# *Hilton Educational PEM Fuel Cell*

# *RE510*


- ***Demonstrates a High Watt Density PEM Fuel Cell, Generating Electrical Power Directly from Hydrogen.***
- ***Integral Variable Load for Performance Investigation***
- ***Power Output of up to 0.75kW***
- ***Integral Computer Control, Safety System and Computer Interface. Software supplied.***
- ***Minimal Operating Costs.***
- ***Safe for Student Operation.***
- ***Two Year Warranty.***

## Introduction

Fuel cells are an exciting development in the harnessing and storage of energy from renewable sources such as wind wave and solar power.

Hydrogen, generated typically by electrolysis may be stored by compression or chemical bonding ready for use in a fuel cell. Unlike a conventional battery, energy stored in this way does not degrade with time. A fuel cell can be available for almost instantaneous electrical power generation, often with very high watt densities.

Typical fuel cells have only heat and pure water as a by-product of electrical power generation. As such they represent the ultimate in green technology.

Several different types of Fuel Cells are in production today. The Hilton Educational PEM (Proton Exchange Membrane) Fuel Cell RE510 uses technology which is at the forefront of most practical fuel cell applications. Notably it is used in several prototype motorised vehicles.

The Hilton Educational RE510 PEM Fuel Cell will provide an interesting experimental bench for instructing students on fuel cell science, technology and implementation. It should be of particular interest for students of:

- Engineering — all disciplines
- Technology — all disciplines
- Electronics
- Physical Sciences
- Environmental Conservation

## Experimental Capabilities

- Measurement of the current density and voltage-current characteristics of a fuel cell.
- Measurement of power density from a fuel cell capable of up to 750W (1 HP) electrical output.
- Measurement and investigation of fuel cell efficiency with reference to fuel and air consumption, power output and heat losses.
- Measurement and display of key temperatures and fluid throughputs fuel stoichiometric and cooling circuits.
- Measurement and investigation of reactant utilization and transport phenomena.

## Description

This version of the Hilton Educational RE510 Fuel Cell utilizes a robust and well proven fuel cell from a major international manufacturer and has been developed to bring the class room as close as possible to the contemporary advances in Fuel Cell technology. The unit offers the following operational advantages:-

a. An all air system — no need for cooling water or heat exchangers .

b. An ambient pressure system with integral fan.

c. Utilisation of a single air stream — the coolant and oxidant streams are the same stream

d. Operated at ambient temperature -20°C to +52°C, stack temperature +38°C to +66°C

e. Compact Fuel Cell size: 103 × 352mm² footprint, 13kg weight.

f. Ambient humidity operation — no additional humidification is required.

g. An integral variable load, allowing the stack to be operated over its full capacity.

The fuel cell module (shown above) incorporates a unique plate stack assembly with a highly intricate optimized internal fuel path geometry and specialized membrane.

The educational unit is designed to allow the estimation of the exothermic heat generated in the stack as power is generated and water formed.

In addition to this, the instrumentation in the educational unit allows the usual key energy performance indicators e.g. power output, fuel consumption, efficiency, oxidant excess (air) etc. to be determined for the unit. The educational unit and computer control software clearly demonstrate the fundamental principles of how the PEM based fuel cell operates.

The educational unit is mounted in a reinforced plastic panel with a transparent window that clearly shows the main components. The

hydrogen supply is internally pressure regulated, metered and controlled via an electronic valve. The heat generated during stack operation is ejected into the residual air in the coolant/oxidant stream which cools the cell. One particular advantageous feature of a single coolant/oxidant stream is that the system is thermally self regulating and thus intrinsically safe.

The system has been designed to ensure continual purging of the Fuel Cell and thus ensure optimal power output during use.

The software, supplied as standard, is used for the smooth starting and stopping of the unit, changing between the internal load settings and provides full computerized data acquisition. A software controlled microprocessor allows the automated start-up and shut down of the system and also monitors for unsafe operating conditions.

A hydrogen leak detector monitors the unit and automatically shuts down the unit, well below the lower ignition limit for hydrogen.

The on board microprocessor regulates the airflow through the stack to match the loading conditions.

A 15A (maximum) auxiliary socket is provided on the front of the panel to allow practically sized external load to be applied to the unit to investigate cell performance under varying loads.

## *Safety*

- The unit is provided with an integral flammable gas sensor that supervises the external electronic hydrogen solenoid valve
- Start up and shut down to a safe condition is controlled by the integral computer control.
- The integral computer control monitors temperature, pressure and power for unsafe conditions and automatically shuts down the system in the event of safe limits being exceeded.
- All electrical circuits are protected by circuit breakers or fuses as appropriate.

## *Dimensions and Weight*

Height: 885mm Width: 1060mm
Depth: 485mm Weight: 54kg

## *Accessories and Spares*

***Unit supplied with:***

1. Integral control and external data acquisition software.
2. One experimental operating and maintenance manual.
3. Accessories and spares for 2 years normal operation.

## *Services Required*

**Electrical**

Either: **A**: 1Amp.220-230 Volts, Single Phase, 50/60Hz (With earth/ground).
**OR**
**B**: 2Amp.110-120 Volts, Single Phase, 50/60Hz (With earth/ground

**Consumables :-**

Hydrogen 99.95% pure (or better) at 1.0 - 2.0 bar (maximum)

## *Order as*

**Order as:** RE510 Educational PEM Fuel Cell.

**Electrical Specification**

Either: **A**: 220-230 Volts, Single Phase, 50/60Hz(With earth/ground).
B: 110-120 Volts, Single Phase, 50/60Hz(With earth/ground).

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