

INTERNATIONAL STANDARD



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



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INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	2
1 Scope.....	8
2 Normative references	9
3 Terms and definitions	10
4 General requirement.....	14
5 General conditions for the tests	14
6 Classification	14
7 Marking and instructions.....	15
8 Protection against access to live parts.....	17
9 Starting of motor-operated appliances	17
10 Power input and current.....	17
11 Heating.....	17
12 Void Charging of metal-ion batteries	20
13 Leakage current and electric strength at operating temperature.....	20
14 Transient overvoltages	20
15 Moisture resistance	21
16 Leakage current and electric strength	21
17 Overload protection of transformers and associated circuits	22
18 Endurance	22
19 Abnormal operation	23
20 Stability and mechanical hazards.....	25
21 Mechanical strength	26
22 Construction	28
23 Internal wiring.....	33
24 Components	33
25 Supply connection and external flexible cords	34
26 Terminals for external conductors.....	34
27 Provision for earthing	34
28 Screws and connections	35
29 Clearances, creepage distances and solid insulation	35
30 Resistance to heat and fire	35
31 Resistance to rusting	35
32 Radiation, toxicity and similar hazards.....	35
Annexes	38
Annex A (informative) Routine tests	39
Annex R (normative) Software evaluation	41
Annex AA (normative) Combination microwave ovens.....	42
Annex BB (normative) Requirements for commercial microwave ovens without a cavity door and with conveyor-type means.....	44
Annex CC (informative) Overview of the requirements for covers, means of access and similar	58

Annex DD (informative) Rationales for the microwave barrier and associated leakage tests	60
Annex EE (normative) Microwave ovens intended to be used on board ships	66
Bibliography	70
Figure 101 – Test rod for door interlock concealment	36
Figure 102 – Probe for measuring surface temperatures	36
Figure 103 – Front view of appliance with identification of excluded areas	37
Figure BB.1.201 – Splash apparatus	55
Figure BB.2.202 – Arrangement for measurement of microwave leakage from access openings	56
Figure BB.3.203 – Examples of definitions of Clause 3 and Clause BB.3	57
Table 101 – Maximum temperature rises of external accessible surfaces under normal operating conditions	19
Table 102 – Maximum temperature rises of external accessible surfaces for appliances intended to be used in areas open to the public under normal operating conditions	20
Table 103 – Number of potatoes	24
Table BB.1.201 – Specifications for microwave barriers	51
Table BB.202 – Assembling torques for screwed connections providing earthing continuity	53
Table CC.1 – Overview of the requirements for covers, means of access and similar	59
Table EE.201 – Assembling torques for screwed connections providing earthing continuity	69

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –
SAFETY –****Part 2-90: Particular requirements for commercial 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.
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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60335-2-90:2015+AMD1:2019 CSV. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60335-2-90 has been prepared by subcommittee 61B: Safety of microwave appliances for household and commercial use, of IEC technical committee 61: Safety of household and similar electrical appliances. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2015 including its Amendment 1:2019. This edition constitutes a technical revision.

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

- a) the appliance used in area open to the public has been introduced in Clause 1, 3.8.107, 7.12, 8.1.1, 11.8, 20.2, 22.103.2, 22.105 and 22.117;
- b) Subclauses 5.5, 7.12.1, 11.2, 11.7, 20.1 and 20.101 have been modified to add for stacking installation;
- c) Subclauses 7.1, 11.7 and 22.61 have been modified for the appliance outlets and socket-outlets;
- d) Subclause 7.12 has been improved in clarity;
- e) maximum temperature rises of external accessible surfaces have been added in Subclause 11.8;
- f) test criterion has been modified in Subclause 15.101;
- g) Subclause 16.101 has been modified to move the content of 16.101.1, 16.101.2 directly under 16.101.
- h) Subclauses 19.11.2, 19.13, Clause 21, Subclauses 22.105, 22.111 and Annex AA have been improved in clarity;
- i) Annex BB and Annex EE have been modified to add screw requirements.

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

Draft	Report on voting
61B/702/FDIS	61B/706/RVD

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

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

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

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

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

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

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

When a particular subclause of Part 1 is not mentioned in 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** type in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in bold.

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

- reconfirmed,
- withdrawn, or
- revised.

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

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

The following differences exist in the countries indicated below.

- 5.3: Microwave leakage is not to exceed 10 W/m² during the initial test (Japan, USA and Canada).
- 6.1: Microwave ovens may be class 0I if the rated voltage does not exceed more than 150 V (Japan).
- 7.12: Some warnings have to be marked on the appliance and be visible to the user (Canada).
- 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 only measured 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 only measured at the end of the test (USA).
- 22.112: Microwave leakage is not to exceed 50 W/m² (Japan and USA).
- 22.116: All access to the cavity has to be prevented (USA).
- 27.2: A terminal for an external equipotential conductor is not required (Japan).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-90: Particular requirements for commercial 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** with a **cavity** door intended for commercial use, their **rated voltage** being not more than 250 V for single-phase appliances connected between one phase and neutral and 480 V for other appliances.

These appliances are not intended for household and similar purposes. They are used for commercial processing of food, also in **areas open to the public**, for example in kitchens of restaurants, canteens, hospitals and in commercial enterprises such as bakeries and butcheries;

- the safety of **combination microwave ovens** with a **cavity** door, the requirements of which are contained in **normative Annex AA**;
- the safety of **microwave ovens** without a **cavity** door and with **transportation means** that are intended for commercial use only, for the heating of food and beverages, the requirements of which are contained in **normative Annex BB**.

Microwave ovens covered by **normative Annex BB** have **transportation means** for moving the **load** through the **microwave oven**. Requirements for tunnel microwave ovens and several types of microwave vending machines are covered.

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

NOTE 101—In **normative Annex BB**, a **microwave oven** without a **cavity** door and with **transportation means** is described as a **microwave oven**. All clauses of this standard apply to these appliances unless otherwise specified in **normative Annex BB**.

This part of IEC 60335 also takes into account **ordinary persons** having access to the **removing area** of the vending machine.

NOTE 102—The appliance ~~may~~ can be built into a vending machine, in which case IEC 60335-2-75 ~~may~~ can also be applicable.

NOTE 103—Appliances that use non-electrical energy are within the scope of this standard.

~~In general, this standard does not take into account~~

- ~~— the use of appliances by young children or infirm persons without supervision;~~
- ~~— playing with the appliance by young children.~~

As far as is practicable, this standard deals with the common hazards presented by these types of appliances.

This standard does not take into account the use of a **microwave oven** without a **cavity** door and with **transportation means** by **ordinary persons** except in the vicinity of **entrance and exit ports**.

NOTE 104—The rationales for particular microwave exposure conditions and measures related to microwave energy being confined by an open structure are given in **normative** Annex BB.

NOTE 105—Attention is drawn to the fact that

- for appliances intended to be used in vehicles or on trains, on board ships or board aircraft, additional requirements ~~may~~ **can** be necessary;
- for appliances intended to be used in tropical countries, special requirements ~~may~~ **can** be necessary;
- in many countries, the national health authorities, the national authorities responsible for the protection of labour and similar authorities specify additional requirements;
- in many countries, national authorities specify additional requirements to BB.22. ~~119~~ **101.1**.

NOTE 106—This standard does not apply to

- ~~household~~ **Microwave ovens** including **combination microwave ovens** for household use covered by IEC 60335-2-25 and used in the following environments by laymen:
 - staff kitchen areas in shops, offices and other working environments;
 - farm houses;
 - by clients in hotels, motels and other residential type environments;
 - bed and breakfast type environments.
- 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 2-6: 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 60335-2-36, *Household and similar electrical appliances – Safety – Part 2-36: Particular requirements for commercial electric cooking ranges, ovens, hobs and hob elements*

IEC 60335-2-42, *Household and similar electrical appliances – Safety – Part 2-42: Particular requirements for commercial electric forced convection ovens, steam cookers and steam-convection ovens*

IEC 60335-2-49, *Household and similar electrical appliances – Safety – Part 2-49: Particular requirements for commercial electric ~~hot cupboards~~ appliances for keeping food and crockery warm*

IEC 60335-2-75, *Household and similar electrical appliances – Safety – Part 2-75: Particular requirements for commercial dispensing appliances and vending machines*

IEC 60436:2004/AMD1:2015, *Electric dishwashers for household use – Methods for measuring the performance*

~~IEC 60436:2004/AMD 1:2009~~

~~IEC 60436:2004/AMD 2:2012~~

IEC 60436:2015/AMD1:2020

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

ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs with specified property classes – Coarse thread and fine pitch thread*

ISO 3506-1, *Fasteners – Mechanical properties of corrosion-resistant stainless steel fasteners – Part 1: Bolts, screws and studs with specified grades and property classes*

ISO 3506-2, *Fasteners – Mechanical properties of corrosion-resistant stainless steel fasteners – Part 2: Nuts with specified grades and property classes*

ISO 3506-3, *Mechanical properties of corrosion-resistant stainless steel fasteners – Part 3: Set screws and similar fasteners not under tensile stress*

ISO 3506-4, *Mechanical properties of corrosion-resistant stainless steel fasteners – Part 4: Tapping screws*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

3.1.7

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

3.1.9

normal operation

Modification:

Replace the first paragraph by the following:

operation of the appliance under the following conditions:

The appliance is operated with $1\,000\text{ g} \pm 50\text{ g}$ of potable water at an initial temperature of $20\text{ °C} \pm 2\text{ °C}$ 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**. If the **rated microwave power output** exceeds 2 200 W, two such vessels are used and placed contiguously in the **cavity**.

~~3.102~~ 3.1.101

rated microwave power output

microwave power output assigned to the appliance by the manufacturer

3.5 Definitions relating to types of appliances

~~3.101~~ 3.5.101

microwave oven

appliance using electromagnetic energy in one or several of the ISM frequency bands⁴ between 300 MHz and 30 GHz, for heating food and beverages in a **cavity**

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

~~3.127~~ 3.5.102

combination microwave oven

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

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

3.6 Definitions relating to parts of an appliance

~~3.103~~ 3.6.101

cavity

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

~~3.104~~ 3.6.102

shelf

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

~~3.105~~ 3.6.103

door interlock

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

~~3.106~~ 3.6.104

monitored door interlock

door interlock system that incorporates a supervision device

~~3.107~~ 3.6.105

temperature-sensing probe

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

~~3.111~~ 3.6.106

transportation means

means to transport the **load** through the **microwave oven**

Note 1 to entry: An example of a **transportation means** is a belt, an arm or an inclined plane.

~~3.113~~ 3.6.107

microwave enclosure

structure that is intended to confine microwave energy to a defined region

Note 1 to entry: Barriers mounted outside the **microwave enclosure** are not considered a part of the **microwave enclosure**.

Note 2 to entry: A **microwave enclosure** ~~may~~ can consist of a **cavity**, quarter wave chokes (acting by impedance transformation), mode chokes (acting by field pattern mismatching) and microwave energy absorbers.

⁴—ISM frequency bands are the electromagnetic frequencies established by the ITU and reproduced in CISPR 11.

~~3.114~~3.6.108

microwave barrier

physical barrier, which is microwave transparent, limiting access to the **microwave enclosure**, mounted outside the **microwave enclosure** and can only be removed with the aid of tools

Note 1 to entry: A **microwave barrier** ~~may~~ can be mounted between the **microwave enclosure** and the external cover of the appliance.

Note 2 to entry: Devices such as an array of metal chains or hinged metal plates at **entrance and exit ports** intended to reduce microwave leakage are not considered **microwave barriers**.

Note 3 to entry: Construction requirements are given in BB.22.~~119~~101.

Note 4 to entry: Informative Annex DD mentions about rationale for the **microwave barrier** and associated leakage test.

~~3.115~~3.6.109

entrance and exit ports

openings in the **microwave enclosure** through which **loads** move

~~3.116~~3.6.110

loading area

area on which the **load** is placed

~~3.117~~3.6.111

means of monitored microwave interlock

means of microwave interlock that incorporates a supervision device

~~3.118~~3.6.112

protective blocking structure

movable mechanical structure located in the **removing area** limiting access to the **microwave enclosure**

~~3.119~~3.6.113

removing area

area from which the **load** is removed

~~3.120~~3.6.114

viewing opening

opening in the **cavity** through which the warm up process can be visually monitored

~~3.121~~3.6.115

fixed means of connection

all parts of the **microwave enclosure** that are permanently open with the exception of **entrance and exit ports** and **viewing openings**

Note 1 to entry: **Fixed means of connection** ~~may~~ can be used for venting and water flushing.

3.6.116

Void

~~3.123~~3.6.117

means of microwave interlock

mechanical or electrical safety devices or systems that operate when certain conditions are not fulfilled (e.g. an interlock system that prevents the operation of the microwave generator when a means of access is open)

3.1243.6.118**maintenance cover**

structural feature of any part of the equipment that can be opened or removed by the use of a tool to provide access for routine maintenance, service, replacement of expendable parts, etc. in microwave containing areas

3.1253.6.119**cleaning cover**

part of the **microwave enclosure** that can be opened or removed, only with the aid of a tool, for frequent cleaning purposes, during operation

3.1263.6.120**reference surface**

surface in the vicinity of entrance and exits ports defined depending on the reading of microwave leakage of ~~Clause BB.32~~ 32.1 of normative Annex BB

Note 1 to entry: If the leakage reading is less or equal to 50 W/m^2 , the **reference surface** is the surface of the geometric opening of the **microwave enclosure** without **microwave barrier**.

Note 2 to entry: If the leakage reading exceeds 50 W/m^2 , the **reference surface** is an artificial surface located 50 mm away from the locations where the sensor of the instrument measures leakage readings of 50 W/m^2 straight inwards towards the appliance.

Note 3 to entry: For further explanation, refer to ~~Clause BB.32~~ 32.1 of normative Annex BB.

3.8 Definitions relating to miscellaneous matters**3.1083.8.101****instructed person**

person who is sufficiently instructed and monitored to know how to avoid any danger caused by the operation of **microwave ovens**

3.1093.8.102**skilled person**

person with suitable professional education, knowledge and experience to discern and to avoid any danger caused by the operation of **microwave ovens**

3.1103.8.103**ordinary person**

person who is neither a **skilled person** nor an **instructed person**

3.1123.8.104**load**

food and beverages that can be heated up in a **microwave oven**

3.8.105**area open to the public**

area in which the general public, including children, can have access

Note 1 to entry: Examples include customer areas in:

- grocery stores;
- canteens;
- train stations;
- self-service restaurants.

3.8.106**open deck**

area that is exposed to marine environment

3.8.107

dayroom

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

~~3.122~~

~~detachable means of access~~

~~all parts of the microwave enclosure that can be opened or removed without the aid of tools to get access to the inside for maintenance, with the exception of entrance and exit ports and viewing openings~~

~~Note 1 to entry: Examples of detachable means of access are tunnels that are opened by drop down or sliding action and cavity lamp covers.~~

~~3.128~~

~~hot functional surface~~

~~surface that is intentionally heated by an internal heat source and that has to be hot to carry out the intended function of the appliance~~

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.

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

5.3 Modification:

Instead of carrying out the tests in the order of clauses, the following sequence of clauses and subclauses applies: 32.1, 22.113, 22.108, 22.116, Clause 7 to Clause 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 and 22.116), Clause 23 to Clause 31 and 32.2, 21.101 to 21.105 and 19.104.

5.5 Addition:

The tests are carried out with the appliances in any stacked combination or any movable part of it placed in the most unfavourable condition that can occur in normal use.

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.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 Addition:

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

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

WARNING: Microwave energy – Do not remove this cover

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

If appliances have external enclosures, other than working surfaces, that cannot meet the limit in Table 3 specified for external enclosures of **motor-operated appliances**, they shall be marked with symbol IEC 60417-5041 (2002-10) or with the substance of the following:

CAUTION: Hot surface.

If appliances have external **accessible surfaces**, for which temperature rise limits are specified in Table 101 and Table 102 and for which the provisions of footnote b to Table 101 and Table 102 apply, then the appliance shall be marked with symbol IEC 60417-5041 (2002-10) or with the substance of the following:

CAUTION: Hot surface

7.6 Addition:



[symbol IEC 60417-5021
(2002-10)]

equipotentiality



[symbol IEC 60417-5041
(2002-10)]

caution, hot surface

7.12 Addition:

The instructions shall include the substance of the following:

- 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 any cover which gives protection against exposure to microwave energy.

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

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

- WARNING: Microwave heating of beverages can result in delayed eruptive boiling, therefore care must be taken when handling the container.
- WARNING: The contents of feeding bottles and baby food jars must be stirred or shaken and the temperature checked before consumption, in order to avoid burns.
- 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**.
- When heating food in plastic or paper containers, keep an eye on the oven due to the possibility of ignition.
- If smoke is observed, switch off or unplug the appliance and keep the door closed in order to stifle any flames.
- 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 appliance should not be cleaned with a water jet (for appliances intended to stand on the floor and which are not at least IPX5).
- Statement on usage on commercial road vehicles (for appliances intended to be used on commercial road vehicles).
- The appliance must not be cleaned with a steam cleaner (for appliances which are not at least IPX5).

~~NOTE 101 If the oven is incorporated in a vending machine, these warnings and instructions may not be relevant and therefore not required.~~

NOTE 102 If the oven is incorporated in a vending machine, no warnings and instructions can be required.

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

The manufacturer shall declare that the appliance is also intended to be used in an **area open to the public**. For this case, it shall be stated whether this appliance is allowed to be placed or installed less than 850 mm above the floor.

If the appliance is not suitable for use in an **area open to the public**, the instruction shall include the substance of the following warning:

WARNING: This appliance shall not be placed or installed where the public has access.

7.12.1 Addition:

If the installation instructions state that a **microwave oven** can be placed on top of another **microwave oven**, they shall state model or type reference of the suitable **microwave ovens**. Instructions shall be given for the stacking way of the **microwave ovens**. The instructions shall state how to use the fixing attachments, if any, in a correct way. The instructions shall also state the maximum number of stacked **microwave ovens**.

7.14 Addition:

The warning specified in 7.1 shall be in lettering at least 3 mm high.

The warning specified in 7.101 shall be in lettering at least 5 mm high.

The height of the triangle used with symbol IEC 60417-5041 (2002-10) shall be at least 12 mm.

7.15 Addition:

~~The marking specified for hot surfaces shall be visible when the appliance is operated as in normal use, including when actuating any switch, adjusting any control or opening a lid or door. It shall not be placed on a **hot functional surface**.~~

If the hot surface marking in 7.1 or symbol IEC 60417-5041 (2002-10) is marked on the appliance, it shall be visible when the appliance is operated as in normal use, including when actuating any switch, adjusting any control or opening a lid or door. It shall not be placed on surfaces that are exempted from the limits in Table 3, Table 101 and Table 102.

7.101 A label shall be provided, together with instructions for fixing it in a conspicuous place close to the appliance. The label shall state the substance of the following.

- WARNING: Liquids or other foods must not be heated in sealed containers since they are liable to explode;
- WARNING: Microwave heating of beverages can result in delayed eruptive boiling, therefore care must be taken when handling the container;
- WARNING: The contents of feeding bottles and baby food jars must be stirred or shaken and the temperature checked before consumption, in order to avoid burns.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable *except as follows*.

8.1.1 Addition:

*For appliances intended to be used in the **area open to the public**, test probe 18 of IEC 61032 is applied.*

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable.

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 intended to be fixed to the floor, **microwave ovens** intended to be stacked onto other **microwave ovens** ~~and/or~~ appliances with a mass greater than 40 kg and not provided with rollers, castors or similar means, are installed in accordance with the installation instructions. If no instructions are supplied, these appliances are placed on the floor as near as possible to the walls of the test corner.

11.3 Addition:

Where the external **accessible surfaces** are suitably flat and access permits, the test probe of Figure 102 is used to measure the temperature rises of external **accessible surfaces** specified in Table 101 and Table 102. The probe is applied with a force of $4\text{ N} \pm 1\text{ N}$ to the surface in such a way that the best possible contact between the probe and the surface is ensured. The measurement is performed after a contact period of 30 s.

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

11.7 Replacement:

Appliances are operated in cycles, each cycle consisting of a heating period of 4 min followed by a rest period of 1 min until steady conditions are established. The last cycle does not include a rest period of 1 min. Boiling water is added to the water **load** when half of the water **load** has evaporated.

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

For **microwave ovens** intended to be stacked onto other **microwave ovens**, the tests shall be also conducted under the most unfavourable stacking conditions in accordance with the instructions. In this case, all **microwave ovens** are operated simultaneously under normal use and supplied by the same voltage.

11.8 Modification:

Replace the first paragraph by the following text:

For appliances intended to be used in **areas open to the public**, the temperature rises are monitored continuously and shall not exceed the values shown in Table 3 and Table 102.

For other appliances, the temperature rise shall not exceed the values shown in Table 3 and Table 101.

Addition:

For Table 3:

- The temperature rises of external surfaces are only measured on the surfaces that are not placed against the wall and the floor of the test corner.
- There are no temperature limits for air-outlet grilles and for surfaces up to a distance of 25 mm from them.
- When the required values for external enclosures of **motor-operated appliances** are not met, the maximum temperature rise shall not ~~be higher~~ exceed the limit by more than ~~two times~~ 25 K to the values indicated.

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

Surface ^a	Temperature rise of external accessible surfaces K ^b
Bare metal	48
Coated metal ^c	59
Glass and ceramic	65
Plastic and plastic coating > 0,4 mm ^{d, e}	74
NOTE The temperature rise limits of handles, knobs, grips, keyboards, keypads and similar parts are specified in Table 3.	
<p>^a The following surfaces or elements shall not be taken into consideration (see Figure 103):</p> <ul style="list-style-type: none"> – cavity (surface temperatures are only measured when the door is closed); – handles or control knobs including keypads, keyboards and the like: part of the equipment that a user needs to touch to operate or adjust the equipment. The equipment shall be installed according to the manufacturer's instructions; – surfaces within 5 mm of touch controls regardless of their shape; – external surfaces of appliances which, according to the installation condition of Subclause 11.2, shall be against the walls and where these surfaces are inaccessible to a 75 mm diameter probe having a hemispherical end; – surfaces on the microwave oven door within 10 mm from the left, right and lower edge of the microwave oven door, or 25 mm from the upper edge of the microwave oven door (Zone 1). For built-in appliances, the edges shall be considered between the microwave oven door and decorative trims, if any; – surfaces around the microwave oven door within 10 mm from the left, right or lower edge of the microwave oven door, or 25 mm from the upper edge of the microwave oven door (Zone 2). For built-in appliances, the edges shall be considered between the microwave oven door and decorative trims, if any; – surfaces within 25 mm of vents such as air-outlet grilles (Zone 3). <p>^b When the required values are not met, the maximum temperature rise shall not exceed the limit by more than 25 K to the values indicated.</p> <p>^c Metal is considered coated when a coating having a minimum thickness of 90 µm made by enamel, powder coating or non-substantially plastic coating is used.</p> <p>^d The temperature rise limit of plastic also applies for plastic material having a metal finish of thickness less than 0,1 mm.</p> <p>^e When the thickness of the plastic coating does not exceed 0,4 mm, the temperature rise limits of the coated metal or of glass and ceramic material apply.</p>	

Table 102 – Maximum temperature rises of external accessible surfaces for appliances intended to be used in areas open to the public under normal operating conditions

Surface ^a	Temperature rise of external accessible surfaces	
	K	
	Appliances and parts situated not more than 850 mm above the floor after installation	Appliances and parts situated more than 850 mm above the floor after installation ^b
Bare metal	38	42
Coated metal ^c	42	49
Glass and ceramic	51	56
Plastic and plastic coating > 0,4 mm ^{d, e}	58	62
NOTE The temperature rise limits of handles, knobs, grips, keyboards, keypads and similar parts are specified in Table 3.		
<p>^a The following surfaces or elements shall not be taken into consideration (see Figure 103):</p> <ul style="list-style-type: none"> – cavity (surface temperatures are only measured when the door is closed); – handles or control knobs including keypads, keyboards and the like: part of the equipment that a user needs to touch to operate or adjust the equipment. The equipment shall be installed according to the manufacturer's instructions; – surfaces within 5 mm of touch controls regardless of their shape; – external surfaces of appliances which, according to the installation condition of Subclause 11.2, shall be against the walls and where these surfaces are inaccessible to a 75 mm diameter probe having a hemispherical end; – surfaces on the oven door within 10 mm from the left, right and lower edge of the oven door, or 25 mm from the upper edge of the oven door (Zone 1). For built-in appliances, the edges shall be considered between the oven door and decorative trims, if any; – surfaces around the oven door within 10 mm from the left, right or lower edge of the oven door, or 25 mm from the upper edge of the oven door (Zone 2). For built-in appliances, the edges shall be considered between the oven door and decorative trims, if any; – surfaces within 25 mm of vents such as air-outlet grilles (Zone 3). <p>^b When the required values are not met, the maximum temperature rise shall not exceed the limit by more than 25 K to the values indicated.</p> <p>^c Metal is considered coated when a coating having a minimum thickness of 90 µm made by enamel, powder or non-substantially plastic coating is used.</p> <p>^d The temperature rise limit of plastic also applies for plastic material having a metal finish of thickness less than 0,1 mm.</p> <p>^e When the thickness of the plastic coating does not exceed 0,4 mm, the temperature rise limits of the coated metal or of glass and ceramic material apply.</p>		

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

This clause of Part 1 is applicable.

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.1 Addition:

In addition, appliances which are intended to be situated not more than 850 mm above the floor, except those marked IPX5 or IPX6, are subjected for 5 min to the following splash test.

The apparatus shown in Figure BB.201 is used. The appliance is placed in normal position of use and adjustable feet shall be set in accordance with the instructions for use to the most unfavourable height.

For appliances normally used on the floor, the bowl is placed on the floor and is moved around in such a way as to splash the appliance from all directions. During the test, the water pressure is so regulated that the water splashes up 150 mm above the bottom of the bowl. The bowl is not positioned underneath the appliance.

For all other appliances, the bowl is placed on the same plane where the appliance is placed and is moved around in such a way as to splash the appliance from all directions. During the test, the water pressure is so regulated that the water splashes up 100 mm above the bottom of the bowl. The bowl is not positioned underneath the appliance.

Care is taken that the appliance is not hit by the direct jet.

15.2 Addition:

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

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

Compliance is checked by the following test.

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

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

The probe shall then withstand the ~~leakage current test of 16.2~~ electric strength test of 16.3.

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

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~~ one of the following tests.

16.101.1

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

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

16.101.2

- For other power transformers, 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 are checked during the tests of Clause 19.

18 Endurance

This clause of Part 1 is replaced by the following.

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

Compliance is checked by the following test.

The door system is subjected to 100 000 cycles of operation with the appliance supplied at **rated voltage** and containing an appropriate microwave-absorbing **load**. It is then subjected to 100 000 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 six cycles per minute. With the agreement of the manufacturer, the rate of operation without microwave generation can be increased to 12 cycles per minute.

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

NOTE 101 Controls ~~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 1 000 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 19.104, the appliance being supplied at **rated voltage**.*

19.11.2 Addition:

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

The filament of the magnetron is not short-circuited.

19.13 Addition:

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

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

*During the tests, the microwave leakage shall not exceed 100 W/m² measured in accordance with 32.1 but with the **load** as specified for each subclause. The appliance shall comply with 32.1 if it can be operated after the tests.*

19.101 *Appliances are operated with controls set at the most unfavourable position and without a **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 exceed 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 s 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;
- 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 potatoes placed on the **shelf** in the position where they are most likely to ignite and propagate flames to other combustible material.*

Each potato has an approximately ellipsoidal shape and a mass between 125 g and 150 g. The length of the shorter principal axis is at least 40 mm. The length of the longer 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 longer axis of the potato, is inserted along this axis of at least one of the potatoes. The number of potatoes to be used is stated in ~~Table 101~~ Table 103.

*If the potatoes do not ignite, the test is repeated with the **load** reduced by one potato. If a single potato does not ignite, it is ignited artificially.*

Table ~~101~~ 103 – Number of potatoes

Rated microwave power output <i>W</i>	Volume of the cavity <i>l</i>	Number of potatoes
<600	≥14 and <28	2
≥600 and <1 000	≥28 and <42	4
≥1 000 and <2 000	≥42 and <56	6
≥2 000	≥56	6 + N ^a
NOTE The rated microwave power output or the volume of the cavity applies, whichever results in the higher number of potatoes.		
^a N is 2 for each 500 W increase in power output or for each 14 l increase in volume.		

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.

20 Stability and mechanical hazards

This clause of part 1 is applicable except as follows.

20.1 Modification:

Replace the first paragraph of the compliance criterion by the following:

*For stacked appliances intended to be placed on the floor, the appliances, not connected to the supply mains, are placed in any normal position of use on a plane inclined at an angle of 15° to the horizontal, the **supply cord** resting on the inclined plane in the most unfavourable position. However, if part of any appliance comes into contact with the horizontal supporting surface when the stacked appliances are tilted through an angle of 15°, the stacked appliances are placed on a horizontal support and tilted in the most unfavourable direction through an angle of 15°.*

*For other than stacked appliances intended to be placed on the floor, the appliances, not connected to the supply mains, are placed in any normal position of use on a plane inclined at an angle of 10° to the horizontal, the **supply cord** resting on the inclined plane in the most unfavourable position. However, if part of any appliance comes into contact with the horizontal supporting surface when the appliances are tilted through an angle of 10°, the appliances are placed on a horizontal support and tilted in the most unfavourable direction through an angle of 10°.*

20.2 Addition:

*For appliances intend to be used in **areas open to the public**, test probe 18 of IEC 61032 is applied.*

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.

For appliances ~~normally~~ intended to be used on the floor, the mass is

- 23 kg for **cavity** doors, or the mass that can be placed in the oven in accordance with the instructions, if this is higher;
- 7 kg for other doors.

For appliances ~~normally~~ intended to be used on a table, the mass is

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

The appliance shall not tilt.

NOTE 1 A sandbag can be used for the **load**.

~~NOTE 2—For appliances having more than one door, the tests are made on each door separately.~~

For microwave ovens intended to be stacked onto other microwave ovens, the test is repeated under the stacking conditions in accordance with the instructions. Each door of microwave ovens in stacked condition is tested one at a time.

If the appliance has more than one door, the test is conducted on each door, one at a time, during the above tests.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

~~21.2—~~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 25 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 25 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 50 times.

The appliance shall then comply with 32.1.

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

This test is carried out 10 times.

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

The force is applied for 15 min.

The appliance shall then comply with 32.1.

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

The force is maintained for 5 s.

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

The appliance shall then comply with 32.1.

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

NOTE The test is not applicable to sliding doors.

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

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

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

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

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

The appliance shall then comply with 32.1.

21.105 *A bottom-hinged door is opened and a hardwood dowel having a diameter of 10 mm and a length of 300 mm is placed along the bottom hinge. The dowel is positioned such that one end is flush with an outside edge of the door. A closing force of 140 N is applied to the centre of the handle in a direction perpendicular to the surface of the door. The force is maintained for 5 s.*

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

The microwave leakage is measured under the conditions specified in 32.1 and shall not exceed 100 W/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** ~~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~~ need to be concealed because there are two independent **monitored door interlocks** incorporating supervision devices.

Compliance is checked by inspection and the following test.

*The door is slowly opened and, simultaneously, an attempt is made to manually defeat any **accessible door interlock** with test probe B. Additionally, for appliances intended to be used in **areas open to the public**, test probe 18 is also used. Each probe is applied one at a time.*

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

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

Compliance is checked by inspection.

22.105 At least one of the **door interlocks** shall be concealed and 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~~ any position and an attempt is made to operate the concealed **door interlock** by applying test probe B ~~of IEC 61032~~ and, for appliances intended to be installed in an **area open to the public**, then test probe 18, 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.~~ The test probes and rod shall be applied one at a time.*

Door interlocks that operate magnetically are also evaluated by applying a magnet to the enclosure over the **door interlock** switch. The magnet has a similar configuration and magnetic orientation to the magnets that operate the **door interlock**. It shall be capable of exerting a force of $50\text{ N} \pm 5\text{ N}$ 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.

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

The door is slowly opened and, simultaneously, an attempt is made to manually defeat any **accessible door interlock** with test probe B, the rod and the magnet, each applied separately. For appliances intended to be used in areas open to the public, test probe 18 is additionally applied separately.

The concealed **door interlocks** shall operate before any **accessible door interlock** can be defeated.

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

Compliance is checked by the following test.

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

NOTE 1—Appliances having a **rated voltage** less than 150 V and a **rated current** over 20 A are supplied at **rated voltage** from a supply source having a short-circuit capacity of at least 5,0 kA.

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

NOTE 2—The supervision device is replaced for subsequent tests if it fails in the closed circuit position.

NOTE 3—It ~~may be~~ is necessary to render other **door interlocks** inoperative in order to perform this test.

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

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

NOTE 4—For appliances having a **rated voltage** under 150 V and those with a **rated current** over 20 A, the test with the series impedance is not carried out.

NOTE 5—Switches are replaced each time the internal fuse ruptures if this is stated in the instructions for servicing.

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

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

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

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

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

Compliance is checked by the following test.

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

The appliance shall comply with 32.1.

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

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

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

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

Compliance is checked by closing the door on a strip of paper having a width of $60\text{ mm} \pm 5\text{ mm}$ 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 32.1.

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 32.1.

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

Compliance is checked by the following test.

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

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

After the test, the appliance shall comply with 32.1.

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

Compliance is checked by the following test.

*The probe is connected as in normal use, the sensing part or cord being allowed to rest in the most unfavourable position likely to occur. The door is closed against the sensing part of the cord with a force of 90 N applied for 5 s in the most unfavourable place. The force is then released and, if the oven can be operated with the **temperature-sensing probe** still being placed in the trapped position, the microwave leakage is measured under the conditions specified in 32.1 and shall not exceed 100 W/m².*

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

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

Compliance is checked by the following test.

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

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

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

22.114 Appliances shall be constructed so that **shelves** do not fall out of their supports when subjected to a **load**. **Shelves** intended to be partially withdrawn in use shall not tip when they have partially been removed from the oven.

Compliance is checked by the following test.

*A vessel filled with sand or shot is placed on the **shelf**. The total mass in kilograms is equal to 30 kg/m² of the **shelf** area. The **shelf**, with the vessel placed centrally on it, is inserted into the oven and moved as close as possible to one of the side walls. It is left in this position for 1 min and then withdrawn. It is then reinserted, moved as close as possible to the other side wall and left for one minute.*

*During the test, the **shelf** shall not fall away from its support.*

*For **shelves** intended to be partially withdrawn in use, the test is repeated with the **shelf** pulled out by 50 % of its depth. An additional force of 10 N is applied vertically downwards on the centre of the exposed front edge of the **shelf**.*

*During the test, the **shelf** shall not tip.*

NOTE A small angle of deflection is ~~allowed~~ ignored.

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

Compliance is checked by inspection and, if necessary, by simulating relevant faults. Wires that ~~may~~ can become loose are disconnected and allowed to fall out of position but are not otherwise

*manipulated. They shall not come into contact with other **live parts** or earthed parts if this results in all **door interlocks** becoming inoperative.*

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

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

22.116 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**.*

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

*Compliance is checked by inspection and by manual test with test probe B, and, for appliances intended to be used in an **area open to the public**, in addition test probe 18, one at a time.*

22.118 Lights, switches or push-buttons for the indication of danger, alarm or similar situations shall ~~only~~ be coloured red.

Compliance is checked by inspection.

22.119 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.

22.120 Appliances for installing in commercial road vehicles, coaches, busses, food stalls and similar vehicles shall withstand the vibrations to which they ~~may~~ **can** be subjected.

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

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

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

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

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

Compliance is checked as follows:

- the fault/error conditions specified in Table R.1 are applied and evaluated in accordance with the relevant requirements of *normative* Annex R; or
- the appliance is operated under conditions of Clause 11 while being supplied at **rated voltage**, the programmable **electronic circuits** being modified to allow simultaneous activation of all heaters and motors under their control. Under these conditions, compliance with 19.13 shall be fulfilled.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1

NOTE 101 IEC 60989² is not applicable to power transformers that supply the magnetron.

24.1.4 ~~Addition~~ Modification:

The number of cycles of operation for **thermostats** is increased to 30 000.

Addition:

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

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

- **door interlocks:** 50 000;
- interlocks only operated during **user maintenance:** 5 000.

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

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

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

~~— 10 A, for other appliances.~~

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

~~Compliance is checked by inspection.~~

~~NOTE The actuating member of miniature circuit breakers may be accessible.~~

² Withdrawn.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 *Modification:*

Appliances shall not be provided with an appliance inlet.

25.3 *Addition:*

Fixed appliances and appliances with a mass greater than 40 kg and not provided with rollers, castors or similar means shall be constructed so that the **supply cord** can be connected after the appliance has been installed in accordance with the installation instructions.

Terminals for the permanent connection of cables to fixed wiring may also be suitable for a **supply cord of type X attachment**. In this case, a cord anchorage complying with 25.16 shall be fitted to the appliance.

25.7 *Modification:*

Instead of the types of **supply cords** specified, the following applies:

Supply cords shall be oil-resistant and shall not be lighter than ordinary polychloroprene sheathed flexible cord (code designation 60245 IEC 57) or equivalent synthetic elastomer sheathed cord.

25.14 *Addition:*

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

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable except as follows.

27.1

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

27.2 *Addition:*

Stationary appliances shall be provided with a terminal for the connection of an external equipotential bonding conductor. This terminal shall be in effective electrical contact with all fixed exposed metal parts and shall allow the connection of a conductor having a nominal cross-sectional area up to 10 mm². It shall be located in a position convenient for the connection of the conductor after installation of the appliance.

NOTE 101 Small fixed exposed metal parts, for example nameplates, are not required to be in electrical contact with the terminal.

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.

32.1 Addition:

Compliance for microwave leakage is checked by the following test.

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

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

The microwave leakage at any point 50 mm or more from the external surface of the appliance shall not exceed 50 W/m².

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

Dimensions in millimetres

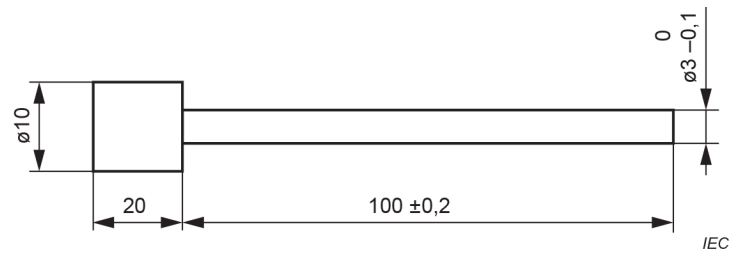
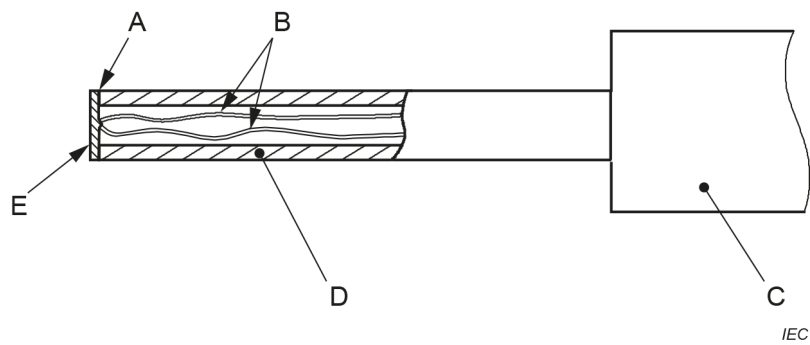


Figure 101 – Test rod for door interlock concealment

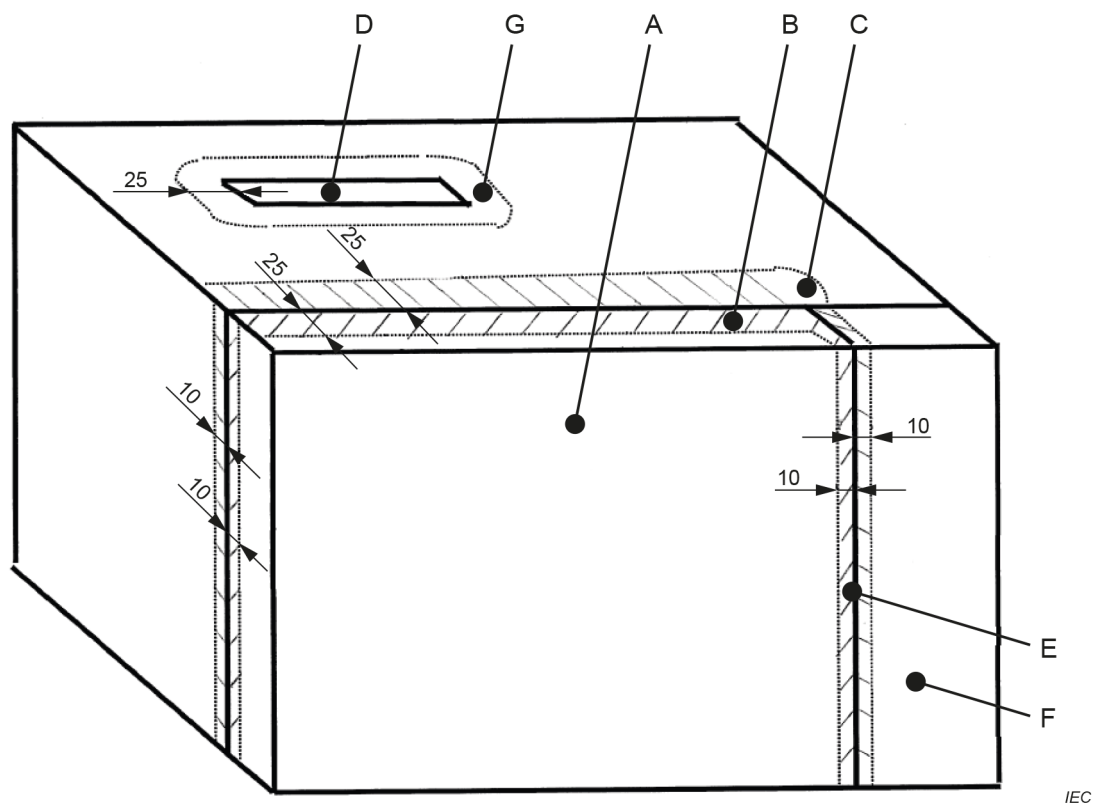


Key

- A adhesive
- B thermocouple wires 0,3 mm diameter to IEC 60584-1 Type K
- C handle arrangement permitting a contact force of $4\text{ N} \pm 1\text{ N}$
- D polycarbonate tube: inside diameter 3 mm, outside diameter 5 mm
- E tinned copper disc: 5 mm diameter, 0,5 mm thick with flat contact face

Figure 102 – Probe for measuring surface temperatures

Dimensions in millimetres



IEC

Key

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

Figure 103 – Front view of appliance with identification of excluded areas

Annexes

The annexes of Part 1 are applicable except as follows.

Annex A (informative)

Routine tests

This annex of Part 1 is applicable except as follows.

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

Modification:

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

A.101 Marking and instructions

The covers dealt with in 7.1 are checked to ensure that they are marked with the warnings concerning microwave energy.

The presence of the warning sign and warning text dealt with in BB.22.119201.6 is checked.

The appliance is checked to ensure that the corresponding labels, instructions and manuals 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

A.103.1 *The **microwave oven** is supplied at **rated voltage** and operated with the microwave power control adjusted to the highest setting. The energy flux density of microwave leakage is measured at any point approximately 50 mm from the*

- *external surface of the appliance for **microwave ovens** not covered by **normative Annex BB**, or*
- ***reference surface** for **microwave ovens** covered by **normative Annex BB**.*

A.103.2 *For **microwave ovens***

- *not covered by **normative Annex BB**, an appropriate **load** may be used, or*
- *covered by **normative Annex BB**, a **load** as specified in ~~BB.3.1.9~~ 3.1.9 of **normative Annex BB** shall be used.*

A.103.3 *The measuring instrument is moved*

- *over the external surface of the appliance for **microwave ovens** not covered by **normative Annex BB**, or*
- *over the external surface of the appliance and any **microwave barrier** for **microwave ovens** covered by **normative Annex BB***

and the microwave leakage is measured.

A.103.4 *The microwave leakage shall not exceed*

- *50 W/m² for **microwave ovens** not covered by **normative Annex BB**, or*

- 50 W/m², averaged over the most onerous 20 s interval and 500 W/m² measured as peak value for **microwave ovens** covered by *normative* Annex BB,

as recorded with an instrument fulfilling at least the specifications in *Clause* A.104 regarding its proper function.

A.104 Microwave leakage instrument minimum specifications

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

A.104.12 Instruments shall be subjected to 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 the measurements specified in A.104.23, the minimum resolution of the instrument under test (IUT) shall be 1 W/m².

A.104.23 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/m² or 50 W/m², 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/m² or 50 W/m², depending on the task and with a tolerance from –40 % to +60 %. By slowly rotating the IUT field sensor for 360° around its axis which is aligned to the propagation direction of the far field and directed towards the radiation source, the minimum and maximum readings shall be found and recorded. If the deviation of minimum and maximum readings is less than or equal to ± 2 dB (i.e. from –37 % to +58 %) related to the reference field, it is assumed that the IUT complies with this standard.

Annex R (normative)

Software evaluation

This annex of Part 1 is applicable except as follows.

R.2.2.5 *Modification:*

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

R.2.2.9 *Modification:*

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

Annex AA (normative)

Combination microwave ovens

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

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

~~For **combination microwave ovens**, IEC 60335-2-36 is also applicable, for **combination microwave ovens** with convection or steam function, IEC 60335-2-42 is also applicable, for **combination microwave ovens** with the function of keeping food and crockery warm, IEC 60335-2-49 is also applicable and for **combination microwave ovens** in conjunction with dispensing appliances or vending machines, IEC 60335-2-75 is also applicable.~~

1 Scope

AA.1.201 For **combination microwave ovens** with commercial electric forced convection ovens, steam cookers and steam-convection ovens, IEC 60335-2-42 is also applicable.

AA.1.202 For **combination microwave ovens** with commercial electric cooking ranges, ovens, hobs and hob element, IEC 60335-2-36 is also applicable.

AA.1.203 For **combination microwave ovens** with commercial electric appliances for keeping food and crockery warm, IEC 60335-2-49 is also applicable.

AA.1.204 For **combination microwave ovens** with commercial dispensing appliances or vending machines, IEC 60335-2-75 is also applicable.

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 (see Clause 2 of this standard). If a **combination microwave oven** has a mode of operation without the use of resistive heating elements, it is tested to comply with the relevant requirements of this standard.

AA.3 Terms and definitions

~~**AA.3.1.9**~~ **normal operation**

Addition:

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

AA.5 General conditions for the tests

~~*Addition:*~~

5.3

NOTE ~~404~~201 When testing the different modes of operation, only those tests having the most unfavourable conditions are carried out.

~~**AA.5.101**~~

Replace as follows.

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

AA.11 Heating

AA.11.7.101201 **Combination microwave ovens** incorporating resistive heating elements where simultaneous operation is intended, are operated with the resistive heating elements switched on as specified in the manufacturer's instructions under the conditions of Clause 11 of the relevant standard but using the **load** specified in 3.1.9, the microwave power output being approximately 50 %.

If no instructions are provided, the appliance is operated until steady conditions are established.

AA.18 Endurance

Addition:

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

- *resistive heating elements for radiant heating are operated for 30 min;*
- *resistive heating elements for convection heating are operated for 60 min.*

AA.19 Abnormal operation

AA.19.1 *Addition:*

Modify as follows.

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

AA.29 Clearances, creepage distances and solid insulation

Replace as follows.

This clause of Part 1 is applicable except as follows.

AA.29.2 *Modification:*

Replace the second paragraph by the following:

The micro-environment is pollution degree 3 unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution during normal use of the appliance.

AA.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)

Requirements for commercial microwave ovens without a cavity door and with conveyor-type means

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

Annex BB modifies the corresponding clauses and subclauses of the main part of this standard or, where this is not applicable, of Part 1 of IEC 60335, to indicate requirements for commercial microwave ovens without a **cavity** door and with conveyor-type means. Where it is unclear whether a clause or subclause of this annex is intended to modify the corresponding text of the main part of this standard or that of Part 1, this is specified.

BB.3 Terms and definitions

NOTE 201 For more details, see ~~Figure BB.3~~ Figure BB.203.

BB.3.1.9 normal operation

Replacement:

operation of the appliance under the following conditions:

The **microwave oven** without a **cavity** door and with conveyor-type means is operated according to the manufacturer's instructions. If no instructions are provided, the appliance is operated under the following conditions.

- a) Tunnel type appliances are operated under the following conditions:
 - 1) if the **entrance and exit port** heights are adjustable, the largest height is used;
 - 2) the highest generator power settings are used.
- b) The **load** to be heated up consists of N cylindrical containers of borosilicate glass with a maximum thickness of 3 mm and an external diameter of approximately 190 mm, filled with $(1\,000 \pm 50)$ g potable water having an initial temperature of (20 ± 2) °C. These containers are placed so that all containers are inside the **cavity** and as many as possible microwave generators are operating at the same time.

The number N results from the following formula:

$$N = P/1\,100\text{ W} \text{ (} P = \text{rated microwave power output [W])}$$

The result of N shall be rounded off to the nearest integer.

If it is not possible to use these containers, containers of the same material and thickness and with a water mass of not less than $275\text{ g} \pm 15\text{ g}$ shall be used.

An excess number of containers are prepared, so that the whole length and width of the **transportation means** inside the **microwave enclosure** is loaded.

The conveyor speed is set to the lowest reasonable value that will not bring the **loads** to boiling.

Loads are taken out and are replaced with new cold **loads** on the **loading area** as they come out on the **removing area**.

c) Single special **load** vending type appliances are operated with their intended **load**. Other vending type appliances are operated under the following conditions.

- 1) Sealed plastic bags with potable water are used, with a water mass corresponding to the weight of typical **loads** for which the appliance is intended.

The appliance is operated for consecutive cycles, the duration of each cycle is determined by the following formula:

$$t = m \times 4,187 \times \Delta T / P$$

where

t is the duration of each cycle (s);

m is the mass of the water (g);

ΔT is the required temperature rise of 55 K, and

P is the **rated microwave power output** (W).

The initial temperature should be $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

- 2) New **loads** are supplied with the shortest possible pauses between runs.

Note 404201 to entry: Care should be taken when handling the **load**.

BB.3.103

3.6.101

Replace as follows.

cavity

space within the **microwave enclosure** where the **load** is heated with high microwave energy

Note 1 to entry: Waveguides between the microwave generator and **cavity** are included since they also contain high microwave energy.

BB.7 Marking and instructions

BB.7.1 Addition to the *first* list of items:

- water pressure or pressure areas in kilopascals (kPa) for the appliances that are determined for the connection to the water supply, or this is fixed in the instructions for use.

~~Modification~~ *Replacement of the 5th dashed item of the first list:*

- model or type reference and serial number of the appliance. If the generator(s) is separate from the **cavity** part of the appliance, this information shall also appear on the generator(s);

BB.7.12 Add the following 3 dashed items:

- WARNING: Do not programme excessive heating times. Overheating can result in contamination or fire.
- Details for necessary cleaning required for hygienic reasons (e.g. **cavity**, **transportation means**) and also for functional reasons (e.g. **means of microwave interlock**, sensor).
- Information necessary for dispatch, positioning, installation and operation, including details of weight, dimensions and required minimum distances.

~~Modification~~ *Replace the ninth dashed item by the following:*

- If smoke is observed, follow the instructions supplied by the manufacturer in order to contain the fire.

~~Addition:~~

BB.7.404201.1

A label shall be provided, together with instructions for fixing it in a conspicuous place close to the exit port. The label shall state the substance of the following, if applicable.

- WARNING: Microwave heating of beverages and similar can result in delayed eruptive boiling, therefore care must be taken when handling the container.
- WARNING: Microwaved food and beverages can be very hot, handle with care.

Compliance is checked by inspection.

BB.7.404201.2 The instructions for the operator shall include the substance of the following warnings.

- WARNING: If parts of **entrance ports and exit ports**, means of access, **viewing openings**, **microwave barriers**, covers, the **microwave enclosure** or any other means named by the manufacturer are damaged, the appliance shall not be operated until it is repaired by a **skilled person**. Until repairs are carried out, the appliance shall be set in a permanent non-operational condition (e.g. with key switch, code-card or similar devices). Further details shall be included in the instructions for use.
- WARNING: Only **instructed persons** shall operate the **microwave oven**. The **instructed persons** shall regularly, but at a minimum of once a year, be instructed by a **skilled person**. A record of the instruction provided shall be recorded.

BB.7.404201.3 The service or repair manual shall include the substance of the following:

- WARNING: The **microwave oven** shall comply with requirements of 32.1 after every repair and according to the instructions of the manufacturer.

Attention: Persons shall not be exposed to excessive emitted microwave energy from the microwave generator. All connections, waveguides, flanges, seals etc. of the **microwave enclosure** and **microwave barriers** shall be safely constructed so that the microwave leakage does not exceed the allowed limit. The operation of the appliance without a microwave absorbing **load** is to be avoided. The appliance shall be regularly maintained and kept in a good condition to ensure that microwave leakage does not exceed the allowed limit.

The **microwave oven** shall only be maintained by **skilled persons**.

The manufacturer shall supply detailed recommendations on the prevention of **cavity** fires together with guidance on how fires should be handled, should they occur. Guidance should also be provided on dealing with low water content foods, metal objects and containers with metal.

BB.8 Protection against accessibility to live parts**BB.8.1.1** *Addition:*

Test probe B of IEC 61032 is applied into openings of less than 75 mm that the probe will permit, to any depth and to a distance of 5 times the minor dimension of openings that are greater than 75 mm, up to a maximum of 850 mm. The probe is rotated or angled to all possible positions, during and after insertion.

BB.9 Starting of motor-operated appliances

BB.9.1201 Motors that drive the **transportation means** shall start under all voltage conditions that ~~may~~ can occur in use.

*Compliance is checked by starting the motor three times at a voltage equal to 0,85 times **rated voltage**, the motor being at room temperature at the beginning of the test.*

*The motor is started each time under the conditions occurring at the beginning of **normal operation** or, for automatic appliances, at the beginning of the normal cycle of operation. The motor shall be allowed to stop between successive starts. For appliances provided with motors having other than centrifugal starting switches, the test is repeated at a voltage equal to 1,06 times **rated voltage**.*

*In all cases, the motor shall start and it shall function in such a way that safety is not affected and overload **protection devices** of the motor shall not operate.*

NOTE Prior to commencing the test, appliances with conveyor means ~~shall be~~ are loaded with the heaviest **load** as specified by the manufacturer. If no instructions are provided, the conditions of ~~BB.3.1.9~~ 3.1.9 of normative Annex BB apply.

BB.11 Heating

BB.11.7 Modification:

The **microwave oven** is operated as specified in ~~BB.3.1.9~~ 3.1.9 of normative Annex BB until steady conditions are established.

~~BB.13 Leakage current and electric strength at operating temperature~~

~~BB.13.2 Modification of Part 1:~~

~~The last sentence of the fourth paragraph is void.~~

~~NOTE—An electronic power converter with a supply of more than one phase can be damaged in most cases.~~

BB.15 Moisture resistance

BB.15.1.1 Addition:

Microwave ovens classified as IPX0, IPX1, IPX2, IPX3 and IPX4, which are intended for placing on the floor, shall be subjected for a period of 5 min to the following splash test.

*The apparatus shown in ~~Figure BB.1~~ Figure BB.201 is used for the test. During the test, the water pressure is regulated so that the water splashes up 150 mm above the bottom of the bowl. The bowl is placed on the floor for **microwave ovens** normally used on the floor. The bowl is moved around in such a way as to splash the **microwave oven** from all directions. Care shall be taken to ensure that the **microwave oven** is not hit directly by the jet.*

BB.15.2 Addition:

*A quantity of 0,5 l of water containing approximately 1 % NaCl is poured steadily over the most unfavourable parts but excluding the **microwave enclosure**, over a period of 15 s.*

*The quantity of 0,5 l of water containing approximately 1 % NaCl, for each kW **rated microwave power output**, is poured steadily at a rate of 0,5 l per 15 s into the **microwave enclosure**.*

BB.15.102201 Microwave ovens that are provided with a tap intended for filling or cleaning shall be constructed so that the water from the tap cannot come into contact with live parts.

Compliance is checked by the following test.

*The tap is fully opened for 1 min with the **microwave oven** connected to a water supply having the maximum water pressure specified by the manufacturer. Movable parts are placed in the least favourable position. Swivelling outlets on water taps are positioned so that water is directed on to those parts that will give the least favourable test result. Immediately following this treatment, the **microwave oven** shall withstand an electric strength test specified in 16.3.*

BB-18 Endurance

Addition:

The means of access and covers shall be opened and then closed as in normal use. The number of operations is 6 cycles per 1 min or the maximum quantity that is given for the construction.

The following means of access are subjected to the following cycles of operation:

- | | |
|---|----------------|
| – Means of access and cleaning covers that can be opened by instructed persons for the purpose of venting, flushing lamp covers, cleaning, etc. | 10 000 cycles |
| – Maintenance covers that can be opened by skilled persons | 300 cycles |
| – Protective blocking structures which protect ordinary persons | 200 000 cycles |

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

NOTE It ~~may~~ can be ~~necessary~~ applicable to render some supervision and system control devices inoperable when carrying out this test.

BB-19 Abnormal operation

BB-19.8 *Addition:*

***Microwave ovens** intended to be star-connected are operated with the neutral conductor being disconnected. Subclause 19.13 shall be applied after the test.*

BB-19.13

Modify as follows.

The microwave leakage shall not exceed 50 W/m².

BB-19.104

Add as follows.

*The most onerous condition, i.e. stopping the belt, shall be selected. During the test, any fire in the **cavity** shall be contained within the appliance.*

Table 101 *Replacement of the Note:*