105/121/CDV

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Titre :

Title : IEC 62282-3-3: Fuel cell technologies - Part 3-3: Stationary fuel cell power systems - Installation

Note d'introduction

Introductory note

In agreement with the French national committee this document is circulated as an English only CDV. The French national committee will provide the French version at a later date.

ATTENTION VOTE PARALLÈLE CEI – CENELEC	ATTENTION IEC – CENELEC PARALLEL VOTING
L'attention des Comités nationaux de la CEI, membres du CENELEC, est attirée sur le fait que ce projet de comité pour vote (CDV) de Norme internationale est soumis au vote parallèle. Un bulletin de vote séparé pour le vote CENELEC leur sera envoyé par le Secrétariat Central du CENELEC.	The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) for an International Standard is submitted for parallel voting. A separate form for CENELEC voting will be sent to them by the CENELEC Central Secretariat.

Project IEC 62282-3-3 Ed. 1.0
Fuel Cell Technologies – Part 3-3:

Stationary Fuel Cell Power Systems - Installation -

CDV

IEC TC105, WG#5

Contents:

1. Foreword

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the 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 National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.
International Standard IEC 62282-3-1 Fuel cell technologies - Part 3-1: Stationary fuel cell power systems - Safety has been prepared by IEC technical committee 105: Fuel cell technologies.
The text of this standard is based on the following documents:

FDIS	Report on voting
105/XX/FDIS	105/XX/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.
IEC 62282 consists of the following parts under the general title Fuel cell technologies:
Part 1: Terminology
Part 2: Fuel cell modules
Part 3: Stationary Fuel Cell Power Systems – Safety
Part 4: Stationary fuel Cell Power Systems – Performance
Part 5: Stationary Fuel Cell Power Systems – Installation
The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be reconfirmed; withdrawn; replaced by a revised edition, or amended.
A bilingual version of this publication may be issued at a later date.

2. Introduction

This document covers the installation of stationary fuel cell power systems that are built in compliance with IEC 62282-3, Stationary Fuel Cell Power Systems - Safety.

The requirements of this standard are not intended to constrain innovation. Installations employing materials and/or methods differing from those detailed in this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

3. Scope

International standard providing minimum safety requirements for installation of stationary fuel cell power systems in compliance with IEC 62282-3-1 Fuel cell technologies - Part 3-1: Stationary fuel cell power systems - Safety and associated interfaces, in particular

- a singular pre-packaged, self-contained power system,
- any combination of pre-packaged, self-contained power systems,
- power systems comprising two or more factory-matched modular components intended to be assembled in the field,
- engineered and field-constructed power systems,

intended for residential, commercial, municipal, and/or industrial use.

The standard applies to the installation of the mentioned systems intended

- for electrical connection to mains directly or with a transfer switch,
- for a stand-alone power distribution system.
- to provide AC or DC power.
- with or without the ability to recover useful heat.
- for operation on:

  a) Natural gas and other methane rich gases derived from renewable (biomass) or fossil fuel sources, e.g. landfill gas, digester gas, coal mine gas.

  b) Fuels derived from oil refining, e.g. diesel, gasoline, kerosene, liquefied petroleum gases such as propane and butane.

  c) Alcohols, esters, ethers, aldehydes, ketones, Fischer-Tropsch liquids and other suitable hydrogen-rich organic compounds derived from renewable (biomass) or fossil fuel sources, e.g. methanol, ethanol, di-methyl ether, biodiesel.

  d) Hydrogen, gaseous mixtures containing hydrogen gas, e.g. synthesis gas, town gas.

Both indoor and outdoor installations are addressed.

The standard does not cover:

- Fuel supply and/or fuel storage systems
- Power connector to the grid
- Portable fuel cell power systems.
- Propulsion fuel cell power systems.
- Transportation and APU (auxiliary power units) applications.

A typical stationary fuel cell power system installation is represented in figure 1.

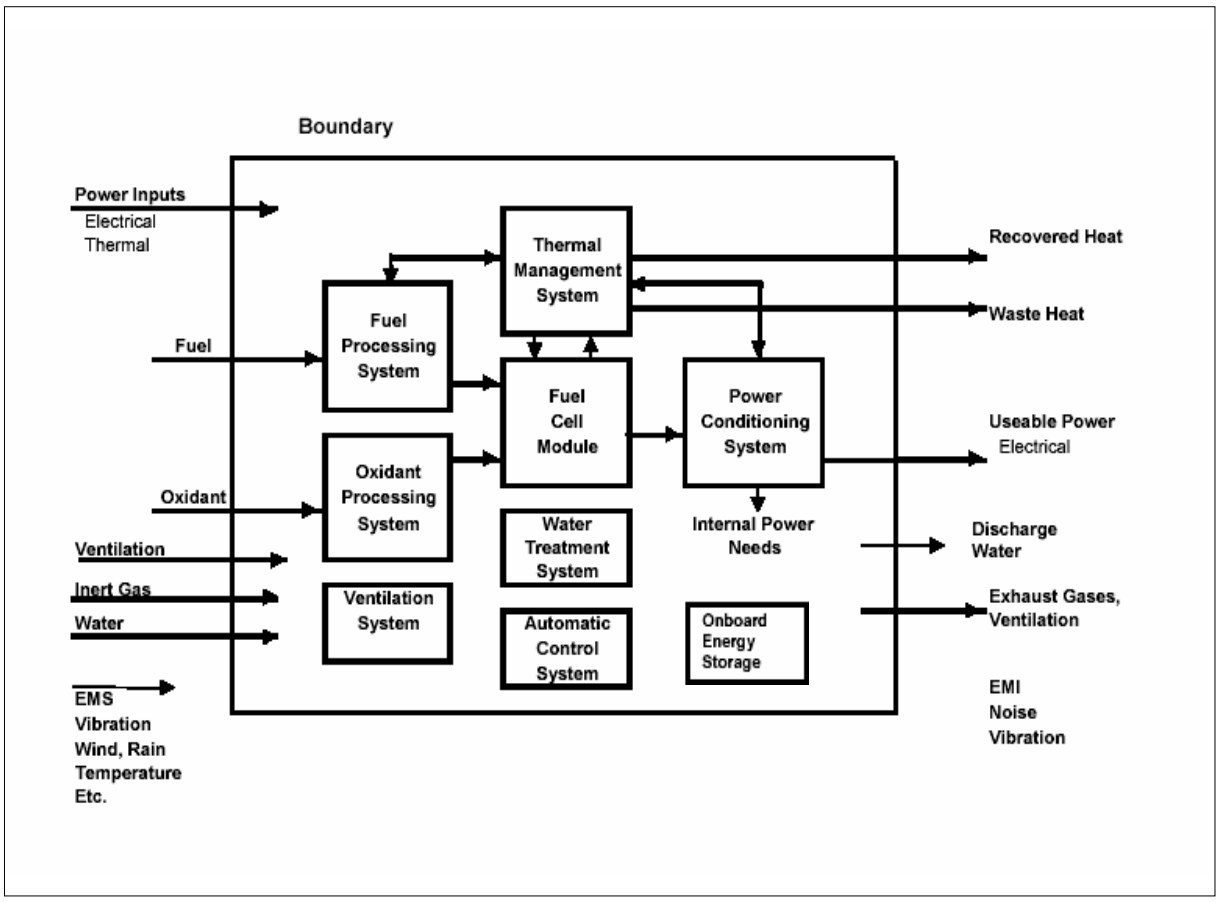

Fig. 1: Fuel Cell Power System

Fuel Cell Power Systems are distinguished into three categories:

- Small Systems
- Medium Systems
- Large Systems

Definition of these systems see chapter 11

4. Normative References

IEC 60079-10 Electrical apparatus for Explosive gas atmospheres – Part 10 Classification of hazardous areas.

IEC 60204-1 Electrical Equipment of Industrial Machines – Part 1: General requirements

IEC 60812 Analysis techniques for system reliability – Procedures for failure mode and effects Analysis (FMEA)

IEC 61025 Fault tree analysis (FTA)

IEC 61511-3 Functional safety – Safety instrumented systems for the process industry sector – Part 3: Guidance for the determination of the required safety integrity levels

IEC 61882 Hazard and operability studies (HAZOP studies) – Application guide

IEC 62282-3-1 Fuel cell technologies - Part 3-1: Stationary fuel cell power systems - Safety

ISO 14121 Safety of machinery – Principles of risk assessment

5. Terms and Definitions

5.1 Accessible: Operator access area. An area to which, under normal operating conditions, one of the following applies:
- access can be gained without the use of a tool;
- the means of access is deliberately provided to the operator;
- the operator is instructed to enter regardless of whether or not a tool is needed to gain access. The terms "access" and "accessible", unless qualified, relate to operator access area as defined above.

5.2 Service access area. An area, other than an operator access area, where it is necessary for service persons to have access with the equipment switched on.

5.3 Approved: Acceptable to the authority having jurisdiction.

5.4 Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

5.5 Automatic Fire Detection System. A fire detection system that senses the presence of fire, smoke, or heat and activates a sprinkler system or an automatic alarm system.

5.6 Automatic Fire Sprinkler System. A sprinkler system of pipes with water under pressure that allows water to be discharged when a sprinkler head operates.

5.7 Biogas Fuel Cell System. A fuel cell system comprised of a conventional biogas source, such as an agricultural biogas plant or a landfill gas site or municipal sewage digester site, a fuel cell specific gas cleanup unit, and a fuel cell power system.

5.8 Digester Gas. The biogas derived by fermentation of organic material, such as sewage, animal and food waste and industrial organic materials.

5.9 Direct-Vented System. A venting system by which all air for combustion is obtained from the outside atmosphere, and all exhaust air/gases are discharged to the outside atmosphere.

5.10 Duct System. A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, fans, and accessory air-managing equipment and appliances.

5.11 Engineered and Field-Constructed Fuel Cell Power System. A fuel cell power system that is not preassembled or does not have factory-matched components.

5.12 Exhaust. Gases removed from a fuel cell power system and not reused.

5.13 Exhaust System. A gas-conveying system for moving gases from a source to a point of discharge.

5.14 Fire Damper. A device, installed in an air distribution system, designed to close automatically upon detection of heat to interrupt migratory airflow and to restrict the passage of flame.

5.15 Fire Risk Evaluation. A detailed engineering review of a plant's construction features and operating process conducted to ensure that applicable fire prevention and fire protection requirements for safeguarding life and physical property are met.

5.16 Fire Prevention. Measures directed toward avoiding the inception of fire.

5.17 Fire Protection. Methods of providing for fire control or fire extinguishment.

5.18 Forced Ventilation. The flow of air or gas created by a fan, blower, or other mechanical means that will push or induce the gas stream through a ventilation system.

5.19 Fuel Supply Interface: Interface point at boundary limits of plant, where fuel streams into the fuel cell power plant

5.20 Hazardous Material (Chemical). A substance that, by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful, is likely to cause death or injury.

5.21 Indoor Installation. A fuel cell power system completely surrounded and enclosed by walls, a roof, and a floor.

5.22 Installation
- The location where a fuel cell power system is sited as a unit or built as an assembly.
- The act to install a fuel cell power system

5.23 Interface Point of Delivery: Location, where media will be delivered to or disposed from the fuel cell power plant.

5.24 Landfill Gas. The biogas derived from decomposition of municipal solid waste (landfill).

5.25 Large Systems: Definition see chapter 11

5.26 Lower Explosive Limit (LEL). The lowest concentration of a flammable gas/vapor in air in which explosion is propagated.

5.27 Lower Flammable Limit (LFL). The lowest concentration of a flammable gas/vapour in air in which flame is propagated.

5.28 Medium Systems; definition see chapter 11

5.29 Natural Ventilation. The flow of air or gases created by the difference in the pressures or gas densities between the outside and inside of a vent, room, or space.
5.30 Non-combustible. Not capable of supporting combustion in accordance with ISO 1182 or equivalent method.
5.31 Outside or Outdoor Installation. A power system installation that is not an indoor installation.
5.32 Portable Fuel Cell Power System.
5.33 fuel cell power system which is intended to be moved while in operation and not fastened or otherwise secure to a specific location
5.34 Pre-Engineered and Matched Modular Components Fuel Cell Power System. A fuel cell power system that has components that are assembled in a factory in separate modules, such as the fuel cell stack, reformer, and inverter. The components are matched in the factory, shipped as modules and are reassembled in the field
5.35 Pre-packaged, Self-Contained Fuel Cell Power System. A fuel cell power system that is designed as one unit, assembled in a factory, and shipped to site.
5.36 Rooftop Installation. A power system installation located on the roof of a building. (This is an outdoor installation, not completely surrounded). Definition delivered by Kelvin
5.37 Room Ventilation Air: Air supply to the room for cooling, heating, makeup atmosphere, safety ventilation. This air can be taken from indoors or outdoors
5.38 Safe Place: A safe place is a location, where the item to be located at, cannot negatively affect other installations, equipment and/or persons.
5.39 Shall. Indicates a mandatory requirement.
5.40 Should. Indicates a recommendation or that which is advised but not required.
5.41 Small Systems; definition see chapter 11
5.42 Smoke Damper. A device that operates automatically, restricts the passage of smoke through a duct, and is controlled by a smoke detector.
5.43 Stationary. Permanently connected and fixed in place.

6. General safety requirements and strategy

The General Safety Strategy of this document is consistent with the Safety Strategy of IEC 62282-3-1 Fuel cell technologies - Part 3-1: Stationary fuel cell power systems - Safety.

The Standard is limited to those conditions that can lead to personnel hazards or damage to equipment or property external to the Fuel Cell System.

Based on the quantity of fuel and other stored energy (e.g. flammable materials, pressurized media, electrical energy, mechanical energy, etc.) within the Fuel Cell Systems there is a need to eliminate potential hazards. The general safety strategy for the installation of the Fuel Cell Systems shall be established according to the following sequence:

- Avoid the possible release of combustible and/or toxic gases and pollutant gases, liquids and solids.

- Eliminate hazards outside the Fuel Cell System and the related installation, when such energy or gases are released nearly instantaneously,

- Provide appropriate safety markings, concerning the remaining risks of hazards.

Hazards
Using the techniques described above, special care shall be taken to address the following:

- Mechanical Hazards -- sharp surfaces, tripping hazards, moving masses and instability, strength of materials, and liquids or gases under pressure

- Electrical Hazards -- contact of persons with live parts, short circuits, high voltage

- Thermal Hazards -- hot surfaces, release of high temperature liquids or gases, thermal fatigue

- Fire and Explosion Hazards -- flammable gases or liquids, potential for explosive mixtures during normal or abnormal operating conditions, potential for explosive mixtures during faulted conditions.

- Malfunction Hazards -- unsafe operation of installation related equipment due to failures of software, control circuit or protective/safety components or incorrect manufacturing or miss-operation

- Material and Substance Hazards -- material deterioration, corrosion, embrittlement, toxic releases, choking hazards (e.g. by superseding, replacing oxygen by inert purge gases)

- Waste Disposal Hazards -- disposal of toxic materials, recycling, disposal of flammable liquids or gases.

- Environmental Hazards -- unsafe operation in hot/cold environments, rain, flooding, wind, earthquake, external fire, smoke.

For medium and large power systems, the preparation for installation process shall ensure that:

- all foreseeable hazards, hazardous situations and events associated with the Fuel Cell System Installation have been identified,

- the risk for each of these hazards has been estimated or derived from the combination of probability of occurrence of the hazard and of its foreseeable severity. Guidance may be found at ISO 14121, IEC 61882, or IEC 61511-3 as applicable, or equivalent.

- the probability and severity of each risk have been reduced as far as practicable,

- the necessary protection measures in relation to risks that cannot be eliminated have been taken (provision of warning and safety devices),

A safety analysis for safety shutdown systems, that have otherwise not been evaluated or certified by a third party, e. g. ancillary site equipment and interfaces to the approved FCPS, shall be performed.

7. Siting Considerations

7.1 General Siting

The fuel cell power system shall comply with IEC 62282-3-1 Fuel cell technologies - Part 3-1: Stationary fuel cell power systems - Safety.

A fuel cell power system(s) and associated equipment, components, and controls shall be sited and installed in accordance with the manufacturer’s instructions and meet the following requirements:

- It shall be placed and fixed firmly so that it will not be easily moved, toppled, or dislocated.

- It shall be located and secured as necessary so that the system and equipment will not be adversely affected by wind, and seismic events. It shall be protected so as not to be adversely affected by rain, snow, ice, water and or freezing temperatures, unless the system and installation equipment is designed for those conditions.

- Sites for medium and large power systems shall be protected against access by unauthorized persons commensurate with the location and installation environment. Fire department access shall be provided.

- It shall be located outside of potentially hazardous atmospheres as defined by IEC 60079-10 (Electrical Apparatus for Explosive Gas atmospheres – Part 10: Classification of hazardous Areas), unless listed and approved for the specific installation.

- It shall be sited so that the power system and equipment do not adversely affect building exits.

- It shall be located so that the power system(s) and components of a fuel cell power system and their respective vent or exhaust terminations are separated from doors, windows, outdoor intakes, and other openings into a building to prevent introduction of exhaust gases into the building.

- The exhaust outlet(s) shall not present a hazard when directed onto walkways or other paths of travel for pedestrians.

- It shall be located in a manner that allows service, maintenance, and emergency access.

- It shall be located away from combustible materials, high-piled stock, and other exposures to fire hazards. Distances and clearance according to manufacturer's installation instructions.

- It shall be located or protected to prevent physical damage from moving vehicles or equipment.
- Multiple power systems shall be located such that a fire or failure of one of the systems does not present an safety hazard to adjacent power systems.

- Where demonstrated by an engineering analysis that the prescriptive requirements in this section are unnecessary to achieve an equivalent level of safety, approved alternatives shall be permitted by Authority Having Jurisdiction

- Discharged liquids shall be disposed according AHJ.

7.2 Outdoor Installations.

7.2.1 Air intakes to a fuel cell power system shall be located so that the plant is not adversely affected by other exhausts, gases, or contaminants. Air intakes to a fuel cell power system shall be kept unobstructed so their flow capacity is not affected by agglomeration of solids, dust, water, ice and snow.

7.2.2 Air intakes and exhaust to and from a fuel cell power system shall not impact travel on walkways or other paths of travel for pedestrians.

7.2.3 The exhaust outlet(s) from process areas or areas that contain fuel-bearing components of a fuel cell power system including outlets from relief valves shall be located in such a manner that it will not affect heating, ventilating, and air-conditioning (HVAC) air intakes, windows, doors, and other openings into buildings.

7.2.4 The area around outlets from fuel processes or compartments that contain fuel-bearing components and relief valves outlets shall be evaluated in accordance with IEC 60079-10.

7.2.5 Security barriers, fences, landscaping, and other enclosures shall not affect the required airflow into or exhaust out of the fuel cell power system and its components.

7.2.6 Fuel cell power systems located in open-air structures; that is, with partial roof and/or walls, may be considered outdoor installations when permitted by local or national regulations.

7.3 Indoor Installations.

7.3.1 Medium and Large fuel cell power systems

- Indoor medium and large fuel cell power systems and their associated components shall be located in rooms that are protected according to national standards.

7.3.1 Small fuel cell power systems
Small fuel cell power systems shall not be required to have fire rated separations

7.4 Rooftop Installation.

7.4.1 Fuel cell power systems and components located on rooftops shall be installed in accordance with Section 7.2.

7.4.2 The material under and within 30 cm horizontally of a fuel cell power system or component shall be non-combustible or shall be tested or certified to afford an appropriate degree of fire

protection to the roof deck. Exemption is made for fuel cell power systems complying with IEC 62282-3-1, section 5.13.b.

8. Ventilation and Exhaust

8.1 General

8.1.1 All indoor fuel cell power system installations shall be provided with ventilation and exhaust systems as noted below.

8.1.2 The ventilation systems for indoor installations shall be designed to provide a negative or neutral pressure in the room with respect to the building, where the fuel cell power system is located.

8.1.3 The intakes and exits of the ventilation and exhaust systems shall meet the requirements specified in 7.2.1, 7.2.2 and 7.2.3.

8.2 Ventilation

The air that is supplied to the room where the fuel cell power system is located, whether taken from the vicinity of the appliance, an adjacent room or outdoors, may serve as ventilation air, process air or both. This air shall be supplied by either a forced ventilation system or natural ventilation in accordance with the manufacturer's installation instructions.

If forced ventilation is required for safety during normal operation, a control interlock shall be provided to alarm and/or shutdown the fuel cell power system upon loss of ventilation consistent with safety analysis described in section 6.

8.3 Exhaust System

8.3.1 The fuel cell power system shall have a dedicated exhaust system that routes the emissions outdoors.

8.3.2 Small fuel cell power systems may exhaust directly into a utility shed, where they are installed, if the shed

a. is unattached from a building or attached without direct access to the building's occupied areas, and
b. has an interlocked exhaust system that has sufficient flow to assure, under all circumstances, that it will prevent
    1. higher concentrations of air free CO than 300 ppm,
    2. 25% of the relevant LFL, and
    3. oxygen concentrations below 18%.

8.4 Process Purging and Venting.

8.4.1 Pressure tanks and piping intended to be purged, pressure regulators, relief valves, and other potential sources of combustible gas shall be vented to the outside of the building. The clause 7.2.3 shall be obeyed. For small fuel cell systems the purging is permitted into room atmosphere, if it is ensured, that in maximum 25 % of the relevant LFL will not be exceeded and that the atmosphere will not exceed 300 ppm of CO air-free anywhere in the room.

8.4.2 The vent shall be designed to prevent entry of water or foreign objects.

9. Fire Protection and Gas Detection

9.1 Fire Protection and Detection.

9.1.1 Site Fire Protection.

9.1.1.1 If fuel cell power systems are sited at locations that do not have hydrant protection, power systems shall be protected in accordance with a fire risk evaluation.

9.1.1.2 Fuel cell power systems located inside buildings shall be protected in accordance with 9.1.2.

9.1.2 Combustible gas detection

9.1.2.1 A combustible gas detection system shall be installed in the fuel cell power system enclosure or exhaust system or in the room containing fuel cell power system installations. Location of gas detection systems in the room shall be chosen to provide the earliest warning of the combustible gases present.
Location of gas detectors shall be in accordance to IEC 61779 Part 6, Electrical Apparatus for the detection and measurement of flammable gases.
The requirements for the gas sensors are defined in IEC 61779 Part 4

For small fuel cell power systems fuelled with odorized gas the combustible gas detection system is not required.

9.1.2.2 The following criteria for combustible gas detection systems shall be met:
(1) The combustible gas detection system shall be arranged to alarm at 25 percent of the lower flammable limit (LFL) and be interlocked to shut down the power system fuel supply at 60 percent LFL.
(2) The LFL used shall be the lowest flammability limit of the gas or gas mixtures.

9.1.2.3 A combustible gas detector that meets the requirements of 9.1.2.2 shall be provided for all indoor or separately enclosed gas compressors. Exempted are separately enclosed gas compressors, provided room ventilation ensures combustible gas concentrations lower than 25 % LEL.

9.1.2.4 The room or area where the fuel cell power system is installed shall have a hydrogen detector located according 9.1.2.1 if hydrogen is piped into the room or area from outside. The gas detection system shall be arranged to alarm at 25 percent LFL and be interlocked to shut down the power system fuel supply at 60 percent LFL.

9.2 Fire Prevention and Emergency Planning.

A written fire prevention and emergency plan shall be provided as required by and in accordance to national standards.

10. Interconnections with Site Interfaces.

All interconnections including piping, electrical wiring, disconnects and ducting between site interfaces and the fuel cell system shall be in accordance to relevant national standards.

10.1 Connections to Fuel Supplies - General.

The installation and location of the interface point equipment downstream the fuel supply system and the associated fuel piping including the necessary components and their connection to the stationary fuel cell power system shall be in accordance with this chapter.
All gaseous fuel piping covered by this document shall be marked or identified in accordance with a relevant national standard.

10.2 Fuel Shut Off and Piping.

10.2.1 An accessible manual shutoff valve shall be located within 1.8 m upstream the fuel cell power system, unless the power system is enclosed by a fire rated room with a fire resistance rating as described in Section 7.3. In that case, the shutoff valve shall be located outside the room.

10.2.2 A second shutoff valve may be located within the room for maintenance. If this second valve is not provided, the shutoff, located outside the room, shall be a lockable type.

10.2.3 Piping, valves, regulators, or other equipment shall be located so that they are not subject to physical damage or otherwise be protected against physical damage.

10.2.4 For indoor installation of a power system being fed by non-odorized fuel gas mixtures, an automatic shutoff valve interlocked with gas detection shall be located outside the building that houses the power system in accordance with Chapter 7. The gas detection system shall be arranged to alarm at 25 percent LFL and be interlocked to shut down the power system fuel supply at 60 percent LFL.

10.3 Connections to auxiliary media supply and media disposal

Different fuel cell power systems need some auxiliary media supply and disposal for e. g. normal operation, safety reasons, start-up or shutdown procedures, purging or protection against internal damages. Water, nitrogen, carbon dioxide, hydrogen are typical auxiliary media for fuel cell power systems. As storage of these media is not part of the standard, only the interfaces shall be defined.

Combustible auxiliary gases:
A redundant safety system consisting of a quick-action shut-off valve controlled by the fuel cell power system's automatic control system and an accessible second valve with an additional manual operability in the feed line are required in each system for combustible gases.

Non combustible or inert auxiliary gases: Connections according national standards

Water: Tap-water, recycled water. Connection according national standards

Waste water disposal. Connection according national standards

Discharge pipe (not necessarily for small fuel cell systems): Connection according national standards.

11. Plant Sizes

From point of view concerning authority approval procedure three categories of plants with respect to plant size shall be considered:

11.1 Small stationary power systems, less than 10 kWe net electrical output, intended for power supply and/or combined heat and power production with the focus on residential applications supplying single homes, clusters of residential houses, small stores, warehouses, small and medium enterprises, small and medium industry, etc.

Small stationary plants are equipped with a control system enabling at least fully automatic and unattended emergency shut down. Fully automatic operation including regular start-up and shut-down procedures are not required.

Small stationary fuel cell power systems are subject of approval tests as per chapter 14.

11.2 Medium stationary power systems, from 10 kWe up to 500 kWe net electrical output, intended for power supply and/or combined heat and power production in the medium power range. Typical applications are found e.g. in big office buildings, supermarkets, cold-stores, industrial, municipal applications and installations as decentralized combined heat and power production.

Medium stationary power systems mostly are equipped with a fully automated control system including start-up, shut-down and emergency shut-down procedures.

Medium stationary fuel cell power systems are subject of approval tests as per chapter 14 and repeated routine tests as per chapter 15.

11.3 Large stationary power systems, more than 500 kWe net electrical output, intended for power supply and/or combined heat and power production with the focus on industrial, municipal and commercial applications, etc.

Large stationary fuel cell power systems shall be operated by the fuel cell power system automatic control system using electrical and/or thermal requirements from grid or stand alone distribution network for control purposes (optional), which can be superseded by safeguard personnel (not mandatory). These safeguard personnel shall be trained for reacting to the above mentioned hazards and shall be prepared to interact with the automatic control system of the fuel cell plant.

Large stationary fuel cell power systems are subject of approval tests as per chapter 14 and repeated routine tests as per chapter 15.

12. Environmental requirements

Emissions, contaminants, and other environmental loads under normal operation, non-normal and failure modes operation are defined under IEC 62282-3-1 Fuel cell technologies - Part 3-1: Stationary fuel cell power systems - Safety.

Requirements during installation and initial commissioning:
The following emissions during installation and initial commissioning shall not exceed levels as limited by applicable national regulations

- Noise
- Toxic and/or pollutant emissions
- Discharge of construction materials
- Auxiliary materials
- Binder burn out gases

If required by national regulations adequate facilities to reduce emissions during installation and commissioning of the fuel cell system have to be provided and operated.

13. Approval Tests

13.1 Gas Leakage

A gas leakage test is required for site installed piping only. The gas leakage test shall be performed according to relevant national standards.

13.2 Site specific shutdown devices

Shutoff devices required by

- 8.2.1 and 8.2.3 (forced ventilation)
- 8.3.1 (forced exhaust)
- 9.1.5.1 and 9.1.5.2. (combustibility sensor)
- 9.1.5.4 (hydrogen sensor)
- 10.2 (hydrogen shutoff valve)

shall be demonstrated to function properly.

14. Repeated Tests

Repeated tests of site-installed items as required for normal periodic maintenance will be performed according to manufacturer’s instructions and national regulations.

15. Documentation

15.1 Markings and Instructions

User Interface Markings. Where user interfaces are located up to a fuel cell power system or on a remote control unit connecting to the fuel cell power system, the input devices must be clearly identifiable in a local language. Any emergency devices must be marked following the local or national regulations.

15.2 Inspection checklist

15.2.1 An inspection checklist shall be included within the documentation package or contained within the installation manual. The inspection checklist shall be kept by the owner of the facility.

15.2.2 The installation checklist shall bear the following information:

- Installer's Company Name
- Installer's Name
- Date of Installation
- Location of Fuel Cell Power System Installation

15.2.3 The installation checklist shall include confirmation by signature of the installer of the proper installation of the following:

- Fuel supply connection requirements as prescribed in section 10.2
- Gas leakage test results as prescribed in section 14.1
- Connections to auxiliary equipment as prescribed in section 10.3
- Ventilation connections, construction, and testing of ventilation interlock as prescribed in section 8.1
- Exhaust connections, construction, and testing of ventilation interlock as prescribed in section 8.3
- Electrical Connections and grounding shall be as prescribed in section 14.2.
- External Safety Sensors as Applicable in section 9.1.5
- Process purge connections that are required by section 8.4

15.3 Installation manual

15.3.1 Reference is made to IEC 62282-3-1 Fuel cell technologies - Part 3-1: Stationary fuel cell power systems - Safety. The installation manual shall be supplied with the fuel cell power system and is written in the prevalent local language or multiple languages to include the prevalent local language. The installation manual is kept by the owner of the facility.

15.4 User's information manual

Reference is made to IEC 62282-3-1 Fuel cell technologies - Part 3-1: Stationary fuel cell power systems - Safety. The User's information manual shall be supplied with the fuel cell power system and is written in the prevalent local language or multiple languages to include the prevalent local language. The user's information manual shall be kept by the owner of the facility.

15.5 Maintenance manual

15.5.1 Reference is made to IEC 62282-3-1 Fuel cell technologies - Part 3-1: Stationary fuel cell power systems - Safety. The Maintenance manual shall be supplied with the fuel cell power system and is written in the prevalent local language or multiple languages to include the prevalent local language. The maintenance manual shall be kept by the owner of the facility.

15.5.2 The Maintenance manual shall be amended with maintenance information in particular to site specific equipment.

16. Informative Appendices:

Appendix 1:

Approval Procedures

Small Fuel Cell Power Systems:

Small fuel cell power systems shall be installed according to a Installation/Commissioning Plan defined by the manufacturer/integrator, provided that these systems are type tested according IEC 62282-3-1 Fuel cell technologies - Part 3-1: Stationary fuel cell power systems - Safety, and approved by the AHJ.

It is proposed that a general approval for installation/erection/commissioning and operation shall be given by the AHJ based upon product certification so, that an additional individual approval shall be not necessary, provided the system is serial manufactured and identical to the type tested one.

Medium Fuel Cell Power Systems:

Medium fuel cell power systems shall be installed according to a Installation/Commissioning Plan defined by the manufacturer/integrator. It is proposed, that they shall be indicated for operation to the approval authority only, provided that these systems are type tested according IEC 62282-3-1 Fuel cell technologies – Part 3-1: Stationary Fuel Cell Power Systems – Safety, and approved by the AHJ.

It is proposed that a general approval for installation/erection/commissioning and operation shall be given by the AHJ based upon product certification; an additional individual approval shall be not necessary any more, provided the system is serial manufactured and identical to the type tested one.

Medium stationary fuel cell power systems shall be subject of repeated routine tests described under chapter 14.

Large Fuel Cell Power Systems:

It is proposed, that the approval for Installation/Erection of large fuel cell systems shall be given by the AHJ, provided that the fuel cell system, which shall be installed, is compliant with the provisions of IEC 62282-3-1 Fuel cell technologies – Part 3-1: Stationary Fuel Cell Power Systems – Safety, and approved by the AHJ.

The initial commissioning and the later operation of the plant shall be subject of approval by the AHJ under the precondition of the successful performance of the approval tests as described in chapter 13.

Large stationary fuel cell power systems shall be subject of repeated tests described under chapter 14.