SVENSK STANDARD

SS-EN IEC 62282-8-201, utg 2:2025

2025-04-02

REDLINE VERSION

Bränsleceller – Del 8-201: Energilagringssystem med bränslecellsmoduler för reversibel drift - Provning av prestanda för stationära system för energilagring

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

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IEC 62282-8-201

Edition 2.0 2024-07
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.070

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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

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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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62282-8-201:2024. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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.

IMPORTANT – The "colour inside" logo on the cover page of this document 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 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 62282-8-103[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 62282-8-202[2]: Power-to-power systems – Safety
- ~~IEC 62282-8-300 (all parts)[3]: Power -to-*substance* systems~~
- 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).

~~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 Future project.

2 Future project.

~~3 Under consideration.~~

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.

~~There are an electrolyser, a hydrogen storage and a fuel cell, or a reversible cell, a hydrogen storage and an overall management system (which may include a pressure management) as indispensable components. There may be a battery, an oxygen storage, a heat management system (which may include a heat storage) and a water management system (which may include a water storage) as optional components. The performance measurement is executed in the area surrounded by the outside thick solid line square (system boundary).~~

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.

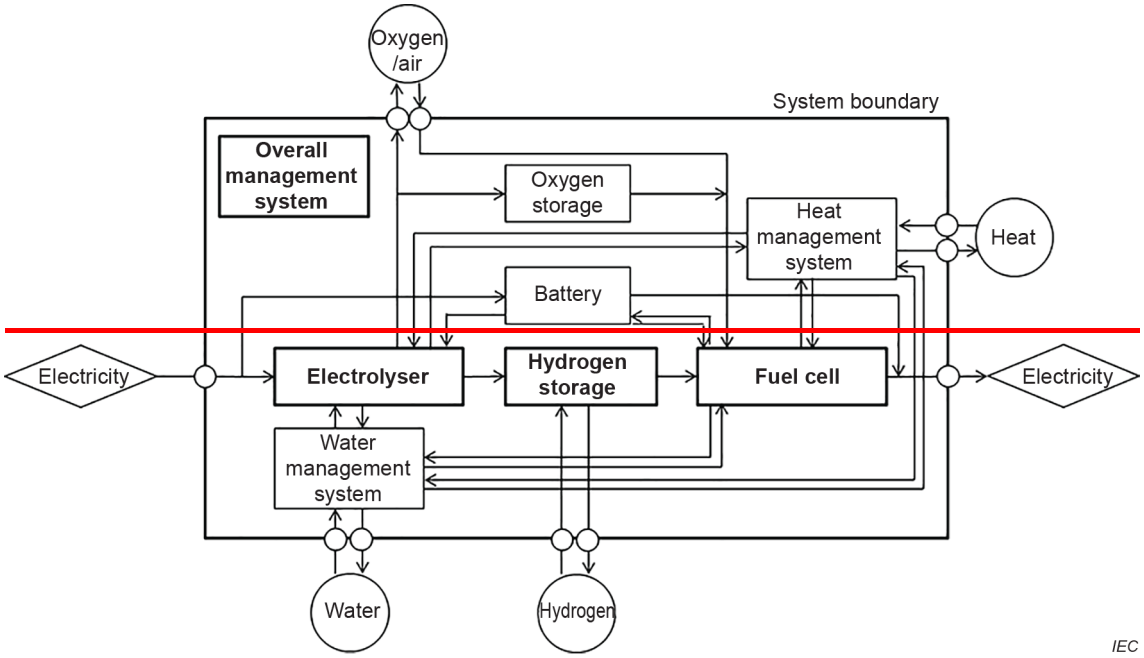
The system can be equipped with either a hydrogen storage or a connection to an external hydrogen supply infrastructure or a combination of both. There can be a battery and an oxygen storage, as optional components.

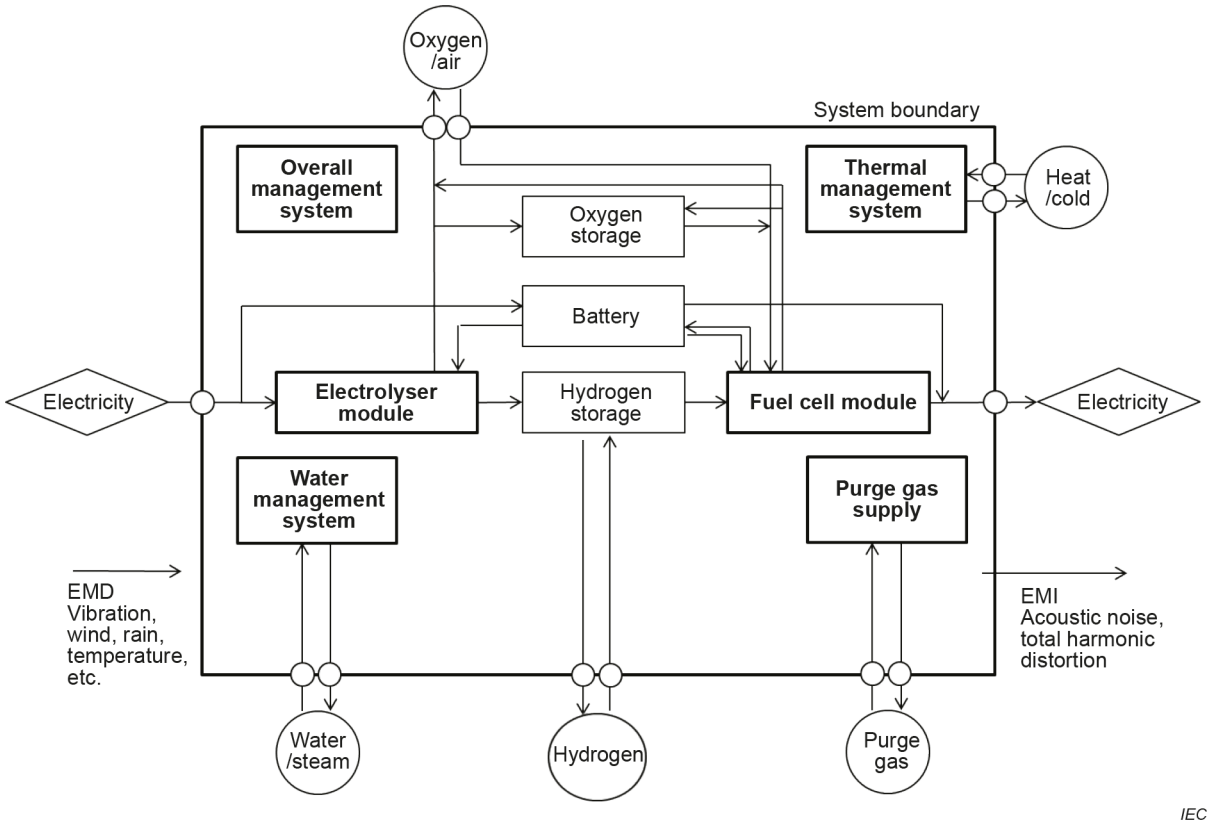
The electrolyser module can comprise one or more electrolysers whether or not of the same type. Depending on the operating conditions and considering the operation history, the overall management system can command the concurrent operation of the electrolysers. The fuel cell module can comprise one or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





Key

EMD electromagnetic disturbance

EMI electromagnetic interference

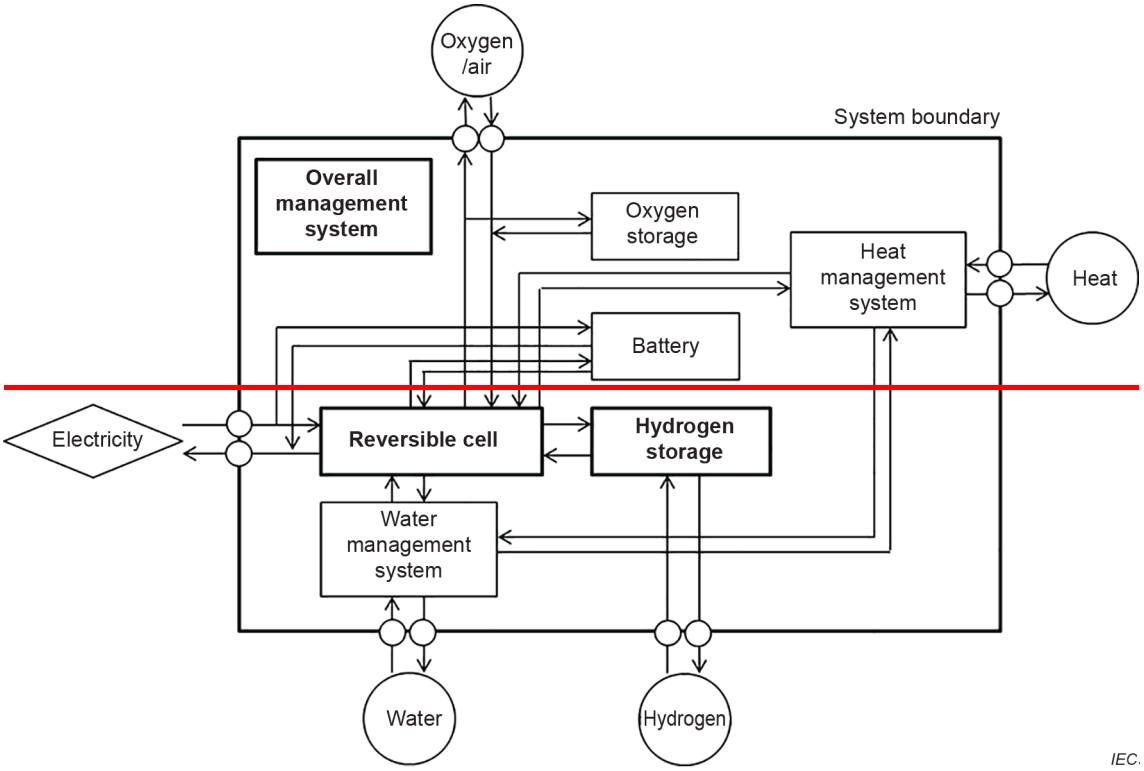
NOTE 1 Overall management system, thermal management system, water management system and purge gas supply can have the relation with electrolyser, fuel cell, battery, hydrogen storage and oxygen storage, and also can have the relation with one another.

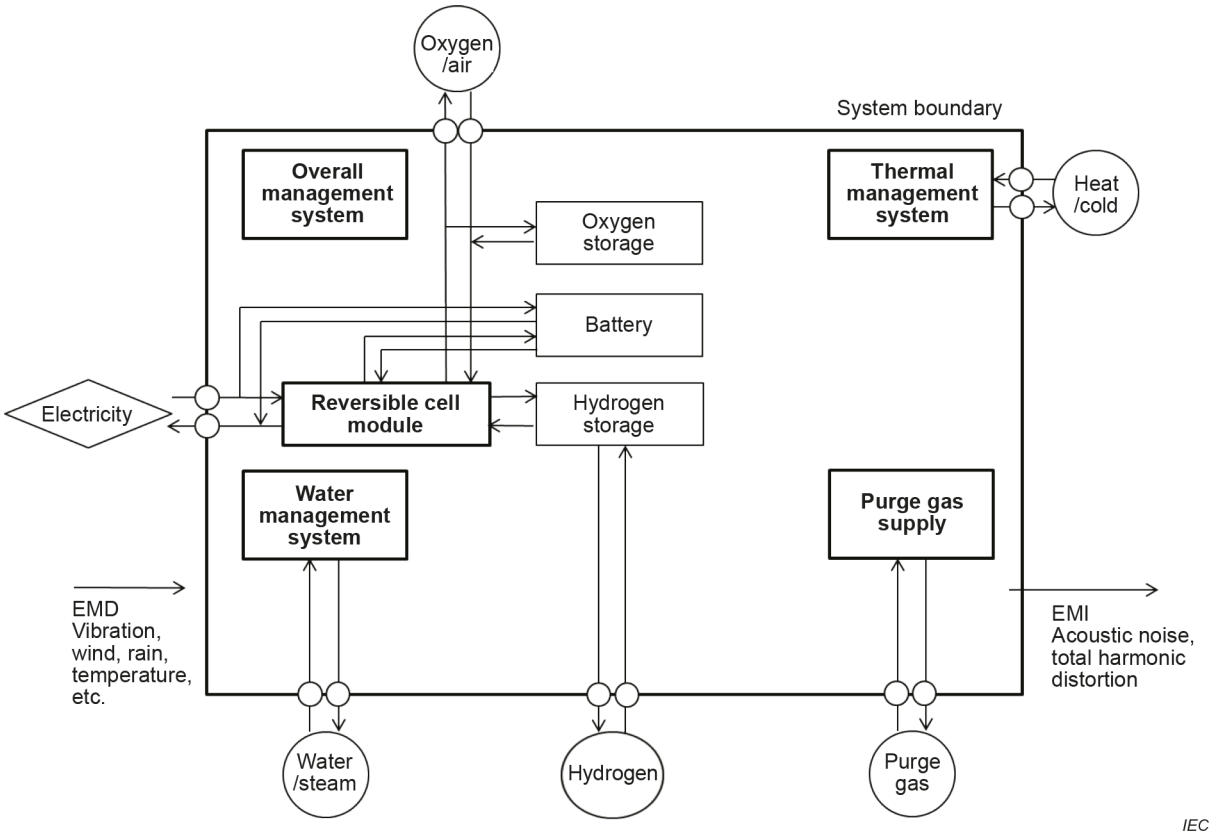
NOTE 2 Other fluid or energy in- or outputs, depending on the used electrolyser and fuel cell types, can be considered.

NOTE 3 The electricity input and output can be DC or AC or both. Power conditioning sub-systems are usually used.

NOTE 4 There can be more than one electricity point of connection for input or output or both.

Figure 1 – System configuration of electric energy storage system using hydrogen – Type with electrolyser and fuel cell





Key

EMD electromagnetic disturbance

EMI electromagnetic interference

NOTE 1 Overall management system, thermal management system, water management system and purge gas supply can have the relation with reversible cell, battery, hydrogen storage and oxygen storage, and also can have the relation with one another.

NOTE 2 Other fluid or energy in- or outputs, depending on the used electrolyser and fuel cell types, can be considered.

NOTE 3 The electricity input and output can be DC or AC or both. Power conditioning sub-systems are usually used.

NOTE 4 There can be more than one electricity point of connection for input or output or both.

Figure 2 – System configuration of electric energy storage system using hydrogen – Type with reversible cell

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 61427-1, *Secondary cells and batteries for renewable energy storage – General requirements and methods of test – Part 1: Photovoltaic off-grid application*

IEC 61427-2, *Secondary cells and batteries for renewable energy storage – General requirements and methods of test – Part 2: On-grid applications*

IEC 62282-3-200, *Fuel cell technologies – Part 3-200: Stationary fuel cell power systems – Performance test methods*

IEC 62282-3-201, *Fuel cell technologies – Part 3-201: Stationary fuel cell power systems – Performance test methods for small fuel cell power systems*

IEC 62282-8-101, *Fuel cell technologies – Part 8-101: Energy storage systems using fuel cell modules in reverse mode – Test procedures for the performance of solid oxide single cells and ~~stack performance~~ stacks, including reversible operation*

IEC 62282-8-102, *Fuel cell technologies – Part 8-102: Energy storage systems using fuel cell modules in reverse mode – Test procedures for ~~PEM~~ the performance of single cells and ~~stack performance~~ stacks with proton exchange membrane, including reversible operation*

IEC 62933-2-1:2017, *Electrical energy storage (EES) systems – Part 2-1: Unit parameters and testing methods – General specification*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO 3746, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane*

~~ISO 4064-1, *Water meters for cold potable water and hot water – Part 1: Metrological and technical requirements*~~

~~ISO 4064-2, *Water meters for cold potable water and hot water – Part 2: Test methods*~~

~~ISO 7888, *Water quality – Determination of electrical conductivity*~~

ISO 9614-1, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 1: Measurement at discrete points*

ISO 11204, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections*

ISO 16111, *Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride*

ISO 19880-1, *Gaseous hydrogen – Fuelling stations – Part 1: General requirements*

ISO 19881, *Gaseous hydrogen – Land vehicle fuel containers*

ISO 19882, *Gaseous hydrogen – Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers*

~~ISO 19884, *Gaseous hydrogen – Cylinders and tubes for stationary storage*~~

ISO 22734:2019, *Hydrogen generators using water electrolysis – Industrial, commercial, and residential applications*

~~ISO 22734-1, *Hydrogen generators using water electrolysis process – Part 1: Industrial and commercial applications*~~

~~ISO 22734-2, *Hydrogen generators using water electrolysis process – Part 2: residential applications*~~

SVENSK STANDARD

SS-EN IEC 62282-8-201, utg 2:2025

Fastställd	Sida	Ansvarig kommitté
2025-04-02	1 (42)	SEK TK 105

Bränsleceller – Del 8-201: Energilagringssystem med bränslecellsmoduler för reversibel drift – Provning av prestanda för stationära system för energilagring

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

Som svensk standard gäller europastandarden EN IEC 62282-8-201:2024. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 62282-8-201:2024.

Nationellt förord

Europastandarden EN IEC 62282-8-201:2024

består av:

– **europastandardens ikraftsättningsdokument,** utarbetat inom CENELEC
– **IEC 62282-8-201, Second edition, 2024 - 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**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN IEC 62282-8-201, utg 1:2020 med eventuella tillägg, ändringar och rättelser gäller ej fr o m 2027-08-14.

ICS 27.070.00

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 62282-8-201

August 2024

ICS 27.070

Supersedes EN IEC 62282-8-201:2020

English Version

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 (IEC 62282-8-201:2024)

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 électrochimiques électriques à électriques (IEC 62282-8-201:2024)

Brennstoffzellentechnologien - Teil 8-201: Energiespeichersysteme mit Brennstoffzellenmodulen im reversiblen Betrieb - Prüfverfahren zum Leistungsverhalten von Power-to-Power-Systemen (IEC 62282-8-201:2024)

This European Standard was approved by CENELEC on 2024-08-14. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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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

Ref. No. EN IEC 62282-8-201:2024 E

SEK Svensk Elstandard

SS-EN IEC 62282-8-201, utg 2:2025

European foreword

The text of document 105/1034/FDIS, future edition 2 of IEC 62282-8-201, prepared by IEC/TC 105 "Fuel cell technologies" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62282-8-201:2024.

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) 2025-05-14
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2027-08-14

This document supersedes EN IEC 62282-8-201:2020 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 62282-8-201:2024 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 standard indicated:

IEC 60079-0	NOTE	Approved as EN IEC 60079-0
IEC 60079-10-1	NOTE	Approved as EN IEC 60079-10-1
IEC 60079-29-2	NOTE	Approved as EN 60079-29-2
IEC 60364 series	NOTE	Approved as HD 60364 series
IEC 61000-4-7	NOTE	Approved as EN 61000-4-7
IEC 61000-4-13	NOTE	Approved as EN 61000-4-13
IEC 61960-3	NOTE	Approved as EN 61960-3
IEC 61987-1	NOTE	Approved as EN 61987-1
IEC 62282-2-100	NOTE	Approved as EN IEC 62282-2-100
IEC 62282-3-100	NOTE	Approved as EN IEC 62282-3-100
IEC 62282-3-300	NOTE	Approved as EN 62282-3-300
IEC 62933-1:2018	NOTE	Approved as EN IEC 62933-1:2018 (not modified)
IEC 62984-2:2020	NOTE	Approved as EN IEC 62984-2:2020 (not modified)

ISO 4064-1	NOTE	Approved as EN ISO 4064-1
ISO 4064-2	NOTE	Approved as EN ISO 4064-2
ISO 7888	NOTE	Approved as EN 27888
ISO 15839	NOTE	Approved as EN ISO 15839

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.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 61427-1	-	Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 1: Photovoltaic off-grid application	EN 61427-1	-
IEC 61427-2	-	Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 2: On-grid applications	EN 61427-2	-
IEC 62282-3-200	-	Fuel cell technologies - Part 3-200: Stationary fuel cell power systems - Performance test methods	EN 62282-3-200	-
IEC 62282-3-201	-	Fuel cell technologies - Part 3-201: Stationary fuel cell power systems - Performance test methods for small fuel cell power systems	EN 62282-3-201	-
IEC 62282-8-101	-	Fuel cell technologies - Part 8-101: Energy storage systems using fuel cell modules in reverse mode - Test procedures for the performance of solid oxide single cells and stacks, including reversible operation	EN IEC 62282-8-101	-
IEC 62282-8-102	-	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 membrane, including reversible operation	EN IEC 62282-8-102	-
IEC 62933-2-1	2017	Electrical energy storage (EES) systems - Part 2-1: Unit parameters and testing methods - General specification	EN IEC 62933-2-1	2018
ISO/IEC Guide 98-3	-	Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)	-	-

Publication	Year	Title	EN/HD	Year
ISO 3746	-	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane	EN ISO 3746	-
ISO 9614-1	-	Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 1: Measurement at discrete points	EN ISO 9614-1	-
ISO 11204	-	Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections	EN ISO 11204	-
ISO 16111	-	Transportable gas storage devices - Hydrogen absorbed in reversible metal hydride	-	-
ISO 19880-1	-	Gaseous hydrogen - Fuelling stations - Part 1: General requirements	-	-
ISO 19881	-	Gaseous hydrogen - Land vehicle fuel containers	-	-
ISO 19882	-	Gaseous hydrogen - Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers	-	-
ISO 22734	2019	Hydrogen generators using water electrolysis - Industrial, commercial, and residential applications	-	-

IEC 62282-8-201

Edition 2.0 2024-07

INTERNATIONAL STANDARD

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colour inside

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 électrochimiques électriques à électriques

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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.

IMPORTANT – The "colour inside" logo on the cover page of this document 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 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 62282-8-103[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 62282-8-202[2]: 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.

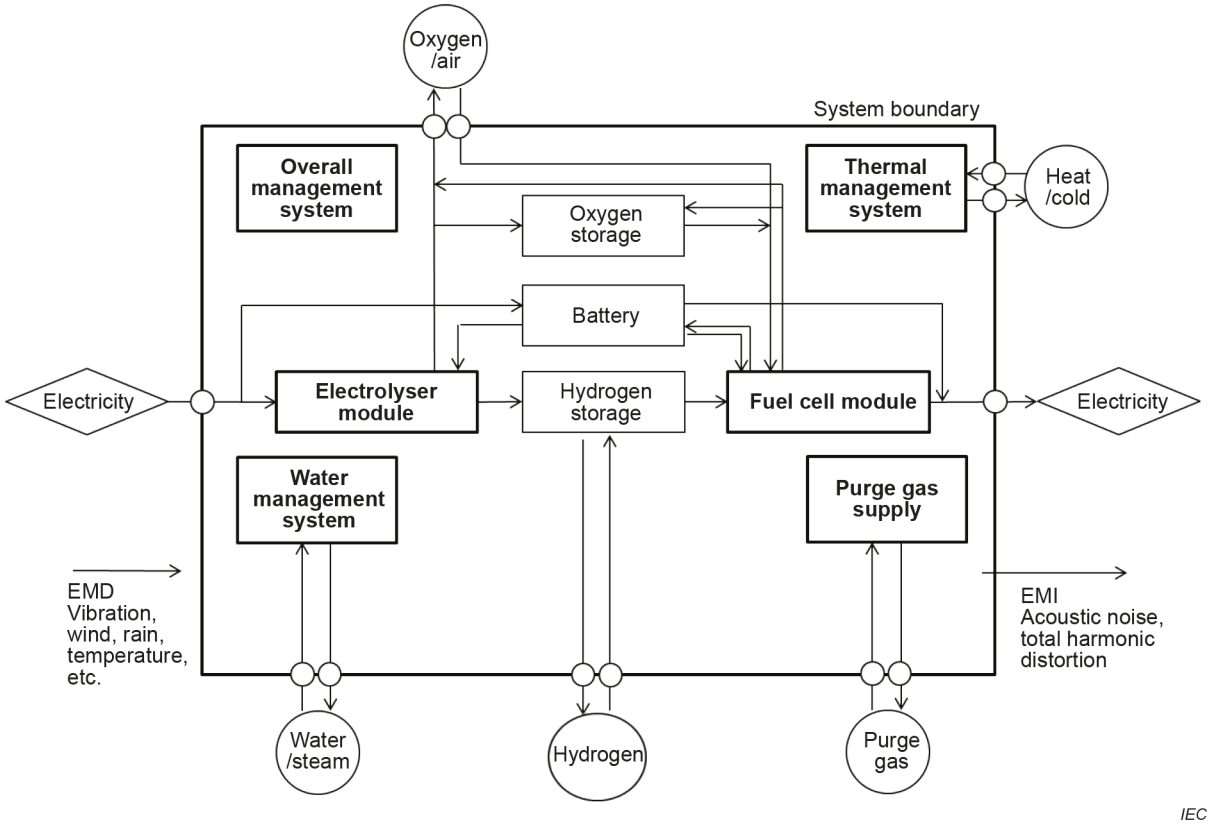
The system can be equipped with either a hydrogen storage or a connection to an external hydrogen supply infrastructure or a combination of both. There can be a battery and an oxygen storage, as optional components.

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.



Key

EMD electromagnetic disturbance

EMI electromagnetic interference

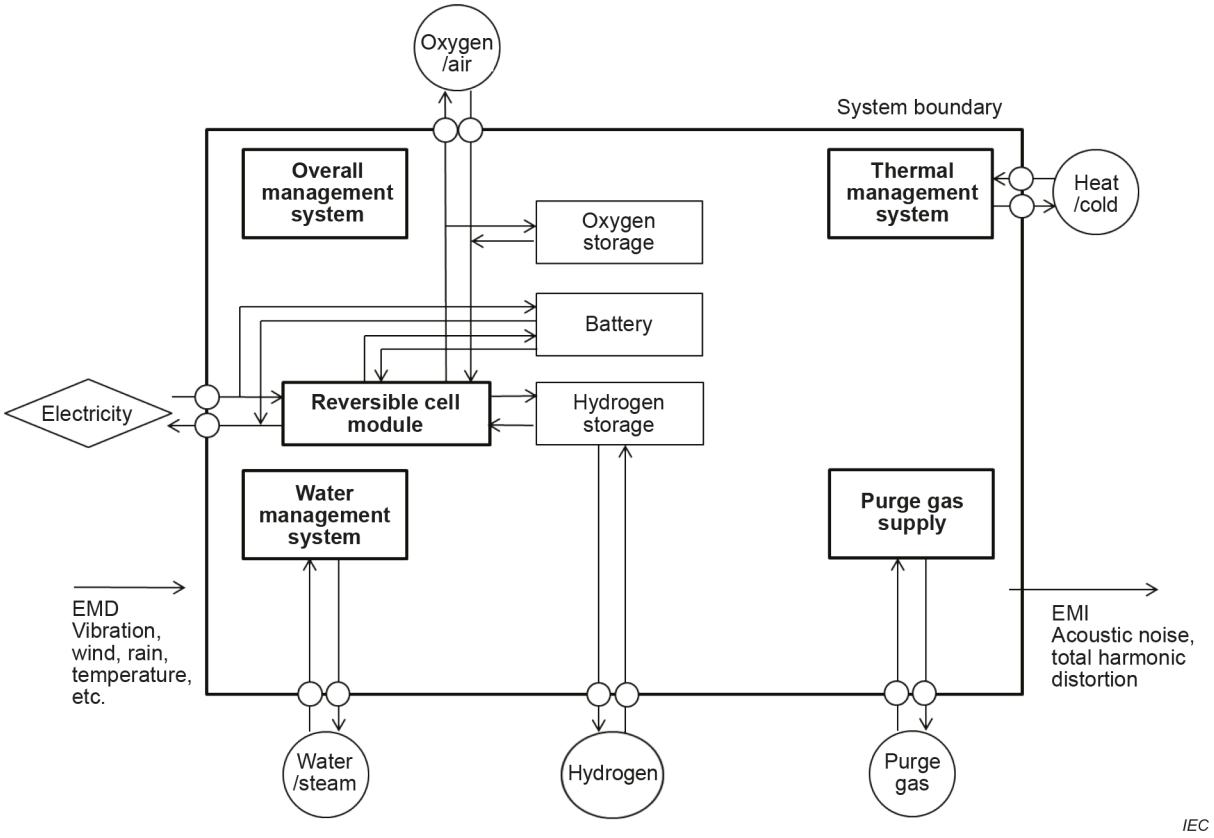
NOTE 1 Overall management system, thermal management system, water management system and purge gas supply can have the relation with electrolyser, fuel cell, battery, hydrogen storage and oxygen storage, and also can have the relation with one another.

NOTE 2 Other fluid or energy in- or outputs, depending on the used electrolyser and fuel cell types, can be considered.

NOTE 3 The electricity input and output can be DC or AC or both. Power conditioning sub-systems are usually used.

NOTE 4 There can be more than one electricity point of connection for input or output or both.

Figure 1 – System configuration of electric energy storage system using hydrogen – Type with electrolyser and fuel cell



Key

EMD electromagnetic disturbance

EMI electromagnetic interference

NOTE 1 Overall management system, thermal management system, water management system and purge gas supply can have the relation with reversible cell, battery, hydrogen storage and oxygen storage, and also can have the relation with one another.

NOTE 2 Other fluid or energy in- or outputs, depending on the used electrolyser and fuel cell types, can be considered.

NOTE 3 The electricity input and output can be DC or AC or both. Power conditioning sub-systems are usually used.

NOTE 4 There can be more than one electricity point of connection for input or output or both.

Figure 2 – System configuration of electric energy storage system using hydrogen – Type with reversible cell

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 61427-1, *Secondary cells and batteries for renewable energy storage – General requirements and methods of test – Part 1: Photovoltaic off-grid application*

IEC 61427-2, *Secondary cells and batteries for renewable energy storage – General requirements and methods of test – Part 2: On-grid applications*

IEC 62282-3-200, *Fuel cell technologies – Part 3-200: Stationary fuel cell power systems – Performance test methods*

IEC 62282-3-201, *Fuel cell technologies – Part 3-201: Stationary fuel cell power systems – Performance test methods for small fuel cell power systems*

IEC 62282-8-101, *Fuel cell technologies – Part 8-101: Energy storage systems using fuel cell modules in reverse mode – Test procedures for the performance of solid oxide single cells and stacks, including reversible operation*

IEC 62282-8-102, *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 membrane, including reversible operation*

IEC 62933-2-1:2017, *Electrical energy storage (EES) systems – Part 2-1: Unit parameters and testing methods – General specification*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO 3746, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane*

ISO 9614-1, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 1: Measurement at discrete points*

ISO 11204, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections*

ISO 16111, *Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride*

ISO 19880-1, *Gaseous hydrogen – Fuelling stations – Part 1: General requirements*

ISO 19881, *Gaseous hydrogen – Land vehicle fuel containers*

ISO 19882, *Gaseous hydrogen – Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers*

ISO 22734:2019, *Hydrogen generators using water electrolysis – Industrial, commercial, and residential applications*