

# INTERNATIONAL STANDARD



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

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IEC 60335-2-110

Edition 2.0 2024-07  
REDLINE VERSION

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 97.040.20

ISBN 978-2-8322-9408-6

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

#### Part 2-110: Particular requirements for commercial microwave appliances with insertion or contacting applicators

#### FOREWORD

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**This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60335-2-110:2013+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 60335-2-110 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 second edition cancels and replaces the first edition published in 2013 and Amendment 1:2019. This edition constitutes a technical revision.

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

- Subclause 7.1 has been improved in clarity.
- Subclauses 19.11.2 and 19.103 have been improved in clarity.
- Clause 28 has been modified to add screw requirements.

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

Draft	Report on voting
61B/688/CDV	61B/691A/RVC

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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/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.

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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 appliances with insertion or contacting applicators.

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

NOTE 2 The following numbering system is used:

- subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
- unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;
- additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

- requirements: in roman type;
- *test specifications: in italic type;*
- notes: in small roman type.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under [webstore.iec.ch](https://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.

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## 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 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 2-110: Particular requirements for commercial microwave appliances with insertion or contacting applicators

#### 1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of microwave appliances 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.

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

~~— persons (including children) whose~~

~~• physical, sensory or mental capabilities; or~~

~~• lack of experience and knowledge~~

~~prevents them from using the appliance safely without supervision or instruction;~~

~~— children playing with the appliance.~~

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

Appliances covered by this standard incorporate an open-ended **applicator** (as example an overview is given in Figure 103) for treatment of the **load**. They are divided into three types:

- with **insertion applicator**, typically for moisture removal by insertion into holes in floors, walls or ceilings (an example is given in Figure 106);
- with **large area contacting applicator**, typically for drying of floors, walls or ceilings (examples are given in Figure 104 and Figure 105);
- with **small area contacting applicator**, typically for paint removal and spot-heating (an example is given in Figure 107).

Microwave appliances with **insertion applicator**, **large area contacting applicator** or **small area contacting applicator** are using electromagnetic energy in one or several of the ISM frequency bands between 300 MHz and 30 GHz, for supplying energy to an external load which is heated so that a resulting process of drying, moisture transport which can result in forces due to formation of steam, decomposition or chemical modification, melting, or termination of organisms such as bacteria or fungus occurs.

NOTE 101 ISM frequency bands are the electromagnetic frequencies established by the ITU and reproduced in CISPR 11.

NOTE 102 Food and beverages are not loads in the meaning of this standard.

~~NOTE 101~~ Appliances with **insertion applicator** and with **large area contacting applicator** are **portable appliances**. Appliances with **small area contacting applicator** are **handheld appliances**.

~~NOTE 102~~ Appliances that use non-electrical energy are within the scope of this standard. The microwave-related portion is considered **motor-operated**.

The rationales for the **microwave barrier** and associated leakage tests are described in informative Annex AA.

**NOTE 103**—Attention is drawn to the fact that

- these appliances can radiate microwave energy outside a **restricted area** where they are used. The additional requirements specified by national authorities responsible for the protection for non-ionising radiation that the limit of power flux density is 10 W/m<sup>2</sup>, averaged over any time period of 6 min, outside this **restricted area** is taken into consideration in this standard;
- these appliances are intended to exclusively treat the **load in normal operation**, i.e. this standard does not apply to appliances or systems employing free space microwave propagation;
- for appliances intended to be used in tropical countries, special requirements can be necessary;
- in many countries, additional requirements are specified by the national health authorities, and national authorities responsible for the protection of labour and for non-ionising radiation protection.

**NOTE 104**—This standard does not apply to

- household microwave ovens, including combination microwave ovens (IEC 60335-2-25);
- commercial microwave ovens with a cavity door, commercial combination microwave ovens with a cavity door and commercial combination microwave ovens without a cavity door and with transportation means (IEC 60335-2-90);
- industrial microwave heating equipment (IEC 60519-6);
- appliances for medical purposes (IEC 60601-1);
- appliances and equipment for laboratory use (IEC 61010 series);
- 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);

**NOTE 105**—Some of the specifications and tests in this standard are not applicable for other than 2 450 MHz appliances.

## 2 Normative references

This clause of Part 1 is applicable except as follows.

*Addition:*

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

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*

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings*

ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

### 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

*Modification:*

##### **normal operation**

*Replace the first paragraph by the following.*

heating operation of the **appliance** under the following conditions:

The **appliance** is operated according to the manufacturer's instructions for **intended use**. However, using a typical **load** for **intended use** ~~may~~ can be impractical, since it ~~may~~ can be part of a building, unless the manufacturer makes useful and realistic such **loads** available for the tests. If that is not the case, the appliance is operated under the following conditions:

The initial temperature of the test **load** which is used for microwave energy absorption shall be  $(20 \pm 5) ^\circ\text{C}$ .

The highest generator power settings are to be used.

Appliances with an **insertion applicator** for moisture removal are operated by insertion into holes in floor, wall or ceiling structures under the following conditions:

- a) The test **load** consists of a metal tank filled with water, having an open top water surface exceeding that of the horizontal dimensions of the appliance by at least 70 mm on all sides and having a water column height of at least 150 mm plus the length of the longest insertion distance of the **insertion applicator**. At the top sides of the tank there are horizontal supports of a **microwave-transparent** material, with a suitable opening for the applicator antenna. The water level is adjusted so that the distance from the housing of the appliance to the test **load** is the same as in its **intended use**.

Note 101 to entry: If it is obvious that good microwave impedance matching of the **insertion applicator** can be obtained only if the hole into which it is inserted is not water-filled, a sleeve or similar of a highly **microwave transparent** material such as PTFE is used around the **insertion applicator**. If wave propagation in the axial direction occurs in the test set-up and the manufacturer can show that it is not possible in actual use, or monitoring devices then shut down the **insertion applicator**, a thin-wall plastic tube with inner diameter corresponding to the maximum hole diameter according to the manufacturer's specification can be used.

- b) Appliances with **large area contacting applicator** for drying of floor, wall or ceiling structures are operated under the following conditions: the test **load** consists of a metal tank filled with water, having an open top water surface exceeding that of the horizontal dimensions of the appliance by at least 70 mm on all sides and having a water column height of at least 150 mm. At the top of two opposite tank sides there are horizontal supports of a **microwave-transparent** material, extending just so far inwards that the **traction drive** rests on the support. The water level is adjusted so that the distance from the **applicator** to the test **load** is the same as in its **intended use**. The proper reversal function of the **traction drive** is tested under the following conditions: the appliance is operated on a horizontal

plywood surface with a thickness of 20 mm and an area sufficient to allow back and forth movement between blocks representing walls.

Note 102 to entry: If needed for representative operation of the appliance, the horizontal supports are extended as to activate the mechanical **microwave interlocks**.

Appliances with **small area contacting applicator** for paint removal and spot-heating are operated under the following conditions:

The test **load** consists of a grinding wheel or grinding block made of fine-grained silicon carbide at least 15 mm in thickness, and its length and width exceeding the corresponding dimensions of the **applicator** opening by at least 30 mm; however this test **load** shall be so large that it can be air-cooled from the underside without the appliance being influenced.

### ~~3.101~~

~~microwave appliance with insertion, large or small area contacting applicator commercial appliance using electromagnetic energy in one or several of the ISM frequency bands between 300 MHz and 30 GHz, for supplying energy to an external load which is heated so that a resulting process of drying, moisture transport which may result in forces due to formation of steam, decomposition or chemical modification, melting, or termination of organisms such as bacteria or fungus occurs~~

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

~~Note 2 to entry: Food and beverages are not loads in the meaning of this standard.~~

### ~~3.108~~3.1.101

#### rated microwave power output

microwave power output assigned to the appliance by the manufacturer

Note 1 to entry: This can be lower than the **available microwave power**, due to intentional microwave power losses in microwave absorbers (see Note in 101.1) and coaxial cables acting for protection of the microwave generator of **small area contacting applicators** (see 22.101).

### ~~3.109~~3.1.102

#### available microwave power

microwave generator nominal output under impedance matched condition which is obtained by the generator manufacturer specification and measurement of its electrical input to the generator in the appliance during the first 10 s of operation at maximum power

Note 1 to entry: Magnetrons will typically have a stationary power output 3 s after energising.

## 3.6 Definitions relating to parts of an appliance

### ~~3.102~~3.6.101

#### applicator

structure which applies the microwave energy to the **load**

### ~~3.104~~3.6.102

#### microwave-transparent transparent

property of a material having negligible absorption and reflection of microwaves

Note 1 to entry: The relative permittivity of a **microwave transparent** material is less than 7 and the relative loss factor is less than 0,015.

### ~~3.105~~3.6.103

#### insertion applicator

**applicator** for insertion into the **load**, in which all **available microwave power** is intended to be absorbed

**3.106**3.6.104

**large area contacting applicator**

**applicator** with a metallic enclosure, having at least one geometric non-metallic opening through which microwave energy is applied to a closely located external **load** in which all **available microwave power** is intended to be absorbed

**3.107**3.6.105

**small area contacting applicator**

**applicator** with a metallic enclosure, having at least one geometric non-metallic opening or appropriate device through which microwave energy is applied to a very closely located external **load** in which all **rated microwave power** is intended to be absorbed

**3.113**3.6.106

**traction drive**

means or system used to accomplish movement of an appliance with **large area contacting applicator** on a floor

**3.114**3.6.107

**microwave enclosure**

overall structure that is intended to confine the microwave energy

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

**3.115**3.6.108

**microwave barrier**

**microwave transparent** part of the microwave appliance that is mounted outside the **microwave enclosure** for limiting access into it and can only be removed with the aid of **tools**

Note 1 to entry: A **microwave barrier** 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 the periphery of the opening of an **applicator** intended to reduce microwave leakage are not considered **microwave barriers**.

Note 3 to entry: **Microwave barriers** cannot be hinged or flexed.

**3.116**3.6.109

**microwave guard**

constructive part of the appliance that is mounted outside or at the **microwave enclosure** for reducing microwave leakage by shielding and/or absorption and can only be removed with the aid of **tools**

Note 1 to entry: **Microwave guards** can move or open when the **applicator** is brought into contact with the **load**.

Note 2 to entry: Devices such as an array of metal chains or hinged metal plates at the periphery of the opening of an **applicator** intended to reduce microwave leakage are considered **microwave guards**.

**3.117**3.6.110

**maintenance door**

constructive part of the appliance that can be opened or removed with the aid of **tools** to get access for service and repair

**3.118**3.6.111

**microwave interlock**

device or system that prevents the operation of the microwave generator if conditions of **excessive** microwave leakage occur or are likely to occur

Note 1 to entry: Examples of **microwave interlock** are switches which stop the microwave power when a contacting **applicator** is lifted up or an **insertion applicator** is removed from its **load** during operation, and an integral leakage monitor which does the same if there is insufficient proximity between an **applicator** and the **load** or if an attempt is made to start the appliance without a **load**.