

Fuel cell technologies —

Part 2: Fuel cell modules

The European Standard EN 62282-2:2004, incorporating amendment A1:2007, has the status of a British Standard

ICS 27.070

National foreword

This British Standard is the UK implementation of EN 62282-2:2004, incorporating amendment A1:2007. It is identical with IEC 62282-2:2004, incorporating amendment 1:2007.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated in the text by **A1** **A1**.

The UK participation in its preparation was entrusted to Technical Committee GEL/105, Fuel cell technologies.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Fuel cell technologies
Part 2: Fuel cell modules
(IEC 62282-2:2004)

Technologies des piles à combustible
Partie 2: Modules à piles à combustible
(CEI 62282-2:2004)

Brennstoffzellentechnologien
Teil 2: Brennstoffzellen-Module
(IEC 62282-2:2004)

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of document 105/73/FDIS, future edition 1 of IEC 62282-2, prepared by IEC TC 105, Fuel cell technologies, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62282-2 on 2004-10-01.

The following dates were fixed:

- | | | |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2005-07-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2007-10-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62282-2:2004 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

The text of document 105/111/CDV, future amendment 1 to IEC 62282-2:2004, prepared by IEC TC 105, Fuel cell technologies, was submitted to the IEC-CENELEC parallel Unique Acceptance Procedure and was approved by CENELEC as amendment A1 to EN 62282-2:2004 on 2007-04-01.

The following dates were fixed:

- | | | |
|---|-------|------------|
| – latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2008-01-01 |
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Endorsement notice

The text of amendment 1:2007 to the International Standard IEC 62282-2:2004 was approved by CENELEC as an amendment to the European Standard without any modification.

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INTRODUCTION

Fuel cell modules, as defined later, are electrochemical devices which convert continuously supplied fuel, such as hydrogen or hydrogen rich gases, alcohols, hydrocarbons, and oxidants to d.c. power, heat, water and other by-products.

NOTE The term fuel cell module describes a subassembly that could comprise slightly more than a stack, for example, sensors, enclosure. This assembly is intended to be integrated into an end product by a systems integrator.

FUEL CELL TECHNOLOGIES –

Part 2: Fuel cell modules

1 Scope

This part of IEC 62282 provides the minimum requirements for safety and performance of fuel cell modules. This standard applies to fuel cell modules with the following electrolyte chemistry:

- alkaline;
- proton exchange membrane (including direct methanol fuel cells);
- phosphoric acid;
- molten carbonate;
- solid oxide fuel cell modules.

Fuel cell modules might be provided either with or without an enclosure and might be operated at significant pressurization levels or close to ambient pressure.

This standard deals with conditions that can yield hazards to persons and damage outside the fuel cell modules only. Protection against damage to the fuel cell modules internals is not addressed in this standard, provided it does not lead to hazards outside the module.

These requirements may be superseded by other standards for equipment containing fuel cell modules as required for particular applications. This part of IEC 62282 is not applicable for road vehicle applications.

This standard is not intended to limit or inhibit technological advancement. An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of these requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

The fuel cell modules are components of final products. These products require evaluation to appropriate end-product safety requirements.

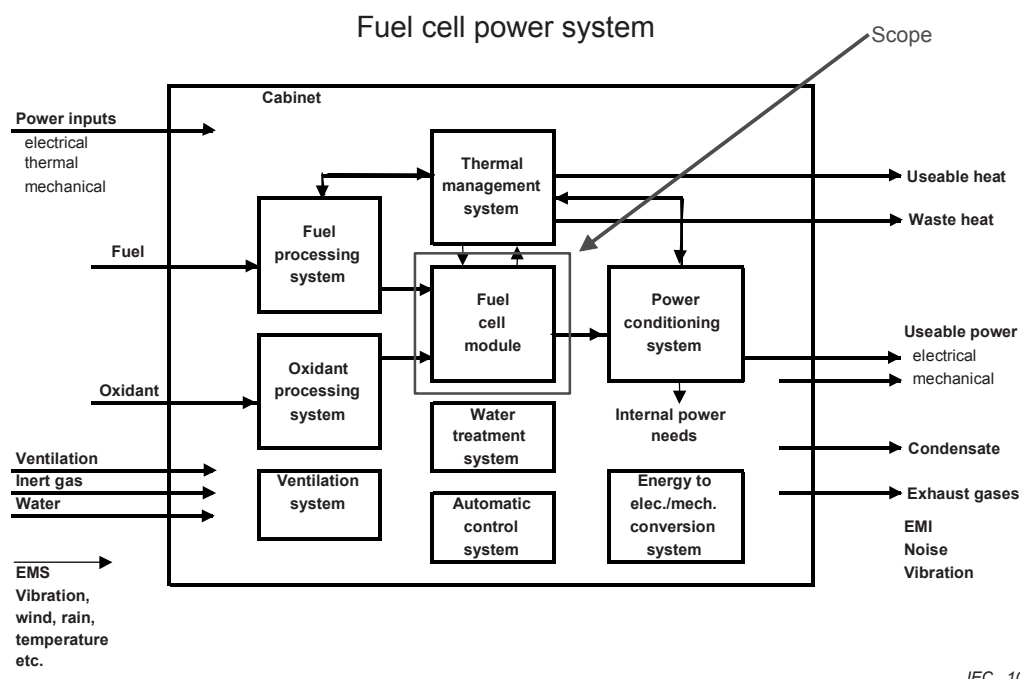


Figure 1 – Fuel cell system components and scope of standard

Unless otherwise specified, the fuel cell module must be capable of operating under the following ambient conditions:

- a) altitude up to 1 000 m;
- b) air containing approximately 21 % $\pm$ 1 % oxygen by volume.

This standard covers only up to the d.c. output of the fuel cell module.

This standard does not apply to peripheral devices as illustrated in Figure 1.

This standard does not cover the storage and delivery of fuel and oxidant to the fuel cell module.

2 Normative references

The following referenced documents are indispensable for the application 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 60079 (all parts), *Electrical apparatus for explosive gas atmospheres*

IEC 60079-10, *Electrical apparatus for explosive gas atmospheres – Classification of hazardous areas*

IEC 60352 (all parts), *Solderless connections*

IEC 60512-8, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 8: Connector test (mechanical) and mechanical test on contacts and terminations*

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

IEC 60617-DB: 2001¹, *Graphical symbols for diagrams*

IEC 60695 (all parts), *Fire hazard testing*

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

IEC 61025, *Fault tree analysis (FTA)*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

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

ISO 37:1994, *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties*

ISO 188:1998, *Rubber, vulcanized or thermoplastic – Accelerated ageing and heat resistance tests*

ISO 1307:1992, *Rubber and plastics hoses for general-purpose industrial applications – Bore diameters and tolerances, and tolerances on length*

ISO 1402:1994, *Rubber and plastics hoses and hose assemblies – Hydrostatic testing*

ISO 1436-1:2001, *Rubber hoses and hose assemblies – Wire-braid-reinforced hydraulic type – Specification – Part 1: Oil-based fluid applications*

ISO 4672:1997, *Rubber and plastics hoses – Sub-ambient temperature flexibility tests*

EN 50178, *Electronic equipment for use in power installations*

3 Terms and definitions

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

3.1

acceptance test

contractual test to prove to the customer that the item meets certain conditions of its specification

[IEV 151-16-23]

3.2

allowable differential working pressure

maximum pressure difference between the anode and cathode side specified by the manufacturer which the fuel cell module can withstand without any damage or permanent loss of functional properties

¹ DB refers to the IEC on-line database.

3.3**allowable working pressure**

maximum gauge pressure specified by the manufacturer which the fuel cell module can withstand without any damage or permanent loss of functional properties

NOTE For fuel cell modules incorporating pressure relief devices, this is normally used to define the threshold of the set pressure.

3.4**ambient temperature**

temperature of the medium surrounding a device, equipment or installation which may affect the performance of the device, equipment or installation

3.5**electrical leakage**

See 3.17 "leakage current".

3.6**electrolyte leakage**

escape of electrolyte from a fuel cell module

3.7**fuel cell**

electrochemical device that converts fuel, such as hydrogen or hydrogen rich gases, alcohols, hydrocarbons, and oxidants to d.c. power, heat, water and other by-products

3.8**fuel cell stack**

assembly of two or more fuel cells which are electrically connected

3.9**fuel cell module**

assembly including a fuel cell stack which electrochemically converts chemical energy to electric energy and thermal energy intended to be integrated into a vehicle or power generation system

NOTE Fuel cell modules comprise the following main components:

- one or more fuel cell stacks;
- piping system for conveying
 - fuels,
 - oxidants,
 - exhausts;
- electrical connections for the power delivered by the stacks.

Additionally, fuel cell modules may comprise:

- means for monitoring and/or control;
- means for conveying additional fluids (for example, cooling media, inert gas);
- means for detecting normal and/or abnormal operating conditions;
- enclosures or pressure vessels;
- ventilation system.

3.10**full load current**

maximum continuous load current as specified by the fuel cell module manufacturer at which the fuel cell module has been designed to operate

3.11

gas crossover

leakage between the fuel side and the oxidant side in either direction

3.12

gas leakage

sum of all gases leaving the fuel cell module except the intended exhaust gases

NOTE Gas leakage may occur from

- the fuel cell stack;
- associated pressure relief devices;
- other gas ducting and flow controlling components.

3.13

general artificial ventilation

movement of air and its replacement with fresh air by artificial means, for example fans, and applied to a general area

3.14

hazards

physical situation with a potential for human injury, damage to property, damage to the environment, or some combination of these.

NOTE Hazards should be recognized and may be eliminated, mitigated, or left to the user. If they are left to the user, the user documentation should make the user fully aware of the extent of the hazard.

3.15

hazardous locations (classified)

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

3.16

heat deflection temperature

temperature at which a standard test bar deflects a specified distance under load. It is used to determine short-term heat resistance

3.17

leakage current

electric current in an unwanted conductive path other than a short circuit

[IEV 151-15-49]

3.18

lower flammability limit (LFL)

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

NOTE 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.

3.19

manifold

conduit which supplies gas to or collects from the fuel cell or the fuel cell stack

3.20

maximum operating pressure

highest pressure for fuel and oxidant, specified by the manufacturer, at which the fuel cell module is designed to operate continuously

3.21

minimum voltage

lowest continuous voltage that a fuel cell module is able to produce at its rated power or the maximum permissible overload conditions, whichever voltage is lower

3.22

natural ventilation

movement of air and its replacement with fresh air due to the effects of wind and/or temperature gradient

3.23

open-circuit voltage

voltage across the terminals of a fuel cell module with fuel and oxidant present, when no external current is flowing

NOTE This is the highest voltage attainable from the fuel cell module.

3.24

routine test

conformity test made on each individual item during or after manufacture

[IEV 151-16-17]

NOTE Conformity test [IEV 151-16-15]: test for conformity evaluation.

Conformity evaluation [IEV 151-16-14]: systematic examination of the extent to which a product, process or service fulfils specified requirements.

3.25

reference conditions

arbitrarily chosen conditions for measured volumes of gases when recalculated to a temperature of 15 °C and an absolute pressure of 101,3 kPa

3.26

safeguarding

procedure for actions of the controlling system based on monitoring of the technical process in order to avoid process conditions which would be hazardous to personnel, plant, product or environment

[IEV 351-18-32]

3.27

thermal equilibrium conditions

stable temperature conditions indicated by temperature changes of no more than 3 K (5 °F) or 1 % of the absolute operating temperature, whichever is higher between two readings 15 min apart

3.28

type test

conformity test made on one or more items representative of the production

[IEV 151-16-16]

NOTE Conformity test [IEV 151-16-15]: test for conformity evaluation.

Conformity evaluation [IEV 151-16-14]: systematic examination of the extent to which a product, process or service fulfils specified requirements.