



## ***Air & Water Heat Pump R832***

Figure 1 : R832



- ***Vapour Compression Heat Pump that allows Performance Investigation from both Air and Water Sources.***
- ***Rapid Stabilisation enables detailed Investigation in a Typical Laboratory Period.***
- ***Permits refrigerant pressure-enthalpy cycle diagrams to be drawn at all operating conditions.***
- ***Optional Computerised Data Acquisition Upgrade.***
- ***May be linked to Hilton Bench Top Cooling Tower H892 by addition of Reservoir System H060.***
- ***Two Year Warranty.***



## ***Introduction***

The vapour compression cycle is the most common form of refrigeration, transferring heat from the area being cooled to a higher temperature region. Heat Pumps use this effect to recover heat at a useful temperature for heating or some other process by upgrading low grade 'free' heat e.g. from ambient air or water.

Due to concerns about the effects of global warming, awareness of energy conservation must increase and heat pumps are an effective method of reducing energy consumption. Hence an understanding of their operation is relevant to many engineering disciplines.

The Hilton Air and Water Heat Pump R832 is a purpose designed and fully instrumented machine operating on ozone friendly R134a, which is not restricted under the terms of the Montreal Protocol.

The unit enables students to plot the pressure enthalpy and performance graphs as conditions are changed, so enhancing their understanding of the theory.

The unit will be a valuable teaching aid for students of:

- **Refrigeration & Air Conditioning**
- **Building Services**
- **Mechanical Engineering**
- **Plant and Process Engineering**
- **Energy Conservation**
- **Energy Management**
- **Chemical Engineering**
- **Food Technology**
- **Marine Engineering**
- **Agriculture Engineering**

## ***Experimental Capabilities***

The following experiments can be performed:

- Determination of Power Input, Heat Output and Coefficient of Performance.
- Production of Heat Pump Performance Curves over a range of source and delivery temperatures.
- Plotting of Vapour Compression Cycle on the Pressure Enthalpy diagram, and comparison with the Ideal Cycle.
- Energy Balances for the Components and the Whole Cycle.
- Estimation of Compressor Volumetric Efficiency Over a Range of Pressure Ratios.
- Estimation of Overall Heat Transfer Coefficients in the Evaporator and Condenser.

## ***Description***

R134a refrigerant vapour is compressed in an hermetic compressor and then flows to a water cooled condenser. Heat is transferred to cooling water and the refrigerant vapour is condensed to a high pressure liquid which passes through a thermostatic expansion valve.

A switch allows the user to direct the flow of the expanding vapour to either an air or water source evaporator where heat is extracted and the cycle is repeated. In order to recover waste heat from the compressor, the condenser cooling water also passes through a heat exchanger in the compressor casing. All components are mounted on a glass reinforced plastic panel and base.





Instrumentation includes pressure gauges, flowmeters, thermocouples and wattmeter allowing students to record all of the relevant parameters to create performance curves and refrigerant cycle diagrams.

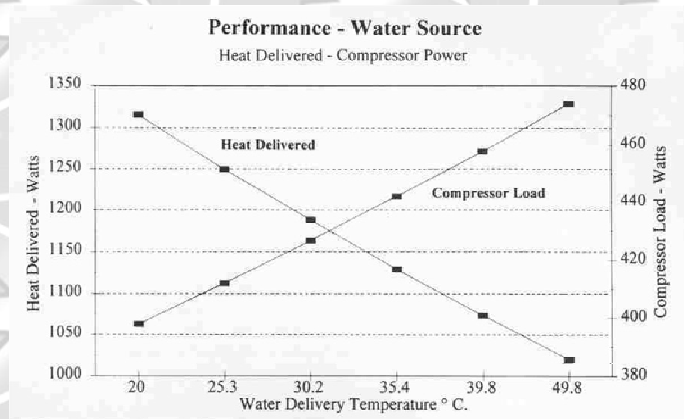
The R832 incorporates mechanical fail safe over pressure cutout, together with a miniature circuit breaker and a 30mA residual current breaker for added protection.

#### Optional Data Acquisition Upgrade

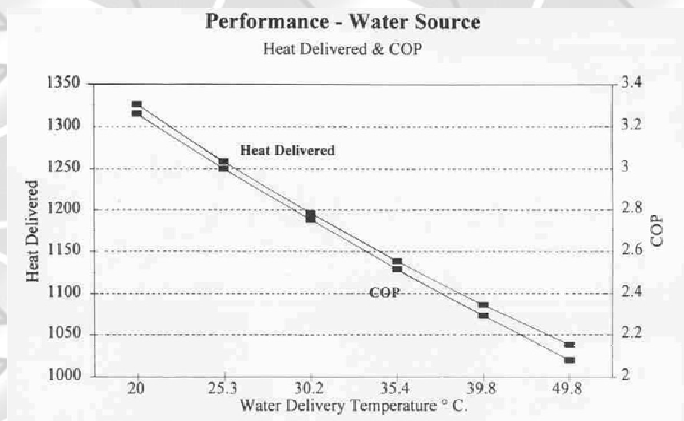
An optional computerised data acquisition upgrade RC832A is available to enable all relevant system parameters to be automatically recorded on a PC for further analysis and display. Data may also be transferred to spreadsheet format for complex analysis and calculation.

## Experimental Results

### Heat Pump Performance Curves showing Heat Delivered and Compressor Load v Water Delivery Temperature (Water Source)



### Heat Pump Performance Curves showing Coefficients of Performance and Heat Delivered v Water Delivery Temperature (Water Source)





## Specification

A fully instrumented heat pump operating on the vapour compression cycle with a special heat pump hermetic compressor using R134a. Three heat exchangers: air source finned tube evaporator, water source plate heat exchanger and concentric coil water cooled condenser.

### Controls:

Operating parameters may be varied by manual adjustment of the evaporator and condenser water control valves, and selecting the air or water source evaporator by panel mounted switch.

### Instrumentation:

**Gauges:** (2) for evaporating and condensing pressures.

### Multi-point Digital Temperature Indicator

with 8 type K thermocouples. Resolution 0.1K

**Flowmeters** (3) for condenser cooling water and evaporator water flow rates and R134a flow rate.

**Analogue Wattmeter** for compressor electrical energy.

All components are mounted on a glass reinforced plastic panel and base.

**Safety Features:** Condenser high pressure switch and compressor thermal overload switch. Residual current circuit breaker and a combined double pole main switch and overload cut out. All electrical components connected to common earth conductor.

## Dimensions

Height: 46.5cm Depth: 65.5cm

Width: 130cm Weight: 75kg

### Optional Data Acquisition Upgrade

An optional Computerised Data Acquisition Upgrade RC832A comprising of an electronic data logger, menu driven software and all necessary transducers, allows all relevant parameters to be simultaneously displayed and recorded on a suitable PC. The software allows review and printing of data and transfer to spreadsheets for complex analysis and calculation.

## Accessories and Spares

Unit supplied with:

One experimental operating and maintenance manual in English, Spanish or French.

Accessories and spares for 2 years normal operation. List available on request.

## Services Required

**Electrical:** A: 700W, 220-240 Volts Single Phase  
50Hz(With earth/ground).

B: 700W, 110-120 Volts Single Phase,  
60Hz (With earth/ground).  
Uses Transformer supplied.

Units for use with other voltages or supply frequencies are available on special order. Details on request.

**Water:** 0.1 litres s<sup>-1</sup> at a minimum of 10m head. This can be continuous to drain or recirculated via a chiller unit. Details available on request.

## Ordering Information

**Order as:** R832 Air & Water Heat Pump.

**Optional:** RC832A Data Acquisition Upgrade.

### Electrical Specification

Either: A: 700W-220-240 Volts Single Phase  
50Hz(With earth/ground).)

B: 700W-110-120 Volts Single  
Phase,  
60Hz(With  
earth/ground).

### Language

Either: English, Spanish or French.

## Shipping Specifications

**Net Weight:** 75kg. (approx.)

**Gross Weight:** 125kg. (approx.)

**Packing Case Dimensions:**

0.92 x 0.65 x 1.05m (approx.)

**Packing Case Volume:**

0.628m<sup>3</sup> (approx.)

## Also Available On Request

Further detailed specification.

Additional copies of instruction manual.

Recommended list of spares for 5 years operation.

Suitable chiller details.





## Optional Data Acquisition Upgrade RC832A

Data may be printed, stored on disc for later analysis and transferred in ASCII form to most spreadsheets for further analysis and projects.

### *Hardware details*

The optional Data Acquisition Upgrade RC832A consists of an externally located 35 channel Hilton Data logger (D102), together with dedicated software that will operate in the Windows<sup>TM</sup> environment.

The combined software and hardware package allows computer monitoring of all eight relevant system temperatures, condenser and evaporator pressures, refrigerant flow rate, condenser and evaporator cooling water flow rates and compressor electrical input.

A duplex set of thermocouples provide the system temperatures. Pressure transducers and water flow transducers connect to factory fitted internal couplings. The refrigerant flow transducer is a variable area type that may be fitted at any time with a signal transmitter.

A motor current transformer and logger internal voltage provides compressor VA.

The additional transducers allow the unit to be operated either with the computer or in the standard manual mode.

As all transducer coupling points are factory fitted the Data Acquisition Upgrade RC832A may be purchased and installed at any time.

### **Software Details**

The pre-configured menu driven Software supplied with the Data Acquisition Upgrade RC832A allows all recommended experiments detailed in the Air & Water Heat Pump R832 manual to be carried out with the aid of computerised data acquisition and on screen data presentation.

This enhances student interest and speeds comprehension of the principles being demonstrated.

Students may be presented with numeric data or graphic data plotted against time.

### **Additional Data Logging Facility Supplied As Standard**

The Hilton Data Logger (D102) is an industrially proven 35 channel interface with 15 thermocouple/differential voltage inputs ( $\pm 80\text{mv}$  dc), 8 single ended dc voltage inputs ( $\pm 8\text{v}$ ), 8 logic or frequency inputs, 3 ac current inputs one mains voltage input and 8 current sinking output channels. In addition there are on board 12v dc,  $\pm 5\text{V}$  dc and  $\pm 15\text{v}$  dc power supplies for most commercially available transducers.

The pre-configured Hilton Data Logging software, supplied as standard with the RC832A package, allows the D102 to be disconnected from the R832 transducers and used together with most standard transducers as a stand alone computer data logger and controller for the monitoring and control of existing laboratory equipment.

This further expands the student project capabilities of the RC832A package from teaching and demonstration into the field of research and postgraduate study.

### **Computer Hardware Requirements**

The menu driven Software supplied with the Data Acquisition Upgrade RC832A will operate on an IBM or IBM compatible PC having at least 32 Mb ram, VGA graphics, 1Gb hard drive and an available RS232 serial port. The software is Windows 2000 and XP compatible and supplied on a CD Rom.

#### **Order as:**

Data Acquisition Upgrade RC832A

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