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Edition 3.0 2016-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fuel cell technologies –
Part 6-200: Micro fuel cell power systems – Performance test methods

Technologies des piles à combustible –
Partie 6-200: Systèmes à micropiles à combustible – Méthodes d'essai des performances

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FUEL CELL TECHNOLOGIES –

Part 6-200: Micro fuel cell power systems – Performance test methods

FOREWORD

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International Standard IEC 62282-6-200 has been prepared by IEC technical committee 105: Fuel cell technologies.

This third edition cancels and replaces the second edition, published in 2012. This edition constitutes a technical revision.

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

a) deletion of 5.3 (Fuel consumption test) as it was impractical to measure the actual consumption rate of some kinds of fuels;
b) addition and modification of some terms and definitions.

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

CDV	Report on voting
105/527/CDV	105/545A/RVC

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

- reconfirmed,
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- replaced by a revised edition, or
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INTRODUCTION

With advancements in technology, the expectation or demand for the commercial introduction of fuel cells has increased dramatically in recent years. It is especially strong for micro fuel cell power systems intended for applications in laptop computers, mobile phones, personal digital assistants (PDAs), cordless home appliances, TV broadcast cameras, autonomous robots, etc. The essential component of a micro fuel cell power system is its power unit. Some micro fuel cell power systems have built-in power units and others have external power units.

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FUEL CELL TECHNOLOGIES –

Part 6-200: Micro fuel cell power systems – Performance test methods

1 Scope

This part of IEC 62282 specifies test methods for the performance evaluation of micro fuel cell power systems for laptop computers, mobile phones, personal digital assistants (PDAs), cordless home appliances, TV broadcast cameras, autonomous robots, etc.

This document describes the performance test methods for power characteristics, and mechanical durability for micro fuel cell power systems with output up to 60 V DC and 240 VA. The functional arrangement of a typical example of a micro fuel cell power system, evaluated according to this document, is shown in Figure 1.

This document does not address the safety of micro fuel cell power systems.

This document does not address the interchangeability of micro fuel cell power systems.

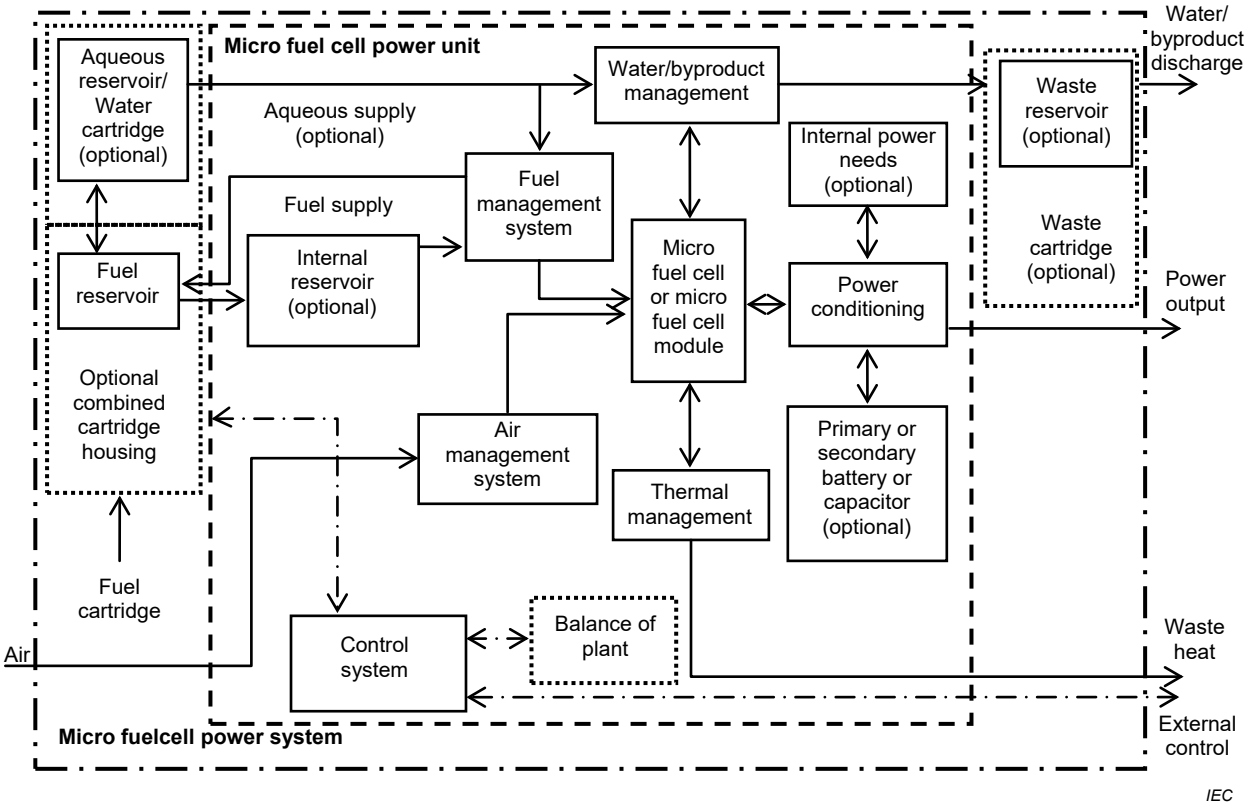

Figure 1 – Micro fuel cell power system block diagram

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

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cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60721-3-7, *Classification of environmental conditions – Part 3-7: Classification of groups of environmental parameters and their severities – Portable and non-stationary use*

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

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 62282-1:2013 and the following apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

NOTE Some terms have been taken from IEC TS 62282-1 and modified for the needs of this document.

3.1
conditioning
placing the micro fuel cell power system in the pre-generation state in the testing environment for a period of time to make the system adjusted to the environment under the prescribed test conditions, prior to a performance test

[SOURCE: IEC TS 62282-1:2013, 3.22, modified]

3.2
micro fuel cell power system
DC power source providing electric power from a fuel cell that includes a fuel cartridge, provides not more than 60 V DC output voltage and 240 VA output power, and is connected to a hand-held or wearable electronic device by flexible cord(s) and plug arrangement or termination connectors integrated into the casing of the portable DC electric device

Note 1 to entry: Examples of hand-held or wearable electronic device are a laptop computer, mobile phone, PDA, cordless home appliance, TV broadcast camera and autonomous robot.

[SOURCE: IEC TS 62282-1:2013, 3.49.1, modified]

3.3
rated current
maximum continuous electric output current that a micro fuel cell power system is designed to achieve at the rated voltage under normal operation conditions specified by the manufacturer

[SOURCE: IEC TS 62282-1:2013, 3.25.2, modified]

3.4
rated power
maximum continuous electric output power that a micro fuel cell power system is designed to achieve under normal operating conditions specified by the manufacturer

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[SOURCE: IEC TS 62282-1:2013, 3.85.4, modified]

3.5
rated voltage
voltage assigned by the manufacturer for the output of micro fuel cell power system

3.6
pre-generation state
state of a micro fuel cell power system with zero electrical output power yet capable of being promptly switched to a state with substantial electric active output power

[SOURCE: IEC TS 62282-1:2013, 3.110.4, modified]

3.7
starting duration
period required for transitioning from the pre-generation state to reach within ±10 % the rated voltage of the micro fuel cell power system after connection to the specified constant resistance

4 General principles

4.1 Testing environment

Unless otherwise specified, performance shall be tested in a controlled environment as specified in this document. The controlled ambient test conditions shall be as follows:

- temperature: 22 °C ± 5 °C;
- pressure: between 83 kPa and 106 kPa;
- humidity: 60 % ± 15 % relative humidity;
- volumetric oxygen concentration: 18 % ≤ O_2 ≤ 21 %.

Measurement shall be conducted in a space with no substantial air movement specified by the manufacturer. The ambient test conditions shall be kept as constant as possible during the test. The parameters of the testing environment shall be recorded in the test report.

4.2 Minimum required measurement accuracy

The measurement parameters and minimum measurement accuracies shall be as follows:

- voltage: ±1 %;
- current: ±1 %;
- time: ±1 %;
- weight: ±1 %;
- temperature: ±2 °C;
- humidity: ±5 percentage points;
- pressure: ±5 %;
- vibration frequency: ±1 Hz (5 Hz < frequency ≤ 50 Hz) or ±2 % (frequency > 50 Hz);
- volume: ±2 %.

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4.3 Measuring instruments

4.3.1 General

The measuring instruments shall be selected in accordance with the required accuracies and the range of values to be measured. The instruments shall be calibrated regularly in order to maintain the levels of accuracy described in 4.2. Refer to IEC/ISO 17025. Calibration information shall be described in the test report. Voltage and current instruments shall be capable of continuous recording for the entire duration of the measurements.

4.3.2 Voltage

The accuracy specified in 4.2 shall be maintained. Internal resistance of the voltage measurement instruments shall be more than or equal to 1 MΩ.

4.3.3 Current

The accuracy specified in 4.2 shall be maintained.

4.3.4 Time

Time measurement instruments shall have an accuracy margin of within ±1 s/h or better in order to maintain the measurement accuracy specified in 4.2.

4.3.5 Weight

The accuracy specified in 4.2 shall be maintained. Weight measurement shall be performed in accordance with the national regulation for measurements, industry guidelines, or guidelines of the relevant organization of each country.

4.3.6 Temperature

The accuracy specified in 4.2 shall be maintained. Recommended instruments for direct measurements of ambient temperatures are as follows:

a) thermocouples with transducer; or

b) resistance thermometer with transducer.

4.3.7 Humidity

The accuracy specified in 4.2 shall be maintained for ambient humidity measurements.

4.3.8 Pressure

The accuracy specified in 4.2 shall be maintained. Pressure measurement shall be performed in accordance with the relevant government standard, industry guidelines or guidelines of the relevant organization of each country. If such is not available, a relevant organization shall create a pressure measurement standard or guidelines for the performance tests.

4.3.9 Vibration frequency

The accuracy specified in 4.2 shall be maintained. For frequency measurement, refer to IEC 60068-2-6.

4.3.10 Volume

The accuracy specified in 4.2 shall be maintained.

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5 Tests

5.1 Test procedure

The performance test method is based on Figure 1. The performance of the system includes the micro fuel cell and (optional) primary battery or rechargeable battery or capacitor as one system.

Each test shall be carried out on three samples. Conditioning of samples shall be conducted for a minimum of 2 h prior to the test measurement in order to adjust the samples to the testing environment. The test shall be started immediately following conditioning. Unless otherwise indicated, a voltmeter and a load specified by the manufacturer shall be connected so as to operate the micro fuel cell power system at the rated power or with the rated current, and measurements shall be taken for a duration sufficient to be representative of the micro fuel cell power system actual operation. The data shall be recorded at a sampling frequency specified by the manufacturer for the entire duration of the measurement. The measured values reported shall be the mean value of the three measured values obtained by averaging the recorded data sample.

Unless otherwise indicated, the data may be recorded at a sampling rate of once every five seconds or longer for the entire duration of the test. The measured value reported for each sample may be the average of all data recorded during the test. The standard deviation and recorded maximum and minimum values may be recorded.

The tests may be executed in series, using one sample group, or in parallel using different sample groups. Electrical measurements shall be taken at the power interface.

The test report should specify the lot number and serial numbers of the test samples to indicate that the results are representative only of that specific small set of samples.

5.2 Power generation characteristics

5.2.1 Starting duration

a) The purpose of this test is to verify the starting duration of micro fuel cell power systems.

b) After conditioning in accordance with 5.1, the time to reach the lower limit of the rated voltage range defined by the manufacturer shall be measured from the time when the power interface circuit is electrically connected to the constant resistance load specified by the manufacturer. The values of the constant resistance load and the starting duration shall be recorded in the test report.

5.2.2 Rated power test and rated voltage test

a) The purpose of this test is to verify the rated power and the rated voltage of micro fuel cell power systems. The performance of the system includes the micro fuel cell and (optional) primary battery of capacitor as one system.

b) Rechargeable batteries or capacitors (optional) shall be in the fully charged state at the beginning of the test. The test shall be started with the sample with a full internal reservoir or fuel cartridge. If the system cannot deliver the rated power, the test shall be terminated. The test shall run for two hours or until there is insufficient fuel to operate the fuel cell, whichever comes first.

c) The output voltage shall be monitored to see whether it is within the upper and lower limits of the rated voltage range specified by the manufacturer. The rated voltage range specified by the manufacturer shall be indicated in the test report. The load connected and the duration of measurement shall be recorded in the test report.

5.2.3 Power generation test after idle condition

a) The purpose of this test is to verify the performance of micro fuel cell power systems after a period of idle condition.

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