IEC 62623

Edition 2.0 2022-04
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Desktop and notebook computers – Measurement of energy consumption

IEC 62623:2022-04 RLV(en)

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC 62623

Edition 2.0 2022-04
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Desktop and notebook computers – Measurement of energy consumption

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 35.160

ISBN 978-2-8322-1103-8

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

DESKTOP AND NOTEBOOK COMPUTERS – MEASUREMENT OF ENERGY CONSUMPTION

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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62623:2012. 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 62623 has been prepared by technical area 19: Environmental and energy aspects for multimedia systems and equipment, of IEC technical committee 100: Audio, video and multimedia systems and equipment. It is an International Standard.

This second edition cancels and replaces the first edition published in 2012. This edition constitutes a technical revision.

The first edition of this standard was originally based on ECMA-383.

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

a) Additions to terms & definitions and modification to short & long idle descriptions.
b) Test setup modifications for notebooks where battery pack cannot be removed for testing.
c) Categorisation procedure based on ECMA-389 removed.
d) Replace majority profile with new duty cycle study including new duty cycle attributes for desktop and notebook in a residential and enterprise application.
e) Removal of any reference and test methodology to ENERGY STAR V5.

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

Draft	Report on voting
100/3583/CDV	100/3669/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. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

In this standard, the following print types or formats are used:

– requirements proper and normative annexes: in roman type;
– notes/explanatory matter: in smaller roman type;
– terms that are defined in 3.1: **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,
- replaced by a revised edition, or
- amended.

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

This document ~~includes~~ provides definitions of energy saving modes and generic energy saving guidance for designers of desktop and notebook computers, by defining a methodology on how to measure the energy consumption of a product whilst providing key categorisation ~~criteria~~ attributes that enable energy consumption comparisons of similar products.

This document is originally based on ECMA-383 and complements the guidance given in IEC 62075.

DESKTOP AND NOTEBOOK COMPUTERS – MEASUREMENT OF ENERGY CONSUMPTION

1 Scope

This document covers personal computing products. It applies to desktop and notebook computers as defined in 4.1 that are marketed as final products and that are hereafter referred to as the equipment under test (EUT) or product.

This document specifies:

– a test procedure to enable the measurement of the power and/or energy consumption in each of the EUT's power modes;

– formulas for calculating the **typical energy consumption** (**TEC**) for a given period (normally annual);

– a majority profile ~~that should~~ to be used with this document which enables conversion of average power into energy within the **TEC** formulas;

~~– a system of categorisation enabling like for like comparisons of energy consumption between EUTs;~~

– a pre-defined format for the presentation of results.

This document does not set any pass/fail criteria for the EUTs. Users of the test results ~~should~~ define such criteria.

2 Normative references

~~The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.~~

~~ECMA-389, *Procedure for the Registration of Categories for ECMA-383 2nd edition*~~

There are no normative references in this document.

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms and definitions apply.

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

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

3.1 Terms and definitions

3.1.1
active workload
simulated amount of productive or operative activity that the EUT performs as represented in the P_{work} (see 4.2.12) and $\boldsymbol{T}_{\textbf{work}}$ (see 3.1.11.6) attributes of the **TEC** equation (see 5.6)

3.1.2
category
~~grouping of EUT configurations~~
classification within a product type that is based on product features and installed components

3.1.3
duty cycle
divisions of time the EUT spends in each of its individual power modes

Note 1 to entry: A duty cycle is expressed as a percentage totalling 1.

3.1.4
energy use
energy used by a product when measured from the mains power supply over a given period of time

Note 1 to entry: Energy is measured in kilowatt hour.

3.1.5
external power supply
EPS
equipment contained in a separate physical enclosure external to the computer casing and designed to convert mains power supply to lower DC voltage(s) for the purpose of powering the computer

Note 1 to entry: This note applies to the French language only.

Note 2 to entry: The **EPS** is sometimes referred to as an AC brick.

Note 3 to entry: A reference to a document which outlines the testing procedures for measuring **EPS** efficiencies (External Power Supply Efficiency Test Method) can be found in the Bibliography.

3.1.6
internal power supply
IPS

component contained ~~in the same physical enclosure to~~ inside the computer casing and designed to convert AC voltage from the mains power supply to lower DC voltage(s) for the purpose of powering the computer components

Note 1 to entry: This note applies to the French language only.

Note 2 to entry: A reference to a document which outlines the testing procedures for measuring **IPS** efficiencies (Generalized Internal Power Supply Efficiency Test Protocol) can be found in the Bibliography.

3.1.7
local area network
LAN
computer network located on a user's premises within a limited geographical area

[SOURCE: IEC 60050-732-01-04]

Note 1 to entry: This note applies to the French language only.

Note 2 to entry: Currently the two primary technologies used in computers are IEEE 802.3 Ethernet or Wired **LAN**, and IEEE 802.11 WiFi or Wireless **LAN.**

3.1.8
manufacturer
organization responsible for the design, development and production of a product in view of its being placed on the market, regardless of whether these operations are carried out by that organization itself or on its behalf

~~**3.1.9**~~
~~**red green blue**~~
~~**RGB**~~
~~primary colours that make up a pixel on a computer display~~

~~Note 1 to entry: The **RGB** values represent the intensity settings of each colour of that pixel to specify an exact colour.~~

3.1.9
typical energy consumption
TEC
number for the consumption of energy of a computer that is used to compare the energy performance of like computers, which focuses on the typical energy consumed by an EUT for a given profile while in normal operation during a representative period of time

Note 1 to entry: This note applies to the French language only.

Note 2 to entry: For desktops and notebook computers, the key criterion of the **TEC** approach is a value for typical annual **energy use**, measured in kilowatt-hours (kWh), using measurements of average operational mode power levels scaled by an assumed typical **duty cycle** that represent annualized use for a profile.

3.1.10
actual energy consumption
TEC measured using P_{work}

Note 1 to entry: The **actual energy consumption** is referenced as $\mathbf{TEC}_{actual}$.

~~**3.1.12**~~
~~**estimated energy consumption**~~
~~**TEC** estimated by substituting P_{sidle} for P_{work}~~

~~Note 1 to entry: The **estimated energy consumption** is referenced as $\mathbf{TEC}_{estimated}$.~~

~~Note 2 to entry: P_{sidle} is defined in detail in 4.2.~~

~~Note 3 to entry: P_{work} is defined in detail in 4.2.~~

3.1.11
duty cycle attributes
percentage of time the EUT spends in each of its individual power modes

Note 1 to entry: Examples of **duty cycle attributes** are defined in 3.1.12.1 to 3.1.12.7.

3.1.11.1
off component of duty cycle
$\boldsymbol{T}_{\mathbf{off}}$
percentage of time the EUT is in the off mode

3.1.11.2
sleep component of duty cycle
$\boldsymbol{T}_{\mathbf{sleep}}$ **and** $\boldsymbol{T}_{\mathbf{sleepWoL}}$
percentage of time the EUT is in the sleep modes

3.1.11.3
on components of duty cycle
$\boldsymbol{T}_{\mathbf{on}}$
percentage of time the EUT is in the on mode

Note 1 to entry: The T_{on} **duty cycle** is equal to the sum of the T_{work} + T_{sidle} + ~~T_{lidle}~~ T_{idle}.

3.1.11.4
short idle component of duty cycle
T_{sidle}
percentage of time the EUT is in the short idle mode

3.1.11.5
long idle component of duty cycle
~~T_{lidle}~~ T_{idle}
percentage of time the EUT is in the long idle mode

3.1.11.6
alternative low power component of duty cycle
T_{alpm}
percentage of time the EUT is in the alternative low power mode

3.1.11.7
active component of duty cycle
T_{work}
percentage of time the EUT is in the active (work) mode

3.1.12
user of the test results
entity that will utilise the test results to apply to their needs

Note 1 to entry: Examples of such an entity are voluntary agreement owners, regulators, private companies, etc.

3.1.13
wake on LAN
WoL
functionality that allows a computer to wake from sleep or off to an active state when directed by a network wake request via Ethernet

Note 1 to entry: This note applies to the French language only.

3.1.14
graphics processor unit
GPU
integrated circuit, separate from the CPU, designed to accelerate the rendering of either 2D and/or 3D content to displays

Note 1 to entry: GPU may be paired with a CPU, on the system board of the computer or elsewhere to offload display capabilities from the CPU

3.1.15
discrete graphics
graphics processor (GPU) which must contain a local memory controller interface and local graphics-specific memory

3.1.16
integrated graphics
graphics solution that does not contain **discrete graphics**

3.1.17
switchable graphics
functionality that allows **discrete graphics** to be disabled when not required in favour of **integrated graphics**

Note 1 to entry: This functionality allows lower power and lower capability integrated GPUs to render the display while on battery or when the output graphics are not overly complex while then allowing the more power consumptive but more capable discrete GPU to provide rendering capability when the user requires it.

3.1.18
system memory bandwidth
rate at which data can be read or stored into computer system's memory

Note 1 to entry: System memory bandwidth is measured in gigabytes per second (GB/s).

3.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

ACPI advanced configuration and power interface

NOTE 1 ACPI specification can be found here: http://www.uefi.org/acpi/specs

ALPM alternative low power mode

CF crest factor

CFR crest factor ratio

CPU central processing unit

DVI Digital Visual Interface

EPS external power supply

EUT equipment under test

NOTE 2 Also referred to as product in this standard and sometimes referred to as UUT (unit under test) in other specifications.

FB_BW frame buffer bandwidth

GPU graphic processing unit

HDD hard disk drive

HDMI®[1] High Definition Multimedia Interface

IPS internal power supply

LAN local area network

LPM low power mode

~~MCF Meter Crest Factor~~

MCR maximum current ratio

OS operating system

PAPR profile active power ratio

PAWR profile active workload ratio

PCF product crest factor

PF power factor

RAM random access memory

~~RGB red green blue~~

RMS root mean square

~~SSD Solid State Drive~~

TEC typical energy consumption

THD total harmonic distortion

[1] HDMI® and HDMI® High-Definition Multimedia Interface are trademarks of HDMI Licensing Administrator, Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.