SLOVENSKI STANDARD
oSIST prEN IEC 62282-6-106:2023

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Tehnologije gorivnih celic - 6-106. del: Elektroenergetski sistemi z mikro gorivnimi celicami - Varnost - Spojine razreda 8 (korozivne)

Fuel cell technologies - Part 6-106: Micro fuel cell power systems - Safety - Indirect Class 8 (corrosive) compounds

Ta slovenski standard je istoveten z: **prEN IEC 62282-6-106:2022**

ICS:

27.070	Gorilne celice	Fuel cells

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105/950/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: IEC 62282-6-106 ED1	
DATE OF CIRCULATION: 2022-12-23	CLOSING DATE FOR VOTING: 2023-03-17
SUPERSEDES DOCUMENTS: 105/808/CD, 105/822/CC	

IEC TC 105 : FUEL CELL TECHNOLOGIES	
SECRETARIAT: Germany	SECRETARY: Mr David Urmann
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☒ SAFETY	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Fuel cell technologies – Part 6-106: Micro fuel cell power systems – Safety - Indirect Class 8 (corrosive) compounds

PROPOSED STABILITY DATE: 2026

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FUEL CELL TECHNOLOGIES –

Part 6-106: Micro fuel cell power systems – Safety – Indirect Class 8 (corrosive) compounds

FOREWORD

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International Standard IEC 62282-6-106 has been prepared by IEC technical committee 105: Fuel cell technologies

The Second Edition of IEC 62282-6-100 and the other new parts of the IEC 62282-6 series cancel and replace IEC 62282-6-100 published in 2010. This constitutes a technical revision.

The main changes with respect to the previous edition are as follows:

a) IEC 62282-6 series has been restructured and split in such a way as to have general requirements for the safety of micro fuel cell power systems within IEC 62282-6-100, and the specific requirements for the individual fuel types within the other parts of the IEC 62282-6 series.

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

FDIS	Report on voting
105/XX/FDIS	105/XX/RVD

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 of the IEC 62282 series, 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.

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.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

Part 106 provides additional requirements, specific to corrosive fuel formulations, which apply in addition to the general requirements prescribed by IEC 62282-6-101. Part 106 is intended to be used together with IEC 62282-6-101, and shall not be utilized as a stand-alone standard.

Clause and subclause numbers in this part are aligned with IEC 62282-6-101, and are intended to provide additional information and refined requirements, as appropriate.

FUEL CELL TECHNOLOGIES –

Part 6-106: Micro fuel cell power systems – Safety – Indirect Class 8 (corrosive) compounds

1 Scope

1.1 Fuels and technologies covered by this part

Part 106 covers micro fuel cell power systems, micro fuel cell power units and fuel cartridges using hydrogen produced from Class 8 (corrosive) borohydride formulations as fuel. These systems and units use proton exchange membrane fuel cell technologies. The designs may include fuel processing subsystems to derive hydrogen gas from the corrosive fuel formulation.

Figure 1 from IEC 62282-6-101 continues to apply.

2 Normative references

The normative references included in Clause 2 of IEC 62282-6-101 apply in their entirety to technologies included in Part 106.

3 Terms and definitions

The terms and definitions below modify and augment those corresponding terms and definitions in Clause 3 of Part 101 for micro fuel cell power systems and fuel cartridges covered by this Part 106. All terms and definitions in Clause 3 not specifically mentioned here also apply.

3.1
fuel
corrosive (UN Class 8) formulation of borohydride compounds used as fuel for an indirect PEM micro fuel cell power system.

The formulation may contain a non-hazardous activator to facilitate the production of hydrogen, and/or an inhibitor, such as an alkali metal hydroxide, to modulate or inhibit the production of hydrogen from the corrosive fuel formulation. The formulation may be solid or liquid, or may include both solid and liquid components that are combined during fuel processing.

This Part 106 only applies to corrosive (UN Class 8) compounds which can be processed to evolve hydrogen gas (e.g. though contact with water, non-hazardous or corrosive aqueous solutions, and/or an activator).

Note 1 to entry: Guidance on classification of materials, including mixtures, may be found in the United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations current Edition.

The additional terms and their definitions below are needed for micro fuel cell power systems, micro fuel cell power units and fuel cartridges covered by this Part 106 in addition to those given in Clause 3 of IEC 62282-6-101.

The following additional terms and conditions shall also apply for the purposes of this Part 106.

3.2
borohydride compounds
sodium or potassium borohydride, or a mixture thereof

3.3
liquid fuel component
Class 8 (corrosive), or non-hazardous, water solutions used to produce hydrogen within the fuel processing subsystem

3.4
fuel byproducts
Class 8 (corrosive), or non-hazardous, compounds produced after hydrogen and/or electricity is produced from fuel

3.5
activator
a substance that facilitates the production of hydrogen from fuel, such as a catalyst

3.6
stabilizer
a substance that modulates or inhibits the production of hydrogen from fuel

4 Safety Principles

The safety principles included in Clause 4 of IEC 62282-6-101 apply in their entirety to technologies included in Part 106.

5 General safety requirements

5.1 General

The general safety requirements of Subclause 5.1 of Part 101 shall apply as written.

NOTE The limited quantity exception for cargo transport of fuel cell cartridges containing corrosive fuel is 1 kg of solid fuel or 1 l of liquid fuel according to the UN Model Regulations. For passenger carriage in the aircraft cabin or in checked baggage the maximum quantity of corrosive fuel permitted inside the cartridge is 200 grams of solid fuel or 200 grams of liquid fuel according to the 2013 edition of the ICAO Technical Instructions.

5.2 Chemical Safety Requirements

Consistent with Part 101, the following limits shall apply for emission and gas loss measurements for micro fuel cell power systems and fuel cartridges tested under this Part 106.

Constituent	Concentration limit[a] (OPERATING DEVICES)	Gas loss rate limit[b] (OPERATING DEVICES)	Gas loss rate limit[c] (NON-OPERATING DEVICES)
Non-hazardous aqueous solutions	Unlimited for pH between 3,5 and 10,5	Unlimited for pH between 3,5 and 10,5	Unlimited for pH between 3,5 and 10,5
Hydrogen	0,8 g/m^3	0,8 g/h total 0,016 g/h from single point leak[d]	0,0032 g/h total (impermissible H2 gas loss)
Formaldehyde[e] *	0,000 1 g/m^3	0,000 6 g/h	0,000 6 g/h
CO*	0,029 g/m^3	0,290 g/h	0,290 g/h
CO_2*	9 g/m^3	60 g/h[f]	60 g/h[f]
Methyl Formate*	0,245 g/m^3	2,45 g/h	0,4 g/h

* Testing for the presence of these constituents may be omitted for micro fuel cell power systems and fuel cartridges that do not contain, or have the potential to evolve, carbon-based compounds. In such cases, the rationale for such omission shall be documented in the FMEA.

a The concentration limit for chemical compounds of interest shall be based on internationally recommended values. All toxicity based limits listed in this Table 4 are based on long-term, time-averaged limits, for instance TWA for ICSC's occupational limit. The gas loss rate limit shall be obtained using similar computation as used in Table 4 to ensure that overall gas loss rates do not exceed time-averaged limits for the constituent of interest. For such constituents, short-term increases in gas loss rate may be permissible, provided that the transient rate does not exceed the short-term exposure limit for that constituent, for instance STEL, and the overall gas loss rate does not exceed the time-averaged rate specified in this Table 4.

b The "Operating" emission rate limit was based on 10 m^3 ACH, selected as the product of the reference volume times the air changes per hour (ACH) because it covers the reasonably foreseeable environments where micro fuel cell power systems will be used. The interior space in a small car and the minimum volume per person on commercial aircraft is at 1 m^3. The minimum ACH used on passenger aircraft is 10 and the lowest ventilation setting in cars is 10 ACH. Homes and offices may have ACH levels as low as 0,5 but the per-person volume is over 20 m^3, so a product of 10 is conservative.

c The non-operating limits have been chosen based on a scenario of devices in an enclosed space with no ventilation. The space chosen has a volume of 0,28 m^3, or approximately 10 cubic feet. The criterion has been prescribed so that a concentration of greater than 25 % LFL is not permitted to develop over a twenty-four hour (24 h) period, if three devices are in the enclosed space. For example, this criterion is applied for determination of a maximum gas-loss rate based on emission of flammable constituents from non-operating micro fuel cell power systems. Note that the control volume for non-operating systems should not be applied using toxicity limits, as the core principle of this enclosed space is that of a storage space, not one that a person might spend time in. For determination of non-operating limits for constituents with both flammable and toxic properties, the lower of the flammability based limit for the "Non-operating" control volume and the toxicity based limit for the "Operating" control volume shall apply.

d 0,016 g/h reflects an emission rate lower than the limit reported by Swain, et al, (Proceedings of the 2001 DOE Program Review; NREL/CP-570-30535; M.R. Swain and M.N. Swain, Codes and Standards Analysis, 2001 (USA); available at: http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/30535bc.pdf) wherein "no hole was able to support a hydrogen flame at less than 3.5 cc/min." (3.5 cc/min ≈ 0,018 g/h). This value was chosen in conformance with the guidelines in Table 3 of IEC 62282-6-101.

e. WHO guideline limit is 0,000 1 g/m^3. Background levels are 0,000 03 g/m^3. The emission limit cannot push the background level above the guideline limit

f A seated human adult has a CO_2 emission rate of 30 g/h. The fuel cell plus human adult emission rates are limited such that the CO_2 concentration does not reach the WHO eight-hour concentration limit of 9 g/m^3. In an environment with 10 m^3 ACH, this limits the contribution from the fuel cell to 60 g/h.

5.3 Material requirements

The requirements of 5.3 of Part 101 shall apply as written.

5.4 Mechanical design requirements

5.4.1 General

The requirements of Subclause 5.4.1 of Part 101 shall apply as written, with the following additions.