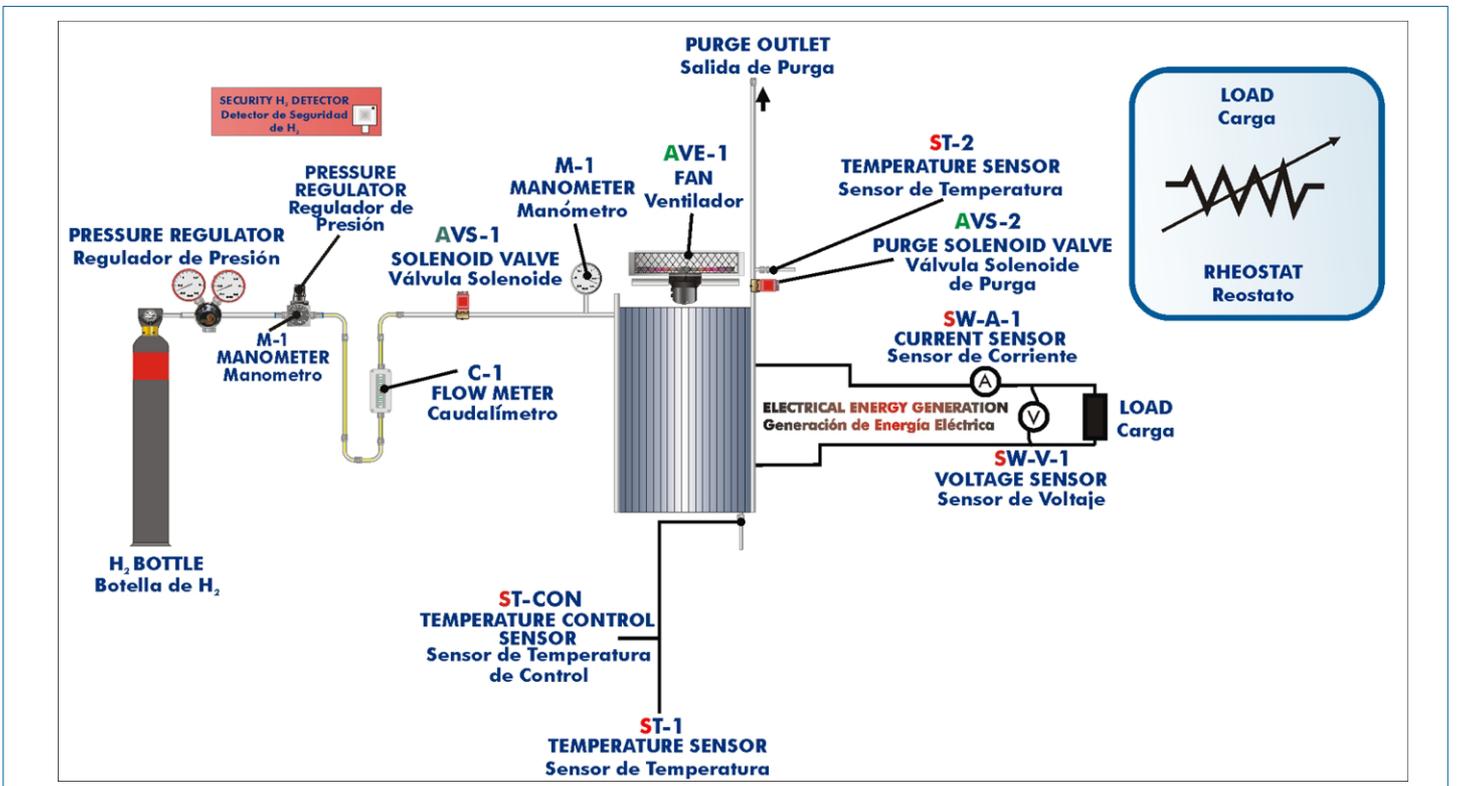


Electronic console

### PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



## GENERAL DESCRIPTION

This unit has been designed to allow the students to understand the fuel cells technology; especially that of a proton exchange membrane fuel cell (PEM).

The main operation principles of a PEM fuel cell can be studied with this unit. It also enables to calculate several fundamental parameters of a PEM type fuel cell, such as power density, polarization curves, efficiency, etc., and the variation of some of these parameters in function of the consumption of reagents and the developed power.

The unit is supplied with a stack of proton exchange membrane fuel cell (PEM) with a rated power of 1000 W. The stack is composed of 72 cells with channelled plate shape that allow the air flow through the membrane. The membrane facilitates the hydrogen flow, generating the electrons release. There are separate plates which conduct electricity, allowing that electrons flow, between each pair of cells.

Cells are self-humidifying and do not require any type of external humidification.

The stack has an integrated fan able to provide the required air for the good operation and maintenance of a suitable temperature.

Besides, the EC6B unit includes two pressure regulators: one for the H<sub>2</sub> cylinder, to regulate its outlet pressure, and the other for the stack inlet, to regulate the inlet pressure.

In addition, the unit includes two solenoid valves. One of them is located before the stack. It controls the hydrogen inlet and when the unit is switched off, the valve is closed to avoid any possible hydrogen leakage. This valve is automatically shutted when the temperature of the stack exceeds 65°C. The other valve is placed at the stack outlet. It purges the excess of water and Hydrogen outside for a correct operation.

The unit also has a load regulation system. It enables the study of the generated electrical energy, the representation of the characteristic operation curves and their comparison with the theoretical curves.

The whole electrical circuit of the stack is protected by a short circuit unit in case of an overcurrent (30A) and low voltage shut down (36V). In the event of one of these problems, the hydrogen inlet solenoid valve is automatically closed.

The unit's connections and hoses are made of materials which are suitable for their use with H<sub>2</sub>.

It includes a hydrogen leak detector with a detection range from 0 to 2% Vol. and from 0 to 100% L.E.L respectively.

## SPECIFICATIONS

Bench-top unit.

Anodized aluminium structure and panels in painted steel.

Diagram in the front panel with similar distribution to the elements in the real unit.

Fuel cell stack with 72 cells and a rated power of 1000W. Cells are self-humidifying and do not require any type of external humidification.

Fan incorporated in the stack.

Solenoid valve to supply H<sub>2</sub>.

Pressure regulator for the H<sub>2</sub> bottle. Inlet at 200 bars and outlet at 5-50 bars.

Pressure regulator for the hydrogen inlet at the PEM fuel cell, range:0-1 bar.

Suitable tubes and hose for its use with H<sub>2</sub> with a high safety factor: up to 210 bar.

Purge solenoid valve.

Load module: Rheostat (22R 760W) + 4 wirewound resistors (10R-300W).

Hydrogen leakage detector (Ip65).

Failure protection with solenoid valve at the stack inlet:

- Over current shut down. (30A).

- Low voltage shut down. (36V).

- Over temperature shut down in the stack.

Flow meter to measure the inlet H<sub>2</sub> flow to the stack.

Control temperature sensor placed between two bipolar plates of the cell.

Temperature sensor for the purging flow.

Pressure manometer to measure the H<sub>2</sub> pressure at the stack inlet, range: 0-1 bar.

Current and voltage sensors.

Electronic console:

- Metallic box.

- Temperature sensors connectors. Digital display for the temperature sensors. Selector for the temperature sensors.

- Voltage sensor connector. Digital display for the voltage sensor.

- Current sensor connector. Digital display for the current sensor.

- Fuel cell switch and led.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

## EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Study of the main principles of a proton exchange fuel cell (PEM) operation.
- 2.- Calculation of the efficiency of a PEM fuel cell.
- 3.- Study of the influence of air consumption and hydrogen consumption in the efficiency of a PEM fuel cell.
- 4.- Study of the power density of a PEM fuel cell.
- 5.- Representation of the polarization curve of a PEM fuel cell.
- 6.- Determination of the voltage and current density characteristics of a PEM fuel cell.
- 7.- Influence of hydrogen consumption in the electric power generation.
- 8.- Study of the influence of the generated power in the efficiency of PEM a fuel cell.
- 9.- Study of the influence of the reagents' flows in the generation of electrical power.
- 10.- Study of the use of reagents and transport phenomena.

### REQUIRED SERVICES

-Electrical supply: single-phase 220V./50 Hz. or 110V./60 Hz.

### CONSUMABLES REQUIRED

-Bottle of compressed hydrogen of degree 4.0 (purity of 99,995%) at a pressure of 150-200 bar.

### RECOMMENDED ACCESSORIES

-Edilab-Elec 2: Electrolyzer with a hydrogen production of 100 NL/h.

### DIMENSIONS & WEIGHTS

EC6B:

Unit:	-Dimensions: 700 x 400 x 550 mm. approx. (27.55 x 15.75 x 21.65 inches approx.)
	-Weight: 25 Kg. approx. (55 pounds approx.)
Load module:	-Dimensions: 490 x 330 x 310 mm. approx. (19.29 x 13 x 12.20 inches approx.)
	-Weight: 10 Kg. approx. (22 pounds approx.)
Electronic console:	-Dimensions: 490 x 330 x 310 mm. approx. (19.29 x 13 x 12.20 inches approx.)
	-Weight: 10 Kg. approx. (22 pounds approx.)

### AVAILABLE VERSIONS

Offered in this catalogue:

-EC6B. PEM Fuel Cell Advanced Unit.

Offered in other catalogue:

-EC6C. Computer Controlled PEM Fuel Cell Advanced Unit.

\* Specifications subject to change without previous notice, due to the convenience of improvements of the product.



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