

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

Household electrical appliances – Measurement of standby power

Appareils électrodomestiques – Mesure de la consommation en veille

IEC 62301:2011

<https://standards.iteh.ai/catalog/standards/sist/1520c687-bf19-4aa8-a5fd-92d8c1760373/iec-62301-2011>



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CH-1211 Geneva 20  
Switzerland  
Email: [inmail@iec.ch](mailto:inmail@iec.ch)  
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Email: [csc@iec.ch](mailto:csc@iec.ch)

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**HOUSEHOLD ELECTRICAL APPLIANCES –  
MEASUREMENT OF STANDBY POWER**

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International Standard IEC 62301 has been prepared by IEC technical committee 59: Performance of household and similar electrical appliances.

This second edition cancels and replaces the first edition published in 2005 and constitutes a technical revision. The main changes from the previous edition are as follows:

- greater detail in set-up procedures and introduction of stability requirements for all measurement methods to ensure that results are as representative as possible;
- refinement of measurement uncertainty requirements for power measuring instruments, especially for more difficult loads with high crest factor and/or low power factor;
- updated guidance on product configuration, instrumentation and calculation of measurement uncertainty;
- inclusion of definitions for low power modes as requested by TC59 and use of these new definitions and more rigorous terminology throughout the standard;
- inclusion of specific test conditions where power consumption is affected by ambient illumination.

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

FDIS	Report on voting
59/555/FDIS	59/561/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.

Words in **bold** in the text are defined in Clause 3 Terms and definitions.

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

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## INTRODUCTION

The methods defined in this standard are intended to cover **low power modes**. They are not intended to be used to measure power consumption of products during **active mode** (also called “on **mode**”), as these are generally covered by IEC or other product standards (see Bibliography for some examples), although the measuring techniques, measurement uncertainty determination and test equipment specifications could be adapted for such measurements with careful review.

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## HOUSEHOLD ELECTRICAL APPLIANCES – MEASUREMENT OF STANDBY POWER

### 1 Scope

This International Standard specifies methods of measurement of electrical power consumption in **standby mode(s)** and other **low power modes (off mode and network mode)**, as applicable. It is applicable to electrical products with a rated input voltage or voltage range that lies wholly or partly in the range 100 V a.c. to 250 V a.c. for single phase products and 130 V a.c. to 480 V a.c. for other products.

The objective of this standard is to provide a method of test to determine the power consumption of a range of products in relevant **low power modes** (see 3.4), generally where the product is not in **active mode** (i.e. not performing a primary function).

NOTE 1 The measurement of energy consumption and performance of products during intended use are generally specified in the relevant product standards and are not covered by this standard.

NOTE 2 The term “products” in this standard means energy using products such as household appliances or other equipment within the scope of TC 59. However, the measurement methodology could be applied to other products.

NOTE 3 Where this International standard is referenced by performance standards or procedures, these should define and name the relevant **low power modes** (see 3.4) to which this test procedure is applied.

NOTE 4 The inclusion of DC powered products within the scope of this standard is under consideration.

This standard does not specify safety requirements. It does not specify minimum performance requirements nor does it set maximum limits on power or energy consumption.

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### 2 Normative references

The following referenced documents are indispensable for the application 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 60050-131, *International Electrotechnical Vocabulary (IEV) – Part 131: Circuit theory*

IEC 60050-300, *International Electrotechnical Vocabulary (IEV) – Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical measurements – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions contained in IEC 60050-131 and IEC 60050-300 as well as the following definitions apply.

#### 3.1

##### **function**

a predetermined operation undertaken by the energy using product. **Functions** may be controlled by an interaction of the user, of other technical systems, of the system itself, from measurable inputs from the environment and/or time

In this standard, **functions** are grouped into 4 main types:

- user oriented secondary **functions** (see 3.6 - **standby mode**)
- network related secondary **functions** (see 3.7 - **network mode**)
- primary **functions** (see 3.8 - **active mode**, which is not the focus of this standard)
- other **functions** (these **functions** do not affect the **mode** classification).

NOTE A list of typical **functions** that may be found in products is included in Annex A. Accurate recording and documentation of **functions** in the relevant **product mode** is a key element of documentation in this standard (see 6.3). **Function** types are generally classified as primary or secondary (remote, network, sensing and protective).

#### 3.2

##### **mode**

a state that has no **function**, one **function** or a combination of **functions** present

NOTE 1 The **low power mode** categories in this standard are intended to provide guidance for the development of specific **mode** definitions for TC59 products by the relevant subcommittees.

NOTE 2 Annex A provides guidance on expected **modes** found in various product configurations and designs based on their circuitry and layout, but it does not define these **modes**. Annex A also provides background and guidance to users of this International standard regarding the development of **mode** definitions for specific products.

NOTE 3 See Annex C for examples of how to calculate total energy consumption from power measurements where the duration of each relevant **mode** is known.

#### 3.3

##### **product mode**

**mode** where the **functions** present, if any, and whether these are activated, depend on the particular product configuration

NOTE The issue of devising appropriate names for **product modes** is a matter for the relevant product committees. While a **product mode** name should generally reflect the **functions** that are activated, they need not contain the terms “standby” or “network” even where the **product mode** falls within these **mode** categories.

#### 3.4

##### **low power mode**

a **product mode** that falls into one of the following broad **mode** categories:

- **off mode(s)**
- **standby mode(s)**
- **network mode(s)**

NOTE 1 **Low power modes** are classified into one of the **mode** categories above (where applicable) on the basis of the **functions** that are present and activated in each relevant **mode**. Where other **functions** are present in a **product mode** (in addition to the ones required for the **mode** categories specified above), these **functions** do not affect the **mode** classification.

NOTE 2 **Low power mode** categories are defined in order to provide guidance to users of this international standard and to provide a consistent framework for the development of **low power modes**.

NOTE 3 Any transition that occurs between **modes**, either through user intervention or automatically, is not considered to be a **mode**.

NOTE 4 Not all **low power mode** categories are present on all products. Some products may have more than one **product mode** in each of the **low power mode** categories with different combination of **functions** activated. The power consumption in each **low power mode** depends on the product design and the **functions** which are activated in the particular **product mode**.

### 3.5

#### **off mode(s)**

any **product modes** where the energy using product is connected to a mains power source and is not providing any **standby mode**, **network mode** or **active mode function** and where the **mode** usually persists. An indicator that only shows the user that the product is in the off position is included within the classification of **off mode**.

NOTE Guidance on **modes** and **functions** may be found in Annex A.

### 3.6

#### **standby mode(s)**

any **product modes** where the energy using product is connected to a mains power source and offers one or more of the following user oriented or protective **functions** which usually persist

- to facilitate the activation of other **modes** (including activation or deactivation of **active mode**) by remote switch (including remote control), internal sensor, timer;
- continuous **function**: information or status displays including clocks;
- continuous **function**: sensor-based functions

NOTE Guidance on **modes** and **functions** may be found in Annex A. A timer is a continuous clock **function** (which may or may not be associated with a display) that provides regular scheduled tasks (e.g. switching) and that operates on a continuous basis.

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### 3.7

#### **network mode(s)**

any **product modes** where the energy using product is connected to a mains power source and at least one network **function** is activated (such as reactivation via network command or network integrity communication) but where the primary **function** is not active

NOTE Where a network **function** is provided but is not active and/or not connected to a network, then this **mode** is not applicable. A network **function** could become active intermittently according to a fixed schedule or in response to a network requirement. A "network" in this context includes communication between two or more separate independently powered devices or products. A network does not include one or more controls which are dedicated to a single product. **Network mode** may include one or more standby **functions**.

### 3.8

#### **active mode(s)**

a **product mode** where the energy using product is connected to a mains power source and at least one primary **function** is activated

NOTE The common terms "on", "in-use" and "normal operation" also describe this **mode**.

### 3.9

#### **disconnected mode**

the state where all connections to mains power sources of the energy using product are removed or interrupted

NOTE Common terms "unplugged" or "cut off from mains" also describe this **mode**. This **mode** is not part of the **low power mode** category.

### 3.10

#### **rated voltage**

supply voltage (range) designated by the manufacturer

### 3.11

#### **rated frequency**

supply frequency (range) designated by the manufacturer

### 3.12

#### **instructions for use**

information that is provided for users of the product

NOTE **Instructions for use** would include a user manual and may be in paper or electronic form. **Instructions for use** do not include any special directions provided by the product supplier to the test laboratory especially for testing purposes.

## 4 General conditions for measurements

### 4.1 General

Unless otherwise specified, measurements shall be made under the test conditions and with measuring instruments specified in 4.2 to 4.4.

### 4.2 Test room

The tests shall be carried out in a room that has an air speed close to the product under test of  $\leq 0,5$  m/s. The ambient temperature shall be maintained at  $(23 \pm 5)$  °C throughout the test.

Where the product has an ambient light sensor that affects the power consumption, the test shall be carried out with controlled ambient light conditions. Where the illuminance levels are externally defined (in a test procedure or in the **instructions for use**), these values shall be used. Where no illuminance levels are stated or defined, reference illuminance levels of  $>300$  lx and  $<10$  lx shall be used.

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Information on the method used to achieve the above illuminance levels, where relevant, shall be recorded in the test report (see 6.3). Where values of illuminance are given, they shall be measured as close to the product's light sensor as practical.

NOTE The measured power for some products and **modes** could be affected by the ambient conditions (e.g. illuminance, temperature).

### 4.3 Power supply

#### 4.3.1 Supply voltage and frequency

Where this standard is referenced by an external standard or regulation that specifies a test voltage and frequency, the test voltage and frequency so defined shall be used for all tests.

Where the test voltage and frequency are not defined by an external standard, the test voltage and the test frequency shall be the nominal voltage and the nominal frequency of the country for which the measurement is being determined  $\pm 1$  % (see Table 1).

NOTE A stabilised power supply may be required to meet these requirements.

**Table 1 – Typical nominal electricity supply details for some regions**

Country/Region	Nominal voltage and frequency <sup>a</sup>
Europe	230 V, 50 Hz
North America	115 V, 60 Hz
Japan <sup>b</sup>	100 V, 50/60 Hz
China	220 V, 50 Hz
Australia and New Zealand	230 V, 50 Hz
<sup>a</sup> Values are for single phase only. Some single phase supply voltages can be double the nominal voltage above (centre transformer tap). The voltage between two phases of a three-phase system is 1,73 times single phase values (e.g. 400 V for Europe). Thus these multiples of the listed nominal voltage are also the nominal voltage for some products (e.g. ovens and clothes dryers) in some markets. <sup>b</sup> “50 Hz” is applicable for the Eastern part and “60 Hz” for the Western part, respectively.	

### 4.3.2 Supply voltage waveform

The total harmonic content of the supply voltage when supplying the product under test in the specified **mode** shall not exceed 2 % (up to and including the 13<sup>th</sup> harmonic); harmonic content is defined as the root-mean-square (r.m.s.) summation of the individual components using the fundamental as 100 %. The value of the harmonic content of the voltage supply shall be recorded during the test and reported (see 6.3).

In addition to the above, the ratio of peak value to r.m.s. value of the test voltage (i.e. crest factor) when supplying the product under test shall be between 1,34 and 1,49.

NOTE Power supplies meeting IEC 61000-3-2 are likely to meet the above requirements.

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### 4.4 Power measuring instruments

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NOTE Many power meters can also record harmonic content, as required by 4.3.2.

#### 4.4.1 Power measurement uncertainty

This section covers the requirements for uncertainty introduced by the instrument that measures the input power to the product under test, including any external shunts.

The maximum permitted uncertainty of measurement depends on the size of the load and the characteristics of the load. The key characteristic of the load used to determine the maximum permitted uncertainty is the Maximum Current Ratio (MCR), which is calculated as follows:

$$\text{Maximum Current Ratio (MCR)} = \frac{\text{Crest Factor (CF)}}{\text{Power Factor (PF)}}$$

where

- the Crest Factor (CF) is the measured peak current drawn by the product divided by the measured r.m.s. current drawn by the product;
- the Power Factor (PF) is a characteristic of the power consumed by the product. It is the ratio of the measured real power to the measured apparent power.

a) Permitted uncertainty for values of MCR ≤ 10

For measured power values of greater than or equal to 1,0 W, the maximum permitted relative uncertainty introduced by the power measurement equipment,  $U_{mr}$ , shall be equal to or less than 2 % of the measured power value at the 95 % confidence level.

For measured power values of less than 1,0 W, the maximum permitted absolute uncertainty introduced by the power measurement equipment,  $U_{ma}$ , shall be equal to or less than 0,02 W at the 95 % confidence level.

#### b) Permitted uncertainty for values of MCR >10

The value of  $U_{pc}$  shall be determined using the following equation:

$$U_{pc} = 0,02 \times [1 + (0,08 \times \{MCR - 10\})]$$

where  $U_{pc}$  is the maximum permitted relative uncertainty for cases where the MCR is > 10.

For measured power values of greater than or equal to 1,0 W, the maximum permitted relative uncertainty introduced by the power measurement equipment shall be equal to or less than  $U_{pc}$  at the 95 % confidence level.

For measured power values of less than 1,0 W, the permitted absolute uncertainty shall be the greater of  $U_{ma}$  (0,02 W) or  $U_{pc}$  when expressed as an absolute uncertainty in W ( $U_{pc} \times$  measured value) at the 95 % confidence level.

NOTE 1 It is preferred that the power measuring instrument detects, indicates, signals and records any "out of range" conditions.

NOTE 2 See Annex D and the *Guide to the Expression of Uncertainty in Measurement (GUM)* for further details.

NOTE 3 Although a specification for the power meter in terms of allowable crest factor is not included here, it is important that the peak current of the measured waveform does not exceed the permitted measurable peak current for the range selected, otherwise the uncertainty requirements above will not be achieved. See B.1.2 for an example calculation for  $U_{pc}$  and for more information.

For products connected to more than one phase, the power measuring instrument shall be capable of measuring the total power of all phases connected.

Where the power is measured using the accumulated energy method (see 5.3.3) the calculated power measurement uncertainty shall meet the above requirements.

#### **4.4.2 Power measurement frequency response**

The power measuring instrument shall be capable of meeting the requirements of 4.4.1 when measuring the following:

- DC
- AC with a frequency from 10 Hz to 2 000 Hz.

NOTE If the power meter contains a bandwidth limiting filter, it should be capable of being taken out of the measurement circuit.

#### **4.4.3 Power measurement long term averaging requirement**

Where it is necessary to perform measurements in accordance with 5.3.3, the power measuring instrument shall either be capable of

- measuring the average power over any operated selected time interval, or;
- integrating energy over any operator selected time interval.

NOTE A data recording capability (sampling) or output to a computer or data recorder is the most desirable capability as required by 5.3.2 – see B.2.5 for further information.

## 5 Measurements

### 5.1 General

The purpose of this test method is to determine the power consumption in the relevant **product mode**, which is either persistent or of a limited duration. A **mode** is considered to be persistent where the power level is constant or where there are several power levels that occur in a regular sequence for an indefinite period of time.

NOTE 1 During transition from one **mode** to another (either automatic or user initiated) some products could wait in a higher power state while transition tasks are performed or circuits are energized or de-energized, so they can take some time to enter a stable state.

NOTE 2 Where the **product mode** changes automatically it can sometimes be necessary to operate a product through the automatic sequence several times on a trial basis to ensure that sequence is fully understood and documented before test results are recorded and reported. A sequence of separate **product modes** could also exhibit a regular ongoing pattern of power levels. See Annex B for further guidance.

NOTE 3 While limited duration **modes** may be documented using measurements to this standard, the results for such **modes** should be reported as an energy consumption (Wh) and duration. A **product mode** that is stable should persist without any user intervention.

### 5.2 Preparation of product

Tests in this standard are to be performed on a single product.

The product shall be prepared and set up in accordance with the **instructions for use**, except where these conflict with the requirements of this standard and / or the relevant product performance standard. If no **instructions for use** are available, then factory or “default” settings shall be used, or where there are no indications for such settings, the product is tested as supplied.

NOTE An appropriate product standard would be, for example, IEC 60436 (dishwashers) or IEC 60456 (washing machines).

Once a product has been selected and is ready for testing, the following steps shall be followed and documented in the test report as applicable:

- remove the product from packaging (where applicable);
- read the **instructions for use** and configure the product in accordance with these instructions;
- determine if the product contains a sensor affecting the measurement result, e.g. an ambient light sensor;
- determine if the product contains a battery and whether the product contains circuitry for recharging a rechargeable battery. Reference shall be made to determine whether there is a legal provision which specifies the conditions to be applied, otherwise the following shall apply. For products containing a recharging circuit, the power consumed in
  - **off mode** and **standby mode** shall be measured after precautions have been taken to ensure that the battery is not being charged during the test, e.g. by removing the battery where this is possible, or ensuring that the battery is kept fully charged if the battery is not removable;
  - a maintenance **mode** shall be measured with the batteries installed and fully charged before any measurements are undertaken.
- refer to the relevant product test procedure, external requirement (e.g. regulation) or **instructions for use** that specifies the **product mode(s)** to test (where applicable). The **product modes** tested should be consumer relevant and representative of expected