IEC 62282-6-200

Edition 2.0 2012-07

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 micro-piles à combustible – Méthodes d'essai des performances

IEC 62282-6-200:2012

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FOREWORD

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

This second edition cancels and replaces the first edition, published in 2007, and constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

a) changes have been incorporated to make this edition fuel independent:
   - the definition of "fuel" is now consistent with that of IEC/TS 62282-1:2010;
   - the restriction on specific fuels (methanol or methanol/water solution, formic acid, hydrogen, methanol clathrate compound, borohydride compound, butane, etc.). has been lifted;
b) modification of definition of "off-state" to "standby state";

c) in Clause 3, Terms and definitions, for the purposes of this document, IEC/TS 62282-1:2010 applies except for the following terms:

- conditioning;
- micro fuel cell power system;
- standby state; and
- starting duration.

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

FDIS	Report on voting
105/394/FDIS	105/401/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 of the IEC 62282 series, 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,
- withdrawn,
- replaced by a revised edition, or
- amended.

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.

FUEL CELL TECHNOLOGIES –

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

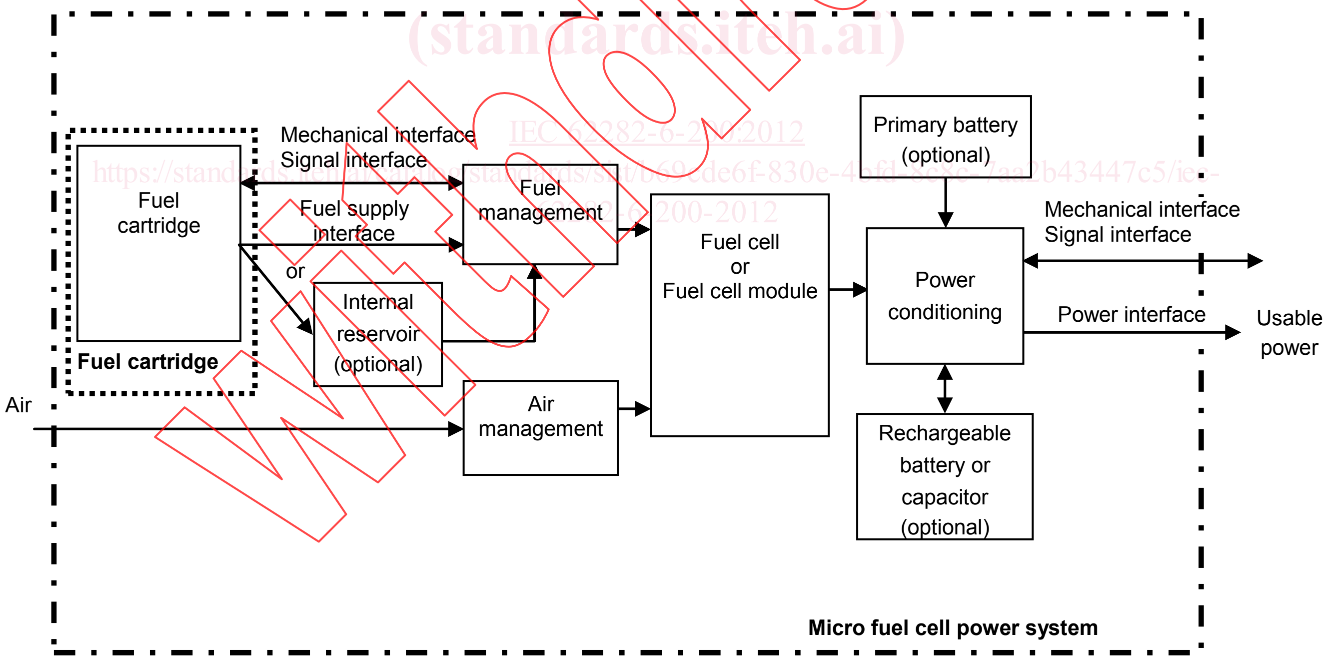
1 Scope

This part of IEC 62282 provides test methods which are required 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 standard describes the performance test methods for power characteristics, fuel consumption and mechanical durability for micro fuel cell power systems with output up to 60 V d.c. and 240 VA. The functional arrangement of a typical example of a micro fuel cell power system, evaluated according to this part of IEC 62282, is shown in Figure 1.

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

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



IEC 1437/12

NOTE Dotted lines represent conceptual boundaries rather than physical ones.

Figure 1 – Typical example of a functional arrangement of a micro fuel cell power system

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) 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 62282-1:2010, *Fuel cell technologies – Part 1: Terminology*

ISO 4677-1, *Atmospheres for conditioning and testing – Determination of relative humidity – Part 1: Aspirated psychrometer method*

ISO 4677-2, *Atmospheres for conditioning and testing – Determination of relative humidity – Part 2: Whirling psychrometer method*

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

3 Terms and definitions

For the purposes of this document, IEC/TS 62282-1:2010 applies except as follows:

3.1
conditioning
operation involving placing the micro fuel cell power system in the standby 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

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 d.c. output voltage and 240 VA output power, and is connected to a hand-held or wearable electronic device such as a laptop computer, mobile phone, PDA, cordless home appliance, TV broadcast camera, autonomous robot, etc., by flexible cord(s) and plug arrangement or termination connectors integrated into the casing of the portable DC electric device

3.3
standby 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

3.4
starting duration
period required for transitioning from the standby state to reach within ±10 % of 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 standard. 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 %.

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 relevant government standard, the industry guideline, or the guideline 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. Refer to ISO 4677-1 and ISO 4677-2 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.

5 Tests

5.1 Test procedure

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 1 h or for the duration specified by the manufacturer in order to observe the characteristics of the micro fuel cell power system during its 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. 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.

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 the conditioning in accordance with 5.1, the time to reach within ± 10 % of the rated voltage defined by the manufacturer shall be measured from the time when the power interface circuit is electrically connected to the constant resistance specified by the

manufacturer. For micro fuel cell power systems with a starting duration shorter than 100 ms, precise measurement may be skipped. If the output voltage is within ± 10 % of the rated voltage defined by the manufacturer when connected, the measurement can be skipped. The value of the resistance 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.

b) The test shall start with the sample with its internal reservoir filled or a full fuel cartridge. Conditioning and measurement shall be performed in accordance with 5.1. If the system cannot deliver the rated power, terminate the test.

c) Data collection and recording shall be performed in accordance with 5.1. 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 disuse

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

b) Rechargeable batteries or capacitors (optional) shall be in the fully charged state at the beginning of the test. Samples shall be conditioned by subjecting them to a period of pre-use, during which they are operated in accordance with 5.1, then put on standby. The minimum duration of pre-use shall be 1 h and the duration of disuse shall be 24 h. The internal reservoir or the fuel cartridge shall be full at the beginning of disuse, and full again at the beginning of the measurement. The output voltage after disuse shall be measured and recorded in accordance with 5.1. The load connected at the measurement and the duration of measurement shall be recorded in the test report.

5.2.4 Power generation test at low and high temperatures

a) The purpose of this test is to verify the performance of micro fuel cell power systems at low and high temperatures.

b) The test temperatures shall be the minimum operating temperature and maximum operating temperature specified by the manufacturer. Rechargeable batteries or capacitors (optional) shall be in the fully charged state at the beginning of the test. The test shall start with the sample with its internal reservoir filled or a full fuel cartridge. The samples shall be conditioned at the test temperature and then measured for output voltage in accordance with 5.1. The test temperatures, the load connected and the duration of measurement shall be recorded in the test report.

5.2.5 Power generation test under low and high humidity conditions

a) The purpose of this test is to verify the performance of micro fuel cell power systems under low and high humidity conditions.

b) The test humidity shall be specified by the manufacturer at a humidity level lower than 20 % relative humidity and at a humidity level higher than 80 % relative humidity. Rechargeable batteries or capacitors (optional) shall be in the fully charged state at the beginning of the test. The test shall start with the sample with its internal reservoir filled or a full fuel cartridge. The samples shall be conditioned at the test humidity and then measured for output voltage in accordance with 5.1. The test humidity, the load connected and the duration of measurement shall be recorded in the test report.

5.2.6 Altitude test

a) The purpose of this test is to verify the performance of micro fuel cell power systems under reduced atmospheric pressure.

b) The test pressure shall be 68 kPa or 10 kPa less, but as close to 68 kPa as possible. Rechargeable batteries or capacitors (optional) shall be in the fully charged state at the beginning of the test. The test shall start with the sample having its internal reservoir full