IEC 60335-2-25

Edition 8.0 2024-07
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Household and similar electrical appliances – Safety –
Part 2-25: Particular requirements for microwave ovens, including combination microwave ovens

IEC 60335-2-25:2024-07 RLV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 13.120; 97.040.20

ISBN 978-2-8322-9404-8

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-25: Particular requirements for microwave ovens, including combination microwave ovens

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60335-2-25:2020. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60335-2-25 has been prepared by subcommittee 61B: Safety of microwave appliances for household and commercial use, of IEC technical committee 61: Safety of household and similar electrical appliances. It is an International Standard.

This eighth edition cancels and replaces the seventh edition published in 2020. This edition constitutes a technical revision.

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

a) some subclauses have been modified for the appliance outlets and socket-outlets;
b) Subclause 7.12 has been improved in clarity;
c) Subclauses 8.1.1 and 20.2 have been modified to adopt test probe 19;
d) Subclauses 10.1 and 10.2 have been improved in clarity for inverter type microwave ovens;
e) maximum temperature rises of external accessible surfaces have been added in Subclause 11.8;
f) test criterion has been modified in Subclause 15.101;
g) Subclause 15.102 has been modified for harmonization with IEC 60335-2-6;
h) Subclauses 8.1.3, 15.103, 19.11.2, 19.13, 22.105, 22.106, 22.111 and Figure 101 have been improved in clarity;
i) Subclauses 22.103.2, 22.105 and 22.120 have been modified to adopt test probe 18;
j) Subclause 16.101 has been modified to move the content of 16.101.1, 16.101.2 directly under 16.101;
k) Subclause 22.119 has been modified to move the content of 22.119.1, 22.119.2 and 22.119.3 directly under 22.119.

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

Draft	Report on voting
61B/701/FDIS	61B/705/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/standardsdev/publications.

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety*, can be found on the IEC website.

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments unless that edition precludes it; in that case, the latest edition that does not preclude it is used. It was established on the basis of the sixth edition (2020) of that standard.

NOTE 1 When "Part 1" is mentioned in this standard, it refers to IEC 60335-1.

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Particular requirements for microwave ovens, including combination microwave ovens.

When a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. When this standard states "addition", "modification" or "replacement", the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;

– unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;

– additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

– requirements: in roman type;

– *test specifications: in italic type;*

– notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in **bold**.

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

- reconfirmed,
- withdrawn, or
- revised.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations can need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

The following differences exist in the countries indicated below.

– 5.3: Microwave leakage is not to exceed 10 W/m^2 during the initial test (Japan and USA).

– 6.1: Microwave ovens may be class 0I if the rated voltage does not exceed more than 150 V (Japan).

– 7.12: Specific instructions exist pertaining to using and servicing **microwave ovens** with respect to the risk of exposure to microwave energy (USA).

– 7.12: It is prohibited to place the appliance in a cabinet with a door (Japan).

– Clause 18: The test is carried out on two appliances (USA).

– 19.11.2: The input voltage variation is not applied (USA).

– 19.13: Microwave leakage is measured only at the end of each test (USA).

– 21.102: The applied force is 222 N (USA).

– 21.105: Microwave leakage is not to exceed 50 W/m^2 (Japan and USA).

– 22.111: Microwave leakage is measured only at the end of the test (USA).

– 22.112: Microwave leakage is not to exceed 50 W/m^2 (Japan and USA).

– 22.115: All access to the cavity has to be prevented (USA).

INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

Guidance documents concerning the application of the safety requirements for appliances can be accessed via TC 61 and SC 61B supporting documents on the IEC website

https://www.iec.ch/tc61/supportingdocuments
https://www.iec.ch/sc61b/supportingdocuments

This information is given for the convenience of users of this International Standard and does not constitute a replacement for the normative text in this standard.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules ~~may~~ can differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another part 2 of IEC 60335, the relevant part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

NOTE 2 ~~Horizontal and generic standards~~ Horizontal publications, basic safety publications and group safety publications covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards. ~~For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 standards.~~

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features which impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard ~~may~~ can be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

NOTE 3 Standards dealing with non-safety aspects of household appliances are:

– IEC standards published by TC 59 concerning methods of measuring performance;
– CISPR 11, CISPR 14-1 and relevant IEC 61000-3 series standards concerning electromagnetic emissions;
– CISPR 14-2 concerning electromagnetic immunity;
– IEC standards published by TC 111 concerning environmental matters.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-25: Particular requirements for microwave ovens, including combination microwave ovens

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of **microwave ovens** for household and similar use, their **rated voltage** being not more than 250 V including direct current (DC) supplied appliances and **battery-operated appliances**.

This standard also deals with **combination microwave ovens**, for which normative Annex AA is applicable.

This standard also deals with **microwave ovens** intended to be used on board ships, for which normative Annex BB is applicable.

Appliances not intended for normal household use but which nevertheless ~~may~~ can be a source of danger to the public, such as appliances intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard. However, if the appliance is intended to be used professionally to process food for commercial purposes, the appliance is not considered to be for household and similar use only.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account

– persons (including children) whose
  - physical, sensory or mental capabilities; or
  - lack of experience and knowledge

  prevents them from using the appliance safely without supervision or instruction;
– children playing with the appliance.

~~NOTE 101~~ Attention is drawn to the fact that

– for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements can be necessary;
– in many countries, additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour and similar authorities.

~~NOTE 102~~ This standard does not apply to

– commercial **microwave ovens** (IEC 60335-2-90);
– commercial microwave appliances with insertion or contacting applicators (IEC 60335-2-110);
– industrial microwave heating equipment (IEC 60519-6);
– appliances for medical purposes (IEC 60601);
– appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-52, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

~~IEC 60335-2-5:2012, *Household and similar electrical appliances – Safety – Part 2-5: Particular requirements for dishwashers*~~

IEC 60335-2-6:~~2014~~ [1], *Household and similar electrical appliances – Safety – Part 2-6: Particular requirements for stationary cooking ranges, hobs, ovens and similar appliances*

IEC 60335-2-9, *Household and similar electrical appliances – Safety – Part 2-9: Particular requirements for grills, toasters and similar portable cooking appliances*

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

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

3.1.7 *Addition:*

Note 101 to entry: The **rated frequency** is the input frequency.

3.1.9
normal operation

Modification:

Replace the first paragraph by the following:

operation of the appliance with 1 000 g ± 50 g of potable water at an initial temperature of 20 °C ± 2 °C in a cylindrical borosilicate glass vessel having a maximum thickness of 3 mm and an outside diameter of approximately 190 mm~~.~~, the vessel ~~is~~ being placed on the centre of the **shelf**

3.5 Definitions relating to types of appliances

3.5.101
microwave oven
appliance using electromagnetic energy in one or several of the ISM frequency bands[2] between 300 MHz and 30 GHz, for heating food and beverages in a **cavity**

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[1] Under preparation. Stage at the time of publication: IEC/FDIS 60335-2-6:2024.

[2] ~~ISM frequency bands are the electromagnetic frequencies established by the ITU and reproduced in CISPR 11.~~

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

3.5.102
combination microwave oven
microwave oven in which heat is also provided in the **cavity** by simultaneous or consecutive operation of resistive heating elements

Note 1 to entry: The resistive heating elements are used to provide radiant heat, convection heat or steam.

3.6 Definitions relating to parts of an appliance

~~3.103~~**3.6.101**
cavity
space enclosed by the inner walls and the door in which the load is placed

~~3.104~~**3.6.102**
shelf
horizontal support in the **cavity** on which the load is placed

~~3.105~~**3.6.103**
door interlock
device or system that prevents the operation of the ~~magnetron~~ microwave generator(s), unless the oven door is closed

~~3.106~~**3.6.104**
monitored door interlock
door interlock system that incorporates a supervision device

~~3.107~~**3.6.105**
temperature-sensing probe
device that is inserted into the food to measure its temperature and is a part of an oven control

3.8 Definitions relating to miscellaneous matters

3.8.101
open deck
area that is exposed to marine environment

3.8.102
dayroom
area that can be exposed to marine environment from time to time

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.2 *Addition:*

~~NOTE 101~~ *An additional sample can be required for the test of 19.104.*

~~NOTE 102~~ *Six samples of the interlocks are required for the test of 24.1.4.*

5.3 *Modification:*

Instead of carrying out the tests in the order of clauses, the following sequence of clauses and subclauses applies: 32.1, 22.113, 22.108, 22.115, 22.116, Clause 7 to 17, Clause 20, Clause 21 (except 21.101 to 21.105), Clause 18, Clause 19 (except 19.104), Clause 22 (except 22.108, 22.113, 22.115 and 22.116), Clause 23 to 31 and 32.2, 21.101 to 21.105 and 19.104.

5.101 ***Microwave ovens*** *are tested as* ***motor-operated appliances****.*

5.102 ***Class III temperature-sensing probes*** *are only subjected to the tests of 22.112.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Modification:*

Microwave ovens shall be **class I** or **class II**.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Addition:*

Appliances shall be marked with the nominal frequency in megahertz of the ISM band in which they operate.

If the removal of any cover results in microwave leakage exceeding the value specified in 32.1, the cover shall be marked with the substance of the following:

WARNING
MICROWAVE ENERGY
DO NOT REMOVE THIS COVER

~~If an appliance incorporates a socket-outlet protected by means of fuses, other than D-type fuses, it shall be marked with the rated current of the relevant fuse. When a miniature fuse-link is provided, this marking shall indicate that the fuse-link is to have a high breaking capacity.~~

When the exempted provisions of footnote b to Table 101 and/or Table 3 apply, the appliance shall be marked with the substance of "CAUTION: Hot surface", or symbol IEC 60417-5041 (2002-10).

7.6 *Addition:*

[symbol IEC 60417-5041 (2002-10)] caution, hot surface

7.12 *Addition:*

~~The instructions shall state the substance of the following:~~

~~IMPORTANT SAFETY INSTRUCTIONS~~
~~READ CAREFULLY AND KEEP FOR FUTURE REFERENCE~~

The instructions shall include the substance of the following warnings:

– WARNING: If the door or door seals are damaged, the oven must not be operated until it has been repaired by a competent person.

– WARNING: It is hazardous for anyone other than a competent person to carry out any service or repair operation that involves the removal of a cover which gives protection against exposure to microwave energy.

NOTE 101 This warning is applicable if microwave leakage exceeds the limit specified in 32.1 during the removal of any cover.

– WARNING: Liquids and other foods must not be heated in sealed containers since they are liable to explode.

– WARNING: Ensure that the cavity does not contain any items or utensils that are not suitable for the use with the microwave oven before you operate the appliance.

– WARNING: Do not use the cavity for storing combustible products, cooking utensils, or food and similar when the microwave oven is not in use.

The instructions shall include the substance of the following:

– This appliance is intended to be used in household and similar applications such as:

- staff kitchen areas in shops, offices and other working environments;
- farm houses;
- by clients in hotels, motels and other residential environments;
- bed and breakfast type environments.

If the manufacturer wishes to limit the use of the appliance to less than the above, this ~~has to~~ shall be clearly stated in the instructions.

– The minimum height of free space necessary above the top surface of the oven.

~~– Only use utensils that are suitable for use in **microwave ovens**.~~

– Metallic containers for food and beverages are not allowed during microwave cooking. This requirement is not applicable if the manufacturer specifies size and shape of metallic containers suitable for microwave cooking.

– When heating food in plastic or paper containers, keep an eye on the oven due to the possibility of ignition.

– The **microwave oven** is intended for heating food and beverages. Drying of food or clothing and heating of warming pads, slippers, sponges, damp cloth and similar ~~may~~ can lead to risk of injury, ignition or fire.

– If smoke is observed, switch off or unplug the appliance and keep the door closed in order to stifle any flames.

– Microwave heating of beverages can result in delayed eruptive boiling, therefore care must be taken when handling the container.

– The contents of feeding bottles and baby food jars shall be stirred or shaken and the temperature checked before consumption, in order to avoid burns.

– Eggs in their shell and whole hard-boiled eggs should not be heated in **microwave ovens** since they ~~may~~ can explode, even after microwave heating has ended.

– Details for cleaning door seals, **cavities** and adjacent parts.

– The oven should be cleaned regularly and any food deposits removed.

– Failure to maintain the oven in a clean condition could lead to deterioration of the surface that could adversely affect the life of the appliance and possibly result in a hazardous situation.

– Only use the temperature probe recommended for this oven (for appliances having a facility to use a **temperature-sensing probe**).

– The instructions for use for **fixed appliances** and **built-in appliances** being used equal or higher than 900 mm above the floor and having **detachable** turntables shall state that care should be taken not to displace the turntable when removing containers from the appliance. This is not applicable for appliances with horizontal bottom hinged door.

– The appliance shall not be cleaned with a steam cleaner.

If symbol IEC 60417-5041 (2002-10) is marked on the appliance, its meaning shall be explained.

The manufacturer shall state in the instructions whether the **microwave oven** is allowed to be placed or installed less than 850 mm above the floor.

The manufacturer shall state in the instructions whether the **microwave oven** is intended to be used freestanding, built-in or in a cabinet. If the appliance can be used while placed in a cabinet,

- the minimum dimensions of the cabinet shall be given by the manufacturer, and
- the instructions shall state that the appliance must be operated with any cabinet door open.

The instructions for **microwave ovens** having an additional decorative door shall state that the appliance must be operated with the decorative door open.

The instructions for **microwave ovens** that are not tested in a cabinet shall state that the appliance must not be placed in a cabinet.

The instructions for **microwave ovens** that are not in compliance with 22.118 shall state that the appliance must not be installed equal or higher than 900 mm above the floor.

7.14 *Addition:*

The height of the lettering of the warning specified in 7.1 shall be at least 3 mm.

The height of symbol IEC 60417-5041 (2002-10) shall be at least 10 mm.

Compliance is checked by measurement.

7.15 *Addition:*

If the hot surface marking in 7.1, or symbol IEC 60417-5041 (2002-10) is marked on the appliance, it shall be visible when the appliance is operated as in normal use, including when actuating any switch, adjusting any control or opening a lid, drawer or door. It shall not be placed on surfaces that are exempted from the limits in Table 3 and Table 101.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1.1 *Addition:*

~~*Test probe 18 of IEC 61032 is also applied, as specified for test probe B. However, it is only applied to parts that are accessible when the oven is operated in normal use.*~~

For part of appliances situated not more than 850 mm above the floor after installation or in normal use, in addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

8.1.3 *Addition:*

Test probe 19 of IEC 61032 is not applied.

~~**8.2** *Addition:*~~

~~*Test probe 18 of IEC 61032 is also applied, as specified for test probe B. However, it is only applied to parts that are accessible when the oven is operated in normal use.*~~

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.1 *Addition:*

*For inverter type **microwave ovens**, if the power input varies throughout the operating cycle, the representative period is considered as specified in 11.7 without the rest periods.*

*For inverter type **microwave ovens**, if the power input does not vary throughout the operating cycle, and for non-inverter type **microwave ovens**, the power input is measured at the end of third operating cycle of 11.7.*

10.2 *Addition:*

*For inverter type **microwave ovens**, if the current varies throughout the operating cycle, the representative period is considered as specified in 11.7 without the rest periods.*

*For inverter type **microwave ovens**, if the current does not vary throughout the operating cycle, and for non-inverter type **microwave ovens**, the current is measured at the end of the third operating cycle of 11.7.*

11 Heating

This clause of Part 1 is applicable except as follows.

11.2 *Addition:*

*Appliances, other than **built-in appliances**, are positioned as specified for **heating appliances**.*

A ceiling is placed over the appliance at the minimum height stated in the instructions. The ceiling has a depth of 300 mm from the back wall of the test corner and a length at least 150 mm in excess of the width of the appliance.

Appliances that can be used when placed in a cabinet are placed in a cabinet with the minimum dimension given in the instructions by the manufacturer, the plywood specified for the test corner being used. The appliance is positioned against the rear wall and one of the side walls.

The cabinet door is in the open position.

11.3 *Addition:*

Where the external ***accessible surfaces*** *are suitably flat and access permits, the test probe of Figure 104 is used to measure the temperature rises of external* ***accessible surfaces*** *specified in Table 101. The probe is applied with a force of 4 N ± 1 N to the surface in such a way that the best possible contact between the probe and the surface is ensured. The measurement is performed after a contact period of 30 s.*

The probe can be held in place using a laboratory stand clamp or similar device. Any measuring instrument giving the same results as the probe can be used.

11.7 *Replacement:*

Appliances are operated for three cycles with ***remote operation*** *enabled, if any. Each cycle consisting of a heating period of 10 min followed by a rest period of 1 min. The last cycle does not include a rest period of 1 min. During the rest periods, the lid, drawer or door is open, the* ***remote operation*** *enabled, if any, and the load is replaced.*

Appliance outlets accessible to the user and socket-outlets accessible to the user are loaded with a resistive load that gives the marked ***outlet load****. The current in the appliance outlets and socket-outlets on the appliance are continuously loaded.*

For appliances incorporating ***integral batteries*** *or* ***separable batteries*** *not disconnected from the appliance for charging purposes:*

– *the* ***battery*** *that has been* ***fully discharged*** *is charged for 1 h, while the appliance is operated as specified, if allowed by the construction of the appliance;*

– *the* ***battery*** *that has been* ***fully discharged*** *is charged, for a duration of 24 h or until it is* ***fully charged****, whichever is shorter, without the* ***battery-operated appliance*** *performing its intended function.*

11.8 *Modification:*

Replace the first paragraph by the following text:

During the test, the temperature rises are monitored continuously and shall not exceed the values shown in Table 3 and Table 101.

Addition:

For Table 3:

– *The temperature rises of external surfaces of* ***microwave ovens*** *are only measured on the surfaces that are not placed against the wall and the floor of the test corner;*

– *There are no temperature rise limits for air-outlet grilles and for surfaces up to a distance of 25 mm from them.*

~~NOTE 101 These surfaces do not include handles.~~

– *When the required values for external enclosure of* ***motor-operated appliances*** *are not met, the maximum temperature rise shall not exceed the limit by more than 20 K to the values indicated.*

NOTE 101 The temperature rises for handles, knobs, grips and similar parts which are specified in Table 3 apply regardless of their position on the above surfaces.

Table 101 – Maximum temperature rises of external accessible surfaces under normal operating conditions

Surface	*Temperature rise of surfaces of appliances allowed to be placed or installed less than 850 mm above the floor* [a] K	*Temperature rise of surfaces of appliances intended to be placed not less than 850 mm above the floor* [a, b] K
Bare metal	*38*	*42*
Coated metal [c]	*42*	*49*
Glass and ceramic	*51*	*56*
Plastic and plastic coating > 0,4 mm [d, e]	*58*	*62*

NOTE The temperature rise limits of handles, knobs, grips, keyboards, keypads and similar parts are specified in Table 3.

[a] *The following surfaces or elements shall not be taken into consideration (see Figure 105):*
- ***cavity*** *(surface temperatures are only measured when the door is closed);*
- *handles or control knobs including keypads, keyboards and the like: part of the equipment that a user needs to touch to operate or adjust the equipment. The equipment shall be installed according to the manufacturer's instructions;*
- *surfaces within 5 mm of touch controls regardless of their shape;*
- *external surfaces of appliances inaccessible to a 75 mm diameter probe having a hemispherical end, when the appliance is installed according to the installation condition of 11.2.*
- *surfaces on the* ***microwave oven*** *door within 10 mm from the left, right and lower edge of the* ***microwave oven*** *door, or 25 mm from the upper edge of the* ***microwave oven*** *door (Zone 1). For built-in appliances, the edges shall be considered between the* ***microwave oven*** *door and decorative trims, if any;*
- *surfaces around the* ***microwave oven*** *door within 10 mm from the left, right or lower edge of the* ***microwave oven*** *door, or 25 mm from the upper edge of the* ***microwave oven*** *door (Zone 2). For built-in appliances, the edges shall be considered between the* ***microwave oven*** *door and decorative trims, if any;*
- *surfaces within 25 mm of vents such as air-outlet grilles (Zone 3).*

[b] *When the required values are not met, the maximum temperature rise shall not be higher than 20 K in excess of the values indicated.*

[c] *Metal is considered coated when a coating having a minimum thickness of 90 µm made by enamel, powder coating or non-substantially plastic coating is used.*

[d] *The temperature rise limit of plastic also applies for plastic material having a metal finish of thickness less than 0,1 mm.*

[e] *When the thickness of the plastic coating does not exceed 0,4 mm, the temperature rise limits of the coated metal or of glass and ceramic material apply.*

[f] *The area that is adjacent to the handle that could be touched whilst using the handle shall comply with 22.13.*

12 ~~Void~~ Charging of metal-ion batteries

This clause of Part 1 is applicable.

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.2 *Addition:*

*A quantity of 0,5 l of the same spillage solution is poured steadily over the **shelf** over a period of 1 min. If the **shelf** can collect spilled liquid, it is filled with the solution and a further 0,5 l is then added over a period of 1 min.*

15.101 Temperature-sensing probes shall be constructed so that their insulation is not affected by water.

Compliance is checked by the following test.

The probe is completely immersed in water containing approximately 1 % NaCl and having a temperature of 20 °C ± 5 °C. The solution is heated to the boiling point in approximately 15 min. The probe is then removed from the boiling solution and immersed in the solution having a temperature of 20 °C ± 5 °C for 30 min.

This procedure is carried out five times, after which the probe is removed from the solution. All traces of liquid are then removed from the surface.

The probe shall then withstand the ~~leakage current~~ electric strength test of 16.~~2~~3.

NOTE **Detachable temperature-sensing probes** are not connected to the appliance for this test. **Non-detachable temperature-sensing probes** are tested in the **cavity**, the probe being immersed as much as possible.

15.102 ~~**Microwave ovens** intended to be built-in as underbench installation and therefore subject to spillage of liquid from containers onto working surfaces shall be constructed so that such spillage does not affect their electrical insulation.~~

~~*Compliance is checked by the following test (see Figure 102).*~~

~~*The **microwave oven** is built-in as underbench installation as specified by the manufacturer. The test cabinet including the working surface is tilted to an angle of 2° in the most unfavourable direction. 500 ml of water containing approximately 1 % NaCl and approximately 0,6 % acid rinsing agent is poured steadily over a period of 20 s through a funnel onto the complete width of the working surface above the **microwave oven**. The funnel has an outlet diameter of approximately 8 mm and the lower edge of its outlet is positioned 20 mm above the working surface. The centre of the funnel is positioned 15 mm inwards from the leading edge of the working surface.*~~

~~*The leading edge of the working surface shall be rounded with a radius of 25 mm and the working surface shall be 50 mm in thickness and free of any drain slots, drain edges, tearing edges and similar.*~~

~~*Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.*~~

~~*The composition of the water containing approximately 1 % NaCl and approximately 0,6 % acid rinsing agent is described in Annex AA of IEC 60335-2-5:2012.*~~

Built-in microwave ovens that are intended for use installed under work surfaces shall be constructed so that such spillage does not affect their electrical insulation.

Compliance is checked by the following test.

*They shall be subjected to a spillage test with 0,5 l of the spillage solution specified in 15.2. They shall be installed according to the manufacturer's instructions except that the front surface of the **microwave oven** (excluding control knobs, handles) shall align with front edge of a 30 mm thick wooden work surface with a square front edge, see Figure 106. The spillage solution shall be poured on the work surface at the area which gives the most unfavourable conditions representing the pouring likely to occur, so that the spillage solution flows down the front surface of the **microwave oven** over controls, joints, vents and similar openings. If necessary, the test is repeated until all different controls or gaps are covered by the spillage test. The appliance is dried between each test.*

The test is performed as follows:

A bottle with a shape similar to the one in Figure 108 and a cap is filled with 0,5 l of the spillage solution.

The cap of the bottle shall have a hole 8 mm diameter, placed off-centre according to Figure 107. The bottle shall also have a hole 8 mm diameter near the bottle base (see Figure 108) to equalize the liquid pressure.

Other suitable containers may be used provided the spillage solution amount is poured over the appliance under test in the same manner.

*The hole in the cap of the bottle is put on the horizontal work surface at approximately 80 mm horizontal distance with respect to the front of the **microwave oven**. The inclination of the bottle shall be higher than 30° and lower than 45°. The lower part of the bottle hole in the cap shall be in contact with the work surface, with the hole in the cap placed down closest to the surface. See Figure 109.*

NOTE 1 The intention of the inclination and distance is avoiding the spillage "jumping" over the front of the **microwave oven**.

NOTE 2 When using holes of 8 mm diameter, the specified solution amount is spilled in about 15 s.

When the 0,5 l of spillage solution has been poured, the remaining solution on the work surface is pushed towards the front so that the remaining solution spills homogeneously over the front with a suitably flat means.

*Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.*

15.103 Microwave ovens intended to be built-in in cabinets underneath other **built-in appliances** and therefore subject to spillage of liquid from filled containers which are handled during usage of these other appliances shall be constructed so that such spillage does not affect their electrical insulation.

Compliance is checked by the following test (see Figure 103).

*The **microwave oven** is built-in as specified by the manufacturer. The test cabinet is tilted to an angle of 2° in the most unfavourable direction. 200 ml of ~~water containing approximately 1 % NaCl and approximately 0,6 % acid rinsing agent~~ the spillage solution specified in 15.2 is poured steadily over a period of 8 s through a funnel onto the complete width of the separation board above the **microwave oven**. The funnel has an outlet diameter of approximately 8 mm and the lower edge of its outlet is positioned 20 mm above the separation board. The centre of the funnel is positioned 15 mm inwards from the leading edge of the separation board.*

*If the manufacturer states in the installation instructions that a separation board above the **microwave oven** is not required, the test shall be repeated while pouring the ~~water containing approximately 1 % NaCl and approximately 0,6 % acid rinsing agent~~ spillage solution directly onto the complete width of the top surface of the **microwave oven**. The lower edge of the funnel outlet is positioned 20 mm above the top surface of the **microwave oven** and its centre is positioned 15 mm inwards from the leading edge of the **microwave oven**.*

*Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.*

~~*The composition of the water containing approximately 1 % NaCl and approximately 0,6 % acid rinsing agent is described in Annex AA of IEC 60335-2-5:2012.*~~

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.101 The windings of the power transformer that supplies the magnetron shall have adequate insulation.

~~*Compliance is checked by the test of 16.101.1 for switch-mode power supplies and by the test of 16.101.2 for other power transformers.*~~

Compliance is checked by one of the following tests.

~~**16.101.1**~~

– *For switch-mode power suppliers, the insulation between the primary and secondary windings of switch-mode power supply transformers is subjected for 1 min to a voltage of substantially sinusoidal waveform and having a frequency of 50 Hz or 60 Hz. The value of the voltage is 1,414 times the peak value of the secondary **working voltage** plus 750 V, with a minimum of 1 250 V.*

There shall be no breakdown between windings or between adjacent turns of the same winding.

~~**16.101.2**~~

– *For other power transformer, twice the **working voltage** is induced in the secondary winding of the transformer by applying a sinusoidal voltage having a frequency higher than **rated frequency** to the primary terminals.*

The duration of the test is

- *60 s, for frequencies up to twice the **rated frequency**, or*
- $120 \times \frac{\textbf{rated frequency}}{\text{test frequency}}$ *s, with a minimum of 15 s, for higher frequencies.*

NOTE The frequency of the test voltage is higher than the **rated frequency** to avoid excessive excitation current.

A maximum of one-third of the test voltage is applied and is then rapidly increased without creating transients. At the end of the test, the voltage is decreased in a similar manner to approximately one-third of its full value before switching off.

There shall be no breakdown between windings or between adjacent turns of the same winding.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable except as follows.

Addition:

The tests are not carried out on the power transformer that supplies the magnetron and its associated circuits, these being checked during the tests of Clause 19.

18 Endurance

This clause of Part 1 is replaced by the following.

The door system, including hinges, microwave seals and other associated parts, shall be constructed to withstand wear that ~~may~~ can be expected in normal use.

Compliance is checked by the following test.

The door system is subjected to 50 000 cycles of operation with the appliance supplied at ***rated voltage*** *and containing an appropriate microwave-absorbing load. It is then subjected to 50 000 cycles of operation without microwave generation.*

The door is opened and closed as in normal use. It is opened from the closed position to a position approximately 10° before fully open. The rate of operation is 6 cycles per minute. With the agreement of the manufacturer, the rate of operation without microwave generation can be increased to 12 cycles per minute.

After the test, the microwave leakage shall not exceed the limit specified in 32.1 and the door system shall still function.

NOTE 101 Controls can be rendered inoperative in order to carry out the test.

NOTE 102 Components, the deterioration of which does not impair compliance with this standard, can be replaced in order to complete the test.

NOTE 103 Bricks or additional water of maximum 500 g can be added if necessary to avoid stopping of the test due to overheating.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 *Modification:*

Instead of subjecting the appliance to the tests of 19.2 to 19.10, compliance is checked by the tests of 19.101 to 19.105, the appliance being supplied at ***rated voltage****.*

19.11.2 *Addition:*

The cathode-to-anode circuit of the magnetron is open-circuited and short-circuited ~~in turn~~ one at a time. If one of these fault conditions results in an input current that increases with decreasing voltage, the test is carried out with the appliance supplied at 0,94 times ***rated voltage****. However, if the input current increases more than proportionally with voltage, the appliance is supplied at 1,06 times* ***rated voltage****.*

The filament of the magnetron is not short-circuited.

19.13 *Addition:*

During the tests, the temperature of windings shall not exceed the values shown in Table 8. Only appliances that allow a pre-selected start time and those operating with a keep-warm function are considered to be appliances operated until steady conditions are established.

However, during the tests of 19.11.3, Table 8 only applies to the windings of the transformer of the power supply of the microwave generator(s), if any.

During the tests, the microwave leakage shall not exceed 100 W/m^2 measured in accordance with 32.1 but with the load as specified for each subclause. The appliance shall comply with 32.1 if it can be operated after the tests.

Modification:

Replace the last paragraph by the following:

In an appliance containing lids, drawer and doors that are controlled by one or more interlocks, one of the interlocks may be released provided that both of the following conditions are fulfilled:

- *the lid, drawer or door does not move automatically to an open position when the interlock is released;*
- *the appliance will not restart after the cycle in which the interlock was released.*

19.101 *Appliances are operated with controls set at the most unfavourable position and without load in the **cavity**.*

The period of operation is the maximum time allowed by the timer or until steady conditions are established, whichever is shorter.

If microwave leakage exceeds 100 W/m^2, the following alternative measurement method shall be applied, which modifies the microwave leakage limit of 19.13.

In order to identify and mark all spots where peak values of microwave leakage exceed 100 W/m^2, the instrument antenna is moved again over the external surface of the appliance, particular attention being given to the door and its seals.

NOTE 1 A peak hold function of the measurement instrument, if any, can be activated for identification of spots where peak values of microwave leakage exceed 100 W/m^2.

The leakage values of each such spot shall be recorded and the averaged leakage value of any spot over the most onerous 20 s shall not exceed 100 W/m^2. Furthermore, the peak value shall not exceed 500 W/m^2.

NOTE 2 Since the stirrer and/or turntable revolution time and the number of microwave stirrer blades determine the frequency and duration of actual peak leakage values, instruments with appropriate specifications (like minimum sampling time, capability to measure peak values of power flux density, capability to average these values) can be used.

19.102 *Appliances are operated under **normal operation** with the timer or other controls that operate in normal use short-circuited. If the appliance is provided with more than one control, these are short-circuited in turn. These short-circuits are applied one at a time.*

19.103 *Appliances are operated under **normal operation** and with any single fault condition simulated that is likely to occur. The controls are adjusted to their most unfavourable setting and the appliance is operated for the maximum time allowed by the timer or 90 min, whichever is shorter.*

NOTE Examples of fault conditions are

- blocking of air openings in the same plane. This fault condition is not applied if the appliance is a **built-in appliance**;

– locking the rotor of motors if the locked rotor torque is smaller than the full load torque;

– locking moving parts liable to be jammed.

19.104 *The appliance is operated with the controls adjusted to their most unfavourable setting and with a potato placed on the **shelf** in the position where it is most likely to ignite and propagate flames to other combustible material.*

The potato has an approximately ellipsoidal shape and a mass between 125 g and 150 g. The length of the shortest principal axis is at least 40 mm. The length of the longest principal axis is not more than 140 mm and may be symmetrically reduced in order to obtain the specified mass. A steel wire, having a diameter of 1,5 mm ± 0,5 mm and approximately the same length as the longest axis of the potato, is inserted along this axis.

*The test is terminated 15 min after the microwave generation has ceased or a fire in the **cavity** has extinguished.*

*During the test, any fire in the **cavity** shall be contained within the appliance.*

NOTE 1 Subclause 19.13 does not apply during the test.

*After the test, if the appliance is still operable, any damaged **detachable shelf** is replaced and 19.13 applies. If the appliance does not comply, the test is repeated on a new appliance.*

NOTE 2 Non-compliance can have resulted from the cumulative effects of previous tests.

19.105 ***Built-in appliances** having an additional decorative door and appliances to be used in a cabinet are operated under **normal operation** but with the decorative door or cabinet door closed.*

The period of operation is the maximum time allowed by the timer or until steady conditions are established, whichever is shorter.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.2 *Addition:*

For part of appliances situated not more than 850 mm above the floor after installation or in normal use, in addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18. During the tests with test probe 19, the appliance is fully assembled as in normal use with any door closed.

20.101 Appliances having doors with a horizontal hinge at their lower edge and on which a load is likely to be placed shall have adequate stability.

Compliance is checked by the following test.

The appliance is placed on a horizontal surface with the door open and a mass is gently placed on the geometric centre of the door.

The mass is

– *7 kg for **stationary appliances**;*

– *3,5 kg for **portable appliances**.*

NOTE A sandbag can be used for the load.

The appliance shall not tilt.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

Addition:

Compliance is also checked by the tests of 21.101 to 21.105. During these tests, the appliance is rigidly supported, except for 21.102.

21.101 *Hinged doors are positioned approximately 30° before the fully open position. Sliding doors are positioned so that they are approximately two-thirds open. A force of 35 N is applied to the inside surface of a hinged door at a point 25 mm from its free edge or to the handle of a sliding door.*

The force is applied by means of a spring balance having a spring constant of 1,05 N/mm. It is initially applied with an opposing force applied to the other side of the door or handle. The opposing force is then removed to allow the door to complete its travel to the fully open position.

The test is carried out five times.

*The test is repeated on doors of **stationary appliances** and **built-in appliances** except that*

- *the door is initially placed midway between the fully open and closed positions*;
- *the applied force is 1,5 times the force required to open the door or 65 N, whichever is greater. However, if the force cannot be measured or if the door is opened indirectly, the 65 N force is applied.*

The test is carried out five times.

Doors are placed midway between the fully open and closed positions. A closing force of 90 N is applied to the outside surface of a hinged door at a point 25 mm from the free edge or to the handle of a sliding door, initially with the opposing force as described above.

This test is carried out ten times.

The appliance shall then comply with 32.1.

21.102 *Side-hinged doors are placed in the fully open position. A downward force of 140 N or the maximum force that can be applied in any door position without tilting the appliance, whichever is smaller, is then applied to the free edge of the door and the door is closed. The door is fully opened again with the force still applied.*

This test is carried out five times.

Bottom-hinged doors are opened. A force of 140 N or the maximum force that can be applied without tilting the appliance, whichever is smaller, is applied to the inside surface of the door at the most unfavourable position 25 mm from the free edge.

The force is applied for 15 min.

The appliance shall then comply with 32.1.

21.103 *A cube of wood having a side dimension of 20 mm is attached to an inside corner farthest from the door hinge. An attempt is made to close the door with a force of 90 N applied*

at the other corner farthest from the hinge in the direction perpendicular to the surface of the door.

The force is maintained for 5 s.

The cube is then removed. The door is slowly closed until microwave generation becomes possible. The door and its opening means are then manipulated in order to determine the position resulting in the highest microwave leakage.

The appliance shall then comply with 32.1.

The test is repeated with the wooden cube attached to the other corner farthest from the hinge.

NOTE The test is not applicable to sliding doors.

21.104 *The door is closed and its outside surface subjected to three impacts, each having an energy of 3 J. These impacts are applied to the central part of the door and may be at the same point.*

The impact is applied by means of a steel ball having a diameter of 50 mm and a mass of approximately 0,5 kg. The ball is suspended by a suitable cord that is held in the plane of the door. The ball is allowed to fall as a pendulum through the distance required to strike the surface with the specified impact energy.

The door is then opened and its mating surface on the oven is subjected to three similar impacts.

The inside surface of a hinged door is subjected to three impacts as before, the test being made with the door in the fully open position. The impacts are applied to the central part of the door and may be at the same point. However, if a bottom-hinged door is horizontal when in the fully open position, the impacts are applied by allowing the steel ball to fall freely through a distance such that the specified impact energy is obtained.

A bottom-hinged door is further tested by subjecting its seal to three similar impacts. The impacts are made at three different locations.

The appliance shall then comply with 32.1.

21.105 *A bottom-hinged door is opened and a hardwood dowel having a diameter of 10 mm and a length of 300 mm is placed along the bottom hinge. The dowel is positioned such that one end is flush with an outside edge of the door. A closing force of 90 N is applied to the centre of the handle in a direction perpendicular to the surface of the door. The force is maintained for 5 s.*

The test is repeated with the end of the dowel flush with the other outside edge and then with the dowel positioned centrally within the door hinge.

The microwave leakage is measured under the conditions specified in 32.1 and shall not exceed 100 W/m^2.

22 Construction

This clause of Part 1 is applicable except as follows.

22.40 *Modification:*

Replace the second paragraph and the NOTE by the following:

Appliances for **remote operation** shall be fitted with a switch for stopping the operation of the appliance. The actuating member of this switch shall be easily visible and accessible.

22.49 *Replacement:*

For **remote operation**, the duration of operation shall be set before the appliance can be started unless the appliance switches off automatically at the end of a cycle.

Compliance is checked by inspection.

22.51 *Replacement:*

A control on the appliance shall be manually adjusted to the setting for **remote operation** before the appliance can be operated in this mode. There shall be a visual indication on the appliance showing that the appliance is adjusted for **remote operation**.

Compliance is checked by inspection and by manual test.

22.101 **Built-in appliances** shall only be vented through the front, unless provisions are made for venting through a duct.

Compliance is checked by inspection.

22.102 **Microwave oven** vents shall be constructed so that any moisture or grease discharged through them cannot affect **clearances** and **creepage distances** between **live parts** and other parts of the appliance.

Compliance is checked by inspection.

22.103 The appliances shall be constructed in compliance with either 22.103.1 or 22.103.2.

22.103.1 Appliances shall incorporate at least two **door interlocks** that are operated by opening the door, one being a **monitored door interlock**. At least one of the **door interlocks** shall be concealed and not operable by manipulation.

Compliance is checked by inspection and concealment is checked by 22.105.

NOTE The two **door interlocks** can be incorporated in the system of the **monitored door interlock**.

22.103.2 Appliances shall incorporate two independent **monitored door interlocks** that are operated by opening the door. In this case, 22.105 is not applicable.

NOTE None of the **door interlocks** ~~have~~ need to be concealed because there are two independent **monitored door interlocks** incorporating supervision devices.

Compliance is checked by inspection and the following test.

The door is slowly opened and, simultaneously, an attempt is made to manually defeat any ***accessible door interlock*** *with test probe B and test probe 18. Each probe is applied one at a time.*

During the tests, the operation of the ~~magnetron~~ microwave generator(s) shall not be possible.

22.104 At least one **door interlock** of 22.103.1 and both **monitored door interlocks** of 22.103.2 shall incorporate a switch that disconnects the microwave generator(s) or its supply main circuit.

Compliance is checked by inspection.

22.105 At least one of the **door interlocks** shall be concealed and shall not be operable by manipulation. This **door interlock** shall operate before any **accessible door interlock** can be defeated.

Compliance is checked by the following test.

*The door is placed in ~~the open or closed~~ any position and an attempt is made to operate the concealed **door interlock** by applying test probe B and then probe 18 of IEC 61032 to all openings. The test is repeated with a rod, as shown in Figure 101, to any openings of the **door interlock** mechanism. Only test probe B, test probe 18, or one rod shall be used one at a time.*

***Door interlocks** that operate magnetically are also evaluated by applying a magnet to the enclosure over the **door interlock** switch. The magnet has a similar configuration and magnetic orientation to the magnets that operate the **door interlock**. It shall be capable of exerting a force of 50 N ± 5 N when applied to a mild steel armature having dimensions of 80 mm × 50 mm × 8 mm. In addition, the magnet shall be capable of applying a force of 5 N ± 0,5 N at a distance of 10 mm from the armature.*

*It shall not be possible to operate the concealed **door interlock(s)** during the tests.*

*The door is slowly opened and, simultaneously, an attempt is made to manually defeat any **accessible door interlock** with test probe B, test probe 18, the rod and the magnet; each apply separately.*

*~~It shall not be possible to operate The concealed **door interlock** during the tests.~~*

*The concealed **door interlock(s)** shall operate before any **accessible door interlock** can be defeated.*

22.106 The supervision device of each **monitored door interlock** shall render the appliance inoperable if its switching part fails to control the microwave generator(s).

Compliance is checked by the following test.

*The switching part of the **monitored door interlock** is rendered inoperative. The appliance is supplied at **rated voltage** from a supply source having a short-circuit capacity of at least 1,5 kA for appliances having a **rated voltage** over 150 V and 1,0 kA for other appliances.*

*Appliances having a **rated voltage** less than 150 V and a **rated current** over 20 A are supplied at **rated voltage** from a supply source having a short-circuit capacity of at least 5,0 kA.*

*The appliance is operated with the door closed and an attempt is then made to gain access to the **cavity** in the normal way. It shall not be possible to open the door, unless the microwave generator(s) cease(s) to function and remains inoperable. The supervision device shall not fail in the open-circuit position.*

~~NOTE 1~~ *The supervision device is replaced for subsequent tests if it fails in the closed-circuit position.*

~~NOTE 2~~ *It ~~can be~~ is necessary to render other **door interlocks** inoperative in order to perform this test in some cases.*

If an internal fuse in the circuit supplying the microwave generator(s) rupture(s), the fuse is replaced and the test is carried out two more times. The internal fuse shall rupture each time.

The test is carried out three more times but with an impedance of (0,4 + j 0,25) Ω in series with the supply source. The internal fuse shall rupture each time.

~~NOTE 3~~ *For appliances having a **rated voltage** under 150 V and those with a **rated current** over ~~16~~ 20 A, the test with the series impedance is not carried out.*

NOTE In case of internal fuse ruptures, the switches, filters and wiring can be replaced each time, if this is stated in the instructions of professional servicing.

22.107 The failure of any single electrical or mechanical component that affects the operation of a **door interlock** shall not cause any other **door interlock**, or the supervision device of the **monitored door interlock** to become inoperative, unless the appliance is rendered inoperable.

Compliance is checked by inspection and, if necessary, by simulating component failure and operating the appliance as in normal use.

NOTE This requirement does not apply to components of the supervision device that comply with the test of 22.106.

22.108 The **door interlocks** incorporated to comply with 22.103 shall operate before undue microwave leakage occurs.

Compliance is checked by the following test.

*All **door interlocks** except one are rendered inoperative. The appliance is supplied at **rated voltage** and operated with the load specified in 32.1. The door opening sequence is carried out in small increments during which the microwave leakage is measured.*

The appliance shall comply with 32.1.

*The test is repeated on each **door interlock** in turn.*

NOTE 1 **Door interlocks** are only tested if they are necessary for compliance with 22.103.

NOTE 2 It can be ~~necessary~~ applicable to render the supervision device of the **monitored door interlock** inoperative when carrying out the test.

22.109 There shall be no undue microwave leakage if thin material is introduced between the door and its mating surface.

Compliance is checked by closing the door on a strip of paper having a width of 60 mm ± 5 mm and a thickness of 0,15 mm ± 0,05 mm, the paper being placed between the door and its mating surface.

The appliance shall then comply with 32.1.

The test is carried out ten times with the paper in different locations.

22.110 There shall be no undue microwave leakage if the door seals become contaminated by food residues.

Compliance is checked by the following test.

The door seal is coated with cooking oil. If the seal has an open choke, the trough is filled with oil.

The appliance shall then comply with 32.1.

22.111 There shall be no undue microwave leakage when the door corners are subjected to distortion.

Compliance is checked by the following test.

*The appliance is supplied at **rated voltage** and operated with the load specified in 32.1. The door and its opening means are manipulated until the largest door gap permitting microwave generation is obtained. A pull force is applied perpendicular to the surface of the door to each corner ~~in turn~~ one at a time. The force is slowly increased to 40 N.*

During the test, the microwave leakage is measured under the conditions specified in 32.1 and shall not exceed 100 W/m^2.

After the test, the appliance shall comply with 32.1.

22.112 There shall be no undue microwave leakage, and the **temperature-sensing probe** shall not become damaged when a probe or its cord is trapped by the door.

Compliance is checked by the following test.

*The probe is connected as in normal use, the sensing part or cord being allowed to rest in the most unfavourable position likely to occur. The door is closed against the sensing part or the cord with a force of 90 N applied for 5 s in the most unfavourable place. The force is then released and, if the oven can be operated with the **temperature-sensing probe** still being placed in the trapped position, the microwave leakage is measured under the conditions specified in 32.1 and shall not exceed 100 W/m^2.*

*After the test, the appliance shall comply with 32.1 and the **temperature-sensing probe** shall comply with 8.1, 15.101 and Clause 29.*

22.113 There shall be no undue microwave leakage when **detachable parts** are removed.

Compliance is checked by the following test.

***Detachable parts** are removed, except **shelves**, unless a horizontal surface greater than 85 mm in diameter is made available when they are removed.*

*The appliance shall then comply with 32.1, the load being placed on the horizontal surface as close as possible to the centre of the **cavity**.*

NOTE In order to avoid detecting non-radiating standing waves, the tip of the instrument probe is not inserted into an opening resulting from the removal of a **detachable part**.

22.114 A single fault such as failure of **basic insulation** or a loose wire bridging the insulation system shall not allow operation of the microwave generator(s) with the door open.

*Compliance is checked by inspection and if, necessary, by simulating relevant faults. Wires that ~~may~~ can become loose are disconnected and allowed to fall out of position but are not otherwise manipulated. They shall not come into contact with other **live parts** or earthed parts if this results in all **door interlocks** becoming inoperative.*

NOTE 1 Failure of **reinforced insulation** or **double insulation** is considered to be two faults.

NOTE 2 Wires secured by two independent fixings are not considered likely to become loose.

22.115 There shall be no access to the **cavity** through the viewing screen.

Compliance is checked by inspection and the following test.

*A straight steel rod having a diameter of 1 mm and a flat end is pressed perpendicularly against the viewing screen with a force of 2 N. The rod shall not enter the **cavity**.*

22.116 Appliances for installing in road vehicles, caravans and similar vehicles shall withstand the vibrations to which they ~~may~~ can be subjected.

Compliance is checked by carrying out the vibration tests specified in IEC 60068-2-6 under the following conditions.

The appliance is fastened in its normal position of use to a vibration-generator by means of straps around the enclosure. The type of vibration is sinusoidal, and the severity is as follows:

- *the direction of vibration is vertical;*
- *the amplitude of vibration is 0,35 mm;*
- *the sweep frequency range is 10 Hz to 55 Hz;*
- *the duration of the test is 30 min.*

The appliance shall show no damage that could impair compliance with 8.1, 16.3 and Clauses 29 and 32, and connections shall not have worked loose.

22.117 If **electronic circuits** are used to provide protection against microwave leakage, they shall be designed so that a fault condition will not affect protection against microwave leakage.

Compliance is checked by applying the tests in Clause 19 in conjunction with the requirements and test specifications in 22.105, 22.106, 22.107 and 22.108.

22.118 Inadvertent operations during handling of the container during normal use of **fixed appliances** and **built-in appliances** being used equal or higher than 900 mm above the floor having **detachable** turntables shall not lead to a hazardous situation due to falling down turntables. This is not applicable for appliances with horizontal bottom hinged door.

Compliance is checked by inspection and the following test.

*The bearing of the **detachable** turntable of **microwave ovens** shall be placed in the most unfavourable position. A force which will be increased from 0 N up to the maximum of 10 N is applied vertically downwards to the front edge of the turntable.*

*During the test, the turntable shall not slide out of the **cavity** and fall down.*

*A cylindrical container of borosilicate glass with a maximum thickness of 3 mm, an external diameter of approximately 190 mm, a height of approximately 90 mm and an outer bottom curvature of approximately 5 mm is filled with 1 000 g ± 50 g cold water and placed on the turntable. With a horizontal force applied at the top of the container which will be increased from 0 N up to the maximum of 10 N, an attempt is made to pull the container out of the **cavity** without any lifting from the turntable.*

*During the test, the turntable shall not slide out of the **cavity** and fall down.*

NOTE During the test, it is possible that the container falls out of the **cavity**.

22.119 Outer glass panels of **microwave oven** doors which break during the test of 21.104 and with an area having any two orthogonal dimensions exceeding 75 mm shall be made from one of the following glasses.

- ~~glass that breaks into small pieces when it fractures in accordance with 22.119.1; or~~
- ~~glass that is not released or dropped from its normal position when broken in accordance with 22.119.2; or~~

~~– glass with enhanced mechanical strength in accordance with 22.119.3.~~

~~22.119.1~~ – Glass that breaks into small pieces when it fractures.

Compliance is checked by the following test which is performed on two samples.

Frames or other parts attached to the glass panel to be tested are removed and the glass is placed on a rigid horizontal flat surface.

NOTE 1 The edges of the sample to be tested are contained within a frame of adhesive tape in such a manner that the broken pieces remain in place after breakage but without hindering expansion of the sample.

The sample under test is broken by means of a test punch having a head with a mass of 75 g ± 5 g and a conical tungsten carbide tip with an angle of 60° ± 2°. The punch shall be positioned approximately 13 mm in from the longest edge of the glass at the midpoint of that edge. The punch is then hit by a hammer so that the glass breaks.

A transparent mask of 50 mm × 50 mm is placed on the fractured glass except within a peripheral margin of 25 mm from the edge of the sample.

The assessment shall be undertaken on at least two areas of the sample, and the areas chosen shall contain the largest particles.

The number of crack free particles within the mask is counted and for each assessment shall not be less than 40. The particle count shall be made within 5 min of the fracture. Each particle wholly contained within the area of the mask shall be counted as one particle and each particle that is partially within the mask shall be counted as a half particle.

NOTE 2 In the case of curved glass, plane pieces of the same material can be used for the test.

~~22.119.2~~ – Glass that is not released or dropped from its normal position when broken.

Compliance is checked by breaking the glass when mounted in its normal position in the appliance by means of a test punch having a head with a mass of 75 g ± 5 g and a conical tungsten carbide tip with an angle of 60° ± 2°. The punch shall be positioned approximately 13 mm in from the longest edge of the glass at the midpoint of that edge. The punch is then hit by a hammer so that the glass breaks.

At the conclusion of this test, the glass shall not be broken or cracked such that pieces are released or dropped from their normal position. Glass that is released within the immediate vicinity of the punch tip as a result of the punch impacting the sample under test is ignored.

~~22.119.3~~ – Glass with enhanced mechanical strength.

Compliance is checked by the pendulum hammer test Eha of IEC 60068-2-75.

For the test, the glass panels are supported according to their method of incorporation in the appliance.

The test is performed with three blows applied at the most critical point on two samples, the impact energy of each blow shall be 5 J.

At the conclusion of the tests, the glass shall not be broken or cracked.

22.120 Where interlocks other than **door interlocks** are required to comply with this standard and are operated by **detachable parts**, they shall be guarded so that accidental operation is prevented.

Compliance is checked by inspection and by manual test with test probe B and test probe 18 one at a time.

22.121 For appliances that are controlled by programmable **electronic circuits** that limit the number of heating elements and motors from being energised at the same time, simultaneous activation of any combination of heating elements and motors shall not render the appliance unsafe.

Compliance is checked as follows:

– *the fault/error conditions specified in Table R.1 are applied and evaluated in accordance with the relevant requirements of normative Annex R; or*

– *the appliance is operated under conditions of Clause 11 while being supplied at **rated voltage**, the programmable **electronic circuits** being modified to allow simultaneous activation of all heaters and motors under their control. Under these conditions, compliance with 19.13 shall be fulfilled.*

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1

NOTE 101 IEC 60989[3] is not applicable to power transformers that supply the magnetron.

24.1.4 *Addition:*

Interlocks are subjected to the following test which is carried out on six samples.

*The interlocks are connected to a load that simulates the conditions occurring in the appliance when it is supplied at **rated voltage**. They are operated at a rate of approximately six cycles per minute. The number of cycles is:*

– ***door interlocks*** *50 000;*

– *interlocks only operated during **user maintenance*** *5 000.*

After the test, the interlocks shall not be damaged to such an extent that their further use is impaired in this standard.

~~**24.101** Socket-outlets incorporated in **class I appliances** shall be single-phase, incorporate an earthing contact and have a rated current not exceeding 16 A. Both poles shall be protected by fuses or miniature circuit-breakers placed behind a **non-detachable cover** and having a rated current not exceeding~~

~~– 20 A, for appliances having a **rated voltage** up to 130 V;~~

~~– 10 A, for other appliances.~~

~~If the appliance is intended to be permanently connected to fixed wiring, or is fitted with a polarized plug, the neutral pole need not be protected.~~

~~*Compliance is checked by inspection.*~~

~~NOTE The actuating member of miniature circuit-breakers can be **accessible**.~~

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.14 *Addition:*

3 Withdrawn.

*For **temperature-sensing probes**, the total number of flexings is 5 000. Probes with circular-section cords are turned through 90° after 2 500 flexings.*

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable except as follows.

27.1

NOTE 101 For **class I appliances**, one pole of the output of power supply of microwave generator(s), if any, is earthed for functional purposes.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2 *Addition:*

*For appliances that allow a preselected start time, appliances with a keep-warm function and appliances with **remote operation**, 30.2.3 is applicable. For other appliances, 30.2.2 is applicable.*

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable except as follows.

32.1 *Addition:*

Compliance for microwave leakage is checked by the following test.

*A load of 275 g ± 15 g of potable water having a temperature of 20 °C ± 2 °C, in a thin-wall borosilicate glass vessel having an inside diameter of approximately 85 mm, is placed on the centre of the **shelf**. The appliance is supplied at **rated voltage** and operated with the microwave power control at the highest setting.*

Microwave leakage is determined by measuring the microwave flux density using an instrument that reaches 90 % of its steady reading in 2 s to 3 s when subjected to a stepped input signal. The instrument antenna is moved over the external surface of the appliance to locate the highest microwave leakage, particular attention being given to the door and its seals.

The microwave leakage at any point 50 mm or more from the external surface of the appliance shall not exceed 50 W/m^2.

NOTE 101 If compliance with the test is in doubt due to a high water temperature, the test is repeated with a fresh load.

Dimensions in millimetres

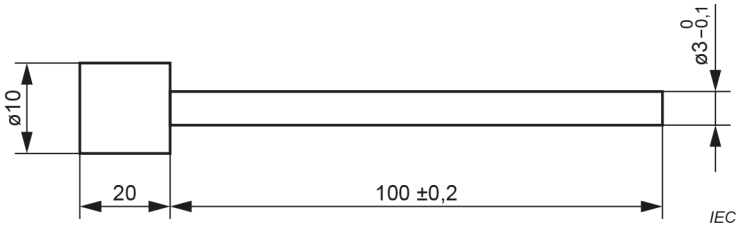
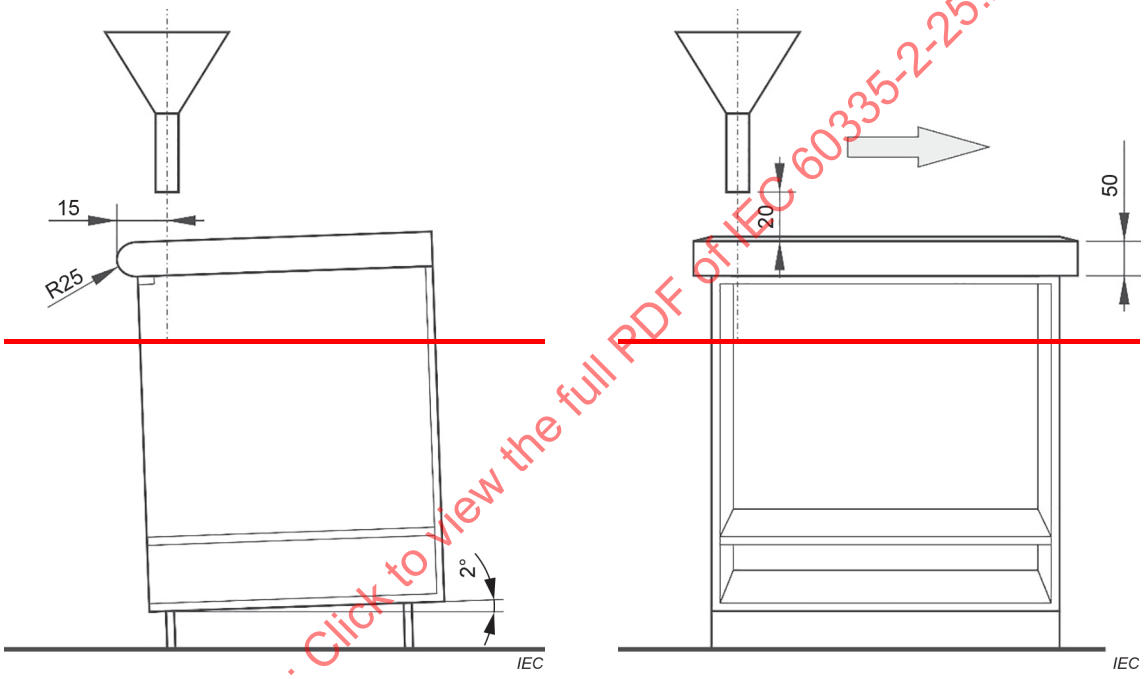


Figure 101 – Test rod for door interlock concealment

~~Dimensions in millimetres~~

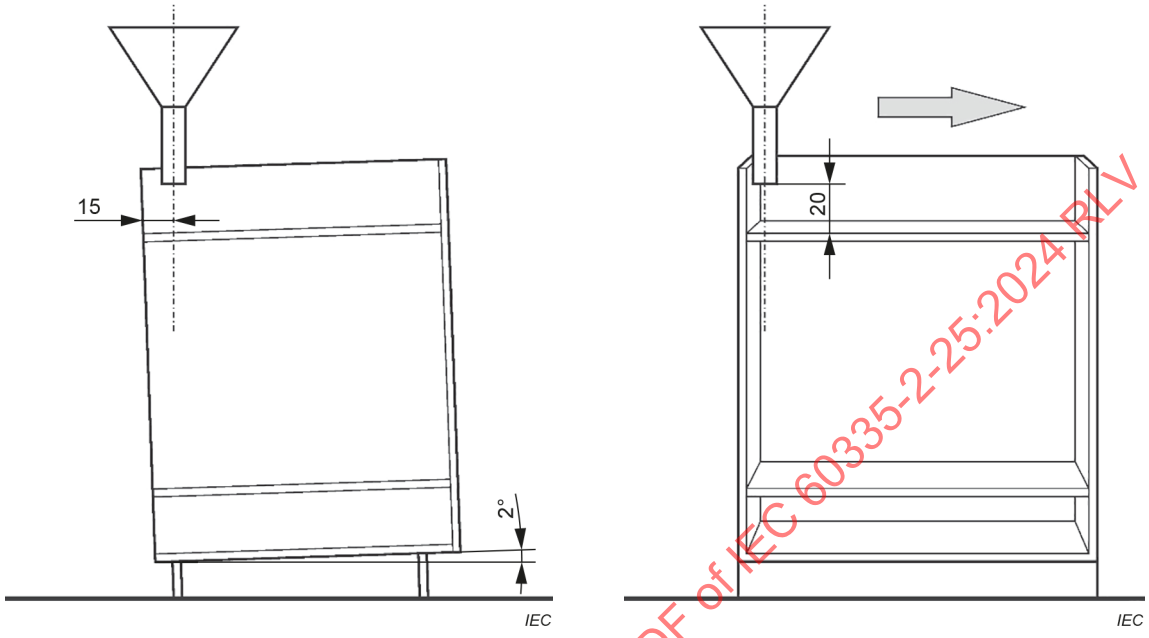


~~a) Side view~~ ~~b) Front view~~

~~**Figure 102 – Test cabinet including working surface, position of funnel and example for direction of tilt**~~

Figure 102 – Void

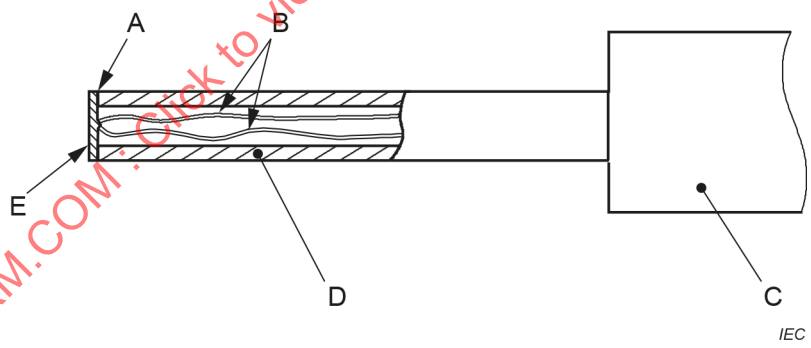
Dimensions in millimetres



a) Side view

b) Front view

Figure 103 – Test cabinet including separation board, position of funnel and example for direction of tilt



Key

A adhesive

B thermocouple wires 0,3 mm diameter to IEC 60584-1 Type K

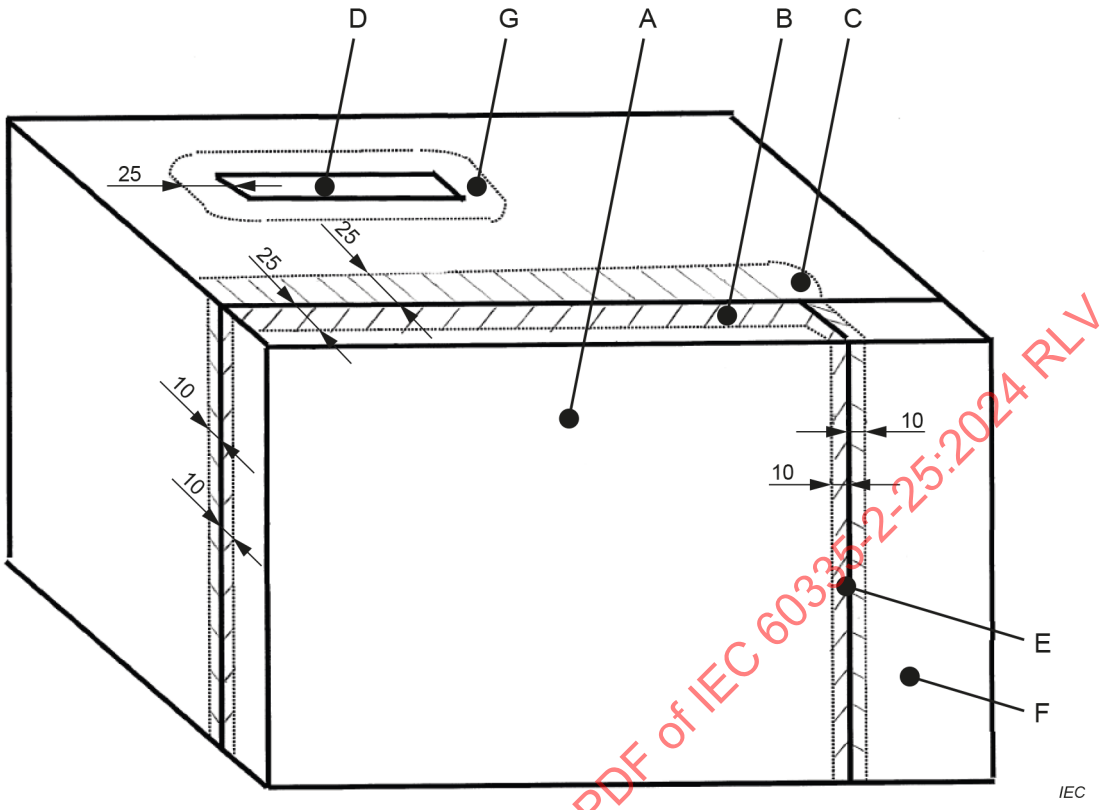
C handle arrangement permitting a contact force of 4 N ± 1 N

D polycarbonate tube: inside diameter 3 mm, outside diameter 5 mm

E tinned copper disc: 5 mm diameter, 0,5 mm thick with flat contact face

Figure 104 – Probe for measuring surface temperatures

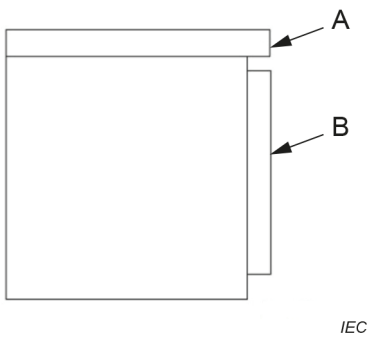
Dimensions in millimetres



Key

A **microwave oven** door
B excluded area on the **microwave oven** door (Zone 1)
C excluded area around the **microwave oven** door (Zone 2)
D vent
E door gap
F **microwave oven** front surface
G excluded area around vents (Zone 3)

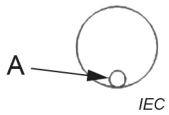
Figure 105 – Front view of appliance with identification of excluded areas



Key

A work surface
B built-in **microwave oven**

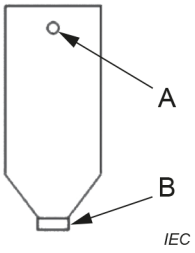
Figure 106 – Arrangement of work surface for spillage test on built-in microwave oven



Key

A bottle cap hole – diameter 8 mm

Figure 107 – Detail of bottle cap and position of hole



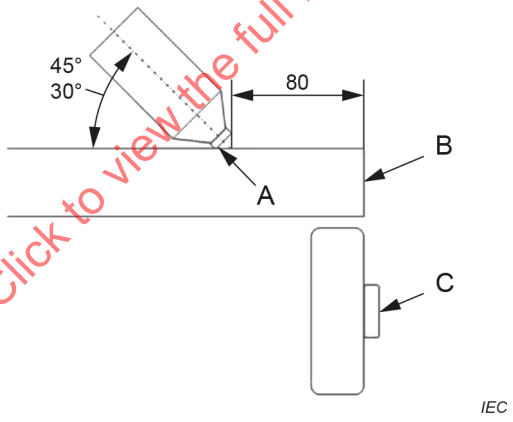
Key

A bottle hole with diameter 8 mm

B bottle cap

Figure 108 – Spillage solution bottle

Dimensions in millimetres



Key

A bottle cap hole position

B edge of work surface

C front of **microwave oven**

Figure 109 – Bottle position for the spillage test

Annexes

The annexes of Part 1 are applicable except as follows.

Annex A
(informative)

Routine tests

This annex of Part 1 is applicable except as follows.

A.2 ~~Electric strength~~ Earth continuity test

Modification:

The current in the test circuit may be increased up to 100 mA.

A.101 Marking and instructions

The covers are checked to ensure that they are marked with the warnings concerning microwave energy.

The appliance is checked to ensure that the corresponding instructions are provided with it.

A.102 Construction

*The operation of the **door interlock** system is checked to ensure that microwave generation ceases when the door is opened.*

A.103 Microwave leakage

*The **microwave oven** is supplied at **rated voltage** and operated with the microwave power control adjusted to the highest setting. A load as specified in 32.1 or a load with equal dielectric and thermal properties shall be used. The energy flux density of microwave leakage is measured at any point approximately 50 mm between the field sensor and the external surface of the appliance. The measuring instrument is moved over the external surface of the oven and the microwave leakage is measured.*

The microwave leakage shall not exceed 50 W/m^2, as recorded with an instrument fulfilling at least the specifications in Clause A.104 regarding its proper function.

A.104 Microwave leakage instrument minimum specifications

A.104.1 *The following specification applies only for routine tests and may also apply for checks of **microwave ovens** after repair or servicing. Instruments for type testing shall fulfil more stringent requirements, which are obtained from National bodies responsible for protection against non-ionising radiation.*

A.104.~~1~~2 *Instruments shall be subjected regular checks by carrying out the following tests, to ensure their proper function is maintained. The tests for instrument compliance are made at room temperature. For carrying out the tests, the position of the field sensor shall be known and preferably be marked. In order to allow measurements specified in A.104.~~2~~3, the minimum resolution of the instrument under test (IUT) shall be 1 W/m^2.*

A.104.~~2~~3 *The checks are carried out either using a generator set-up in an anechoic chamber or using a reference instrument in substitution mode. The far field shall be linearly polarized. The field sensor of the instrument under test (IUT) shall be placed at the position of the reference field, where the flux density is 10 W/m^2 or 50 W/m^2, depending on the task. The range selector, if any, shall be set to the most appropriate range to measure a flux density of 10 W/m^2 or 50 W/m^2, depending on the task and with a tolerance from −40 % to ± 60 %. By slowly rotating the IUT field sensor for 360° around its axis which is aligned to the propagation direction of the far field and directed towards the radiation source, the minimum and maximum reading shall be found and recorded. If the deviation of minimum and maximum readings is less than or equal to ± 2 dB (i.e. from −37 % to +58 %) related to the reference field, it is assumed that the IUT complies with this standard.*

Annex B
(normative)

Battery-operated appliances, separable batteries and detachable batteries for battery-operated appliances

This annex of Part 1 is applicable except as follows.

B.11.1 *Modification:*

*For appliances operated with **detachable batteries** or **separable batteries** that are disconnected from the appliance for charging purposes, the appliance is operated as specified in 11.7 or AA 11.7 until it completes that duration of the test as specified or it no longer operates due to depletion of the **battery**. If the battery is depleted before the appliance completes the duration of the test, the depleted **battery** is immediately replaced with another **battery** that is **fully charged**, the **battery** being the model or type reference of the **battery** provided or indicated in the instructions. The test is continued until the appliance completes the duration of the test as specified or it no longer operates due to depletion of the **battery**.*

*For appliances incorporating **integral batteries** or **separable batteries** not disconnected from the appliance for charging purposes, and that cannot perform their intended function while the **batteries** are being charged, the appliance is operated as specified in 11.7 and AA.11.7 until it cannot perform its intended function due to the depletion of the **batteries**.*

*For appliances operated with **batteries** that are replaceable, including **integral batteries** that are replaceable, or **non-rechargeable batteries**, the appliance is operated until the minimum capacity of the **battery** as specified in Table B.1 has been delivered or the appliance competes the duration of the test as specified in 11.7 and AA.11.7, whichever occurs first.*

B.22.3 *Addition:*

For parts of appliances situated not more than 850 mm above the floor after installation or in normal use, in addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

B.22.4 *Addition:*

For parts of appliances situated not more than 850 mm above the floor after installation or in normal use, in addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

Annex R
(normative)

Software evaluation

This annex of Part 1 is applicable except as follows.

R.2.2.5 *Modification:*

For programmable **electronic circuits** with functions requiring software incorporating measures to control the fault/error conditions specified in Table R.1 or Table R.2, detection of a fault/error shall occur before compliance with Clause 19 or 22.121 is impaired.

R.2.2.9 *Modification:*

The software and safety-related hardware under its control shall be initialized and shall terminate before compliance with Clause 19 or 22.121 is impaired.

Annex AA
(normative)

Combination microwave ovens

The following modifications to this standard are applicable for **combination microwave ovens**.

The clause numbers in this annex refer to the clause numbers in the main part of this standard. Clauses that are additional to the clauses in the main part of this standard are identified by adding the annex letter with the numbering starting at 201.

1 Scope

AA.1.201 For **stationary combination microwave ovens**, IEC 60335-2-6 is also applicable. For **portable combination microwave ovens**, IEC 60335-2-9 is also applicable. However, the requirements of these standards do not take precedence over this standard.

NOTE If a **combination microwave oven** has a mode of operation independent of microwave generation, then this mode is tested only according to the requirements in the relevant standard. If a **combination microwave oven** has a mode of operation without the use of resistive heating elements, it is tested to comply with the relevant requirements of this standard.

3 Terms and definitions

3.1.9
normal operation

Addition:

The appliance is operated with the controls adjusted to the most unfavourable setting in accordance with the instructions for the intended mode of operation.

5 General conditions for the tests

5.3 ~~*Addition:*~~

NOTE ~~101~~201 When testing the different modes of operation, only those tests having the most unfavourable conditions are carried out.

5.101 ~~*Addition:*~~

Replace as follows.

***Combination microwave ovens** are tested as **combined appliances**.*

7 Marking and instructions

7.12 *Addition:*

The instructions for use shall also include the substance of the following.

WARNING: When the appliance is operated in the combination mode, children should only use the oven under adult supervision due to the temperatures generated.

11 Heating

AA.11.7.201 ~~*Replacement:*~~

Microwave ovens *having a grill that can be operated simultaneously with microwave generation are operated for 30 min, the microwave power output being approximately 50 %.*

Microwave ovens *having convection heating that can be operated simultaneously with microwave generation are operated for 60 min, the microwave power output being approximately 50 %.*

Microwave ovens *having a grill or convection heating that can be operated sequentially with microwave generation are operated for 15 min with the microwave power output control adjusted to the highest setting, followed by 30 min of operation without microwave generation.*

If more than half the water evaporates during the test, the vessel is refilled with boiling water, the door not being opened for more than 10 s.

NOTE ~~101~~201 These tests are considered to cover appliances having programmers or timers.

For appliances incorporating ***integral batteries*** *or* ***separable batteries*** *not disconnected from the appliance for charging purposes:*

– *the* ***battery*** *that has been* ***fully discharged*** *is charged for 1 h, while the appliance is operated as specified, if allowed by the construction of the appliance;*

– *the* ***battery*** *that has been* ***fully discharged*** *is charged, for a duration of 24 h or until it is* ***fully charged*** *whichever is shorter, without the* ***battery-operated appliance*** *performing its intended function.*

11.8

NOTE ~~101~~201 When **combination microwave ovens** are operated under the combination mode, the limit values in IEC 60335-2-6 are applied for **stationary appliances** and the limit values in IEC 60335-2-9 are applied for **portable appliances**.

15 Moisture resistance

Addition:

Subclause 15.102 and Subclause 15.103 in the main part of this standard take precedence over the similar requirements of IEC 60335-2-6.

18 Endurance

Addition:

Before measuring the microwave leakage, the following additional conditioning is carried out:

– *resistive heating elements for radiant heating are operated for 15 min;*

– *resistive heating elements for convection heating are operated for 30 min;*

– *pyrolytic self-cleaning ovens are operated for one cleaning cycle.*

19 Abnormal operation

19.1

Modify as follows:

The test of 19.102 is carried out with the appliance supplied at 1,06 times ***rated voltage****.*

22 Construction

22.51 *Addition:*

~~*Subclause 22.120 of IEC 60335-2-6:2014 is not applicable.*~~

For pyrolytic function in **combination microwave ovens**, the requirements of IEC 60335-2-6:—, 22.51 for **remote operation** apply.

Subclause 22.119 in the main part of this standard takes precedence over the similar requirements of IEC 60335-2-6.

29 Clearances, creepage distances and solid insulation

Replace as follows.

This clause of Part 1 is applicable except as follows.

29.2 ~~*Addition*~~ *Modification:*

Add the following dash to the second paragraph:

– the insulation is exposed to exhaust air from the oven **cavity**, in which case pollution degree 3 applies.

29.3 *Addition:*

There are no thickness requirements for sheaths of **visibly glowing heating elements** if the **door interlocks** provide **all-pole disconnection**.

Annex BB
(normative)

Microwave ovens intended to be used on board ships

The following modifications to this standard are applicable for **microwave ovens** intended to be used on board ships.

The clause numbers in this annex refer to the clause numbers in the main part of this standard. Clauses that are additional to the clauses in the main part of this standard are identified by adding the annex letter with the numbering starting at 201.

~~NOTE Where it is unclear whether a clause or subclause of this annex is intended to modify Part 1 or Part 2-25, this is specified.~~

~~3 Terms and definitions~~

~~**3.BB.101**~~
~~**open deck**~~
~~area that is exposed to marine environment~~

~~**3.BB.102**~~
~~**dayroom**~~
~~area that may be exposed to marine environment from time to time~~

6 Classification

6.2 *Addition:*

Appliances for **open deck** use shall be IPX6.

7 Marking and instructions

7.1 ~~*Replacement*~~ *Modification:*

Replace the second dashed item ~~of Part 1~~ in the first paragraph by the following:

– **rated frequency** or **rated frequency range** in Hz;

7.12 *Addition:*

The instructions for use shall also include the substance of the following.

– usage on board ships;
– installation place (**open deck** protective enclosure, **dayrooms**);
– fastening means.

The instructions for **microwave ovens** that are intended to be used on board ships shall state:

CAUTION: Verify that the voltage and frequency of the mains supply of the ship matches the **rated voltage** and **rated frequency** or **rated frequency range** of the **microwave oven**.

22 Construction

BB.22.~~BB.101~~201 Appliances shall withstand the pulses to which they ~~may~~ can be subjected.

Compliance is checked by carrying out the half-sine pulse tests specified in IEC 60068-2-27 under the following conditions.

The appliance is fastened in its normal position of use to a shock-testing machine by means of straps around the enclosure.

The type of pulse is a half-sine pulse and the severity is as follows.

- *application of the half-sine pulse is in all 3 axes;*
- *peak acceleration: 250 m/s^2,*
- *duration of each half-sine pulse: 6 ms;*
- *number of half-sine pulses in each direction: 1 000 ± 10.*

The appliance shall show no damage that could impair compliance with 8.1, 16.3, Clause 29 and 32.1, and connections shall not have worked loose.

BB.22.~~BB.102~~202 Appliances shall withstand the vibrations to which they ~~may~~ can be subjected.

Compliance is checked by carrying out the vibration tests specified in IEC 60068-2-6 under the following conditions.

The appliance is fastened in its normal position of use upon a vibration table by means of straps around the enclosure. The type of vibration is sinusoidal and the severity is as follows:

- *direction of vibration is vertical and horizontal;*
- *amplitude of vibration: 0,35 mm;*
- *sweep frequency range: 10 Hz to 150 Hz;*
- *duration of the test: 30 min.*

The appliance shall show no damage that could impair compliance with 8.1, 16.3, Clause 29 and 32.1, and connections shall not have worked loose.

31 Resistance to rusting

Replace as follows:

This clause of Part 1 is applicable except as follows.

Addition:

Compliance is checked by the salt mist test Kb of IEC 60068-2-52,

- *for **open deck** use, severity 1 is applicable;*
- *for **dayrooms** use, severity 2 is applicable.*

Before the test, coatings are scratched by means a hardened steel pin, the end of which has the form of a cone with an angle of 40°. Its tip is rounded with a radius of 0,25 mm ± 0,02 mm. The pin is loaded so that the force exerted along its axis is 10 N ± 0,5 N. The scratches are made by drawing the pin along the surface of the coating at the speed of approximately 20 mm/s. Five scratches are made at least 5 mm apart and at least 5 mm from the edges.

After the test, the appliance shall not have deteriorated to such an extent that compliance with this standard, in particular with Clauses 8 and 27, is impaired. The coating shall not be broken and shall not have detached from the metal surface.

Bibliography

The Bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60335-2-90, *Household and similar electrical appliances – Safety – Part 2-90: Particular requirements for commercial microwave ovens*

IEC 60335-2-110, *Household and similar electrical appliances – Safety – Part 2-110: Particular requirements for commercial microwave appliances with insertion or contacting applicators*

IEC 60519-6, ~~*Safety in electroheat installations – Part 6: Specifications for safety in industrial microwave heating equipment*~~ *Safety in installations for electroheating and electromagnetic processing – Part 6: Particular requirements for high frequency dielectric and microwave heating and processing equipment*

IEC 60989:1991 [4], *Separating transformers, autotransformers, variable transformers and reactors*

~~ISO 13732-1, *Ergonomics of the thermal environment – Methods for the assessment of human responses to contact with surfaces – Part 1: Hot surfaces*~~

4 Withdrawn.

IEC 60335-2-25

Edition 8.0 2024-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Household and similar electrical appliances – Safety –
Part 2-25: Particular requirements for microwave ovens, including combination microwave ovens

Appareils électrodomestiques et analogues – Sécurité –
Partie 2-25: Exigences particulières pour les fours à micro-ondes, y compris les fours à micro-ondes combinés

IEC 60335-2-25:2024-07(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-25: Particular requirements for microwave ovens, including combination microwave ovens

FOREWORD

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IEC 60335-2-25 has been prepared by subcommittee 61B: Safety of microwave appliances for household and commercial use, of IEC technical committee 61: Safety of household and similar electrical appliances. It is an International Standard.

This eighth edition cancels and replaces the seventh edition published in 2020. This edition constitutes a technical revision.

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

a) some subclauses have been modified for the appliance outlets and socket-outlets;
b) Subclause 7.12 has been improved in clarity;

c) Subclauses 8.1.1 and 20.2 have been modified to adopt test probe 19;

d) Subclauses 10.1 and 10.2 have been improved in clarity for inverter type microwave ovens;

e) maximum temperature rises of external accessible surfaces have been added in Subclause 11.8;

f) test criterion has been modified in Subclause 15.101;

g) Subclause 15.102 has been modified for harmonization with IEC 60335-2-6;

h) Subclauses 8.1.3, 15.103, 19.11.2, 19.13, 22.105, 22.106, 22.111 and Figure 101 have been improved in clarity;

i) Subclauses 22.103.2, 22.105 and 22.120 have been modified to adopt test probe 18;

j) Subclause 16.101 has been modified to move the content of 16.101.1, 16.101.2 directly under 16.101;

k) Subclause 22.119 has been modified to move the content of 22.119.1, 22.119.2 and 22.119.3 directly under 22.119.

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

Draft	Report on voting
61B/701/FDIS	61B/705/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/standardsdev/publications.

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety*, can be found on the IEC website.

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments unless that edition precludes it; in that case, the latest edition that does not preclude it is used. It was established on the basis of the sixth edition (2020) of that standard.

NOTE 1 When "Part 1" is mentioned in this standard, it refers to IEC 60335-1.

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Particular requirements for microwave ovens, including combination microwave ovens.

When a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. When this standard states "addition", "modification" or "replacement", the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;

– unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;

– additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

– requirements: in roman type;

– *test specifications: in italic type;*

– notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in **bold**.

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

- reconfirmed,
- withdrawn, or
- revised.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations can need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

The following differences exist in the countries indicated below.

– 5.3: Microwave leakage is not to exceed 10 W/m^2 during the initial test (Japan and USA).

– 6.1: Microwave ovens may be class 0I if the rated voltage does not exceed more than 150 V (Japan).

– 7.12: Specific instructions exist pertaining to using and servicing **microwave ovens** with respect to the risk of exposure to microwave energy (USA).

– 7.12: It is prohibited to place the appliance in a cabinet with a door (Japan).

– Clause 18: The test is carried out on two appliances (USA).

– 19.11.2: The input voltage variation is not applied (USA).

– 19.13: Microwave leakage is measured only at the end of each test (USA).

– 21.102: The applied force is 222 N (USA).

– 21.105: Microwave leakage is not to exceed 50 W/m^2 (Japan and USA).

– 22.111: Microwave leakage is measured only at the end of the test (USA).

– 22.112: Microwave leakage is not to exceed 50 W/m^2 (Japan and USA).

– 22.115: All access to the cavity has to be prevented (USA).

INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

Guidance documents concerning the application of the safety requirements for appliances can be accessed via TC 61 and SC 61B supporting documents on the IEC website

https://www.iec.ch/tc61/supportingdocuments
https://www.iec.ch/sc61b/supportingdocuments

This information is given for the convenience of users of this International Standard and does not constitute a replacement for the normative text in this standard.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules can differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another part 2 of IEC 60335, the relevant part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

NOTE 2 Horizontal publications, basic safety publications and group safety publications covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features which impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard can be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

NOTE 3 Standards dealing with non-safety aspects of household appliances are:

– IEC standards published by TC 59 concerning methods of measuring performance;
– CISPR 11, CISPR 14-1 and relevant IEC 61000-3 series standards concerning electromagnetic emissions;
– CISPR 14-2 concerning electromagnetic immunity;
– IEC standards published by TC 111 concerning environmental matters.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-25: Particular requirements for microwave ovens, including combination microwave ovens

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of **microwave ovens** for household and similar use, their **rated voltage** being not more than 250 V including direct current (DC) supplied appliances and **battery-operated appliances**.

This standard also deals with **combination microwave ovens**, for which normative Annex AA is applicable.

This standard also deals with **microwave ovens** intended to be used on board ships, for which normative Annex BB is applicable.

Appliances not intended for normal household use but which nevertheless can be a source of danger to the public, such as appliances intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard. However, if the appliance is intended to be used professionally to process food for commercial purposes, the appliance is not considered to be for household and similar use only.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account

– persons (including children) whose
  - physical, sensory or mental capabilities; or
  - lack of experience and knowledge

  prevents them from using the appliance safely without supervision or instruction;
– children playing with the appliance.

Attention is drawn to the fact that

– for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements can be necessary;
– in many countries, additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour and similar authorities.

This standard does not apply to

– commercial **microwave ovens** (IEC 60335-2-90);
– commercial microwave appliances with insertion or contacting applicators (IEC 60335-2-110);
– industrial microwave heating equipment (IEC 60519-6);
– appliances for medical purposes (IEC 60601);
– appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-52, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60335-2-6:—[1], *Household and similar electrical appliances – Safety – Part 2-6: Particular requirements for stationary cooking ranges, hobs, ovens and similar appliances*

IEC 60335-2-9, *Household and similar electrical appliances – Safety – Part 2-9: Particular requirements for grills, toasters and similar portable cooking appliances*

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

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

3.1.7

Note 101 to entry: The **rated frequency** is the input frequency.

3.1.9
normal operation

Modification:

Replace the first paragraph by the following:

operation of the appliance with 1 000 g ± 50 g of potable water at an initial temperature of 20 °C ± 2 °C in a cylindrical borosilicate glass vessel having a maximum thickness of 3 mm and an outside diameter of approximately 190 mm, the vessel being placed on the centre of the **shelf**

3.5 Definitions relating to types of appliances

3.5.101
microwave oven
appliance using 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.

[1] Under preparation. Stage at the time of publication: IEC/FDIS 60335-2-6:2024.

3.5.102
combination microwave oven
microwave oven in which heat is also provided in the **cavity** by simultaneous or consecutive operation of resistive heating elements

Note 1 to entry: The resistive heating elements are used to provide radiant heat, convection heat or steam.

3.6 Definitions relating to parts of an appliance

3.6.101
cavity
space enclosed by the inner walls and the door in which the load is placed

3.6.102
shelf
horizontal support in the **cavity** on which the load is placed

3.6.103
door interlock
device or system that prevents the operation of the microwave generator(s), unless the oven door is closed

3.6.104
monitored door interlock
door interlock system that incorporates a supervision device

3.6.105
temperature-sensing probe
device that is inserted into the food to measure its temperature and is a part of an oven control

3.8 Definitions relating to miscellaneous matters

3.8.101
open deck
area that is exposed to marine environment

3.8.102
dayroom
area that can be exposed to marine environment from time to time

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.2 *Addition:*

An additional sample can be required for the test of 19.104.

Six samples of the interlocks are required for the test of 24.1.4.

5.3 *Modification:*

Instead of carrying out the tests in the order of clauses, the following sequence of clauses and subclauses applies: 32.1, 22.113, 22.108, 22.115, 22.116, Clause 7 to 17, Clause 20, Clause 21 (except 21.101 to 21.105), Clause 18, Clause 19 (except 19.104), Clause 22 (except 22.108, 22.113, 22.115 and 22.116), Clause 23 to 31 and 32.2, 21.101 to 21.105 and 19.104.

5.101 ***Microwave ovens*** *are tested as* ***motor-operated appliances****.*

5.102 ***Class III temperature-sensing probes*** *are only subjected to the tests of 22.112.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Modification:*

Microwave ovens shall be **class I** or **class II**.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Addition:*

Appliances shall be marked with the nominal frequency in megahertz of the ISM band in which they operate.

If the removal of any cover results in microwave leakage exceeding the value specified in 32.1, the cover shall be marked with the substance of the following:

WARNING
MICROWAVE ENERGY
DO NOT REMOVE THIS COVER

When the exempted provisions of footnote b to Table 101 and/or Table 3 apply, the appliance shall be marked with the substance of "CAUTION: Hot surface", or symbol IEC 60417-5041 (2002-10).

7.6 *Addition:*

[symbol IEC 60417-5041 (2002-10)] caution, hot surface

7.12 *Addition:*

The instructions shall include the substance of the following warnings:

– WARNING: If the door or door seals are damaged, the oven must not be operated until it has been repaired by a competent person.

– WARNING: It is hazardous for anyone other than a competent person to carry out any service or repair operation that involves the removal of a cover which gives protection against exposure to microwave energy.

NOTE 101 This warning is applicable if microwave leakage exceeds the limit specified in 32.1 during the removal of any cover.

– WARNING: Liquids and other foods must not be heated in sealed containers since they are liable to explode.

– WARNING: Ensure that the cavity does not contain any items or utensils that are not suitable for the use with the microwave oven before you operate the appliance.

– WARNING: Do not use the cavity for storing combustible products, cooking utensils, or food and similar when the microwave oven is not in use.

The instructions shall include the substance of the following:

– This appliance is intended to be used in household and similar applications such as:

  - staff kitchen areas in shops, offices and other working environments;
  - farm houses;
  - by clients in hotels, motels and other residential environments;
  - bed and breakfast type environments.

  If the manufacturer wishes to limit the use of the appliance to less than the above, this shall be clearly stated in the instructions.

– The minimum height of free space necessary above the top surface of the oven.

– Metallic containers for food and beverages are not allowed during microwave cooking. This requirement is not applicable if the manufacturer specifies size and shape of metallic containers suitable for microwave cooking.

– When heating food in plastic or paper containers, keep an eye on the oven due to the possibility of ignition.

– The **microwave oven** is intended for heating food and beverages. Drying of food or clothing and heating of warming pads, slippers, sponges, damp cloth and similar can lead to risk of injury, ignition or fire.

– If smoke is observed, switch off or unplug the appliance and keep the door closed in order to stifle any flames.

– Microwave heating of beverages can result in delayed eruptive boiling, therefore care must be taken when handling the container.

– The contents of feeding bottles and baby food jars shall be stirred or shaken and the temperature checked before consumption, in order to avoid burns.

– Eggs in their shell and whole hard-boiled eggs should not be heated in **microwave ovens** since they can explode, even after microwave heating has ended.

– Details for cleaning door seals, **cavities** and adjacent parts.

– The oven should be cleaned regularly and any food deposits removed.

– Failure to maintain the oven in a clean condition could lead to deterioration of the surface that could adversely affect the life of the appliance and possibly result in a hazardous situation.

– Only use the temperature probe recommended for this oven (for appliances having a facility to use a **temperature-sensing probe**).

– The instructions for use for **fixed appliances** and **built-in appliances** being used equal or higher than 900 mm above the floor and having **detachable** turntables shall state that care should be taken not to displace the turntable when removing containers from the appliance. This is not applicable for appliances with horizontal bottom hinged door.

– The appliance shall not be cleaned with a steam cleaner.

If symbol IEC 60417-5041 (2002-10) is marked on the appliance, its meaning shall be explained.

The manufacturer shall state in the instructions whether the **microwave oven** is allowed to be placed or installed less than 850 mm above the floor.

The manufacturer shall state in the instructions whether the **microwave oven** is intended to be used freestanding, built-in or in a cabinet. If the appliance can be used while placed in a cabinet,

- the minimum dimensions of the cabinet shall be given by the manufacturer, and
- the instructions shall state that the appliance must be operated with any cabinet door open.

The instructions for **microwave ovens** having an additional decorative door shall state that the appliance must be operated with the decorative door open.

The instructions for **microwave ovens** that are not tested in a cabinet shall state that the appliance must not be placed in a cabinet.

The instructions for **microwave ovens** that are not in compliance with 22.118 shall state that the appliance must not be installed equal or higher than 900 mm above the floor.

7.14 *Addition:*

The height of the lettering of the warning specified in 7.1 shall be at least 3 mm.

The height of symbol IEC 60417-5041 (2002-10) shall be at least 10 mm.

Compliance is checked by measurement.

7.15 *Addition:*

If the hot surface marking in 7.1, or symbol IEC 60417-5041 (2002-10) is marked on the appliance, it shall be visible when the appliance is operated as in normal use, including when actuating any switch, adjusting any control or opening a lid, drawer or door. It shall not be placed on surfaces that are exempted from the limits in Table 3 and Table 101.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1.1 *Addition:*

For part of appliances situated not more than 850 mm above the floor after installation or in normal use, in addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

8.1.3 *Addition:*

Test probe 19 of IEC 61032 is not applied.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.1 *Addition:*

*For inverter type **microwave ovens**, if the power input varies throughout the operating cycle, the representative period is considered as specified in 11.7 without the rest periods.*

*For inverter type **microwave ovens**, if the power input does not vary throughout the operating cycle, and for non-inverter type **microwave ovens**, the power input is measured at the end of third operating cycle of 11.7.*

10.2 *Addition:*

*For inverter type **microwave ovens**, if the current varies throughout the operating cycle, the representative period is considered as specified in 11.7 without the rest periods.*

*For inverter type **microwave ovens**, if the current does not vary throughout the operating cycle, and for non-inverter type **microwave ovens**, the current is measured at the end of the third operating cycle of 11.7.*

11 Heating

This clause of Part 1 is applicable except as follows.

11.2 *Addition:*

*Appliances, other than **built-in appliances**, are positioned as specified for **heating appliances**.*

A ceiling is placed over the appliance at the minimum height stated in the instructions. The ceiling has a depth of 300 mm from the back wall of the test corner and a length at least 150 mm in excess of the width of the appliance.

Appliances that can be used when placed in a cabinet are placed in a cabinet with the minimum dimension given in the instructions by the manufacturer, the plywood specified for the test corner being used. The appliance is positioned against the rear wall and one of the side walls.

The cabinet door is in the open position.

11.3 *Addition:*

*Where the external **accessible surfaces** are suitably flat and access permits, the test probe of Figure 104 is used to measure the temperature rises of external **accessible surfaces** specified in Table 101. The probe is applied with a force of 4 N ± 1 N to the surface in such a way that the best possible contact between the probe and the surface is ensured. The measurement is performed after a contact period of 30 s.*

The probe can be held in place using a laboratory stand clamp or similar device. Any measuring instrument giving the same results as the probe can be used.

11.7 *Replacement:*

Appliances are operated for three cycles with ***remote operation*** *enabled, if any. Each cycle consisting of a heating period of 10 min followed by a rest period of 1 min. The last cycle does not include a rest period of 1 min. During the rest periods, the lid, drawer or door is open, the* ***remote operation*** *enabled, if any, and the load is replaced.*

Appliance outlets accessible to the user and socket-outlets accessible to the user are loaded with a resistive load that gives the marked ***outlet load****. The current in the appliance outlets and socket-outlets on the appliance are continuously loaded.*

For appliances incorporating ***integral batteries*** *or* ***separable batteries*** *not disconnected from the appliance for charging purposes:*

– *the* ***battery*** *that has been* ***fully discharged*** *is charged for 1 h, while the appliance is operated as specified, if allowed by the construction of the appliance;*

– *the* ***battery*** *that has been* ***fully discharged*** *is charged, for a duration of 24 h or until it is* ***fully charged****, whichever is shorter, without the* ***battery-operated appliance*** *performing its intended function.*

11.8 *Modification:*

Replace the first paragraph by the following text:

During the test, the temperature rises are monitored continuously and shall not exceed the values shown in Table 3 and Table 101.

Addition:

For Table 3:

– *The temperature rises of external surfaces of* ***microwave ovens*** *are only measured on the surfaces that are not placed against the wall and the floor of the test corner;*

– *There are no temperature rise limits for air-outlet grilles and for surfaces up to a distance of 25 mm from them.*

– *When the required values for external enclosure of* ***motor-operated appliances*** *are not met, the maximum temperature rise shall not exceed the limit by more than 20 K to the values indicated.*

NOTE 101 The temperature rises for handles, knobs, grips and similar parts which are specified in Table 3 apply regardless of their position on the above surfaces.

Table 101 – Maximum temperature rises of external accessible surfaces under normal operating conditions

Surface	***Temperature rise of surfaces of appliances allowed to be placed or installed less than 850 mm above the floor*** [a] K	***Temperature rise of surfaces of appliances intended to be placed not less than 850 mm above the floor*** [a, b] K
Bare metal	*38*	*42*
Coated metal [c]	*42*	*49*
Glass and ceramic	*51*	*56*
Plastic and plastic coating > 0,4 mm [d, e]	*58*	*62*

NOTE The temperature rise limits of handles, knobs, grips, keyboards, keypads and similar parts are specified in Table 3.

[a] *The following surfaces or elements shall not be taken into consideration (see Figure 105):*
- ***cavity*** *(surface temperatures are only measured when the door is closed);*
- *handles or control knobs including keypads, keyboards and the like: part of the equipment that a user needs to touch to operate or adjust the equipment. The equipment shall be installed according to the manufacturer's instructions;*
- *surfaces within 5 mm of touch controls regardless of their shape;*
- *external surfaces of appliances inaccessible to a 75 mm diameter probe having a hemispherical end, when the appliance is installed according to the installation condition of 11.2.*
- *surfaces on the* ***microwave oven*** *door within 10 mm from the left, right and lower edge of the* ***microwave oven*** *door, or 25 mm from the upper edge of the* ***microwave oven*** *door (Zone 1). For built-in appliances, the edges shall be considered between the* ***microwave oven*** *door and decorative trims, if any;*
- *surfaces around the* ***microwave oven*** *door within 10 mm from the left, right or lower edge of the* ***microwave oven*** *door, or 25 mm from the upper edge of the* ***microwave oven*** *door (Zone 2). For built-in appliances, the edges shall be considered between the* ***microwave oven*** *door and decorative trims, if any;*
- *surfaces within 25 mm of vents such as air-outlet grilles (Zone 3).*

[b] *When the required values are not met, the maximum temperature rise shall not be higher than 20 K in excess of the values indicated.*

[c] *Metal is considered coated when a coating having a minimum thickness of 90 µm made by enamel, powder coating or non-substantially plastic coating is used.*

[d] *The temperature rise limit of plastic also applies for plastic material having a metal finish of thickness less than 0,1 mm.*

[e] *When the thickness of the plastic coating does not exceed 0,4 mm, the temperature rise limits of the coated metal or of glass and ceramic material apply.*

[f] *The area that is adjacent to the handle that could be touched whilst using the handle shall comply with 22.13.*

12 Charging of metal-ion batteries

This clause of Part 1 is applicable.

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.2 *Addition:*

*A quantity of 0,5 l of the same spillage solution is poured steadily over the **shelf** over a period of 1 min. If the **shelf** can collect spilled liquid, it is filled with the solution and a further 0,5 l is then added over a period of 1 min.*

15.101 Temperature-sensing probes shall be constructed so that their insulation is not affected by water.

Compliance is checked by the following test.

The probe is completely immersed in water containing approximately 1 % NaCl and having a temperature of 20 °C ± 5 °C. The solution is heated to the boiling point in approximately 15 min. The probe is then removed from the boiling solution and immersed in the solution having a temperature of 20 °C ± 5 °C for 30 min.

This procedure is carried out five times, after which the probe is removed from the solution. All traces of liquid are then removed from the surface.

The probe shall then withstand the electric strength test of 16.3.

NOTE **Detachable temperature-sensing probes** are not connected to the appliance for this test. **Non-detachable temperature-sensing probes** are tested in the **cavity**, the probe being immersed as much as possible.

15.102 Built-in microwave ovens that are intended for use installed under work surfaces shall be constructed so that such spillage does not affect their electrical insulation.

Compliance is checked by the following test.

*They shall be subjected to a spillage test with 0,5 l of the spillage solution specified in 15.2. They shall be installed according to the manufacturer's instructions except that the front surface of the **microwave oven** (excluding control knobs, handles) shall align with front edge of a 30 mm thick wooden work surface with a square front edge, see Figure 106. The spillage solution shall be poured on the work surface at the area which gives the most unfavourable conditions representing the pouring likely to occur, so that the spillage solution flows down the front surface of the **microwave oven** over controls, joints, vents and similar openings. If necessary, the test is repeated until all different controls or gaps are covered by the spillage test. The appliance is dried between each test.*

The test is performed as follows:

A bottle with a shape similar to the one in Figure 108 and a cap is filled with 0,5 l of the spillage solution.

The cap of the bottle shall have a hole 8 mm diameter, placed off-centre according to Figure 107. The bottle shall also have a hole 8 mm diameter near the bottle base (see Figure 108) to equalize the liquid pressure.

Other suitable containers may be used provided the spillage solution amount is poured over the appliance under test in the same manner.

*The hole in the cap of the bottle is put on the horizontal work surface at approximately 80 mm horizontal distance with respect to the front of the **microwave oven**. The inclination of the bottle shall be higher than 30° and lower than 45°. The lower part of the bottle hole in the cap shall be in contact with the work surface, with the hole in the cap placed down closest to the surface. See Figure 109.*

NOTE 1 The intention of the inclination and distance is avoiding the spillage "jumping" over the front of the **microwave oven**.

NOTE 2 When using holes of 8 mm diameter, the specified solution amount is spilled in about 15 s.

When the 0,5 l of spillage solution has been poured, the remaining solution on the work surface is pushed towards the front so that the remaining solution spills homogeneously over the front with a suitably flat means.

*Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.*

15.103 Microwave ovens intended to be built-in in cabinets underneath other **built-in appliances** and therefore subject to spillage of liquid from filled containers which are handled during usage of these other appliances shall be constructed so that such spillage does not affect their electrical insulation.

Compliance is checked by the following test (see Figure 103).

*The **microwave oven** is built-in as specified by the manufacturer. The test cabinet is tilted to an angle of 2° in the most unfavourable direction. 200 ml of the spillage solution specified in 15.2 is poured steadily over a period of 8 s through a funnel onto the complete width of the separation board above the **microwave oven**. The funnel has an outlet diameter of approximately 8 mm and the lower edge of its outlet is positioned 20 mm above the separation board. The centre of the funnel is positioned 15 mm inwards from the leading edge of the separation board.*

*If the manufacturer states in the installation instructions that a separation board above the **microwave oven** is not required, the test shall be repeated while pouring the spillage solution directly onto the complete width of the top surface of the **microwave oven**. The lower edge of the funnel outlet is positioned 20 mm above the top surface of the **microwave oven** and its centre is positioned 15 mm inwards from the leading edge of the **microwave oven**.*

*Immediately after the test, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.*

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.101 The windings of the power transformer that supplies the magnetron shall have adequate insulation.

Compliance is checked by one of the following tests.

– *For switch-mode power suppliers, the insulation between the primary and secondary windings of switch-mode power supply transformers is subjected for 1 min to a voltage of substantially sinusoidal waveform and having a frequency of 50 Hz or 60 Hz. The value of the voltage is 1,414 times the peak value of the secondary* ***working voltage*** *plus 750 V, with a minimum of 1 250 V.*

There shall be no breakdown between windings or between adjacent turns of the same winding.

– *For other power transformer, twice the* ***working voltage*** *is induced in the secondary winding of the transformer by applying a sinusoidal voltage having a frequency higher than* ***rated frequency*** *to the primary terminals.*

The duration of the test is

- *60 s, for frequencies up to twice the* ***rated frequency****, or*
- $120 \times \frac{\textbf{rated frequency}}{\text{test frequency}}$ *s, with a minimum of 15 s, for higher frequencies.*

NOTE The frequency of the test voltage is higher than the **rated frequency** to avoid excessive excitation current.

A maximum of one-third of the test voltage is applied and is then rapidly increased without creating transients. At the end of the test, the voltage is decreased in a similar manner to approximately one-third of its full value before switching off.

There shall be no breakdown between windings or between adjacent turns of the same winding.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable except as follows.

Addition:

The tests are not carried out on the power transformer that supplies the magnetron and its associated circuits, these being checked during the tests of Clause 19.

18 Endurance

This clause of Part 1 is replaced by the following.

The door system, including hinges, microwave seals and other associated parts, shall be constructed to withstand wear that can be expected in normal use.

Compliance is checked by the following test.

The door system is subjected to 50 000 cycles of operation with the appliance supplied at ***rated voltage*** *and containing an appropriate microwave-absorbing load. It is then subjected to 50 000 cycles of operation without microwave generation.*

The door is opened and closed as in normal use. It is opened from the closed position to a position approximately 10° before fully open. The rate of operation is 6 cycles per minute. With the agreement of the manufacturer, the rate of operation without microwave generation can be increased to 12 cycles per minute.

After the test, the microwave leakage shall not exceed the limit specified in 32.1 and the door system shall still function.

NOTE 101 Controls can be rendered inoperative in order to carry out the test.

NOTE 102 Components, the deterioration of which does not impair compliance with this standard, can be replaced in order to complete the test.

NOTE 103 Bricks or additional water of maximum 500 g can be added if necessary to avoid stopping of the test due to overheating.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 *Modification:*

Instead of subjecting the appliance to the tests of 19.2 to 19.10, compliance is checked by the tests of 19.101 to 19.105, the appliance being supplied at ***rated voltage****.*

19.11.2 *Addition:*

The cathode-to-anode circuit of the magnetron is open-circuited and short-circuited one at a time. If one of these fault conditions results in an input current that increases with decreasing voltage, the test is carried out with the appliance supplied at 0,94 times ***rated voltage****. However, if the input current increases more than proportionally with voltage, the appliance is supplied at 1,06 times* ***rated voltage****.*

The filament of the magnetron is not short-circuited.

19.13 *Addition:*

During the tests, the temperature of windings shall not exceed the values shown in Table 8. Only appliances that allow a pre-selected start time and those operating with a keep-warm function are considered to be appliances operated until steady conditions are established.

However, during the tests of 19.11.3, Table 8 only applies to the windings of the transformer of the power supply of the microwave generator(s), if any.

During the tests, the microwave leakage shall not exceed 100 W/m^2 measured in accordance with 32.1 but with the load as specified for each subclause. The appliance shall comply with 32.1 if it can be operated after the tests.

Modification:

Replace the last paragraph by the following:

In an appliance containing lids, drawer and doors that are controlled by one or more interlocks, one of the interlocks may be released provided that both of the following conditions are fulfilled:

– *the lid, drawer or door does not move automatically to an open position when the interlock is released;*
– *the appliance will not restart after the cycle in which the interlock was released.*

19.101 *Appliances are operated with controls set at the most unfavourable position and without load in the* ***cavity****.*

The period of operation is the maximum time allowed by the timer or until steady conditions are established, whichever is shorter.

If microwave leakage exceeds 100 W/m^2, the following alternative measurement method shall be applied, which modifies the microwave leakage limit of 19.13.

In order to identify and mark all spots where peak values of microwave leakage exceed 100 W/m^2, the instrument antenna is moved again over the external surface of the appliance, particular attention being given to the door and its seals.

NOTE 1 A peak hold function of the measurement instrument, if any, can be activated for identification of spots where peak values of microwave leakage exceed 100 W/m^2.

The leakage values of each such spot shall be recorded and the averaged leakage value of any spot over the most onerous 20 s shall not exceed 100 W/m^2. Furthermore, the peak value shall not exceed 500 W/m^2.

NOTE 2 Since the stirrer and/or turntable revolution time and the number of microwave stirrer blades determine the frequency and duration of actual peak leakage values, instruments with appropriate specifications (like minimum sampling time, capability to measure peak values of power flux density, capability to average these values) can be used.

19.102 *Appliances are operated under **normal operation** with the timer or other controls that operate in normal use short-circuited. If the appliance is provided with more than one control, these are short-circuited in turn. These short-circuits are applied one at a time.*

19.103 *Appliances are operated under **normal operation** and with any single fault condition simulated that is likely to occur. The controls are adjusted to their most unfavourable setting and the appliance is operated for the maximum time allowed by the timer or 90 min, whichever is shorter.*

NOTE Examples of fault conditions are

– blocking of air openings in the same plane. This fault condition is not applied if the appliance is a **built-in appliance**;

– locking the rotor of motors if the locked rotor torque is smaller than the full load torque;

– locking moving parts liable to be jammed.

19.104 *The appliance is operated with the controls adjusted to their most unfavourable setting and with a potato placed on the **shelf** in the position where it is most likely to ignite and propagate flames to other combustible material.*

The potato has an approximately ellipsoidal shape and a mass between 125 g and 150 g. The length of the shortest principal axis is at least 40 mm. The length of the longest principal axis is not more than 140 mm and may be symmetrically reduced in order to obtain the specified mass. A steel wire, having a diameter of 1,5 mm ± 0,5 mm and approximately the same length as the longest axis of the potato, is inserted along this axis.

*The test is terminated 15 min after the microwave generation has ceased or a fire in the **cavity** has extinguished.*

*During the test, any fire in the **cavity** shall be contained within the appliance.*

NOTE 1 Subclause 19.13 does not apply during the test.

*After the test, if the appliance is still operable, any damaged **detachable shelf** is replaced and 19.13 applies. If the appliance does not comply, the test is repeated on a new appliance.*

NOTE 2 Non-compliance can have resulted from the cumulative effects of previous tests.

19.105 ***Built-in appliances** having an additional decorative door and appliances to be used in a cabinet are operated under **normal operation** but with the decorative door or cabinet door closed.*

The period of operation is the maximum time allowed by the timer or until steady conditions are established, whichever is shorter.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.2 *Addition:*

For part of appliances situated not more than 850 mm above the floor after installation or in normal use, in addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18. During the tests with test probe 19, the appliance is fully assembled as in normal use with any door closed.

20.101 Appliances having doors with a horizontal hinge at their lower edge and on which a load is likely to be placed shall have adequate stability.

Compliance is checked by the following test.

The appliance is placed on a horizontal surface with the door open and a mass is gently placed on the geometric centre of the door.

The mass is

– *7 kg for **stationary appliances**;*
– *3,5 kg for **portable appliances**.*

NOTE A sandbag can be used for the load.

The appliance shall not tilt.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

Addition:

Compliance is also checked by the tests of 21.101 to 21.105. During these tests, the appliance is rigidly supported, except for 21.102.

21.101 *Hinged doors are positioned approximately 30° before the fully open position. Sliding doors are positioned so that they are approximately two-thirds open. A force of 35 N is applied to the inside surface of a hinged door at a point 25 mm from its free edge or to the handle of a sliding door.*

The force is applied by means of a spring balance having a spring constant of 1,05 N/mm. It is initially applied with an opposing force applied to the other side of the door or handle. The opposing force is then removed to allow the door to complete its travel to the fully open position.

The test is carried out five times.

*The test is repeated on doors of **stationary appliances** and **built-in appliances** except that*

– *the door is initially placed midway between the fully open and closed positions*;
– *the applied force is 1,5 times the force required to open the door or 65 N, whichever is greater. However, if the force cannot be measured or if the door is opened indirectly, the 65 N force is applied.*

The test is carried out five times.

Doors are placed midway between the fully open and closed positions. A closing force of 90 N is applied to the outside surface of a hinged door at a point 25 mm from the free edge or to the handle of a sliding door, initially with the opposing force as described above.

This test is carried out ten times.

The appliance shall then comply with 32.1.

21.102 *Side-hinged doors are placed in the fully open position. A downward force of 140 N or the maximum force that can be applied in any door position without tilting the appliance, whichever is smaller, is then applied to the free edge of the door and the door is closed. The door is fully opened again with the force still applied.*

This test is carried out five times.

Bottom-hinged doors are opened. A force of 140 N or the maximum force that can be applied without tilting the appliance, whichever is smaller, is applied to the inside surface of the door at the most unfavourable position 25 mm from the free edge.

The force is applied for 15 min.

The appliance shall then comply with 32.1.

21.103 *A cube of wood having a side dimension of 20 mm is attached to an inside corner farthest from the door hinge. An attempt is made to close the door with a force of 90 N applied at the other corner farthest from the hinge in the direction perpendicular to the surface of the door.*

The force is maintained for 5 s.

The cube is then removed. The door is slowly closed until microwave generation becomes possible. The door and its opening means are then manipulated in order to determine the position resulting in the highest microwave leakage.

The appliance shall then comply with 32.1.

The test is repeated with the wooden cube attached to the other corner farthest from the hinge.

NOTE The test is not applicable to sliding doors.

21.104 *The door is closed and its outside surface subjected to three impacts, each having an energy of 3 J. These impacts are applied to the central part of the door and may be at the same point.*

The impact is applied by means of a steel ball having a diameter of 50 mm and a mass of approximately 0,5 kg. The ball is suspended by a suitable cord that is held in the plane of the door. The ball is allowed to fall as a pendulum through the distance required to strike the surface with the specified impact energy.

The door is then opened and its mating surface on the oven is subjected to three similar impacts.

The inside surface of a hinged door is subjected to three impacts as before, the test being made with the door in the fully open position. The impacts are applied to the central part of the door and may be at the same point. However, if a bottom-hinged door is horizontal when in the fully open position, the impacts are applied by allowing the steel ball to fall freely through a distance such that the specified impact energy is obtained.

A bottom-hinged door is further tested by subjecting its seal to three similar impacts. The impacts are made at three different locations.

The appliance shall then comply with 32.1.

21.105 *A bottom-hinged door is opened and a hardwood dowel having a diameter of 10 mm and a length of 300 mm is placed along the bottom hinge. The dowel is positioned such that one end is flush with an outside edge of the door. A closing force of 90 N is applied to the centre of the handle in a direction perpendicular to the surface of the door. The force is maintained for 5 s.*

The test is repeated with the end of the dowel flush with the other outside edge and then with the dowel positioned centrally within the door hinge.

The microwave leakage is measured under the conditions specified in 32.1 and shall not exceed 100 W/m^2.

22 Construction

This clause of Part 1 is applicable except as follows.

22.40 *Modification:*

Replace the second paragraph and the NOTE by the following:

Appliances for **remote operation** shall be fitted with a switch for stopping the operation of the appliance. The actuating member of this switch shall be easily visible and accessible.

22.49 *Replacement:*

For **remote operation**, the duration of operation shall be set before the appliance can be started unless the appliance switches off automatically at the end of a cycle.

Compliance is checked by inspection.

22.51 *Replacement:*

A control on the appliance shall be manually adjusted to the setting for **remote operation** before the appliance can be operated in this mode. There shall be a visual indication on the appliance showing that the appliance is adjusted for **remote operation**.

Compliance is checked by inspection and by manual test.

22.101 **Built-in appliances** shall only be vented through the front, unless provisions are made for venting through a duct.

Compliance is checked by inspection.

22.102 **Microwave oven** vents shall be constructed so that any moisture or grease discharged through them cannot affect **clearances** and **creepage distances** between **live parts** and other parts of the appliance.

Compliance is checked by inspection.

22.103 The appliances shall be constructed in compliance with either 22.103.1 or 22.103.2.

22.103.1 Appliances shall incorporate at least two **door interlocks** that are operated by opening the door, one being a **monitored door interlock**. At least one of the **door interlocks** shall be concealed and not operable by manipulation.

Compliance is checked by inspection and concealment is checked by 22.105.

NOTE The two **door interlocks** can be incorporated in the system of the **monitored door interlock**.

22.103.2 Appliances shall incorporate two independent **monitored door interlocks** that are operated by opening the door. In this case, 22.105 is not applicable.

NOTE None of the **door interlocks** need to be concealed because there are two independent **monitored door interlocks** incorporating supervision devices.

Compliance is checked by inspection and the following test.

The door is slowly opened and, simultaneously, an attempt is made to manually defeat any ***accessible door interlock*** *with test probe B and test probe 18. Each probe is applied one at a time.*

During the tests, the operation of the microwave generator(s) shall not be possible.

22.104 At least one **door interlock** of 22.103.1 and both **monitored door interlocks** of 22.103.2 shall incorporate a switch that disconnects the microwave generator(s) or its supply main circuit.

Compliance is checked by inspection.

22.105 At least one of the **door interlocks** shall be concealed and shall not be operable by manipulation. This **door interlock** shall operate before any **accessible door interlock** can be defeated.

Compliance is checked by the following test.

The door is placed in any position and an attempt is made to operate the concealed ***door interlock*** *by applying test probe B and then probe 18 of IEC 61032 to all openings. The test is repeated with a rod, as shown in Figure 101, to any openings of the* ***door interlock*** *mechanism. Only test probe B, test probe 18, or one rod shall be used one at a time.*

Door interlocks *that operate magnetically are also evaluated by applying a magnet to the enclosure over the* ***door interlock*** *switch. The magnet has a similar configuration and magnetic orientation to the magnets that operate the* ***door interlock****. It shall be capable of exerting a force of 50 N ± 5 N when applied to a mild steel armature having dimensions of 80 mm × 50 mm × 8 mm. In addition, the magnet shall be capable of applying a force of 5 N ± 0,5 N at a distance of 10 mm from the armature.*

It shall not be possible to operate the concealed ***door interlock(s)*** *during the tests.*

*The door is slowly opened and, simultaneously, an attempt is made to manually defeat any **accessible door interlock** with test probe B, test probe 18, the rod and the magnet; each apply separately.*

*The concealed **door interlock(s)** shall operate before any **accessible door interlock** can be defeated.*

22.106 The supervision device of each **monitored door interlock** shall render the appliance inoperable if its switching part fails to control the microwave generator(s).

Compliance is checked by the following test.

*The switching part of the **monitored door interlock** is rendered inoperative. The appliance is supplied at **rated voltage** from a supply source having a short-circuit capacity of at least 1,5 kA for appliances having a **rated voltage** over 150 V and 1,0 kA for other appliances.*

*Appliances having a **rated voltage** less than 150 V and a **rated current** over 20 A are supplied at **rated voltage** from a supply source having a short-circuit capacity of at least 5,0 kA.*

*The appliance is operated with the door closed and an attempt is then made to gain access to the **cavity** in the normal way. It shall not be possible to open the door, unless the microwave generator(s) cease(s) to function and remains inoperable. The supervision device shall not fail in the open-circuit position.*

The supervision device is replaced for subsequent tests if it fails in the closed-circuit position.

*It is necessary to render other **door interlocks** inoperative in order to perform this test in some cases.*

If an internal fuse in the circuit supplying the microwave generator(s) rupture(s), the fuse is replaced and the test is carried out two more times. The internal fuse shall rupture each time.

The test is carried out three more times but with an impedance of (0,4 + j 0,25) Ω in series with the supply source. The internal fuse shall rupture each time.

*For appliances having a **rated voltage** under 150 V and those with a **rated current** over 20 A, the test with the series impedance is not carried out.*

NOTE In case of internal fuse ruptures, the switches, filters and wiring can be replaced each time, if this is stated in the instructions of professional servicing.

22.107 The failure of any single electrical or mechanical component that affects the operation of a **door interlock** shall not cause any other **door interlock**, or the supervision device of the **monitored door interlock** to become inoperative, unless the appliance is rendered inoperable.

Compliance is checked by inspection and, if necessary, by simulating component failure and operating the appliance as in normal use.

NOTE This requirement does not apply to components of the supervision device that comply with the test of 22.106.

22.108 The **door interlocks** incorporated to comply with 22.103 shall operate before undue microwave leakage occurs.

Compliance is checked by the following test.

*All **door interlocks** except one are rendered inoperative. The appliance is supplied at **rated voltage** and operated with the load specified in 32.1. The door opening sequence is carried out in small increments during which the microwave leakage is measured.*

The appliance shall comply with 32.1.

*The test is repeated on each **door interlock** in turn.*

NOTE 1 **Door interlocks** are only tested if they are necessary for compliance with 22.103.

NOTE 2 It can be applicable to render the supervision device of the **monitored door interlock** inoperative when carrying out the test.

22.109 There shall be no undue microwave leakage if thin material is introduced between the door and its mating surface.

Compliance is checked by closing the door on a strip of paper having a width of 60 mm ± 5 mm and a thickness of 0,15 mm ± 0,05 mm, the paper being placed between the door and its mating surface.

The appliance shall then comply with 32.1.

The test is carried out ten times with the paper in different locations.

22.110 There shall be no undue microwave leakage if the door seals become contaminated by food residues.

Compliance is checked by the following test.

The door seal is coated with cooking oil. If the seal has an open choke, the trough is filled with oil.

The appliance shall then comply with 32.1.

22.111 There shall be no undue microwave leakage when the door corners are subjected to distortion.

Compliance is checked by the following test.

*The appliance is supplied at **rated voltage** and operated with the load specified in 32.1. The door and its opening means are manipulated until the largest door gap permitting microwave generation is obtained. A pull force is applied perpendicular to the surface of the door to each corner one at a time. The force is slowly increased to 40 N.*

During the test, the microwave leakage is measured under the conditions specified in 32.1 and shall not exceed 100 W/m^2.

After the test, the appliance shall comply with 32.1.

22.112 There shall be no undue microwave leakage, and the **temperature-sensing probe** shall not become damaged when a probe or its cord is trapped by the door.

Compliance is checked by the following test.

*The probe is connected as in normal use, the sensing part or cord being allowed to rest in the most unfavourable position likely to occur. The door is closed against the sensing part or the cord with a force of 90 N applied for 5 s in the most unfavourable place. The force is then released and, if the oven can be operated with the **temperature-sensing probe** still being placed in the trapped position, the microwave leakage is measured under the conditions specified in 32.1 and shall not exceed 100 W/m^2.*

*After the test, the appliance shall comply with 32.1 and the **temperature-sensing probe** shall comply with 8.1, 15.101 and Clause 29.*

22.113 There shall be no undue microwave leakage when **detachable parts** are removed.

Compliance is checked by the following test.

***Detachable parts** are removed, except **shelves**, unless a horizontal surface greater than 85 mm in diameter is made available when they are removed.*

*The appliance shall then comply with 32.1, the load being placed on the horizontal surface as close as possible to the centre of the **cavity**.*

NOTE In order to avoid detecting non-radiating standing waves, the tip of the instrument probe is not inserted into an opening resulting from the removal of a **detachable part**.

22.114 A single fault such as failure of **basic insulation** or a loose wire bridging the insulation system shall not allow operation of the microwave generator(s) with the door open.

*Compliance is checked by inspection and if, necessary, by simulating relevant faults. Wires that can become loose are disconnected and allowed to fall out of position but are not otherwise manipulated. They shall not come into contact with other **live parts** or earthed parts if this results in all **door interlocks** becoming inoperative.*

NOTE 1 Failure of **reinforced insulation** or **double insulation** is considered to be two faults.

NOTE 2 Wires secured by two independent fixings are not considered likely to become loose.

22.115 There shall be no access to the **cavity** through the viewing screen.

Compliance is checked by inspection and the following test.

*A straight steel rod having a diameter of 1 mm and a flat end is pressed perpendicularly against the viewing screen with a force of 2 N. The rod shall not enter the **cavity**.*

22.116 Appliances for installing in road vehicles, caravans and similar vehicles shall withstand the vibrations to which they can be subjected.

Compliance is checked by carrying out the vibration tests specified in IEC 60068-2-6 under the following conditions.

The appliance is fastened in its normal position of use to a vibration-generator by means of straps around the enclosure. The type of vibration is sinusoidal, and the severity is as follows:

- *the direction of vibration is vertical;*
- *the amplitude of vibration is 0,35 mm;*
- *the sweep frequency range is 10 Hz to 55 Hz;*
- *the duration of the test is 30 min.*

The appliance shall show no damage that could impair compliance with 8.1, 16.3 and Clauses 29 and 32, and connections shall not have worked loose.

22.117 If **electronic circuits** are used to provide protection against microwave leakage, they shall be designed so that a fault condition will not affect protection against microwave leakage.

Compliance is checked by applying the tests in Clause 19 in conjunction with the requirements and test specifications in 22.105, 22.106, 22.107 and 22.108.

22.118 Inadvertent operations during handling of the container during normal use of **fixed appliances** and **built-in appliances** being used equal or higher than 900 mm above the floor having **detachable** turntables shall not lead to a hazardous situation due to falling down turntables. This is not applicable for appliances with horizontal bottom hinged door.

Compliance is checked by inspection and the following test.

*The bearing of the **detachable** turntable of **microwave ovens** shall be placed in the most unfavourable position. A force which will be increased from 0 N up to the maximum of 10 N is applied vertically downwards to the front edge of the turntable.*

*During the test, the turntable shall not slide out of the **cavity** and fall down.*

*A cylindrical container of borosilicate glass with a maximum thickness of 3 mm, an external diameter of approximately 190 mm, a height of approximately 90 mm and an outer bottom curvature of approximately 5 mm is filled with 1 000 g ± 50 g cold water and placed on the turntable. With a horizontal force applied at the top of the container which will be increased from 0 N up to the maximum of 10 N, an attempt is made to pull the container out of the **cavity** without any lifting from the turntable.*

*During the test, the turntable shall not slide out of the **cavity** and fall down.*

NOTE During the test, it is possible that the container falls out of the **cavity**.

22.119 Outer glass panels of **microwave oven** doors which break during the test of 21.104 and with an area having any two orthogonal dimensions exceeding 75 mm shall be made from one of the following glasses.

– Glass that breaks into small pieces when it fractures.

  Compliance is checked by the following test which is performed on two samples.

  Frames or other parts attached to the glass panel to be tested are removed and the glass is placed on a rigid horizontal flat surface.

  NOTE 1 The edges of the sample to be tested are contained within a frame of adhesive tape in such a manner that the broken pieces remain in place after breakage but without hindering expansion of the sample.

  The sample under test is broken by means of a test punch having a head with a mass of 75 g ± 5 g and a conical tungsten carbide tip with an angle of 60° ± 2°. The punch shall be positioned approximately 13 mm in from the longest edge of the glass at the midpoint of that edge. The punch is then hit by a hammer so that the glass breaks.

  A transparent mask of 50 mm × 50 mm is placed on the fractured glass except within a peripheral margin of 25 mm from the edge of the sample.

  The assessment shall be undertaken on at least two areas of the sample, and the areas chosen shall contain the largest particles.

  The number of crack free particles within the mask is counted and for each assessment shall not be less than 40. The particle count shall be made within 5 min of the fracture. Each particle wholly contained within the area of the mask shall be counted as one particle and each particle that is partially within the mask shall be counted as a half particle.

  NOTE 2 In the case of curved glass, plane pieces of the same material can be used for the test.

– Glass that is not released or dropped from its normal position when broken.

Compliance is checked by breaking the glass when mounted in its normal position in the appliance by means of a test punch having a head with a mass of 75 g ± 5 g and a conical tungsten carbide tip with an angle of 60° ± 2°. The punch shall be positioned approximately 13 mm in from the longest edge of the glass at the midpoint of that edge. The punch is then hit by a hammer so that the glass breaks.

At the conclusion of this test, the glass shall not be broken or cracked such that pieces are released or dropped from their normal position. Glass that is released within the immediate vicinity of the punch tip as a result of the punch impacting the sample under test is ignored.

– Glass with enhanced mechanical strength.

Compliance is checked by the pendulum hammer test Eha of IEC 60068-2-75.

For the test, the glass panels are supported according to their method of incorporation in the appliance.

The test is performed with three blows applied at the most critical point on two samples, the impact energy of each blow shall be 5 J.

At the conclusion of the tests, the glass shall not be broken or cracked.

22.120 Where interlocks other than **door interlocks** are required to comply with this standard and are operated by **detachable parts**, they shall be guarded so that accidental operation is prevented.

Compliance is checked by inspection and by manual test with test probe B and test probe 18 one at a time.

22.121 For appliances that are controlled by programmable **electronic circuits** that limit the number of heating elements and motors from being energised at the same time, simultaneous activation of any combination of heating elements and motors shall not render the appliance unsafe.

Compliance is checked as follows:

– *the fault/error conditions specified in Table R.1 are applied and evaluated in accordance with the relevant requirements of normative Annex R; or*

– *the appliance is operated under conditions of Clause 11 while being supplied at **rated voltage**, the programmable **electronic circuits** being modified to allow simultaneous activation of all heaters and motors under their control. Under these conditions, compliance with 19.13 shall be fulfilled.*

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1

NOTE 101 IEC 60989[2] is not applicable to power transformers that supply the magnetron.

24.1.4 *Addition:*

[2] Withdrawn.

Interlocks are subjected to the following test which is carried out on six samples.

*The interlocks are connected to a load that simulates the conditions occurring in the appliance when it is supplied at **rated voltage**. They are operated at a rate of approximately six cycles per minute. The number of cycles is:*

– ***door interlocks*** *50 000;*
– *interlocks only operated during **user maintenance*** *5 000.*

After the test, the interlocks shall not be damaged to such an extent that their further use is impaired in this standard.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.14 *Addition:*

*For **temperature-sensing probes**, the total number of flexings is 5 000. Probes with circular-section cords are turned through 90° after 2 500 flexings.*

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable except as follows.

27.1

NOTE 101 For **class I appliances**, one pole of the output of power supply of microwave generator(s), if any, is earthed for functional purposes.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2 *Addition:*

*For appliances that allow a preselected start time, appliances with a keep-warm function and appliances with **remote operation**, 30.2.3 is applicable. For other appliances, 30.2.2 is applicable.*

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable except as follows.

32.1 *Addition:*

Compliance for microwave leakage is checked by the following test.

A load of 275 g ± 15 g of potable water having a temperature of 20 °C ± 2 °C, in a thin-wall borosilicate glass vessel having an inside diameter of approximately 85 mm, is placed on the centre of the ***shelf****. The appliance is supplied at* ***rated voltage*** *and operated with the microwave power control at the highest setting.*

Microwave leakage is determined by measuring the microwave flux density using an instrument that reaches 90 % of its steady reading in 2 s to 3 s when subjected to a stepped input signal. The instrument antenna is moved over the external surface of the appliance to locate the highest microwave leakage, particular attention being given to the door and its seals.

The microwave leakage at any point 50 mm or more from the external surface of the appliance shall not exceed 50 W/m^2.

NOTE 101 If compliance with the test is in doubt due to a high water temperature, the test is repeated with a fresh load.

Dimensions in millimetres

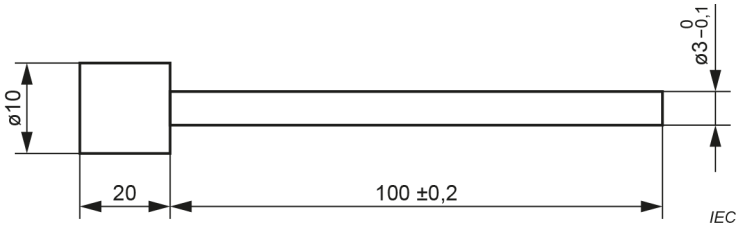
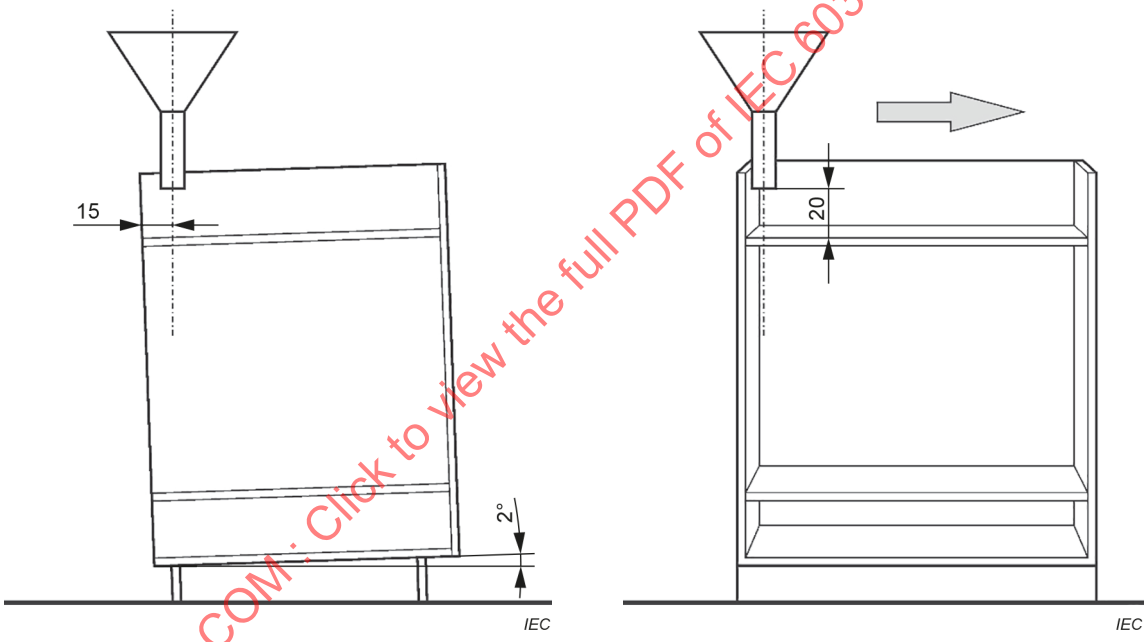


Figure 101 – Test rod for door interlock concealment

Figure 102 – Void

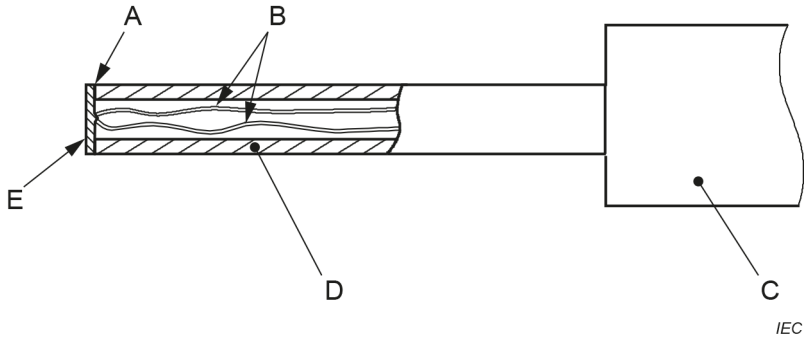
Dimensions in millimetres



a) Side view

b) Front view

Figure 103 – Test cabinet including separation board, position of funnel and example for direction of tilt



Key

A adhesive

B thermocouple wires 0,3 mm diameter to IEC 60584-1 Type K

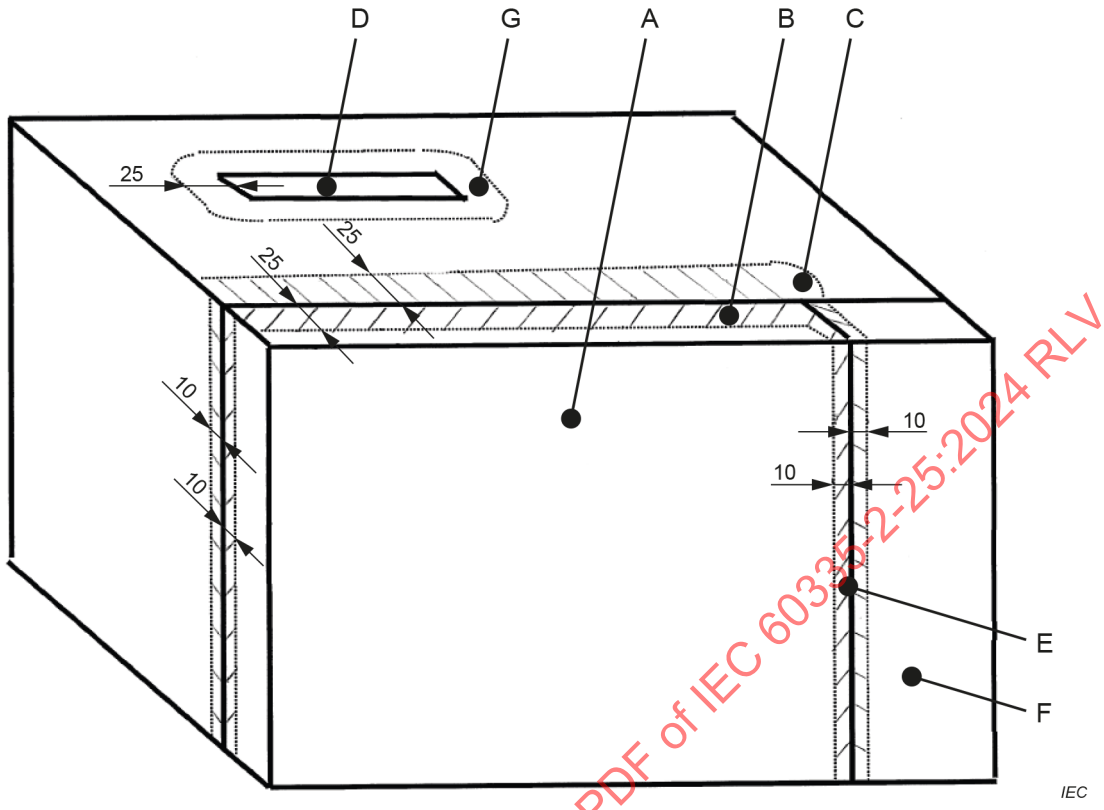
C handle arrangement permitting a contact force of 4 N ± 1 N

D polycarbonate tube: inside diameter 3 mm, outside diameter 5 mm

E tinned copper disc: 5 mm diameter, 0,5 mm thick with flat contact face

Figure 104 – Probe for measuring surface temperatures

Dimensions in millimetres



Key

A **microwave oven** door

B excluded area on the **microwave oven** door (Zone 1)

C excluded area around the **microwave oven** door (Zone 2)

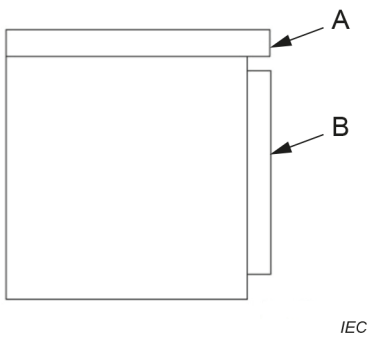
D vent

E door gap

F **microwave oven** front surface

G excluded area around vents (Zone 3)

Figure 105 – Front view of appliance with identification of excluded areas

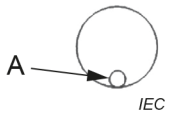


Key

A work surface

B built-in **microwave oven**

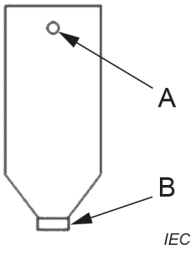
Figure 106 – Arrangement of work surface for spillage test on built-in microwave oven



Key

A bottle cap hole – diameter 8 mm

Figure 107 – Detail of bottle cap and position of hole



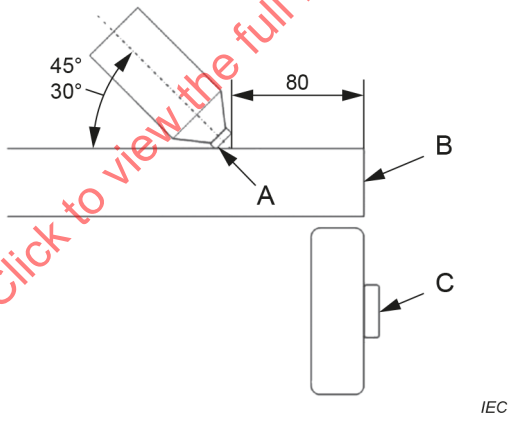
Key

A bottle hole with diameter 8 mm

B bottle cap

Figure 108 – Spillage solution bottle

Dimensions in millimetres



Key

A bottle cap hole position

B edge of work surface

C front of **microwave oven**

Figure 109 – Bottle position for the spillage test

Annexes

The annexes of Part 1 are applicable except as follows.

Annex A
(informative)

Routine tests

This annex of Part 1 is applicable except as follows.

A.2 Earth continuity test

Modification:

The current in the test circuit may be increased up to 100 mA.

A.101 Marking and instructions

The covers are checked to ensure that they are marked with the warnings concerning microwave energy.

The appliance is checked to ensure that the corresponding instructions are provided with it.

A.102 Construction

*The operation of the **door interlock** system is checked to ensure that microwave generation ceases when the door is opened.*

A.103 Microwave leakage

*The **microwave oven** is supplied at **rated voltage** and operated with the microwave power control adjusted to the highest setting. A load as specified in 32.1 or a load with equal dielectric and thermal properties shall be used. The energy flux density of microwave leakage is measured at any point approximately 50 mm between the field sensor and the external surface of the appliance. The measuring instrument is moved over the external surface of the oven and the microwave leakage is measured.*

The microwave leakage shall not exceed 50 W/m^2, as recorded with an instrument fulfilling at least the specifications in Clause A.104 regarding its proper function.

A.104 Microwave leakage instrument minimum specifications

A.104.1 *The following specification applies only for routine tests and may also apply for checks of **microwave ovens** after repair or servicing. Instruments for type testing shall fulfil more stringent requirements, which are obtained from National bodies responsible for protection against non-ionising radiation.*

A.104.2 *Instruments shall be subjected regular checks by carrying out the following tests, to ensure their proper function is maintained. The tests for instrument compliance are made at room temperature. For carrying out the tests, the position of the field sensor shall be known and preferably be marked. In order to allow measurements specified in A.104.3, the minimum resolution of the instrument under test (IUT) shall be 1 W/m^2.*

A.104.3 *The checks are carried out either using a generator set-up in an anechoic chamber or using a reference instrument in substitution mode. The far field shall be linearly polarized. The field sensor of the instrument under test (IUT) shall be placed at the position of the reference field, where the flux density is 10 W/m^2 or 50 W/m^2, depending on the task. The range selector, if any, shall be set to the most appropriate range to measure a flux density of 10 W/m^2 or 50 W/m^2, depending on the task and with a tolerance from −40 % to ± 60 %. By slowly rotating the IUT field sensor for 360° around its axis which is aligned to the propagation direction of the far field and directed towards the radiation source, the minimum and maximum reading shall be found and recorded. If the deviation of minimum and maximum readings is less than or equal to ± 2 dB (i.e. from −37 % to +58 %) related to the reference field, it is assumed that the IUT complies with this standard.*

Annex B
(normative)

Battery-operated appliances, separable batteries and detachable batteries for battery-operated appliances

This annex of Part 1 is applicable except as follows.

B.11.1 *Modification:*

*For appliances operated with **detachable batteries** or **separable batteries** that are disconnected from the appliance for charging purposes, the appliance is operated as specified in 11.7 or AA 11.7 until it completes that duration of the test as specified or it no longer operates due to depletion of the **battery**. If the battery is depleted before the appliance completes the duration of the test, the depleted **battery** is immediately replaced with another **battery** that is **fully charged**, the **battery** being the model or type reference of the **battery** provided or indicated in the instructions. The test is continued until the appliance completes the duration of the test as specified or it no longer operates due to depletion of the **battery**.*

*For appliances incorporating **integral batteries** or **separable batteries** not disconnected from the appliance for charging purposes, and that cannot perform their intended function while the **batteries** are being charged, the appliance is operated as specified in 11.7 and AA.11.7 until it cannot perform its intended function due to the depletion of the **batteries**.*

*For appliances operated with **batteries** that are replaceable, including **integral batteries** that are replaceable, or **non-rechargeable batteries**, the appliance is operated until the minimum capacity of the **battery** as specified in Table B.1 has been delivered or the appliance competes the duration of the test as specified in 11.7 and AA.11.7, whichever occurs first.*

B.22.3 *Addition:*

For parts of appliances situated not more than 850 mm above the floor after installation or in normal use, in addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

B.22.4 *Addition:*

For parts of appliances situated not more than 850 mm above the floor after installation or in normal use, in addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

Annex R
(normative)

Software evaluation

This annex of Part 1 is applicable except as follows.

R.2.2.5 *Modification:*

For programmable **electronic circuits** with functions requiring software incorporating measures to control the fault/error conditions specified in Table R.1 or Table R.2, detection of a fault/error shall occur before compliance with Clause 19 or 22.121 is impaired.

R.2.2.9 *Modification:*

The software and safety-related hardware under its control shall be initialized and shall terminate before compliance with Clause 19 or 22.121 is impaired.

Annex AA
(normative)

Combination microwave ovens

The following modifications to this standard are applicable for **combination microwave ovens**.

The clause numbers in this annex refer to the clause numbers in the main part of this standard. Clauses that are additional to the clauses in the main part of this standard are identified by adding the annex letter with the numbering starting at 201.

1 Scope

AA.1.201 For **stationary combination microwave ovens**, IEC 60335-2-6 is also applicable. For **portable combination microwave ovens**, IEC 60335-2-9 is also applicable. However, the requirements of these standards do not take precedence over this standard.

NOTE If a **combination microwave oven** has a mode of operation independent of microwave generation, then this mode is tested only according to the requirements in the relevant standard. If a **combination microwave oven** has a mode of operation without the use of resistive heating elements, it is tested to comply with the relevant requirements of this standard.

3 Terms and definitions

3.1.9
normal operation

Addition:

The appliance is operated with the controls adjusted to the most unfavourable setting in accordance with the instructions for the intended mode of operation.

5 General conditions for the tests

5.3

NOTE 201 When testing the different modes of operation, only those tests having the most unfavourable conditions are carried out.

5.101

Replace as follows.

***Combination microwave ovens** are tested as **combined appliances**.*

7 Marking and instructions

7.12 *Addition:*

The instructions for use shall also include the substance of the following.

WARNING: When the appliance is operated in the combination mode, children should only use the oven under adult supervision due to the temperatures generated.

11 Heating

AA.11.7.201

Microwave ovens *having a grill that can be operated simultaneously with microwave generation are operated for 30 min, the microwave power output being approximately 50 %.*

Microwave ovens *having convection heating that can be operated simultaneously with microwave generation are operated for 60 min, the microwave power output being approximately 50 %.*

Microwave ovens *having a grill or convection heating that can be operated sequentially with microwave generation are operated for 15 min with the microwave power output control adjusted to the highest setting, followed by 30 min of operation without microwave generation.*

If more than half the water evaporates during the test, the vessel is refilled with boiling water, the door not being opened for more than 10 s.

NOTE 201 These tests are considered to cover appliances having programmers or timers.

For appliances incorporating ***integral batteries*** *or* ***separable batteries*** *not disconnected from the appliance for charging purposes:*

– *the* ***battery*** *that has been* ***fully discharged*** *is charged for 1 h, while the appliance is operated as specified, if allowed by the construction of the appliance;*

– *the* ***battery*** *that has been* ***fully discharged*** *is charged, for a duration of 24 h or until it is* ***fully charged*** *whichever is shorter, without the* ***battery-operated appliance*** *performing its intended function.*

11.8

NOTE 201 When **combination microwave ovens** are operated under the combination mode, the limit values in IEC 60335-2-6 are applied for **stationary appliances** and the limit values in IEC 60335-2-9 are applied for **portable appliances**.

15 Moisture resistance

Addition:

Subclause 15.102 and Subclause 15.103 in the main part of this standard take precedence over the similar requirements of IEC 60335-2-6.

18 Endurance

Addition:

Before measuring the microwave leakage, the following additional conditioning is carried out:

– *resistive heating elements for radiant heating are operated for 15 min;*

– *resistive heating elements for convection heating are operated for 30 min;*

– *pyrolytic self-cleaning ovens are operated for one cleaning cycle.*

19 Abnormal operation

19.1

Modify as follows:

The test of 19.102 is carried out with the appliance supplied at 1,06 times ***rated voltage****.*

22 Construction

22.51 *Addition:*

For pyrolytic function in **combination microwave ovens**, the requirements of IEC 60335-2-6:—, 22.51 for **remote operation** apply.

Subclause 22.119 in the main part of this standard takes precedence over the similar requirements of IEC 60335-2-6.

29 Clearances, creepage distances and solid insulation

Replace as follows.

This clause of Part 1 is applicable except as follows.

29.2 *Modification:*

Add the following dash to the second paragraph:

– the insulation is exposed to exhaust air from the oven **cavity**, in which case pollution degree 3 applies.

29.3 *Addition:*

There are no thickness requirements for sheaths of **visibly glowing heating elements** if the **door interlocks** provide **all-pole disconnection**.

Annex BB
(normative)

Microwave ovens intended to be used on board ships

The following modifications to this standard are applicable for **microwave ovens** intended to be used on board ships.

The clause numbers in this annex refer to the clause numbers in the main part of this standard. Clauses that are additional to the clauses in the main part of this standard are identified by adding the annex letter with the numbering starting at 201.

6 Classification

6.2 *Addition:*

Appliances for **open deck** use shall be IPX6.

7 Marking and instructions

7.1 *Modification:*

Replace the second dashed item in the first paragraph by the following:

– **rated frequency** or **rated frequency range** in Hz;

7.12 *Addition:*

The instructions for use shall also include the substance of the following.

– usage on board ships;
– installation place (**open deck** protective enclosure, **dayrooms**);
– fastening means.

The instructions for **microwave ovens** that are intended to be used on board ships shall state:

CAUTION: Verify that the voltage and frequency of the mains supply of the ship matches the **rated voltage** and **rated frequency** or **rated frequency range** of the **microwave oven**.

22 Construction

BB.22.201 Appliances shall withstand the pulses to which they can be subjected.

Compliance is checked by carrying out the half-sine pulse tests specified in IEC 60068-2-27 under the following conditions.

The appliance is fastened in its normal position of use to a shock-testing machine by means of straps around the enclosure.

The type of pulse is a half-sine pulse and the severity is as follows.

– *application of the half-sine pulse is in all 3 axes;*
– *peak acceleration: 250 m/s^2,*
– *duration of each half-sine pulse: 6 ms;*

– *number of half-sine pulses in each direction: 1 000 ± 10.*

The appliance shall show no damage that could impair compliance with 8.1, 16.3, Clause 29 and 32.1, and connections shall not have worked loose.

BB.22.202 Appliances shall withstand the vibrations to which they can be subjected.

Compliance is checked by carrying out the vibration tests specified in IEC 60068-2-6 under the following conditions.

The appliance is fastened in its normal position of use upon a vibration table by means of straps around the enclosure. The type of vibration is sinusoidal and the severity is as follows:

– *direction of vibration is vertical and horizontal;*
– *amplitude of vibration: 0,35 mm;*
– *sweep frequency range: 10 Hz to 150 Hz;*
– *duration of the test: 30 min.*

The appliance shall show no damage that could impair compliance with 8.1, 16.3, Clause 29 and 32.1, and connections shall not have worked loose.

31 Resistance to rusting

Replace as follows:

This clause of Part 1 is applicable except as follows.

Addition:

Compliance is checked by the salt mist test Kb of IEC 60068-2-52,

– *for **open deck** use, severity 1 is applicable;*
– *for **dayrooms** use, severity 2 is applicable.*

Before the test, coatings are scratched by means a hardened steel pin, the end of which has the form of a cone with an angle of 40°. Its tip is rounded with a radius of 0,25 mm ± 0,02 mm. The pin is loaded so that the force exerted along its axis is 10 N ± 0,5 N. The scratches are made by drawing the pin along the surface of the coating at the speed of approximately 20 mm/s. Five scratches are made at least 5 mm apart and at least 5 mm from the edges.

After the test, the appliance shall not have deteriorated to such an extent that compliance with this standard, in particular with Clauses 8 and 27, is impaired. The coating shall not be broken and shall not have detached from the metal surface.

Bibliography

The Bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60335-2-90, *Household and similar electrical appliances – Safety – Part 2-90: Particular requirements for commercial microwave ovens*

IEC 60335-2-110, *Household and similar electrical appliances – Safety – Part 2-110: Particular requirements for commercial microwave appliances with insertion or contacting applicators*

IEC 60519-6, *Safety in installations for electroheating and electromagnetic processing – Part 6: Particular requirements for high frequency dielectric and microwave heating and processing equipment*

IEC 60989:1991 [3], *Separating transformers, autotransformers, variable transformers and reactors*

[3] Withdrawn.

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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APPAREILS ÉLECTRODOMESTIQUES ET ANALOGUES – SÉCURITÉ –

Partie 2-25: Exigences particulières pour les fours à micro-ondes, y compris les fours à micro-ondes combinés

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L'IEC 60335-2-25 a été établie par le sous-comité 61B: Sécurité des appareils à micro-ondes à usage domestique et commercial, du comité d'études 61 de l'IEC: Sécurité des appareils électrodomestiques et analogues. Il s'agit d'une Norme internationale.

Cette huitième édition annule et remplace la septième édition parue en 2020. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) certains paragraphes ont été modifiés pour les socles femelles de connecteurs et les socles de prises de courant;
b) le 7.12 a été amélioré pour plus de clarté;
c) les 8.1.1 et 20.2 ont été modifiés afin d'utiliser le calibre d'essai 19;
d) les 10.1 et 10.2 ont été améliorés pour les fours à micro-ondes de type onduleur;
e) des valeurs d'échauffement maximales ont été ajoutées pour les surfaces accessibles extérieures en 11.8;
f) le critère d'essai a été modifié en 15.101;
g) le 15.102 a été modifié à des fins d'harmonisation avec l'IEC 60335-2-6;
h) les 8.1.3, 15.103, 19.11.2, 19.13, 22.105, 22.106, 22.111 et la Figure 101 ont été améliorés pour plus de clarté;
i) les 22.103.2, 22.105 et 22.120 ont été modifiés afin d'utiliser le calibre d'essai 18;
j) le 16.101 a été modifié de manière à déplacer le contenu du 16.101.1 et du 16.101.2 directement sous le 16.101;
k) le 22.119 a été modifié de manière à déplacer le contenu du 22.119.1, du 22.119.2 et du 22.119.3 directement sous le 22.119.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
61B/701/FDIS	61B/705/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La version française de la norme n'a pas été soumise au vote.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Une liste de toutes les parties de la série IEC 60335, publiées sous le titre général *Appareils électrodomestiques et analogues – Sécurité*, se trouve sur le site web de l'IEC.

La présente partie 2 doit être utilisée conjointement avec la dernière édition de l'IEC 60335-1 et ses amendements sauf si cette édition l'exclut. Dans ce cas, la dernière édition qui n'exclut pas la présente partie 2 est utilisée. Elle a été établie sur la base de la sixième édition (2020) de cette norme.

NOTE 1 L'expression "la Partie 1" utilisée dans la présente norme fait référence à l'IEC 60335-1.

La présente Partie 2 complète ou modifie les articles correspondants de l'IEC 60335-1, de façon à transformer cette publication en norme IEC: Exigences particulières pour les fours à micro-ondes, y compris les fours à micro-ondes combinés.

Lorsqu'un paragraphe particulier de la Partie 1 n'est pas mentionné dans cette Partie 2, ce paragraphe s'applique pour autant que cela soit raisonnable. Lorsque la présente norme mentionne "addition", "modification" ou "remplacement", le texte correspondant de la Partie 1 doit être adapté en conséquence.

NOTE 2 Le système de numérotation suivant est utilisé:

– les paragraphes, tableaux et figures qui s'ajoutent à ceux de la Partie 1 sont numérotés à partir de 101;

– à l'exception de celles qui sont dans un nouveau paragraphe ou de celles qui concernent des notes de la Partie 1, les notes sont numérotées à partir de 101, y compris celles des articles ou paragraphes qui sont remplacés;

– les annexes qui sont ajoutées sont désignées AA, BB, etc.

NOTE 3 Les caractères d'imprimerie suivants sont utilisés:

– exigences: caractères romains;

– *modalités d'essais: caractères italiques;*

– notes: petits caractères romains.

Les termes en **gras** dans le texte sont définis à l'Article 3. Lorsqu'une définition concerne un adjectif, l'adjectif et le nom associé figurent également en **gras**.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé, ou
- révisé.

NOTE 4 L'attention des Comités nationaux est attirée sur le fait que les fabricants d'appareils et les organismes d'essai peuvent avoir besoin d'une période transitoire après la publication d'une nouvelle publication IEC, ou d'une publication amendée ou révisée, pour fabriquer des produits conformes aux nouvelles exigences et pour adapter leurs équipements aux nouveaux essais ou aux essais révisés.

Le comité recommande que le contenu de cette publication soit adopté pour application nationale (obligatoire) au plus tôt 12 mois et au plus tard 36 mois après la date de publication.

Les différences suivantes existent dans les pays indiqués ci-après.

– 5.3: Les fuites micro-ondes ne doivent pas dépasser 10 W/m^2 pendant l'essai initial (Japon et États-Unis).
– 6.1: Les fours à micro-ondes peuvent être de classe 0I si leur tension assignée ne dépasse pas 150 V (Japon).
– 7.12: Il existe des instructions particulières liées à l'utilisation et à la maintenance des **fours à micro-ondes** concernant le risque d'exposition à l'énergie micro-ondes (États-Unis).
– 7.12: Il est interdit de placer l'appareil dans un meuble qui comporte une porte (Japon).
– Article 18: L'essai est réalisé sur deux appareils (États-Unis).
– 19.11.2: La variation de tension absorbée n'est pas appliquée (États-Unis).
– 19.13: Les fuites micro-ondes sont mesurées seulement à l'issue de chaque essai (États-Unis).
– 21.102: La force appliquée est de 222 N (États-Unis).
– 21.105: Les fuites micro-ondes ne doivent pas dépasser 50 W/m^2 (Japon et États-Unis).
– 22.111: Les fuites micro-ondes sont mesurées seulement à l'issue de l'essai (États-Unis).
– 22.112: Les fuites micro-ondes ne doivent pas dépasser 50 W/m^2 (Japon et États-Unis).
– 22.115: Tout accès à la cavité doit être empêché (États-Unis).

INTRODUCTION

Il a été admis par hypothèse, en établissant la présente Norme internationale, que l'exécution de ses dispositions était confiée à des personnes expérimentées et ayant une qualification appropriée.

Les documents de recommandations concernant l'application des exigences de sécurité pour les appareils peuvent être consultés dans les documents de support du CE 61 et du SC 61B, accessibles sur le site web de l'IEC à l'adresse:

https://www.iec.ch/tc61/supportingdocuments
https://www.iec.ch/sc61b/supportingdocuments

Cette information est donnée à l'intention des utilisateurs de la présente Norme internationale et ne constitue nullement un remplacement du texte normatif de la présente norme.

La présente norme reconnaît le niveau de protection internationalement accepté contre les dangers électriques, mécaniques, thermiques, liés au feu et au rayonnement des appareils, lorsqu'ils fonctionnent comme en usage normal en tenant compte des instructions du fabricant. Elle couvre également les situations anormales auxquelles on peut s'attendre dans la pratique et elle tient compte de la façon dont les phénomènes électromagnétiques peuvent affecter le fonctionnement sûr des appareils.

Cette norme tient compte autant que possible des exigences de l'IEC 60364, de façon à rester compatible avec les règles d'installation quand l'appareil est raccordé au réseau d'alimentation. Cependant, des règles nationales d'installation peuvent être différentes.

Si un appareil relevant du domaine d'application de la présente norme comporte également des fonctions couvertes par une autre Partie 2 de l'IEC 60335, la Partie 2 correspondante est appliquée à chaque fonction séparément, dans la limite du raisonnable. Si cela s'applique, l'influence d'une fonction sur les autres fonctions est prise en compte.

Lorsqu'une Partie 2 ne comporte pas d'exigences complémentaires pour couvrir les risques traités dans la Partie 1, la Partie 1 s'applique.

NOTE 1 Cela signifie que les comités d'études responsables pour les Parties 2 ont déterminé qu'il n'était pas nécessaire de spécifier des exigences particulières pour l'appareil en question en plus des exigences générales.

Cette norme est une norme de famille de produits traitant de la sécurité d'appareils et a préséance sur les normes horizontales et génériques couvrant le même sujet.

NOTE 2 Les publications horizontales, les publications fondamentales de sécurité et les publications groupées de sécurité couvrant un danger ne s'appliquent pas, parce qu'elles ont été prises en considération lorsque les exigences générales et particulières ont été étudiées pour la série de normes IEC 60335.

Un appareil conforme au texte de la présente norme ne sera pas nécessairement jugé conforme aux principes de sécurité de la norme si, lorsqu'il est examiné et soumis aux essais, il apparaît qu'il présente d'autres caractéristiques qui compromettent le niveau de sécurité visé par ces exigences.

Un appareil utilisant des matériaux ou présentant des modes de construction différents de ceux décrits dans les exigences de cette norme peut être examiné et essayé en fonction de l'objectif poursuivi par ces exigences et, s'il est jugé pratiquement équivalent, il peut être estimé conforme aux principes de sécurité de la norme.

NOTE 3 Les normes traitant des aspects non relatifs à la sécurité des appareils électrodomestiques sont:

– les normes IEC publiées par le comité d'études 59 concernant les méthodes de mesure d'aptitude à la fonction;
– les normes CISPR 11 et CISPR 14-1, ainsi que les normes applicables de la série IEC 61000-3 concernant les émissions électromagnétiques;
– la norme CISPR 14-2 concernant l'immunité électromagnétique;
– les normes IEC publiées par le comité d'études 111 concernant l'environnement.

APPAREILS ÉLECTRODOMESTIQUES ET ANALOGUES – SÉCURITÉ –

Partie 2-25: Exigences particulières pour les fours à micro-ondes, y compris les fours à micro-ondes combinés

1 Domaine d'application

L'article de la Partie 1 est remplacé par le texte suivant.

La présente partie de l'IEC 60335 traite de la sécurité des **fours à micro-ondes** à usage domestique et analogue dont la **tension assignée** est inférieure ou égale à 250 V, y compris les appareils alimentés en courant continu (CC) et les **appareils alimentés par batteries**.

La présente norme traite également des **fours à micro-ondes combinés**, pour lesquels l'Annexe AA normative s'applique.

La présente norme traite également des **fours à micro-ondes** destinés à être utilisés à bord de navires, pour lesquels l'Annexe BB normative s'applique.

Les appareils non destinés à un usage domestique normal, mais qui peuvent néanmoins constituer une source de danger pour le public, tels que les appareils destinés à être utilisés par des utilisateurs non avertis dans des magasins, chez des artisans et dans des fermes, sont compris dans le domaine d'application de la présente norme. Toutefois, si l'appareil est destiné à être utilisé par des professionnels pour la préparation d'aliments à des fins commerciales, cet appareil n'est pas considéré comme étant destiné uniquement à un usage domestique et analogue.

Dans la mesure du possible, la présente norme traite des dangers courants que présentent les appareils et auxquels sont exposés tous les individus situés à l'intérieur et autour de l'habitation. Cependant, elle ne tient en général pas compte:

– des personnes (y compris des enfants) dont:
  - les capacités physiques, sensorielles ou mentales; ou
  - le manque d'expérience et de connaissance

  les empêchent d'utiliser l'appareil en toute sécurité sans surveillance ou instruction;
– des enfants qui jouent avec l'appareil.

L'attention est attirée sur le fait que

– pour les appareils destinés à être utilisés dans des véhicules ou à bord de navires ou d'avions, des exigences supplémentaires peuvent être nécessaires;
– dans de nombreux pays, des exigences supplémentaires sont spécifiées par les organismes nationaux de la santé, par les organismes nationaux responsables de la protection des travailleurs et par des organismes similaires.

La présente norme ne s'applique pas

– aux **fours à micro-ondes** à usage commercial (IEC 60335-2-90);
– aux appareils à micro-ondes commerciaux avec applicateurs à insertion ou à contact (IEC 60335-2-110);
– aux installations de chauffage industriel à hyperfréquences (IEC 60519-6);

– aux appareils destinés à des usages médicaux (IEC 60601);
– aux appareils destinés à être utilisés dans des locaux qui présentent des conditions particulières, telles que la présence d'une atmosphère corrosive ou explosive (poussière, vapeur ou gaz).

2 Références normatives

L'article de la Partie 1 s'applique, avec l'exception suivante.

Addition:

IEC 60068-2-6, *Essais d'environnement – Partie 2: Essais – Essai Fc: Vibrations (sinusoïdales)*

IEC 60068-2-27, *Essais d'environnement – Partie 2-27: Essais – Essai Ea et guide: Chocs*

IEC 60068-2-52, *Essais d'environnement – Partie 2-52: Essais – Essai Kb: Brouillard salin, essai cyclique (solution de chlorure de sodium)*

IEC 60335-2-6:— [1], *Appareils électrodomestiques et analogues – Sécurité – Partie 2-6: Exigences particulières pour les cuisinières, les tables de cuisson, les fours et les appareils fixes analogues*

IEC 60335-2-9, *Appareils électrodomestiques et analogues – Sécurité – Partie 2-9: Exigences particulières pour les grils, les grille-pain et les appareils de cuisson mobiles analogues*

IEC 60584-1, *Couples thermoélectriques – Partie 1: Spécifications et tolérances en matière de FEM*

3 Termes et définitions

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

3.1 Définitions relatives aux caractéristiques physiques

3.1.7

Note 101 à l'article: La **fréquence assignée** est la fréquence absorbée.

3.1.9
conditions de fonctionnement normal

Modification:

Remplacer le premier alinéa par ce qui suit:

fonctionnement de l'appareil avec 1 000 g ± 50 g d'eau potable à une température initiale de 20 °C ± 2 °C dans un récipient cylindrique en verre de borosilicate d'une épaisseur maximale de 3 mm et d'un diamètre extérieur de 190 mm environ, le récipient étant placé au centre de l'**étagère**.

[1] À l'étude. Stade au moment de la publication: IEC/FDIS 60335-2-6:2024.

3.5 Définitions relatives aux types d'appareils

3.5.101
four à micro-ondes
appareil qui utilise l'énergie électromagnétique d'une ou de plusieurs bandes de fréquence ISM (Industriel, Scientifique et Médical) comprises entre 300 MHz et 30 GHz, pour le chauffage des aliments et des boissons dans une **cavité**

Note 1 à l'article: Les bandes de fréquences ISM sont les fréquences électromagnétiques établies par l'UIT et reproduites dans la CISPR 11.

3.5.102
four à micro-ondes combiné
four à micro-ondes dans lequel la chaleur est également fournie dans la **cavité** par le fonctionnement simultané ou consécutif d'éléments chauffants résistifs

Note 1 à l'article: Les éléments chauffants résistifs sont utilisés pour fournir de la chaleur radiante, de la chaleur par convection ou de la vapeur.

3.6 Définitions relatives aux parties d'appareils

3.6.101
cavité
espace délimité par les parois internes et la porte, dans lequel est placée la charge

3.6.102
étagère
support horizontal dans la **cavité** sur lequel est placée la charge

3.6.103
verrouillage de porte
dispositif ou système qui empêche le fonctionnement du ou des générateurs de micro-ondes, sauf si la porte du four est fermée

3.6.104
verrouillage de porte asservi
système de **verrouillage de porte** qui incorpore un dispositif de surveillance

3.6.105
sonde thermique
dispositif qui fait partie de la commande du four et qui est inséré dans les aliments afin de mesurer leur température

3.8 Définitions relatives à des sujets divers

3.8.101
pont découvert
surface exposée à un environnement marin

3.8.102
salle de séjour
surface qui peut occasionnellement être exposée à un environnement marin

4 Exigences générales

L'article de la Partie 1 s'applique.

5 Conditions générales d'essais

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

5.2 *Addition:*

Un échantillon supplémentaire peut être exigé pour l'essai du 19.104.

Six échantillons du système de verrouillage sont exigés pour l'essai du 24.1.4.

5.3 *Modification:*

Au lieu d'effectuer les essais dans l'ordre des articles, ils sont effectués dans l'ordre suivant des articles et paragraphes: 32.1, 22.113, 22.108, 22.115, 22.116, Articles 7 à 17, Article 20, Article 21 (sauf 21.101 à 21.105), Article 18, Article 19 (sauf 19.104), Article 22 (sauf 22.108, 22.113, 22.115 et 22.116), Articles 23 à 31, 32.2, 21.101 à 21.105, et 19.104.

5.101 Les ***fours à micro-ondes*** *sont soumis à l'essai comme des* ***appareils à moteur****.*

5.102 Les ***sondes thermiques de la classe III*** *ne sont soumises qu'aux essais du 22.112.*

6 Classification

L'article de la Partie 1 s'applique, avec l'exception suivante.

6.1 *Modification:*

Les **fours à micro-ondes** doivent être de la **classe I** ou de la **classe II**.

7 Marquage et instructions

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

7.1 *Addition:*

Les appareils doivent porter le marquage de la fréquence nominale, en mégahertz, de la bande ISM dans laquelle ils fonctionnent.

Si le retrait d'un couvercle provoque une fuite micro-ondes qui dépasse la valeur spécifiée en 32.1, ce couvercle doit porter un marquage qui comporte en substance l'indication suivante:

MISE EN GARDE
ÉNERGIE MICRO-ONDES
NE PAS ENLEVER CE COUVERCLE

Lorsque les dispositions de la note de bas de tableau b du Tableau 101 et/ou du Tableau 3 s'appliquent, l'appareil doit porter un marquage qui indique en substance "ATTENTION: surface très chaude" ou le symbole IEC 60417-5041 (2002-10).

7.6 *Addition:*

[symbole IEC 60417-5041 (2002-10)] Attention: surface très chaude

7.12 *Addition:*

Les instructions doivent comporter en substance les mises en garde suivantes:

– MISE EN GARDE: Si la porte ou les joints de porte sont endommagés, le four ne doit pas être mis en fonctionnement avant d'avoir été réparé par une personne compétente.

– MISE EN GARDE: Il est dangereux pour toute personne n'ayant pas le statut de personne compétente d'effectuer une opération de maintenance ou de réparation qui implique le retrait d'un couvercle assurant une protection contre l'exposition à l'énergie micro-ondes.

NOTE 101 Cette mise en garde s'applique si les fuites micro-ondes dépassent la limite spécifiée en 32.1 lors du retrait d'un couvercle.

– MISE EN GARDE: Les liquides et autres aliments ne doivent pas être chauffés dans des récipients fermés hermétiquement, car ils risquent d'exploser.

– MISE EN GARDE: Avant d'utiliser l'appareil, s'assurer qu'aucun élément ou ustensile non adapté à une utilisation avec le four à micro-ondes n'est présent dans la cavité du four.

– MISE EN GARDE: Ne pas utiliser la cavité pour entreposer des produits combustibles, des ustensiles de cuisine, ou de la nourriture et analogues lorsque le four à micro-ondes n'est pas utilisé.

Les instructions doivent comporter en substance les indications suivantes:

– Cet appareil est destiné à être utilisé dans des applications domestiques et analogues telles que:

  - les coins cuisines réservés au personnel des magasins, bureaux et autres environnements professionnels;
  - les fermes;
  - par les clients dans les hôtels, les motels et autres environnements résidentiels;
  - les environnements de type chambre d'hôtes.

  Si le fabricant souhaite limiter l'utilisation de l'appareil à un domaine plus restreint que celui décrit ci-dessus, cette restriction doit être clairement indiquée dans les instructions.

– Hauteur minimale de l'espace libre nécessaire au-dessus de la surface supérieure du four.

– Les récipients métalliques contenant des aliments ou des boissons ne sont pas admis pour la cuisson micro-ondes. Cette exigence ne s'applique pas si le fabricant spécifie la taille et la forme de récipients métalliques adaptés à la cuisson micro-ondes.

– Pendant le chauffage d'aliments dans des récipients en plastique ou en papier, surveiller le four en raison de la possibilité d'inflammation.

– Le **four à micro-ondes** est destiné au réchauffage des aliments et des boissons. Le séchage d'aliments ou de linge et le chauffage de coussins chauffants, pantoufles, éponges, linge humide et autres analogues peuvent entraîner des risques de blessures, d'inflammation ou de feu.

– Si de la fumée apparaît, arrêter ou débrancher l'appareil, et garder la porte fermée pour étouffer les flammes éventuelles.

– Le chauffage de boissons au micro-ondes peut provoquer un jaillissement différé de liquide en ébullition; par conséquent, des précautions doivent être prises lors de la manipulation du récipient.

– Le contenu des biberons et des pots d'aliments pour bébé doit être remué ou agité, et la température doit être vérifiée avant consommation de façon à éviter les brûlures.
– Il convient de ne pas chauffer les œufs dans leur coquille et les œufs durs entiers dans un **four à micro-ondes**, dans la mesure où ils peuvent exploser, même après la fin de cuisson.
– Les détails relatifs au nettoyage des joints de porte, des **cavités** et des parties adjacentes.
– Il convient de nettoyer le four régulièrement et d'enlever tout dépôt alimentaire.
– Si le four n'est pas maintenu dans un bon état de propreté, sa surface peut se dégrader, ce qui peut altérer la durée de vie de l'appareil, voire conduire à une situation dangereuse.
– Utiliser uniquement la sonde de température recommandée pour ce four (pour les appareils qui permettent l'emploi d'une **sonde thermique**).
– Les instructions d'emploi des **appareils installés à poste fixe** et des **appareils à encastrer** installés à une hauteur supérieure ou égale à 900 mm au-dessus du sol et équipés de plateaux **amovibles** doivent indiquer qu'il convient de veiller à ne pas déplacer le plateau lors du retrait des récipients de l'appareil. Cela ne s'applique pas aux appareils équipés d'une porte à charnière inférieure horizontale.
– L'appareil ne doit pas être nettoyé à l'aide d'un nettoyeur à vapeur.

Si le symbole IEC 60417-5041 (2002-10) est marqué sur l'appareil, sa signification doit être expliquée.

Le fabricant doit indiquer dans les instructions si le **four à micro-ondes** peut être placé ou installé à moins de 850 mm au-dessus du sol.

Le fabricant doit indiquer dans les instructions si le **four à micro-ondes** est destiné à être installé librement, encastré ou placé dans un meuble. Si l'appareil peut être utilisé en étant placé dans un meuble:

- les dimensions minimales du meuble doivent être données par le fabricant; et
- les instructions doivent indiquer que l'appareil doit être mis en fonctionnement avec la porte du meuble ouverte.

Les instructions des **fours à micro-ondes** équipés d'une porte décorative supplémentaire doivent indiquer que l'appareil doit être mis en fonctionnement avec la porte décorative ouverte.

Les instructions des **fours à micro-ondes** qui ne sont pas soumis à l'essai dans un meuble doivent indiquer que l'appareil ne doit pas être placé dans un meuble.

Les instructions des **fours à micro-ondes** qui ne sont pas conformes au 22.118 doivent indiquer que l'appareil ne doit pas être installé à une hauteur supérieure ou égale à 900 mm au-dessus du sol.

7.14 *Addition:*

La hauteur des lettres de la mise en garde spécifiée en 7.1 doit être d'au moins 3 mm.

La hauteur du symbole IEC 60417-5041 (2002-10) doit être d'au moins 10 mm.

La vérification est effectuée par des mesurages.

7.15 *Addition:*

Si le marquage des surfaces très chaudes donné en 7.1 ou le symbole IEC 60417-5041 (2002-10) est apposé sur l'appareil, il doit être visible lorsque l'appareil est mis en fonctionnement comme en usage normal, y compris lors de l'actionnement d'un interrupteur, du réglage d'un dispositif de commande ou de l'ouverture d'un couvercle, d'un tiroir ou d'une porte. Celui-ci ne doit pas être placé sur des surfaces qui sont exemptées des limites du Tableau 3 et du Tableau 101.

8 Protection contre l'accès aux parties actives

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

8.1.1 *Addition:*

Pour les parties d'appareils qui sont situées au maximum à 850 mm du sol après installation ou en usage normal, en plus d'utiliser le calibre d'essai 18, le calibre d'essai 19 de l'IEC 61032 est également appliqué chaque fois que le calibre d'essai 18 est utilisé, dans les mêmes conditions d'essai que le calibre d'essai 18.

8.1.3 *Addition:*

Le calibre d'essai 19 de l'IEC 61032 ne s'applique pas.

9 Démarrage des appareils à moteur

L'article de la Partie 1 ne s'applique pas.

10 Puissance et courant

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

10.1 *Addition:*

*Pour les **fours à micro-ondes** de type onduleur, si la puissance varie tout au long du cycle de fonctionnement, la période représentative spécifiée en 11.7 est retenue, sans les périodes de repos.*

*Pour les **fours à micro-ondes** de type onduleur, si la puissance ne varie pas tout au long du cycle de fonctionnement, et pour les **fours à micro-ondes** qui ne sont pas de type onduleur, la puissance est mesurée à la fin du troisième cycle de fonctionnement du 11.7.*

10.2 *Addition:*

*Pour les **fours à micro-ondes** de type onduleur, si le courant varie tout au long du cycle de fonctionnement, la période représentative spécifiée en 11.7 est retenue, sans les périodes de repos.*

*Pour les **fours à micro-ondes** de type onduleur, si le courant ne varie pas tout au long du cycle de fonctionnement, et pour les **fours à micro-ondes** qui ne sont pas de type onduleur, le courant est mesuré à la fin du troisième cycle de fonctionnement du 11.7.*

11 Échauffements

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

11.2 *Addition:*

*Les appareils, autres que les **appareils à encastrer**, sont placés de la manière spécifiée pour les **appareils chauffants**.*

Un plafond est placé au-dessus de l'appareil à la hauteur minimale indiquée dans les instructions. Le plafond a une profondeur de 300 mm à partir de la paroi arrière du coin d'essai et une longueur qui dépasse d'au moins 150 mm la largeur de l'appareil.

Les appareils qui peuvent être utilisés à l'intérieur d'un meuble sont placés dans un meuble dont les dimensions minimales sont celles données par le fabricant dans les instructions, le contre-plaqué utilisé étant celui spécifié pour le coin d'essai. L'appareil est placé contre la paroi arrière et contre l'une des parois latérales.

La porte du meuble est en position ouverte.

11.3 *Addition:*

Lorsque les **surfaces accessibles** extérieures sont suffisamment planes et permettent l'accès, le calibre d'essai de la *Figure 104* est utilisé pour mesurer les échauffements des **surfaces accessibles** extérieures spécifiées dans le *Tableau 101*. *Le calibre est appliqué avec une force de 4 N ± 1 N sur la surface de manière à établir le meilleur contact possible entre le calibre et la surface. Le mesurage est réalisé après une durée de contact de 30 s.*

Le calibre peut être maintenu en place à l'aide d'une pince de laboratoire sur statif ou d'un dispositif analogue. Tout instrument de mesure qui produit les mêmes résultats que le calibre peut être utilisé.

11.7 *Remplacement:*

*Les appareils sont mis en fonctionnement pendant trois cycles, en activant la **commande à distance**, le cas échéant. Chaque cycle est constitué d'une période de chauffage de 10 min suivie d'une période de repos de 1 min. Le dernier cycle ne comporte pas de période de repos de 1 min. Pendant les périodes de repos, le couvercle, le tiroir ou la porte est ouvert, la **commande à distance** est activée le cas échéant, et la charge est remplacée.*

*Les socles femelles de connecteurs accessibles à l'utilisateur et les socles de prises de courant accessibles à l'utilisateur sont chargés avec une charge résistive qui donne la **charge de sortie** marquée. Le courant dans les socles femelles de connecteurs et les socles de prises de courant de l'appareil est chargé en permanence.*

*Pour les appareils comportant des **batteries intégrées** ou des **batteries séparables** non déconnectées de l'appareil à des fins de chargement:*

- *la **batterie** qui a été **complètement déchargée** est chargée pendant 1 h, tandis que l'appareil fonctionne comme cela est spécifié, si la construction de l'appareil le permet;*
- *la **batterie** qui a été **complètement déchargée** est chargée pendant une durée de 24 h ou jusqu'à ce qu'elle soit **complètement chargée**, si cet événement se produit en premier, sans que l'**appareil alimenté par batteries** n'exécute la fonction pour laquelle il a été conçu.*

11.8 *Modification:*

Remplacer le premier alinéa par le texte suivant:

Pendant l'essai, les échauffements sont relevés en permanence et ne doivent pas dépasser les valeurs indiquées dans le Tableau 3 et dans le Tableau 101.

Addition:

Pour le Tableau 3:

– *Les échauffements des surfaces extérieures des* ***fours à micro-ondes*** *sont mesurés uniquement sur les surfaces qui ne sont pas placées le long de la paroi et du sol du coin d'essai.*

– *Aucune limite d'échauffement n'est spécifiée pour les grilles de sortie d'air ni les surfaces situées à moins de 25 mm.*

– *Lorsque les valeurs exigées pour les enceintes externes des* ***appareils à moteur*** *ne sont pas respectées, l'échauffement maximal ne doit pas* dépasser la limite de plus de 20 K par rapport aux valeurs indiquées.

NOTE 101 Les valeurs d'échauffement spécifiées dans le Tableau 3 pour les poignées, boutons et parties analogues s'appliquent, quelle que soit leur position sur les surfaces ci-dessus.

Tableau 101 – Échauffements maximaux des surfaces accessibles extérieures en conditions de fonctionnement normal

Surface	*Échauffement des surfaces des appareils pouvant être placés ou installés à moins de 850 mm au-dessus du sol* [a] K	*Échauffement des surfaces des appareils destinés à être placés à plus de 850 mm au-dessus du sol* [a, b] K
Métal nu	*38*	*42*
Métal recouvert [c]	*42*	*49*
Verre et céramique	*51*	*56*
Plastique et revêtement en plastique > 0,4 mm [d, e]	*58*	*62*

NOTE Les limites d'échauffement des poignées, boutons, manettes, claviers, pavés numériques et parties analogues sont spécifiées dans le Tableau 3.

[a] *Les surfaces ou éléments suivants ne doivent pas être pris en compte (voir Figure 105):*

- *la **cavité** (les températures de surface ne sont mesurées que lorsque la porte est fermée);*
- *les poignées ou boutons de commande, y compris les pavés numériques, claviers et analogues: toute partie de l'équipement que l'usager a besoin de toucher pour faire fonctionner ou régler le matériel. Le matériel doit être installé conformément aux instructions du fabricant;*
- *les surfaces situées à moins de 5 mm des boutons tactiles, quelle que soit leur forme;*
- *les surfaces extérieures des appareils inaccessibles par un calibre d'un diamètre de 75 mm et à extrémité hémisphérique, lorsque l'appareil est installé conformément aux conditions d'installation spécifiées en 11.2;*
- *les surfaces de la porte du **four à micro-ondes** situées à moins de 10 mm du bord gauche, droit et inférieur de la porte du **four à micro-ondes**, ou à moins 25 mm du bord supérieur de la porte du **four à micro-ondes** (Zone 1). Pour les appareils à encastrer, les bords doivent être pris en compte entre la porte du **four à micro-ondes** et les garnitures décoratives, le cas échéant;*
- *les surfaces autour de la porte du **four à micro-ondes** situées à moins de 10 mm du bord gauche, droit ou inférieur de la porte du **four à micro-ondes**, ou à moins de 25 mm du bord supérieur de la porte du **four à micro-ondes** (Zone 2). Pour les appareils à encastrer, les bords doivent être pris en compte entre la porte du **four à micro-ondes** et les garnitures décoratives, le cas échéant;*
- *les surfaces situées à moins de 25 mm des évents, comme les grilles de sortie d'air (Zone 3).*

[b] *Lorsque les valeurs exigées ne sont pas respectées, l'échauffement maximal ne doit pas dépasser les valeurs indiquées de plus de 20 K.*

[c] *Un métal est considéré comme recouvert lorsqu'un revêtement en émail d'une épaisseur minimale de 90 µm ou qu'un revêtement non constitué majoritairement de plastique est utilisé.*

[d] *La limite d'échauffement du plastique s'applique également aux matières plastiques dont l'épaisseur de la finition métallique est inférieure à 0,1 mm.*

[e] *Lorsque l'épaisseur du revêtement plastique ne dépasse pas 0,4 mm, les limites d'échauffement du métal recouvert ou du matériau en verre ou céramique s'appliquent.*

[f] *La zone adjacente à la poignée qui pourrait être touchée lors de l'utilisation de la poignée doit être conforme au 22.13.*

12 Charge des batteries à ions métalliques

L'article de la Partie 1 s'applique.

13 Courant de fuite et rigidité diélectrique à la température de régime

L'article de la Partie 1 s'applique.

14 Surtensions transitoires

L'article de la Partie 1 s'applique.

15 Résistance à l'humidité

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

15.2 *Addition:*

*Une quantité de 0,5 l de la même solution de débordement est versée régulièrement sur l'**étagère** en 1 min. Si l'**étagère** peut recueillir le liquide qui a débordé, celle-ci est remplie de la solution et une quantité supplémentaire de 0,5 l est alors ajoutée en 1 min.*

15.101 Les **sondes thermiques** doivent être conçues de telle sorte que leur isolation ne soit pas altérée par l'eau.

La vérification est effectuée par l'essai suivant.

La sonde est totalement immergée dans de l'eau à 20 °C ± 5 °C qui contient environ 1 % de NaCl. La solution est portée à ébullition en 15 min environ. Ensuite, la sonde est retirée de la solution bouillante et immergée pendant 30 min dans la solution dont la température est de 20 °C ± 5 °C.

Cette procédure est répétée cinq fois, après quoi la sonde est retirée de la solution. Toute trace de liquide est alors enlevée de la surface.

La sonde doit ensuite satisfaire à l'essai de rigidité diélectrique du 16.3.

NOTE Les **sondes thermiques amovibles** ne sont pas reliées à l'appareil pour cet essai. Les **sondes thermiques non amovibles** sont soumises à l'essai dans la **cavité** en étant immergées le plus possible.

15.102 Les **fours à micro-ondes encastrés** destinés à être installés sous des plans de travail doivent être construits de sorte qu'un tel débordement ne compromette pas leur isolation électrique.

La vérification est effectuée par l'essai suivant.

*Ils doivent être soumis à un essai de débordement avec 0,5 l de la solution de débordement spécifiée en 15.2. Ils doivent être installés conformément aux instructions du fabricant, excepté que la surface avant du **four à micro-ondes** (à l'exclusion des boutons de commande et des poignées) doit s'aligner sur le bord avant d'un plan de travail en bois d'une épaisseur de 30 mm avec un bord avant carré, voir Figure 106. La solution de débordement doit être versée sur le plan de travail à l'endroit où les conditions sont les plus défavorables, en reproduisant le déversement susceptible de se produire en usage normal de sorte que la solution de débordement s'écoule sur la surface avant du **four à micro-ondes** sur les dispositifs de commande, les joints, les évents et les ouvertures analogues. Si nécessaire, l'essai est répété jusqu'à ce que l'ensemble des commandes ou espaces soient recouverts par l'essai de débordement. L'appareil est séché entre chaque essai.*

L'essai est réalisé comme suit:

Une bouteille de forme similaire à celle de la Figure 108 avec son bouchon est remplie de 0,5 l de la solution de débordement.

Le bouchon de la bouteille doit être percé d'un trou d'un diamètre de 8 mm, décentré conformément à la Figure 107. La bouteille doit également être percée d'un trou d'un diamètre de 8 mm à sa base (voir Figure 108) afin d'équilibrer la pression du liquide.

D'autres récipients adaptés peuvent être utilisés à condition de verser la quantité de solution de débordement de la même manière sur l'appareil en essai.

*Le trou percé dans le bouchon de la bouteille est placé sur le plan de travail horizontal à une distance horizontale d'environ 80 mm par rapport à l'avant du **four à micro-ondes**. L'inclinaison de la bouteille doit être supérieure à 30° et inférieure à 45°. La partie basse du trou de la bouteille doit être en contact avec le plan de travail, en orientant le trou vers le bas et le plus près possible de la surface. Voir Figure 109.*

NOTE 1 L'inclinaison et la distance ont pour objet d'éviter les fuites sur l'avant du **four à micro-ondes**.

NOTE 2 Si les trous ont un diamètre de 8 mm, la quantité de solution spécifiée est déversée en 15 s environ.

Lorsqu'une quantité de 0,5 l de la solution de débordement a été versée, la solution restante sur le plan de travail est ramenée vers l'avant par un procédé suffisamment plat de manière à déverser la solution de façon homogène sur l'avant.

*Immédiatement après l'essai, l'appareil doit résister à l'essai de rigidité diélectrique du 16.3; l'examen ne doit révéler aucune trace d'eau sur l'isolation pouvant entraîner une réduction des **distances d'isolement** ou des **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.*

15.103 Les **fours à micro-ondes** destinés à être encastrés dans des meubles sous d'autres **appareils à encastrer** et par conséquent exposés aux débordements de liquides provenant de récipients remplis et manipulés pendant l'utilisation de ces autres appareils doivent être conçus de telle sorte que le débordement n'altère pas leur isolation électrique.

La vérification est effectuée par l'essai suivant (voir Figure 103).

*Le **four à micro-ondes** est encastré conformément aux spécifications du fabricant. Le meuble d'essai est incliné de 2° dans la direction la plus défavorable. À l'aide d'un entonnoir, une quantité de 200 ml de la solution de débordement spécifiée en 15.2 est versée régulièrement sur la largeur totale de la planche de séparation au-dessus du **four à micro-ondes**, en 8 s. Le diamètre de sortie de l'entonnoir est d'environ 8 mm; le bord inférieur de la sortie est placé à 20 mm au-dessus de la planche de séparation. Le centre de l'entonnoir est placé à 15 mm vers l'intérieur à partir du bord d'attaque de la planche de séparation.*

*Si le fabricant indique dans les instructions d'installation qu'une planche de séparation n'est pas exigée au-dessus du **four à micro-ondes**, l'essai doit être répété en versant la solution de débordement directement sur la largeur totale de la surface supérieure du **four à micro-ondes**. Le bord inférieur de la sortie de l'entonnoir est placé à 20 mm au-dessus de la surface supérieure du **four à micro-ondes**; son centre est placé à 15 mm vers l'intérieur à partir du bord d'attaque du **four à micro-ondes**.*

*Immédiatement après l'essai, l'appareil doit résister à l'essai de rigidité diélectrique du 16.3; l'examen ne doit révéler aucune trace d'eau sur l'isolation pouvant entraîner une réduction des **distances d'isolement** ou des **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.*

16 Courant de fuite et rigidité diélectrique

L'article de la Partie 1 s'applique, avec l'exception suivante.

16.101 Les enroulements du transformateur de puissance qui alimente le magnétron doivent avoir une isolation adéquate.

La vérification est effectuée par l'un des essais suivants.

– *Pour les alimentations à découpage, l'isolation entre les enroulements primaire et secondaire des transformateurs d'alimentation à découpage est soumise pendant 1 min à une tension de forme d'onde pratiquement sinusoïdale et d'une fréquence de 50 Hz ou 60 Hz. La valeur de la tension est égale à 1,414 fois la valeur de crête de la* ***tension de service*** *secondaire plus 750 V, avec une valeur minimale de 1 250 V.*

  Aucun claquage ne doit se produire entre les enroulements ou entre les spires adjacentes du même enroulement.

– *Pour les autres transformateurs de puissance, une tension égale à deux fois la* ***tension de service*** *est induite dans l'enroulement secondaire du transformateur en appliquant aux bornes de l'enroulement primaire une tension sinusoïdale dont la fréquence est supérieure à la* ***fréquence assignée****.*

  La durée de l'essai est de:

  - *60 s pour des fréquences inférieures ou égales au double de la* ***fréquence assignée****; ou*
  - $120 \times \frac{\textbf{fréquence assignée}}{\text{fréquence d'essai}}$ *s, avec une durée minimale de 15 s, pour les fréquences supérieures.*

  NOTE La fréquence de la tension d'essai est supérieure à la **fréquence assignée** pour éviter un courant d'excitation excessif.

  Une tension de valeur maximale égale au tiers de la tension d'essai est appliquée, puis rapidement augmentée sans provoquer de transitoires. À l'issue de l'essai, la tension est réduite d'une manière similaire jusqu'à approximativement un tiers de sa valeur totale avant la mise hors tension.

  Aucun claquage ne doit se produire entre les enroulements ou entre les spires adjacentes du même enroulement.

17 Protection contre la surcharge des transformateurs et des circuits associés

L'article de la Partie 1 s'applique, avec l'exception suivante.

Addition:

Les essais ne sont pas effectués sur le transformateur de puissance qui alimente le magnétron et ses circuits associés, ceux-ci étant vérifiés pendant les essais de l'Article 19.

18 Endurance

L'article de la Partie 1 est remplacé par le texte suivant.

Le système de porte, y compris les charnières, les joints de micro-ondes et autres parties associées, doit être construit de façon à résister à l'usure qui peut survenir en usage normal.

La vérification est effectuée par l'essai suivant.

Le système de porte est soumis à 50 000 cycles de fonctionnement, l'appareil étant alimenté à la ***tension assignée*** *et contenant une charge appropriée absorbant les micro-ondes. Il est ensuite soumis à 50 000 cycles de fonctionnement sans génération de micro-ondes.*

La porte est ouverte et fermée comme en usage normal. Elle est ouverte depuis la position fermée jusqu'à un angle d'environ 10° avant d'être entièrement ouverte. La cadence de fonctionnement est de 6 cycles par minute. Avec l'accord du fabricant, la cadence de fonctionnement sans génération de micro-ondes peut être portée à 12 cycles par minute.

Après l'essai, les fuites micro-ondes ne doivent pas dépasser la limite spécifiée en 32.1 et le système de porte doit toujours fonctionner.

NOTE 101 Les dispositifs de commande peuvent être rendus inopérants pour effectuer l'essai.

NOTE 102 Les composants dont la détérioration ne compromet pas la conformité à la présente norme peuvent être remplacés pour mener l'essai à son terme.

NOTE 103 Des briques ou une quantité d'eau supplémentaire de 500 g au maximum peuvent être ajoutées, si nécessaire, afin d'éviter d'interrompre l'essai par suite d'une surchauffe.

19 Fonctionnement anormal

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

19.1 *Modification:*

Au lieu de soumettre l'appareil aux essais du 19.2 au 19.10, la vérification est effectuée par les essais du 19.101 au 19.105, l'appareil étant alimenté à la ***tension assignée****.*

19.11.2 *Addition:*

Le circuit anode-cathode du magnétron est successivement ouvert et court-circuité. Si l'une de ces conditions de défaut entraîne un courant d'entrée qui augmente lorsque la tension diminue, l'essai est effectué en alimentant l'appareil à une tension égale à 0,94 fois la ***tension assignée****. Cependant, si le courant d'entrée augmente plus que proportionnellement par rapport à la tension, l'appareil est alimenté à une tension égale à 1,06 fois la* ***tension assignée****.*

Le filament du magnétron n'est pas court-circuité.

19.13 *Addition:*

Pendant les essais, la température des enroulements ne doit pas dépasser les valeurs indiquées dans le Tableau 8. Seuls les appareils avec présélection de l'heure de démarrage et ceux qui comportent une fonction de maintien au chaud sont considérés comme des appareils qui sont en mis en fonctionnement jusqu'à l'établissement des conditions de régime.

Toutefois, lors des essais du 19.11.3, le Tableau 8 s'applique uniquement aux enroulements du transformateur de l'alimentation du ou des générateurs de micro-ondes, le cas échéant.

Pendant les essais, les fuites micro-ondes, mesurées conformément au 32.1, mais avec la charge spécifiée pour chaque paragraphe, ne doivent pas dépasser 100 W/m^2. L'appareil doit être conforme au 32.1 s'il peut être mis en fonctionnement après les essais.

Modification:

Remplacer le dernier alinéa par ce qui suit:

Dans un appareil qui comporte des couvercles, un tiroir ou des portes commandés par un ou plusieurs verrouillages, l'un des verrouillages peut être neutralisé si les conditions suivantes sont remplies:

– *le couvercle, le tiroir ou la porte ne se met pas automatiquement en position ouverte lorsque le verrouillage est relâché;*

– *l'appareil ne redémarre pas après le cycle où le verrouillage a été relâché.*

19.101 *Les appareils sont mis en fonctionnement avec les dispositifs de commande réglés à la position la plus défavorable et sans charge dans la* ***cavité****.*

La durée de fonctionnement est le temps maximal autorisé par la minuterie ou le temps nécessaire pour établir les conditions de régime, si cette durée est plus courte.

Si les fuites micro-ondes dépassent 100 W/m^2, la méthode alternative de mesurage suivante, qui modifie la limite des fuites micro-ondes du 19.13, doit être appliquée.

Pour identifier et marquer tous les points où les valeurs de crête des fuites micro-ondes dépassent 100 W/m^2, l'antenne de l'instrument est à nouveau déplacée sur la surface extérieure de l'appareil, en portant une attention particulière à la porte et à ses joints.

NOTE 1 Une fonction de retenue de crête de l'instrument de mesure, le cas échéant, peut être activée pour identifier les points où les valeurs de crête des fuites micro-ondes dépassent 100 W/m^2.

Les valeurs de fuites de chaque point doivent être enregistrées, et la valeur moyenne des fuites de tout point sur l'intervalle de 20 s le plus défavorable ne doit pas dépasser 100 W/m^2. De plus, la valeur de crête ne doit pas dépasser 500 W/m^2.

NOTE 2 Étant donné que le temps de rotation du brasseur et/ou du plateau ainsi que le nombre de pales de l'agitateur de micro-ondes déterminent la fréquence et la durée des valeurs de crête réelles des fuites, des instruments aux spécifications appropriées (temps d'échantillonnage minimal, capacité à mesurer les valeurs de crête de la puissance surfacique, capacité à établir la moyenne de ces valeurs, par exemple) peuvent être utilisés.

19.102 *Les appareils sont mis en fonctionnement dans les **conditions de fonctionnement normal**, en mettant en court-circuit la minuterie ou les autres dispositifs de commande qui fonctionnent en usage normal. Si l'appareil comporte plusieurs dispositifs de commande, ceux-ci sont successivement court-circuités. Ces courts-circuits sont appliqués successivement.*

19.103 *Les appareils sont mis en fonctionnement dans les **conditions de fonctionnement normal** et en simulant les conditions de premier défaut susceptibles de se produire. Les dispositifs de commande sont réglés sur la position la plus défavorable et l'appareil est mis en fonctionnement pendant le temps maximal autorisé par la minuterie ou 90 min, si cette durée est plus courte.*

NOTE Les conditions de défaut sont par exemple:

– l'obturation des ouvertures d'air sur un même plan. Cette condition de défaut ne s'applique pas aux **appareils à encastrer**;

– le blocage du rotor des moteurs si le couple de démarrage du rotor bloqué est inférieur au couple à pleine charge;

– le blocage des parties mobiles susceptibles d'être coincées.

19.104 *L'appareil est mis en fonctionnement en réglant les dispositifs de commande sur la position la plus défavorable et en plaçant une pomme de terre sur l'**étagère** dans la position, où elle est la plus susceptible de s'enflammer et de propager des flammes aux autres matières combustibles.*

La pomme de terre a une forme approximativement ellipsoïdale et une masse comprise entre 125 g et 150 g. La longueur du petit axe principal est d'au moins 40 mm. La longueur du grand axe principal ne dépasse pas 140 mm et peut être réduite symétriquement de manière à obtenir la masse spécifiée. Un fil d'acier, d'un diamètre de 1,5 mm ± 0,5 mm et approximativement de la même longueur que le grand axe de la pomme de terre, est inséré le long de cet axe.

*L'essai est achevé 15 min après l'arrêt de la génération de micro-ondes ou l'extinction du feu dans la **cavité**.*

*Pendant l'essai, tout feu déclaré dans la **cavité** doit rester confiné à l'intérieur de l'appareil.*

NOTE 1 Le 19.13 ne s'applique pas pendant l'essai.