

**Kütuseelementide kasutamistehnika. Osa 5-1: Kantavad kütuseelement-energiaallikad. Ohutus**

**Fuel cell technologies - Part 5-1: Portable fuel cell power systems - Safety (IEC 62282-5-1:2012)**

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 62282-5-1:2012 sisaldab Euroopa standardi EN 62282-5-1:2012 ingliskeelset teksti.	This Estonian standard EVS-EN 62282-5-1:2012 consists of the English text of the European standard EN 62282-5-1:2012.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 23.11.2012.	Date of Availability of the European standard is 23.11.2012.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

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English version

**Fuel cell technologies -  
Part 5-1: Portable fuel cell power systems -  
Safety  
(IEC 62282-5-1:2012)**

Technologies des piles à combustible -  
Partie 5-1: Systèmes à piles à  
combustible portables -  
Sécurité  
(CEI 62282-5-1:2012)

Brennstoffzellentechnologien -  
Teil 5-1: Portable Brennstoffzellen-  
Energiesysteme -  
Sicherheit  
(IEC 62282-5-1:2012)

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## Foreword

The text of document 105/396/FDIS, future edition 2 of IEC 62282-5-1, prepared by IEC/TC 105 "Fuel cell technologies" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62282-5-1:2012.

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) 2013-07-23
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-10-23

This document supersedes EN 62282-5-1:2007.

EN 62282-5-1:2012 includes the following significant technical changes with respect to EN 62282-5-1:2007:

- normative references and definitions have been updated (e.g., hazardous locations, micro fuel cell power systems, transportable equipment, etc.);
- subclause 4.2.2 has been updated referencing an alternative test method in response to a comment;
- the limit on flammable atmospheres has been reduced from 50 % of LFL to 25 % of LFL in 4.5.4 and in 7.20;
- subclause 4.14 and the corresponding tests in 7.22 have been updated to include more effluents and criteria to establish if a system is suitable for indoor or outdoor operation;
- specific criteria for oxygen detector sensor performance requirements have been revised in 7.21;
- subclause 7.18 has been updated with a new test method and new drop heights in response to comments;
- Table 1 has been added giving limits on emission of effluents using limits drawn from the micro fuel cell power system standard.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

### Endorsement notice

The text of the International Standard IEC 62282-5-1:2012 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 60439-1	NOTE	Harmonized as EN 60439-1.
IEC 62282-6-100	NOTE	Harmonized as EN 62282-6-100.
ISO 15156-1	NOTE	Harmonized as EN ISO 15156-1.

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60034	Series	Rotating electrical machines	EN 60034	Series
IEC 60068-2-75	-	Environmental testing - Part 2-75: Tests - Test Eh: Hammer tests	EN 60068-2-75	-
IEC 60079-0	-	Explosive atmospheres - Part 0: Equipment - General requirements	EN 60079-0	-
IEC 60079-2	-	Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure "p"	EN 60079-2	-
IEC 60079-10	-	Electrical apparatus for explosive gas atmospheres - Part 10: Classification of hazardous areas	EN 60079-10	-
IEC 60079-15	-	Explosive atmospheres - Part 15: Equipment protection by type of protection "n"	EN 60079-15	-
IEC 60079-20-1	-	Explosive atmospheres - Part 20-1: Material characteristics for gas and vapour classification - Test methods and data	EN 60079-20-1	-
IEC 60079-29-1	-	Explosive atmospheres - Part 29-1: Gas detectors - Performance requirements of detectors for flammable gases	EN 60079-29-1	-
IEC 60086-4	-	Primary batteries - Part 4: Safety of lithium batteries	EN 60086-4	-
IEC 60204-1 (mod)	2005	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	EN 60204-1 + corr. February	2006 2010
IEC 60216-4-1	-	Electrical insulating materials - Thermal endurance properties - Part 4-1: Ageing ovens - Single-chamber ovens	EN 60216-4-1	-
IEC 60335-1 (mod) + corr. July + corr. April	2010 2010 2011	Household and similar electrical appliances - Safety - Part 1: General requirements	EN 60335-1	2012
IEC 60364-4-41	-	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41	-
IEC 60529	-	Degrees of protection provided by enclosures - (IP Code)		-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60664-1	-	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1	-
IEC 60695-2-11	-	Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products	EN 60695-2-11	-
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	EN 60695-2-13	-
IEC 60695-11-5	-	Fire hazard testing - Part 11-5: Test flames - Needle-flame test method - Apparatus, confirmatory test arrangement and guidance	EN 60695-11-5	-
IEC 60695-11-10	-	Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	-
IEC 60695-11-20	-	Fire hazard testing - Part 11-20: Test flames - 500 W flame test methods	EN 60695-11-20	-
IEC 60730-1 (mod)	2010	Automatic electrical controls for household and similar use - Part 1: General requirements	EN 60730-1	2011
IEC 60730-2-5-	-	Automatic electrical controls for household and similar use - Part 2-5: Particular requirements for automatic electrical burner control systems	EN 60730-2-5	-
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	-	-
IEC 60812	-	Analysis techniques for system reliability - Procedure for failure mode and effects analysis (FMEA)	EN 60812	-
IEC 60884-1	-	Plugs and socket-outlets for household and similar purposes - Part 1: General requirements	-	-
IEC 60934	-	Circuit-breakers for equipment (CBE)	EN 60934	-
IEC 60950-1 (mod) + corr. August	2005 2006	Information technology equipment - Safety - Part 1: General requirements	EN 60950-1 + A11 + A12 + AC	2006 2009 2011 2011
IEC 60990	1999	Methods of measurement of touch current and protective conductor current	EN 60990	1999
IEC 61000-3-2	-	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current $\leq 16$ A per phase)	EN 61000-3-2	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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	EN 61000-3-3	-
IEC 61000-6-1	-	Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments	EN 61000-6-1	-
IEC 61000-6-2	-	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments	EN 61000-6-2	-
IEC 61000-6-3	-	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments	EN 61000-6-3	-
IEC 61000-6-4	-	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments	EN 61000-6-4	-
IEC 61025	-	Fault Tree Analysis (FTA)	EN 61025	-
IEC 61032	-	Protection of persons and equipment by enclosures - Probes for verification	EN 61032	-
IEC 61140	-	Protection against electric shock - Common aspects for installation and equipment	EN 61140	-
IEC 61439-1	-	Low-voltage switchgear and controlgear assemblies - Part 1: General rules	EN 61439-1	-
IEC 61508-1	-	Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements	EN 61508-1	-
IEC 61511-1	-	Functional safety - Safety instrumented systems for the process industry sector - Part 1: Framework, definitions, system, hardware and software requirements	EN 61511-1	-
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	EN 61511-3	-
IEC 61882	-	Hazard and operability studies (HAZOP studies) - Application guide	-	-
IEC 62040-1	-	Uninterruptible Power Systems (UPS) - Part 1: General and safety requirements for UPS	EN 62040-1	-
IEC 62040-2	-	Uninterruptible power systems (UPS) - Part 2: Electromagnetic compatibility (EMC) requirements	EN 62040-2	-
IEC 62133	-	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	EN 62133	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62282-2	-	Fuel cell technologies - Part 2: Fuel cell modules	EN 62282-2	-
ISO 3864	Series	Graphical symbols - Safety colours and safety - signs		-
ISO 4080	-	Rubber and plastics hoses and hose assemblies - Determination of permeability to gas	EN ISO 4080	-
ISO 7000	-	Graphical symbols for use on equipment - Index and synopsis	-	-
ISO 7010	-	Graphical symbols - Safety colours and safety signs - Registered safety signs	EN ISO 7010	-
ISO 15649	-	Petroleum and natural gas industries - Piping	-	-
ISO 16000-3	-	Indoor air - Part 3: Determination of formaldehyde and other carbonyl compounds - 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/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	EN ISO 16017-1	2000
ISO 16110-1	2007	Hydrogen generators using fuel processing technologies - Part 1: Safety	-	-
ISO 16111	-	Transportable gas storage devices - Hydrogen- absorbed in reversible metal hydride	-	-
ISO 16528	-	Boilers and pressure vessels - Registration of Codes and Standards to promote international recognition	-	-

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## FUEL CELL TECHNOLOGIES –

### Part 5-1: 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 standard applies to a.c. and d.c. type portable fuel cell power systems, with a rated output voltage not exceeding 600 V a.c., or 850 V d.c. for indoor and outdoor use. These portable fuel cell power systems are not to be used in hazardous locations as defined by IEC 60079-0 unless additional protective measures are added in accordance with IEC 60079-0.

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

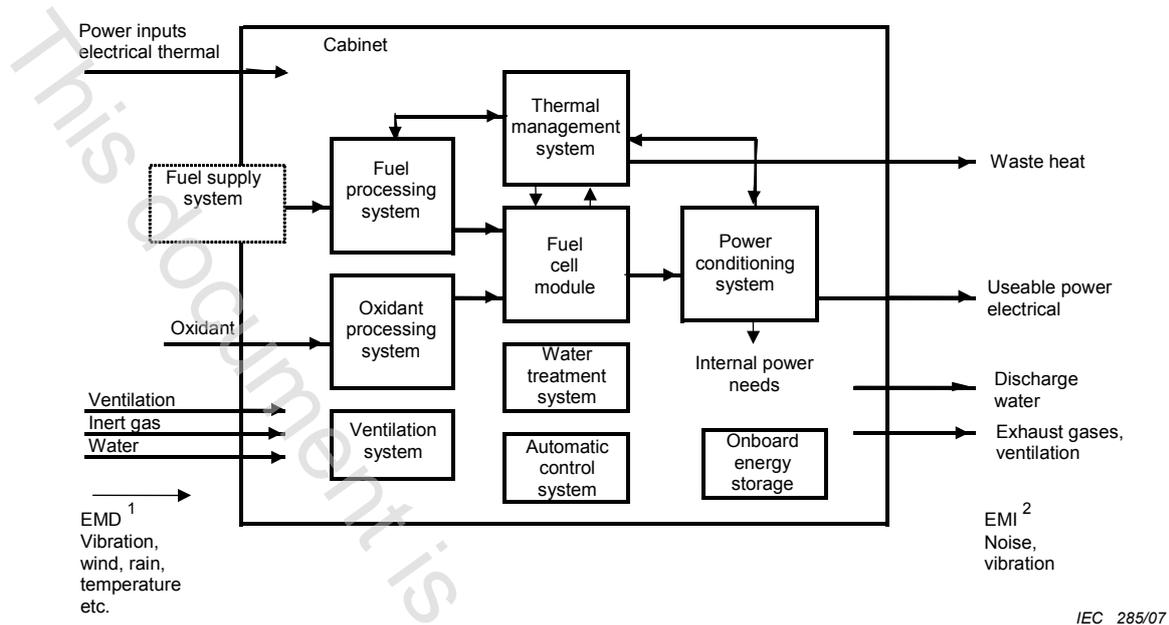
- a) permanently connected (hard wired) to the electrical distribution system,
- b) permanently connected to a utility fuel distribution system,
- c) exporting power to the grid,
- d) for propulsion of road vehicles,
- e) intended to be used on board passenger aircraft.

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 standard

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

- natural gas;
- liquefied petroleum gas, such as propane and butane;
- liquid alcohols, for example methanol, ethanol;
- gasoline;
- diesel;
- kerosene;
- hydrogen;
- metals (e.g. Mg, Al or Zn) or metal alloys immersed in electrolyte (e.g. aqueous solutions of salts or alkali) in air or oxygen;
- chemical hydrides.

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



**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 standard shall form 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.

**Onboard 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 standard, provided that such alternatives have been considered and equivalent testing yields equivalent safety performance to that prescribed by this standard. In considering alternative designs or construction, this standard may be used to evaluate the alternative materials or methods to be used as to their ability to yield equivalent performance to that prescribed by this standard.

This standard 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 standard are considered to be gauge pressures, unless otherwise specified.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

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

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

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

IEC 60079-20-1, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

IEC 60079-29-1, *Explosive atmospheres – Part 29-1: Gas detectors – Performance requirements of detectors for flammable gases*

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

IEC 60204-1:2005, *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 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 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

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

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 methods*

IEC 60730-1:2010, *Automatic electrical controls for household and similar use – Part 1: General requirements*

IEC 60730-2-5, *Automatic electrical controls for household and similar use – Part 2-5: Particular requirements for automatic electrical burner control*

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*

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 60990:1999, *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 for residential, commercial and light-industrial environments*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standards – Immunity 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 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61439-1, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

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 software 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: General and safety requirements for UPS*

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

IEC 62133, *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 4080, *Rubber and plastics hoses and hose assemblies – Determination of permeability to gas*

ISO 7000, *Graphical symbols for use on equipment – Index and synopsis*

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 – 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 16017-1:2007, *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 16110-1:2007, *Hydrogen generators using fuel processing technologies – Part 1: Safety*

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

ISO 16528, *Boilers and pressure vessels – Registration of Codes and Standards to promote international recognition*

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

#### 3.1 basic insulation

insulation of hazardous-live-parts which provides basic protection

[SOURCE: IEC 60050-195:1998, definition 195-06-06, modified – Note not included] [1]<sup>1</sup>

#### 3.2 double insulation

insulation comprising both basic insulation and supplementary insulation

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

#### 3.3 electromagnetic interference

EMI

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

[SOURCE: IEC 60050-161:1990, definition 161-01-06, modified – Notes not included] [2]

#### 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

[SOURCE: IEC 60050-161:1990, definition 161-01-05, modified – Notes not included]

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<sup>1</sup> References in square brackets refer to the Bibliography.