

Fuel Cell Inspection

INTRODUCTION

Introduction: Safety concerns associated with fuel cells are generally hazardous interactions when fuel is integrated in such systems, mainly fire, explosion and electrical shock hazards. Per the 2013 California Mechanical Code, fuel cell power plants with a power output of:

- Less than 49.9 kW shall be listed and installed in accordance with the manufacturer's instructions.
- More than 49.9 kW shall be installed in accordance with NFPA 853

Two areas posing the highest risk for electrical hazards within a fuel cell are the main AC supply and the DC electrical output of the fuel cell stack. Due to high potential for hazardous interactions of components within a fuel cell, access should only be limited to personnel who are competent and educated in recognizing and dealing with such hazards. Special care should be practiced when dealing with Hydrogen fueled cells since Hydrogen has inherent hazardous properties. Special care must be practiced when choosing equipment used in conjunction with hydrogen.

Cited Regulations:

- California Mechanical Code, Chapters 9, 16
- California Building Code
- National Fire Protection Agency Standard 853, 2

DEFINITIONS

Fuel Cell: A self-contained package or factory-matched packages that constitute an automatically operated assembly of integrated systems for generating useful electrical energy and recoverable energy that is permanently connected and fixed in place.

For any questions or clarifications, please contact EH&S at 949.824-6200, email fbrahim@uci.edu.

Date of Inspection:

Follow-up Date:

EH&S Surveyor:

Dept.	
Building:	Room Number:

Principal Investigator Name:

Principal Investigator Phone/Email:

Staff Performing Operation Name (s):

Staff Phone/Email(s):

DESCRIPTION OF FUEL CELL

Fuel Cell Power Output:

Fuel Used:

Notes:

Fire Prevention-Hazardous Materials

Fuel Cell Systems

1. GENERAL REQUIREMENTS FOR FUEL CELL INSTALLATIONS	Status	Comments
1.1 Room separated by the rest of the building by a 1-hour fire rated construction (NFPA 853).		
1.2 All penetrations (electrical, plumbing etc.) must have a 1-hour fire resistance rating through walls (NFPA 853).		
1.3 Room must be protected by fire dampers and doors (NFPA 80/90A compliant) if between the room and an occupied space.		
1.4 Fire doors have a rating equivalent to the barrier (NFPA 853)..		
1.5 Egress must be reasonable and according to California Building Code. Location does not affect building or emergency exits during possible emergencies.		
1.6 Fire department access must be provided through an approved location.		
1.7 It is located 5 ft (1.5 m) away from stored combustible materials, hazardous chemicals, high piled stock and other fire hazards.		
1.8 A fire prevention or emergency plan is provided. Exception: No fire prevention or emergency plan is required if the following requirements are met: a. Pre-packaged or pre-engineered and indicated to meet the ANSI CSA FC.1 standard. b. Custom made systems must also be tested based on operational performance at a comparable level with the standard.		
1.9 If outside, exhaust outlets are not directed to area of pedestrian flow AND are exhausting to a safe location.		
1.10 Outdoors-Exhaust outlets should be 10 ft or more from HVAC air intakes, windows, doors and other openings into buildings or toward pedestrians		
2. FUEL REQUIREMENTS FOR ALL FUEL CELL SYSTEMS	Status	Comments
2.1 All piping physically outside the fuel cell must be marked according to piping labeling standards (ANSI A13.1)		
2.2 Piping, valves and fitting to the fuel system must follow all rules of other fuel gas piping (alternate EH&S checklist according to NFPA 54)		
2.3 If deodorized gas is used, piping should be configured to prohibit reverse flow of natural gas into other piping		
2.4 Depending on the fuel sources, these extra requirements are necessary: a. Compressed Natural Gas-extra requirements of NFPA 52 b. Liquefied Petroleum Gas-extra requirements of NFPA 58 c. Hydrogen Gas or liquefied hydrogen-extra requirements of NFPA 55 d. Hydrogen-fueled fuel cells need to comply with the following requirements <input type="checkbox"/> Accessible manual shut-off valve must be located in the piping within 6 ft (1.8 m) of the storage container. <input type="checkbox"/> Hydrogen supply piping must also have a second manual shut-off valve that is located less than 6 ft of the power system (not required if the		

N/A- Not Applicable ✓ - Compliance R- Requiring Correction

Fire Prevention-Hazardous Materials

Fuel Cell Systems

hydrogen source is within 6 ft of the fuel cell).

- If power system is inside and the fuel supply outside, an automatic shut-off valve interlocked with gas detection is required outside the building.
- Piping, valves and regulators must be located so they are not easily subjected to physical damage.
- Hydrogen containers and associated piping must be grounded/bonded in accordance with NFPA 70.

3. DETECTION

3.1 Combustible gas detectors must be installed in the fuel cell system enclosure, exhaust system OR the room. Detectors must initiate a local alarm.

3.2 Separately enclosed gas compressors must also have combustible gas detectors.

3.3 If Hydrogen is piped from the outside it must comply with the following requirements: hydrogen detectors must be installed. (see 8.1.5.7 for requirements).

Exception: Requirements 3.1-3.3 are not necessary if the system is below 50 kW, is listed for indoor use and the fuel is ODORIZED natural gas or LP-gas.

4. GENERAL REQUIREMENTS FOR FUEL CELL INSTALLATIONS OPERATING BELOW 50KW

Status

Comments

4.1 Fuel cell power systems using flammable liquids that are **not located outside** must meet the requirements for 50KW or more installations or meet the following 4 requirements (NFPA 853, 9.3.6.1-9.3.6.4)

- The fuel cell enclosure plus the connected indoor liquid fuel piping must contain less than 20 L (5 gallons) of liquid fuel (during all modes of operation, standby, shutdown)
- Bulk fuel storage for the system must be located outside.
- Piping used to supply fuel to the indoor system must be solid, all-welded, soldered or brazed until the fuel cell power system enclosure.
- The fuel cell system should be equipped with leakage detection and automatic isolation of the indoor fuel piping from the outside bulk storage once leakage is detected (isolation methods can include pump stoppage, valve closure or other methods, consult the manufacturer).

4.2 Indoor installations that operate without ventilation air from the outside shall be provided with limit controls that will not permit O2 levels in the room to drop below 18%. Outdoor air intake is recommended for all indoor installations.

4.3 Vent terminations do not exhaust into other doors, windows or openings.

4.4 Do fuel cell systems with the **hydrogen** supply **more than 400 ft³** have fire rated separation?

5. REQUIREMENTS FOR FUEL CELLS OPERATING ABOVE 50kW

Status

Comments

Fire Prevention-Hazardous Materials

Fuel Cell Systems

<p>5.1 Location of manual fuel shut-offs must be marked at the same location of the primary disconnecting means from building circuits</p>		
<p>5.2 Transformers located in compartments, modules or rooms must be of the dry type.</p>		
<p>5.3 Oil-filled transformers that have 500 gallon capacity or more need extra requirements, NFPA 853 8.1.3.3.</p>		
<p>5.4 Indoor: Liquid fuel systems must be provided with curbing, diking or draining</p>		
<p>5.5 Systems with liquid fuels require leak detection.</p>		
<p>5.6 Detection should be interlocked with the fuel source and designed to shut down the power system fuel supply at 60% LFL. <i>Exception: Fuel systems that do not use gaseous fuels or generate flammable gas mixtures are not required to have combustible gas detection.</i></p>		
<p>5.7 Does the Fuel cell system have its own ventilation and exhaust? <i>Additional exhaust and ventilation are not required if the system is either directly vented operating at negative pressure with respect to the room OR total emissions are nontoxic and cannot exceed 25% LFL under normal conditions.</i></p>		