

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

Fuel cell technologies –  
Part 5-100: Portable fuel cell power systems – Safety

Technologies des piles à combustible –  
Partie 5-100: Systèmes à piles à combustible portables – Sécurité

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## CONTENTS

FOREWORD.....	6
1 Scope.....	8
2 Normative references .....	10
3 Terms and definitions .....	13
4 Design and construction requirements .....	18
4.1 Physical environment and operating conditions.....	18
4.1.1 General requirements .....	18
4.1.2 Electrical power input .....	18
4.1.3 Handling, transportation, and storage .....	18
4.2 Material compatibility .....	18
4.2.1 General requirements for material compatibility .....	18
4.2.2 Polymeric and elastomeric components .....	19
4.2.3 Fuel connection devices .....	19
4.3 Protection against mechanical hazards .....	19
4.4 Protection against toxicity of fuels and fuel feedstocks.....	20
4.5 Protection against explosion hazards .....	20
4.5.1 General requirements for protection against explosion hazards .....	20
4.5.2 Flammable atmospheres within the portable fuel cell power system.....	20
4.5.3 Normal operation .....	20
4.5.4 Abnormal operation .....	20
4.5.5 Purging.....	20
4.5.6 Electrostatic discharge.....	21
4.6 Protection against electric shock.....	21
4.6.1 General requirements for protection against electric shock .....	21
4.6.2 Protection against direct contact with live parts .....	21
4.6.3 Protection against indirect contact with live parts.....	22
4.6.4 Protection by the use of SELV .....	22
4.7 Selection of electrical components and equipment .....	23
4.7.1 Area classification and suitability .....	23
4.7.2 Turning moments .....	23
4.7.3 Fuses .....	23
4.7.4 Capacitor discharge.....	23
4.7.5 Securing of parts .....	23
4.7.6 Current-carrying parts.....	24
4.7.7 Internal wiring.....	24
4.7.8 Cord-connected portable fuel cell power systems .....	24
4.7.9 Strain relief.....	25
4.7.10 Creepage and clearances .....	25
4.7.11 Separation of circuits .....	25
4.7.12 Protection of receptacles .....	26
4.7.13 Earthing and bonding.....	26
4.8 Protection against fire hazard .....	26
4.8.1 General intent and purpose of protection against fire hazard .....	26
4.8.2 Flammability .....	26
4.8.3 Openings in equipment .....	27
4.9 Protection against temperature hazards .....	28
4.9.1 General requirements for protection against temperature hazards .....	28

4.9.2	Surface temperatures .....	28
4.9.3	Component temperatures .....	28
4.9.4	Wall, floor and ceiling temperatures .....	28
4.10	Protection against electromagnetic disturbances .....	28
4.11	Hazard and risk assessment .....	28
4.11.1	General requirements for hazard and risk assessment and the approach .....	28
4.11.2	Safety and reliability analysis .....	29
4.12	Safety control circuits .....	29
4.13	Protection against oxygen depletion .....	29
4.14	Emission of effluents .....	30
4.15	Fuel supply .....	30
4.16	Fuel processing systems (if applicable) .....	30
4.17	Enclosures .....	31
4.17.1	General requirements for all enclosures .....	31
4.17.2	Enclosure requirements for outdoor use .....	31
4.18	Battery supplies .....	31
4.18.1	General requirements for batteries .....	31
4.18.2	Battery compartments .....	31
4.18.3	Vented wet cell batteries .....	32
4.18.4	Ventilation of battery compartments .....	32
4.19	Pressure vessels and piping .....	32
4.19.1	General requirements for pressure vessels and piping .....	32
4.19.2	Piping systems .....	32
4.20	Hoses .....	33
4.21	Automatic shut-off valves .....	33
4.22	Regulators .....	33
4.23	Process control equipment .....	33
4.24	Filters .....	33
4.24.1	Air filters .....	33
4.24.2	Liquid fuel filters .....	34
4.25	Motors .....	34
4.26	Fuel pumps .....	34
5	Instructions .....	34
5.1	Operation and maintenance manual .....	34
5.2	User's information manual .....	36
5.2.1	User's information manual general requirements .....	36
5.2.2	User's information manual front cover .....	36
5.2.3	Users information manual safety section .....	36
6	Labelling .....	37
6.1	General labelling requirements .....	37
6.2	Marking .....	37
6.3	Warnings .....	38
7	Type tests .....	38
7.1	General requirements for type tests .....	38
7.2	Tests sequence .....	39
7.3	Leakage test for liquid fueled systems .....	39
7.3.1	General requirements for leakage tests for liquid fueled systems .....	39
7.3.2	Method of test .....	39
7.4	Flammable fuel gas concentration test .....	40

7.4.1	General requirements for flammable gas concentration testing .....	40
7.4.2	Method of test.....	40
7.5	Surface temperature test.....	40
7.6	Component temperature test.....	40
7.7	Wall, floor and ceiling temperatures test .....	40
7.8	Dielectric strength test .....	41
7.8.1	General requirements for dielectric strength and testing .....	41
7.8.2	Test method .....	41
7.9	Humidity test.....	41
7.10	Leakage current at operating temperature.....	41
7.10.1	Leakage current testing requirement and duration .....	41
7.10.2	Test method .....	42
7.11	Abnormal operation testing .....	42
7.11.1	Abnormal operation testing – General requirements.....	42
7.11.2	Abnormal operation tests – Outcomes and further testing requirements.....	42
7.11.3	Abnormal operation test methods .....	42
7.12	Strain relief test .....	43
7.13	Insulating material test.....	43
7.14	Earthing test .....	43
7.15	Tank pressure test .....	43
7.16	Stability.....	44
7.17	Impact test.....	44
7.18	Free drop test .....	45
7.19	Adhesion and legibility of marking materials.....	46
7.20	Flammable gas accumulation .....	46
7.20.1	Flammable gas accumulation test basis and applicability.....	46
7.20.2	Test set-up .....	47
7.20.3	Test method .....	47
7.21	Oxygen depletion test .....	47
7.21.1	Oxygen depletion test basis and applicability.....	47
7.21.2	Test set-up .....	47
7.21.3	Test method .....	48
7.22	Emission of effluents tests .....	48
7.22.1	Emission of effluents testing sequence .....	48
7.22.2	Emission of effluents for indoors.....	48
7.23	Wind test .....	50
7.23.1	Wind test applicability.....	50
7.23.2	Method of test.....	50
7.24	Strength test .....	51
7.24.1	Strength test sequencing and alternative compliance methods .....	51
7.24.2	Method of test (liquid).....	51
7.24.3	Method of test (gas).....	51
7.24.4	Passing criteria.....	51
7.25	Stress relief test.....	52
7.26	Fuel supply securement test .....	52
7.27	Shutdown parameters .....	52
7.28	Non-metallic tubing conductivity test .....	52
7.28.1	Passing criteria.....	52
7.28.2	Test method .....	52

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IEC 62282-5-100:2018

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7.29	Non-metallic tubing test for accumulation of static electricity.....	53
7.29.1	Passing criteria.....	53
7.29.2	Test method .....	53
8	Routine tests .....	53
8.1	Routine test requirements .....	53
8.2	Liquid leakage test.....	53
8.3	Gas leakage test.....	53
8.4	Dielectric strength test .....	54
8.5	Routine test records.....	54
Annex A	(normative) Ventilation rates for batteries .....	55
A.1	Ventilation rate for valve regulated lead acid batteries .....	55
A.2	Ventilation rate for vented wet cell batteries.....	55
Annex B	(informative) Shock and vibration limits for high shock environments .....	56
B.1	Field of application.....	56
B.2	Vertical axis test .....	56
B.3	Longitudinal and lateral axes tests .....	56
Annex C	(normative) Uncertainty of measurements .....	58
Bibliography	.....	59
Figure 1	– Portable fuel cell power systems .....	9
Figure 2	– Articulated probe.....	46
Table 1	– Emission limits based on STEL .....	50
Table B.1	– Vertical axis vibration conditions .....	56
Table B.2	– Longitudinal and lateral axes vibration conditions .....	57
Table C.1	– Measurements and their maximum uncertainties .....	58

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Figure 1	– Portable fuel cell power systems .....	9
Figure 2	– Articulated probe.....	46
Table 1	– Emission limits based on STEL .....	50
Table B.1	– Vertical axis vibration conditions .....	56
Table B.2	– Longitudinal and lateral axes vibration conditions .....	57
Table C.1	– Measurements and their maximum uncertainties .....	58

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## FUEL CELL TECHNOLOGIES –

## Part 5-100: Portable fuel cell power systems – Safety

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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

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## FUEL CELL TECHNOLOGIES –

### Part 5-100: Portable fuel cell power systems – Safety

#### 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]<sup>1)</sup>.

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, (standards.iteh.ai)
- 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

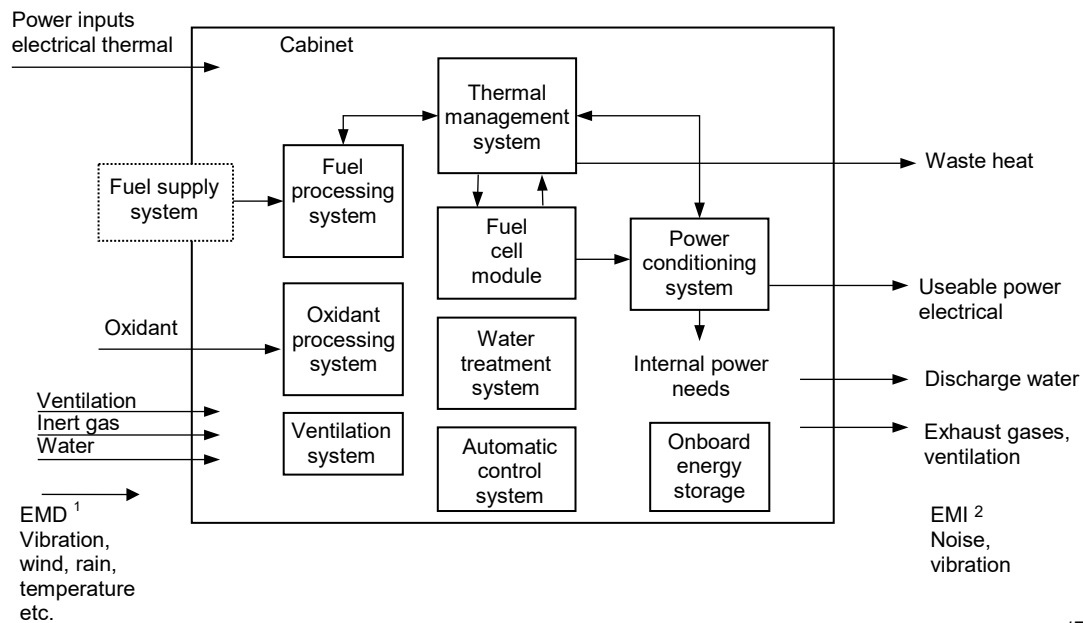
The following fuels and fuel feedstocks are considered within the scope of this document:

- 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.

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1) Numbers in square brackets refer to the Bibliography.



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**Key**

- 1 EMD electromagnetic disturbance
- 2 EMI electromagnetic interference

**Figure 1 – Portable fuel cell power systems**  
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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

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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<sup>2)</sup>*

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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  $\leq 16$  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  $\leq 16$  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*

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2) Withdrawn.

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*

<https://standards.iteh.ai/catalog/standards/sist/4532414c-fb7d-4664-9ec4-1f300efd62df/iec-62282-5-100-2018>

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*

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<sup>®</sup> 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