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# INTERNATIONAL STANDARD



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**Fuel cell technologies –  
Part 6-100: Micro fuel cell power systems – Safety**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## CONTENTS

FOREWORD.....	9
1 Scope.....	12
1.1 General.....	12
1.2 Fuels and technologies covered .....	12
1.3 Equivalent level of safety.....	14
2 Normative references .....	14
3 Terms and definitions .....	15
4 Materials and construction of micro fuel cell power systems, micro fuel cell power units and fuel cartridges .....	19
4.1 General.....	19
4.2 FMEA / hazard analysis.....	19
4.3 General materials.....	19
4.4 Selection of materials .....	19
4.5 General construction .....	20
4.6 Fuel valves.....	20
4.7 Materials and construction – system.....	21
4.8 Ignition sources .....	21
4.9 Enclosures and acceptance strategies.....	22
4.9.1 Parts requiring a fire enclosure.....	22
4.9.2 Parts not requiring a fire enclosure .....	22
4.9.3 Materials for components and other parts outside fire enclosures .....	23
4.9.4 Materials for components and other parts inside fire enclosures .....	24
4.9.5 Mechanical enclosures .....	25
4.10 Protection against fire, explosion, corrosivity and toxicity hazard.....	25
4.11 Protection against electrical hazards .....	26
4.12 Fuel supply construction.....	26
4.12.1 Fuel cartridge construction .....	26
4.12.2 Fuel cartridge fill requirement.....	27
4.13 Protection against mechanical hazards.....	27
4.13.1 Piping and tubing other than fuel lines .....	27
4.13.2 Exterior surface and component temperature limits .....	27
4.13.3 Motors .....	28
4.14 Construction of electric device components.....	29
4.14.1 Limited power sources.....	29
4.14.2 Devices that use electronic controllers.....	30
4.14.3 Electrical conductors/wiring .....	30
4.14.4 Output terminal area.....	31
4.14.5 Electric components and attachments.....	31
4.14.6 Protection.....	31
5 Abnormal operating and fault conditions testing and requirements.....	32
5.1 General.....	32
5.2 Compliance testing.....	32
5.3 Passing criteria .....	33

5.4	Simulated faults and abnormal conditions for limited power and SELV circuits .....	33
5.5	Abnormal operation – electromechanical components .....	33
5.6	Abnormal operation of micro fuel cell power systems or units with integrated batteries .....	34
5.7	Abnormal operation – simulation of faults based on hazard analysis.....	34
6	Instructions and warnings for micro fuel cell power systems, micro fuel cell power units and fuel cartridges .....	35
6.1	General .....	35
6.2	Minimum markings required on the fuel cartridge.....	35
6.3	Minimum markings required on the micro fuel cell power system .....	35
6.4	Additional information required either on the fuel cartridge or on accompanying written information or on the micro fuel cell power system or micro fuel cell power unit.....	36
6.5	Technical documentation .....	36
7	Type tests for micro fuel cell power systems, micro fuel cell power units and fuel cartridges .....	37
7.1	General .....	37
7.2	Leakage measurement of methanol and the measuring procedure.....	38
7.3	Type tests .....	45
7.3.1	Pressure differential tests .....	45
7.3.2	Vibration test .....	47
7.3.3	Temperature cycling test .....	48
7.3.4	High temperature exposure test.....	49
7.3.5	Drop test .....	49
7.3.6	Compressive loading test .....	50
7.3.7	External short-circuit test.....	51
7.3.8	Surface, component and exhaust gas temperature test.....	52
7.3.9	Long-term storage test .....	52
7.3.10	High-temperature connection test .....	57
7.3.11	Connection cycling tests .....	57
7.3.12	Emission test.....	60
	Annex A (normative) Formic acid micro fuel cell power systems.....	65
	Annex B (normative) Hydrogen stored in hydrogen absorbing metal alloy and micro fuel cell power systems.....	97
	Annex C (normative) Reformed methanol micro fuel cell power systems .....	146
	Annex D (normative) Methanol clathrate compound micro fuel cell power systems.....	160
	Annex E (normative) Borohydride micro fuel cell power systems: Class 8 (corrosive) compounds in indirect borohydride fuel cells.....	184
	Annex F (normative) Borohydride micro fuel cell power systems: Class 4.3 (water reactive) compounds in indirect borohydride fuel cells .....	242
	Annex G (normative) Borohydride micro fuel cell power systems: Class 8 (corrosive) compounds in direct borohydride fuel cells.....	300
	Annex H (normative) Butane solid oxide micro fuel cell power systems .....	347
	Bibliography.....	386

Figure 1 – Micro fuel cell power system block diagram.....	13
Figure 2 – Fuel cartridge leakage and mass loss test flow chart for pressure differential, vibration, drop, and compressive loading tests.....	39
Figure 3 – Fuel cartridge leakage and mass loss test flow chart for temperature cycling test and high temperature exposure test .....	40
Figure 4 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for pressure differential, vibration, temperature cycling, drop and compressive loading tests.....	41
Figure 5 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for external short-circuit test .....	42
Figure 6 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for 68 kPa low external pressure test .....	43
Figure 7 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for 11,6 kPa low external pressure test .....	44
Figure 8 – Temperature cycling.....	49
Figure 9 – Fuel cartridge leakage and mass loss test flow chart for long-term storage test ..	56
Figure 10 – Operational emission rate testing apparatus.....	61
Figure 11 – Operational emission concentration testing apparatus.....	61
Figure A.1 – Formic acid micro fuel cell power system block diagram – Replaces Figure 1 .....	65
Figure A.2 – Fuel cartridge leakage and mass loss test flow chart for pressure differential, vibration, drop, and compressive loading tests – Replaces Figure 2 .....	71
Figure A.3 – Fuel cartridge leakage and mass loss test flow chart for temperature cycling test and high temperature exposure test – Replaces Figure 3 .....	72
Figure A.4 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss flow chart for pressure differential, vibration, temperature cycling test, drop, and compressive loading tests – Replaces Figure 4.....	73
Figure A.5 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for external short-circuit test – Replaces Figure 5 .....	74
Figure A.6 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for 68 kPa low external pressure test – Replaces Figure 6.....	75
Figure A.7 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for 11,6 kPa low external pressure test – Replaces Figure 7.....	76
Figure A.9 – Fuel cartridge leakage and mass loss test flow chart for long-term storage test – Replaces Figure 9 .....	83
Figure A.10 – Operational emission rate testing apparatus – Replaces Figure 10 .....	84
Figure A.11 – Operational emission concentration testing apparatus – Replaces Figure 11 .....	85
Figure A.12 – Hydrogen emission test procedure for operating micro fuel cell power system.....	93
Figure B.2 – Fuel cartridge leakage test flow chart for pressure differential, vibration, drop, and compressive loading tests – Replaces Figure 2 .....	108
Figure B.3 – Fuel cartridge leakage test flow chart for temperature cycling test and high temperature exposure test – Replaces Figure 3 .....	109
Figure B.4 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss flow chart for pressure differential, vibration, temperature cycling, drop, and compressive loading tests – Replaces Figure 4.....	110
Figure B.5 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for external short-circuit test – Replaces Figure 5 .....	111

Figure B.8 – Temperature cycling – Replaces Figure 8 .....	121
Figure B.9 – Fuel cartridge hydrogen leakage and mass loss test flow chart for long-term storage test – Replaces Figure 9 .....	132
Figure B.10 – Operational emission rate testing apparatus – Replaces Figure 10 .....	138
Figure B.12 – Hydrogen emission test procedure for operating micro fuel cell power system .....	142
Figure C.1 – General block diagram of a reformed methanol micro fuel cell power system – Replaces Figure 1 .....	146
Figure C.10 – Operational emission rate testing apparatus – Replaces Figure 10 .....	150
Figure C.11 – Operational emission concentration testing apparatus – Replaces Figure 11 .....	151
Figure C.12 – Hydrogen emission test procedure for operating micro fuel cell power system .....	156
Figure D.1 – Methanol clathrate compound micro fuel cell power system block diagram – Replaces Figure 1 .....	160
Figure D.2 – Fuel cartridge leakage and mass loss test flow chart for pressure differential, vibration, drop, and compressive loading tests – Replaces Figure 2 .....	166
Figure D.3 – Fuel cartridge leakage and mass loss test flow chart for temperature cycling test and high temperature exposure test – Replaces Figure 3 .....	167
Figure D.4 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for pressure differential, vibration, temperature cycling, drop and compressive loading tests – Replaces Figure 4 .....	168
Figure D.5 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for external short-circuit test – Replaces Figure 5 .....	169
Figure D.9 – Fuel cartridge leakage and mass loss test flow chart for long-term storage test – Replaces Figure 9 .....	180
Figure D.12 – Fuel cartridge of methanol clathrate compound .....	161
Figure D.13 – Usage of methanol clathrate compound with micro fuel cell power unit .....	161
Figure E.1 – Micro fuel cell power system block diagram for liquid Class 8 (corrosive) borohydride compound fuel with onboard fuel processing – Replaces Figure 1 .....	184
Figure E.2 – Fuel cartridge leakage and hydrogen leakage and test flow chart for vibration, drop, compressive loading – Replaces Figure 2 .....	199
Figure E.3 – Fuel cartridge leakage and mass loss hydrogen leakage test flow chart for temperature cycling test and high temperature exposure test – Replaces Figure 3 .....	201
Figure E.4 – Micro fuel cell power system or micro fuel cell power unit leakage and mass hydrogen gas loss test flow chart for pressure differential, vibration, temperature cycling, drop and compressive loading tests – Replaces Figure 4 .....	203
Figure E.5 – Micro fuel cell power system or micro fuel cell power unit leakage and mass hydrogen gas loss test flow chart for external short-circuit test – Replaces Figure 5 .....	205
Figure E.6 – Micro fuel cell power system or micro fuel cell power unit leakage and mass hydrogen gas loss test flow chart for 68 kPa low external pressure test – Replaces Figure 6 .....	206
Figure E.7 – Micro fuel cell power system or micro fuel cell power unit leakage and mass hydrogen gas loss test flow chart for 11,6 kPa low external pressure test – Replaces Figure 7 .....	207
Figure E.8 – Temperature cycling – Replaces Figure 8 .....	213
Figure E.9 – Fuel cartridge hydrogen leakage and mass loss test flowchart for long-term storage test – Replaces Figure 9 .....	220

Figure E.10 – Operational emission rate testing apparatus – Replaces Figure 10 .....	230
Figure E.11 – Operational emission concentration testing apparatus – Replaces Figure 11 .....	231
Figure E.12 – Hydrogen emission test procedure for operating micro fuel cell power system – Replaces Figure 12.....	237
Figure E.13 – Micro fuel cell power system block diagram for liquid Class 8 (corrosive) borohydride compound fuel with fuel cartridge fuel processing.....	185
Figure E.14 – Micro fuel cell power system block diagram for solid Class 8 (corrosive) borohydride compound fuel with fuel cartridge fuel processing and cartridge fuel management.....	186
Figure E.15 – Micro fuel cell power system block diagram for solid Class 8 (corrosive) compound fuel with cartridge fuel processing and fuel management internal to the micro fuel cell power unit .....	187
Figure E.16 – Fuel cartridge leakage test flow chart for <b>low</b> external pressure test.....	239
Figure F.1 – Borohydride micro fuel cell power system block diagram for Class 4.3 (water reactive) compound fuel in indirect borohydride fuel cell system; fuel management in micro fuel cell power unit – Replaces Figure 1 .....	243
Figure F.2 – Fuel cartridge leakage <b>and hydrogen leakage</b> test flow chart for pressure differential, vibration, drop, and compressive loading tests – Replaces Figure 2 .....	257
Figure F.3 – Fuel cartridge leakage and <b>mass loss hydrogen leakage</b> test flow chart for temperature cycling test and high temperature exposure test – Replaces Figure 3.....	259
Figure F.4 – Micro fuel cell power system or micro fuel cell power unit leakage and <b>mass hydrogen gas</b> loss test flow chart for pressure differential, vibration, temperature cycling, drop and compressive loading tests – Replaces Figure 4 .....	261
Figure F.5 – Micro fuel cell power system or micro fuel cell power unit leakage and <b>mass hydrogen gas</b> loss test flow chart for external short-circuit test – Replaces Figure 5 .....	263
Figure F.6 – Micro fuel cell power system or micro fuel cell power unit leakage and <b>mass hydrogen gas</b> loss test flow chart for 68 kPa low external pressure test – Replaces Figure 6.....	264
Figure F.7 – Micro fuel cell power system or micro fuel cell power unit leakage and <b>mass hydrogen gas</b> loss test flow chart for 11,6 kPa low external pressure test – Replaces Figure 7.....	265
Figure F.8 – Temperature cycling – Replaces Figure 8 .....	271
Figure F.9 – Fuel cartridge <b>hydrogen</b> leakage and mass loss test flow chart for long-term storage test – Replaces Figure 9 .....	278
Figure F.10 – Operational emission rate testing apparatus – Replaces Figure 10 .....	288
Figure F.11 – Operational emission concentration testing apparatus – Replaces Figure 11 .....	288
Figure F.12 – Borohydride micro fuel cell power system block diagram for Class 4.3 (water reactive) compound fuel in indirect borohydride fuel cell system; fuel management in fuel cartridge.....	244
Figure F.13 – Hydrogen emission test procedure for operating micro fuel cell power system.....	295
Figure F.14 – Fuel cartridge leakage test flow chart for <b>low</b> external pressure test.....	297
Figure G.1 – Direct borohydride micro fuel cell power system block diagram – Replaces Figure 1.....	300
Figure G.2 – Fuel cartridge leakage test flow chart for pressure differential, vibration, drop, and compressive loading tests – Replaces Figure 2.....	311

Figure G.3 – Fuel cartridge leakage and mass loss test flow chart for temperature cycling test and high temperature exposure test – Replaces Figure 3 .....	312
Figure G.4 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss flow chart for pressure differential, vibration, temperature cycling, drop, and compressive loading tests – Replaces Figure 4.....	313
Figure G.5 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for external short-circuit test – Replaces Figure 5 .....	314
Figure G.6 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for 68 kPa low external pressure test – Replaces Figure 6.....	315
Figure G.7 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for 11,6 kPa low external pressure test – Replaces Figure 7.....	316
Figure G.8 – Temperature cycling – Replaces Figure 8.....	322
Figure G.9 – Fuel cartridge hydrogen leakage and mass loss test flow chart for long-term storage test – Replaces Figure 9 .....	327
Figure G.10 – Operational emission rate testing apparatus – Replaces Figure 10 .....	336
Figure G.11 – Operational emission concentration testing apparatus – Replaces Figure 11 .....	337
Figure G.12 – Hydrogen emission test procedure for operating micro fuel cell power system.....	344
Figure G.13 – Fuel cartridge leakage test flow chart for low external pressure test .....	317
Figure H.1 – Butane solid oxide micro fuel cell power system block diagram – Replaces Figure 1.....	347
Figure H.2 – Fuel cartridge leakage and mass loss test flow chart for vibration, drop and compressive loading tests – Replaces Figure 2.....	354
Figure H.3 – Fuel cartridge leakage and mass loss test flow chart for temperature cycling test and high temperature exposure test – Replaces Figure 3 .....	355
Figure H.4 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for pressure differential, vibration, temperature cycling, drop and compressive loading tests – Replaces Figure 4.....	356
Figure H.5 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for external short-circuit test – Replaces Figure 5 .....	357
Figure H.6 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for 68 kPa low external pressure test – Replaces Figure 6.....	358
Figure H.7 – Micro fuel cell power system or micro fuel cell power unit leakage and mass loss test flow chart for 11,6 kPa low external pressure test – Replaces Figure 7.....	359
Figure H.8 – Temperature cycling – Replaces Figure 8 .....	365
Figure H.9 – Fuel cartridge leakage and mass loss test flow chart for long-term storage test – Replaces Figure 9 .....	372
Figure H.10 – Operational emission rate testing apparatus – Replaces Figure 10 .....	377
Figure H.11 – Operational emission concentration testing apparatus .....	378
Table 1 – Summary of material flammability requirements.....	23
Table 2 – Temperature limits .....	28
Table 3 – Limits for inherently limited power sources .....	29
Table 4 – Limits for power sources not inherently limited (Over-current protection required).....	30

Table 5 – List of type tests .....	37
Table 6 – Laboratory standard conditions .....	38
Table 7 – Emission limits .....	64
Table A.5 – List of type tests – Replaces Table 5.....	69
Table A.6 – Laboratory standard conditions – Replaces Table 6 .....	70
Table A.7 – Emission limits – Replaces Table 7 .....	94
Table A.8 – Occupational exposure limits .....	94
Table B.5 – List of type tests – Replaces Table 5.....	106
Table B.6 – Laboratory standard conditions – Replaces Table 6 .....	107
Table B.7 – Emission limits – Replaces Table 7 .....	143
Table C.5 – List of type tests – Replaces Table 5 .....	149
Table C.6 – Laboratory standard conditions – Replaces Table 6 .....	150
Table C.7 – Emission limits – Replaces Table 7 .....	157
Table C.8 – Occupational exposure limits .....	157
Table D.5 – List of type tests – Replaces Table 5 .....	164
Table D.6 – Laboratory standard conditions – Replaces Table 6 .....	165
Table E.5 – List of type tests – Replaces table 5.....	195
Table E.6 – Laboratory standard conditions – Replaces Table 6 .....	196
Table E.7 – Emission limits – Replaces Table 7 .....	236
Table F.5 – List of type tests – Replaces Table 5.....	252
Table F.6 – Laboratory standard conditions – Replaces Table 6 .....	253
Table F.7 – Emission limits – Replaces Table 7 .....	294
Table G.5 – List of type tests – Replaces Table 5 .....	308
Table G.6 – Laboratory standard conditions – Replaces Table 6.....	309
Table G.7 – Emission limits – Replaces Table 7.....	343
Table H.5 – List of type tests – Replaces Table 5 .....	352
Table H.6 – Laboratory standard conditions – Replaces Table 6 .....	353
Table H.7 – Emission Limits – Replaces Table 7.....	381
Table H.8 – Occupational exposure limits .....	382



## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FUEL CELL TECHNOLOGIES –Part 6-100: Micro fuel cell power systems –  
Safety

## FOREWORD

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**This consolidated version of IEC 62282-6-100 consists of the first edition (2010) [documents 105/255/FDIS and 105/261/RVD], its amendment 1 (2012) [documents 105/402/FDIS and 105/408/RVD] and its corrigendum of December 2011. It bears the edition number 1.1.**

**The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.**

International Standard IEC 62282-6-100 has been prepared by IEC technical committee 105: Fuel cell technologies

This standard cancels and replaces IEC/PAS 62282-6-1 published in 2006. This first edition constitutes a technical revision.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

How to use this standard:

The subclauses and clauses of the main body of the text are modified, replaced or applied as they are in each of the annexes, which applies to a different technology. Instructions are written in *Italic type*.

- a) For the methanol, and methanol and water fuels covered by Clauses 1 through 7, all requirements are given in Clauses 1 through 7 and the annexes should not be used for these fuels.
- b) For the specific fuels and technologies covered by Annexes A through H, each annex outlines the additional or modified requirements with respect to the requirements contained in Clauses 1 through 7 for certification of such micro fuel cell power systems, micro fuel cell power units and their respective fuel cartridges covered by the specific annex.
- c) Where possible, the numbering system of the annexes corresponds to the numbering of Clauses 1 through 7 and their subclauses. Requirements from Clauses 1 through 7 and their subclauses not specifically addressed in an annex apply to the fuels and technologies covered by that particular annex as written in Clauses 1 through 7.
- d) Where an annex gives specific subclause direction – preceded by the annex letter designator – those specific subclauses in the annex reflect the additional or modified requirements for the fuels and technologies covered by the particular annex and shall be followed for that annex. Any additional subclauses have been assigned new numbers and shall be followed.
- e) Modified or replacement figures or tables have been given modified table or figure designators – based on the figure or table number in Clauses 1 through 7 preceded by the annex letter designator. New figures or tables in the annexes have been given new figure or table designators and shall also be used.

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 the base publication and its amendments 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.

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication or one that replaces an existing Publicly Available Specification (PAS) in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months from the date of publication.

In the meantime, IEC/PAS 62282-6-1 can still be ordered by contacting the local IEC member National Committee or the IEC Central Office.

A bilingual version of this publication may be issued at a later date.

<p><b>IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.</b></p>
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## **FUEL CELL TECHNOLOGIES –**

### **Part 6-100: Micro fuel cell power systems – Safety**

## **1 Scope**

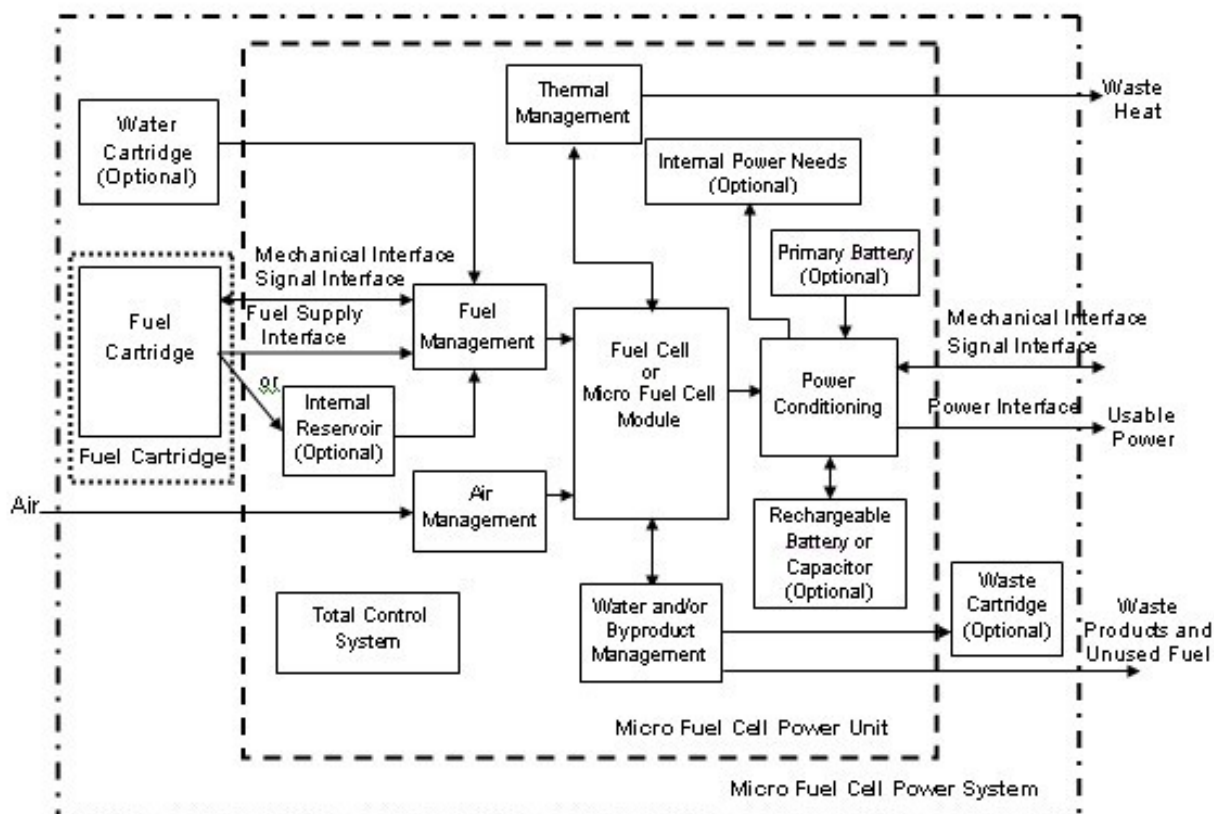
### **1.1 General**

- a) This consumer safety standard covers micro fuel cell power systems, micro fuel cell power units and fuel cartridges that are wearable or easily carried by hand, providing d.c. outputs that do not exceed 60 V d.c. and power outputs that do not exceed 240 VA. Portable fuel cell power systems that provide output levels that exceed these electrical limits are covered by IEC 62282-5-1.
- b) Externally accessible circuitry is therefore considered to be safety extra low voltage (SELV) circuitry as defined in IEC 60950-1:2005, and as limited power circuits if further compliance with 2.5 of IEC 60950-1:2005 is demonstrated. Micro fuel cell power systems or units that have internal circuitry exceeding 60 V d.c. or 240 VA should be appropriately evaluated in accordance with the separate criteria of IEC 60950-1:2005.
- c) This consumer safety standard covers all micro fuel cell power systems, micro fuel cell power units and fuel cartridges. This standard establishes requirements for all micro fuel cell power systems, micro fuel cell power units and fuel cartridges to ensure a reasonable degree of safety for normal use, reasonably foreseeable misuse, and consumer transportation of such items. The fuel cartridges covered by this standard are not intended to be refilled by the consumer. Fuel cartridges refilled by the manufacturer or by trained technicians shall meet all requirements of this standard.
- d) These products are not intended for use in hazardous areas as defined by IEC 426-03-01.

### **1.2 Fuels and technologies covered**

- a) A micro fuel cell power system block diagram is shown in Figure 1.
- b) All portions of this standard, including all annexes, apply to micro fuel cell power systems, micro fuel cell power units and fuel cartridges as defined in Subclause 1.1 above.
- c) Clauses 1 through 7 of this standard cover direct methanol fuel cells using methanol or methanol and water solutions as fuel. Clauses 1 through 7 cover specific requirements for direct methanol fuel cells using proton exchange membrane technologies. Clauses 1 through 7 also cover general requirements applicable to all fuel cell technologies and all fuels covered in Annexes A through H.
- d) Annexes A through H cover fuels and fuel cell technologies as follows.
  - 1) Annex A covers micro fuel cell power systems, micro fuel cell power units and fuel cartridges that use formic acid in water solutions – that are comprised of less than 85 % formic acid by weight – as fuel. These systems and units use direct formic acid fuel cell technologies.
  - 2) Annex B covers micro fuel cell power systems, micro fuel cell power units and fuel cartridges that use hydrogen gas – that has been stored in a hydrogen absorbing metal alloy – as fuel. These systems and units use proton exchange membrane fuel cell technologies.
  - 3) Annex C covers micro fuel cell power systems, micro fuel cell power units and fuel cartridges that convert methanol or methanol and water solutions through a reformer into hydrogen rich methanol reformat – which is then immediately fed to the fuel cell or fuel cell stack – as fuel. These systems and units use proton exchange membrane fuel cell technologies.

- 4) Annex D covers micro fuel cell power systems, micro fuel cell power units and fuel cartridges that use methanol or methanol and water solutions – derived from methanol clathrate compounds – as fuel. These systems and units use direct methanol fuel cell technologies.
- 5) Annex E covers micro fuel cell power systems, micro fuel cell power units and fuel cartridges using hydrogen produced from Class 8 (corrosive) borohydride compounds as fuel. These systems and units use proton exchange membrane fuel cell technologies. The designs may include fuel processing subsystems to derive hydrogen gas from the borohydride compound fuel.
- 6) Annex F covers micro fuel cell power systems, micro fuel cell power units and fuel cartridges using hydrogen produced from Class 4.3 (water reactive) borohydride compounds as fuel. These systems and units use proton exchange membrane fuel cell technologies. The designs may include fuel processing subsystems to derive hydrogen gas from the borohydride compound fuel.
- 7) Annex G covers micro fuel cell power systems, micro fuel cell power units and fuel cartridges that use Class 8 (corrosive) borohydride compounds as fuel. These systems and units use direct borohydride fuel cell technologies.
- 8) Annex H covers micro fuel cell power systems, micro fuel cell power units and fuel cartridges that use butane and butane/propane mixtures – consisting of at least 75 % butane by mass – as fuel. These systems and units use solid oxide fuel cell technologies.



**Figure 1 – Micro fuel cell power system block diagram**

### 1.3 Equivalent level of safety

- a) The requirements of this standard are not intended to constrain innovation. The manufacturer may consider fuels, materials, designs or constructions not specifically dealt with in this standard. These alternatives should be evaluated as to their ability to yield levels of safety equivalent to those prescribed by this standard.
- b) It is understood that all micro fuel cell power systems, micro fuel cell power units and fuel cartridges shall comply with applicable country and local requirements including, but not limited to, those concerning transportation, child-resistance and storage, where required.

## 2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60050-426:2008, *International Electrotechnical Vocabulary – Part 426: Equipment for explosive atmospheres*

IEC 60079-15:2005, *Electrical apparatus for explosive gas atmospheres – Part 15: Construction, test and marking of type of protection 'n' electrical apparatus*

IEC 60086-4, *Primary batteries – Part 4: Safety of lithium batteries*

IEC 60086-5, *Primary batteries – Part 5: Safety of batteries with aqueous electrolyte*

IEC 60695-1-1: *Fire hazard testing – Part 1-1: Guidance for assessing the fire hazard of electrotechnical products – General guidelines*

IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

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IEC 60730-1:1999, *Automatic electrical controls for household and similar use – Part 1: General requirements*  
 Amendment 1 (2003)  
 Amendment 2 (2007)<sup>1)</sup>

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*

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IEC 62133:2002, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications*

IEC 62281:2004, *Safety of primary and secondary lithium cells and batteries during transport*

ISO 175, *Plastics – Methods of test for determination of the effects of immersion in liquid chemicals*

ISO 188, *Rubber, vulcanized or thermoplastic – Accelerated ageing and heat resistance tests*

ISO 1817, *Rubber, vulcanized – Determination of the effect of liquids*

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<sup>1)</sup> There exists a consolidated edition 3.2 (2007) that comprises IEC 60730-1 (1999), its Amendment 1 (2003) and its Amendment 2 (2007).

ISO 7010:2003, *Graphical symbols – Safety colours and safety signs – Safety signs used in workplaces and public areas*

ISO 9772, *Cellular plastics – Determination of horizontal burning characteristics of small specimens subjected to a small flame*

ISO 15649, *Petroleum and natural gas industries – Piping*

ISO 16000-3, *Indoor air – Part 3: Determination of formaldehyde and other carbonyl compounds – Active sampling method*

ISO 16000-6, *Indoor air – Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS/FID*

ISO 16017-1, *Indoor, ambient and workplace air – Part 1: Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography – Part 1: Pumped sampling*