

Compression Refrigeration System Test Rig (integrated with digital output unit)

KS/ME/CREFTSTRIG

Apparatus must includes:

Typical compression system with piston compressor, thermostatic expansion valve, evaporator and condenser (each in the shape of a pipe coil).

Two units of manometers with integrated temperature scale for (High & Low pressure sides) & 2 water-filled tanks with thermometer to demonstrate the cooling and heating effect.

Thermostatic expansion valve along with compressor protection with (high pressure cut- off) pressure switch.

Compressor which is in used must be piston type.

Refrigerant used is R513A having GWP631 & sight glass for monitoring the refrigerant state.

Compressor unit

cooling capacity: 275-300 W at 5°C/40°C

displacement Volume: 2.70-2.75 cm³

Pressure Gauges

Range 1: -1 to 12.5 bar

Range 2: -1 to 25 bar

Temperature

Range -50 to 40°C, -40 to 80°C,

2x thermometers: Range -10 to 50°C

Storage Tank

4x Range: 1500-1800 ml.

Refrigerant filling volume: 450-475 g



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Scope

It is a self-contained computer-controlled vapour-compression refrigeration system with automatic recording of all-important process variables using an integral USB interface device. Compressor speed and power supplied should be displayed on the PC. The hermetically sealed refrigerant exiting the compressor should pass through a condenser, receiver, filter, variable area flow meter, expansion valve and evaporator before returning to the inlet side of the compressor.

Overall performance of the system is calculated and displayed continuously enabling the effect of changes in the system to be evaluated.

Submersible variable speed pumps supply water at a stable temperature and pressure from the reservoir to the condenser and evaporator eliminating fluctuations.

Condenser and evaporator both use plate heat exchangers enabling a full energy balance to be carried out while varying the operating conditions on both sides of the compressor.

Real-time superheat conditions in the condenser and evaporator should be calculated and displayed.

Real-time display for Coefficient of Performance (COP)

Provision to change expansion valve setting by the operator to change the operating point (evaporator superheat setting)

A refrigerant flow meter as a sight glass enables observation of any vapour bubbles downstream of the compressor when conditions are not optimal • Alarm system to protect the equipment from misuse by switching the compressor off if pressures, temperatures, flow rates or pumps drift outside acceptable limits. Advanced warnings for operator to take remedial action before the compressor is switched off • Bourdon type gauges indicate the pressure and corresponding refrigerant saturation temperature on both sides of the compressor independent from the electronic systems.

Provision to future expansion and integration

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Experimental capabilities:

Ability to changing the operation of different parts of the process and recording the response of the complete system
To operate vapour-compression refrigeration system and understand the relation between the hardware components and the refrigeration cycle

First Law of Thermodynamics - The law of conservation of energy

To investigate the effect on the refrigeration system of the flow of water through the condenser and to determine the optimum flow rate for a given load

To investigate the effect on the refrigeration system of the flow of water through the evaporator and to determine the optimum flow rate for a given system load

To investigate the effect of the flow of refrigerant through the refrigeration system, and whether there is an optimum flow rate

To investigate the effect of closing/opening the expansion valve on a refrigeration system, and to determine the optimum setting for a particular application

Coefficient of Performance (COP)

Thermodynamic system modeling

To perform appropriate energy balances and a detailed analysis of the performance of the refrigeration system Layout Frame

Metallic frame and panels.

The unit includes wheels to facilitate its mobility.



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Dimensions Layout

Refrigeration unit:

Length: 1.00m (Maximum)

Width: 0.60m (Maximum)

Height: 0.50m (Maximum)

Water reserve:

Length: 1.00m (Maximum)

Width: 0.80m (Maximum)

Height: 0.78m (Maximum)

Technical specifications:

Refrigerant: R-5134a

Hermetically sealed compressor: 2000 to 4500 RPM

Hermetically sealed compressor supply: 24V DC to speed controller of brushless 3 phase DC motor

Water cooled condenser through Plate heat exchanger

Water cooled evaporator via Plate Heat Exchanger with submersible pump

Variation of flow through plate Heat Exchanger

Thermostatic Expansion valve: Danfoss TN2 Internally equalized valve

Refrigerant flow measurement: Rotameter, Range: 10-35 Liters/min calibrated for 134-A

Bourdon Pressure Gauge: 0-25Bar

Bourdon Compound Gauge 0-10Bar

HP/LP CUTOUT: Low Pressure 2 Bar/ High Pressure 16 Bar

24V DC Speed controller on compressor with integral power measurement on PC

Electrically isolated

USB computer connectivity



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Temperature Sensors

9 x Thermostats to measure -25 to 100°C at

Water in evaporator tank

Water entering condenser

Evaporator outlet

Compressor inlet

Condenser outlet

Evaporator tank

Water entering evaporator.

Continuous indicator for evaporator superheat.

Continuous indicator for condenser super cooling

Components:

Vapor compression refrigeration test rig

Control Interface Box

Data Acquisition Board:

Data Management Software

Cables and Accessories

Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

A Compatible computer (PC) should be supplied

Processor: 7th Gen. Intel Core i5 -7400 (6MB Cache) 3.0 GHz or higher

16GB DDR4 RAM or higher

1TB 5400 RPM SATA SSD or higher

OS: Windows 10 (64bit) is recommended

Keyboard /Mouse

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Ports (recommended specs)

4 x USB 3.0

HDMI-out

Display Port 1.2

2 x Thunderbolt 3 (supports Type-C, USB3.1, DisplayPort, PS)

Ethernet, audio out

Computer Display: 21.5" LED monitor is recommended



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