

Edition 1.0 2025-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fuel cell technologies - iTeh Standards

Part 3-202: Stationary fuel cell power systems – Performance test methods for small fuel cell power systems for multiple units operation

Technologies des piles à combustible - Preview

Partie 3-202: Systèmes à piles à combustible stationnaires – Méthodes d'essai des performances pour petits systèmes à piles à combustible destinés à l'exploitation d'unités multiples eac4e94-5064-4534-8366-56e01e4a0ffe/iec-62282-3-202-2025





THIS PUBLICATION IS COPYRIGHT PROTECTED Copyright © 2025 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 Secretariat Tel.: +41 22 919 02 11

3, rue de Varembé info@iec.ch CH-1211 Geneva 20 www.iec.ch

Switzerland

About the IFC

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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

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 once a month by email.

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

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

202.2025

Centre: sales@iec.ch.atalog/standards/iec/3eac4e94-5064-4534-8366-56e01e4a0ffe/iec-62282-3-202-2025

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.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

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 une fois par mois par email.

Service Clients - webstore.iec.ch/csc

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

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications, symboles graphiques et le glossaire. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 500 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 25 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



Edition 1.0 2025-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fuel cell technologies - iTeh Standards

Part 3-202: Stationary fuel cell power systems – Performance test methods for small fuel cell power systems for multiple units operation

Technologies des piles à combustible - Preview

Partie 3-202: Systèmes à piles à combustible stationnaires – Méthodes d'essai des performances pour petits systèmes à piles à combustible destinés à

https://stl'exploitation d'unités multiples eac4e94-5064-4534-8366-56e01e4a0ffe/iec-62282-3-202-2025

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 27.070 ISBN 978-2-8327-0298-7

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

FOREWORI	D	4
INTRODUC	TION	6
1 Scope.		7
2 Normat	ive references	7
3 Terms	and definitions	7
4 Symbo	s	12
•	ration of small stationary fuel cell power system	
•	nce conditions	
	y value base	
· ·		
•	eparation	
	eneral	
	ncertainty analysis	
	ata acquisition plan	
	t-up	
	ents and measurement methods	
10.1 G	eneral	18
	easurement instruments	
10.3 M	easurement points	19
	inimum required measurement systematic tolerance	
	nditions	
11.1 La	aboratory conditions	21
11.2 lr	stallation and operating conditions of the system	21
	est fuel	
	eter list IEC 62282-3-202:2025	
standards.ifE	lectrical characteristics for fuel cell power system	21
12.1.1	Power generation electrical efficiency (rated, partial load)	21
12.1.2	Start-up, shut-down energy	21
12.1.3	Ramp-up rate and ramp-down rate between rated and minimum load	
12.1.4	Waiting time for restart (hot restart)	
12.2 T	hermal characteristics for fuel cell power system	21
12.2.1	Heat recovery efficiency	
12.2.2	Full heat storage amount of hot water tank	
12.2.3	Remaining hot storage amount of hot water tank	
12.2.4	Heat insulating performance of hot water tank	
12.2.5	Heat recovery temperature	
12.2.6	Pressure drop characteristics from feed water inlet to hot water outlet	
	ethods	
	lectrical characteristics for fuel cell power system	
13.1.1	Power generation electrical efficiency (rated, partial load)	
13.1.2	Start-up, shut-down energy	
13.1.3	Ramp-up rate and ramp-down rate between rated and minimum load	
13.1.4	Waiting time for restart (hot restart)	
	hermal characteristics for fuel cell power system	
13.2.1	Heat recovery test	
13.2.2	Full heat storage amount of hot water tank	37

13.2.3 Remaining heat storage amount of hot water tank	38	
13.2.4 Heat insulating performance of hot water tank	39	
13.2.5 Heat recovery temperature	39	
13.2.6 Pressure drop characteristics from feed water inlet to hot water outlet	40	
14 Test reports	40	
14.1 General	40	
14.2 Title page	40	
14.3 Table of contents	40	
14.4 Summary report		
Annex A (informative) Heating values for components of natural gases	42	
Annex B (informative) Examples of nominal composition for natural gas and propane	4.4	
gas		
Annex C (informative) Guidelines for the contents of detailed and full reports		
C.1 General		
C.2 Detailed report C.3 Full report		
Annex D (informative) Pressure drop characteristics from feed water inlet to hot water	41	
outlet	48	
Bibliography	49	
supplementary heat generator or thermal storage system covered by this document Figure 2 – Test set-up for small stationary fuel cell power system fed with gaseous fuel which supplies electricity and useful heat Figure 3 – Test set-up for small stationary fuel cell power system fed with gaseous fuel	17	
which supplies only electricity		
Figure 4 – Example of electric power chart during start-up time		
Figure 5 - Example of liquid fuel supply systems 064-4534-8366-56e01e4a0ffe/iec-622	82-328 ⁰	
Figure 6 – Electric power chart during shutdown time	29	
Figure 7 – Electric power output change pattern for ramp-up and ramp-down rate test		
Figure 8 – Example for electric power change stabilization criteria		
Figure 9 – Explanation of temperature sensor locations and V_j	38	
Figure D.1 – Example for the pressure drop characteristics from feed water inlet to hot water outlet	48	
Table 1 – Symbols and their meanings for electric and thermal performance	12	
Table A.1 – Heating values for components of natural gases at various combustion		
reference conditions for ideal gas	42	
Table B.1 – Examples of composition of natural gas (%)	45	
Table B.2 – Examples of composition of propage gas (%)	46	

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FUEL CELL TECHNOLOGIES -

Part 3-202: Stationary fuel cell power systems – Performance test methods for small fuel cell power systems for multiple units 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.
- 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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62282-3-202 has been prepared by IEC technical committee 105: Fuel cell technologies. It is an International Standard.

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

Draft	Report on voting
105/1094/FDIS	105/1101/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.

iTeh Standards (https://standards.iteh.ai) Document Preview

IEC 62282-3-202:2025

https://standards.iteh.ai/catalog/standards/iec/3eac4e94-5064-4534-8366-56e01e4a0ffe/iec-62282-3-202-2025