

AS 62282.5.100:2024



STANDARDS
Australia



Fuel cell technologies

Part 5.100: Portable fuel cell power systems — Safety (IEC 62282-5-100:2018 (ED. 1.0) MOD)



AS 62282.5.100:2024

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- Australian Gas Association
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- Australian Industry Group
- Chemistry Australia
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- Engineers Australia
- Gas Energy Australia
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- Institute of Electrical Inspectors
- National Association of Testing Authorities Australia
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Preface

This Standard was prepared by the Standards Australia Committee ME-093, Hydrogen Technologies.

The objective of this document is to specify construction, marking and test requirements for portable fuel cell power systems to produce electrical power.

This document applies to AC and DC type portable fuel cell power systems, with a rated output voltage not exceeding 600 V AC, or 850 V DC, for indoor and outdoor use.

This document does not apply to portable fuel cell power systems that are —

- (a) permanently connected (hard wired) to the electrical distribution system;
- (b) permanently connected to a utility fuel distribution system;
- (c) exporting power to the grid;
- (d) for propulsion of road vehicles; or
- (e) intended to be used on board passenger aircraft.

Fuel cells that provide battery charging for hybrid vehicles where the battery provides power and energy for propulsion of the vehicle are not included in the scope of this document.

The following fuels and fuel feedstocks are considered within the scope of this document:

- (i) Natural gas.
- (ii) Liquefied petroleum gas, such as propane and butane.
- (iii) Liquid alcohols, for example methanol, ethanol.
- (iv) Gasoline.
- (v) Diesel.
- (vi) Kerosene.
- (vii) Hydrogen.
- (viii) Chemical hydrides.

This document does not preclude the use of similar fuels or oxidants from sources other than air provided the unique hazards are addressed through additional requirements.

This document does not cover requirements of pressurized or non-pressurized fuel supply containers upstream of the appliance gaseous or liquid fuel supply connector that are not integral to the portable fuel cell power system.

All pressures in this document are considered to be gauge pressures, unless otherwise specified.

This document is an adoption, with national modifications, and has been reproduced from IEC 62282-5-100:2018, *Fuel cell technologies – Part 5-100: Portable fuel cell power systems – Safety*.

The modifications are additional requirements and are set out in Appendix ZZ, which has been added at the end of the source text.

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- (B) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

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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 62282-5-100 has been prepared by IEC technical committee 105: Fuel cell technologies.

This edition cancels and replaces the second edition of IEC 62282-5-1, published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 62282-5-1:

- the requirements and verification method regarding [4.13](#) and [7.21](#) for oxygen depletion have been modified;

- the requirements and verification method regarding [4.14](#) and [7.22](#) for emission of effluents have been modified;
- [Subclauses 4.21](#) and [7.20.3](#), for fuel cell power systems with flammable gas generators relying on water reactive technology, new safety requirements and test procedures have been added;
- [Subclause 7.11.1 e\)](#) has been updated; for an overcurrent test in abnormal operations, a new test procedure in consideration of safety has been added.

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

CDV	Report on voting
105/649/CDV	105/670/RVC

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.

A list of all parts in the IEC 62282 series, published under the general title *Fuel cell technologies*, 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.

NOTES

Australian Standard®

Fuel cell technologies

Part 5.100: Portable fuel cell power systems — Safety (IEC 62282-5-100:2018 (ED. 1.0) MOD)

1 Scope

This part of IEC 62282 covers construction, marking and test requirements for portable fuel cell power systems. These fuel cell systems are movable and not fastened or otherwise secured to a specific location. The purpose of the portable fuel cell power system is to produce electrical power.

This document applies to AC and DC type portable fuel cell power systems, with a rated output voltage not exceeding 600 V AC, or 850 V DC for indoor and outdoor use. These portable fuel cell power systems cannot be used in hazardous locations as defined in IEC 60050-426:2008, 426-03-01 unless there are additional protective measures in accordance with IEC 60079-0[5]¹⁾.

This document does not apply to portable fuel cell power systems that are

- 1) permanently connected (hard wired) to the electrical distribution system,
- 2) permanently connected to a utility fuel distribution system,
- 3) exporting power to the grid,
- 4) for propulsion of road vehicles,
- 5) intended to be used on board passenger aircraft.

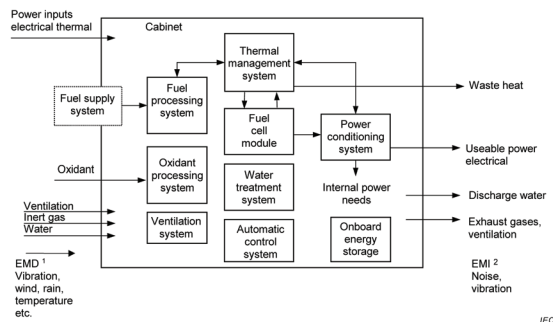
Fuel cells that provide battery charging for hybrid vehicles where the battery provides power and energy for propulsion of the vehicle are not included in the scope of this document

The following fuels and fuel feedstocks are considered within the scope of this document:

- natural gas,
- liquefied petroleum gas, such as propane and butane,
- liquid alcohols, for example methanol, ethanol,
- gasoline,
- diesel,
- kerosene,
- hydrogen,
- chemical hydrides.

This document does not preclude the use of similar fuels or oxidants from sources other than air provided the unique hazards are addressed through additional requirements.

1) Numbers in square brackets refer to the [Bibliography](#).



Key

- 1 EMD electromagnetic disturbance
2 EMI electromagnetic interference

Figure 1 — Portable fuel cell power systems

The overall design of a portable fuel cell power system anticipated by this document forms an assembly of some or all of the following systems (see [Figure 1](#)), integrated as necessary, to perform designated functions, as follows:

Fuel processing system – chemical processing equipment including any associated heat exchangers and controls required to convert input fuel to a composition suitable for the fuel cell stack.

Oxidant processing system – subsystem that meters, conditions, processes and may pressurize the incoming oxidant supply for use within the fuel cell power system.

Thermal management system – subsystem intended to provide cooling and heat rejection in order to maintain thermal equilibrium within the fuel cell power system, and, if necessary, to provide for the recovery and utilization of excess heat and to assist in heating the fuel cell power systems during start-up.

Power conditioning system – equipment which is used to change the magnitude or waveform of the voltage, or otherwise alter or regulate the output of a power source.

Automatic control system – assembly of sensors, actuators, valves, switches and logic components (including process controllers) that maintains the fuel cell power system parameters within the manufacturer's specified limits without manual intervention.

Fuel cell module – assembly, including a fuel cell stack(s), which electrochemically converts chemical energy to electric energy and thermal energy intended to be integrated into a power generation system.

Fuel supply system – either integral to the portable fuel cell power system or supplied through a removable and refillable container assembly.

On-board energy storage system – an internal energy source intended to aid or complement the fuel cell module in providing power to internal or external loads.

Ventilation systems – subsystem of the fuel cell power system that provides, by mechanical means, air to its cabinet.

Water treatment systems – provides for treatment and purification of recovered or added water for use within the portable fuel cell power system.

These requirements are not intended to prevent the design and construction of a portable fuel cell power system not specifically described in this document, provided that such alternatives have been considered and equivalent testing yields equivalent safety performance to that specified in this document. In considering alternative designs or construction, this document can be used to evaluate the alternative materials or methods to be used as to their ability to yield equivalent performance to that specified in this document.

This document does not cover requirements of pressurized or non-pressurized fuel supply containers upstream of the appliance gaseous or liquid fuel supply connector that are not integral to the portable fuel cell power system.

All pressures in this document are considered to be gauge pressures, unless otherwise specified.

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 60034 (all parts), *Rotating electrical machines*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60079-2, *Explosive atmospheres – Part 2: Equipment protection by pressurized enclosure "p"*

IEC 60079-10 (all parts), *Explosive atmospheres – Part 10: Classification of areas*

IEC 60079-15, *Explosive atmospheres – Part 15: Equipment protection by type of protection "n"*

IEC 60079-29 (all parts), *Explosive atmospheres – Part 29: Gas detectors*

IEC 60086-4, *Primary batteries – Part 4: Safety of lithium batteries*

IEC 60204-1:2016, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60216-4-1, *Electrical insulating materials – Thermal endurance properties – Part 4-1: Ageing ovens – Single-chamber ovens*

IEC 60335-1:2010, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60335-1:2010/AMD1:2013

IEC 60335-1:2010/AMD2:2016

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)*

IEC 60695-2-13, *Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignition temperature (GWIT) test method for materials*

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60695-11-20, *Fire hazard testing – Part 11-20: Test flames – 500 W flame test method*

IEC 60730-1:2013, *Automatic electrical controls – Part 1: General requirements*

IEC 60730-1:2013/AMD1:2015

IEC 60730-2-5, *Automatic electrical controls – Part 2-5: Particular requirements for automatic electrical burner control systems*

IEC 60730-2-17, *Automatic electrical controls for household and similar use – Part 2-17: Particular requirements for electrically operated gas valves, including mechanical requirements*²⁾

IEC 60812, *Analysis techniques for system reliability – Procedure for failure mode and effects analysis (FMEA)*

IEC 60884-1, *Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*

IEC 60934, *Circuit-breakers for equipment (CBE)*

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

IEC 60950-1:2005/AMD1:2009

IEC 60950-1:2005/AMD2:2013

IEC 60990:2016, *Methods of measurement of touch current and protective conductor current*

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

IEC 61000-3-3, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection*

IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity standard for residential, commercial and light-industrial environments*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61025, *Fault tree analysis (FTA)*

IEC 61032, *Protection of persons and equipment by enclosures – Probes for verification*

IEC 61508-1, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements*

IEC 61511-1, *Functional safety – Safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and application programming requirements*

IEC 61511-3, *Functional safety – Safety instrumented systems for the process industry sector – Part 3: Guidance for the determination of the required safety integrity levels*

IEC 61882, *Hazard and operability studies (HAZOP studies) – Application guide*

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

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

IEC 62133 (all parts), *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications*

IEC 62282-2, *Fuel cell technologies – Part 2: Fuel cell modules*

2) Withdrawn.

ISO 3864 (all parts), *Graphical symbols – Safety colours and safety signs*

ISO 7000, *Graphical symbols for use on equipment* (available at <http://www.graphical-symbols.info/equipment>)

ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

ISO 15649, *Petroleum and natural gas industries – Piping*

ISO 16000-3, *Indoor air – Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air – Active sampling method*

ISO 16000-6, *Indoor air – Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA® sorbent, thermal desorption and gas chromatography using MS or MS-FID*

ISO 16017-1:2000, *Indoor, ambient and workplace air – Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography – Part 1: Pumped sampling*

ISO 16111, *Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride*

ISO 16528 (all parts), *Boilers and pressure vessels*

3 Terms and definitions

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

basic insulation

insulation of hazardous-live-parts which provides basic protection

[SOURCE: IEC 60050-195:1998, 195-06-06 modified – The note has been deleted.]

3.2

double insulation

insulation comprising both basic insulation and supplementary insulation

[SOURCE: IEC 60050-195:1998, 195-06-08]

3.3

electromagnetic interference

EMI

degradation of the performance of an equipment, transmission channel or system caused by an electromagnetic disturbance

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

[SOURCE: IEC 60050-161:1990, 161-01-06 modified – The notes have been deleted.]

3.4

electromagnetic disturbance

EMD

any electromagnetic phenomenon which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter

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

[SOURCE: IEC 60050-161:1990, 161-01-05 modified – The note has been deleted.]

3.5 enclosure

housing affording the type and degree of protection suitable for the intended application

Note 1 to entry: One type of enclosure can be inside another type (e.g. an electrical enclosure inside a fire enclosure or a fire enclosure inside an electrical enclosure). Also, a single enclosure can provide the functions of more than one type (e.g. those of both an electrical enclosure and a fire enclosure). Enclosures may be electrical, mechanical, fire or another type of enclosure to provide protection from these hazards or from wind, weather and other hazards.

[SOURCE: IEC 60050-195:1998, 195-02-35 modified – The note has been added.]

3.6 electrical enclosure

enclosure providing protection against the foreseen dangers created by electricity

[SOURCE: IEC 60050-195:1998, 195-06-13]

3.7 fire enclosure

part of the equipment intended to minimize the spread of fire or flames from within

3.8 mechanical enclosure

part of the equipment intended to reduce the risk of injury due to mechanical and other physical hazards

3.9 hazardous location

any area or space where combustible dust, ignitable fibres, or flammables, volatile liquids, gases, vapours or mixtures are or may be present in the air in quantities sufficient to produce an explosive atmosphere or ignitable mixtures

3.10 explosive atmosphere

mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour, dust, fibres, or flyings which, after ignition, permits self-sustaining propagation

[SOURCE: IEC 60050-426:2008, 426-01-06]

3.11 hazardous energy level

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

[SOURCE: IEC 60950-1:2005, 1.2.8.10]

3.12 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 circuit

[SOURCE: IEC 60950-1:2005, 1.2.8.6]

3.13 heat deflection temperature HDT

measure of a polymer's resistance to distortion under a given load at elevated temperatures

Note 1 to entry: The deflection temperature is the temperature at which a test bar, loaded to the specified bending stress, deflects by 0,25 mm.

Note 2 to entry: This note only applies to the French language.

3.14

lower flammability limit

LFL

minimum concentration of fuel in a fuel-air mixture where a combustion can be ignited by an ignition source

Note 1 to entry: A fuel-air mixture is flammable when combustion can be started by an ignition source. The main component is the proportions or composition of the fuel-air mixture. A mixture that has less than a critical amount of fuel, known as the lower flammability limit (LFL) or more than a critical amount of fuel, known as the rich or upper flammability limit (UFL), will not be flammable.

Note 2 to entry: This note only applies to the French language.

3.15

limited current circuit

circuit that is so designed and protected that, under both normal operating conditions and single fault conditions, the current that can be drawn is not hazardous

Note 1 to entry: The limit values of currents under normal operating conditions and single fault conditions (see IEC 60950-1:2005, 1.4.14) are specified in IEC 60950-1:2005, 2.4.

[SOURCE: IEC 60950-1:2005, 1.2.8.9]

3.16

live part

conductor or conductive part intended to be energized in normal operation, including a neutral conductor, but by convention not a PEN conductor or PEM conductor or PEL conductor

Note 1 to entry: This concept does not necessarily imply a risk of electric shock.

[SOURCE: IEC 60050-195:1998, 195-02-19]

3.17

maximum allowable working pressure

MAWP

maximum pressure at which a fuel cell or fuel cell power system may be operated

Note 1 to entry: The maximum allowable working pressure is expressed in Pa.

Note 2 to entry: The maximum allowable working pressure is the pressure used in determining the setting of pressure limiting and relieving devices installed to protect a component or system from accidental over-pressuring.

Note 3 to entry: For the purposes of this document, all pressures are to be given and used as gauge pressures unless absolute pressure is indicated.

Note 4 to entry: This note only applies to the French language.

3.18

maximum operating pressure

maximum pressure, specified in gauge pressure by the manufacturer, of a component or system at which it is designed to operate continuously

Note 1 to entry: The maximum operating pressure is expressed in Pa.

Note 2 to entry: This includes all normal operation, both steady state and transient.

3.19

operator access area

area for which under normal operating conditions

- a) access is gained without the use of a tool; or
- b) the means of access is deliberately provided to the operator; or
- c) the operator is instructed to enter regardless of whether or not tools are needed to gain access

Note 1 to entry: In this document, the terms "access" and "accessible", unless qualified, relate to operator access as defined above.

3.20

portable fuel cell power system

fuel cell power system that is not intended to be permanently fastened or otherwise secured in a specific location

3.21

portable stand-alone fuel cell power system

portable fuel cell power system that is not designed to be connected to the energized mains

3.22

reinforced insulation

insulation of hazardous-live-parts which provides a degree of protection against electric shock equivalent to double insulation

Note 1 to entry: Reinforced insulation may comprise several layers which cannot be tested singly as basic insulation or supplementary insulation.

[SOURCE: IEC 60050-195:1998, 195-06-09]

3.23

secondary circuit

circuit that has no direct connection to a primary circuit and derives its power from a transformer, converter or equivalent isolation device, or from a battery

Note 1 to entry: Conductive parts of an interconnecting cable may be part of a secondary circuit as stated in IEC 60950-1:2005, 1.2.11.6.

[SOURCE: IEC 60950-1:2005, 1.2.8.5]

3.24

SELV

safety extra low voltage

voltage, the peak value of which does not exceed 42,4 V for alternating current and which does not exceed 60 V for direct current

Note 1 to entry: When safety extra low voltage is obtained from the supply mains, it is to be through a safety isolating transformer or a converter with separate windings, the insulation of which complies with double insulation or reinforced insulation requirements.

Note 2 to entry: The voltage limits specified are based on the assumption that the safety isolating transformer is supplied at its rated voltage.

[SOURCE: IEC 60335-1:2010, 3.4.2 modified – The definition has been revised.]

3.25

SELV circuit

safety extra low voltage circuit

secondary circuit that is so designed and protected that under normal operating conditions and single fault conditions, its voltages do not exceed a safe value

Note 1 to entry: For commercial, industrial and telecommunication applications, the SELV voltage limits provided in IEC 60950-1:2005 are applicable. For household applications, the SELV voltage limits in IEC 60335-1:2010 shall be used.

Note 2 to entry: The limit values of voltages under normal operating conditions and single fault conditions (see IEC 60950-1:2005, 1.4.14) are specified in IEC 60950-1:2005, 2.2. See IEC 60950-1:2005, Table 1.A.

Note 3 to entry: This definition of a SELV circuit differs from the term “SELV system” as used in IEC 61140.

[SOURCE: IEC 60950-1:2005, definition 1.2.8.8 modified – Note 1 has been added.]

3.26

service personnel

trained persons having familiarity and experience with the construction and operation of the system and the risks involved

3.27

standard litre

volume in litre at temperature of 288,15 K (15 °C) and pressure of 101,325 kPa

3.28

supplementary insulation

independent insulation applied in addition to basic insulation in order to reduce the risk of electric shock in the event of a failure of the basic insulation

3.29

thermal equilibrium

stable temperature conditions, pseudo steady-state, arbitrarily indicated by temperature changes of no more than 3 K or 1 % of the absolute operating temperature, whichever is higher between two readings 15 min apart

3.30

tool

screwdriver, coin, key, or any other object that may be used to operate a screw, latch, or similar fastening means

3.31

touch voltage

voltage between conductive parts when touched simultaneously by a person or an animal

Note 1 to entry: The value of the effective touch voltage may be appreciably influenced by the impedance of the person or the animal in electric contact with these conductive parts.

3.32

uninterruptible power system

UPS

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

3.33

wet cell battery

battery in which the electrolyte is in liquid and mobile form

3.34

transportable equipment

movable equipment that is intended to be routinely carried by a user

Note 1 to entry: Examples include laptop and notebook personal computers, pen-based tablet computers, and their portable accessories such as printers and CD-ROM drives.

[SOURCE: IEC 60950-1:2005, 1.2.3.3]

3.35

hand-supported equipment

equipment that is physically supported by any part of the body of the user during the performance of its intended functions