BRITISH STANDARD

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1183 : 1997

Materials and articles in contact with foodstuffs — Test methods for thermal shock and thermal shock endurance

The European Standard EN 1183 : 1997 has the status of a British Standard

ICS 67.250

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee CW/29, Tableware, upon which the following bodies were represented:

Association of Consulting Scientists
Association of Metropolitan Authorities
Association of Public Analysts
British Ceramic Confederation
British Ceramic Gift and Tableware Manufacturers' Association
British Ceramic Research Ltd.
British Glass Manufacturers' Confederation
British Hardware and Housewares Manufacturers' Association
British Importers' Association
British Retail Consortium
CESA — The Association of Catering Equipment Manufacturers and Importers
Co-operative Union
Consumer Policy Committee of BSI
Department of Trade and Industry, Consumer Safety Unit
Stoneware Potteries Association
Vitreous Enamellers' Association

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National foreword

This British Standard has been prepared by Technical Committee CW/29 and is the English language version of EN 1183 : 1997 *Materials and articles in contact with foodstuffs — Test methods for thermal shock and thermal shock endurance*, published by the European Committee for Standardization (CEN).

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 6, an inside back cover and a back cover.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1183

March 1997

ICS 67.250

Descriptors: Kitchen utensils, materials, food-container contact, thermal shock tests, thermal shock resistance

English version

Materials and articles in contact with foodstuffs — Test methods for thermal shock and thermal shock endurance

Matériaux et objets en contact avec les denrées alimentaires — Méthodes d'essai pour le choc thermique et la résistance au choc thermique

Werkstoffe und Gegenstände in Kontakt mit Lebensmitteln — Prüfverfahren für Temperaturschock und Temperaturwechselbeständigkeit

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 1183 : 1997 E

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 194, Utensils in contact with food, the secretariat of which is held by BSI.

Further European Standards are being prepared with the following titles:

EN 1184 *Materials and articles in contact with foodstuffs — Test methods for translucency of ceramic articles*

EN 1217 *Materials and articles in contact with foodstuffs — Test method for water absorption of ceramic articles*

A further standard is proposed with the following title

Materials and articles in contact with foodstuffs — Test method for crazing resistance of ceramic articles

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 1997, and conflicting national standards shall be withdrawn at the latest by September 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

1 Scope

This European Standard specifies test methods for thermal shock and for thermal shock endurance for brittle materials, for example glass, glass-ceramics and ceramics intended for use in ovens or as tableware.

Two test methods are described:

– Test method A is used for articles known to be sensitive to thermal shock;

– Test method B is generally applicable.

The test method to be applied depends on the intended use of the article and/or its thermal shock resistance.

2 Definitions

For the purpose of this European Standard, the following definitions apply:

2.1 thermal shock

Sudden change in temperature.

2.2 thermal shock endurance, Δt_{50}

Value for the resistance against sudden change in temperature corresponding to the temperature difference at which, for the first time, 50 % of the samples fail.

2.3 temperature variation

Difference at any given time between the temperature at the centre of the working space of the water bath or test oven and at any other point in that working space.

2.4 temperature fluctuation

Short term change in temperature at any point in the working space of the water bath or test oven.

3 Principle

Samples are heated and then cooled rapidly under controlled conditions to determine their resistance to thermal shock.

Thermal shock tests are repeated using increasing temperature differences until 50 % of the samples fail. The temperature difference Δt_{50} is given as the thermal shock endurance.

4 Apparatus

NOTE. Clauses **4.1**, **4.2** and **4.4** apply to method A, clauses **4.1**, **4.3**, **4.4**, **4.5** and **4.6** apply to method B.

4.1 *Cold water bath*, comprising a bath or tank capable of containing at least five times the apparent volume of the overall dimensions of the samples being tested (including the volume of the basket) at one time; fitted with a water circulator, a thermometer and thermostatic control capable of maintaining during all the duration of the test the water temperature to within ± 2 °C of a specified lower temperature, t_2, within the range 10 °C to 20 °C.

4.2 *Hot water bath*, comprising a bath or tank capable of containing at least five times the apparent volume of the overall dimensions of the samples being tested (including the volume of the basket) at one time; fitted with a water circulator, a thermometer and thermostatically-controlled heater capable of maintaining during all the duration of the test the water temperature to within ± 2 °C of the specified upper temperature, t_1.

4.3 *Test oven*, preferably electrically heated, capable of achieving a temperature of at least 300 °C, 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 temperature fluctuation to within ± 2 °C up to 180 °C and to within ± 3 °C above 180 °C.

4.4 *Basket*, for testing two or more samples simultaneously, made out of, or coated with, an inert material which will not damage the surface of the samples during the test procedure. The basket is capable of holding the samples in a position which ensures that air escapes and water can immediately enter the inside of holloware. The samples are held separately to allow free passage of water between them. The basket is fitted with clamps to prevent the samples from floating when immersed.

NOTE. For the multiple testing of samples, the basket may be combined with an automatic device for immersing it in the hot water bath (**4.2**) or oven (**4.3**) and transferring it to the cold water bath (**4.1**).

4.5 *Tongs*, with tips protected by a head resisting material such as glass or mineral wool.

4.6 *Gloves*, gauntlet-type, made from a heat-resisting material.

4.7 *Staining agent*

NOTE. A suitable staining agent is eosine present at a concentration of (5 ± 1) g/l and a domestic washing up liquid present at a concentration of (5 ± 1) g/l.

5 Samples

The test shall be performed on not less than ten samples. Use only unused samples to start the test.

6 Procedures

6.1 Test method A

6.1.1 Remove any dirt or loose debris from the samples and allow the samples to reach ambient temperature.

Protect the apparatus from draughts throughout the test.

6.1.2 Fill the cold water bath (**4.1**) with water, containing a staining agent, to a volume equal to not less than five times the apparent volume of the overall dimensions of the samples to be tested including the volume of the basket and to a depth sufficient for complete immersion of the samples plus not less than 50 mm. Adjust and maintain the water temperature to within ± 2 °C of the specified lower temperature, t_2.

6.1.3 Fill the hot water bath (**4.2**) with not less than the same volume of water and to the same depth as in **6.1.2**, then adjust and maintain the water temperature to within ± 2 °C of the specified upper temperature, t_1 (see **6.3**).

6.1.4 Place the empty samples in the basket (**4.4**) so that they are held separately and meet the conditions of **4.4**, then fasten the samples and immerse the basket in the hot water bath, until the tops of the samples are not less than 50 mm below the water level and, in the case of holloware they are completely filled with water. If necessary, adjust the heat control to maintain the bath temperature to within ± 2 °C of the specified temperature, t_1, and keep the samples immersed at this temperature until they have reached equilibrium.

6.1.5 Drain the loaded articles and transfer the loaded basket, either mechanically or manually, within 5 s or 6 s after removal from the hot water bath to the cold water bath so that the samples are completely immersed in the cold water bath. Keep the samples immersed for 30 s, then remove the basket and its contents from the cold water bath.

6.1.6 Inspect immediately each sample for chipping, cracking, crazing or breakage and determine the number of samples which have failed the test.

6.2 Test method B

6.2.1 Remove any dirt or loose debris from the samples and, if necessary, dry the sample.

CAUTION: Handle hot samples only with dry tongs or gloves.

6.2.2 Fill the cold water bath (**4.1**) with water, containing a staining agent (**4.7**), to a volume equal to not less than five times the apparent volume of the overall dimensions of the samples to be tested (including the volume of the basket) and to a depth sufficient for complete immersion of the samples plus not less than 50 mm.

Locate the cold water bath (**4.1**) near to the test oven and adjust and maintain the water temperature to within $\pm$ 2 °C of the specified lower temperature, t_2.

6.2.3 Place the samples, either separately or contained in the basket (**4.4**) in the test oven (**4.3**) which has been previously heated to the upper temperature, t_1 (see **6.3**). Maintain the samples at this temperature until they have reached equilibrium.

6.2.4 Remove the samples from the test oven either one at a time, holding them with the tongs (**4.5**) or, if the samples are large or contained in the basket (**4.4**), with the gloves (**4.6**). Immerse the samples without impact completely in the cold water bath for a specified period between 8 s and 2 min ensuring that all holloware is filled with water.

Complete the process of transferring each sample, or the basket with samples, from opening of the test oven to immersion in (5 ± 1) s. Ensure that the difference in temperature between the test oven (**4.3**) and the cold water (**4.1**) is not more than ± 3 °C from the required temperature value at the time of transference.

6.2.5 Remove the samples from the cold water bath. Inspect immediately each sample for chipping, cracking, crazing or breakage and determine the number of samples which have failed the test.

6.3 Determination of thermal shock resistance

Repeat the testing procedure with the remaining test samples according to method A (**6.1**) or method B (**6.2**) as appropriate, with increasing temperature difference values, $t_1 - t_2$, until all samples have failed.

Commence testing with a temperature difference value, $t_1 - t_2$ of not less than 40 °C and increase temperature t_1, by 10 °C for $t_1 - t_2 \leq 100$ °C and by 20 °C for $t_1 - t_2$ >100 °C.

7 Expression of results

7.1 Requirements for failure by thermal shock

Samples which do chip, crack, craze or break are recorded as having failed the thermal shock test at the temperature difference $t_1 - t_2$.

7.2 Thermal shock endurance

Record the number of failures at each temperature difference and determine the Δt_{50} - value by listing the cumulative percentage of failures versus the temperature difference at which the samples failed (see annex B). Determine the standard deviation s by computing the failure/temperature difference data for the complete set of results.

8 Test report

The test report shall include the following details:

a) a reference to this European Standard;

b) an identification of the article tested;

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

d) for the thermal shock test:

– the test method used, i.e. A or B;

– the temperature difference $t_1 - t_2$ in degrees Celsius;

– the number of samples which failed the test and the mode of their failure;

e) for the thermal shock endurance test:

– the test method used for thermal shock, i.e. A or B;

– the temperature difference Δt_{50} at which 50 % of the samples have failed;

– the standard deviation s.

NOTE. Any unusual features noted during the determinations should also be reported.

Annex A (informative)
Bibliography

ISO 718	*Laboratory glassware — Thermal shock and thermal shock endurance — Test methods*
ISO 2747	*Vitreous and porcelain enamels — Enamelled cooking utensils — Determination of resistance to thermal shock*
ISO 7459	*Glass containers — Thermal shock resistance and thermal shock endurance — Test methods*

Annex B (informative)
Calculation of thermal shock endurance from test results

Example for Method B

t_1 °C	t_2 °C	$t_1 - t_2$ °C	No. of failures at t_1	Cumulative failures in %
180	20	160	1	10
200	20	180	1	20
220	20	200	3	50
240	20	220	2	70
260	20	240	2	90
280	20	260	1	100
			—	
	Total		10	

Δt_{50} = 200

Standard deviation s = 30,1

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