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Sampling procedures for inspection by attributes —

Part 2:
Sampling plans indexed by limited 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)

[Revision of first edition (ISO 2859-2:1985)]

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Foreword

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ISO 2859-2 was prepared by Technical Committee ISO/TC 69, *Application of statistical methods*, Subcommittee SC 5, *Acceptance sampling*.

This edition cancels and replaces ISO 2859:1985 has been technically revised.

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: Sequential sampling plans indexed by acceptance quality limit (AQL) for inspection by attributes*

— *Part 10: Introduction to the ISO 2859 series of attribute sampling standards*

Introduction

ISO 2859-2 presents sampling plans indexed by limiting quality (LQ) whereas ISO 2859-1 is an acceptance sampling system indexed by the acceptance quality limit (AQL). The concept of AQL is not appropriate for isolated lots. It is widely used for various applications, but it was originally designed for the inspection of a continuing sequence of lots, where switching rules are employed. These switching rules provide protection to the consumer (by the prospect of switching to tightened inspection and discontinuation) and also provide an incentive to the supplier to improve the quality level. However, there are various cases where the switching rules of ISO 2859-1:1999 are not applicable, such as isolated lots or a short series of lots. This part of ISO 2859 is designed for such cases.

This part of ISO 2859 provides sampling plans indexed by limiting quality (LQ). AQLs are not used to index plans. This is the major difference from the special procedure for limiting quality protection given in ISO 2859-1:1999.

This part of ISO 2859 has been designed in accordance with the following principles:

(1) The sampling plans indexed by LQ can be found from among the plans indexed by AQL in ISO 2859-1:1999.

(2) The series of preferred LQs for indexing should be different from the series of preferred AQLs, to avoid confusion.

(3) Whenever practicable, the following five basic values associated with a single sampling plan may be found in the same table;

* lot size,
* sample size,
* acceptance number,
* producer's risk quality or AQL, and
* LQ.

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

1 Scope

This part of ISO 2859 specifies an acceptance sampling system for inspection by attributes indexed by limiting quality (LQ). This sampling system is used for lots in isolation (isolated sequences of lots, an isolated lot, a unique lot or a short series of lots), where switching rules, such as those of ISO 2859-1, are not applicable. The purpose of this part of ISO 2859 is to supplement ISO 2859-1:1999 by providing sampling plans that are compatible with ISO 2859-1:1999. There is little doubt that in many industrial situations, in which switching rules might be used, they are not applied for a number 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 schemes 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) lots are small (use of the hypergeometric distribution required);

f) lots are isolated;

g) lots are re-submitted after inspection.

The sampling plans in this part of ISO 2859 are indexed by a series of preferred values of limiting quality (LQ), where a consumer’s risk is usually below 10% and is, except for two instances, below 13%. This method of indexing provides a standard procedure, which is more convenient than the special procedure for limiting quality protection of ISO 2859-1:1999 (see 5.4).

NOTE The sampling plans in ISO 2859-1 are indexed by inspection levels and by the preferred series of AQLs. 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 similar direct relationship with the process average (see 5.4).

This part of ISO 2859 is intended for inspection for nonconforming items. In addition it is also applicable for inspection for nonconformities per 100 items except where the LQ is too large. If this part of ISO 2859 is not applicable, users should refer to the special procedure for limiting quality protection given in 12.6.2 of ISO 2859-1:1999 (see 5.4).

This part of ISO 2859 is to be used when the supplier and the consumer both regard the lot to be in isolation. That is, the lot is unique in that it is the only one of its type produced. It may also be used when there is a series of lots too short for switching rules to be applied.

This part of ISO 2859 provides two annexes. Annex A provides information on the relationship between this part and part 1 of ISO 2859. Annex B contains double and multiple sampling plans for isolated lots.

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.

However, parties to agreements based on this part of ISO 2859 are encouraged to investigate the possibility of applying the most recent edition of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2859-1:1999, *Sampling procedures for inspection by attributes – Part 1: Sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3534-2:2006, *Statistics Vocabulary and symbols – Part 2: Applied Statistics*

3 Terms and definitions

For the purposes of this part of ISO 2859, the terms and definitions given in ISO 2859-1:1999, ISO 3534-1:2006 and ISO 3534-2:2006 apply. For ease of reference, some terms are quoted from these standards.

3.1
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 3534-2:2006, 4.6.13)

3.2
consumer's risk quality (CRQ)
quality of a lot or process which, in the acceptance sampling plan, corresponds to a specified consumer's risk (ISO3534-2:2006,4.6.9)

4 Symbols and abbreviated terms

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

Ac	acceptance number
Ac_0	acceptance number for the corresponding single sampling plan
AQL	acceptance quality limit
CRQ	consumer's risk quality
D	number of nonconforming items in the lot
LQ	limiting quality
N	lot size
n	sample size

n_0	sample size for the corresponding single sampling plan
p	lot quality in proportion nonconforming (or nonconformities per item).
Pa	probability of acceptance
PRQ	producer's risk quality
R	number of nonconformities in the lot
Re	rejection number.
α:	producer's risk.
β	consumer's risk.
OC	operating characteristic

NOTE In this part of ISO 2859, the quality level is usually expressed in percent nonconforming, such as PRQ = 2%. If this part of ISO 2859 is applied to inspection for nonconformities per 100 items, "percent nonconforming" and "fraction nonconforming" should be replaced by "nonconformities per 100 items" and "nonconformities per item," respectively

5 Choice of sampling plan

5.1 General

The following procedures shall be followed in advance of acceptance sampling.

a) The value of the limiting quality (LQ) shall be specified in accordance with 5.3.
b) The lot size shall be determined.

The sampling plan to be used shall be found in accordance with 5.4.

With reference to Table 1, an applicable sampling plan is identified from the lot size and the limiting quality (LQ).

With the specified lot size and the limiting quality as indexing values, the sample size (n) and acceptance number (Ac) are read from Table 1.

Although the primary index to Table 1 is the limiting quality (LQ), the producer/supplier needs guidance on the quality level required if lots are to have a high probability of acceptance. Information on the producer's risk point is contained in Tables 2 and 3. Information on the probability of acceptance of relatively good lots by "Ac = 0" plans is given in Tables 4 to 6. Information on the producer's risk quality for "Ac = 0" plans for large lots is given in Table 7.

Table 1 — Single sampling plans (master table)

Lot size (*N*)		Limiting quality, LQ (in percent nonconforming or in nonconformities per 100 items)									
		0,50	0,80	1,25	2,00	3,15	5,00	8,00	12,5	20,0	31,5
16 to 25	*n*	*	*	*	*	*	*	17	13	9	6
	Ac							0	0	0	0
26 to 50	*n*	*	*	*	*	*	28	22	15	10	6
	Ac						0	0	0	0	0
51 to 90	*n*	*	*	*	50	44	34	24	16	10	8
	Ac				0	0	0	0	0	0	0
91 to 150	*n*	*	*	90	80	55	38	26	18	13	13
	Ac			0	0	0	0	0	0	0	1
151 to 280	*n*	200	170	130	95	65	42	28	20	20	13
	Ac	0	0	0	0	0	0	0	0	1	1
281 to 500	*n*	280	220	155	105	80	50	32	32	20	20
	Ac	0	0	0	0	0	0	0	1	1	3
501 to 1 200	*n*	380	255	170	125	125	80	50	32	32	32
	Ac	0	0	0	0	1	1	1	1	3	5
1 201 to 3 200	*n*	430	280	200	200	125	125	80	50	50	50
	Ac	0	0	0	1	1	3	3	3	5	10
3 201 to 10 000	*n*	450	315	315	200	200	200	125	80	80	80
	Ac	0	0	1	1	3	5	5	5	10	18
10 001 to 35 000	*n*	500	500	315	315	315	315	200	125	125	80
	Ac	0	1	1	3	5	10	10	10	18	18
35 001 to 150 000	*n*	800	500	500	500	500	500	315	200	125	80
	Ac	1	1	3	5	10	18	18	18	18	18
150 001 to 500 000	*n*	800	800	800	800	800	500	315	200	125	80
	Ac	1	3	5	10	18	18	18	18	18	18
500 001 or over	*n*	1 250	1 250	1 250	1 250	800	500	315	200	125	80
	Ac	3	5	10	18	18	18	18	18	18	18

If any of the following is satisfied, carry out 100% inspection; the sample size (*n*) exceeds the lot size (*N*), * is shown in the cell.

NOTE * denotes that either no sampling plan is available or the limiting quality implies less than one nonconforming item or nonconformity in the lot.

Table 2 — Summary of key properties of sampling plans for percent nonconforming

Lot size	Limiting quality, LQ (in percent nonconforming)									
	0,50	0,80	1,25	2,00	3,15	5,00	8,00	12,5	20,0	31,5
16 to 25	*	*	*	*	*	*	17; 0 9,3 0,0	13; 0 8,2 0,0	9; 0 8,2 0,0	6; 0 7,0 0,0
26 to 50	*	*	*	*	*	28; 0 8,5 0,0	22; 0 8,9 0,0	15; 0 9,0 0,0	10; 0 8,3 0,0	6; 0 8,5 0,0
51 to 90	*	*	*	50; 0 19,5 0,0	44; 0 12,9 0,0	34; 0 10,3 0,0	24; 0 9,5 0,0	16; 0 9,4 0,0	10; 0 9,4 0,0	8; 0 4,0 0,0
91 to 150	*	*	90; 0 915,8 0,0	80; 0 9,9 0,0	55; 0 9,8 0,0	38; 0 10,3 0,0	26; 0 9,2 0,0	18; 0 7,7 0,0	13; 0 4,8 0,0	13; 1 4,4 3,08
151 to 280	200; 0 8,1 0,0	170; 0 10,2 0,0	130; 0 9,5 0,0	95; 0 8,9 0,0	65; 0 8,9 0,0	42; 0 9,7 0,0	28; 0 8,5 0,0	20; 0 6,2 0,0	20; 1 6,2 1,94	13; 1 4,7 2,93
281 to 500	280; 0 8,9 0,0	220; 0 9,7 0,0	155; 0 9,5 0,0	105; 0 9,2 0, 0	80; 0 6,0 0,0	50; 0 6,7 0,0	32; 0 6,3 0,0	32; 1 7,1 1,20	20; 1 6,5 1,88	20; 3 7,9 7,30
501 to 1 200	380; 0 10,1 0,0	255; 0 9,8 0,0	170; 0 10,0 0,0	125; 0 6,9 0,0	125; 1 8,1 0,326	80; 1 7,9 0,479	50; 1 7,8 0,747	32; 1 7,5 1,15	32; 3 9,0 4,45	32; 5 3,3 8,59
1 201 to 3 200	430; 0 9,9 0,0	280; 0 9,5 0,0	200; 0 7,4 0,0	200; 1 8,3 0,189	125; 1 8,8 0,296	125; 3 11,9 1,13	80; 3 10,6 1,75	50; 3 11,2 2,80	50; 5 4,7 5,39	50; 10 5.0 12,91
3 201 to 10 000	450; 0 9,9 0,0111	315; 0 7,6 0,0159	315; 1 9,1 0,116	200; 1 8,7 0,181	200; 3 12,0 0,684	200; 5 6,1 1,33	125; 5 5, 8 2,12	80; 5 5,5 3,33	80; 10 5,6 7,92	80; 18 5,0 16,17
10 001 to 35 000	500; 0 8,0 0,0101	500; 1 8,9 0,072 1	315; 1 9,4 0,114	315; 3 12,3 0,437	315; 5 6,6 0,836	315; 10 8,0 1,98	200; 10 6,9 3,12	125; 10 7,7 5,02	125; 18 6,9 10,26	80; 18 5,0 16,15
35 001 to 150 000	800; 1 9,0 0,0447	500; 1 9,0 0,071 3	500; 3 12,8 0,274	500; 5 6,5 0,525	500; 10 8,3 1,24	500; 18 8,6 2,50	315; 18 7,7 3,99	200; 18 7,8 6,31	125; 18 6,9 10,19	80; 18 5,0 16,15
150 001 to 500 000	800; 1 9,1 0,044 5	800; 3 11,8 0,171	800; 5 6,6 0,327	800; 10 7,5 0,773	800; 18 8,2 1,56	500; 18 8,6 2,50	315; 18 7,7 3,99	200; 18 7,8 6,31	125; 18 6,9 10,19	80; 18 5,0 16,15
500 001 or over	1250; 3 12,9 0,109	1250; 5 6,6 0,209	1250; 10 9,0 0,495	1250; 18 9,0 0,998	800; 18 8,2 1,56	500; 18 8,6 2,50	315; 18 7,7 3,99	200; 18 7,8 6,31	125; 18 6,9 10,19	80; 18 5,0 16,15

The three entries of each cell in the table give the following values:
upper entry, the samples size and the acceptance number (*n* ; Ac); lower left entry, the consumer's risk at LQ (β in %); lower right entry, the producer's risk quality (PRQ) in percent nonconforming

NOTE 1 The given consumer's risk is the maximum for lot qualities equal to or worse than the LQ in the given lot size interval.

NOTE 2 The given producer's risk quality is the worst quality for which the producer's risk is guaranteed not to exceed 5% for lot sizes in the given range. A PRQ of zero means that the producer's risk can exceed 5% even when there is only one nonconforming item in the lot.

NOTE 3 denotes 100% inspection is to be carried out (see Table 1).