



BSI Standards Publication

Fuel cell technologies

Part 8-102: Energy storage systems using fuel cell modules in reverse mode — Test procedures for the performance of single cells and stacks with proton exchange membranes, including reversible operation

National foreword

This British Standard is the UK implementation of EN IEC 62282-8-102:2020. It is identical to IEC 62282-8-102:2019. It supersedes BS IEC 62282-8-102:2019, which is withdrawn.

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.

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Published by BSI Standards Limited 2020

ISBN 978 0 539 13388 2

ICS 27.070

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2020.

Amendments/corrigenda issued since publication

Date	Text affected
31 March 2020	This corrigendum renumbers BS IEC 62282-8-102:2019 as BS EN IEC 62282-8-102:2020. The supersession details in the National Foreword have also been updated.

English Version

Fuel cell technologies - Part 8-102: Energy storage systems
using fuel cell modules in reverse mode - Test procedures for
the performance of single cells and stacks with proton exchange
membranes, including reversible operation
(IEC 62282-8-102:2019)

Technologies des piles à combustible - Partie 8-102:
Systèmes de stockage de l'énergie utilisant des modules à
piles à combustible en mode inversé - Procédures d'essai
pour la performance des cellules élémentaires et des piles
à membrane échangeuse de protons, comprenant le
fonctionnement réversible
(IEC 62282-8-102:2019)

Brennstoffzellentechnologien - Teil 8-102:
Energiespeichersysteme mit Brennstoffzellenmodulen im
Umkehrbetrieb - Prüfverfahren zum Leistungsverhalten von
Einzelzellen und Stacks mit Protonen-Austausch-Membran
einschließlich Umkehrbetrieb
(IEC 62282-8-102:2019)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 105/763/FDIS, future edition 1 of IEC 62282-8-102, prepared by IEC/TC 105 "Fuel cell technologies" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62282-8-102:2020.

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) 2020-10-17
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2023-01-17

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Endorsement notice

The text of the International Standard IEC 62282-8-102:2019 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 62282-8-101 NOTE Harmonized as EN IEC 62282-8-101¹

IEC 62282-8-201 NOTE Harmonized as EN IEC 62282-8-201²

¹ To be published. Stage at the time of publication: FprEN IEC 62282-8-101:2019.

² To be published. Stage at the time of publication: FprEN IEC 62282-8-201:2019.

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-485	2020	International Electrotechnical Vocabulary - Part 485: Fuel cell technologies	-	-
IEC/TS 62282-7-1	2017	Fuel cell technologies - Part 7-1: Test methods - Single cell performance tests for polymer electrolyte fuel cells (PEMFC)	-	-

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INTERNATIONAL STANDARD

NORME INTERNATIONALE



Fuel cell technologies –

**Part 8-102: Energy storage systems using fuel cell modules in reverse mode –
Test procedures for the performance of single cells and stacks with proton
exchange membranes, including reversible operation**

Technologies des piles à combustible –

**Partie 8-102: Systèmes de stockage de l'énergie utilisant des modules à
piles à combustible en mode inversé – Procédures d'essai pour la
performance des cellules élémentaires et des piles à membrane
échangeuse de protons, comprenant le fonctionnement réversible**

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ISBN 978-2-8322-7675-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FUEL CELL TECHNOLOGIES –

Part 8-102: Energy storage systems using fuel cell modules in reverse mode – Test procedures for the performance of single cells and stacks with proton exchange membranes, including reversible operation

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62282-8-102 has been prepared by IEC technical committee 105: Fuel cell technologies.

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

FDIS	Report on voting
105/763/FDIS	105/776/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 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 62282 describes test methods for a single cell and stack (denoted as "cell/stack" hereafter) that are intended for use in energy storage systems that use proton exchange membrane fuel cells (PEMFC) in combination with proton exchange membrane water electrolyzers (PEMWE), or directly using proton exchange membrane cells (Re-PEM).

This document is intended to be used for data exchanges in commercial transactions between cell/stack manufacturers and system developers or for acquiring data on a cell or stack in order to estimate the performance of a system based on it. Users of this document can selectively execute test items suitable for their purposes from those described in this document.

PEMFCs, PEMWEs and Re-PEMs have a broad range of geometry and size. As such, in general, peripherals like current collectors and gas manifolds are unique to each cell or stack and are often incorporated into a cell or stack to form one integrated unit. In addition, they tend to have a significant effect on the power generation characteristics of the cell or stack. This document therefore introduces as its subject "cell/stack assembly unit", which are defined as those units containing not only a cell or a stack, but also peripherals.

IEC 62282-8 (all parts) aims to develop performance test methods for power storage and buffering systems based on electrochemical modules (combining electrolysis and fuel cells, in particular reversible fuel cells), taking into consideration both options of re-electrification and substance (and heat) production for sustainable integration of renewable energy sources.

Under the general title *Energy storage systems using fuel cell modules in reverse mode*, the IEC 62282-8 series consists of the following parts:

- IEC 62282-8-101: *Test procedures for the performance of solid oxide single cells and stacks, including reversible operation*
- IEC 62282-8-102: *Test procedures for the performance of single cells and stacks with proton exchange membranes, including reversible operation*
- IEC 62282-8-103 ¹: *Alkaline single cell and stack performance including reversible operation*
- IEC 62282-8-201: *Test procedures for the performance of power-to-power systems*
- IEC 62282-8-202²: *Power-to-power systems – Safety*
- IEC 62282-8-300 (all parts)³: *Power-to-substance systems*

As a priority dictated by the emerging needs for industry and opportunities for technological development, IEC 62282-8-101, IEC 62282-8-102 and IEC 62282-8-201 have been initiated jointly and as a priority. These parts are presented as a package to highlight the need for an integrated approach as regards the system application (i.e. a solution for energy storage) and its fundamental constituent components (i.e. fuel cells operated in reverse or reversing mode).

IEC 62282-8-103, IEC 62282-8-202 and IEC 62282-8-300 (all parts) are suggested but are left for initiation at a later stage.

¹ Under consideration.

² Under consideration.

³ Under consideration.

FUEL CELL TECHNOLOGIES –

Part 8-102: Energy storage systems using fuel cell modules in reverse mode – Test procedures for the performance of single cells and stacks with proton exchange membranes, including reversible operation

1 Scope

This part of IEC 62282 deals with PEM cell/stack assembly units, testing systems, instruments and measuring methods, and test methods to test the performance of PEM cells and stacks in fuel cell mode, electrolysis and/or reversible mode.

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 60050-485:—⁴, *International Electrotechnical Vocabulary – Part 485: Fuel cell technologies*

IEC TS 62282-7-1:2017, *Fuel cell technologies – Part 7-1: Test methods – Single cell performance tests for polymer electrolyte fuel cells (PEMFC)*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-485 and the following 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>

3.1.1

active electrode area

geometric area of the electrode perpendicular to the direction of the current flow

Note 1 to entry: Usually this corresponds to the smaller of the two areas of negative electrode or positive electrode.

[SOURCE: IEC 60050-485:—, 485-02-08, modified – "electrode" added to the term, the term "effective area" has been deleted, and the notes to entry have been replaced with a new note to entry.]

⁴ Under preparation. Stage at the time of preparation: IEC FDIS 60050-485:2019.

3.1.2**area-specific resistance****ASR**

internal resistivity with respect to the active electrode area, including the change of potential due to the electrochemical reaction

Note 1 to entry: This note applies to the French language only.

3.1.3**catalyst**

substance that accelerates (increases the rate of) a reaction without being consumed itself

Note 1 to entry: The catalyst lowers the activation energy of the reaction, allowing for an increase in the reaction rate.

3.1.4**catalyst-coated membrane****CCM**

<in a PEMFC (3.1.24)> polymer membrane whose surfaces are coated with a catalyst layer (3.1.5) to form the reaction zone of the electrode (3.1.8)

Note 1 to entry: See also membrane electrode assembly (MEA) (3.1.17).

Note 2 to entry: This note applies to the French language only.

[SOURCE: IEC 60050-485:—, 485-04-03]

3.1.5**catalyst layer**

surface porous region adjacent to either side of the membrane containing the catalyst (3.1.3), typically with ionic and electronic conductivity

Note 1 to entry: The catalyst layer comprises the spatial region where the electrochemical reactions can take place.

3.1.6**current collector**

conductive material in a fuel cell (3.1.13) that collects electrons from the negative electrode (3.1.20) side or conducts electrons to the positive electrode (3.1.25) side

3.1.7**current density**

current per unit active area (IEV 485-02-08)

Note 1 to entry: Current density is expressed in A/m² or A/cm².

3.1.8**electrode**

electronic conductor (or semi-conductor) through which an electric current enters or leaves the electrochemical cell as the result of an electrochemical reaction

Note 1 to entry: An electrode is either a positive electrode (3.1.25) or a negative electrode (3.1.20).

3.1.9**electrolyte**

liquid or solid substance containing mobile ions that render it ionically conductive

Note 1 to entry: The electrolyte is the main distinctive feature of the different fuel cell technologies (e.g. a liquid, polymer, molten salt, solid oxide) and determines the usable operating temperature range.