

Refrigeration Cycle Demonstration Unit







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 TCRB unit 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 niquelplated 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 condender. 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 has a high pressure switch that turns off the compressor when the pressure in the condenser reaches 2.3 bar. Besides, at the condenser upper part, the unit disposes of a relief valve that opens itself when the condenser pressure exceeds 2.4 bar.

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.

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TCRB is bench-top unit that is assembled in anodized aluminium structure and panels in painted steel (epoxy paint).

Main metallic elements in stainless steel.

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

Compressor: hermetic compressor of 1/2CV.

Condenser: vertical cylinder, made of glass, through which the coil can be seen where in its inside cooling water circulates. The cylinder is stabilised over special bridles that reduce the formation of tensions and turn it hermetic by using special viton joints. The heat transmission surface is formed by 9 nickel-plated copper spires of 1/4" diameter through which the water flows. The heat transmission area is approx. 0.032 m².

Evaporator: of similar structure to that of the condenser, and with a specially treated copper coil to promote the ebullition. The heat transmission area is approx. 0.032 m².

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

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

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.

Temperature sensors range: 0-100°C.

Maximum working temperature: 100°C.

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

2 Pressure meters indicate the refrigerant fluid pressure in the condenser and in the evaporator.

Pressure meter (condenser): from 0 to 6 bar.

Pressure meter (evaporator): from -1 to 1 bar.

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

There is a 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.

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

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.

The unit is supplied with following diagrams:

Mollier diagram for SES36 refrigerant.

Entalpy diagram for SES36 refrigerant.

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.

Some Practical Possibilities of the Unit:

- 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.

REQUIRED SERVICES =

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

9.- Measurement of the electrical power.

10.-Estimation of the heat transmission global coefficient between the SES36 refrigerant and the water.

DIMENSIONS & WEIGHTS

Unit:

TCRB:

-Dimensions: 700 x 700 x 720 mm. approx. -Weight: 70 Kg. approx. Electronic Console: -Dimensions: 490 x 330 x 310 mm. approx. -Weight: 10 Kg. approx.

AVAILABLE VERSIONS

Offered in this catalogue:

- TCRB. **Refrigeration Cycle Demonstration Unit.**

Offered in other catalogue:

- TCRC. Computer Controlled Refrigeration Cycle Demonstration Unit.

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



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