

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Fuel cell technologies –
Part 8-201: Energy storage systems using fuel cell modules in reverse mode –
Test procedures for the performance of power-to-power systems**

**Technologies des piles à combustible –
Partie 8-201: Systèmes de stockage de l'énergie à partir de modules de piles à
combustible réversibles – Procédures d'essai pour la performance des
systèmes de conversion électromécaniques électriques à électriques**



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IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 27.070

ISBN 978-2-8322-8973-0

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FUEL CELL TECHNOLOGIES –

Part 8-201: Energy storage systems using fuel cell modules in reverse mode – Test procedures for the performance of power-to-power systems

FOREWORD

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IEC 62282-8-201 has been prepared by IEC technical committee 105: Fuel cell technologies. It is an International Standard.

This second edition cancels and replaces the first edition published in 2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) consideration of systems connected to hydrogen supply infrastructure (hydrogen grids, vessels, caverns or pipelines);
- b) hydrogen input and output rate is added in the system parameters (5.10);
- c) electric energy storage capacity test is revised (6.2);

- d) roundtrip electrical efficiency test is revised (6.5);
- e) hydrogen input and output rate test is added (6.6.6).

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

Draft	Report on voting
105/1034/FDIS	105/1050/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.

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INTRODUCTION

This part of IEC 62282 specifies performance evaluation methods for electric energy storage systems using hydrogen that employ electrochemical reactions both for water and steam electrolysis and electric power generation.

NOTE Heat generation can be a secondary purpose.

This document is intended for power-to-power systems which typically employ a set of electrolyser and fuel cell, or a reversible cell for devices of electric charge and discharge.

A typical target application of the electric energy storage systems using hydrogen is in the class of energy intensive electric energy storage. The systems are recognized as critically useful for the relatively long-term power storage operation, such as efficient storage and supply of the renewable power derived electric energy and grid stabilization.

The IEC 62282-8 series aims to develop performance test methods for power storage and buffering systems based on electrochemical modules (combining electrolysis and fuel cells, in particular reversible 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 membrane, including reversible operation
- IEC 62282-8-103¹: 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 62282-8-301: Power to methane energy systems based on solid oxide cells including reversible operation – Performance test methods

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 were initiated jointly and firstly. These parts are presented as a package to highlight the need for an integrated approach as regards the system's application (i.e. a solution for energy storage) and its fundamental constituent components (i.e. fuel cells operated in reverse or reversing mode).

¹ Future project.

² Future project.

FUEL CELL TECHNOLOGIES –

Part 8-201: Energy storage systems using fuel cell modules in reverse mode – Test procedures for the performance of power-to-power systems

1 Scope

This part of IEC 62282 defines the evaluation methods of typical performances for electric energy storage systems using hydrogen. It is applicable to the systems that use electrochemical reaction devices for both power charge and discharge. This document applies to systems that are designed and used for service and operation in stationary locations (indoor and outdoor).

The conceptual configurations of the electric energy storage systems using hydrogen are shown in Figure 1 and Figure 2.

Figure 1 shows the system independently equipped with an electrolyser module and a fuel cell module. Figure 2 shows the system equipped with a reversible cell module.

Indispensable components are an electrolyser module and a fuel cell module, or a reversible cell module, an overall management system (which includes a data interface and can include a pressure management), a thermal management system (which can include a thermal storage), a water management system (which can include a water storage) and a purge gas supply (inert gas, practically neither oxidizing nor reducing).

NOTE 1 Indispensable components are indicated by bold lines in Figure 1 and Figure 2.

The system can be equipped with either a hydrogen storage or a connection to an external hydrogen supply infrastructure or a combination of both. There can be a battery and an oxygen storage, as optional components.

The electrolyser module can comprise one or more electrolysers whether or not of the same type. Depending on the operating conditions and considering the operation history, the overall management system can command the concurrent operation of the electrolysers. The fuel cell module can comprise one or more fuel cells whether or not of the same type. Depending on the operating conditions and considering the operation history, the overall management system can command concurrent operation of the fuel cells. The reversible cell module can comprise one or more reversible cells whether or not of the same type. The fuel cell module can comprise one or more fuel cells whether or not of the same type. Depending on the operating conditions and considering the operation history, the overall management system can command concurrent operation of the reversible cells.

The performance measurement is executed in the defined area surrounded by the bold outside solid line (system boundary).

NOTE 2 In the context of this document, the term "reversible" does not refer to the thermodynamic meaning of an ideal process. It is common practice in the fuel cell community to call the operation mode of a cell that alternates between fuel cell mode and electrolysis mode "reversible".

This document is intended to be used for data exchanges in commercial transactions between the system manufacturer and customer. Users of this document can selectively execute test items suitable for their purposes from those specified in this document.