Gas Information Sheet 66

Fuel cells and fuel cell systems

Overview

This document aims to provide guidance for industry on the requirements when installing and commissioning fuel cell(s) and fuel cell systems. This page includes information about electrical requirements applying to fuel cell systems.

Definitions

Energy Safe Victoria uses these definitions:

- **Fuel cell –** an electrochemical device that converts the chemical energy of a fuel and an oxidant to electrical energy (DC power), heat and other reaction products.[1] (Cl 3.12 from AS 62282.3.100:2021 'Fuel cell technologies – Stationary fuel cell power systems-Safety')
- **Fuel cell power system –** a generator system that uses one or more fuel cell module(s) to generate electric power and heat.[1] (Cl 3.13 from AS 62282.3.100:2021 'Fuel cell technologies – Stationary fuel cell power systems-Safety')
- **Battery Energy Storage System (BESS) –** consists of PCE, battery system(s), and isolation and protection devices.[2] (Cl 1.3.13 from AS/NZS 5139:2019 'Electrical installations – Safety of battery systems for use with power conversion equipment')
  Note: Examples of “power conversion equipment” (PCE) include, but are not limited to d.c./a.c. inverters, d.c./d.c. converters and charge controllers.
- The *Gas Safety Act 1997* (the Act) defines a gas appliance as 'a device which uses gas to produce flame, heat, light, power or special atmosphere'.

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About fuel cells

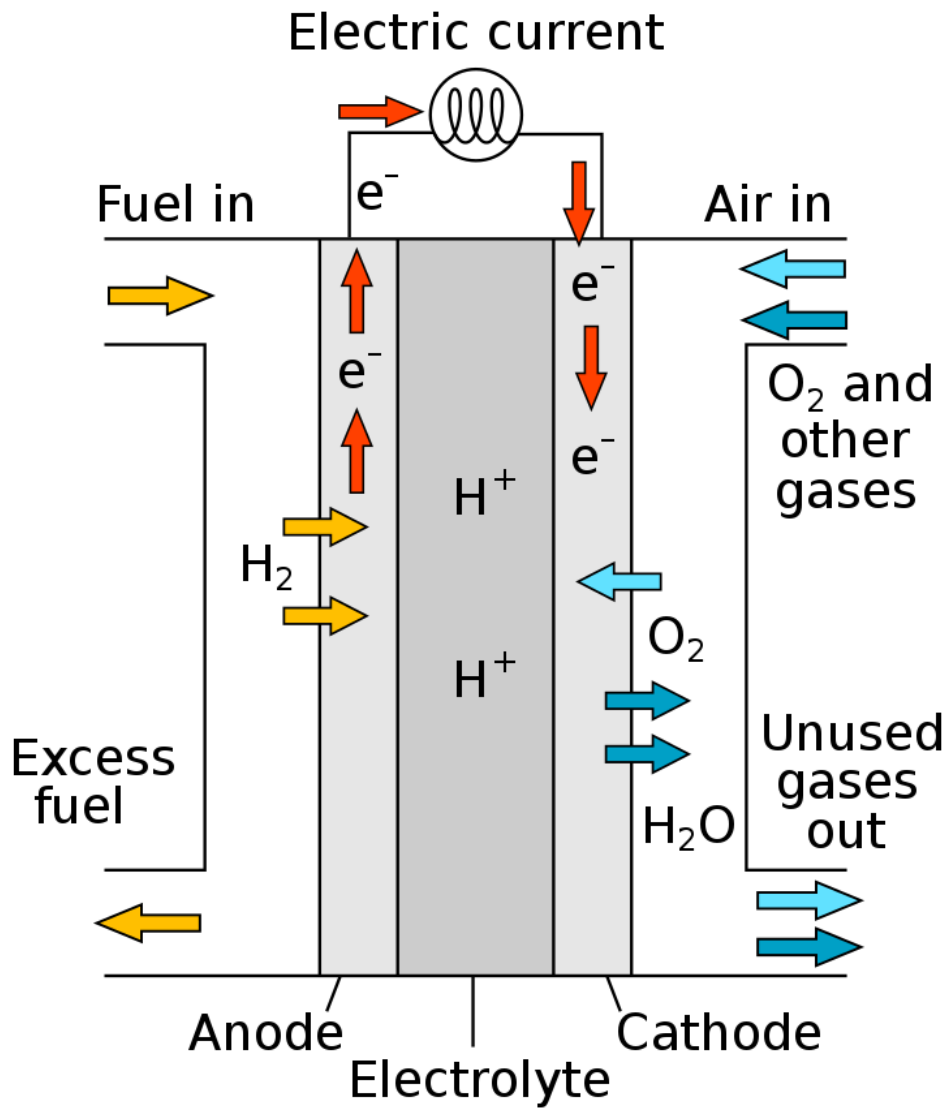
Fuel cells and fuel cell power systems work like batteries, but rather than discharging and needing to be re-charged, thy produce electricity, water and heat as long as hydrogen fuel is supplied.

A fuel cell consists of two electrodes – a negative electrode (or anode) and a positive electrode (or cathode) – sandwiched around an electrolyte.

Hydrogen is supplied to the anode, and air is supplied to the cathode. A catalyst at the anode separates hydrogen molecules into protons and electrons, which take different paths to the cathode. The electrons go through an external circuit, creating a flow of electricity. The protons migrate through the electrolyte to the cathode, where they unite with oxygen and the electrons to produce water and heat.

Fuel cells and fuel cell power systems use hydrogen gas or a hydrocarbon gas with a reforming process to produce electrical power and are considered a gas appliance.

Schematic diagram of a proton exchange membrane (PEM) fuel cell



Certification

As there is currently no scheme for certification of a fuel cell or fuel cell system as a Type A gas appliance, it is therefore considered a Type B gas appliance. The Gas Safety Act 1997 deems the installation and commissioning of a fuel cell to be work on a complex gas installation.

The prescribed standard for gasfitting work carried out on Type B gas appliances (including commissioning) is AS 3814, Industrial and commercial gas fired appliances.

However, AS 3814 is not a suitable standard for fuel cells as the requirements are applicable to conventional gas fired appliances and fuel cells do not burn gas. An application for exemption to the prescribed standard under the Gas Safety (Gas Installation) Regulations 2018 will be required as a result.

Gas installation licensing and registration

The construction, installation, servicing, maintenance, commissioning, replacement or repair of a fuel cell is deemed to be either:

- Type B gasfitting work if the nominal gas consumption is between 10 MJ/h (2.77kW) and less than 5000 MJ/h (1389kW)
  or
- Type B gasfitting advanced work (if the nominal gas consumption is 10 MJ/h (2.77kW) or greater)

between the connection of the isolation valve adjacent to the appliance and any flue connection.

Type of Victorian Building Authority (VBA) licence and registration required

This table shows the type of VBA licence and registration work on different fuel cells require, based on nominal gas consumption.

Fuel cell's nominal gas consumption	Required VBA licence and registration
10 MJ/h and less than 5,000 MJ/h (2.77 kW and less than 1389 kW)	Type B gasfitting or Type B gasfitting advanced
5,000 MJ/h or greater (1389 kW or greater)	Type B gasfitting advanced

As fuel cells and fuel cell systems are relatively new technology and are not covered through the competency unit training pathway, Type B or Type B advanced gasfitters are encouraged to take additional training prior to working on the appliance.

This could include training from the original equipment manufacturer (OEM) or working with them directly as part of the job. Gaining competency and knowledge will reduce the risk of non-compliant and unsafe installations of fuel cells and fuel cell systems.

For further information on registration and licensing see Plumbing registration and licensing (VBA):

https://www.vba.vic.gov.au/registration-and-licensing/plumbing-registration-and-licensing

Applications

The following applications will need to be made with Energy Safe for the installation of a hydrogen fuel cell or fuel cell power system.

Applications for acceptance of:

- **exemption from compliance** with prescribed standards
  Note: Applications for exemptions can be made by both persons with or without a gasfitting licence
- **the complex gas installation** from a person licensed in gasfitting work by the VBA
- **the Type B gas appliance** from a person licensed in Type B gasfitting work or Type B gasfitting advanced work by the VBA.
  Note: Applications for both complex gas installations and Type B appliances can be made by the same person if that person is licensed for both gasfitting work and Type B gasfitting work by the VBA.

Complex gas installations

A gas application must be submitted to Energy Safe for the installation of a stationary or transportable fuel cell power system.

Regulation 23 of the Gas Safety (Gas Installation) Regulations 2018 requirement

It is common for hydrogen consumer piping to be operating at pressures in excess of 200 kPa. Before working on consumer piping which is to have an operating pressure more than 200 kPa a person must:

- apply to Energy Safe for authorisation to carry out that work
- not carry out gasfitting work unless it has been authorised by Energy Safe.

For the purposes of section 72(2) of the Gas Safety Act 1997, the prescribed standard for consumer piping which is to have an operating pressure in excess of 200 kPa is the standard determined by Energy Safe in respect of that piping in an authorisation for the gasfitting work.

Additional supporting information will also be required where operating pressures of the installation exceed 200kPa as set out in the form of Schedule 8 of the Gas Safety (Gas Installations) Regulations 2018.

For fuel cell power systems, Energy Safe will require the following when submitting a gas application:

- The location of fuel cell appliance onsite (indicated on a site schematic) along with a risk assessment
- A declaration from the Duty Holder (Occupier) that the storage and location of hydrogen cylinders will be in accordance with the Dangerous Goods (Storage and Handling) Regulations 2022 administered by Worksafe Victoria. This includes carrying out Hazard Identification Risk Controls (including, for example ignition, separation, ventilation, fire protection, placarding)
- Pipe material selection and jointing methods
- Test and purge procedures specific to the fuel cell
- Identification of any safety interlocks and details of operations (this may include an electrical schematic).

For further information on the additional supporting information required as set out in the form of a Schedule 8 gas application, please refer to Gas Information Sheet 60 and Gas Information Sheet 7

Commissioning

A Type B or Type B Advanced gasfitter will need to apply for acceptance of the fuel cell. The gasfitter will need to supply additional information for Type B appliance acceptance – these requirements are set out in the Gas Safety (Gas installations) Regulations 2018.

For further information on the Schedule 9 additional information required for Type B appliance acceptance for fuel cells, see Gas Information Sheet 67

Exemptions

Because AS 3814 'Industrial and commercial gas-fired appliances' is not a suitable standard for fuel cells, an application to exempt the use of AS 3814 as the prescribed standard will be required.

Note: For further information on applying for an exemption under the Gas Safety (Gas Installation) Regulations 2018 please see Gas Information Sheet 64.

The exemption process allows a licensed Type B or Type B Advanced gasfitter to nominate appropriate standards for the installation and commissioning of fuel cells.

Energy Safe recommends fuel cell work be in accordance with any of these standards:

- AS 62282.3.300 Fuel cell technologies Part 3.300: Stationary fuel cell power systems – Installation
- AS 62282.3.100 Fuel cell technologies Part 3.100: Stationary fuel cell power systems – Safety
- AS 62282.2.100 Fuel cell technologies, Part 2.100: Fuel cell modules – Safety
- AS 62282.5.100 Fuel cell technologies, Part 5.100: Portable fuel cell power systems - Safety.

You can purchase Australian Standards publications from the Standards Australia store: https://store.standards.org.au/

More information

For more information:

- call the Gas Technical Information help line on 1800 625 563 (option 3)
- email gastechnicalenquiries@energysafe.vic.gov.au

Electrical requirements of fuel cells

Equipment

Fuel cells that generate electricity are captured by the electrical equipment requirements under the Electricity Safety Act 1998.

Depending on the voltage level that they generate or output, whether or not they are designed or marketed as suitable for household, personal or similar use they can be classified as either:

- in-scope electrical equipment
- not in-scope electrical equipment.

Regardless of the classification of the equipment, it is the responsibility of the supplier or importer to ensure that the equipment is compliant to the prescribed Standard and is safe to be connected to the electricity supply. Type B gasfitters should check for evidence from the supplier or importer to ensure that the equipment is electrically compliant and safe to install.

To find out more, see Selling appliances and equipment:

home > industry guidance > electrical > appliances, equipment and manufacturers > selling appliances and equipment

https://www.energysafe.vic.gov.au/industry-guidance/electrical/appliances-equipment-and-manufacurers/selling-appliances-and-equipment

Installation

Fuel cells systems are able to generate either alternating current (AC) or direct current (DC) depending on the configuration of the equipment. The legislation has different requirements depending on the output.

Output voltage

Where the output voltage of the fuel cell system is greater than 50V AC or 120 volts ripple-free DC, the

- installation
- alteration
- repair
- maintenance

of the system is defined as a class of electrical work that requires a license. See Regulation 18 of Electricity Safety (Registration and Licensing) Regulations 2020: https://www.energysafe.vic.gov.au/about-us/regulatory-framework/legislation-and-regulations

There are different ways the fuel cell system can be used, and the relevant requirements are listed below.

Direct connection

Where a fuel cell is directly connected to an electrical installation, the connection of the system to the electrical installation must be done by a person holding an electrician's license that is recognised in Victoria.

This work is also prescribed electrical installation work, meaning the electrical work carried out to connect the system to an electrical installation must be inspected by a Licensed Electrical Inspector. See Prescribed and

non-prescribed work: https://www.energysafe.vic.gov.au/certificates-electrical-safety/obligations-and-guidelines/prescribed-and-non-prescribed-work

Inlet connection

Where the fuel cell is connected to an electrical installation via an inlet socket, the installation of the inlet socket to the installation must be done by a person holding an electrician's license that is recognised in Victoria.

This work is also prescribed electrical installation work that must be inspected by a Licensed Electrical Inspector. See Prescribed and non-prescribed work This work must be done by a person holding an electrician's license that is recognised in Victoria.

The connection of the fuel cell to the inlet by way of a plug fitted to the fuel cell is not electrical installation work that requires a licence, therefore, the person doing the connection is not required to hold an electrician's license.

Not connected to an electrical installation

Where equipment is only plugged in to a fuel cell and the fuel cell is not connected to an electrical installation no electrical installation work has occurred. Therefore, a license is not required.

Battery Energy Storage System (BESS)

If the fuel cell is connected to – or contains – a BESS, the installation, modification, repair or maintenance is a class of electrical work that must be done by a person holding an electrician's license that is recognised in Victoria.

The installation of a BESS is also prescribed electrical installation work that must be inspected by a Licensed Electrical Inspector. For more information, see Prescribed and non-prescribed work

Note:

- this work must be done by someone holding an electrician's license that is recognised in Victoria
- the installation of a BESS is also prescribed electrical installation work that must be inspected by a Licensed Electrical Inspector
- the most common connection method is via direct connection to a piece of electrical equipment (for example, an inverter) and is prescribed electrical installation work.

For more information see Prescribed and non-prescribed work
For other connection methods please contact us using the contact details at the top of this page.

Who we are

At Energy Safe Victoria we work to keep Victoria energy safe.

We regulate the energy industry and sector to ensure generation, supply and usage uphold safety standards, and engage with the community to raise awareness of energy safety risks.

In everything we do, we strive to deliver on our purpose to keep Victoria energy safe. Always.

www.energysafe.vic.gov.au