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Tehnologije gorivnih celic - 3-201. del: Nepremični elektroenergetski sistemi z gorivnimi celicami - Metode za preskušanje zmogljivosti majhnih elektroenergetskih sistemov z gorivnimi celicami

Fuel cell technologies - Part 3-201: Stationary fuel cell power systems - Performance test methods for small fuel cell power systems

Brennstoffzellentechnologien - Teil 3-201: Stationäre Brennstoffzellen-Energiesysteme - Leistungskennwerteprüfverfahren für kleine Brennstoffzellen-Energiesysteme

Technologies des piles à combustible - Partie 3-201: Systèmes à piles à combustible stationnaires - Méthodes d'essai des performances pour petits systèmes à piles à combustible

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OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
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TITLE: Fuel cell technologies – Part 3-201: Stationary fuel cell power systems – Performance test methods for small fuel cell power systems

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FUEL CELL TECHNOLOGIES –

**Part 3-201: Stationary fuel cell power systems –
Performance test methods for small fuel cell power systems**

FOREWORD

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IEC 62282-3-201 has been prepared by IEC technical committee 105: Fuel cell technologies. It is an International Standard.

This third edition cancels and replaces the second edition published in 2017, Amendment 1:2022. 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 definitions;
- c) Revision of Table 1;
- d) Revision of Figure 1;

- e) Revision of Figure 2;
- f) Revision of Figure 3 and Figure 4;
- g) Revision of measurement instruments (10.2);
- h) Revision of Minimum required measurement systematic uncertainty (10.4);
- i) Revision of Test conditions (11);
- j) Revision of Operating process (12);
- k) Revision of Fuel consumption test (14.2);
- l) Revision of Heat recovery test (14.4);
- m) Revision of Figure 13;
- n) Revision of Figure 14;
- o) Revision of Calculation of results (14.14.4);
- p) Revision of Annex A and Annex B

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.

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- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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1

INTRODUCTION

2 This part of IEC 62282 provides consistent and repeatable test methods for the electrical,
3 thermal and environmental performance of small stationary fuel cell power systems.

4 This document limits its scope to small stationary fuel cell power systems (electrical power
5 output below 10 kW, which is typical for residential, small commercial and off-grid applications)
6 and provides test methods specifically designed for them in detail. It is based on IEC 62282-3-
7 200, which generally describes performance test methods that are common to all types of fuel
8 cells.

9 This document is intended for manufacturers of small stationary fuel cell power systems and/or
10 those who evaluate the performance of their systems for certification purposes.

11 Users of this document may selectively execute test items that are suitable for their purposes
12 from those described in this document. This document is not intended to exclude any other
13 methods.

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FUEL CELL TECHNOLOGIES –

Part 3-201: Stationary fuel cell power systems – Performance test methods for small fuel cell power systems

1 Scope

This part of IEC 62282 provides test methods for the electrical, thermal, and environmental performance of small stationary fuel cell power systems that meet the following criteria:

- output: rated electric power output of less than 10 kW;
- output mode: grid-connected/independent operation or stand-alone operation with single-phase AC output or 3-phase AC output not exceeding 1 000 V, or DC output not exceeding 1 500 V;

NOTE The limit of 1 000 V for alternating current comes from the definition for "low voltage" given in IEC 60050-601:1985, 601-01-26.

- operating pressure: maximum allowable working pressure of less than 0,1 MPa (gauge) for the fuel and oxidant passages;
- fuel: gaseous fuel (natural gas, liquefied petroleum gas, propane, butane, hydrogen, etc.) or liquid fuel (kerosene, methanol, etc.);
- oxidant: air.

This document describes type tests and their test methods only. No routine tests are required or identified, and no performance targets are set in this document.

This document provides test methods to be carried out under laboratory conditions.

This document covers fuel cell power systems whose primary purpose is the production of electric power and whose secondary purpose may be the utilization of heat. Accordingly, fuel cell power systems for which the use of heat is primary and the use of electric power is secondary are outside the scope of this document.

All systems with integrated batteries are covered by this document. This includes systems where batteries are recharged internally or recharged from an external source.

This document does not cover additional auxiliary heat generators that produce thermal energy.

2 Normative references

The following documents are referred to in the text in such a way that some or all 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.

CISPR 11, *Industrial, scientific, and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

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

54 IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement*
55 *techniques – Electrostatic discharge immunity test*

56 IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement*
57 *techniques – Radiated, radio-frequency, electromagnetic field immunity test*

58 IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement*
59 *techniques – Electrical fast transient/burst immunity test*

60 IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement*
61 *techniques – Surge immunity test*

62 IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement*
63 *techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

64 IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement*
65 *techniques – Power frequency magnetic field immunity test*

66 IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement*
67 *techniques – Voltage dips, short interruptions and voltage variations immunity tests*

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

70 IEC 62282-3-200:2015, *Fuel cell technologies – Part 3-200: Stationary fuel cell power systems*
71 *– Performance test methods*

72 **3 Terms and definitions**

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

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

- 76 • IEC Electropedia: available at <http://www.electropedia.org/>
- 77 • ISO Online browsing platform: available at <http://www.iso.org/obp>

78 **3.1**

79 **noise level**

80 sound pressure level produced by the fuel cell power system

81 Note 1 to entry: Expressed as decibels (dB) and measured as described in 15.2.

82 **3.2**

83 **background noise level**

84 sound pressure level of ambient noise at the measurement point

85 Note 1 to entry: This measurement is taken as described in 15.2 with the fuel cell power system in the cold state.

86 **3.3**

87 **battery**

88 electrochemical energy storage device that provides energy input to auxiliary machines and
89 equipment necessary to operate the fuel cell power system and/or provides electric energy
90 output

91 Note 1 to entry: Back-up batteries for control software memory and similar applications are not included.

92 **3.4**
93 **cold state**
94 State of a fuel cell power system, which is entirely at ambient temperature with no power input
95 or output, ready for start-up.

96 Note 1 to entry: Power input to a control device for monitoring the fuel cell power system during cold state is not
97 considered.

98 [SOURCE: IEC 60050-485:2020, 485-21-01, modified — “which is entirely” and “ready for start-
99 up” added; Note 1 to entry added.]

100 **3.5**
101 **mass discharge rate**
102 mass of discharged exhaust gas component per unit of time

103 **3.6**
104 **discharge water**
105 water that is discharged from the fuel cell power system including waste water and condensate

106 Note 1 to entry: Discharge water does not constitute part of a thermal recovery system.

107 **3.7**
108 **electrical efficiency**
109 ratio of the average net electric power output produced by a fuel cell power system to the
110 average fuel power input supplied to the fuel cell power system

111 Note 1 to entry: Lower heating value (LHV) is assumed unless otherwise stated

112 Note 2 to entry: Only the fuel energy is considered as input power to small fuel cell power systems

113 [SOURCE: IEC 60050-485:2020, 485-10-02,, modified — “electrical” instead of “electric” in the
114 term; “average net electric power output” instead of “net electric power”; “average fuel power
115 input” instead of “total enthalpy flow”.]

116 **3.8**
117 **electric energy input**
118 integrated value of electric power input at the electric input terminal

119 **3.9**
120 **electric energy output**
121 integrated value of electric power output at the electric output terminal

122 **3.10**
123 **electric power input**
124 electric power input at the electric input terminal of the fuel cell power system

125 **3.11**
126 **electric power output**
127 electric power output at the electric output terminal of the fuel cell power system

128 **3.12**
129 **fuel cell power system**
130 generator system that uses one or more fuel cell modules to generate electric power and heat

131 [SOURCE: IEC 60050-485:2020, 485-09-01]

132 **3.13**
133 **fuel energy input**
134 amount of chemical energy which is supplied to the fuel cell power system by the fuel

3.14**fuel input**

amount of natural gas, hydrogen, methanol, liquid petroleum gas, propane, butane, or other material containing chemical energy entering the fuel cell power system while it is working at the specified operating conditions

3.15**fuel power input**

fuel energy input per unit of time

3.16**heat recovery efficiency**

ratio of the average recovered thermal power output of a fuel cell power system to the average fuel power input supplied to the fuel cell power system

Note 1 to entry: Lower heating value (LHV) is assumed unless otherwise stated

Note 2 to entry: Only the fuel energy is considered as input power to small fuel cell power systems

[SOURCE: IEC 60050-485:2020, 485-10-04, modified — “average recovered thermal power output” instead of “recovered heat flow”; “average total power input” instead of “total enthalpy flow”; Note 1 to entry deleted.]

3.17**heat recovery fluid**

fluid circulating between the fuel cell power system and a heat sink for recovering the thermal energy output

3.18**inert purge gas**

inert gas or dilution gas, not containing chemical energy, supplied to the fuel cell power system during specific conditions to make it ready for operation or shutdown

Note 1 to entry: Dilution gas containing chemical energy shall be considered as fuel.

3.19**integrated fuel input**

volume or mass of fuel consumed by the fuel cell power system under specified operating conditions

3.20**interface point**

measurement point at the boundary of a fuel cell power system at which material or energy, or both, either enters or leaves

Note 1 to entry: This boundary is intentionally selected to accurately measure the performance of the system, including all normal operation, both steady state and transient. If necessary, the boundary or the interface points of the fuel cell power system (Figure 2) to be assessed should be determined by agreement between the parties.

[SOURCE: IEC 60050-485:2020, 485-09-12, modified — Note 2 to entry deleted.]

3.21**mass concentration**

concentration of mass of exhaust gas component per unit of volume

3.22**minimum electric power output**

minimum net power output, at which a fuel cell power system is able to operate continuously at a steady state