TECHNICAL REPORT

ISO/TR 8550-1

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Guidance on the selection and usage of acceptance sampling systems for inspection of discrete items in lots —

Part 1: Acceptance sampling

Lignes directrices pour la sélection d'un système, d'un programme ou d'un plan d'échantillonnage pour acceptation pour le contrôle d'unités discrètes en lots —

Partie 1: Lignes directrices générales pour l'échantillonnage pour acceptation

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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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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/TR 8550-1 was prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 5, *Acceptance sampling*.

This first edition of ISO/TR 8550-1, together with ISO/TR 8550-2 and ISO/TR 8550-3, cancels and replaces ISO/TR 8550:1994.

ISO/TR 8550 consists of the following parts, under the general title *Guidance on the selection and usage of acceptance sampling systems for inspection of discrete items in lots*:

— *Part 1: Acceptance sampling*

— *Part 3: Sampling by variables*

The following part is under preparation:

— *Part 2: Sampling by attributes*

Introduction

This part of ISO/TR 8550 gives guidance on the selection of an appropriate acceptance sampling scheme for the inspection of discrete items submitted in lots from the schemes described in various national and international standards.

There are many situations where products (materials, parts, components, assemblies and systems) are transferred from one organization to another, where the organizations may be different companies or parts of a single company or even different shops within a plant. In these situations both the supplier and the customer may use acceptance sampling procedures to satisfy themselves that the product is of acceptable quality. Suppliers will be seeking to maintain a reputation for good quality and to reduce the likelihood of claims under warranty, but without incurring unnecessary production and supply costs. On the other hand, customers will require adequate evidence, at minimum cost to themselves, that the product they receive conforms to specifications. Compared with, say, 100 % inspection, suitable sampling methods will often be beneficial in achieving these aims. Sometimes acceptance sampling methods are the only practical procedure, especially when the tests for conformance are destructive.

Several types of sampling systems, schemes and plans are available for these purposes. They are presented in a number of ISO Standards that explain how they are to be used. However, it is often difficult to decide on the most appropriate procedure for use in a particular situation. The purpose of this part of ISO/TR 8550 is to assist in that decision.

The choice of sampling system, scheme or plan depends on a number of conditions and on the prevailing circumstances. In any supply situation, the first essential is that the supplier and the customer understand, and have agreed upon, the requirements and the basis for release and acceptance of the product, including any acceptance sampling methods to be used.

Lots that are non-acceptable cause difficulties for both supplier and customer. The supplier incurs additional costs in rework, scrap, increased inspection, damage to reputation and possibly loss of sales. Delays in delivery and re-inspection costs are a burden to the customer. For these reasons, it is usually considered essential for the supplier to provide lots that have a very high probability of being accepted, i.e. 95 % or more. The supplier has to ensure that quality control of the production or delivery process provides lots of a quality sufficient to meet this objective. A basic principle of some acceptance sampling inspection schemes is to promote the production of lots of acceptable quality. The primary purpose of these schemes is not to discriminate between acceptable and non-acceptable lots, i.e. to sort, but to keep production under control to yield an acceptable process average quality. Although all acceptance sampling plans are discriminatory to some degree, the process average quality (expressed in terms of percent nonconforming or number of nonconformities) should not be greater than half the acceptance quality limit in order to ensure a very high probability of acceptance.

The primary purpose of the ISO/TR 8550 series is to give guidance on the selection of an acceptance sampling system, scheme or plan. It does this principally by reviewing the available systems specified by various standards and showing ways in which these can be compared in order to assess their suitability for an intended application. The guide also indicates how prior knowledge of the manufacturing or service delivery process and quality performance might influence the choice of sampling system, scheme or plan, and likewise how the particular needs of the customer affect selection. Some specific circumstances encountered in practice are described and the method of choosing a plan is explained. Some checklists or pointers and tables are provided to assist users in selecting an appropriate system, scheme or plan for their purposes. Charts are included to illustrate the procedures to be followed in the selection process.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Guidance on the selection and usage of acceptance sampling systems for inspection of discrete items in lots —

Part 1:
Acceptance sampling

1 Scope

This part of ISO/TR 8550 gives general guidance on the selection of an acceptance sampling system, scheme or plan. It does this principally in the context of standards that either already exist or are presently under development. (For more detailed information about specific acceptance sampling systems, see ISO/TR 8550-2 for sampling by attributes or ISO/TR 8550-3 for sampling by variables.)

The guidance in this part of ISO/TR 8550 is confined to acceptance sampling of products that are supplied in lots and that can be classified as consisting of discrete items (i.e. discrete articles of product). It is assumed that each item in a lot can be identified and segregated from the other items in the lot and has an equal chance of being included in the sample. Each item of product is countable and has specific characteristics that are measurable or classifiable as being conforming or nonconforming (to a given product specification).

Standards on acceptance sampling are typically generic, as a result of which they can be applied to a wide variety of inspection situations. These include, but are not limited to, the following:

a) end items, such as complete products or sub-assemblies;

b) components and raw materials;

c) services;

d) materials in process;

e) supplies in storage;

f) maintenance operations;

g) data or records;

h) administrative procedures.

Although this part of ISO/TR 8550 is written principally in terms of manufacture and production, this should be interpreted liberally, as it is applicable to the selection of sampling systems, schemes and plans for all types of products and processes as defined in ISO 9000.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition listed applies. For undated references, the latest edition of the referenced document (including any amendment) applies.

ISO 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

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

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

3 Terms and definitions

For the purposes of this part of ISO/TR 8550, the terms and definitions given in ISO 3534-1, ISO 3534-2 and ISO 9000 apply.

4 Abuses and uses of acceptance sampling

4.1 Abuses of acceptance sampling

Acceptance sampling has become unpopular since the early 1980s. Some of the reasons for this (although certainly not all) are well founded, so it is important to be able to distinguish those situations where acceptance sampling should not be used from those where it may be appropriate.

The chief arguments used against the use of acceptance sampling are as follows.

a) When quality is generally very high, the sample sizes needed to detect a slip in quality are uneconomically large.

b) Quality cannot be inspected into a product.

c) It is far better to establish a robust design and to implement comprehensive process controls than to try to find and eliminate nonconforming items after manufacture.

d) Most acceptance sampling standards are indexed in terms of acceptable quality level (AQL). Once an AQL has been established and quality has been brought sufficiently below the AQL to achieve high probabilities of lot acceptance, there is no incentive for the producer to try continuously to improve quality.

e) Quoting an AQL is tantamount to granting a licence to produce defects.

f) The only acceptable quality level is zero defects.

These arguments are examined in turn in the following subclauses.

4.2 Example 1

The following simplified example, devised by Baillie [18], demonstrates how the optimum sampling plan can vary according to the quality level against which it is desired to guard. A certain item is produced in lots of size 10 000, with a unit production cost of £10,00. The selling price per item is £a in accepted lots and at a discounted price of £0,50 in lots non-accepted by the acceptance procedure. Testing is destructive, and the cost of testing each item is £1,00. The downstream cost (e.g. warranty cost plus loss of goodwill) of a nonconforming item in an accepted lot is £10 000, but zero in non-accepted lots sold at a discount. Historical data indicate that the process fraction nonconforming is p for 99 % of lots, but that it unaccountably and randomly slips to 100p for 1 % of the lots. A single sampling plan by attributes is to be used, i.e. a random sample of size n is to be selected from each lot, and the lot is to be considered acceptable if the sample contains no more than Ac nonconforming items. What is the optimal sampling plan, i.e. the plan that maximizes the profit per item sold?

Mathematical details are provided in Annex A for information. Table 1 shows the optimal sampling plan for a range of values of the process quality level p. The results are instructive.

