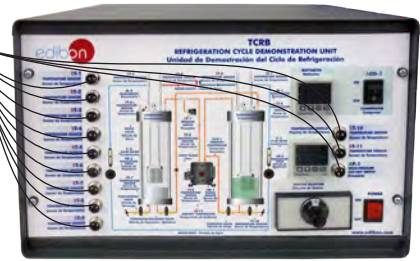


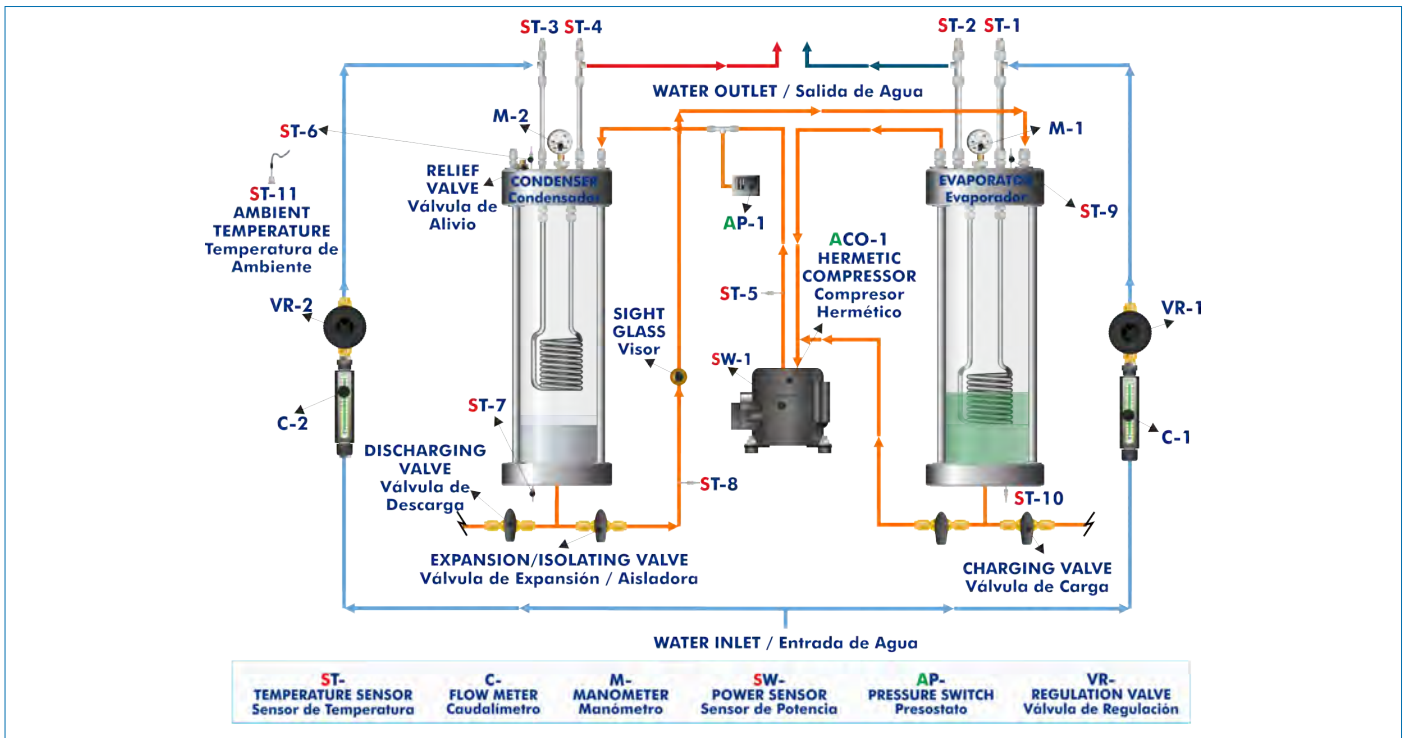


www.edibon.com
 Products
 Products range
 Units
 9.- Thermodynamics & Thermotechnics



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)



Certificate and Worlddidac Member

INTRODUCTION

The vapour compression refrigeration and heat pump cycle is very important in food and drug preservation, air conditioning and heat pumps, as well as other industrial and commercial process.

Cooling is the process of reducing and maintaining the temperature of an object or space.

A very common refrigerating installation is the so-called compression cooling installation. It forces the flowing of a fluid inside a closed circuit mechanically, creating high and low pressure areas so that the fluid can absorb heat in one place and dissipate it in the other place.

In this installation, the coolant flows through four main elements: the compressor, the condenser, the expansion element and the evaporator. It is an advantage in a cooling installation the fact that the coolant has a lower boiling temperature at low pressure. For that reason, evaporation takes place at the low pressure side. During the coolant evaporation, heat is extracted from the air, that is to say, the environment cools down.

Condensation takes place at the high pressure side after the evaporator. In this case heat is emitted to the environment. A heat pump is the name given when not the cooling effect, but the emitted heat, is used.

The Refrigeration Cycle Demonstration Unit, "TCRB", makes it possible to visualize clearly all the processes of a compression cooling system and the heat pump cycle, the analysis and demonstration of the pressure-temperature relationship during evaporation and condensation processes, the influence of diverse parameters on the process, etc.

GENERAL DESCRIPTION

The vapour compression refrigeration and heat pump cycle is very important in food and drug preservation, air conditioning and heat pumps, as well as other industrial and commercial process.

The Refrigeration Cycle Demonstration Unit, "TCRB", allows the demonstration of vapour compression refrigeration and heat pump cycle with visual observation of all important processes.

Thanks by utilising a non-toxic refrigerant fluid with a low vapour pressure (SES36 refrigerant, environmental friendly), the evaporation and condensation processes are clearly visible in the glass cylinders (evaporator and condenser).

The evaporator is a vertical cylinder, made of glass, containing SES36, closed on both ends. Into the glass cylinder there is a nickelplated copper coil.

An hermetic compressor draws vapour from the evaporator and compresses this before discharging it to the condenser. The low pressure of the evaporator causes the refrigerant to boil. The water flowing through the coil heats the refrigerant causing the vapours generation and the water temperature decreases.

From the compressor the high pressure vapour passes to the condenser.

The condenser, as the evaporator, is a glass recipient closed on both ends with a nickel-plated copper coil into it. Vapour condenses on the surface of the coil and falls to the bottom of the condenser. The liberated heat by the refrigerant phase change is transferred to the cooling water flowing through the coil.

The float valve located at the base of the condenser, that works as an expansion valve, controls the flow of high pressure refrigerant liquid returning to the evaporator. The refrigerant, after passing through the float valve, expands to form a liquid vapour mixture at the same pressure as the evaporator and the cycle is repeated.

Besides, an insulating valve is installed in the condenser inferior part that can be closed for the demonstration of the technique used in the maintenance of refrigeration installations, whether commercial or industrial, where the refrigerant is collected and stored in the condenser. This technique is important for demonstrating how to prevent a possible refrigerant gas leak during the maintenance operations.

The unit allows a safe operation since it includes different safety elements, such as a high pressure switch that turns off the compressor when the pressure in the condenser and at the condenser upper part, the unit has a relief valve that opens itself when the condenser pressure is higher than the maximum valve allowed.

By adjustment of the water flow to the evaporator and condenser coils, using control valves, the condensing and evaporating pressures can be varied.

The supplied instruments with the unit, allow to know at any time the measure of:

- The temperature and pressure of the refrigerant fluid in the evaporator and in the condenser.
- The temperature of the compression and expansion processes.
- The temperature of the water inlet and outlet at the coils of the evaporator and condenser.
- The water flow in the two coils.
- The room temperature.
- The electrical power used in the compression stage.

Etc.

Bench-top unit.

Anodized aluminum structure and panels of painted steel.

Main metallic elements of stainless steel.

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

Compressor:

Hermetic compressor.

Power: 1/2 CV.

Condenser:

Vertical transparent cylinder, through which the coil of heat exchange can be seen.

Totally hermetic by viton joints.

It has a copper coil through which circulates cooling water inside:

9 nickel-plated copper spires.

Diameter of coil: 1/4".

Heat transfer area: 0.032 m² approx.

Expansion:

Expansion valve, float type, that is assembled on the condenser.

Sight glass placed between the expansion valve and the evaporator, to show the formation of vapour bubbles after the expansion valve.

Evaporator:

Vertical transparent cylinder, through which the coil of heat exchange can be seen.

Totally hermetic by viton joints.

It has a copper coil through which circulates water to promote the ebullition inside:

9 nickel-plated copper spires.

Diameter of coil: 1/4".

Heat transfer area: 0.032 m² approx.

Instrumentation:

11 temperature sensors ("J" type) that indicate the water output and input temperatures, both in the condenser and in the evaporator, and the evaporation, condensation, expansion and environmental temperatures.

2 flow meters, rotameter type, to measure the water flow (condenser and evaporator). Flow meters range: 0-2 l./min.

2 manometers indicate the refrigerant fluid pressure in the condenser and in the evaporator:

Manometer (condenser): from 0 to 6 bar.

Manometer (evaporator): from -1 to 1 bar.

Power measurement (wattmeter). Measure range from 0 to 1000W.

The unit has all **necessary security measures** for safe work:

Relief valve with a tare of 2.4 bar, so in case of overpressure in the condenser it will open.

High pressure cut-out, that stops the compressor if the condensation pressure exceeds 2.3 bar.

Other valves:

Isolation valves to allow easy maintenance and modification.

Control valves.

This unit has been designed for the use with the SES36 refrigerant gas, environmental friendly.

With the unit is supply following diagrams:

Mollier diagram of SES36 refrigerant.

Entalpy diagram of SES36 refrigerant.

Electronic console:

Metallic box.

Temperature sensors connections.

Digital display for temperature sensors.

Selector for temperature sensors.

Compressor switch.

Wattmeter digital display.

High pressure control connection.

Cables and Accessories, for normal operation.

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

EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Demonstration of the vapour compression refrigeration and heat pump cycle.
- 2.- Relation between pressure and temperature.
- 3.- Demonstration of the refrigerant transfer from the evaporator to the condenser.
- 4.- Charging demonstration.
- 5.- Demonstration of the air effect in a refrigeration (cooling) system.
- 6.- Evaporation and condensation temperatures effect in the refrigeration (cooling) rate and in the heat transfer at the condenser.
- 7.- Analysis of the pressures relation effect in the system behaviour.
- 8.- Determination of the system operation coefficients.
- 9.- Measurement of the electrical power.
- 10.- Estimation of the heat transmission global coefficient between the SES36 refrigerant and the water.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50 Hz or 110V./60 Hz.
- Water supply and drainage.

DIMENSIONS AND WEIGHTS

TCRB:

Unit:

-Dimensions: 700 x 700 x 720 mm. approx.
(27.55 x 27.55 x 28.34 inches approx.)

-Weight: 70 Kg. approx.
(154.32 pounds approx.).

Electronic console:

-Dimensions: 490 x 330 x 310 mm. approx.
(19.29 x 12.99 x 12.20 inches approx.)

-Weight: 10 Kg. approx.
(22 pounds approx.).

AVAILABLE VERSIONS

Offered in this catalogue:

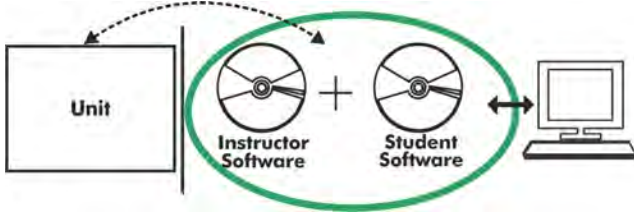
- TCRB. Refrigeration Cycle Demonstration Unit.

Offered in other catalogue:

- TCRC. Computer Controlled Refrigeration Cycle Demonstration Unit.

Optional

TCRB/ICAI. Interactive Computer Aided Instruction Software System:



Without no physical connection between unit and computer (PC), 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 Workgroups, Tasks and Training sessions.

Creation and Integration of Practical Exercises and Multimedia Resources.

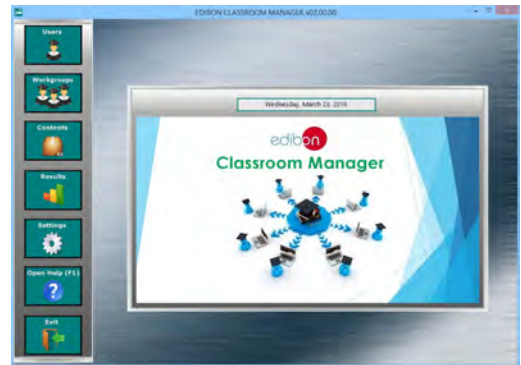
Custom Design of Evaluation Methods.

Creation and assignment of Formulas & Equations.

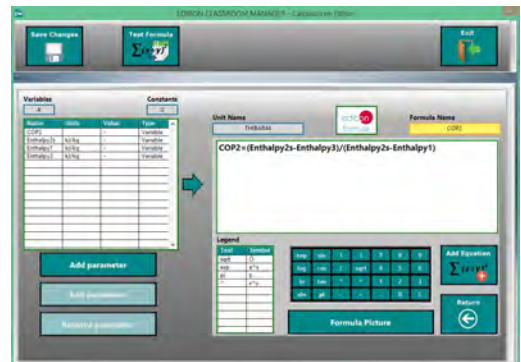
Equation System Solver Engine.

Updatable Contents.

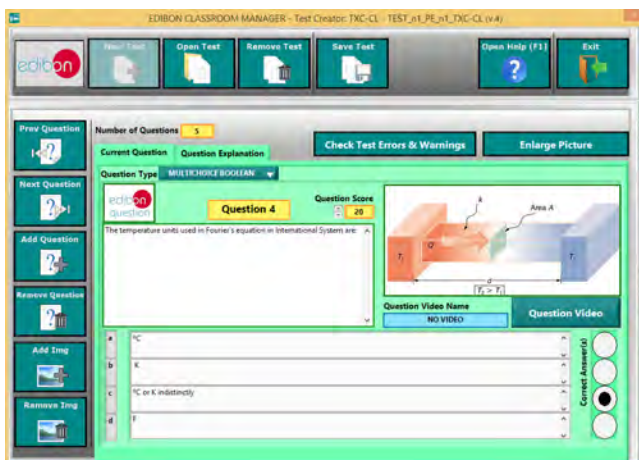
Report generation, User Progression Monitoring and Statistics.



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

-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.

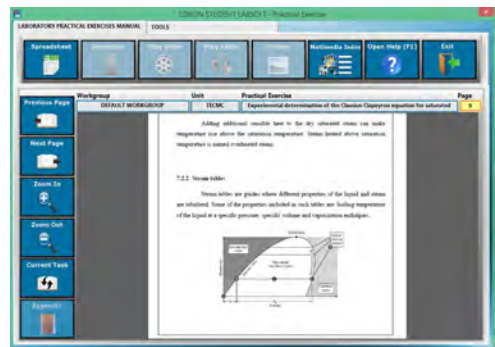
Innovative features:

- 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.**

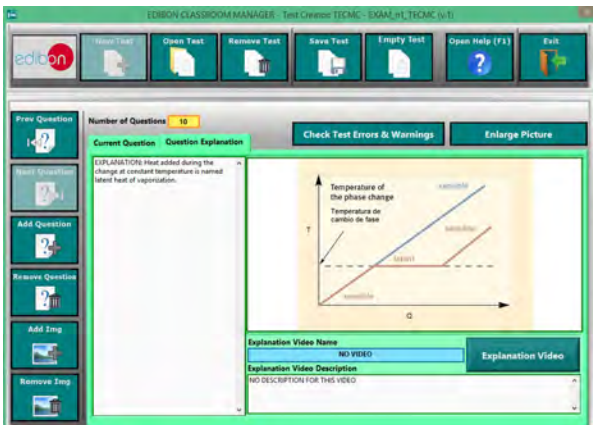
For more information see ICAI catalogue. Click on the following link:
www.edibon.com/products/catalogues/en/ICAI.pdf



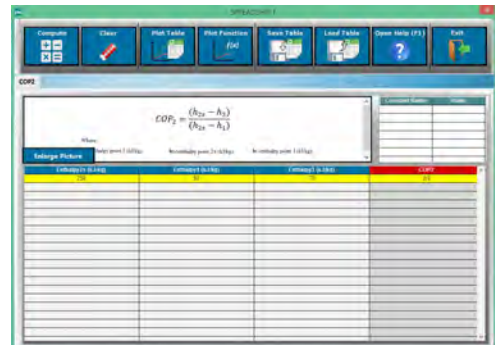
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



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:

