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

Part 1: Guidelines for the APP approach

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

Partie 1: Lignes directrices relatives à l'approche APP

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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 13448-1 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 principle (APP)*:

— *Part 1: Guidelines for the APP approach*

— *Part 2: Coordinated single sampling plans for acceptance sampling by attributes*

Introduction

The ISO 13448 series of International Standards provides a new acceptance sampling methodology in support of quality management. This could be beneficial for users of ISO 9001 or ISO 9004. This part of ISO 13448 gives guidance and explains the methodology, which is based on the “allocation of priorities principle” (APP). ISO 13448-2 provides attributes sampling plans. Development of ISO 13448-3, to provide variables sampling plans, is under consideration.

The procedures in the ISO 13448 series have considerable advantages under certain circumstances. A novel feature is the ability to use practically any type of prior objective and subjective information when determining the appropriate sampling plan. Examples of such information are inspection results for previous lots, certification of quality management systems as being in conformity with ISO 9001, quality control data and customers' subjective estimates of the supplier's capability to provide the desired quality, all of which may be summarized in a trust level. This allows a progressive reduction in sample size as the customer's trust in the producer increases.

Another advantage of the procedures arises when successive inspections of the same lot are carried out by different parties (i.e. customer, producer and/or a third party). In the past, it was generally accepted that the parties should use similar inspection plans or schemes. This could sometimes prove impossible, due to the parties having different resources and capabilities for inspection. Moreover, due to sampling variability, in up to 25 % of cases the use of similar inspection plans or schemes could result in contradictory results between two parties. This can lead to considerable effort being required to resolve disputes that could have been avoided from the very beginning. The APP enables each of the parties to organize inspection in accordance with its own resources and capabilities for inspection, thereby significantly reducing the probability of occurrence of contradictory results. The parties are not required to coordinate their sampling plans with each other, only with specific requirements of the sampling plans such as customer's or supplier's risks.

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

Part 1:
Guidelines for the APP approach

1 Scope

This part of ISO 13448 provides guidelines specifying the organizational principles of acceptance sampling in situations where the contract or the legislation provides for successive inspection to be carried out by different parties: the supplier, the customer and/or a third party.

These guidelines are designed for inspection of populations of any product supplied or delivered in discrete items in lots. They are applicable to

— supplier inspection (final inspection, product certification upon supplier's request),

— customer inspection (incoming inspection, audit inspection, acceptance sampling),

— third-party inspection (certification of product, inspection and supervision for observance of International Standard requirements, quality inspection carried out at the supplier, and/or customer, request),

where the quality levels and the lot acceptability criteria are specified unilaterally by the supplier or contractually by the supplier and the customer.

These guidelines are also applicable to situations when only one sampling inspection is actually needed.

NOTE Single sampling APP plans by attributes are given in ISO 13448-2.

The guidelines provided by this part of ISO 13448 may be applied in developing standards on acceptance sampling for standard inspection models, specific items or quality levels, as well as in developing contracts, specifications and instructions. In contractual use of the APP, the parties concerned should acknowledge in the contract that they approve of its principles (also by referring to the present guidelines). The parties may also provide for the use of the APP in disputes and arbitration.

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 3951, *Sampling procedures and charts for inspection by variables for percent nonconforming*

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

ISO 8423, *Sequential sampling plans for inspection by variables for percent nonconforming (known standard deviation)*

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

ISO 13448-2:2004, *Acceptance sampling procedures based on the allocation-of-priorities principle (APP) — Part 1: Coordinated single sampling plans for acceptance sampling by attributes*

3 Terms, definitions, symbols and abbreviated terms

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

3.1 Terms and definitions

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 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 not 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
β_0
for an acceptance sampling plan fixed by the supplier, the maximum probability of a decision that classifies 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
α_0
for an acceptance sampling plan fixed by the customer, the maximum probability of a decision that classifies a lot as unsatisfactory when the actual lot quality level is not worse than the specified NQL

3.1.6
schematic customer's risk at supplier inspection
β_a
maximum probability of accepting the lot when the lot quality level in a sequence of lots is unsatisfactory and the sampling scheme specified by a supplier is used

NOTE A schematic risk takes into account the probability of switching to inspection plans of differing severity.

3.1.7
schematic supplier's risk at customer inspection
α_a
maximum probability of non-acceptance of the lot when the lot quality level in a sequence of lots is satisfactory and the sampling scheme specified by a customer is used

NOTE A schematic risk takes into account the probability of switching to inspection plans of differing severity.

3.1.8
arbitration situation
situation which arises due to sampling variation when a customer rejects a lot which was accepted by the supplier on supplier inspection using the same quality level

3.1.9
arbitration characteristic curve
curve that provides a 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

3.1.10
inspecting party
any party that organizes and conducts sampling inspection of the lot for the purpose of acceptance

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

3.1.11
trust level
customer's estimate of the weight of prior, supplementary and indirect evidence of the supplier's capability to fulfill the specified quality requirements

3.1.12
supplier
organization or person that provides a product

NOTE Adapted from ISO 9000:2000, definition 3.3.6.

3.1.13
customer
organization or person that receives a product

NOTE Adapted from ISO 9000:2000, definition 3.3.5.

3.2 Symbols and abbreviated terms

Ac acceptance number

APP allocation of priorities principles

AQL acceptance quality limit

LQ limiting quality

NQL normative quality limit

TQM total quality management

n sample size

N lot size

T1 to T7 trust levels

α_0 supplier's risk on customer inspection

α_a schematic supplier's risk at customer inspection

β_0 customer's risk on supplier inspection

β_a schematic customer's risk at supplier inspection

4 General overview of quality

4.1 Quality measures

The most common measures of quality are the percentage of nonconforming items and the number of nonconformities per 100 items of product. However, in general cases there may be other characteristics, especially in the inspection of friable, liquid, or linearly or spatially stretched kinds of product. The particular quality measure is specified in standards, specifications or contracts.

NOTE The inspections organized on the basis of these guidelines are treated not as an instrument for economic and psychological pressure upon the supplier to enhance quality of the lots, but as an instrument for information support and determination of the relations among the parties mentioned above in matters of lot quality. Each party has the opportunity to protect its interests and rights while still observing the interests and rights of the other parties. Thus, the ISO 13448 system treats the supplier, customer and third-party inspection plans as an integrated and coordinated system.

4.2 Role of information on quality assurance

The efficiency resulting from using the principles stated in these guidelines increases with the degree of attention the supplier and customer pay to the quality assurance aspects of information. The efficiency depends on the amount and integrity of prior information (the more the amount of positive information and the greater its integrity, the less the amount of sampling that is required). Prior information is taken into account in defining initial data for choosing sampling plans (first of all in defining the customer's risk on supplier inspection) and in constructing sampling schemes. These guidelines treat acceptance sampling as one of the elements in the information processes among the parties. In other words, sampling procedures are treated together with all data on quality.

Annex A gives the main aspects of the allocation of priorities principle (APP).

Annex B gives recommendations for choosing the customer's risk for supplier inspection.

5 Selection of a sampling system

5.1 Relations between sampling systems

The acceptance sampling system of the present guidelines supplement ISO 2859, ISO 3951, ISO 8422 and ISO 8423. The following information should be referred to for the selection from these International Standards.

5.2 Continuing series of lots

The sampling systems described in ISO 2859-1, ISO 2859-3, ISO 3951, ISO 8422 and ISO 8423 are beneficial in the following situations:

a) a sampling inspection is conducted by a single party only (normally by the customer);

b) a continuing series of lots is considered;

c) the lots are inspected in the same sequence as those produced;

d) two or more suppliers are in competition;

e) the quality level is generally better than the AQL.

In this case, the switching rules given in ISO 2859-1, ISO 2859-3, ISO 3951, ISO 8422 and ISO 8423 can give the supplier a good incentive for improvement of the quality level, while purchasers can expect tolerable protection.

5.3 Separate lots

The ISO 2859-2 system is advantageous when:

a) acceptance sampling is conducted by a single party only;

b) a unique lot is produced or an isolated one inspected;

c) it is impossible, for some reason, to use prior information on the supplier's capabilities in order to meet the quality requirements;

d) a long-term business relationship between the producer and the customer is not presumed;

e) large sample sizes are available.

In this case, ISO 2859-2 is reasonably supportive for the customer.

5.4 Features of the ISO 13448 sampling system

The ISO 13448 sampling system may assist when:

a) inspection is first conducted by the supplier on final inspection and then, for the same lot, by the customer on incoming inspection (occasionally by a third party);

b) there is a long-term relationship between the producer and the customer;

c) prior information about the supplier's capabilities to meet specified requirements is available;

d) the supplier's responsibility for a quality guarantee involving a sampling inspection was agreed upon in the contract;

e) both parties are interested in reducing the cost of inspection.

Data relating to an effective quality system, statistical process control, preventative actions and other information may be considered by the customer for an approximate assessment of the strength of the lot quality guarantee and for specifying the degree of severity of supplier lot quality inspection to be performed.

6 Requirements for the quality of lots and relationships between the parties

6.1 Lot quality requirements

6.1.1 The form of lot quality requirements

Lot quality requirements should be specified in a contract and/or specification by agreement between the supplier and the customer.

The requirements should be specified in terms of the normative quality limits (NQLs).

If the requirements for lot quality levels are not specified in this way, the ISO 13448 sampling system is not applicable.

NOTE In non-contractual production, the requirements for the lot quality levels may be set in specifications and considered as supplier information about the quality of the lots produced.

6.1.2 Satisfactory and unsatisfactory lots

In compliance with the quality level set in a contract, the delivered production lots should be judged by the parties to be satisfactory lots (i.e. meeting specified requirements, see 3.1.2) or unsatisfactory lots (i.e. not meeting specified requirements, see 3.1.3). Thus any lot with a quality level better than the agreed NQL is considered to be a satisfactory lot. On the other hand, any lot with a quality level worse than the agreed NQL is considered to be an unsatisfactory lot.

6.1.3 Objectives

For individual and wholesale deliveries, the production lot becomes the object of relationships among the supplier, the customer and the third party and it is necessary to establish the criteria fixing the parties' relations regarding the lot of product. The allocation of priorities principle enables each party to make a free choice of sampling plans and schemes (see 8.3). Therefore, in the ISO 13448 sampling system, the lot quality criterion (NQL) should be specified regardless of the sampling plans, that is, applied for inspection of quality conformance. This is an essential distinction of the NQL from the AQL and the ISO 13448 sampling system from the ISO 2859 sampling system. NQL means that, in spite of the activities undertaken, including sampling and screening, the supplier cannot guarantee 100 % conformity of all items of product in a lot. However, the supplier guarantees that the actual quality level will not exceed the specified NQL. A complete guarantee is infeasible, not least due to sampling error and to errors inherent in the measurement and testing facilities and methods.

6.2 Relationships of the parties concerning lot quality

The supplier is obliged to deliver lots of satisfactory quality, i.e. corresponding to the specified requirements, with the submission of enough evidence of the adequacy of lot quality to satisfy the customer. On the other hand, the customer is not obliged to accept lots of unsatisfactory quality. On receipt of an unsatisfactory lot and after submission of the evidence to the supplier, the customer may return the whole lot or make the supplier undertake measures to ensure that the lot quality conforms to specified requirements.

It is wrong to believe that an NQL allows the supplier to deliver a percentage of the product that does not meet the requirements. The supplier is liable for the quality of each item of product. When a nonconforming item is found, the supplier should take every necessary measure to recompense the customer, including reclamation, repair or replacement of the nonconforming item even if the lot has been accepted.

6.3 Preventative measures

Information about the NQL allows the customer, and/or a supplier, to establish measures for preventing potential losses. In particular, a customer may specify in a contract the delivery of extra quantities of items if critical defects are found, establish the rules for introducing discounts depending on the NQL, or undertake other measures. Thus the NQL is the guaranteed information on lot quality for the customer and the basis for setting the relations among the parties.