

GEOTHERMAL ENERGY TRAINER



DL GEOTHERM

TRAINING OBJECTIVES

The trainer replicates a ground source heat pump air conditioning system. The heating and cooling power is simulated using a fan coil, while a water tank with electric heater is used to simulate the constant temperature of the subsoil.

Based on the simulated operating conditions of the system, the teacher and students can observe the behavior of components and sub-systems directly on the HMI panel or through a PC.

The simulation in progress is controlled in real time through an onboard HMI that constantly monitors analog and digital signals and meters. The student can study and troubleshoot the system's behavior in various conditions by performing different measurements and tests.

The training platform is mounted on a robust aluminium chassis frame, reducing the overall weight of the equipment while ensuring its strength. The trainer can be easily moved thanks to the 4 wheels at the bottom of the structure.

The DL GEOTHERM has been designed as a miniaturized ground source heat pump air conditioning system to study the cooling and heating processes of the reversible heat pump plant with water-to-water heat exchangers.

This training device allows students to study in detail the working principle and thermal cycle process of the ground source heat pump and learn about the system characteristics and control methods. It covers several topics such as hydraulics, mechanics, and thermodynamics and control.

Its working principle is based on the Carnot cycle, using groundwater or surface water. A compressor system, consuming a small amount of electricity, is used to continuously take out a large amount of low-grade heat energy from the water and convert it into a small amount of high-grade heat energy for indoor heating.

In summer, the cooling water system of the unit runs in reverse to take out the residual heat in the room and release it to the ground or water to cool down the air conditioner. In addition, energy can be stored in summer and released in winter.

TARGET

Ideal for 4 students to work simultaneously.

Vocational and technical schools.

Applicable to courses in: **Renewable energies, Automation, Thermodynamics; Physics.**

TECHNICAL DESCRIPTION

The trainer is organized using an open frame structure where each component is accessible and easy to operate following a clear layout. The trainer's front panel has a schematic diagram of the entire system, with indicators of main components' operating status. The entire system can be monitored in real-time through the HMI's touch screen that also allows fault insertion to simulate a system failure.



The refrigeration cycle pipeline is laid on the equipment installation board, and the high and low temperature areas are clearly identified with different colours for easy observation.

The equipment includes several safety and protection systems. A high- and low-pressure protection switch installed in the refrigeration cycle can immediately stop the compressor when the system pressure is abnormal to protect the system. On the electrical side, a reliable grounding, a leakage circuit breaker switch, and an emergency stop button ensure the student's and equipment's safety.

DIDACTIC EXPERIENCE

1. Operation principle and structure of the ground source heat pump unit.
2. Ground source heat pump air conditioning system electrical control.
3. Study of ground-source heat pump air-conditioning system in summer operating conditions.
4. Study of ground source heat pump air-conditioning system in winter operating conditions.
5. Demonstration of failure and troubleshooting of the ground source heat pump air conditioning system

The main components of the system are:

- Refrigeration unit:
Complete with Compressor, condenser (plate heat exchanger), evaporator (concentric tube heat exchanger), four-way reversing valve, gas-liquid separator, liquid storage tank, thermal expansion valve, sight glass and filter drier. The pipeline is equipped with control valves and other necessary parts for training. The sight glass in the pipeline can be used to observe the refrigerant status and other equipment components.
- Simulated groundwater source water system:
Composed of a stainless-steel water tank and a cooling water pump. It completes the cooling and heat dissipation work of the refrigeration unit.
- Air conditioning system (windpipe assembly):
Includes the water-cooled evaporator, water pump, and fan with adjustable speed.
- Control and configuration unit:
It controls the entire system, collects, and processes the operating data provided by the various electronic sensors and displays its running status in real time on the HMI's touch screen. The parameter setting and control operation can be carried out directly on the touch screen, or on a local PC through the communication bus.

TECHNICAL SPECIFICATIONS

- Input power: 220V±10% 50Hz
- Dimensions: 1300mm×800mm×1800mm
- Net Weight: 180kg
- Working conditions: ambient temperature 10°C~30°C relative humidity <75% (25°C)
- Refrigerant: R134a
- Average training hours: 10 h.