INTERNATIONAL STANDARD

ISO 7459

Second edition
2004-03-01

Glass containers — Thermal shock resistance and thermal shock endurance — Test methods

Récipients en verre — Résistance au choc thermique et endurance au choc thermique — Méthodes d'essai

Reference number
ISO 7459:2004(E)

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Published in Switzerland

Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7459 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 63, *Glass containers*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

This second edition cancels and replaces the first edition (ISO 7459:1984), which has been technically revised.

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Foreword

This document (EN ISO 7459:2004) has been prepared by Technical Committee CEN /TC 261, "Packaging", the secretariat of which is held by AFNOR, in collaboration with Technical Committee ISO/TC 63 "Glass containers".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2004, and conflicting national standards shall be withdrawn at the latest by September 2004.

This document includes a Bibliography.

Efficient packaging is of great importance for the distribution and the protection of goods and the environment. Insufficient or inappropriate packaging can lead to damage or wastage of the contents of the pack.

This standard is part of a series of standards for "Glass containers - Test methods":

— EN ISO 7458, *Glass containers — Internal pressure resistance — Test methods (ISO 7458:2004)*

— EN ISO 7459, *Glass containers — Thermal shock resistance and thermal shock endurance — Test methods (ISO:2004)*

— prEN ISO 8106, Glass containers — Determination of capacity by gravimetric method — Test method (ISO/FDIS 8106:2003)

— EN ISO 8113, *Glass containers — Resistance to vertical load — Test method (ISO 8113:2004)*

— EN 29008, *Glass bottles — Verticality — Test method (ISO 9008:1991)*

— EN 29009, *Glass containers — Height and non-parallelism of finish with reference to container base — Test methods (ISO 9009:1991)*

— EN 29885, *Wide-mouth glass containers — Deviation from flatness of top sealing surface — Test methods (ISO 9885:1991)*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard specifies test methods for determining the thermal shock resistance and thermal shock endurance of glass containers.

This European Standard does not apply to the determination of properties of laboratory glassware (see ISO 718).

2 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

2.1
container
general term applied to glass bottles and jars

2.2
thermal shock
sudden change in temperature applied to containers

2.3
thermal shock resistance
thermal shock, measured in °C , which a container can withstand without breaking

2.4
thermal shock endurance
interpolated thermal shock resistance value at which 50 % of the containers will probably fail

3 Apparatus

3.1 Cold water bath

Comprising a bath or tank capable of containing at least 8 dm^3 of water for each kilogram of glass tested at one time. It shall be fitted with a water circulator, a control unit for temperature and a thermostatic control capable of maintaining the water temperature to within ± 1 °C of a specified lower temperature, t_2, within the range of (22 ± 5) °C (see NOTE to 6.3).

3.2 Hot water bath

Comprising a bath or tank capable of containing at least 8 dm^3 of water for each kilogram of glass being tested at one time. It shall be fitted with a water circulator, a control unit for temperature and a thermostatically controlled heater capable of maintaining the water temperature to within ± 1 °C of a specified upper temperature, t_1.

3.3 Basket

Basket made out of or coated with an inert material which will not damage the containers. The basket shall be capable of holding the containers upright and separate, and shall be fitted with a perforated lid to prevent the containers from floating when immersed. For the multiple testing of containers, it may be combined with an automatic device for immersing the basket of containers in the hot bath (3.2) and transferring it to the cold bath (3.1).

4 Sampling

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

The containers used for the test shall not have been subjected to any other mechanical or thermal test procedure

which could adversely affect their thermal shock resistance.

The samples shall be selected to provide the information which is required from the particular test.

5 Procedure

5.1 Fill the cold bath (3.1) with water to a volume equal to at least 8 dm^3 for each kilogram of glass to be tested and to a depth sufficient for complete immersion of the containers plus at least 50 mm. Adjust the water temperature to within ± 1 °C of the specified lower temperature, t_2.

5.2 Fill the hot bath (3.2) with at least the same volume of water as in 5.1, then heat and maintain the temperature to within ± 1 °C of the specified upper temperature, t_1.

5.3 Place the empty containers in the basket (3.3) so that they are held upright and separate, then fasten the lid and immerse the basket in the hot bath, until the containers are completely filled with water and the tops of their finishes are at least 50 mm below the water level. If necessary, adjust the heat control to maintain the bath temperature to within ± 1 °C of the specified upper temperature, t_1, and keep the containers immersed at this temperature for at least 5 min.

5.4 Transfer the basket with the filled containers, either mechanically or manually, within max. 16 s, from the hot bath to the cold bath so that the containers are completely immersed. Keep the containers immersed for 30 s, then remove the basket and its contents from the cold bath.

5.5 Determine as soon as possible the number of containers which have failed the test, by inspecting each one for cracks or breakage.

6 Thermal shock resistance

6.1 Pass test

A sample shall be deemed to have passed the test if no more than the agreed number are cracked or broken, after being subjected to an agreed thermal shock of $t_1 - t_2$.

6.2 Progressive test to a specified percentage of breakages

Containers which pass the test shall be repeatedly tested, as described in clause 5, but with increasing $t_1 - t_2$ values, until a specified percentage of the containers fail the test.

NOTE Normally, the difference between t_2 and t_1 is increased in 5 °C increments.

6.3 Total progressive test

Containers which pass the test, described in clause 5, shall be tested in accordance with 6.2, until all the containers fail the test.

NOTE If the test has not been concluded by the time the temperature of the hot water bath reaches 95 °C, the test should be continued by lowering the temperature of the cold water bath.

6.4 High-level test

Containers shall be tested in accordance with clause 5, but at a temperature difference, $t_1 - t_2$, sufficiently high to cause an agreed percentage to fail in a single test.

7 Thermal shock endurance

The containers shall be tested in accordance with the total progressive test, described in 6.3, and the number of failures at each temperature difference shall be recorded.

The thermal endurance, which is the probable temperature difference at which 50 % of the containers would have failed, is determined from a graph of the cumulative percentage of failures against the temperature difference at which the containers failed.

8 Safety requirements

This test procedure may be injurious to health if adequate precautions are not taken by the operator. Tests should be carried out in a safe manner as recommended.

9 Test report

The test report shall include the following:

a) reference to this European Standard,

b) number of containers in the sample tested and sampling method,

c) temperature of the cold bath,

d) test results:

1) for the pass test, in accordance with 6.1:

— temperature difference, t_1 , t_2

— number of containers which failed the test

— specification limit and whether the samples passed the test

2) for the progressive test, in accordance with 6.2:

— highest temperature difference, t_1 - t_2, at which no failure occurred

— number of containers which failed at each temperature difference

— temperature difference needed to achieve the predetermined percentage of failures, expressed to the nearest increment step

3) for the total progressive test, in accordance with 6.3:

— temperature differences used in the test

— number of containers which failed at each temperature difference

— mean temperature difference at which failure occurs

4) for the high-level test, in accordance with 6.4:

— temperature difference used in the test

— percentage of containers which failed at that temperature difference

5) for the thermal shock endurance test, in accordance with clause 7:

— temperature difference at which 50 % of the sample would have failed.

e) date of test