



Air & Water Heat Pump R833

Figure 1: R833



- *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 H893 by addition of Reservoir System H060*
- *Optional RE590 Ground Source Simulator Available*
- *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 R833 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 or 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 high quality ABS 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.



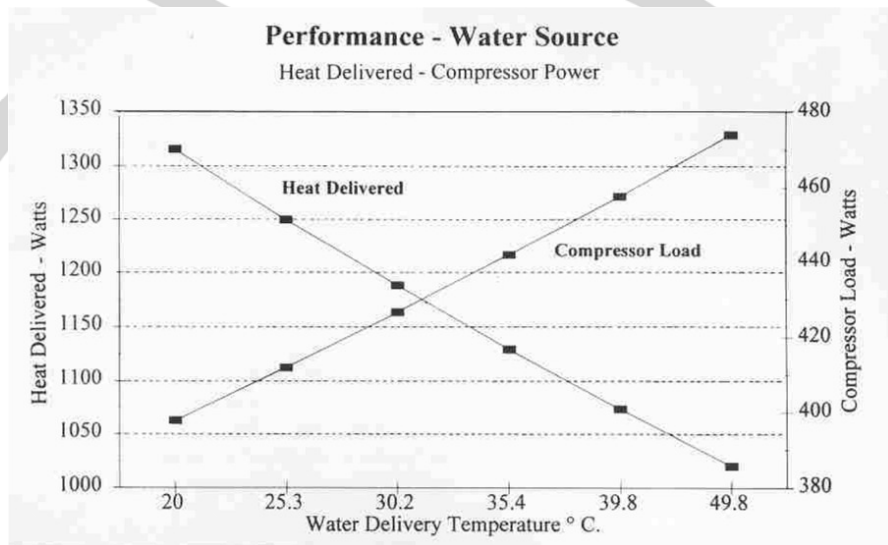
The R833 incorporates mechanical fail safe over pressure cutout, together with a miniature circuit breaker and a 30mA residual current breaker for added protection.

Optional Data Acquisition Upgrade

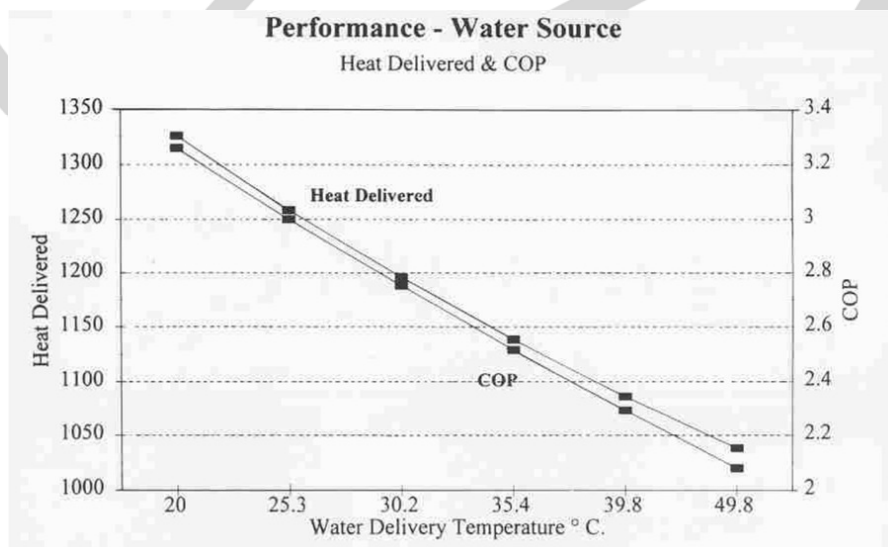
An optional computerised data acquisition upgrade RC833A is available to enable all relevant system parameters to be automatically recorded on a PC for further analysis and display. Data may also be transferred to spreadsheet format for complex analysis and calculation. Refer to Page #6 for additional details.

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 water cooled plate 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 9 type K thermocouples. Resolution 0.1K

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

Digital Wattmeter for compressor electrical energy.

All components are mounted on a high quality ABS 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 RC833A 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⁻¹ 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: R833 Air & Water Heat Pump.

Optional:

RE590 Ground Source Simulator
RC833A Data Acquisition Upgrade.

Electrical Specification

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

Or

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: 0.628m³ (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 Extra RE590 **Ground Source Simulator**



Accessories and Spares

Unit supplied with:

One experimental operating and maintenance manual in English, Spanish, French
Accessories and spares for 2 years normal operation. List available on request

Also Available On Request

Further detailed specification.
Additional copies of instruction manual.
Recommended list of spares for 5 years operation.

Specification

Optional upgrade – self-contained ground source simulator tank containing ground source coils, complete with a high pressure circulating pump and hoses for connection to the R833. Can be filled with a range of locally sourced materials such as water, sand or soil.

Dimensions

Height: 42cm
Depth: 82cm
Width: 60cm

Weight: 15kg (empty)

Experimental Capabilities: **(Depending upon fill material)**

- Comparison of a static water-source with a flowing water supply
- Analysis of soil composition on efficiency of ground source heat pump
- Analysis of moisture content of soil on efficiency of ground source heat pump.

Ordering Information

Order as: Ground Source Simulator RE590



Optional Extra RC833A **Data Acquisition Upgrade**

Hardware details

The Optional Computerised Data Acquisition Upgrade RC833A consists of a 21 channel Hilton Data logger (D103), together with pre-configured, ready to use, Windows™ compatible educational software.

Factory fitted coupling points on the R833 allow installation of the upgrade to the unit at any time in the machine's extensive life.

The Hilton Data logger (D103) connects, using the cable supplied, to a standard USB port on the user-supplied PC. If more than one logger is required connection is via a second USB port or standard USB hub.

The combined educational software and hardware package allows immediate computer monitoring and display of all relevant parameters on the R833.

Software Details

The pre-configured menu driven Software supplied with the Computer Upgrade RC833A allows all recommended experiments involving the electronic transducers and instruments on the R833 to be carried out with the aid of computerised data acquisition, data storage and on-screen data presentation. This enhances student interest and speeds comprehension of the principles being demonstrated.

Students are presented with either raw data for later hand calculation or alternatively data may be transferred to most spreadsheets for computerised calculation and graphical presentation.

Data may be stored on disc and displayed at any time using the software supplied. Alternatively data may be transferred to any compatible spreadsheet together with individual time and date stamp on each reading for complex analysis.

Additional Data Logging Facility Supplied As Standard

The D103 is the third generation of Hilton Data Logger. It comprises an industrially proven 21 channel interface with 8 thermocouples (type T and K as standard) / differential voltage inputs ($\pm 100\text{mV}$ DC), 8 single ended DC voltage inputs ($\pm 8\text{v}$), 4 logic or frequency inputs and one mains voltage input. 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 Hilton Data Logging software supplied as standard with the RC833A package allows the D103 to be disconnected from the R833 and used together with most standard transducers as a stand-alone computer data logger for the instrumentation and monitoring of existing laboratory equipment using locally sourced industrial transducers. The software is also backwards compatible with our many second generation D102 data loggers that are already in use worldwide.

Full data logger command protocol and communications details are provided in an extensive user manual that allows other software applications to communicate with the logger via the USB interface. Users can write their own software, typically in LabView, Matlab, C, C++, Visual Basic etc. This further expands the student project capabilities of the RC833A package from teaching and demonstration into the field of research and postgraduate study.

New for 2013; p-h software also available. Contact a sales representative for more details

Computer Hardware Requirements

The menu driven Software supplied with the Computer Upgrade RC833A will operate on a PC which has at least 0.5Gb Mb ram, VGA graphics, 1Gb hard drive, CD drive and an available USB port. The software is Windows 2000, XP and 7 compatible.

Ordering Information

Order as: Data Acquisition Upgrade RC833A

P.A.HILTON Ltd.

Horsebridge Mill, King's Somborne,
Stockbridge, Hampshire, SO20 6PX, England

Telephone: National (01794) 388382
International +44 1794 388382

Fax: National (01794) 388129
International +44 1794 388129

E-mail: sales@p-a-hilton.co.uk
Website: www.p-a-hilton.co.uk

