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**Acceptance sampling procedures based  
on the allocation of priorities principle  
(APP) —**

Part 2:

**Coordinated single sampling plans for  
acceptance sampling by attributes**

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*Règles d'échantillonnage pour acceptation fondées sur le principe  
d'attribution de priorités (APP) —*

*Partie 2: Plans d'échantillonnage simple coordonnés pour  
l'échantillonnage pour acceptation par attributs*



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## Foreword

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

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 13448-2 was prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 5, *Acceptance sampling*.

ISO 13448 consists of the following parts, under the general title *Acceptance sampling procedures based on the allocation of priorities principles (APP)* (standards.iteh.ai)

- *Part 1: Guidelines for the APP approach* [ISO 13448-2:2004](https://standards.iteh.ai/catalog/standards/sist/af86ec5a-2d62-4348-a57a-7801693c4dc7/iso-13448-2-2004)
- *Part 2: Coordinated single sampling plans for acceptance sampling by attributes* <https://standards.iteh.ai/catalog/standards/sist/af86ec5a-2d62-4348-a57a-7801693c4dc7/iso-13448-2-2004>

## Introduction

This part of ISO 13448 provides single sampling plans for inspection of lots by attributes. All subjective and objective information of the supplier's capability to provide the desired quality, including any certification of its quality management system to ISO 9001 or an equivalent standard, may be taken into account by the customer or a third party when deciding on his sampling plan, thus allowing smaller sample sizes when the information is favourable.

This part of ISO 13448 is applicable also in the case where successive sample inspections are performed on the same lot by different parties (i.e. producer, customer and/or a third party), allowing each party independence of choice of sampling plan, needing only to coordinate their sampling plans with specific requirements such as customer's or producer's risks. This feature enables each party to organise inspection in accordance with its own resources and significantly reduces the chance of different parties obtaining conflicting results due to sampling variability.

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# Acceptance sampling procedures based on the allocation of priorities principle (APP) —

## Part 2: Coordinated single sampling plans for acceptance sampling by attributes

### 1 Scope

This part of ISO 13448 provides attributes sampling procedures and single sampling plans for successive independent inspections of the same lot conducted by the supplier, customer and/or a third party.

This part of ISO 13448 addresses:

- supplier inspection (final inspection, product certification upon supplier's request);
- customer inspection (incoming inspection, surveillance, acceptance sampling);
- third party inspection.

This part of ISO 13448 may also be applicable when only one inspection is needed.

A catalogue of single sampling plans is given, indexed by the normative quality limits (NQLs).

This part of ISO 13448 provides sampling procedures for:

- finished product;
- components and discrete items;
- operations;
- discrete items and the processes that produce them;
- data and records.

Attributes sampling procedures are provided for inspection of an isolated lot or a continuing series of lots of a discrete product. These procedures are applicable when a normative quality limit (NQL) is given and expressed in terms of percent nonconforming or nonconformities per 100 items.

This part of ISO 13448 provides a co-ordinated system of supplier, customer and third party acceptance sampling procedures. It is also applicable to the case where a supplier individually, or on agreement with a customer, in a contract, specifies a lot quality criterion expressed in terms of an NQL. In either case, it provides a coherent methodology for designating lots as satisfactory or unsatisfactory for shipment and proposed use.

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

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

ISO 2859-3, *Sampling procedures for inspection by attributes — Part 3: Skip-lot sampling procedures*

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

ISO 8258:1991, *Shewhart control charts*

ISO 8422:1991, *Sequential sampling plans for inspection by attributes*

ISO 9000:2000, *Quality management systems — Fundamentals and vocabulary*

ISO 13448-1, *Acceptance sampling procedures based on the allocation of priorities principles (APP) — Part 1: Guidelines to the APP approach*

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## 3 Terms, definitions, symbols and abbreviations

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### 3.1 Terms and definitions

ISO 13448-2:2004

For the purposes of this document, the terms and definitions given in ISO 3534-2, ISO 9000:2000, ISO 13448-1 and the following apply.

#### 3.1.1

##### normative quality limit

##### NQL

limiting value of the lot quality level specified for the purpose of acceptance as a guaranteed lot quality level

NOTE A limiting quality (LQ) may also be considered to be a guaranteed lot quality level although in that case the guarantee is assured only by a sampling plan that has a low probability of acceptance when the lot is of the limiting quality (LQ). Normally it requires large sample sizes. A specified NQL should be considered as a lot quality level guaranteed in part by a sampling plan and in part through supplementary evidence supporting the supplier's capability to satisfy the specified requirements. A sampling plan for LQ is utilized in the case of prior distrust in the lot quality. A sampling plan for a NQL depends on the level of trust in the lot quality and encourages a supplier to submit evidence other than the inspection data in support of the declared quality. In a variety of situations, it allows a considerable decrease in the cost of inspection for both the supplier and the customer.

#### 3.1.2

##### satisfactory lot

lot for which the actual quality level is no worse than the specified NQL

#### 3.1.3

##### unsatisfactory lot

lot for which the actual quality level is worse than the specified NQL



### 3.1.4 customer's risk on supplier inspection

 $\beta_0$ 

for an acceptance sampling plan fixed by the supplier, the maximum probability of classifying a lot as satisfactory when the actual lot quality level is worse than the specified NQL

### 3.1.5 supplier's risk on customer inspection

 $\alpha_0$ 

for an acceptance sampling plan fixed by the customer, the maximum probability of classifying a lot as unsatisfactory when the actual lot quality level is no worse than the specified NQL

### 3.1.6 arbitration situation

situation which arises due solely to sampling variation when a customer rejects the lot which was previously accepted by the supplier on supplier inspection with the same quality level

### 3.1.7 arbitration characteristic curve

probability that a lot with a specific quality level will be classified as satisfactory by the sampling plan used by the supplier and as unsatisfactory by the sampling plan used by the customer

### 3.1.8 inspecting party

any party which organizes and conducts sampling inspection of the lot for the purpose of acceptance

NOTE An inspecting party may be the supplier, the customer, or a third party.

### 3.1.9 trust level

form of a customer's estimate of the weight of prior, supplementary and indirect evidence of the supplier's capabilities to fulfil the specified quality requirements

### 3.1.10 supplier

organization or person that provides a product

### 3.1.11 customer

organization or person that receives a product

## 3.2 Symbols and abbreviations

Ac	acceptance number
$n$	sample size
$N$	lot size
NQL	normative quality limit
$p$ chart	Shewhart control chart for percent nonconforming
Re	rejection number
T1 to T7	trust levels
$u$ chart	Shewhart control chart for number of nonconformities per item
UCL	upper control limit introduced in Shewhart control charting

- $\alpha_0$  supplier's risk on customer inspection
- $\beta_0$  customer's risk on supplier inspection
- $\gamma_0$  confidence level on supplier inspection

## 4 Selection from among sampling systems by attributes

### 4.1 Relationship between sampling systems

An acceptance sampling system of this part of ISO 13448 is supplementary to ISO 2859-1, ISO 2859-2, ISO 2859-3 and ISO 8422. Refer to the guidelines given in 4.2 to 4.4 for the most suitable selection from these International Standards.

### 4.2 Suitable environments for applying ISO 13448-2

An ISO 13448-2 sampling system may be applicable when the following conditions are satisfied:

- a) an inspection of the same lot is initially conducted by the supplier on final inspection, and then by the customer on incoming inspection (occasionally by a third party);
- b) a long-term relationship between the supplier and the customer exists or is anticipated;
- c) prior information is available about the supplier's capability to meet, or not to meet, the specified requirements;
- d) a supplier's responsibility for a quality guarantee, involving a sampling inspection, has been agreed upon in the contract;
- e) both parties are interested in making the inspection procedure more cost-effective.

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Under these conditions, the use of ISO 13448-2 may be profitable. As quality improves, the inspection cost may be significantly reduced in one of two ways:

- by reducing the sample size for customer incoming inspection up to the point when an inspection may be abandoned altogether;
- by reducing the sample size for supplier final inspection to the extent that the customer may sanction shipment of the lot without final supplier inspection.

Information on the effectiveness of the quality system, the statistical process control methods being used, the preventative actions being undertaken and any other relevant information may be considered by the customer in determining an appropriate lot quality guarantee and for specifying the degree of severity of supplier lot quality inspection to be performed.

### 4.3 Suitable environments for applying ISO 2859-1, ISO 2859-3 and ISO 8422

Use of ISO 2859-1, ISO 2859-3 and ISO 8422 sampling systems is beneficial in the following situations:

- a) sampling inspection is conducted by a single party only (normally by the customer);
- b) a continuing series of lots from a long-run production is considered;
- c) lots are inspected in the same sequence as they are produced.

The switching rules outlined in ISO 2859-1, ISO 2859-3 and ISO 8422 may give the supplier an incentive for improving the quality level, while the purchaser may expect tolerable protection.

#### 4.4 Suitable environments for applying ISO 2859-2

Use of an ISO 2859-2 sampling plan is advantageous when

- a) acceptance sampling is conducted by a single party only (normally by the supplier);
- b) a unique or isolated lot is inspected;
- c) there is no relevant prior information on the supplier's capabilities to meet quality requirements in preparing an inspection;
- d) there is no long-term partnership between the supplier and the customer;
- e) large sample sizes are practicable.

Under these conditions ISO 2859-2 is reasonably supportive for the customer.

### 5 Lot quality

#### 5.1 Lot quality measures

For the purpose of this part of ISO 13448, a lot quality level is described in terms of either percent nonconforming or nonconformities per 100 items.

#### 5.2 Satisfactory and unsatisfactory lots

For the purpose of this part of ISO 13448, in concluding a contract, the supplier and the customer should agree and specify an associated normative quality limit NQL from among the preferred levels. It is regarded as a guaranteed value for the actual quality level of an isolated lot, or separate lot in a sequence.

This part of ISO 13448 cannot be used prior to the selection of an appropriate NQL.

#### 5.3 Types of requirements

For the purposes of this part of ISO 13448, the normative quality limit NQL should be expressed in terms of either percent nonconforming or number of nonconformities per 100 items.

#### 5.4 Preferred NQLs

The NQLs presented in the tables of this part of ISO 13448 are preferred values. For any other values of NQL, this part of ISO 13448 does not apply. Small values of the NQL are incompatible with small lot sizes. If in any doubt, it is advisable to refer to Table 1 before designating an NQL value for the given lot size.

In cases when Table 1 suggests NQL values that may be far too large and unsuitable for a particular situation, shifting to smaller NQL values may lead to a requirement of zero nonconforming items or nonconformities in a lot, which are equivalent requirements. This corresponds to setting the NQL to zero (see Clause 12).

#### 5.5 Disposition of unsatisfactory lots

A customer is normally concerned with the quality of the lot as an integrated whole. A nonconforming item should be regarded as a loss to the customer to be compensated in some way. However, when a critical number of these items have been found, an additional loss can be imposed on the supplier. This can be illustrated by the common situation where the product supplied is to be used in the customer's production process. The designation of an NQL does not imply that a supplier may knowingly ship nonconforming items. Nevertheless, no lot that is usable for its intended application may be rejected. A customer should not submit a claim for a whole unsatisfactory lot if a supplier is prepared to replace, or repair, nonconforming items and

compensate for the customer's inconvenience, unless the proportion of nonconforming items in the lot is so excessive that there is a further consequential loss to the customer.

## 6 Limits for other party's risk

### 6.1 Supplier's sampling plans

#### 6.1.1 Assignment of a customer's risk on supplier inspection

For contractual and long-term practical use, a limit for the customer's risk on supplier inspection should be assigned.

NOTE A customer's risk on supplier inspection does not correspond to the actual customer's risk. A customer's risk is a limit for the probability of acceptance on supplier sampling inspection given that an unsatisfactory lot is being supplied. An actual customer's risk denotes the probability both that the lot to be supplied is unsatisfactory and that it is accepted on supplier final inspection.

When a customer's estimate of the probability of an unsatisfactory lot being produced is relatively small, a stringent restriction for the probability of accepting this lot (a customer's risk on supplier inspection  $\beta_0$ ) is inappropriate for it leads to unnecessarily large samples and inspection costs on supplier inspection. This in turn leads to increases in production costs and prices. A customer should request the supplier to produce convincing indirect evidence of his capacity to manufacture the required quality. The more convincing this evidence is, the more relaxed the limitation on the customer's risk on supplier inspection that may be set.

Therefore, if the probability of manufacturing an unsatisfactory lot is small, the actual customer's risk will not be great either, even with large values of a customer's risk on supplier inspection (see ISO 13448-1).

In the ISO 13448 sampling system, when estimating the probability of producing an unsatisfactory lot and designating a customer's risk on supplier inspection, all available measures concerning the supplier's capabilities to meet the requirements should be taken into account.

#### 6.1.2 Trust levels

This part of ISO 13448 provides trust levels in accordance with which the customer may qualify his appraisal of the supplier's capabilities and designate a preferred value  $\beta_0$  of the customer's risk on supplier inspection (see the recommended criteria for assigning an appropriate trust level, provided in Table 2).

The mere fact that a supplier meets the requirements set out in Table 2 does not automatically imply product compliance. Therefore, for the purposes of implementing this part of ISO 13448, the customer should assign an appropriate trust level depending on all prior information available.

Under appropriate conditions, the quality information from previous lots may be used to modify a trust level and, as a result, shift to another sampling inspection plan.

#### 6.1.3 Supplementary trust levels

In some cases, for instance on acceptance sampling for important safety parameters, a sampling plan on supplier inspection for  $\beta_0$  falling between 0,1 and 0 may be required. Then tables given in other ISO standards apply.

### 6.2 Customer's sampling plans

The risk  $\alpha_0$  of rejecting a satisfactory lot on customer's inspection and submitting an unjust claim to the supplier, compelling the supplier to provide compensation for an unsatisfactory lot, should be limited. In this part of ISO 13448, the supplier's risk on customer inspection  $\alpha_0$  is fixed at 0,05.

Table 1 — Relation of lot size to NQL

Lot size	Normative quality limit (NQL) <sup>a</sup> % or number of nonconformities per 100 items													
	0,15	0,25	0,4	0,65	1,0	1,5	2,5	4,0	6,5	10,0	15	25	40	≥ 65
2														∇
3													∇	∇
4 to 6												∇	∇	∇
7 to 9											∇	∇	∇	∇
10 to 15										∇	∇	∇	∇	∇
16 to 24									∇	∇	∇	∇	∇	∇
25 to 39								∇	∇	∇	∇	∇	∇	∇
40 to 66							∇	∇	∇	∇	∇	∇	∇	∇
67 to 99						∇	∇	∇	∇	∇	∇	∇	∇	∇
100 to 153					∇	∇	∇	∇	∇	∇	∇	∇	∇	∇
154 to 249				∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇
250 to 399			∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇
400 to 666		∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇
> 667	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇

<sup>a</sup> ∇ means that the NQL is available for the given range of lot sizes.

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**Table 2 — Table for seven levels of trust in prior information about the supplier's capabilities to meet specified requirements**

Trust level in supplier's capabilities	Customer's risk and confidence level on supplier inspection
<p>T7 Full (absolute) trust in the supplier's capabilities</p> <p>Corresponds to availability of a supplier's certificate for his quality system in compliance with ISO 9001, national or international quality awards, a tested manufacturing model, unimpeachable reputation of the supplier, presence of "quality history" confirming supplier's ability to ensure the customer's quality requirements, implementation of statistical process control and/or long-term period of lot shipment without claims, supplier's devotion to TQM, etc.</p>	<p><math>\beta_0 = 1; \gamma_0 = 0</math></p> <p>(shipment of finished product without supplier inspection)</p>
<p>T6 High level of trust in the supplier's capabilities</p> <p>Corresponds to availability of a supplier's certificate for his quality system in compliance with ISO 9001, national or international quality awards, implementation of statistical process control and positive experience obtained from long-term orders, partial supplier's involvement in TQM activities</p>	<p><math>\beta_0 = 0,9; \gamma_0 = 0,1</math></p>
<p>T5 Average level of trust in the supplier's capabilities</p> <p>Corresponds to the availability of a supplier's certificate for the quality system in compliance with ISO 9001; implementation of statistical process control, long-term shipment of acceptable products</p>	<p><math>\beta_0 = 0,75; \gamma_0 = 0,25</math></p>
<p>T4 Neutral (indifferent) attitude to the supplier's capabilities</p> <p>Corresponds to a lack of a certified quality assurance system but the following redeeming factors are taken into consideration: long-term shipment of lots of satisfactory quality, quality system assessment by the customer, partial implementation of statistical process control</p>	<p><math>\beta_0 = 0,5; \gamma_0 = 0,5</math></p>
<p>T3 Uncertain supplier's capabilities</p> <p>Corresponds to the lack of a certificate for the quality system and customer's experience of orders from the supplier, the absence of statistical quality control, but indirect positive data from other customers or customer communities</p>	<p><math>\beta_0 = 0,25; \gamma_0 = 0,75</math></p>
<p>T2 Unknown supplier's capabilities</p> <p>Corresponds to the lack of any reliable information about the supplier's capacity to ensure the required quality</p>	<p><math>\beta_0 = 0,1; \gamma_0 = 0,9</math></p>
<p>T1 Special level <sup>a</sup></p> <p>Corresponds to especially important safety and ecology parameters of products and the lack of prior information on the supplier's capabilities</p>	<p><math>\beta_0 = 0; \gamma_0 = 1</math></p> <p>(requiring 100 % inspection prior to shipment)</p>
<p><sup>a</sup> Special level T1 means resorting to 100 % inspection. Its implementation should be stipulated in relevant documents in cases when especially important parameters are inspected and when there is no information or unfavourable information on supplier's capabilities to ensure required quality. Switching to T1 shall not be carried out by the customer unilaterally, but only on the basis of a bilateral agreement. With the permission of the responsible authority. One may move up or down one trust level from the selected trust level to take into account the importance of the items being inspected.</p>	

**6.3 Permissible sampling plans**

Any sampling plan with a probability no greater than  $\beta_0$  (specified by the customer) of accepting a lot with a quality level worse than the NQL should be qualified as permissible on supplier inspection.

Any sampling plan with a probability no greater than  $\alpha_0$  (specified in this part of ISO 13448 as 0,05) of rejecting a lot with a quality level no worse than the NQL should be qualified as permissible on customer inspection.

For the purpose of acceptance, and regarding the provisions set out in this part of ISO 13448, an inspecting party should only adopt permissible plans.

## 6.4 Coordination of supplier's and customer's sampling plans

The sampling plans, satisfying 6.3 and distinct for both of the parties, should be made consistent with an NQL specified in a contract.

Coordinated plans will greatly reduce the chance of the supplier and the customer reaching different decisions on the acceptability of the same lot as a result of sampling variation (see ISO 13448-1).

## 6.5 Rule of the third party inspection

A third party should follow a permissible sampling procedure (either supplier or customer in accordance with 6.3) depending on whose interest it represents.

## 7 Inspecting party's risk

### 7.1 Supplier's sampling plans

Due to sampling variation, there is a possibility that the supplier will erroneously reject a satisfactory lot (i.e. one having a quality level that is better than the NQL) on supplier's inspection. This part of ISO 13448 enables a supplier to choose from among plans with supplier's risk on supplier inspection lower than 0,05.

### 7.2 Customer's sampling plans

Due to sampling variation, there is a possibility that the customer will erroneously accept an unsatisfactory lot (i.e. one having a quality level that is worse than the NQL) on customer's inspection.

As this decision is only concerned with customer's interests, the customer is entitled to limit the customer's risk on customer inspection in establishing a relevant plan or customer's risk quality (CRQ) for a fixed customer's risk on customer inspection.

## 8 Basic data

### 8.1 Supplier's sampling plans

The following data should be considered in establishing a sampling plan:

- a) NQL;
- b) trust level;
- c) lot size;
- d) supplier's estimate of the lot quality level based on the supplier's inspection of an isolated lot, or process quality level from a sequence of lots.

A lot size may be specified by the responsible authority without reference to the constraints imposed by this part of ISO 13448.

### 8.2 Customer's sampling plans

The following data are to be considered when establishing a sampling plan:

- a) NQL;
- b) lot size.