

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Uninterruptible power systems (UPS) –
Part 5-3: DC output UPS – Performance and test requirements**

**Alimentations sans interruption (ASI) –
Partie 5-3: ASI à tension de sortie continue – Performances et exigences d'essai**

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UNINTERRUPTIBLE POWER SYSTEMS (UPS) –

Part 5-3: DC output UPS – Performance and test requirements

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International Standard IEC 62040-5-3 has been prepared by subcommittee 22H: Uninterruptible power systems (UPS), of IEC technical committee 22: Power electronic systems and equipment.

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

FDIS	Report on voting
22H/208/FDIS	22H/211/RVD

Full information on the voting for the approval of this document 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.

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- requirements proper and normative annexes: in roman type;
- compliance statements and test specifications: *in italic type*;
- notes and other informative matter: in smaller roman type;
- normative conditions within tables: in smaller roman type;
- terms that are defined in Clause 3: **bold**.

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UNINTERRUPTIBLE POWER SYSTEMS (UPS) –

Part 5-3: DC output UPS – Performance and test requirements

1 Scope

This part of IEC 62040 establishes the performance and test requirements applied to movable, stationary and fixed electronic **DC uninterruptible power systems (DC UPS)** that

- are supplied from an AC voltage source not exceeding 1 000 V,
- deliver a **DC output voltage** not exceeding 1 500 V,
- incorporate an **energy storage device**, and
- have a primary function to ensure continuity of DC power to loads.

This document specifies performance and test requirements of a complete **DC UPS** and not of individual **DC UPS functional units**. The individual **DC UPS functional units** are dealt with in IEC publications referred to in the bibliography that apply so far that they are not in contradiction with this document.

DC UPSs have been developed over a wide range of power, from less than a hundred watts to megawatts, to meet requirements for availability and quality of power to a variety of loads. Refer to Annexes A and B for information on typical **DC UPS** configurations and topologies.

This document also includes **DC UPS** performance and test requirements related to **interrupters**, isolating switches, and tie switches, if any, which are integral to the **DC UPS**. These components interact with other **functional units** of the **DC UPS** to maintain **continuity of load power**.

This document does not cover

- conventional AC input distribution boards and their associated switches,
- conventional DC distribution boards and their associated switches,
- conventional AC UPSs covered by IEC 62040-3,
- low-voltage DC power supply devices covered by a specific product standard, for example IEC 61204, and those covered by a specific product standard, for example ITU communication standards, and
- systems wherein the **output voltage** is derived from a rotating machine.

NOTE 1 This document recognises that power availability to information technology (IT) equipment represents a major UPS application. The **DC UPS** output characteristics specified in this document are therefore also aimed at ensuring compatibility with the requirements of IT equipment. This, subject to any limitation stated in the manufacturer's declaration, includes requirements for steady state and **transient** voltage variation as well as for the supply of both resistive and **constant power load** characteristics of IT equipment.

NOTE 2 Test loads specified in this document simulate both resistive and **constant power load** characteristics. Their use is prescribed with the objective of verifying design and performance, as declared by the manufacturer, and also of minimising any complexity and energy consumption during the tests.

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 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60146-1-1:2009, *Semiconductor converters – General requirements and line commutated converters – Part 1-1: Specification of basic requirements*

IEC 60146-2:1999, *Semiconductor converters – Part 2: Self-commutated semiconductor converters including direct d.c converters*

IEC 60364-1:2005, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

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IEC TR 60721-4-3, *Classification of environmental conditions - Part 4-3: Guidance for the correlation and transformation of environmental condition classes of IEC 60721-3 to the environmental tests of IEC 60068 - Stationary use at weatherprotected locations*

IEC 61000-2-2:2002, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

IEC 62040-1, *Uninterruptible power systems (UPS) – Part 1: General and safety requirements for UPS*

IEC 62040-2, *Uninterruptible power systems (UPS) – Part 2: Electromagnetic compatibility (EMC) requirements*

ISO 7779, *Acoustics – Measurement of airborne noise emitted by information technology and telecommunications equipment*

3 Terms and definitions

3.1 General

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>

NOTE In this document, IEC 60050 definitions are referenced wherever possible, particularly those of IEC 60050-551.

When an existing IEC 60050 definition needs amplification or additional information, this is indicated by adding the word “modified” after the IEC 60050 reference.

3.2 System and component definitions

3.2.1

DC uninterruptible power system

DC UPS

combination of **converters**, switches and **energy storage devices** (such as batteries), constituting a power system for maintaining **continuity of DC load power** in case of **AC input power failure**

Note 1 to entry: **AC input power failure** occurs when voltages are outside rated steady-state and **transient tolerance bands** or when distortion or interruptions are outside the limits specified for the **DC UPS**.

3.2.2

electronic power converter

power converter

converter

operative unit for electronic power conversion, comprising one or more electronic valve devices, transformers and filters if necessary and auxiliaries if any

Note 1 to entry: In English, the two spellings “converter” and “conver~~ter~~” are in use, and both are correct. In this document, the spelling “**converter**” is used in order to avoid duplications.

Note 2 to entry: Figure 1 shows examples of basic **electronic power converters**.

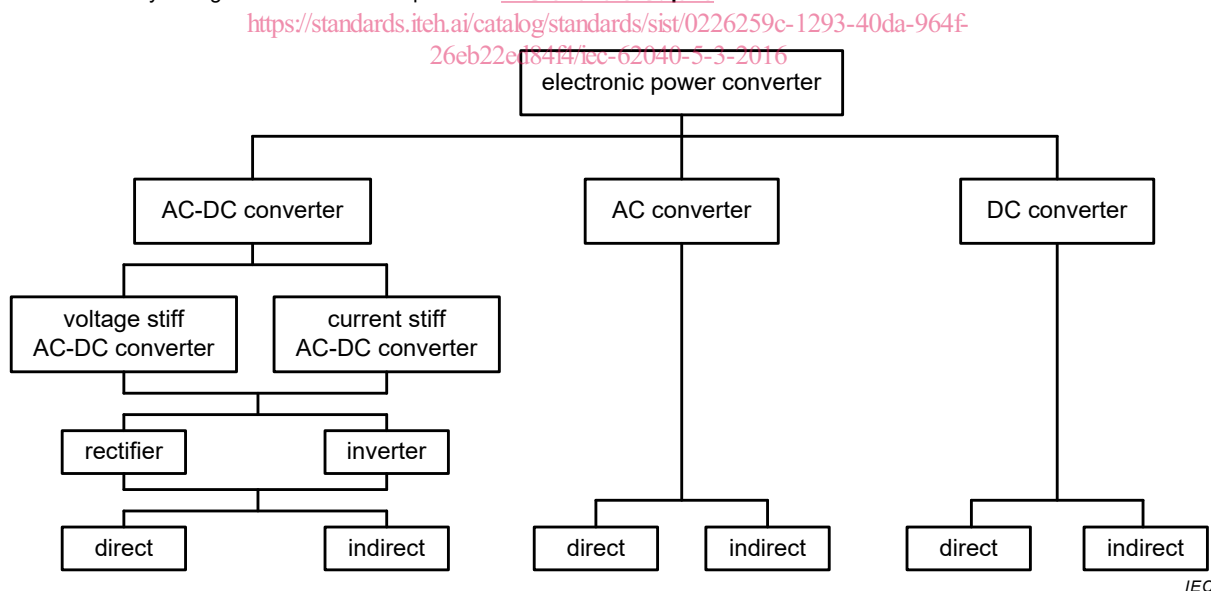


Figure 1 – Examples of basic electronic power converters

[SOURCE: IEC 60050-551:1998, 551-12-01, modified — Note 2 to entry and the figure have been added.]

3.2.3

functional unit

<DC UPS> complete subassembly that performs a given function in a **DC UPS**

EXAMPLE **Converter**, rectifier.

3.2.4

energy storage device

system consisting of single or multiple devices and designed to provide power to the **DC UPS** for the required **stored energy time**

Note 1 to entry: Notwithstanding challenges with respect to recharge, examples of an **energy storage device** include but are not limited to **battery**, double-layer capacitor ("super" or "ultra" capacitor), flywheel and fuel-cell systems.

3.2.5

internal DC bus

integral DC power interface of the components of the **DC UPS (battery, DC circuits, rectifiers, converters, etc)** including points of connection for the DC output but excluding the physical DC output

3.2.6

battery

one or more electrochemical cells fitted with devices necessary for use, for example case, terminals, marking and protective devices

Note 1 to entry: A typical **battery** consists of

- one string of a quantity of series connected cells, or
- two or more paralleled strings, each string containing the same quantity of series connected cells

[SOURCE: IEC 60050:2004, 482-01-04], modified — The word "electrochemical" has been added to the definition, as well as the note to entry.]

3.2.7

secondary battery

<electrochemical cells> **battery** intended to be discharged and recharged

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Note 1 to entry: A valve regulated **secondary battery** consists of cells which are closed but have a valve which allows the escape of gas if the internal pressure exceeds a predetermined value. Valve regulated lead-acid cells are abbreviated "VRLA cells" (see IEC 60050-482:2004, 482-05-15).

Note 2 to entry: A vented **secondary battery** consists of cells having a cover provided with an opening through which products of electrolysis and evaporation are allowed to escape freely, or through a venting system, from the cell to the atmosphere (see IEC 60050-482:2004, 482-05-14).

3.2.8

flywheel storage system

mechanical **energy storage device** wherein stored kinetic energy can be converted to DC power during stored energy mode of operation

3.2.9

battery charger

device for **battery** charging and maintaining the charged state of the **battery**

3.2.10

DC UPS switch

controllable switch used in accordance with applicable requirements for load power continuity to interconnect or isolate power ports of **DC UPS units**, or load

3.2.11

DC UPS rectifier

electronic **converter** for rectification

3.2.12**interrupter**

DC UPS switch which is capable of making, carrying and breaking currents under normal circuit conditions, making and carrying currents for a specified time and breaking currents under specified unusual circuit conditions

3.2.13**DC distribution network**

DC system that connects sources and storage systems to distributed loads

3.2.14**AC input power****grid input power**

product of instantaneous components of the alternating grid input current and voltage averaged over a complete cycle

3.2.15**DC UPS unit**

complete **DC UPS** consisting of at least one of each of the following **functional units**: **DC UPS**, **DC output power** module, and **battery** or other **energy storage device(s)**

3.2.16**single DC UPS**

DC UPS comprising only one **DC UPS unit**

3.2.17**parallel DC UPS**

DC UPS comprising two or more **DC UPS units** operating in parallel

3.2.18**redundant system**

system in which one or more **functional units** can fail without affecting **continuity of load power**

3.2.19**parallel redundant DC UPS**

DC UPS with a number of paralleled **load sharing DC UPS units**, which, upon failure of one or more **DC UPS units**, can take over full load with the remaining units

3.3 Performance of systems and components**3.3.1****primary power**

external electrical power source, usually the public mains supply or other equivalent source that may be generated locally

3.3.2**stand-by power**

external electrical power source intended to replace **primary power** in the event of **primary power failure**

3.3.3**power failure**

any variation in power supply which can cause unacceptable performance of the load equipment

3.3.4

continuity of load power

maintenance of power delivery within the limits specified for the **DC UPS** output under abnormal utility supply conditions

3.3.5

battery ripple current

superimposed effective (RMS) alternating component of the **battery** current

3.3.6

normal mode

stable mode of operation that the **DC UPS** attains under the following conditions:

- a) AC input supply is within required tolerances and supplies the **DC UPS**;
- b) the **energy storage device** remains charged or is under recharge;
- c) the load is within the specified **rating** of the **DC UPS**

3.3.7

stored energy mode of DC UPS operation

stable mode of operation that the **DC UPS** attains under the following conditions:

- a) **AC input power** is disconnected or is out of required tolerance;
- b) all power is derived from the **energy storage device**;
- c) the load is within the specified **rating** of the **DC UPS**

3.3.8

movable DC UPS

equipment which is either 18 kg or less in mass and not fixed, or equipment with wheels, castors or other means to facilitate movement as required to perform its intended use

Note 1 to entry: Derived from IEC 60950-1.

3.3.9

stationary DC UPS

equipment that is not **movable** equipment

Note 1 to entry: Derived from IEC 60950-1.

3.3.10

fixed DC UPS

stationary equipment which is fastened or otherwise secured at a specific location

Note 1 to entry: Derived from IEC 60950-1.

3.3.11

skilled person

person with relevant education and experience to enable him or her to perceive risks and to avoid hazards which the equipment can create

[SOURCE: IEC 60050-826: 2004, 826-18-01, modified — The reference to "electricity" has been replaced by a reference to "the equipment".]

3.3.12

type test

conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-151:2001, 151-16-16]

3.3.13**routine test**

conformity test made on each individual item during or after manufacture

[SOURCE: IEC 60050-151:2001, 151-16-17]

3.4 Specified values – General**3.4.1****rating**

set of **rated values** and operating conditions of a machine, device or equipment

[SOURCE: IEC 60050-151:2001, 151-16-11, modified — The words "of a machine, device or equipment" have been added.]

3.4.2**rated value**

value of a quantity used for specification purposes, generally established by a manufacturer for a specified set of operating conditions of a component, device, equipment, or system

[SOURCE: IEC 60050-151:2001, 151-16-08, modified — The words "generally" and "by a manufacturer" have been added.]

3.4.3**reference test load****rated DC load**

load or condition in which the output of the **DC UPS** delivers the power (W) for which the **DC UPS** is rated

Note 1 to entry: Rated load is a value of load used for specification purposes, generally established by a manufacturer for a specified set of operating conditions of a component, device, equipment, or system.

3.4.4**resistive load**

load that when supplied from a source with a variable voltage presents a resistive impedance that for practical purposes is constant

3.4.5**constant power load**

load that when supplied from a source with a variable voltage V presents a resistive impedance R that for practical purposes varies so that the **active power** P consumed by the circuit is constant, i.e. $P = V^2/R = \text{constant}$

3.4.6**step load**

instantaneous addition or removal of electrical loads

3.4.7**light load**

condition at which the **DC UPS** supplies approximately 10 % of **rated output power**

3.4.8**nominal value**

value of a quantity used to designate and identify a component, device, equipment, or system

Note 1 to entry: The **nominal value** is generally a rounded value.

[SOURCE: IEC 60050-151:2001, 151-16-09]