

INTERNATIONAL STANDARD

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Industrial microwave heating installations - Test methods for the determination
of power output

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Industrial microwave heating installations -
Test methods for the determination of power output**

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 61307:2011. 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 61307 has been prepared by IEC technical committee 27: Industrial electroheating and electromagnetic processing. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2011. This edition constitutes a technical revision.

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

- a) it covers not only the standby and hibernation modes, but also start-up, standby and holding power consumption, as well as other aspects of operation flexibility;
- b) more detailed descriptions of the aspects of microwave power, and handling of the A and B types of equipment.

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

Draft	Report on voting
27/1243/FDIS	27/1247/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/publications.

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- withdrawn, or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.

1 Scope

This document specifies test methods for the determination of ~~the available microwave output power and~~ the efficiency of frequency conversion from the electrical input, and of the available and workload microwave output power in industrial microwave heating installations, as well as operational flexibility.

~~This standard also specifies test methods for assessing the microwave power deposition in the microwave workload — the microwave workload power, in microwave-only installations.~~

This document is in principle applicable to industrial microwave heating equipment and installations in the frequency range from 300 MHz to 300 GHz but focussed on the microwave ISM frequencies below 6 GHz.

This document relates to industrial microwave heating equipment operating ~~under normal load~~ as intended by the manufacturer's specifications for normal operation.

This document does not apply to appliances for household and similar use (covered by IEC 60335-2-25 [1]¹), commercial use (covered by IEC 60335-2-90 [2] and IEC 60335-2-110 [3]) or laboratory use (covered by IEC 61010-2-010 [4]).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

~~IEC 60050-221:1990, International Electrotechnical Vocabulary — Chapter 221: Magnetic materials and components
Amendment 1 (1993)
Amendment 2 (1999)
Amendment 3 (2007)~~

IEC 60050-841:2004, *International Electrotechnical Vocabulary (IEV) - Part 841: Industrial electroheat*

~~IEC 60050-726:1982, International Electrotechnical Vocabulary — Chapter 726: Transmission lines and waveguides~~

IEC 60519-6, *Safety in ~~electroheat~~ installations for electroheating and electromagnetic processing - Part 6: ~~Specifications for safety in industrial microwave heating equipment~~ Particular requirements for high frequency dielectric and microwave heating and processing equipment*

¹ Numbers in square brackets refer to the Bibliography.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60519-6, IEC 60050-841 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

microwave heating equipment

assembly of electrical and mechanical devices intended for the transfer of microwave energy to the ~~microwave load~~ workload and comprising, in general, power supplies, microwave generators or microwave generator assemblies with cooling arrangements and circulators if used, microwave applicators or cavities with ventilation arrangements if used, interconnecting cables and waveguides, control circuitry, and means for transporting the ~~microwave load~~ workload if used

~~[IEC 60050-841:2004, 841-29-06, modified]~~

3.2

equipment class

group within a type of equipment, using the same principle for processing of the workload either type A or type B

SEE: Annex A.

Note 1 to entry: An example of type is microwave equipment, and a class example is such equipment for wood drying heating in a specified capacity interval using the ISM frequency 2,45 GHz.

3.3

type A equipment

<microwave> equipment with the microwave generator (frequency converter part) independent of, or separable from, the applicator to which the microwave power is provided

EXAMPLE A coaxial feeder, a waveguide junction.

Note 1 to entry: This allows the integration of a circulator as protection for the magnetron against reflected microwave power as well as a tuner to minimize microwave reflection for proper tuning/matching.

Note 2 to entry: Any ancillary microwave generator components such as cathode heater transformers and the generator cooling system are also separable.

3.4

type B equipment

<microwave> equipment with the microwave generator (frequency converter part) being directly coupled to the applicator, without a transmission line in between

3.5

electrical conversion efficiency of microwave heating equipment

quotient between the available microwave power output and the electrical input to the mains frequency power supply or microwave generator assembly, at power settings for ~~normal~~ intended operation

3.6

overall efficiency

efficiency of the complete system including all ancillary power consumption except for workload transport

EXAMPLE Cooling fans or pumps and other cooling systems.

3.7

microwave generator

source used to produce electromagnetic energy in the frequency range from 300 MHz to 300 GHz

~~[IEC 60050-841:2004, 841-29-16]~~

Note 1 to entry: In the context of this document, the microwave generator is only the component where the frequency conversion takes place. ~~See 3.2.~~

3.8

microwave generator assembly

part of the microwave heating equipment comprising an apparatus producing microwave energy and its associated transmission line output port

Note 1 to entry: The assembly includes the microwave generator, the power supply of the microwave generator and its ancillary and control circuits. If a circulator is used, it is also included.

Note 2 to entry: Microwave heating equipment containing a microwave generator assembly was classified as type A in earlier editions of IEC 61307; equipment where a transmission line output port is not available was classified as type B.

3.9

microwave applicator

structure which applies the microwave energy to the load

~~[IEC 60050-841:2004, 841-29-11]~~

3.10

microwave cavity

space enclosed by inner metal walls and a door or an access opening and in which the microwave load is placed

~~[IEC 60050-841:2004, 841-29-19, modified]~~

3.11

microwave enclosure

structure which is intended to confine the microwave energy to a defined region

EXAMPLE A cavity, door seals and waveguides.

~~[IEC 60050-841:2004, 841-29-20]~~

3.12

microwave workload

object to be treated by microwaves

~~NOTE Workload containers are not a part of the microwave workload but of the microwave load.~~

Note 1 to entry: The workload includes any container, holder or other device necessary for the processing and which is directly or indirectly subjected to the output power. The processed object/material as such is also called the load.

~~[IEC 60050-841:2004, 841-29-13]~~

3.13

normal load

nominal microwave ~~load~~ workload at full rated microwave output power as specified by the manufacturer's documentation

3.14**normal operation**

~~range of microwave output power with the normal loads in allowable working conditions of the microwave heating equipment, as specified by the manufacturer's documentation~~

equipment operation under normal load conditions under nominal ambient conditions including the nominal electrical supply network

3.15**intended operation**

range of microwave output and allowable electrical input conditions, for intended workloads as specified by the manufacturer

Note 1 to entry: Several setting combinations are typically specified.

3.16**performance**

<of an electroheating installation> degree to which the intended functions, including energy or power consumption and output as well as the result of the treatment of the workload are accomplished

3.17**equipment capacity**

measure of the production rate capability of equipment when in intended normal operation

EXAMPLE Flow, mass or volume.

Note 1 to entry: The equipment capacity does not refer to the volume of the available cavity space.

3.18**cold start-up**

process by which the equipment is energised into hot standby operation from the cold state, including all other start-up operations which enable the equipment to run under intended operation

Note 1 to entry: This mode of operation applies to cases where there is a significant energy consumption needed for obtaining a state of the equipment allowing the actual processing of the workload.

3.19**holding power**

electric power consumption during which the workload is kept in the treatment chamber at a specified temperature

Note 1 to entry: The temperature is typically maintained for a period of time, intended to equalize the workload temperature.

Note 2 to entry: This mode of operation is not applicable for certain types of electroheating equipment.

3.20**standby ~~(mode of)~~ operation**

~~condition allowing immediate normal operation~~

standby mode of operation

condition of zero output power between periods of continuous intended power operation with power output

~~NOTE 1—This mode typically occurs immediately before and after normal operation.~~