
International Standard



695

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Glass — Resistance to attack by a boiling aqueous solution of mixed alkali — Method of test and classification

Verre — Résistance à l'attaque par une solution aqueuse bouillante d'un mélange alcalin — Méthode d'essai et classification

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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 695 was prepared by Technical Committee ISO/TC 48, *Laboratory glassware and related apparatus*.

ISO 695 was first published in 1975. This second edition cancels and replaces the first edition, of which it constitutes a technical revision.

Glass — Resistance to attack by a boiling aqueous solution of mixed alkali — Method of test and classification

1 Scope and field of application

This International Standard specifies

- a) a method for determining the resistance of glass to attack by a boiling aqueous solution of sodium carbonate and sodium hydroxide. The resistance is measured inversely by the loss in mass per total surface area of the glass;
- b) a classification of glass according to the alkali resistance determined by the method of this International Standard.

2 References

ISO 719, *Glass — Hydrolytic resistance of glass grains at 98 °C — Method of test and classification.*

ISO 720, *Glass — Hydrolytic resistance of glass grains at 121 °C — Method of test and classification.*

ISO 3696, *Water for laboratory use — Specifications.*¹⁾

ISO 3819, *Laboratory glassware — Beakers.*¹⁾

ISO 4799, *Laboratory glassware — Condensers.*

3 Principle

Attack on the glass sample having a total surface area of 10 to 15 cm², by a boiling aqueous solution of equal volumes of sodium carbonate, $c(\text{Na}_2\text{CO}_3) = 0,5 \text{ mol/l}$, and sodium hydroxide, $c(\text{NaOH}) = 1 \text{ mol/l}$, for 3 h. Determination of the loss in mass per total surface area of this glass sample.

4 Reagents

During the test, unless otherwise stated, use only reagents of recognized analytical grade, and only distilled water or water of equivalent purity (grade 3 water complying with the requirements of ISO 3696).

4.1 Ethanol, $\text{C}_2\text{H}_5\text{OH}$, or acetone, CH_3COCH_3 .

4.2 Hydrochloric acid solution, $c(\text{HCl}) \approx 1 \text{ mol/l}$.

4.3 Sodium carbonate solution, $c(\text{Na}_2\text{CO}_3) = 0,5 \pm 0,01 \text{ mol/l}$, freshly prepared for each test.

4.4 Sodium hydroxide solution, $c(\text{NaOH}) = 1 \pm 0,02 \text{ mol/l}$, freshly prepared for each test.

5 Apparatus

5.1 **Test vessel**, of pure silver or alkali-resistant silver alloy. A recommended vessel, as shown in the figure, is cylindrical with a hemispherical base and has a close-fitting lid. The lid has a wide neck and is fitted on the underside with four hooks from which to suspend the samples. Where a gasket is required to ensure an adequate joint between the body and the lid, it shall be of a material which remains inert under the conditions of test.

5.2 **Condenser**, of the Allihn or Liebig-West type, complying with the requirements of ISO 4799 and class HGA 1 of ISO 720²⁾. It shall be made of chemically resistant glass, fitted to the neck of the lid through a bung of suitable inert material which has previously been boiled for 60 min in water.

5.3 **Balance**, accurate to $\pm 0,1 \text{ mg}$.

5.4 **Desiccator**, containing a suitable drying agent.

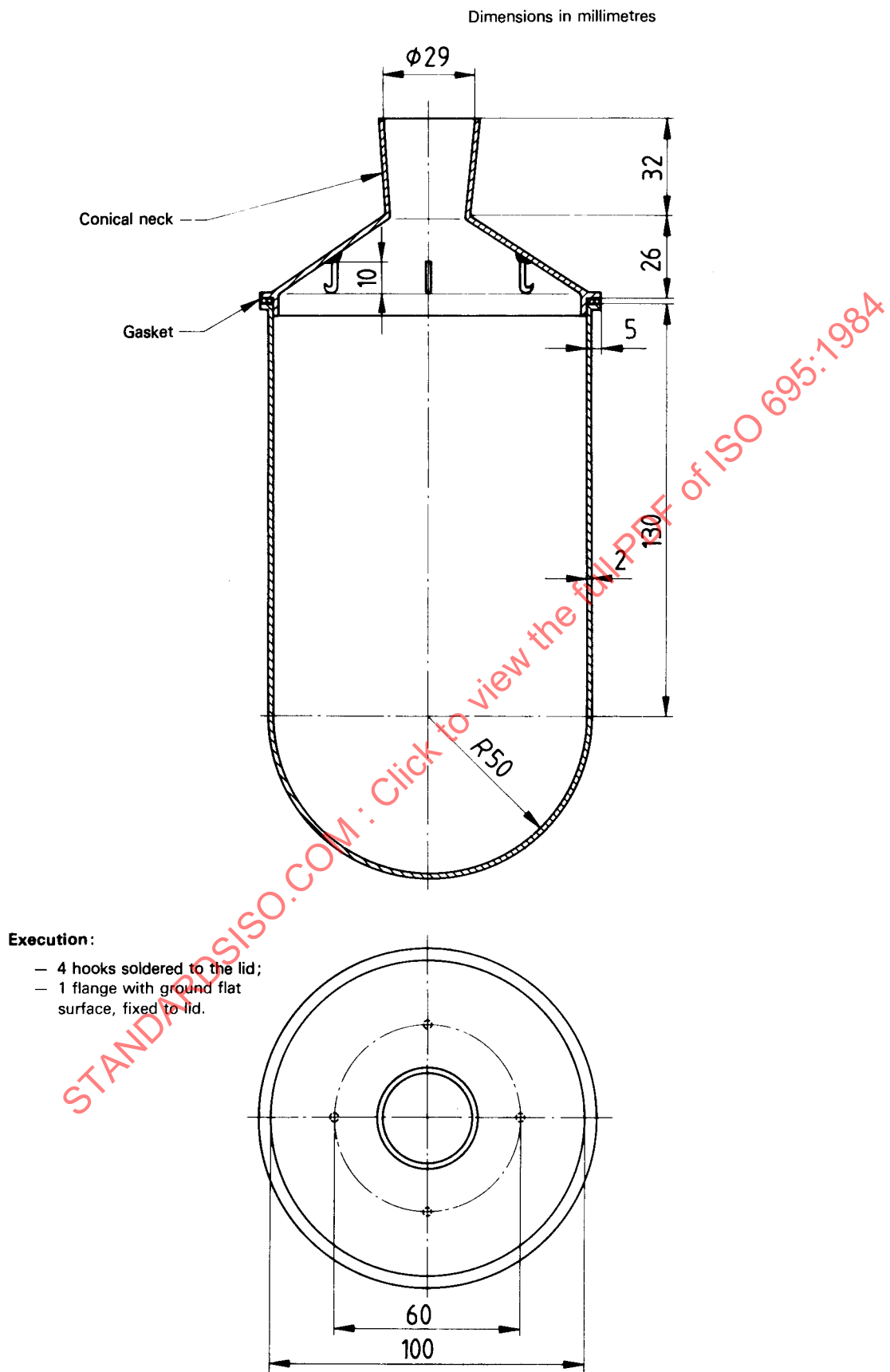
5.5 **Measuring instruments**, suitable for measuring lengths and diameters to an accuracy of $\pm 1 \%$.

5.6 **Drying oven**, suitable for operation at a temperature of 150 °C.

5.7 **Beaker**, 1 l capacity, complying with the requirements of ISO 3819.

1) At present at the stage of draft.

2) Glass of hydrolytic resistance grain class ISO 719-HGB 1 sufficiently meets the requirements of class HGA 1 of ISO 720.



View of lid from above, showing position of hooks

Figure — Example of suitable test vessel

5.8 Silver wire.

5.9 Tongs, tipped, if necessary, with a suitable material, e.g. plastics, silver, platinum.

6 Preparation of sample

The sample piece or pieces (hereinafter referred to as "sample") shall be of regular geometric shape having a total surface area of 10 to 15 cm². Remove from the edges any sharp angles, "hackles" or splinters by a minimum of grinding and polishing. Do not fire-polish the edges.

7 Procedure

Calculate the total surface area of the sample to an accuracy of 2 % and record the value obtained. Wash the sample, using the tongs (5.9) to hold the glass (as in subsequent operations), three times with separate portions of water (see first paragraph of clause 4) and then rinse it with the ethanol (4.1) or acetone (4.1). Dry the sample in the drying oven (5.6) at 150 °C for 30 min, transfer it to the desiccator (5.4) and allow it to cool to room temperature, then weigh it to an accuracy of ± 0,1 mg. Record the mass.

Transfer 800 ml of a mixture of equal volumes of the sodium carbonate (4.3) and the sodium hydroxide (4.4) solutions to the test vessel (5.1), and heat to gentle boiling and avoid bumping.

NOTE — In order to avoid bumping the test vessel should preferably be heated eccentrically.

Suspend the sample by a silver wire sling (5.8) from the hooks on the lid of the vessel and immerse in the boiling solution so that the whole sample is completely covered by the solution and no contact is made between the sample pieces themselves or with the wall of the vessel. Fit the condenser (5.2) to the lid of the vessel and turn on the flow of water through the condenser. From the time of immersion maintain the sample in the boiling solution for 3 h ± 2 min.

Remove the sample from the boiling solution and submerge it three times in 500 ml of the hydrochloric acid solution (4.2). Wash it three times with separate portions of water and finally rinse it with the ethanol (4.1) or acetone (4.1). Dry the sample in the drying oven at 150 °C for 30 min, transfer it to the desiccator (5.4) and allow it to cool to room temperature, then weigh it to an accuracy of ± 0,1 mg. Record the mass.

Repeat the procedure with a new sample of glass and with fresh solutions.

8 Expression of results

8.1 Calculation

From each of the results obtained, calculate and report the loss in mass per total surface area of the glass sample, ϱ_A , in milligrams per square decimetre, from the formula

$$\varrho_A = \frac{100 (m_1 - m_2)}{A}$$

where

m_1 is the initial mass, in milligrams, of the sample;

m_2 is the final mass, in milligrams, of the sample;

A is the total surface area, in square centimetres, of the sample.

Calculate the mean of the values obtained.

If the two values differ by more than 5 % from the mean value, repeat the test.

8.2 Classification

Glass shall be classified as shown in the table, according to the loss in mass per total surface area, expressed in milligrams per square decimetre, when tested for 3 h by the method specified in this International Standard.

Table — Limit values in the alkali resistance test

Class	Characteristics	Loss in mass per total surface area after 3 h mg/dm ²
A1	Low attack	Up to 75
A2	Slight attack	Above 75 up to 175
A3	High attack	Above 175

8.3 Designation

For convenience of reference to the alkali resistance of glass complying with the classification of this International Standard, the use is recommended of a designation as follows:

Example: For a glass with a loss in mass per total surface area of 90 mg/dm² (class A2):

Glass, alkali resistance class ISO 695 - A2

9 Test report

The test report shall include the following details:

- a) a reference to this International Standard;
- b) identification of the sample;
- c) the total surface area, in square centimetres, of the sample tested, to the nearest 0,1 cm² ;
- d) the loss in mass per total surface area of the glass, in milligrams per square decimetre, to the nearest 1 mg/dm², mean value;
- e) alkali resistance class A (designation);
- f) any unusual features noted during the determination.

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