IEC 60335-2-110

Edition 1.0 2013-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Appareils électrodomestiques et analogues – Sécurité –
Partie 2-110: Exigences particulières pour les appareils à micro-ondes à usage commercial avec applicateurs par insertion ou par contact

IEC 60335-2-110:2013

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

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

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This part of International Standard IEC 60335 has been prepared by subcommittee SC61B: Safety of microwave appliances for household and commercial use, of IEC technical committee 61: Safety of household and similar electrical appliances.

The text of this standard is based on the following documents:

FDIS	Report on voting
61B/477/FDIS	61B/483/RVD

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

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

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fifth edition (2010) of that standard.

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

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety 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 publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

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

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

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.

INTRODUCTION

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

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

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

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

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

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

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

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

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

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

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

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

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard 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.

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).

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**.

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^2, 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 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 (series of IEC 61010);
– 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*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.7 *Addition:*

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

3.1.9 *Replacement:*
normal operation
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 be impractical, since it may 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 ± 5) °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.

3.102
applicator
structure which applies the microwave energy to the **load**

3.103
load
object to be treated into which the **applicator** is introduced or put in close position to

3.104
microwave transparency
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
insertion applicator
applicator for insertion into the **load**, in which all **available microwave power** is intended to be absorbed

3.106
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
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

3.108
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
available microwave power
the 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.

3.110
instructed person
person who is sufficiently instructed and monitored to know how to avoid any danger caused by the operation of a microwave appliance with **insertion applicator**, **large area contacting applicator**, or **small area contacting applicator**

3.111
skilled person
person with suitable professional education, knowledge and experience to discern and to avoid any danger caused by the operation of a microwave appliance with **insertion applicator**, **large area contacting applicator**, or **small area contacting applicator**

3.112
ordinary person
person who is neither a **skilled person** nor an **instructed person**

3.113
traction drive
means or system used to accomplish movement of an appliance with **large area contacting applicator** on a floor

3.114
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
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
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
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
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**.

3.119
intended use
any use of the appliance which is reasonably foreseeable, as described in the user instructions, and which is consistent with such activities as operating, starting, stopping, connecting to or disconnecting from the supply mains

3.120
control
any control device requiring the operator's actuation to perform specific functions

3.121
viewing opening
opening into the **applicator** through which the treatment can be visually monitored

3.122
restricted area
the space where the operation of the equipment takes place, plus any area outside this where the exposure level from the equipment may exceed 10 W/m^2, averaged over any 6 min

Note 1 to entry: The **restricted area** is determined by measuring the microwave leakage through floor, wall or ceiling structures of the treatment zone. The thickness of the **load** in the radially outgoing direction from the **applicator** is considered only if the **load** is accessible from behind for microwave leakage measurements in **normal operation**.

3.123
biased-off switch
switch that automatically returns to the **off-position** when its actuating member is released

3.124
start switch
biased-off switch that shall be actuated by the operator before the **operation switch** will function

3.125
operation switch
biased-off switch designed so that it will automatically disconnect the microwave generator or the supply main circuit when the operator's actuating force is removed

4 General requirement

This clause of Part 1 is applicable except as follows.

4.101 *Instead of the requirements on supervision of the **microwave interlocks** by monitored microwave interlocks as in IEC 60335-2-90, this standard applies the concepts of **restricted area** and microwave leakage checks of **microwave interlock** function for l**arge area contacting applicators** and **insertion applicators** – and **start switch** as well as **operation switch** for **small area contacting applicators**.*

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.3 *Modification:*

Instead of carrying out the tests in the order of clauses, the following sequence of clauses and subclauses applies: 32, 22.107, 101, 7 to 17, 20, 21, 18, 19, 22 (except 22.107), 23 to 31.

NOTE 101 Clause 101 deals with the protection against leakage by basic design of **microwave enclosures**; Clause 22 deals with the additional requirements applicable when handling and against improper handling of the appliance, and against other hazards caused by the microwaves; Clause 32 deals with the leakage measurement instrumentation and handling, plus limiting values.

5.101 *Addition:*

The microwave-related portion of the appliance is considered **motor-operated**.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Modification:*

Microwave appliances shall be **class I**.

6.2 *Addition:*

Large area contacting applicators and **insertion applicators** shall be at least IPX1. **Small area contacting applicators** shall be at least IPX5.

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.

Appliances shall be marked with the **rated microwave power output**.

Appliances shall be marked on an affixed inspection tag or similar, with the date when the latest complying microwave leakage and function test in accordance with the service manual was carried out.

Compliance is checked by inspection.

7.12 *Addition:*

The instructions shall include the substance of the following.

- WARNING: If **microwave barriers** or **microwave guards** are damaged, the appliance must not be operated until repairs by a **skilled person** have been carried out;
- WARNING: It is hazardous for anyone other than a **skilled person** to carry out any service or repair operation that involves the removal of any cover or barrier which gives protection against exposure to microwave energy;
- if smoke is observed, switch off or unplug the appliance;
- failure to maintain the appliance in a clean condition could lead to deterioration that could adversely affect the life of the appliance and possibly result in a hazardous situation;
- the appliance shall not be cleaned with a water jet.

The substance of the following warnings, if applicable, shall be placed in a prominent position on the appliance. The letters, which may be in upper or lower case, shall be a minimum of 3 mm high, in black on a yellow background. Where appropriate IEC/ISO symbols or pictograms are available, they may be used. Markings or symbols giving cautionary information shall be located close to the hazard.

- WARNING: Switch off and remove plug from mains before adjusting, cleaning or if the cord is entangled or damaged.
- WARNING: Read the instruction sheet.
- WARNING: Keep the flexible supply cord away from the microwave-energised parts.

A microwave warning sign (IEC 60417-5140 (2003-04)) of a size specified in IEC 60417, shall be placed in a location where any **microwave barrier** or **microwave guard** is visible, or near the opening in the **microwave barrier** of a **contacting applicator** under which there is a **load**.

The warning text shall include the substance of the following:

WARNING

MICROWAVE ENERGY

DO NOT INSERT THE HAND OR FOREIGN OBJECTS

The same type of warning sign shall be placed at **viewing openings** with holes larger than diameter 12 mm and which are not protected by visually transparent protective devices. A warning not to insert objects shall also be given.

Appliances shall be operated only by **instructed persons** or **skilled persons**.