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Household microwave ovens – Methods for measuring performance

Fours à micro-ondes à usage domestique – Méthodes de mesure de l'aptitude à la fonction

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CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Classification.....	9
4.1 According to type.....	9
4.2 According to characteristics	9
5 List of measurements	9
6 General conditions for measurements.....	10
6.1 General.....	10
6.2 Supply voltage	11
6.3 Test room	11
6.4 Water.....	11
6.5 Initial condition of the appliance.....	11
6.6 Control setting	11
6.7 Instruments and measurements	11
6.8 Positioning the appliance	12
7 Dimensions and volume.....	12
7.1 External dimensions.....	12
7.2 Internal dimensions and calculated volume.....	13
7.2.1 General	13
7.2.2 Internal height	14
7.2.3 Internal width.....	15
7.2.4 Internal depth	15
7.2.5 Reciprocating tray	15
7.2.6 Calculated volume	15
7.3 Dimensions of accessories.....	16
7.3.1 Dimensions of food support	16
7.3.2 Dimensions of grill grids	16
7.4 Overall internal dimensions and overall volume.....	17
7.4.1 General	17
7.4.2 Overall height (<i>H</i>)	17
7.4.3 Overall width (<i>W</i>).....	17
7.4.4 Overall depth (<i>D</i>).....	18
7.4.5 Overall volume of rectangular cavities	18
7.4.6 Overall volume of non-rectangular cavities	18
8 Determination of microwave power output	18
9 Efficiency.....	19
10 Energy consumption for the microwave function	19
10.1 Purpose	19
10.2 Test load.....	20
10.3 Preparation	20
10.4 Positioning the load in the appliance.....	20
10.5 Measurement of energy consumption for a cooking cycle.....	20
10.6 Calculation for the energy consumption of a cooking cycle.....	21
10.7 Final result.....	23

10.8	Reporting of test results	23
11	Consumption measurement of low-power modes	23
12	Technical tests for performance	23
12.1	Purpose	23
12.2	Square tank test.....	24
12.2.1	Procedure.....	24
12.2.2	Assessment.....	24
12.3	Multiple beakers test.....	24
12.3.1	Procedure.....	24
12.3.2	Assessment.....	27
13	Heating beverages	27
13.1	Purpose	27
13.2	Procedure	27
13.3	Assessment	28
14	Cooking performance	28
14.1	General.....	28
14.2	Assessment	28
14.3	Tests	29
14.3.1	Egg custard	29
14.3.2	Sponge cake.....	29
14.3.3	Meatloaf	30
14.3.4	Potato gratin.....	31
14.3.5	Cake.....	32
14.3.6	Chicken	33
15	Defrosting performance	33
15.1	Purpose	33
15.2	Assessment	33
15.3	Measurement.....	34
15.3.1	Container.....	34
15.3.2	Ingredients	35
15.3.3	Procedure.....	35
Annex A	(informative) Defrosting raspberries	36
A.1	Purpose	36
A.2	Test method – Raspberries	36
A.2.1	Container.....	36
A.2.2	Ingredients	36
A.2.3	Procedure.....	36
Annex B	(informative) Stirrer.....	37
Annex C	(informative) Glass container for Clause 8 and Clause 10.....	38
Bibliography	39
Figure 1	– External dimensions of the microwave oven	13
Figure 2	– Gauge for measuring these dimensions.....	14
Figure 3	– Internal dimensions	14
Figure 4	– Turntable	16
Figure 5	– Examples for determining the entire area and usable area of a grill grid.....	17
Figure 6	– Square tank	24

Figure 7 – Beaker 25

Figure 8 – Position of beakers on rectangular food supports 26

Figure 9 – Position of beakers on the turntable 26

Figure 10 – Beaker position for the test of heating beverages 27

Figure 11 – Shallow dish..... 35

Figure B.1 – Plastic stirring adapter 37

Figure B.2 – Example stirrer 37

Figure C.1 – Example: small beaker (600 ml)..... 38

Table 1 – List of measurements 10

Table 2 – Instruments 12

Table 3 – Measurements..... 12

Table 4 – Test loads for measuring the energy consumption 20

Table C.1 – Specification – Glass containers 38

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**HOUSEHOLD MICROWAVE OVENS –
METHODS FOR MEASURING PERFORMANCE**

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IEC 60705 has been prepared by subcommittee 59K: Performance of household and similar cooking appliances, of IEC technical committee 59: Performance of household and similar electrical appliances. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2010, Amendment 1: 2014 and Amendment 2: 2018. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) thematically ordered new sequence of the clauses;
- b) updated normative references;
- c) introduced a new definition for microwave generator to open the standard for microwave ovens with one or more magnetrons or solid-state components;
- d) aligned with IEC 60350-1:2023 regarding the definitions and references;

- e) aligned preparation of water load for Clause 8 and Clause 10;
- f) removed the definitions for set to off mode and set to standby mode ;
- g) added new definitions regarding low power modes;
- h) aligned the low power mode measurement, Clause 11, to IEC 60350-1:2023;
- i) revised square tank tests to one new 12.2;
- j) revised the dishes used for Clause 12, Clause 13 and Clause 14 and removal of Annex B;
- k) removed A.3.3;
- l) removed Annex F for measuring the energy consumption of the cooling down period;
- m) former Annex E will be substituted by a supporting document located on the IEC's website.

The text of this International Standard is based on the following documents:

Draft	Report on voting
59K/400/FDIS	59K/404/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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HOUSEHOLD MICROWAVE OVENS – METHODS FOR MEASURING PERFORMANCE

1 Scope

This document applies to **microwave ovens** for household and similar use, it also applies to **microwave ovens with grills** and **combination microwave ovens**.

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

The manufacturer defines the primary cooking function of the appliance, **microwave function** or thermal heat. The primary cooking function will be measured with an existing method according to energy consumption.

If the primary cooking function is declared as a **microwave function**, IEC 60705 will be applied for energy consumption measurement. If the primary cooking function is declared as a thermal heat, IEC 60350-1 will be applied for energy consumption measurement. If the manufacturer does not declare the primary function, the performance of the **microwave function** and thermal heat is measured as far as it is possible.

NOTE 1 There is currently no measurement method for the energy consumption for grilling and steam functions.

NOTE 2 This document does not deal with safety requirements (see IEC 60335-2-25 [1]¹).

NOTE 3 This document does not apply to appliances incorporating thermal heat, steam function or hot steam function only. These appliances are covered by IEC 60350-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60350-1:2023, *Household electric cooking appliances – Part 1: Ranges, ovens, steam ovens and grills – Methods for measuring performance*

IEC 60584-1, *Thermocouples – Part 1: EMF specification and tolerances*

ISO 80000-1:2022, *Quantities and units – Part 1: General*

¹ Numbers in square brackets refer to the Bibliography.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

combination microwave function

heat transfer by electromagnetic energy simultaneously or consecutively with energy transfer by a heating function, by hot steam or by steam

Note 1 to entry: For definitions of a heating function, hot steam function and steam function, IEC 60350-1 is relevant.

3.2

combination microwave oven

appliance which can be operated by **microwave function**, **combination microwave function** and heating function

Note 1 to entry: For the definition of a heating function, IEC 60350-1 is relevant.

3.3

food support

horizontal support in the cavity on which the load is placed

Note 1 to entry: 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**.

3.4

microwave function

function using only electromagnetic energy in one or several of the ISM frequency bands between 300 MHz and 30 GHz for heating food and beverages in a cavity

3.5

microwave function with grill

heat transmission by electromagnetic energy simultaneously or consecutively with energy transfer by radiant heat typically from the top of the cavity

3.6

microwave oven with grill

microwave oven in which microwave energy is combined with grill

3.7

microwave generator

device in an appliance for generating microwave energy, i.e. one or more magnetrons or solid-state components

3.8

microwave oven

appliance using only electromagnetic energy in one or several of the ISM frequency bands between 300 MHz and 30 GHz, for heating food and beverages in a cavity

Note 1 to entry: ISM frequency bands are the electromagnetic frequencies established by the ITU and reproduced in CISPR 11 [2].

3.9

microwave transparent

property of a material with microwaves passing through, having negligible absorption and reflection

Note 1 to entry: The relative permittivity of a **microwave transparent** material is less than 7 and the relative loss factor is less than 0,015.

3.10

rated voltage

voltage assigned to the appliance by the manufacturer

4 Classification

4.1 According to type

Appliances are classified according to their type:

- **microwave oven,**
- **combination microwave oven,**
- **microwave oven with grill.**

The type shall be reported.

4.2 According to characteristics

Appliances are classified according to their characteristics:

- cavity dimensions,
- dimensions of shelves,
- moved **food support**, e.g. reciprocating tray, turntable,
- possible thermal heating modes (grilling, heating function, steam function etc.), combination modes.

The characteristics shall be reported.

5 List of measurements

Table 1 shows which measurement shall be applied for the relevant function.

Table 1 – List of measurements

Measurements	Clause or subclause	Applicable to				
		microwave function	microwave function with grill	microwave function in combination with heating function	microwave function in combination with hot steam	microwave function in combination with steam
Dimensions and volume	7	Applicable to all appliances which are under the scope.				
Microwave power output	8	x	-	-	-	-
Efficiency	9	x	-	-	-	-
Energy consumption	10	x	-	-	-	-
Consumption measurement of low power modes	11	Applicable to all appliances which are under the scope.				
Square tank	12.2	x	-	-	-	-
Multiple beakers	12.3	x	-	-	-	-
Heating beverages	13	x	-	-	-	-
Egg custard	14.3.1	x	-	-	-	x
Sponge cake	14.3.2	x	-	-	-	x
Meatloaf	14.3.3	x	-	-	-	x
Potato gratin	14.3.4	-	x	x	x	-
Cake	14.3.5	-	x	x	x	-
Chicken	14.3.6	-	x	x	x	-
Meat defrosting	15	x	-	-	-	x
For definition of grill, heating function, hot steam function and steam function, IEC 60350-1 is relevant.						

6 General conditions for measurements

6.1 General

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

When a metal **food support** is provided and used for the measurements, the load position and the corresponding shape of the metal **food support** shall be reported.

If not otherwise specified, the **food support** is placed in the cavity in its lowest position.

NOTE The positioning influences the repeatability of the test results.

If numbers shall be rounded, they shall be rounded according to ISO 80000-1:2022, Clause B.3 Rule B. If the rounding takes place to the right of the comma, the omitted places shall not be filled with zeros.

6.2 Supply voltage

The supply voltage shall be maintained at the main terminal at **rated voltage** $\pm 1\%$, while the microwave operation is switched on. 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.

The supply frequency shall be at the rated frequency $\pm 1\%$ throughout the test. If a frequency range is indicated, then the test frequency shall be the nominal frequency of the country in which the appliance is intended to be used.

The supply voltage measured during the tests shall be recorded.

The supply voltage shall be essentially sinusoidal.

NOTE 1 For recording the supply voltage, only the power on period is relevant.

NOTE 2 In the case of a fixed cable, the plug (or the end of the cable furthest from the appliance) is the reference point to maintain the voltage.

6.3 Test room

For the tests in Clause 8, Clause 10 and Clause 11, the temperature shall be $23\text{ °C} \pm 2\text{ °C}$ during the entire test.

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

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

6.4 Water

Potable water is used for the tests.

6.5 Initial condition of the appliance

At the beginning of each test, the appliance has not been operated for a period of at least 6 h.

NOTE 1 The period of at least 6 h can be reduced if it can be demonstrated that the temperature of the **microwave generator** and the power supply is within 5 K of the ambient temperature and 2 K of the ambient temperature for tests Clause 8 and Clause 10.

Forced cooling can be used to assist in reducing the appliance temperature.

6.6 Control setting

The tests are carried out with the controls set to give the highest power output. Unless otherwise specified, the measurements are made with boost function, if available.

6.7 Instruments and measurements

Instruments used and measurements made for this document shall comply with the following specifications detailed in Table 2 and Table 3.

Table 2 – Instruments

Parameter	Unit	Minimum resolution	Maximum permissible error	Additional requirements
Mass	g	0,5 g	± 1 g	
Temperature				
– ambient temperature	°C	0,1 °C	± 1 K	
– water load	°C	0,1 °C	± 1,5 K	1 mm steel tube diameter, class 1 according to IEC 60584-1
Time	s	1 s	± 1 s	
Energy	Wh	–	± 1 %	
Dimensions	mm	1 mm	1 mm	≤ 1 mm or 0,5 % whatever is the greater

Table 3 – Measurements

Parameter	Unit	Minimum resolution	Maximum permissible error	Additional requirements
Electrical energy	Wh		± 1,0 %	
Voltage	V		± 0,5 %	
Temperature and energy consumption measurement				Sampling rate ≤ 1 s

6.8 Positioning the appliance

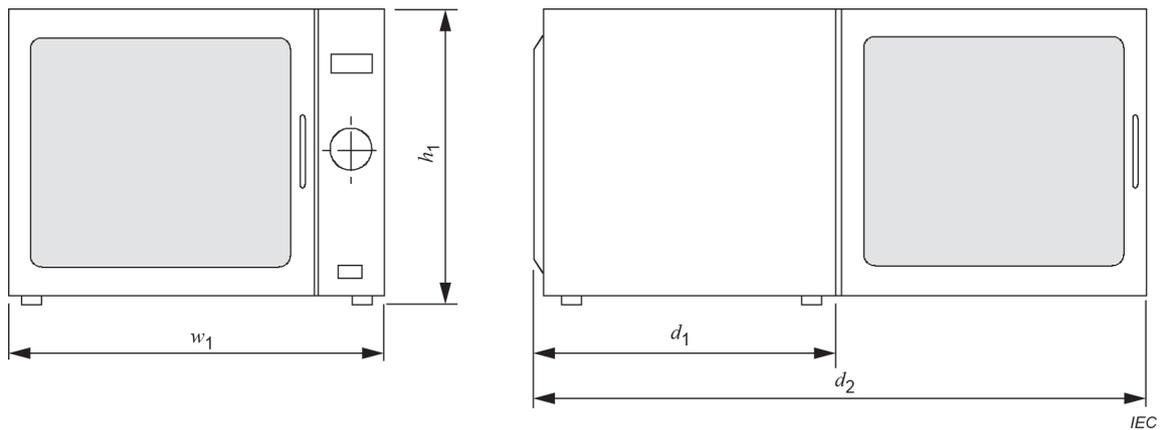
Freestanding appliances are placed with their back against a wall and positioned away from sidewalls, unless otherwise specified in the instructions. Other appliances are installed in accordance with the instructions for installation.

7 Dimensions and volume

7.1 External dimensions

For free-standing appliances or appliances placed on a surface, the overall height, width and depth of the appliance, excluding any knobs and handles on the front surface, are measured. The depth is also measured with the door fully open. The dimensions are shown in Figure 1. If adjustable feet are provided, the height of the appliance is determined with the feet in their minimum and maximum positions.

The dimensions are stated in millimetres.

**Key** h_1 height w_1 width d_1 depth d_2 depth with the door open**Figure 1 – External dimensions of the microwave oven**

For built-in appliances, IEC 60350-1:2023, Figure 3, is applicable.

7.2 Internal dimensions and calculated volume**7.2.1 General**

The measurement of the calculated volume is to be carried out at ambient temperature.

For verification purposes, a gauge, as shown in Figure 2, shall be used to determine all of the three dimensions. The gauge shall be used without appreciable force. Dimensions are stated in millimetres.

The height, width and depth of the calculated volume in the cavity shall be measured according to 7.2.2 to 7.2.4. The measurements are shown in Figure 3.

The turntable is essential for the operation of the appliance, therefore it is not removed. How to consider the turntable is shown in Figure 4.

Appliances having an internal height of less than 120 mm are disregarded.