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Incorporating corrigendum November 2012



BSI Standards Publication

Household microwave ovens — Methods for measuring performance

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National foreword

This British Standard is the UK implementation of EN 60705:2012+A1:2014. It is identical to IEC 60705:2010, incorporating amendment 1:2014. It supersedes BS EN 60705:2012, which is withdrawn.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags **C** **C**.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

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.

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Date	Text affected
30 November 2012	CENELEC common modifications implemented in IEC core document
31 October 2014	Implementation of IEC amendment 1:2014 with CENELEC endorsement A1:2014

**Household microwave ovens -
Methods for measuring performance**
(IEC 60705:2010, modified)

Fours à micro-ondes à usage domestique
-
Méthodes de mesure de l'aptitude à la
fonction
(CEI 60705:2010, modifiée)

Mikrowellengeräte für den Hausgebrauch
und ähnliche Zwecke -
Verfahren zur Messung der
Gebrauchstauglichkeit
(IEC 60705:2010, modifiziert)

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CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

This document (EN 60705:2012) consists of the text of IEC 60705:2010 prepared by IEC/SC 59K "Ovens and microwave ovens, cooking ranges and similar appliances", together with the common modifications prepared by CLC/TC 59X "Performance of household and similar electrical appliances".

The following dates are fixed:

- latest date by which this document has to be implemented (dop) 2013-03-12
at national level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2015-03-12

This document supersedes EN 60705:1999 + A1:2004 + A2:2006.

EN 60705:2012 includes the following significant technical changes with respect to EN 60705:1999:

- the usable volume is renamed to calculated volume and the measurement method for the calculated volume is revised (see 7.2)
- new definitions for microwave function, combination microwave function, set to off mode, set to standby mode, cooling down period and food support in Clause 3;
- a method for measuring the energy consumption of the microwave function in Clause 9;
- more precise requirements for instruments and measurements in Table Z.1;
- measurement uncertainties of results in Clause Z.1;
- additional product specific requirements for measuring the energy consumption of low power modes in Clause Z.2;
- a method for measuring the energy consumption for the cooling down period in Annex ZD (informativ).

In this standard, the following print types are used:

- *test specifications: in italic type*
- notes: in small roman type
- other texts: in roman type.

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

This standard contains an attached file in the form of an Excel®¹ 97-2003 data sheet program. This file is intended to be used as a complement and does not form an integral part of the standard.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60705:2010 are prefixed "Z".

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Endorsement notice

The text of the International Standard IEC 60705:2010 was approved by CENELEC as a European Standard with agreed common modifications.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

- [3] IEC 60350:1999 NOTE Harmonized as EN 60350:1999 (modified).
- [4] CISPR 11:2009 NOTE Harmonized as EN 55011:2009 (modified).

Foreword to amendment A1

The text of document 59K/252/FDIS, future IEC 60705:2010/A1, prepared by SC 59K "Ovens and microwave ovens, cooking ranges and similar appliances" of IEC/TC 59: "Performance of household and similar electrical appliances." was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60705:2012/A1:2014.

The following dates are fixed:

- latest date by which the document has (dop) 2015-05-04
to be implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2017-08-04
standards conflicting with the
document have to be withdrawn

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

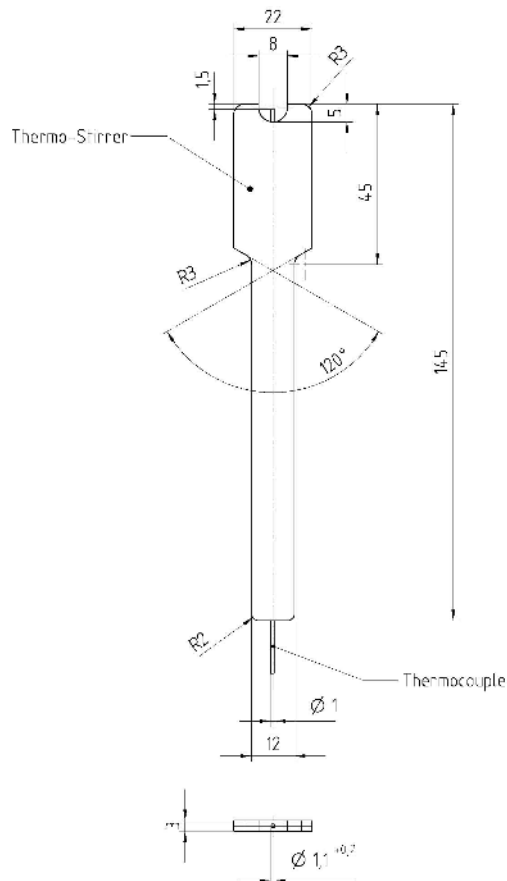
<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60350-1 (mod)	2011	Household electric cooking appliances - Part 1: Ranges, ovens, steam ovens and grills - Methods for measuring performance	EN 60350-1	201X ¹⁾
IEC 60584-2 + A1	1982 1989	Thermocouples - Part 2: Tolerances	EN 60584-2	1993
EN 50564	2011	Electrical and electronic household and office equipment - Measurement of low power consumption	-	-
ISO 80000-1	2009	Quantities and units - Part 1: General	-	-
IEC 60350-1	2011	Household electric cooking appliances -- Part 1: Ranges, ovens, steam ovens and grills - Methods for measuring performance	EN 60350-1	2013
IEC 60584-2	-	Thermocouples -- Part 2: Tolerances	EN 60584-2	-
IEC 62301	2011	Household electrical appliances - Measurement of standby power	EN 50564	2011

¹⁾ At draft stage.

Annex ZB (informative)

Stirrer

This annex specifies the thermocouple with a plastic adapter to sustain a homogenous temperature in the water load. This thermocouple with stirring adapter should be used in Clauses 8 and 9. A thermocouple according to 6.7 should be used.



Material: Makrolon
Heat capacity: 1, 17 kJ/kgK

Figure ZB.1 – plastic stirring adapter

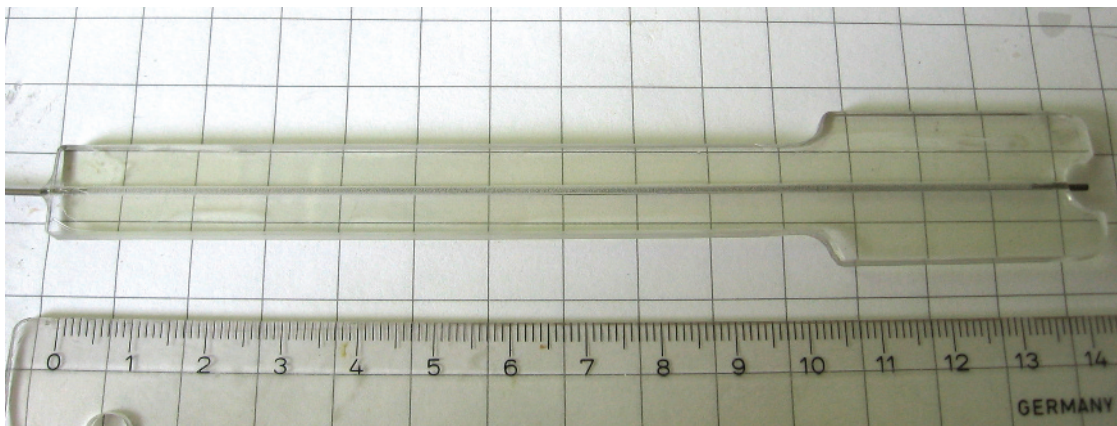


Figure ZB.2– example stirrer

Annex ZC (informative)

Glass container for Clauses 8 and 9

A possible supplier is Duran. Following Cat.-No. are relevant for the glass container used in Clauses 8 and 9.

Table ZC.1

Load	Glass container, cylindrical (in mm) made of borosilicate glass	Nominal water amount (m_w) pure tape water (in g)	Possible supplier glass container
Small (s) (clause 9)	External diameter $d \text{ } \varnothing 90 \pm 1$ external height $h 125 \pm 1$ capacity 600 ml Maximum weight 200 g	275 ± 1	Duran Cat.-No 2110648 "Beaker low height"
Middle (m) (clause 9)	External diameter $d \text{ } \varnothing 140 \pm 1$ external height $h 76 \pm 1$ capacity 900 ml Maximum weight 250 g	350 ± 1	Duran Cat.-No 2131354 "Crystallizing dish"
Large (l) (clause 8 and 9)	External diameter $d \text{ } \varnothing 190 \pm 1$ external height $h 90 \pm 1$ capacity 2000 ml Maximum weight 450 g	1000 ± 1	Duran Cat.-No 2131359 "Crystallizing dish"

Figure ZC.1 shows how to measure the dimensions from the recommended containers.

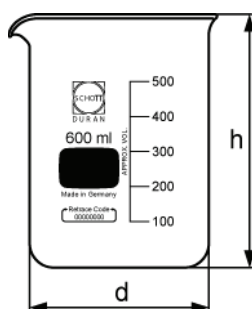


Figure ZC.1 – Example: small beaker – 600 ml

Annex ZD (informative)

Energy consumption for the cooling down period

For measuring the energy consumption of the cooling down period the loads according to Table Z.2 are placed in the appliance according to 9.4.

NOTE 1 As residual heat from components influence the duration of ventilation the appliance should be cooled consequently before measuring, at least for more than 6 h.

The heating shall be started by switching on the appliance within 30 s after the preparation of the water load. The power control for the microwave function is set to the highest possible position. If available the measurements are made with boost function.

The heating time is calculated for a temperature rise of 50 K determined by 9.5 rounded to seconds as follows:

The quotient of time per temperature rise ($Q_{50, t}$) in seconds/K is calculated.

$$Q_{50, t} = \frac{(t_{\text{high}} - t_{\text{low}})}{(\text{norm } \Delta T_{\text{high}} - \text{norm } \Delta T_{\text{low}})} \quad (1)$$

NOTE 2 Definitions for $\text{norm } \Delta T_{\text{high}}$ and $\text{norm } \Delta T_{\text{low}}$ are given in 9.6 formula 3a and 3b.

The time to heat up the amount of water by 50 K (t_{50}) is calculated.

$$t_{50} = t_{\text{low}} + Q_{50} \times (50 - \text{norm } \Delta T_{\text{low}}) \quad (2)$$

The time for operating the oven t_{50} is calculated for each load separately.

After the respective heating up time t_{50} for the small, middle and large load is up, then the appliance is **set to off mode**. If the appliance doesn't offer an off mode it is **set to standby mode**.

The load is removed and the door shall be closed after (30 ± 2) s. The measurement of the energy consumption is started immediately when the appliance is **set to off mode** (see Figure ZD.1).

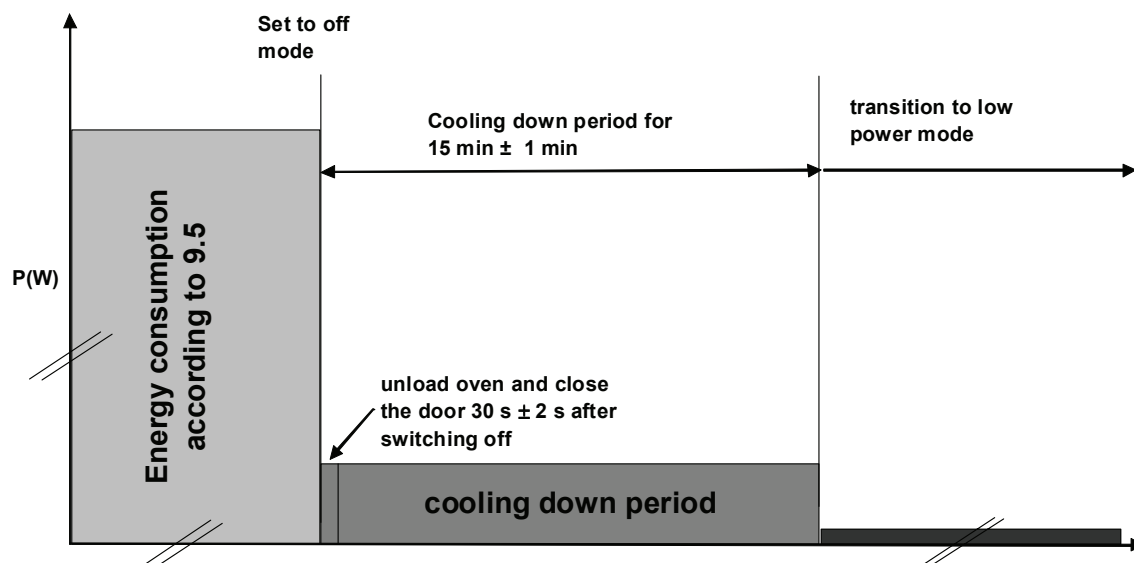


Figure ZD.1 - Phases of energy consumption measurement -example

The measurement is stopped after 15 min $\pm$ 2 s independent if the ventilation stops automatically.

The energy consumption for the cooling down period W_v is noted in Wh for each load.

Ensure that the following conditions remain relevant for the duration of the measurement:

- connected to mains power for the duration of the test;
- no network is connected to the product.

Annex ZE
(informative)

Table ZE.1 – Data and calculation sheet: Energy consumption for a cooking cycle with microwave function (Clause 9) (1 of 2)

Identification of the appliance:		Factory & Brand:		Test lab:	
Supply voltage:	V	Calculated volume	Liter	Operator:	
Rated output-power	W	Cavity material:		Date:	
Type microwave oven or combi oven:		Turntable, reciprocating tray:		Position of load:	

Output-Power (see 8.1)	W	Comment:	
------------------------	---	----------	--

Nominal mass of water:		1000	g	Ambient Temperature:			°C		Container-Diameter outside:			190	mm					
Target Temperature:				55°C - 60°C														
Heating time t _{low} :			sec	Mass of container:		g	Initial water temp.:		°C	Mass of water		g	Final water temp.:		°C	Energy-Consumption:		Wh
Temperatur rise:			calc	K	Total-Temp. rise:	calc	K	Normalized temp. rise:	calc	K								
Target Temperature:				60°C - 65°C														
Heating time t _{high} :			sec	Mass of container:		g	Initial water temp.:		°C	Mass of water		g	Final water temp.:		°C	Energy-Consumption:		Wh
Temperatur rise:			calc	K	Total-Temp. rise:	calc	K	Normalized temp. rise:	calc	K	Quotient	calc	Wh/K	Energy to reach 50K:	calc	Wh	Time to reach 50K	Sec

NOTE Cells with content "calc." should be calculated.

Table ZE.1 – Data and calculation sheet: Energy consumption for a cooking cycle with microwave function (Clause 9) (2 of 2)

Nominal mass of water: 350 g										Container-Diameter outside: 140 mm	
55°C - 60°C											
Target Temperature:				Mass of container:				Initial water temp.:		°C	
Heating time t _{low} :		sec				g				Final water temp.:	
Temperatur rise:		calc		K		calc		K		°C	
60°C - 65°C											
Target Temperature:				Mass of container:				Initial water temp.:		°C	
Heating time t _{high} :		sec				g				Final water temp.:	
Temperatur rise:		calc		K		calc		K		Wh <br/ Time to reach 50K	
60°C - 65°C											
Target Temperature:				Mass of container:				Initial water temp.:		°C	
Heating time t _{high} :		sec				g				Final water temp.:	
Temperatur rise:		calc		K		calc		K		Wh <br/ Time to reach 50K	
55°C - 60°C											
Target Temperature:				Mass of container:				Initial water temp.:		°C	
Heating time t _{low} :		sec				g				Final water temp.:	
Temperatur rise:		calc		K		calc		K		Wh <br/ Time to reach 50K	
60°C - 65°C											
Target Temperature:				Mass of container:				Initial water temp.:		°C	
Heating time t _{high} :		sec				g				Final water temp.:	
Temperatur rise:		calc		K		calc		K		Wh <br/ Time to reach 50K	

Consumption per cooking cycle:					
Water load:		Weighting factor:			
	1000 g	2		calc	Wh
	350 g	6		calc	Wh
	275 g	3		calc	Wh
				Total Energy Consumption:	
				calc	Wh

NOTE Cells with content "calc." should be calculated.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD MICROWAVE OVENS – METHODS FOR MEASURING PERFORMANCE

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60705 has been prepared by subcommittee 59K: Ovens and microwave ovens, cooking ranges and similar appliances, of IEC technical committee 59: Performance of household and similar electrical appliances.

This fourth edition cancels and replaces the third edition published in 1999, its amendment 1 (2004) and its amendment 2 (2006), and constitutes a technical revision. The main changes from the previous edition are as follows:

- the definition of rounding is given in 3.5;
- the usable volume and the overall volume are respectively determined in 7.2 and 7.3.

The text of this standard is based on the following documents:

FDIS	Report on voting
59K/195/FDIS	59K/198/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

In this standard, the following print types are used:

- *test specifications: in italic type*
- notes: in small roman type
- other texts: in roman type.

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

A1 This standard contains an attached file in the form of an Excel®¹ 97-2003 data sheet program. This file is intended to be used as a complement and does not form an integral part of the standard. **A1**

The following differences exist in some countries:

Clause 7: Metric dimensional measures are not in common use (USA).

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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HOUSEHOLD MICROWAVE OVENS – METHODS FOR MEASURING PERFORMANCE

1 Scope

This International Standard applies to **microwave ovens** for household use. It also applies to **combination microwave ovens**.

This standard defines the main performance characteristics of household microwave ovens which are of interest to the user, and it specifies methods for measuring these characteristics.

NOTE 1 This standard does not deal with

- Ⓐ₁ – microwave ovens which cannot accept a load having a diameter of ≥ 200 mm or a height of ≥ 120 mm; Ⓐ₁
- safety requirements (see IEC 60335-2-25 [1]* and IEC 60335-2-90 [2]).

- Ⓒ – microwave ovens which cannot accept a load having a diameter of ≥ 200 mm or a height of ≥ 120 mm. Ⓒ

NOTE 2 This standard does not apply to ovens incorporating conventional heating means only (see IEC 60350) [3].

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.

ISO 80000-1:2009, *Quantities and units – Part 1: General*

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

EN 50564:2011, Electrical and electronic household and office equipment – Measurement of low power consumption Ⓒ

- Ⓐ₁ IEC 60350-1:2011, *Household electric cooking appliances – Part 1: Ranges, ovens, steam ovens and grills – Methods for measuring performance*

IEC 60584-2, *Thermocouples – Part 2: Tolerances*

IEC 62301:2011, *Household electrical appliances – Measurement of standby power* Ⓐ₁

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1

microwave oven

appliance using electromagnetic energy in the ISM frequency band of 2 450 MHz, for heating food and beverages in the cavity

Ⓒ Text deleted Ⓒ

NOTE Ⓒ 1 Ⓒ ISM frequency bands are the electromagnetic frequencies established by the ITU and reproduced in CISPR 11 [4].

* Figures in square brackets refer to the bibliography.

Ⓒ ¹⁾ At draft stage. Ⓒ

3.2

combination microwave oven

microwave oven in which the microwave energy is combined with thermal energy

 Note 1 to entry: Energy transfer by steam is included in the term thermal heat. 

3.3

microwave transparent

property of a material having negligible absorption and reflection of microwaves

NOTE The relative permittivity of a microwave transparent material is less than 7 and the relative loss factor is less than 0,015.

3.4

rated voltage

voltage assigned to the appliance by the manufacturer

3.5

microwave function

heat transfer exclusively by electromagnetic energy in the ISM frequency band of 2 450 MHz

3.6

combination microwave function

heat transfer by electromagnetic energy simultaneously or sequentially with thermal heat

NOTE Thermal heat can be a conventional heating function, a forced air circulation function, a hot steam function or steam function. These functions are defined in 3.12 to 3.15 of IEC 60350-1:2011.

3.7

set to off mode

action where the product is switched off using appliance controls or switches that are accessible and intended for operation by the user during normal use to attain the lowest power consumption that may persist for an indefinite time while connected to a main power source and used in accordance with the manufacturer's instructions

NOTE 1 All actions required to **set to off mode** like for example empty the water tank, remove food, close the door, etc. have to be taken.

NOTE 2 See 3.5 of IEC 62301:2011 for the definition of "off mode".

3.8

set to standby mode

action where the product is switched to standby using appliance controls or switches that are accessible and intended for operation by the user during normal use to attain the lowest power consumption that may persist for an indefinite time while connected to a main power source and used in accordance with the manufacturer's instructions

NOTE See 3.6 of IEC 62301:2011 for the definition of "standby mode".

3.9

cooling down period

unstable condition persisting after completion of the active mode and the appliance is **set to off mode** where the power consumption may change without any intervention by the user

3.10

food support

horizontal support in the cavity on which the load is placed

NOTE If the appliance is fitted with a turntable, the turntable is the **food support**. The **food support** can also be a shelf or a reciprocating tray. If recommended by manufacturer's instruction also the cavity bottom can be the **food support**.

3.Z1

microwave function

heat transfer exclusively by electromagnetic energy in the ISM frequency band of 2 450 MHz

3.Z2

combination microwave function

heat transfer by electromagnetic energy simultaneously or sequentially with thermal heat

Note 1 to entry: Thermal heat can be a conventional heating function, a forced air circulation function, a hot steam function or steam function. Definitions are given in EN 60350-1.

3.Z3

Set to off mode

action where the product is switched off using appliance controls or switches that are accessible and intended for operation by the user during normal use to attain the lowest power consumption that may persist for an indefinite time while connected to a main power source and used in accordance with the manufacturer's instructions. All actions required to set to off mode like for example empty the water tank, remove food, close the door etc have to be taken

Note 1 to entry: For definition of off mode EN 50564 is relevant.

3.Z4

Set to standby mode

action where the product is switched to standby using appliance controls or switches that are accessible and intended for operation by the user during normal use to attain the lowest power consumption that may persist for an indefinite time while connected to a main power source and used in accordance with the manufacturer's instructions

Note 1 to entry: For definition of standby mode EN 50564 is relevant.

3.Z5

cooling down period

unstable condition persisting after completion of the active mode and the appliance is set to off mode where the power consumption may change without any intervention by the user

3.Z6

food support

horizontal support in the cavity on which the load is placed. If the appliance is fitted with a turntable, the turntable is the food support. The food support can also be a shelf or a reciprocating tray. If recommended by manufacturer's instruction also the cavity bottom can be the food support 