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## Milk and milk products — Sampling — Inspection by variables

*Lait et produits laitiers — Échantillonnage — Contrôle par mesures*

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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.

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 8197 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*, in collaboration with the International Dairy Federation (IDF) and the Association of Official Analytical Chemists (AOAC) and will also be published by these organizations.

Annex A forms an integral part of this International Standard.

## Introduction

Inspection by variables is a method which consists in measuring a quantitative characteristic for each item of a sample taken from a population. The acceptability of the population is established statistically from the number of items in the sample that meet specified requirements.

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# Milk and milk products — Sampling — Inspection by variables

## 1 Scope

This International Standard describes the basis of sampling plans for the inspection by variables of milk and milk products.

It is intended primarily for use under the following conditions :

- a) where the inspection procedure is to be applied to a continuous series of lots of discrete products, all supplied by one producer using one production process;
- b) where only a single quality characteristic,  $x$ , which must be measurable on a continuous scale, is taken into consideration (if several such characteristics are of importance, this International Standard applies to each of them separately);
- c) where production is stable (under statistical control) and the quality characteristic,  $x$ , is distributed according to a normal distribution law or a close approximation to the normal distribution law;
- d) where a contract or specification defines an upper specification limit  $U$ , a lower specification limit  $L$ , or both.

NOTE — The product is qualified as complying with the requirements of the contract or specification if the measured quality characteristic,  $x$ , satisfies one of the following conditions :

$$\begin{aligned} x &\leq U && \dots (1) \\ \text{or } x &\geq L && \dots (2) \\ \text{or } x &\leq U \text{ and } x \geq L && \dots (3) \end{aligned}$$

Conditions (1) and (2) are called cases with a single specification limit and condition (3) a case with double specification limits.

This International Standard does not apply in the case of examination for microbiological defects.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to

agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 707 : 1985, *Milk and milk products — Methods of sampling.*

ISO 2859 : 1974/Add.1 : 1977, *General information on sampling inspection, and guide to the use of the ISO 2859 tables.*

ISO 3534 : 1977, *Statistics — Vocabulary and symbols.*

ISO 3951 : 1981, *Sampling procedures and charts for inspection by variables for percent defective.*

## 3 Definitions

For the purposes of this International Standard, the definitions given in ISO 3534 apply.

## 4 Selection of sampling plan

### 4.1 Classification of defects

Before selection of a sampling plan, the contract or specification shall clearly define all critical, major and minor defects in such a way that they are unambiguously understood by all users of the contract, specification or document containing or referring to the sampling plan.

**4.1.1 A critical defect** is one that would make the product unacceptable.

NOTE — Inspection by variables should not be used for critical defects. For this category, inspection by attributes should be used (see ISO 5538 : 1987, *Milk and milk products — Sampling — Inspection by attributes*).

**4.1.2 A major defect** is one that is likely to make the product unfit for use, i.e. in the case of milk and milk products, unfit for

sale to the consumer. A major defect would result in the product spoiling or becoming unfit for sale or processing. Examples include

- a) composition defect, where this would affect keeping quality;
- b) contamination with inhibitory substances.

**4.1.3** A **minor defect** is a failure to comply with a specification, but which does not make the unit unfit for use and sale, nor cause it to spoil; for example, a unit, the chemical composition or net content of which falls outside, but close to, a specification limit.

**4.2 Choice of inspection level and acceptable quality level (AQL)**

See ISO 3951 : 1981, clause 11.

Sampling plans for major defects shall be selected from the tables in ISO 3951 using an AQL of not more than 6,5 %.

Sampling plans for minor defects shall be selected from the tables in ISO 3951 using an AQL of not more than 10 %.

**5 Sampling and inspection procedures**

**5.1 Method of sampling**

Sampling shall be carried out using the methods specified in ISO 707.

**5.2 Procedure**

**5.2.1** Take a sample of  $n$  items at random from the lot, in accordance with ISO 2859 : 1974/Add.1 : 1977, clause 15.

**5.2.2** Examine each such item separately. A total of  $n$  values will be obtained  $(x_1, \dots, x_n)$ .

**5.2.3** Calculate the arithmetic mean,  $\bar{x}$ , of the  $n$  results by means of the formula

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

where

$x_i$  is the value obtained for the  $i^{\text{th}}$  item in the sample of  $n$  items ( $i = 1, \dots, n$ );

$n$  is the number of items in the sample.

**5.2.4** Calculate the sample standard deviation,  $s$ , by means of the formula

$$s = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2}$$

where the symbols have the same meaning as in 5.2.3.

**5.2.5** Calculate the values of  $Q_L$  and/or  $Q_U$  by means of the formulae

$$Q_L = \frac{\bar{x} - L}{s}$$

and

$$Q_U = \frac{U - \bar{x}}{s}$$

where

$\bar{x}$  is the arithmetic mean calculated in 5.2.3;

$s$  is the standard deviation calculated in 5.2.4;

$L$  is the lower specification limit;

$U$  is the upper specification limit.

**6 Conformity**

The lot shall be considered to comply with the requirements if

- a) in the case of a lower specification limit :

$$Q_L \geq k$$

- b) in the case of an upper specification limit :

$$Q_U \geq k$$

- c) in the case of a double specification limit :

$$Q_L \geq k \text{ and } Q_U \geq k$$

where  $k$  is the acceptability constant of the sampling plan (see annex A).

The lot shall be deemed not to comply with the requirements if the appropriate condition a), b) or c) is not satisfied.

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NOTE The value of  $Q_L$  is calculated if the measured characteristic has a lower specification limit,  $Q_U$  if the measured characteristic has an upper specification limit, and  $Q_L$  and  $Q_U$  if the measured characteristic has double specification limits.

**Annex A**  
(normative)

**Inspection by variables sampling plans**

This annex sets out six typical sampling plans based on AQLs of 1 %, 1,5 %, 2,5 %, 4 %, 6,5 % and 10 % at inspection level 1, for normal, tightened and reduced inspection. Switching rules are given in ISO 3951.

**Table A.1 – Inspection level 1 – AQL = 1 %**

Lot size	Normal inspection		Tightened inspection		Reduced inspection	
	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>
Up to 50	4	1,45	5	1,65	4	1,34
51 to 90	5	1,53	5	1,65	4	1,34
91 to 150	7	1,62	7	1,75	4	1,34
151 to 280	10	1,72	10	1,84	4	1,34
281 to 500	15	1,79	15	1,91	5	1,40
501 to 1 200	20	1,82	20	1,96	7	1,50
1 201 to 3 200	25	1,85	25	1,98	10	1,58
3 201 to 10 000	35	1,89	35	2,03	15	1,65
10 001 to 35 000	50	1,93	50	2,08	20	1,69
35 001 to 150 000	75	1,98	75	2,12	25	1,72
150 001 to 500 000	100	2,00	100	2,14	35	1,76
500 001 and over	150	2,03	150	2,18	50	1,80

**Table A.2 – Inspection level 1 – AQL = 1,5 %**

Lot size	Normal inspection		Tightened inspection		Reduced inspection	
	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>
Up to 50	4	1,34	4	1,45	3	1,12
51 to 90	5	1,40	5	1,53	3	1,12
91 to 150	7	1,50	7	1,62	3	1,12
151 to 280	10	1,58	10	1,72	4	1,17
281 to 500	15	1,65	15	1,79	5	1,24
501 to 1 200	20	1,69	20	1,82	7	1,33
1 201 to 3 200	25	1,72	25	1,85	10	1,41
3 201 to 10 000	35	1,76	35	1,89	15	1,47
10 001 to 35 000	50	1,80	50	1,93	20	1,51
35 001 to 150 000	75	1,84	75	1,98	25	1,53
150 001 to 500 000	100	1,86	100	2,00	35	1,57
500 001 and over	150	1,89	150	2,03	50	1,61

Table A.3 – Inspection level 1 – AQL = 2,5 %

Lot size	Normal inspection		Tightened inspection		Reduced inspection	
	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>
Up to 25	3	1,12	4	1,34	3	0,958
26 to 50	4	1,17	4	1,34	3	0,958
51 to 90	5	1,24	5	1,40	3	0,958
91 to 150	7	1,33	7	1,50	3	0,958
151 to 280	10	1,41	10	1,58	4	1,01
281 to 500	15	1,47	15	1,65	5	1,07
501 to 1 200	20	1,51	20	1,69	7	1,15
1 201 to 3 200	25	1,53	25	1,72	10	1,23
3 201 to 10 000	35	1,57	35	1,76	15	1,30
10 001 to 35 000	50	1,61	50	1,80	20	1,33
35 001 to 150 000	75	1,65	75	1,84	25	1,35
150 001 to 500 000	100	1,67	100	1,86	35	1,39
500 001 and over	150	1,70	150	1,89	50	1,42

Table A.4 – Inspection level 1 – AQL = 4 %

Lot size	Normal inspection		Tightened inspection		Reduced inspection	
	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>
Up to 25	3	0,958	3	1,12	3	0,765
26 to 50	4	1,01	4	1,17	3	0,765
51 to 90	5	1,07	5	1,24	3	0,765
91 to 150	7	1,15	7	1,33	3	0,765
151 to 280	10	1,23	10	1,41	4	0,814
281 to 500	15	1,30	15	1,47	5	0,874
501 to 1 200	20	1,33	20	1,51	7	0,955
1 201 to 3 200	25	1,35	25	1,53	10	1,03
3 201 to 10 000	35	1,39	35	1,57	15	1,09
10 001 to 35 000	50	1,42	50	1,61	20	1,12
35 001 to 150 000	75	1,46	75	1,65	25	1,14
150 001 and over	100	1,48	100	1,67	35	1,18

Table A.5 – Inspection level 1 – AQL = 6,5 %

Lot size	Normal inspection		Tightened inspection		Reduced inspection	
	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>
Up to 25	3	0,765	3	0,958	3	0,566
26 to 50	4	0,814	4	1,01	3	0,566
51 to 90	5	0,874	5	1,07	3	0,566
91 to 150	7	0,955	7	1,15	3	0,566
151 to 280	10	1,03	10	1,23	4	0,617
281 to 500	15	1,09	15	1,30	5	0,675
501 to 1 200	20	1,12	20	1,33	7	0,755
1 201 to 3 200	25	1,14	25	1,35	10	0,828
3 201 to 10 000	35	1,18	35	1,39	15	0,886
10 001 to 35 000	50	1,21	50	1,42	20	0,917
35 001 and over	75	1,24	75	1,46	25	0,936



Table A.6 – Inspection level 1 – AQL = 10 %

Lot size	Normal inspection		Tightened inspection		Reduced inspection	
	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>	<i>n</i>	<i>k</i>
Up to 25	3	0,566	3	0,765	3	0,341
26 to 50	4	0,617	4	0,814	3	0,341
51 to 90	5	0,675	5	0,874	3	0,341
91 to 150	7	0,755	7	0,955	3	0,341
151 to 280	10	0,828	10	1,03	4	0,393
281 to 500	15	0,886	15	1,09	5	0,455
501 to 1 200	20	0,917	20	1,12	7	0,536
1 201 to 3 200	25	0,936	25	1,14	10	0,611
3 201 to 10 000	35	0,969	35	1,18	15	0,664
10 001 and over	50	1,00	50	1,21	20	0,695

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