

➤ **World leading
supplier of
engineering
teaching
equipment**

Refrigeration & Air Conditioning

Air Conditioning



Refrigeration



Refrigeration and air conditioning is central to much of our everyday lives whether that be food preparation and transportation, storage or indeed from a medical, or in fact general life perspective.

The P.A.Hilton's range of refrigeration and air conditioning teaching equipment is designed to provide class leading learning capabilities from a definitive range, so maximising return on investment

Our range is designed to provide students with a clearly defined learning path from a basic understanding relating to vocational fault finding through to undergraduate level where a more thorough numeric understanding is required.



 **PA Hilton**

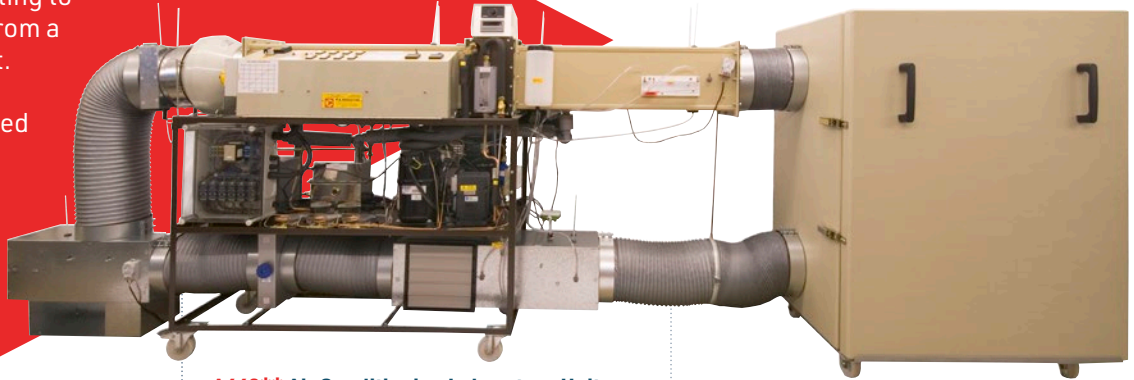

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Air Conditioning

A high specification unit designed to deliver all learning outcomes relating to air conditioning study from a single upgradeable unit.

Options can be purchased over time to enhance the units learning capabilities which includes PRESSURE ENTHALPY (PH) SOFTWARE.



A660** Air Conditioning Laboratory Unit

Air-cooling is provided by a vapour compression refrigeration system with pressure, temperature and refrigerant flow measurement. This allows students to construction of a full cycle diagram and the balancing of refrigerant system energy balance against the airside energy transfer.

Specification includes:

- Variable speed radial acting axial flow fan
- Steam humidifier
- Electrical pre-heaters
- Direct expansion cooling coil/de-humidifier
- Electrical re-heaters
- Orifice plate for airflow measurement.

A661A Digital Temperature Upgrade

- A standard feature of the A660 range. Allows all of the above experiments with all temperatures displayed on a single switched digital temperature indicator to 0.1°C resolution.

A661B Recirculating Duct Upgrade

- Available as an option as additional cost Recirculating Duct Upgrade Allows the proportion of recirculated air to be varied and its effect upon the energy requirements for air conditioning to be investigated. Additional psychrometric measuring points supplied allow the enthalpy of two-mixed streams to be investigated.

*Available with optional data acquisition

**Available with optional data acquisition and additionally R100 Pressure Enthalpy Software

A660C PID Control Upgrade

- Available as an option as additional cost PID Control Upgrade. Allows the proportion of recirculated air to be varied and its effect upon the energy requirements for air conditioning to be investigated.

A660D Environmental Chamber Upgrade

- Available as an option at additional cost. Environmental Chamber Upgrade
- Data Acquisition Available as an option at additional cost. Data acquisitioned A660 Air conditioning Laboratory Unit, with all the functionality of the A660 standard unit, but computer linked, recirculating duct and PID controller.

R100 Pressure Enthalpy (Ph) Software



Limerick Institute of Technology – standard unit



In 1820, English scientist and inventor Michael Faraday discovered that compressing and liquefying ammonia could chill air when the liquefied ammonia was allowed to evaporate.



Michael Faraday 1791-1867



De Montfort - features additional bespoke evaporative cooling unit



Institute of Technology Tallaght - features customer fitted recirculating duct

Ventilation Trainer



B500 Ventilation Trainer

- A realistically scaled ventilation training unit capable of enabling students to study both basic airflow and fluid mechanics as well as the more complex process of commissioning and balancing a multi-ducted air distribution system.

B500B Duct configuration

- The optional duct configuration B500B allows the addition of a third parallel branch and two air supply units

B500C Duct configuration

- The optional duct configuration B500C allows the addition of a 6m branch and two air supply units.

Refrigeration



R434 Vortex Tube refrigerator

- The Vortex Tube refrigeration unit uses a compressed gas (usually air) divided into two streams at a lower pressure. One of these streams is about 50K colder, and the other is about 50K hotter than the compressed gas supplied. It is an unusual method for producing cooling air.



R515** Mechanical Heat Pump

- The R515 Hilton Mechanical Heat Pump has been designed to allow students to obtain an overall understanding and appreciation of the performance and characteristics of a heat pump working on the vapour compression cycle and having an electrically driven compressor, and is suitable for all course levels, from vocational to undergraduate.



R534 Thermo-Electric Heat Pump Unit

- The Hilton Thermo-Electric Heat Pump has been designed to enable students to investigate the performance of a semi-conductor module which, on the application of an electrical power supply, will produce a refrigerating effect. Though the power required to produce this cooling effect is high, modules of this type find applications in a variety of high technology fields.



R560** Water to Water Heat Pump

- The R560 Hilton Water to Water Heat Pump has been designed specifically to allow students to obtain an overall understanding and appreciation of the performance and characteristics of a heat pump working on the vapour compression cycle and having an electrically driven compressor.



R634* Vapour compression refrigeration

- 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.



R634B Digital wattmeter

- The optional digital wattmeter comprises a 3½ digit true power AC wattmeter and current transformer. The current drawn by the compressor is sensed by a current transformer and sent as a mA signal to the wattmeter.



R634A Optional digital temperature indicator

- The optional digital temperature indicator not only increases the resolution of temperature measurements from 0.5°C to 0.1°C but a thermocouple sensor is provided to record the temperatures of the liquid in the base of the condenser chamber. The additional temperatures allow a complete vapour compression cycle diagram to be produced on a refrigerant SES36 pressure-enthalpy diagram.



R634R Refrigerant flowmeter upgrade

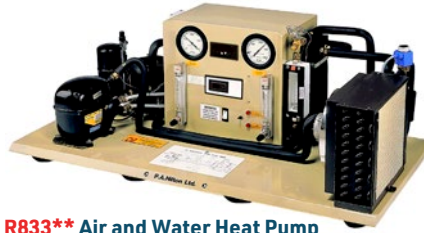
- An optional Refrigerant flowmeter upgrade R634R allows measurement of the refrigerant flow whilst also acting as an expansion valve for the refrigerant cycle.



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.

*Available with optional data acquisition
 **Available with optional data acquisition and additionally R100 Pressure Enthalpy Software



R833** 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.



R853 Vapour Jet Refrigerator/Heat Pump

- This 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 (F823S) is also available to demonstrate the generation of a refrigeration effect directly from solar radiation.



In 1758, Benjamin Franklin and John Hadley, a chemistry professor at Cambridge University, conducted an experiment to explore the principle of evaporation as a means to rapidly cool an object. Franklin and Hadley confirmed that evaporation of highly volatile liquids (such as alcohol and ether) could be used to drive down the temperature of an object past the freezing point of water. They conducted their experiment with the bulb of a mercury thermometer as their object and with a bellows used to speed up the evaporation. They lowered the temperature of the thermometer bulb to -14°C (7°F) while the ambient temperature was 18°C (64°F). Franklin noted that, soon after they passed the freezing point of water 0°C (32°F), a thin film of ice formed on the surface of the thermometer's bulb and that the ice mass was about 6 mm (1/4 in) thick when they stopped the experiment upon reaching -14°C (7°F). Franklin concluded: "From this experiment one may see the possibility of freezing a man to death on a warm summer's day." [9]



Vocational Refrigeration

A range of technology college learning equipment developed to provide hands on problem solving capabilities.

Units are provided as both high level learning and some with inbuilt fault solution scenarios.



801 Visual Refrigeration Training Unit

- This unit is designed to demonstrate the basic principles of heat transfer, the Vapour compression refrigeration cycle and the function and application of different flow controls.



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.



803 Basic Installation Training Package

- The 803 provides students with experience and practice in the correct location of components, cutting, flaring, bending and brazing of copper pipe, electrical wiring, evacuation, charging and leak testing, operation, temperature control and switch adjustment



804 Hermetic Refrigeration System Training Unit

- The Hermetic Refrigeration System Training Unit allows trainers to set various failure scenarios using its five system faults functions system. These faults include excess discharge pressure, faulty compressor valve, choked capillary, overcharged system and undercharged system.



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.



808 Reverse Cycle Refrigeration and Air Conditioning Unit

- The 808 unit allows students to explore a more sophisticated refrigeration system incorporating reverse cycle operation, air cooled and water cooled condensers, forced air and static evaporators and dual temperature operation.



809 Refrigeration System - Domestic

- The 809 unit allows students to study the workings of domestic refrigeration systems and understanding key principles relating to evacuation, charging, fault finding, recovery and repair.



810 Automotive Air Conditioning Trainer - 4 Faults

- This unit allows students to study a car based refrigeration system and to understand its layout, design and how to repair it should the occasion arise. The unit has four built in faults that can be activated to offer students different issues to resolve, these being blocked thermostatic expansion valve, blocked drier, compressor fault and poor condensing.



811 Advanced Training Unit for Fault Location - 25 Faults

- Demonstrates multi-evaporator system operating at different temperatures. Incorporates 25 typical system faults, each activated by a push-button switch.



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.



814a Refrigeration and Air Conditioning Control and Fault Simulator

- The Refrigeration and Air Conditioning Control and Fault Simulator, Model 814a, enables the study and operation of various components as applied to the refrigeration plant used in air conditioning systems. Both cooling and heating modes (Reverse cycle operation can be studied).



814b The Heating, Ventilation and Air Conditioning Control and Fault Simulator

- The Heating, Ventilation and Air Conditioning Control and Fault Simulator, Model 814b, enables the study and operation of various controls and control theory as applied to heating, ventilation and air conditioning systems. It enables the user to simulate different conditions to show how the various components work in a control scheme.



816 Absorption refrigerator

- The absorption refrigerator 816 is a fully operational ammonia-water refrigerator with all of the of the main absorption cycle components visible at the rear of the unit. With the built-in load and optional instrumentation students can investigate a refrigeration system that operates from an electrical heat source.



817 Split Air Conditioning Trainer

- When initially training student in the fault finding and repair of air conditioning systems, difficulties can be experienced when evaluating a standard commercial unit. This is due to the fact that commercial systems are necessarily compact, of basic design and thermally insulated. The Hilton Model 817 with its open but fully operational format ensures that both the Trainer and the Trainee are able to study the major air conditioning parts and components on a working system and promotes a clear understanding of Air Conditioning Systems and in particular the reverse cycle operation of air conditioning systems for heating purposes.



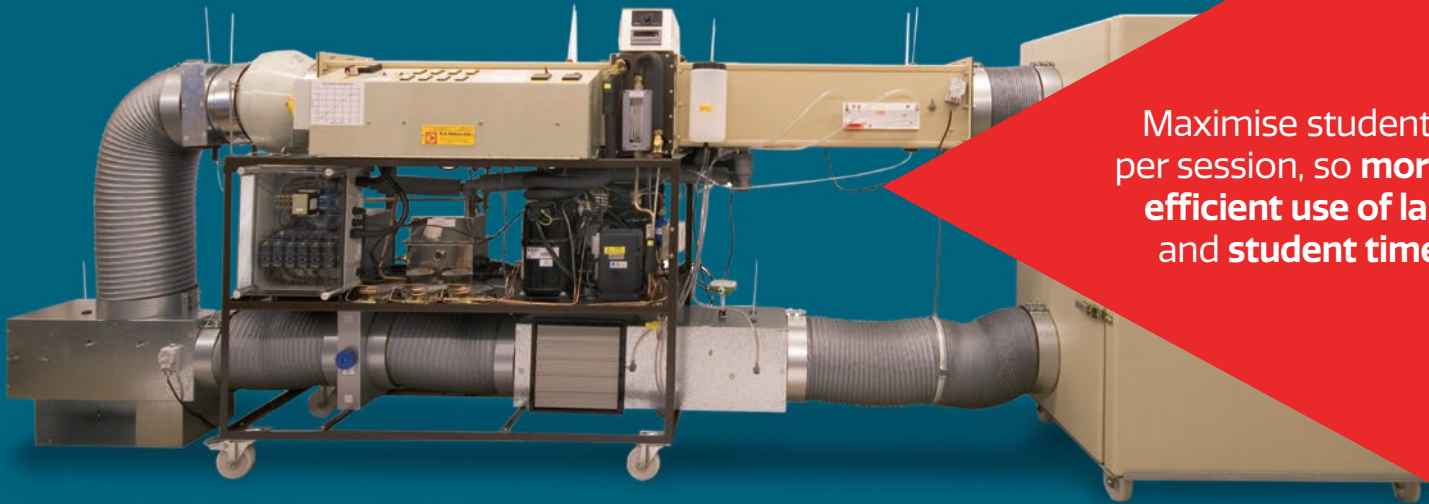
TKB Student Tool



TSE Test and Service Package

*Available with optional data acquisition

**Available with optional data acquisition and additionally R100 Pressure Enthalpy Software



Maximise students per session, so **more efficient use of lab and student time.**

Innovative teaching software

Hilton Data Acquisition

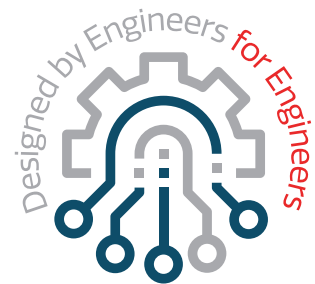
A means of recording key measurements for uploading and utilisation within a proprietary spreadsheet.

R100 Pressure Enthalpy (PH) Software

The R100 Pressure-Enthalpy Software upgrade is universal for all Hilton refrigeration, heat pump and air conditioning applications on units fitted with the optional Hilton Data Logger including:

- A660 Air Conditioning Laboratory Unit
- R515 Mechanical Heat Pump
- R560 Water Water Heat Pump
- R715 Refrigeration Laboratory Unit
- R833 Air and Water Heat Pump

The software gives an animated (real-time) pressure-enthalpy cycle diagram as well as component energy balances where appropriate.



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