

SLOVENSKI STANDARD oSIST prEN IEC 62282-3-200:2024

01-februar-2024

Tehnologije gorivnih celic - 3-200. del: Nepremični elektroenergetski sistemi z gorivnimi celicami - Preskusne metode zmogljivosti

Fuel cell technologies - Part 3-200: Stationary fuel cell power systems - Performance test methods

Brennstoffzellentechnologien - Teil 3-200: Stationäre Brennstoffzellen-Energiesysteme - Leistungskennwerteprüfverfahren

Technologies des piles à combustible - Partie 3-200: Systèmes à piles à combustible stationnaires - Méthodes d'essai des performances

Ta slovenski standard je istoveten z: prEN IEC 62282-3-200:2023

ICS:

27.070 Gorilne celice Fuel cells

oSIST prEN IEC 62282-3-200:2024 en

oSIST prEN IEC 62282-3-200:2024

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

oSIST prEN IEC 62282-3-200:2024

https://standards.iteh.ai/catalog/standards/sist/f7296151-0bb3-489e-9cbd-f4d10ca899e5/osist-pren-iec-62282-3-200-202

oSIST prEN IEC 62282-3-200:2024

PROJECT NUMBER:

IEC 62282-3-200 ED3



105/1016/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

	DATE OF CIRCULATION:		CLOSING DATE FOR VOTING:
	2023-12-08		2024-03-01
	SUPERSEDES DOCUMENT	SUPERSEDES DOCUMENTS:	
	105/974/CD, 105/988	105/974/CD, 105/988A/CC	
150 TO 405 Fire			
IEC TC 105 : FUEL CELL TECHNOLOGI	ES	_	
SECRETARIAT:		SECRETARY:	
Germany		Mr David Urmann	
OF INTEREST TO THE FOLLOWING COM	MITTEES:	PROPOSED HORIZONTAL STANDARD:	
		Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.	
FUNCTIONS CONCERNED:			
□ EMC □] ENVIRONMENT	Quality assurance	E SAFETY
SUBMITTED FOR CENELEC PARALI	LEL VOTING	☐ NOT SUBMITTED FO	R CENELEC PARALLEL VOTING
Attention IEC-CENELEC parallel v	roting iTeh S1	andards	
The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.			
The CENELEC members are invited to vote through the CENELEC TO Preview online voting system.			
This document is still under study a	oSIST prEN IEC	62282-3-200-202	4
This document is still under study and subject to change. It should not be used for reference purposes. Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.			
Recipients of this document are invited to submit, with their comments, notification of any relevant "In Some Countries" clauses to be included should this proposal proceed. Recipients are reminded that the CDV stage is the final stage for submitting ISC clauses. (See AC/22/2007 or NEW GUIDANCE DOC).			
TITLE:			
Fuel cell technologies - Part 3-200: Stationary fuel cell power systems - Performance test methods			
PROPOSED STABILITY DATE: 2028			
NOTE FROM TC/SC OFFICERS:			

Copyright © 2023 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

CONTENTS

С	ONTENTS		1
F	OREWORD.		5
١N	NTRODUCTION	ON	7
1	Scope		8
2	Normativ	e references	9
3		efinitions, operating process and symbols	
	,	ns and definitions	
		erating process	
	•	nbols	
4	Referenc	e conditions	21
	4.1 Ger	eral	21
		perature and pressure	
		ting value base	
5	Item of pe	erformance test	21
6	Test prep	aration	22
	6.1 Ger	eral	22
		ertainty analysis	
	6.2.1	Uncertainty analysis items	
	6.2.2	Data acquisition plan	
7	Measurer	nent instruments and measurement methods	23
	7.1 Ger	eral (httms://standards.iteh.ai)	23
	7.2 Mea	surement instruments	23
	7.3 Mea	surement methods	23
	7.3.1	General	23
	7.3.2	Electric power measurements	24
	rds 7.3.3 _{ai/ca}	Fuel input measurement	iee-6 24 82-3-200-2024
	7.3.4	Recovered heat measurement	27
	7.3.5	Purge gas flow measurement	
	7.3.6	Oxidant (air) input measurement	
	7.3.7	Other fluid flow measurement	=0
	7.3.8	Exhaust gas flow measurement	
	7.3.9	Discharge water measurement	
	7.3.10	Noise level measurement	
	7.3.11	Vibration level measurement	
	7.3.12	Total harmonic distortion measurement	
8	7.3.13	Ambient condition measurement	
0	•		
		eral	
		pient conditionstimum permissible variation in steady state operating conditions	
		t operating proceduretiperating conditions in steady state operating conditions in steady state operating	
		ation of test and frequency of readings	
9		nods and computation of test results	
•		eral	
	J — — — — — — — — — — — — — — — — — —		

9.2	Efficiency test	34
9.2.1	General	34
9.2.2	Test method	34
9.2.3	Computation of inputs	34
9.2.4	Computation of output	44
9.2.5	Computation of waste heat rate	46
9.2.6	Computation of efficiencies	46
9.3	Electric power and thermal power response characteristics test	47
9.3.1	General	47
9.3.2	Criteria for the determination of attaining the steady state set value	48
9.3.3	Electric power output response time test	49
9.3.4		
9.3.5		
9.4	Start-up and shutdown characteristics test	
9.4.1	•	
9.4.2		
9.4.3	•	
9.4.4		
9.4.5	Селения становический под становительный под становический под становительный под становический под становический под становический под становический под становический под становический под становительный под становический под с	
9.4.6		
9.4.7	, 3,	
9.4.7	Purge gas consumption test	
9.5 9.5.1	iloh Standards	
9.5.1		
9.5.2	Water consumption test (optional)	
9.6 9.6.1		
9.6.1	Hacilment Preview	
9.7	Exhaust gas emission test	
9.7.1		
dards 9.7.2		
9.7.3	1 3	
9.7.4	3	
9.7.5		
9.8	Noise level test	
9.8.1		
9.8.2		
9.8.3	1 3	
9.9	Vibration level test	
9.10	Discharge water quality test	59
9.10	1 General	59
9.10	2 Test method	59
10 Test	reports	60
10.1	General	60
10.2	Title page	60
10.3	Table of contents	60
10.4	Summary report	60
10.5	Detailed report	
10.6	Full report	61

Annex A (informative) Uncertainty analysis	62	
A.1 General	62	
A.2 Preparations	62	
A.3 Basic assumptions	63	
A.4 General approach	63	
Annex B (informative) Calculation of fuel heating value	65	
Annex C (normative) Reference gas	69	
Annex D (informative) Maximum acceptable instantaneous electric power outp		
Bibliography	73	
	_	
Figure 1 – Fuel cell power system diagram		
Figure 2 – Operating process chart of fuel cell power system		
Figure 3 – Symbol diagram for power inputs and outputs	21	
Figure 4 – Electric and thermal power response time	48	
Figure 5 – Criteria for attaining steady state	49	
Figure 6 – Example of electric power chart at start-up	52	
Figure 7 – Electric power chart at shutdown	53	
Table 1 – Symbols	18	
Table 2 – Test classification and test item		
Table 3 – Test item and system status		
Table 4 – Maximum permissible variations in test operating conditions		
Table 5 – Vibration correction factors		
Table B.1 – Heating value for component of gaseous fuel	65	
Table B.2 – Worksheet 1 – Calculation worksheet for energy of fuel gases	67	
Table B.3 – Worksheet 2 – Calculation worksheet for energy of air		
Table C.1 – Example of compositions for natural gas	70	
Table C.2 – Examples for compositions of liquified petroleum gas (LPG)	70	

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FUEL CELL TECHNOLOGIES -

Part 3-200: Stationary fuel cell power systems – Performance test methods

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.
- 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.

IEC 62282-3-200 has been prepared by IEC technical committee105: Fuel cell technologies. It is an International Standard.

This third edition cancels and replaces the second edition of IEC 62282-3-200 published in 2015. This edition constitutes a technical revision.

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

- a) Revision of Introduction;
- b) Revision of Scope (Clause 1)
- c) Revision of definitions (Clause 3);
- d) Revision of Table 1;
- e) Revision of Figure 3;
- f) Revision of measurement methods (7.3);
- g) Revision of Efficiency test (9.2);
- h) Revision of Electric power and thermal power response characteristics test (9.3);
- i) Revision of Start-up and shutdown characteristics test (9.4)
- j) Revision of Annex C

IEC has published a related but independent standard IEC 62282-3-201 on performance test methods of small stationary fuel cell power systems which is harmonized with this standard.

- 6 -

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

Draft	Report on voting
105/XXXX/FDIS	105/XXXX/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.

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,
- replaced by a revised edition, or eh Standards
- amended.

https://standards.iteh.ai)
Document Preview

oSIST prEN IEC 62282-3-200:2024

https://ctandards.iteh.gi/catalog/ctandards/sist/f7796151_0bb3_489e_9cbd_f4d10ca899e5/osist_prep_iec_62282_3_200_20

IEC CDV 62282-3-200 © IEC 2023

-7 -

105/1016/CDV

INTRODUCTION

- This part of IEC 62282 describes how to measure the performance of stationary fuel cell power systems for residential, commercial, agricultural and industrial applications.
- This standard describes type tests and their test methods only. In this standard, no routine tests
- 5 are required or identified, and no performance targets are set.

6

1

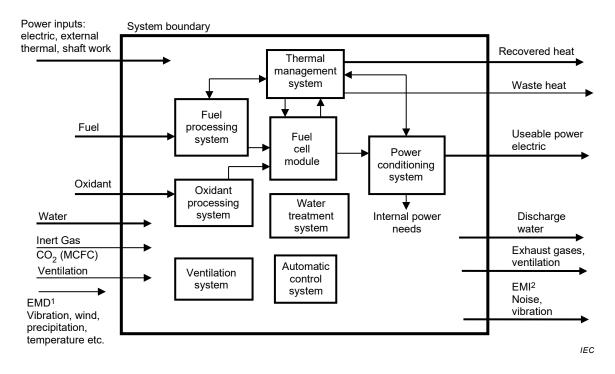
7

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

oSIST prFN IFC 62282_3_200:2024

https://standards.iteh.ai/catalog/standards/sist/f7296151-0bh3-489e-9chd-f4d10ca899e5/osist-pren-jec-62282-3-200-202

8	FUEL CELL TECHNOLOGIES -
9	Part 3-200: Stationary fuel cell power systems –
10 11	Performance test methods
12	
13	
14	
15	1 Scope
16 17	This part of IEC 62282 covers operational and environmental aspects of the stationary fuel cell power systems performance. The test methods apply as follows:
18	 power output under specified operating and transient conditions;
19	 electrical and heat recovery efficiency under specified operating conditions;
20 21	 environmental characteristics; for example, exhaust gas emissions, noise, etc. under specified operating and transient conditions.
22	This document applies to all kinds of stationary fuel cell technologies, such as:
23	alkaline fuel cells (AFC);
24	phosphoric acid fuel cells (PAFC);
25	polymer electrolyte fuel cells (PEFC);
26	 molten carbonate fuel cells (MCFC);
27	- solid oxide fuel cells (SOFC). I leh Standards
28	This standard does not provide coverage for electromagnetic compatibility (EMC).
29 30	This standard does not apply to small stationary fuel cell power systems with rated electric power output of less than 10 kW which are dealt with IEC 62282-3-201.
31 /32 33 34	Fuel cell power systems may have different subsystems depending upon types of fuel cell and applications, and they have different streams of material and energy into and out of them. 223-200-2024 However, a common system diagram and boundary has been defined for evaluation of the fuel cell power system (see Figure 1).
35 36	The following conditions are considered in order to determine the system boundary of the fuel cell power system:
37	 all energy recovery systems are included within the system boundary;
38	 all kinds of electric energy storage devices are considered outside the system boundary;
39 40 41	 calculation of the heating value of the input fuel (such as natural gas, propane gas and pure hydrogen gas, etc.) is based on the conditions of the fuel at the boundary of the fuel cell power system.
42 43 44	The standard does not provide safety requirements for the testing of stationary fuel cell power systems. Safe conduct of the performance tests shall be ensured by following the local safety regulations and the manufacturers instructions.



45

46

48

Key

Fuel cell power system including subsystems. The interface is defined as a conceptual or functional one instead of hardware such as a power package.

Subsystems; fuel cell module, fuel processor, etc. These subsystem configurations depend on the kind of fuel, type of fuel cell or system.

The interface points in the boundary to be measured for calculation data.

¹ EMD electromagnetic disturbance

² EMI electromagnetic interference

Figure 1 - Fuel cell power system diagram 99e5/osist-pren-jec-62282-3-200-2024

2 Normative references

- The following documents, in whole or in part, are normatively referenced in this document and
- are indispensable for its application. For dated references, only the edition cited applies. For
- undated references, the latest edition of the referenced document (including any amendments)
- 52 applies.
- IEC 60051 (all parts), Direct acting indicating analogue electrical measuring instruments and
- 54 their accessories
- 55 IEC 60359, Electrical and electronic measurement equipment Expression of performance
- IEC 60688, Electrical measuring transducers for converting A.C. and D.C. electrical quantities
- 57 to analogue or digital signals
- IEC 61000-4-7, Electromagnetic compatibility (EMC) Part 4-7: Testing and measurement
- 59 techniques General guide on harmonics and interharmonics measurements and
- 60 instrumentation, for power supply systems and equipment connected thereto

– 10 **–**

- IEC 61000-4-13, Electromagnetic compatibility (EMC) Part 4-13: Testing and measurement
- 62 techniques Harmonics and interharmonics including mains signalling at a.c. power port, low
- 63 frequency immunity tests
- 1EC 61028, Electrical measuring instruments X-Y recorders
- 65 IEC 61143 (all parts), Electrical measuring instruments X-t recorders
- 66 IEC 61672-1, Electroacoustics Sound level meters Part 1: Specifications
- 67 IEC 61672-2, Electroacoustics Sound level meters Part 2: Pattern evaluation tests
- 68 IEC 62052-11, Electricity metering equipment (AC) General requirements, tests and test
- 69 conditions Part 11: Metering equipment
- 70 IEC 62053-22, Electricity metering equipment (a.c.) Particular requirements Part 22: Static
- 71 meters for active energy (classes 0,2 S and 0,5 S)
- 72 IEC 62282-3-201, Fuel cell technologies Part 3-201: Stationary fuel cell power systems –
- 73 Performance test methods for small fuel cell power systems
- 180 3648, Aviation fuels Estimation of net specific energy
- 75 ISO 3744, Acoustics Determination of sound power levels and sound energy levels of noise
- sources using sound pressure Engineering methods for an essentially free field over a
- 77 reflecting plane
- 78 ISO 4677-1, Atmospheres for conditioning and testing Determination of relative humidity –
- 79 Part 1: Aspirated psychrometer method
- ISO 4677-2, Atmospheres for conditioning and testing Determination of relative humidity –
- 81 Part 2: Whirling psychrometer method
- 82 ISO 5167 (all parts), Measurement of fluid flow by means of pressure differential devices 2-3-200-2024
- inserted in circular cross-section conduits running full
- 84 ISO 5348, Mechanical vibration and shock Mechanical mounting of accelerometers
- 85 ISO 5815-2, Water quality Determination of biochemical oxygen demand after n days (BODn)
- 86 Part 2: Method for undiluted samples
- 87 ISO 6060, Water quality Determination of the chemical oxygen demand
- 88 ISO 6326 (all parts), Natural gas Determination of sulfur compounds
- 89 ISO 6974 (all parts), Natural gas Determination of composition and associated uncertainty by
- 90 gas chromatography
- ISO 6975 (all parts), Natural gas Extended analysis Gas chromatographic method
- 92 ISO 7934, Stationary source emissions Determination of the mass concentration of sulfur
- 93 dioxide Hydrogen peroxide/barium perchlorate/Thorin method
- 94 ISO 7935, Stationary source emissions Determination of the mass concentration of sulfur
- 95 dioxide Performance characteristics of automated measuring methods

_ 11 _

- 96 ISO 8217, Petroleum products Fuel (class F) Specifications of marine fuels
- 97 ISO 10101 (all parts), Natural gas Determination of water by the Karl Fisher method
- 98 ISO 10396, Stationary source emissions Sampling for the automated determination of gas
- 99 emission concentrations for permanently installed monitoring systems
- 100 ISO 10523, Water quality Determination of pH
- 101 ISO 10849, Stationary source emissions Determination of the mass concentration of nitrogen
- 102 oxides Performance characteristics of automated measuring systems
- 103 ISO 11042-1, Gas turbines Exhaust gas emission Part 1: Measurement and evaluation
- 104 ISO 11042-2, Gas turbines Exhaust gas emission Part 2: Automated emission monitoring
- 105 ISO 11541, Natural gas Determination of water content at high pressure
- 106 ISO 11564, Stationary source emissions Determination of the mass concentration of nitrogen
- oxides Naphthylethylenediamine photometric method
- 108 ISO 11632, Stationary source emissions Determination of mass concentration of sulfur
- 109 dioxide Ion chromatography method
- 110 ISO 14687-1, Hydrogen fuel Product specification Part 1: All applications except proton
- 111 exchange membrane (PEM) fuel cell for road vehicles
- 112 ISO/TR 15916, Basic consideration for the safety of hydrogen systems
- 113 ISO 16622, Meteorology Sonic anemometers/thermometers Acceptance test methods for
- 114 mean wind measurements
- ASTM D4809, Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by
- 116 Bomb Calorimeter (Precision Method)
- 117 ASTM F2602, Standard Test Method for Determining the Molar Mass of Chitosan and Chitosan
- 118 Salts by Size Exclusion Chromatography with Multi-angle Light Scattering Detection (SEC-
- 119 *MALS*)

120 3 Terms, definitions, operating process and symbols

- 121 3.1 Terms and definitions
- For the purposes of this document, the following terms and definitions apply.
- 123 ISO and IEC maintain terminology databases for use in standardization at the following
- 124 addresses:
- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at https://www.electropedia.org
- 127 **3.1.1**
- 128 auxiliary electric power input
- 129 electric power for auxiliary machines and equipment supplied from outside the system boundary

- 12 -

- 3.1.2 130
- background noise level 131
- sound pressure level of ambient noise at the measurement point 132
- 133 Note 1 to entry: This measurement is taken as described in this standard with the fuel cell power system in the cold
- 134 state.
- 3.1.3 135
- background vibration level 136
- mechanical oscillations caused by the environment that affect vibration level readings 137
- Note 1 to entry: In this standard, background vibration is measured with the fuel cell power system in the cold state. 138
- 3.1.4 139
- cold state 140
- state of a fuel cell power system, which is entirely at ambient temperature with no power input 141
- or output, ready for start-up. 142
- Note 1 to entry: Power input to a control device for monitoring the fuel cell power system during cold state is not 143
- 144 considered.
- [SOURCE: IEC 60050-485:2020, 485-21-01, modified "which is entirely" and "ready for start-145
- up" added; Note 1 to entry added.] 146
- 147 3.1.5
- discharge water 148
- water discharged from the fuel cell power system including waste water and condensate 149
- 3.1.6 150
- 151 electrical efficiency
- 152 ratio of the average net electric power output produced by a fuel cell power system to the
- average total power input supplied to the fuel cell power system 153
- 154 Note 1 to entry: Lower heating value (LHV) is assumed unless otherwise stated.
- 155 Note 2 to entry: Any electric power that is supplied to auxiliary machines and equipment of a fuel cell power system
- 156 from an external source is deducted from the electric power output of the fuel cell power system.
- [SOURCE: IEC 60050-485:2020, 485-10-02, modified "electrical" instead of "electric" in the 157
- term; "average net electric power output" instead of "net electric power"; "average total power 158
- input" instead of "total enthalpy flow"; Note 2 to entry" added] 159
- 160 3.1.7
- 161 external thermal energy
- additional thermal energy input from outside the system boundary 162
- 163 Note 1 to entry: External thermal energy can be supplied e.g. by make-up water or process condensate return.
- 3.1.8 164
- fuel cell module 165
- assembly incorporating one or more fuel cell stacks and, if applicable, additional components, 166
- that is intended to be integrated into a power system 167
- Note 1 to entry: A fuel cell module comprises the following main components: one or more fuel cell stack(s), a 168
- piping system for conveying fuels, oxidants and exhausts, electric connections for the power delivered by the stack(s), 169
- and means for monitoring, control or both. Additionally, a fuel cell module can comprise: means for conveying additional fluids (e.g. cooling media, inert gas, CO₂ (MCFC)), means for detecting normal and abnormal operating 170
- 171
- 172 conditions, enclosures or pressure vessels and module ventilation systems, and the required electronic components
- 173 for module operation and power conditioning.
- [SOURCE: IEC 60050-485:2020, 485-09-03, modified "or a vehicle" deleted, "CO $_2$ added)] 174