BS EN IEC 62040-1:2019+A1:2023
Incorporating corrigenda October 2019 and August 2020



BSI Standards Publication

Uninterruptible power systems (UPS)

Part 1: Safety requirements

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Full document details: BS EN IEC 62040-1:2019+A1:2023

National foreword

This British Standard is the UK implementation of EN IEC 62040-1:2019+A1:2023. It is derived from IEC 62040-1:2017, incorporating corrigendum October 2019 and amendment 1:2021. It supersedes BS EN IEC 62040-1:2019+A11:2021, which is withdrawn.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by IEC corrigendum October 2019 is indicated in the text by ⟦AC1⟩ ⟨AC1⟧.

The UK participation in its preparation was entrusted to Technical Committee PEL/22, Power electronics.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Date	Text affected
30 November 2019	Implementation of IEC corrigendum October 2019
31 August 2020	Correction to supersession information in national foreword
28 February 2021	Implementation of CENELEC amendment A11:2021: addition of Annex ZZ
31 December 2023	Implementation of IEC amendment 1:2021 with CENELEC endorsement A1:2023

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 62040-1:2019+A1

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English Version

Uninterruptible power systems (UPS) - Part 1: Safety requirements (IEC 62040-1:2017)

Alimentations sans interruption (ASI) - Partie 1: Exigences de sécurité (IEC 62040-1:2017)

Unterbrechungsfreie Stromversorgungssysteme (USV) - Teil 1: Sicherheitsanforderungen (IEC 62040-1:2017)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 22H/217/FDIS, future edition 2 of IEC 62040-1, prepared by SC 22H "Uninterruptible power systems (UPS)" of IEC/TC 22 "Power electronic systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62040-1:2019.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2020-01-19
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-07-19

This document supersedes EN 62040-1:2008 and all of its amendments and corrigenda (if any).

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Endorsement notice

The text of the International Standard IEC 62040-1:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60076-11:2004	NOTE	Harmonized as EN 60076-11:2004 (not modified)
IEC 60364-5-52	NOTE	Harmonized as HD 60364-5-52
IEC 60947-1:2007	NOTE	Harmonized as EN 60947-1:2007 (not modified)
IEC 60947-3:2008	NOTE	Harmonized as EN 60947-3:2009 (not modified)
IEC 60947-6-1:2005	NOTE	Harmonized as EN 60947-6-1:2005 (not modified)
IEC 60947-6-1:2005/A1:2013	NOTE	Harmonized as EN 60947-6-1:2005/A1:2014 (not modified)
IEC 61347 (series)	NOTE	Harmonized as EN 61347 (series)
IEC 61439-1:2011	NOTE	Harmonized as EN 61439-1:2011 (not modified)
IEC 61508 (series)	NOTE	Harmonized as EN 61508 (series)
IEC 62040-3:2011	NOTE	Harmonized as EN 62040-3:2011 (not modified)
IEC 62310-1	NOTE	Harmonized as EN 62310-1
IEC 62368-1:2014	NOTE	Harmonized as EN 62368-1:2014/AC:2015 (not modified)

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Foreword to amendment A11

This document (EN IEC 62040-1:2019/A11:2021) has been prepared by CLC/TC 22X "Power electronics".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2021-08-05
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2023-11-17

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For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

European foreword to amendment A1

The text of document 22H/269/FDIS, future IEC 62040-1/A1, prepared by SC 22H "Uninterruptible power systems (UPS)" of IEC/TC 22 "Power electronic systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62040-1:2019/A1:2023.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2024-04-20
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2026-10-20

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Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 62040-1:2017/A1:2021 was approved by CENELEC as a European Standard without any modification.

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60364-4-42 (mod)	-	Low-voltage electrical installations - Part 42: Protection for safety - Protection against thermal effects	HD 60364-4-42	-
IEC 60384-14	-	Fixed capacitors for use in electronic equipment - Part 14: Sectional specification - Fixed capacitors for electromagnetic interference suppression and connection to the supply mains	EN 60384-14	-
IEC/TR 60755	-	General requirements for residual current-operated protective devices		-
IEC 60947-2	2006	Low-voltage switchgear and controlgear - Part 2: Circuit-breakers	EN 60947-2	2006
IEC 60950-1 (mod)	2005	Information technology equipment - Safety - Part 1: General requirements	EN 60950-1	2006
			+ A11	2009
			+ A12	2011
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	EN 61000-2-2	2002
IEC 61008-1 (mod)	-	Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) - Part 1: General rules	EN 61008-1	-
IEC 61009-1 (mod)	-	Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) - Part 1: General rules	EN 61009-1	-
IEC 62040-2	2005	Uninterruptible power systems (UPS) -- Part 2: Electromagnetic compatibility (EMC) requirements	EN 62040-2	2006

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Publication	Year	Title	EN/HD	Year
IEC 62477-1	2012	Safety requirements for power electronic converter systems and equipment - Part 1: General	EN 62477-1	2012

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Annex ZZ
(informative)

Relationship between this European Standard and the safety objectives of Directive 2014/35/EU [2014 OJ L96] aimed to be covered

This European Standard has been prepared under a Commission's standardization request relating to harmonized standards in the field of the Low Voltage Directive, M/511, to provide one voluntary means of conforming to safety objectives of Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits [2014 OJ L96].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZZ.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding safety objectives of that Directive, and associated EFTA regulations.

Table ZZ.1 — Correspondence between this European Standard and Annex I of Directive 2014/35/EU [2014 OJ L96]

Safety objectives of Directive 2014/35/EU	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
1. General		
1 a) the essential characteristics, the recognition and observance of which will ensure that electrical equipment will be used safely and in applications for which it was made, shall be marked on the electrical equipment, or, if this is not possible, on an accompanying document	6	
1 b) the electrical equipment, together with its component parts, shall be made in such a way as to ensure that it can be safely and properly assembled and connected;	4.3 4.8 4.11, 4.102, 4.103 6.3 Annex CC	
1 c) the electrical equipment shall be so designed and manufactured as to ensure that protection against the hazards set out in points 2 and 3 is assured, providing that the equipment is used in applications for which it was made and is adequately maintained.	1, 2, 3 6.2, 6.4, 6.5	refer to 2a to 2d and 3a to 3c in this table
2. Protection against hazards arising from the electrical equipment		

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Safety objectives of Directive 2014/35/EU	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
2 a) persons and domestic animals are adequately protected against the danger of physical injury or other harm which might be caused by direct or indirect contact;	4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.8, 4.9, 4.101. 4.103 Annex A, Annex D, Annex F 5.1, 5.2.1, 5.2.2, 5.2.3, 5.2.4	
2 b) temperatures, arcs or radiation which would cause a danger, are not produced	4.1, 4.2, 4.3, 4.5, 4.6, 4.9, 4.11, 4.12 5.1, 5.2.6 5.2.3.9, 5.2.4, 5.2.3.10, 5.2.5	Hazards arising from electric, magnetic and electromagnetic fields, other ionizing and non-ionizing radiation are covered by separate standards.
2 c) persons, domestic animals and property are adequately protected against non-electrical dangers caused by the electrical equipment which are revealed by experience;	4.1, 4.2, 4.7, 4.12 5.1 5.2.1, 5.2.2, 5.2.4	
2 d) the insulation is suitable for foreseeable conditions.	4.1, 4.2, 4.4.7, 4.6.4, 4.101 5.1 5.2.1, 5.2.3, 5.2.4, 5.2.3.10, 5.2.5	
3. Protection against hazards which may be caused by external influences on the electrical equipment		
3 a) meets the expected mechanical requirements in such a way that persons, domestic animals and property are not endangered;	4.1, 4.2, 4.7, 4.9, 4.12 5.1 5.2.1, 5.2.2, 5.2.4, 5.2.6 Annex GG	
3 b) is resistant to non-mechanical influences in expected environmental conditions, in such a way that persons, domestic animals and property are not endangered;	4.2, 4.9, 5.1 5.2.1, 5.2.6, 5.2.7	EMC is not covered.
3 c) does not endanger persons, domestic animals and property in foreseeable conditions of overload.	4.1, 4.2, 4.3 5.1 5.2.1, 5.2.4 Annex CC	

WARNING 1: Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2: Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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UNINTERRUPTIBLE POWER SYSTEMS (UPS) –

Part 1: Safety requirements

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.
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International Standard IEC 62040-1 has been prepared by subcommittee 22H: Uninterruptible power systems (UPS), of IEC technical committee 22: Power electronic systems and equipment.

This second edition cancels and replaces the first edition published in 2008 and its Amendment 1:2013. This edition constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition: the reference document has been changed from IEC 60950-1:2005 (safety for IT equipment) to IEC 62477-1 (group safety standard for power electronic converters).

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

FDIS	Report on voting
22H/217/FDIS	22H/218/RVD

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

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

This International Standard is to be read in conjunction with IEC 62477-1:2012.

The provisions of the general rules dealt within IEC 62477-1:2012 are only applicable to this document insofar as they are specifically cited. Clauses and subclauses of IEC 62477-1:2012 that are applicable in this document are identified by reference to IEC 62477-1:2012, for example, "Clause 4 of IEC 62477-1:2012 applies, except as follows".

The exceptions are then listed. The exceptions can take the form of a deletion, a replacement or an addition of subclauses, tables, figures or annexes.

Subclauses, tables and figures that are additional to those in IEC 62477-1:2012 are, in this document, identified by a suffix in the format of X.10x, for example 4.3.101.

Annexes that are additional to those in IEC 62477-1:2012 are, in this document, lettered AA, BB, etc.

In this document, the following print types are used:

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

A list of all parts in the IEC 62040 series, published under the general title *Uninterruptible Power Systems (UPS)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://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.

The contents of the corrigendum of October 2019 have been included in this copy.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

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INTRODUCTION

IEC technical sub-committee 22H: Uninterruptible power systems (UPS) carefully considered the relevance of each paragraph of IEC 62477-1:2012 in UPS applications. This part of IEC 62040 utilizes IEC 62477-1:2012 as a reference document and references, adds, replaces or modifies requirements as relevant. This is because product-specific topics not covered by the reference document are the responsibility of the technical committee using the reference document.

IEC 62477-1:2012 relates to products that include power electronic converters, with a rated system voltage not exceeding 1 000 V AC or 1 500 V DC. It specifies requirements to reduce risks of fire, electric shock, thermal, energy and mechanical hazards, except functional safety as defined in IEC 61508 (all parts). The objectives of this document are to establish a common terminology and basis for the safety requirements of products that contain power electronic converters across several IEC technical committees.

IEC 62477-1:2012 was developed with the intention:

- to be used as a reference document for product committees inside IEC technical committee 22: Power electronic systems and equipment in the development of product standards for power electronic converter systems and equipment;
- to replace IEC 62103 as a product family standard providing minimum requirements for safety aspects of power electronic converter systems and equipment in apparatus for which no product standard exists; and

  NOTE The scope of IEC 62103 contains reliability aspects, which are not covered by this document.
- to be used as a reference document for product committees outside TC 22 in the development of product standards of power electronic converter systems and equipment intended for renewable energy sources. TC 82, TC 88, TC 105 and TC 114, in particular, have been identified as relevant technical committees at the time of publication.

The reference document, being a group safety standard, will not take precedence over this product-specific standard according to IEC Guide 104. IEC Guide 104 provides information about the responsibility of product committees to use group safety standards for the development of their own product standards.

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UNINTERRUPTIBLE POWER SYSTEMS (UPS) –

Part 1: Safety requirements

1 Scope

This part of IEC 62040 applies to movable, stationary, fixed or built-in **UPS** for use in low-voltage distribution systems and that are intended to be installed in an area accessible by an **ordinary person** or in a restricted access area as applicable, that deliver fixed frequency AC output voltage with port voltages not exceeding 1 000 V AC or 1 500 V DC and that include an energy storage device. It applies to pluggable and to permanently connected **UPS**, whether consisting of a system of interconnected units or of independent units, subject to installing, operating and maintaining the **UPS** in the manner prescribed by the manufacturer.

NOTE 1 Typical **UPS** configurations, including voltage and/or frequency converters and other topologies, are described in IEC 62040-3, the test and performance product standard for **UPS**.

NOTE 2 **UPS** generally connect to their energy storage device through a DC link. A chemical battery is used throughout the standard as an example of an energy storage device. Alternative devices exist, and as such, where "battery" appears in the text of this document, this is to be understood as "energy storage device".

This document specifies requirements to ensure safety for the **ordinary person** who comes into contact with the **UPS** and, where specifically stated, for the **skilled person**. The objective is to reduce risks of fire, electric shock, thermal, energy and mechanical hazards during use and operation and, where specifically stated, during service and maintenance.

This product standard is harmonized with the applicable parts of group safety publication IEC 62477-1:2012 for power electronic converter systems and contains additional requirements relevant to **UPS**.

This document does not cover:

- UPS that have a DC output;
- systems for operation on moving platforms including, but not limited to, aircrafts, ships and motor vehicles;
- external AC or DC input and output distribution boards covered by their specific product standard;
- stand-alone static transfer systems (STS) covered by IEC 62310-1;
- systems wherein the output voltage is directly derived from a rotating machine;
- telecommunications apparatus other than **UPS** for such apparatus;
- functional safety aspects covered by IEC 61508 (all parts).

NOTE 3 Even if this document does not cover the applications listed above, it is commonly taken as a guide for such applications.

NOTE 4 Specialized **UPS** applications are generally governed by additional requirements covered elsewhere, for example **UPS** for medical applications.

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.

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Clause 2 of IEC 62477-1:2012 applies, except as follows:

Add the following normative references:

IEC 60364-4-42, *Low-voltage electrical installations – Part 4-42: Protection for safety – Protection against thermal effects*

IEC 60384-14, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification – Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

IEC TR 60755, *General requirements for residual current operated protective devices*

IEC 60947-2:2006*, Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*[1]

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*

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

IEC 61008-1, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*

IEC 61009-1, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*

IEC 62040-2:2005, *Uninterruptible power systems (UPS) – Part 2: Electromagnetic compatibility (EMC) requirements*[2]

IEC 62477-1:2012, *Safety requirements for power electronic converter systems and equipment – Part 1: General*

3 Terms and definitions

Clause 3 of IEC 62477-1:2012 applies, except as follows:

Add the following new terms and definitions, and new notes:

1 4th edition (2006). This 4th edition has been replaced in 2016 by a 5th edition IEC 60947-2:2016, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*.

2 2nd edition (2005). This 2 nd edition has been replaced in 2016 by a 3rd edition IEC 62040-2:2016, *Uninterruptible power systems (UPS) – Part 2: Electromagnetic compatibility (EMC) requirements*.

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Table 1 – Alphabetical list of terms

Terms	Term number		Terms	Term number	
	62040-1	62477-1		62040-1	62477-1
adjacent circuit		3.1	power semiconductor device		3.34
active power	3.111		primary power	3.108	
apparent power	3.112		prospective short-circuit current	3.122	
backfeed	3.127		protective equipotential bonding		3.36
backfeed protection	3.128		protective class I		3.37
basic insulation		3.2	protective class II		3.38
basic protection		3.3	protective class III		3.39
bypass	3.110		protective earthing (PE)		3.40
commissioning test		3.4	PE conductor		3.41
cord	3.109		protective impedance		3.42
decisive voltage class (*DVC*)		3.5	(electrically) protective screening		3.43
double insulation		3.6	protective separation		3.44
DVC As		3.7	PEC		3.45
DVC Ax		3.8	PECS		3.46
earth fault	3.131		rated conditional short-circuit current	3.120	
electrical breakdown		3.9	rated current	3.117	
(electrical) insulation		3.10	rated load	3.115	
(electronic) (power) conversion		3.11	rated peak withstand current	3.118	
enclosure		3.12	rated short-time withstand current	3.119	
enhanced protection		3.13	rating	3.113	
expected lifetime		3.14	rated value	3.114	
Extra Low Voltage (ELV)		3.15	rated voltage	3.116	
fault protection		3.16	reference non-linear load	3.126	
field wiring terminal		3.17	reference test load	3.125	
fire enclosure		3.18	reinforced insulation		3.47
functional insulation		3.19	restricted access area		3.48
hazardous energy	3.107		routine test		3.49
hazardous live part		3.20	sample test		3.50
hazardous voltage	3.106		SELV (systems)		3.51
installation		3.21	short-circuit backup protection		3.52
instructed person	3.103		service acces area	3.105	
linear load	3.123		short-circuit protective device (SCPD)	3.130	
live part		3.22	simple separation		3.53
low impedance path	3.121		single fault condition		3.54
low voltage		3.23	skilled person	3.102	
mains supply		3.24	startle reaction		3.55
muscular reaction (inability to let go)		3.25	supplementary insulation		3.56

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Terms	Term number		Terms	Term number	
	62040-1	62477-1		62040-1	62477-1
non-linear load	3.124		surge protective device (SPD)		3.57
non-mains supply		3.26	system		3.58
open type		3.27	system voltage		3.59
ordinary person	3.104		stored energy mode	3.129	
output short-circuit current		3.28	temporary overvoltage		3.60
PELV (systems)		3.29	touch current		3.61
Permanently connected		3.30	type test		3.62
pluggable equipment type A		3.31	ventricular fibrillation		3.63
pluggable equipment type B		3.32	working voltage		3.64
port		3.33	uninterruptible power system (UPS)	3.101	
			zone of equipotential bonding		3.65

Note 1 to entry: Where the terms "voltage" and "current" are used, RMS values are implied unless otherwise specified.

Note 2 to entry: Non-sinusoidal signals are measured with appropriate true RMS measuring instruments.

3.101
uninterruptible power system
UPS
combination of convertors, switches and energy storage devices (such as batteries), constituting a power system for maintaining continuity of load power in case of input power failure

Note 1 to entry: Continuity of load power occurs when voltage and frequency are within rated steady-state and transient tolerance bands, and with distortion and interruptions within the limits specified for the output port. Input power failure occurs when voltage and frequency are outside rated steady-state and transient tolerance bands, or with distortion or interruptions outside the limits specified for the **UPS**.

3.102
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

Note 1 to entry: Such person has access to restricted access areas.

[SOURCE: IEC 60050-195:1998, 195-04-01, modified – The word "(electrically)" has been deleted from the term, and "electricity" has been replaced by "the equipment" in the definition. The note has been added.]

3.103
instructed person
person adequately advised or supervised by **skilled persons** to enable him or her to perceive risks and to avoid hazards which the equipment can create

Note 1 to entry: Such person has access to restricted access areas.

Note 2 to entry: Examples of activities performed by an **instructed person** can be found in IEC 61140:2001, Clause 8.

[SOURCE: IEC 60050-195:1998, 195-04-02, modified – The word "(electrically)" has been deleted from the term, and the notes have been added.]

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3.104
ordinary person
person who is neither a **skilled person** nor an **instructed person**

Note 1 to entry: Such person does not have access to a restricted access area and is not trained to identify hazards. Such person may otherwise have access to the equipment or may be in the vicinity of the equipment. An ordinary person will not intentionally create hazards nor have access to hazardous parts under normal and **single fault conditions**.

[SOURCE: IEC 60050-195:1998, 195-04-03, modified – The note has been added.]

3.105
service access area
area accessible by **skilled person**s by the use of a tool, where it is necessary for **skilled person** to have access regardless of the equipment being energized

3.106
hazardous voltage
voltage exceeding 42,4 V peak, or 60 V DC, existing in a circuit that does not meet the requirements for either a limited current circuit or a TNV-1 circuit

Note 1 to entry: A limited current circuit is understood in the context of "protection by means of protective impedance" as described in IEC 62477-1:2012, 4.4.5.4.

[SOURCE: IEC 60950-1:2005, 1.2.8.6 modified – TNV has been replaced by TNV-1.]

3.107
hazardous energy
available power level of 240 VA or more, having a duration of 60 s or more, or a stored energy level of 20 J or more (for example, from one or more capacitors), at a potential of 2 V or more

Note 1 to entry: See IEC 62477-1:2012, 4.5.1.2.

3.108
primary power
power supplied by an electrical utility company or by a local generator

3.109
cord
flexible cable with a limited number of conductors of small cross-sectional area

[SOURCE: IEC 60050-461:2008, 461-06-15.]

3.110
bypass
alternative power path, either internal or external to the **UPS**

3.111
active power
under periodic conditions, mean value, taken over one period T, of the instantaneous power p

$$P = \frac{1}{T}\int_0^T p\,\mathrm{d}t$$

Note 1 to entry: Under sinusoidal conditions, the **active power** is the real part of the complex power $\underline{S}$, thus $\underline{P}$ = Re $\underline{S}$

Note 2 to entry: The coherent SI unit for **active power** is watt, W.

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Note 3 to entry: DC, fundamental and harmonic voltages and currents contribute to the magnitude of the **active power**. Where applicable, instruments used to measure **active power** should therefore present sufficient bandwidth and be capable of measuring any significant non-symmetrical and harmonic power components.

[SOURCE: IEC 60050-131: 2013, 131-11-42, modified – A third note to entry has been added.]

3.112
apparent power
product of the RMS voltage and RMS current

3.113
rating
set of **rated values** and operating conditions of a machine, a device or equipment

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

3.114
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 word "established" has been expanded to read "generally established by a manufacturer".]

3.115
rated load
load or condition in which the output of the **UPS** delivers the power for which the **UPS** is rated

Note 1 to entry: The **rated load** is expressed in **apparent power** (VA) and **active power** (W) resulting in a (rated) power factor that includes the effect of any applicable combination of **linear** and of **non-linear load** as prescribed in Annex BB.

Note 2 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

3.116
rated voltage
input or output voltage as declared by the manufacturer

Note 1 to entry: For a three-phase supply, the rated voltage corresponds to the phase-to-phase voltage.

3.117
rated current
input or output current of the **UPS** as declared by the manufacturer

3.118
rated peak withstand current
I_{pk}
value of peak short-circuit current, declared by the **UPS** manufacturer, that can be withstood under specified conditions

Note 1 to entry: For the purpose of this document, I_{pk} refers to the initial asymmetric peak value of the prospective test current listed in Table 104.

3.119
rated short-time withstand current
I_{cw}
RMS value of short-time current, declared by the **UPS** manufacturer, that can be carried under specified conditions, defined in terms of current and time

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[SOURCE: IEC 61439-1:2011, 3.8.10.3, modified – The definition has been rephrased and the word "assembly" has been replaced by "**UPS**".]

3.120
rated conditional short-circuit current
I_{cc}
RMS value of **prospective short-circuit current**, declared by the **UPS** manufacturer, that can be withstood for the total operating time (clearing time) of the **short-circuit protective device** (**SCPD**) under specified conditions

Note 1 to entry: The **short-circuit protective device** does not necessarily form an integral part of the **UPS**.

[SOURCE: IEC 61439-1:2011, 3.8.10.4, modified – The word "RMS" has been added to "value", the word "assembly" has been replaced by "**UPS**", and the note has been rephrased.]

3.121
low impedance path
path containing devices that for **UPS** load purposes present negligible impedance, such as cabling, switching devices, protecting devices and filtering devices

Note 1 to entry: The devices in a **low impedance path** generally present current limiting characteristics under short-circuit conditions.

Note 2 to entry: Examples include current limiting fuses, current limiting circuit-breakers, transformers and inductors.

3.122
prospective short-circuit current
I_{cp}
RMS value of the current which would flow if the supply conductors to the circuit are short-circuited by a conductor of negligible impedance located as near as practicable to the supply terminals of the **UPS**

[SOURCE: IEC 61439-1:2011, 3.8.7, modified – The word "assembly" has been replaced by "**UPS**".]

3.123
linear load
load where the current drawn from the supply is defined by the relationship:

$$I = U/Z$$

where

I is the load current;

U is the supply voltage;

Z is the constant load impedance

Note 1 to entry: Application of a **linear load** to a sinusoidal voltage results in a sinusoidal current.

[SOURCE: IEC 62040-3:2011, 3.2.4]

3.124
non-linear load
load where the parameter Z (load impedance) is no longer a constant but is a variable dependent on other parameters, such as voltage or time

[SOURCE: IEC 62040-3:2011, 3.2.5]

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3.125
reference test load
load or condition in which the output of the **UPS** delivers the **active power** (W) for which the **UPS** is rated

Note 1 to entry: This definition permits, when in test mode and subject to local regulations, the **UPS** output to be injected into the input AC supply.

[SOURCE: IEC 62040-3:2011, 3.3.5]

3.126
reference non-linear load
non-linear load that when connected to a **UPS**, consumes the **apparent power** at which the **UPS** shall be tested

Note 1 to entry: Refer to Clause BB.5 for test details.

[SOURCE: IEC 62040-3:2011, 3.3.6, modified – The expression "the apparent and active power for which the UPS is rated in accordance with Annex E" has been replaced by "the apparent power at which the **UPS** shall be tested", and the note has been added.]

3.127
backfeed
condition in which a voltage or energy available within the **UPS** is fed back to any of the input terminals, either directly or by a leakage path while operating in the **stored energy mode** and with **primary power** not available

[SOURCE: IEC 62040-3:2011, 3.2.3, modified – The words "while AC input power is" have been replaced by "with **primary power**".]

3.128
backfeed protection
control scheme that reduces the risk of electric shock due to **backfeed**

3.129
stored energy mode
stable mode of operation that the **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 **UPS**

[SOURCE: IEC 62040-3:2011, 3.2.10, modified – The words "of UPS operation" have been deleted in the term, and the word "system" has been replaced by "device" in b).]

3.130
short-circuit protective device
SCPD
device intended to protect a circuit or parts of a circuit against short-circuit currents by interrupting them

[SOURCE: IEC 60947-1:2007, 2.2.21]

3.131
earth fault
occurrence of an accidental conductive path between a live conductor and the earth

[SOURCE: IEC 60050-826:2004, 826-04-14, modified – The second preferred term "ground fault" has been deleted, as well as the notes.]

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4 Protection against hazards

Clause 4 of IEC 62477-1:2012 applies, except as follows:

4.2 Fault and abnormal conditions

Subclause 4.2 in IEC 62477-1:2012 applies, except as follows:

Replace the fourth paragraph of IEC 62477-1:2012, 4.2 by the following:

Compliance is checked by analysis or by test according to 5.2.4.6 of IEC 62477-1:2012.

Compliance through analysis only is permitted when such analysis conclusively shows that no hazard will result from failure of the component.

4.3 Short-circuit and overload protection

Subclause 4.3 in IEC 62477-1:2012 applies except as follows:

Add the following:

4.3.101 AC input current

The input current to the **UPS** shall not exceed that declared by the **UPS** manufacturer – see 6.2 a).

In determining the steady state input current, the consumption due to optional features offered or provided by the manufacturer for inclusion in or with the **UPS** shall be considered and adjusted to give the most unfavourable result.

NOTE Transient input current arising from dynamic occurences, for example inrush or overload current, is not considered.

Compliance is checked when highest current measured or calculated (as applicable) when performing the test described in 5.2.3.102 does not exceed the input current declared by the manufacturer (see 6.2).

4.3.102 Transformer protection

Transformers shall be protected against overtemperature.

NOTE Means of protection include:

- overcurrent protection,
- internal thermal cut-outs,
- use of current limiting devices.

Compliance is checked by the applicable tests of 5.2.3.104.

4.3.103 AC input short-circuit current

The **UPS** manufacturer shall specify the **rated conditional short-circuit current** (I_{cc}) or the **rated short-time withstand current** (I_{cw}) at each AC input port of the **UPS**. The UPS manufacturer may specify both. Individual AC input ports of a **UPS** may have individual **ratings**.

A **UPS** with AC input ports that may be configured with jumpers or busbars to present a single AC input port or multiple AC input ports shall be tested as having multiple AC input ports. Testing with installed jumpers or busbars that combine multiple AC input ports into a single

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