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BSI Standards Publication

Household and similar electrical appliances — Safety

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

bsi.

National foreword

This British Standard is the UK implementation of EN 60335-2-25:2012+A2:2016. It is derived from IEC 60335-2-25:2010 incorporating amendment 1:2014, and amendment 2:2015. It supersedes BS EN 60335-2-25:2012+A1:2015, which will be withdrawn on 28 December 2018.

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

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

The UK participation in its preparation was entrusted by Technical Committee CPL/61, Safety of household and similar electrical appliances, to Subcommittee CPL/61/7, Safety of electrical appliances - Heated appliance group.

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

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

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

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Date	Text affected
30 November 2015	Implementation of IEC amendment 1:2014 with CENELEC endorsement A1:2015. Annex ZA updated
30 April 2016	Implementation of IEC amendment 2:2015 with CENELEC endorsement A2:2016. Annex ZA updated
31 July 2016	Supersession date corrected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60335-2-25:2012+A2

February 2016

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English version

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

(IEC 60335-2-25:2010, modified)

Appareils électrodomestiques et analogues - Sécurité - Partie 2-25: Règles particulières pour les fours à micro-ondes, y compris les fours à micro-ondes combinés (CEI 60335-2-25:2010, modifiée)

Sicherheit elektrischer Geräte für den Hausgebrauch und ähnliche Zwecke - Teil 2-25: Besondere Anforderungen für Mikrowellenkochgeräte und kombinierte Mikrowellenkochgeräte (IEC 60335-2-25:2010, modifiziert)

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 60335-2-25:2012 E

Foreword

This document (EN 60335-2-25:2012) consists of the text of IEC 60335-2-25:2010 prepared by IEC/SC 61B "Safety of microwave appliances for household and commercial use", together with the common modifications prepared by CLC/TC 61, "Safety of household and similar electrical appliances".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2012-11-28
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2014-11-28

This document supersedes EN 60335-2-25:2002 + A1:2005 + A2:2006 + A11:2010.

EN 60335-2-25:2012 includes the following significant technical changes with respect to EN 60335-2-25:2002:

– the scope is extended by microwave ovens on board ships and Annex BB contains requirements and test specifications for microwave ovens on board ships;

– the scope and the requirements for the instructions are modified for better separation between “household and similar use” and “commercial use”;

– the scope is modified by so that this International Standard does not take into account persons whose capabilities or lack of experience and knowledge prevents them from using the appliance safely without supervision or instruction and children playing with the appliance;

– the intended use is defined for clarification;

– the door endurance test is rationalised;

– the replacement of 22.103, 22.104 and 22.105 allows interlock systems with at least one concealed door interlock as well as alternative interlock systems without concealed door interlock;

– the tests on electronic door interlock systems and similar are defined for clarification;

– the pollution degree of combination microwave ovens is defined for clarification;

– the thickness requirement for sheaths of visibly glowing heating elements of combination microwave ovens is defined for clarification;

– there is an editorial correction of Clause 19 of Annex AA.

This standard is to be used in conjunction with the latest edition of EN 60335-1 and its amendments. When “Part 1” is mentioned in this standard, it refers to EN 60335-1.

This part 2 supplements or modifies the corresponding clauses in EN 60335-1, so as to convert that publication into the European 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 1 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 2 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.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60335-2-25:2010 are prefixed “Z”.

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

Endorsement notice

The text of the International Standard IEC 60335-2-25:2010 was approved by CENELEC as a European Standard with common modifications.

Foreword to amendment A1

The text of document 61B/494/FDIS, future IEC 60335-2-25:2010/A1, prepared by SC 61B ”Safety of microwave appliances for household and commercial use” of IEC/TC 61 “Safety of household and similar electrical appliances" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60335-2-25:2012/A1:2015.

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• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2016-04-23
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-09-16

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

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 60335-2-25:2010/A1:2014 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A2

The text of document 61B/537/FDIS, future IEC 60335-2-25:2010/A2, prepared by SC 61B "Safety of microwave appliances for household and commercial use", of IEC/TC 61 "Safety of household and similar electrical appliances" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60335-2-25:2012/A2:2016.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-09-28
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2018-12-28

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

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 60335-2-25:2010/A2:2015 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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

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

***Addition** to the Annex ZA of EN 60335-1:*

Publication	Year	Title	EN/HD	Year
IEC 60068-2-6	-	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	-
IEC 60068-2-27	-	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	-
IEC 60068-2-52	-	Environmental testing - Part 2: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)	EN 60068-2-52	-
IEC 60335-2-6 (mod)	-	Household and similar electrical appliances - Safety - Part 2-6: Particular requirements for stationary cooking ranges, hobs, ovens and similar appliances	EN 60335-2-6	2015
IEC 60335-2-9	-	Household and similar electrical appliances - Safety - Part 2-9: Particular requirements for grills, toasters and similar portable cooking appliances	-	-
IEC 60335-2-5 (mod)	2012	Household and similar electrical appliances - Safety - Part 2-5: Particular requirements for dishwashers	EN 60335-2-5	2015

CONTENTS

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.

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 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 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 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.

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

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

1 Scope

〈C〉 This European Standard deals with the safety of **microwave ovens** for household and similar use, their **rated voltage** being not more than 250 V.

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

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

As far as is practicable, this European Standard deals with the common hazards presented by appliances that are encountered by all persons in household and similar environments.

However, in general, it does not take into account:

- **children** playing with the appliance;
- the **use of the appliance** by **very young children**;
- the **use of the appliance** by **young children** without supervision.

It is recognized that **very vulnerable people** may have needs beyond the level addressed in this European Standard.

NOTE Z101 Examples of appliance for household environment are appliances for typical housekeeping functions used in the household environment that may also be used by non expert users for typical housekeeping functions:

– in shops and other similar working environments;
– in farm houses;
– by clients in hotels, motels and other residential type environments;
– in bed and breakfast type environments.

NOTE Z102 Household environments include the dwelling and its associated buildings, the garden, etc.

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 Z103 Attention is drawn to the fact that

- for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may 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 Z104 This standard does not apply to

- commercial **microwave ovens** (EN 60335-2-90)
- industrial microwave heating equipment (EN 60519-6)
- appliances for medical purposes (EN 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). 〈C〉

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 60335-2-6:2014, *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 60335-2-5:2012, *Household and similar electrical appliances – Safety – Part 2-5: Particular requirements for dishwashers*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.7 *Addition:*

NOTE 101 The **rated frequency** is the input frequency.

3.1.9 *Replacement:*

normal operation
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 placed on the centre of the **shelf**.

3.101
microwave oven
appliance using electromagnetic energy in one or several of the ISM frequency bands[1)] between 300 MHz and 30 GHz, for heating food and beverages in a **cavity**

3.102
combination microwave oven
microwave oven in which heat is also provided in the **cavity** by simultaneous or consecutive operation of resistive heating elements

NOTE The resistive heating elements are used to provide radiant heat, convection heat or steam.

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

1) ISM frequency bands are the electromagnetic frequencies established by the ITU and reproduced in CISPR 11.

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

3.105
door interlock
device or system that prevents the operation of the magnetron, unless the oven door is closed

3.106
monitored door interlock
door interlock system that incorporates a supervision device

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

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 may 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: Clause 32, 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, 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 Clause 32, 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.

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

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.

  NOTE 101 If the manufacturer wishes to limit the use of the appliance to less than the above, this has to 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 lead to risk of injury, ignition or fire.

– [C] If smoke is emitted [C], 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 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**).

[A1] – 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. [A1]

[A2] – The appliance shall not be cleaned with a steam cleaner. [A2]

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.

[A1] 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. [A1]

7.14 *Addition:*

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

Compliance is checked by measurement.

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.

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.

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.

11.7 *Replacement:*

Appliances are operated for three cycles, each cycle consisting of a heating period of 10 min followed by a rest period of 1 min. During the rest periods, the door is open and the load is replaced.

11.8 *Addition:*

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

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.

*Replace in Table 3 the row "External enclosure of **motor-operated appliances**, except handles held in normal use" and the corresponding footnotes by the following Table Z101.*

〈C〉 Table Z101 — Maximum temperature rises for external surfaces under normal operating conditions

Surface [c]	***Temperature rise of external surfaces*** [a] *K*	
	Surfaces of appliances situated up to 850 mm above the floor after installation	*Surfaces of appliances situated more than 850 mm above the floor after installation and portable appliances*
Bare metal	*40*	*45*
Coated metal [d]	*45*	*55*
Glass and ceramic	*55*	*60*
Plastic and plastic coating > 0,3 mm [b]	*60*	*65*

[a] When, for appliance covered by Annex AA, due to their construction or dimensional limitations, the required values cannot be met, the maximum temperature rise shall not be higher than twice the values indicated. In such cases, a warning shall be marked on the appliance.

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

[c] When the thickness of the plastic coating does not exceed 0,3 mm, the temperature rise limits of the coated metal or of glass and ceramic material apply.

[d] Metal is considered coated when a coating having a minimum thickness of 80 µm made by enamel or non substantially plastic coating is used.

〈C〉

12 Void

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 water containing approximately 1 % NaCl is poured steadily over the **shelf** over a period of 1 min. If the **shelf** can collect spilled liquid, it is filled with the saline 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 water is heated to the boiling point in approximately 15 min. The probe is then removed from the boiling water and immersed in water 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 water. All traces of liquid are then removed from the surface.

The probe shall then withstand the leakage current test of 16.2.

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

〈A1〉 **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.

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. 〈A1〉

〈A1〉 *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 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 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. 〈A1〉

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.

16.101.1 *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 *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 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 Clause 32 and the door system shall still function.

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

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

NOTE 103 Bricks or additional water of maximum 500 g may 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. 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:*

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.

During the tests, the microwave leakage shall not exceed 100 W/m^2 measured in accordance with Clause 32 but with the load as specified for each subclause. The appliance shall comply with Clause 32 if it can be operated after the tests.

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.

19.102 *Appliances are operated under* ***normal operation*** *with the timer or other controls that operate in normal use short-circuited.*

NOTE If the appliance is provided with more than one control, these are short-circuited in turn.

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 may 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.

20.101 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 may 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.

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 10 times.

The appliance shall then comply with Clause 32.

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 Clause 32.

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 Clause 32.

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 Clause 32.

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 Clause 32, and shall not exceed 100 W/m^2.

22 Construction

This clause of Part 1 is applicable except as follows.

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 Oven vents shall be constructed so that any moisture or grease discharged through them cannot affect **creepage distances** and **clearances** 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** may 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 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*** *by test probe B one at a time.*

During the tests, the operation of the magnetron 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 or its supply main circuit.

Compliance is checked by inspection.

22.105 At least one of the **door interlocks** shall be concealed and not 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 position and an attempt is made to operate the concealed ***door interlock*** *by applying* 〚C〛 test probe B and test probe 18 of IEC 61032 in turn *to all openings.* 〚C〛 *The test is repeated with a rod, as shown in Figure 101, to any openings of the* ***door interlock*** *mechanism. Only one rod shall be used 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* $\pm$ *5 N when applied to a mild steel armature having dimensions of 80 mm* $\times$ *50 mm* $\times$ *8 mm. In addition, the magnet shall be capable of applying a force of 5 N* $\pm$ *0,5 N at a distance of 10 mm from the armature.*

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

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

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.

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.*

*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 ceases 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 may be necessary to render other **door interlocks** inoperative in order to perform this test.

If an internal fuse in the circuit supplying the microwave generator ruptures, 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 A, the test with the series impedance is not carried out.

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 Clause 32. The door opening sequence is carried out in small increments during which the microwave leakage is measured.*

The appliance shall comply with Clause 32.

*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 may be necessary 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 Clause 32.

The test is carried out 10 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 Clause 32.

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 Clause 32. 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. The force is slowly increased to 40 N.*

During the test, the microwave leakage is measured under the conditions specified in Clause 32 and shall not exceed 100 W/m^2.

After the test, the appliance shall comply with Clause 32.

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, the microwave leakage is measured under the conditions specified in Clause 32 and shall not exceed 100 W/m^2.

*After the test, the appliance shall comply with Clause 32 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 Clause 32, 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 with the door open.

*Compliance is checked by inspection and if, necessary, by simulating relevant faults. Wires that may 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 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.

〈A1〉 **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. 〈A1〉

〈A2〉 **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

– glass that breaks into small pieces when it fractures; or
– glass that is not released or dropped from its normal position when broken; or
– glass with enhanced mechanical strength.

For 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 totally 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.

NOTE 2 In the case of curved glass, plane pieces of the same material can be used for the test. 〈A2〉

For 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.

For 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.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1 *Addition*:

NOTE 101 IEC 60989 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.

24.101 Socket-outlets incorporated in 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 may be accessible.

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.

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 and those with a keep-warm function, 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.

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/m2.

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

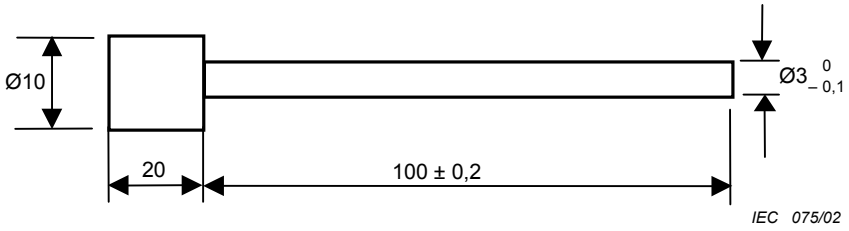
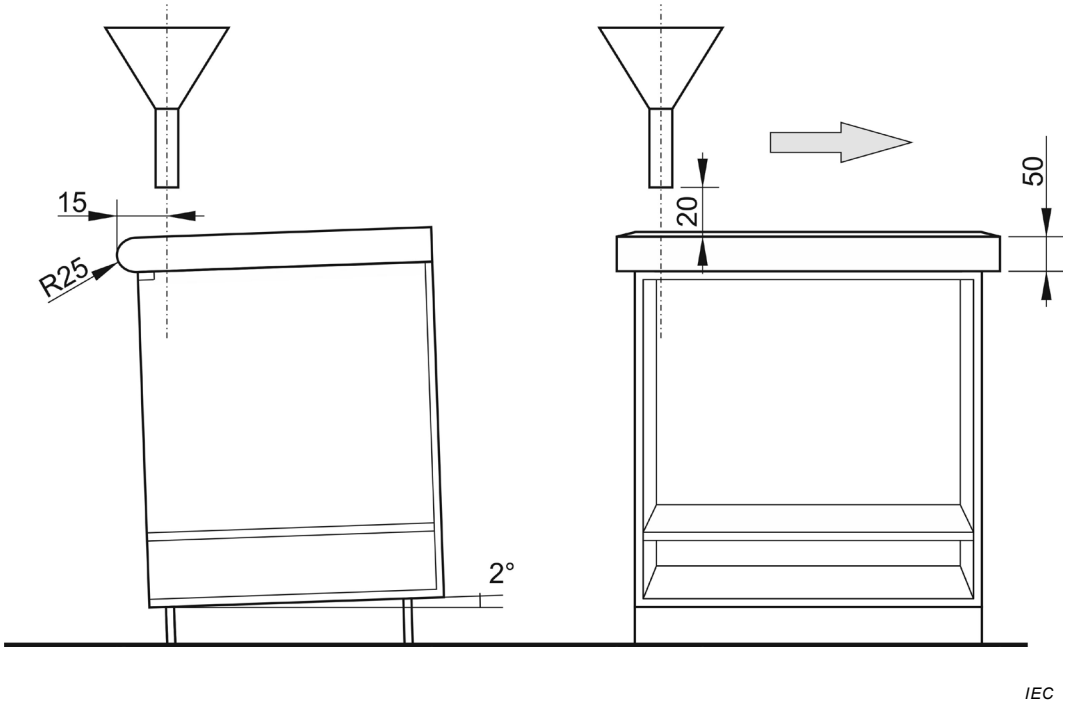


Figure 101 – Test rod for interlock concealment

A1

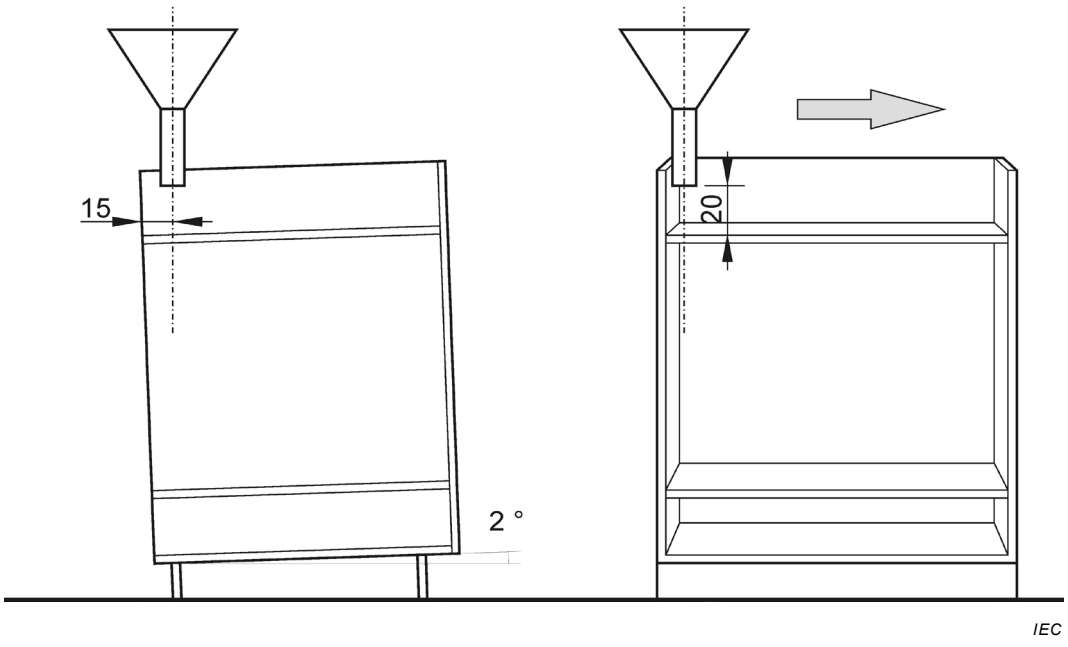
Dimensions in millimetres



a) Side view **b) Front view**

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

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

A1

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 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

〈A2〉 *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 Clause 32 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 A.104 regarding its accuracy.

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. 〈A2〉

A.104.2 *Instruments shall be subjected to regular calibration by carrying out the following tests, to ensure their accuracy 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 to A.104.5 the minimum resolution of the instrument under test shall be 1 W/m^2.*

A.104.3 *The level calibrations 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 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 %. The overall inaccuracy of the IUT shall be less than or equal to ± 1 dB (i.e. from −21 % to +26 %) related to the average of minimum and maximum reading. The field sensor is positioned to the minimum reading and then rotated 4 times for 90° around its axis which is aligned to the propagation direction of the far field and directed towards the radiation source.*

A.104.4 *During the rotation in A.104.3 the maximum deviation of the IUT readings shall be less than or equal to ± 2 dB (i.e. from −37 % to +58 %) related to the average of readings.*

A.104.5 *The IUT field sensor is rotated for maximum reading as described in A.104.3 and then held in this position. The field sensor of an equal IUT is rotated as described in A.104.3 and slowly brought in close proximity of the field sensor of the static IUT. During the approach to 50 mm distance between the field sensors, the reading of the static IUT shall not change by more than ± 1 dB (i.e. from −21% to +26 %). During the test the axis of each field sensor has to be aligned to the propagation direction of the far field and each field sensor has to be directed towards the radiation source.*

Annex AA
(normative)

Combination microwave ovens

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

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 has to be tested only according to the requirements in the relevant standard. If a **combination microwave oven** has a mode of operations 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 *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 When testing the different modes of operation, only those tests having the most unfavourable conditions are carried out.

5.101 *Addition:*

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

7 Marking and instructions

〈C〉 **7.1** When the provisions of footnote a to Table Z101 apply, the appliance shall be marked with: -

the substance of “CAUTION: Hot surface”; or

- symbol IEC 60417-5041.

The warning shall be put on the surface of the appliance having the highest temperature and shall be visible during normal operation.

AA.7.6 *Addition:*

[symbol IEC 60417-5041] Caution, hot surface 〈C〉

〈C〉 *Text deleted* 〈C〉

〈C〉 **7.14** *Addition:*

The height of the warning “CAUTION. Hot surface” shall be at least 4 mm (measured on the capital letters).

NOTE Z101 For the evaluation of legibility and clarity of safety warnings guidance can be found on IEC 62079.

The height of the symbol IEC 60417-5041 shall be at least 12 mm. 〈C〉

11 Heating

11.7 *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 These tests are considered to cover appliances having programmers or timers.

11.8 *Addition:*

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

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 *Modification:*

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

〈A2〉 22 Construction

Modification:

22.120 of IEC 60335-2-6:2014 is not applicable. 〈A2〉

29 Clearances, creepage distances and solid insulation

Replacement:

This clause of Part 1 is applicable except as follows.

29.2 *Addition 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.

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:*

Replace the second dashed item of Part 1 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

22.BB.101 Appliances shall withstand the pulses to which they may 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 Clause 32, and connections shall not have worked loose.

22.BB.102 Appliances shall withstand the vibrations to which they may 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 Clause 32, and connections shall not have worked loose.

31 Resistance to rusting

Replacement:

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*

〚C〛 NOTE Harmonized as EN 60335-2-90. 〚C〛

IEC 60519-6, *Safety in electroheat installations – Part 6: Specifications for safety in industrial microwave heating equipment*

〚C〛 NOTE Harmonized as EN 60519-6. 〚C〛

IEC 60989, *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*

〚C〛 NOTE Harmonized as EN ISO 13732-1. 〚C〛

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