P·A·Hilton Ltd

REFRIGERATION & AIR CONDITIONING

Refrigeration and air conditioning is an aspect of modern life that is accepted almost without thought. Food storage, the long distance transport of foodstuffs, stockpiling of vaccines and medicines, operating theatres and hospital facilities all rely upon effective refrigeration. Without refrigeration all of these facilities, plus transport systems and accommodation in broad equatorial regions would be unusable. Today, worldwide communications rely upon networked server computers in various key locations. Refrigeration of these facilities is essential for their operation and wellbeing. The training of refrigeration and air conditioning engineers for both the design and maintenance of such systems is therefore a vital academic task.

The Hilton range of refrigeration and air conditioning equipment has been a market leader from their inception over 40 years ago right through to current newly developed units. We have worked with UNIDO and other respected consultants in industrial CFC phase-out projects around the world and continue to offer cutting edge refrigeration and air conditioning training equipment for both undergraduate and vocational refrigeration applications. Our academic and industrial experience together with our reputation for after sales service in all of our range is unrivalled by our many competitors.

VAPOUR COMPRESSION

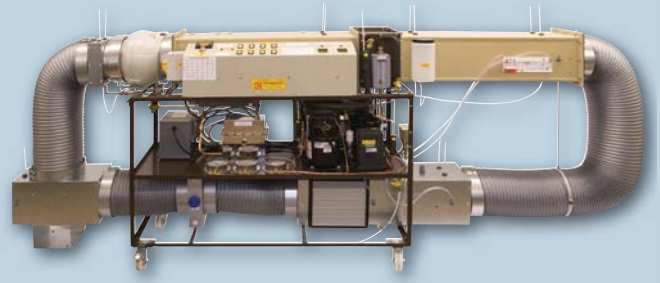
HEAT PUMPS

VENTILATION

VOCATIONAL

A660 Air Conditioning Unit

A complete, upgradeable, instrumented air conditioning laboratory unit mounted on a steel frame and castor wheels. Upgrades may be added at any stage in the unit's long life to spread the investment costs.



A660 shown complete with **A661B** Recirculating Duct Upgrade fitted

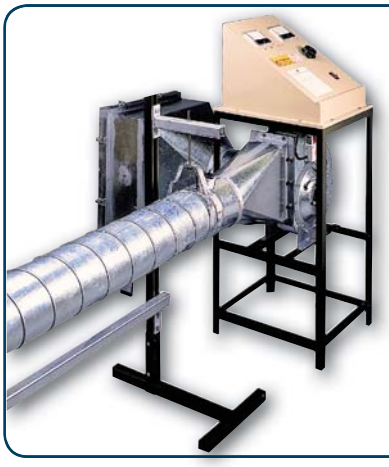
The base unit comprises a variable speed radial acting axial flow fan discharging into a 250mm square duct with steam humidifier, electrical pre-heaters, direct expansion cooling coil/de-humidifier, electrical re-heaters and orifice plate for airflow measurement. Air-cooling is provided by vapour compression refrigeration system with pressure, temperature and refrigerant flow measurement. This allows the construction of a full cycle diagram and the balancing of refrigerant system energy balance against the airside energy transfer.

Air condition is recorded before and after each process using precision wet and dry bulb thermometers.

Instrumentation allows the electrical power to each resistive load to be measured and balanced against the air enthalpy change and mass flow.

Optional Extras:

A661A – Digital Temperature Upgrade
A661B – Recirculating Duct Upgrade
A660C – PID Control Upgrade
A660D – Environmental Chamber Upgrade
AC660A – Computer Linked Upgrade



B500 Ventilation Trainer

A realistically scaled ventilation training unit capable of enabling students to study both the basic airflow and fluid mechanics as well as the more complex process of commissioning and balancing a multi-ducted distribution system. The unit consists of a forward curved variable speed centrifugal fan and integral control console together with a rectangular air intake and filter holder. The fan discharges directly into a 200mm diameter galvanised steel duct and this connects directly to the distribution ductwork. Sufficient components are supplied with the unit to enable parallel branch and line balancing experiments to be undertaken. A minimum of six air supply points are provided that may be balanced on the assembled unit to supply a range of airflows.

A portable manometer, pitot static tube and hand held anemometer allow a large range of experiments to be undertaken.

R634 Refrigeration Cycle Demonstration Unit

A bench mounted vapour compression refrigeration cycle demonstration unit using a hermetic compressor. The water cooled flooded glass condenser and evaporator allows both evaporation and condensation to be observed and understood.

The unit operates on low-pressure non-toxic ozone friendly refrigerant. Internal electrical and mechanical safety devices allow for unsupervised operation by students.

Standard instrumentation enables measurement of the condenser and evaporator pressures and temperatures as well as water flow rates and water temperatures.

Unit supplied with a detailed experimental operating and maintenance manual giving example experimental results and sample calculations.

Optional Extras:

R634A – Digital Temperature Indicator Upgrade
R634B – Digital Wattmeter Upgrade
R634R – Refrigerant Flowmeter

R634 shown complete with **R634A** and **R634B** fitted

R715 Refrigeration Laboratory Unit

A fully instrumented refrigerant vapour compression refrigerator with belt driven compressor, electrically heated evaporator, thermostatic expansion valve and water cooled condenser. Operating parameters can be varied by adjustment of condenser cooling water flow and electrically heated evaporator supply voltage. Components have a low thermal mass resulting in immediate response to control variations and rapid stabilisation. Instrumentation includes all relevant temperatures, condenser pressure, evaporator pressure, refrigerant and cooling water flow rates, evaporator and motor power, motor torque and compressor speed.

Data Acquisition Upgrade Available

Heat Pumps

The principle behind refrigeration is that "It is impossible to generate cold, but only to move heat from one place to another". This is a concept that will confuse many students.
There is no fundamental difference between a heat pump and a refrigerator. Both use the input of work (or high grade heat) to move heat from a low temperature source, to a higher temperature sink. The only difference between heat pump and refrigerator is in fact the application requirement.
Concern about rising CO_2 emissions means that the use of heat pumps to move low temperature heat from a large source such as flowing water, soil, or ambient air to a higher temperature application such as water heating or space heating will become more prevalent. Research into improving heat pump Coefficient of Performance (COP) is also increasingly important.

The Hilton range of air, water and air-water heat pumps have been further enhanced and developed to improve student understanding of this important concept.

R515 Mechanical Heat Pump

A unit illustrating the circuit of a commercial and domestic type heat pump in which free low grade heat from the atmosphere is upgraded and delivered at an elevated temperature for hot water or space heating. Standard refrigeration components are used that are all visible and logically arranged on the bench-mounted panel. Instrumentation is provided for the measurement of refrigerant and water mass flow rates, temperatures, refrigerant pressures and electrical power consumed by the compressor.

The heat pump consists of a hermetic compressor, an insulated plate type water cooled heat exchanger/condenser, a liquid receiver, a thermostatically controlled expansion valve and air heated evaporator. The components are clearly but compactly arranged in a manner similar to that used for many domestic air-water heat pumps and all are visible from the front of the unit.

Data Acquisition Upgrade Available

R534 Thermoelectric Heat Pump Unit

The assembly consists of a module sandwiched between aluminium blocks giving both mechanical strength and thermometer wells for temperature measurement. A nickel chrome alloy element heats the outer face of the cold side aluminium block and this is thermally insulated within a stainless steel casing.

Each experimental configuration may be established by switching four control switches. Variation of the power supplied to both the heater and semi-conductor module is achieved by separate transistorised power controls.

Ammeters and voltmeters measure the power supplied to the heater and module. A small lamp provides a 'load' which may be switched across the module in order to investigate the generating effect and a milli-ammeter and voltmeter allow measurement of the power generated.

R832 Air and Water Heat Pump

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 corrosion proof 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.

Data Acquisition Upgrade Available

R852 Vapour Jet Refrigerator/Heat Pump

A bench top example of a refrigerator/heat pump that is driven by a heat source. The unit operates on a combined Rankine and vapour compression refrigeration cycle using a low pressure, non-toxic ozone friendly refrigerant. A simple ejector (or thermo-compressor) performs the expansion and compression processes involved in the combined cycles. A small electric motor drives the pump of the Rankine cycle. The heat source is electrically heated and produces high pressure vapour to drive the ejector.

An optional set of Solar Panels and Installation Package (F820S) is also available to demonstrate the generation of a refrigeration effect directly from solar radiation.

Vocational Range

The Hilton range of vocational refrigeration and air conditioning equipment is specifically designed for the practical training of installation and service engineers. Though standard and recognisable refrigeration components are used, the units are designed to provide students with experience that is not available using modified commercial equipment. The units are designed for safe operation by students of all abilities.

801 Visual Refrigeration Training Unit

A fundamental level vocational refrigeration unit with a translucent evaporator. This device enables students to see the change of state from liquid to gas. Three different types of expansion device may be introduced (constant pressure, thermostatic and capillary) allowing their relative performance to be investigated.

Designed specifically for vocational applications, the unit is manufactured from standard refrigeration components.

802 Commercial Refrigeration Training Unit

This unit quickly enables the student engineer to learn how the basic principles of the vapour compression cycle are applied in practical refrigeration. The unit provides valuable 'hands-on' experience in: fault diagnosis and correction, refrigerant recovery and recycling, evacuation and charging, changing components and electrical work.

The unit is also available in kit form, with a comprehensive assembly manual, as the model **803** for student assembly practice.

804 Hermetic Refrigeration Training Unit

A dedicated hermetic refrigeration trainer with a capillary flow control and a range of switch activated faults for student practice. Using the push-button switches, **5 system faults** can be introduced into the system: excess discharge pressure, faulty compressor valve, overcharged system, undercharged system and choked capillary. Students can then practice fault location.

805 Advanced Refrigeration Training Unit

The Advanced Training Unit 805 is a fully operational, small scale coldroom, which enables the student to relate all test results, system faults and adjustments directly to situations encountered in service and maintenance.

It is a multiple circuit unit, incorporating important secondary controls, is constructed entirely from standard commercial components and will give the student invaluable experience in fault diagnosis, system adjustment and replacement of faulty components.

Using the push-button switches, **10 system faults** can be introduced into the system.

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808 Reverse Cycle Refrigeration and Air Conditioning Training Unit

A small scale forced draught evaporator demonstrating both air conditioning and refrigeration principles, where reverse cycle operation is utilised for evaporator defrost. An air cooled condensing unit is fitted in addition to a water cooled condenser and condenser pressure control for comparison purposes. Four different types of expansion device are also fitted for comparison purposes.

810 Automotive Air Conditioning Trainer

The 810 is designed to train students in the operation, fault finding, maintenance and repair of automotive air conditioning systems.

It comprises a complete automotive air conditioning system on a stainless steel frame suitable for bench mounting. The unit has **4 common faults** that may be introduced for student training and operates on R134a refrigerant used in most current vehicle air conditioning systems. Connections are provided to allow the use of standard R134a manifold gauges for student practice.

811 Advanced Training Unit for Fault Location

The largest of the vocational range, this unit incorporates two display evaporators operating at different temperatures from a single three-phase semi-hermetic compressor. A combination of **25 refrigeration circuit and electrical circuit faults** can be activated by the instructor allowing both normal and fault condition to be investigated. The system includes reverse gas defrost, suction accumulator, oil separation and variable speed evaporator and condenser fans.

812 Water Chiller Training Unit

The 812 is a fully operational water chiller, which enables the student to adjust and investigate a typical water cooler operating under load, either with or without evaporator pressure regulation.

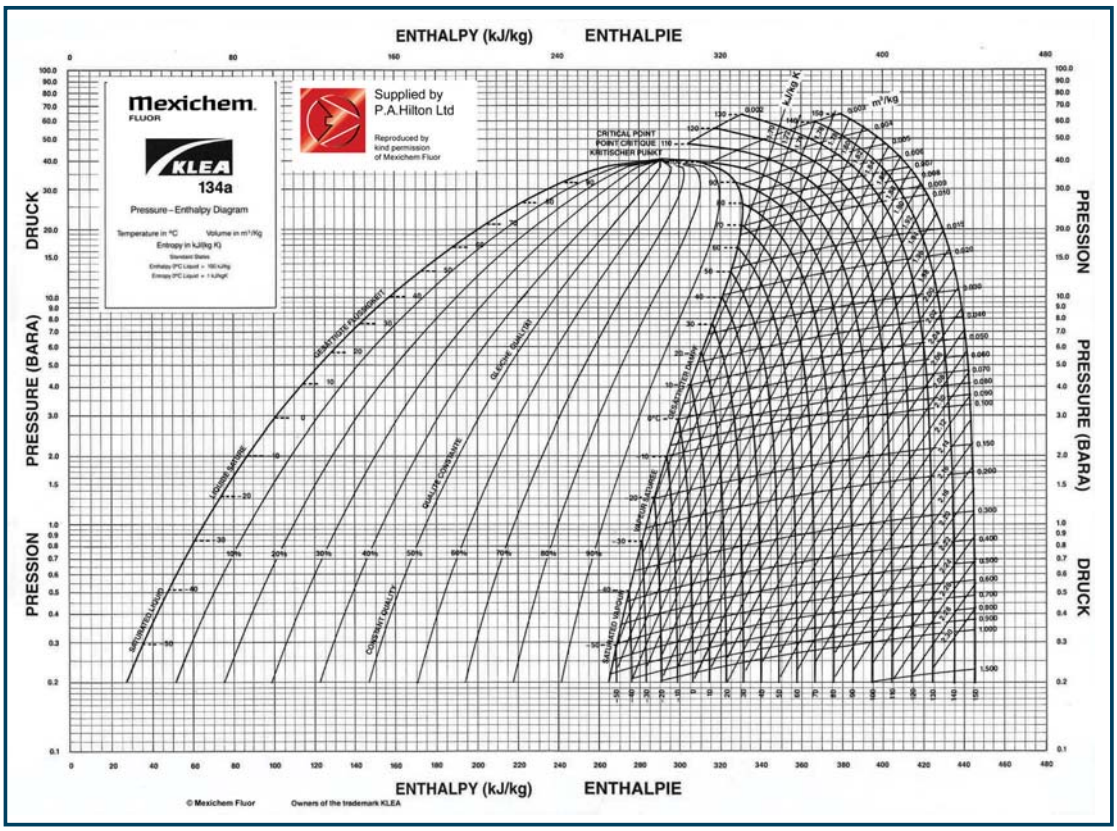
The cooling of pure water requires that the evaporator surface temperature does not fall below 0°C or the system will freeze and may result in damage. This unit allows students to safely explore the parameters affecting evaporating pressure without danger to the operator or equipment.

816 Absorption Refrigeration Demonstrator

An electrically driven ammonia-water absorption refrigeration system with insulated chiller compartment. All major components of the refrigeration system: generator, absorber, condenser and reservoir are visible and an instrumentation and control console allows measurement and control of all relevant system parameters.

R434 Vortex Tube Refrigerator

The Vortex Tube consists of two joined concentric cylindrical chambers of different diameters, open at their ends. Spaced around the circumference of the larger chamber and close to the junction with the smaller chamber, are nozzles arranged to discharge tangentially into the cylinder. When compressed gas is supplied to these nozzles, the jets discharge into the chamber at a near sonic velocity, and a forced vortex is created. The core of this vortex is cold and extracted from the smaller end of the chamber, while the periphery which is hot is extracted from the larger end. The ratio of cold and hot gas flow rates can be varied by a valve which controls the hot gas discharge. Differences of up to 50K between the hot and cold streams can be achieved.



Typical PH Diagram for R134a Refrigerant

OTHER EXPERIMENTS AVAILABLE *(Refer to our Website for details)*

F300F	Vortex Tube Refrigerator Module	**803**	Commercial Refrigeration Training Package
H112Q	Thermoelectric Heat Pump Module	**806**	Educational Coldroom
R560	Water Water Heat Pump	**814a**	Refrigeration & AC Control and Fault Simulator
RE590	Ground Source Heat Pump	**814b**	Heating, Ventilation & AC Control and Fault Simulator

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HI-TECH EDUCATION

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