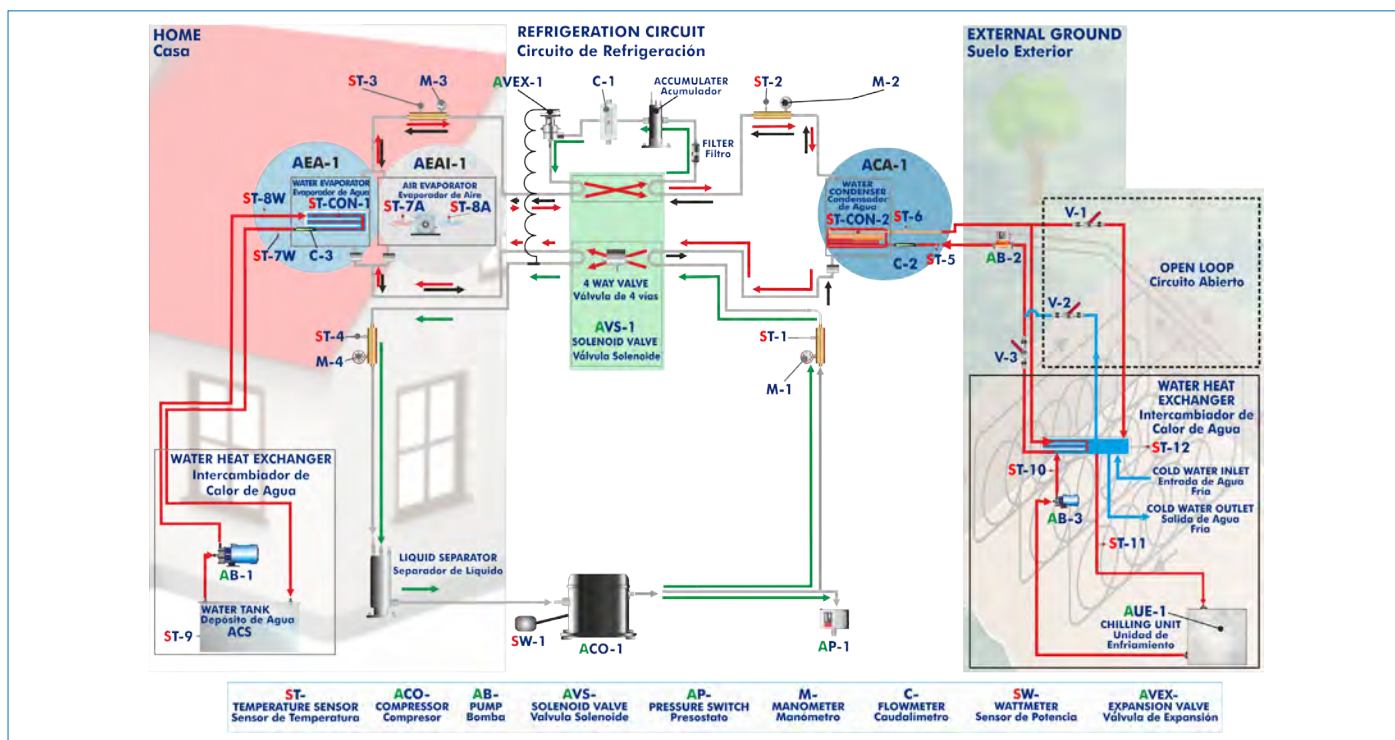




Electronic console

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)



European Union Certificate (total safety)



Certificates ISO 14001 and ECO-Management and Audit Scheme (environmental management)



"Worlddidac Quality Charter" and Platinum Member of Worlddidac

INTRODUCTION

Geothermal energy is generated using the heat given off by the Earth to obtain energy. The use of this energy is spreading quickly because it is a clean, renewable and almost unlimited source. Besides, depending on the Earth's layer and the temperature at which it is obtained, the geothermal energy can be employed for different purposes:

High enthalpy geothermal energy is the energy that uses a geothermal resource found at specific high temperature (higher than 150°C) and pressure conditions.

Low enthalpy geothermal energy is based on the capacity of the subsoil to accumulate heat and keep a sensibly constant temperature, at a depth between 10 and 20 m, throughout the year.

The objective of the Geothermal (low enthalpy) Energy Unit, "EG5B", designed by EDIBON, is to introduce the student into an increasingly leading renewable energy and, particularly, in the use of this energy for the climate control of buildings.

Moreover, the unit allows the student to start learning about systems that include heat pumps and to study and calculate the characteristic operating parameters of the unit depending on the environmental requirements (heat, temperature, refrigeration, etc.).

GENERAL DESCRIPTION

The Geothermal (low enthalpy) Energy Unit, "EG5B", designed by EDIBON, consists of a cooling circuit, a small tank with pipes covered with water (bath) and a chilling unit (heat pump). The inside of the earth is simulated with them. There is another tank where the sanitary hot water heated by the unit is stored.

The cooling circuit consists of a compressor, an air condenser/evaporator, and two water condensers/evaporators. The reason is that the unit has a 4 ways valve that can detect if it is summer or winter by the environmental conditions. According to this, it sends the refrigerant gas to one or another exchanger. So they are able to work as evaporators or condensers of the refrigerant liquid. The ground is simulated by means of a small tank that covers some pipes and a heat pump. The water of the tank is at a constant temperature, the same temperature that the earth has at 20 m of depth (15°C [59°F] approximately). This water goes to a bath, heating or cooling the water that flows through the pipes immersed in the bath.

Finally, there is a tank to store the water heated by the unit. It simulates the sanitary hot water of a house.

The unit has a cycle inversion valve, which is able to simulate winter and summer conditions, as it was mentioned before. Since the temperature of the earth at 20 m of depth is always 15°C, this temperature will be higher than the environmental temperature in winter; therefore, the ground is used to heat (heating mode use). However, the environmental temperature in summer will be higher than 15°C, so the ground's water will be used to cool (refrigerating mode).

SPECIFICATIONS

Unit mounted in anodized aluminum frame and panels of painted steel.

This unit includes wheels for its mobility.

Main metallic elements in stainless steel.

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

Heat pump:

Hermetic compressor:

Power: 0.5 CV, 4 A. Coefficient of performance: 1111 W at 0°C.

Two water condensers/evaporators, depending on heating or cooling configuration (winter or summer conditions), by using the cycle inversion valve:

Capacity: 1580 W. Consumption: 170 l/h.

Air condenser/evaporator, depending on heating or cooling configuration (winter or summer conditions), by the cycle inversion valve:

Maximum air flow: 980 m³/h. Coefficient of performance: 1591 W at 5°C.

High pressure control: 8 - 32 bar.

Coolant storage tank. Refrigerant filter.

Refrigerant separation tank. Expansion valve.

Four way-valve (cycle inversion valve) - solenoid valve.

Four "J" type temperature sensors for the refrigerant circuit.

Two "J" type temperature sensors for the air temperature measurement.

Four manometers for the refrigerant circuit.

Refrigerant flowmeter, range: 5 - 60 l/h.

Sanitary water circuit:

Water tank. Capacity: 130 l.

Water pump.

Water flowmeter to measure water flow.

Three "J" type temperature sensors for the water temperature.

Geothermal exchanger simulator:

Water heat exchanger:

A pipe system inside a water bath (at constant temperature).

Three "J" type temperature sensors for the water temperature.

Water pump, to send the water from the pipe system (located inside the bath) to the water evaporator/condenser.

Chilling unit to maintain constant temperature in the water bath:

Power: 2 HP, 1464 W. Optimum water flow: 3000 - 6000 l/h.

Water pump, to send the water from the chilling unit to the water bath.

Two "J" type temperature sensors for the water temperature.

Water flowmeter to measure water flow.

Enthalpy diagram of the refrigerant R134a.

Electronic console:

Metallic box.

Temperature sensors connections. Selector for temperature sensors. Digital display for temperature sensors.

Chilling unit and compressor, pumps switches. Air evaporator regulator. Wattmeter display.

High pressure control connection. Solenoid valve switch and connection.

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.



EG5B detail

EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Study of geothermal energy using a geothermal heat pump system for heating and/or cooling.
 - 2.- Study of the system with different ground temperatures.
 - 3.- Determination of the inlet power, produced heat and coefficient of performance, working in heating mode. Water-water heat pump.
 - 4.- Determination of the inlet power, produced heat and coefficient of performance, working in cooling mode. Water-water heat pump.
 - 5.- Determination of the inlet power and valuation of the air temperatures, working in heating mode. Water-air heat pump.
 - 6.- Determination of the inlet power and valuation of the air temperature, working in cooling mode. Water-air heat pump.
 - 7.- Preparation of performance curves of the heat pump, working in heating mode, with different inlet and outlet temperatures. Waterwater heat pump.
 - 8.- Preparation of performance curves of the heat pump, working in cooling mode, with different inlet and outlet temperatures. Waterwater heat pump.
 - 9.- Lay out of the steam compression cycle in a P-H diagram and comparison with the ideal cycle. Water-water heat pump. Heating mode.
 - 10.- Lay out of the steam compression cycle in a P-H diagram and comparison with the ideal cycle. Water-air heat pump. Heating mode.
 - 11.- Preparation of the performance curves of the heat pump based on the properties of the refrigerant and at different condensation and evaporation temperatures. Water-water heat pump. Heating mode.
 - 12.- Preparation of the performance curves of the heat pump based on the properties of the refrigerant and at different condensation and evaporation temperatures. Water-water heat pump. Cooling mode.
- Additional practical possibilities:
- 13.- Sensors calibration.

REQUIRED SERVICES

- Electrical supply: three-phase, 380V./50 Hz. or 208V./60 Hz., 3 kW.
- Water supply and drain.

DIMENSIONS AND WEIGHTS

EG5B:

Unit:

- Dimensions: 2000 x 800 x 1550 mm approx.
(78.74 x 31.49 x 61.02 inches approx.)
- Weight: 200 Kg approx.
(440.92 pounds approx.)

Electronic console:

- Dimensions: 490 x 330 x 310 mm approx.
(19.29 x 12.99 x 12.2 inches approx.)
- Weight: 15 Kg approx.
(33 pounds approx.)

AVAILABLE VERSIONS

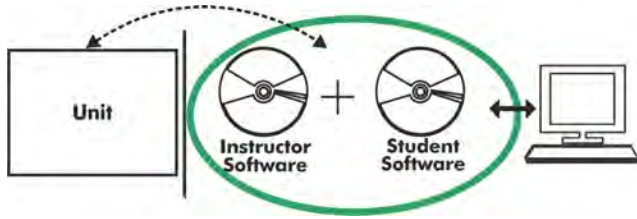
Offered in this catalogue:

- EG5B. Geothermal (low enthalpy) Energy Unit.

Offered in other catalogue:

- EG5C. Computer Controlled Geothermal (low enthalpy) Energy Unit.

EG5B/ICAI. Interactive Computer Aided Instruction Software System:



With no physical connection between unit and computer, this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

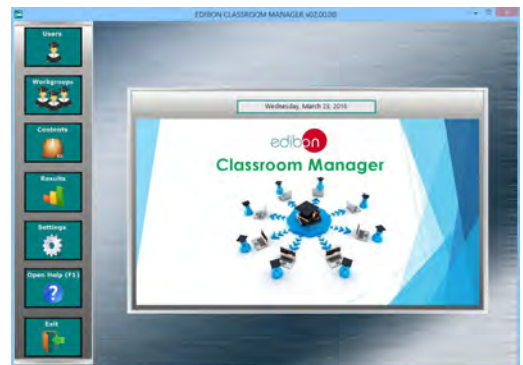
Instructor Software

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

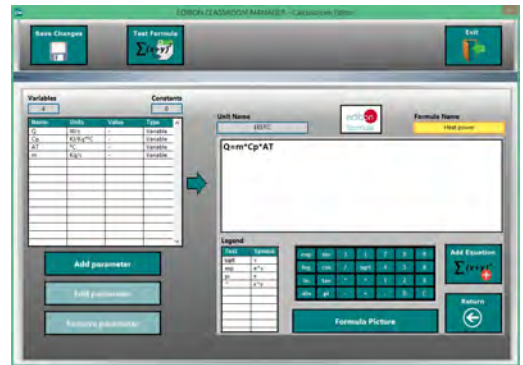
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

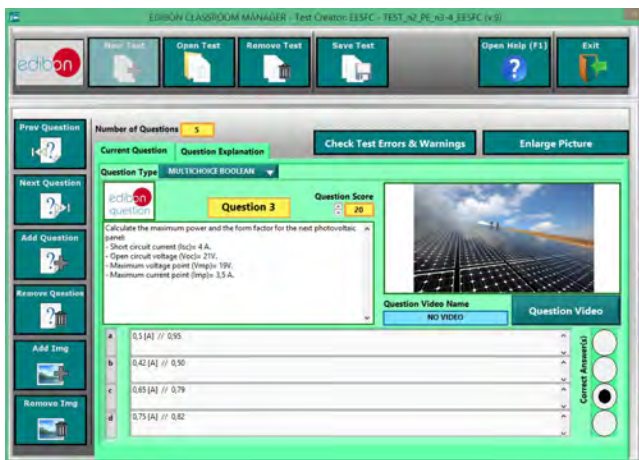
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.



ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question



ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

Optional
Student Software

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- Test self-correction.
- Calculations computing and plotting.
- Equation System Solver Engine.
- User Monitoring Learning & Printable Reports.
- Multimedia-Supported auxiliary resources.

For more information see ICAI catalogue. Click on the following link:

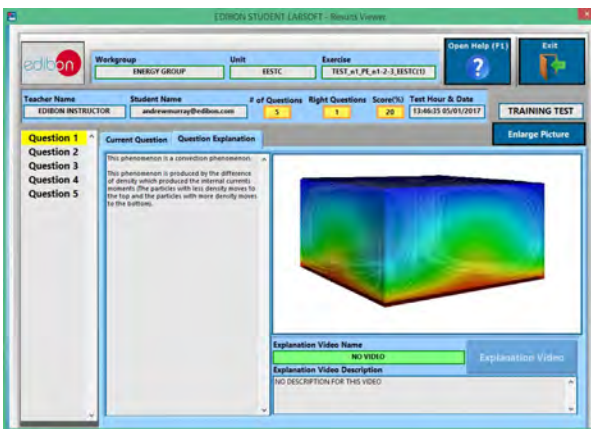
www.edibon.com/en/files/expansion/ICAI/catalog



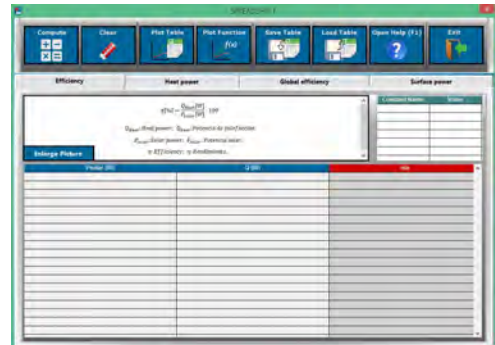
ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

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



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REPRESENTATIVE:

