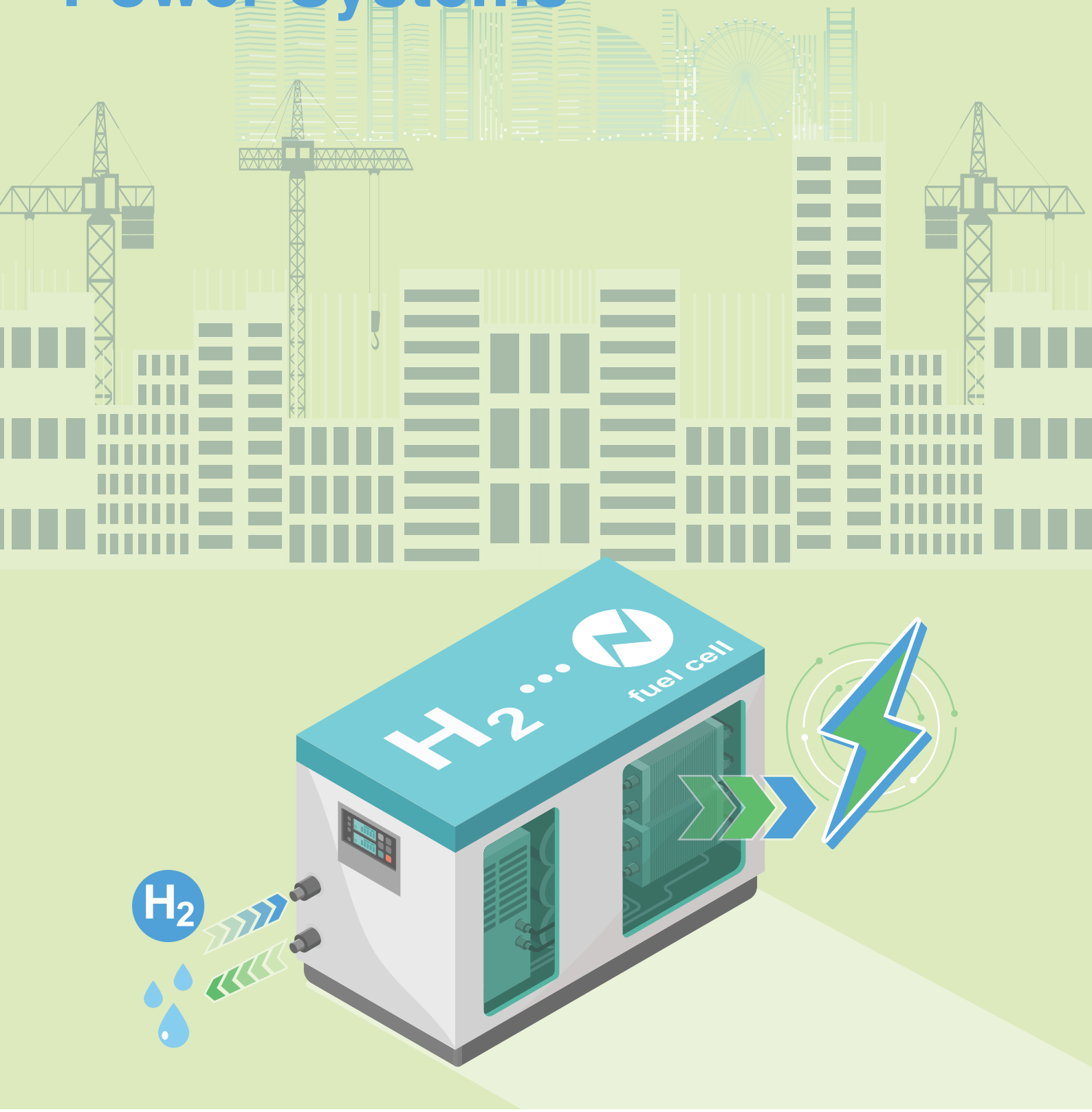
Code of Practice for

Stationary Hydrogen Fuel Cell Power Systems



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Code of Practice

for

Stationary Hydrogen Fuel Cell Power Systems

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Electrical and Mechanical Services Department

PREFACE

This Code of Practice provides guidelines for the siting, design and construction, testing and commissioning, operation, inspection and maintenance of stationary hydrogen fuel cell power systems, as well as incident reporting and investigation, with specific safety requirements for the hydrogen storage/supply system.

The basis of this Code of Practice includes relevant standards from:

- The International Electrotechnical Commission (IEC);
- The National Standards of the People's Republic of China (GB);
- The International Organization for Standardization (ISO);
- The National Fire Protection Association (NFPA); and
- The American Society of Mechanical Engineers (ASME).

While this Code of Practice tends to be specific in important aspects affecting safety and reliability, it should be seen as offering guidance to engineers, operators and other users who should continue to exercise judgement and skill in the fulfilment of their obligations.

Notwithstanding the standards specified in this Code of Practice, equivalent standards, codes or guidance notes that are prevailing and well adopted will be accepted if deemed appropriate by the Electrical and Mechanical Services Department (EMSD).

In addition to the gas safety requirements outlined in this Code of Practice, owners, operators and users of stationary hydrogen fuel cell power systems should also comply with the statutory requirements in Hong Kong.

Content

1. INTERPRETATION OF TERMS

Explosive gas atmosphere – an environment under atmospheric conditions where a flammable substance in the form of gas, vapour or mist mixes with air, and upon ignition, will combust and spread to the entire unburned mixture.

EMSD – the Electrical and Mechanical Services Department of the Government of the Hong Kong Special Administrative Region of the People's Republic of China.

Forced ventilation – the movement of air and its replacement with fresh air by mechanical means.

Hydrogen fuel cell power system – a generator system that uses a hydrogen fuel cell module to generate electric power.

Pressure Swing Adsorption (PSA) – the extraction of hydrogen from hydrogen-rich gaseous mixture (e.g. town gas), which is purified via a PSA system.

High-pressure gaseous hydrogen storage – the storage of gaseous hydrogen in specially designed pressure vessels at pressures ranging from 10 to 100 MPa.

Hydrogen storage/supply system – an equipment that stores hydrogen fuel and supplies and delivers it to a hydrogen fuel cell power system.

Indoor installation – a power system completely surrounded and enclosed by walls, a roof and a floor.

Micro hydrogen fuel cell power system – a portable hydrogen fuel cell power system with a DC output voltage not exceeding 60V and an output power not exceeding 240W. Refer to GB/T 23751.1 for details.

Natural ventilation – the movement of air and its replacement with fresh air due to the effects of wind and/or temperature gradients.

Outdoor installation – a power system installation that is not an indoor installation. An open-air structure with a partial roof and/or walls may be considered an outdoor installation.

Potentially hazardous atmosphere – an area where an explosive gas atmosphere may be formed due to process operations, equipment failure or substance release.

Propulsion hydrogen fuel cell power system – a hydrogen fuel cell power system designed to supply power to vehicles or other propulsion devices.

Stationary hydrogen fuel cell power system (SHFCPS) – a hydrogen fuel cell power generation system that is fixed in place while in operation. This includes both permanent fixed type and skid mounted type using proton exchange membrane fuel cell (PEMFC) technology for power generation.

2. OBJECTIVES AND SCOPES

2.1 Objectives

2.1.1. This Code of Practice provides a general outline of the minimum safety requirement to be followed when using the Stationary Hydrogen Fuel Cell Power Systems (SHFCPS). It aims to protect the health and safety of relevant personnel and ensure the safe operations of SHFCPS.

2.2 Scope

2.2.1 This Code of Practice outlines the safety requirements for SHFCPS and the associated hydrogen storage/supply system, including site selection, design and construction, testing and commissioning, operation, inspection and maintenance, incident reporting and investigation.

2.2.2 This Code of Practice is applicable to the SHFCPS with a capacity of less than 1 megawatt (MW) using proton exchange membrane fuel cells (PEMFCs) for power generation. For the SHFCPS with a capacity exceeding 1MW, separate consultation with the EMSD is required.

2.2.3 This Code of Practice does not cover:

a) Micro hydrogen fuel cell power systems; and

b) Propulsion hydrogen fuel cell power systems.

A schematic diagram of the SHFCPS covered by this Code of Practice is shown in Appendix A, and the SHFCPS and the hydrogen storage/supply system can be configured either as separate systems or as a single integrated unit within the same enclosure.

2.3 Regulations and References

2.3.1 The SHFCPS shall comply with the local statutory safety requirements. Particular reference should be made to the following ordinances and regulations where applicable:

- Gas Safety Ordinance (Cap. 51)
- Construction Sites (Safety) Regulations (Cap. 59I)
- Fire Services Ordinance (Cap. 95)
- Buildings Ordinance (Cap. 123)
- Dangerous Goods Ordinance (Cap. 295)

- Noise Control Ordinance (Cap. 400)
- Electricity Ordinance (Cap. 406)
- Occupational Safety and Health Ordinance (Cap. 509)
- Buildings Energy Efficiency Ordinance (Cap. 610)

2.3.2 This Code of Practice makes reference to the following publications (latest editions of these publications should be used in each case):

IEC – International Electrotechnical Commission

IEC 60079: *Explosive atmospheres – ALL PARTS*

IEC 60204-1: *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60335-1: *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60529: *Degree of protection provided by enclosures (IP Code)*

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

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

IEC 61000-3-3: *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤16 A per phase and not subject to conditional connection*

IEC TS 61000-3-4: *Electromagnetic compatibility (EMC) – Part 3-4: Limits – Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 16 A*

IEC TS 61000-3-5: *Electromagnetic compatibility (EMC) – Part 3-5: Limits – Limitation of voltage fluctuations and flicker in low-voltage power supply systems for equipment with rated current greater than 75 A*

IEC 61000-3-11: *Electromagnetic compatibility (EMC) – Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤75 A and subject to conditional connection*

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

IEC 61000-6-2: *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

IEC 61000-6-3: *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for equipment in residential environments*

IEC 61000-6-4: *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61010-1: *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

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

IEC 62282-3-100: *Fuel cell technologies – Part 3-100: Stationary fuel cell power systems – Safety*

IEC 62282-3-300: *Fuel cell technologies – Part 3-300: Stationary fuel cell power systems – Installation*

GB – National Standards of the People's Republic of China

GB 7231: *Basic identification colors and code indications and safety sign for industrial pipelines*

GB 50177: *Design code for hydrogen station*

GB 50156: *Technical standard of fuelling station*

GB 50516: *Technical code for hydrogen fuelling station*

GB/T 24499: *Technology glossary for gaseous hydrogen, hydrogen energy and hydrogen energy system*

GB/T 24554: Performance test methods for fuel cell system

GB/T 26779: Hydrogen fuel cell electric vehicle refueling receptacle

GB/T 26990: Fuel cell electric vehicles – Onboard hydrogen system technical specifications

GB/T 27748.1: *Stationary fuel cell power systems–Part 1: Safety*

GB/T 27748.3: *Stationary fuel cell power system–Part 3: Installation*

GB/T 29729: *Essential requirements for the safety of hydrogen systems*

GB/T 34583: *Safety technical requirements for hydrogen storage devices used in hydrogen fuelling station*

GB/T 34542.1: *Storage and transportation systems for gaseous hydrogen–Part 1: General requirements*

GB/T 35544: *Fully-wrapped carbon fiber reinforced cylinders with an aluminum liner for the on-board storage of compressed hydrogen as a fuel for land vehicles*

GB/T 42612: *Fully-wrapped carbon fiber reinforced cylinders with a plastic liner for the on-board storage of compressed hydrogen as a fuel for land vehicles*

GB/T 42857: *Safety of pressure swing adsorption systems for hydrogen purification*

GB/T 43674: *General requirements of hydrogen fueling stations*

NFPA – National Fire Protection Association

NFPA 2: Hydrogen Technologies Code

NFPA 68: Standard on Explosion Protection by Deflagration Venting

NFPA 853: *Standard for the installation of stationary fuel cell power systems*

ISO – International Organization for Standardization

ISO 4126-1: *Safety devices for protection against excessive pressure – Part 1: Safety valves*

ISO 4126-2: *Safety devices for protection against excessive pressure – Part 2: Bursting disc safety devices*

ISO 14687: *Hydrogen fuel quality – Product specification*

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

ISO 17268: Gaseous hydrogen land vehicle refuelling connection devices

ISO 19880-3: *Gaseous hydrogen – Fuelling stations – Part 3: Valves*

ISO 19881: *Gaseous hydrogen – Land vehicle fuel containers*

ISO 19882: *Gaseous hydrogen – Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers*

ISO/TS 19883: *Safety of pressure swing adsorption systems for hydrogen separation and purification*

ISO 26142: *Hydrogen detection apparatus – Stationary applications*

ASME – American Society of Mechanical Engineers

ASME B31.3: *Process Piping*

ASME B31.12: *Hydrogen Piping and Pipelines*

ASME *Boiler and pressure vessel code*

SAE – Society of Automotive Engineers

SAE J2600: *Compressed Hydrogen Surface Vehicle Fueling Connection Devices*

British Standards

BS 476: Fire tests on building materials and structures

BS EN 14994: Gas explosion venting protective systems**BS EN/IEC 62305:** Protection against lightning

BS 7671: Requirements for Electrical Installations – IET Wiring Regulations

BCGA CP4: *Gas supply and distribution systems (excluding acetylene)*

Codes of Practice in Hong Kong

Code of Practice for Hydrogen Fuelled Vehicles and Maintenance Workshops (issued by the EMSD)

Code of Practice for Hydrogen Filling Stations (issued by the EMSD)

Code of Practice for the Electricity (Wiring) Regulations (issued by the EMSD)

Guidance Note on Quantitative Risk Assessment Study for Hydrogen Installations in Hong Kong (issued by the EMSD)

Code of Practice for Fire Safety in Buildings (issued by the Buildings Department (BD))

Codes of Practice for Minimum Fire Service Installations and Equipment and Inspection, Testing and Maintenance of Installations and Equipment (issued by the Fire Services Department)

Safety Handbook for Construction Site Workers (issued by the Labour Department)

Hong Kong Planning Standards and Guidelines (issued by the Planning Department)

2.3.3 Apart from the above standards, other equivalent international or national standards may be acceptable.

3. TECHNICAL INFORMATION SUBMISSION REQUIREMENTS

3.1 General

3.1.1 Prior to the installation of a SHFCPS, the following hydrogen safety-related information should be submitted to the EMSD for consideration:

- General Risk Assessment (GRA) Report or Quantitative Risk Assessment (QRA) Report (Refer to Section 3.2);
- A compliance check report to confirm that the requirements in Section 5 have been met;
- Type test reports of the hydrogen fuel cell components and the SHFCPS;
- Overall site layout plan with detailed dimensions specified;
- Elevation and sectional views of the SHFCPS and the hydrogen storage/supply system with all key dimensions specified;
- Specifications, past references (if any) and expected service life of the SHFCPS;
- Determination and zoning of hazardous areas;
- Piping layout;
- A list of major components in the SHFCPS and the hydrogen storage/supply system. For electrical apparatus, the type of protection appropriate for the respective hazardous zones should be indicated;
- Layout plan showing the positions of hydrogen detectors and emergency devices/switches;
- Operating principles of safety control systems, including the alarm settings of the hydrogen detectors;
- Installation details of the hydrogen storage/supply system;
- Plans showing the fire service installations;
- Plans showing the ventilation arrangements for the SHFCPS;
- Electrostatic discharge prevention measures;
- Explosive atmosphere (Ex) certificates for the relevant electrical apparatus;
- Quality certification for hydrogen storage containers and pressure vessels;
- Design and calculation of the lightning protection system;

- Training programmes and course content for equipment operation and maintenance personnel;
- Sources of hydrogen supply, composition, quality requirements, quantities supplied and transportation routes;
- Operations and maintenance manual;
- Isolation procedures;
- Site security arrangement;
- Fire prevention and emergency response plan;
- Testing and commissioning procedures and programme; and
- Other relevant information as requested.

3.1.2 Upon completion of all installation works and before the SHFCPS is put into operation, the following information should be submitted to the EMSD for consideration:

- A compliance check report to confirm that the requirements in Section 6 (Testing and Commissioning) have been met;
- Test reports for the SHFCPS;
- Test reports for the hydrogen storage/supply system;
- Pipework pressure test report;
- Earthing impedance report;
- Electrical testing certificate for bonding and grounding;
- Test report for emergency shutdown system;
- Test report for hydrogen detectors;
- Work completion certificate for fixed electrical installations (WR1); and
- Other relevant information as requested.

3.2 Risk Analysis or Assessment Report

3.2.1 A GRA Report or QRA report should be included in the submitted information as stated in Section 3.1.1.

3.2.2 General Risk Assessment Report

3.2.2.1 A GRA should be conducted if the following conditions are met:

a) the water capacity per cylinder of the hydrogen storage system does not exceed 165 litres and the working pressure does not exceed 35 MPa; and

b) the total number of cylinders does not exceed 18.

3.2.2.2 The GRA report is required to:

a) identify all hazards associated with the use of SHFCPS and the hydrogen storage/supply system;

b) conduct risk assessment of the identified hazards in (a) above; and

c) eliminate or mitigate all risks to an acceptable level through the following ways:

1） improve the safety design;

2） apply passive safety measures (such as using safety partitions, exhaust valves, thermal insulation materials, etc.) or safety controls to shut down the SHFCPS without endangering the surroundings; or

3） take safety actions such as using warning labels or providing special training to ensure that operational and maintenance personnel fully understand these hazards.

3.2.3 Quantitative Risk Assessment Report

3.2.3.1 A QRA report should be submitted if the water capacity per cylinder, the working pressure or the total number of cylinders exceeds the limits stated in Section 3.2.2.1.

3.2.3.2 The QRA report should demonstrate that the risk levels of the SHFCPS and the associated hydrogen storage/supply system comply with the requirements outlined in Section 4.4 (Risk Guidelines), Chapter 12 of the Hong Kong Planning Standards and Guidelines.

3.2.3.3 The QRA report should take into account the hydrogen storage facilities, site topography, meteorological conditions, ignition sources, interaction with other flammable fuels and existing planned population in the vicinity.

3.2.3.4 The QRA report should consider the appropriate design of forced/natural ventilation and the means/placement of hydrogen detection and appropriate contingency measures.

3.2.3.5 The standard approach to conducting the QRA for hydrogen installations should refer to the Guidance Note on Quantitative Risk Assessment Study for Hydrogen Installations in Hong Kong issued by the EMSD.

3.2.4 If major alterations are made to the SHFCPS or operating conditions are changed, such as increase in hydrogen storage capacity, a new GRA or QRA is required.

4. SITING REQUIREMENTS

4.1 General

4.1.1 This section defines the siting requirements of the SHFCPS and its associated hydrogen storage/supply system from a gas safety point of view. The minimum separation distance requirements between the hydrogen storage/supply system and other critical features are also specified.

4.1.2 The SHFCPS, along with its associated hydrogen storage/supply system, should be sited in accordance with the manufacturer's specifications and comply with the general siting requirements as detailed below:

- It should normally be located on ground level;
- It should be located on open ground and positioned in a well-ventilated area for outdoor installation;
- It should be placed and fixed firmly to prevent it from being easily moved, toppled or dislocated during operations;
- The operation of the SHFCPS should not be adversely affected by wind, rain, water, or temperature conditions;
- It should be positioned to allow sufficient space for service, maintenance and emergency access;
- It should be located outside of potentially hazardous atmospheres, as defined by IEC 60079-10-1;
- It should not obstruct the entrances and exits of the building;
- It should be located so that the vent and exhaust outlets of the SHFCPS are away from doors, windows, outdoor air intakes, and other building openings to prevent exhaust gases of the SHFCPS from entering the building;
- The vent and exhaust outlet(s) should not be directed onto walkways or paths used by pedestrians;
- Air intakes of the SHFCPS should be placed to avoid being affected by other exhausts, gases or contaminants;
- Air intakes, vent and exhaust outlets of the SHFCPS should be kept unobstructed to maintain their flow capacity and prevent blockages from materials, plants, dust and water;
- It should be located away from combustible materials and other fire hazards;
- It should be protected to prevent physical damage from moving vehicles;

- When multiple units of SHFCPS are installed together, they should be protected such that a fire or failure of one of the systems does not present a safety hazard to adjacent systems;
- Barriers, fences, landscaping and other enclosures should not affect the required airflow into or exhaust out of the SHFCPS; and
- Other relevant requirements from the local Codes of Practice in Section 2.3.2 should be met.

4.1.3 Separation Distance Requirements

4.1.3.1 Typical hazards/ equipment on the site should be positioned away from the gaseous hydrogen storage, maintaining the minimum separation distances as specified in Table 1.

Table 1: Minimum separation distance between the gaseous hydrogen storage and typical hazards/ equipment (metre (m))

Typical Hazards/ Equipment	Minimum Distance (m)
• Flammable gas cylinder storage; • Fuel gas vent pipes; • Continuous sections of pipelines containing flammable gases or liquids not interrupted by fittings, e.g. valves, unions, flanges, etc.; • Flanges and unions in pipelines containing flammable gases or liquids.	3
• Sources of ignition, e.g. open flames, smoking, welding, electrical operations, etc.; • Bulk flammable liquid storage (excluding LPG); • Wooden structures, small stocks of combustible materials, site huts, work sheds, etc.; • Occupied buildings and areas where people are likely to congregate; • Air intakes (ventilator, compressor and air conditioning); • Railway lines; • Property boundaries.	5
• LPG Storage	8

4.1.3.2 Other inert materials or those that are not explicitly listed in Table 1 may be placed within these minimum separation distances. The measurement of separation distance is detailed in Appendix B.

4.1.4 Indication of Minimum Separation Distances

Minimum separation distances as stated in Table 1 should be clearly indicated by ground markings or other suitable means to alert users if deemed necessary.

4.2 Indoor Installation

4.2.1 For indoor installation of SHFCPS, the plant room should be located on ground level.

4.2.2 The plant room of SHFCPS should be separated from other buildings or boundaries by at least 5m. If it is part of the same building, it must be separated by an imperforated wall with a fire resistance rating of not less than two hours. The plant room should not be located in a building that includes residential accommodation.

4.2.3 The plant room should have an independent exhaust duct and forced ventilation system that provides a minimum of 15 air changes per hour (ACH) upon detecting a maximum 1.0% v/v hydrogen concentration by the hydrogen detection system, as specified in Section 5.7.5. The hydrogen detector and forced ventilation system should be certified in accordance with the explosion protection requirements of the IEC 60079 series standards, GB/T 3836 series standards or other equivalent standards.

5. DESIGN AND CONSTRUCTION

5.1 General

5.1.1 The SHFCPS should be suitable for the environment and conditions of use, taking all factors into account, such as temperature, humidity, material compatibility, operational stability, maintainability and fire safety.

5.1.2 The selection of materials should comply with the following specific requirements:

- The materials used to construct the SHFCPS should not pose any hazards or risks to personal safety or health; and
- Where erosion, abrasion, corrosion or other chemical attacks may arise and impact the system safety, appropriate measures should be implemented to:
  a) Minimise these effects through suitable design or protective measures;
  b) Allow for the replacement of the most affected parts or components; and
  c) Specify the types and frequency of necessary inspections and maintenance, highlighting which parts are subject to wear and the criteria for replacement.

5.1.3 The SHFCPS should be so designed and constructed that they are stable and without the risk of overturning, falling, or unexpected movement.

5.1.4 All moving machines should be designed, constructed and arranged to eliminate hazards to operation and maintenance personnel. Suitable guards or protective devices should be installed to prevent accidental contact of moving parts.

5.1.5 All parts should be securely mounted and rigidly supported. Shock resistant mounts should be used as appropriate.

5.1.6 The SHFCPS should be so designed, constructed, and equipped to eliminate risks to operation and maintenance personnel from gases, liquids, dust, or vapours released during operation or maintenance of the system.

5.1.7 Surface temperatures for parts of the SHFCPS that can be touched should be below 70 degree Celsius. Protective covers or guards should be provided to mitigate risk of accidental contact of the parts exceeding this temperature.

5.1.8 Measures should be implemented to ensure that vented gas is directed through the vent pipe and does not escape through the condensate drain lines.

5.1.9 For SHFCPS and hydrogen storage/supply system forming a single integrated unit within the same enclosure, a partition should be provided to separate the hydrogen storage/supply system from other systems, preventing the ingress of hydrogen from the storage/supply system into other systems in the event of a leak.

5.2 Hydrogen Fuel Cell Power System

5.2.1 The schematic diagram of a typical hydrogen fuel cell power system is shown in the Appendix A, which includes the following major components:

a） Hydrogen Fuel cell stack/module;

b） Hydrogen processing system;

c） Oxidant processing system;

d） Water treatment system;

e） Thermal management system;

f） Power conditioning system;

g） Automatic control system;

h） Ventilation system; and

i） Onboard energy storage device.

5.2.2 Safety Tests

5.2.2.1 The SHFCPS should be tested in an environment at the design conditions.

5.2.2.2 The fuel cell power generation component of the SHFCPS should undergo the following type tests in accordance with GB/T 24554 or equivalent standards:

a) **Air tightness test** (Section 8.8, GB/T 24554-2022): To verify the integrity of the system function that prevents leaks; and

b) **Insulation resistance test** (Section 8.9, GB/T 24554-2022): To assess the effectiveness of insulation in the electrical system.

5.2.2.3 The following tests of the SHFCPS should be conducted in accordance with Section 5 of GB/T 27748.1 or IEC 62282-3-100, either at the factory or using alternative methods on-site, to ensure the product safety:

a) **Leakage test** (Section 5.4.2, GB/T 27748.1): To verify that gas leakage does not exceed the specified limit;

b) **Electrical overload test** (Section 5.7, GB/T 27748.1): To ensure the system is capable to withstand an electrical overload without damage; and

c) **Shutdown parameters test** (Section 5.8, GB/T 27748.1): To verify that the system can automatically shut down under specified design conditions to protect the system.

5.3 Hydrogen Storage/Supply System

5.3.1 Hydrogen Storage System (high-pressure gaseous hydrogen storage)

- The hydrogen storage system and the SHFCPS can be configured as either separate systems or as a single integrated unit within the same enclosure.
- The materials, design, manufacturing, and pre-shipment testing of the hydrogen storage cylinders are required to comply with one of the following requirements, with the respective compliance certificates submitted:
  a) Type approved under United Nations Economic Commission for Europe (UNECE) Regulation No. 134 and the European Parliament and Council Regulation No. 79/2009; or
  b) Designed, manufactured and certified in accordance with one of the following standards: GB/T 35544, GB/T 42612, ISO 19881; or
  c) Approved by the Fire Services Department and listed in the "List of Approved Cylinders or other Containers"; or
  d) Supported by an alternative approval or mechanism that is considered appropriate by the EMSD to demonstrate its safety.
- The cylinders, pipelines, valves, and other attachments in the hydrogen storage system should be securely fixed and protected to prevent damage from collisions.
- The hydrogen storage system should be equipped with the following components:
  - Automatic shut-off valve;
  - Pressure relief device or pressure safety valve;
  - Pressure gauge or pressure sensor with display;
  - Overpressure and low-pressure alarm devices; and
  - Thermally activated pressure relief devices (TPRD).
- The layout of hydrogen pipelines, valves, and fittings from the hydrogen storage system to the SHFCPS should comply with the relevant requirements of ASME B31.3 or ASME B31.12.
- A receptacle should be installed at the hydrogen storage system that is compatible with the nozzle of the dispenser at the hydrogen filling station. The receptacle for hydrogen refilling should conform to one of the following standards:

- United Nations Economic Commission for Europe (UNECE) Regulation No. 134;
- GB/T 26779 Hydrogen fuel cell electric vehicle - refuelling receptacle;
- SAE J2600 Compressed Hydrogen Surface Vehicle Fuelling Connection Devices;
- ISO 17268 Gaseous hydrogen land vehicle refuelling connection devices.

5.3.2 Refilling of Hydrogen Storage System

5.3.2.1 For SHFCPS that utilises a separate hydrogen storage system, the hydrogen storage containers should be either replaced on-site or refilled at a hydrogen filling station or an equivalent facility.

5.3.2.2 For an integrated unit within the same enclosure, the hydrogen storage containers can either be replaced on-site or refilled in a designated on-site area by connecting to external hydrogen containers by means of their pressure differential for hydrogen transfer. The setup of the external hydrogen containers should meet the requirements as specified in Section 5.3.1.

5.3.2.3 The hydrogen refilling process should be included in the operational procedures as specified in Section 7.3.2. The entire refilling process should be executed and closely monitored by trained personnel with the use of a portable hydrogen detector to detect any hydrogen leaks.

5.3.3 Pressure Swing Adsorption (PSA) System

5.3.3.1 For on-site production of hydrogen using PSA system, it should comply with one of the following standards:

- GB/T 42857 Safety of pressure swing adsorption systems for hydrogen purification.
- ISO/TS 19883 Safety of pressure swing adsorption systems for hydrogen separation and purification.

5.3.3.2 The PSA system should equip with fire protection facilities and hydrogen leakage alarm devices.

5.3.4 Liquid Hydrogen Storage System

5.3.4.1 Liquid hydrogen storage system may be used for supplying hydrogen to SHFCPS. The system should comply with relevant national/ international standards. QRA should be performed to demonstrate that the risk levels of the SHFCPS and the associated liquid hydrogen storage system are in compliance with the Hong Kong Risk Guidelines outlined in Chapter 12, Section 4.4 of the Hong Kong Planning Standards and Guidelines.

5.4 Piping System

5.4.1 Pipes and fittings should comply with the relevant requirements of ISO 15649 or equivalent. Pipes and fittings should be designed and manufactured with adequate strength for functioning properly and preventing leakage.

5.4.2 The pipe material should be S31603 grade stainless steel or other materials proven by testing to have good hydrogen compatibility, in accordance with GB 50516, Section 6.5.1.

5.4.3 Standard colours or distinctive markings should be applied to all fuel piping and components, in accordance with GB 7231.

5.4.4 The internal surfaces of both rigid and flexible pipes and fittings should be thoroughly cleaned to remove loose particles. The ends of piping should also be reamed to remove obstructions and burrs.

5.4.5 All external connecting hydrogen pipelines and fittings should be adequately protected to prevent mechanical damage.

5.5 Valves

5.5.1 Shut-off valves

a) Shut-off valves should be installed on all components where they are necessary to contain or block the flow of process fluid during shutdown, testing, maintenance, or in emergency conditions;

b) Shut-off valves should be rated for the service pressure, temperature, and fluid characteristics;

c) Actuators mounted on shut-off valves should be temperature-rated to withstand the local ambient temperature and additional heat conducted from the valve body;

d) Electrically, hydraulically or pneumatically operated shut-off valves should be designed to move to a failsafe position if they lose actuation energy.

5.5.2 The manual shut-off valves for hydrogen supply to the SHFCPS should be installed in easily accessible positions and displayed with shut-off direction indication.

5.5.3 Hydrogen fuel valves

The hydrogen fuel supplied to the SHFCPS should pass through a hydrogen fuel valve set, which consists of at least two automatic valves in series, each of which serves as a safety shut-off valve and may serve as an operating control valve.

5.5.4 The following valves should comply with ISO 19880-3 Gaseous hydrogen – Fuelling stations – Part 3: Valves or an equivalent standard.

- Check / non-return valves;
- Excess flow valves;
- Flow control valves;
- Shut-off valves;
- Manual shut-off valves.

5.5.5 Pressure safety valve (PSV) should comply with ISO 4126-1 Safety devices for protection against excessive pressure – Part 1: Safety valves or an equivalent standard.

5.5.6 Pressure relief devices (PRD) should comply with ISO 4126-2 Safety devices for protection against excessive pressure – Part 2: Bursting disc safety devices or an equivalent standard.

5.5.7 TPRD should comply with ISO 19882 Gaseous hydrogen – Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers or an equivalent standard.

5.6 SHFCPS Exhaust System

5.6.1 The SHFCPS should be equipped with an exhaust system to direct the exhausted air from the hydrogen fuel cell to outdoor.

5.6.2 Exhaust system should comply with the requirements outlined in Section 4.5.3 of GB/T 27748.1 or IEC 62282-3-100, or equivalent, with specific requirements as follows:

- The exhaust system components should be designed to prevent breakage, disassembly, or damage, ensuring safe operation;
- The exhaust pipe should be properly supported and equipped with a rain cap to prevent ingress of rain while ensuring that gas flow is not restricted or obstructed;
- The exhaust system should include a drain point at the lowest point to discharge accumulated water and debris inside the exhaust pipe;
- The exhaust pipe should be leak-tight; and
- The exhaust pipe outlet should be positioned in a safe outdoor location, away from user areas, ignition sources, air intakes and building passages.

5.7 Hydrogen Venting System

5.x7.1 All vent lines from TPRD, PRD and PSV should be connected to hydrogen vent pipes for discharging hydrogen into the atmosphere.

5.7.2 The hydrogen vent pipe diameter should not be smaller than the diameter of the connected TPRD, PRD or PSV outlet, and large enough to ensure that discharged gas flow is not restricted.

5.7.3 The height of hydrogen vent pipe outlet should be extended to 2m above the highest point of the SHFCPS, or 5m above the ground level in an open environment, whichever is higher. Alternately, it could be calculated in accordance with the Clause N6.17.3 of NFPA 2 (2023 Edition) taking into consideration the thermal radiation, impingement distance, the extent of the hazardous area and physical location of the discharge.

5.7.4 The hydrogen vent pipe should also be positioned at least 9m away from operable openings and 15m from air intake of the surrounding buildings. The termination point should have good ventilation to prevent accumulation of gas, and thus avoiding the forming a potentially explosive atmosphere.

5.7.5 The hydrogen vent pipe should be adequately supported to cope with thrust loads created from discharge and external forces created by the weather, such as wind loading.

5.8 Hydrogen Detection System

5.8.1 The hydrogen detectors should comply with the accuracy requirements of ISO 26142 Hydrogen Detection Apparatus – Stationary Applications or equivalent standard.

5.8.2 The hydrogen detector and forced ventilation fan should be certified in accordance with the explosion protection requirements of the IEC 60079 series standards, GB/T 3836 series standards or other equivalent standards.

5.8.3 Alarm signals generated by the hydrogen detectors should be integrated with a remote monitoring system. This system should be configured to transmit alerts to the designated personnel's mobile device.

5.8.4 Hydrogen detectors should be installed at the highest point inside the enclosure(s) of the SHFCPS and the hydrogen storage system, and:

a) Upon detection of 1.0% v/v hydrogen concentration or above, all the following responses should be initiated:

- An audible alarm sounds outside the enclosure;
- A red light flashes outside the enclosure; and

- Forced ventilation of the enclosure set to minimum 15 air changes per hour (ACH).

b) Upon detection of 2.0% v/v hydrogen concentration or above, further response should be initiated:

- Automatically shut off the hydrogen fuel supply and shut down the SHFCPS (except for the forced ventilation fan and other explosion proof equipment, such as emergency equipment, alarms and lights, which may be powered by other electricity supply sources).

5.8.5 For hydrogen storage system and/or SHFCPS installed indoor or inside a storage area, additional hydrogen detectors should be provided and installed above the potential hydrogen accumulation points or at the upper part of the room, and:

a) trigger an audible alarm sound and a red flash light outside the storage area, and activate a forced ventilation system of minimum 15 air changes per hour (ACH) inside the storage area when hydrogen concentration at 1.0% v/v or above; and

b) automatically shut-off the hydrogen fuel supply and shut down the SHFCPS (except for the forced ventilation fan and other explosion proof equipment, such as emergency equipment, alarms and lights, which may be powered by other electricity supply sources) when the hydrogen concentration at 2.0% v/v or above.

5.9 Control Systems and Protective Devices

5.9.1 General

5.9.1.1 The SHFCPS should be designed to ensure that if one component fails, it does not lead to a hazardous situation. To prevent a chain reaction of failures, the following measures should be implemented:

- Protection of mechanical equipment, such as interlocking guards and trip devices that provide protection against overloads and overpressure; and
- Protection of electrical circuits, such as protective interlocks for electrical faults.

5.9.1.2 The control devices of the system should be clearly labelled and designed to prevent accidental adjustment or activation.

5.9.2 System start-up

5.9.2.1 The SHFCPS operation should only be started when all protective devices are in place and fully functional.

5.9.2.2 Appropriate interlocks should be provided to ensure correct sequential starting.

5.9.3 Emergency shutdown

5.9.3.1 The SHFCPS should be equipped with an emergency shutdown system that operates without manual intervention.

5.9.3.2 Emergency shutdown should be provided with the following functions:

- Shut off the main hydrogen supply and electrical power when an internal fault is detected;
- Stop the dangerous conditions without creating additional hazards;
- Initiate protective actions as necessary;
- Override all other functions and operations in all modes of operation;
- Prevent accidental system restart unless the system has been intentionally reset; and
- When an emergency shutdown is triggered, a relevant status signal should be sent to the control system for recording system information.

5.9.4 Normal shutdown

A normal shutdown is an action initiated by the control system to shut off the main fuel supply. During a normal shutdown, power to all electrical equipment should be disconnected, and power be retained only for the control devices of the SHFCPS.

5.9.5 Manual emergency stop

5.9.5.1 At least one manual emergency stop button should be provided in the SHFCPS to activate the emergency shutdown.

5.9.5.2 The manual emergency stop button should be easily identifiable, clearly visible and quickly accessible.

5.10 Protection against Explosion Hazards

5.10.1 The SHFCPS should be assembled to prevent hazards related to the accumulation of flammable atmosphere within the system.

5.10.2 All electrical components and equipment used in hazardous areas should be certified in accordance with the explosion protection requirements of the IEC 60079 series standards, GB/T 3836 series standards or other equivalent standards.

5.10.3 The risk of static discharge should be eliminated through proper bonding and grounding of metallic components.

5.11 Hazardous Areas Classification

5.11.1 Hazardous areas classification should be developed based on IEC 60079-10-1 Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres.

5.11.2 All electrical equipment in hazardous areas should be protected in accordance with the IEC 60079 series (i.e. IEC 60079-0 and other appropriate parts of the IEC 60079) , GB/T 3836 series standards or other equivalent standards. For example, an intrinsically safe electrical system should comply with IEC 60079-0, IEC 60079-11 and IEC 60079-25.

5.12 Electrical Safety

5.12.1 The design and construction of electrical systems, as well as the application of electrical and electronic equipment, should comply with relevant electrical product application standards, including:

- IEC 60335-1;
- IEC 60204-1;
- IEC 60950-1; and
- IEC 62040-1.

5.12.2 All batteries used in the SHCPS, such as the onboard energy storage device and backup power supply should conform to relevant national or international standard.

5.13 Electromagnetic Compatibility (EMC)

5.13.1 The SHFCPS should not generate electromagnetic disturbances exceeding the acceptable levels for its intended application. In addition, the electrical equipment should possess sufficient immunity to electromagnetic disturbances to ensure proper operation within its intended environment. The SHFCPS should comply with the relevant standards: IEC 61000-3-2, IEC 61000-3-3, IEC TS 61000-3-4, IEC TS 61000-3-5, IEC 61000-3-11, IEC 61000-6-1, IEC 61000-6-2, IEC 61000-6-3 and IEC 61000-6-4.

5.14 Enclosures for SHFCPS

5.14.1 The enclosure of SHFCPS should have sufficient strength, rigidity, durability, corrosion resistance and other physical properties to support and protect all components and piping. It should also meet the requirements for storage, transport, installation and final location conditions.

5.14.2 The enclosure, designed for indoor use or weather-protected outdoor locations, should be tested to achieve at least an IP20 rating according to IEC 60529, while the enclosure for outdoor use should meet a minimum IP23 rating.

5.14.3 Enclosures and compartments containing hydrogen equipment should be equipped with forced ventilation systems.

5.14.4 Ventilation openings should be designed to prevent obstruction from dust or vegetation.

5.14.5 Any access panels, covers or insulation that require to be removed for routine maintenance and services should be designed to allow repeated removal and replacement without causing damage or reducing insulation effectiveness.

5.14.6 Access panels, covers or doors intended to protect equipment from unauthorised entry should require a tool, key or similar mechanical means to open.

5.15 Explosion Relief Measures for Hydrogen Storage

5.15.1 Explosion relief measures should be provided for the hydrogen storage enclosure to mitigate the hazards associated with an explosion.

5.15.2 The size and configuration of the explosion relief vents should be determined according to the methodologies outlined in NFPA 68 or BS EN 14994. If calculations are not performed, the total vent area should not be less than either the area of the roof or the area of one of the longest sides of the enclosure.

5.15.3 Explosion relief vents should be installed to direct the pressure wave to a safe location for minimizing associated risks.

5.15.4 The entire explosion relief system should be regularly inspected and maintained to ensure mechanical integrity and unimpeded functionality in the event of an explosion.

5.16 Backup Power Supply

5.16.1 A backup power supply should be provided to the alarm system and the associated hydrogen detectors to maintain the monitoring function when the SHFCPS is shut down.

5.16.2 The backup power supply should be capable of providing continuous power for at least 48 hours. A contingency plan should be formulated, such as upgrade of backup battery, to maintain the function of the alarm system for shutdowns lasting more than 48 hours.

5.17 Earthing and Electrostatic Discharge

5.17.1 Earthing should be provided for the SHFCPS, ensuring electrical continuity covering the SHFCPS, hydrogen storage/supply system, vent stack and all relevant piping.

5.17.2 A fixed electrostatic discharge pole should be installed at the entrance for incoming personnel to eliminate their own static electricity.

5.18 Lightning Protection

5.18.1 Lightning protection comply with BS EN/IEC 62305 should be provided for the SHFCPS and the hydrogen storage/supply system.

5.18.2 The design report of the lightning protection system should be certified by a Registered Professional Engineer or members of professional institutions of relevant disciplines.

5.19 Canopy

5.19.1 If a canopy is required for the protection of the SHFCPS and the hydrogen storage/supply system, it should be designed and approved by a qualified structural engineer and constructed of non-combustible materials.

5.19.2 The interior surface of the canopy should be smooth and sloped outward to prevent the accumulation of hydrogen.

5.20 Security Fence

5.20.1 A protective fence should be installed around the SHFCPS and the hydrogen storage/supply system to restrict unauthorised access and enhance safety. The minimum clearance between the fence and the SHFCPS and its associated storage/supply system shall be 0.6m to allow free access to and escape from the enclosure. Combustible materials should not be used for fencing. The height of the fencing should be at least 1.8m.

5.20.2 If the SHFCPS and the hydrogen storage/supply system are situated in controlled areas with restricted access and appropriate security measures are implemented, the installation for a protective fence may not be required.

5.21 Building Works

5.21.1 For any installation works of SHFCPS which involve building works on private land, unless they are exempted works or minor works, an authorized person[1] should be appointed to submit building plans to the BD in accordance with the Buildings Ordinance. Such building works can only be carried out after obtaining prior approval and consent to the commencement of works from the BD. If the building works involved are minor works, a prescribed building professional[2] and/or a prescribed registered contractor[3] should be appointed to carry out the works through the simplified requirements of the Minor Works Control System under the Buildings Ordinance.

[1] It means a person whose name is on the authorized person's register kept under section 3(1) of the Buildings Ordinance (Cap. 123) – (a) as an architect; (b) as an engineer; or (c) as a surveyor.

[2] A prescribed building professional means an authorized person, a registered structural engineer, a registered geotechnical engineer or a registered inspector under section 2(1) of the Buildings Ordinance (Cap. 123). The appointment of prescribed building professionals in respect of minor works should comply with section 27 of the Building (Minor Works) Regulation (Cap. 123N).

[3] A prescribed registered contractor means a registered general building contractor, a registered specialist contractor or registered minor works contractor under section 2(1) of the Buildings Ordinance (Cap. 123). The appointment of prescribed registered contractor in respect of minor works should comply with section 28 of the Building (Minor Works) Regulation (Cap.123N).

6. TESTING AND COMMISSIONING

6.1 General

6.1.1 The SHFCPS should be tested and commissioned according to its design standards, manufacturer's instructions, and the requirements of this Code of Practice.

6.1.2 All replacement, purging, testing and commissioning work should be carried out by suitably trained personnel.

6.1.3 Fire service installations and equipment should be made available on-site during testing and commissioning. Appropriate personal protective clothing and safety equipment, including handheld/ portable hydrogen detectors, should be used when performing the work.

6.2 Testing and Commissioning Plan

6.2.1 Prior to the actual testing and commissioning work, a plan should be in place to clearly outline all relevant testing activities, procedures and schedules. Factory Acceptance Tests (FAT) and Site Acceptance Tests (SAT) should be indicated in the plan.

6.2.2 The functional and safety tests outlined in Section 6.3 should be carried out on-site as far as practicable.

6.3 Functional and Safety Tests

6.3.1 All components should be tested according to the manufacturer's instructions.

6.3.2 All measuring instruments, including temperature sensors, pressure gauges, pressure sensors and hydrogen detectors, used for testing should be calibrated.

6.3.3 A functional test for the hydrogen detection system should be conducted at its design settings and according to the requirements in Section 5. The test procedures should follow ISO 26142 or other suitable methods.

6.3.4 A functional test for the emergency shutdown system, manual emergency stop devices and normal shutdown system should be conducted according to their design settings and the requirements in Section 5.

6.3.5 Each safety device in the SHFCPS should be checked to ensure it functions according to its design intent.

6.3.6 Electrical continuity for bonding and grounding should be tested.

6.3.7 All pressure bearing parts of the SHFCPS should undergo type tests or FAT prior to installation.

6.3.8 All external hydrogen pipelines of the SHFCPS (both rigid and flexible types) should undergo pressure and leak tests according to the requirements of GB 50516, GB 50177, GB/T 26990 or equivalent methods.

6.3.9 The tests should be of pneumatic type, using nitrogen or helium as the testing medium.

6.3.10 Test pressures and procedures should be based on the design standards of the SHFCPS.

6.4 Purging and Venting Processes

6.4.1 The SHFCPS should be purged with an inert gas, such as nitrogen, prior to filling the system with hydrogen.

6.4.2 When purging, any released gas should be vented to a safe area through the vent system or dedicated discharge points that do not pose a fire and explosion risk.

6.4.3 After the purging, the residual oxygen concentration should be checked to ensure it does not exceed 0.5% v/v.

6.5 Hydrogen Quality Requirements

6.5.1 The hydrogen quality should meet the requirements set by the SHFCPS manufacturer or the quality specified in Table 3 – Category 3 of ISO 14687-2025 or an equivalent standard.

6.5.2 The test report on hydrogen quality provided by the hydrogen supplier should be reviewed before refuelling.

7. OPERATION

7.1 General

7.1.1 Sufficient manpower and resources should be allocated for the operation and maintenance of the SHFCPS.

7.1.2 Operating instructions for all equipment should be established to ensure safe and reliable operation of the SHFCPS.

7.1.3 To prevent hydrogen safety incidents, on-site hydrogen leak checks with a portable hydrogen detector should be conducted in the following circumstances:

- Twice per day;
- Prior to each system startup;
- In any other situations where there is uncertainty about hydrogen leakage.

7.2 Training

7.2.1 System operators and maintenance personnel should receive proper training and possess practical experience.

7.2.2 The training content should include at least the following topics:

- Gas properties of hydrogen and related safety precautions;
- Normal operation procedures of the system;
- Use of safety devices, including hydrogen detectors and emergency shutdowns; and
- Emergency procedures.

7.2.3 Newcomers should be provided with induction training, and regular refresher courses should also be conducted.

7.2.4 Personnel should be required to undergo tests to assess the effectiveness of their training.

7.3 System Operation

7.3.1 Before operating the SHFCPS, all operators should eliminate their own static electricity by using a fixed electrostatic discharge pole or other equivalent devices.

7.3.2 Detailed procedures should be established for system cleaning, purging, leakage monitoring, repair, modification, hydrogen refilling and emergency response, along with regular assessments of their effectiveness.

7.3.3 A safety management system should be established, covering at least the following areas:

- On-site safety management;
- Fire safety management;
- Equipment safety management;
- Personnel safety management;
- Safety inspection;
- Incident handling and reporting; and
- Periodic inspection.

7.3.4 All safety devices in the system are required to be maintained in normal working condition and fully functional at all times.

7.3.5 System operation records should be kept and made available for inspection upon request by the relevant regulatory authorities.

7.3.6 The owner of the SHFCPS should provide the safety data of the SHFCPS as required by the relevant government departments. The data shall be provided in the format and within the timeframe indicated by the concerned government department, including real-time online data. The owner of the SHFCPS should make any necessary arrangements and provisions to facilitate the data transfer.

7.4 Emergency Response

7.4.1 An emergency response plan should be established to cover critical incident scenarios.

7.4.2 An incident reporting mechanism should be implemented, which comprises designated contacts, required actions, and emergency procedures, as referenced in Section 10.

7.4.3 Safety and emergency procedures should be displayed at the following locations:

- Near the hydrogen storage/supply system; and
- Near the SHFCPS.

7.4.4 Safety and emergency procedures should cover at least the following:

- Emergency shutdown procedures; and
- Measures to deal with overpressure in the hydrogen storage system.

7.4.5 In case of hydrogen leakage that leads to fire or personal injury, the following actions should be taken:

- Immediately call emergency services;
- Shut off the gas supply and perform an emergency shutdown of the system; and
- Evacuate all personnel on site.

7.4.6 Emergency drills should be conducted every six months.

8. PERIODIC INSPECTION AND MAINTENANCE

8.1 General

8.1.1 All repair, maintenance, purging, inspection and testing of the SHFCPS should be undertaken by properly trained personnel.

8.1.2 Proper tools and parts should be provided and used.

8.1.3 Maintenance manuals and operating instructions should be provided for maintenance personnel on site.

8.1.4 All test and maintenance records, as well as certificates, should be retained until the end of the equipment's service life or for at least 6 years.

8.2 Inspection and Maintenance

8.2.1 A routine maintenance plan should be established and documented. It should include detailed instructions on maintenance tasks, scope of work, and maintenance intervals. It should also be reviewed and updated as necessary.

8.2.2 The SHFCPS and the hydrogen storage/supply system should be maintained and inspected at least once per year, or according to the intervals specified in the routine maintenance plan or recommended by the manufacturer, whichever is more stringent.

8.2.3 Inspection and maintenance documentation should be reviewed regularly. Any issues identified during inspections should be promptly resolved by trained personnel.

8.2.4 All adjustments, maintenance, repair, cleaning, and servicing should be conducted while the system is not in operation. If these tasks must be conducted while the system is operating, a risk assessment should be carried out to identify the possible risk and necessary precautionary measures.

8.2.5 Safety instructions or diagrams should be displayed using a permanent method.

8.2.6 The site should be kept in good condition, free from overgrown vegetation and unnecessary materials.

8.2.7 Identification labels, emergency instructions, warning signs, and line diagrams should be regularly checked to ensure that they are properly positioned and timely updated.

8.2.8 A risk assessment should be carried out to identify the possible risk and implement precautionary measures for any work that could create an ignition source, such as drilling, welding and cutting, near hydrogen installations.

8.3 Hydrogen Detectors

8.3.1 Hydrogen detectors should be maintained and tested at least once a year or at the frequency recommended by the manufacturer, whichever is shorter.

8.3.2 Maintenance and testing should be performed by qualified organisations and personnel with proper training. Regular maintenance and testing should include the following:

a) Calibration of each detector using certified gas mixtures;

b) Inspection of the detectors in the whole system;

c) Conducting functional tests.

8.3.3 The validity period of calibrated hydrogen detectors should be clearly labelled on the SHFCPS and the associated hydrogen storage/supply system for easy checking.

8.3.4 Special attention should be given to pollutants in the environment where the hydrogen detectors are located, as well as any substances they come into contact, since these factors may reduce the detectors' lifespan.

9. FIRE SERVICES REQUIREMENTS

9.1 General

9.1.1 The overall layout plan of the SHFCPS, including the fire service installations, should be submitted to relevant regulatory authorities for approval. All fire service installations and equipment should be designed and installed to meet the standards recognised by relevant regulatory authorities.

9.1.2 Fire service installations and equipment shall be installed, maintained, repaired, inspected and tested by registered fire service installation contractors of appropriate class.

9.1.3 All relevant requirements stipulated by the regulatory authorities shall be complied with.

9.1.4 The hydrogen storage area should be clearly marked with fire hazard signs, such as "Flammable Gas", "No Smoking", "No Open Flames", and equipped with fire extinguishers and hydrogen leakage alarm devices.

9.2 Fire Prevention and Emergency Response Plan

9.2.1 A written fire prevention and emergency response plan should be formulated, having regard to the size and location of the SHFCPS, and covers the following:

a) Fire prevention procedures, plant emergency alarms, and emergency response procedures;

b) Safety procedures for the handling and storage of hydrogen;

c) Procedures for the control of potential ignition sources;

d) Frequency and requirements for periodic inspection, testing, and maintenance of the fire services system;

e) Emergency response plan that includes the following:

1) Procedures for responding to fire alarms and hydrogen detection alarms, along with notifications of designated personnel;

2) Evacuation plans for all personnel in the affected area;

3) Coordination with security personnel or responsible persons to facilitate the entry of officers of the Fire Services Department;

4) Periodic drills to validate the feasibility and effectiveness of the plan;

5) Emergency procedures for operators during fire incidents.

10. INCIDENT REPORTING AND INVESTIGATION

10.1 Incident Reporting

10.1.1 Any of the following hydrogen incidents shall be notified to the EMSD within one (1) hour after the incident occurs:

a) Leak of hydrogen above the design alarm level;

b) Smoke, fire or explosion of any magnitude;

c) Injury of any personnel involving the SHFCPS;

d) Other incidents related to the SHFCPS that have attracted media interest or public attention.

10.1.2 For all hydrogen incidents, including but not limited to those listed in Section 10.1.1, a preliminary written incident report with the following information shall be submitted to the EMSD within two (2) working days after the incident occurs:

a) the date and time of the incident;

b) the location of the incident;

c) summary of the incident;

d) the suspected/preliminary cause of the incident;

e) the identification number of the hydrogen detectors that were activated during the incidents;

f) the extent of the damage of the equipment or parts;

g) the date and time of despatch of maintenance/emergency personnel to deal with the incident;

h) the time when such personnel arrived at the location of the incident;

i) the actions taken by such personnel to deal with the incident; and

j) the rectification time for the incident and service restoration time.

10.1.3 Following the preliminary incident report, a detailed incident report with the following information shall be submitted to the EMSD not later than seven (7) working days after the incident occurs:

a) the root causes of the incident; and

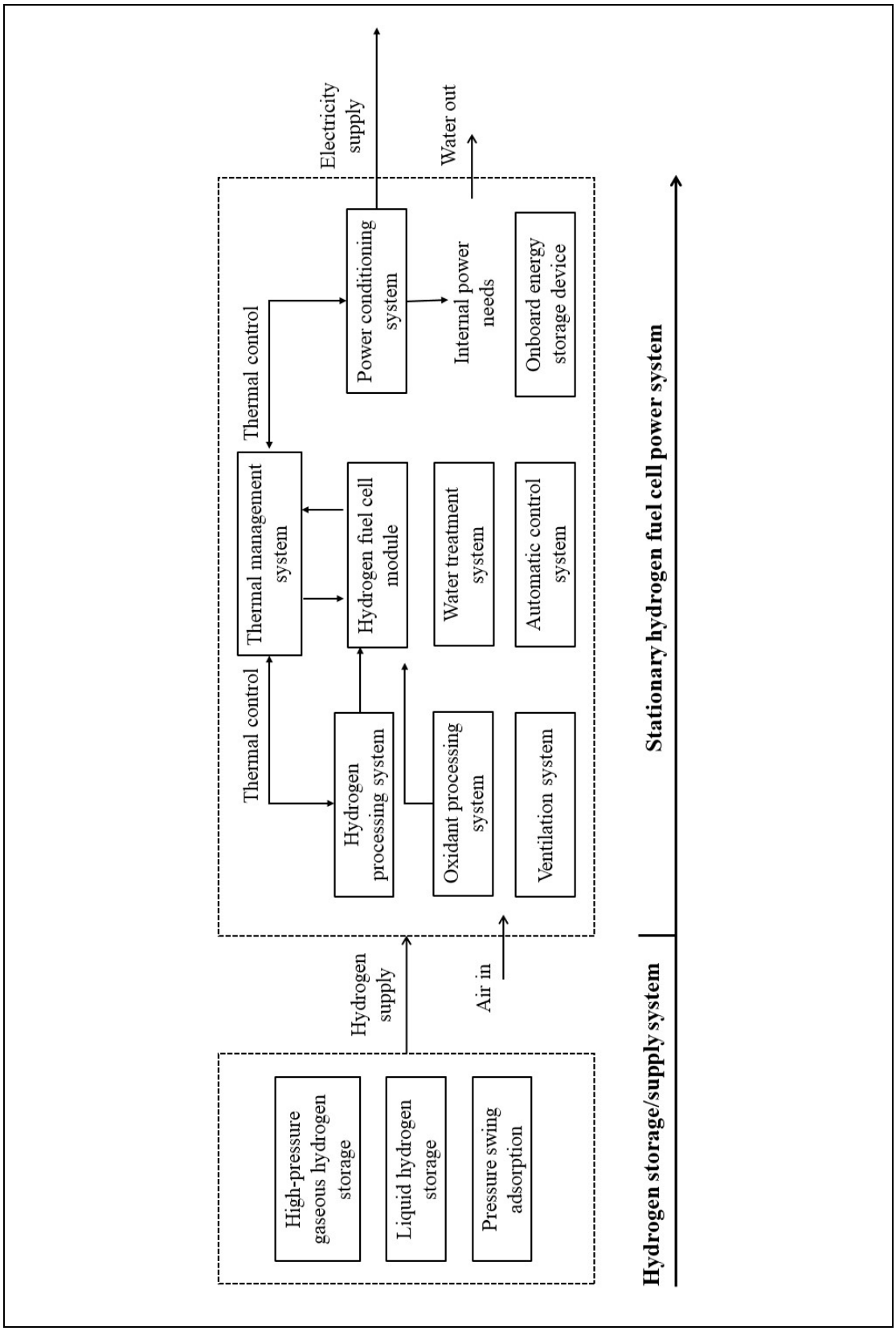
b) the proposed measures to prevent recurrence of similar incidents.

10.2 Incident Handling and Investigation

10.2.1 All incidents of the SHFCPS should be rectified by suitably trained persons as soon as practicable.

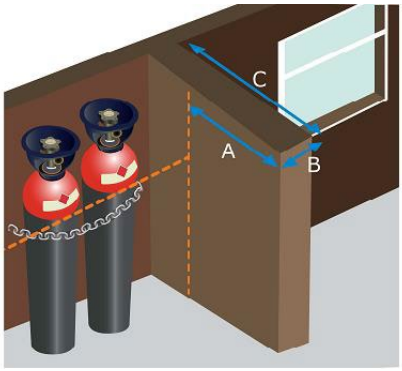
10.2.2 The causes of the incidents should be investigated thoroughly and preventive measures should be implemented to avoid recurrence of similar incidents.

Appendix A – Schematic Diagram of Stationary Hydrogen Fuel Cell Power System



Appendix B – Minimum Separation Distance

- Distances are measured from any point on the system where product release may occur during normal operation.
- Where space restraints exist, a permanent physical partition may be used to achieve the required minimum separation distances. The height of the partition should be appropriate to the hazard and not less than 2m.
- The required minimum separation distance can include the length of the sides of the partition, as shown in the figure below.



[Source: BCGA Code of Practice 4: Gas supply and distribution systems (excluding acetylene)]

- Partitions are expected to be imperforate and constructed of suitable materials, such as solid masonry or concrete. Where protection against fire hazards is needed, partitions should provide at least 30 minutes of fire resistance in accordance with BS 476. If the partition is used to separate vulnerable populations from gas containers, a minimum of 60 minutes of fire resistance is recommended.