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**Uninterruptible power systems (UPS) –
Part 1: Safety requirements**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Protection against hazards	15
5 Test requirements.....	29
6 Information and marking requirements.....	42
Annexes	49
Annex A (normative) Additional information for protection against electric shock.....	50
Annex M (informative) Test probes for determining access	51
Annex AA (informative) Minimum and maximum cross-section of copper conductors suitable for connection to terminals for external conductor	52
Annex BB (normative) Reference loads.....	54
Annex CC (normative) Ventilation of lead-acid battery compartments	58
Annex DD (informative) Guidance for disconnection of batteries during shipment	61
Annex EE (informative) Short-time withstand current test procedure – Guidance and typical values.....	63
Annex FF (informative) Maximum heating effect in transformer tests.....	67
Annex GG (normative) Requirements for the mounting means of rack-mounted equipment.....	69
Bibliography.....	71
Figure 101 – Examples of design of openings preventing vertical access.....	18
Figure 102 – Test circuit for load-induced change of reference potential – Single- phase output.....	35
Figure 103 – Test circuit for load-induced change of reference potential – Three-phase output	35
Figure 104 – Voltage backfeed warning label.....	45
Figure M.101 – Jointed test finger (IP2X).....	52
Figure BB.1 – Reference resistive load	54
Figure BB.2 – Reference inductive-resistive load (series)	55
Figure BB.3 – Reference inductive-resistive load (parallel)	55
Figure BB.4 – Reference capacitive-resistive load (series).....	55
Figure BB.5 – Reference capacitive-resistive load (parallel).....	55
Figure BB.6 – Reference non-linear load	56
Figure DD.1 – Precautionary label for products shipped with the battery disconnected	61
Figure DD.2 – Precautionary label for products shipped with the battery connected.....	62
Figure EE.1 – 3-wire test circuit for UPS short-time withstand current.....	63
Figure EE.2 – 4-wire test circuit for UPS short-time withstand current.....	64
Figure EE.3 – 2-wire test circuit for single phase UPS short-time withstand current	65
Table 1 – Alphabetical list of terms	9

Table 101 – UPS input port configuration.....	16
Table 102 – Overvoltage categories.....	19
Table 103 – Maximum temperature limits for magnetic components during stored energy mode of operation	22
Table 22 – Test overview	29
Table 104 – Short-time withstand current.....	37
Table 105 – Temperature limits for transformer windings	40
Table A.101 – Comparison of limits of working voltage	50
Table AA.1 – Conductor cross-sections (extract from IEC 61439-1:2011).....	53
Table FF.1 – Test steps	67

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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.
- 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.
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- 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.
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In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

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 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).

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 the base publication and its amendment 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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- amended.

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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.

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.

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*

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*.

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FINAL VERSION



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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Protection against hazards	15
5 Test requirements.....	29
6 Information and marking requirements.....	42
Annexes	49
Annex A (normative) Additional information for protection against electric shock.....	50
Annex M (informative) Test probes for determining access	51
Annex AA (informative) Minimum and maximum cross-section of copper conductors suitable for connection to terminals for external conductor	52
Annex BB (normative) Reference loads.....	54
Annex CC (normative) Ventilation of lead-acid battery compartments	58
Annex DD (informative) Guidance for disconnection of batteries during shipment	61
Annex EE (informative) Short-time withstand current test procedure – Guidance and typical values.....	63
Annex FF (informative) Maximum heating effect in transformer tests.....	67
Annex GG (normative) Requirements for the mounting means of rack-mounted equipment.....	69
Bibliography.....	71
Figure 101 – Examples of design of openings preventing vertical access.....	18
Figure 102 – Test circuit for load-induced change of reference potential – Single-phase output.....	35
Figure 103 – Test circuit for load-induced change of reference potential – Three-phase output	35
Figure 104 – Voltage backfeed warning label.....	45
Figure M.101 – Jointed test finger (IP2X).....	52
Figure BB.1 – Reference resistive load	54
Figure BB.2 – Reference inductive-resistive load (series)	55
Figure BB.3 – Reference inductive-resistive load (parallel)	55
Figure BB.4 – Reference capacitive-resistive load (series).....	55
Figure BB.5 – Reference capacitive-resistive load (parallel).....	55
Figure BB.6 – Reference non-linear load	56
Figure DD.1 – Precautionary label for products shipped with the battery disconnected	61
Figure DD.2 – Precautionary label for products shipped with the battery connected.....	62
Figure EE.1 – 3-wire test circuit for UPS short-time withstand current.....	63
Figure EE.2 – 4-wire test circuit for UPS short-time withstand current.....	64
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Table 104 – Short-time withstand current.....	37
Table 105 – Temperature limits for transformer windings	40
Table A.101 – Comparison of limits of working voltage	50
Table AA.1 – Conductor cross-sections (extract from IEC 61439-1:2011).....	53
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