

INTERNATIONAL STANDARD



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

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 RLV



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2020 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IECNORM.COM : Click to view the full text IEC 60352-2-25:2020 RLV



IEC 60335-2-25

Edition 7.0 2020-01
REDLINE VERSION

INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 13.120; 97.040.20

ISBN 978-2-8322-7766-9

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	4
INTRODUCTION	2
1 Scope	8
2 Normative references	9
3 Terms and definitions	9
4 General requirement.....	10
5 General conditions for the tests	10
6 Classification.....	10
7 Marking and instructions.....	10
8 Protection against access to live parts.....	12
9 Starting of motor-operated appliances	13
10 Power input and current.....	13
11 Heating.....	13
12 Void.....	13
13 Leakage current and electric strength at operating temperature.....	13
14 Transient overvoltages	13
15 Moisture resistance	14
16 Leakage current and electric strength.....	15
17 Overload protection of transformers and associated circuits	16
18 Endurance	16
19 Abnormal operation	16
20 Stability and mechanical hazards.....	18
21 Mechanical strength	18
22 Construction	20
23 Internal wiring.....	26
24 Components	26
25 Supply connection and external flexible cords	27
26 Terminals for external conductors.....	27
27 Provision for earthing	27
28 Screws and connections	27
29 Clearances, creepage distances and solid insulation	27
30 Resistance to heat and fire.....	27
31 Resistance to rusting	27
32 Radiation, toxicity and similar hazards.....	27
Annexes	30
Annex A (informative) Routine tests	30
Annex AA (normative) Combination microwave ovens.....	32
Annex BB (normative) Microwave ovens intended to be used on board ships.....	34
Bibliography.....	36
Figure 101 – Test rod for interlock concealment.....	28

Figure 102 – Test cabinet including working surface, position of funnel and example
for direction of tilt..... 28

Figure 103 – Test cabinet including separation board, position of funnel and example
for direction of tilt..... 29

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 RLV

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

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

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

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

This seventh edition cancels and replaces the sixth edition published in 2010, Amendment 1:2014 and Amendment 2:2015. This edition constitutes a technical revision.

This edition includes the following significant changes with respect to the sixth edition:

- 11.7 and 19.13 are improved in clarity;
- in 19.102, a note is converted into normative text;
- 19.101 is improved with an alternative measurement method;
- 22.121 is improved with requirements for simultaneous activation of heating elements and motors;
- 15.2, 15.101, 21, 22.102, 22.112, 22.119, 22.120, 24.101 and 27.1 are improved in clarity;
- Annex A has editorial improvements and feasible limits of deviations.

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

CDV	RVC
61B/611/CDV	61B/626/RVC
61B/615/CDV	61B/627/RVC
61B/621/CDV	61B/628/RVC
61B/622/CDV	61B/629/RVC
61B/623/CDV	61B/630/RVC

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

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

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. It was established on the basis of the fifth edition (2010) 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 web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

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/m² 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/m² (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/m² (Japan and USA).
- 22.115: All access to the **cavity** has to be prevented (USA).

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

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.

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.

This 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.

Appliances not intended for normal household use but which nevertheless may 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 knowledgeprevents 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 ~~may~~ 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);
- 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, *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*

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 bands¹ 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 1 to entry: 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~~ 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: 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.
- 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 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.

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.

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. The last cycle does not include a rest period of 1 min. During the rest periods, the door is open and the load is replaced.

11.8 Addition:

*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.

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~~ 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 ~~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 $20\text{ °C} \pm 5\text{ °C}$. The ~~water~~ solution is heated to the boiling point in approximately 15 min. The probe is then removed from the boiling ~~water~~ solution and immersed in ~~water~~ the solution having a temperature of $20\text{ °C} \pm 5\text{ °C}$ for 30 min.

This procedure is carried out five times, after which the probe is removed from the ~~water~~ solution. 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~~ 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.

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 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.

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
- $120 \times \frac{\text{rated frequency}}{\text{test frequency}}$ 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~~ 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, ~~may~~ can be replaced in order to complete the test.

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

During the tests, the microwave leakage shall not exceed 100 W/m² 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.

If microwave leakage exceeds 100 W/m² 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 exceeds 100 W/m², 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 exceeds 100 W/m².

The leakage values of each such spot shall be recorded and the averaged leakage value of any spot over the most onerous 20 seconds shall not exceed 100 W/m². Furthermore, the peak value shall not exceed 500 W/m².

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.*

~~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~~ 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.

20.101 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~~ 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 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/m².

22 Construction

This clause of Part I 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 **clearances** and **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~~ 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 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 test probe B 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 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 $50\text{ N} \pm 5\text{ N}$ when applied to a mild steel armature having dimensions of $80\text{ mm} \times 50\text{ mm} \times 8\text{ mm}$. In addition, the magnet shall be capable of applying a force of $5\text{ N} \pm 0,5\text{ N}$ 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 inoperative. 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 $(0,4 + j 0,25) \Omega$ 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 inoperative.

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 $60 \text{ mm} \pm 5 \text{ mm}$ and a thickness of $0,15 \text{ mm} \pm 0,05 \text{ mm}$, 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/m².

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 with the **temperature-sensing probe still being placed in the trapped position**, the microwave leakage is measured under the conditions specified in Clause 32 and shall not exceed 100 W/m².*

*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.

Detachables 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.

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

- 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 *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 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 *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.

22.119.3 *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.

22.120 Where 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.

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 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 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 **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 ~~may~~ can 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 except as follows.

27.1 Addition:

NOTE 101 For **class I appliances**, one pole of the output of power supply of microwave generator, 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 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 $275 \text{ g} \pm 15 \text{ g}$ of potable water having a temperature of $20 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$, 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

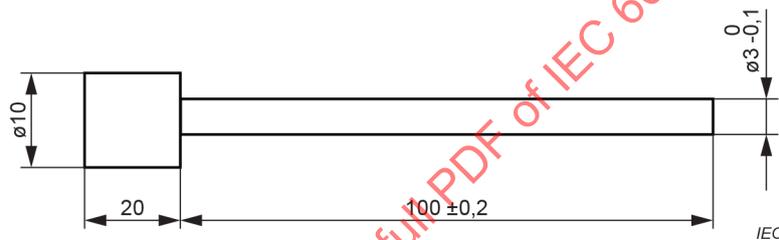
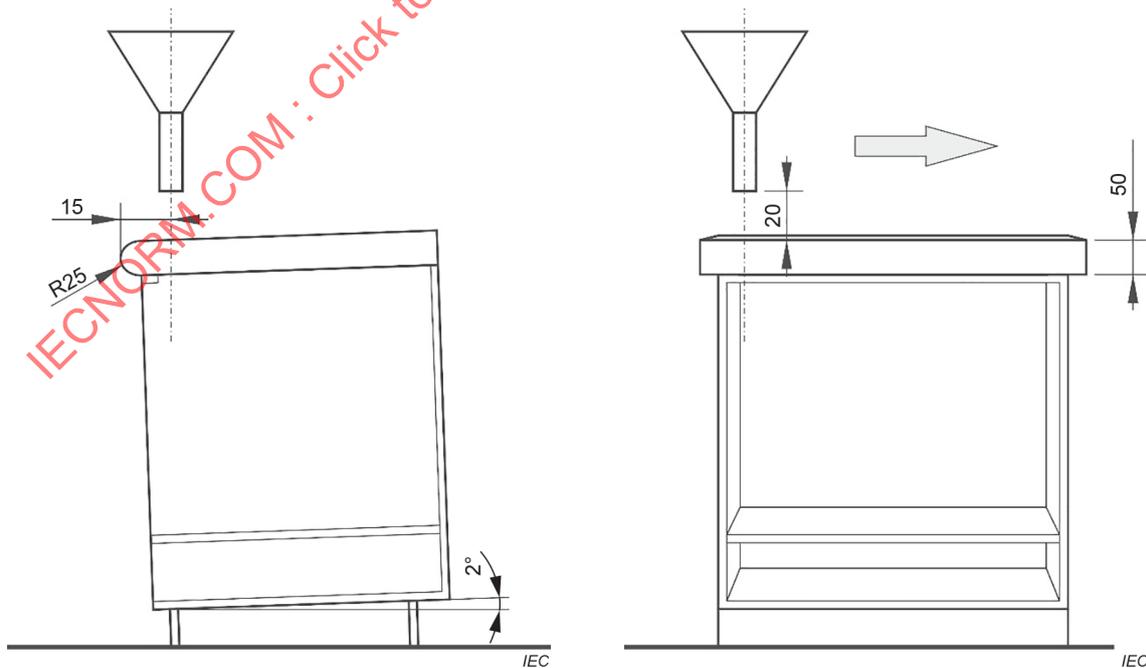


Figure 101 – Test rod for interlock concealment

Dimensions in millimetres

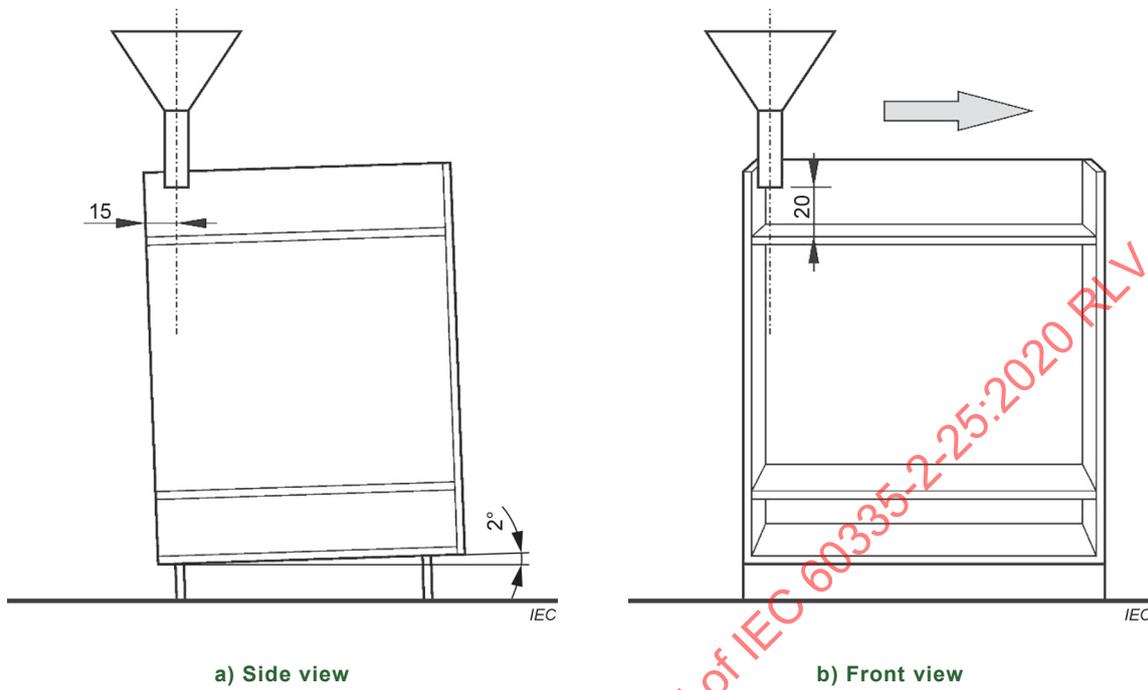


a) Side view

b) Front view

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

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

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 RLV

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

*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 ~~from~~ between the field sensor and the external surface of the appliance. ~~An appropriate load may be used.~~ 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/m², 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

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 *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 the minimum resolution of the instrument under test shall be 1 W/m^2 .

A.104.2 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 $\pm 60 \%$. 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 $\pm 2 \text{ dB}$ (i.e. from -37% to $+58 \%$) related to the reference field it is assumed that the IUT complies with this standard.

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 RLV

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~~ is 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

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

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~~ are applied for **stationary appliances** and the limit values in IEC 60335-2-9 ~~should be~~ are 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**.

22 Construction

Addition:

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

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/s²,
- 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*

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

IEC 60989², *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*

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 RLV

² Withdrawn.

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**

CONTENTS

FOREWORD	4
INTRODUCTION	7
1 Scope	8
2 Normative references	9
3 Terms and definitions	9
4 General requirement.....	10
5 General conditions for the tests	10
6 Classification	10
7 Marking and instructions.....	10
8 Protection against access to live parts	12
9 Starting of motor-operated appliances	13
10 Power input and current.....	13
11 Heating.....	13
12 Void.....	13
13 Leakage current and electric strength at operating temperature.....	13
14 Transient overvoltages	13
15 Moisture resistance	14
16 Leakage current and electric strength.....	15
17 Overload protection of transformers and associated circuits	16
18 Endurance	16
19 Abnormal operation	16
20 Stability and mechanical hazards.....	18
21 Mechanical strength	18
22 Construction	20
23 Internal wiring.....	26
24 Components	26
25 Supply connection and external flexible cords	27
26 Terminals for external conductors	27
27 Provision for earthing	27
28 Screws and connections	27
29 Clearances, creepage distances and solid insulation	27
30 Resistance to heat and fire	27
31 Resistance to rusting	27
32 Radiation, toxicity and similar hazards.....	27
Annexes	30
Annex A (informative) Routine tests	30
Annex AA (normative) Combination microwave ovens.....	32
Annex BB (normative) Microwave ovens intended to be used on board ships.....	34
Bibliography.....	36
Figure 101 – Test rod for interlock concealment.....	28

Figure 102 – Test cabinet including working surface, position of funnel and example for direction of tilt..... 28

Figure 103 – Test cabinet including separation board, position of funnel and example for direction of tilt..... 29

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 RLV

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

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

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

This seventh edition cancels and replaces the sixth edition published in 2010, Amendment 1:2014 and Amendment 2:2015. This edition constitutes a technical revision.

This edition includes the following significant changes with respect to the sixth edition:

- 11.7 and 19.13 are improved in clarity;
- in 19.102, a note is converted into normative text;
- 19.101 is improved with an alternative measurement method;
- 22.121 is improved with requirements for simultaneous activation of heating elements and motors;
- 15.2, 15.101, 21, 22.102, 22.112, 22.119, 22.120, 24.101 and 27.1 are improved in clarity;

– Annex A has editorial improvements and feasible limits of deviations.

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

CDV	RVC
61B/611/CDV	61B/626/RVC
61B/615/CDV	61B/627/RVC
61B/621/CDV	61B/628/RVC
61B/622/CDV	61B/629/RVC
61B/623/CDV	61B/630/RVC

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

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

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. It was established on the basis of the fifth edition (2010) 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 web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

- amended.

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/m² 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/m² (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/m² (Japan and USA).
- 22.115: All access to the **cavity** has to be prevented (USA).

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

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.

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.

This 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.

Appliances not intended for normal household use but which nevertheless may 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 knowledgeprevents 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);
- 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, *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*

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 bands¹ 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 1 to entry: 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 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: 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.

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.
- 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 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.

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.

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. The last cycle does not include a rest period of 1 min. During the rest periods, the door is open and the load is replaced.

11.8 Addition:

*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.

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 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 $20\text{ °C} \pm 5\text{ °C}$. 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 $20\text{ °C} \pm 5\text{ °C}$ 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 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 **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.

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 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.

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
- $120 \times \frac{\text{rated frequency}}{\text{test frequency}}$ 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 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. 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.

During the tests, the microwave leakage shall not exceed 100 W/m² 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.

If microwave leakage exceeds 100 W/m² 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 exceeds 100 W/m², 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 exceeds 100 W/m².

The leakage values of each such spot shall be recorded and the averaged leakage value of any spot over the most onerous 20 seconds shall not exceed 100 W/m². Furthermore, the peak value shall not exceed 500 W/m².

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.

20.101 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 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/m².

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 **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 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 test probe B 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 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 $50\text{ N} \pm 5\text{ N}$ when applied to a mild steel armature having dimensions of $80\text{ mm} \times 50\text{ mm} \times 8\text{ mm}$. In addition, the magnet shall be capable of applying a force of $5\text{ N} \pm 0,5\text{ N}$ 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 can 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 $(0,4 + j 0,25) \Omega$ 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 can 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 $60 \text{ mm} \pm 5 \text{ mm}$ and a thickness of $0,15 \text{ mm} \pm 0,05 \text{ mm}$, 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/m².

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 with the **temperature-sensing probe** still being placed in the trapped position, the microwave leakage is measured under the conditions specified in Clause 32 and shall not exceed 100 W/m².*

*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.

Detachables 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.

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 \pm 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

- 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 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 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 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.

22.119.3 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.

22.120 Where 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.

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 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 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 **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:

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 Addition:

NOTE 101 For **class I appliances**, one pole of the output of power supply of microwave generator, 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 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.

Dimensions in millimetres

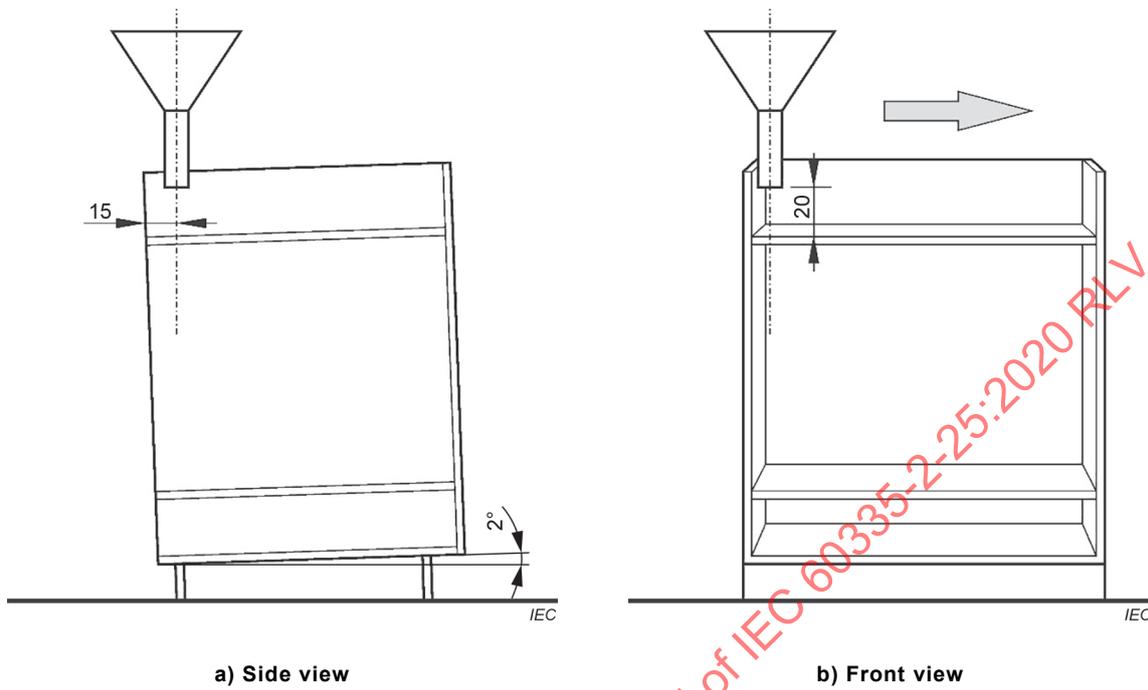


Figure 103 – Test cabinet including separation board, position of funnel and example for direction of tilt

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 RLV

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

*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/m², 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

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 *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 the minimum resolution of the instrument under test shall be 1 W/m^2 .

A.104.2 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 $\pm 60 \%$. 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 $\pm 2 \text{ dB}$ (i.e. from -37% to $+58 \%$) related to the reference field it is assumed that the IUT complies with this standard.

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 PLV

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 is 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

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

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 are applied for **stationary appliances** and the limit values in IEC 60335-2-9 are 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**.

22 Construction

Addition:

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

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/s²,
- 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*

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

IEC 60989², *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*

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 RLV

² Withdrawn.

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 RLV

SOMMAIRE

AVANT-PROPOS	40
INTRODUCTION	43
1 Domaine d'application	44
2 Références normatives	45
3 Termes et définitions	45
4 Exigences générales	46
5 Conditions générales d'essais	46
6 Classification	46
7 Marquage et instructions	47
8 Protection contre l'accès aux parties actives	49
9 Démarrage des appareils à moteur	49
10 Puissance et courant	49
11 Echauffements	49
12 Vacant	50
13 Courant de fuite et rigidité diélectrique à la température de régime	50
14 Surtensions transitoires	50
15 Résistance à l'humidité	50
16 Courant de fuite et rigidité diélectrique	51
17 Protection contre la surcharge des transformateurs et des circuits associés	52
18 Endurance	52
19 Fonctionnement anormal	53
20 Stabilité et dangers mécaniques	54
21 Résistance mécanique	55
22 Construction	57
23 Conducteurs internes	63
24 Composants	63
25 Raccordement au réseau et câbles souples extérieurs	64
26 Bornes pour conducteurs externes	64
27 Dispositions en vue de la mise à la terre	64
28 Vis et connexions	64
29 Distances dans l'air, lignes de fuite et isolation solide	64
30 Résistance à la chaleur et au feu	64
31 Protection contre la rouille	64
32 Rayonnement, toxicité et dangers analogues	65
Annexes	67
Annexe A (informative) Essais de série	67
Annexe AA (normative) Fours à micro-ondes combinés	69
Annexe BB (normative) Fours à micro-ondes destinés à être utilisés à bord de navires	72
Bibliographie	75
Figure 101 – Tige d'essai pour verrouillage dissimulé	65

Figure 102 – Meuble d'essai avec surface de travail, position de l'entonnoir et exemple de direction d'inclinaison..... 66

Figure 103 – Meuble d'essai avec planche de séparation, position de l'entonnoir et exemple de direction d'inclinaison..... 66

IECNORM.COM : Click to view the full PDF of IEC 60335-2-25:2020 RLV

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

APPAREILS ÉLECTRODOMESTIQUES ET ANALOGUES –
SÉCURITÉ –Partie 2-25: Exigences particulières pour les fours à micro-ondes,
y compris les fours à micro-ondes combinés

AVANT-PROPOS

- 1) La Commission Electrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
- 2) Les décisions ou accords officiels de l'IEC concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de l'IEC intéressés sont représentés dans chaque comité d'études.
- 3) Les Publications de l'IEC se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de l'IEC. Tous les efforts raisonnables sont entrepris afin que l'IEC s'assure de l'exactitude du contenu technique de ses publications; l'IEC ne peut pas être tenue responsable de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
- 4) Dans le but d'encourager l'uniformité internationale, les Comités nationaux de l'IEC s'engagent, dans toute la mesure possible, à appliquer de façon transparente les Publications de l'IEC dans leurs publications nationales et régionales. Toutes divergences entre toutes Publications de l'IEC et toutes publications nationales ou régionales correspondantes doivent être indiquées en termes clairs dans ces dernières.
- 5) L'IEC elle-même ne fournit aucune attestation de conformité. Des organismes de certification indépendants fournissent des services d'évaluation de conformité et, dans certains secteurs, accèdent aux marques de conformité de l'IEC. L'IEC n'est responsable d'aucun des services effectués par les organismes de certification indépendants.
- 6) Tous les utilisateurs doivent s'assurer qu'ils sont en possession de la dernière édition de cette publication.
- 7) Aucune responsabilité ne doit être imputée à l'IEC, à ses administrateurs, employés, auxiliaires ou mandataires, y compris ses experts particuliers et les membres de ses comités d'études et des Comités nationaux de l'IEC, pour tout préjudice causé en cas de dommages corporels et matériels, ou de tout autre dommage de quelque nature que ce soit, directe ou indirecte, ou pour supporter les coûts (y compris les frais de justice) et les dépenses découlant de la publication ou de l'utilisation de cette Publication de l'IEC ou de toute autre Publication de l'IEC, ou au crédit qui lui est accordé.
- 8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
- 9) L'attention est attirée sur le fait que certains des éléments de la présente Publication de l'IEC peuvent faire l'objet de droits de brevet. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets et de ne pas avoir signalé leur existence.

La Norme internationale IEC 60335-2-25 a été établie par le sous-comité 61B: Sécurité des fours à micro-ondes à usage domestique et commercial, du comité d'études 61 de l'IEC: Sécurité des appareils électrodomestiques et analogues.

Cette septième édition annule et remplace la sixième édition parue en 2010, l'Amendement 1:2014 et l'Amendement 2:2015. Cette édition constitue une révision technique.

Cette édition inclut les modifications majeures suivantes par rapport à la sixième édition:

- clarification de 11.7 et de 19.13;
- en 19.102, conversion d'une note en texte normatif;
- en 19.101, ajout d'une méthode de mesure alternative;

- en 22.121, ajout d'exigences relatives à l'activation simultanée des éléments de chauffage et des moteurs;
- clarification des 15.2, 15.101, 21, 22.102, 22.112, 22.119, 22.120, 24.101 et 27.1;
- amélioration rédactionnelle de l'Annexe A et introduction de limites d'écartés réalisables.

Le texte de cette Norme internationale est issu des documents suivants:

CDV	RVC
61B/611/CDV	61B/626/RVC
61B/615/CDV	61B/627/RVC
61B/621/CDV	61B/628/RVC
61B/622/CDV	61B/629/RVC
61B/623/CDV	61B/630/RVC

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 60335, publiées sous le titre général: *Appareils électrodomestiques et analogues – Sécurité*, peut être consultée 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. Elle a été établie sur la base de la cinquième édition (2010) 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 "<http://webstore.iec.ch>" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,

- supprimée,
- remplacée par une édition révisée, ou
- amendée.

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 entériné au niveau national 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/m² pendant l'essai initial (Japon et USA).
- 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 (USA).
- 7.12: Il est interdit de placer l'appareil dans un meuble muni d'une porte (Japon).
- Article 18: L'essai est réalisé sur deux appareils (USA).
- 19.11.2: La variation de tension absorbée n'est pas appliquée (USA).
- 19.13: Les fuites micro-ondes sont mesurées seulement à la fin de chaque essai (USA).
- 21.102: La force appliquée est de 222 N (USA).
- 21.105: Les fuites micro-ondes ne doivent pas dépasser 50 W/m² (Japon et USA).
- 22.111: Les fuites micro-ondes sont mesurées seulement à la fin de l'essai (USA).
- 22.112: Les fuites micro-ondes ne doivent pas dépasser 50 W/m² (Japon et USA).
- 22.115: Tout accès à la **cavité** doit être empêché (USA).

IMPORTANT – Le logo "colour inside" qui se trouve sur la page de couverture de cette publication indique qu'elle contient des couleurs qui sont considérées comme utiles à une bonne compréhension de son contenu. Les utilisateurs devraient, par conséquent, imprimer cette publication en utilisant une imprimante couleur.

INTRODUCTION

Il a été admis, en établissant la présente Norme internationale, que l'exécution de ses dispositions était confiée à des personnes expérimentées et ayant une qualification appropriée.

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.

La présente 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 compris dans le domaine d'application de la présente norme comporte également des fonctions qui sont 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 est applicable, 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 dangers 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 normes horizontales et génériques couvrant un danger ne sont pas applicables, parce qu'elles ont été prises en considération lorsque les exigences générales et particulières ont été étudiées pour la série de normes IEC 60335. Par exemple, dans le cas des exigences de température de surface pour de nombreux appareils, des normes génériques, comme l'ISO 13732-1 pour les surfaces chaudes, ne sont pas applicables en plus de la Partie 1 ou des parties 2.

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 soumis aux essais 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.

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** n'est pas supérieure à 250 V.

La présente norme traite également des **fours à micro-ondes combinés**, pour lesquels l'Annexe AA est applicable.

La présente norme traite également des **fours à micro-ondes** destinés à être utilisés à bord de navires, pour lesquels l'Annexe BB est applicable.

Les appareils qui ne sont pas 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, l'appareil n'est pas vu comme étant uniquement à usage domestique et analogue.

Dans la mesure du possible, la présente norme traite des dangers ordinaires présentés par les appareils, encourus par tous les individus à l'intérieur et autour de l'habitation. Cependant, la présente norme ne tient pas compte en général:

- des personnes (y compris des enfants) dont:
 - les capacités physiques, sensorielles ou mentales; ou
 - le manque d'expérience et de connaissanceles empêchent d'utiliser l'appareil en toute sécurité sans surveillance ou instruction;
- de l'utilisation de l'appareil comme jouet par des enfants.

NOTE 101 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.

NOTE 102 La présente norme ne s'applique pas

- aux **fours à micro-ondes** à usage commercial (IEC 60335-2-90);
- aux installations de chauffage industriel à micro-ondes (IEC 60519-6);
- aux appareils destinés à des usages médicaux (IEC 60601);
- aux appareils destinés à être utilisés dans des locaux présentant 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 est applicable avec l'exception suivante.

Addition:

IEC 60068-2-6, *Essais d'environnement – Partie 2-6: 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 60335-2-5:2012, *Appareils électrodomestiques et analogues – Sécurité – Partie 2-5: Exigences particulières pour les lave-vaisselle*

IEC 60335-2-6:2014, *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*

3 Termes et définitions

L'article de la Partie 1 est applicable avec les exceptions suivantes.

3.1.7 *Addition:*

NOTE 101 La **fréquence assignée** est la fréquence absorbée.

3.1.9 *Remplacement:*

conditions de fonctionnement normal

fonctionnement de l'appareil avec 1 000 g \pm 50 g d'eau potable à une température initiale de 20 °C \pm 2 °C dans un récipient cylindrique en verre de borosilicate ayant une épaisseur maximale de 3 mm et un diamètre extérieur d'environ 190 mm. Le récipient est placé au centre de l'étagère

3.101

four à micro-ondes

appareil utilisant l'énergie électromagnétique d'une ou plusieurs bandes de fréquences ISM¹ entre 300 MHz et 30 GHz, pour le chauffage des aliments et des boissons dans une **cavité**

3.102

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 résistifs chauffants

Note 1 à l'article: Les éléments résistifs chauffants sont utilisés pour fournir de la chaleur radiante ou par convection ou de la vapeur.

¹ Les bandes de fréquences ISM sont les fréquences électromagnétiques établies par l'UIT et reproduites dans la publication CISPR 11.

3.103

cavité

espace délimité par les parois internes et la porte et dans lequel la charge est placée

3.104

étagère

support horizontal dans la **cavité** sur lequel la charge est placée

3.105

verrouillage de porte

dispositif ou système qui empêche le fonctionnement du magnétron, sauf si la porte du four est fermée

3.106

verrouillage de porte asservi

système de **verrouillage de porte** incorporant un dispositif de surveillance

3.107

sonde thermique

dispositif introduit dans les denrées alimentaires pour en mesurer la température, et faisant partie de la commande du four

4 Exigences générales

L'article de la Partie 1 est applicable.

5 Conditions générales d'essais

L'article de la Partie 1 est applicable avec les exceptions suivantes.

5.2 Addition:

NOTE 101 Un échantillon supplémentaire peut être exigé pour l'essai de 19.104.

NOTE 102 Six échantillons du système de verrouillage sont exigés pour l'essai de 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: Article 32, 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, 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 de 22.112.

6 Classification

L'article de la Partie 1 est applicable 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 est applicable 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 quelconque couvercle provoque une fuite micro-ondes dépassant la valeur spécifiée à l'Article 32, ce couvercle doit porter, en substance, l'indication suivante:

MISE EN GARDE
ÉNERGIE MICRO-ONDES
NE PAS ENLEVER CE COUVERCLE

Si un appareil comporte un socle de prise de courant protégé par des fusibles autres que des fusibles de type D, il doit porter le marquage du courant assigné du fusible approprié. Lorsqu'un fusible miniature est utilisé, le marquage doit indiquer que le fusible doit avoir un pouvoir de coupure élevé.

7.12 Addition:

Les instructions doivent comporter, en substance, l'indication suivante:

INSTRUCTIONS DE SÉCURITÉ IMPORTANTES
LIRE AVEC ATTENTION ET A CONSERVER EN VUE DE REFERENCE FUTURE

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 quiconque autre qu'une personne compétente d'effectuer des opérations de maintenance ou de réparation entraînant le retrait d'un couvercle qui protège de l'exposition à l'énergie micro-ondes.
- MISE EN GARDE: Les liquides et autres denrées alimentaires ne doivent pas être chauffés dans des récipients fermés hermétiquement, car ils risquent d'exploser.

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;
 - l'utilisation par les clients des hôtels, motels et autres environnements à caractère résidentiel;
 - les environnements de type chambres d'hôtes.

Si l'utilisation de l'appareil est volontairement limitée par rapport aux applications ci-dessus, le fabricant doit l'indiquer clairement dans les instructions.

- Hauteur minimale de l'espace libre nécessaire au-dessus de la surface supérieure du four.
- Utiliser uniquement des ustensiles appropriés à l'usage dans les **fours à micro-ondes**.

- 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 de denrées alimentaires dans des récipients en plastique ou en papier, garder un œil sur le four en raison de la possibilité d'inflammation.
- Le **four à micro-ondes** est prévu pour chauffer des denrées alimentaires et des boissons. Le séchage de denrées alimentaires ou de linge et le chauffage de coussins chauffants, pantoufles, éponges, linge humide et autres articles similaires 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 des boissons par micro-ondes peut provoquer un jaillissement brusque et différé de liquide en ébullition. Pour cette raison, des précautions doivent être prises lors de la manipulation des récipients.
- 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 affecter défavorablement la durée de vie de l'appareil et éventuellement conduire à une situation dangereuse.
- Utiliser uniquement la sonde de température recommandée pour ce four (pour les appareils présentant la possibilité d'utiliser une **sonde thermique**).
- Les instructions d'utilisation des **appareils fixes** et des **appareils à encastrer** installés à une hauteur égale ou supérieure 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 avec porte à charnière inférieure horizontale.
- L'appareil ne doit pas être nettoyé à l'aide d'un nettoyeur vapeur.

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 toute porte du meuble ouverte.

Les instructions des **fours à micro-ondes** disposant 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 à 22.118 doivent indiquer que l'appareil ne doit pas être installé à une hauteur égale ou supérieure 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 au moins de 3 mm.

La vérification est effectuée par des mesures.

8 Protection contre l'accès aux parties actives

L'article de la Partie 1 est applicable avec les exceptions suivantes.

8.1.1 Addition:

Le calibre d'essai 18 de l'IEC 61032 est également appliqué, comme spécifié pour le calibre d'essai B. Toutefois, il est appliqué uniquement aux parties qui sont accessibles lorsque le four est mis en fonctionnement comme en usage normal.

8.2 Addition:

Le calibre d'essai 18 de l'IEC 61032 est également appliqué, comme spécifié pour le calibre d'essai B. Toutefois, il est appliqué uniquement aux parties qui sont accessibles lorsque le four est mis en fonctionnement comme en usage normal.

9 Démarrage des appareils à moteur

L'article de la Partie 1 n'est pas applicable.

10 Puissance et courant

L'article de la Partie 1 est applicable.

11 Echauffements

L'article de la Partie 1 est applicable avec les exceptions suivantes.

11.2 Addition:

*Les appareils, autres que les **appareils à encastrer**, sont placés comme spécifié 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.

11.7 Remplacement:

Les appareils sont mis en fonctionnement pendant trois cycles, chaque cycle étant 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, la porte est ouverte et la charge remplacée.

11.8 Addition:

*Les échauffements des surfaces externes des **fours à micro-ondes** ne sont mesurés que sur les surfaces qui ne sont pas placées le long de la paroi et de la base du coin d'essai.*

Il n'y a pas de limites d'échauffement pour les grilles de sortie d'air ni pour les surfaces situées à une distance de moins de 25 mm de ces grilles.

NOTE 101 Ces surfaces ne comprennent pas les poignées.

12 Vacant

13 Courant de fuite et rigidité diélectrique à la température de régime

L'article de la Partie 1 est applicable.

14 Surtensions transitoires

L'article de la Partie 1 est applicable.

15 Résistance à l'humidité

L'article de la Partie 1 est applicable avec les exceptions suivantes.

15.2 Addition:

Une quantité de 0,5 l de la même solution de déversement est versée de façon régulière sur l'étagère en 1 min. Si l'étagère peut recueillir le liquide qui a débordé, elle est remplie avec 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 façon telle que leur isolation ne soit pas affectée par l'eau.

La vérification est effectuée par l'essai suivant.

La sonde est totalement immergée dans de l'eau à $20\text{ °C} \pm 5\text{ °C}$ contenant environ 1 % de NaCl. La solution est portée à ébullition en 15 min environ. La sonde est ensuite retirée de la solution bouillante et immergée dans la solution à $20\text{ °C} \pm 5\text{ °C}$ pendant 30 min.

Cette procédure est effectuée cinq fois, après quoi la sonde est retirée de la solution. Toute trace de liquide est alors enlevée de la surface.

La sonde doit alors satisfaire à l'essai de courant de fuite de 16.2.

NOTE Les **sondes thermiques amovibles** ne sont pas raccordées à l'appareil pour cet essai. Les **sondes thermiques non amovibles** sont soumises à l'essai dans la **cavité** en étant immergées autant qu'il est possible.

15.102 Les **fours à micro-ondes** destinés à être encastrés sous plan et par conséquent exposés aux débordements de liquides provenant de récipients placés sur les surfaces de travail doivent être conçus de façon telle que le débordement n'affecte pas leur isolation électrique.

La vérification est effectuée par l'essai suivant (voir Figure 102).

*Le **four à micro-ondes** est encastré sous plan conformément aux spécifications du fabricant. Le meuble d'essai (surface de travail comprise) est incliné de 2° dans la direction la plus défavorable. 500 ml d'eau contenant environ 1 % de NaCl et environ 0,6 % d'agent de rinçage acide sont versés de façon régulière, à travers un entonnoir, sur la largeur totale de la surface de travail au-dessus du **four à micro-ondes**, en 20 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 surface de*

travail. Le centre de l'entonnoir est placé à 15 mm vers l'intérieur à partir du bord d'attaque de la surface de travail.

Le bord d'attaque de la surface de travail doit être arrondi suivant un rayon de 25 mm; la surface de travail doit avoir une épaisseur de 50 mm et être exempte de gorges d'écoulement, de bords d'écoulement, de bords tranchants ou d'éléments similaires.

*Immédiatement après l'essai, l'appareil doit satisfaire à l'essai de rigidité diélectrique de 16.3; l'examen ne doit révéler aucune trace d'eau sur l'isolation pouvant entraîner une réduction des **distances dans l'air** ou des **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.*

La composition de l'eau contenant environ 1 % de NaCl et environ 0,6 % d'agent de rinçage acide est décrite à l'Annexe AA de l'IEC 60335-2-5:2012.

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 façon telle que le débordement n'affecte 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. 200 ml d'eau contenant environ 1 % de NaCl et environ 0,6 % d'agent de rinçage acide sont versés de façon régulière, à travers un entonnoir, 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 de l'eau contenant environ 1 % de NaCl et environ 0,6 % d'agent de rinçage acide 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 satisfaire à l'essai de rigidité diélectrique de 16.3; l'examen ne doit révéler aucune trace d'eau sur l'isolation pouvant entraîner une réduction des **distances dans l'air** ou des **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.*

La composition de l'eau contenant environ 1 % de NaCl et environ 0,6 % d'agent de rinçage acide est décrite à l'Annexe AA de l'IEC 60335-2-5:2012.

16 Courant de fuite et rigidité diélectrique

L'article de la Partie 1 est applicable avec les exceptions suivantes.

16.101 Les enroulements du transformateur de puissance qui alimente le magnétron doivent avoir une isolation appropriée.

La vérification est effectuée par l'essai de 16.101.1 pour les alimentations à découpage et par l'essai de 16.101.2 pour les autres transformateurs de puissance.

16.101.1 *L'isolation entre les enroulements primaire et secondaire des transformateurs des alimentations à découpage est soumise pendant 1 min à une tension de forme d'onde pratiquement sinusoïdale et de fréquence 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** du secondaire plus 750 V, avec un minimum de 1 250 V.

Il ne doit se produire aucun claquage entre les enroulements ou entre les spires jointives du même enroulement.

16.101.2 Le double de la **tension de service** est induit à 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
- $120 \times \frac{\text{fréquence assignée}}{\text{fréquence d'essai}}$ s, avec un minimum 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.

Un maximum d'un tiers de la tension d'essai est appliqué; la tension est ensuite rapidement augmentée sans provoquer de transitoires. A la fin de l'essai, la tension est ramenée d'une façon similaire à environ un tiers de sa valeur totale avant de mettre hors tension.

Il ne doit se produire aucun claquage entre les enroulements ou entre les spires jointives du même enroulement.

17 Protection contre la surcharge des transformateurs et des circuits associés

L'article de la Partie 1 est applicable avec l'exception suivante.

Addition:

Les essais ne sont pas effectués sur le transformateur de puissance qui alimente le magnétron ni sur ses circuits associés, ceux-ci étant vérifiés au cours des 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 pouvant se produire 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 sous 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 l'ouverture complète. 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 à l'Article 32 et le système de porte doit encore 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, pour éviter d'arrêter l'essai à cause d'une surchauffe.

19 Fonctionnement anormal

L'article de la Partie 1 est applicable avec les exceptions suivantes.

19.1 Modification:

*Au lieu de soumettre l'appareil aux essais de 19.2 à 19.10, la vérification est effectuée par les essais de 19.101 à 19.105, l'appareil étant alimenté sous la **tension assignée**.*

19.11.2 Addition:

*Le circuit anode-cathode du magnétron est ouvert et court-circuité tour à tour. Si l'une de ces conditions de défaut entraîne un courant d'entrée qui augmente lorsque la tension diminue, l'essai est effectué avec l'appareil alimenté sous 0,94 fois la **tension assignée**. Toutefois, si le courant d'entrée augmente plus que proportionnellement par rapport à la tension, l'appareil est alimenté sous 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 comportant une fonction de maintien au chaud sont vus comme des appareils fonctionnant jusqu'à établissement des conditions de régime.

Pendant les essais, les fuites micro-ondes, mesurées conformément à l'Article 32, mais avec la charge spécifiée pour chaque paragraphe, ne doivent pas dépasser 100 W/m². L'appareil doit être conforme à l'Article 32 s'il peut être mis en fonctionnement après les essais.

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, suivant la durée la plus courte.

Si les fuites micro-ondes dépassent 100 W/m², la méthode de mesure alternative suivante doit être appliquée, laquelle modifie la limite des fuites micro-ondes donnée en 19.13.

Afin d'identifier et d'indiquer tous les points où les valeurs de crête des fuites micro-ondes dépassent 100 W/m², l'antenne de l'instrument est à nouveau déplacée le long de la surface externe de l'appareil, en portant une attention particulière à la porte et à ses joints.

NOTE 1 Une fonction de maintien de crête de l'instrument de mesure, le cas échéant, peut être activée pour l'identification des points où les valeurs de crête des fuites micro-ondes dépassent 100 W/m².

Les valeurs des fuites en chacun de ces points doivent être enregistrées et la valeur moyenne des fuites en tout point au cours des 20 secondes les plus défavorables ne doit pas dépasser 100 W/m². De plus, la valeur de crête ne doit pas dépasser 500 W/m².

NOTE 2 Etant donné que le temps de rotation de l'agitateur 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**, la minuterie ou autres dispositifs de commande qui fonctionnent en usage normal étant court-circuités. Si l'appareil comporte plusieurs dispositifs de commande, ils sont court-circuités tour à tour. Ces courts-circuits sont appliqués un à un.

19.103 Les appareils sont mis en fonctionnement dans les **conditions de fonctionnement normal** et en simulant une des 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, suivant la durée la 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 avec les dispositifs de commande réglés sur la position la plus défavorable et avec une pomme de terre placée sur l'**étagère** dans la position où elle est le 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 plus petit axe principal est d'au moins 40 mm. La longueur du plus grand axe principal ne dépasse pas 140 mm et peut être réduite symétriquement de manière à obtenir la masse spécifiée. Un fil d'acier, de 1,5 mm ± 0,5 mm de diamètre et approximativement de la même longueur que l'axe le plus long 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 Paragraphe 19.13 ne s'applique pas pendant l'essai.

Après l'essai, si l'appareil est encore en état de fonctionner, toute **étagère amovible** endommagée est remplacée et 19.13 s'applique. Si l'appareil est non conforme, l'essai est répété sur un appareil neuf.

NOTE 2 La non-conformité peut résulter de l'effet cumulatif des essais précédents.

19.105 Les **appareils à encastrer** disposant d'une porte décorative supplémentaire et les appareils destinés à être utilisés à l'intérieur d'un meuble sont mis en fonctionnement dans les **conditions de fonctionnement normal**, la porte décorative ou la porte du meuble étant fermée.

La durée de fonctionnement est le temps maximal autorisé par la minuterie ou le temps nécessaire pour établir les conditions de régime, suivant la durée la plus courte.

20 Stabilité et dangers mécaniques

L'article de la Partie 1 est applicable avec l'exception suivante.