Heat Pump + Air Conditioning + Refrigeration Unit with Cycle Inversion Valve

Technical Teaching Equipment

(four condensers (two of water and two of air) and four evaporators (two of water and two of air))

THIBAR44B

Electronic console

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION
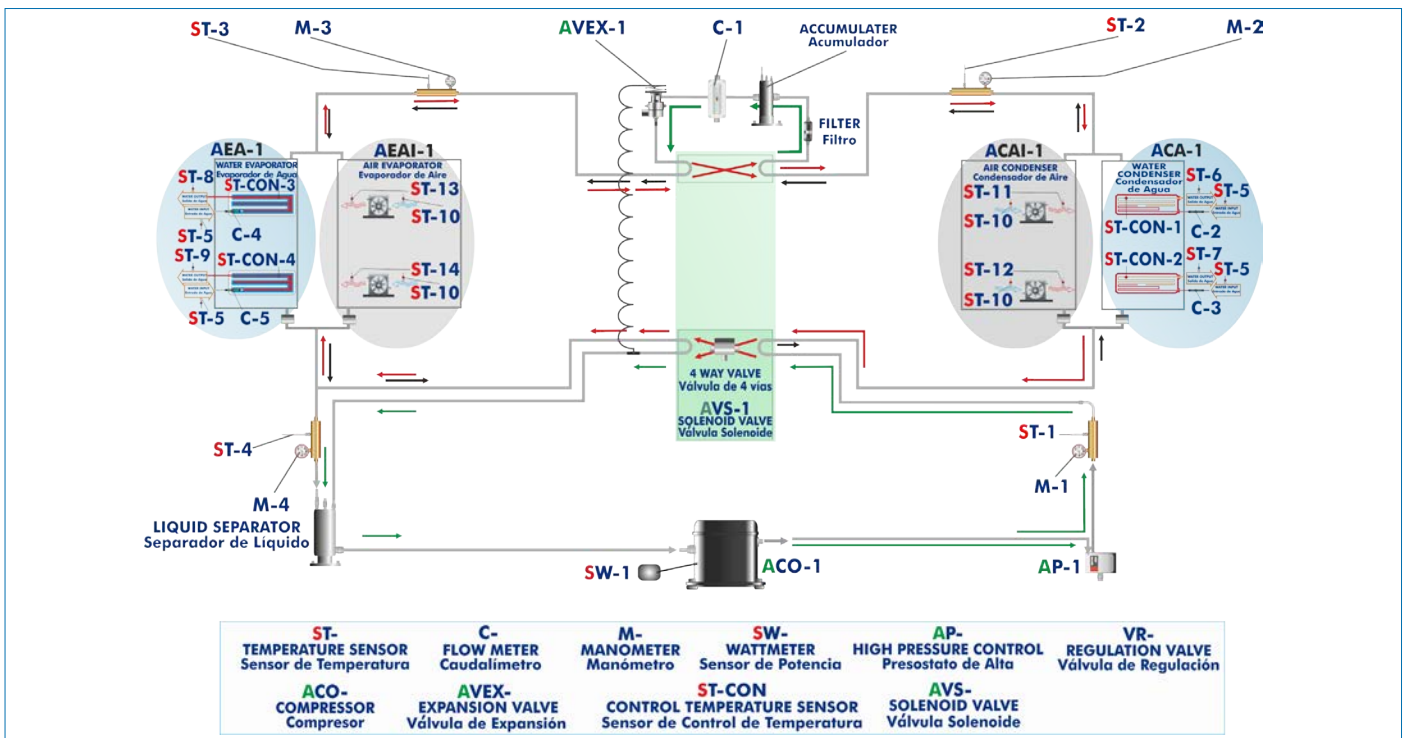
ST- TEMPERATURE SENSOR Sensor de Temperatura	C- FLOW METER Caudalímetro	M- MANOMETER Manómetro	SW- WATTMETER Sensor de Potencia	AP- HIGH PRESSURE CONTROL Presostato de Alta	VR- REGULATION VALVE Válvula de Regulación
ACO- COMPRESSOR Compresor	AVEX- EXPANSION VALVE Válvula de Expansión	ST-CON CONTROL TEMPERATURE SENSOR Sensor de Control de Temperatura		AVS- SOLENOID VALVE Válvula Solenoide	

INTRODUCTION

A heat pump is a device that provides thermal energy from a cold focus to a hotter one. For that purpose, some work is required since, according to the second law of thermodynamics, heat is transferred spontaneously from a hot focus to cold one, until their temperatures are equal.

The objective of the heat pump, cooling or air-conditioning unit designed by EDIBON, is to introduce the student into the complex world of heat pumps systems, as well as to study and determine the characteristic operating parameters of the unit in function of the environmental demands (heat, temperature, cooling, etc.).

GENERAL DESCRIPTION

The objective of the "THIBAR44B" unit is to introduce the user into the study of heat pumps, air-conditioning and cooling, as well as to analyze and determine the operation typical parameters of the unit depending on the two types of fluids used in the evaporation and condensation processes (air and water).

This unit can have different applications, depending on the type of cold focus or hot focus used in the evaporation and condensation processes.

This unit consists of the following stages:

- Compression: this stage begins when the coolant enters the compressor. This coolant is compressed, increasing its pressure and temperature. To measure these variables the unit includes a manometer and a temperature sensor.

- Condensation: the coolant has two possibilities, to be diverted towards the air condenser or towards the water condenser. The coolant transfers its heat to the water (or to the air) that flows through the condenser. At the end of this stage, the pressure and temperature of the coolant are measured with a manometer and a temperature sensor.

- Expansion: the coolant flows through an accumulator and a filter, to retain particles of condensate, and a flow meter. Then it is directed to the expansion valve, which causes a pressure and temperature drop in the coolant. At the end of this stage the pressure and temperature of the coolant are measured with a manometer and a temperature sensor.

- Evaporation: the coolant has two possibilities, to be diverted towards the air evaporator or towards the water evaporator. The coolant absorbs the heat of the water (or the air) that flows through the evaporator. At the end of this stage the pressure and temperature of the coolant are measured with a manometer and a temperature sensor. Finally, the coolant passes through a liquid separator to retain liquid particles before being directed to the compressor.

The unit includes a high pressure switch to avoid overpressure in the unit and a four-way valve to change the direction of the coolant.

The four-way valve (or cycle inversion valve) allows to obtain different combinations of Heat Pump, Air Conditioning and Cooling in only one unit.

SPECIFICATIONS

Bench-top unit with anodized aluminum structure and panels of painted steel.

Main metallic elements of stainless steel.

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

Cooling compressor:

    Type: hermetic.

    Power: 1 CV.

2 air condensers.

2 water condensers, capacity: 1580 W.

High pressure switch.

Coolant accumulator.

Coolant filter to retain particles of condensate.

Expansion valve.

2 water evaporators, capacity: 1580 W.

2 air evaporators.

Liquid separator to retain liquid particles before being directed to the compressor.

4 manometers, situated at important points of the process.

13 type "J" temperature sensors.

5 flow meters:

    Flow meters to measure the flow of coolant, range: 5-60 l./h.

    2 water flow meters to measure the flow of water that circulates through the two water condensers, range: 0.2-2 l./min.

    2 water flow meters to measure the flow of water that circulates through the two water evaporators, range: 0.2-2 l./min.

Wattmeter and power measurement.

Four-way valve (solenoid valve) .

4 valves to direct the coolant through the condensers and evaporators.

Enthalpy diagram of the R134a coolant.

Electronic console:

    Metallic box.

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

    High pressure control connection.

    Fans ON/OFF switches. Fans speed regulators.

    Cycle inversion valve connection. Cycle inversion valve switch.

    Wattmeter display.

    Compressor ON/OFF switch. Electronic console ON/OFF switch.

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.

Detail of the unit

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Determination of the inlet power, generated heat and performance coefficient. Water as heat source. (Water-water heat pump).

2.- Determination of the inlet power, generated heat and performance coefficient. Air as heat source. (Water-air heat pump).

3.- Determination of the inlet power, generated heat and performance coefficient. Air as heat source. (Air-air heat pump).

4.- Determination of the inlet power, generated heat and performance coefficient. Water as heat source. (Air-water heat pump).

5.- Preparation of performance curves of the heat pump with different inlet and outlet temperatures. Water as heat source. (Water-water heat pump).

6.- Preparation of performance curves of the heat pump at different inlet and outlet temperatures. Air as a heat source. (Water-air heat pump).

7.- Preparation of performance curves of the heat pump with different inlet and outlet temperatures. Water as heat source. (Air-water heat pump).

8.- Preparation of the performance curves of the heat pump with different inlet and outlet temperatures. Air as heat source. (Air-air heat pump).

9.- Lay out of the steam compression cycle in a diagram P-H and comparison with the ideal cycle. Water as heat source. (Water-water heat pump).

10.-Lay out of the steam compression cycle in a diagram P-H and comparison with the ideal cycle. Air as heat source. (Water-air heat pump).

11.-Lay out of the steam compression cycle in a diagram P-H and comparison with the ideal cycle. Water as heat source. (Air-water heat pump).

12.-Lay out of the steam compression cycle in a diagram P-H and comparison with the ideal cycle. Air as heat source. (Air-air heat pump).

13.-Preparation of the performance curves of the heat pump based on the properties of the refrigerant and at different condensation and evaporation temperatures. Water as heat source. (Water-water heat pump).

14.-Preparation of the performance curves of the heat pump based on the properties of the refrigerant and at different condensation and evaporation temperatures. Air as heat source. (Water-air heat pump).

15.-Preparation of the performance curves of the heat pump based on the properties of the refrigerant and at different condensation and evaporation temperatures. Water as heat source. (Air-water heat pump).

16.-Preparation of the performance curves of the heat pump based on the properties of the refrigerant and at different condensation and evaporation temperatures. Air as heat source. (Air- air heat pump).

17.-Practices with cycle inversion.

Additional practical possibilities:

18.-Sensors calibration.

19.-Energy balance for the different components and for the complete cycle.

20.-Evaluation of the volumetric effectiveness of the compressor at different pressure relations.

21.-To estimate of the total thermotransference coefficient at the condenser and evaporator.

22.-Energy balance at the air evaporator.

23.-To estimate of the exchange heat at the water evaporator and outlet temperature of the water.

24.-Determination of the characteristic parameters of the steam compression cooling.

25.-Characteristic parameters of the steam compression cycle.

26.-Influence of overheating and overcooling during the operating cycle.

REQUIRED SERVICES

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

RECOMMENDED ACCESSORIES (Not incluided)

For refilling R134a refrigerant and maintenance, we recommend:

- T/KIT1. Maintenance Kit, containing: vacuum pump, hoses and manometers.
- T/KIT2. Maintenance Kit, containing: leakage detector.
- R134a refrigerant (to be acquired by the customer locally).

DIMENSIONS AND WEIGHTS

THIBAR44B:
  Unit:
      -Dimensions: 1000 x 950 x 750 mm. approx.
                        (39.37 x 37.40 x 29.52 inches approx.)
      -Weight: 200 Kg. approx.
                        (440 pounds approx.).
  Electronic console:
      -Dimensions: 490 x 450 x 470 mm. approx.
                        (19.29 x 17.71 x 18.5 inches approx.)
      -Weight: 20 Kg. approx.
                        (44 pounds approx.).

AVAILABLE VERSIONS

Offered in this catalogue:

- THIBAR44B. Heat Pump + Air Conditioning + Refrigeration Unit with Cycle Inversion Valve (four condensers (water and air) and four evaporators (water and air)).

Offered in other catalogue:

- THIBAR44C. Computer Controlled Heat Pump + Air Conditioning + Refrigeration Unit with Cycle Inversion Valve (four condensers (water and air) and four evaporators (water and air)).

OTHER UNITS

- THIBAR22B. Heat Pump + Air Conditioning + Refrigeration Unit with Cycle Inversion Valve (two condensers (water and air) and two evaporators (water and air)).
- THIBAR22C. Computer Controlled Heat Pump + Air Conditioning + Refrigeration Unit with Cycle Inversion Valve (two condensers (water and air) and two evaporators (water and air)).

THIBAR44B/ICAI. Interactive Computer Aided Instruction Software System:
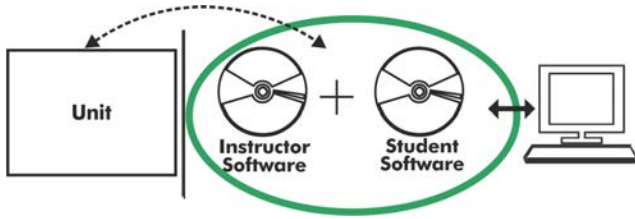
Whit no physical connection between unit and computer (PC), **this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM) totally integrated with the Student Software (EDIBON Student Labsoft -ESL).** Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

-ECM. EDIBON Classroom Manager (Instructor Software).

ECM 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.

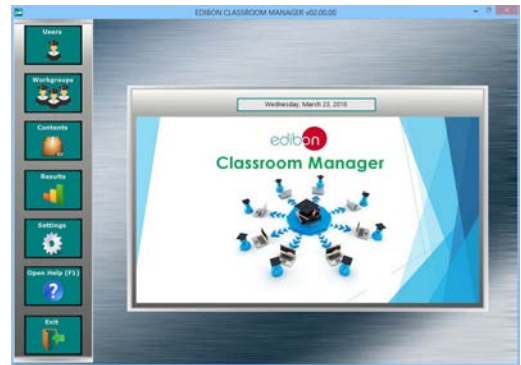   Creation and Integration of Practical Exercises and Multimedia Resources.

   Custom Design of Evaluation Methods.
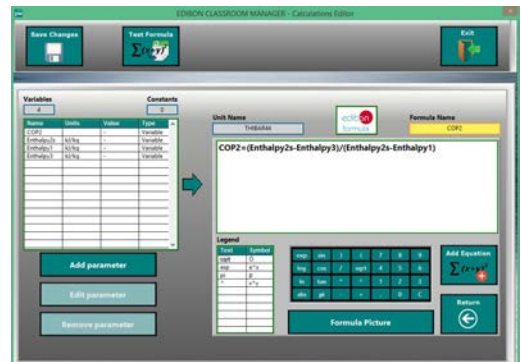
   Creation and assignment of Formulas & Equations.

   Equation System Solver Engine.

   Updatable Contents.
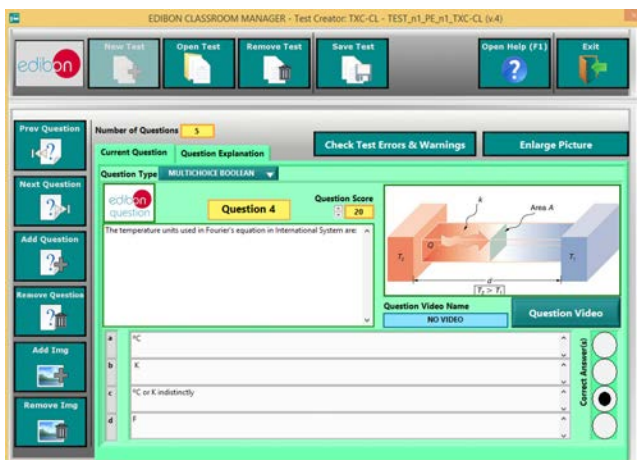
   Report generation, User Progression Monitoring and Statistics.

ECM. 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. EDIBON Student Labsoft (Student Software).

ESL 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.

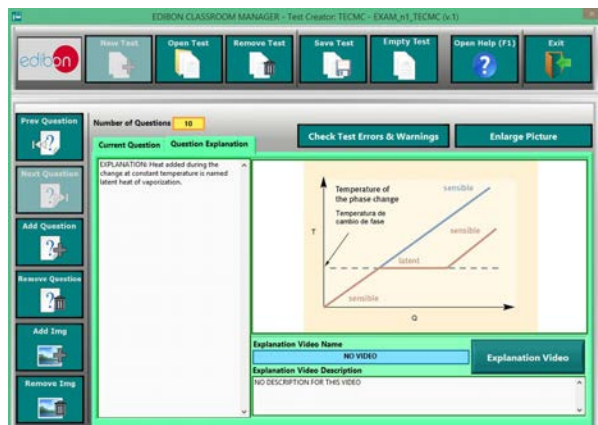For more information see **ICAI** catalogue. Click on the following link:

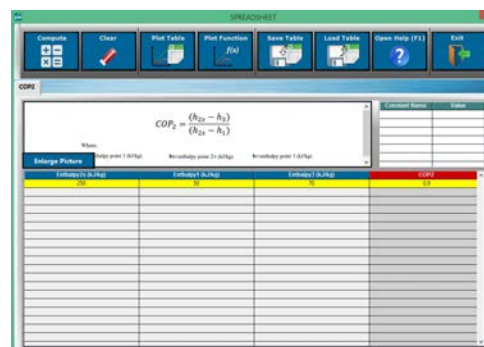**www.edibon.com/products/catalogues/en/ICAI.pdf**

ESL. EDIBON Student LabSoft (Student Software) Application Main Screen
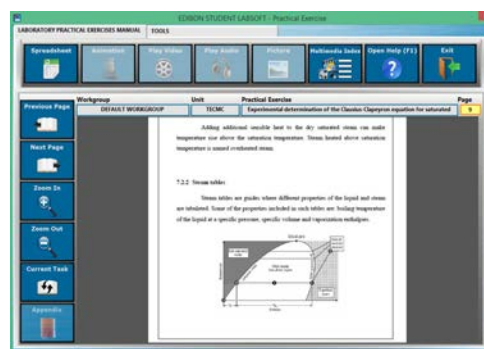
EPE. EDIBON Practical Exercise Program Package Main Screen

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