in the appropriate column. If the sample size equals or exceeds the lot size, carry out 100 % inspection.															

NOTE The sample size code letters in this document correspond to those given in ISO 2859-1 and ISO 3951-2 in all cases where a correspondence can reasonably be considered.

Table 4 (continued)

Code letter	Acceptance quality limit (in percent nonconforming)															
	0,01	0,015	0,025	0,04	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>
<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>
	There is no suitable plan in this area; use the last sampling plan in the appropriate column.															
NOTE The sample size code letters in this document correspond to those given in ISO 2859-1 and ISO 3951-2 in all cases where a correspondence can reasonably be considered.																

14.2 Form k for single sampling plans: σ -method