

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Fuel cell technologies –
Part 3-400: Stationary fuel cell power systems – Small stationary fuel cell power system with combined heat and power output

Technologies des piles à combustible –
Partie 3-400: Systèmes à piles à combustible stationnaires – Petits systèmes à piles à combustible stationnaires avec chaleur et puissance en sortie combinées



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2016 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms, containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Fuel cell technologies –
Part 3-400: Stationary fuel cell power systems – Small stationary fuel cell power system with combined heat and power output

Technologies des piles à combustible –
Partie 3-400: Systèmes à piles à combustible stationnaires – Petits systèmes à piles à combustible stationnaires avec chaleur et puissance en sortie combinées

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 27.070

ISBN 978-2-8322-3720-5

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

FOREWORD.....	6
1 Scope.....	8
2 Normative references	11
3 Terms, definitions and symbols.....	13
3.1 Terms and definitions.....	13
3.2 Symbols.....	19
4 Appliance classification	21
4.1 Gases and gas categories.....	21
4.2 Mode of air supply and evacuation of combustion products	21
4.3 Maximum water side operating pressure	22
4.4 Expansion system.....	22
4.5 Output power characteristic	22
5 Safety requirements and protective measures	22
5.1 General safety strategy.....	22
5.2 Construction requirements for safety.....	23
5.2.1 General	23
5.2.2 Use and servicing	23
5.2.3 Connections to the supply systems	25
5.2.4 Soundness	27
5.2.5 Material	29
5.2.6 Electrical safety	29
5.2.7 Subsystems and safety related control functions	30
5.3 Operational requirements for safety.....	39
5.3.1 General requirements	39
5.3.2 Soundness	40
5.3.3 Safety of operation (temperature/limit gas)	46
5.3.4 Start/release and adjusting, control and safety devices (if applicable).....	54
5.3.5 Resistance of the materials to pressure	57
5.3.6 EMC	57
5.3.7 Outdoor or semi-outdoor for Type A small fuel cell CHP appliance	57
5.4 Safety requirements test methods	58
5.4.1 General test conditions	58
5.4.2 Soundness	63
5.4.3 Safety of operation	68
5.4.4 Start/release and adjusting, control and safety devices.....	87
5.4.5 Resistance of the materials to pressure	90
5.4.6 EMC	90
5.4.7 Outdoor or semi-outdoor small fuel cell CHP appliances.....	90
6 Functional (normal operating) performance.....	95
6.1 Performance parameters and requirements.....	95
6.1.1 Efficiency.....	95
6.1.2 Heat input and heat and electrical output.....	95
6.1.3 Operation	96
6.1.4 Combustion and NO _x emissions	96
6.1.5 EMC	97
6.2 Performance test methods	97

6.2.1	Efficiency.....	97
6.2.2	Heat input and heat and electrical output.....	103
6.2.3	Operation	104
6.2.4	Combustion and NO _x emissions.....	104
6.2.5	EMC	106
7	Marking, installation and operating instructions	106
7.1	Marking of the small fuel cell CHP appliance.....	106
7.1.1	Data plate.....	106
7.1.2	Supplementary markings	107
7.1.3	Packaging.....	107
7.1.4	Warnings on the small fuel cell CHP appliance and the packaging.....	107
7.1.5	Other information.....	107
7.2	Installation instructions	107
7.2.1	General	107
7.2.2	Technical instructions	110
7.3	Operating instructions (i.e. users instructions)	113
7.4	Conversion instructions (if applicable).....	113
7.5	Presentation	113
Annex A (informative)	Significant hazards, hazardous situations and events dealt with in this standard	114
Annex B (informative)	Requirements specific for Europe	116
Annex C (informative)	Requirements specific for stationary fuel cell power system in Japan	149
Annex D (informative)	Requirements specific for the USA	171
Annex E (informative)	Composition of the supply gas circuit.....	175
Annex F (informative)	Classification of gas appliances according to the method of supplying air and evacuation of the combustion products (types)	176
Annex G (informative)	Sampling of flue gas combustion products	187
Annex H (informative)	Practical method of calibrating the test rig to enable the heat loss Q_{loss} to be determined.....	189
Annex I (informative)	Test rig for the measurement of the stand-by heat losses	190
Bibliography	192
Figure 1	– Configuration with and without integrated supplementary heat generator	11
Figure 2	– Illustration of Table 3: Surrounding of the combustion products circuit by the combustion air circuit.....	44
Figure 3	– Test rig for Type C ₁ appliances, equipped with horizontal wind protection device at a vertical wall.....	73
Figure 4	– Test rig for Type C ₁ small fuel cell CHP appliances for installation in buildings with tilted roof	74
Figure 5	– Test rig for Type C ₃ and Type C ₉ small fuel cell CHP appliances for installation in flat roofed buildings	75
Figure 6	– Test rig for Type C ₃ and Type C ₉ small fuel cell CHP appliances for installation in buildings with tilted roof.....	76
Figure 7	– Wind test setup for indoor small fuel cell CHP appliances	80
Figure 8	– Water shower test setup for outdoor small fuel cell CHP appliance	91
Figure 9	– Wind test setup for outdoor small fuel cell CHP appliance	93
Figure 10	– Energy/power inputs and outputs relevant for overall energy efficiency	95

Figure 11 – Test rig for efficiency measurement of small fuel cell CHP appliances, with or without supplementary heat generator, connected to a central heating system or a heat storage system.....	99
Figure 12 – Test rig for efficiency measurement of small fuel cell CHP appliances, without supplementary heat generator, connected to a domestic hot water storage only	100
Figure B.1 – Test rig for thermostats: shortcut circulation	131
Figure B.2 – Test rig for thermostats with heat exchanger.....	132
Figure B.3 – Test rig for the determination of water losses.....	136
Figure C.1 – Configuration for stationary fuel cell power system	150
Figure C.2 – Test rig for measuring the insulation resistance	158
Figure C.3 – Example of combustion exhaust gas collectors and collection locations.....	166
Figure E.1 – Automatic gas shut-off valves in the supply gas circuit for small fuel cell CHP appliances	175
Figure F.1 – Types of small fuel cell CHP appliance with its key duct elements.....	176
Figure F.2 – Type B ₂	181
Figure F.3 – Type B ₃	181
Figure F.4 – Type B ₅	182
Figure F.5 – Type C ₁	183
Figure F.6 – Type C ₃	183
Figure F.7 – Type C ₄	184
Figure F.8 – Type C ₅	184
Figure F.9 – Type C ₆	185
Figure F.10 – Type C ₈	185
Figure F.11 – Type C ₉	186
Figure G.1 – Example of a sampling probe for the measurement of the products of combustion	187
Figure G.2 – Example of the location of the probe for a an appliance with circular coaxial ducts.....	188
Figure I.1 – Test rig	190
Table 1 – Symbols and their meanings.....	19
Table 2 – Composition of the supply gas circuit according on the valve classification of ISO 23551-1	31
Table 3 – Maximum admissible leakage rates	43
Table 4 – Allowable surface temperatures rises	46
Table 5 – Uncertainty of measurement.....	63
Table 6 – Soundness tests of the internal cooling circuits	68
Table 7 – $\varphi_{ex,th}(CO_2)$ volume fraction of the theoretical dry air-free combustion products, in percent	84
Table 8 – Emission classes for NO _x	96
Table A.1 – Hazardous situations and events.....	114
Table B.1 – Mechanical properties and chemical compositions of carbon and stainless steels.....	120
Table B.2 – Minimum requirements for cast iron	120
Table B.3 – Parts in aluminium and aluminium alloys.....	121
Table B.4 – Parts in copper or copper alloys.....	121

iTeh STANDARD PREVIEW

(standards.iteh.ai)

IEC 62282-3-400:2016

<https://standards.iteh.ai/catalog/standards/sist/37dd435e-134e-49e4-b5ce-55e4b6acb3e0/iec-62282-3-400-2016>

Table B.5 – Minimum thicknesses for rolled parts	121
Table B.6 – Nominal minimum thicknesses of small fuel cell CHP appliance sections	121
Table B.7 – Weld joints and welding processes.....	122
Table B.8 – $\varphi_{\text{ex,th}}(\text{CO}_2)$ volume fraction of the theoretical dry air-free combustion products, in percent	134
Table B.9 – Weighting factor F_{CHP} for weighting $\eta_{\text{eq,CHP}}$ in the η_{son} calculation.....	139
Table B.10 – Weighting factors	144
Table B.11 – Weighting factors	145
Table B.12 – Weighting factor F_{CHP} for weighting $\varepsilon_{\text{CHP}}(\text{NO}_x)$ and $\varepsilon_{\text{SUP}}(\text{NO}_x)$ in the $\varepsilon_{\text{pond}}(\text{NO}_x)$ calculation	146
Table B.13 – Supplementary markings.....	147
Table C.1 – Insulation resistance value.....	158

iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 62282-3-400:2016](https://standards.iteh.ai/catalog/standards/sist/37dd435e-134e-49e4-b5ce-55e4b6acb3e0/iec-62282-3-400-2016)

<https://standards.iteh.ai/catalog/standards/sist/37dd435e-134e-49e4-b5ce-55e4b6acb3e0/iec-62282-3-400-2016>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FUEL CELL TECHNOLOGIES –

**Part 3-400: Stationary fuel cell power systems –
Small stationary fuel cell power system
with combined heat and power output**

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62282-3-400 has been prepared by IEC technical committee 105: Fuel cell technologies.

The text of this standard is based on the following documents:

FDIS	Report on voting
105/620/FDIS	105/624/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication 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 reader's attention is drawn to the fact that Annex B, Annex C and Annex D list all of the "in-some-countries" clauses on differing practices of a less permanent nature relating to the subject of this standard.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication 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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 62282-3-400:2016](https://standards.iteh.ai/catalog/standards/sist/37dd435e-134e-49e4-b5ce-55e4b6acb3e0/iec-62282-3-400-2016)

<https://standards.iteh.ai/catalog/standards/sist/37dd435e-134e-49e4-b5ce-55e4b6acb3e0/iec-62282-3-400-2016>

FUEL CELL TECHNOLOGIES –

Part 3-400: Stationary fuel cell power systems – Small stationary fuel cell power system with combined heat and power output

1 Scope

This part of IEC 62282 applies to small stationary fuel cell power systems serving as a heating appliance providing both electric power and useful heat with or without a supplementary heat generator providing peak load function.

This standard applies to fuel cell power systems that are intended to be permanently connected to the electrical system of the customer (end user). Direct connection to the mains (parallel operation) is also within the scope of this standard.

NOTE 1 Parallel operation is subject to the permission of the local electric power supply utility.

This standard is limited to gas and liquid fuelled fuel cell CHP appliances that have a heat input based on lower heating value of less than or equal to 70 kW. For some regional applications, the output electric power is limited. Specific limitations are given in Clause C.1 for Japan.

(standards.iteh.ai)

This standard applies to systems as shown in Figure 1.

IEC 62282-3-400:2016

One is a system where both stationary fuel cell power system and supplementary heat generator are installed in one enclosure without any partition.

This standard does not have to apply to the supplementary heat generator of systems where the stationary fuel cell power system and the supplementary heat generator are not built in one enclosure, and whose ducts are not common (that is, each appliance has its own dedicated duct system).

This standard applies to systems intended for operation on the following supplied input fuels:

- natural gas and other methane rich gases;
- fuels derived from oil refining (liquefied petroleum gases, propane, and butane);
- hydrogen as supply gas for the CHP generator.

NOTE 2 It is possible that other fuels such as alcohols (methanol, ethanol), kerosene, or hydrogen for the supplementary heat generator will be added in future amendments or revisions.

This part of IEC 62282 applies to systems where:

- the heat transfer fluid (heat output) is water or a mixture of water and additives to prevent corrosion and to prevent freezing;
- the heat transfer fluid circuit (heat output) can be designed for open or sealed operation;
- the maximum temperature of the heat transfer fluid (heat output) does not exceed 100 °C, or the value given in Clause B.1 for Europe or in Clause D.1 for the USA;
- the maximum pressure of the heat transfer fluid (heat output) circuit does not exceed 0,3 MPa, or the limits given in Clause B.1 for Europe, or C.4.3 for Japan or Clause D.1 for the USA;
- the maximum pressure of the domestic hot water circuit, if installed, does not exceed 0,1 MPa, or the limits as given in Clause D.1 for the USA.

This standard applies to systems with either condensing or non-condensing conditions in the exhaust gas.

This standard applies to appliances

- with ducts included as part of the appliance (Type B, Type C) and
- without ducts (Type A)

Duct systems are shown in Annex F. The chimney in the figures is part of the building and is not within the scope of this standard.

Different combustion air/flue duct circuit configurations are accommodated, see Annex F.

This standard applies to both indoor and outdoor installations.

This standard applies to type testing only.

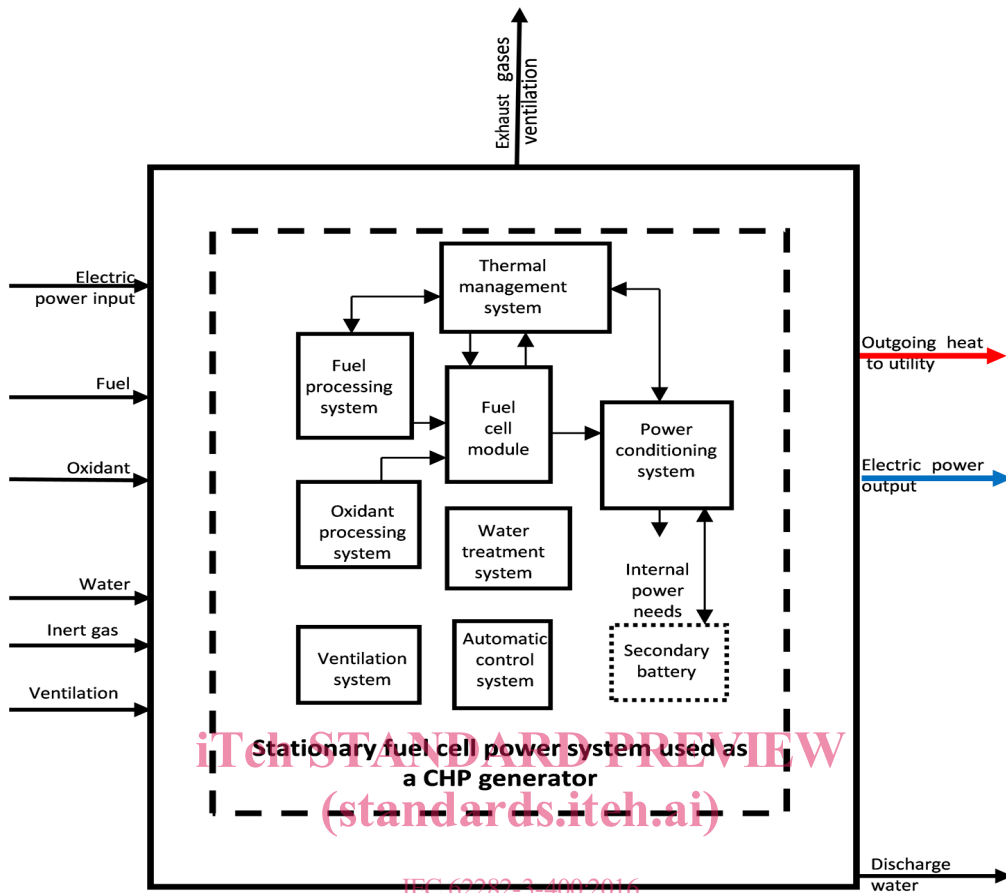
This standard specifies the requirements for construction, safety, installation, fitness for purpose, rational use of energy, marking, and performance measurement of these appliances.

This standard also provides regional and country specific requirements to facilitate the worldwide application of this IEC standard. These essential regional and country specific requirements are given in Annex B for Europe, in Annex C for Japan and in Annex D for the USA.

iTeh STANDARD PREVIEW

If the user or manufacturer chooses a regional specific annex to apply this standard, then that annex applies to the appliance in its entirety without mixing requirements between annexes. The chosen regional or country specific annex becomes normative.

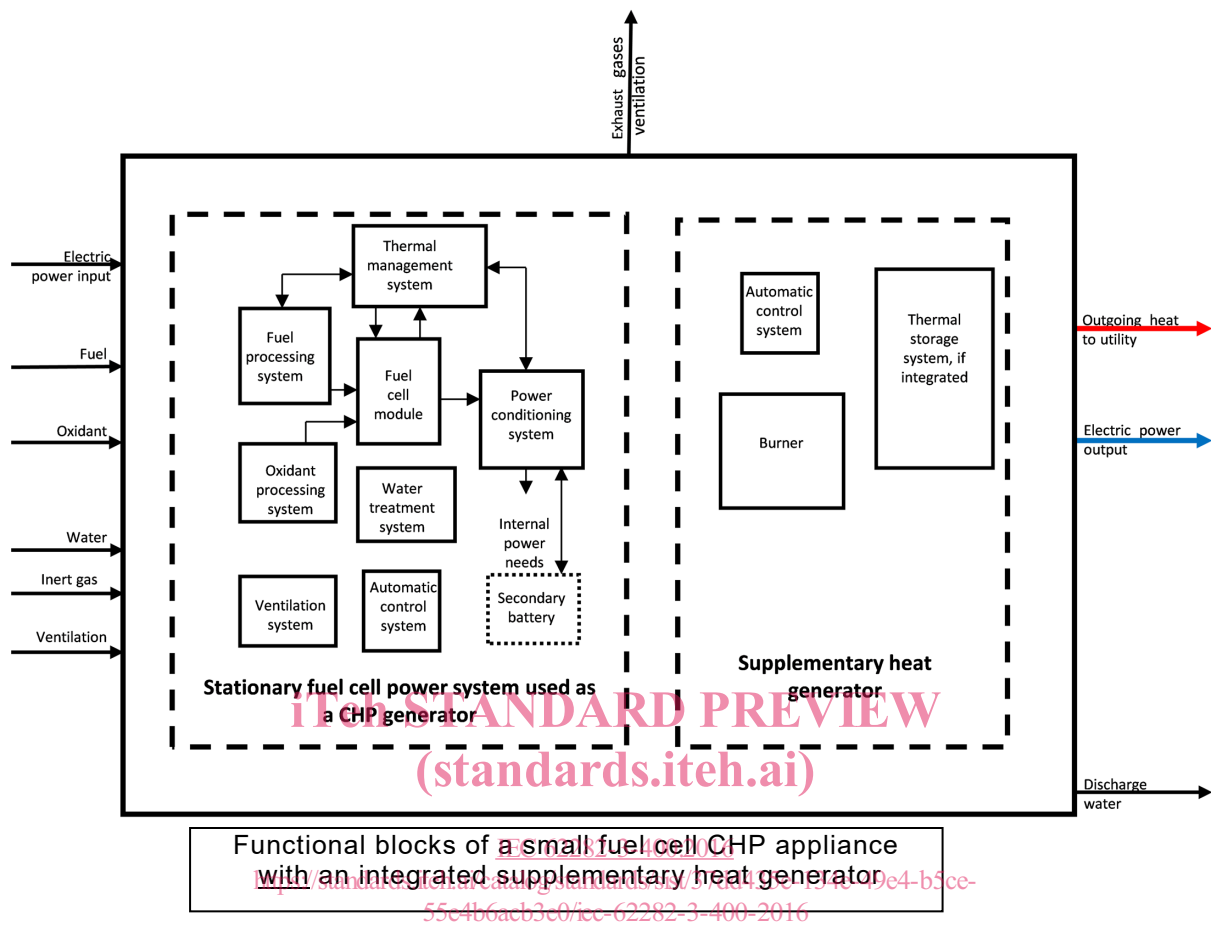
<https://standards.iteh.ai/catalog/standards/sist/37dd435e-134e-49e4-b5ce-55e4b6acb3e0/iec-62282-3-400-2016>



Stationary fuel cell power system used as a CHP generator
(standards.iteh.ai)

IEC 62282-3-400:2016

Functional blocks of a small fuel cell CHP appliance without an integrated supplementary heat generator



IEC

Figure 1 – Configuration with and without integrated supplementary heat generator

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.

NOTE Regional specific standards are given in Clause B.2 for Europe, in Clause C.2 for Japan and in Clause D.2 for the USA.

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-2, *Explosive atmospheres – Part 2: Equipment protection by pressurized enclosure "p"*

IEC 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*

IEC 60079-20-1, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

IEC 60079-30-1, *Explosive atmospheres – Part 30-1: Electrical resistance trace heating – General and testing requirements*

IEC 60335-1, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60335-2-102:2004, *Household and similar electrical appliances – Safety – Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections*

IEC 60335-2-102:2004/AMD1:2008

IEC 60335-2-102:2004/AMD2:2012

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

IEC 60721-3-1, *Classification of environmental conditions – Part 3 Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2, *Classification of environmental conditions – Part 3 Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 60721-3-3, *Classification of environmental conditions – Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use at weatherprotected locations*

IEC 60730-1, *Automatic electrical controls – Part 1: General requirements*

<https://standards.iteh.ai/catalog/standards/sist/37dd435e-134e-49e4-b5ce->

IEC 60730-2-5, *Automatic electrical controls – Part 2-5: Particular requirements for automatic electrical burner control systems*

IEC 60730-2-9, *Automatic electrical controls – Part 2-9: Particular requirements for temperature sensing control*

IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic currents emissions (equipment input current ≤ 16 A per phase)*

IEC 61000-3-3, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection*

IEC TS 61000-3-4, *Electromagnetic compatibility (EMC) – Part 3-4: Limits – Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 16 A*

IEC 61000-3-11, *Electromagnetic Compatibility (EMC) – Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤ 75 A and subject to conditional connection*

IEC 61000-3-12, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤ 75 A per phase*

IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

IEC TS 62282-1:2013, *Fuel cell technologies – Part 1: Terminology*

IEC 62282-2:2012, *Fuel cell technologies – Part 2: Fuel cell modules*

IEC 62282-3-201:2013, *Fuel cell technologies – Part 3-201: Stationary fuel cell power systems – Performance test methods for small fuel cell power systems*

CISPR 14-1, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

CISPR 14-2, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard;*

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads – Part 1: Dimensions, tolerances and designation*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads – Part 1: Dimensions, tolerances and designation*

ISO 262, *ISO general purpose metric screw threads – Selected sizes for screws, bolts and nuts*

ISO 3166-1 *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes*

ISO 4126-1, *Safety devices for protection against excessive pressure – Part 1: Safety valves*

ISO 23550:2011, *Safety and control devices for gas burners and gas-burning appliances – General requirements*

ISO 23551-1, *Safety and control devices for gas burners and gas burning appliances – Particular requirements – Part 1: Automatic and semi-automatic valves*

ISO 23551-2, *Safety and control devices for gas burners and gas-burning appliances – Particular requirements – Part 2: Pressure regulators*

ISO 23551-3, *Safety and control devices for gas burners and gas-burning appliances – Particular requirements – Part 3: Gas/air ratio controls, pneumatic type*

ISO 23552-1, *Safety and control devices for gas and/or oil burners and gas and/or oil appliances – Particular requirements – Part 1: Fuel/air ratio controls, electronic type*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>