Heat Pump + Air Conditioning + Refrigeration Unit with <u>Cycle Inversion Valve</u>

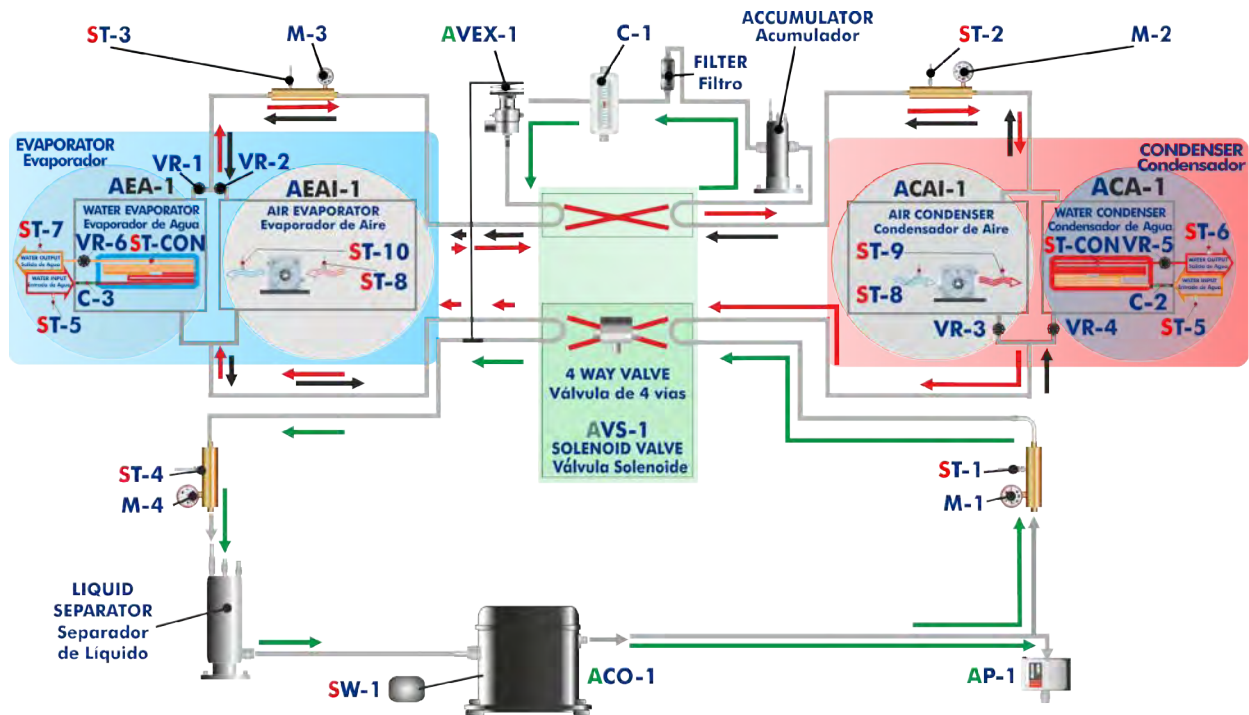**edibon**

Technical Teaching Equipment

THIBAR22B

Electronic console

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

9 UNITS IN ONE
6 of them Heat Pump + Air Conditioning + Refrigeration and 3 of them Heat Pump + Air Conditioning
All these units are included in the unit THIBAR22B, as it has 2 EVAPORATORS, 2 CONDENSERS and CYCLE INVERSION VALVE

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		

INTRODUCTION

A heat pump is a device that provides thermal energy from a cold focus to hotter other one. For this, it is necessary a contribution of work, so in agreement with the 2° law of the thermodynamics, the heat is transfered in a spontaneous way from a hot focus to cold other one, until their temperatures are equal.

The Heat Pump + Air Conditioning + Refrigeration Unit with Cycle Inversion Valve "THIBAR22B" is an unit designed to study the thermodynamic processes that happen in a circuit that it can work as heat pump, air conditioning and refrigeration and through which a coolant circulates.

GENERAL DESCRIPTION

The unit "THIBAR22B" has as aim introduce the student to the study of the heat pumps, air conditioning and refrigeration, as well as the analysis and determination of the operation typical parameters of the unit depending on the two types of fluids used in the processes of evaporation and condensation (air and water).

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

Compression:
This stage begins when the coolant enters to 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: divert the coolant through the air condenser, or through the water condenser. The coolant transfers its heat to the water (or to the air) that flows for the condenser. At the end of this stage, the pressure and the temperature of the coolant are measured by means of a manometer and a temperature sensor.

Expansion:
The coolant circulates through an accumulator and a filter, to retain particles of condensate, and a flow meter. Next it circulates through the valve of expansion, which causes a fall of pressure and temperature of the coolant. At the end of this stage, the pressure and the temperature of the coolant are measured by means of a manometer and temperature sensor.

Evaporation:
The coolant has two possibilities: divert the coolant through the air evaporator, or through the water evaporator. The coolant absorbs the heat of the water (or the air) that flows for the evaporator. At the end of this stage, the pressure and the temperature of the coolant are measured by means of manometer and a temperature sensor. Finally, the coolant circulates through a liquid separator to retain liquid particles before going on to the compressor.

The condensers and evaporators have different meters for the measure of the most important parameters (temperatures and flows). In addition, the unit includes a high pressure control to avoid an excess of pressure in the unit and a 4-way valve to change the direction of the coolant.

The 4-way valve (or cycle inversion valve) allows to obtain different combinations of Heat Pump, Air Conditioning and Refrigeration in a only unit. So that using the cycle inversion valve, we have 9 units in one, 6 of them Heat Pump + Air Conditioning + Refrigeration and 3 of them Heat Pump + Air Conditioning.

SPECIFICATIONS

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

Main metallic elements of stainless steel.

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

Cooling compressor, power: ½ CV.

Air condenser. Air evaporator.

High pressure control.

Coolant accumulator. Coolant filter to retain particles of condensate.

Water evaporator, capacity: 1580 W. Water condenser, capacity: 1580 W.

Liquid separator to retain liquid particles before going on to the compressor. Expansion valve.

4 Manometers, situated at important points of the unit.

10 Temperature sensors (4 sensors measure the cooling temperature, 3 sensors measure the water temperature, 3 sensors measure the air temperature):

Temperature sensor, J type (compressor outlet).
Temperature sensor, J type (condenser outlet/evaporator inlet).
Temperature sensor, J type (evaporator inlet/condenser outlet).
Temperature sensor, J type (compressor inlet).
Temperature sensor, J type (water inlet).
Temperature sensor, J type (condenser outlet/evaporator).
Temperature sensor, J type (evaporator outlet/condenser).
Temperature sensor, J type (room air).
Temperature sensor, J type (condenser outlet/evaporator).
Temperature sensor, J type (evaporator outlet/condenser).

3 Flow meters: Cooling flow meter, range: 5-60 l./h. 2 Water flow meters (water condenser and water evaporator), range: 0.2-2 l./min.

Wattmeter.

4-Way valve (solenoid valve). Four 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 whit the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

1.- Determination of COP (coefficient of performance) of a heat pump. Water as heat source. (Water-water heat pump).

2.- Determination of COP (coefficient of performance) of a heat pump. Air as heat source. (Water-air heat pump).

3.- Determination of COP (coefficient of performance) of a heat pump. Air as heat source. (Air-air heat pump).

4.- Determination of COP (coefficient of performance) of a heat pump. Water as heat source. (Air-water heat pump).

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

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

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

8.- Representation of 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 refrigeration 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 refrigeration 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 refrigeration 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 refrigeration compression cycle in a diagram P-H and comparison with the ideal cycle. Air as heat source. (Air-air heat pump).

13.- Representation 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.- Representation 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.- Representation 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.- Representation 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.

REQUIRED SERVICES

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

RECOMMENDED ACCESSORIES

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 & WEIGHTS

THIBAR22B:

Unit: -Dimensions: 900 x 600 x 500 mm. approx.
                (35.43 x 23.62 x 19.68 inches approx.)

                -Weight: 100 Kg. approx.
                (220 pounds approx.)

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

                -Weight: 15 Kg. approx.
                (33 pounds approx.)

AVAILABLE VERSIONS

Offered in this catalogue:

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

Offered in other catalogue:

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

Other available versions:

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

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

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

REPRESENTATIVE: