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Uninterruptible power systems (UPS) –
Part 3: Method of specifying the performance and test requirements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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UNINTERRUPTIBLE POWER SYSTEMS (UPS) –

Part 3: Method of specifying the performance and test 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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IEC 62040-3 was prepared by subcommittee 22H: Uninterruptible power systems (UPS), of IEC technical committee 22: Power electronic systems and equipment. It is an International Standard.

This third edition cancels and replaces the second edition published in 2011 and constitutes a technical revision.

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

a) environmental conditions aligned with IEC 62040-1:2017 (UPS safety requirements);
b) compliance requirements included in all sub-clauses referenced in Table 5 UPS test schedule;
c) non-linear step load is no longer a type test and was removed from 6.4 in consistency with requirements for switch mode power supplies incorporating inrush current controls; this resulted in the performance classification coding being shortened from 8 to 7 characters (see 5.3.4);
d) free-fall test aligned with ISO 4180 (see 6.5.1.3);

e) multiple normal mode UPS test requirements introduced;

f) non-linear load requirements relaxed in Annex E in consistency with requirements for switch mode power supplies complying with the applicable limits for harmonic current in IEC 61000-3-2 and IEC 61000-3-12;

g) minimum UPS efficiency values referenced in Annex I became normative and are based on active output power rating and utilisation of weighting factors rather than on allowances related to isolation transformers, input harmonic current filters and input voltages.

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

FDIS	Report on voting
22H/267/FDIS	22H/270/RVD

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 has been drafted in accordance with the 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 document, the following print types are used:

- 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**.

A list of all parts of 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.

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UNINTERRUPTIBLE POWER SYSTEMS (UPS) –

Part 3: Method of specifying the performance and test requirements

1 Scope

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

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

This document specifies performance and test requirements of a complete **UPS** and, where applicable, of individual **UPS functional units**. Requirements for the individual **UPS functional units** found in IEC publications listed in the Bibliography apply so far that they are not in contradiction with this document.

UPS are developed for a wide range of power, from less than hundred watts to several megawatts, to meet requirements for availability and quality of power to a variety of **loads**. Refer to Annex A and Annex B for information on typical **UPS** configurations and topologies.

This document also includes **UPS** performance and test requirements related to **UPS switches** that interact with **UPS functional units** to maintain **continuity of load power**.

This document does not cover

- conventional AC and DC distribution boards and their associated switches,
- stand-alone static transfer systems covered by IEC 62310-3,
- rotary UPS covered by IEC 88528-11, and
- DC UPS covered by IEC 62040-5-3.

NOTE 1 This document recognises that **continuity of load power** to information technology (IT) equipment represents a major **UPS** application. The **UPS** output characteristics specified in this document are therefore also aimed at ensuring compatibility with the requirements of IT equipment. This, subject 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 **linear** and **non-linear load** characteristics of IT equipment.

NOTE 2 Test **loads** specified in this document simulate both **linear** and **non-linear load** characteristics. Their use permits verification of the performance declared by the manufacturer while minimising complexity and energy consumption during the tests.

NOTE 3 This document is aimed at 50 Hz and 60 Hz applications but does not exclude other frequency applications within the domain of IEC 60196. This is subject to an agreement between manufacturer and purchaser with respect to any particular requirements arising.

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 cited edition applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60038:2009, *IEC standard voltages*

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-78:2012, *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, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60364-5-52, *Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC TR 60721-4-3:2001, *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 TR 60721-4-3/AMD1:2003

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 61000-2-2:2002/AMD1:2017
IEC 61000-2-2:2002/AMD2:2018

IEC 61000-3-2:2018, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

IEC TS 61000-3-4:1998, *Electromagnetic compatibility (EMC) – Part 3-4: Limits – Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 16 A*

IEC 61000-3-12:2011, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase*

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

IEC 62040-2:2016, *Uninterruptible power systems (UPS) – Part 2: Electromagnetic compatibility (EMC) requirements*

ISO 3744:2010, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

ISO 3746:2010, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane*

ISO 4180:2019, *Packaging – Complete, filled transport packages – General rules for the compilation of performance test schedules*