SLOVENSKI STANDARD
SIST EN 60705:2012

01-julij-2012

Gospodinjske mikrovalovne pečice - Metode za merjenje lastnosti

Household microwave ovens - Methods for measuring performance

Mikrowellengeräte für den Hausgebrauch und ähnliche Zwecke - Verfahren zur Messung der Gebrauchstauglichkeit

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

Ta slovenski standard je istoveten z: **EN 60705:2012**

ICS:

97.040.20	Štedilniki, delovni pulti, pečice in podobni aparati	Cooking ranges, working tables, ovens and similar appliances

SIST EN 60705:2012   **en,fr,de**

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60705

May 2012

ICS 97.040.20

Supersedes EN 60705:1999 + A1:2004 + A2:2006

English version

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

Ref. No. EN 60705:2012 E

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• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2015-03-12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

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".

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).

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COMMON MODIFICATIONS

1 Scope

Add *the following sentence to Note 1:*

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

2 Normative references

Add *the following references:*

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

EN 60350-1: 20xx[1]), Household electric cooking appliances — Part 1: Ranges, ovens, steam ovens and grills - Methods for measuring performance (IEC 60350-1:2011, modified)

3 Definitions

In 3.1, *delete Note 1 and renumber Note 2 in Note 1.*

Add *the following note to 3.2:*

Note 1 to entry: Energy transfer by steam is included.

Add *the following new definitions to Clause 3:*

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.

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[1]) At draft stage.

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

4.1 According to type

Add the following paragraph and NOTE after the second dash:

The manufacturers shall define the primary cooking function of the appliance**, microwave function** or thermal heat. The primary cooking function has to be measured with an existing method according to energy consumption.
If the primary cooking function is declared as a microwave function the EN 60705 shall be applied for energy consumption measurement. If the primary cooking function is declared as a thermal heat the EN 60350-1 is applied for energy consumption measurement.

NOTE Z1 There is no measurement method for the energy consumption for grilling and steam functions.

4.2 According to characteristics

After the first dash item, **add** *the following new dash item:*

– dimensions of shelves;

Replace *the second dash item by:*

– moved food support, e.g. reciprocating tray, turntable;

After the last dash item, **add** *the following new dash item:*

– possible thermal heating modes (grilling, hot air, steam function etc.).

5 List of measurements

Revise *Clause 5, Table 1:*

- *Line 6: Cancel efficiency, add instead energy consumption.*

- *Line 5: Add efficiency to microwave power output*

Table 1 — List of measurements

Item of measurement	Clause or subclause	Reproducibility	Microwave ovens 1)	Combination microwave ovens
External dimensions	7.1	Yes	*	*
Usable cavity dimensions	7.2	Yes	*	*
Calculated cavity volume	7.3	Yes	*	*
Microwave power output and efficiency	8	Yes	*	
Energy consumption for the microwave function	9	Yes	*	
Square tank	10.1	Yes	*	
Multiple cup	10.2	Yes	*	
Heating beverages	11.1	Yes	*	
Heating simulated food	11.2	Yes	*	
Egg custard	12.3.1	No	*	
Sponge cake	12.3.2	No	*	
Meatloaf	12.3.3	No	*	
Potato gratin	12.3.4	No		*
Cake	12.3.5	No		*
Chicken	12.3.6	No		*
Meat defrosting	13.3	No	*	
Batter	Annex A	No	*	
* Test is applicable.				
1) Except for the tests of 10.1, these tests are also applicable to **combination microwave ovens** when operated in the microwave only mode.				

The methods described in Clauses 8 and 9 are only applicable for appliances with **microwave function**. If a combination microwave oven doesn't provide a **microwave function** the tests are not applicable. The energy consumption measurement cannot be carried out with **combined microwave function**.

6.1 General

Substitute "turn table or any metal accessories" by "food support":

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,..

Add the following sentence after the 2nd paragraph:

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

6.2 Supply voltage

Replace the text of 6.2, including the note, by:

The supply voltage shall be maintained at the main terminal at 230 V ± 1 % or at 400 V ± 1 % as defined by the manufacturer's installation guide, while the microwave operation is switched on. The supply frequency shall be at a nominal 50 Hz ± 1 %.

The supply voltage measured during the tests shall be recorded.

The supply voltage shall be essentially sinusoidal.

Add the following notes:

NOTE Z1   For recording the supply voltage only the power on period is relevant.

NOTE Z2   In case of a fixed cable, the plug (or the end of the cable) is the reference point to maintain the voltage.

6.3 Test room

Add *the following requirements after the first paragraph:*

For tests Clauses 8 and 9 the temperature shall be at 23 °C ± 2 °C during the complete test. The measurement of the ambient temperature shall not be influenced by the appliance itself or by any other appliance.

6.5 Initial condition of the oven

Replace the whole clause by:

At the beginning of each test, the oven has not been operated for a period of at least 6 h. However, this period may be reduced if it can be demonstrated that the microwave power output, as determined in Clause 8, is available earlier.

NOTE 1 The temperatures of the magnetron and the power supply shall be within 5 K of the ambient temperature and 2 K of the ambient temperature for tests Clauses 8 and 9.

NOTE 2 Forced cooling may be used to assist in reducing the oven temperature.

6.Z7 Instruments and measurements

Instruments used and measurements made for this document shall comply with the following specifications.

Table Z.1

Instruments:

Parameter	Unit	Minimum resolution	Minimum accuracy	Additional requirements
mass	g	0,5 g	± 1 g	
temperature				
ambient temperature	°C	0,1 °C	± 1K	
water load	°C	0,1 °C	± 1,5 K	1 mm steel tube diameter, class 1 according to EN 60584-2
time	s	1s	± 1 s	
energy	Wh	-	± 1 %	

Measurements:

Parameter	Unit	Minimum resolution	Minimum accuracy	Additional requirements
Electrical energy	Wh		± 1,0 %	
voltage	V		± 0,5 %	
temperature and energy consumption measurement				sampling rate ≤ 1s
For test 9.5.2 and Z1 the power measurement requirements shall be in accordance with EN 50564	W			according to EN 50564

6.Z8 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.

Change headline of 7.2 Usable internal dimensions and usable volume to 7.2 Usable internal dimensions and calculated volume.

7.2 Usable internal dimensions and calculated volume

7.2.1 General

Add the following sentence before the following note:

The turntable is essential for the operation of the appliance therefore it is not removed.
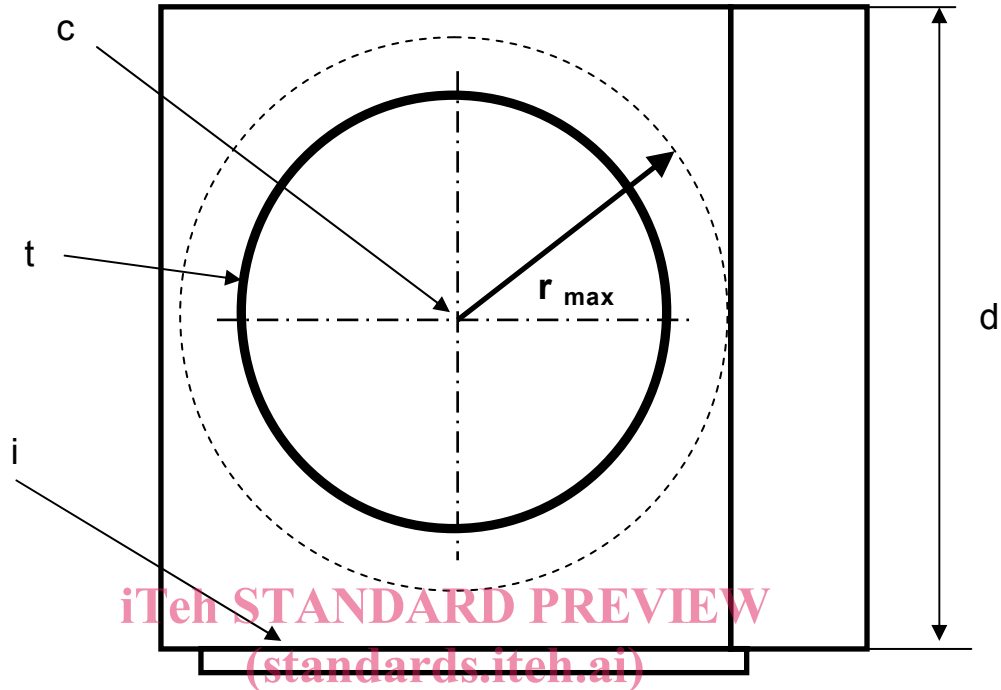
Add the following note after the first paragraph:

NOTE Safety operation should be guaranteed. Therefore necessary parts e.g. lamp cover cannot be removed for measuring the usable volume.

Revise reference in 7.2.1, 3*rd* paragraph:

…according to 7.2.2 – 7.2.4.

Change the 2*nd* drawing of Figure 2b by an improved version which better shows r*max*. *Adapt* also the key:

Key

d usable depth	*t turntable*
g heating element	*I inside surface of oven door*
h usable height	*w usable width*
c centre of rotation of the turntable	*r distance from c to the nearest wall*

Change headine of 7.2.6 Usable volume to 7.2.6 Calculated volume

7.2.2 Usable height

Add to the first sentence:

….from the centre of the cooking cavity bottom <u>or turntable</u> to the lowest point on the ceiling.

7.2.6 Calculated volume

Change the wording in the first sentence "next full litre" to "nearest full litre".

*Add after the 2*nd* paragraph:*

If the turntable can be switched off the rectangular volume from the dimensions width, height and depth is calculated.

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Both circular and rectangular volumes are stated.

7.2.Z7 Dimensions of food support

The usable width and usable depth of the shelf and for a round shelf the diameter 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 **food support** may be a shelf, a grid, baking sheet, a turntable or the bottom of cavity.

8 Determination of microwave power output

Replace the title by

8 Determination of microwave power output and energy efficiency

Add *the following title:*

8.1 Determination of microwave power output

Revise *the 2nd paragraph:*

A cylindrical container of borosilicate glass is used for the test as described in Clause 9, Table Z.2. It has an external diameter of approximately 190 mm and a height of approximately 90 mm. The mass of the container is to be stated.

Revise *the 4th paragraph, 2nd sentence:*

The food support for microwave heating is placed in the appliance according to the instructions of manufacturers. The container is placed in the centre of this support immediately.

Revise *the formula and the key therefore:*

$$P = \frac{4{,}187 \cdot m_{\mathrm{w}}(T_1 - T_0) + 0{,}55 \cdot m_{\mathrm{c}}(T_1 - T_A)}{t}$$

where

P is the microwave power output, in watts;

m_{w} is the mass of the water, in grams;

m_{c} is the mass of the container, in grams;

T_A is the ambient temperature, in degrees Celsius;

T_0 is the initial temperature of the water, in degrees Celsius;

T_1 is the final temperature of the water, in degrees Celsius;

t is the heating time, in seconds, excluding the magnetron filament heating-up time.

9 Efficiency

Change *Clause 9 to 8.2 Efficiency:*

8.2 Efficiency

Add a new Clause 9:

9 Energy consumption for the microwave function

9.1 General

The purpose of this test is to measure the energy consumption of the appliance by a defined load and temperature rise which is considered as energy consumption for a cooking cycle. Therefore three different water loads in glass containers which have different sizes and shapes are used.

9.2 Test load

Three different test loads as shown in Table Z.2 are used:

Table Z.2 – test loads for measuring the energy consumption

Load	Glass container, cylindrical (in mm) made of borosilicate glass	Nominal water amount (m_w) pure tape water (in g)
Small (s)	External diameter Ø 90 ± 1 external height 125 ± 1 capacity 600 ml Maximum weight 200 g	275 ± 1
Middle (m)	External diameter Ø 140 ± 1 external height 76 ± 1 capacity 900 ml Maximum weight 250 g	350 ± 1
Large (l)	External diameter Ø 190 ± 1 external height 90 ± 1 capacity 2000 ml Maximum weight 450 g	1000 ± 1

The properties of the glass containers shall be in accordance with 3.3. The actual mass of the used container (m_c) is determined and noted. The actual mass of the water amount is determined and noted (m_w).

NOTE   For calculating the energy consumption the heat capacity of the beaker is taken into account. Therefore the theoretical energy in the beaker is calculated.

9.3 Preparation

At the start of the test the empty glass container and the appliance shall have laboratory ambient temperature. The water is poured into the container and stirred. The temperature is measured when the average temperature of container and water is balanced. The initial temperature, T_0, shall be in the range of 10 °C ± 0, 5 °C.

NOTE 1   Water having an initial temperature 1°C – 2 °C below the target temperature minimizes the stirring time.

NOTE 2 The filled container should not be stored in the fridge to avoid the rims getting too cold.

NOTE 3 To guarantee a sufficient stirring a thermocouple with a plastic adapter should be used. An example is described in Annex ZB. The stirrer should have a low heat capacity.

9.4 Positioning the load in the appliance

The food support for microwave heating is placed in the appliance according to the instructions of manufacturers. The container is placed in the centre of this support immediately.

If no instructions are given the container is placed in the centre of the turntable or reciprocating tray. If the appliance is not fitted with a turntable or reciprocating tray the load is placed on the lowest possible shelf position.

9.5 Measurement of energy consumption for a cooking cycle

The energy consumption for a cooking cycle is measured.

Two tests are performed for each amount of water (see 9.2):

The measurement 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 oven is operated and the time for the water to reach a temperature in between 60 °C and 65 °C (T_{high}) is measured (t_{high}). The oven is then switched off. The water load is removed from the oven and positioned on a thermally insulating pad. The water is stirred with the thermometer and the final temperature is measured within 20 s after heating is finished.

The oven is cooled down (see 6.5) and the measurement with the same water load is repeated with a target temperature of 55 °C - 60 °C (T_{low}). The time is measured (t_{low}).

The difference between T_{high} and T_{low} shall be minimum 2 K, otherwise one of the measurements shall be repeated with an adjusted time.

This procedure is carried out for each load defined in 9.2.

The following data shall be recorded for each water load:
–   heating time t_{low} and t_{high} in seconds; including the magnetron filament heating-up time;
–   initial temperature T_0 in °C;
–   final temperature T_{low} and T_{high} in °C;
–   energy consumption W_{low} and W_{high} in Wh;
–   ambient temperature in °C at the start of the test (when the water is positioned in the appliance);
–   actual and nominal mass of water, in grams.

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.

NOTE 2 The recording of the heating time t_{low} and t_{high} are informative and simplify the measurement. Therefore the magnetron filament heating-up time is included.

NOTE 3 It is recommended to start with the higher temperature range of 60 °C – 65 °C (T_{high}).

NOTE 4 To guarantee a sufficient stirring a thermocouple with a plastic adapter should be used. Examples are described in Annex ZB. The stirrer should have a low heat capacity.

9.6 Calculation for the energy consumption of a cooking cycle

The energy consumption to reach a temperature increase of 50 K (W_{50}) is calculated for each load (see 9.2) using the linear regression based on the measured data points.

The temperature rise (ΔT) is calculated as the difference between the initial temperature T_0 and final temperature T_{low} or T_{high}.

$$\Delta T_{high} = T_{high} - T_0 \tag{1a}$$

$$\Delta T_{low} = T_{low} - T_0 \tag{1b}$$

To calculate the total temperature rise the heat capacity of the container is considered as follows for ΔT_{high} and ΔT_{low}

$$total\ \Delta T_{high} = \frac{0,55 \times m_c \times \Delta T_{high}}{4,187 \times m_w} + \Delta T_{high} \tag{2a}$$

$$total\ \Delta T_{low} = \frac{0,55 \times m_c \times \Delta T_{low}}{4,187 \times m_w} + \Delta T_{low} \tag{2b}$$

where

m_w is the actual mass of the water, in grams;

$m_{w,n}$ is the nominal mass of water (275 g, 350 g, 1 000 g);

m_c is the actual mass of the container, in grams;

T_0 is the initial temperature of the water, in degrees Celsius;

T_{low} is the final temperature of the water for the low temperature range, in degrees Celsius;

T_{high} is the final temperature of the water for the high temperature range, in degrees Celsius;

The total temperature rise (total ΔT) is normalized by the actual load.

$$norm\ \Delta T_{high} = total\ \Delta T_{high} \times \frac{m_w}{m_{w,n}} \tag{3a}$$

$$norm\ \Delta T_{low} = total\ \Delta T_{low} \times \frac{m_w}{m_{w,n}} \tag{3b}$$

The quotient of energy consumption per temperature rise (Q) in Wh/K is calculated.

$$Q = \frac{\left(W_{high} - W_{low}\right)}{\left(norm\ \Delta T_{high} - norm\ \Delta T_{low}\right)} \tag{4}$$

The energy consumption to heat up the amount of water by 50 K (W_{50}) is calculated.