INTERNATIONAL STANDARD

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Laboratory glassware — Thermal shock and thermal shock endurance — Test methods

Verrerie de laboratoire — Choc thermique et endurance au choc thermique — Méthodes d'essai

Reference number
ISO 718:1990(E)

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 voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 718 was prepared by Technical Committee ISO/TC 48, *Laboratory glassware and related apparatus*.

This second edition cancels and replaces the first edition (ISO 718:1982), of which it constitutes a technical revision.

Annex A of this International Standard is for information only.

International Organization for Standardization
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Laboratory glassware — Thermal shock and thermal shock endurance — Test methods

1 Scope

This International Standard specifies a thermal shock test and the procedure for determining the thermal shock endurance for laboratory glassware in the condition received by the customer.

This International Standard does not apply to fused silica ware and annealed containers made from soda-lime-silicate glass.

Annealed containers made from soda-lime-silicate glass shall be tested according to ISO 7459.

2 Definitions

For the purposes of this International Standard, the following definitions apply.

2.1 thermal shock: A sudden change in temperature applied to laboratory glassware.

2.2 thermal shock endurance Δt_{50}: A temperature difference interpolated by linear regression at which 50 % of the samples will probably fail.

2.3 temperature variation: The difference at any moment between the temperature at the centre of the working space and at any other point in the working space of the cold water bath or the test oven.

2.4 temperature fluctuation: The short term changes in temperature at any point in the working space of the cold water bath or the test oven.

3 Apparatus

3.1 Cold water bath, comprising a bath or tank capable of containing at least five times the total volume of the samples being tested at one time. It shall be fitted with a water circulator, a thermometer and a thermostatic control capable of maintaining the water temperature to within ± 1 °C of a specified lower temperature, t_2, within the range 0 °C to 27 °C.

NOTE 1 The total volume of the samples is taken as the sum of the volume of the individual samples when each is regarded as being solid.

3.2 Test oven, preferably electrically heated with a temperature range up to at least 300 °C. It shall be fitted with an air circulating device to ensure that the temperature variation does not exceed ± 5 °C and a thermostatic control capable of maintaining the test oven temperature fluctuation within ± 1 °C up to 180 °C and within ± 2 °C between 180 °C and 300 °C.

3.3 Tongs, with tips protected by a heat resisting material such as glass or mineral wool.

3.4 Gloves, gauntlet-type and preferably made from an asbestos- substitute material.

3.5 Basket, for testing two or more samples simultaneously. It shall be made out of or coated with a material which will not scratch or scuff the samples during the test procedure. It shall be capable of holding the samples upright and separate and of allowing a free passage of water and air between them. It shall prevent the sample from floating when immersed. For the multiple testing of samples, it may be combined with an automatic device for placing the basket of samples in the test oven (3.2) and transferring it to the cold water bath (3.1).

4 Sampling

The test shall be performed on a predetermined number of articles.

The number of articles to be taken as samples from a consignment should be specified in the appropriate standard for the type of article to be tested. In default of this the number should be agreed between the interested parties.

The articles used for the test shall not have been subjected to any other mechanical or thermal test procedure which could adversely affect their thermal shock endurance.

The samples shall be selected to provide the information which is required from the particular test. If the selecting procedure is not specified, the samples shall be taken at random.

5 Procedure

5.1 Remove any dirt or loose debris from the samples and dry them if necessary.

5.2 Place the samples, either separately or contained in the basket (3.5), in the test oven (3.2) which has been previously heated to the upper temperature, t_1. Maintain the samples at that temperature for a period of time sufficient to ensure that the glass has reached temperature equilibrium; 30 min is normally sufficient.

NOTE 2 The time required to reach temperature equilibrium depends on the maximum glass thickness and experience has shown that at least 6 min/mm is needed.

Place the cold water bath (3.1) near the test oven and achieve and maintain it at the specified lower temperature, t_2, within the range 0 °C to 27 °C.

5.3 Then remove the samples from the test oven (3.2) either one at a time, holding them with the tongs (3.3) or gloves (3.4) if the samples are large, or contained in the basket (3.5). Immerse the samples which are not containers as completely as possible in the cold water bath (3.1), for a specified period of at least 8 s but not more than 2 min. Keep the tips of the tongs or the fingers of the gloves dry. Do not handle hot glassware with wet tips or gloves.

Immerse containers to half the total height less the neck if any.

When the rims of the articles are to be tested, immerse the samples vertically, rim first, to a depth of about 25 mm and take care that entrapped air does not escape.

The process of transferring the samples, timed from opening the test oven to the immersion, shall be completed in 5 s $\pm$ 1 s for each sample or for the basket containing the samples. The difference in temperature between the test oven and the cold water bath shall not be more than $\pm$ 3 °C from the required value at the time of transference.

5.4 Then remove the samples from the cold water bath and evaluate them immediately according to 6.1.

5.5 For determining the thermal shock endurance, repeat the testing according to 5.2 to 5.4 with increasing temperature difference values, $t_1 - t_2$, until all of the samples have failed. The increments of temperature t_1, shall be 5 °C for $t_1 - t_2 \leq 100$ °C and 10 °C for $t_1 - t_2 > 100$ °C.

6 Expression of results

6.1 Samples which do not chip, crack or break after removal from the cold water bath (3.1) are considered to have passed the thermal shock test at the temperature difference of $t_1 - t_2$.

6.2 For the thermal shock endurance, record the number of failures at each temperature difference and determine the Δt_{50} value and the standard deviation s from a graph of the cumulative percentage of failures against the temperature difference at which the samples failed.

7 Test report

The test report shall include:

a) a reference to this International Standard;

b) an identification of the article tested (e.g. shape, volume, mass, description, glass colour, surface condition);

c) the number of articles in the consignment;

d) the number of samples taken for the test and sampling method;

e) for the thermal shock test:

- the temperature difference $t_1 - t_2$ in degrees Celsius,
- the number of samples which passed the test;

f) for the thermal shock endurance test:

- the temperature difference Δt_{50} at which 50 % of the samples will probably fail,
- the standard deviation s.