

P.A.Hilton Ltd

LABORATORY PROPOSAL

CIVIL ENGINEERING

P.A.Hilton Ltd.

'Engineered to enthuse, educate and endure'



Lab Planning Guide

Prepared By

Hazel Lambert

Area Sales Manager

P.A.Hilton Ltd.

sales@p-a-hilton.co.uk

Contents

Introduction to P.A.Hilton	Page 3
Customer References	Page 4
Civil Engineering – Product Guide	Page 5
1. Measurement Fundamentals	Page 6
2. Heat Transfer	Page 7
3. Hydraulics Bench	Page 8
4. Structures	Page 9
4.1. Structures Accessories	Page 13
4.2. Structures Software	Page 14
5. Full-Scale Material Testing	Page 15
6. Strength of Materials	Page 16
7. Vibrations	Page 17
8. Air Conditioning	Page 18
9. Ventilation	Page 19
10. Refrigeration & Heat Pumps	Page 20
11. Pressure – Enthalpy Software	Page 23
Laboratory Layout & Design	Page 24
Example Laboratory	Page 25
Next Steps	Page 28

Introduction to P.A.Hilton Ltd.

P.A.Hilton Ltd is a leading brand name in the provision of educational teaching equipment for engineering. Founded in 1959, we offer customers the reassurance of our knowledge and experience in the field. We are committed to our customers and continue to support units supplied years and indeed decades ago with on-going sales and aftersales support. The longevity and reliability of our products speaks volumes about our high quality standards of production. We manufacture all products in the UK and test each item on our premises to ensure our high quality standards are adhered to before sending out each item. Our research and development team continue to further enhance our product range with the latest ideas and innovations. Unlike other manufacturers we do not simply scale-down industrial equipment for the lab, but start from the perspective of an engineering question or theorem which we then devise custom equipment to suit in a robust format. This lends itself to our motto:

‘Engineered to enthuse, educate and endure’

We **enthuse** students by making engineering theorems come to life in the lab by our equipment

We solely focus on products that **educate** meaning our range is focused on learning outcomes with the student at the centre of the process

We build robust products to **endure** class after class of inquisitive students

Customer References

P.A.Hilton Ltd. has helped to set up numerous Civil and Building Services Engineering Labs around the world over the last half century. We can supply customer lists by country or by product on request. Relevant reference sites for P.A.Hilton Ltd equipment include:

Europe

Athlone Institute of Technology, Ireland

Cordoba University, Spain

Hochschule Ingolstadt, Germany

Imperial College London, UK

Pierre & Marie Curie University, France

Middle East

College of the North Atlantic, Qatar

Ministry of Manpower, Oman

Zamil Training Centre, Saudi Arabia

The Americas

Queens University, Canada

University of Florida, USA

University of Illinois, USA

Africa

Air Force Training Centre Marrakech (ERA), Morocco

Covenant University, Nigeria

Ministry of Education, Egypt

Zawiyah University, Libya

Asia & Australasia

Indian Institute of Technology,
Madras, India

Nanyang Polytechnic, Singapore

Turkmenistan Polytechnic Institute,
Turkmenistan

University of Technology, Malaysia

University of Queensland, Australia

Product Range Overview

We would be pleased to assist with laboratory planning based on syllabus requirements, budget and space available. We recommend the following products for Civil Engineering, divided for clarity into three academic levels, introductory, intermediate and advanced:

Level 1: Introductory

Measurement Fundamentals:

H813	Dew Point Hygrometer
H814	Humidity Measurement Bench
F110	Pressure Measurement Bench

Optional Extras

F110A	Deadweight Tester
F110B	Pressure Transducer and Digital Display
H981	Temperature Measurement Methods & Calibration Unit

Heat Transfer

H102	Heat Transfer Service Unit
----------------------	----------------------------

Optional Extras

H102A	Concentric Tube Heat Exchanger
H102B	Plate Heat Exchanger
H102C	Shell & tube Heat Exchanger
H102D	Jacketed Vessel with Coil and Stirrer

H112	Heat Transfer Service Unit
----------------------	----------------------------

Optional Extras

H112A	Linear Heat Conduction
H112B	Radial Heat Conduction
H112C	Laws of Radiant Heat Transfer/Exchange
H112D	Combined Convection & Radiation

Hydraulics Bench

HB100	Hydraulics Bench
-------	------------------

Optional Extras

HB100B	Bernoulli's Theorem Demonstrator
HB100C	Flow Meter Demonstrator (Includes Venturi Meter and Orifice Plate)
HB100D	Pressure Losses In Bends And Fittings
HB100E	Stability Of A Floating Body
HB100F	Centre of Pressure
HB100G	Impact of a Jet
HB100J	Osborne Reynolds Apparatus
HB100K	High Flow Flowmeter
HB100L	Twin Pump (Series or Parallel)

Refrigeration & Heat Pumps

R634	Refrigeration Cycle Demonstration Unit
----------------------	--

Structures

HST1	Universal Frame and Stand
HST100	Bench Top Frame and Stand
HDA200	Interface for Digital Display of Force, Strain, Deflection and Angle

Experiments available: Introductory Level

HST2	Simple Suspension Bridge
HST9	Shear Force in a Beam
HST10	Bending Moment in a Beam
HST17	Forces in a Truss (Resolution)
HST23	Equilibrium of Forces
HST24	Equilibrium of Parallel Forces
HST25	Equilibrium of a Rigid Body
HST26	Deflections of Beams
HST30	Modulus of Elasticity
HST31	Suspension Cable
HST41	Equilibrium of a Beam
HST42	Forces in a Truss (Sections)
HST46	Combined Shear Force & Bending Moment Apparatus

Experiments available: Introductory to Intermediate Level

HST13	Deflections of Beams and Cantilevers
HST20	Bending Stress in a Beam
HST21	Unsymmetrical Bending & Shear Centre Apparatus
HST22	Torsion of rods and Tubes
HST27	Three Dimensional Equilibrium
HST28	Area Moment Method
HST29	Shear Centre Apparatus
HST32	Laminated Spring
HST35	Strain Measurement for Structures
HST36	Column Buckling Failure
HST44	Fixed End Beam Apparatus
HST45	Buckling of Struts
HST50	Unsymmetrical Bending

Vibrations

HVT12	with HVT12a Pendulum Module
-------	-----------------------------

Strength of Materials

HSM58	Universal Material Tester (20kN)
-------	----------------------------------

Level 2: Intermediate

Heat Transfer

[H102](#) Heat Transfer Service Unit

Optional Extras

H102E	Extended Concentric Tube Heat Exchanger
H102F	Extended Plate Heat Exchanger
H102G	Water Water Turbulent Flow Heat Exchanger
H102H	Coiled Concentric Tube Heat Exchanger
H102J	Recycle Loops
H102K	Film and Dropwise Condensation
HC103A	Data Acquisition Upgrade

[H112](#) Heat Transfer Service Unit

Optional Extras

H112E	Extended Surface Heat Transfer
H112F	Radiation Errors in Temperature Measurement
H112G	Unsteady State Heat Transfer
H112H	Thermal Conductivity of Liquids & Gases
H112J	Perfect Gas Laws Demonstration Unit
H112S	Boiling Heat Transfer
HC113A	Data Acquisition Upgrade

Air Conditioning

[A660](#) Air Conditioning Laboratory Unit

Ventilation

[B500](#) Ventilation Trainer

Structures

HST1	Universal Frame and Stand
HST100	Bench Top Frame and Stand
HDA200	Interface for Digital Display of Force, Strain, Deflection and Angle

Experiments available: Introductory to Intermediate Level

HST13	Deflections of Beams and Cantilevers
HST20	Bending Stress in a Beam
HST21	Unsymmetrical Bending & Shear Centre Apparatus
HST22	Torsion of rods and Tubes
HST27	Three Dimensional Equilibrium
HST28	Area Moment Method
HST29	Shear Centre Apparatus

HST32	Laminated Spring
HST35	Strain Measurement for Structures
HST36	Column Buckling Failure
HST44	Fixed End Beam Apparatus
HST45	Buckling of Struts
HST50	Unsymmetrical Bending

Experiments available: Intermediate Level

HST4	Three Hinged Arch
HST7	Deflection of Frames
HST11	Continuous and Indeterminate Beams
HST12	Deflection of Curved Bars
HST14	Shear Force Influence lines
HST15	Bending moment Influence Lines
HST18	Suspended Centre Span Bridge
HST33	Beam Stiffness and Carry Over Factors
HST37	Deflections of Beams
HST38	Deflections of Trusses
HST39	Suspension Bridge

Vibrations

HVT5	Seismic Table
HVT12	with HVT12g Free and Forced Vibrations Module
HVT13	Torsional Vibration

Strength of Materials

[HSM58](#) Universal Material Tester (20kN)

Optional Extras

HSM58B	Brinell Hardness Test Set
HSM58C	Bending Test Set
HSM58E	Symmetrical Shearing Test Set
HSM58G	Asymmetrical Shearing Test Set
HSM58i	Spring Testing Set
HSM58P	Deep Drawing Test Set

Destructive Testing

HSM11	Combined Bending and Torsion
HSM41	Pendulum Impact Tester
HSM43	Torsion Testing Machine

Non Destructive Testing

HSM10	Curved Bars
HSM38	Polariscope

Refrigeration & Heat Pumps

R515	Mechanical Heat Pump
R560	Water Water Heat Pump
R833	Air And Water Heat Pump

Level 3: Advanced

Air Conditioning:

[A660](#) Air Conditioning Laboratory Unit

Optional Extras

A661A Digital Temperature Upgrade
A661B Recirculation Duct Upgrade
A660C PID Control Upgrade
A660D Environmental Chamber
AC661A Data Acquisition Upgrade
R100 Pressure Enthalpy Software

Structures

[HST1](#) Universal Frame and Stand
[HST100](#) Bench Top Frame and Stand
[HDA200](#) Interface for Digital Display of Force, Strain, Deflection and Angle

Experiments available: Advanced Level

HST3 Plastic Bending of Beams
HST5 Two Hinged Parabolic Arch
HST6 Parabolic Fixed Arch
HST8 Plastic Bending of Portals
HST16 Redundant Truss
HST19 Pin Jointed Frameworks
HST34 Virtual Work
HST40 Two Dimensional Bending
HST49 Deformation of a Ring, Square and Rectangle

Heat Transfer

[H112](#) Heat Transfer Service Unit

Optional Extras

H112M Marcet Boiler
H112N Thermal Conductivity of Building Materials
H112P Free and Forced Convection from Flat Pinned and Finned Plates
H112Q Thermoelectric Heat Pump
H112R Closed Cycle Hot Air Engine (Sterling Engine)
H112S Boiling Heat Transfer
HC113A Data Acquisition Upgrade

[H352](#) Cross Flow Heat Exchanger

Optional Extras

H352A Plain Tube and Tube Bundle in Cross Flow
H352B Local Heat Transfer Element
H352C Finned Tube Bundle in Cross Flow
H352D Free and Forced Convection from Flat Pinned and Finned Plates
H352E Heat Pipe Investigation Accessory
H352F Pitot Static Traverse Plate

Strength of Materials

Destructive Testing

HSM34 Creep Testing Machine
HSM19D Rotating Fatigue Machine

Non Destructive Testing

HSM48 Round Diaphragm Apparatus

Vibrations

[HVT12](#) with HVT12c Beam Bending (Transverse) Vibrations Module

Refrigeration & Heat Pumps

[R833](#) Air and Water Heat Pump
[R715](#) Refrigeration Laboratory Unit

Pressure-Enthalpy Software

R100 Optional Pressure-Enthalpy Software Upgrade

Full Scale Material Testing

HPM Magnus

Experiments Available

HPM4/1 Ultimate Moment of a Reinforced Concrete Beam
HPM4/2 Crack Control in a Reinforced Concrete Beam
HPM5/1 Stress Grading of Timber Joists
HPM5/2 Load Distribution in a Timber Grillage
HPM6/1 Plane Frame
HPM6/1A Plane Frame Fitted with Strain Gauges
HPM6/2 Braced Arch Fitted with Strain Gauges

1. MEASUREMENT FUNDAMENTALS

Introductory

H813 DEW POINT HYGROMETER



The **Measurement Fundamentals** trainers ensure students are competent in understanding core foundations of pressure, temperature and humidity measurement, crucial for further learning. Often students will not understand "how" the fundamental units are measured. This range of equipment helps with this understanding.

H814 HUMIDITY MEASUREMENT BENCH



Optional Extra

HC814A DATA ACQUISITION UPGRADE

F110 PRESSURE MEASUREMENT BENCH



Optional Extras

F110A DEADWEIGHT TESTER

F110B PRESSURE TRANSDUCER AND DIGITAL DISPLAY

H981 TEMPERATURE MEASUREMENT METHODS & CALIBRATION UNIT



Optional Extra

HC982A DATA ACQUISITION UPGRADE

2. HEAT TRANSFER

Introductory to Intermediate



H102 Heat Exchanger Service Unit, shown with optional H102C 'Shell and Tube Heat Exchanger' fitted.

This fully modular unit uniquely offers **ten** optional heat exchangers plus an optional data acquisition system.



H112 Heat Transfer Service Unit, shown without any optional extras fitted.

This fully modular unit uniquely offers **fifteen** optional heat transfer experiments plus an optional data acquisition system.

Advanced



H352 Cross Flow Heat Exchanger Service Unit, shown with H352A 'Plain Tube and Tube Bundle in Cross Flow' fitted.

This fully modular unit uniquely offers **seven** optional Cross Flow Heat Exchanger experiments plus an optional data acquisition system.

3. HYDRAULICS BENCH



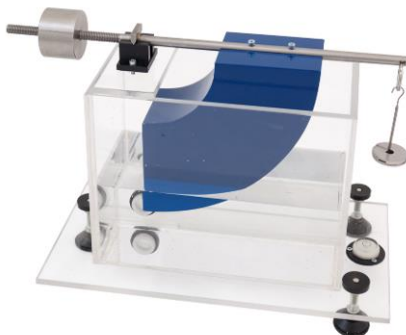
H100B Bernoulli's Theorem Demonstrator



HB100C Flow measurement Demonstrator



HB100E Optional Extra Stability of a Floating Body



HB100F Centre of Pressure

4. STRUCTURES

Introductory

HST2 SIMPLE SUSPENSION BRIDGE



HST23 EQUILIBRIUM OF FORCES



HST30 MODULUS OF ELASTICITY



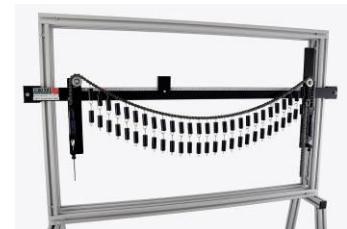
HST9 SHEAR FORCE IN A BEAM



HST24 EQUILIBRIUM OF PARALLEL FORCES



HST31 SUSPENSION CABLE



HST10 BENDING MOMENT IN A BEAM



HST25 EQUILIBRIUM OF A RIGID BODY



HST42 FORCES IN A TRUSS (SECTIONS)



HST17 FORCES IN A TRUSS (RESOLUTION)



HST26 DEFLECTIONS OF BEAMS



HST46 COMBINED SHEAR FORCE & BENDING MOMENT APPARATUS



Introductory to Intermediate

HST13 DEFLECTIONS OF BEAMS AND CANTILEVERS



HST22 TORSION OF RODS AND TUBES



HST35 STRAIN MEASUREMENT FOR STRUCTURES



HST20 BENDING STRESS IN A BEAM



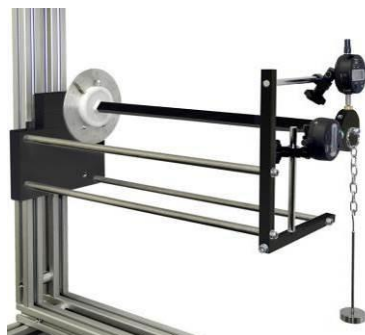
HST27 THREE DIMENSIONAL EQUILIBRIUM



HST36 COLUMN BUCKLING FAILURE



HST21 UNSYMMETRICAL BENDING & SHEAR CENTRE APPARATUS



HST29 SHEAR CENTRE APPARATUS



HST45 BUCKLING OF STRUTS



Intermediate

HST4 THREE HINGED ARCH



HST12 DEFLECTION OF CURVED BARS



HST15 BENDING MOMENT INFLUENCE LINES



HST7 DEFLECTION OF FRAMES



HST18 SUSPENDED CENTRE SPAN BRIDGE



HST11 CONTINUOUS AND INDETERMINATE BEAMS



HST14 SHEAR FORCE INFLUENCE LINES



HST38 DEFLECTIONS OF TRUSSES

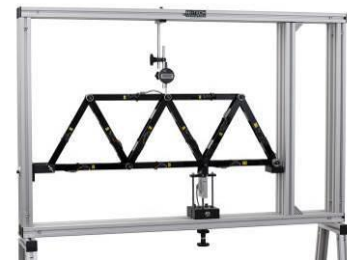


Advanced

HST3 PLASTIC BENDING OF BEAMS



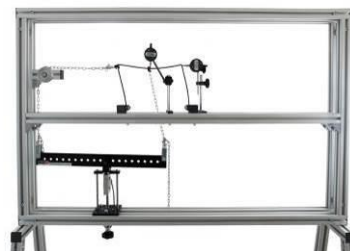
HST19 PIN JOINTED FRAMEWORKS



HST5 Two Hinged Parabolic Arch



HST8 PLASTIC BENDING OF PORTALS



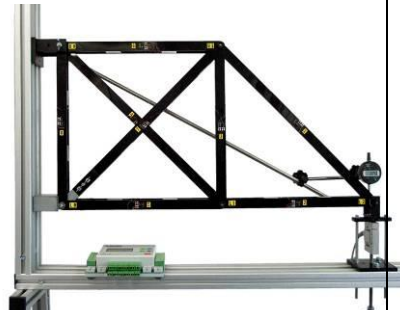
HST40 TWO DIMENSIONAL BENDING



HST6 Parabolic Fixed Arch



HST16 REDUNDANT TRUSS



HST49 DEFORMATION OF A RING, SQUARE AND RECTANGLE



4.1 STRUCTURES ACCESSORIES

Nearly all structures experiments will need to be mounted in a HST1 Frame. The **HST1 Universal Frame and Stand** is designed for either floor or bench mounting. The bench mounting kit is supplied as standard in the frame. Optional casters are available for the HST1 so that experiments can be easily wheeled around the lab for storage or demonstrations.

The majority of structures experiments are compatible with the **HST100 Bench-mounted Frame** as an alternative to the HST1. The small number which are not, are typically because they require the additional working-area of the HST1 floor mounted frame – e.g. to accommodate over-hanging weights. Contact us for a complete list.

HST1 UNIVERSAL FRAME AND STAND



HST100 BENCH MOUNTED FRAME



HDA200 INTERFACE FOR DIGITAL DISPLAY OF FORCE, STRAIN, DEFLECTION AND ANGLE



The HDA200 is an incredibly versatile unit and digitally displays force, strain, deflection and angle.

To be specific the HDA200 has 8 force channels, 15 strain channels, 6 deflection channels and 2 angle channels. In total there are over 30 different on board channels.

This feature is unique to P. A. Hilton Limited and you can imagine the resource this would be for student projects particularly in the final year if they were given the task of designing their own experiment.

The HDA200 can also be connected to a computer with the appropriate software for on screen data display and collection. The data can then be imported into a spread sheet for data manipulation if required.

4.2 STRUCTURES SOFTWARE

The Structures Software can be run in a standalone mode away from hardware (offline), or accompanying the hardware experiment (online) as it is being run making it an invaluable tool for comparing actual and theoretical hardware results.

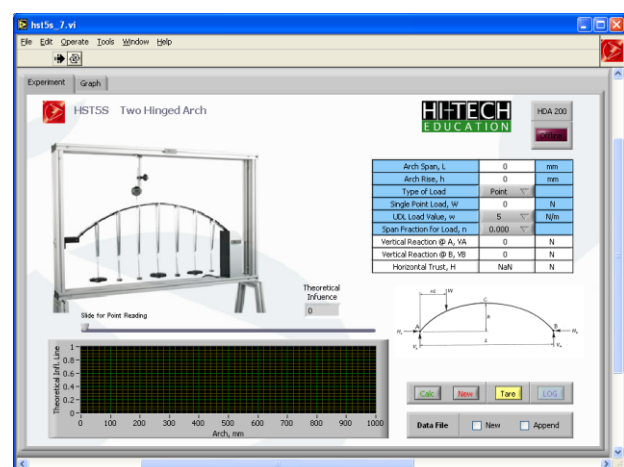
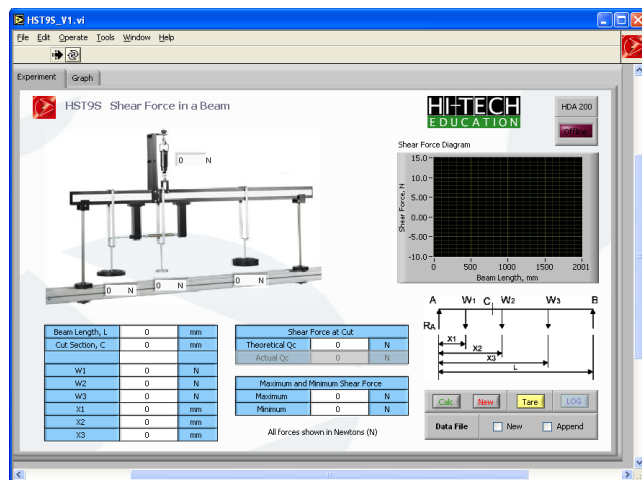
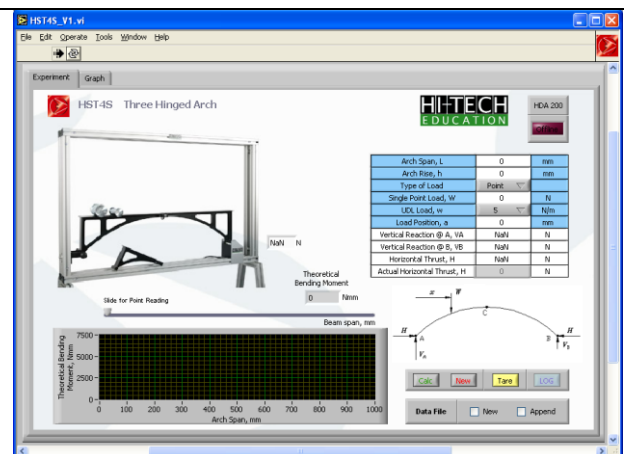
The majority of Structures experiments have experimental software available. The small number which do not are typically because a software is not a practical add-on due to the nature of the experiment.

Parameters displayed vary from experiment to experiment and include: loads, Young's modulus, material, material width, material height, material diameters and length. The students are also able to store, retrieve, manipulate, print and graphically represent data captured from certain experiments. Data stored can be imported in spread sheet software for further analysis and presentation.

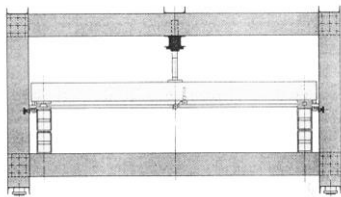
A software is included free of charge with each dedicated HDA200 ordered with a HST range experiment.

If a HDA200 is ordered to be shared between multiple HST experiments, then the software will need to be purchased separately.

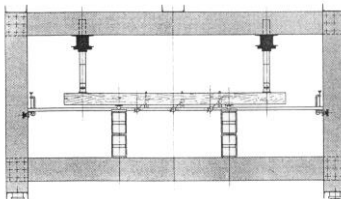
Alternatively, the **HSTS Complete Experimental Software Package** can be purchased which includes all currently available Structures software.



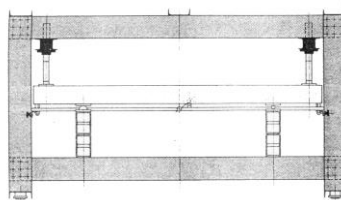
5. FULL SCALE MATERIAL TESTING



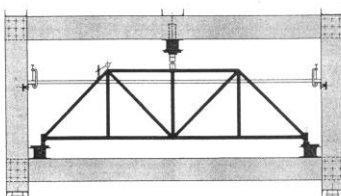
Ultimate Moment in a Reinforced Concrete Beam



Stress Grading in Timber Joists



Crack Width in a Reinforced Concrete Beam



Plane Frame

HPM Series Magnus 300kN Material Tester

The **Magnus** enables students to conduct tests on a range of full scale material samples such as timber joists, concrete beams and plane frames. It is complementary to our smaller, lab scale HST structures teaching range.

Its sturdy Steel Channel Section Frame makes unit robust for student or demonstration use. The hand-operated hydraulic system enables manual control of loading for maximum precision. The kit includes a full range of rocker and roller bearings, plates, support blocks, clamps and dial gauge mounting systems for setting up test specimens, giving unlimited potential for student projects

Data acquisition system with computer linking available as an optional extra, along with additional experimental tests.

6. STRENGTH OF MATERIALS

Destructive Testing



HSM11 Combined Bending and Torsion



HSM19D Rotating Fatigue Machine



HSM34 Creep Testing Machine



HSM41 Pendulum Impact Tester



HSM43 Torsion Testing Machine

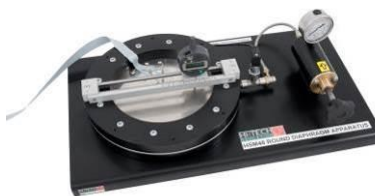


HSM58 Universal Material Tester

Non-Destructive Testing



HSM10 Curved Bars



HSM48 Round Diaphragm Apparatus

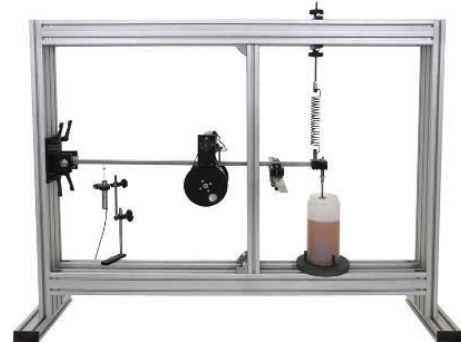


HSM38 Polariscope

The Strength of Materials range includes many other units in destructive and non-destructive testing plus optional extras including data acquisition, software and additional samples. Several of the above machines are available in different capacities to test smaller or larger test samples. See our brochure or contact us for more details.

7. VIBRATIONS

The **HVT12 Universal Vibration Apparatus** is an ideal candidate for university level education in Vibrations. Owing to the modular nature of the unit, customers can select different options depending on their preferred area(s) of study within the field of vibrations, making it particularly versatile. Within this one unit, several of the stand-alone modules are available as optional extras, providing excellent value for money including:



HVT12 Module

Stand-alone Alternative

HVT12a Pendulum Module

Includes:

HVT12a.1 Pendulum Module
HVT12a.2 Centre of Percussion
HVT12a.3 Bifilar/Trifilar Suspension

HVT1 Simple & HVT2 Reversible Pendulums,
(N/A)
HVT8 Bifilar/Trifilar Suspension

HVT12b Torsional Oscillation (Free and Damped) Module

HVT11 Comprehensive Torsional Vibration Apparatus

HVT12c Beam Bending (Transverse) Vibrations Module

N/A

HVT12g Free and Forced Vibrations Experiment

N/A

HVT12h Spring Mass Vibration Module

HVT14 Spring Mass Vibration **or**
HVT14d Spring Mass Vibration with digital acquisition

The **HVT13 Torsional Vibration Apparatus** doesn't overlap with the HVT12 so would be a complementary trainer to have with the HVT12. It is about a 50:50 split on the unit distribution list between universities and colleges for this unit, showing it appeals to both. See attached.



The **HVT5 Seismic Table** is a new addition to our range which has been developed with a University level of education in mind. It would be relevant for universities with a course in seismology. It also neatly complements the above two recommendations to provide a complete offering in Vibrations.

8. AIR CONDITIONING

A660 AIR CONDITIONING LABORATORY UNIT



The **A660 Air Conditioning Laboratory Unit** is a best seller around the world. It allows undergraduates to be able to investigate the thermodynamics of the processes within air conditioning. These include psychrometry, energy and mass balances between air stream and the various heating, humidifying and dehumidifying processes. The analysis of data on this unit can be as simple or as complex as the curriculum requires.

Optional Extras

A661A DIGITAL TEMPERATURE UPGRADE

A661B RECIRCULATION DUCT UPGRADE



A660C PID CONTROL UPGRADE

Note: The A660C must be preceded by A661B

A660D ENVIRONMENTAL CHAMBER

Note: The A660D must be preceded by A661B

AC661A DATA ACQUISITION UPGRADE

Note: The AC661A requires the A661A for operation

R100 PRESSURE ENTHALPY SOFTWARE

Note: The R100 requires the A661A and AC661A for operation

Optional extras available to extend learning further.

9. VENTILATION

B500 VENTILATION TRAINER



Optional Extras

B500B DUCTING UPGRADE 'B'

B500C DUCTING UPGRADE 'C'

The **B500 Ventilation Trainer**, helps students to understand the process that goes on between the air conditioning plant and the rooms within a building.

Study areas include airflow measurement, pressure losses and balancing of a multi-discharge ventilation system.

Below: B500 Unit shown in-situ with one of a number of duct configurations



10. REFRIGERATION & HEAT PUMPS

The **Refrigeration & Heat Pump** units are divided into levels of complexity. These units are intended for undergraduate to graduate engineers (i.e. **non-Vocational**).

INTRODUCTORY

R634 REFRIGERATION CYCLE DEMONSTRATION UNIT



Optional Extras

R634A DIGITAL TEMPERATURE INDICATOR

R634B DIGITAL WATTMETER UPGRADE

R634R REFRIGERANT FLOWMETER

The simplest of all the Refrigeration and Heat Pump Units is the **R634 Refrigeration Cycle Demonstration unit**.

This unit allows the students to safely see evaporation and condensation occurring inside glass cylinders as we use a low pressure solvent as the refrigerant. This unit is equally at home in the vocational setting as it is a very graphic unit where sight & touch (hot & cold) are as important as measurements.

The three heat pumps in the range offer an introductory to advanced level of complexity.

The **R515 Mechanical Heat Pump** provides a Water-Air circuit.

The **R560 Water Water Heat Pump**, as the name suggests, demonstrates a Water-Water circuit.

Meanwhile, the **R833 Air and Water Heat Pump**, includes both an Air-Water circuit and a Water-Water circuit. The user is able to switch between them by use of a solenoid valve. This is therefore a more advanced unit.

Both the R560 Water Water Heat Pump and the R833 Air and Water Heat Pump are compatible with the **RE590 Ground Source Simulator** and so also make a an ideal addition to renewable energy teaching too.

REFRIGERATION & HEAT PUMPS

Introductory to Intermediate

R515 MECHANICAL HEAT PUMP



Optional Extras

R515A DIGITAL WATTMETER UPGRADE

RC516A DATA ACQUISITION UPGRADE

R100 PRESSURE ENTHALPY SOFTWARE

Note: The R100 requires the RC515A for operation

Intermediate

R560 WATER WATER HEAT PUMP



Optional Extras

R560A DIGITAL WATTMETER UPGRADE

RC560A DATA ACQUISITION UPGRADE

RE590 GROUND SOURCE SIMULATOR

R100 PRESSURE ENTHALPY SOFTWARE

Note: The R100 requires the RC560A for operation

Intermediate to Advanced

R833 AIR AND WATER HEAT PUMP



Optional Extras

RC833A DATA ACQUISITION UPGRADE

RE590 GROUND SOURCE SIMULATOR

R100 PRESSURE ENTHALPY SOFTWARE

Note: The R100 requires the RC833A for operation

REFRIGERATION & HEAT PUMPS

Advanced

The most advanced in academic and technical level is the **R715 Refrigeration Laboratory Unit**. This allows every single parameter to be measured on a belt driven open compressor vapour compression cycle. The evaporator is electrically loaded by an adjustable heater where input power is measured. The condenser is water cooled and condensing pressure can be adjusted by cooling water flow. The motor driving the compressor is mounted in trunnion bearings so that we can measure the torque being generated by the motor. Compressor speed is measured and motor speed derived from the pulley ratio. This allows the motor shaft power to be measured. In addition the motor electrical power can be measured by the same meter as the evaporator heater. We record condensing and evaporating pressures and all the relevant system temperatures including refrigerant system temperatures and cooling water inlet and outlet temperatures. We also record refrigerant flow rate. Hence by creating a refrigeration cycle diagram (from measurements) on an R134a Pressure –enthalpy chart the students can carry out full energy balances across, condenser, evaporator and compressor.

R715 REFRIGERATION LABORATORY UNIT



Optional Extras

RC716A DATA ACQUISITION UPGRADE

R100 PRESSURE ENTHALPY SOFTWARE

Note: The R100 requires the RC716A for operation

H893 BENCH TOP COOLING TOWER



We include a **H893 Water Cooling Tower** in the advanced section as these often are the means of rejecting the heat from a building A/C system. Again this is looking at the thermodynamics of the process.

Optional Extras

H893A COLUMN A - 7 PLATES

H893C COLUMN C - 18 PLATES

H893D COLUMN D - EMPTY COLUMN

H893E PACKING CHARACTERISTICS COLUMN

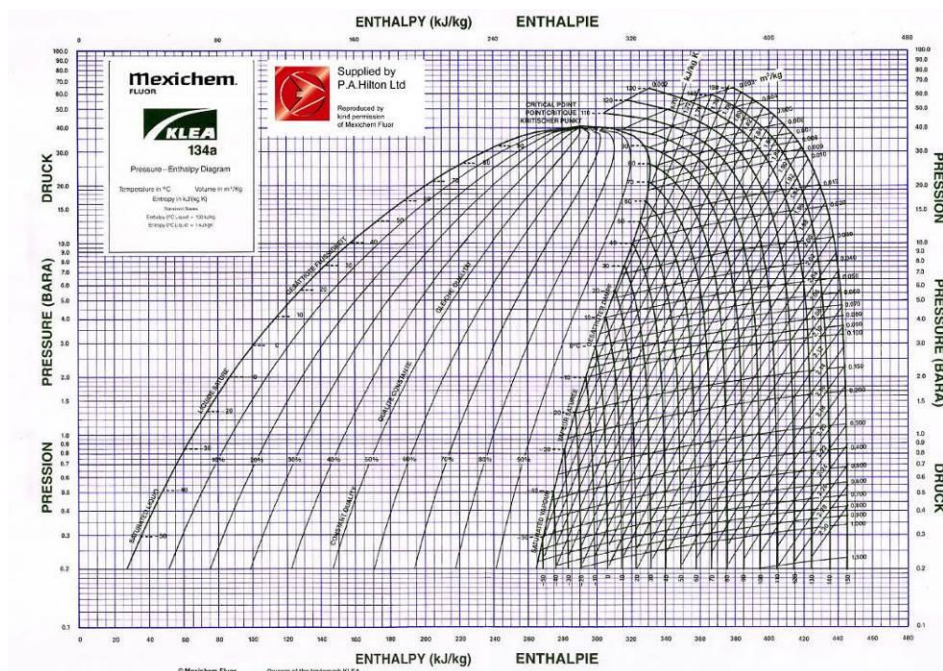
HC894A DATA ACQUISITION UPGRADE

11. PRESSURE ENTHALPY SOFTWARE

R100 OPTIONAL PH SOFTWARE UPGRADE

Requires Data Acquisition Upgrade for operation, compatible with many units

We have recently added the **R100 Pressure-enthalpy software** to our range. It can do energy balances calculations and create real time animated p-h diagrams for many units in our Ref & AC range where the optional computerised data acquisition has been purchased (namely A660, R515, R560 and R715).



We still supply a hardcopy A3 version of the pressure enthalpy chart with each unit so students can complete hand-calculations and understand the formulae required. For more advanced students, for example those conducting final year projects, the R100 software speeds the process of data acquisition and enables the calculations to be automated for more rapid data collection and results to be exported for printing, tabulating and importing to Microsoft Excel.

Laboratory Layout & Design

Whether a vocational pathway or a non-vocational pathway of education is selected, it is crucial to ensure physical laboratory space is of optimum design to contain the units. If modifications are required, it is best to plan these in advance of receiving equipment on-site.

Services Required:

- Once you have selected the units of interest, refer to the technical leaflets or website for more information on the services required, which may include:
 - Water
 - Drain
 - Electricity
 - Peripherals such as computers/laptops/tablets
- Lab furnishing and layout - consider:
 - Weights and dimensions of units
 - Storage of peripherals
 - Access for loading and transporting units
 - Working areas for students and technicians

How we can help:

- Pre-purchase – we can assist with:
 - Lab planning
 - Selection of appropriate products
 - Site visits to advise on layout and services required.
- Post-purchase – we can assist with:
 - Installation
 - Commissioning
 - Training of Technical and Teaching staff on-site

Example Laboratory

Newcrest Mining Laboratory at the University of Queensland, Australia








Civil Engineering Laboratory Proposal

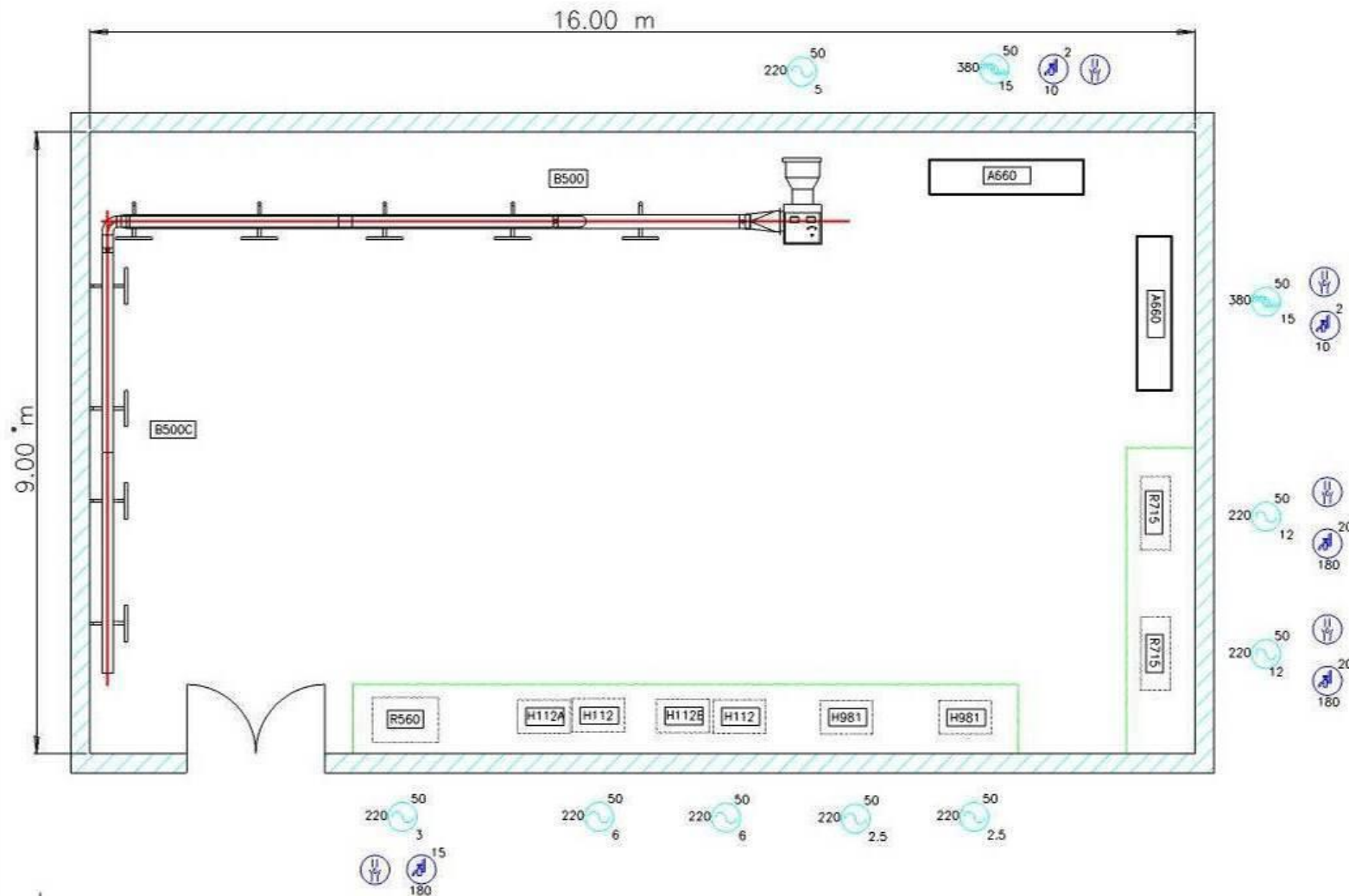
P.A.Hilton Ltd


HFL

The scope of supply included:

Newcrest Mining Laboratory University of Queensland, Australia	
	(Qty 2.) H112 Heat transfer Units plus H112A Linear Heat Conduction H112B Radial Heat Conduction http://www.p-a-hilton.co.uk/products/H112-Heat-Transfer-Service-Unit
	(Qty. 2) H981 Temperature Measure Methods and Calibration Unit http://www.p-a-hilton.co.uk/products/H981-Temperature-Measurement-Methods-and-Calibration-Unit
	(Qty. 2) A660 Air Conditioning Laboratory Unit http://www.p-a-hilton.co.uk/products/A660-Air-Conditioning-Laboratory-Unit
	(Qty. 1) B500 Ventilation Trainer http://www.p-a-hilton.co.uk/products/B500-Ventilation-Trainer
	(Qty. 2) R715 Refrigeration Laboratory Unit http://www.p-a-hilton.co.uk/products/R714-Refrigeration-Laboratory-unit

Civil Engineering Sample Lab Layout shown with Services Required



-  DRAIN REQUIRED
-  WATER SUPPLY: MIN. PRESS. m HEAD
FLOW l/h
-  SINGLE PHASE WITH EARTH
VOLT Hz
AMPS
-  THREE PHASE WITH EARTH
VOLT Hz
AMPS
-  BENCH/DESK MOUNTING
-  FLOOR MOUNTING
-  TROLLEY MOUNTING

DO NOT SCALE



P.A.HILTON Ltd.
Horsebridge Mill, Kings Somborne
Stockbridge, Hampshire SO20 6PX,
ENGLAND
Telephone: 01794-388382
Fax: 01794-388129

DATE DRAWN :	01.08.13
DRAWN BY :	HFL
ISSUE No. :	1.1
SCALE :	---

CUSTOMER NAME :	SAMPLE
CUSTOMER REFERENCE :	THERMODYNAMICS LABS
LABORATORY TITLE :	

DRAWING No.
96500/D

Next Steps

We would be pleased to assist with helping you take the next steps towards completing your new Civil Engineering Laboratory.

We have provided information within this guide as a general overview, so what we will need to do next is to ensure that we can put together a package suited to your individual requirements.

Contact your local representative for more information or alternatively P.A.Hilton Ltd directly:



P.A.Hilton Ltd

P.A.Hilton Limited
Horsebridge Mill
King's Somborne
Stockbridge
Hampshire SO20 6PX
England
F: +44 (0)1794 388129
T: +44 (0)1794 388382
Email: sales@p-a-hilton.co.uk
Web: www.p-a-hilton.co.uk

Registered in England No: 743785

VAT Registration No: GB18836303