

## DIDACTIC SYSTEM FOR THE STUDY OF ENERGY EFFICIENCY IN HVAC SYSTEMS

### DL CLIMA-6



The bench for the Study of Energy Efficiency in HVAC (Air Conditioning) Systems was designed to allow the study and measurement of electrical consumption, temperature gradients, possible failures and loss of performance in an air conditioning system that includes the reverse cycle. It allows to demonstrate in practice, the differences in the energy consumption and the energy efficiencies of the system, with the insertion of faults that commonly occur in climate-controlled environments.

The bench is made of structural aluminum profiles, reinforced, anodized and finished on the surface. Approximate dimensions are: 1500 mm wide x 900 mm deep x 1400 mm high, with an air conditioning chamber of approximately 0.5 cubic meters, and is suitable for the installation of drive equipment, electrical circuits, cooling gas pipes and system components, and instruments such as pressure gauges, valves, pressure switches, liquid inspection glass.

The entire circuit, its pipes and components are installed on an external panel to make it more didactic, which allows the operation of several valves that interfere with the operation of the system, in order to insert disturbances that simulate faults or losses of performance. The workbench consists of the following modules/functions.

### CONTROL PANEL

A panel that provides power and protection for the system with circuit breakers, switches, pushbuttons and signal lights and allows manual control. The necessary equipment for the measurement of electrical parameters and temperatures, as well as the data acquisition system, are installed.



### MULTIMETER WITH DATA ACQUISITION

This multimeter allows the reading of electric parameters directly on the bench, without having to use a computer, by operating the bench manually. The multimeter is supplied with a RS485 to USB conversion cable and software to display the measured values on PC/Windows (not supplied), with the possibility of storing them.



### EVAPORATOR

The evaporator, from which the air conditioning exits, is installed inside the thermal chamber that is closed on all sides to form a sealed environment as an isolated area.

### CONDENSER

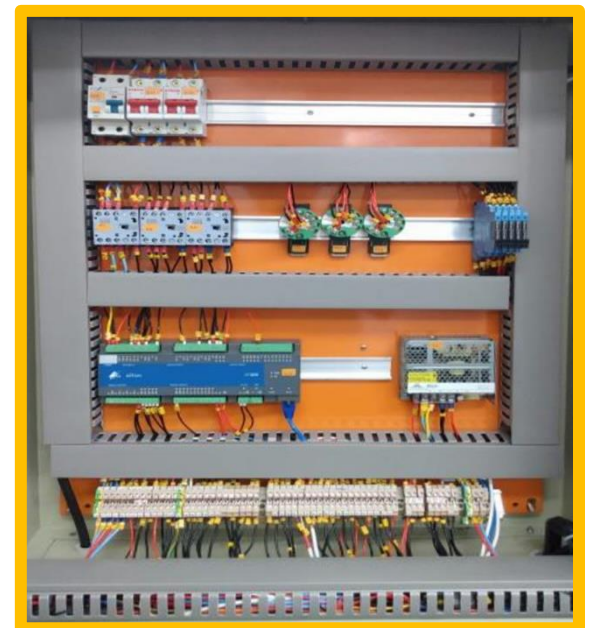
The air conditioning is rated at 9,000 BTU's in reverse cycle, i.e. it can be cooled and heated.

### COMPRESSOR

The compressor, liquid/gas circuit, condenser, instruments, valves and other devices are installed on the sides and base of the bench, so they are visible and easily accessible.

### TEMPERATURE GAUGES

Two digital thermometers are installed (without transmission, but with local indication), externally visualizing, at equidistant points of the indoor climate area, an internal temperature transmitter and an external temperature transmitter, in order to capture the temperature differences at these points. Two more temperature transmitters are installed in the compressor, one at the suction and one at the discharge, to observe the temperatures in the refrigeration circuit. Four transmitters send the information to the data collection system.





## SYSTEM DIDACTIC ACTIVITIES

- a) Electrical experiments designed to study the electrical principles used in air conditioning and test its components.
- b) Diagnosis of the electrical part and monitoring of the working conditions.
- c) Electrical experiments related to the cooling system and component operating states.
- d) Pipe design, such as pipe cutting, pipe bending, pipe welding, and pipe expansions and their connections.
- e) Analysis of the complete air conditioning vacuum system and filling with cooling gas.
- f) Vacuum cleaning and filling with cooling gas, electrical connections and monitoring of working conditions.
- g) Power measurements
- h) Pressure measurements
- i) Temperature measurements
- j) Energy efficiency assessments in various modes and work points.
- k) Supervision program

## THE SYSTEM INCLUDES

- Manuals with theoretical information and practical activities
- A set of leads with a banana plug in sufficient quantity to make all necessary connections.