International Standard ISO 2859/2

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

Règles d'échantillonnage pour les contrôles par attributs — Partie 2: Plans d'échantillonnage pour les contrôles de lots isolés, indexés d'après la qualité limite (QL)

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 2859/2 was prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*. It replaces, in part, the first edition of ISO 2859, published in 1974.

NOTE — ISO 2859/2 was originally circulated as ISO/DIS 7362.

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0 Introduction

0.1 General

ISO 2859 comprises four parts:

Part 0: General introduction.

Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.

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

Part 3: Skip lot sampling plan.

ISO 2859/1 sampling plans, indexed in terms of AQL, which is defined as a process average, were primarily designed for the assessment of a continuing series of lots. This enables switching rules to be employed which not only give protection to the consumer (by the switch to tightened inspection and discontinuation where necessary) but also provide an incentive to the producer (by the switch to reduced inspection) with a reduction to test and inspection costs (when consistently good quality is achieved). However, there is little doubt that in many industrial situations today the switching rules are not applied for a variety of reasons or excuses, not all of which may be valid:

a) individual ISO 2859/1 plans are used alone but "AQL" protection is still claimed or AQL re-defined, to suit "so-called unique products";

b) "our industry... product is special so ISO 2859/1 standard plans need not apply to us";

c) production is intermittent (not continuous);

d) production is from several different sources in varying quantities, i.e. "job lots";

e) purchases are from stock-holders — no source data available;

f) lots are "small" (use of hypergeometric distribution required);

g) lots are "isolated";

h) lots are re-submitted after initial rejection.

Consequently, in certain of the above cases consumer protection may need to be attained or measured by other methods. This part of ISO 2859 uses the limiting quality to measure consumer protection. It should be remembered, however, that prior information on the supplier's quality assurance system and its effectiveness may play a major part in deciding whether or not to accept a single lot.

0.2 Objectives

In an attempt to reconcile the somewhat diverse requests for assistance made over the past few years by committees of international standardizing bodies representing various product sectors, this part of ISO 2859 was drawn up in accordance with the following principles:

a) the new LQ plans can be easily integrated with the existing AQL plans in ISO 2859/1;

b) the LQ indexing uses a preferred series of values that cannot be confused with the preferred series of AQL values;

c) the five basic numbers associated with a single sampling plan, i.e. lot size, sample size, acceptance number, AQL (or quality accepted with probability 0,95) and LQ, appear in the same table, whenever possible.

0.3 Summary

The problems associated with acceptance sampling inspection involve defining unambiguously the criteria used to judge discrete individual items supplied in quantity, the quality level expected from the manufacturing process, the discrimination offered by the plans and the procedure to be followed when a lot is not accepted. Above all, however, it is necessary to design the sampling scheme so that it may easily be invoked in a purchasing contract. The plans in this part of ISO 2859 make maximum use of the established plans given in ISO 2859/1, so that sub-clause 12.6 of ISO 2859/1 (see 1.1) can be made directly operational, by providing a rationalized series of plans indexed in terms of limiting quality (LQ).

1 Scope and field of application

1.1 Scope

This part of ISO 2859 establishes LQ sampling plans and procedures for inspection by attributes compatible with ISO 2859/1 that can be used when the switching rules given in ISO 2859/1are not applied, for example, when lots are of an isolated nature.

The plans in this part of ISO 2859 are indexed by a preferred series of limiting qualities (LQ) with a consumer's risk usually below 10 %, but always below 13 %. This method of indexing permits the "ad-hoc" procedure[1] mentioned in sub-clause 12.6 of ISO 2859/1 to be implemented as a standard procedure.

NOTE — The plans in ISO 2859/1 are indexed by a preferred series of AQL values and inspection levels. During the inspection of a continuing series of lots the application of switching rules helps to ensure that the process average in that series of lots is kept below the specified AQL. Limiting quality does not have the same direct relationship with the process average (see 3.5.1).

1.2 Field of application

Alternative procedures are provided in this part of ISO 2859 to cater for two situations often met in practice:

a) **Procedure A**, to be used when the supplier and consumer both wish to regard the lot in isolation. The tables are based on random sampling from finite lots for both consumer and producer risks. This procedure shall be used unless there is a specific instruction to use procedure B.

b) **Procedure B**, to be used when the supplier regards the lot as one of continuing series but the consumer considers the lot received in isolation. The tables are based on random sampling from a finite lot for consumer's risk at the limiting quality, but random sampling from a process for the producer's risk and the tabulated values of the operating characteristic (OC) curves. The plans used are a selection of the plans available in ISO 2859/1 so that a producer can maintain consistent procedures for customers whether or not they receive individual lots or a continuing series of lots. This procedure is suitable for inclusion in product standards or specifications that contain sampling clauses. The manufacturer will be concerned with all of his production, but the individual consumer only with the particular lot received.

2 Definitions

The definitions given in ISO 2859/1 shall apply.

3 Choice of sampling plan

3.1 Specifying a sampling plan

When reference is made to this part of ISO 2859 in a contract or specification, it is necessary to specify the procedure to be used (i.e. either A or B). In the absence of any reference to either procedure, then procedure A shall be used.

3.2 Choice of sampling procedure

Although procedure A is based on the hypergeometric distribution for sampling results, this distribution is well approximated by the binomial distribution for plans with non-zero acceptance numbers in procedure A. Hence the OC curves for these plans are well approximated by the tabulated performance of the same plans in procedure B. However, procedure A uses plans with acceptance number zero and with sample sizes based on the hypergeometric distribution of sampling results while procedure B excludes accept zero plans, replacing them with 100 % inspection.

The choice between the procedures is dominated by the attitude towards accept zero plans. Procedure A uses accept zero plans linking the sample size and the lot size by the hypergeometric distribution until the proposed plan corresponds to the accept zero plan in ISO 2859/1 corresponding to that limiting quality. Thereafter the progression of sampling size and acceptance number with lot size is based on the inspection levels available in ISO 2859/1. The overall effect of procedure A resembles inspection level II for limiting quality less than 8 % and level I for limiting quality greater than 8 % with 8 % being intermediate between these levels.

Procedure B provides greater flexibility in the choice of inspection levels. The tabulated OC curves are based on the probability of producing a nonconforming unit so they are approximately correct for small sampling fractions but as the sampling fraction increases the curves (and tables) underestimate the probability of acceptance for good quality and underestimate the probability of rejection for poor quality. For sufficiently small lots, procedure B requires 100 % inspection.

Both procedures treat the limiting quality (LQ) as the actual percent nonconforming units in the submitted lots and the probability of acceptance at this limiting quality can be found in table D1 for procedure A and tables B1 to B10 for procedure B. Procedure B is indicated as the appropriate procedure if the manufacturer is concerned with a continuing series of lots; whether or not these go to the same consumer. Procedure A is indicated as the appropriate procedure when the lot is a single lot and shall be used if accept zero plans are required to be part of the sampling scheme.

3.3 Procedure A (use table A)

A plan is identified by the lot size and the limiting quality (LQ).

With the specified lot size and limiting quality as indexing values, the sampling size (n) and acceptance number (Ac) are given in table A.

1) ISO 2859/1 sub-clause 12.6.2, states: "If the lot or batch is of an isolated nature, it may be desirable to limit the selection of sampling plans to those, associated with a designated AQL value, that provide not less than a specified limiting quality protection. Sampling plans for this purpose can be selected by choosing a limiting quality (LQ) and a consumer's risk to be associated with it. Tables 6 and 7 give process levels for which the probabilities of lot acceptance under various sampling plans are 10 % and 5 %, respectively." This part of ISO 2859 establishes preferred values for the LQ and allows the consumer's risk to vary as indicated above.