IEC 62282-6-101

Edition 1.0 2024-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fuel cell technologies –
Part 6-101: Micro fuel cell power systems – Safety – General requirements

Technologies des piles à combustible –
Partie 6-101: Systèmes à micropiles à combustible – Sécurité – Exigences générales



IEC 62282-6-101:2024-02(en-fr)



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FUEL CELL TECHNOLOGIES –

Part 6-101: Micro fuel cell power systems – Safety – General requirements

FOREWORD

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IEC 62282-6-101 has been prepared by IEC technical committee 105: Fuel cell technologies. It is an International Standard.

This first edition, together with the other parts of the IEC 62282-6-1XX series, cancels and replaces IEC 62282-6-100:2010 and IEC 62282-6-100:2010/AMD1:2012.

This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 62282-6-100:2010 and IEC 62282-6-100:2010/AMD1:2012:

a) A new structure has been set up: IEC 62282-6-101 covers the general safety requirements common to all fuel types whereas IEC 62282-6-102 and subsequent parts of the IEC 62282-6-1XX series cover particular requirements for specific fuel types based on the requirements given in IEC 62282-6-101.

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

Draft	Report on voting
105/1010/FDIS	105/1023/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 was drafted in accordance with 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/publications.

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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months from the date of publication.

INTRODUCTION

IEC 62282-6-100 has been restructured to make it more user friendly.

The new IEC 62282-6-1XX series consists of IEC 62282-6-101 and subsequent parts of the IEC 62282-6-1XX series which will replace IEC 62282-100 on a case-by-case basis. Until subsequent specific parts of the IEC 62282-6-1XX series are completed, a suitable transition period will apply.

IEC 62282-6-101 covers general safety requirements common to all fuel types.

IEC 62282-6-102 and subsequent parts in the IEC 62282-6-1XX series will cover detailed requirements for specific fuel cartridges based on the requirements of IEC 62282-6-101, as shown in Table 1: Technology specific parts.

FUEL CELL TECHNOLOGIES –

Part 6-101: Micro fuel cell power systems – Safety – General requirements

1 Scope

1.1 General

a) This part of IEC 62282 covers micro fuel cell power systems and fuel cartridges that are wearable or easily carried by hand, providing direct current outputs that do not exceed 60 V DC and power outputs that do not exceed 240 VA. Portable fuel cell power systems that provide output levels that exceed these electrical limits are covered by IEC 62282-5-100.

b) Externally accessible circuitry is therefore considered to be ES1 energy source as defined in IEC 62368-1, and as limited power source if further compliance with IEC 62368-1:2023, Annex Q is demonstrated. Micro fuel cell power systems that have internal circuitry exceeding 60 V DC or 240 VA are addressed with the separate criteria of IEC 62368-1.

c) This document covers micro fuel cell power systems and fuel cartridges. This document establishes the requirements for micro fuel cell power systems and fuel cartridges to ensure a reasonable degree of safety for normal use, reasonably foreseeable misuse, and cargo and consumer transportation and storage of such items. Fuel cartridges refilled by the manufacturer or by trained technicians are covered by this document. The fuel cartridges covered by this document are not intended to be refilled by the consumer.

d) Micro fuel cell power systems and fuel cartridges that are covered by this document are not intended for use in hazardous areas as defined by IEV 426-03-01.

1.2 Fuels and technologies covered

a) A micro fuel cell power system block diagram is shown in Figure 1.

b) This document, including all annexes, apply to micro fuel cell power systems and fuel cartridges as defined in 1.1 above.

c) Clause 4 to Clause 8 cover the general safety requirements for all micro fuel cell power systems. IEC 62282-6-101 together with the appropriate technology specific parts shown in Table 1 cover the requirements for the specific technologies in the IEC 62282-6-1XX series.

Table 1 – Technology specific parts

Specific technology supplement standard	Title
IEC 62282-6-106	Fuel cell technologies – Part 6-106: Micro fuel cell power systems – Safety – Indirect Class 8 (corrosive) compounds
IEC 62282-6-107	Fuel cell technologies – Part 6-107: Micro fuel cell power systems – Safety – Indirect water reactive (Division 4.3) compounds

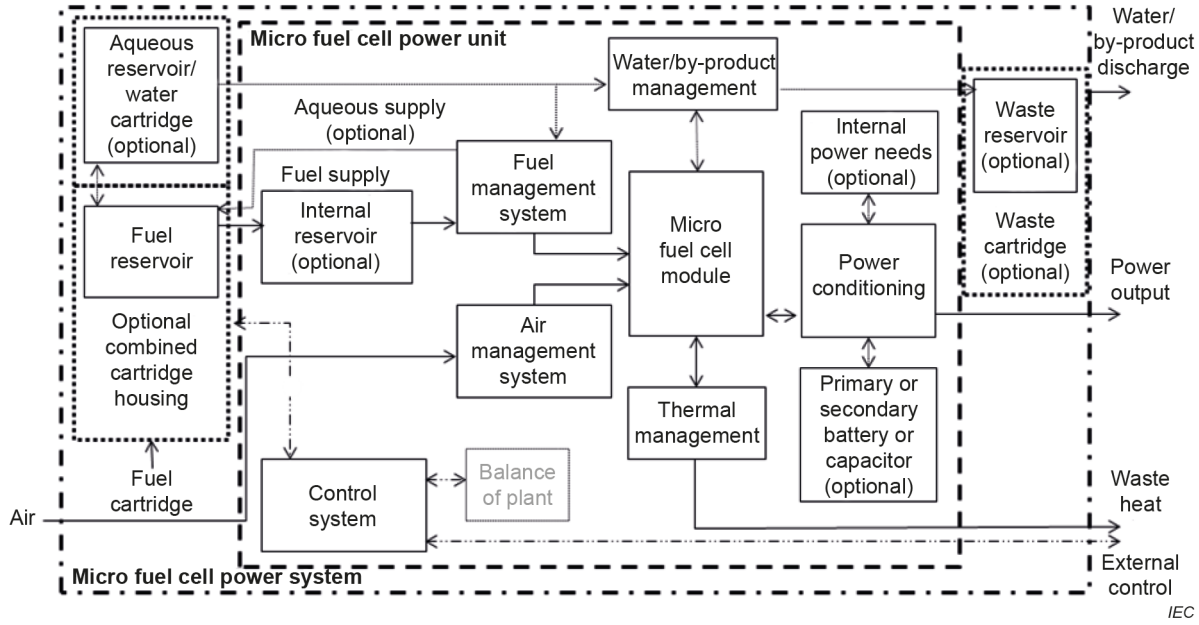


Figure 1 – Micro fuel cell power system block diagram

1.3 Equivalent level of safety

a) The requirements of this document are not intended to constrain innovation. The manufacturer can consider fuels, materials, designs or constructions not specifically dealt with in this document. These alternatives can be evaluated as to their ability to yield levels of safety equivalent to those specified in this document.

b) It is understood that all micro fuel cell power systems and fuel cartridges comply with applicable country and local requirements including, but not limited to, those concerning transportation, child-resistance and storage, where required.

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

IEC 60086-5, *Primary batteries – Part 5: Safety of batteries with aqueous electrolyte*

IEC 60730-1:2022, *Automatic electrical controls – Part 1: General requirements*

IEC 61032:1997, *Protection of persons and equipment by enclosures – Probes for verification*

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 62281, *Safety of primary and secondary lithium cells and batteries during transport*

IEC 62368-1:2023, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

IEC 62282-6-300:2012, *Fuel cell technologies – Part 6-300: Micro fuel cell power systems – Fuel cartridge interchangeability*

ISO 175, *Plastics – Methods of test for the determination of the effects of immersion in liquid chemicals*

ISO 188, *Rubber, vulcanized or thermoplastic – Accelerated ageing and heat resistance tests*

ISO 1817, *Rubber, vulcanized or thermoplastic – Determination of the effect of liquids*

ISO 7010:2019, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

ISO 11114-4, *Transportable gas cylinders – Compatibility of cylinder and valve materials with gas contents – Part 4: Test methods for selecting steels resistant to hydrogen embrittlement*

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

ISO 16000-6, *Indoor air – Part 6: Determination of organic compounds (VVOC, VOC, SVOC) in indoor and test chamber air by active sampling on sorbent tubes, thermal desorption and gas chromatography using MS or MS FID*

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

United Nations Recommendations on the Transport of Dangerous Goods: Model Regulations Twentieth revised edition, Manual of Tests and Criteria: Seventh revised edition, available at https://unece.org/fileadmin/DAM/trans/danger/publi/manual/Rev7/Manual_Rev7_E.pdf (viewed 2023-08-08)

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
air management system
set of components that can be used to control air properties, if necessary, to support the micro fuel cell power system operation

3.2
attached cartridge
fuel cartridge, which has its own enclosure that connects to the device powered by the micro fuel cell power system

3.3
aqueous reservoir
optional reservoir within a fuel cartridge which contains an aqueous solution used in fuel processing

Note 1 to entry: Any hazards associated with aqueous solutions should be addressed in the hazard analysis and risk assessment or in a fuel specific standard.

3.4
control system
set of components of the micro fuel cell power system that coordinates properties of the micro fuel cell power system and reactants using any combination of the following to effect proper micro fuel cell power system start-up, operation and shutdown, when necessary: electrical, mechanical, or digital inputs, outputs, software, or functions

3.5
corrosive liquid
aqueous solution with a pH < 3,5 or pH > 10,5 or any liquid which can cause the full thickness destruction of skin after not more than 60 min exposure when observed after 14 days, or which otherwise meets the criteria of UN class 8 materials

3.6
exterior cartridge
fuel cartridge, which has its own enclosure that forms a portion of the enclosure of the device powered by the micro fuel cell power system

3.7
flammable liquid
liquid meeting the criteria for inclusion in UN Class 3 "flammable liquids" (i.e. having a flash point of not more than 60,5 °C)

3.8
flammable gas
gas meeting the criteria for inclusion in UN division 2.1 "flammable gas" (i.e. any material which is a gas at 20 °C or less and at a pressure of 101,3 kPa which is ignitable at 101,3 kPa when in a mixture of 13 % or less by volume with air; or has a flammable range at 101,3 kPa with air of at least 12 % regardless of the lower limit)

3.9
fuel
energy containing material used directly from the cartridge or indirectly, after processing and conversion, in the electrochemical reaction of the fuel cell

3.10
fuel cartridge
article that stores fuel

3.11
fuel cell
electrochemical device that converts the chemical energy of a fuel and an oxidant to electrical energy (DC power), heat and reaction products

3.12
fuel cell power system
system that uses a fuel cell to generate electric power and heat

Note 1 to entry: A fuel cell power system is composed of all or some of the systems shown in Figure 1.

3.13
fuel management system
optional set of components used to control fuel or hydrogen properties (e.g. concentration, flow rate, purity, temperature, humidity or pressure), if necessary to support the micro fuel cell power system operation or the storage of generated reactants or both

Note 1 to entry: Not all micro fuel cell power systems will include all functions. Some micro fuel cell power systems will include additional functions.

3.14
gas loss
hazardous gas emission, as determined in accordance with 4.2 and 5.2

3.15
hazardous substance
any solid, liquid or gas which meets the criteria for being hazardous as defined in 4.2 and 5.2

3.16
internal reservoir
structure in a micro fuel cell power system that stores fuel and cannot be removed but not including fuel lines or fittings not intended to provide sustained fuel storage

3.17
insert cartridge
fuel cartridge, which has its own enclosure and is installed within the enclosure of the device powered by the micro fuel cell power system

3.18
in-service cartridge
fuel cartridge representative of fuel cartridges put into use and then removed from a system

Note 1 to entry: For systems that allow removal of a fuel cartridge from the system at any time during operation, an in-service cartridge would be a fuel cartridge that has been put into operation such that approximately half of the initial fuel charge has been utilized and the cartridge allowed to stabilize; for systems that include a lock-out mechanism to prevent removal of a cartridge during operation, an in-service cartridge shall mean the fuel cartridge in the state in which it is removable from the system.

3.19
leakage
accessible hazardous solid or hazardous liquid substance (fuel, hazardous fuel by-products, electrolyte, or hazardous liquid fuel) outside the micro fuel cell power system or fuel cartridge

3.20
limited power source
electrical supply either isolated from a mains supply or supplied by a battery or other device (i.e. fuel cell power unit) where the voltage, current and power levels are either inherently or non-inherently limited to levels that do not result in an electric shock or fire hazard as defined in IEC 62368-1

Note 1 to entry: An inherently limited power source does not rely on a current-limiting device to meet limited power requirements although it may rely on an impedance to limit its output. However, a non-inherently limited power source relies upon a current-limiting device such as a fuse to meet limited power requirements.

3.21
maximum developed pressure
maximum gauge pressure seen inside the fuel cartridge under operation, transport and storage

EXAMPLE Pressure at the maximum temperature (at least 70 °C in accordance with 8.3.4) to which the cartridge can be exposed during operation, transport and storage.

3.22
micro fuel cell module
assembly incorporating one or more fuel cells and, if applicable, additional components, which is intended to be integrated into a micro fuel cell power system

3.23
micro fuel cell power system
micro fuel cell power unit and associated fuel cartridges that is wearable or easily carried by hand

3.24
micro fuel cell power unit
fuel cell based electric generator providing a DC voltage that does not exceed 60 V and a continuous net electrical power that does not exceed 240 VA

Note 1 to entry: The micro fuel cell power unit does not include a fuel cartridge.

3.25
non-operating
turned "off" or no longer operational

3.26
primary battery
non-rechargeable battery

3.27
rated power
maximum continuous electric output power that a fuel cell power system is designed to achieve under normal operating conditions, specified by the manufacturer

Note 1 to entry: The rated power is expressed in W.

3.28
refilling valve
component of the non-user-refillable fuel cartridge that allows refilling the fuel cartridge only by trained technicians

3.29
satellite cartridge
fuel cartridge that is intended to be connected to and removed from the micro fuel cell power system to transfer fuel to the internal reservoir inside the micro fuel cell power system

3.30
shut-off valve
component of a fuel cartridge that controls the release of fuel

3.31
toxic material
any material having a toxic hazard rating of 2 (medium) or higher, in the Sax’s dangerous properties of industrial materials 11th Edition, or related reference guide

3.32
waste cartridge
cartridge that stores waste and by-products from the micro fuel cell power system

3.33
water reactive material
material meeting the criteria for UN division 4.3 "water reactive materials" (e.g. materials which react with water to evolve dangerous quantities of flammable gas)