INTERNATIONAL STANDARD

ISO 7086-2

Second edition
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Glass hollowware in contact with food — Release of lead and cadmium —

Part 2: Permissible limits

Vaisselle creuse en verre en contact avec les aliments — Émission de plomb et de cadmium —

Partie 2: Limites admissibles

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 part of ISO 7086 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 7086-2 was prepared by Technical Committee ISO/TC 166, *Ceramic ware, glassware and glass ceramic ware in contact with food.*

This second edition cancels and replaces the first edition (ISO 7986-2:1982), which has been technically revised.

ISO 7086 consists of the following parts, under the general title *Glass hollowware in contact with food — Release of lead and cadmium*:

— *Part 1: Test method*

— *Part 2: Permissible limits*

Introduction

Lead and cadmium release from glassware surfaces is an issue which requires effective means of control to ensure the protection of the population against possible hazards arising from the use of improperly formulated and/or processed glassware used for the preparation, serving and storage of food and beverages. As a secondary consideration, different requirements from country to country for the control of the release of toxic materials from the surfaces of glassware present non-tariff barriers to international trade in these commodities. Accordingly, there is a need to maintain internationally accepted methods of testing glassware for lead and cadmium release, and to define permissible limits for the release of these toxic heavy metals.

The limits for lead and cadmium release specified in this part of ISO 7086 are not intended to be regarded as the maximum amount of these metals to which exposure can be considered safe. They are levels which are consistent with good manufacturing practice in the respective industries, harmonize regulatory levels in principal world markets and reflect a general objective of reducing overall exposure to these metals.

Glass hollowware in contact with food — Release of lead and cadmium —

Part 2:
Permissible limits

1 Scope

This part of ISO 7086 specifies permissible limits for the release of lead and cadmium from glass hollowware that is intended to be used in contact with food.

This part of ISO 7086 is applicable to glass hollowware intended for use in the preparation, cooking, serving and storage of food and beverages, excluding glass ceramic ware, glass flatware, and all articles used in food manufacturing industries or those in which food is sold.

2 Terms and definitions

For the purposes of this part of ISO 7086, the following terms and definitions apply.

2.1
atomic absorption spectrometry (AAS)
spectroanalytical method for qualitative determination and quantitative evaluation of element concentrations. The technique determines these concentrations by measuring the atomic absorption of free atoms

2.2
atomic absorption
absorption of electromagnetic radiation by free atoms in the gas phase where a line spectrum is obtained which is specific for the absorbing atoms

2.3
bracketing technique
analytical method consisting of bracketing the measured absorption or machine reading of the sample between two measurements made on calibration solutions of neighbouring concentrations within the optimum working range

2.4
calibration function
function relating atomic absorption instrument readings, either in absorption or in other machine units, to the concentration of lead or cadmium which generated the instrument reading

2.5
direct method of determination
analytical method consisting of inserting the measured absorption or machine reading into the calibration function and deducing the concentration of the analyte

2.6
drinking rim
20 mm wide section of the external surface of a drinking vessel, measured downwards from the upper edge along the wall of the vessel

2.7
extraction solution
acetic acid, 4 % (*V*/*V*), recovered after the extraction test and which is analysed for lead and cadmium concentration

2.8
flame atomic absorption spectrometry (FAAS)
atomic absorption spectrometry that uses a flame to create free atoms of the analyte in the gas phase

2.9
flatware
glassware having an internal depth not exceeding 25 mm, measured from the lowest point to the horizontal plane passing through the point of overflow

2.10
foodware
articles which are intended to be used for the preparation, cooking, serving and storage of food or drinks

2.11
glass ceramic
inorganic material produced by the complete fusion of raw materials at high temperatures into a homogeneous liquid which is then cooled to a rigid condition and temperature treated in such a way as to produce a mostly micro crystalline body

2.12
glassware
glass articles that are intended to be used in contact with foodstuffs

2.13
glass
inorganic material produced by the complete fusion of raw materials at high temperature into a homogeneous liquid which is then cooled to a rigid condition, essentially without crystallization

NOTE The material may be clear, coloured or opaque.

2.14
hollowware
glassware having an internal depth greater than 25 mm, measured from the lowest point to the horizontal plane passing through the point of overflow

NOTE Hollowware is subdivided into three categories based on volume:

— small: hollowware with a capacity of less than 600 ml;

— large: hollowware with a capacity between 600 ml and 3 l;

— storage: hollowware with a capacity of 3 l or greater.

2.15
optimum working range
range of concentrations of an analyte over which the relationship between absorption and concentration is practically linear

2.16
reference surface area
the area that is intended to come into contact with foodstuffs in normal use

2.17
test solution
the solvent used in the test to extract lead and cadmium from the glassware (acetic acid, 4 % (*V*/*V*)

3 Permissible limits

The permissible limits for lead and cadmium release are given in Table.

Table 1 — Permissible limits for release of lead and cadmium

Type of glass hollowware	n [a]	Permissible limit criterion	Unit of measure	Lead limit	Cadmium limit
Small	4	All specimens ⩽ Limit	mg/l	1,5	0,5
Large	4	All specimens ⩽ Limit	mg/l	0,75	0,25
Storage	4	All specimens ⩽ Limit	mg/l	0,5	0,25

[a] n is the number of specimens in the sample under test.

4 Reproducibility and variability

4.1 General

Lead and cadmium release measurements from glass foodware are subject to analytical reproducibility errors and sampling variability. The material presented in this section is of scientific and technological interest but is not of normative or statutory value in the context of this part of ISO 7086.

4.2 Reproducibility

Three types of determination error occur in the analytical measurement of lead and cadmium concentrations. Each is listed in Table 2 with an approximate value for the standard deviation of each [6].

Table 2 — Sources of variation in analytical determination of Pb and Cd

1	Source of variation	Standard deviation, Pb determination, (mg/l)	Standard deviation, Cd determination, (mg/l)
2	Analysis, within laboratory	0,04	0,004
3	Analysis, between laboratories	0,06	0,007
4	Laboratory × sample interaction	0,06	0,01
5	Reproducibility	0,094	0,012

The statistical interaction term, row 4 in Table 2, reflects the failure of the differences in sample analyses to be the same from laboratory to laboratory. A detailed discussion may be found in elementary statistical texts that address Analysis of Variance (ANOVA) methods. The reproducibility is the square root of the sum of the squares of the standard deviations from the three sources of variation.

4.3 Variability

Analytical reproducibility is quite good compared to the intrinsic variability of the extraction behaviour of glass surfaces. This variability, termed sampling variability, is by far the greatest source of experimental error. Moore [7] has shown that the coefficient of variability for lead and cadmium release for large samples is typically 60 %. Thus, the true average lead release value for a large population must be approximately 0,58 mg/l in order to avoid one of four test specimens from exceeding a 2 mg/l limit 1 in 10 000 times. Table 3 illustrates the effect of population mean and standard deviation values on the probability that 1 in 4 or 1 in 6 specimens will exceed a 2 mg/l limit value.

Table 3 — Probabilities of exceeding 2 mg/l limit

Population mean	Population standard deviation	Probability of 1 in 4 at > 2 mg/l	Probability of 1 in 6 at > 2 mg/l
0,4	0,24	< 0,000 01	< 0,000 01
0,8	0,48	0,138 26	0,200 05
1,2	0,72	0,758 36	0,881 22
0,4	0,12	< 0,000 01	< 0,000 01
0,8	0,24	0,000 02	0,000 04
1,2	0,36	0,325 68	0,446 27

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