INTERNATIONAL STANDARD

ISO 2859-5

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Sampling procedures for inspection by attributes —

Part 5: System of sequential sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection

Règles d'échantillonnage pour les contrôles par attributs —

Partie 5: Système de plans d'échantillonnage progressif pour le contrôle lot par lot, indexés d'après la limite d'acceptation de qualité (LAQ)

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Contents

Page

Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 2859-5 was prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 5, *Acceptance sampling*.

This first edition cancels and replaces Annex A of ISO 8422:1991, which has been technically revised to greatly improve its compatibility with the sampling systems in ISO 2859-1.

ISO 2859 consists of the following parts, under the general title *Sampling procedures for inspection by attributes*:

— *Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

— *Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection*

— *Part 3: Skip-lot sampling procedures*

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

— *Part 5: System of sequential sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

— *Part 10: Overview of the ISO 2859 attribute sampling systems*

Introduction

In contemporary production processes quality is often expected to reach such high levels that the number of nonconforming items is reported in parts per million (10^{-6}). Under such circumstances, popular acceptance sampling plans, such as those presented in ISO 2859-1, require prohibitively large sample sizes. To overcome this problem, users apply acceptance sampling plans with higher probabilities of wrong decisions or, in extreme situations, abandon the use of acceptance sampling procedures altogether. However, in many situations there is still a need to accept products of high quality using standardized statistical methods. In such cases, there is a need to apply statistical procedures that require the smallest possible sample sizes. Sequential sampling plans are the only statistical procedures that satisfy that need as, among all possible sampling plans having similar statistical properties, the sequential sampling plan has the smallest average sample number. Therefore, there is a strong need to present sequential sampling plans which are statistically equivalent to the commonly used acceptance sampling plans from ISO 2859-1, but which require significantly smaller average sample numbers.

The principal advantage of sequential sampling plans is the reduction in the average sample number. The average sample number is the weighted average of all the sample sizes that may occur under a sampling plan for a given lot or process quality level. Like double and multiple sampling plans, the use of sequential sampling plans leads to a smaller average sample number than single sampling plans having the equivalent operating characteristics. However, the average savings are even greater when using a sequential sampling plan than when a double or multiple sampling plan is used. For lots of very good quality, the maximum savings for sequential sampling plans may reach 85 %, as compared to 37 % for double sampling plans and 75 % for multiple sampling plans. On the other hand, when using a double, multiple or sequential sampling plan, the actual number of items inspected for a particular lot may exceed the sample size of the corresponding single sampling plan n_0. For double and multiple sampling plans, there is an upper limit of 1,25 n_0 to the actual number of items to be inspected. For classical sequential sampling plans there is no such limit, and the actual number of inspected items may considerably exceed the corresponding single sample size, n_0, or even the lot size, N. For the sequential sampling plans in this part of ISO 2859, a curtailment rule has been introduced involving an upper limit of 1,5 n_0 on the actual number of items to be inspected.

Other factors that should be taken into account include the following.

a) Simplicity

The rules of a sequential sampling plan are more easily misunderstood by inspectors than the simple rules for a single sampling plan.

b) Variability in the amount of inspection

As the actual number of items inspected for a particular lot is not known in advance, the use of sequential sampling plans brings about various organisational difficulties. For example, scheduling of inspection operations may be difficult.

c) Ease of drawing sample items

If drawing sample items is expensive at different times, the reduction in the average sample number by sequential sampling plans may be cancelled out by the increased sampling cost.

d) Duration of test

If the test of a single item is of long duration and a number of items can be tested simultaneously, sequential sampling plans are much more time-consuming than the corresponding single sampling plans.

e) Variability of quality within the lot

If the lot consists of two or more sublots from different sources and if there is likely to be any substantial difference between the qualities of the sublots, drawing of a representative sample under a sequential sampling plan is far more awkward than under the corresponding single sampling plan.

The advantages and disadvantages of double and multiple sampling plans always lie between those of single and sequential sampling plans. The balance between the advantage of a smaller average sample number and the above disadvantages leads to the conclusion that sequential sampling plans are suitable only when inspection of individual items is costly in comparison with inspection overheads.

The choice between the use of a single, double, multiple, or sequential sampling plan shall be made before the inspection of a lot is started. During the inspection of a lot, it is not permitted to switch from one type of plan to another, because the operating characteristics of the plan may be drastically changed if the actual inspection results influence the choice of acceptability criteria.

Although use of sequential sampling plans is on average much more economical than the use of corresponding single sampling plans, during inspection of a particular lot, acceptance or non-acceptance may occur at a very late stage due to the cumulative count of nonconforming items (or nonconformities) remaining between the acceptance number and the rejection number for a long time. When using the graphical method, this corresponds to the random progress of the step curve remaining in the indecision zone. Such a situation is most likely to occur when the lot or process quality level (in terms of percent nonconforming or in nonconformities per 100 items) is close to ($100g$), where g is the parameter giving the slope of the acceptance and rejection lines.

To improve upon this situation the sample size curtailment value is set before the inspection of a lot begins. If the cumulative sample size reaches the curtailment value n_t without determination of lot acceptability, inspection terminates and the acceptance or non-acceptance of the lot is then determined using the curtailment values of the acceptance and rejection numbers.

For sequential sampling plans in common use, curtailment usually represents a deviation from their intended usage, leading to a distortion of their operating characteristics. In this part of ISO 2859; however, the operating characteristics of the sequential sampling plans have been determined with curtailment taken into account, so curtailment is an integral component of the provided plans.

Sampling procedures for inspection by attributes —

Part 5:
System of sequential sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection

1 Scope

This part of ISO 2859 specifies sequential sampling schemes that supplement the ISO 2859-1 acceptance sampling system for inspection by attributes.

The ISO 2859-1 acceptance sampling system is indexed in terms of the acceptance quality limit (AQL). Its purpose is to induce a supplier, through the economic and psychological pressure of lot non-acceptance, to maintain a process average at least as good as the specified acceptance quality limit, while at the same time providing an upper limit for the risk to the consumer of accepting the occasional poor lot.

The sampling schemes defined in this part of ISO 2859 are applicable, but not limited, to the inspection of:

— end items,

— components and raw materials,

— operations,

— materials in process,

— supplies in storage,

— maintenance operations,

— data or records, and

— administrative procedures.

These schemes are designed to be applied to a continuing series of lots, that is, a series long enough to permit the switching rules in 10.3 to be applied. These switching rules provide

a) enhanced protection to the consumer (by means of tightened sampling inspection criteria or discontinuation of sampling inspection) should deterioration in quality occur,

b) an incentive, at the discretion of the responsible authority, to reduce inspection costs (by means of reduced sampling inspection criteria) should consistently good quality be demonstrated over time.

The individual sampling plans are not designed to be used outside of the schemes in which they are presented. Where lots are produced in isolation or in a series too short for this part of ISO 2859 to apply, the user is advised to consult ISO 2859-2 for appropriate sampling plans.

2 Normative references

The following referenced documents are indispensable for the application 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 2859-1:1999, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3534-2:—[1)], *Statistics — Vocabulary and symbols — Part 2: Applied statistics*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
inspection
conformity evaluation by observation and judgement accompanied as appropriate by measurement, testing or gauging

[ISO 3534-2]

3.2
original inspection
inspection of a lot, or other amount, not previously inspected

NOTE This is in contrast, for example, to inspection of a lot which has previously been designated as not acceptable and which is submitted again for inspection after having been further sorted, reprocessed, etc.

[ISO 3534-2]

3.3
inspection by attributes
inspection by noting the presence, or absence, of the characteristic(s) in each of the items in the group of consideration, and counting how many items do, or do not, possess the characteristic(s), or how many such events occur in the item, group or opportunity space

NOTE When inspection is performed by simply noting whether the item is nonconforming or not, the inspection is termed inspection for nonconforming items. When inspection is performed by noting whether the number of nonconformities on each unit, the inspection is termed inspection for number of nonconformities

[ISO 3534-2]

3.4
item
anything that can be described and considered separately

EXAMPLES A discrete physical item; a defined amount of bulk material, a service, activity, person and or some combination thereof.

[ISO 3534-2]

3.5
nonconformity
non-fulfilment of a requirement

[ISO 3534-2]

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1) To be published. (Revision of ISO 3534-2:1993)

NOTE 1 In some situations, specified requirements coincide with customer usage requirements (see **defect**, 3.6). In other situations they may not coincide, being either more or less stringent, or the exact relationship between the two is not fully known or understood.

NOTE 2 Nonconformity is generally classified according to its degree of seriousness such as:

— Class A: those nonconformities of a type considered to be of the highest concern; in acceptance sampling such types of nonconformities will be assigned a very small acceptance quality limit value;

— Class B: those nonconformities of a type considered to have the next lower degree of concern; therefore, these can be assigned a larger acceptance quality limit value than those in Class A and smaller than in Class C, if a third class exists, etc.

NOTE 3 Adding characteristics and classes of nonconformities generally affects the overall probability of acceptance of the product.

NOTE 4 The number of classes, the assignment into a class, and the choice of acceptance quality limit for each class should be appropriate to the quality requirements of the specific situation.

3.6
defect
non-fulfilment of a requirement related to an intended or specified use

NOTE 1 The distinction between the concepts “defect” and “nonconformity” is important as it has legal connotations, particularly those associated with product liability issues. Consequently the term “defect” should be used with extreme caution.

NOTE 2 The intended use by the customer can be affected by the nature of information, such as operating or maintenance instructions, provided by the customer.

[ISO 3534-2]

3.7
nonconforming item
item (3.4) with one or more **nonconformities** (3.5)

[ISO 3534-2]

NOTE Nonconforming items are generally classified by their degree of seriousness such as:

— Class A: an item which contains one or more nonconformities of Class A and may also contain nonconformities of Class B and/or Class C, etc.;

— Class B: an item which contains one or more nonconformities of Class B and may also contain nonconformities of Class C, etc. but contains no nonconformity of Class A.

3.8
percent nonconforming
⟨in a sample⟩ 100 times the number of **nonconforming items** (3.7) in the **sample** (3.15) divided by the **sample size** (3.16), viz:

$$100 \times \frac{d}{n}$$

where

d is the number of nonconforming items in the sample;

n is the sample size.

[ISO 2859-1:1999, 3.1.8]

3.9
percent nonconforming
⟨in a population or lot⟩ 100 times the number of **nonconforming items** (3.7) in the population or **lot** (3.13) divided by the population or **lot size** (3.14), viz:

$$100 \times p_{\text{ni}} = 100 \times \frac{D_{\text{ni}}}{N}$$

where

p_{ni} is the proportion of nonconforming items;

D_{ni} is the number of nonconforming items in the population or lot;

N is the population or lot size.

NOTE 1 Adapted from ISO 2859-1:1999, 3.1.9.

NOTE 2 In this part of ISO 2859 the terms **percent nonconforming** (3.8 and 3.9) or **nonconformities per 100 items** (3.10 and 3.11) are mainly used in place of the theoretical terms “proportion of nonconforming items” and “nonconformities per item” because the former terms are the most widely used.

3.10
nonconformities per 100 items
⟨in a sample⟩ 100 times the number of **nonconformities** (3.5) in the **sample** (3.15) divided by the **sample size** (3.16), viz:

$$100 \times \frac{d}{n}$$

where

d is the number of nonconformities in the sample;

n is the sample size.

[ISO 2859-1:1999, 3.1.10]

3.11
nonconformities per 100 items
⟨in a population or lot⟩ 100 times the number of **nonconformities** (3.5) in the population or **lot** (3.13) divided by the population or **lot size** (3.14), viz:

$$100 \times p_{\text{nt}} = 100 \times \frac{D_{\text{nt}}}{N}$$

where

p_{nt} is the number of nonconformities per **item** (3.4);

D_{nt} is the number of nonconformities in the population or lot;

N is the population or lot size.

NOTE 1 Adapted from ISO 2859-1:1999, 3.1.11.

NOTE 2 An **item** (3.4) can contain one or more nonconformities.

3.12
responsible authority
concept used to maintain the neutrality of this part of ISO 2859 (primarily for specification purposes), irrespective of whether it is being invoked or applied by the first, second or third party

[ISO 2859-1:1999, 3.1.12]

NOTE 1 The responsible authority may be:

a) the quality department within a supplier's organisation (first party);

b) the purchaser or procurement organization (second party);

c) an independent verification or certification authority (third party);

d) any of a), b) or c), differing according to function (see Note 2) as described in a written agreement between two of the parties, for example a document between supplier and purchaser.

NOTE 2 The duties and functions of a responsible authority are outlined in ISO 2859-1:1999, 5.2, 6.2, 7.2, 7.3, 7.5, 7.6, 9.1, 9.3.3, 9.4, 10.1, 10.3, 13.1.

3.13
lot
definite part of a population constituted under essentially the same conditions as the population with respect to the sampling purpose

NOTE The sampling purpose may, for example, be to determine lot acceptability, or to estimate the mean value of a particular characteristic.

[ISO 3534-2]

3.14
lot size
number of **items** (3.4) in a **lot** (3.13)

[ISO 2859-1:1999, 3.1.14]

3.15
sample
subset of a population made up of one or more sampling units

[ISO 3534-2]

3.16
sample size
number of sampling units in a **sample** (3.15)

[ISO 3534-2]

3.17
acceptance sampling plan
plan which states the **sample size**(s) (3.16) to be used and the associated criteria for lot acceptance

[ISO 3534-2]

NOTE 1 A single sampling plan is a combination of sample size and acceptance and rejection numbers. A double sampling plan is a combination of two sample sizes and acceptance and rejection numbers for the first sample and for the combined sample.

NOTE 2 A sampling plan does not contain the rules on how to draw the sample.

NOTE 3 For the purposes of this part of ISO 2859, a distinction should be made between the terms **acceptance sampling plan** (3.17), **acceptance sampling scheme** (3.18) and **acceptance sampling inspection system** (3.19).

3.18
acceptance sampling scheme
combination of **acceptance sampling plans** (3.17) with switching rules for changing from one plan to another

[ISO 3534-2]

NOTE See 10.3.

3.19
acceptance sampling inspection system
collection of **acceptance sampling plans** (3.17), or **acceptance sampling schemes** (3.18) together with criteria by which appropriate sampling plans or schemes may be chosen

[ISO 3534-2]

NOTE This part of ISO 2859 is a sampling system indexed by lot-size ranges, inspection levels and AQLs. A sampling system for **LQ** (3.30) plans is given in ISO 2859-2.

3.20
normal inspection
inspection (3.1) which is used when there is no reason to think that the quality level achieved by the process differs from a specified level

[ISO 3534-2]

3.21
tightened inspection
inspection (3.1) more severe than **normal inspection** (3.20), to which the latter is switched when inspection results of a predetermined number of **lots** (3.13) indicate that the quality level achieved by a process is poorer than that specified

[ISO 3534-2]

3.22
reduced inspection
inspection (3.1) less severe than **normal inspection** (3.20), to which the latter is switched when inspection results of a predetermined number of **lots** (3.13) indicate that the quality level achieved by a process is better than that specified

[ISO 3534-2]

NOTE The discriminatory ability under reduced inspection is less than under normal inspection.

3.23
switching score
indicator that is used under **normal inspection** (3.20) to determine whether the current inspection results are sufficient to allow for a switch to **reduced inspection** (3.22)

[ISO 2859-1:1999, 3.1.23]

NOTE See 10.3.3.

3.24
process average
process level averaged over a defined time period or quantity of production

[ISO 2859-1:1999, 3.1.25]

NOTE In this part of ISO 2859 the process average is the quality level (percent nonconforming or number of nonconformities per 100 items) during a period when the process is in a state of statistical control.

3.25
acceptance quality limit
AQL
worst tolerable product quality level

[ISO 3534-2]

NOTE 1 This concept only applies when a sampling scheme with rules for switching and for discontinuation, such as in this part of ISO 2859, ISO 2859-1 or ISO 3951, is used.

NOTE 2 Although individual lots with quality as bad as the acceptance quality limit may be accepted with fairly high probability, the designation of an acceptance quality limit does not suggest that this is a desirable quality level. Sampling schemes found in International Standards such as in this part of ISO 2859 or ISO 2859-1, with their rules for switching and for discontinuation of sampling inspection, are designed to encourage suppliers to have process averages consistently better than the AQL. Otherwise, there is a high risk that the inspection severity will 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 pending such improvement will be invoked.

3.26
consumer's risk
CR
probability of acceptance when the quality level has a value stated by the **acceptance sampling plan (3.17)** as unsatisfactory

[ISO 3534-2]

3.27
producer's risk
PR
probability of non-acceptance when the quality level has a value stated by the plan as acceptable

[ISO 3534-2]

3.28
consumer's risk quality
Q_{CR}
quality level of a **lot** (3.13) or process which, in the **acceptance sampling plan** (3.17), corresponds to a specified **consumer's risk** (3.26)

[ISO 3534-2]

NOTE The specified consumer's risk is usually 10 %.

3.29
producer's risk quality
Q_{PR}
quality level of a **lot** (3.13) or process which, in the **acceptance sampling plan** (3.17), corresponds to a specified **producer's risk** (3.27)

[ISO 3534-2]

NOTE The specified producer's risk is usually 5 %.

3.30
limiting quality
LQ
quality level, when a lot is considered in isolation, which, for the purposes of acceptance sampling inspection, is limited to a low probability of acceptance

[ISO 3534-2]

3.31
count
when inspection by attributes is performed, the result of the inspection of each sample item

NOTE In the case of inspection for nonconforming items, the count is set to 1 if the sample item is nonconforming or to 0 otherwise. In the case of inspection for nonconformities, the count is set to the number of nonconformities found in the sample item

3.32
cumulative count
when a sequential sampling plan is used, the total number of counts during inspection, counting from the start of the inspection of the lot up to, and including, the sample item last inspected

3.33
cumulative sample size
when a sequential sampling plan is used, the total number of sample items during inspection, counting from the start of the inspection of the lot up to, and including, the sample item last inspected

3.34
acceptance value
⟨for sequential sampling⟩ value used in the graphical method for determination of acceptance of the lot, that is derived from the specified parameters of the sampling plan and the cumulative sample size

3.35
acceptance number
⟨for sequential sampling⟩ number used in the numerical method for determination of acceptance of the lot, that is obtained by rounding the acceptance value down to the nearest integer

3.36
rejection value
⟨for sequential sampling⟩ value used in the graphical method for determination of non-acceptance of the lot, that is derived from the specified parameters of the sampling plan and the cumulative sample size

3.37
rejection number
⟨for sequential sampling⟩ number used in the numerical method for determination of non-acceptance of the lot, that is obtained by rounding the rejection value up to the nearest integer

3.38
acceptability table
table used for the lot acceptability determination in the numerical method

3.39
acceptability chart
chart used for the lot acceptability determination in the graphical method, consisting of the following three zones:

— acceptance zone;

— rejection zone;

— indecision zone;

the borders being acceptance, rejection and curtailment lines

4 Symbols and abbreviated terms

The symbols and abbreviated terms used in this part of ISO 2859 are as follows:

A	acceptance value (for sequential sampling plan)
Ac	acceptance number
Ac_0	acceptance number for a corresponding single sampling plan
Ac_t	acceptance number at curtailment (curtailment value)
AQL	acceptance quality limit (in percent nonconforming items or in nonconformities per 100 items)
AOQ	average outgoing quality (in percent nonconforming items or in nonconformities per 100 items)
AOQL	average outgoing quality limit (in percent nonconforming items or in nonconformities per 100 items)
d	count
D	cumulative count
g	parameter giving the slope of the acceptance and rejection lines
h_A	parameter giving the intercept of the acceptance line
h_R	parameter giving the intercept of the rejection line
LQ	limiting quality (in percent nonconforming items or in nonconformities per 100 items)
N	lot size
n_0	sample size for a corresponding single sampling plan
n_cum	cumulative sample size
n_t	cumulative sample size at curtailment (curtailment value)
$\bar{P}$	process average
p_x	quality level for which the probability of acceptance is x, where x is a fraction
P_a	probability of acceptance (in percent)
Q_CR	consumer's risk quality (in percent nonconforming items or in nonconformities per 100 items)
Q_PR	producer's risk quality (in percent nonconforming items or in nonconformities per 100 items)
R	rejection value (for sequential sampling plan).
Re	rejection number
Re_0	rejection number for a corresponding single sampling plan
Re_t	rejection number at curtailment (curtailment value)

NOTE $\mathrm{Re}_\mathrm{t} = \mathrm{Ac}_\mathrm{t} + 1$

5 Expression of nonconformity

5.1 General

The extent of nonconformity shall be expressed either in terms of **percent nonconforming** (see 3.8 and 3.9) or in terms of **nonconformities per 100 items** (see 3.10 and 3.11). Tables given in Annexes A, B and C are based on the assumption that nonconformities occur randomly and with statistical independence. If it is known that one nonconformity in an item could be caused by a condition also likely to cause others, the items shall be considered just as conforming or not, and multiple nonconformities ignored.

5.2 Classification of nonconformities

Since most acceptance sampling involves evaluation of more than one quality characteristic, and since they may differ in importance in terms of quality and/or economic effects, it is often desirable to classify the types of nonconformities according to agreed classes as defined in 3.5. The number of classes, the assignment of nonconformities into classes, and the choice of AQL for each class should be appropriate to the quality requirements of the specific situation.

6 Acceptance quality limit (AQL)

6.1 Use and application

The AQL, together with the sample size code letter (see 11.2), is used for indexing the sampling plans and schemes provided in this part of ISO 2859.

When a specific value of the AQL is designated for a certain nonconformity or group of nonconformities, it indicates that the sampling scheme will accept the great majority of the lots submitted, provided the quality level (percent nonconforming or nonconformities per 100 items) in these lots is no greater than the designated value of the AQL. The sampling plans provided are so arranged that the probability of acceptance at the designated AQL value depends upon the sample size for a given AQL, being generally higher for large samples than for small ones.

The AQL is a parameter of the sampling scheme and should not be confused with the process average that describes the operating level of the manufacturing process. It is expected that the process average will be better than the AQL to avoid excessive rejections under this system.

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

6.2 Specifying AQLs

The AQL to be used shall be designated in the contract or by (or in accordance with the prescription laid down by) the responsible authority. Different AQLs may be designated for groups of nonconformities considered collectively or for individual **nonconformities** as defined in 3.5. The classification into groups should be appropriate to the quality requirements of the specific situation. An AQL for a group of nonconformities may be designated in addition to AQLs for individual nonconformities, or subgroups, within that group. When the quality level is expressed as **percent of nonconforming items** (3.8 and 3.9), AQL values shall not exceed 10 % nonconforming. When the quality level is expressed as number of **nonconformities per 100 items** (3.10 and 3.11), AQL values up to 1 000 nonconformities per 100 items may be used.

6.3 Preferred AQLs

The series of values of AQLs given in the tables is known as the preferred series of AQLs. If, for any product, an AQL is designated other than one of these values, these tables are not applicable.

7 Submission of product for sampling

7.1 Formation of lots

The product shall be assembled into identifiable lots, sublots, or in such other manner as may be laid down (see 7.2). Each lot shall, as far as is practicable, consist of items of a single type, grade, class, size and composition, manufactured under uniform conditions at essentially the same time.

7.2 Presentation of lots

The formation of the lots, the lot size and the manner in which each lot shall be presented and identified by the supplier shall be designated or approved by, or according to, the responsible authority. As necessary, the supplier shall provide adequate and suitable storage space for each lot, equipment needed for proper identification and presentation, and personnel for all handling of product required for drawing of samples.

8 Acceptance and non-acceptance

8.1 Acceptability of lots

Acceptability of a lot shall be determined by the use of a sampling plan.

The term “non-acceptance” is used in this context for “rejection” when it refers to the result of following the procedure. When the acceptance criteria are not satisfied, forms of the term “reject” are retained when they refer to actions the consumer takes.

8.2 Disposition of non-acceptable lots

The responsible authority shall decide how lots that are not accepted will be disposed of. Such lots may be scrapped, sorted (with or without nonconforming items being replaced), reworked, re-evaluated against more specific usability criteria, or held for additional information, etc.

8.3 Nonconforming items

If a lot has been accepted, the right is reserved to not accept any item found nonconforming during inspection, whether that item formed part of a sample or not. Items found nonconforming may be reworked or replaced by conforming items, and resubmitted for inspection with the approval of, and in the manner specified by, the responsible authority.

8.4 Classes of nonconformities or nonconforming items

Specific assignment of nonconformities or nonconforming items to two or more classes requires using a set of sampling plans. In sequential sampling the set of sampling plans have different parameters for each class having a different AQL, such as in tables given in Annexes A, B and C.

8.5 Special reservation for critical classes of nonconformities

Some types of nonconformities may have critical importance. This subclause specifies the special provisions for such types of designated nonconformities. At the discretion of the responsible authority, every item in the lot may be required to be inspected for such designated classes of nonconformities. The right is reserved to inspect every item submitted for such designated nonconformities and to not accept the lot immediately if a nonconformity of this class is found. The right is also reserved to sample, for specified classes of nonconformities, every lot submitted by the supplier and to not accept any lot if a sample drawn from it is found to contain one or more of these nonconformities.

8.6 Resubmitted lots

All parties shall be immediately notified if a lot is found to be not acceptable. Such lots shall not be resubmitted until all items are re-examined or retested and the supplier is satisfied that all nonconforming items have been removed or replaced by conforming items, or all nonconformities have been corrected. The responsible authority shall determine whether normal or tightened inspection shall be used on re-inspection, and whether re-inspection shall include all types or classes of nonconformities or only the particular types or classes of nonconformities that caused initial non-acceptance.

9 Drawing of samples

9.1 Sample selection

The items selected for the sample shall be drawn from the lot by simple random sampling (as defined in ISO 3534-2:—). However, when the lot consists of sublots or strata, identified by some rational criterion, representative sampling shall be used, i.e., the probability of sampling a consecutive item from each sublot or stratum shall, as far as possible, be proportional to the size of that sublot or stratum.

9.2 Time for drawing the samples

Samples may be drawn after the lot has been produced, or during production of the lot. In either case, the samples shall be selected according to 9.1.

10 Normal, tightened and reduced inspection

10.1 Start of inspection

Normal inspection shall be carried out at the start of inspection, unless otherwise directed by the responsible authority.

10.2 Continuation of inspection

Normal, tightened or reduced inspection shall continue unchanged on successive lots, except where the switching procedures (see 10.3) require the severity of the inspection to be changed. The switching procedures shall be applied to each class of nonconformities or nonconforming items independently.

10.3 Switching rules and procedures (see Figure 1)

10.3.1 Normal to tightened

When normal inspection is being carried out, tightened inspection shall be implemented as soon as two out of five (or fewer than five) consecutive lots have been found to be non-acceptable on original inspection (that is, ignoring resubmitted lots or batches for this procedure).

10.3.2 Tightened to normal

When tightened inspection is being carried out, normal inspection shall be re-instated when five consecutive lots have been considered acceptable on original inspection.

10.3.3 Normal to reduced

10.3.3.1 General

When normal inspection is being carried out, reduced inspection shall be implemented provided that all of the following conditions are satisfied:

a) the current value of the switching score (see 10.3.3.2) is at least 30; and

b) production is at a steady rate; and

c) reduced inspection is considered desirable by the responsible authority.

10.3.3.2 Switching score

The calculation of the switching score shall be initiated at the start of normal inspection unless otherwise specified by the responsible authority.

The switching score shall be set at zero at the start and updated following the inspection of each subsequent lot on original normal inspection.

Add 3 to the switching score if the lot is accepted while the cumulative sample size n_{cum} is less than or equal to a half of the curtailment value (i.e., does not exceed $0{,}5n_{\text{t}}$); otherwise reset the switching score to zero.

10.3.3.3 Skip-lot sampling procedures

Skip-lot sampling procedures from ISO 2859-3 are not applicable when the sequential sampling plans from this part of ISO 2859 are used.

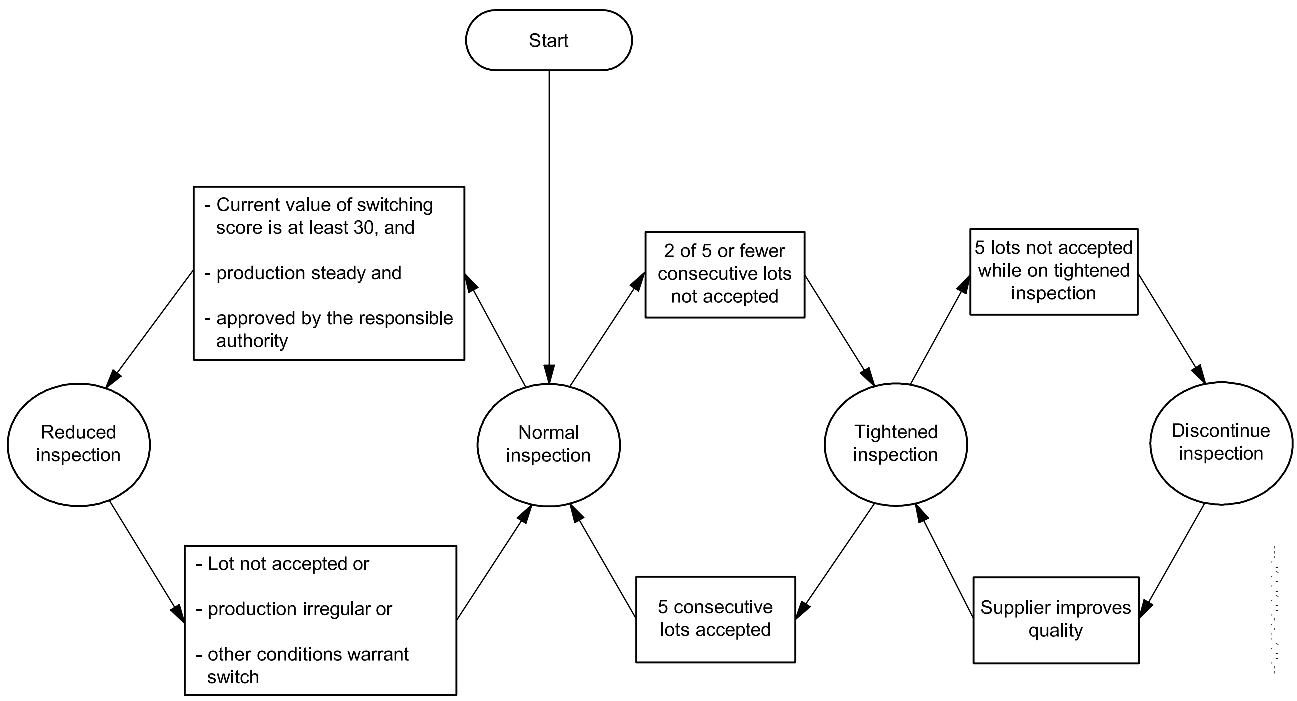


Figure 1 — Outline of the switching rules (see 10.3)

10.3.4 Reduced to normal

When reduced inspection is being carried out, normal inspection shall be re-instated if any of the following occur on original inspection:

a) a lot is not accepted; or

b) production becomes irregular or delayed; or

c) other conditions warrant that normal inspection shall be re-instated.

10.4 Discontinuation of inspection

If the cumulative number of lots not accepted in a sequence of consecutive lots on original tightened inspection reaches 5, the acceptance procedures of this part of ISO 2859 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 as if 10.3.1 had been invoked.

11 Sampling plans

11.1 Inspection level

The inspection level designates the relative amount of inspection. Three inspection levels, I, II and III, are given in Table 1 for general use. Unless otherwise specified, Level II shall be used. Level I may be used when less discrimination is needed or Level III when greater discrimination is required. Two additional special levels, S-3 and S-4 are also given in Table 1 and may be used where relatively small sample sizes are necessary and larger sampling risks can be tolerated.

The inspection level required for any particular application shall be specified by the responsible authority. This allows the authority to require greater discrimination for some purposes and less for others. At each inspection level, the switching rules shall operate to require normal, tightened and reduced inspection, as specified in Clause 10. The choice of inspection level is quite separate from these 3 severities of inspection. Thus, the inspection level that has been specified shall be kept unchanged when switching between normal, tightened and reduced inspection.

In the designation of inspection levels S-3 to S-4, care shall be exercised to avoid AQLs inconsistent with these inspection levels. For instance, it will be seen that the code letters under S-3 go no further than H for which the lowest AQL is 1,0 %, so it is of no use specifying S-3 if the AQL is 0,65 % or less.

The amount of information about the quality of a lot gained from examining samples drawn from the lot depends upon the absolute size of the samples, not upon the relative size of the sample to the lot size, provided the sample is small relative to the lot that is examined. In spite of this, there are at least two reasons for varying the sample size with the lot size:

a) when the loss due to a wrong decision is high, it is more important to make the correct decision;

b) truly random sampling is relatively more difficult if the sample is too small a proportion of the lot.

Table 1 — Sample size code letters

Lot size	Special levels		General inspection levels		
	S-3	S-4	I	II	II
51 to 90	a	a	a	a	F
91 to 150	a	a	a	F	G
151 to 280	a	a	a	G	H
281 to 500	a	a	F	H	J
501 to 1200	a	F	G	J	K
1 201 to 3200	a	G	H	K	L
3 201 to 10 000	F	G	J	L	M
10 001 to 35 000	F	H	K	M	N
35 001 to 150 000	G	J	L	N	P
150 001 to 500 000	G	J	M	P	Q
500 001 and over	H	K	K	Q	R

[a] Use the corresponding multiple sampling plan from ISO 2859-1.

11.2 Sample size code letters

Sample sizes are designated by sample size code letters. Table 1 shall be used to find the applicable code letter for the particular lot size and the prescribed inspection level.

NOTE For economy of space in the tables or to avoid unnecessary repetition in the text, the abbreviated term "code letter" is sometimes used.

11.3 Obtaining a sampling plan

The AQL and the sample size code letter shall be used to obtain the sampling plan from tables given in Annexes A, B, and C. For a specified AQL and a given lot size, the same combination of AQL and sample size code letter shall be used to obtain the sampling plan from the table for normal, tightened and reduced inspection.

When no sampling plan is available for a given combination of AQL and sample size code letter, arrows in the tables direct the user to a different letter. The sampling plan to be used is given by the new sample size code letter, not by the original letter. If this procedure leads to different curtailment values for different classes of nonconformities or nonconforming items, the sample size code letter corresponding to the largest curtailment value derived may be used for all classes of nonconformities or nonconforming items, when designated or approved by the responsible authority.

For some combinations of AQL and sample size code letter, the entry in the table is an asterisk (*) indicating that the corresponding single sampling plan has acceptance number zero there. In such a case, the sequential sampling plan is identical with the corresponding single sampling plan with curtailment, and the user is advised to use the simpler single sampling plan in place of the more complicated sequential sampling plan. Then the curtailment rule for these plans is that the inspection shall be terminated and the lot shall be considered non-acceptable if, and as soon as, one nonconforming item is found.

11.4 Operation of a sequential sampling plan

11.4.1 Specification of the plan

Before operation of a sequential sampling plan, the inspector shall record on the sampling document the specified values of the parameters, h_A, h_R and g, and the curtailment values, n_t and Ac_t.

11.4.2 Drawing a sample item

The individual sample items shall be drawn at random from the lot and inspected one by one in the order in which they are drawn.

11.4.3 Count and cumulative count

11.4.3.1 Count

For inspection for percent nonconforming, if the sample item is nonconforming, the count d for the sample item is 1, otherwise the count d is zero.

For inspection for nonconformities per 100 items, the count d for the sample item is the number of nonconformities found in the sample item.

11.4.3.2 Cumulative count

The cumulative count D is the cumulative sum of the count d from the first sample item up to the most recent (i.e. n_{cum}) sample item inspected so far.

11.4.4 Choice between numerical and graphical methods

This part of ISO 2859 provides two methods of operating a sequential sampling plan: a numerical method and a graphical method, either one of which may be chosen.

The numerical method uses an acceptability table for operating, and has the advantage of being accurate, thereby avoiding disputes about acceptance or non-acceptance in marginal cases. An acceptability table can also be used as an inspection record sheet, after inscribing the inspection results.

The graphical method uses an acceptability chart for operating, and has the advantage of displaying the increase in the information on the lot quality as additional items are inspected, information being represented by the step curve within the indecision zone, until the line reaches, or crosses, one of the boundaries of that zone. On the other hand, the method is less accurate, due to the inaccuracy inherent in plotting points and in drawing lines.

The numerical method is the standard method so far as acceptance or non-acceptance is concerned (see the caution in 11.4.6.2). When the numerical method is applied, it is recommended that the calculation and preparation of an acceptability table be done using appropriate software.

The following provisions are based on the assumption that either the acceptability table or the acceptability chart is prepared on a sheet of paper. However, if a computer program is used, the acceptability table can be displayed on a computer screen, so that entering a minimum of data may be sufficient to determine acceptability of the lot. Furthermore, it is possible to incorporate additional features, such as;

- displaying both the acceptability table and the acceptability chart on different windows of the same computer screen,
- printing out the inspection record sheet after determination of the lot acceptability, or
- compressing the inspection record to the necessary minimum.

11.4.5 Numerical method

11.4.5.1 Preparation of the acceptability table

When the numerical method is used, the following calculations shall be carried out and an acceptability table shall be prepared.

For each value, n_{cum}, of the cumulative sample size that is less than the curtailment value of the sample size, the acceptance value A is given by Equation (1):

$$A = \left(g \times n_{cum}\right) - h_A \qquad (1)$$

and the acceptance number Ac is obtained by rounding the acceptance value, A, down to the nearest integer.

For each value of n_{cum} , the rejection value R is given by Equation (2):

$$R = \left(g \times n_{cum}\right) + h_R \qquad (2)$$

and the rejection number Re is obtained by rounding the rejection value, R, up to the nearest integer.

Whenever the value of A is negative, the cumulative sample size is too small to permit acceptance of the lot. Conversely, whenever the value of Equation (2) is larger than the cumulative sample size, the cumulative sample size is too small to permit non-acceptance of the lot under inspection for percent nonconforming.

Whenever the rejection number Re is larger than the curtailment value, Re_t, the former should be replaced by the latter, because no chance of acceptance remains once the cumulative count, D, exceeds the curtailment value, Re_t.

The values, A and R, given by Equations (1) and (2) shall have the same number of digits after the decimal marker as g.

The smallest cumulative sample size permitting acceptance of the lot is obtained by rounding the value, h_A/g, up to the nearest integer. The smallest cumulative sample size permitting non-acceptance of the lot under inspection for percent nonconforming is obtained by rounding the value, $h_R/(1 - g)$, up to the nearest integer. Finally, an acceptability table is established by entering the necessary data.

11.4.5.2 Making decisions

Enter the count and the cumulative count into the acceptability table prepared in accordance with 11.4.6.1, after the inspection of each item.

— If the cumulative count, D, is less than or equal to the acceptance number, Ac, for the cumulative sample size, n_{cum}, the lot shall be considered acceptable and the inspection shall be terminated.

— If the cumulative count, D, is greater than or equal to the rejection number, Re, for the cumulative sample size, n_{cum}, the lot shall be considered not acceptable and the inspection shall be terminated.

— If neither a) nor b) is satisfied, another item shall be sampled and inspected.

When the cumulative sample size reaches the curtailment value n_t, the rules in a) and b) apply with the curtailment values of the acceptance number, Ac_t, and the rejection number Re_t (equal to $Ac_t + 1$).

11.4.6 Graphical method

11.4.6.1 Preparation of the acceptability chart

When the graphical method is used, an acceptability chart shall be prepared in accordance with the following procedures. Prepare a graph with the cumulative sample, n_{cum}, as the horizontal axis, and the cumulative count, D, as the vertical axis. Draw two straight lines with the same slope g corresponding to the acceptance and rejection values, A and R, given by Equations (1) and (2). The lower line with the intercept of $-h_{\text{A}}$ is designated the acceptance line, and the upper line with the intercept of h_{R} is designated the rejection line. Add a vertical line, the curtailment line, at $n_{\text{cum}} = n_{\text{t}}$. A horizontal line, the truncation line, should be added at Re_{t}.

The lines define three zones on the chart.

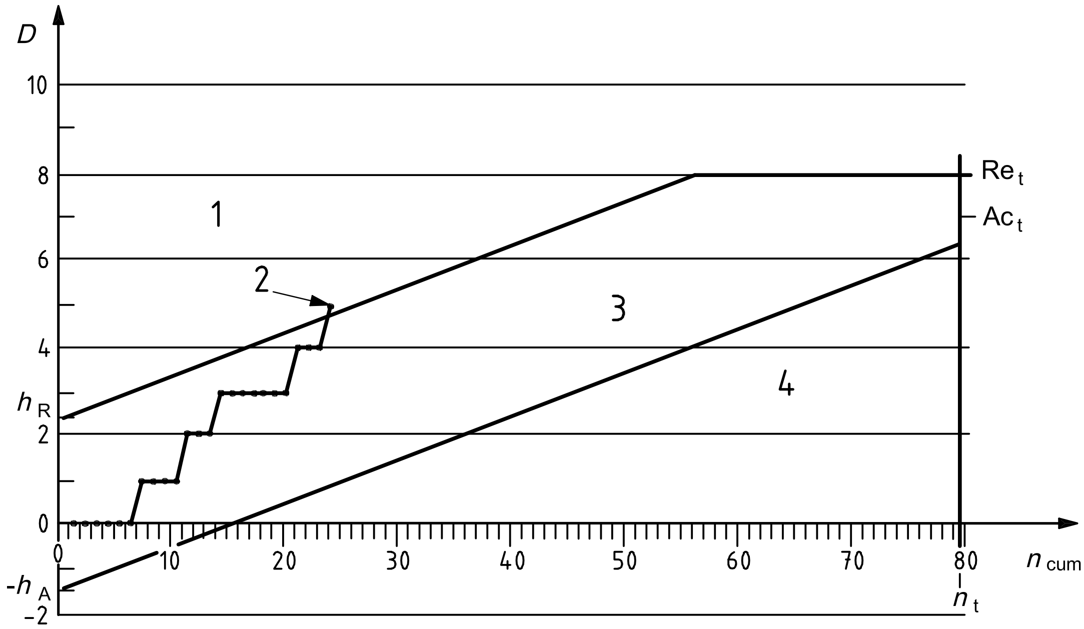
— The acceptance zone is the zone below (and including) the acceptance line together with that part of the curtailment line that is below and includes the point (n_{t},Ac_{t}).

— The rejection zone is the zone above (and including) the rejection line together with that part of the curtailment line that is above and includes the point (n_{t},Re_{t}).

— The indecision zone is the strip between acceptance and rejection lines that is to the left of the curtailment line.

When the truncation line is added, the triangle at the top of the indecision zone bordered by the rejection line, the curtailment line and the truncation line (including each side) should be considered as a part of the rejection zone.

In this part of ISO 2859, points on the chart representing the cumulative count will never lie on the acceptance or rejection lines. An example of the prepared graph is given as Figure 2.



Key

1 rejection zone

2 inspection terminates

3 indecision zone

4 acceptance zone

Figure 2 — Acceptability chart

11.4.6.2 Making decisions

When the graphical method is used, the following procedures shall be followed.

Plot the point (n_{cum},D) on the acceptability chart prepared in accordance with 11.4.6.1, after the inspection of each item.

a) If the point lies in the acceptance zone, the lot shall be considered acceptable and the inspection of that lot shall be terminated.

b) If the point lies in the rejection zone, the lot shall be considered not acceptable and the inspection of that lot shall be terminated.

c) If the point lies in the indecision zone, another item from that lot shall be sampled and inspected.

The successive points on the acceptability chart shall be connected by a step curve to show up any trend in the inspection results.

CAUTION — If the point is close to the acceptance or rejection lines, the numerical method shall be used to make the decision.

11.5 Numerical examples

The following examples illustrate how to use sequential sampling plans in this part of ISO 2859.

EXAMPLE 1

The ISO 2859-1 sampling system has been used for inspection of a certain product. The specified AQL is 4,0 % nonconforming. Inspection Level I is being used. The single sampling plan for normal inspection has been used for a few lots. The lot size (N) is 1 500 for each lot.

It is decided to use the sequential sampling scheme from this part of ISO 2859. For the inspection Level I and the lot size 1 500 we find from Table 1 that the sample size code letter is H. The parameters (h_A, h_R and g) and the curtailment values (n_t and Ac_t) of the sequential sampling plan are found in Table A.1.

The parameters are as follows: $h_A = 1{,}426$, $h_R = 2{,}449$ and $g = 0{,}097$. The curtailment values are as follows; $n_t = 80$ and $Ac_t = 7$. Therefore, rejection and acceptance values (R and A) are given by the following equations;

$$R = (g \times n_{cum}) + h_R = (0{,}097 \times n_{cum}) + 2{,}449$$

and

$$A = (g \times n_{cum}) - h_A = (0{,}097 \times n_{cum}) - 1{,}426$$

When the numerical method is used, rejection and acceptance values (R and A) can be calculated for $n_{cum} = 1$ to $n_t - 1$ (equal to 79), and then rounded to acceptance and rejection numbers (Ac and Re), respectively. When the rejection number (Re) is larger than the curtailment value ($Re_t = 8$), each Re should be replaced by 8.

Suppose now that consecutive items randomly selected from the lot are submitted for inspection. The results of the inspection are as follows:

n_{cum}	D
7	1
11	2
14	3
21	4
24	5

For $n_{cum} = 24$ we have $D = 5$, and this value is greater than the calculated rejection value R. Hence, the inspection is terminated, and the inspected lot is rejected. The acceptability chart for this example is presented as Figure 2.

EXAMPLE 2

The situation is similar to that from Example 1, except that the specified AQL is 0,65 % nonconforming for quality characteristics of class A and 4,0 % nonconforming for quality characteristics of class B (see 3.5 and 3.7). The sample size code letter is, as previously, H. From Table A.1 of this part of ISO 2859, we find that for quality characteristics of class A the arrow directs us to use the sample size code letter J in place of H. The parameters (h_A, h_R and g) and the curtailment values (n_t and Ac_t) of the applicable sequential sampling plan are as follows: $h_A = 0{,}854$, $h_R = 0{,}932$ and $g = 0{,}016\,7$, $n_t = 125$ and $Ac_t = 2$. Therefore, rejection and acceptance values (R and A) are given by the following equations:

$$R = \left(g \times n_{cum}\right) + h_R = \left(0{,}016\,7 \times n_{cum}\right) + 0{,}932$$

and

$$A = \left(g \times n_{cum}\right) - h_A = \left(0{,}016\,7 \times n_{cum}\right) - 0{,}854$$

When the numerical method is to be used, acceptance and rejection values (A and R) can be calculated for $n_{cum} = 1$ to $n_t - 1$ (equal to 124), and then rounded to acceptance and rejection numbers (Ac and Re), respectively. When the rejection number (Re) is larger than the curtailment value ($Re_t = 3$), each Re should be replaced by 3.

For quality characteristics of Class B, the results are the same as given in Example 1.

NOTE In the case of sequential sampling plans, there is no problem even if different sample size code letters are reached for different classes of quality characteristics.

EXAMPLE 3

In Example 2, updating of the switching score is to be confirmed. The current switching scores are 10 and 15 for quality characteristics of Class A and Class B, respectively. First, confirm the cumulative sample sizes at which an accept decision is permitted, and then compare with the limit value for addition to the switching score (0,5 n_t).

a) For quality characteristics of Class A:

Acceptance for Class A is permitted only at the following cumulative sample sizes;

n_{cum}	A	Ac
52	0,014 4	0
112	1,016 4	1
125	—	2

Among the above, only the combination of $n_{cum} = 52$ and $Ac = 0$ meets the criteria for addition to the switching score ($n_{cum} \leqslant 0{,}5n_t = 62{,}5$). Therefore, add 3 to the current switching score if the lot is accepted at $n_{cum} = 52$ with $Ac = 0$; otherwise reset the switching score to zero.

b) For quality characteristics of Class B:

Acceptance for Class B is permitted only at the following cumulative sample sizes;

n_{cum}	A	Ac
15	0,029	0
26	1,096	1
36	2,066	2
46	3,036	3
56	4,006	4
67	5,073	5
77	6,043	6
80	—	7

Among the above, the combinations of $n_{cum} \leqslant 36$ and $Ac \leqslant 2$ meet the criteria for addition to the switching score ($n_{cum} \leqslant 0{,}5n_t = 40$). Therefore, add 3 to the current switching score if the lot is accepted while $n_{cum} \leqslant 36$; otherwise reset the switching score to zero.

12 Determination of acceptability

12.1 Inspection for nonconforming items

To determine acceptability of a lot under percent nonconforming inspection, the applicable sampling plan shall be used in accordance with 11.1 to 11.4.

When different AQL values are specified for two or more classes of nonconforming items or nonconformities, lot acceptability shall be determined for each class separately. In other words, even after determination of lot acceptability for any of the classes, inspection shall be continued for the other class(es), so that the switching rules may be separately applied.

12.2 Inspection for nonconformities

In order to determine the acceptability of a lot in a nonconformities per 100 items inspection, the procedure specified for nonconforming inspection (see 12.1) shall be used, except that the term “nonconformities” shall be substituted for “nonconforming items”.

13 Further information

13.1 Operating characteristic (OC) curves

The operating characteristic curves for normal and tightened inspection indicate the percentage of lots which may be expected to be accepted under the various sampling plans for a given process quality. The sampling plans in this part of ISO 2859 have been determined such that their operating characteristic (OC) curves match as closely as practicable the OC curves of the corresponding sampling plans in ISO 2859-1:1999. For practical purposes, the curves and tables in Table 10 of ISO 2859-1:1999 may be used to determine the OC curves of the sampling plans in this part of ISO 2859.

The OC curves shown for AQLs greater than 10 are applicable to inspection for number of nonconformities; those for AQLs of 10 or less are applicable to inspection for nonconforming items. For AQLs of 10 or less, these OC curves are also applicable to inspection for number of nonconformities.

13.2 Process average

The process average can be estimated by the average percent nonconforming or average number of nonconformities per 100 items (whichever is applicable) found in the samples of product submitted by the supplier for original inspection. In order to limit the bias of the estimate, the cumulative number of items on which estimates shall be based is at least the sample size for $p = 0$ (given in Table D.1 or Table D.2 as appropriate) or the cumulative sample size at rejection if this occurs sooner.

13.3 Use of individual plans

This part of ISO 2859 is intended to be used as a system employing tightened, normal and reduced inspections on a successive series of lots to achieve consumer protection, while assuring the producer that acceptance will occur most of the time if quality is better than the AQL.

CAUTION — Occasionally, specific individual plans are selected from this part of ISO 2859 and used without the switching rules. For example, a purchaser may be using the plans for verification purposes only. This is not the intended application of the system given in this part of ISO 2859 and its use in this way shall not be referred to as “inspection in compliance with ISO 2859-5:2005”. When used in this way, this part of ISO 2859 simply represents a repository for a collection of individual plans indexed by AQL. The operating characteristic curves and other measures of a plan so chosen shall be assessed individually for a plan from the tables provided in ISO 2859-1.

14 Tables

Table 1 in 11.1 should be used for the determination of the sample size code letter.

Sequential sampling plans for normal inspection are given in Tables A.1, A.2, and A.3 in Annex A.

Sequential sampling plans for tightened inspection are given in Tables B.1, B.2, and B.3 in Annex B.

Sequential sampling plans for reduced inspection are given in Tables C.1, C.2, and C.3 in Annex C.

Annex A
(normative)

Sampling plans for normal inspection

This annex contains the tables of sequential sampling plans for normal inspection.

Table A.1 shall be used when AQL is defined in terms of percent nonconforming, and the total number of inspected items does not exceed 315.

Table A.2 shall be used when AQL is defined in terms of percent nonconformities per 100 items, and the total number of inspected items does not exceed 315.

Table A.3 shall be used when AQL is defined either in terms of percent nonconforming or in terms of percent nonconformities per 100 items. The total number of inspected items may exceed 315.

Table A.1 — Parameters and curtailment values for sequential sampling plans for normal inspection, percent nonconforming (Master table)

Sample size code letter[a]	n_0[b]	n_t[c]	Parameter[d]	Acceptance quality limit (AQL) in percent nonconforming items (normal inspection)[e]															
				0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
F	20	32	h_A	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0,860	0,861	1,161	1,162
			h_R													0,857	1,465	1,525	2,201
			g													0,071 6	0,096 0	0,158	0,240
			Ac_t													2	3	5	7
G	32	50	h_A	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0,916	0,917	1,329	1,423	1,581
			h_R												0,906	1,471	1,472	2,157	2,496
			g												0,045 6	0,061 2	0,104	0,158	0,215
			Ac_t												2	3	5	7	10
H	50	80	h_A	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0,783	0,965	1,331	1,426	1,657	1,905
			h_R											0,925	1,454	1,540	2,449	2,777	3,057
			g											0,025 1	0,041 8	0,065 3	0,097 0	0,136	0,192
			Ac_t											2	3	5	7	10	15
J	80	125	h_A	↓	↓	↓	↓	↓	↓	*	↑	↓	0,854	1,004	1,391	1,514	1,679	2,127	2,432
			h_R										0,932	1,420	1,547	2,388	2,826	2,999	3,466
			g										0,016 7	0,026 4	0,040 9	0,061 3	0,083 5	0,122	0,171
			Ac_t										2	3	5	7	10	15	21
K	125	200	h_A	↓	↓	↓	↓	↓	*	↑	↓	0,949	0,953	1,400	1,533	1,802	2,103	2,457	2,732
			h_R									0,910	1,505	1,549	2,485	2,868	3,218	3,813	5,373
			g									0,011 6	0,016 0	0,026 4	0,039 3	0,054 6	0,077 1	0,108	0,159
			Ac_t									2	3	5	7	10	15	21	31
L	200	315	h_A	↓	↓	↓	↓	*	*	↓	0,852	1,088	1,383	1,484	1,775	2,175	2,605	3,021	↑
			h_R								0,935	1,401	1,582	2,555	2,922	3,208	3,741	4,933	
			g								0,006 5	0,011 1	0,016 1	0,023 7	0,033 4	0,048 1	0,068 0	0,101	
			Ac_t								2	3	5	7	10	15	21	31	

a For sample size code letters A to E, use sampling plans from ISO 2859-1.

b n_0 is the corresponding single sample size.

c n_t is the curtailment sample size.

d Ac_t is the curtailment acceptance number.

e ↓ = means use the first sampling plan below the arrow.
↑ = means use the first sampling plan above the arrow. If no sampling plan is given, use the corresponding multiple sampling plan from ISO 2859-1.
* = means use the corresponding curtailed single sampling plan from ISO 2859-1 with Ac = 0.

Table A.2 — Parameters and curtailment values for sequential sampling plans for normal inspection, nonconformities per 100 items (Master table)

Sample size code letter[a]	n_0[b]	n_t[c]	Parameter[d]	**Acceptance quality limit (AQL) in nonconformities per 100 items** (normal inspection)[e]															
				0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
F	20	32	h_A	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0,752	0,955	1,339	1,340
			h_R													0,936	1,365	1,498	2,574
			g													0,062 6	0,106 0	0,167	0,233
			Ac_t													2	3	5	7
G	32	50	h_A	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0,916	1,075	1,324	1,372	1,887
			h_R												0,906	1,356	1,496	2,604	2,679
			g												0,045 6	0,071 5	0,101	0,141	0,218
			Ac_t												2	3	5	7	10
H	50	80	h_A	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0,948	0,949	1,405	1,427	1,851	2,216
			h_R											0,909	1,496	1,531	2,617	2,850	3,151
			g											0,029 5	0,039 6	0,066 8	0,094 0	0,137	0,195
			Ac_t											2	3	5	7	10	15
J	80	125	h_A	↓	↓	↓	↓	↓	↓	*	↑	↓	0,885	0,958	1,366	1,429	1,768	2,254	2,620
			h_R										0,916	1,473	1,559	2,614	2,907	3,161	3,777
			g										0,017 0	0,025 1	0,040 1	0,057 4	0,083 5	0,121	0,169
			Ac_t										2	3	5	7	10	15	21
K	125	200	h_A	↓	↓	↓	↓	↓	*	↑	↓	0,875	0,991	1,393	1,487	1,779	2,302	2,688	2,957
			h_R									0,925	1,483	1,583	2,619	3,021	3,184	3,869	5,619
			g									0,010 8	0,016 5	0,026 0	0,038 0	0,053 2	0,078 6	0,109	0,158
			Ac_t									2	3	5	7	10	15	21	31
L	200	315	h_A	↓	↓	↓	↓	*	↑	↓	0,847	0,941	1,385	1,499	1,878	2,216	2,659	3,040	↑
			h_R								0,941	1,520	1,584	2,564	2,852	3,271	3,889	5,340	
			g								0,006 50	0,009 80	0,016 1	0,023 7	0,034 1	0,047 9	0,067 4	0,099 0	
			Ac_t								2	3	5	7	10	15	21	31	

a For sample size code letters A to E, use sampling plans from ISO 2859-1.

b n_0 is the corresponding single sample size.

c n_t is the curtailment sample size.

d Ac_t is the curtailment acceptance number.

e ↓ = means use the first sampling plan below the arrow.

↑ = means use the first sampling plan above the arrow. If no sampling plan is given, use the corresponding multiple sampling plan from ISO 2859-1.

* = means use the corresponding curtailed single sampling plan from ISO 2859-1 with Ac = 0.

Table A.3 — Parameters and curtailment values for sequential sampling plans for normal inspection, percent nonconforming and nonconformities per 100 items (Master table)

Sample size code letter	n_0 [a]	n_t [b]	Parameter [c]	Acceptance quality limit (AQL) in percent nonconforming items (normal inspection) [d]															
				0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
M	315	500	h_A	↓	↓	↓	*	↑	↓	0,819	0,902	1,391	1,495	1,777	2,138	2,495	2,832	↑	↑
			h_R							0,946	1,556	1,579	2,581	2,983	3,328	4,011	5,574		
			g							0,004 01	0,006 01	0,010 3	0,015 1	0,021 1	0,030 1	0,042 1	0,062 1		
			Ac_t							2	3	5	7	10	15	21	31		
N	500	800	h_A	↓	↓	*	↑	↓	0,811	0,898	1,328	1,525	1,811	2,114	2,472	2,893	↑	↑	↑
			h_R						0,948	1,568	1,630	2,591	2,999	3,421	4,160	5,749			
			g						0,002 51	0,003 77	0,006 26	0,009 60	0,013 4	0,018 8	0,026 3	0,039 2			
			Ac_t						2	3	5	7	10	15	21	31			
P	800	1 250	h_A	↓	*	↑	↓	0,843	0,931	1,392	1,451	1,744	2,280	2,685	3,084	↑	↑	↑	↑
			h_R					0,943	1,533	1,593	2,608	3,009	3,204	3,834	5,157				
			g					0,001 61	0,002 41	0,004 01	0,005 78	0,008 14	0,012 1	0,016 9	0,024 9				
			Ac_t					2	3	5	7	10	15	21	31				
Q	1 250	2 000	h_A	*	↑	↓	0,816	0,900	1,331	1,514	1,812	2,123	2,541	2,947	↑	↑	↑	↑	↑
			h_R				0,948	1,568	1,629	2,610	3,018	3,443	4,111	5,750					
			g				0,001 01	0,001 51	0,002 51	0,003 82	0,005 34	0,007 51	0,010 6	0,015 7					
			Ac_t				2	3	5	7	10	15	21	31					
R	2 000	3 150	h_A	↑	↑	0,826	0,923	1,368	1,471	1,768	2,211	2,603	3,050	↑	↑	↑	↑	↑	↑
			h_R			0,946	1,542	1,608	2,615	3,019	3,309	3,981	5,360						
			g			0,000 635	0,000 960	0,001 59	0,002 33	0,003 28	0,004 77	0,006 67	0,009 90						
			Ac_t			2	3	5	7	10	15	21	31						

a n_0 is the corresponding single sample size.

b n_t is the curtailment sample size.

c Ac_t is the curtailment acceptance number.

d ↓ = means use the first sampling plan below the arrow.

↑ = means use the first sampling plan above the arrow. If no sampling plan is given, use the corresponding multiple sampling plan from ISO 2859-1.

* = means use the corresponding curtailed single sampling plan from ISO 2859-1 with Ac = 0.

The above parameters for sequential sampling plans are for both percent nonconforming items and nonconformities per 100 items.

Annex B
(normative)

Sampling plans for tightened inspection

This annex contains the tables of sequential sampling plans for tightened inspection.

Table B.1 shall be used when AQL is defined in terms of percent nonconforming, and the total number of inspected items does not exceed 315.

Table B.2 shall be used when AQL is defined in terms of percent nonconformities per 100 items, and the total number of inspected items does not exceed 315.

Table B.3 shall be used when AQL is defined either in terms of percent nonconforming or in terms of percent nonconforming per 100 items. The total number of inspected items may exceed 315.

Table B.1 — Parameters and curtailment values for sequential sampling plans for tightened inspection, percent nonconforming (Master table)

Sample size code letter[a]	n_0[b]	n_t[c]	Parameter[d]	Acceptance quality limit (AQL) in percent nonconforming items (normal inspection)[e]															
				0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
F	20	32	h_A	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	0,860	0,861	1,161
			h_R														0,857	1,465	1,525
			g														0,071 6	0,096 0	0,158
			Ac_t														2	3	5
G	32	50	h_A	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	0,916	0,917	1,329	1,423
			h_R													0,906	1,471	1,472	2,157
			g													0,045 6	0,061 2	0,104	0,158
			Ac_t													2	3	5	7
H	50	80	h_A	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	0,783	0,965	1,331	1,426	1,689
			h_R												0,925	1,454	1,540	2,449	2,793
			g												0,025 1	0,041 8	0,065 3	0,097 0	0,152
			Ac_t												2	3	5	7	12
J	80	125	h_A	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	0,854	1,004	1,391	1,514	1,911	2,226
			h_R											0,932	1,420	1,547	2,388	2,827	3,316
			g											0,016 7	0,026 4	0,040 9	0,061 3	0,097 0	0,145
			Ac_t											2	3	5	7	12	18
K	125	200	h_A	↓	↓	↓	↓	↓	↓	*	↓	↓	0,949	0,953	1,400	1,533	1,853	2,272	2,731
			h_R										0,910	1,505	1,549	2,485	2,934	3,572	4,329
			g										0,011 6	0,016 0	0,026 4	0,039 3	0,060 7	0,091 9	0,139
			Ac_t										2	3	5	7	12	18	27
L	200	315	h_A	↓	↓	↓	↓	↓	*	↓	↓	0,852	1,088	1,383	1,484	1,925	2,346	2,824	↑
			h_R									0,935	1,401	1,582	2,555	2,923	3,563	4,380	
			g									0,006 52	0,011 1	0,016 1	0,023 7	0,038 1	0,057 3	0,086 3	
			Ac_t									2	3	5	7	12	18	27	

a For sample size code letters A to E, use sampling plans from ISO 2859-1.

b n_0 is the corresponding single sample size.

c n_t is the curtailment sample size.

d Ac_t is the curtailment acceptance number.

e ↓ = means use the first sampling plan below the arrow.

↑ = means use the first sampling plan above the arrow. If no sampling plan is given, use the corresponding multiple sampling plan from ISO 2859-1.

* = means use the corresponding curtailed single sampling plan from ISO 2859-1 with Ac = 0.

Table B.2 — Parameters and curtailment values for sequential sampling plans for tightened inspection, nonconformities per 100 items (Master table)

Sample size code letter[a]	n_0[b]	n_t[c]	Parameter[d]	Acceptance quality limit (AQL) in nonconformities per 100 items (normal inspection)[e]															
				0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
F	20	32	h_A	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	0,752	0,955	1,339
			h_R														0,936	1,365	1,498
			g														0,062 6	0,106 0	0,167
			Ac_t														2	3	5
G	32	50	h_A	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	0,916	1,075	1,324	1,372
			h_R													0,906	1,356	1,496	2,604
			g													0,045 6	0,071 5	0,101	0,141
			Ac_t													2	3	5	7
H	50	80	h_A	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	0,948	0,949	1,405	1,427	1,927
			h_R												0,909	1,496	1,531	2,617	2,851
			g												0,029 5	0,039 6	0,066 8	0,094 0	0,154
			Ac_t												2	3	5	7	12
J	80	125	h_A	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	0,885	0,958	1,366	1,429	2,029	2,483
			h_R											0,916	1,473	1,559	2,614	2,908	3,445
			g											0,017 0	0,025 1	0,040 1	0,057 4	0,097 0	0,146
			Ac_t											2	3	5	7	12	18
K	125	200	h_A	↓	↓	↓	↓	↓	↓	*	↓	↓	0,875	0,991	1,393	1,487	1,885	2,445	2,909
			h_R										0,925	1,483	1,583	2,619	3,029	3,597	4,615
			g										0,010 8	0,016 5	0,026 0	0,038 0	0,060 1	0,092 8	0,138
			Ac_t										2	3	5	7	12	18	27
L	200	315	h_A	↓	↓	↓	↓	↓	*	↓	↓	0,847	0,941	1,385	1,499	1,964	2,405	2,975	↑
			h_R									0,941	1,520	1,584	2,564	2,934	3,628	4,495	
			g									0,006 50	0,009 80	0,016 1	0,023 7	0,038 1	0,057 2	0,088 4	
			Ac_t									2	3	5	7	12	18	27	

a For sample size code letters A to E, use sampling plans from ISO 2859-1.

b n_0 is the corresponding single sample size.

c n_t is the curtailment sample size.

d Ac_t is the curtailment acceptance number.

e ↓ = means use the first sampling plan below the arrow.
↑ = means use the first sampling plan above the arrow. If no sampling plan is given, use the corresponding multiple sampling plan from ISO 2859-1.
* = means use the corresponding curtailed single sampling plan from ISO 2859-1 with Ac = 0.

Table B.3 — Parameters and curtailment values for sequential sampling plans for tightened inspection, percent nonconforming and nonconformities per 100 items (Master table)

Sample size code letter	n_0 [a]	n_t [b]	Parameter [c]	Acceptance quality limit (AQL) in percent nonconforming items (normal inspection) [d]															
				0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
M	315	500	h_A	↓	↓	↓	↓	*	↓	↓	0,819	0,902	1,391	1,495	1,930	2,329	2,788	↑	↑
			h_R								0,946	1,556	1,579	2,581	2,984	3,679	4,620		
			g								0,004 01	0,006 01	0,010 3	0,015 1	0,024 1	0,036 1	0,054 1		
			Ac_t								2	3	5	7	12	18	27		
N	500	800	h_A	↓	↓	↓	*	↓	↓	0,811	0,898	1,328	1,525	1,911	2,318	2,841	↑	↑	↑
			h_R							0,948	1,568	1,630	2,591	3,014	3,780	4,698			
			g							0,002 51	0,003 77	0,006 26	0,009 60	0,015 1	0,022 6	0,034 2			
			Ac_t							2	3	5	7	12	18	27			
P	800	1 250	h_A	↓	* ↓	*	↓	↓	0,843	0,931	1,392	1,451	2,050	2,488	3,017	↑	↑	↑	↑
			h_R						0,943	1,533	1,593	2,608	3,010	3,522	4,398				
			g						0,001 61	0.002 41	0,004 01	0,005 78	0,009 70	0,014 5	0,021 7				
			Ac_t						2	3	5	7	12	18	27				
Q	1 250	2 000	h_A	↓	*	↓	↓	0,816	0,900	1,331	1,514	1,902	2,318	2,894	↑	↑	↑	↑	↑
			h_R					0,948	1,568	1,629	2,610	3,045	3,819	4,713					
			g					0,001 01	0,001 51	0,002 51	0,003 82	0,006 01	0,009 01	0,013 7					
			Ac_t					2	3	5	7	12	18	27					
R	2 000	3 150	h_A	*	↑	↓	0,826	0,923	1,368	1,471	1,981	2,418	2,942	↑	↑	↑	↑	↑	↑
			h_R				0,946	1,542	1,608	2,615	3,020	3,654	4,581						
			g				0,000 635	0,000 960	0,001 59	0,002 33	0,003 81	0,005 72	0,008 58						
			Ac_t				2	3	5	7	12	18	27						
S	3 150	5 000	h_A	↑	↑	0,819								↑	↑	↑	↑	↑	↑
			h_R			0,948													
			g			0,000 401													
			Ac_t			2													

[a] n_0 is the corresponding single sample size.

[b] n_t is the curtailment sample size.

[c] Ac_t is the curtailment acceptance number.

[d] ↓ = means use the first sampling plan below the arrow.

↑ = means use the first sampling plan above the arrow. If no sampling plan is given, use the corresponding multiple sampling plan from ISO 2859-1.

* = means use the corresponding curtailed single sampling plan from ISO 2859-1 with Ac = 0.

The above parameters for sequential sampling plans are for both percent nonconforming items and nonconformities per 100 items.

Annex C
(normative)

Sampling plans for reduced inspection

This annex contains the tables of sequential sampling plans for reduced inspection.

Table C.1 shall be used when AQL is defined in terms of percent nonconforming, and the total number of inspected items does not exceed 315.

Table C.2 shall be used when AQL is defined in terms of percent nonconformities per 100 items, and the total number of inspected items does not exceed 315.

Table C.3 shall be used when AQL is defined either in terms of percent nonconforming or in terms of percent nonconformities per 100 items. The total number of inspected items may exceed 315.

Table C.1 — Parameters and curtailment values for sequential sampling plans for reduced inspection, percent nonconforming (Master table)

Sample size code letter[a]	n_0[b]	n_t[c]	Parameter[d]	Acceptance quality limit (AQL) in percent nonconforming items (normal inspection)[e]															
				0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
H	20	32	h_A	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	↓	0,860	0,861	1,161	1,162	1,179
			h_R												0,857	1,465	1,525	2,201	2,233
			g												0,071 6	0,096 0	0,158	0,240	0,282
			Ac_t												2	3	5	7	9
J	32	50	h_A	↓	↓	↓	↓	↓	↓	*	↑	↓	↓	0,916	0,917	1,329	1,423	1,573	1,663
			h_R											0,906	1,471	1,472	2,157	2,173	2,549
			g											0,045 6	0,061 2	0,104	0,158	0,188	0,242
			Ac_t											2	3	5	7	9	12
K	50	80	h_A	↓	↓	↓	↓	↓	*	↑	↓	↓	0,783	0,965	1,331	1,426	1,509	1,679	1,905
			h_R										0,925	1,454	1,540	2,449	2,450	2,793	3,057
			g										0,025 1	0,041 8	0,065 3	0,097 0	0,114	0,152	0,192
			Ac_t										2	3	5	7	9	12	15
L	80	125	h_A	↓	↓	↓	↓	*	↑	↓	↓	0,854	1,004	1,391	1,514	1,643	1,911	2,127	↑
			h_R									0,932	1,420	1,547	2,388	2,414	2,827	2,999	
			g									0,016 7	0,026 4	0,040 9	0,061 3	0,072 1	0,097 0	0,122	
			Ac_t									2	3	5	7	9	12	15	
M	125	200	h_A	↓	↓	↓	*	↑	↓	↓	0,949	0,953	1,400	1,533	1,609	1,853	2,103	↑	↑
			h_R								0,910	1,505	1,549	2,485	2,535	2,934	3,218		
			g								0,011 6	0,016 0	0,026 4	0,039 3	0,045 6	0,060 7	0,077 1		
			Ac_t								2	3	5	7	9	12	15		
N	200	315	h_A	↓	↓	*	↑	↓	↓	0,852	1,088	1,383	1,484	1,661	1,925	2,175	↑	↑	↑
			h_R							0,935	1,401	1,582	2,555	2,556	2,923	3,208			
			g							0,006 55	0,011 1	0,016 1	0,023 7	0,028 6	0,038 1	0,048 1			
			Ac_t							2	3	5	7	9	12	15			

a For sample size code letters A to E, use sampling plans from ISO 2859-1.

b n_0 is the corresponding single sample size.

c n_t is the curtailment sample size.

d Ac_t is the curtailment acceptance number.

e ↓ = means use the first sampling plan below the arrow.

↑ = means use the first sampling plan above the arrow. If no sampling plan is given, use the corresponding multiple sampling plan from ISO 2859-1.

* = means use the corresponding curtailed single sampling plan from ISO 2859-1 with Ac = 0.

Table C.2 — Parameters and curtailment values for sequential sampling plans for reduced inspection, nonconformities per 100 items (Master table)

Sample size code letter[a]	n_0[b]	n_t[c]	Parameter[d]	Acceptance quality limit (AQL) in nonconformities per 100 items (normal inspection)[e]															
				0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
H	20	32	h_A	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	↓	0,752	0,955	1,339	1,340	1,513
			h_R												0,936	1,365	1,498	2,574	2,575
			g												0,062 6	0,106 0	0,167	0,233	0,282
			Ac_t												2	3	5	7	9
J	32	50	h_A	↓	↓	↓	↓	↓	↓	*	↑	↓	↓	0,916	1,075	1,324	1,372	1,698	2,021
			h_R											0,906	1,356	1,496	2,604	2,605	2,680
			g											0,045 6	0,071 5	0,101	0,141	0,181	0,251
			Ac_t											2	3	5	7	9	12
K	50	80	h_A	↓	↓	↓	↓	↓	*	↑	↓	↓	0,948	0,949	1,405	1,427	1,600	1,927	2,216
			h_R										0,909	1,496	1,531	2,617	2,618	2,851	3,151
			g										0,029 5	0,039 6	0,066 8	0,094 0	0,113	0,154	0,195
			Ac_t										2	3	5	7	9	12	15
L	80	125	h_A	↓	↓	↓	↓	*	↑	↓	↓	0,885	0,958	1,366	1,429	1,725	2,029	2,254	↑
			h_R									0,916	1,473	1,559	2,614	2,615	2,908	3,161	
			g									0,017 0	0,025 1	0,040 1	0,057 4	0,072 1	0,097 0	0,121	
			Ac_t									2	3	5	7	9	12	15	
M	125	200	h_A	↓	↓	↓	*	↑	↓	↓	0,875	0,991	1,393	1,487	1,638	1,885	2,302	↑	↑
			h_R								0,925	1,483	1,583	2,619	2,620	3,029	3,184		
			g								0,010 8	0,016 5	0,026 0	0,038 0	0,045 1	0,060 1	0,078 6		
			Ac_t								2	3	5	7	9	12	15		
N	200	315	h_A	↓	↓	*	↑	↓	↓	0,847	0,941	1,385	1,499	1,703	1,964	2,216	↑	↑	↑
			h_R							0,941	1,520	1,584	2,564	2,566	2,934	3,271			
			g							0,006 50	0,009 80	0,016 1	0,023 7	0,028 7	0,038 1	0,047 9			
			Ac_t							2	3	5	7	9	12	15			

a For sample size code letters A to E, use sampling plans from ISO 2859-1.

b n_0 is the corresponding single sample size.

c n_t is the curtailment sample size.

d Ac_t is the curtailment acceptance number.

e ↓ = means use the first sampling plan below the arrow.
↑ = means use the first sampling plan above the arrow. If no sampling plan is given, use the corresponding multiple sampling plan from ISO 2859-1.
* = means use the corresponding curtailed single sampling plan from ISO 2859-1 with Ac = 0.

Table C.3 — Parameters and curtailment values for sequential sampling plans for reduced inspection, percent nonconforming and nonconformities per 100 items (Master table)

Sample size code letter	n_0 [a]	n_t [b]	Parameter [c]	Acceptance quality limit (AQL) in percent nonconforming items (normal inspection) [d]															
				0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0
P	315	500	h_A	↓	*	↑	↓	↓	0,819	0,902	1,391	1,495	1,666	1,930	2,138	↑	↑	↑	↑
			h_R						0,946	1,556	1,579	2,281	2,582	2,984	3,328				
			g						0,004 01	0,006 01	0,010 3	0,015 1	0,018 1	0,024 1	0,030 1				
			Ac_t						2	3	5	7	9	12	15				
Q	500	800	h_A	*	↑		↓	0,811	0,898	1,328	1,525	1,645	1,911	2,114	↑				
			h_R					0,948	1,568	1,630	2,591	2,599	3,014	3,421					
			g					0,002 51	0,003 77	0,006 26	0,009 60	0,011 3	0,015 1	0,018 8					
			Ac_t					2	3	5	7	9	12	15					
R	800	1 250	h_A	↑			0,843	0,931	1,392	1,451	1,732	2,050	2,280	↑					
			h_R				0,943	1,533	1,593	2,608	2,609	3,010	3,204						
			g				0,001 61	0,002 41	0,004 01	0,005 78	0,007 21	0,009 70	0,012 1						
			Ac_t				2	3	5	7	9	12	15						

a n_0 is the corresponding single sample size.

b n_t is the curtailment sample size.

c Ac_t is the curtailment acceptance number.

d ↓ = means use the first sampling plan below the arrow.

↑ = means use the first sampling plan above the arrow. If no sampling plan is given, use the corresponding multiple sampling plan from ISO 2859-1.

* = means use the corresponding curtailed single sampling plan from ISO 2859-1 with Ac = 0.

The above parameters for sequential sampling plans are for both percent nonconforming items and nonconformities per 100 items.

Annex D
(informative)

Average sample numbers for sequential sampling plans

The principal advantage of sequential sampling plans is the reduction in the average sample number. However, there exist disadvantages of sequential sampling (see Introduction). To evaluate possible profits from having small average sample numbers we need to know their values for particular sequential sampling plans. Unfortunately, there is no closed mathematical formula for the calculation of the average sample number in the case of sequential sampling. Thus, the average sample number for the given sequential sampling plan and the given quality level (in percent nonconforming or in nonconformities per 100 items) can be only found using numerical procedures. Approximate values of the average sample number (ASN) for the sequential sampling plans from this part of ISO 2859 are given in Tables D.1 and D.2 for selected values of quality levels. Table D.1 gives the values for percent nonconforming inspection, and Table D.2 is for nonconformities per 100 items inspection. It is worth noting that the sampling plans both for percent nonconforming inspection and for nonconformities per 100 items inspection are the same for sample size code letters M to Q. Moreover, statistical properties for these sample plans are practically the same for both types of inspection.

The sequential sampling plans from this part of ISO 2859 are matched with the corresponding (i.e. described by the same code letter and AQL) sampling plans from ISO 2859-1. This means that they have practically the same operating characteristic (OC) curves as the corresponding single sampling plans from ISO 2859-1. Matching of the sequential sampling plans from this standard and the corresponding single sampling plans from ISO 2859-1 is given in Tables D.3 and D.4. Thus, it is possible to index sequential sampling plans using the parameters (n_0 and Ac_0) of the corresponding single sampling plans from ISO 2859-1. Such indexation of Tables D.1 and D.2 allows the user to compare sample sizes of single sampling plans and average sample numbers of the corresponding sequential sampling plans. For each sampling plan, Tables D.1 and D.2 give the approximate values of the average sample number corresponding to the following four key quality levels:

a) zero (perfect quality level without any nonconforming item);

b) Q_{PR} (of the corresponding single plan with 95 % of probability of acceptance);

c) $100g$ (giving a large average sample number close to the maximum, where g is the parameter of the sequential sampling plan);

d) Q_{CR} (of the corresponding single plan with 10 % of probability of acceptance).

The values of Q_{PR} and Q_{CR} with respective associated risks $P_{\mathrm{r}}(Q_{\mathrm{PR}})$ and $P_{\mathrm{a}}(Q_{\mathrm{CR}})$ are given in Tables D.5 and D.6. Approximate values of the average sample number corresponding to process quality levels that are not tabulated may be found by interpolation.

EXAMPLE

The ISO 2859-1 sampling system has been used for inspection of a certain product. The specified AQL is 4,0 % nonconforming. Inspection level I is being used. The lot size (N) is 1 500 for each lot.

It is decided to use the sequential sampling scheme from this part of ISO 2859. For the inspection Level I and the lot size 1 500 we find from Table 1 that the sample size code letter is H. The parameters (h_{A}, h_{R} and g) and the curtailment values (n_{t} and Ac_{t}) of the sequential sampling plan are found in Table A.1. The parameters are as follows: $h_{\mathrm{A}} = 1{,}426$, $h_{\mathrm{R}} = 2{,}449$ and $g = 0{,}097$. The curtailment values are as follows: $n_{\mathrm{t}} = 80$ and $\mathrm{Ac}_{\mathrm{t}} = 7$. From Table 2A of ISO 2859-1:1999 or from Table D.3 of this part of ISO 2859 we find that the corresponding single sampling plan is given by ($n_0 = 50$, $\mathrm{Ac}_0 = 5$).

From Table D.5, we find that for the chosen sequential sampling plan, the producer's risk quality (Q_{PR}) equals 5,357 1 % (with the actual producer's risk equal to 5,002 3 %), and the consumer's risk quality (Q_{CR}) equals 17,761 8 % (with the actual consumer's risk equal to 10,078 6 %). When the quality of submitted lots is equal to Q_{PR}, from Table D.1 we find that the average sample number is 29,6 (i.e. 59,2 % of the sample size of the corresponding single sampling plan). When the quality of submitted lots is equal to Q_{CR}, from Table D.1 we find that the average sample number is 28,5 (i.e., 57,0 % of the sample size of the corresponding single sampling plan). When the quality of the submitted lot is perfect (no nonconforming items), from Table D.1 we find that the lot is accepted after the inspection of 15 items. In the worst case (i.e. quality level equal to $100g = 9{,}7$ %), the average sample number is equal to 39,3. This means that the average sampling costs are reduced by at least 20 %.

Table D.1 — Average sample numbers for sequential sampling plans for percent nonconforming

n_0	$100p$	Ac_0											
	(%)	1	2	3	5	6	7	8	10	12	14	18	21
20	0	13	9	8	5	5	5						
	Q_{PR}	15,1	13,4	12,5	10,9	10,8	10,8						
	$100g$	15,8	15,9	15,4	15,1	14,8	15,6						
	Q_{CR}	9,74	10,3	10,3	11,7	11,5	13,0						
32	0	21	15	13	10	9	8	7	6				
	Q_{PR}	24,3	21,8	19,9	18,5	18,2	17,9	17,8	16,8				
	$100g$	25,1	25,4	23,8	24,3	24,0	24,5	24,3	23,8				
	Q_{CR}	15,0	16,0	15,6	17,9	17,3	18,6	18,0	18,2				
50	0	32	24	21	15	14	13	12	10	9	9		
	Q_{PR}	38,0	33,8	31,8	29,6	29,2	28,3	27,9	27,1	26,5	26,0		
	$100g$	40,0	39,0	37,8	39,3	38,2	38,6	37,7	37,8	37,8	37,7		
	Q_{CR}	23,2	24,4	24,2	28,5	26,9	28,8	27,4	28,1	28,6	29,2		
80	0	52	39	35	25	23	21	20	18	16	15	13	11
	Q_{PR}	60,9	54,1	52,3	47,8	47,0	46,0	45,9	44,3	43,4	42,6	41,7	41,1
	$100g$	63,1	61,7	61,0	61,9	60,6	61,3	61,3	60,0	59,7	59,5	59,5	60,6
	Q_{CR}	36,5	38,2	38,4	43,4	41,4	44,0	43,3	42,9	43,5	44,0	45,0	47,4
125	0	82	60	54	40	36	34	31	28	25	23	20	18
	Q_{PR}	95,1	85,4	80,5	75,2	73,7	72,2	71,4	69,6	68,6	67,5	66,1	66,9
	$100g$	97,4	98,5	94,1	97,7	95,1	96,7	94,8	94,5	94,7	94,5	94,9	99,1
	Q_{CR}	56,7	60,0	59,3	68,7	64,8	69,4	66,3	67,4	68,6	69,5	71,4	78,8
200	0	131	99	86	63	59	54	51	46	41	39	33	30
	Q_{PR}	154	136	130	122	119	117	115	112	111	109	107	106
	$100g$	159	153	152	157	153	154	152	150	150	150	150	153
	Q_{CR}	90,8	94,4	94,4	109	104	109	105	105	107	108	110	116
315	0	205	151	136	100	93	85	81	72	65	60	52	46
	Q_{PR}	242	218	204	192	188	184	183	178	175	173	170	170
	$100g$	252	250	238	247	241	244	240	238	237	238	237	244
	Q_{CR}	143	150	148	171	163	172	165	167	169	171	175	187
500	0	324	239	213	159	146	136	127	113	103	94	84	74
	Q_{PR}	384	345	325	304	298	293	289	283	279	276	270	271
	$100g$	400	398	381	394	382	389	380	379	379	380	379	391
	Q_{CR}	227	239	235	273	256	274	261	266	270	274	279	302
800	0	524	387	348	252	241	215	212	189	172	159	140	124
	Q_{PR}	617	553	523	490	483	471	468	452	444	440	431	429
	$100g$	638	632	607	626	620	616	620	598	596	596	595	604
	Q_{CR}	361	378	375	428	418	429	428	414	418	423	429	448

Table D.1 (*continued*)

n_0	100p (%)	Ac_0 1	2	3	5	6	7	8	10	12	14	18	21
1 250	0	808	597	531	397	365	340	317	283	258	240	212	188
	Q_{PR}	956	862	809	760	744	733	722	707	698	688	676	678
	100g	997	992	948	982	951	971	947	945	946	945	947	974
	Q_{CR}	565	595	586	680	638	683	650	661	670	678	692	747
2 000	0	1 301	962	861	632	597	539	520	464	423	391	343	309
	Q_{PR}	1 535	1 377	1 301	1 224	1 203	1 174	1 167	1 130	1 112	1 099	1 080	1 077
	100g	1 594	1 577	1 515	1 567	1 542	1 542	1 531	1 499	1 496	1 495	1 495	1 523
	Q_{CR}	902	944	935	1 074	1 036	1 077	1 049	1 040	1 052	1 062	1 081	1 137
3 150	0	2043											
	Q_{PR}	2415											
	100g	2514											
	Q_{CR}	1423											

Table D.2 — Average sample numbers for sequential sampling plans for nonconformities per 100 items

n_0	100p (%)	Ac_0 1	2	3	5	6	7	8	10	12	14	18	21
20	0	13	10	9	6	6	5						
	Q_{PR}	15,2	13,7	13,2	12,1	12,0	12,1						
	100g	16,0	15,7	15,5	15,8	15,6	16,1						
	Q_{CR}	9,38	9,85	9,94	11,3	10,8	11,6						
32	0	21	16	14	10	10	9	9	8				
	Q_{PR}	24,2	21,7	20,9	19,9	19,7	18,8	18,6	18,2				
	100g	24,9	24,5	24,3	24,4	25,6	24,7	24,0	24,1				
	Q_{CR}	14,7	15,3	15,4	17,7	17,6	17,4	16,7	16,9				
50	0	33	24	22	16	15	14	13	12	11	10		
	Q_{PR}	38,1	34,4	32,5	30,6	30,3	29,4	28,9	28,3	27,9	27,5		
	100g	39,0	39,6	37,9	39,7	39,0	39,1	37,9	37,9	38,0	37,9		
	Q_{CR}	22,9	24,1	23,9	27,8	26,5	27,7	26,3	26,7	27,1	27,4		
80	0	53	39	35	25	24	22	21	19	18	16	14	13
	Q_{PR}	61,7	55,0	52,5	49,3	48,5	47,0	46,9	45,4	44,6	44,2	43,3	42,9
	100g	63,4	62,7	60,9	63,0	62,6	61,7	61,6	60,1	59,8	59,9	59,8	60,5
	Q_{CR}	36,4	38,0	37,9	43,3	42,5	43,0	42,4	41,8	42,1	42,6	43,1	44,7
125	0	82	61	54	40	37	34	32	30	27	25	22	19
	Q_{PR}	95,9	85,4	81,2	76,5	75,2	73,6	72,7	70,5	69,6	68,7	67,8	68,0
	100g	99,0	97,8	94,9	98,9	96,4	97,7	95,4	94,2	94,5	94,6	95,0	97,7
	Q_{CR}	56,7	59,4	59,0	68,6	64,9	68,9	65,5	65,9	67,0	67,7	69,4	74,5
200	0	131	97	87	64	60	56	52	47	43	40	35	31
	Q_{PR}	154	138	131	122	120	117	116	113	112	110	108	108
	100g	160	158	152	157	154	154	151	150	150	150	150	153
	Q_{CR}	90,6	94,9	94,0	108	103	107	103	104	106	107	108	114

Table D.3 — Matched sequential sampling plans for percent nonconforming

n_0	Seq. plan	Ac_0											
		1	2	3	5	6	7	8	10	12	14	18	21
20	h_A	0,860	0,861	1,161	1,162	1,179	1,337						
	h_R	0,857	1,465	1,525	2,201	2,233	2,659						
	g	0,071 6	0,096 0	0,158	0,240	0,282	0,334						
	Ac_t	2	3	5	7	9	10						
32	h_A	0,916	0,917	1,329	1,423	1,573	1,581	1,663	1,737				
	h_R	0,906	1,471	1,472	2,157	2,173	2,496	2,549	2,705				
	g	0,045 6	0,061 2	0,104	0,158	0,188	0,215	0,242	0,304				
	Ac_t	2	3	5	7	9	10	12	15				
50	h_A	0,783	0,965	1,331	1,426	1,509	1,657	1,689	1,905	2,105	2,185		
	h_R	0,925	1,454	1,540	2,449	2,450	2,777	2,793	3,057	3,195	3,443		
	g	0,025 1	0,041 8	0,065 3	0,097 0	0,114	0,136	0,152	0,192	0,234	0,273		
	Ac_t	2	3	5	7	9	10	12	15	18	21		
80	h_A	0,854	1,004	1,391	1,514	1,643	1,679	1,911	2,127	2,226	2,432	2,629	2,711
	h_R	0,932	1,420	1,547	2,388	2,414	2,826	2,827	2,999	3,316	3,466	3,919	4,386
	g	0,016 7	0,026 4	0,040 9	0,061 3	0,072 1	0,083 5	0,097 0	0,122	0,145	0,171	0,219	0,255
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31
125	h_A	0,949	0,953	1,400	1,533	1,609	1,802	1,853	2,103	2,272	2,457	2,731	2,732
	h_R	0,910	1,505	1,549	2,485	2,535	2,868	2,934	3,218	3,572	3,813	4,329	5,373
	g	0,011 6	0,016 0	0,026 4	0,039 3	0,045 6	0,054 6	0,060 7	0,077 1	0,091 9	0,108	0,139	0,159
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31
200	h_A	0,852	1,088	1,383	1,484	1,661	1,775	1,925	2,175	2,346	2,605	2,824	3,021
	h_R	0,935	1,401	1,582	2,555	2,556	2,922	2,923	3,208	3,563	3,741	4,380	4,933
	g	0,006 55	0,011 1	0,016 1	0,023 7	0,028 6	0,033 4	0,038 1	0,048 1	0,057 3	0,068 0	0,086 3	0,101
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31
315	h_A	0,819	0,902	1,391	1,495	1,666	1,777	1,930	2,138	2,329	2,495	2,788	2,832
	h_R	0,946	1,556	1,579	2,581	2,582	2,983	2,984	3,328	3,679	4,011	4,620	5,574
	g	0,004 01	0,006 01	0,010 3	0,015 1	0,018 1	0,021 1	0,024 1	0,030 1	0,036 1	0,042 1	0,054 1	0,062 1
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31
500	h_A	0,811	0,898	1,328	1,525	1,645	1,811	1,911	2,114	2,318	2,472	2,841	2,893
	h_R	0,948	1,568	1,630	2,591	2,599	2,999	3,014	3,421	3,780	4,160	4,698	5,749
	g	0,002 51	0,003 77	0,006 26	0,009 60	0,011 3	0,013 4	0,015 1	0,018 8	0,022 6	0,026 3	0,034 2	0,039 2
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31
800	h_A	0,843	0,931	1,392	1,451	1,732	1,744	2,050	2,280	2,488	2,685	3,017	3,084
	h_R	0,943	1,533	1,593	2,608	2,609	3,009	3,010	3,204	3,522	3,834	4,398	5,157
	g	0,001 61	0,002 41	0,004 01	0,005 78	0,007 21	0,008 14	0,009 70	0,012 1	0,014 5	0,016 9	0,021 7	0,024 9
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31
1 250	h_A	0,816	0,900	1,331	1,514	1,645	1,812	1,902	2,123	2,318	2,541	2,894	2,947
	h_R	0,948	1,568	1,629	2,610	2,611	3,018	3,045	3,443	3,819	4,111	4,713	5,750
	g	0,001 01	0,001 51	0,002 51	0,003 82	0,004 51	0,005 34	0,006 01	0,007 51	0,009 01	0,010 6	0,013 7	0,015 7
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31
2 000	h_A	0,826	0,923	1,368	1,471	1,707	1,765	1,981	2,211	2,418	2,603	2,942	3,050
	h_R	0,946	1,542	1,608	2,615	2,616	3,019	3,020	3,309	3,654	3,981	4,581	5,360
	g	0,000 635	0,000 960	0,001 59	0,002 33	0,002 86	0,003 28	0,003 81	0,004 77	0,005 72	0,006 67	0,008 58	0,009 90
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31
3 150	h_A	0,819											
	h_R	0,948											
	g	0,000 401											
	Ac_t	2											

Table D.4 — Matched sequential sampling plans for nonconformities per 100 items

n_0	Seq. plan	Ac_0											
		1	2	3	5	6	7	8	10	12	14	18	21
20	h_A	0,752	0,955	1,339	1,340	1,513	1,553						
	h_R	0,936	1,365	1,498	2,574	2,275	3,087						
	g	0,062 6	0,106	0,167	0,233	0,282	0,334						
	Ac_t	2	3	5	7	9	10						
32	h_A	0,916	1,075	1,324	1,372	1,698	1,887	2,021	2,108				
	h_R	0,906	1,356	1,496	2,604	2,605	2,679	2,680	3,088				
	g	0,045 6	0,071 5	0,101	0,141	0,181	0,218	0,251	0,301				
	Ac_t	2	3	5	7	9	10	12	15				
50	h_A	0,948	0,949	1,405	1,427	1,600	1,851	1,927	2.216	2,323	2,570		
	h_R	0,909	1,496	1,531	2,617	2,618	2,850	2,851	3,151	3,536	3,833		
	g	0,029 5	0,039 6	0,066 8	0,094 0	0,113	0,137	0,154	0,195	0,231	0,271		
	Ac_t	2	3	5	7	9	10	12	15	18	21		
80	h_A	0,885	0,958	1,366	1,429	1,725	1,768	2,029	2,254	2,483	2,620	3,038	3,221
	h_R	0,916	1,473	1,559	2,614	2,615	2,907	2,908	3,161	3,445	3,777	4,249	4,816
	g	0,017 0	0,025 1	0,040 1	0,057 4	0,072 1	0,083 5	0,097 0	0,121	0,146	0,169	0,219	0,255
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31
125	h_A	0,875	0,991	1,393	1,487	1,638	1,779	1,885	2,302	2,445	2,688	2,909	2,957
	h_R	0,925	1,483	1,583	2,619	2,620	3,021	3,029	3,184	3,597	3,869	4,615	5,619
	g	0,010 8	0,016 5	0,026 0	0,038 0	0,045 1	0,053 2	0,060 1	0,078 6	0,092 8	0,109	0,138	0,158
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31
200	h_A	0,847	0,941	1,385	1,499	1,703	1,878	1,964	2,216	2,405	2,659	2,975	3,040
	h_R	0,941	1,520	1,584	2,564	2,566	2,852	2,934	3,271	3,628	3,889	4,495	5,340
	g	0,006 5	0,009 8	0,016 1	0,023 7	0,028 7	0,034 1	0,038 1	0,047 9	0,057 2	0,067 4	0,088 4	0,099 0
	Ac_t	2	3	5	7	9	10	12	15	18	21	27	31

Table D.5 — Q_{PR}, Q_{CR} and associated risks of sequential plans by attributes for percent nonconforming (expressed in percent)

n_0	Para-meter	Ac₀											
		1	2	3	5	6	7	8	10	12	14	18	21
20	Q_{PR}	1,806 5	4,216 9	7,135 4	13,955 4	17,731 1	21,706 9						
	Q_{CR}	18,096 1	24,476 5	30,418 7	41,489 0	46,726 7	51,803 1						
	$P_r(Q_{PR})$	4,864 1	5,010 7	4,992 4	5,189 7	4,999 3	4,961 5						
	$P_a(Q_{CR})$	10,024 4	10,088 7	9,942 5	10,987 8	10,344 2	9,946 7						
32	Q_{PR}	1,121 9	2,604 3	4,384 5	8,495 5	10,744 7	13,0933	15,527 8	20,618 3				
	Q_{CR}	11,619 5	15,787 5	19,698 9	27,067 0	30,593 8	34,040 8	37,419 1	43,998 9				
	$P_r(Q_{PR})$	5,041 6	4,963 5	5,043 7	5,022 9	5,006 5	4,997 1	5,003 2	5,003 8				
	$P_a(Q_{CR})$	10,071 1	9,962 6	10,485 2	10,055 7	9,942 1	9,831 7	9,710 8	10,098 9				
50	Q_{PR}	0,715 4	1,655 2	2,778 8	5,357 1	6,759 7	8,218 5	9,724 8	12,855 7	16,117 5	19,488 5		
	Q_{CR}	7,558 1	10,295 9	12,875 6	17,761 8	20,113 1	22,419 2	24,687 4	29,129 7	33,468 3	37,720 3		
	$P_r(Q_{PR})$	5,004 5	5,010 6	5,018 3	5,002 3	5,003 4	4,998 3	5,012 5	4,996 0	5,010 3	4,998 6		
	$P_a(Q_{CR})$	10,062 0	9,962 0	10,086 0	10,078 6	9,831 2	10,091 5	10,029 1	10,041 7	10,014 3	10,023 4		
80	Q_{PR}	0,446 0	1,029 8	1,725 7	3,316 5	4,178 9	5,073 8	5,995 9	7,906 4	9,888 3	11,927 9	16,145 9	19,409 4
	Q_{CR}	4,775 2	6,516 0	8,160 3	11,285 0	12,793 1	14,275 2	15,735 6	18,603 7	21,415 2	24,181 2	29,603 7	33,591 9
	$P_r(Q_{CR})$	5,006 1	5,001 7	4,995 6	5,000 8	5,001 6	5,003 4	4,752 8	4,991 4	4,994 9	5,001 9	5,001 8	5,000 1
	$P_a(Q_{CR})$	10,161 2	10,053 3	9,842 2	10,025 0	9,995 6	10,008 8	9,888 3	9,950 6	9,987 9	10,012 7	9,980 9	9,986 0
125	Q_{PR}	0,285 0	0,657 3	1,100 3	2,110 8	2,657 4	3,224 1	3,807 3	5,018 5	6,262 1	7,544 4	10,188 1	12,226 2
	Q_{CR}	3,076 0	4,201 6	5,266 3	7,293 2	8,273 2	9,237 1	10,187 9	12,057 8	13,894 2	15,704 0	19,261 2	21,885 7
	$P_r(Q_{PR})$	5,002 8	4,997 6	5,001 9	4,996 9	5,006 3	5,000 0	4,997 1	5,001 8	5,000 5	5,002 2	5,000 7	5,000 6
	$P_a(Q_{CR})$	10,037 1	10,000 8	10,037 4	10,017 1	10,017 1	10,020 9	10,007 1	9,998 5	9,992 0	9,994 9	10,000 7	9,829 7
200	Q_{PR}	0,178 0	0,410 1	0,686 0	1,314 4	1,654 0	2,005 7	2,367 4	3,114 7	3,887 3	4,679 7	6,310 6	7,565 3
	Q_{CR}	1,930 9	2,639 1	3,309 7	4,587 9	5,206 4	5,815 3	6,416 2	7,599 0	8,761 8	9,908 9	12,167 1	13,835 8
	$P_r(Q_{PR})$	4,996 2	4,998 8	4,998 8	5,001 8	4,851 3	5,000 4	4,957 2	5,001 1	5,000 5	5,000 3	4,999 0	5,003 5
	$P_a(Q_{CR})$	9,971 1	10,000 1	9,991 4	9,998 5	9,980 9	10,002 6	9,961 6	10,001 8	10,005 2	9,992 4	10,004 8	10,020 2

Table D.5 (*continued*)

n_0	Parameter	Ac_0											
		1	2	3	5	6	7	8	10	12	14	18	21
315	Q_{PR}	0,112 9	0,260 1	0,434 9	0,832 7	1,047 5	1,269 9	1,498 5	1,970 7	2,458 1	2,957 9	3,985 5	4,775 2
	Q_{CR}	1,229 2	1,680 7	2,108 5	2,924 4	3,319 5	3,708 5	4,092 6	4,849 0	5,593 0	6,327 5	7,774 4	8,844 6
	$P_r(Q_{PR})$	5,002 3	5,002 8	4,993 1	5,003 8	4,894 6	5,005 3	4,949 8	5,006 1	4,999 3	5,001 7	4,998 5	4,999 7
	$P_a(Q_{CR})$	9,970 4	10,014 3	10,017 4	9,990 0	9,974 4	10,019 2	9,886 4	9,986 0	10,021 1	9,995 6	10,035 0	10,035 5
500	Q_{PR}	0,071 1	0,163 7	0,273 7	0,523 9	0,658 9	0,798 6	0,942 2	1,238 6	1,544 6	1,858 2	2,502 4	2,997 2
	Q_{CR}	0,775 7	1,060 9	1,331 2	1,847 0	2,096 9	2,343 0	2,586 0	3,064 7	3,535 7	4,000 9	4,917 7	5,596 2
	$P_r(Q_{PR})$	5,001 6	5,000 3	5,005 4	5,005 9	4,991 6	4,999 0	5,001 9	5,001 5	5,001 7	4,999 6	4,999 0	4,999 9
	$P_a(Q_{CR})$	9,989 6	10,031 8	9,993 7	10,013 3	10,020 6	10,036 6	10,024 5	10,038 9	9,997 4	9,982 9	10,045 4	10,041 8
800	Q_{PR}	0,044 4	0,102 3	0,171 0	0,327 1	0,411 4	0,498 5	0,588 1	0,773 0	0,963 8	1,159 2	1,560 7	1,868 9
	Q_{CR}	0,485 3	0,663 9	0,833 2	1,156 2	1,312 8	1,467 0	1,619 3	1,919 3	2,214 7	2,506 4	3,081 4	3,507 2
	$P_r(Q_{PR})$	4,997 0	4,998 7	5,007 6	5,003 3	4,625 8	5,004 2	4,546 4	5,009 0	5,006 3	5,005 4	5,001 9	5,002 2
	$P_a(Q_{CR})$	10,020 8	10,023 8	9,996 2	10,006 1	10,000 2	10,030 2	9,994 7	10,010 7	10,063 9	10,023 3	10,041 9	10,031 9
1 250	Q_{PR}	0,028 4	0,065 4	0,109 4	0,209 2	0,263 1	0,318 9	0,376 1	0,494 3	0,616 2	0,741 1	0,997 6	1,194 4
	Q_{CR}	0,310 8	0,425 2	0,533 7	0,740 7	0,841 0	0,939 9	1,037 5	1,229 9	1,419 2	1,606 3	1,975 1	2,248 2
	$P_r(Q_{PR})$	4,993 0	5,004 3	5,003 6	5,000 1	4,997 6	5,012 9	4,999 7	5,000 7	5,010 5	5,004 8	5,002 0	5,001 8
	$P_a(Q_{CR})$	10,059 1	10,075 9	10,081 9	10,089 8	10,086 7	10,044 1	10,094 0	10,090 3	10,057 3	10,069 0	10,060 1	10,090 7
2 000	Q_{PR}	0,017 8	0,040 9	0,068 3	0,130 7	0,164 4	0,199 2	0,235 0	0,308 7	0,384 9	0,462 9	0,623 0	0,745 8
	Q_{CR}	0,194 3	0,265 9	0,333 7	0,463 2	0,526 0	0,587 8	0,648 9	0,769 3	0,887 8	1,004 9	1,235 7	1,406 7
	$P_r(Q_{PR})$	5,000 7	5,003 0	5,006 7	5,019 2	4,750 5	5,001 5	4,799 1	5,000 3	4,999 8	5,000 2	5,001 6	4,998 4
	$P_a(Q_{CR})$	10,062 9	10,086 7	10,064 4	10,017 4	10,005 8	10,089 7	9,996 4	10,090 4	10,093 2	10,098 7	10,092 2	10,066 5
3 150	Q_{PR}	0,011 3											
	Q_{CR}	0,123 4											
	$P_r(Q_{PR})$	4,990 0											
	$P_a(Q_{CR})$	10,056 3											

Table D.6 — Q_{PR}, Q_{CR} and probabilities of acceptance of sequential plans by attributes for nonconformities per 100 items

n_0	Parameter	Ac_0											
		1	2	3	5	6	7	8	10	12	14	18	21
20	Q_{PR}	1,776 8	4,088 5	6,831 6	13,065 1	16,426 6	19,904 1						
	Q_{CR}	19,448 6	26,611 6	33,403 9	46,373 4	52,660 4	58,854 6						
	$P_r(Q_{PR})$%	5,085 7	5,059 2	4,894 1	4,993 6	4,828 3	5,022 4						
	$P_a(Q_{CR})$%	10,066 1	9,801 6	9,842 8	10,432 1	10,135 6	9,909 9						
32	Q_{PR}	1,110 5	2,555 3	4,269 7	8,165 7	10,266 6	12,440 1	14,672 6	19,278 1				
	Q_{CR}	12,155 4	16,632 3	20,877 4	28,983 4	32,912 7	36,784 1	40,608 5	48,145 8				
	$P_r(Q_{PR})$%	5,022 9	5,007 3	4,993 0	4,992 6	4,392 0	5,005 5	4,971 2	4,986 0				
	$P_a(Q_{CR})$%	10,315 7	10,083 5	10,055 1	9,982 8	9,810 5	9,944 3	9,874 1	10,014 0				
50	Q_{PR}	0,710 7	1,635 4	2,732 6	5,226 0	6,570 6	7,961 6	9,390 5	12,338 0	15,379 2	18,492 7		
	Q_{CR}	7,779 4	10,644 6	13,361 6	18,549 3	20,064 1	23,541 8	25,989 4	30,813 3	35,563 2	40,256 0		
	$P_r(Q_{PR})$%	5,002 0	5,013 3	4,959 8	4,988 9	4,840 2	5,000 5	4,990 7	5,000 2	4,997 8	4,996 8		
	$P_a(Q_{CR})$%	10,062 4	10,065 3	10,016 6	10,056 8	9,812 7	9,920 2	10,015 0	9,997 0	9,983 8	10,027 4		
80	Q_{PR}	0,444 2	1,022 1	1,707 9	3,266 3	4,106 6	4,976 0	5,869 0	7,711 3	9,612 0	11,557 9	15,552 4	18,617 2
	Q_{CR}	4,862 2	6,652 9	8,351 0	11,593 3	13,165 1	14,713 6	16,243 4	19,258 3	22,227 0	25,160 0	30,945 4	35,230 3
	$P_r(Q_{PR})$%	5,019 6	5,015 2	5,005 8	4,995 7	4,542 4	4,999 0	4,736 8	4,998 5	5,000 0	4,998 6	5,001 1	5,002 9
	$P_a(Q_{CR})$%	9,955 2	10,021 6	9,955 6	10,012 3	10,046 3	9,994 2	9,956 3	10,009 3	10,033 7	10,009 2	10,007 7	9,997 7
125	Q_{PR}	0,284 3	0,654 2	1,093 1	2,090 4	2,628 3	3,184 7	3,756 2	4,935 2	6,151 7	7,397 1	9,953 6	11,915 0
	Q_{CR}	3,111 8	4,257 9	5,344 6	7,419 7	8,425 7	9,416 7	10,395 8	12,325 3	14,225 3	16,102 4	19,805 0	22,547 4
	$P_r(Q_{PR})$%	5,010 2	5,001 1	4,991 8	4,998 4	4,916 9	5,001 0	5,000 0	5,000 6	5,002 5	4,999 8	4,997 7	5,001 0
	$P_a(Q_{CR})$%	9,942 1	10,011 3	9,995 6	9,994 8	9,937 1	9,998 3	9,962 7	9,994 7	9,997 8	9,994 5	10,000 0	9,997 3
200	Q_{PR}	0,177 7	0,408 8	0,683 2	1,306 5	1,652 7	1,990 4	2,347 6	3,084 5	3,844 8	4,623 2	6,221 0	7,446 9
	Q_{CR}	1,944 9	2,661 2	3,340 4	4,637 3	5,266 0	5,885 5	6,497 4	7,703 3	8,890 8	10,064 0	12,378 1	14,092 1
	$P_r(Q_{PR})$%	4,994 8	5,002 2	5,003 4	5,000 9	4,837 6	4,998 8	4,997 1	5,001 6	4,999 5	4,999 4	4,999 4	5,000 0
	$P_a(Q_{CR})$%	9,994 6	9,999 2	9,979 5	10,004 5	9,967 8	10,000 1	10,001 3	10,002 4	9,998 4	9,994 3	9,997 4	9,995 0

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