Heat Exchangers in the Refrigeration Unit

THER

www.edibon.com

⮩PRODUCTS
⮩90.- THERMODYNAMICS
& THERMOTECHNICS

Electronic console

INTRODUCTION

A heat exchanger is an energy (heat) exchange system between a hot and a cold fluid. Heat exchangers are essential elements in refrigeration systems.

In refrigeration circuits, during cooling heat exchangers are used as evaporator, to absorb energy from the refrigerant. On the other hand, during heating, exchangers are used as refrigerant condensers to discharge energy.

In some refrigeration cycles, depending on the application, it is necessary to superheat or supercool the refrigerant. Heat exchangers are also used in those cases.

There are several types of heat exchangers and different classifications:

In function of the working fluids employed:

  Air / refrigerant.

  Water / refrigerant.

  Refrigerant / refrigerant.

In function of the heat exchanger constructive design:

  Coaxial coil heat exchanger.

  Finned tube heat exchanger.

  Plate heat exchanger.

  Tube heat exchanger.

The "THER" unit designed by EDIBON allows the student to visualize and study typical heat exchangers of refrigeration systems, work with different media – water/refrigerant, refrigerant/refrigerant and air/refrigerant – and observe the influence of the refrigerant superheating and supercooling in the thermodynamic cycle.

The "THER" consists of a refrigeration circuit, with the most common heat exchangers in refrigeration circuits. All the elements are clearly mounted in the front panel of the unit.

The evaporator is an air cooling finned tube heat exchanger and a water-heated plate heat exchanger.

As condenser there is a water-cooled coaxial coil heat exchanger and as superheater, to study its influence, a tube heat exchanger.

The function of these exchangers is different depending on the type of system and the operation mode. The same exchanger can be used as evaporator and condenser, as for example the finned tube heat exchanger.

In order to cool or heat in the condenser or evaporator there is a water tank and a pump to impel the water to the heat exchanger.

The unit includes two flow meters to know the heating water and cooling water used in the heat exchangers. Together with the temperature sensors located at the inlet and outlet, they allow the student to determine the exchanged energy fluxes.

Besides, there are manometers and temperature sensors at all relevant points of the system.

The unit includes basic elements of refrigeration circuits, such as compressor, receiver, filter to remove impurities, expansion element, low pressure switch and high pressure switch, etc.

SPECIFICATIONS

Experimental unit for the training of apprentices in the refrigeration area.

Anodized aluminum frame and panels made of stainless steel.

The unit includes wheels for its mobility.

Main metallic elements made of stainless steel.

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

Refrigeration system with four different heat exchangers:

    Coaxial coil heat exchanger (condenser).

    Finned tube heat exchanger (evaporator).

    Plate heat exchanger (evaporator).

    Tube heat exchanger (superheater).

Different combinations of working fluids can be used:

    Water / refrigerant.

    Refrigerant / refrigerant.

    Air / refrigerant.

Water circuit consisting of:

    Water storage tank.

    Pump to impel water to cool the condenser and heat the evaporator.

    Two flow meters for the cooling and heating water. Range: 0 – 250 l/h. These mass flows, together with the inlet and outlet temperatures, allow the student to calculate the exchanged energy fluxes.

The superheater can be disabled via bypass.

Compressor:

    Refrigeration capacity: 1013 W at -5/32°C

    Power consumption: 793 W at -10/32°C

Refrigerant receiver. Capacity: 1,5 l.

Two expansion valves.

Filter to remove impurities.

Double pressure switch of 32/7,5 bar.

A refrigerant flow meter. Range: 5 – 60 l/h.

Thirteen temperature sensors at relevant points of the system:

    Nine temperature sensors of range 0 – 60°C.

    One temperature sensor of range 0 – 100°C.

    Three temperature sensors of range -20 – 30°C.

Two manometers:

    Low pressure manometer in the intake side. Range: -1 – 10 Bar.

    High pressure manometer in the delivery side. Range: -1 – 30 Bar.

The unit has been designed to be used with environmental friendly CFC-free R134a refrigerant.

Enthalpy diagram of the R134a coolant.

Electronic console:

    Metallix box.

    Temperature sensors connectors.

    Digital display for the temperature sensors.

    Selector for the temperature sensors.

    Switch for the compressor.

    High pressure control 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.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Study and visualization of different heat exchangers and their application in refrigeration:

    Coaxial coil heat exchanger.

    Finned tube heat exchanger.

    Plate heat exchanger.

    Tube heat exchanger.

2.- Study of the correct installation position.

3.- Energy fluxes determination.

4.- Influence of the refrigerant superheating and supercooling on the thermodynamic cycle.

5.- Design of a compression refrigeration system.

6.- Representation of the thermodynamic cycle in the log p-h diagram.

Additional practical possibilities:

7.- Properties of the R134a refrigerant.

8.- Enthalpy-pressure diagram for the R134a refrigerant.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

THER:

    Unit:

        -Dimensions: 1100 x 600 x 1500 mm. approx.

                (43.30 x 23.62 x 59.05 inches approx.)

        -Weight: 70 Kg. approx.

                (154 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.).

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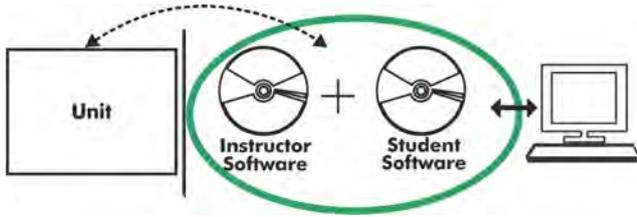
With no physical connection between unit and computer (PC), **this complete software package consists of an Instructor Software (EDIBON Classroom Manager-ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft-ESL-SOF).** Both are interconnected so that the teacher knows at any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

<u>Instructor Software</u>

-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.
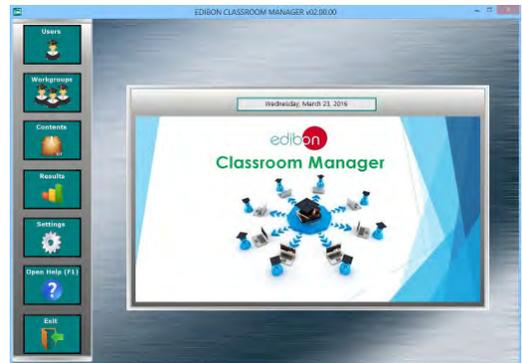
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application main screen
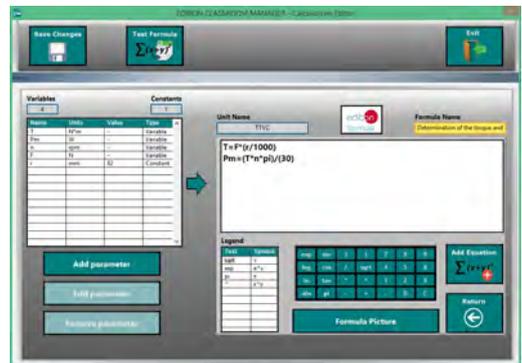
ECAL. EDIBON Calculations Program Package - Formula Editor Screen
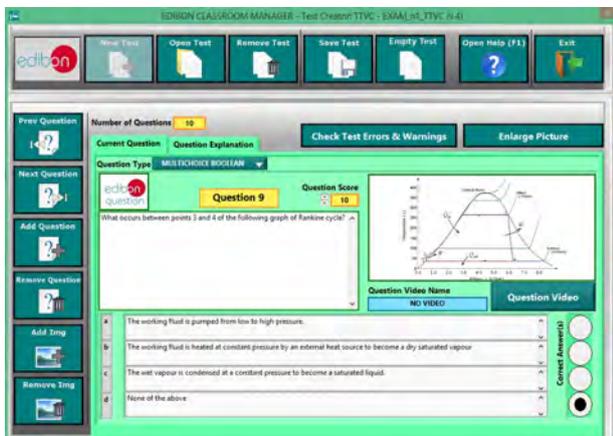
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

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

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/products/catalogues/en/ICAI.pdf

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

EPE. EDIBON Practical Exercise Program Package Main Screen
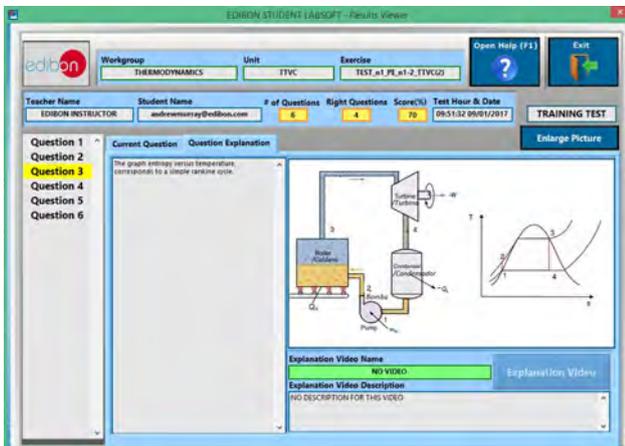
ERS. EDIBON Results & Statistics Program Package-Question Explanation
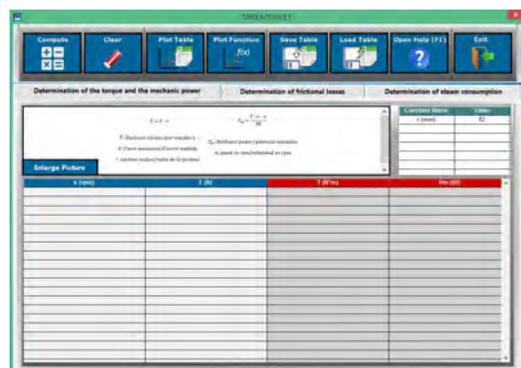
ECAL. EDIBON Calculations Program Package Main Screen

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

REPRESENTATIVE

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