EXPERIMENTAL CAPABILITIES

- Determine the energy flows and coefficient of performance for given operating instructions.
- Examine the behaviour of refrigerating cycle under variable loads and speeds.
- Operate the refrigeration unit over a range of conditions.
- Estimate the Heat Transfer Coefficient.
- Determine the Mechanical, Thermodynamic (Isentropic) and Volumetric efficiencies.
- Estimate the rate at which heat is transferred to the system from the surrounding environment.
- Compile an energy balance under light load and full load conditions.

FEATURES

- Rapid stabilization allowing the effect of operating changes to be demonstrated directly
- Compact, self-contained and portable
- Infinitely variable dynamometer speed control
- All temperature measurements from multi-point digital thermometer
- Quiet operation via anti-vibration mountings
- Direct flow measurement of refrigerant
- Infinitely variable heating of water/glycol bath

INTRODUCTION

Cussons Refrigerator and Heat Pump Apparatus has been specially developed for the study of the thermodynamics of the vapour compression cycle operating as either a refrigerator or as a heat pump. It is self-contained and carries instrumentation to enable a comprehensive series of experiments to be carried out, including refrigerant cycle evaluation and thermodynamic energy balances of the condenser, evaporator and compressor. The front panel mimic shows the refrigeration circuit and measuring points with maximum clarity.

DESCRIPTION

The unit is designed to use Tetrafluoroethane (refrigerant R134a) as the refrigerant with a twin cylinder reciprocating compressor, belt driven by the variable speed dynamometer. The refrigeration circuitry includes a water cooled condenser complete with isolating valves, manual expansion valve, evaporator, variable area flowmeter for mass flow of refrigerant, filter/drier unit, sight glass and over pressure cut-out for unit protection.

The evaporator coil is mounted in an electrically stirred water/glycol mixture contained in a thermally insulated, stainless steel tank. Heating of this water/glycol mix is infinitely variable enabling balanced experimental conditions over a wide range of temperatures to be obtained. The water/glycol mixture is protected from over temperature conditions by a thermostat should the heater should be left on when the compressor is not circulating refrigerant.

The trunnion mounted DC dynamometer is by a DC Thyristor drive unit and gives the compressor an infinitely variable speed range between 8 and 16 rev s\(^{-1}\). The DC speed control unit incorporates over current protection and ‘soft start’ circuitry to give a controlled speed ramp start if the speed control is pre-set.

Dynamometer torque is measured using a strain gauge load cell energized, conditioned and displayed by a high accuracy instrument meter, mounted on the front panel. The refrigeration capacity depends on the temperature level maintained in the water-glycol mixture, but has a maximum value of about 1.8 kW.
The remaining instrumentation includes 3 pressure gauges, temperature measurement at 8 points, selected on a digital readout unit, digital tachometer for compressor speed, a digital meter for heater current and variable area flowmeters for refrigerant and cooling water mass flow.

All instrumentation and controls have been integrated into a multi-colour flow mimic diagram to encourage immediate correlation between a measurement and its position in the refrigeration circuit.

The unit is constructed within a wheeled frame so it can easily pass through any standard doorway. It requires services of cold water and single phase AC supply (3 kW max.).

The dynamometer/compressor assembly is resiliently mounted and vibration is negligible. The unit with its instrumentation permits analysis of a widely used refrigeration system. Analysis may be carried out at different speeds, pressures and temperatures. Heat balance tests may be carried out and the conditions in each experimental component investigated. Particular attention has been given to ensuring that operating conditions stabilise rapidly, keeping preparatory periods to a minimum allowing the effects of even small changes to the operating conditions can be quickly evaluated.

**TENDER SPECIFICATION**

Vapour Compression Refrigerator and heat pump for R134a with two cylinder reciprocating compressor tapped for optional pressure transducer, dynamometer drive by DC machine with a solid state control unit, water cooled condenser manually controlled expansion valve, evaporator and water-glycol bath with electrical heating (2 kW). Instrumentation includes pressure gauges (3), selectable multi-point direct reading digital thermometer for all temperatures, variable area flowmeters (2), digital ammeter for heater current, digital meter for torque readout and digital tachometer, the instrumentation is integrated into an operator panel printed with a five colour mimic diagram.

**RECOMMENDED ACCESSORY**

P5751 Sensor pack and Data acquisition module together with optional entry level personal computer, to allow display of live data on a software mimic diagram and also allowing the calculation of results from live spreadsheet data. The sensor pack consists of 3 transducers one each for compressor inlet, outlet and expansion valve outlet pressure, plus 2 turbine flowmeters for water and refrigerant flow. The P5751 can only be factory fitted to P5750.

**OPTIONAL ACCESSORY**

P2255 Sectioned refrigeration compressor similar to unit on P5750 showing all functions and mounted on a base.

**INSTALLATION REQUIREMENTS**

220/240 volt 50/60 Hz single phase operation (3kW max). Other voltages to special order. Supply of cold water.

**DIMENSIONS AND WEIGHTS**

- Length: 1.37m
- Width: 0.7m
- Height: 1.6m
- Nett weight: 320kg

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_head@cussons.co.uk_  /  www.cussons.co.uk

The company may alter specifications as its discretion and without notice, in line with its policy of continuous development.