

BS EN 50304:2009
BS EN 60350:2009



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Electric cooking ranges, hobs, ovens and grills for household use — Methods for measuring performance

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National foreword

This British Standard is the UK implementation of EN 50304:2009, which is dual numbered as BS EN 60350:2009. It was derived by CENELEC from IEC 60350:1999, incorporating Amendment 1:2005 and Amendment 2:2008. It supersedes BS EN 50304:2001 and BS EN 60350:1999, which are withdrawn.

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by tags (e.g. C C1). The UK participation in its preparation was entrusted to Technical Committee CPL/59, Performance of household electrical appliances.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Amendments issued since publication

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English version

**Electric cooking ranges, hobs, ovens and grills for household use -
Methods for measuring performance**
(IEC 60350:1999 + A1:2005 + A2:2008, modified)

Cuisinières, foyers de cuisson, fours
électriques et grils à usage domestique -
Méthodes de mesure de l'aptitude à la
fonction
(CEI 60350:1999 + A1:2005 + A2:2008,
modifiée)

Elektrische Herde, Kochmulden, Backöfen
und Grillgeräte für den Hausgebrauch -
Verfahren zur Messung der
Gebrauchseigenschaften
(IEC 60350:1999 + A1:2005 + A2:2008,
modifiziert)

This European Standard was approved by CENELEC on 2008-12-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Central Secretariat: avenue Marnix 17, B - 1000 Brussels

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 59X, Consumer information related to household electrical appliances.

A first draft, based on IEC 60350:1999 + A1:2005, with common modifications prepared by CENELEC TC 59X, was submitted to the Unique Acceptance Procedure.

The text of document 59K/161/FDIS, future amendment A2 to IEC 60350:1999, was submitted the IEC-CENELEC parallel vote procedure. A further draft amendment (DRAFT), covering the common modifications requested by the National Committees during the parallel vote on IEC 60350:1999/A2 (59K/161/FDIS), was submitted to the formal vote.

The combined texts were approved by CENELEC on 2008-12-01 for publication as a consolidated edition of the double-numbered European Standard EN 50304/EN 60350, consisting of IEC 60350:1999 + A1:2005 + A2:2008 + common modifications + the text of EN 50304:2001.

This European Standard supersedes EN 50304:2001 (+ corrigendum March 2002) and EN 60350:1999 (+ corrigendum February 2000).

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2009-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2009-12-01

According to the decision of CLC/TC 59X, taken at the meeting in Brussels in January 2006, this European Standard has been drawn up as a document which follows, as far as suitable, the structure of IEC 60350:1999 + A1:2005 + A2:2008.

In this European Standard the common modifications to the International Standard are indicated by tagging **[C]** **[C]**.

This European Standard has been prepared under Mandate M/203 given to CEN and CENELEC by the European Commission.

This European Standard is suitable for direct comparison and is considered sufficiently reproducible within given limits for the purpose of energy labelling according to the Commission Directive 92/75/EEC on "Indication by labelling and standard product information of the consumption of energy and other resources by household appliances". All paragraphs which are relevant for the measuring of energy labelling are listed in Annex ZA.

This European Standard also defines permitted tolerances to values declared by the manufacturer and control procedures for checking these values.

Words in **bold** in the text are defined in Clause 3.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60350:1999 are prefixed "Z".

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1 Scope

This European Standard defines methods for measuring the performance of electric cooking **ranges, hobs, ovens** and **grills** for household use.

NOTE 1 Appliances covered by this standard may be built-in or for placing on a working surface or the floor.

NOTE 2 This standard does not apply to

- microwave **ovens** (EN 60705),
- portable appliances for cooking, grilling and similar functions (EN 61877)

This standard defines the main performance characteristics of these appliances which are of interest to the user and specifies methods for measuring these characteristics.

NOTE 3 Some of the tests which are specified in this standard are not considered to be reproducible since the results may vary between laboratories. They are therefore intended for comparative testing purposes only.

This standard does not specify requirements for performance.

NOTE 4 This standard does not deal with safety requirements (EN 60335-2-6 and EN 60335-2-9).

NOTE 5 For measurement of energy consumption and time for heating a load (see 8.3), this standard is furthermore not applicable to:

- microwave combination **ovens**;
- **small cavity ovens**;
- **ovens** without adjustable temperature control;
- heating functions other than defined in 3.16 to 3.18.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 60584-2:1993, *Thermocouples – Part 2: Tolerances* (IEC 60584-2:1982 + A1:1989)

EN 62301:2005, Household electrical appliances – Measurement of standby power (IEC 62301:2005, mod.)

ISO 7724-1:1984, *Paints and varnishes – Colorimetry – Part 1: Principles*

ISO 7724-2:1984, *Paints and varnishes – Colorimetry – Part 2: Colour measurement*

ISO 7724-3:1984, *Paints and varnishes – Colorimetry – Part 3: Calculation of colour differences*

ISO/CIE 10526:1991, *CIE standard colorimetric illuminants*

ISO/CIE 10527:1991, *CIE standard colorimetric observers*

CIE 15.2:1986, *Colorimetry*

3 Definitions

For the purposes of this document the following definitions apply.

3.1

cooking range

appliance having a **hob** and at least one **oven**. It may incorporate a **grill**

3.2

hob

appliance or part of an appliance which incorporates one or more **cooking zones**

NOTE A **hob** is also known as a cooktop.

3.3

cooking zone

part of the **hob** or area marked on the surface of a **hob** on which pans are placed for heating

3.4

hotplate

part attached to the surface of a **hob** which forms a **cooking zone**

3.5

solid hotplate

hotplate having a closed surface which is usually constructed from cast iron with an integrated heating element

3.6

tubular hotplate

hotplate having a surface which is formed by the configuration of a **tsheathed** heating element in a substantially flat plane

3.7

glass ceramic hob

hob in which the heating elements are located beneath a glass ceramic surface

3.8

induction cooking zone

cooking zone on which the pan is heated by means of eddy currents

NOTE 1 The eddy currents are induced in the bottom of the pan by the electromagnetic field of a coil.

NOTE 2 The **hob** surface may be of glass ceramic.

3.9

grill

appliance or part of an appliance in which food is cooked by radiant heat

3.10

oven

appliance or compartment of a **cooking range** in which food is cooked by radiation, by natural convection, by forced-air circulation or by a combination of these heating methods

3.11

pyrolytic self-cleaning oven

oven in which cooking deposits are removed by heating the **oven** to a sufficiently high temperature

3.12

oven with catalytic cleaning

oven in which cooking deposits are removed by breaking them down on a special coating

3.13

warming compartment

separate compartment in which dishes are placed in order to preheat them prior to serving, or in which food is maintained at serving temperature

3.14

small cavity oven

oven with the following dimensions related to the usable volume:

- both width and depth < 250 mm,
- or height < 120 mm

NOTE The definition of **small cavity ovens** in this standard is due to the size of the test load used in 8.3.

3.15

multiple cavity appliance

appliance that has more than one separate **oven** cavity, in which food is cooked and which can be controlled independently, but cannot be installed separately.

3.16

conventional heating function

heat transmission to the food by radiation and natural convection only

NOTE This does not include ovens that have a top heating element only (i.e. for the grilling function).

3.17

forced air circulation function

heat transmission to the food by forced air convection, i.e. circulating the air with the help of a fan

NOTE This does not include circulated air functions which operate a grill element only.

3.18

hot steam function

heat transmission to the food with hot steam (temperature \gg 100 °C) at ambient pressure (1 bar)

4 List of measurements

The performance of the appliance is determined by the tests listed in 4.1 to 4.6.

4.1 Dimensions and mass

The following measurements are carried out:

- overall dimensions (see 6.1);
- dimensions of **hotplates** and **cooking zones** (see 6.2);
- internal dimensions of **ovens** (see 6.3);
- dimensions of shelves (see 6.4);
- dimensions of grill grids (see 6.5);
- dimensions of **warming compartments** (see 6.6);
- level of **hotplates** (see 6.7);
- distance between the **hotplates** or **cooking zones** (see 6.8);
- level of the shelf (see 6.9);
- mass of the appliance (see 6.10).

4.2 Hotplates and cooking zones

The following tests are carried out:

- ability to heat water (see 7.1);
- ability to control the temperature of a load (see 7.2);
- heat distribution (see 7.3).

4.3 Oven

The following tests are carried out:

- preheating the empty **oven** (see 8.1);
- accuracy of the control (see 8.2);
- energy consumption and time for heating a load (8.3);
- heat distribution (see 8.4);
- ability to supply heat (see 8.5).

4.4 Grill

The following tests are carried out:

- grilling area (see 9.1);
- grilling (see 9.2).

4.5 Warming compartments

The following test is carried out:

- temperature control and energy consumption (see Clause 10).

4.6 Cleaning

The following tests are carried out:

- spillage capacity of **hobs** (see 11.1);
- cleaning of **pyrolytic self-cleaning ovens** (see 11.2);
- cleaning of **ovens with catalytic cleaning** (see 11.3).

5 General conditions for the measurements

Unless otherwise specified, the measurements are made under the following conditions.

5.1 Test room

The tests are carried out in a substantially draught-free room in which the ambient temperature is maintained at $20\text{ °C} \pm 5\text{ °C}$.

For tests 8.1 and 8.3 and 8.4.2 (23 ± 2) °C shall be maintained during the complete test.

This ambient temperature is measured at a point that is at the same height as the centre of the usable volume of the **oven** cavity in test and at a distance of 0,5 m diagonally from one of the front edges of the appliance, see Figure 10.

The measurement of the ambient temperature shall not be influenced by the appliance itself or by any other appliance.

5.2 Electricity supply

The appliance is supplied at rated voltage, $\pm 1\%$

If the appliance has a rated voltage range, the tests are carried out at the nominal voltage of the country where the appliance is intended to be used.

For tests 8.1 and 8.3:

Ⓒ The supply voltage shall be maintained at the main terminal at $230\text{ V} \pm 1\%$ or at $400\text{ V} \pm 1\%$ as defined by the manufacturer's installation guide, while the heating elements are switched on. The supply frequency shall be at a nominal $50\text{ Hz} \pm 1\%$. Ⓒ

The supply voltage measured during the tests shall be recorded.

NOTE In case of a fixed cable, the plug (or the end of the cable) is the reference point to maintain the voltage.

5.3 Instrumentation

The temperature measuring instrument including thermocouples shall have an accuracy of 0,5 K within the temperature range of 0 °C to 100 °C and an accuracy of 2 K within the temperature range 100 °C to 300 °C.

The energy measuring meter shall have an accuracy of 1 %.

For tests 8.1 and 8.3:

- air temperature measurements in the empty **oven** are made with a thermocouple with a welded point (not with a black copper plate);
- temperature measurements in the brick (see 8.3) are made with two thermocouples with 1 mm steel tube diameter, class 1 according to EN 60584-2. The thermocouple shall be accurate to $\pm 1,5\text{ K}$.

NOTE The steel tube of the thermocouple eases the insertion of the thermocouple into the brick. Other types of thermocouples may be used provided they are shown to give the same results. (Care should be taken that the measuring point is the first contact point of the two thermowires.)

- the temperature measurement system excluding the thermocouple shall be accurate to $\pm 1,0\text{ K}$.
- the energy measurements shall be accurate to $\pm 1,5\%$ or $\pm 10\text{ Wh}$, whatever is the greater;
- the measurement of the voltage shall be accurate to $\pm 0,5\%$;
- the measurements of mass shall be accurate to $\pm 3\text{ g}$;
- the measurements of time shall be accurate to $\pm 5\text{ s}$;
- the scale for weighing the ingredients shall be accurate to $\pm 0,1\text{ g}$.

5.4 Positioning the appliance

Built-in appliances are installed in accordance with the instructions for installation. Other appliances are placed with their back against a wall, unless otherwise specified in the instructions.

Floor-standing appliances are positioned between kitchen cabinets. Table-top appliances are positioned away from side walls.

For tests 8.1 and 8.3 on **ovens** with integrated air-extraction by a fan (or similar device) to the outside of the building, the air outlet is discharged into a flue which has a pressure drop of 50 Pa when there is an airflow of 200 m³/h.

NOTE The condition of measurement for **ovens** with integrated air-extraction is similar to EN 61591:1997.

5.5 Preheating

The appliance is initially at room temperature. However, if preheating is specified, the appliance is preheated in accordance with the instructions for use. If no instructions are given, the appliance is considered to be preheated after the thermostat has switched off the first time.

5.6 Setting of controls

The control is set to give the temperature specified for the test. However, if the temperature cannot be attained due to the construction of the control, the nearest setting related to the specified temperature is chosen.

6 Dimensions and mass

6.1 Overall dimensions

The overall dimensions of the appliance are measured and stated in millimetres as follows:

- **cooking ranges** and other appliances placed on a surface are measured as shown in Figure 1;
- built-in **ovens** are measured as shown in Figure 2;
- built-in **hobs** are measured as shown in Figure 3.

6.2 Dimensions of hotplates and cooking zones

The main dimensions of **hotplates** and **cooking zones** are determined as follows:

- for **solid hotplates**, the diameter of the surface intended to come into direct contact with the bottom of saucepans is measured;
- for **tubular hotplates**, the diameter of the smallest periphery excluding any lead-in section is measured;
- for **glass ceramic hobs**, the diameters of the **cooking zones** are measured.

The dimensions are indicated in millimetres rounded to the nearest 5 mm.

If the **hotplates** or **cooking zones** are not circular the dimensions are determined as follows:

- for rectangular shapes, the lengths of the sides are measured;
- for elliptical and similar shapes, the major and minor dimensions are measured.

NOTE If the markings identifying **cooking zones** are not clear, this is stated.

6.3 Usable internal dimensions and usable volume of ovens

Removable items specified in the user instructions shall be removed before a measurement is carried out.

The measurement of the usable **oven** volume is to be carried out at ambient temperature.

The height, width and depth of the usable volume in the cavity shall be measured in accordance with 6.3.1 to 6.3.3. The measurement procedure is also shown in Figure 4a.

For verification purposes a gauge, as shown in Figure 4b, shall be used to determine all of the three dimensions. The gauge shall be used without appreciable force.

Dimensions are stated in millimeters.

6.3.1 Usable height

The usable height is the maximum length of a cylinder with a diameter of 200 mm reaching vertically from the centre of the cavity floor to the lowest point on the ceiling. The lowest point of the ceiling can be constituted by a lamp, a heating element or similar object in the area of the cylinder.

In the event that either the width or the depth of the cavity is less than 250 mm, the diameter of the cylinder to be measured shall be reduced to 120 mm.

NOTE The centre of the cavity bottom is defined by the middle of the usable depth and the middle of the usable width.

6.3.2 Usable width

The usable width is the maximum length of a cylinder with a diameter of 200 mm reaching horizontally from the left-hand side wall to the right-hand side wall of the cavity.

In the event that either the height or the depth of the cavity is less than 250 mm, the diameter of the cylinder to be measured shall be reduced to 120 mm.

NOTE The centre of the side wall of the cavity is defined by the middle of the usable depth and the middle of the usable height.

6.3.3 Usable depth

The usable depth is the maximum length of a cylinder with a diameter of 200 mm reaching horizontally from the centre of the rear wall to the inner face of the closed door.

In the event that either the width or the height of the cavity is less than 250 mm, the diameter of the cylinder to be measured shall be reduced to 120 mm.

For measuring the usable depth, the gauge is placed on a support in such a way that the axis lies horizontally in the centre of the cavity, the axis being extended slightly over the expected usable depth. The door is closed carefully so that the gauge is compressed to give the usable depth.

NOTE The centre of the rear wall of the cavity is defined by the middle of the usable height and the middle of the usable width.

6.3.4 Usable volume

The usable volume is calculated from these three dimensions and is stated in litres rounded to the next full litre.

Ⓒ This usable volume shall apply for energy label purposes. Ⓒ

6.4 Overall internal dimensions and overall volume of ovens

For the determination of the energy label clause 6.4 is not applicable

Where the surfaces forming the boundaries of the cavity incorporate protrusions or depressions, the planes used for measurement shall be those comprising the largest percentages of the total areas of the surfaces. Holes in surfaces shall be disregarded when calculating areas for this determination.

The following volumes or spaces shall be disregarded.

- Those occupied by removable items specified by the manufacturer as not essential for the operation of the appliance, such as shelves, racks or temperature probes.
- Those occupied by heating elements.

- Those occupied by minor irregularities in the cooking compartment walls, including covers over temperature sensors and lamps.
- Those occupied by the convection baffle.
- Corner radii smaller than 50 mm at the intersections of the interior surfaces of the cooking cavity.

Dimensions are stated in millimeters.

NOTE The overall dimensions of warming drawers may be measured using the same principles.

6.4.1 Overall height (H)

The maximum vertical distance in mm between the plane of the cooking cavity bottom and the plane of the cavity ceiling.

6.4.2 Overall width (W)

The maximum horizontal distance in mm between the planes of the cavity side walls.

6.4.3 Overall depth (D)

The maximum horizontal distance in mm from the plane of the inside surface of the door when closed to the plane of the rear cavity wall.

6.4.4 Overall volume of rectangular cavities

The overall volume is the total internal volume of the cavity in which cooking takes place, expressed as the product of H, W and D determined as above, divided by 10^6 and rounded to the nearest litre.

6.4.5 Overall volume of non-rectangular cavities

Non-rectangular cavities shall have the volume of any non-conforming section such as a curved door or cavity wall determined by direct measurement and the application of conventional geometrical calculations. The remainder of the cavity shall be treated as a rectangular cavity and the individual volumes added together. The volume is expressed to the nearest litre.

6.5 Dimensions of shelves

The usable width and usable depth of the shelf are measured. The dimensions are determined 5 mm above the surface of the shelf.

The surface area is calculated and stated in square centimetres, rounded to the nearest 10 cm^2 .

NOTE The shelf may be a grid or a baking sheet.

6.6 Dimensions of grill grids

The width and depth of the grill grid are measured.

The surface area is calculated and stated in square centimetres, rounded to the nearest 10 cm^2 .

NOTE If the grill grid is the shelf of an oven, the dimensions are measured in accordance with 6.4.

6.7 Dimensions of warming compartments

The height, width and depth of the usable volume within the **warming compartment** are measured and indicated in millimetres.

NOTE When a heating element is located inside the **warming compartment**, the dimensions are measured up to its most protruding part.

6.8 Level of hotplates

Cooking ranges with adjustable feet and **hobs** are installed with the perimeter of the hob surface horizontal.

A device consisting of a disc and an annular ring is placed centrally on the **hotplate**. A spirit level is placed centrally on the ring, as shown in Figure 5.

A mass of 3 kg is placed on each of the remaining **hotplates**.

The spirit level is rotated to the position where it shows the maximum inclination from the horizontal. Its lower side is then lifted to the horizontal by inserting a feeler gauge between the level and the ring.

The measurement is carried out on each **hotplate**.

The deviation from the horizontal is given by the thickness of the gauge, in millimetres, to two decimal places. It is expressed as a percentage, rounded to the nearest 0,1 %.

NOTE The direct conversion from millimetres to percentage is possible due to the ring having a diameter of 100 mm.

6.9 Distance between hotplates or cooking zones

The shortest distance between the edges of adjacent **hotplates** or **cooking zones** is measured and indicated in millimetres, rounded to the nearest millimetre. If the **hob** has more than two **hotplates** or **cooking zones**, the distance between each pair is determined.

NOTE The result may be shown by means of a sketch.

6.10 Level of shelf

The shelf is placed in a central position in the **oven**.

NOTE 1 The shelf may be a grid or a baking sheet.

A device consisting of a disc and an annular ring is placed centrally on the shelf. A spirit level is placed centrally on the ring as shown in Figure 5. The spirit level is rotated to the position where it shows the maximum inclination from the horizontal. Its lower side is then lifted to the horizontal by inserting a feeler gauge between the level and the ring.

The deviation from the horizontal is given by the thickness of the gauge, in millimetres, to two decimal places. It is expressed as a percentage, rounded to the nearest 0,1 %.

NOTE 2 The direct conversion from millimetres to percentage is possible due to the ring having a diameter of 100 mm.

6.11 Mass of the appliance

The mass of the appliance, including accessories, is determined and expressed in kilograms, rounded to the nearest kilogram.

7 Hotplates and cooking zones

7.1 Ability to heat water

The purpose of this test is to assess the heat transfer from the **cooking zone** to water in a pan.

NOTE 1 This test is applicable for comparative testing only.

A steel saucepan which completely covers the **cooking zone** is used for the test, as specified in Figure 6.

NOTE 2 In order to prevent distortion of the base, a pan with sidewalls glued to the base by silicon-rubber may be used for heating water.

NOTE 3 Commercially available pans which have equivalent thermal and mechanical properties may be used.

The saucepan is filled with the quantity of potable water specified in Table 1. The water has a temperature of $15\text{ °C} \pm 1\text{ °C}$. The saucepan covered with the lid is positioned centrally on the **cooking zone**.

NOTE 4 For non-circular **cooking zones**, an appropriately shaped saucepan may be used.

Table 1 – Quantity of water in the saucepan

Diameter of cooking zone mm	Quantity of water ℓ
≤ 145	1
> 145 and ≤ 180	1,5
> 180 and ≤ 220	2

The **cooking zone** is heated with the control set at maximum. During the test the water is stirred continuously with the aid of a non-metallic stirrer. The time taken for the water temperature to rise by 75 K and the corresponding energy consumption are measured. The test is repeated with the pan turned through 90°.

The average value of the two results is determined.

The time is stated in minutes and seconds. The energy consumption is expressed in watt-hours.

7.2 Ability to control the temperature of a load

7.2.1 Temperature control

The purpose of this test is to check the function of a control.

NOTE 1 This test is applicable for comparative testing only.

NOTE 2 Controls may be automatic, step-by-step, energy-regulated or temperature-regulated.

A saucepan as shown in Figure 6 but without a lid is filled to a height of 30 mm with fresh sunflower oil at room temperature and placed on the **cooking zone**.

NOTE 3 Sunflower oil is considered to be fresh if it has not been used more than three times.

The **cooking zone** is heated with the control set at the minimum marked position. The temperature at the centre of the oil is recorded continuously by means of a thermocouple. The oil is not stirred. The time taken for the oil to reach a steady temperature is measured.

The test is repeated with the control set at the maximum position and also at an intermediate position.

NOTE 4 If a steady temperature is not reached within 30 min or when the oil temperature reaches 250 °C, the test is interrupted and the result noted.

The heating-up time and the temperature obtained for each setting are stated.

7.2.2 Temperature overshoot

The purpose of this test is to assess the heat retention of the **hotplate**.

NOTE This test is applicable for comparative testing only.

A saucepan, as shown in Figure 6 but without a lid, is filled to a height of 30 mm with fresh sunflower oil at room temperature and placed on the **cooking zone**.

The **cooking zone** is heated with the control set at the maximum position. The temperature at the centre of the oil is recorded. When the oil temperature reaches $80\text{ °C} \pm 0,5\text{ °C}$, the supply is switched off. The temperature of the oil is recorded continuously until the temperature starts declining.

The temperature overshoot is the difference between the highest recorded temperature and the temperature of the oil when the supply is switched off.

The temperature overshoot is stated in kelvins.

7.3 Heat distribution

The purpose of this test is to determine whether the **cooking zone** can steadily maintain a medium-high temperature and an even heat distribution when frying continuously.

NOTE This test is applicable for comparative testing only.

The assessment is made by frying a batch of pancakes in a frying pan, as shown in Figure 7.

7.3.1 Recipe for pancakes

The quantities of ingredients and approximate cooking durations corresponding to the diameter of the **cooking zone** are given in Table 2.

Table 2 – Ingredients and cooking durations

Ingredients	Diameter of the cooking zone mm		
	≤ 145	> 145 and ≤ 180	> 180 and ≤ 220
White wheat flour, without raising agent	140 g	140 g	200 g
Fresh milk, fat content 3 % to 4 %	270 g	270 g	400 g
Egg (without shell)	110 g	110 g	160 g
Salt	3 g	3 g	4 g
Batter quantity for each pancake	45 ml	55 ml	85 ml
Cooking duration for the first side	40 s to 60 s	50 s to 70 s	60 s to 80 s

7.3.2 Procedure

Whisk the milk and egg together, sieve the flour and salt together and add to the milk and egg mixture.

Leave the batter to rest for one hour at room temperature before baking the pancakes.

Grease the frying pan with approximately 5 g of vegetable oil. Heat the pan until the centre of the base has reached a temperature of $230\text{ °C} \pm 5\text{ °C}$. Pour the relevant quantity of batter into the pan.

Fry the pancake until bubbles appear in the upper surface and the batter has set (approximate times are shown in Table 2). Turn the pancake and fry until the second side is golden brown. Fry a total of eight pancakes, maintaining the same orientation between the frying pan and the **cooking zone**.

NOTE 1 A preliminary test may be necessary to determine the control setting in order to achieve the specified temperature.

NOTE 2 The frying pan is only greased for the first pancake.

NOTE 3 A contact probe can be used to measure the temperature of the pan.

7.3.3 Assessment

The evenness of browning of the side which is fried first is evaluated for each pancake by using the shade chart of Annex B.

The browning of each quadrant is determined. The difference between the lightest and the darkest shade of each pancake is stated.

The average browning of each pancake is determined. The maximum difference between these average values is stated.

7.4 Heat performance of hobs

7.4.1 Test purpose

Ceramic and induction **hobs** utilise electronic components for thermal protection. Temperature sensors are integrated into the **hob** or range, which reduce or cut off the power to the **cooking zones** when temperatures reach critical limits. Also, the electronic control system itself may require thermal protection. This design characteristic may alter the **hobs'** ability to heat food. The purpose of the test method is to determine the heating performance of **hobs** that have thermal protection.

7.4.2 Test procedure

Select saucepans according to Figure 6. Use the saucepan with oil on the **cooking zone** that has the maximum diameter according to Table 4. On the other **cooking zones**, fill the saucepans with water as indicated in Table 4. The water and the oil shall be at ambient temperature. The chips shall be frozen at $-18\text{ °C} \pm 2\text{ °C}$.

Table 4 – Quantities

Quantity of fresh sunflower oil in the saucepan		
Diameter of cooking zone mm	Quantity of oil l	Quantity of potato chips g
≤ 145	1	250
> 145 and ≤ 180	2	500
≥ 180 and ≤ 220	3	500
Quantity of potable water in the saucepan		
Diameter of cooking zone mm	Quantity of water l	
≤ 145	1	
> 145 and ≤ 180	1,5	
≥ 180 and ≤ 220	2	

The vessels filled with water are covered with glass lids. The temperature of the oil is recorded continuously by means of a suitable temperature sensor. The position of the sensors shall be 10 mm above the bottom of the saucepan and at a distance of 10 mm from the side of the saucepan. The vessels shall be centred over the **cooking zones**.

NOTE 1 Thermocouples are suitable solutions for sensors.

Set the power level for the saucepan selected for frying to maximum power.

Set the power level for the remaining saucepans to maximum power.

For a **hob** range equipped with an **oven**, the **oven** is to be operated. Set the thermostat so that the mean **oven** temperature is $180\text{ °C} \pm 5\text{ °C}$ for **ovens** with forced air circulation and $200\text{ °C} \pm 5\text{ °C}$ for **ovens** with natural convection. Operate the **oven** and be sure it is empty. When the **oven** reaches the temperature or after a maximum time of 20 min, set all **cooking zone** controls to maximum.

NOTE 2 An **oven** with a “cooling” fan can have a favourable influence on the thermal characteristics of the **hob**; in this case, the **oven** is not operated. A cooling fan is not the same as a convection fan. A convection fan is visible in the rear of the **oven** cavity.

After the water starts to boil, adjust the controls so that the water boils gently during the relevant test time.

When the temperature of the oil reaches $180\text{ °C} \pm 5\text{ °C}$, remove one portion of chips from the freezer and transfer it to the oil immediately. Fry for the time specified in Table 5.

Table 5 – Frying times

Diameter of cooking zone mm	Time min
≤ 145	4
> 145 and ≤ 180	5
≥ 180 and ≤ 220	7

If the temperature of the oil has dropped below $180\text{ °C} \pm 5\text{ °C}$ during frying, wait after the chips are taken out until the oil is heated up again at maximum setting to $180\text{ °C} \pm 5\text{ °C}$ before putting the next portion of chips into the oil. This is to prevent the oil from cooling down gradually during the test.

If the oil temperature rises over $180\text{ °C} \pm 5\text{ °C}$, reduce the power level.

This procedure is continued for 45 min after the **cooking zones** are switched on.

The following values should be recorded:

- the heat-up time for the oil to reach 180 °C ;
- the heat-up time for the oil to reach 180 °C again, after taking out a portion of chips;
- the number of chip portions fried during the test.

8 Ovens

The purpose of these tests is to assess the performance of the **oven** in relation to preheating, functioning of the control and energy consumption. The performance is also assessed by means of cooking tests.

The air temperature in the empty **oven** is measured with a thermocouple according to 5.3 fixed to the grid which is delivered with the appliance and placed in the **oven** in a way that the welding point of the thermocouple is located at the centre of the usable volume of the **oven** with a distance of at least 30 mm from the grid.

NOTE 1 If no grid can be purchased from the manufacturer of the appliance, the thermocouple must be positioned in the centre in a suitable way.

Thermocouples are led through the door gap in a way that the door is completely closed without applying additional force.

NOTE 2 The completely closed door is very essential for tests 8.1 and 8.3.

The baking tests of this clause are carried out using corrected control settings according to the differences determined by the test of 8.2.

NOTE The tests of 8.1 and 8.2 are considered to give reproducible results. The tests of 8.3 and 8.4 are applicable for comparative testing only.

8.1 Preheating the empty oven

The purpose of this test is to measure the energy consumption and time it takes to preheat an empty **oven** from room temperature by a given temperature rise.

Prior to the measurement, the whole appliance (this includes the material and the insulation) shall be at ambient temperature of $(23 \pm 2)\text{ °C}$. In **multiple cavity appliances**, each **oven** cavity has to be measured separately. Only the cavity measured shall be switched on.

The temperature control is set at the maximum position for each function. The **oven** is heated until the rise is:

- 180 K for **conventional heating function**,
- 155 K for **forced air circulation function**,
- 155 K for **hot steam function**.

The temperature rise is the difference of the **oven** temperatures measured at the beginning and at the end of the test.

The time t_{ph} in minutes and seconds and the energy consumption E_{ph} in kWh shall be measured. (ph-preheating)

☒ The time for preheating of the empty **oven** t_{ph} , shall be reported; rounded off to the nearest half min.

The energy consumption for preheating the empty **oven** E_{ph} shall be reported rounded off to the nearest kWh to two decimals. ☒

If the **oven** has an additional preheating setting, the test is repeated with this setting.

NOTE 1 The energy consumption of components, such as lamps and fans which are automatically switched on with the appliance, is included in the measurement.

8.2 Accuracy of the control

The temperature control is set to the position marked 150 °C and the **oven** is heated, the temperature being recorded continuously. When steady conditions are attained, the control is positioned at the setting marked 200 °C. When steady conditions are again attained, the control is positioned at the highest marked setting. The test is terminated when steady conditions are finally attained.

NOTE 1 Steady conditions are considered to be attained after five cycles of the thermostat or 1 h, whichever is shorter.

NOTE 2 Markings of the control for grilling are ignored.

NOTE 3 If the control is not marked in degrees Celsius, the control is set at appropriate markings taking into account the instructions for use.

The mean temperature is stated in degrees Celsius for each setting when steady conditions are established. The difference between the maximum and minimum temperatures at steady conditions is also stated as the differential, in kelvins.

8.3 Energy consumption and time for heating a load

The purpose of this test is to measure the energy consumption and the time for heating a load. The load is a water saturated brick which simulates both the thermal properties and the water content of food (e.g. meat).

Prior to the measurement, the whole appliance (this includes the material and the insulation) shall be at ambient temperature of (23 ± 2) °C. In **multiple cavity appliances**, each **oven** cavity has to be measured separately. Only the cavity measured shall be switched on.

8.3.1 Test load

The test load shall be a brick with two holes for temperature measurements, as shown in Figure D.1.

8.3.1.1 Pre-treatment

A new brick shall be dried before using it for the first time in an **oven** of about 50 l volume with **forced air circulation function** at ≥ 175 °C for 3 h. No more than two bricks shall be dried at the same time in the same **oven**.

NOTE 1 A brick which is still damp due to a previous test needs at least 8 h to be dried as described above. However, see Note 1 in 8.3.1.2.

The weight m_d of the completely dry brick without thermocouples shall be measured within 5 min after removal from the **oven** and shall be noted in grams. The dry weight m_d shall be in accordance with the dry weight specified in Clause D.1. The brick shall be identified for accurate calculation of the water absorption according to 8.3.1.2. (d-dry)

Place markings 32 mm from the measuring point of the two thermocouples according to 5.3, and insert the thermocouples into the holes until the marking matches with the surface of the brick. The thermocouples shall be fixed to ensure that the measuring points remain at a depth of 32 mm during the whole test procedure.

NOTE 2 The thermocouples may be fixed by means of a droplet of silicon glue at the surface of the brick or by other suitable means, see Figure 11.

NOTE 3 Due to the porosity of the brick, care should be taken that the holes of the brick are not enlarged if the thermocouples are removed and reinserted.

NOTE 4 A brick can be used for about twenty tests when handled with normal care.

8.3.1.2 Preparation

The brick, pre-treated according to 8.3.1.1 shall be prepared for energy measurement as follows.

NOTE 1 It is not necessary to pre-treat the brick between uses. It gets approximately the same water content each time it is soaked in water.

The brick shall be put into a water container so that it is completely covered with water at less than 20 °C. The water container with the brick is placed for at least 8 h into a refrigerator and cooled down to a centre temperature (both thermocouples) of (5 ± 2) °C.

A hot brick shall be cooled down in air to a centre temperature below 25 °C before putting it into the cold water.

NOTE 2 A hot brick put directly into cold water would absorb substantially more water due to the capillary effect and different water viscosity at different temperatures.

NOTE 3 Between test series, the brick should be stored in a refrigerator, preferably not soaked with water. The brick soaking water should be kept (to reduce dissolving processes); i.e. re-use of the brick storage water.

After the brick has been taken out of the water container, excessive water is allowed to drip off (for about 1 min). Then the weight of the wet brick m_w shall be measured and the absorbed amount of water is determined in g taking into account the weight of the thermocouples, if appropriate, by calculating $\Delta m = m_w - m_d$ (m_d measured according to 8.3.1.1). The amount of absorbed water shall be as specified in Clause D.1. (w – wet or water)

The temperature of the brick is measured. Both thermocouples shall read (5 ± 2) °C.

8.3.2 Measurement

8.3.2.1 Procedure

Three tests are performed for each heating function, as appropriate (see 3.16 to 3.18 and Table 6).

NOTE 1 In case an **oven** has several variants of the functions as described in 3.16 to 3.18, the manufacturer can choose the variant to be tested. This must be reported (see 8.3.4).

With the appliance at ambient temperature, according to 8.3, the brick, prepared according to 8.3.1.2, is placed in the geometric centre of the usable **oven** cavity with its largest surface centrally on the grid delivered with the appliance, with the thermocouples on the upper side. The grid is inserted into a shelf support level of the **oven** so that the centre of the brick comes as close as possible to the centre but not higher than to the centre of the usable **oven** cavity. The longest axis of the brick shall be parallel with the appliance front.

NOTE 2 If no grid can be purchased from the manufacturer of the appliance, any suitable grid must be used, however not a baking sheet, tin or similar.

NOTE 3 Where the grid can be inserted in two different positions (e.g. upside down gives a different height), the position should be taken that brings the brick centre closest to the cavity centre, but not higher.

The thermocouple shall be lead through the door gap in a way that the door is completely closed without applying additional force.

The measurement shall be started by switching on the **oven** within 3 min from the removal of the brick from the refrigerator. The temperature control is set to positions where the mean **oven** temperature rises ΔT_k^i as defined in Table 6 can be expected. ΔT_k^i is the difference between the average ambient temperature and the actual **oven** temperature (measured in 8.3.2.2), $k = 1, 2, 3$. (k - summing index, i - heating mode)

The average ambient temperature during the test is determined by the arithmetic mean of the ambient temperatures at the beginning of the test (i.e. when switching on the **oven**) and when the last of the two thermocouples in the brick has reached a centre temperature rise of 55 K.

Table 6 – Oven settings

Heating mode	Heating functions		
	Conventional "ic"	Forced air "if"	Hot steam "ih"
ΔT_1^i	(140 ± 10) K	(135 ± 10) K	(135 ± 10) K
ΔT_2^i	(180 ± 10) K	(155 ± 10) K	(155 ± 10) K
ΔT_3^i	(220 ± 10) K ^a	(175 ± 10) K ^a	(175 ± 10) K ^a
^a or the maximum temperature rise if this value cannot be reached.			

These temperatures correspond to the measured energy consumption $E_1^{i...}, E_2^{i...}$ and $E_3^{i...}$, as appropriate.

The following data is measured:

- the energy consumption(s) $E_{k...}^{i...}$ in kWh and the time(s) $t_{k...}^{i...}$ in minutes and seconds, as appropriate, when the last of the two thermocouples in the brick reaches a temperature rise of 55 K, $k = 1, 2, 3$;
- centre temperatures of the brick in °C;
- ambient temperature at the start of the test (when the **oven** is switched on) and at the end of the test (i.e. when the last of the two thermocouples in the brick has reached 55 K temperature rise) in °C.

NOTE 4 The energy consumption of components such as lamps and fans, which are automatically switched on with the appliance, is included in the measurement.

8.3.2.2 Checking the oven temperature

After the test according to 8.3.2.1, the brick is removed from the **oven** and the **oven** is run for some extra time without changing the setting. The **oven** temperature is determined as the arithmetic mean between the maximum and minimum temperatures at steady state conditions.

NOTE 1 Steady conditions are considered to be attained after five cycles of the thermostat or 1 h, whichever is shorter.

NOTE 2 A cycle is defined as the time between two thermostat switch off conditions.

8.3.2.3 Acceptance verification of the test results

Results of the tests according to 8.3.2.1 shall only be accepted if

- a) the mean temperature rises $\Delta T_k^{i\dots}$ are within the temperatures specified in Table 6, and
- b) the standard deviation $\sigma^{i\dots}$ as defined in equation (1) is below 0,050 kWh.

Otherwise, for the appropriate function, all measurements according to 8.3.2 shall be repeated.

The standard deviation $\sigma^{i\dots}$ is calculated from the data points $\Delta T_k^{i\dots} / E_k^{i\dots}$ measured according to 8.3.2.1 and calculated according to equation (1) for each tested function, $k = 1, 2, 3$ [see: Lothar Sachs: *Applied statistics*, equations 5.29a and 5.69, modified] 1).

$$\sigma^{i\dots} = 1,2 \sqrt{\frac{Q_y^{i\dots} - (Q_{xy}^{i\dots})^2 / Q_x^{i\dots}}{n - 2}} \quad (1)$$

where

n is the number of measuring points; for the purpose of this standard, $n = 3$;

1,2 is an approximation factor for f .

NOTE For the purpose of this standard, $\Delta T_k^{i\dots}$ can only vary between 125 K and 185 K for **forced air circulation** and **hot steam functions** resulting in f factor between 1,16 and 1,21 and between 130 K and 230 K for **conventional heating function** resulting in factor f between 1,155 and 1,168.

$$f^{i\dots} = \sqrt{1 + \frac{1}{n} + \frac{(\overline{T_0^{i\dots}} - \overline{\Delta T^{i\dots}})^2}{Q_x^{i\dots}}} \quad (2)$$

$$Q_y^{i\dots} = \sum_{k=1}^n (E_k^{i\dots})^2 - \frac{\left(\sum_{k=1}^n E_k^{i\dots}\right)^2}{n} \quad (3)$$

$$Q_{xy}^{i\dots} = \sum_{k=1}^n \Delta T_k^{i\dots} \cdot E_k^{i\dots} - \overline{E^{i\dots}} \sum_{k=1}^n \Delta T_k^{i\dots} \quad (4)$$

$$Q_x^{i\dots} = \sum_{k=1}^n (\Delta T_k^{i\dots})^2 - \frac{\left(\sum_{k=1}^n \Delta T_k^{i\dots}\right)^2}{n} \quad (5)$$

$$\overline{\Delta T^{i\dots}} = \frac{1}{n} \sum_{k=1}^n \Delta T_k^{i\dots} \quad (6)$$

$$\overline{E^{i\dots}} = \frac{1}{n} \sum_{k=1}^n E_k^{i\dots} \quad (7)$$

1) See the Bibliography.

8.3.3 Evaluation and calculation

8.3.3.1 Electric energy consumption

The energy consumption $E_{\Delta T_0}^{i\dots}$ for the reference temperature rise $\Delta T_0^{i\dots}$ is calculated using the linear regression based on the measured data points $\Delta T_k^{i\dots} / E_k^{i\dots}$, according to the equation:

$$E_{\Delta T_0}^{i\dots} = S^{i\dots} \Delta T_0^{i\dots} + B^{i\dots} \quad (8)$$

where

$E_{\Delta T_0}^{i\dots}$ is the calculated nominal energy consumption in kWh for heating a load for the different heating functions "ic", "if" or "ih" at $\Delta T_0^{i\dots}$;

$\Delta T_0^{i\dots}$ = 180 K for **conventional heating function**,
 = 155 K for both **forced air circulation** and **hot steam functions**

$S^{i\dots}$ is the slope related to the different heating functions "ic", "if" or "ih", which is calculated according to equation (9)

$B^{i\dots}$ is the intercept which is calculated according to equation (10):

$$S^{i\dots} = \frac{n \sum_{k=1}^n (\Delta T_k^{i\dots} \cdot E_k^{i\dots}) - \left(\sum_{k=1}^n \Delta T_k^{i\dots} \right) \left(\sum_{k=1}^n E_k^{i\dots} \right)}{n \sum_{k=1}^n (\Delta T_k^{i\dots})^2 - \left(\sum_{k=1}^n \Delta T_k^{i\dots} \right)^2} \quad (9)$$

$$B^{i\dots} = \frac{\sum_{k=1}^n E_k^{i\dots} - S^{i\dots} \sum_{k=1}^n \Delta T_k^{i\dots}}{n} \quad (10)$$

where

$\Delta T_k^{i\dots}$ is the actual temperature difference for the different heating functions "ic", "if" or "ih", as defined in 8.3.2.1;

$E_k^{i\dots}$ is the energy consumption in kWh measured according to 8.3.2.1 at the different $\Delta T_k^{i\dots}$ for the different heating functions "ic", "if" or "ih";

n is the number of measuring points; for the purpose of this standard, $n = 3$.

8.3.3.2 Time for heating the load

The time for heating the load shall be calculated and determined in the same way as the energy consumption is calculated and determined according to 8.3.3.1.

Replace in the equations (8) to (10) E values by the appropriate t values, i.e. replace

- in equation (8) $E_{\Delta T_0}^{i\dots}$ by $t_{\Delta T_0}^{i\dots}$ and

– in equations (9) and (10) $E_k^{i...}$ by $t_k^{i...}$.

where

$t_k^{i...}$ is the time measured in minutes and seconds according to 8.3.2.1 at the different $\Delta T_k^{i...}$ for the different heating function *ic*, *if* or *ih*;

$t_{\Delta T_0}^{i...}$ is the calculated nominal time in minutes and seconds for heating a load for the different heating function *ic*, *if* or *ih* at $\Delta T_0^{i...}$.

NOTE As an example for evaluation sheets, see Annex E. An Excel 97 evaluation program, which corresponds directly to Annex E, is available with this standard for the automatic calculation of both energy consumption (8.3.3.1) and the time for heating the load (8.3.3.2). These calculations can also be made in any other spreadsheet program under the condition that the same results are achieved.

8.3.4 Reporting of test results

The following data shall be reported for all heating functions:

- type of the appliance, available heating function(s) according to 3.16 to 3.18;
- supply voltage at which the measurements were made;
- tested functions or variant;
- energy consumption(s) in kWh to two decimals, according to 8.3.3.1;
- time(s) in minutes, according to 8.3.3.2, rounded off to the nearest half minute;
- water absorption of the brick according to 8.3.1.2.

This data shall be reported for all heating functions (according to 3.16 to 3.18) as appropriate. For **multiple cavity appliances**, the values shall be reported separately for each cavity.

8.4 Heat distribution

The heat distribution is assessed by means of the tests of 8.4.1 or 8.4.2 depending on the construction of the **oven** and the instructions for use.

8.4.1 Shortbread

The purpose of this test is to assess the heat distribution within the **oven**.

8.4.1.1 Ingredients

- 500 g white wheat flour, without raising agent
- 200 g baking margarine with 80 % fat content, or salted butter
- 200 g castor sugar (max. grain size 0,3 mm)
- 2 eggs (55 g to 60 g, with shell)
- 3 g salt

8.4.1.2 Procedure

Mix together the flour, castor sugar and salt. Rub in the margarine. Beat the eggs and add to the flour mixture, mix lightly in a food mixer until the dough is smooth. Remove the dough from the mixing bowl and form it into a loaf. Cover and store it in a refrigerator at a temperature of $5\text{ °C} \pm 2\text{ °C}$ for at least 8 h. Remove the loaf from the refrigerator approximately 1 h before further handling.

Extrude the loaf into strips by means of a worm conveyor attachment using the nozzle as shown in Figure 8. Cut the strips to a length that fits the baking sheet supplied with the **oven** or that recommended by the manufacturer. Position the pastry strips as shown in Figure 9 so that they will be parallel to the **oven** door.

8.4.1.3 Preliminary measurements

Preliminary tests are carried out to determine the appropriate baking time to achieve the specified browning.

The control is set in accordance with the instructions for use for this type of mixture. If instructions are not given, the control is set so that the centre **oven** temperature is 175 °C for **ovens** with forced-air circulation and 200 °C for **ovens** with natural convection. When the thermostat cuts out for the first time, the sheet is inserted into the **oven** in accordance with the instructions for use. If instructions are not given, the sheet is positioned as close as possible to the centre of the **oven**. The sheet is removed from the **oven** when the strips have attained a golden brown colour. The baking time is noted.

The sheet is placed on a grid and allowed to cool down. The browning of the top is measured using the colour measuring instrument specified in annex A. The instrument is passed over the strips lengthwise, beginning and ending approximately 20 mm from the end of each strip. The measurements are carried out in steps of approximately 50 mm. The average browning is calculated by dividing the sum of the values by their number.

The baking time is suitable when the average browning on top of the strips correlates to a reflection value R_y of $(43 \pm 5) \%$.

NOTE A supplier of the colour measuring instrument is given in annex C.

8.4.1.4 Heat distribution test

The procedure stated for preliminary measurements is followed, the strips being baked for the time which has been determined.

The strips are loosened from the sheet while still hot but left in their original position.

If the instructions state that a number of sheets can be baked simultaneously, an additional test is carried out with the maximum number of sheets, the baking time being increased, if necessary.

8.4.1.5 Assessment

Within 1 h after baking, the browning is determined for both the top and bottom of the strips as stated for the preliminary measurements.

The following results are calculated and stated:

- the maximum browning difference on the top;
- the maximum browning difference on the bottom;
- the average browning on the top;
- the average browning on the bottom.

8.4.2 Small cakes

This test is intended to assess the vertical and horizontal heat distribution, especially for a mixture that rises during cooking.

NOTE The test is carried out using the general conditions of measurements as stated in Clause 5.

8.4.2.1 Ingredients

The quantities of ingredients for 30 to 40 small cakes are indicated in Table 3. For a reproducible result always prepare the same amount and discard any surplus mixture.

Table 3 – Ingredients

Ingredients	Quantities g	Remarks
Butter, with a fat content of 83 % ± 2 %	340 ± 0,5	Unsalted butter should be used. If unsalted butter is not available the fat content of butter should be subtracted from the salt added to the mixture.
White sugar, fine (grain size 0,10 mm – 0,35 mm, d95/d05)	340 ± 0,5	d95/d05: 90 % of the sugar crystals shall have a grain size of 0,10 mm – 0,35 mm
Eggs	300 ± 1	Middle sized hen eggs (approximately 55g ± 5g) are beaten and sieved until homogeneous, then weighed. If frozen egg mixture is used follow the instructions of Clause C.1.
Wheat flour without raising agent, unbleached Mineral content: maximum 0,5 % (dry substance)	450 ± 1	Gluten: at least 24,0 %
Baking powder	15 ± 0,5	Phosphate baking powder (double acting) shall be used (not baking soda).
Salt	6 ± 0,1	
NOTE 1 For reproducible results ingredients as defined in Annex C shall be used.		
NOTE 2 The eggs are sieved to remove any chalazae.		
NOTE 3 If more than 40 small cakes are required, two identical kitchen machines should be used simultaneously.		

8.4.2.2 Paper cases

As the paper quality affects the rising height and spreading, only the paper cases specified in Annex C shall be used for reproducible results. The paper cases are 48 mm in base diameter and 29 mm in height. They are made of 70 g/m² bleached greaseproof paper.

NOTE A supplier of paper cases is indicated in Annex C.

8.4.2.3 Quantity

The baking sheet shall be measured according to 6.4 and cover at least 80 % of the usable width and 70 % of the usable depth of the cavity measured according to 6.3. If the supplied baking sheet or the sheet recommended in the instructions fits these dimensions, this baking sheet shall be used. If the supplied or recommended baking sheet does not fit the above condition or no recommendation is given, then a baking sheet fitting the above condition, made of aluminium, no coating, matt finished, 0,9 mm ± 0,1 mm thickness, lip height maximum 6 mm shall be used.

The width and the depth of the baking sheets are measured in accordance with 6.4 and each divided by 75 mm to give the number of small cakes to be placed along its sides. The numbers are rounded down to give a whole number of cakes. Multiply the number of cakes from the depth and the width to give the total number for the whole tray.

Example:

A width of 470 mm divided by 75 mm equals 6,3. This gives 6 columns of cakes.

A depth of 295 mm divided by 75 mm equals 3,9. This gives 3 rows of cakes.

Therefore the total number of cakes on the tray is 18.

The base of the outermost cakes should be at a distance of approximately 14 mm from the edge of the usable area of the baking sheet measured according to 6.4. Distribute the cakes evenly on the tray, in such a way that they do not touch each other.

The manufacturer's instructions regarding the number of baking sheets, which may be cooked simultaneously, are followed.

8.4.2.4 Procedure

All ingredients shall be at ambient temperature before starting.

Beat together butter and sugar in a food mixer until it becomes soft and pale in colour so that all the sugar is incorporated into the mix. Gradually add the egg mixture. Sift the flour, baking powder and salt together and gently fold into the mixture; loosen the mixture as required from the edge of the bowl to ensure that the mixture is homogeneous.

The temperature of the mixture shall be $23\text{ °C} \pm 2\text{ °C}$ directly after mixing.

NOTE 1 A suitable food mixer for which the mixing time has been determined is indicated in Annex C.

NOTE 2 Ensure that the paper cases maintain a uniform circular shape by carefully peeling cases from the outside of the batch without distortion.

Weigh $28\text{ g} \pm 0,5\text{ g}$ of the mixture into the centre of the paper cases and place them evenly on the baking sheets. Bake immediately.

NOTE 3 The tests are carried out using corrected temperature control settings according to the differences determined by the test of 8.2.

a) Baking on one level

Follow the operating instructions with respect to the heating function, temperature, shelf position and preheating. If preheating is recommended, small cakes are placed in the **oven** when the end of the preheating phase is indicated, for example by visual or acoustic signal, or after a recommended pre-heating time. If no instructions are given, the **oven** is set to 160 °C for **forced air circulation function** or to 185 °C for **conventional heating function** and the baking sheet is placed in the middle of the usable cavity of the cold **oven**. While the small cakes are baking, the position of the baking sheet shall not be changed.

The baking time shall not exceed 40 min when baking on one level (including preheating time).

b) Baking on two levels

The baking sheets are placed simultaneously in the **oven** one above the other and removed simultaneously at the end of baking. While the small cakes are baking, the position of the baking sheets shall not be changed. Follow the operating instructions with respect to the heating function, temperature, shelf position and preheating. If preheating is recommended, the small cakes are placed in the **oven** when the end of the preheating phase is indicated, for example by visual or acoustic signal, or after a recommended pre-heating time.

If no instructions for small cakes on two levels are given, the **oven** is set to 160 °C for **forced air circulation function** and the baking sheets are spaced evenly in the cold **oven**. The horizontal position of the baking sheets shall be in the middle of the cavity base area. The vertical position of the sheets shall be spaced at one third and two third of the usable height of the **ovens** as near as possible without modifying the shelf racks.

NOTE 4 Baking on two levels is not carried out for **small oven cavities**, as defined in 3.14

The baking time shall not exceed 50 minutes when baking on two levels (including preheating time).

c) Baking on more than two levels

If the operating instructions recommend baking on more than two levels simultaneously then cakes are baked in accordance with the instructions (heating function, temperature, shelf position, preheating and baking time).

8.4.2.5 Assessment

Within 30 minutes after baking, the paper cases are very carefully removed so that the largest base area possible can be assessed. For assessment according to 8.4.2.5.3, at least 50 % of the base shall be undamaged. Otherwise the test shall be repeated.

NOTE Cooling the small cakes quickly can aid clean removal of paper cases.

Browning of the top and base of the cakes, the differences of browning between these, and the evenness of rise, are assessed within one hour after baking. If small cakes have been baked on several levels simultaneously each sheet shall be assessed separately (single result) and additionally they are assessed together (overall result).

The requirements of the results of these small cakes baked on one or more levels are different. This shall be considered in the evaluation.

8.4.2.5.1 Visual assessment

For comparative results the evaluation of browning may be done by a visual check using the criteria for assessment in 8.4.2.5.3.

The shade numbers of the Table B.1 of annex B are used to evaluate browning. For a visual check, the same background colour and illumination shall be used for each tray.

8.4.2.5.2 Digital assessment

For reproducible results of the evaluation of browning any digital measurement system shall be used which meets the following requirements when the measurements are taken.

a) Evenness of light distribution on the measurement area

The reflection value R_V of a uniform coloured shade chart shall be measured over the entire surface to be analysed, for example, the size of the baking sheet or one small cake. The shade chart shall be coloured in shade number 10, which is defined in Annex B.

The mean value of the reflection value R_V over the entire surface is determined. More than 90 % of the entire surface may deviate from the mean value by up to ± 5 %. Less than 10 % of the entire surface may deviate by up to ± 8 %.

The entire surface is divided in 1 cm² sections. None of the mean values of the 1 cm² sections shall deviate by more than ± 5 % of the mean value of the entire surface.

NOTE 1 Shade number 10 is used to check the quality of the illumination as it is the most desired shade.

NOTE 2 Each small cake can be measured separately.

b) Recognition of the reference colours

The shade numbers defined in annex B shall be confirmed in all positions of the surface to be assessed.

This is ensured using the following check:

Flat circular calibrated colour samples with a diameter of 70 mm in every shade number defined in Annex B are placed at a height of 28 mm. The reflection value R_y of the calibrated colour samples shall be measured in the corners of the area to be assessed (where the outermost small cakes are positioned during the measurement), as well as in the centre.

The reflection value R_y of the calibrated colour samples shall be measured with the deviations given in Annex 5.

NOTE 3 To ensure that the light conditions and the focal length which will be used for the assessment are comparable, the colour samples should be at the height of 28 mm.

NOTE 4 Squared colour samples with a length of 70 mm and width of 70 mm could be used as well.

NOTE 5 Technical details are not fixed in order to be open for technical progress (e.g. camera, software).

c) Consistent colour recognition on a convex surface

A convex colour sample (shape as defined in Figure 13) with a smooth and matt finished surface painted in shade number 10, is placed at a height of 13 mm in the corners of the area to be assessed (where the outermost small cakes are positioned during the measurement), as well as in the centre. The reflection value is measured in 13 sections (defined in Figure 14). The mean value of the reflection values of all sections in each position is calculated. The extreme values may deviate by $\pm 9\%$ of the mean value.

Definition of the convex colour sample: A ball with a smooth surface and a diameter of 100 mm is cut at a depth of 15 mm, as illustrated in Figure 13, and the smaller section is used as the convex colour sample.

NOTE 6 The surface of the convex colour sample should be <35 specular gloss value for an angle of 85° (according to ISO 2813:1994).

NOTE 7 To ensure that the light conditions and the focal length which will be used for the assessment are comparable, the convex colour samples (height of convex colour sample is 15 mm) should be positioned at the height of 13 mm (total height 28 mm at the highest point).

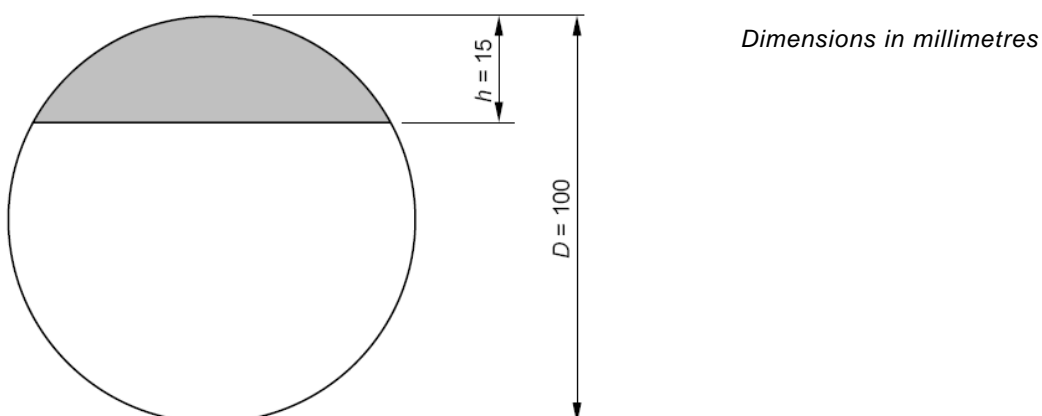


Figure 13 – Convex colour sample

d) Definition of the illuminance

The measurement is taken under a full spectral fluorescent triband or equivalent from 6 000 K to 7 000 K, colour rendering index $R_a > 90$ % illumination.

NOTE 8 Suppliers for suitable lamps are indicated in Clause C.

NOTE 9 A supplier of a colour measuring system which meets these requirements, is given in Clause C.

8.4.2.5.3 Criteria for assessment (digital and visual)

a) Evaluation on the top of the small cakes

The top of each small cake is divided into 13 nearly equally sized sections, as shown schematically in Figure 14.

The values are adapted to the size and shape of each small cake.

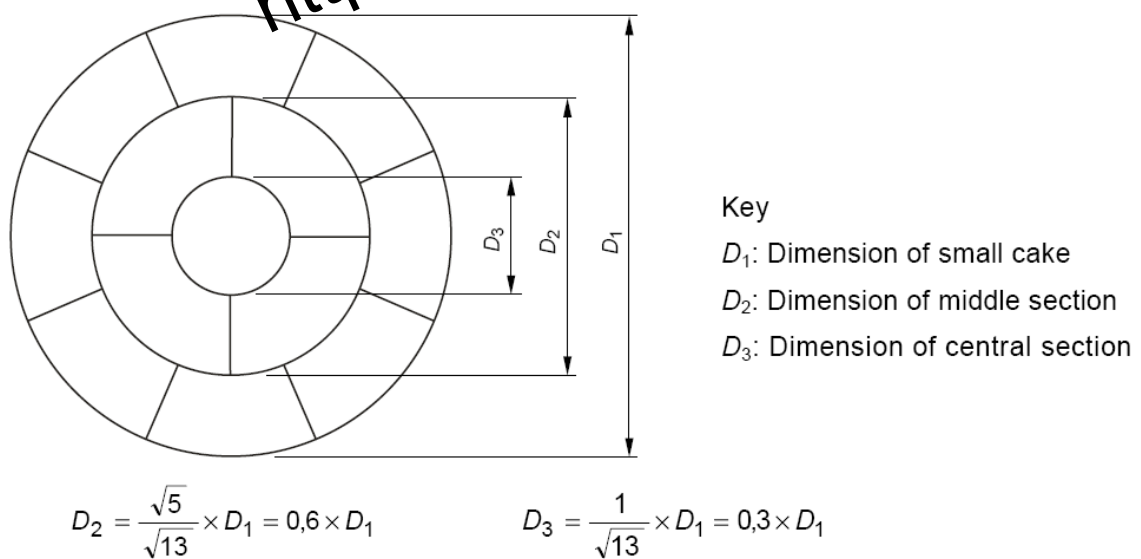


Figure 14 – Template for the sectioning of small cakes

The arithmetic average of reflection value R_y is calculated for the whole area of each section.

A shade number is determined according to Annex B and noted for each section.

1 Acceptable browning on the top

The average browning on the top of each single sheet and of all sheets baked simultaneously is calculated by dividing the sum of the shade numbers by thirteen times the number of cakes.

$$\text{average browning} = \frac{\text{sum of the shade numbers}}{13 * \text{number of cakes}}$$

The average browning on the top is reported to one decimal place (single results per sheet and overall result).

Results of the test according to 8.4.2 shall only be accepted if the average browning on the top of all baking sheets baked simultaneously is in the range of 9,5 to 10,5. Otherwise, the test shall be repeated with a modified setting. If the baking time exceeds 40 minutes (preheating time included) for baking on one level or 50 minutes (preheating time included) for baking on two levels respectively, the **oven** temperature shall be increased accordingly.

NOTE 1 The average browning should be within the given range for a comparable result.

2 CPB (*Cakes properly browned*) on the top

All cakes with at least one section having a shade number outside the range 8 to 12 are not included.

CPB = Number of cakes where all sections have shade numbers between 8 and 12

3 PPB (*Percentage properly browned*) on the top

PPB = CPB / total number of cakes * 100 %

4 Browning difference on the top

The maximum difference between the shade numbers of all sections is determined and reported as browning difference on the top of each baking sheet separately and of all sheets baked simultaneously (single results per sheet and overall results).

b) Evaluation of the base of the small cakes

The reflection value R_y for the undamaged part of the base of each small cake is determined. A shade number is determined according to Annex B and noted for each small cake.

NOTE 2 At least 50 % of the base of each small cake should not be damaged after removing the paper case. Otherwise the test should be repeated.

1 Average browning on the base

The average browning on the base for each sheet separately and of all sheets baked simultaneously is calculated by dividing the sum of the shade numbers by the number of cakes.

$$\text{Average browning of the bottom} = \frac{\text{sum of the shade numbers}}{\text{number of cakes}}$$

The average browning on the base is reported to one decimal place (single results per sheet and overall result).

2 Browning difference on the base

The maximum browning difference between the shade numbers is determined and reported as browning difference on the base of each baking sheet separately and of all sheets baked simultaneously (single result per sheet and overall result).

c) Evaluation of the browning difference between top and base (top - base)

The browning difference between top and base is calculated by subtracting the average browning on the base from the average browning on the top.

$$\text{top - base} = |\text{average browning on the top} - \text{average browning on the base}|$$

The browning difference between top and base (absolute value) is reported for each sheet separately and of all sheets baked simultaneously (single results per sheet and overall result).

d) Measurement of the height of small cakes

The highest point of each small cake is measured and recorded in millimetres. Cutting or stabbing shall not affect the height of the cake.

The minimum height and the maximum height shall be recorded for each sheet separately.

8.5 Ability to supply heat

8.5.1 Fatless sponge cake

The purpose of this test is to assess the evenness of the heat supply by cooking a medium load at medium temperature.

NOTE This test is applicable for comparative testing only.

8.5.1.1 Ingredients

- 100 g white wheat flour without raising agent
- 100 g maize flour (corn flour)
- 3 g baking powder
- 150 g castor sugar (max. grain size 0,3 mm)
- 3 eggs (55 g to 60 g, with shell)
- 30 ml hot water (approximately 45 °C)

These ingredients are sufficient to make one cake.

8.5.1.2 Procedure

Separate the egg whites from the yolks.

Whisk the egg whites with the hot water until a firm consistency is reached. Add the sugar and egg yolks and whisk for 2,5 min. Sift the wheat flour, maize flour and baking powder together and gently fold into the egg and sugar mixture.

Line the base of an ungreased cake tin with greaseproof paper. The tin is uncoated and has a diameter of 260 mm ± 10 mm and a height of 65 mm ± 10 mm. Spoon in the cake mixture and distribute to a uniform thickness. Follow the instructions for use for this type of cake with regard to preheating, positioning in the **oven** and setting of the thermostat. If no instructions are given, place the cake as close as possible to the centre of the **oven** and set the thermostat so that the **oven** temperature is 150 °C for **ovens** with forced-air circulation and 175 °C for **ovens** with natural convection. After baking for approximately 35 min, take the cake out of the **oven** and allow it to cool. Remove the cake from the tin and carefully remove the paper lining.

If the instructions for use state that the cakes can be baked on more than one level, the test is carried out accordingly.

8.5.1.3 Assessment

The shade chart of Annex B is used to assess browning. Small irregularities are ignored.

The following results are stated:

- the maximum browning difference on the top;
- the maximum browning difference on the bottom.

The cake is cut vertically through the centre and the baking is evaluated. The height of the cake is measured at the centre and at the lowest and highest point of the edge.

NOTE The evaluation of baking includes a visual assessment of the thickness of the crust, cracks, craters and texture. The baking result may be documented by photographs.

8.5.2 Apple pie

The purpose of this test is to assess the ability to supply sufficient heat to cook a heavy load.

NOTE This test is applicable for comparative testing only.

8.5.2.1 Ingredients

Dough:

- 300 g white wheat flour without raising agent
- 175 g baking margarine with 80 % fat content or salted butter
- 75 g castor sugar (max. grain size 0,3 mm)
- 1 egg (55 g to 60 g, with shell)
- 50 ml water

Filling:

- 25 g fresh white breadcrumbs
- 50 g seedless raisins
- 400 g fresh cooking apples (prepared weight)
- 75 g castor sugar, grain size max. 0,3 mm

These ingredients are sufficient to make one pie.

8.5.2.2 Procedure

Mix the flour and sugar together and rub in the margarine. Add the beaten egg and sufficient water to bind into a soft dough. Mix until a uniform consistency has been reached and knead the dough into a ball. Cover and store for at least half-an-hour in a refrigerator at a temperature of $5\text{ °C} \pm 2\text{ °C}$. Peel, core and cut the apples into slices up to 13 mm thick.

Remove the dough from the refrigerator and divide it into a two-third and one-third portion. Roll out each portion to a thickness of 5 mm without kneading it again. Use the larger portion to line the base and sides of a baking tin having a diameter of $200\text{ mm} \pm 10\text{ mm}$ and a height of $50\text{ mm} \pm 15\text{ mm}$.

Sprinkle the breadcrumbs evenly over the dough. Place the apple slices, raisins and sugar evenly over the breadcrumbs packing them down well. Cover the top with the remaining layer of pastry. Seal and trim the edges. Make an incision in the top to allow the steam to escape.

Follow the instructions for use for this type of pie with regard to preheating, positioning in the **oven**, setting of thermostat and cooking time. If no instructions are given, the pie is positioned as close as possible to the centre of the **oven** and the thermostat is set so that the mean **oven** temperature is 160 °C for **ovens** with forced-air circulation and 185 °C for **ovens** with natural convection and the pie is left in the **oven** until it is cooked.

In **ovens** with forced-air circulation, the maximum number of shelves are used in accordance with the instructions for use, one pie being placed on each shelf. All the pies are removed from the **oven** at the same time. In **ovens** with natural convection up to two pies are baked simultaneously, in accordance with the instructions for use, either on one shelf or two separate shelves. If two separate shelves are used, one pie may be removed from the **oven** first and the other moved into its place.

Alternatively, the pies may be interchanged once.

NOTE Only one pie is cooked if there is insufficient space in the **oven** to cook two pies simultaneously.

8.5.2.3 Assessment

The pie is removed from the **oven** and allowed to cool down.

The uniformity of browning on the top and on the bottom of the pie is assessed by using the colour measuring instrument specified in Annex A or the shade chart specified in Annex B.

The following results are stated:

- the maximum browning difference on the top;
- the maximum browning difference on the bottom.

The pie is cut vertically and assessed to check whether the filling is sufficiently cooked.

The cooking time is stated.

9 Grills

The purpose of these tests is to determine the performance of **grills** in relation to their size and ability to cook.

9.1 Grilling area

The purpose of this test is to determine the effective area of the **grill**.

NOTE This test is applicable for comparative testing only.

9.1.1 Procedure

The measurements are made with factory-made white bread which is commonly available and suitable for toasting. Care has to be taken to ensure that if more than one loaf is necessary, bread from the same batch is used.

Slices of bread of uniform size having a thickness of $12\text{ mm} \pm 1\text{ mm}$ are used for the test with the crust removed. The grill grid is completely covered with bread.

NOTE It may be necessary to trim some slices to fit the grill grid.

The **grill** is preheated on the maximum setting in accordance with the instructions for use. If no instructions are given, the **grill** is preheated for 5 min.

The grill grid, together with the grill pan, is placed under the grill element in the position recommended in the instructions for use. If no instructions are given, the grill grid is placed in the highest position suitable for grilling. The door is in the open position, unless otherwise specified in the instructions for use.

The grill grid is removed when a part of the bread is well browned but before burning occurs. If there is any shrinkage of the bread, the slices are moved so that the edges coincide with those of the grill grid.

9.1.2 Assessment

The shade chart of annex B is used to determine the area of the bread where the browning is within shade numbers 8 to 14. The effective grilling area is stated in square centimetres and expressed as a percentage of the surface area of the grill grid.

9.2 Grilling

The purpose of this test is to determine the uniformity of cooking and browning of meat.

NOTE This test is applicable for comparative testing only.

9.2.1 Ingredients

2 500 g fresh minced beef, fat content 10 % to 20 %.

This quantity is sufficient for 20 burgers.

9.2.2 Procedure

Form the minced beef into burgers using a ring mould, each burger weighing 125 g and having a diameter of 75 mm. Compress the burger so that its height is approximately 35 mm.

Distribute the burgers evenly over the grill grid, allowing approximately 15 mm between each burger and between the burgers and the edges.

Preheat the **grill** on maximum setting in accordance with the instructions for use. If no instructions are given, preheat the **grill** for 5 min.

Place the grill grid and the grill pan under the grill element in the position recommended in the instructions for use. If no instructions are given, place the grill grid so that the top of the burgers is 50 mm to 75 mm below the grill element. The door is in the open position, unless otherwise specified in the instructions for use.

Grill the burgers as recommended in the instructions for use. If no instructions are given, grill one side for 12 min to 15 min, turn the burgers over and grill the other side for 10 min to 15 min.

9.2.3 Assessment

The grill grid is removed from the **oven** and the temperature is measured at the centre of five burgers using a temperature measuring probe. The burgers are selected from the four corners and the centre of the grill grid. The measurement shall be performed within 2 min.

The difference between the maximum and minimum centre temperatures is stated.

The browning of each burger is assessed as follows:

- heavily charred – A
- lightly charred – B
- medium dark – C
- medium light – D
- grey – E

10 Warming compartments

The purpose of this test is to evaluate the temperature control and the energy consumption of **warming compartments**.

NOTE This test is considered to give reproducible results.

A thermocouple is placed in the geometrical centre of the **warming compartment**. The control is set to the lowest marked position and the **warming compartment** is heated until steady conditions are established. The control is then set to the medium position and heating is continued. When steady conditions are established heating is continued with the control at maximum setting.

When steady conditions are again established the test is continued for 1 h and the energy consumption is measured during this period.

The temperatures for the different settings of the control are stated. If the control cycles, the average temperatures and the temperature differentials are stated.

The energy consumption is stated in watt-hours for 1 h of operation.

11 Cleaning

11.1 Spillage capacity of hobs

The purpose of this test is to evaluate the capability of the **hob** to retain spillage.

NOTE This test is considered to give reproducible results.

The appliance is positioned so that the perimeter of the **hob** surface is horizontal. A saucepan which has the smallest diameter required to cover the **cooking zone** is placed on one of the **cooking zones** and completely filled with water. An additional quantity of 0,5 l of water is poured steadily into it within 1 min. The effect of this spillage is determined and stated. If the **hob** does not hold the excess quantity, it is stated which way the water runs.

The quantity of water that the **hob** will retain before it overflows is measured and stated in millilitres.

11.2 Pyrolytic self-cleaning ovens

The purpose of this test is to evaluate the self-cleaning process of the **oven**.

NOTE 1 This test is applicable for comparative testing only.

The interior surfaces of the **oven** cavity and door are artificially soiled using a paintbrush.

NOTE 2 The soil is not applied to the door seal and overlapping surfaces between the door and the **oven** cavity.

The artificial soil is made from

- 30 g gravy (20 g meat extract and 10 g water);
- 15 g hydrogenated oil shortening (vegetable cooking fat).

The mixture is evenly applied in a quantity of 0,15 g/dm².

The door is closed and the **oven** energized for 3 h with the temperature control set to 250 °C or the maximum obtainable if this is lower. The **oven** is then allowed to cool down.

The **oven** is then operated in the cleaning mode in accordance with the instructions for use and the energy consumption is measured.

After the **oven** has cooled down it is inspected. It is stated to what extent residues are left and whether they can be removed by means of a damp cloth.

The energy consumption during the cleaning cycle is measured and stated in kilowatt-hours, rounded off to 0,1 kWh.

11.3 Ovens with catalytic cleaning

The purpose of this test is to evaluate the catalytic cleaning ability of the **oven**.

NOTE This test is applicable for comparative testing only.

Approximately 1 kg of pork belly is placed in an open roasting pan and 0,125 l of water added. The pan is positioned as close as possible to the centre of the **oven** and heated for 1,5 h at an **oven** temperature of 200 °C for **ovens** with forced-air circulation and 225 °C for **ovens** with natural convection. The pan is removed and the **oven** is allowed to cool down.

The **oven** is inspected and the extent of residues remaining on surfaces with catalytic coating is stated.

NOTE Pork belly is used because this meat provides sufficient fat for soiling the surfaces.

12 Standby power

The standby power shall be determined in accordance to EN 62301 with the following modifications.

For multifunctional appliances which may consist of a variety of different **hobs** and **ovens** which are designed to be combined in a single range, the recommended combination as declared in the manufacturer's instruction are used for the test.

For the determination of standby power, the appliance shall be in the state recommended in the manufacturer's instructions, if any, when the (product) intended function is not in use.

NOTE 1 Appropriate advices in the manufacturer's instructions how to reduce standby energy has to be taken into account when preparing the appliance for the test.

When testing appliances that are fitted with a clock, the clock shall be adjusted to the correct time and date as specified in the instructions. If an option is provided to switch off the display it is tested in this mode.

NOTE 2 If the brightness of the display can be altered by the user, the brightest illumination should be selected for the measurement. If the brightness of the display is affected by the ambient light conditions, a steady state condition should be used during the measurement and the ambient illumination level recorded in the test report.

The appliance shall be at ambient temperature before the power is monitored.

The appliance shall be connected to the power source and allowed to stabilize before the measurements are made.

If the power reading is not stable the power consumption in each relevant mode shall be determined as an average power measurement over a period of not less than 30 min.

When preparing the test report for multifunction appliances the combination of types of main powered parts (**hobs, ovens, grills**, warming plates, griddles etc) used for the measurement shall be recorded in addition to the brand, model, type, and serial number of each part.

Ⓒ Z1 Tolerances and control procedures

For test 6.3, 6.4, 8.1 and 8.3:

Z1.1 Energy consumption with a load

The energy consumptions determined according to 8.3 shall not be greater than the value declared by the manufacturer plus 10 % plus 0,040 kWh.

If the result of the test carried out on the first appliance is greater than the declared value plus 10 % plus 0,040 kWh the test shall be carried out on a further three appliances, which shall be randomly selected from the market.

The arithmetical mean of the values of these three appliances shall not be greater than the declared value plus 6 % plus 0,040 kWh.

Z1.2 Energy consumption for pre-heating an empty oven

The energy consumptions determined according to 8.1 shall not be greater than the value declared by the manufacturer plus 15 %.

If the result of the test carried out on the first appliance is greater than the declared value plus 15 % the test shall be carried out on a further three appliances, which shall be randomly selected from the market.

The arithmetical mean of the values of these three appliances shall not be greater than the declared value plus 10 %.

Z1.3 Preheating time of the empty oven

The preheating time of the empty **oven** measured according to 8.1 shall not be greater than the value declared by the manufacturer plus 15 %.

If the result of the test carried out on the first appliance is greater than the declared value plus 15 %, the test shall be carried out on a further three appliances, which shall be randomly selected from the market.

The arithmetical mean of the values of these three appliances shall not be greater than the declared value plus 10 %.

Z1.4 Time for heating the load

The time determined according to 8.3 shall not be greater than the value declared by the manufacturer plus 15 %. **Ⓒ**

☐ If the result of the test carried out on the first appliance is greater than the declared value plus 15 %, the test shall be carried out on a further three appliances, which shall be randomly selected from the market.

The arithmetical mean of the values of these three appliances shall not be greater than the declared value plus 10 %.

Z1.5 Oven volume

The volume determined according to 6.3 shall not differ from the value declared by the manufacturer plus or minus 5 %.

If the result of the test carried out on the first appliance differs from the declared value by more than plus or minus 5 %, the test shall be carried out on a further three appliances, which shall be randomly selected from the market.

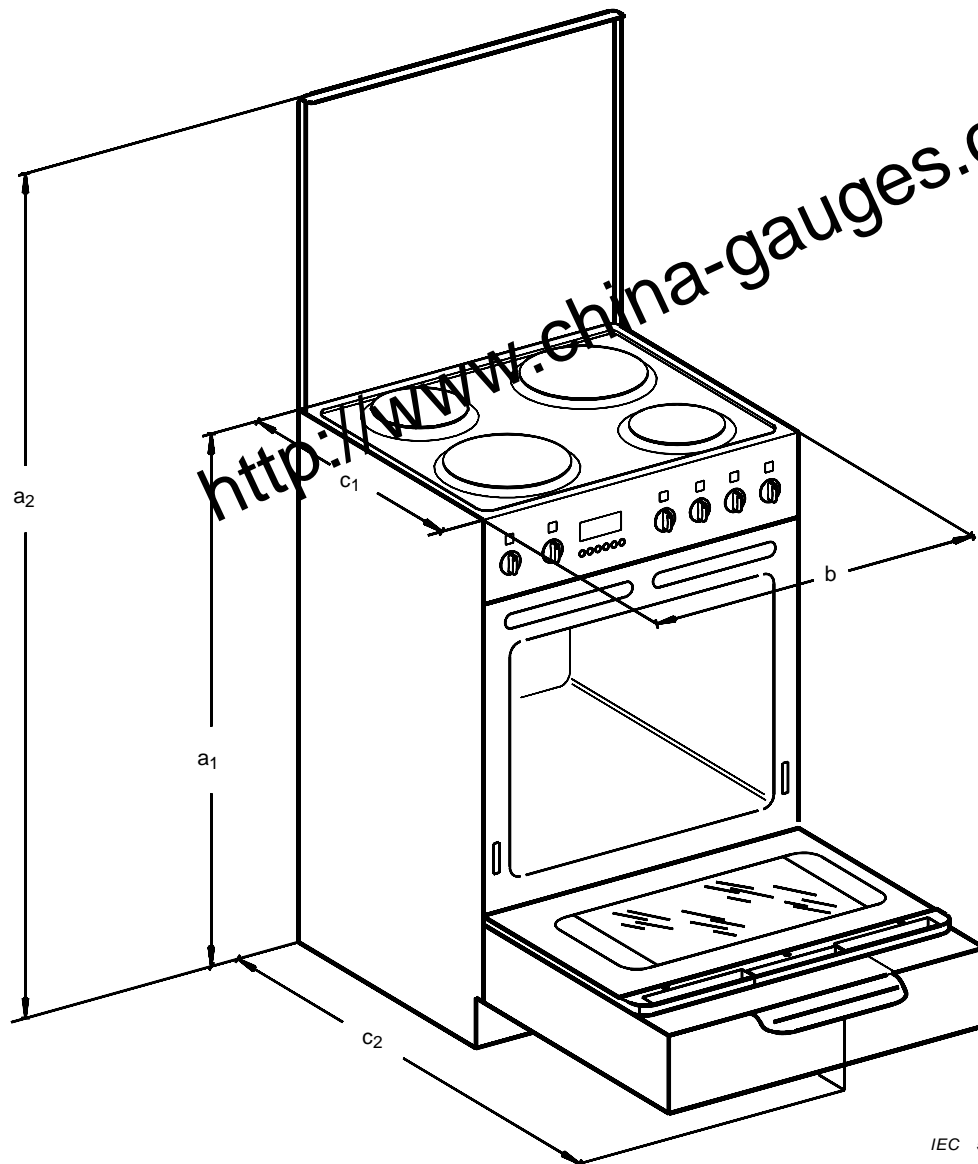
The arithmetical mean of the values of these three appliances shall not differ from the declared value by more than plus or minus 3 %.

Z1.6 Surface area

The surface area determined according to 6.4 shall not differ from the value declared by the manufacturer plus or minus 5 %.

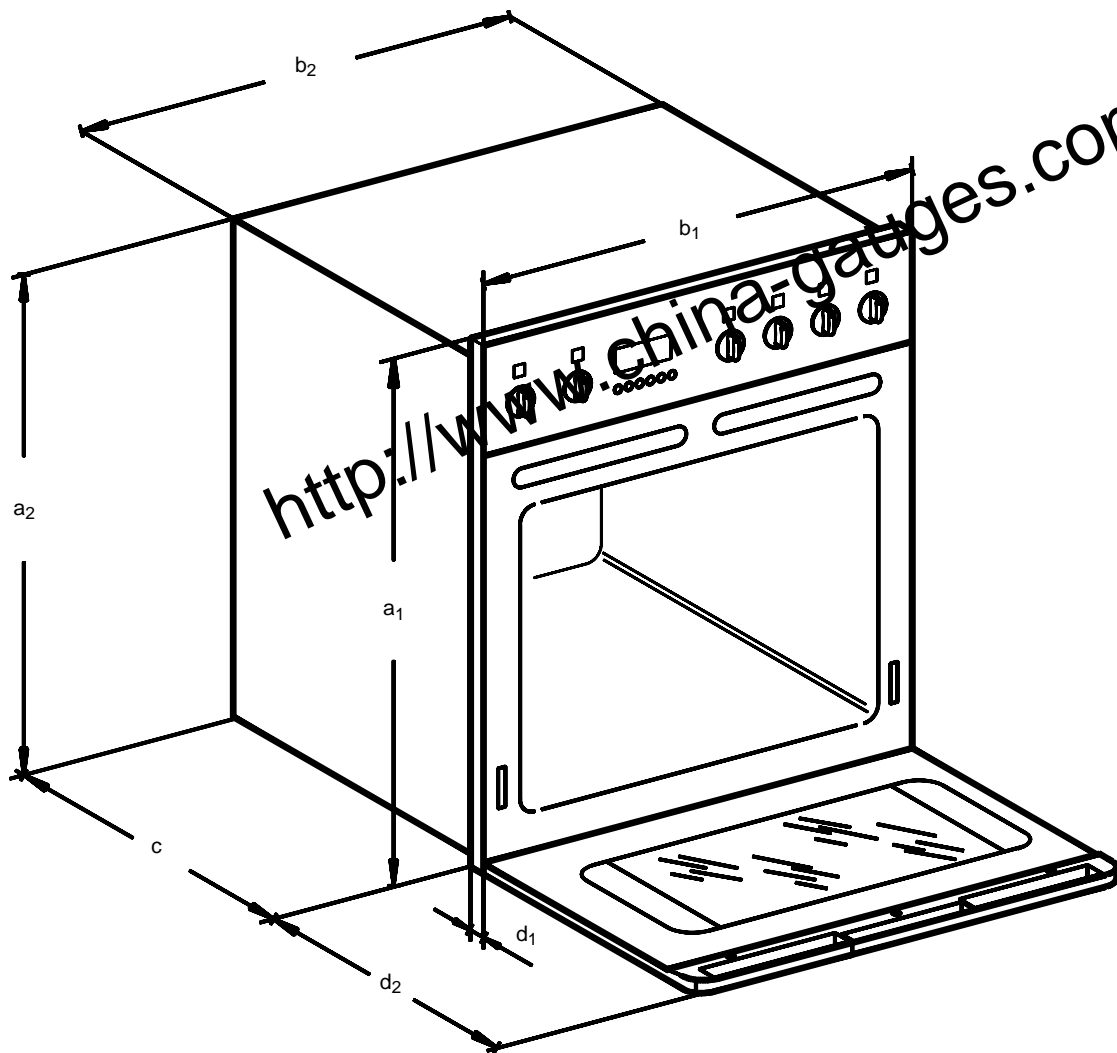
If the result of the test carried out on the first appliance differs from the declared value by more than plus or minus 5 %, the test shall be carried out on a further three appliances, which shall be randomly selected from the market.

The arithmetical mean of the values of these three appliances shall not differ from the declared value by more than plus or minus 3 %. ☐



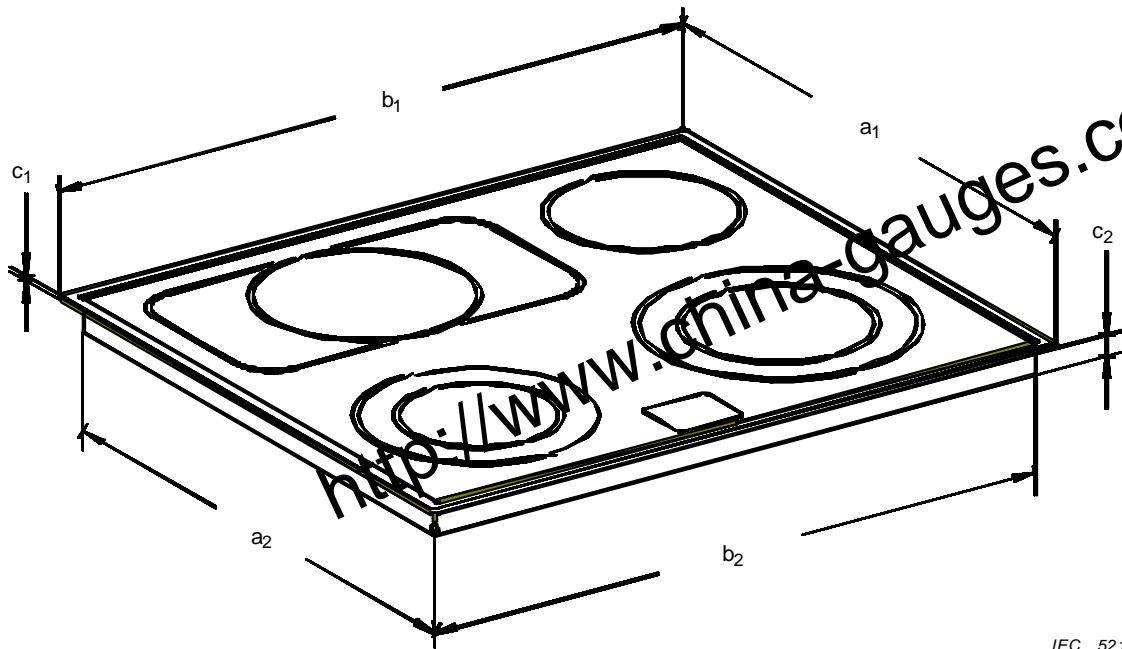
- a_1 height from the supporting surface to the hob surface
NOTE If adjustable feet are provided, the height is measured with the feet in both extreme positions.
- b overall width of the appliance
- a_2 maximum height from the supporting surface to the uppermost part of the appliance, with any lid in the open position
- c_1 depth of the appliance, ignoring any knobs, etc.
- c_2 maximum depth of the appliance, with any doors and drawers fully open

Figure 1 – Dimensions of appliances



- a_1 front height of the appliance
- b_1 front width of the appliance
- c maximum depth of the appliance within the kitchen furniture
- a_2 maximum height of the appliance within the kitchen furniture
- b_2 maximum width of the appliance within the kitchen furniture
- d_1 depth of the appliance outside the kitchen furniture, ignoring any knobs, etc.
- d_2 depth of the appliance outside the kitchen furniture, with any doors and drawers fully open

Figure 2 – Dimensions of built-in ovens



IEC 521/99

- a₁ depth of the hob
- b₁ width of the hob
- c₁ height of the hob on the outside of the kitchen furniture
- c₂ height of the hob on the inside of the kitchen furniture
- a₂ depth of the hob on the inside of the kitchen furniture
- b₂ width of the hob on the inside of the kitchen furniture

Figure 3 – Dimensions of built-in hobs

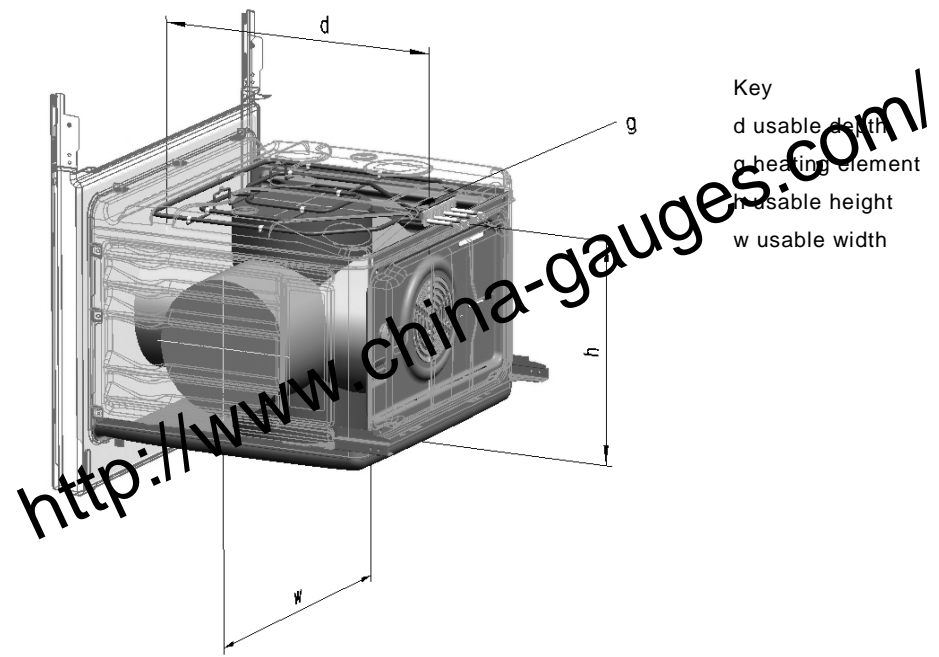


Figure 4a – Measurement procedure

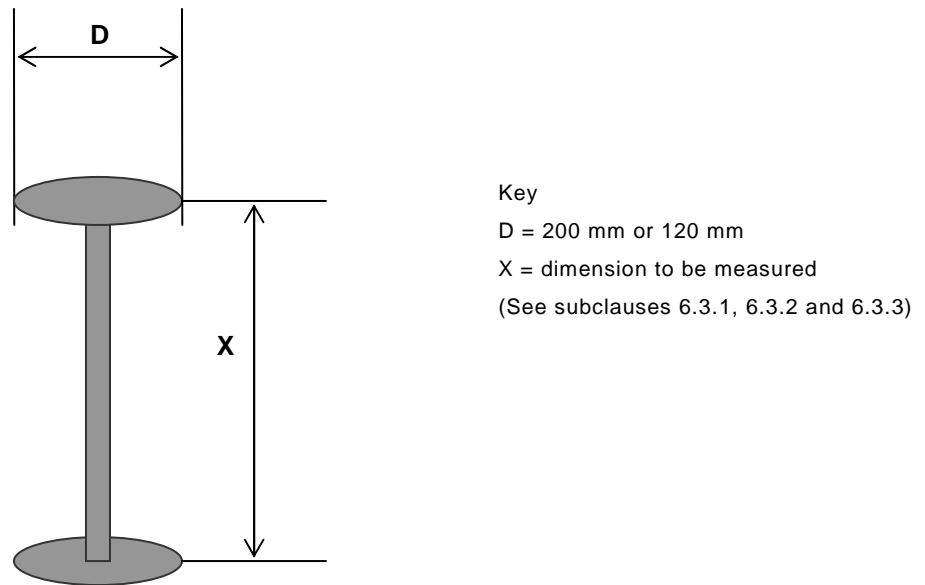
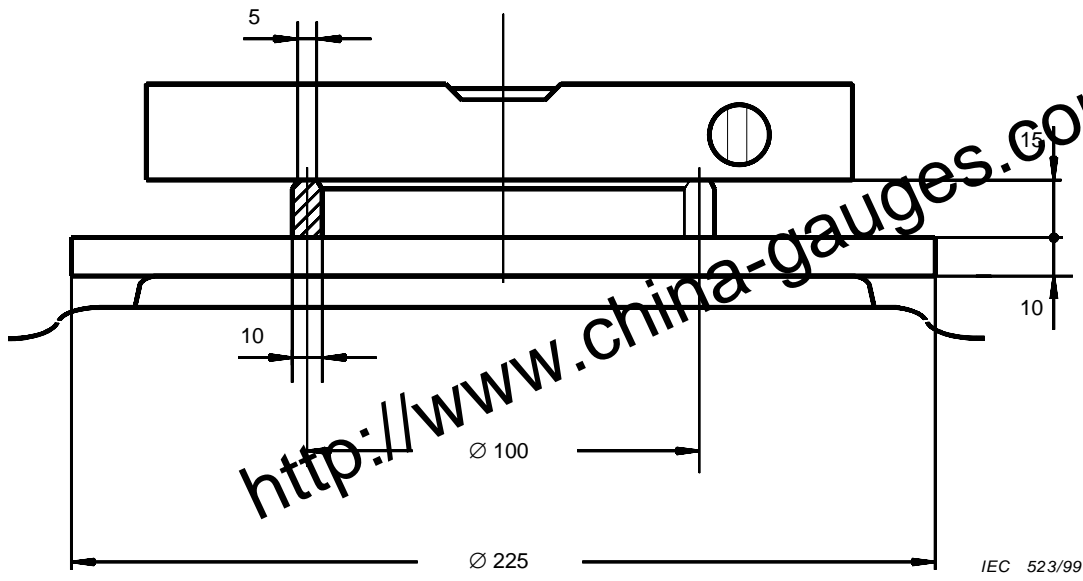


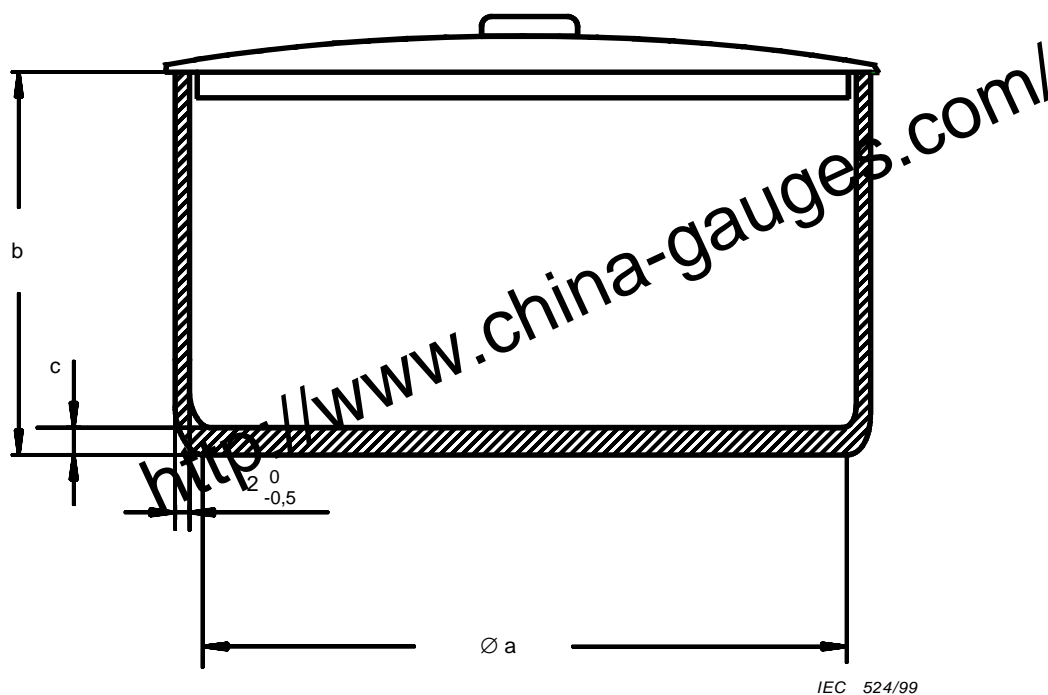
Figure 4b – Gauge for determining the usable volume

Figure 4 – Usable internal dimensions and usable volume of ovens



Dimensions in millimetres

Figure 5 – Device for checking the level of hotplates and shelves



Specification of the saucepan

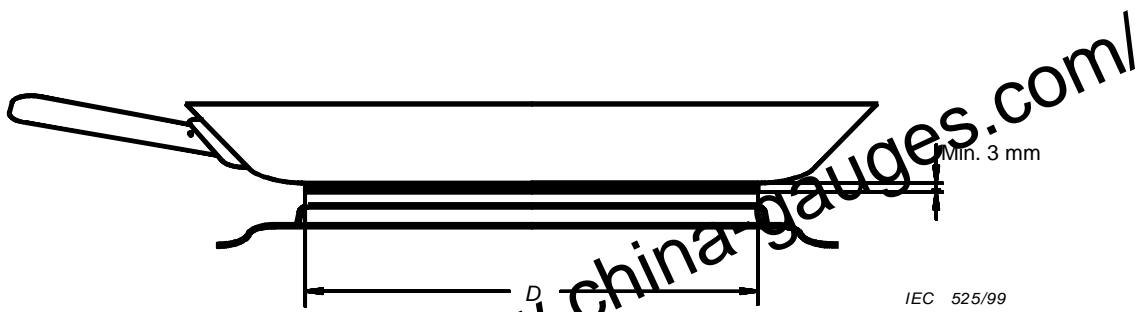
Diameter of cooking zone mm	Dimensions of the saucepan		
	a	b	c
≤ 145	145	140	3
> 145 ≤ 180	180	140	≥ 3 ≤ 5
> 180 ≤ 220	220	140	≥ 3 ≤ 5

The saucepan is made of low carbon steel having a maximum carbon content of 0,08 %. It is cylindrical without metallic handles or protrusions. The diameter of the flat area at the base of the saucepan is to be at least the diameter of the cooking zone. The maximum concavity of the base of the saucepan is to be not more than 0,006 a, where a is the diameter of the flat area at the base of the saucepan.

NOTE 1 The lid is adapted to accommodate a stirrer.

NOTE 2 The base of the saucepan shall not to be convex.

Figure 6 – Saucepan



Specification of the frying pan

The frying pan is made of aluminium or stainless steel with an additional bottom layer of aluminium, at least 3 mm thick.

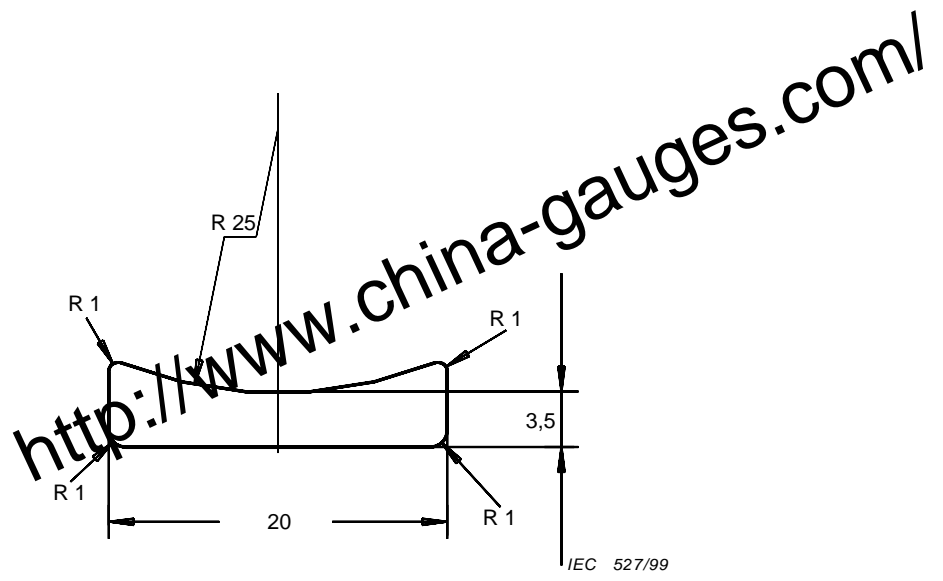
The inner surface of the pan has a non-stick surface coating of polytetrafluoroethylene (PTFE).

The diameter D of the flat part of the bottom is to be not less than the diameter of the hotplate or cooking zone and is not to exceed this diameter by more than 20 mm.

The concavity of the bottom of the pan at ambient temperature is not to exceed $0,003 D$ and is not to be convex.

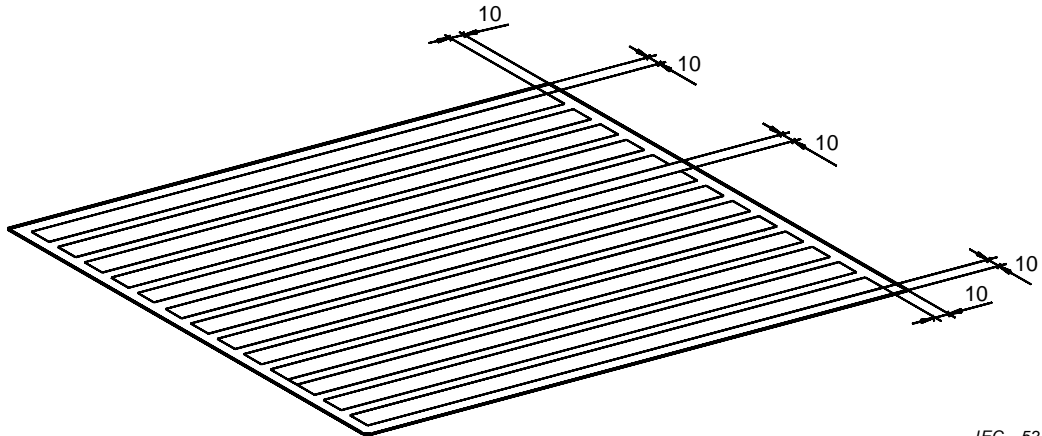
For cooking zones of induction hobs the bottom surface of the pan has a thin layer of magnetic low carbon steel, for the absorption of magnetic energy from the induction **hob**.

Figure 7 – Frying pan



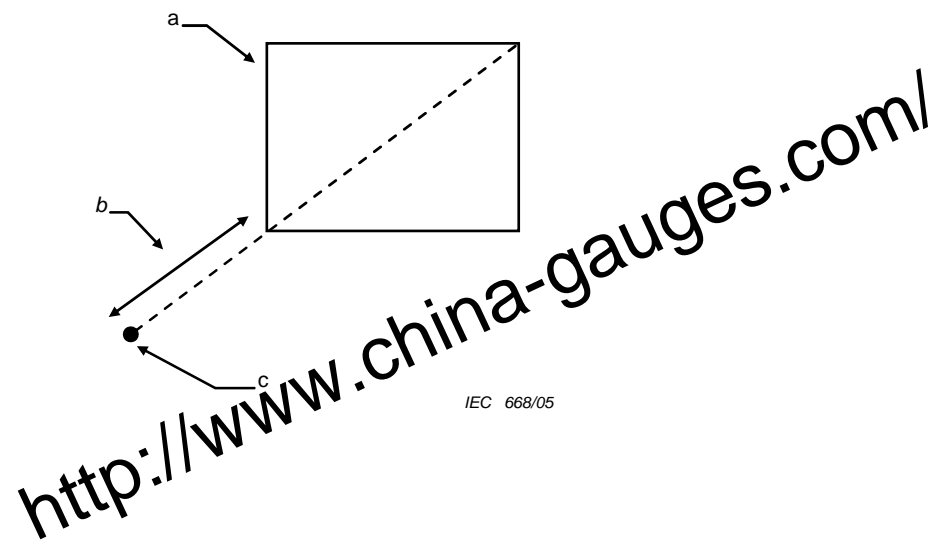
Dimensions in millimetres

Figure 8 – Shape of the nozzle for extruding pastry



Dimensions in millimetres

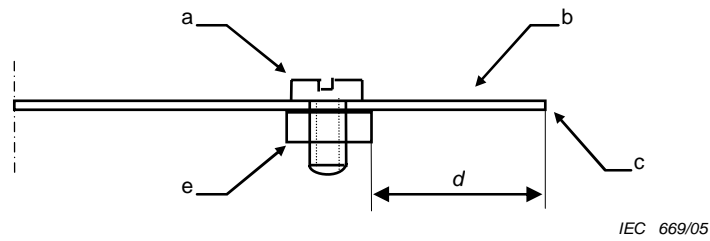
Figure 9 – Position of pastry strips on the baking sheet



Key

- a Oven (top view)
- b 0,5 m
- c Thermocouple

Figure 10 – Position of the thermocouple for measuring ambient temperature



Key

- a Screw with a hole of 1 mm
- b Steel tube
- c Measuring point
- d 32 mm
- e Nut

Figure 11 – Example of a method of fixing a thermocouple for the test of 8.3

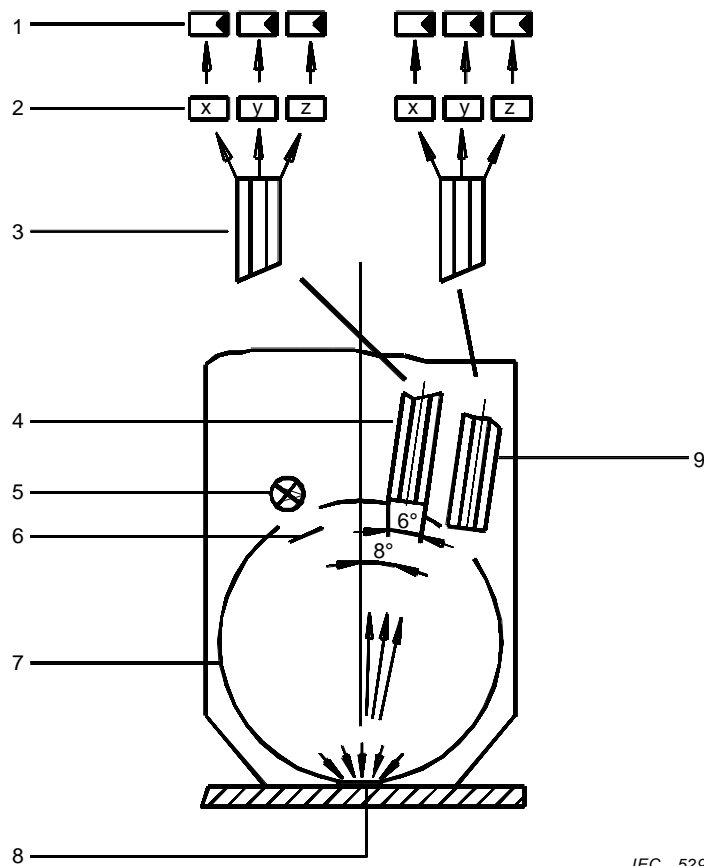
Annex A
 (normative)

Colour measuring instrument

The instrument is in accordance with ISO 7724 and CIE 15.2 with the following specification:

- measuring geometry: diffuse, 8° vertical deviation
- measuring aperture: diameter 20 mm, closed by a disk of quartz glass;
- calibration standard: white, according to ISO 7724;
- standard illuminant: D 65, according to ISO/CIE 10526;
- standard observer: 10°, according to ISO/CIE 10527;
- evaluation: reflection value R_y .

- | | |
|---------------------|-------------------------------------|
| 1 Photoreceptors | 6 Shutter |
| 2 Filters | 7 Integrating sphere |
| 3 Light wave guide | 8 Specimen under measuring aperture |
| 4 Measuring channel | 9 Reference channel |
| 5 Xenon flash bulb | |



IEC 529/99

Figure A.1 – Colour measuring instrument

Annex B
 (normative)

Shade chart

This annex specifies the relation between reflection value R_y and shade numbers corresponding to NCS shade charts.

Table B.1 – Classification of shade numbers

Measured reflection value R_y		Tolerances for 8.4.2.5.2	Shade number
\geq			
	7,2	$\pm 14 \%$	17
7,2	9,3	$\pm 13 \%$	16
9,3	12,2	$\pm 12 \%$	15
12,2	16,4	$\pm 11 \%$	14
16,4	20,1	$\pm 10 \%$	13
20,1	22,9	$\pm 10 \%$	12
22,9	26,5	$\pm 9 \%$	11
26,5	31,7	$\pm 9 \%$	10
31,7	38,5	$\pm 8 \%$	9
38,5	46,9	$\pm 8 \%$	8
46,9	54,2	$\pm 8 \%$	7
54,2	64,3	$\pm 8 \%$	6
64,3	75,2	$\pm 8 \%$	5
75,2		$\pm 8 \%$	4

Table B.2 – Examples for the shade charts

NCS		
Shade chart	L^*	R_y
S 8502-Y	30,3	6,4
S 7020-Y50R	34,4	8,2
S 6030-Y50R	38,6	10,4
S 5040-Y40R	44,5	14,2
S 4050-Y30R	50,4	18,8
S 4040-Y30R	53,4	21,4
S 4030-Y30R	56,6	24,5
S 3040-Y30R	60,5	28,7
S 2060-Y20R	65,7	34,9
S 2040-Y20R	71,1	42,3
S 1050-Y20R	77,1	51,7
S 1040-Y20R	80,1	56,9
S 0530-Y10R	88,1	72,3
S 0520-Y10R	90,9	78,3

NOTE 1 The measured reflection value R_y does not correlate linearly to the visual perception. Although the widths of the intervals given above increase with increasing reflection value R_y , visually the steps from shade number to shade number are fairly uniform.

NOTE 2 R_y Reflection values are calculated from the L^* values based on the CIE $L^*a^*b^*$ colour system, (D65, 2° observer, T/8°).

NOTE 3 Shade numbers defined in Table B.1 are used for the visual and digital assessment instead of colour gauge, reference BS 3999: Part 5G to provide intermediate shades.

NOTE 4 The NCS shade charts can be ordered at official NCS Centres all over the world. The following address shows potential distributors.

Sweden (**Head Office**)

Telephone: +46-8-617 47 00

Scandinavian Colour Institute AB

Fax: +46-8-617 47 47

Visit: <http://www.china-gauges.com/>

Address: P.O. Box 49022, S -100 28 Stockholm

Internet: www.ncscolour.com

E-mail: info@ncscolour.com

Annex C
(informative)

Addresses of suppliers

C.1 General

The following information is given for the convenience of users of this standard and does not constitute an endorsement by the IEC.

C.2 Testing ingredients for small cakes
(see 8.4.2.5.2)

All ingredients for preparation of small cakes as specified in this standard and the paper cases may be obtained from: Stamminger & Demirel Testmaterialien

Telephone: +49 9123 98 89 75
Fax: +49 9123 98 84 89
e-mail: r.stamminger@web.de
Erbsenbodenstr. 31
D-91207 Lauf – Germany
www.sta-de.com

All ingredients used for reproducible results shall be from the same batch. It is recommended that the ingredients used match the definitions in the Table C.1

Table C.1 – Ingredient specification

Ingredients	Problems of constant quality	Quality criteria
Butter	Variation with season and region of origin Salt content	Ingredients: cow's cream, lactobacilli ☒ Fat content 82,5 % (minimum 81 %) Water content <16 % Unsalted, pH value of serum 5,2 – 6,3
Sugar	Humidity uptake.	Disaccharide Saccharose, anhydrous Refined white sugar EU cat.1 "Raffinade fein RFF" grain size 0,10 mm – 0,35 mm, d95/d05
Egg mixture	Variation of biochemical composition of eggs with season and nutrition.	Hen's egg mixture, pasteurised, homogeneous Packed in Tetra Brik ² , deep frozen (at least – 18 °C) pH 6,4 – 7,0 Dry substance 22,7 % – 23,7 %
Flour	Variation with season and region of origin. Humidity uptake. Additives.	Wheat flour (triticum aestivum L.) Mineral content: maximum 0,5 % (dry substance) humidity: maximum 15,0 % Falling number: at least 250 sec Gluten: at least 24,0 % Sedimentation: at least 26 ml Protein: approx.10.6 % (dry substance) fat: approx. 1.0 % carbohydrates: approx. 70.9 % Energy: approx.1 409 kJ / approx.332 kcal Additive: ascorbic acid
Salt		Grain size <1 mm
Baking powder	Relation and sort of expanding agent	Substance of content: Natriumhydrogencarbonate (E 500, 33,3 %), Dinatriumdiphosphate (E 450, 46,7 %) Wheat starch

² Tetra Brik is the trade name of a product supplied by Stamminger & Demirel.Testmaterialien. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

a) Specification for the paper cases

48 mm in base diameter and 29 mm in height. 70 g/m² bleached greaseproof paper

Manufacturer: Bacher und Demmler GmbH & Co. KG
 Kaiser-Wilh.-Str. 7-15
 12247 Berlin
 Germany
bu@demmler.de
 Telephone: + 49 (0) 30 77 000 8-0; Fax: 0049 (0) 30 77 000 8 - 54
 Artikel no: Backförmchen weiß, PE 4,8/2-900, 70 4812 70 109 20 14

b) Handling the frozen egg mixture

For defrosting the frozen whole egg package put approximately 5 litres of water into a large vessel at a temperature of 30 °C ± 2 °C. Put the Tetra Brik of frozen egg into the warm water so that it is covered completely. It might be necessary to weight it down, e.g. with a cup. Stir the water from time to time and shake the Tetra Brik.

After one hour discard the first lot of water and completely renew with another 5 litres of warm water at 30 °C ± 2 °C completely covering the Tetra Brik again. Stir the water from time to time and shake the Tetra Brik.

It should be defrosted within 2 hours. The whole egg mixture can be used when it has reached a temperature of 23 °C ± 2 °C. Open the Tetra Brik and mix the egg with a fork for approximate 30 sec until it looks homogenous and can thus be used like fresh egg.

After opening the Tetra Brik must be used within one day. The egg mixture is beaten with a fork until homogeneous, prior to use.
 An unopened Tetra Brik can be stored in a fridge.

**C.3 Food mixer
 (see 8.4.2)**

Specification: Power rating: 550 ± 50 watts

- Revolutions per min

	Revs per min			
	Level 1	Level 2	Level 3	Level 4
Wire whisk	53 ± 5 %	93 ± 5 %	185 ± 5 %	325 ± 5 %

- Wire balloon whisk
- Bowl, approximately 3 500 cm³, top diameter 23 cm ± 2 cm
- The machine should be able to beat the sugar and butter to a soft and pale mixture in approximately 5 minutes. A supplier is:

Bosch und Siemens Hausgeräte GmbH
 Werner von Siemens Straße 200
 D-83301 Traunreut
 Fax +49 8669 30 2098
BSH-Foodmixer-Info@bshg.com

Recommended mixing time (small cakes) determined for Bosch MUM 4600:

	Mixing time	Recommended

	(small cakes)	setting
Beat together butter and sugar	Approx. 5 min	After stirring at level 1 speed up to level 4
Add egg mixture	Approx. 2,5 min	Start with level 1 and gradually increase to level 4
Fold in flour, baking powder and salt	Approx. 1 min	After stirring at level 1 increase to level 4

C.4 Lamps for digital measurement systems (see 8.4.2.5.2)

Possible suppliers are:

1. NARVA - Lichtquellen GmbH + Co. KG
Narva Typ "BIO light 960"
www.narva-bel.de
office@nava-bel.de
Telephone: +49 37322/17200
Fax: +49 37322/17203
2. ELEC Handels AG Beleuchtungssysteme
True-light Typ ESL 15
elech@bluewin.ch
www.truelight.ch/elec/index.html
Eichenweg 33
CH-8121 Benglen ZH
Telephone: +41 44 825 24 14
Fax: +41 44 825 28 73

C.5 Digital measurement system

Possible suppliers are:

1. SLG Prüf- und Zertifizierungs GmbH
Burgstädterstraße 20
Germany – 09232 Hartmannsdorf
<http://www.slg.de.com>
service@slg.de.com
Telephone: +49(0)3722/7323-0
Fax: +49(0)3722/7323-899
2. Ing.-Büro W. Neubauer
Paradiesweg 4
Germany - 96148 Baunach
<http://www.fpga-design.de>
wn@fpga-design.de
Telephone: +49(0)170/296 60 38

C.6 Colour measuring instrument (see 8.4.1 and Annex A)

A supplier of the colour measuring instrument is:

Dr. Lange
Postfach 19 02 29
40549 Düsseldorf

C.7 Brick for testing energy consumption of ovens (see 8.3)

Bricks are available under the type designation “Skamol Hipor” from the following supplier:

Skamol Insulation
Östergade 58-60
DK-7900 Nykøbing Mors
Denmark

<http://www.china-gauges.com/>

Annex D (normative)

Description of the test brick

D.1 Specification

Name	Hipor ³⁾
Bulk density, dry	(550 ±40) kg/m ³
Total porosity	77 %
Dry weight	(920 ± 75) g (without thermocouples), see 8.3.1.1
Water absorption	(1 050 ± 50) g, see 8.3.1.2
Height	(64 ± 0,5) mm

The brick is brittle. Tolerances of dry weight, water absorption and height are critical and have to be checked.

D.2 Supplier and order specification

SKAMOL INSULATION
Östergade 58 – 60
DK – 7900 Nyköbing Mors

When ordering please state:

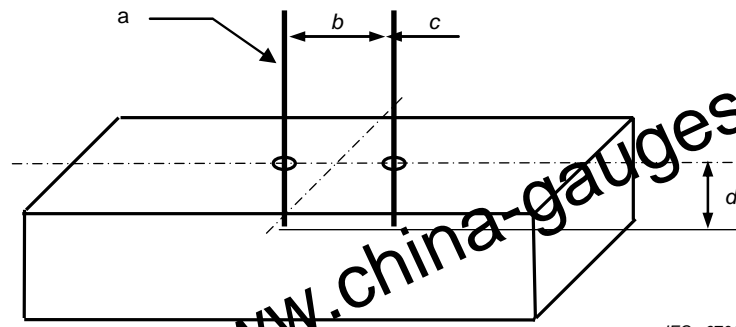
- the brick name "Hipor", according to Electrolux agreement,
- length x width x height: 230 mm x 114 mm x 64 mm (see sketch in Figure D.1),
- machined on all six surfaces, tolerances ± 0,5 mm.

NOTE 1 According to Electrolux agreement, a minimum of 126 bricks have to be ordered. Alternatively quantities of 168, 282 or 504 bricks can be ordered to take advantage of a reduced price range.

NOTE 2 The diameter of the hole need not and should not be bigger than the diameter of the thermocouple.

NOTE 3 If it is not possible to drill the holes 32 mm deep, drill the holes to a depth of about 25 mm, insert the thermocouples into the holes and push them carefully further down the remaining 7 mm. Alternatively, a self-made rigid wire with 1 mm diameter could serve as a drill.

³⁾ Hipor is the trade name of a product supplied by SKAMOL INSULATION. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.



Key

- a Two metal sheet tube thermocouples
- b 50 mm, with holes at $b/2$
- c 1 mm \varnothing , both thermocouples and holes
- d 32 mm both thermocouples and holes (see NOTE 3 above)

Figure D.1 – Position of the thermocouples

Annex E
(informative)

Calculation sheet: Energy consumption of electric ovens

Oven type:		Factory & brand:		Test lab:	
Voltage:	V	Usable volume:	l	Operator:	
Standby power:	W	Tray surface area:	cm ²	Date:	

Function:		Conventional heating "ic"								Nominal temperature rise:					180 K	
Preheating		With load														
180 K		Bricks							Measured		Room	Oven temperature				
Energy	Time	Nr.	Dry weight	Wet weight	Absorbed water	End cooking weight	Weight loss (info.)	Start temperature	E_k	t_k	Average ambient temp.	Nominal value	Real value	Real value		
kWh	min		m_d	m_w	Δm	g	g	°C	kWh	min	°C	K	°C	K		
--	--				Calc.		Calc.					140 ± 10		Calc.		
					Calc.		Calc.					180 ± 10		Calc.		
--	--				Calc.		Calc.					220 ± 10		Calc.		
Results at 180 K							Slope S		Intercept B			Standard deviation				
Energy (linear regression)				(kWh)		Calc.		Calc.		Calc.						
Time (linear regression)				(min)		Calc.		Calc.		Calc.						

http://www.china-gauges.com/





Calculation sheet: Energy consumption of electric ovens (continued)

Oven type:		Factory & brand:		Test lab:	
Voltage:	V	Usable volume:	l	Operator:	
Standby power:	W	Tray surface area:	cm ²	Date:	

Function:		Forced air heating "if"							Nominal temperature rise:			155 K		
Preheating 155 K		With load												
		Bricks							Measured		Room	Oven temperature		
Energy	Time	Nr.	Dry weight m_d	Wet weight m_w	Absorbed water Δm	End cooking weight	Weight loss (info.)	Start temperature	E_k	t_k	Average ambient temp.	Nominal value	Real value	Real value
kWh	min		g	g	g	g	g	°C	kWh	min	°C	°C	°C	K
--	--				Calc.		Calc.					135 ± 10		Calc.
					Calc.		Calc.					155 ± 10		Calc.
--	--				Calc.		Calc.					175 ± 10		Calc.
Results at 155 K							Slope S		Intercept B			Standard deviation		
Energy (linear regression)		(kWh)					Calc.		Calc.			Calc.		
Time (linear regression)		(min)					Calc.		Calc.			Calc.		

http://www.chinacnanges.com/



Calculation sheet: Energy consumption of electric ovens (continued)

Oven type:		Factory & brand:		Test lab:	
Voltage:	V	Usable volume:	l	Operator:	
Standby power:	kW	Tray surface area	cm ²	Date:	

Function:		Hot steam "ih"							Nominal temperature rise:			155 K		
Preheating		With load												
155 K		Bricks						Measured		Room	Oven temperature			
Energy	Time	Nr.	Dry weight	Wet weight	Absorbed water	End cooking weight	Weight loss (info.)	Start temperature	E_k	t_k	Average ambient temp.	Nominal value	Real value	Real value
kWh	min		m_d g	m_w g	Δm g	g	g	°C	kWh	min	°C	°C	°C	K
--	--				Calc.		Calc.					135 ± 10		Calc.
					Calc.		Calc.					155 ± 10		Calc.
--	--				Calc.		Calc.					175 ± 10		Calc.
Results at 155 K							Slope S		Intercept B		Standard deviation			
Energy (linear regression)			(kWh)				Calc.		Calc.		Calc.			
Time (linear regression)			(min)				Calc.		Calc.		Calc.			



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Ⓒ Annex ZA
(normative)

**Overview – Clauses required for the Commission Directive on
Energy Labelling**

For the procedure required for the Commission Directive on Energy Labelling the following clauses are applicable:

- 1 Scope
- 2 Normative references 3

Definitions

- 4 List of Measurements
4.3 Ovens
- 5 General conditions for the measurements
- 6 Dimensions and mass
6.3 Internal dimensions of ovens
6.5 Dimensions of shelves
6.6 Dimensions of grill grids 8

Ovens

- 8.1 Preheating the empty oven
- 8.3 Energy consumption and time for heating a load

- 12 Standby power

- Z1 Tolerances and control procedures

Figure 4 Usable internal dimensions and usable volume of ovens

Figure 10 Position of the thermocouple for measuring ambient temperature

Figure 11 Example of a method of fixing a thermocouple for the test of 8.3

Annex C Addresses of suppliers
C.5 Brick for testing energy consumption of ovens

Annex D Description of the test brick

Annex E Calculation sheet: Energy consumption of electric ovens

Annex ZA Overview – Clauses required for the Commission Directive on Energy Labelling **Ⓒ**

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