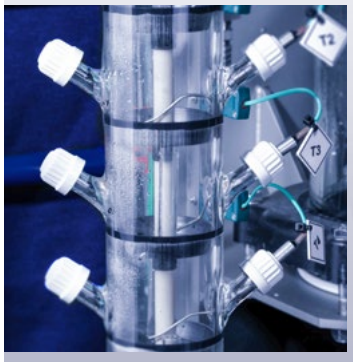
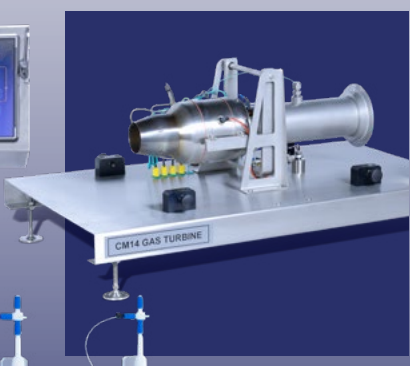
armfield

ENGINEERING EDUCATION

Teaching & Research Equipment

ISSUE 17





Part of Judges Scientific PLC

CHEMICAL/CIVIL/MECHANICAL/GEOSCIENCE/ENVIRONMENTAL/AGRICULTURAL/FOOD SCIENCE

Preface

Today, Armfield is the world leader in the supply of Innovative, Education, Teaching and Research equipment and Industrial Research & Development equipment for Food and Pharmaceutical laboratories.

At the heart of our business, we recognize that people are the driving force, the source of innovation, and the true essence of our success. We believe that investing in our people is investing in our future.

In 2023 we opened our new inhouse manufacturing centre that has become the cornerstone of our commitment to quality, control, and innovation. By producing our products internally, we ensure precision, adaptability, and a direct line to excellence.

Our dedication to making our products feature-rich is driven by our passion for delivering exceptional value to our customers. We believe that every added feature is an opportunity to enhance user experience and provide solutions that exceed expectations.

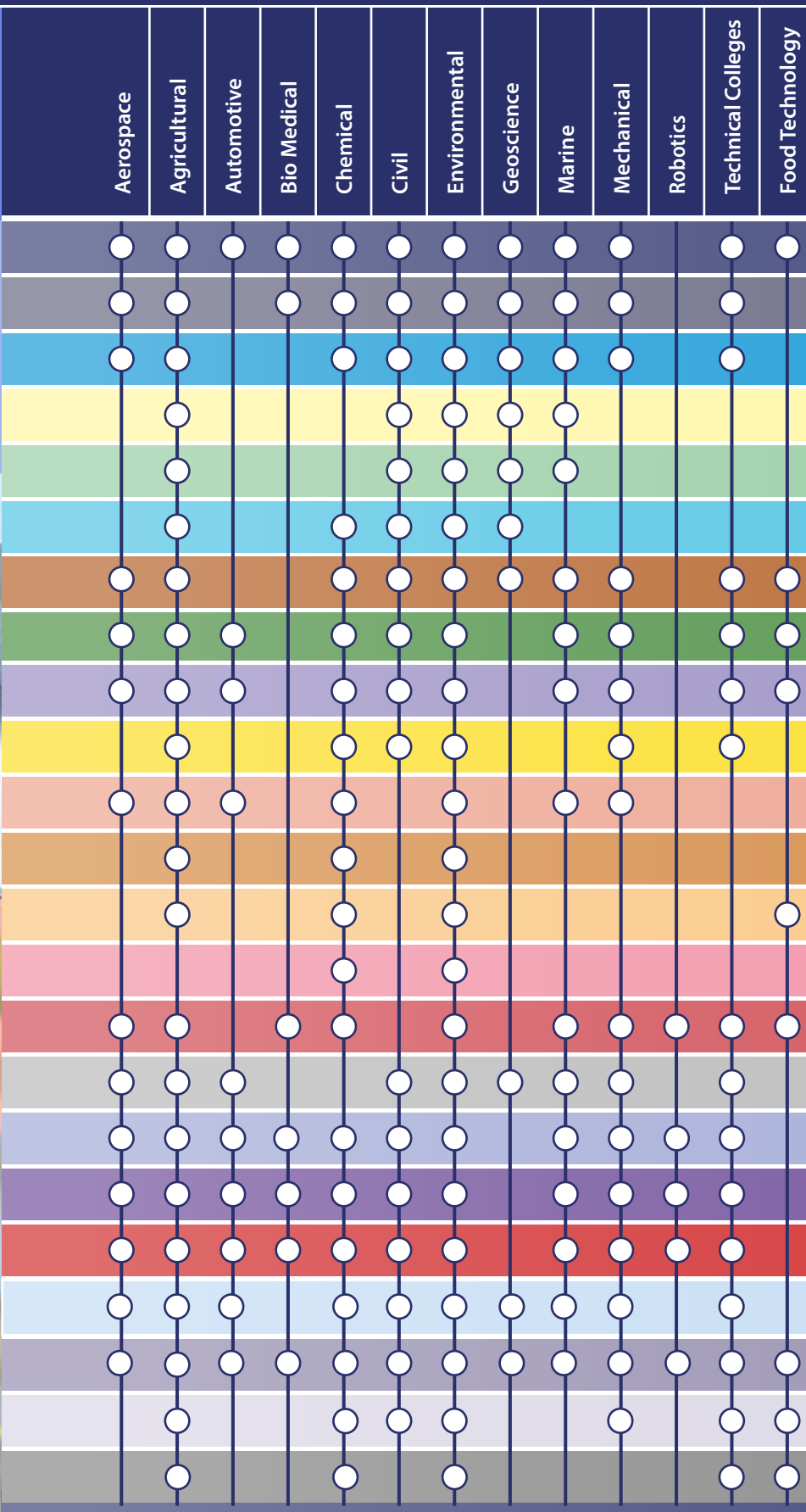
Our equipment empowers the next generation of engineer covering topics such as Fluid Dynamics, Chemical, Civil, Mechanical Engineering, Food and Pharmaceutical Processing.

If you require more detailed data on any of the products contained within this catalogue, we are represented by a global network of agents, distributors and an international sales team who will be more than happy to support your requests.

You will find our comprehensive list of agents and distributors on our website.

Andy Macpherson
Managing Director Armfield Limited

ENGINEERING Education teaching and research



Contents

Link to F Series

F SERIES

Fluid Mechanics

The Armfield Fluid Mechanics range plays a fundamental role in engineering teaching across multiple disciplines. The comprehensive range covers the complete curriculum requirement in Mechanical, Civil and Chemical Engineering encompasses subjects such as Hydrostatics and Properties of Fluids, Fluid Dynamics, Open Channel Flow (Free Surface Flow), Flow Around Bodies, Compressible Flow and Rotodynamic Machines.

Hydrostatics and Properties of Fluids

The Armfield Hydrostatics portfolio offers a complete range of teaching equipment for the study of fluids at rest. Topics covered include Hydrostatics, Properties of Fluids, Static Pressure, Pressure Gauges and Manometers, buoyancy force and stability of floating bodies.

Fluid Properties and Hydrostatic Bench - F9092

Requirements

A practical instruction unit designed to demonstrate the properties of fluids and their behaviour under hydrostatic conditions.

With this apparatus students can develop their knowledge of a wide range of principles and techniques that will be of lasting value in their studies of fluid mechanics.

The equipment enables over 16 distinct experiments, is entirely self-contained, mobile, and independent of all laboratory services.

It includes a full range of ancillary equipment required for the experiments.

Dead Weight Pressure Gauge Calibrator - F1-11

Requirements

The Dead Weight Pressure Gauge Calibrator consists of a precision-machined piston and cylinder assembly mounted on levelling screws.

The unit is supplied with a Bourdon gauge for calibration.

The weights supplied are added to the upper end of the piston rod, which is rotated to minimise friction effects. The gauge is thus subject to known pressures, which may be compared with the gauge readings and an error curve drawn.

NEW

Hydrostatic Pressure - F1-12-MKII

Requirements

The Hydrostatic Pressure accessory has been designed to determine the hydrostatic thrust acting on a plane surface immersed in water when the surface is partially submerged or fully submerged.

It also enables comparison of the measured magnitude and position of this force with the theoretical position.

Requirements

COLD

Metacentric Height - F1-14-MKII

This unit allows the position of the metacentric height to be varied to produce stable and unstable equilibrium.

The F1-14-MKII Metacentric Height Apparatus consists of a small rectangular floating pontoon that incorporates movable weights to allow manipulation of the Centre of Gravity and the transverse inclination (angle of heel).

Practical results are taken for the stability of the floating body in different conditions, and these are compared to theoretical results derived from first principles.

Optionally available:

F1-14A Floating Bodies containing an additional Round Bilge Hull and a V-Shaped Hull.

Optional extra basins F1-14a

Requirements

COLD

Fluid Statics and Manometry - F1-29

The right-hand manometer tube is separate from the other tubes and incorporates a pivot and indexing mechanism at the base that enables this tube to be inclined at fixed angles of 5°, 30°, 60° and 90° (vertical).

The reservoir incorporates a hook and point gauge with Vernier scale, mounted through the lid, that enables large changes in level to be measured with precision.

A vertical transparent piezometer tube through the lid of the reservoir enables the static head above the water in the reservoir to be observed, when the air space above the water is not open to atmosphere.

Requirements

Requirements

COLD

Fluid Properties Apparatus - F1-30

This apparatus provides an introduction to the fundamental properties of liquids that affect their behaviour in practical applications.

This unit includes:

- Universal hydrometer
- 2 calibrated falling-sphere viscometer tubes
- 3 steel spheres
- Thermometer
- Aneroid barometer
- 6 varying diameter capillary tubes
- Pycnometer and a dual scale level balance

Requirements

COLD

Pascal's Apparatus - F1-31-MKII

The Pascal's Apparatus provides a simple but effective demonstration that the intensity of pressure in a liquid depends only on the depth of the liquid and not on the shape of the vessel, container, reservoir etc.

By comparing the pressure/force at the base of three vessels with different shapes when filled to the same depth with water, Students learn that pressure in a liquid varies with the depth and does depend on the shape or area of the vessel and pressure in a liquid varies with depth but not volume.

Fluid Mechanics - F Series

Fluid Dynamics

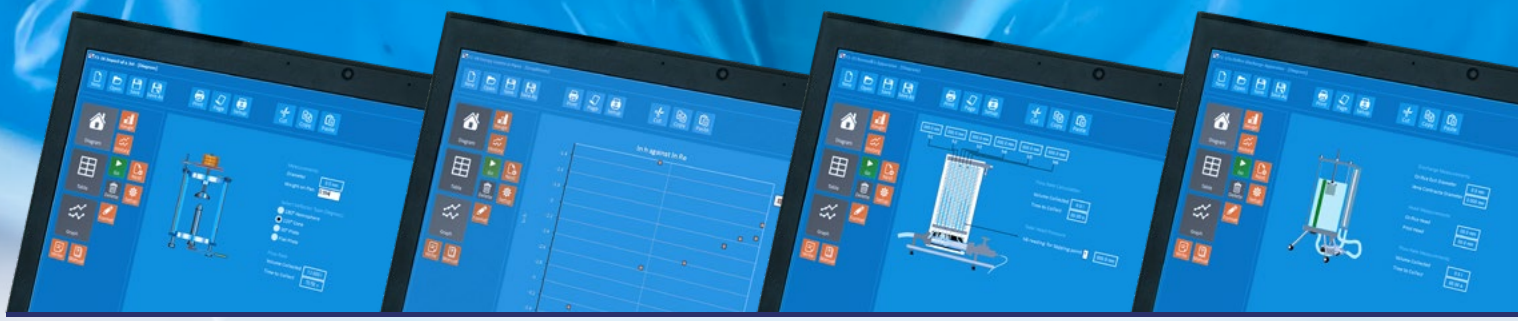
The Armfield Fluid Dynamics range covers the complete curriculum requirement of fluids in motion for Chemical, Mechanical and Civil Engineering.

The range includes studies into the various properties of fluids, such as velocity, pressure, conservation laws of mass, energy and momentum.

Link to F1 Series

F1-23-MKII Free and Forced Vortex

Fluid Mechanics Software F1-aBASIC included as standard:



Built in flow channel

Optional Digital Flow Meter

Basic Hydraulics Bench - F1-10 (Factory fit, digital flow meter option shown)

The Armfield Hydraulics Bench and its comprehensive range of optional accessories have been developed to instruct students on the many different aspects of hydraulic theory.

Each accessory to the F1-10 is supplied as a complete piece of equipment needing no additional service items other than the Hydraulics Bench. When coupled with the bench they are immediately ready for use.

- Fluid Mechanics Software F1-aBASIC included as standard
- The GRP bench top incorporates an open flow channel with weir carrier and ledges along both sides to support appropriate accessories on test
- Quick-release pipe connector for rapid exchange of accessories, no need for hand tools
- The volumetric measuring tank is stepped to accommodate low or high flow rates
- Optional F1-10-1 External Flowmeter accessory for existing F1-10 bench's available
- Optional F1-10-2 Hydraulics Bench with integrated digital flow meter available

Requirements

Requirements

F1-10

Bernoulli's Theorem Demonstration - F1-15-MKII

The Bernoulli's Theorem Demonstration Apparatus consists of a classical Venturi shape machined from clear acrylic. A series of wall tappings in the longest taper allows measurement of static head changes as the cross section varies.

A total head tube can be traversed along the centreline of the test section to obtain total head readings at any location along the test section.

The apparatus enables students to investigate the validity of the Bernoulli equation when applied to the steady flow of water in a converging or a diverging duct.

The test section can be reversed to show applications where the Bernoulli equation applies and applications where it breaks down because of frictional losses.

Requirements

F1-10

Impact of a Jet - F1-16-MKII

The Impact of Jet Apparatus, consists of clear acrylic test cylinder, into which water is fed vertically through a nozzle. The water strikes a target mounted on a stem. A weight pan mounted at the top of the stem allows the force of the water to be counterbalanced by applied masses.

The F1-16-MKII allows students to investigate the reaction forces produced by the change in momentum of a fluid flow, by measurement of the forces produced by a jet impinging on solid surfaces which produce different degrees of flow deflection.

Models included:

- Cup Target 120°
- Cup Target 135°
- Cup Target 180°
- 30° Target
- 60° Target
- Oblique Target, 30/150°
- Oblique Target, 45 / 135°

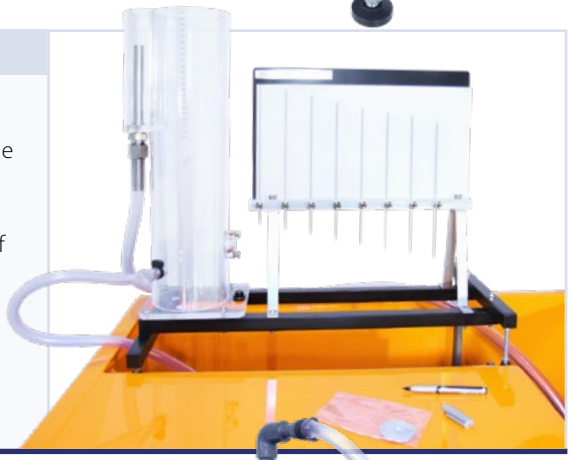
Requirements

F1-10

Orifice and Free Jet Flow - F1-17

The Orifice and Jet Apparatus, consists of a reservoir of water with an orifice plate (3mm or 6mm) set into it. A jet of water issues from this hole and its trajectory may be measured using 8-point gauges to determine the discharge coefficient.

The F1-17 allows students to determine the coefficient of velocity by measurement of the trajectory of a jet issuing from an orifice in the side of a reservoir under steady flow conditions (constant reservoir head).



Requirements

F1-10

Orifice Discharge - F1-17a

The Orifice Discharge accessory enables full analysis of the flow through different orifices over a range of flow rates.

It consists of:

- Seven orifice plates
- A cylindrical clear acrylic tank, with an orifice fitted in the base
- A carrier enables a pitot tube to be accurately positioned anywhere in the jet
- A wire micrometre is used to accurately measure the jet diameter and the vena contracta diameter and so determine the contraction coefficient

Fluid Mechanics - F Series

Energy Losses in Pipes - F1-18-MKII

The Energy Losses in Pipes accessory consists of a test pipe, orientated vertically on the side of the equipment, which may be fed directly from the hydraulics bench supply or, alternatively, from the integral constant head tank.

These sources provide high or low flow rates which can be controlled by a valve at the discharge end of the test pipe. Head loss between two tapping points in the test pipe is measured using two manometers, digital handheld manometer for large pressure differentials and a pressurised water manometer for small pressure differentials.

Excess water discharging from the constant head tank is returned to the sump tank of the hydraulics bench.

Requirements

F1-10

Osborne Reynolds' Demonstration - F1-20

The Osbourne Reynolds' apparatus is a classic experiment and is a visualisation of flow behaviour by injection of dye into a steady flow in a pipe.

The apparatus enables students to observe laminar, transitional, and turbulent pipe flow.

A header tank containing stilling media provides a constant head of water through a bellmouth entry to the flow visualisation pipe. Flow through this pipe is regulated using a control valve at the discharge end.

The flow rate can be measured using the volumetric tank (or measuring cylinder) of the Hydraulics Bench. Velocity of the water can therefore be determined to enable calculation of Reynolds' number.

Requirements

F1-10

Flow Meter Demonstration - F1-21-MKII

The Flow Meter demonstration unit consists of a Venturi meter, a variable area meter and an orifice plate installed in a series configuration to allow for direct comparison.

The apparatus allows students to investigate the operation and characteristics of three different basic types of flowmeter.

This includes accuracy and energy losses, by measurement of volume flow rates and associated pressure losses with three flowmeters connected in series and using timed volume collection to produce a reference measurement of flow rate.

Accessories:
F1-21-MKII-1 Pitot-Static Tube
F1-21-MKII-2 Flow Nozzle

Requirements

F1-10

Energy Losses in Bends and Fittings - F1-22-MKII

This accessory permits losses in different bends, a sudden contraction, sudden enlargement and a typical control valve, to be demonstrated.

- Mitre bend - 90° elbow - Swept bends (large and small radius)
- Sudden contraction and sudden enlargement

Fully Instrumented with upstream and downstream pressure tappings.

A bank of 12 water manometer tubes, mounted on the framework for visualisation of the pressure drop profiles.

Requirements

F1-10

Requirements

F1-10

Free and Forced Vortex - F1-23-MKII

The Free and Forced Vortex equipment is designed to produce and measure the characteristics of free and forced vortices.

It enables students to determine the surface profile of a forced vortex, and compare with theoretical values, by measuring the speed of rotation and length of needles that represent the forced vortex.

Coupled with the ability to measure the profile of a free vortex, and investigate the changes in velocity head throughout the vortex. By employing the Pitot tubes and measuring the elevation of water in the cylinder at different radius of the vortex.

Requirements

F1-10

Hydraulic Ram - F1-24

If flowing water is suddenly brought to rest in a long pipe, a phenomenon known as water hammer occurs, which produces a pressure wave that travels along the pipe.

This principle is used in the hydraulic ram to pump water. The Hydraulic Ram Pump apparatus consists of a base unit incorporating two fluid chambers, pulse and non-return valves and a supply reservoir on a stand.

The unit allows students to demonstrate the operating principles of the hydraulic ram.

Requirements

F1-10

Cavitation Demonstration - F1-28

The Cavitation Demonstration Apparatus, demonstrates to students visually, audibly and numerically the phenomenon of cavitation and its association with the vapour pressure of a liquid. The following demonstrations are possible using the F1-28 in conjunction with the F1-10:

- Observation of the phenomenon of cavitation in a liquid (by reducing the static pressure of the liquid to its vapour pressure)
- Comparison of theoretical and actual pressure at cavitation conditions
- Observation of air-release due to free and dissolved gasses in a liquid
- Demonstration of reducing cavitation by increasing the static pressure in a liquid

Requirements

F1-10

Pitot Tube Demonstrator - F1-33

The Armfield unit is designed to demonstrate the operation and characteristics of a Pitot-static tube that is used to determine fluid velocity by measuring the difference between the total head and the static head of water flowing inside a pipe using a manometer.

A series of simple teaching exercises show how the Pitot-static tube works, how it can be used to measure fluid velocity using an appropriate instrument to measure differential head and how Velocity head and therefore fluid velocity varies across the diameter of a pipe.

The rigid horizontal cylindrical pipe, incorporating the Pitot-static tube, is constructed from clear acrylic and PVC for durability and ease of maintenance. The Pitot-static tube can be traversed across the diameter of the pipe to show changes in dynamic head profile inside the pipe.

Shown with the F1-10 Bench

Flow Over Weirs - F1-13-MKII/F1-13a

Requirements: F1-10

The Flow Over Weirs accessory is used in conjunction with the flow channel in built to the Hydraulics bench. The apparatus demonstrates the characteristics of flow and the relationship between upstream water level and weir discharge for various notches.

F1-13-MKII Flow Over Weirs	F1-13a Advanced Weirs
Stilling Baffle And Inlet Nozzle Vernier Hook And Point Gauge And Instrument Carrier Large Notch Plate Weir 30mm Large Notch Plate Weir 50mm Large V Plate Weir 90° Regular V Plate Weir 90°	Large Trapezoidal Weir 30mm Large Trapezoidal Weir 50mm Large V Plate Weir 30° Dog Bone Weir

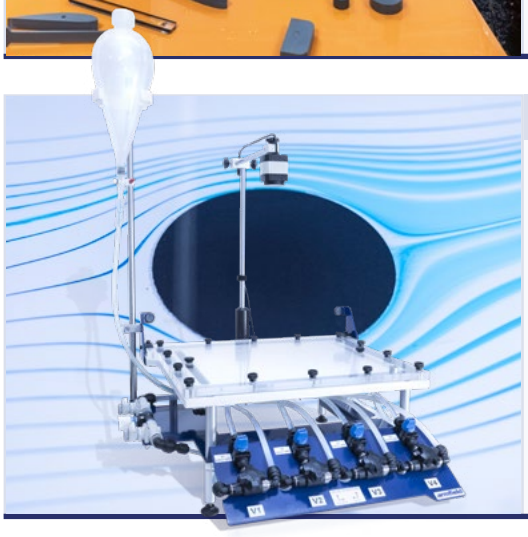
Flow Channel - F1-19

Requirements: F1-10

The Flow Visualisation Apparatus consists of a perspex channel with a large depth to width ratio, which is fed with water, into which dye may be injected.

This apparatus allows students to achieve three objectives:

- To visualise a range of open-channel flow behaviour, by creating flow phenomena in an open channel, using an undershot weir, overshot weir, sharp-edged and broad-crested weirs including both super-critical (fast) and sub-critical (slow) behaviour
- To visualise flow patterns around immersed objects in steady flow by creating a relatively low Reynolds number and quasi-2-dimensional flow around models located in a narrow channel
- To visualise the flow patterns by dye streak lines, which in steady flow are the same as streamlines



Hele Shaw Apparatus - F1-38

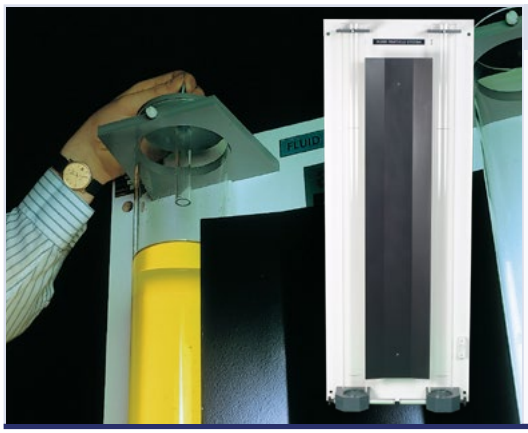
Requirements: F1-10

The Hele Shaw Apparatus provides a very visual means of showing potential flow in the field of fluid dynamics. The water flows through a very narrow channel which is formed between two plates causing the water to flow in a special way.

The mean velocity of the water along the channel obeys equations as those for local velocity in potential flow. The water flow within the channel is designed to be in a steady, laminar state.

This apparatus is supplied with models and blank material to create your own:

- Venturi half X2
- Orifice plate half X2
- Disc
- Aerofoil NACA633-618
- Aerofoil Gottingen 535
- Blank material



Particle Drag Coefficients - F12

Requirements: 1Ph

A wall mounted apparatus in which particles of various size and density can be used to introduce the fundamental characteristics of the behaviour of particle/fluid systems. In particular, the relationship between the drag coefficients of falling particles and their Reynolds' number value.

- Compact, wall mounted apparatus to study the behaviour of particles and shapes within fluids
- 2 x Ceramic Spheres (One off each: 6.35mm and 9.5mm Diameter)
- 4 x Stainless Steel Spheres (One off each: 3.17mm, 6.35mm, 7.9mm and 9.5mm Diameter)

Rotodynamic Machines

The Rotodynamic Machines range from Armfield introduces students to kinetic machines in which energy is continuously imparted to the pumped fluid by means of a rotating impeller, propeller, or rotor.

The range also offers a comparison with positive displacement pumps.

Requirements

F1-10

Demonstration Pelton Turbine - F1-25-MKII

The Demonstration Pelton Turbine provides a simple low cost introduction to turbine performance.

The unit consists of:

- Turbine wheel inside cast housing with acrylic panel to enable viewing
- Mechanical torque measured using dynamometer with spring balances
- Inlet pressure gauge
- Quick-release fitting for easy connection to Hydraulics Bench

Tachometer included as standard

Requirements

F1-10

Demonstration Francis Turbine - F1-32

This demonstration turbine provides an introduction to the Francis inward flow reaction turbine.

The unit consists of:

- Francis runner surrounded by six guide vanes inside a volute with clear acrylic front panel for visualisation
- Guide vanes adjustable when turbine is running with scale to indicate degree of opening
- Francis runner 60mm diameter with 12 blades
- Brake force determined using Prony-type brake dynamometer
- Inlet pressure gauge with range 0-2 bar

Tachometer included as standard

Requirements

1Ph

F1-10

Centrifugal Pump Characteristics - F1-27

The Centrifugal Pump Characteristics Accessory, used in conjunction with the sump tank and volumetric tank on the F1-10 bench demonstrates the characteristics of a single centrifugal pump by the measurement of the pump head, discharge and power characteristics at varying speeds.

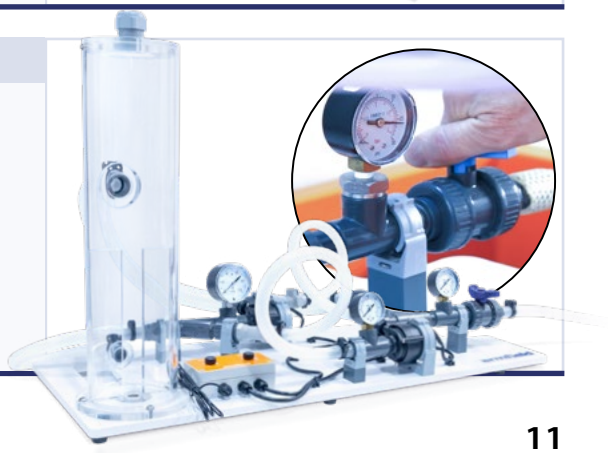
The speed of the pump on F1-27 can be varied to demonstrate the characteristics of two dissimilar pumps when connected in series or parallel.

Requirements

1Ph

F1-10

Series/Parallel Pumps - F1-35



The Series/Parallel pumps accessory is used to demonstrate the head/flowrate characteristics of a centrifugal pump for several different configurations, by measurement of pressure at pump inlet and outlet and discharge flowrate.

The F1-35 Series / Parallel pumps apparatus enable students to gain an understanding of the following pump theory:

- Series Pump Operation, that pumps can be combined in series to obtain an increase in head at the same flowrate as the single pump
- Parallel Pump Operation, that pumps can be combined in parallel to obtain an increase in flowrate at the same head as the single pump

C SERIES

Advanced Fluid Mechanics

Link to C Series

C3-MKII Flowmeter Demonstrator

The rig can accommodate both rotodynamic and positive displacement pumps, and is supplied with the most common example of each type as standard.

Supplied Pumps (centrifugal pump and a gear pump)

A range of other pump types are available as accessories, including axial, turbine, flexible impeller, diaphragm and plunger; plus a second centrifugal pump for series/parallel demonstrations.

Multi-Pump Test Rig - C3-MKII

Up to four pumps can be accommodated within the rig simultaneously for use within a single laboratory period, and each can be run without disconnecting any pipework or connections.

- ArmSoft Educational software and data logging hardware as standard.

Determining the performance of different types of pumps at constant speed by producing a set of characteristic curves:

- For rotodynamic pumps:
  - Pressure head vs flow
  - Power absorbed vs flow
  - Pump efficiency vs flow
- For positive displacement pumps:
  - Flow vs pressure head
  - Power absorbed vs pressure head
  - Volumetric efficiency vs pressure head

Requirements

- 1Ph
- PC
- USB

- **C3-MKII-20** Centrifugal Pump *(Supplied as standard)*
- **C3-MKII-20SP** Second Centrifugal Pump
- **C3-MKII-21** Gear Pump *(Supplied as standard)*
- **C3-MKII-22** Axial Flow Pump
- **C3-MKII-23** Flexible Impeller Pump
- **C3-MKII-24** Turbine Pump
- **C3-MKII-25** Diaphragm Pump *(requires C3-MKII-40*
- **C3-MKII-26** Plunger Pump *(requires C3-MKII-40)*
- **C3-MKII-40** Volumetric Measurement System

C9-MKII Flowmeter Demonstrator

The C9-MKII Flowmeter Demonstrator is designed to allow the user to understand the different types of flowmeters commonly found in use throughout various industries.

The experimental content includes the measurement of pressure loss across a range of flowmeters and the direct use of flowmeters for the determination of flowrates, either visually or by the use of a pressure differential. The unit is supplied with armBUS software (manual data entry for non-electronic flow meters, automatic datalogging for electronic flow meters (Requires AIU-4)) as standard.

C9-MKII-1 Electromagnetic Flowmeter

F1-10 Hydraulics Bench

C9-MKII Flowmeter Service Unit

AIU-4 Interface Unit

Requirements

1Ph | PC | USB | COLD

Comprehensive Flow Meter Demonstration - C9-MKII

The flowmeters available are of both electronic and non-electronic types with the options covering both mechanical and passive systems.

Features & Benefits:

- Modular flowmeter demonstration unit optionally supplied with 13 flowmeters
- Allows students to understand the advantages and disadvantages of various flowmeters
- Assess the pressure drop which occurs with flowmeters within a simple piped system
- Understand the practical use and characteristics of industrial flowmeters
- Supplied with armBUS software as standard
- Understand flow measurement by using flowmeters which relay on a pressure change across the system
- Utilises Armfield F1-10 Hydraulics Bench

Software inc

C9-MKII Software screen

C9-MKII-2 Ultrasonic Flowmeter

C9-MKII-5 Orifice Plate Flowmeter

C9-MKII-10 Vortex Flowmeter

C9-MKII-13 Baffle Plate Flowmeter

C9-MKII-3 Venturi Nozzle

C9-MKII-6 Paddle Wheel Flowmeter

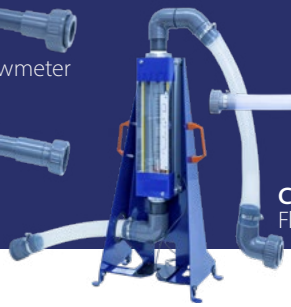
C9-MKII-11 Orifice Plate Flowmeter with Transducer

C9-MKII-8 Variable Area Flowmeter

C9-MKII-4 Pitot Tube

C9-MKII-7 Turbine Wheel Flowmeter

C9-MKII-12 Bypass Flowmeter



C9-MKII-9 Variable Area Flowmeter with Transducer

Fluid Dynamics

The Armfield C6-MKII-10 Fluid Friction Measurements

This unit provides facilities for the detailed study of fluid friction head losses, which occur when an incompressible fluid flows through pipes, fittings and flow metering devices.

A wide range of measurements, demonstrations and training exercises are possible:

- Confirming the relationship between head loss due to fluid friction and velocity for flow of water
- Determining the head loss associated with flow through a variety of standard pipe fittings
- Determining the relationship between pipe friction coefficients and Reynolds' number for flow through a pipe with roughened bore
- Demonstrating the application of differential head devices in the measurement of flow rate and velocity
- Providing practical training of pressure measurement techniques
- Enhancing understanding of the hydraulic principles involved through the use of complementary computer software

C6-MKII-DTA-ALITE software (optional)

Fluid Friction Measurements - C6-MKII-10

The Armfield Fluid Friction Measurements unit provides facilities for the detailed study of fluid friction head losses, which occur when an incompressible fluid flows through pipes, fittings and flow metering devices.

Armfield recommend the use of a water manometer for the low-pressure measurements and an electronic pressure meter for the high-pressure measurements.

- H12-2: Liquid manometer (water)
- H12-8: Portable pressure meter (electronic)

Also available for use with data acquisition instruments is a software package, which performs all the necessary calculations from readings entered manually.

- C6-MkII-ABASIC: Educational software for fluid friction measurements (manual data entry)
- C6-MkII-DTA-ALITE: Computer Data Capture Unit (Automatic Data Acquisition)

Requirements

F1-10

PC

USB

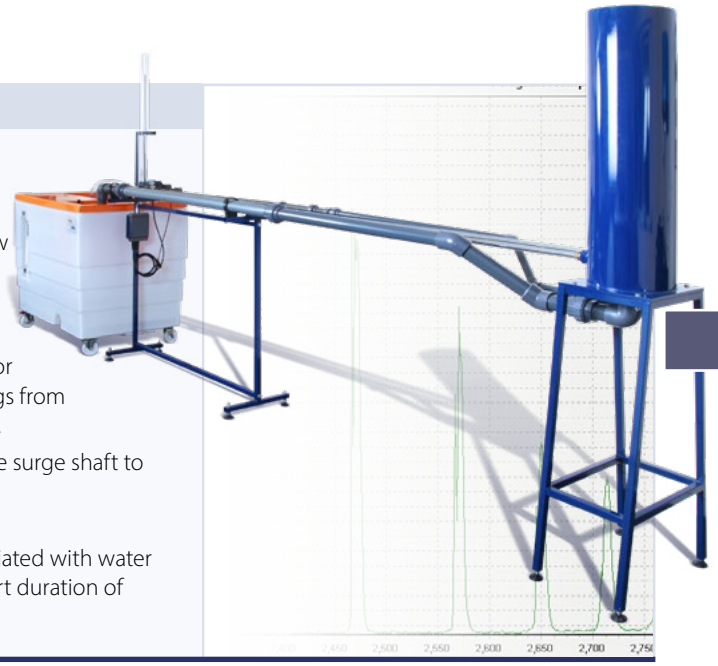
Requirements

F1-10

PC

USB

Pipe Surge & Water Hammer Apparatus - C7-MKII



The Armfield Pipe Surge and Water Hammer Apparatus contains two independent pipe systems:

One demonstrates pipe surge and the use of a surge shaft to attenuate changes in pressure following slow changes to the flow in a system, the other pipe system allows a detailed examination of the shock waves (Water Hammer) generated by rapid changes to the flow in a system such as a valve closing quickly.

A single USB connection to a PC (not supplied) provides power for the three pressure transducers on the unit and allows the readings from the pressure transducers to be recorded and stored using the PC.

Data logging software allows the relatively slow oscillations in the surge shaft to be viewed in real time and stored for analysis.

A virtual oscilloscope allows the rapid changes in pressure, associated with water hammer, to be viewed for analysis after the event due to the short duration of pressure transients following operation of the fast-acting valve.

Requirements

COLD

Laminar Flow Table - C10

Enables comprehensive grid measurement and photography of two dimensional laminar flow patterns in incompressible fluids.

The equipment extends the classical Hele-Shaw approach by including eight sinks and sources, plus a dye injection system, enabling flow patterns to be seen more vividly.

Demonstration Capabilities:

- Ideal flow around immersed bodies
- Ideal flow associated with sinks and sources
- Ideal flow in channels and at boundaries
- Use of streamlines to analyse two-dimensional flow
- Research – modelling two-dimensional systems

Requirements

1Ph

Hydrogen Bubble Flow Visualisation System - C16

An elegant method of flow visualisation, where hydrogen bubbles are used to visualise fluid mechanics phenomena so difficult to describe theoretically.

The system utilises a unique fluid drive unit to provide smooth flow in the working channel.

An optional high resolution firewire webcam can be used to link to projectors or displays for large-scale presentations.

Features:

- LED illumination
- Low-voltage operation

Supplied with:

- Set of Three Weirs
- Set of Three Electrodes
- Set of Clear Acrylic Flow Visualisation Models

Link to C4-MKII

C4-MKII – Multi-Purpose Teaching Flume

The Multi-purpose Teaching Flume has been specifically designed to demonstrate the principles of fluid mechanics when applied to engineering structures in open channel flow.

Set of models provided with the flume as standard

Multi-Purpose Teaching Flume - C4-MKII-10

The C4-MkII flume is supplied with either a 2.5 metre long or 5.0 metre long working section. Although small in comparison with the majority of flumes Armfield flumes, the dimensions of the working section have been sized so that the various phenomena may be clearly seen and accurate results may be obtained from measurements taken.

A set of models and gauges are provided with the flume as standard:

- Venturi flume
- Sharp and broad crested weirs
- Crump weir
- Adjustable undershot weir
- Two Vernier level gauges

The flume requires the use of a standard Armfield Hydraulics Bench F1-10 (ordered separately) which stores water for recirculation making the unit self-contained, except for the provision of an electrical supply. The construction of the flume allows for easy disassembly if later it is required to move the unit to a different location.

Optional educational software is available (C4-MKII-ABASIC) offering a complete teaching package of coursework.

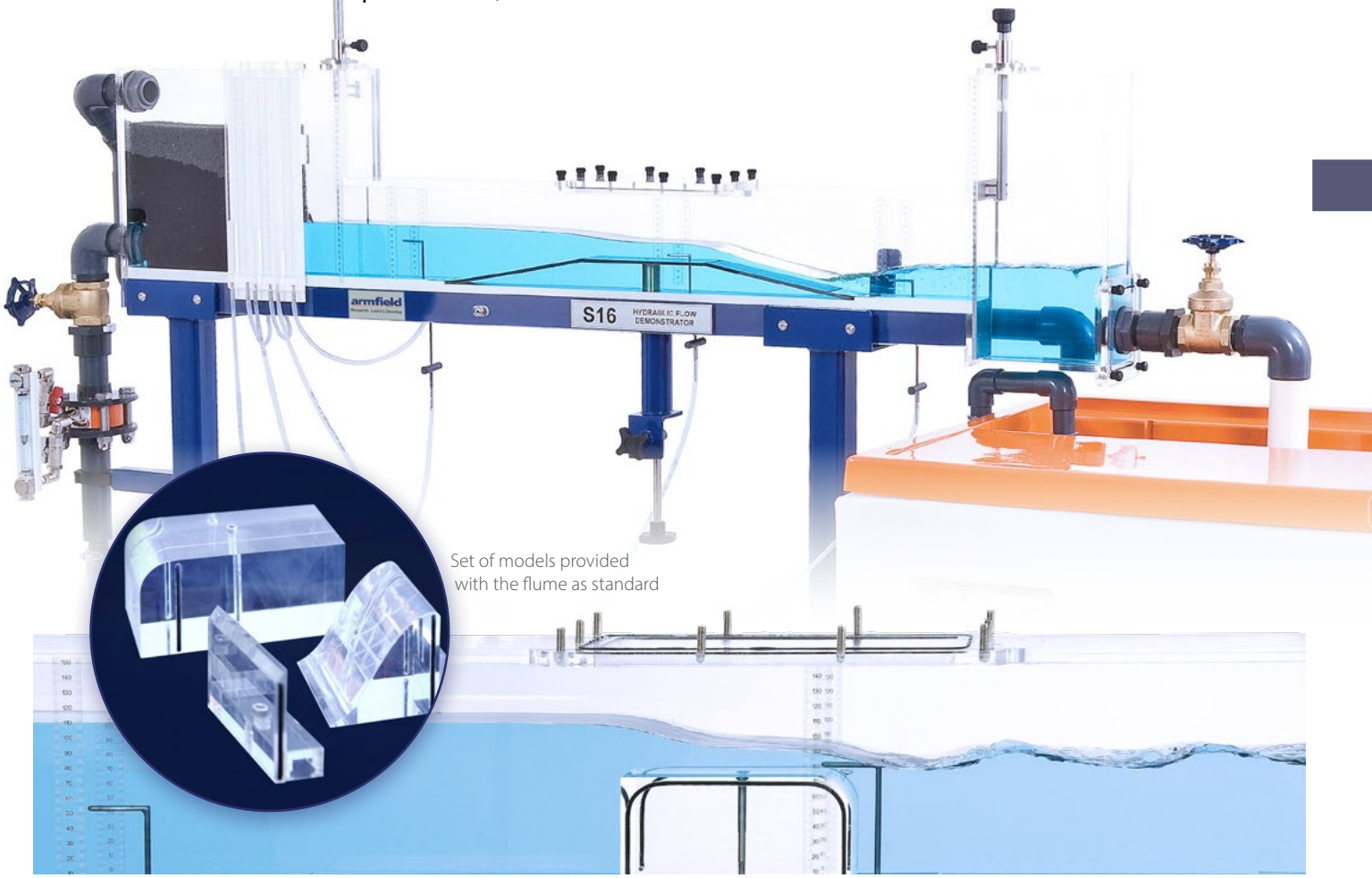
Requirements

F1-10

PC

S16 - Open Channel Flow (Free Surface Flow)

Armfield supplies a range of open-channel flow products, ranging from an introduction to the characteristics of flow in an open channel, free surface flow and closed conduit flow.



Set of models provided with the flume as standard

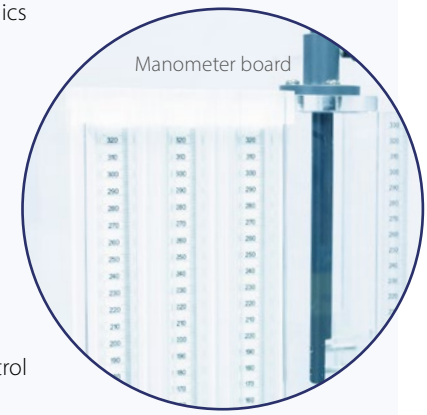
Requirements

F1-10

Hydraulic Flow Demonstrator - S16

The Armfield S16 Hydraulic Flow Demonstrator has been developed to provide practical demonstrations of various flow phenomena. The ease of use allows the student to set up different demonstrations relatively quickly and to observe the effect of changes in upstream water level, downstream water level etc.

The Armfield S16 Hydraulic Flow Demonstrator simply connects to a standard F1-10 Hydraulics Bench to permit the study of the following basic aspects of fluid flow:



Manometer board

Closed conduit flow

- Application of the Bernoulli and Continuity equations to converging and diverging flow
- Effect of gradual and sudden changes in cross section (energy losses)
- Using a contraction as a flow measuring device
- Using a Pitot tube to measure velocity / velocity profile.
- Flow through a Culvert

Open channel flow

- Flow beneath a Sluice Gate (an undershot Weir)
- Flow over Sharp Crested, Broad Crested and Ogee Weirs
- Sub-critical, Critical and Super-critical flow / depth. Changes in Specific Energy and control imposed by the minimum energy condition.
- Characteristics of Hydraulic Jumps
- Flow over Drop Structures / Energy Dissipation
- Changes in flow profile in relation to the Froude Number (predicting flow conditions in an open channel
- Observation of flow patterns associated with flow around hydraulic structures.
- Velocity of gravity waves in shallow water / Formation of surface waves near critical depth
- Project work – Evaluation of user constructed hydraulic structures

Wind Tunnels - C Series

C SERIES

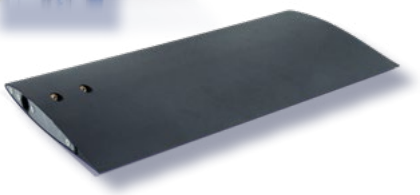
C30 - Computer Controlled Subsonic Wind Tunnel

Link to C Series

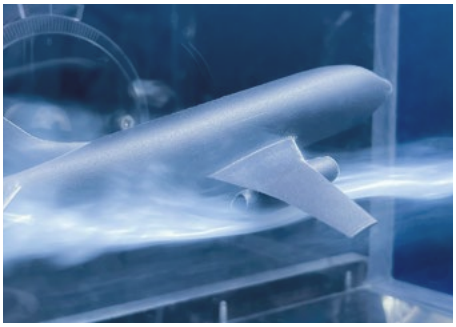
Armfield Educational wind tunnels are specifically designed for the study and research of aerodynamics, fluid dynamics, and related fields. These tunnels create controlled airflow conditions to simulate various scenarios, allowing researchers, students, and engineers to better understand the behaviour of fluids and the interaction of objects within them. Our wind tunnels serve as valuable tools for learning and experimentation across various disciplines, including aerospace engineering, mechanical engineering, civil engineering, architecture, and more.

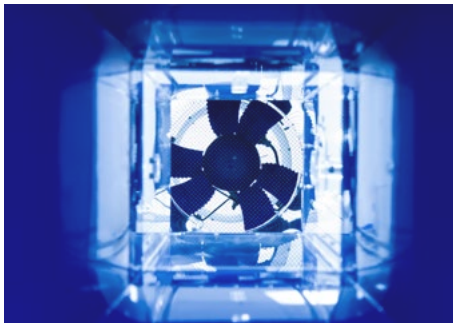
The Armfield **C30-Subsonic Wind Tunnel** enables the user to carry out advanced studies in the aerodynamics fields including boundary layer experiments, flow visualisation, pressure distribution, study of turbulence and offering the possibility of developing self-design aerodynamics profiles to be tested.

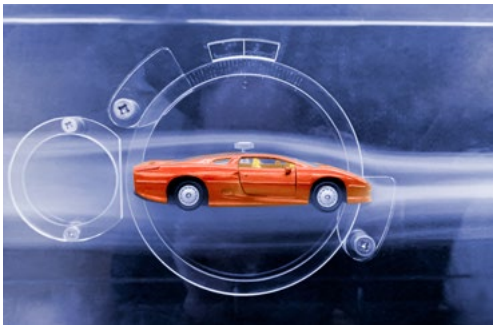
The wind tunnel comprises outstanding features such as computer control, up to 40m/s flow velocity, remote operation, datalogging and diagram plotting in real time.



Wing Model - C30-30-6







Computer Controlled Subsonic Wind Tunnel - C30

The Wind Tunnel is a computer controlled subsonic wind tunnel designed for undergraduate teaching.

It has a 600mm (23.6 inches) long by 310mm wide and 310mm tall transparent working section and offers a wide range of models for aerodynamic and air flow studies.

An extensive range of models, accessories & instrumentation is available for the C30.

F-16 Airplane Model - C30-40

Requirements

PC

USB

1Ph

Requirements

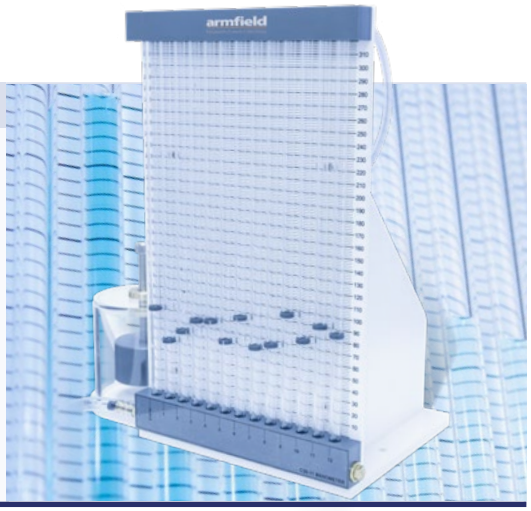
C30

Manometer Bank - C30-11

A bank of 13 transparent tubes positioned vertically to measure small pressure differences (0 – 320 mm H2O) using water as the working fluid for safe operation and convenience in use.

The C30-11 manometer incorporates a water reservoir with a screw operated displacer to allow rapid adjustment of the datum level in the manometer. Any change in the level in one tube affects the level in all of the other tubes because they are connected to the common reservoir.

The manometer incorporates quick release connectors on the side for rapid connection to appropriate models and instruments.



Requirements

C30

Electronic Manometer Bank C30-12

An electronic console incorporating 16 differential pressure sensors each with a range of 0-178 mm H_2O. The electrical supply for the manometer is obtained from the outlet socket on the front of the IFD7.

A common tapping ensures that all of the differential pressure sensors are referenced to atmospheric pressure. Quick release connectors (7 x single and 1 x 10-way) allow for rapid connection to models and instruments.

The electronic manometer connects to the control PC using a second USB port on the PC, and the readings are fully integrated with the wind tunnel control software for ease of use.

Requirements

C30

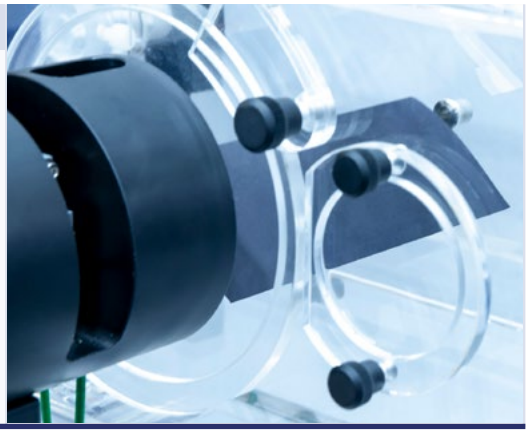
C30-20 or C30-22

Lift and Drag Balance - C30-13 (*requirement)

A two-component balance which measures the lift and drag forces on models mounted within the C30 wind tunnel. The balance mechanism enables test models to be mounted and held securely in position in the working section of the wind tunnel.

The incorporated hex support arm transmits the forces on the test model directly to the integrated load cells. The lift and drag balance can be manually adjusted through pitch angles of ±45°.

*requires essential accessory C30-20 or C30-22)



Requirements

C30

Pitot - C30-14

A miniature Pitot Static Tube mounted in a support plug that can be located in the roof of the working section at three alternative positions, i.e. the start of the working section and upstream and downstream of the model mounting position. The support plug incorporates an 'O' ring to retain the Pitot Tube where it is positioned and allows the tube to traverse over the full height of the working section to measure the velocity profile inside the working section of the tunnel.

The overall diameter of the Pitot Static Tube is 4 mm to give a stiff assembly without unduly disturbing the airflow downstream and the 'L' shaped arrangement, with the tip pointing into the flow, gives minimal disturbanceat the point of measurement.

The two flexible tubes from the Pitot Static Tube incorporate a quick release connector that allows it to be connected to one of the optional manometers.

The Pitot Static tube is of Prandtl design and may be used with a negligible correction up to angles of yaw of at least 5 degrees.

Wake Survey Rake - C30-15 (requires C30-11 or C30-12)

The rake consists of 10 stainless steel tubes positioned vertically in a row and pointing towards the airflow. The rake is mounted downstream of the model being used via the small access hatch in the side wall of the working section. The tubes are mounted at a fixed pitch of 11mm and are connected via flexible tubing to a multi-way quick release connector to suit the C30-11 or C30-12 manometers.

The rake is designed so that when mounted as described, the centre of the rake is aligned with the centre point or zero-angle centreline of models mounted through the large hatch. It will therefore cross the wake downstream of the model, allowing the pressure changes across the wake and therefore the changes in velocity to be measured.

When used with models such as the C30-21 Pressure Wing, readings can be taken from the pressure tappings on the model and the Wake Survey Rake without changing any settings by simply swapping the quick release connector on the appropriate manometer.

Requirements

C30

C30-11 or C30-12

3-Component Balance - C30-16

A 3-component balance used to measure lift, drag and moment forces on appropriate models. The models connect to the balance using a simple fixing that ensures correct orientation of the model.

The system is designed to work with a series of Armfield models and also enables the user to manufacture and test their own 3D printed or fabricated wings to test and evaluate for project work.

Integrated electronic sensors are used to measure the lift, drag and moment forces. The model being tested can also be rotated on the mounting and the angle of rotation measured electronically.

The readings from the lift, drag, moment sensors and the rotation sensor are displayed on the control software screen running on the PC, and are available for data logging.

Requirements

C30

3-Component Driven Balance - C30-17 (*requirement)

A PC controlled Driven 3-component balance incorporates a closed loop stepper drive for precise driven rotation angles particularly beneficial for remote operation/ remote learning activities and repetitious test and development.

*requires essential accessory C30-19

Requirements

C30

C30-19

Requirements

C30

C30-19

Additional Power Supply - C30-19

The C30-19-FC is an additional power supply used to power the C30-18-FC driven model mount. The C30-19-FC is connected to the mains cabinet and requires no additional power inputs to the C30-10

Requirements

C30

C30-13

Drag Models - C30-22 (requires C30-13)

Seven different models are provided for use with the C30 -13 lift and drag balance for investigations into the influence of shape on the drag forces. Five models are supplied with a common equatorial diameter of 50 mm, thus all presenting the same cross section to the airflow:

- Sphere (50 mm), Hemisphere, Convex to Airflow, Hemisphere, Concave to Airflow, Circular Disc, Streamlined Shape
- Additionally, a dimpled golf ball and plain sphere of 43 mm diameter are supplied to demonstrate the difference in drag force due to the dimples
- A spare support rod is supplied for drag calibration purposes

Requirements

C30

C30-44

Car Model - C30-35 (requires C30-44)

1:20th 3D printed scale model of a saloon car. It is easily mounted to the C30-44 Base Mount.

Note: All models can be used in conjunction with the C-SMOKE Probe Smoke Generator to visualise airflow over the aircraft, car or wing models.

Airbus A320 Airplane Model - C30-36 (requires C30-43)

1:140th 3D printed scale model of an Airbus A320. It is easily mounted to the C30-43 Manual Model Mount through the rear of the aircraft and can be actuated ± 45°.

Airbus A380 Airplane Model - C30-37 (requires C30-43)

1:140th 3D printed scale model of an Airbus A380. It is easily mounted to the C30-43 Manual Model Mount through the rear of the aircraft and can be actuated ± 45°.

Boeing 737 Airplane Model - C30-38 (requires C30-43)

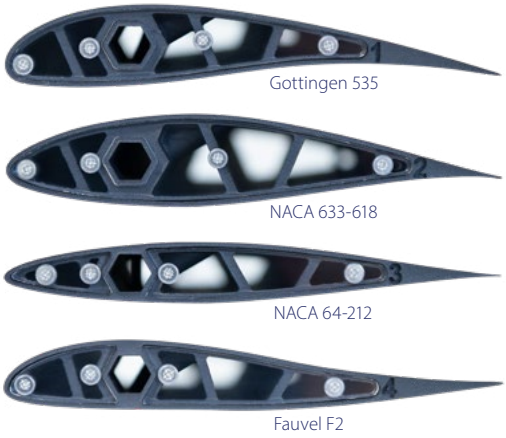
1:140th 3D printed scale model of a Boeing 737. It is easily mounted to the C30-43 Manual Model Mount through the rear of the aircraft and can be actuated ± 45°.

Beech Bonanza A36 Airplane Model - C30-39 (requires C30-43)

1:140th 3D printed scale model of a Beech Bonanza A36. It is easily mounted to the C30-43 Manual Model Mount through the rear of the aircraft and can be actuated ± 45°.

F-16 Airplane Model - C30-40 (requires C30-43)

1:140th 3D printed scale model of a General Dynamics F-16 Figting Falcon. It is easily mounted to the C30-43 Manual Model Mount through the rear of the aircraft and can be actuated ± 45°.



Wing Model - C30-30-01 to 04 (requires C30-13 or C30-16/17)

Wing model designed with a **Gottingen 535 Air foil** profile, as used on a slingsby T21b glider. The high camber profile is designed into an air foil to maximise its lift coefficient.

Wing model designed with a **NACA 633-618** profile, as used on the Schleicher Ka6b Glider. The profile is less cambered than the Gottingen 535 allowing direct comparison.

Wing model designed with a **NACA 64-212** profile, as used on the MDM-1 Fox aerobatic glider. The profile is almost symmetrical and cuts through the air evenly.

Wing model designed with a **Fauvel F2** as used on the FV-36 Flying Wing. The profile is a reflexed camber air foil where the camber line curves back up near the trailing edge. Such an air foil is useful in certain situations such as with tailless aircraft.

Requirements: C30, C30-13 or C30-16 or C30-17

Wing Model - C30-30-6 (requires C30-13 or C30-16/17)

Wing model designed with an asymmetric NACA 54118 profile.

(Requires C30-13 or C30-16/17)

Wing Model - C30-30-7 (requires C30-13 or C30-16/17)

Wing model designed with a cambered NACA 4415 air foil profile, as used on a Murphy JDM-8 ultralight aircraft.

(Requires C30-13 or C30-16/17)

Requirements: C30, C30-13 or C30-16 or C30-17

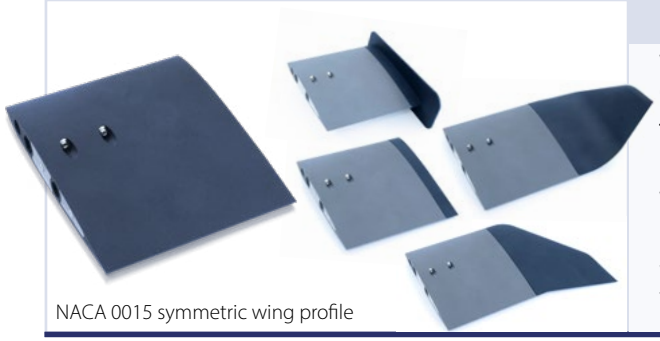
Aerofoil Model with Flap - C30-31 (requires C30-13 or C30-16/17)

The aerofoil is a **NACA 2412** which has an symmetrical section with adjustable flap of ± 90°. This adjustable flap allows students to investigate the effects of control surfaces such as flaps, ailerons, elevator or rudder.

When used in conjunction with the C30-16/17 3-Component Balance, students can study the effects of lift, drag and pitch moment when adjusting this flap.

Adjustment of the flap is controlled manually through a hatch on the opposite side of the wind tunnel.

Requirements: C30, C30-13 or C30-16 or C30-17



NACA 0015 symmetric wing profile

Winglets Kit - C30-42 (requires C30-13 or C30-16/17)

Wingtip devices (or winglets) are intended to improve the efficiency of fixed-wing aircraft by reducing drag.

The winglets kit comes with five different winglet profiles:

Plain, Raked Winglet, Car Rear Spoiler, Wingtip Fence and Blended Winglet.

Each of these can be secured in turn, to the NACA 0015 symmetric wing profile and mounted to the C30-13 lift and drag or C30-16/17 three component balance.

Requirements: C30, C30-13 or C30-16 or C30-17

Requirements

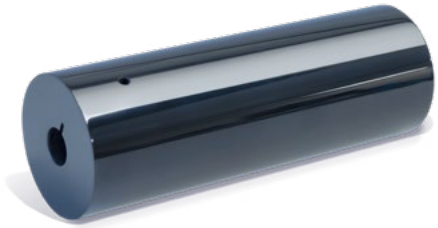
C30

C30-19

Cylinder With Pressure Tapping For 360º Drive - C30-18-01

Cylinder with single pressure tapping to interface with the driven 360-degree model unit enabling the study of pressure acting on a cylinder at various velocities and angular positions.

(Requires C30-19)



Requirements

C30

C30-11 or C30-12

Pressure Wing NACA 0015 - C30-21 (requires C30-11 or C30-12)

A symmetrical NACA 0015 aerofoil incorporating 10 tapping points distributed around the wing profile that allow the pressure distribution to be measured from the leading edge to the trailing edge. The wing is mounted in the horizontal plane through the side of the working section, and the angle of attack is adjustable by rotating the circular hatch. Although only instrumented on one side, the effective pressure distribution on both surfaces can be obtained by inclining the aerofoil at positive and negative angles of attack.

The tapping points are all flush with the surface of the aerofoil and connected via flexible tubing to a multi-way quick release connector to suit the C30-11 or C30-12 manometers.

The NACA 0015 is one of a standard series of aerofoils. The 00 indicates that the two faces are symmetrical. The 15 indicates that the aerofoil has a 15% thickness to chord (width) ratio, (i.e. its thickness is 15% of its chord). This ratio is fairly typical for low-speed aerofoils, and possible applications include boat rudders as well as aircraft wings.

Requirements

C30

C30-20 or C30-22

Pressure Cylinder - C30-23 (requires C30-20 or C30-22)

A plain cylinder, 30mm diameter, incorporating 10 equi-spaced pressure tappings around half of the circumference that allow the pressure distribution around the cylinder to be measured.

The cylinder is mounted in the horizontal plane through the side of the working section and can be rotated through 180° to plot the pressure distribution over the whole circumference.

The tapping points are all flush with the surface of the cylinder and connected via flexible tubing to a multi-way quick release connector to suit the C30-11 or C30-12 manometers.

(Requires C30-20 or C30-22)

Requirements

C30

C30-11 or C30-12

Wing Model Type 4-Fauvel F2 - C30-30-04

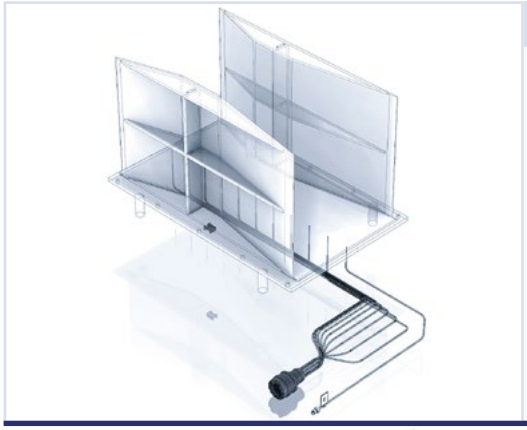
An asymmetric NACA 54118 and NACA 4415 aerofoil incorporating 16 tapping points distributed around the wing profile that allow the pressure distribution to be measured from the leading edge to the trailing edge.

The wing is mounted in the horizontal plane through the side of the working section, and the angle of attack is adjustable by rotating the circular hatch.

The tapping points are all flush with the surface of the aerofoil and connected via flexible tubing to a multi-way quick release connector and single quick release connectors to suit the C30-11 or C30-12 manometers.

(Requires C30-11 or C30-12)

NACA 54118 NACA 4415



Bernoulli Apparatus - C30-24 (requires C30-11 or C30-12)

A Venturi profile that is installed in the working section of the tunnel via the removable floor. The Venturi incorporates 11 pressure tappings in the floor, connected via flexible tubing to quick release connectors to suit the C30-11 or C30-12 manometers.

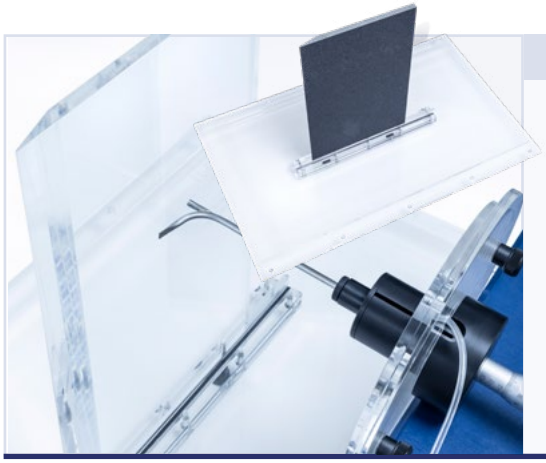
The Venturi occupies the full height of the working section, and the width varies from full width at the inlet and outlet to 209mm at the throat. It is manufactured from clear acrylic for full visualisation.

By itself the C30-24 may be used to show the variation in static pressure with change in cross-section, but when used in conjunction with the Pitot Static Tube (C30-14) the Total Head and Static Head can also be measured at three locations allowing the local velocity to be measured and the Bernoulli equation to be fully demonstrated.

Requirements

C30

C30-11 or C30-12



Boundary Layer Plate - C30-25 (requires C30-11 or C30-12)

A flat plate is mounted vertically in the working section via a removable floor panel incorporating a horizontal slot. A special flattened pitot tube mounted on a traversing micrometer allows the air velocity to be measured at different distances from the surface of the plate. The plate can be moved relative to the pitot tube to allow the velocity profile to be measured at any position between the leading edge and the trailing edge of the plate.

The special pitot tube (Total Head Tube) allows the average air velocity to be determined over a relatively small change in height by comparing the reading obtained with the static pressure reading in the working section.

A smooth plate and artificially roughened plate are included to show the difference between the development of laminar and turbulent boundary layers. The flexible tubing from the pitot tube incorporates a quick release connector to suit the C30-11 or C30-12 manometers.

Requirements

C30

C30-11 or C30-12

Project Kit - C30-26 (requires C30-20 or C30-22)

The Project Kit provides a range of mountings suitable for models of the students' own design.

These mountings are made to fit the working section, so that students may concentrate on the design of the model itself. The kit also includes a selection of suitable flexible tubing for connecting tapping points to sensors, and connectors for use with the optional manometers.

Requirements

C30

C30-20 or C30-22

Spring Mounted Wing Model - C30-34

A symmetric aerofoil suspended on springs within a frame used to demonstrate the principle of wing flutter. Wing flutter is a dynamic instability of a flight vehicle associated with the interaction of aerodynamic, elastic and inertial forces.

The suspension positions of the wing, spring rate and centre of mass can be altered as well as the angle of attack ±10°.

Requirements

C30

Requirements

C30

C30-19

Driven 360 Degree Model Unit - C30-18 (requires C30-19)

A PC controlled driven 360-degree model interface with single pressure tapping take off to allow test models to be fitted with incorporated pressure tapping.

Suitable for use with C30-18-01 Cylinder With Pressure Tapping For 3600 Drive or for users to manufacture and test their own 3D printed or fabricated samples to test and evaluate for project work.

Particularly beneficial for remote operation/ remote learning activities and repetitious test and development.

(Requires C30-19)

Requirements

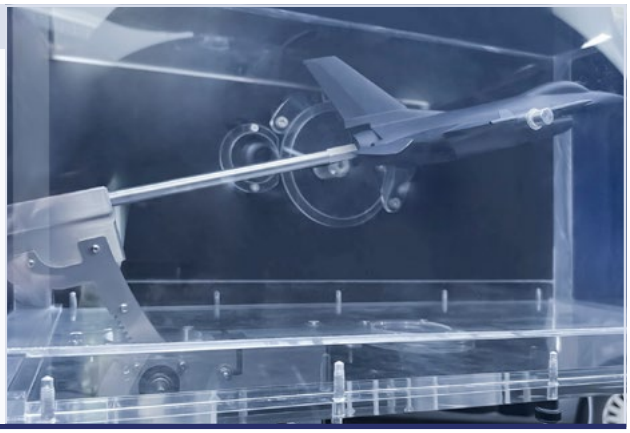
C30

Manual Model Mount - C30-43

The Manual Model Mount is to be used in conjunction with the airplane models to change the angle of attack of the aircraft whilst in operation.

The aircraft is secured onto the hex rod of the mount and rotates roughly around the centre of the aircraft wing.

The manual mount is capable of actuating ±35° using the angle adjusment.



Requirements

C30

Base Mount - C30-44

A Base Mount used in conjunction with the C30-35 Car Model, also suitable for project work.

Requirements

C30

C15

C-Smoke: Probe Smoke Generator

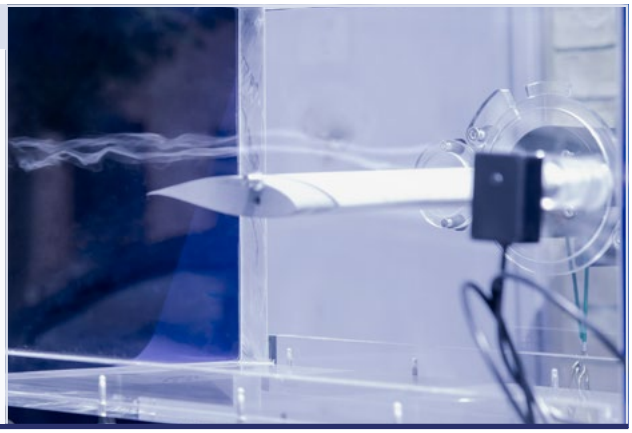
The C-Smoke smoke generator is designed to facilitate the observation of air movements and air tracing in wind tunnels.

With a rapid warm up time and simple to set up and use, it produces a controllable, non-hazardous smoke effect.

The system produces a point source of smoke on the end of a 425mm long stainless steel wand, commonly used when a very precise point source of aerosol smoke is required. The probe is shaped to minimise wake generation, ensuring that the smoke can be entrained into the airstream smoothly.

Supplied with:

- Control Box
- Swan Neck Probe - 425mm long
- 2 x Vaporisers
- 3 x 500ml Bottle of Oil



Link to C Series

C SERIES

C15 – Computer Controlled Subsonic Wind Tunnel

A compact benchtop wind tunnel, with visible working section.

A wide range of accessories and instrumentation options are available, allowing a comprehensive study of Subsonic Aerodynamics and Fluid Mechanics.

Computer Controlled Subsonic Wind Tunnel - C15

The unit is a computer controlled subsonic bench-top wind tunnel designed for undergraduate teaching.

It has a 150mm (6 inch) long, 150mm wide and 150mm tall transparent working section and offers a wide range of models for aerodynamic and air flow studies.

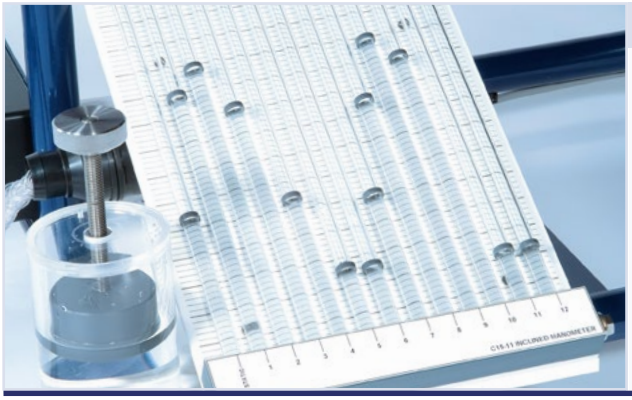
An extensive range of models, accessories & instrumentation is available for the C15.

Requirements

PC

USB

⚡ 1Ph



Inclined Manometer Bank - C15-11

A bank of 13 transparent tubes positioned vertically to measure small pressure differences (0 – 320 mm H2O) using water as the working fluid for safe operation and convenience in use.

The C15-11 manometer incorporates a water reservoir with a screw operated displacer to allow rapid adjustment of the datum level in the manometer. Any change in the level in one tube affects the level in all of the other tubes because they are connected to the common reservoir.

The manometer incorporates quick release connectors on the side for rapid connection to appropriate models and instruments.

Requirements

C15

Electronic Manometer Bank C15-12

An electronic console incorporating 16 differential pressure sensors each with a range of 0-178 mm H_2O. The electrical supply for the manometer is obtained from the outlet socket on the front of the IFD7.

A common tapping ensures that all of the differential pressure sensors are referenced to atmospheric pressure. Quick release connectors (7 x single and 1 x 10-way) allow for rapid connection to models and instruments.

The electronic manometer connects to the control PC using a second USB port on the PC, and the readings are fully integrated with the wind tunnel control software for ease of use.

Requirements

C15

Requirements

C15

C15-20 or C15-22

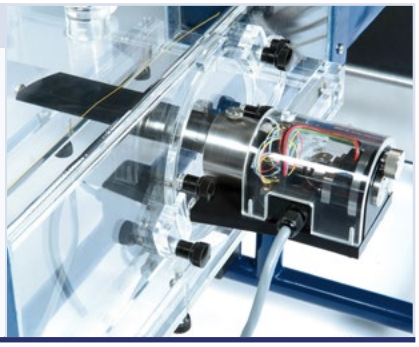
Lift and Drag Balance - C15-13 (*requirement)

A 2-component, electronic balance used to measure the lift and drag on appropriate models. The lift and drag models connect to the balance using a simple fixing that ensures correct orientation of the model.

Electronic sensors are used to measure the lift and drag forces, the drag being measured directly, and the lift by a reduction in the model weight. The model being tested can also be rotated on the mounting and the angle of rotation measured electronically.

The readings from the lift and drag sensors and the rotation sensor are displayed on the control software screen running on the PC, and are available for data logging.

*requires essential accessory C15-20 or C15-22



Requirements

C15

C15-11 or C15-12

Pitot Static Tube - C15-14 (requires C15-11 or C15-12)

A miniature Pitot Static Tube mounted in a support plug that can be located in the roof of the working section at three alternative positions (i.e. the start of the working section and upstream and downstream of the model mounting position). The support plug incorporates an 'O' ring to retain the Pitot Tube where it is positioned and allows the tube to traverse over the full height of the working section to measure the velocity profile inside the working section of the tunnel.

The overall diameter of the Pitot Static Tube is 4 mm to give a stiff assembly without unduly disturbing the airflow downstream and the 'L-shaped' arrangement, with the tip pointing into the flow, gives minimal disturbance at the point of measurement.

The two flexible tubes from the Pitot Static Tube incorporate a quick release connector that allows it to be connected to one of the optional manometers.

The Pitot Static tube is of Prandtl design and may be used with a negligible correction up to angles of yaw of at least 5 degrees.

Requirements

C15

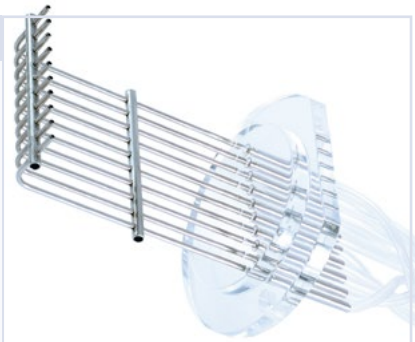
C15-11 or C15-12

Wake Survey Rake - C15-15 (requires C15-11 or C15-12)

The rake consists of 10 tubes positioned vertically in a row and pointing towards the airflow. The rake is mounted downstream of the model being used.

The tubes are mounted at a fixed pitch of 5mm but the assembly can be displaced 2.5mm allowing measurements at intervals of 2.5mm by interlacing two sets of readings.

The tubes are connected via flexible tubing to a multi-way quick release connector.



Requirements

C15

3-Component Balance - C15-16

A 3-component balance used to measure lift, drag and moment forces on appropriate models. The models connect to the balance using a simple fixing that ensures correct orientation of the model. The system is designed to work with a series of Armfield models and also enables the user to manufacture and test their own 3D printed or fabricated wings to test and evaluate for project work.

Integrated electronic sensors are used to measure the lift, drag and moment forces. The model being tested can also be rotated on the mounting and the angle of rotation measured electronically.

The readings from the lift, drag, moment sensors and the rotation sensor are displayed on the control software screen running on the PC, and are available for data logging.

Requirements

C15

C15-19

3-Component Driven Balance - C15-17 (*requirement)

A PC controlled Driven 3-component balance incorporates a closed loop stepper drive for precise driven rotation angles particularly beneficial for remote operation/ remote learning activities and repetitious test and development.

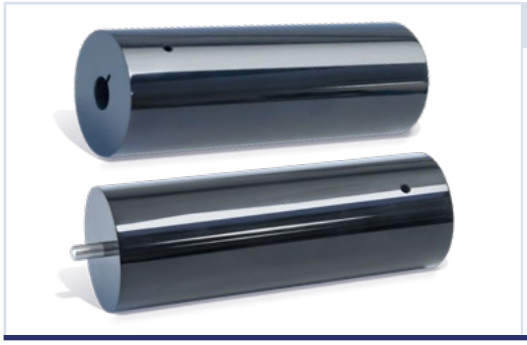
*requires essential accessory C15-19

Driven 360° Balance - C15-18 (*requirement)

A PC controlled driven 360-degree model interface with single pressure tapping take off to allow test models to be fitted with incorporated pressure tapping. Suitable for use with C1518-01 pressure cylinder or for users to manufacture and test their own 3D printed or fabricated samples to test and evaluate for project work. particularly beneficial for remote operation/ remote learning activities and repetitious test and development.

*requires essential accessory C15-19

Requirements: C15, C15-19



Cylinder with Pressure Tapping for 360° drive - C15-18-01

Cylinder with single pressure tapping to interface with the driven 360-degree model unit enabling the study of pressure acting on a cylinder at various velocities and angular positions.

Requirements: C15, C15-19

Lift & Drag Aerofoil - C15-20 (requires C15-13)

A plain symmetrical aerofoil to NACA 0015 profile, incorporating a mounting rod that allows it to be installed on the C15-13 Lift & Drag Balance, thus allowing the lift and drag to be measured with the aerofoil at different angles of attack.

Requirements: C15, C15-11 or C15-12

Pressure Wing- C15-21 (requires C15-11 or C15-12)

A symmetrical aerofoil incorporating 10 tapping points distributed along the wing profile on one side, which allows the pressure distribution to be measured from the leading edge to the trailing edge.

The pressure distribution on the upper and lower surface can be obtained by inclining the aerofoil at positive and negative angles of attack. Machined to NACA 0015 profile, the aerofoil has the same section as the C15-20 to allow direct comparison of pressure distribution with the lift characteristics.

Requirements: C15, C15-11 or C15-12

Drag Models - C15-22 (requires C15-13)

Seven different models are provided for use with the C30 -13 lift and drag balance for investigations into the influence of shape on the drag forces. Five models are supplied with a common equatorial diameter of 50 mm, thus all presenting the same cross section to the airflow:

- Sphere (50 mm), Hemisphere, Convex to Airflow, Hemisphere, Concave to Airflow, Circular Disc, Streamlined Shape
- Additionally, a dimpled golf ball and plain sphere of 43 mm diameter are supplied to demonstrate the difference in drag force due to the dimples
- A spare support rod is supplied for drag calibration purposes

Requirements: C15, C15-13

Requirements

C15

C15-11 or C15-12

Pressure Cylinder - C15-23 (requires C15-11 or C15-12)

A plain cylinder, 30mm diameter, incorporating 10 equi-spaced tapping points around half of the circumference that allow the pressure distribution around the cylinder to be measured.

The cylinder can be rotated through 180° to plot the pressure distribution over the whole circumference.

*requires essential accessory C15-11 or C15-12

Requirements

C15

C15-11 or C15-12

Bernoulli Apparatus - C15-24 (requires C15-11 or C15-12)

A Venturi profile that is installed in the working section of the tunnel via the removable floor. The Venturi incorporates 11 pressure tappings in the floor, connected via flexible tubing to quick release connectors.

The Venturi occupies the full height of the working section and the width varies from 150mm (full width of the working section) at the inlet and outlet to 100mm at the throat. It is manufactured from clear acrylic for full visualisation.

*requires essential accessory C15-11 or C15-12

Requirements

C15

C15-11 or C15-12

Bernoulli Apparatus - C15-25 (requires C15-11 or C15-12)

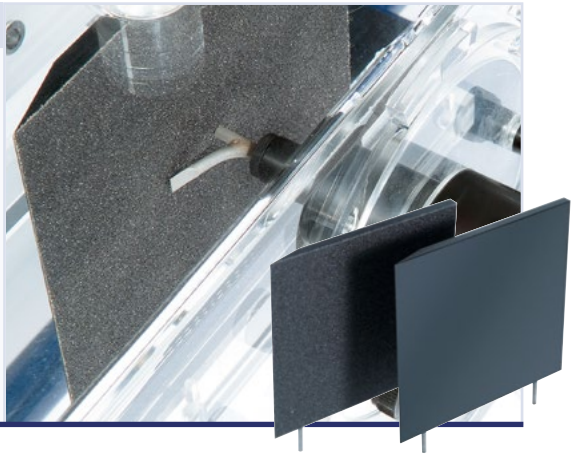
A flat plate, with a bevelled leading edge, that is mounted vertically in the working section via the removable floor. A flattened Pitot tube, mounted on a traversing micrometer, allows the air velocity to be measured at different distances from the surface of the plate.

A smooth plate and artificially roughened plate (above) are included to show the difference between laminar and turbulent boundary layers. The flexible tubing from the Pitot tube incorporates a quick release connector.

C15-26: Project Kit

A selection of components that allow alternative models to be constructed by the user. Includes a floor panel, a circular hatch and a set of connectors with appropriate flexible tubing.

*requires essential accessory C15-11 or C15-12



Requirements

C15 | C30

C-Smoke: Probe Smoke Generator

The C-Smoke smoke generator is designed to facilitate the observation of air movements and air tracing in wind tunnels.

With a rapid warm up time and simple to set up and use, it produces a controllable, non-hazardous smoke effect.

The system produces a point source of smoke on the end of a 425mm long stainless steel wand, commonly used when a very precise point source of aerosol smoke is required. The probe is shaped to minimise wake generation, ensuring that the smoke can be entrained into the airstream smoothly.

Supplied with:

- Control Box
- Swan Neck Probe - 425mm long
- 2 x Vaporisers
- 3 x 500ml Bottle of Oil

Link to FM Series

FM SERIES

Fluid Machines

Computer Controlled Fans, Compressors, Pumps and Turbines

The Armfield Fluid Machines range introduces students to a range of Desktop Computer-Controlled Turbo Machines covering Fans & Compressors, Pumps and Turbines.

These highly visual products offer full computer control and data logging as standard.

Software inc

Propeller Turbine Demonstration Unit - FM63

A miniature-scale propeller turbine unit, which is supplied as a floor-standing unit complete with a sump tank and recirculating pump.

The turbine is housed in clear acrylic pipe work permitting excellent visibility.

The turbine is loaded by an electronically controlled brake fitted with a load cell to measure the torque.

Requirements

- 1Ph
- IFD 7
- PC
- USB

Requirements

IFD 7

Turbine Service Unit - FM6X

A bench mounted unit consisting of a clear acrylic reservoir and a variable speed centrifugal pump, which provides water to power the accessory on test.

The service unit also incorporates a water flow meter and electrically controlled dynamometer, which puts a load on to the turbine and measures the torque and speed.

FM6X Turbine Service Unit shown with FM62 Pelton Turbine Demonstration Unit.

Software inc

Requirements

FM 6X

IFD 7

Axial Flow Impulse Turbine - FM60

A miniature-scale axial flow, impulse turbine consisting of a brass runner, which is acted on by four jets of water.

The flow to the turbine can be adjusted by changing the pump speed or closing off any of the nozzles.

The turbine is housed in clear acrylic for excellent visibility.

The unit is designed to mount on the FM6X Turbine Service Unit.

Software inc

Requirements

FM 6X

IFD 7

Radial Flow Reaction Turbine - FM61

A miniature-scale radial flow reaction turbine, where water enters through a face seal and exits tangentially through two orifices. The reaction of these jets causes rotation of the runner.

The turbine is housed in clear acrylic for excellent visibility.

The unit is designed to mount on the FM6X Service Unit.

Software inc

Requirements

FM 6X

IFD 7

Pelton Turbine - FM62

A miniature-scale Pelton wheel turbine, complete with a spear valve to control the water flow. The turbine buckets are shaped to extract maximum momentum from the passing jet of water, while the spear valve is designed to enable adjustment of the cross sectional area of the jet.

The turbine is housed in clear acrylic for excellent visibility.

The unit is designed to mount on the FM6X Service Unit.

Software inc

Centrifugal Fan Demonstration Unit - FM40

The centrifugal fan is a radial flow machine, which produces the necessary pressure to move gas by the centrifugal force built up inside the fan casing. The design of the fan blade has a primary influence on performance.

These types of fans are usually employed for ventilating duties requiring a somewhat higher delivery pressure than that available from axial fans.

Requirements

IFD 7

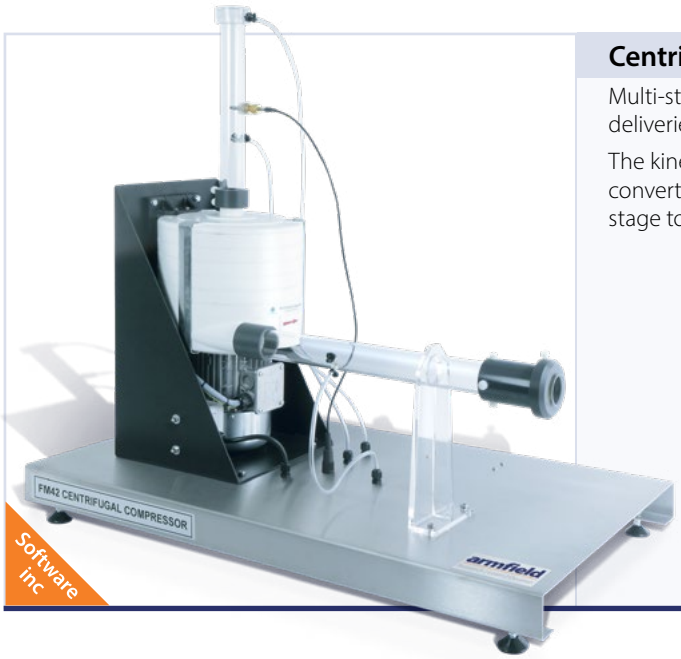
Axial Fan Demonstration Unit - FM41

The axial fan produces gas flow by virtue of the momentum changes imparted across the rotary blades, parallel to the axis of rotation. Such fans are more suitable for higher flows at lower delivery pressures than their centrifugal counterparts.

Comparison of the performance characteristics of the FM41 Axial Fan with those of the FM40 Centrifugal Fan thus provides an instructional exercise of valuable practical application.

Requirements

IFD 7



Centrifugal Compressor Demonstration Unit - FM42

Multi-stage compressors are used industrially for high pressure deliveries of gas flows or suction duties.

The kinetic energy imparted to the gas by the impeller rotation is converted into pressure energy, which progressively increases from stage to stage.

Requirements

IFD 7

Requirements

IFD 7

Centrifugal Pump Demonstration Unit - FM50

The centrifugal pump is the machine most commonly used to move liquids from one place to another. As such it's a particularly instructive unit, which introduces students to the whole subject of rotodynamic fluid machines.

Discovering the relationship between head, flow, rotational speed and power provides a framework of general applicability.

For example, matching the required duty point to the conditions of maximum energy efficiency may be explored as a creative student project.

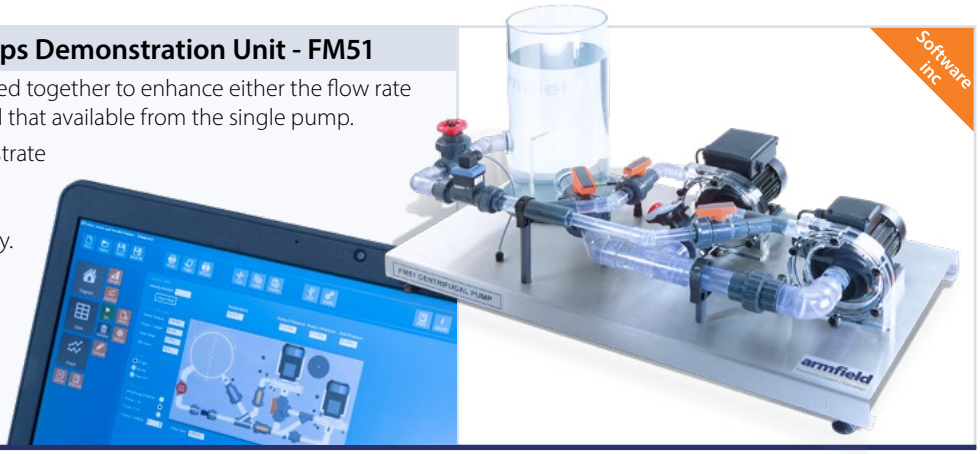
Requirements

IFD 7

Series and Parallel Pumps Demonstration Unit - FM51

Centrifugal pumps are often used together to enhance either the flow rate or the delivery pressure beyond that available from the single pump.

The unit is designed to demonstrate the operational advantages of parallel or series operation, depending on the required duty.



Requirements

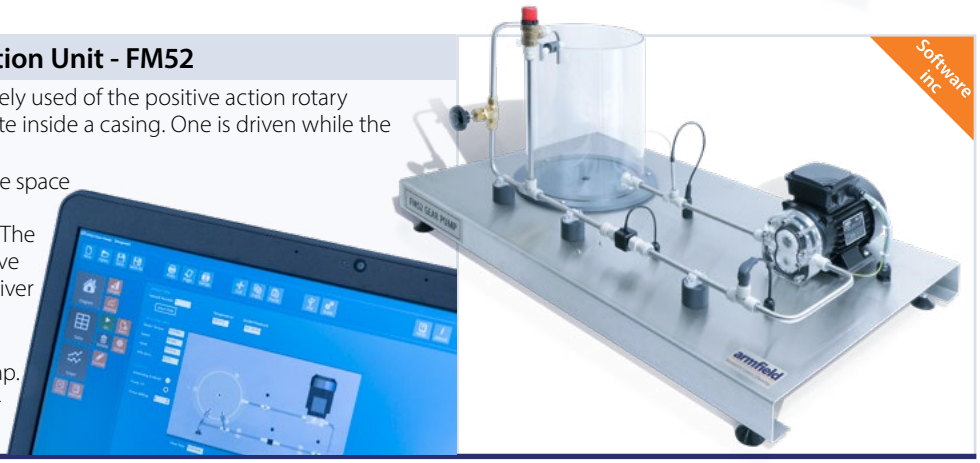
IFD 7

Gear Pump Demonstration Unit - FM52

The gear pump is the most widely used of the positive action rotary pumps. Two gear wheels operate inside a casing. One is driven while the other rotates in mesh with it.

The liquid is carried around in the space between consecutive teeth and then ejected as the teeth mesh. The pump has no valves. It is a positive displacement pump and will deliver against high pressures.

The output is a more even flow than that of a reciprocating pump. It is particularly suitable for high-viscosity fluids.



Requirements

IFD 7

Plunger Pump Demonstration Unit - FM53

The plunger or ram pump is a positive displacement pump and is used for pumping small quantities of liquid at high pressures. It is similar to a piston pump except that the sealing gland is at one end of the cylinder.

The reciprocating motion of the plunger gives an uneven flow, although the inclusion of a damping vessel can reduce this effect.

**Priming is unnecessary.*

Link to S Series

S SERIES

Hydraulics & Hydrology

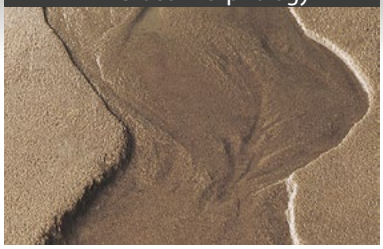
Rainfall, Drainage, Sediment Flow and Erosion

This range of products offers both laboratory and field-learning opportunities. It also introduces such diverse topics as crop water requirements, erosion, soil moisture content, ground water flow, plant water need and sprinkler irrigation systems.

Piezometric surface studies

Scouring around a circular bridge pier

Riverbed morphology



Environmental Hydrology System - S12-MKII-50

Advanced Environmental Hydrology System - S12-MKII-50

This floor-standing Hydrology System includes features suitable for studying fluvial geomorphology. It combines the capabilities of the Rainfall Hydrographs and Ground Water Flow Unit into a single comprehensive, unit. The system is fully instrumented for investigation of rainfall/run off hydrographs, ground water abstraction studies and unique to this apparatus, fluvial mechanics.

The System includes as standard instrumentation and a data logging system that is used to measure both the water flow and the sediment flow and a set of models which are used to facilitate various additional experiments.

Models include:

Fabricated trays and rings:
- Circular open-ended ring
- Small square open-ended ring
- Closed ring with removable central clear plastic standpipe
- Large rectangular open-ended ring
- Large rectangular closed ring with hole

Impermeable catchment
Permeable catchment
Model structures machined from solid PVC:
- Cylinder
- Rectangular bridge pier
- Rounded bridge pier
- Streamlined bridge pier

Requirements

1Ph
PC
USB
COLD

Requirements

1Ph

COLD

Hydraulic Flow Demonstrator - S16

A free-standing accessory to the F1-10 Hydraulic Bench that enables hydraulic phenomena, associated with the flow of water through both open channels and close conduits, to be set up quickly, easily and visually demonstrated. Measurements taken in each configuration permit the associated flow conditions to be analysed.

An elevating section of the bed inside the channel and models of various hydraulic structures enable the difficult concepts of critical flow/velocity/depth and energy changes to be clearly demonstrated and analysed.

Models supplied include the Undershot Weir, Overshot Weir, Narrow crested Weir, Broad crested Weir, Ogee Weir and Culvert. In all cases, the effects of changes in upstream and downstream water level can be investigated.

Requirements

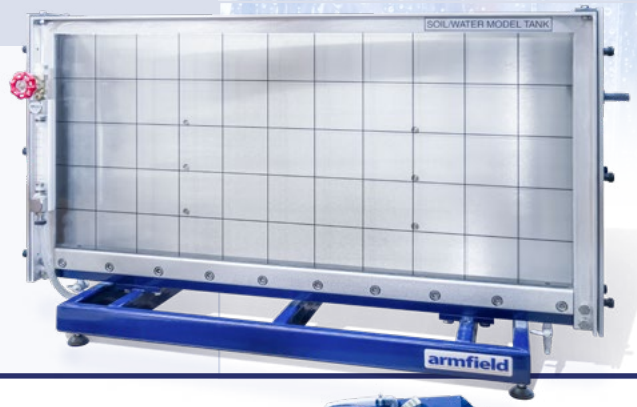
1Ph

COLD

Soil/Water Model Tank - FEL2

The soil/water model tank has been developed to help students of irrigation understand more fully the interaction of factors which influence water movement both on the soil surface and in the soil profile.

The equipment allows actual surface irrigation experiments to be performed on a small scale in the laboratory.



Requirements

1Ph

COLD

Rainfall Simulator - FEL3

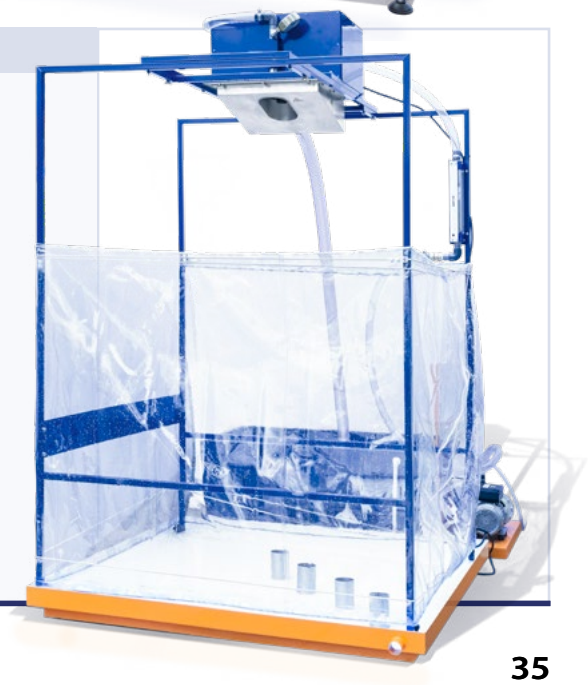
The Rainfall Simulator can also be used in the laboratory or in the field for a wide range of research from studies of infiltration under sprinkler irrigation to estimating soil loss in high intensity tropical storms.

Erodibility of soils can be studied in the laboratory and the influence of crop cover on the effect of rainfall can also be investigated.

It is ideal for investigating the relationship between rainfall and soil erosion, the nature of soil erosion potential on different soil types and identifying methods by which erosion may be prevented.

The simulator incorporates:

- Aperture adjustment
- Field and lab test plots
- Tilting stand
- Rain gauges



Drainage and Seepage Tank - S1

Requirements: 1Ph, COLD

This self-contained facility is designed to enable a comprehensive study of flow through permeable media. Using sand and the various two dimensional models supplied, it is possible to determine flow lines, seepage rates and the distribution of uplift pressures.

A useful facility for student project work in engineering hydrology.

- Flow line visualisation
- Flow net construction
- Determining seepage rates
- Verification of Darcy's Law
- Boundary Conditions
- Comparison of experimental results with analytical solutions

Rainfall Hydrographs - S10

Requirements: 1Ph, COLD

This apparatus sets out to demonstrate, on a small scale, some of the physical processes found in hydrology. These processes fall into two related categories: the relationship between rainfall and runoff from catchment areas of varying permeability and the abstraction of ground water using wells, both with and without surface recharge from rainfall.

Experimental content includes:

- Obtaining the hydrograph from a single storm
- Multiple storms in sequence
- Impermeable catchment
- Catchment with reservoir storage
- Investigating the effect of land drainage and direction of storm movement on the run-off hydrograph of a catchment

Ground Water Flow Unit - S11

Requirements: 1Ph, COLD, F1-10

A bench top unit sand tank capable of demonstrating hydrological principles of ground water flow and the applications of these to certain water resource engineering constructions.

Demonstrations of flood risks associated with land drainage works, the use of wells for both water abstraction, de-watering and the drainage of lakes and polders are all readily performed.

The unit enables simple three-dimensional flow situations to be set up quickly and measurements of piezometric levels taken at appropriate positions within the model.

Requirements

1Ph

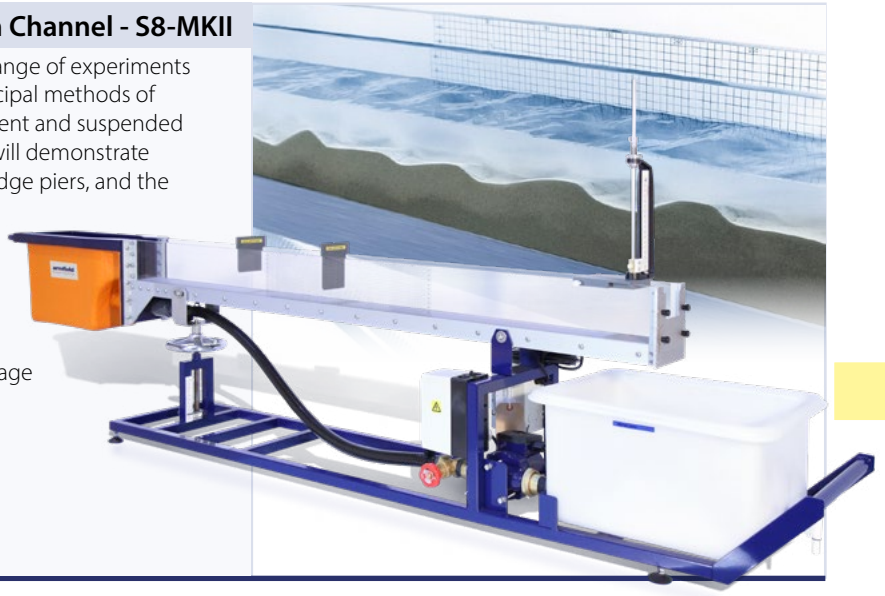
COLD

Sediment Transport Demonstration Channel - S8-MKII

This apparatus has been designed to allow a range of experiments to be performed to demonstrate the two principal methods of sediment transport in water: bed load movement and suspended sediment transport. In addition, experiments will demonstrate local scour at channel obstructions such as bridge piers, and the secondary flow in channel beds.

Experimental content includes:

- Regimes of Fixed-Bed Flow
- Initiation of Bedload Motion
- Bedforms in Sand
- Hysteresis of Bedforms during Changing Stage
- Scour at Structures
- Sediment Transport Rate
- Flow Resistance in a Gravel Bed



Requirements

1Ph

COLD

Mobile Bed and Flow Visualisation Tank - S2

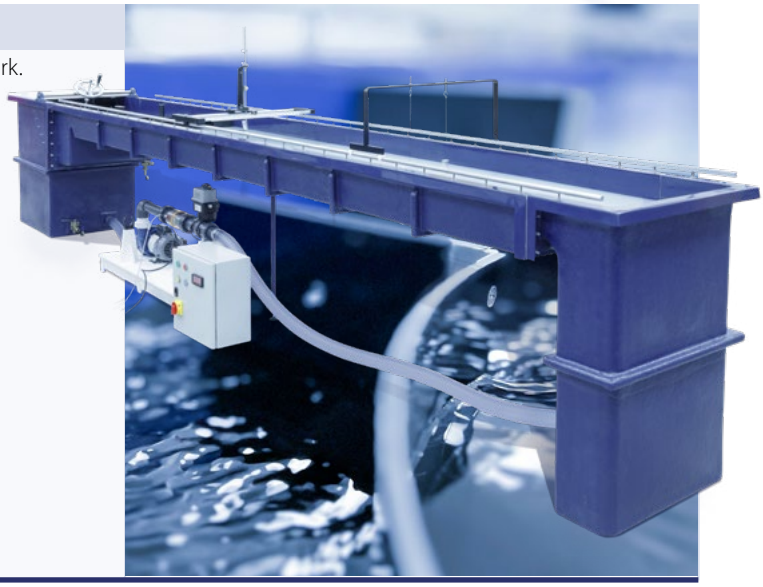
A versatile apparatus for teaching, project and research work. Available with 2.0m or 4.0m long working section.

The tank may be used in two principal fields of study:

- Hydraulic modelling of mobile bed situations such as water courses or civil engineering structures
- Two-dimensional flow visualisation using, for example, the Ahlborn dust indicator technique

Experimental content includes:

- Two-dimensional Flow Patterns
- Three-dimensional Flow Patterns
- Hydraulic Model Studies
- Unsteady Flow Patterns
- Loose Boundary Demonstrations



Requirements

1Ph

COLD

River Flow Simulator - S17

The S17 River Flow Simulator is unique equipment capable of demonstrating, on a small scale, principles of river formation and bed load motion. The demonstrations are of interest in areas such as geology, fluvial geomorphology, hydrology, and water resources.

The experimental capabilities achieved with the S17 include experimental investigation in erosion and deposition, study of characteristics of:

- Meandering
- Straight and braided courses
- Study on formation of river features
- Analysis of bed load motion and sediment transport, etc.

Link to H Series

H SERIES

Hydraulic Instruments

The H12 series is a range of low cost, easy to use manometers measuring differential water pressures scales and are graduated in 1mm divisions in all cases.

Vernier Hook and Point Gauge

Requirements

The measurement of steady state water surface position is frequently needed during hydraulic investigations. This is done by using a small point or hook manually adjusted to touch the water surface, and a reading is taken of the vertical movement using a scale or vernier.

H1-1	150mm Scale Vernier Hook and Point Gauge
H1-2	300mm Scale Vernier Hook and Point Gauge
H1-3	450mm Scale Vernier Hook and Point Gauge
H1-7	300mm Scale Digital Hook and Point Gauge
H1-8	500mm Scale Digital Hook and Point Gauge
H1-11	Adjustable Tripod Stand with Mountings

Series Liquid Manometers

Requirements

A range of general purpose laboratory manometers using liquid displacement to measure differential pressure.

H12-1 1m Scale Open Water Manometer
(This is a simple open water manometer with a 1 metre scale length that allows two different heads of water to be compared).

H12-2 1m Scale Pressurised Water Manometer

(This manometer is the same as H12-1 but includes the ability to pressurise the top manifold block, allowing the measurement of small differences in head where the static pressure is greater than the differential measurement).

H12-5 500mm Scale Kerosene-Water Manometer

(This manometer is a simple inverted 'U' tube manometer with a 0.5 metre scale length that incorporates a valve and reservoir on the top manifold allowing kerosene to be admitted above the water. This arrangement produces a manometer that is very sensitive to changes in differential pressure).

H12-8 Basic Portable Pressure Meter

H12-9 Portable Pressure Meter - 140mBar

(The H12-8 and H12-9 portable pressure meters are versatile handheld battery-operated pressure meters suitable for measuring the gauge (single input) or differential (dual inputs) pressure of air or water. The measuring range of the H12-8 is 0 – 2000 mBar with a limit of 6000mBar on either port without damage. The measuring range of the H12-9 is 0 – 140 mBar with a limit of 400 mBar on either port without damage).

Requirements

H12

Pitot Tubes

A range of Pitot tubes for the measurement of water velocity in open channels and closed ducts.

H30-1H 150mm Pitot Tube

H30-2H 300mm Pitot Tube

H30-3H 450mm Pitot Tube

Requirements

PC

Propeller Velocity Flowmeter

Used to measure and record very low point velocities in water and other conductive fluids, the H33 uses the change in impedance of a rotating multi-bladed impeller to indicate rotational speed caused by the flowing fluid.

H33-1	5.0 to 150 cm/sec Velocity Probe
H33-2	60 to 300 cm/sec Velocity Probe
H33-3	(+90 degree head), 5.0 to 150 cm/sec Velocity Probe
H33-10	Digital Indicator c/w 3m cable
H33-DTA-ALITE	Data Logger

Requirements

1Ph

Wave Probe System

The wave gauge is a simple and reliable device for measuring rapidly changing water levels in physical models. The wave probe case contains the signal conditioning circuitry for up to eight wave probes and a network connection to allow a computer to configure the probes via the built-in web page.

H40-MKII	Wave Probe Case 8 Channels
H40-MKII-1	Twin Wire Wave Probe 300mm
H40-MKII-2	Twin Wire Wave Probe 600mm
H40-MKII-3	Twin Wire Wave Probe 900mm
H40-MKII-4	Twin Wire Wave Probe 1200mm
H40-MKII-6	Twin Wire wave Probe stand (for 300mm wave probe)
H40-MKII-7	Twin Wire wave Probe Tripod (for 600mm to 1200mm wave probes)

Link to S6-MKIII

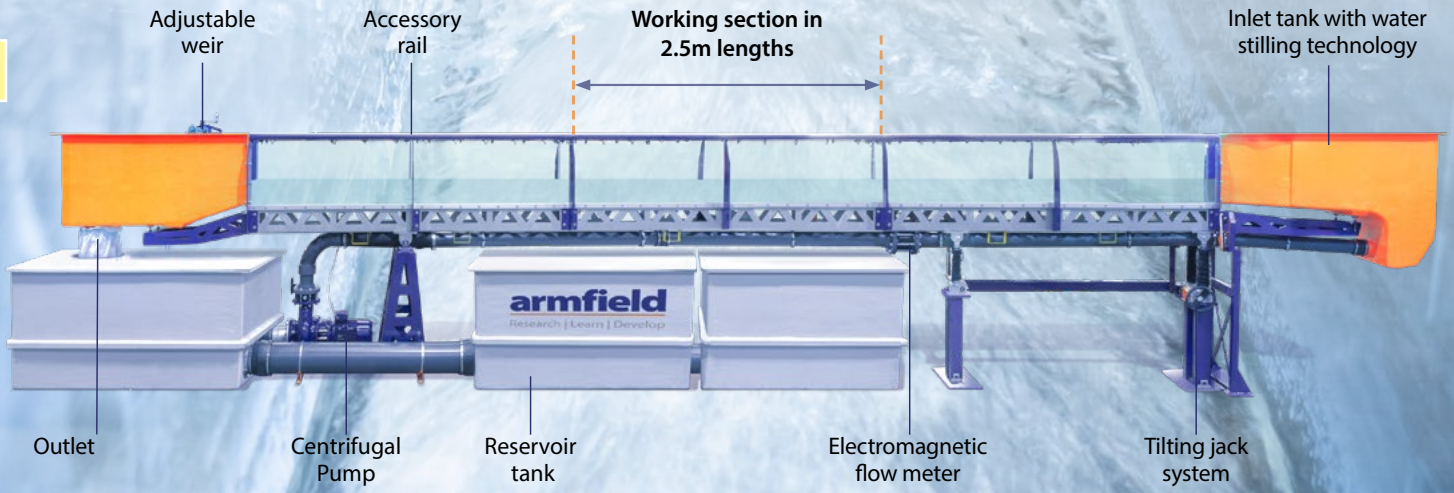
Standard Teaching Flume S6-MKIII

The Armfield S6-MKIII laboratory flow channel is one of the most important tools available to the hydraulics or civil engineer, whether engaged in teaching basic principles or researching solutions to practical problems. Many applications in fluid mechanics are associated with the flow of water through an open channel where the water has a free surface that is exposed to the air at atmospheric pressure.

The flumes are available in different lengths from **5** to **17.5m** in 2.5m sections and examples are installed in educational and research establishments throughout the world.

A comprehensive range of accessories, and measuring instruments are available including discharge control, wave generation and a closed loop for sediment transport studies.

S6-MKIII - Teaching and research flume




Centrifugal pump

Crump weir model S6-31


Electrical jacking

Standard Teaching and Research Flume – S6-MKIII

Requirements

3Ph

0.3m wide x 0.45m deep x 2.5m section.
Flumes are available from 5 to 17.5m in 2.5m increments.

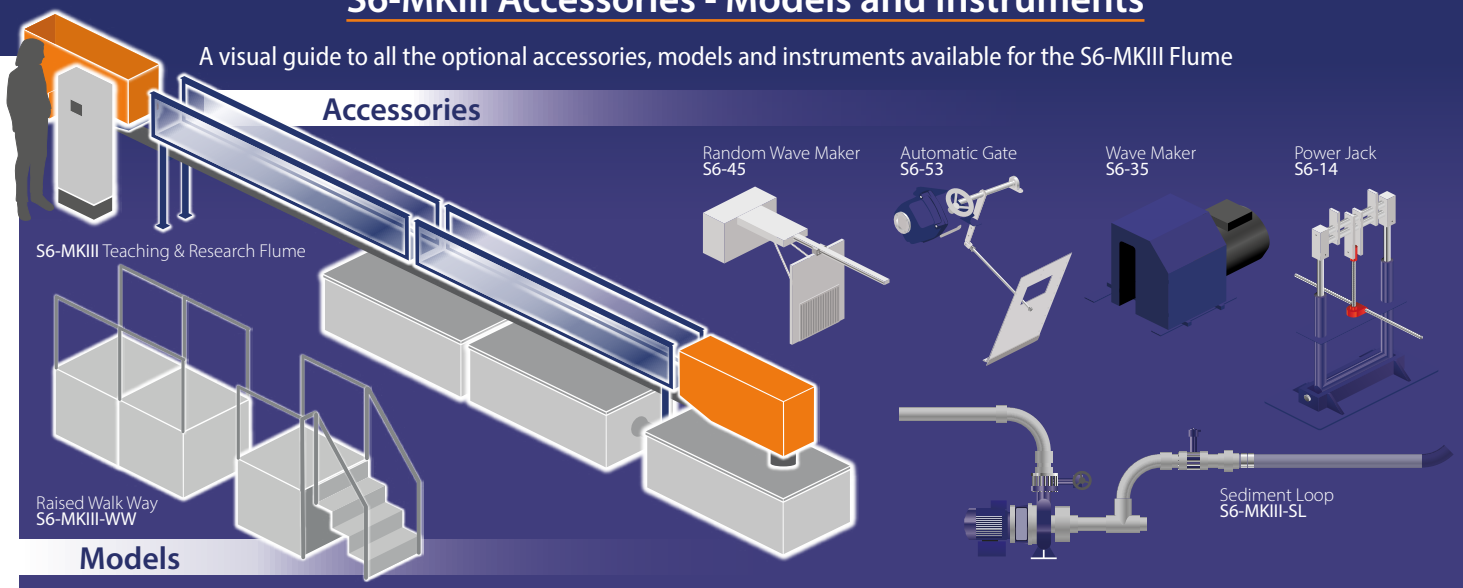
Options, models and instruments available:

- Tilting up to 17.5 meters
- Sediment transport options
- Manual or electric jacking
- Software Control and Data Acquisition Package option
- Data Logging & Instrumentation Package option
- Multiple model options available
- Walkway option
- Window options

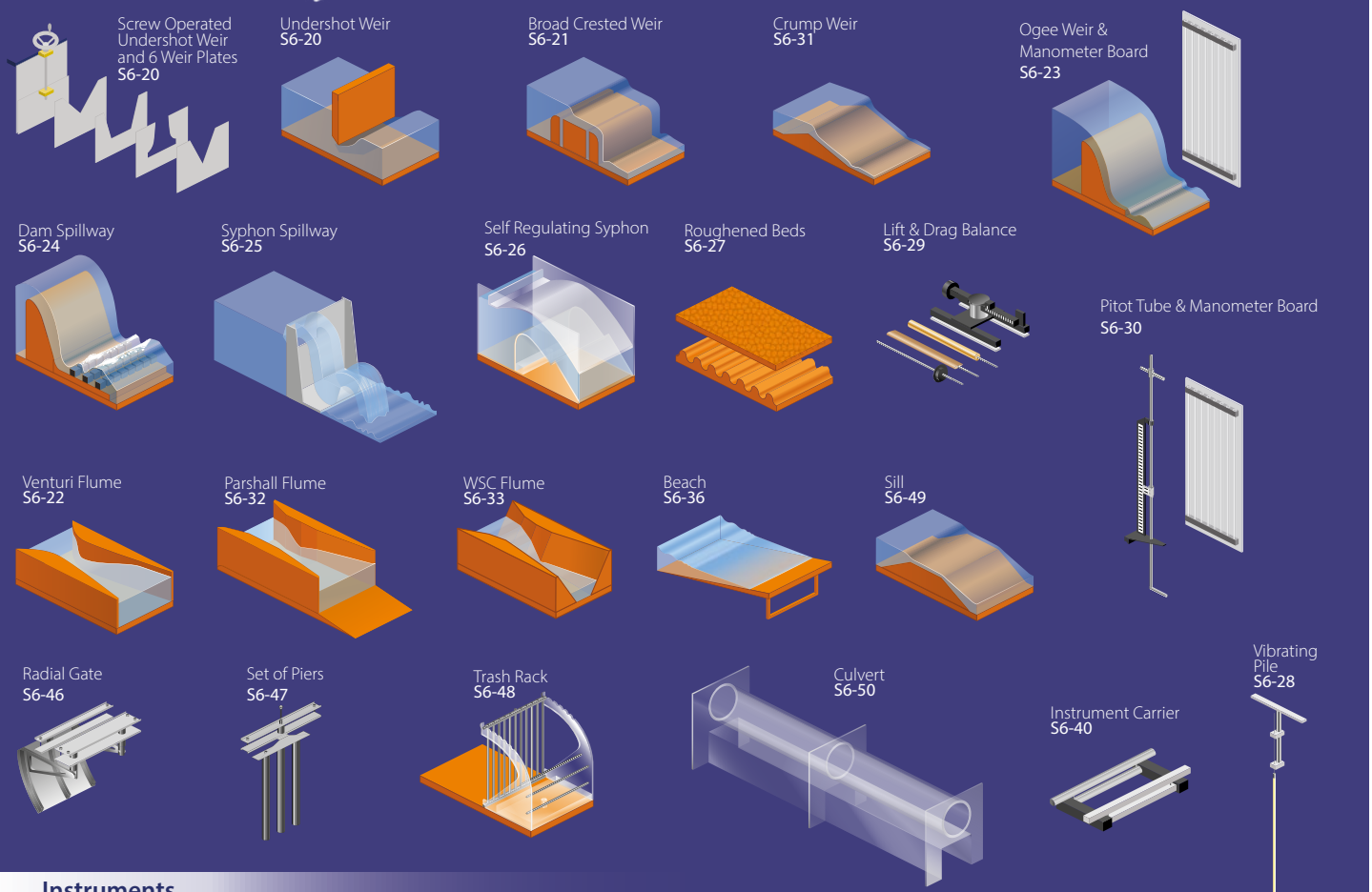
S6-MKIII Accessories - Models and Instruments

A visual guide to all the optional accessories, models and instruments available for the S6-MKIII Flume

Accessories



Models



Instruments

Details of the H Series can be found on page **34 & 35**

Link to S Series

S SERIES

Research Flumes

The world-leading fixed bed and tilting flume technology supplier for over 50 years

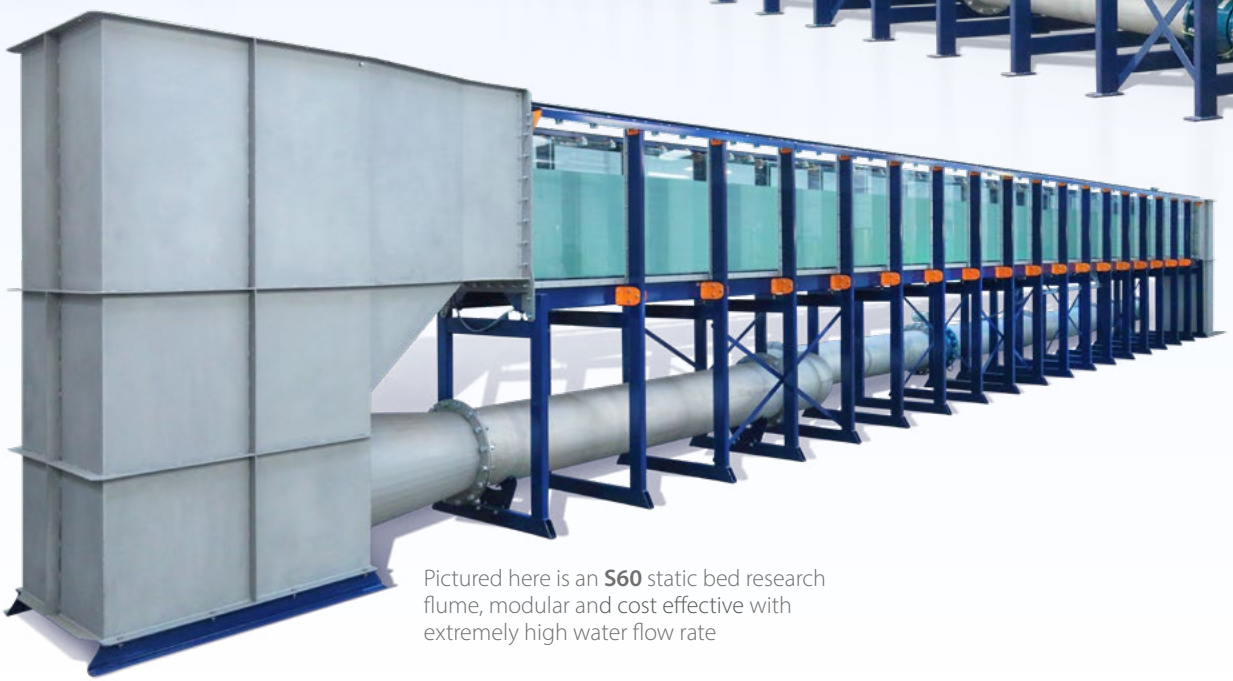
Representing innovative product evolution, Armfield's latest series of fully configurable, modular flume systems are designed to exceed the requirements of research and teaching facilities alike.

Available as free discharge, recirculation or a combination of both; flumes systems are accompanied by a range of Hydraulic & Hydrology equipment that includes tanks, basins, experimentation models and instrumentation.

- **Standard research flumes** (available as tilting or fixed bed and in several working lengths)
- **Standard computer controlled research flumes** (available as tilting or fixed bed and in several working lengths)
- **Special flumes, tanks and basins**
- **Ancillary equipment:**
  - Sediment transport facilities
  - Mono and random wave makers
  - Instrumentation
  - Wind simulation

The **S6-MKIII** teaching flume with walkway

The **S80** wind over wave research flume built to simulate enviromental effects



Pictured here is an **S60** static bed research flume, modular and cost effective with extremely high water flow rate

Example of a **S100** tilting bed research flume, engineered for minimum deflection in an easily shipped modular design

Bespoke system design for your application available from Armfield

As with all of our equipment, we can install, commission and offer full training and on site maintenance.

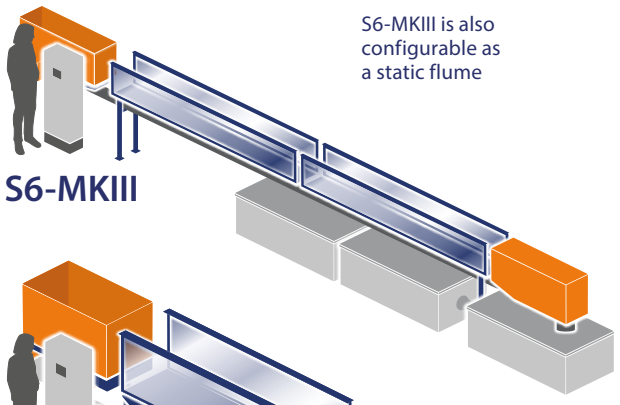
Channels can be designed to incorporate the following features (depending on customer requirements):

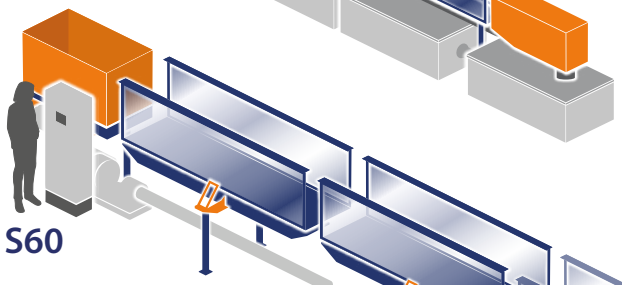
- Fixed bed or variable slope
- Self-contained or laboratory supplied water
- Open circuit or re-circulating sediment load
- Choice of working section materials (glass, metal, wood)
- Wind and wave generators
- Instrumentation systems for flow, velocity, level, etc.
- Sediment sampling and weighing
- Extremely high flow rates possible

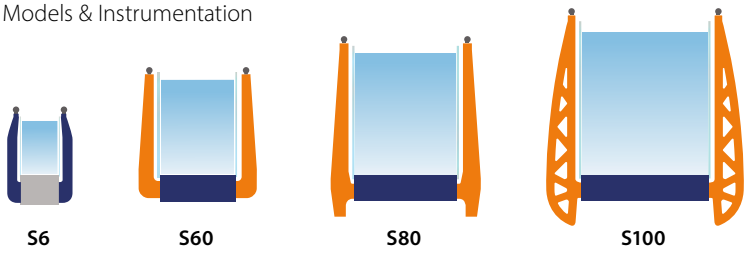
Modular Standard Fixed Bed and Standard Tilting Bed Flumes

Armfield flumes are engineered with the industry's most comprehensive range of options:

- Control and acquisition
- Sediment transport/feeding/weighing/extraction
- Random and mono wave generation systems
- Walkways, gantries and jacking systems
- Bespoke pumping solutions from single to multiple pumps with flow rates ranging from 1-1000 l/sec
- Weir types including: venetian weir; base hinge; stop log; gate & sluice
- Integrated touchscreen PLC control and logging systems
- Optional glass base sections for full particle image velocimetry (PIV analysis)
- Standard Lengths from 5m- 50m
- Models & Instrumentation







Flume range cross section

Configurable modular flumes

Working section dimensions

Flume	Type	Width	Depth	Length (in 2.5m increments)
S6-MKIII	Tilting	0.3m	0.45m	From 5m-17.5m
S60ST	Static	0.6m	0.8m	From 5m-50m+
S60	Tilting	0.6m	0.8m	From 5m-30m
S80ST	Static	0.8m	1.0m	From 5m-50m+
S80	Tilting	0.8m	1.0m	From 5m-30m
S100ST	Static	1.0m	1.2m	From 5m-50m+
S100	Tilting	1.0m	1.2m	From 5m-30m

Standard size flumes, available in free discharge or recirculation. Bespoke lengths and widths can also be offered.

*Note: length of tilting flume subject to tilt requirements

Flumes can be built to length in multiples of 2.5m working sections (add end & feed tanks, plus pumps and any other outboard ancillaries to obtain overall flume length and width)

Requirements

3Ph
PC
USB
COLD

Standard Teaching and Research Flume – S60 PLC control included 0.6m wide x 0.8m deep x 2.5m sections

Options, models and instruments:

- Free discharge or recirculation configurations
- Sediment transport options
- Tilting up to 30 meters
- Static bed up to 50 meters
- Weir options available

Tilting bed shown

Requirements

3Ph
PC
USB
COLD

Standard Teaching and Research Flume – S80 PLC control included 0.80m wide x 1.0m deep x 2.5m sections

Options, models and instruments:

- Tilting up to 30 meters
- Static bed up to 50 meters
- Sediment transport options
- Weir options available
- Free discharge or recirculation configurations

Static bed shown

Requirements

3Ph
PC
USB
COLD

Standard Teaching and Research Flume – S100 PLC control included 1.0m wide x 1.2m deep x 2.5m sections

Options, models and instruments:

- Free discharge or recirculation configurations
- Sediment transport options
- Tilting up to 30 meters
- Static bed up to 50 meters
- Weir options available

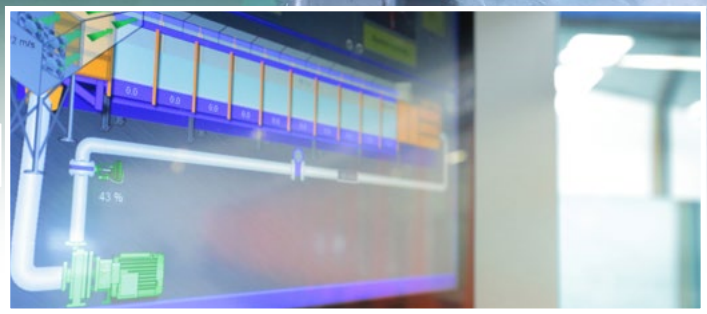
Tilting bed shown

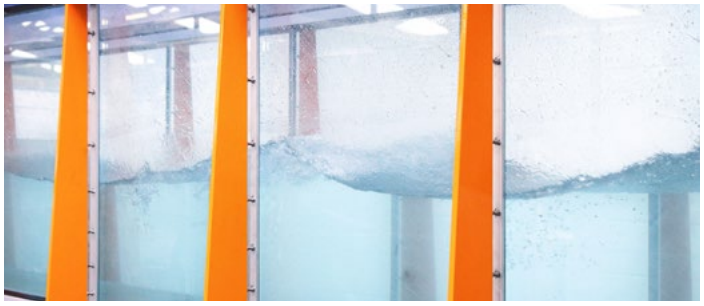
Brouchure

Research Flume Options & Solutions

Wind Generation/Wave Generation/Sediment Transport/Electrical Jacking/Reservoir Tanks

Armfield offer numerous options for incorporation into our range of large Flumes (S60, S80, S100). Many of these options can be combined together to offer greater flexibility for simulation and research.





PLC Flume Computer Control

All Armfield large scale research flumes are supplied with a floor standing control panel. The cabinet houses the frequency inverters which control the tilt and pump motor speeds. As standard the Armfield flume is supplied with a PLC control system with HMI touch screen interface.

The system can be run in manual mode enabling the user to operate flow, depth, infeed, tilt etc, (depending on options).

When the system is set in automatic mode the desired water depth, incline and flow rate can be selected, the system will then monitor the settings and using PID control data maintain the desired output (depending on options).

Wind Simulation

An optional Integrated computer operated wind simulation system can be provided, offering mono or bi-direction wind.

The wind simulation is provided with a variable speed fan system connected to a clear cowling running over the flume.

Variable wind simulation speeds up to and more than 25 m/s are available.

Wavemaking

Armfield offers multiple wave generator options from simple paddle systems, through to multi-paddle computer-controlled wave generating systems.

For many applications, particularly coastal models and flume studies, long crested and directional random waves are sufficient to model the sea state. For offshore studies and some shallow water problems multi-directional components are required.

Flumes may be used to study breakwaters, sea walls and beach behaviour or for fundamental research.

Flood Gate

Flood event research with a computer controlled release system, this option will open up environmental experimentation.

Our engineers have designed an option to carry out flood event studies, leaky barriers, dam research, effect on structures and more. This flume furthers our involvement in creating equipment for environmental erosion studies.

Braided river, accumulations of logs and flood sediment studied in an Armfield research flume

Research being conducted into macro algae at the total environment simulator built by Armfield for the University of Hull

Sediment Transfer

Armfield can offer options for running sediment transfer experimentation within the flumes.

Dedicated transfer – A separate solids handling pump is installed and connected to the drop out section. The pump can be used with sedimentation up to 10mm in size, which is then pumped to the start of the working section for redistribution. This system can be operated continuously.

Sediment transfer through the main circulation pump – This is particularly suitable for experimentation of fine suspended sediment. The pumps are lined and are designed to handle sedimentation up to 4mm in size. The suspended sediment is pumped through the main pipework and this system can be operated continuously.

Sediment collection and extraction – Where sediment needs to be collected and not automatically recirculated a series of valves are fitted to the drop out section enabling periodic extraction of deposited sediment.

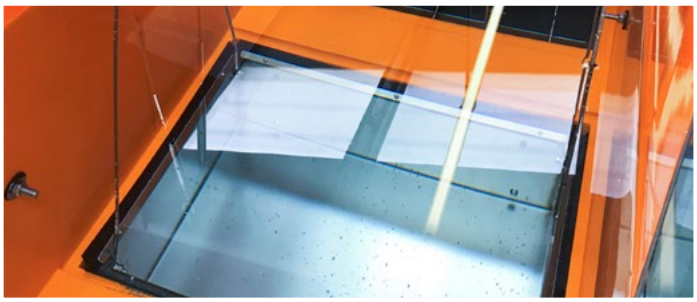
Sediment Weighing

Armfield offer a dedicated sediment weighing facility.

The system catches mobile bed sediment in conjunction with an expansion point and removable diverter plate to drop out suspended sediment.

The mass of the captured sediment is measured and shown on the main control console this is then recorded on the data logging system.

Note: *the weigh system needs to be removed if operating sediment transport option*



Reservoir Tanks

Storage/reservoir tanks can be offered along with walkways mounted above to give access to the flume working section.

The S6 flumes are supplied with reservoir tanks as standard.

- Armfield can use existing header tanks or sumps
- Flumes can be supplied as a fully self-contained system

Actuated Flume Tilt Control

This is available for S60, S80 and S100 flumes

- Tilting up to 30 meter working section
- Integrated control within our bespoke flume software
- Tilting flume configuration (maximum available tilt 5%)

River bed and bank studies into erosion via fish and crustacean activity

W SERIES

Water Treatment

Link to W Series

Common processes covered by Armfield's Water Treatment range

- This range of simple yet comprehensive products covers the major elements of water treatment processes
- Several of the products can also be used industrially both for testing and experimentation

- Wastewater Treatment Process
  - Mechanical
    - Aeration: W10-MKII
    - Sedimentation: W2-MKII, W7
    - Filtration
      - RO, UF, MF, NF: FT18-MKII, UOP12
      - Deep Bed Filtration: W4-MKII, W5-MKII
      - Surface Filtration: FT17, W3-MKII
  - Chemical
    - Ion Exchange: W9-MKII
    - Flocculation: W1-MKII
    - Adsorption: UOP15
  - Biological
    - Aerobic Process: W11
    - Anaerobic Process: W8, BE3, BE4

W10-MKII Aeration Unit

W11 Aerobic Digester

Requirements

1Ph

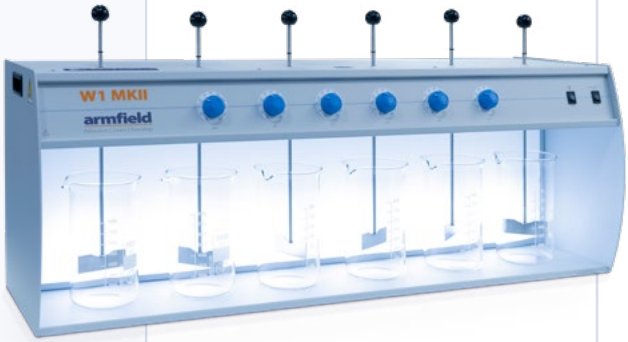
Flocculation Test Unit - W1-MKII

Analysis of a water or waste preparatory to help in the design of a treatment sequence often involves coagulation and flocculation experiments in the laboratory. These tests, called jar tests, are widely used for control of plant operations and are routinely performed by treatment plant operators.

The coagulation and flocculation tests serve to indicate the optimum chemical dosages for removal of turbidity and colour, including such auxiliary facets as pH adjustment, and the necessity for the supplemental use of activated carbon.

The Flocculation test unit allows students to investigate the following:

- Determination of optimum coagulant dosage
- Determination of optimum pH
- Effect of mixing time and intensity



Requirements

1Ph

Sedimentation Studies Apparatus - W2-MKII

The study of how particles settle in a liquid is of importance to many industries. The Armfield Sedimentation Studies Apparatus provides students with the opportunity of observing settling or sedimentation phenomena in a simple and readily identifiable manner. Students can measure settling rates as a function of particle size, density, and concentration in a static water system. From these results, batch settling curves may be deduced, which can then be used for the design of industrial settlers and thickeners. The equipment supplied also allows industrial tests to be made on any slurry system of interest. **The equipment allows students to study the following topics:**

- Effect of initial concentration on sedimentation characteristics
- Construction of the rate of settling curve against concentration from a single batch test
- Effect of initial height on sedimentation characteristics

Requirements

1Ph

PC

USB

Permeability/Fluidisation Studies Apparatus - W3-MKII – armBUS integrated

This apparatus is designed for students to measure and understand the characteristics of flow through a bed of particles. Such flows occur naturally and in process plant designs.

It may also be used for a part of the testing of media for water and waste water treatment processes.

Requirements

1Ph

PC

USB

Filterability Index Unit - W4-MKII – armBUS integrated

The unit enables a water treatment test to be made on a suspension to be filtered through sand or similar granular media.

Whilst developed as a teaching tool, it can also be used in routine control at waterworks, or at a sewage treatment works that employs tertiary filtration.

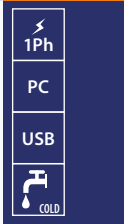
Water Treatment - W Series

Deep Bed Filter Column - W5-MKII – armBUS integrated

This laboratory deep bed filter column has been designed to operate identically to full-scale granular filters.

Using the same bed depth and filter media, tests on this unit provide operational data, which may be scaled up to full size. Pilot trials of possible filter designs for water and sewage works can be made reliably at low cost.

Requirements



Model Sedimentation Tank - W7-MKII

This unit has been designed to demonstrate the hydraulic characteristics and settling efficiencies of a model settling basin.

Although scale-up to industrial size sedimentation tanks is difficult, relevant deductions can be made as to how non-uniform flows occur and how these interact with the settling characteristics of particular suspensions.

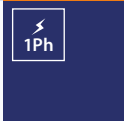
Requirements

Anaerobic Digester - W8

Anaerobic treatment processes involve bacteria, which function only in the absence of air.

This digester is designed as a bench top training facility and as a means of providing operational process data for plant design purposes.

Requirements

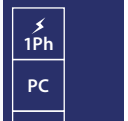


Ion Exchange Unit - W9-MKII – armBUS integrated

A low cost, bench mounted unit designed to demonstrate the use of ion exchange resins for either continuous water softening or demineralisation.

The equipment is designed to emulate the industrial operation of such units, including monitoring breakthrough and regeneration cycles.

Requirements



Requirements

1Ph
PC
USB

Aeration Unit - W10-MKII – armBUS integrated

The purpose of this aeration unit is to permit the study of the oxygen transfer characteristics of diffused air systems including the physical and chemical parameters that influence their oxygenation capacity.

These studies are a necessary prelude to the understanding of the biological treatment of waste waters.

Requirements

1Ph

Aerobic Digester - W11

The continuous activated sludge process has been successfully employed in public health engineering installations for nearly a century.

The bench top aerobic digester is a comprehensive study facility of this biological water treatment process - using a safe, synthetically prepared waste water.

Chilled Water Circulation Unit - CW-17 (Option)

Requirements

1Ph
PC
USB

Cross Flow Membrane Filtration - FT17

A lab-scale system for evaluating membranes in a cross flow filtration application enabling rapid determination of cross flow filtration performance using a range of membrane types with small product volumes (1 litre).

It can also be used in teaching applications to demonstrate features of different membrane types and the effect of varying filtration variables.

Requirements

3Ph
COLD
COMP. AIR

Reverse Osmosis/Ultrafiltration Unit - FT18-MKII

A small pilot-scale cross-flow filtration system designed to operate with a range of membrane module configurations. It can be operated with as little as 5-10 litres of material to give data that is useful for process scale-up.

It can be used over the full range of cross-flow filtration applications from microfiltration through to reverse osmosis.

- Integral data logging of all parameters
- Capable of: **Microfiltration/Ultrafiltration/Nanofiltration & Reverse Osmosis**
- **Ceramic, Spiral Wound, Tubular** and **Hollow Fibre** membranes available

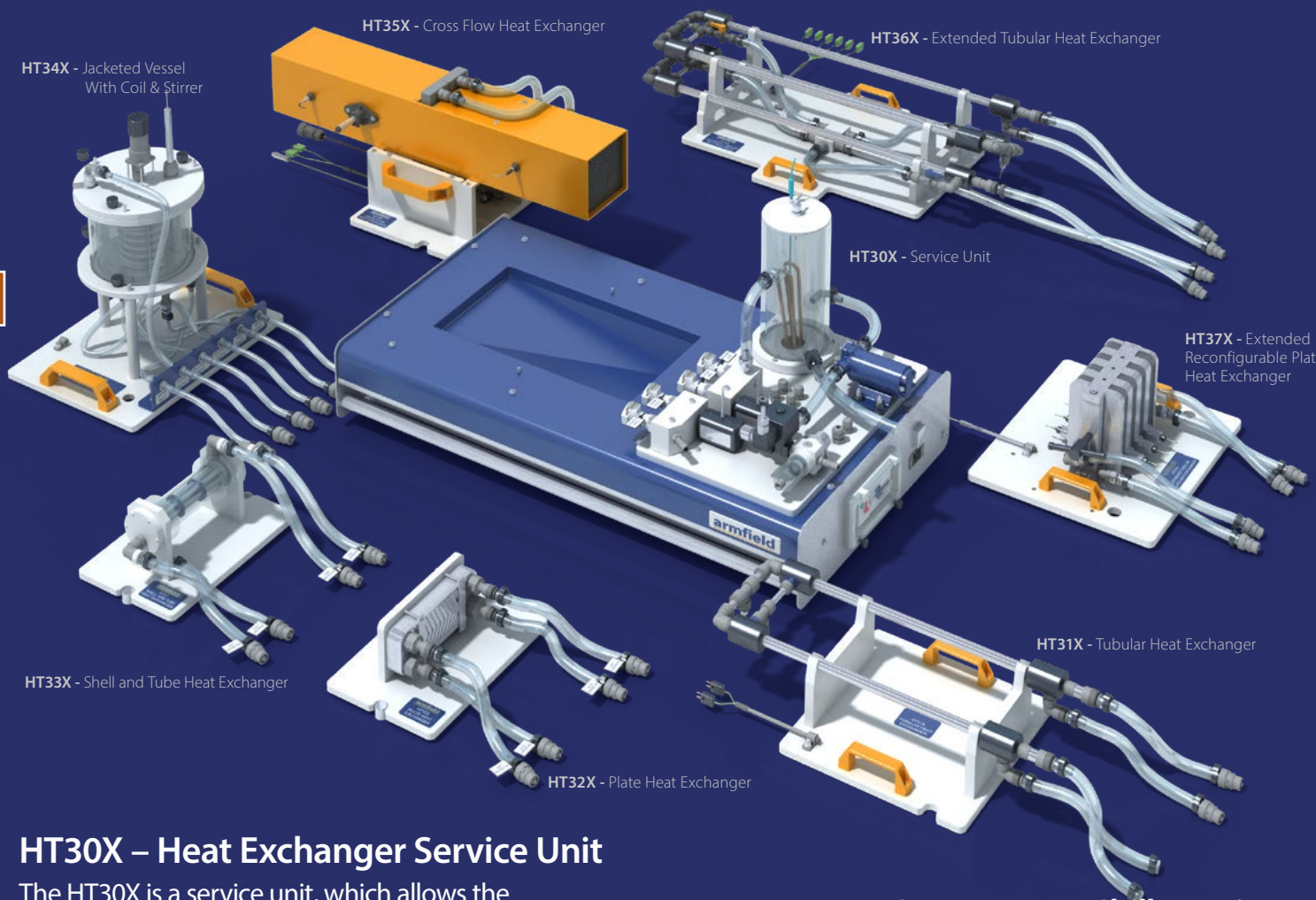
Link to HT Series

HT SERIES Heat Exchangers

Computer Controlled Heat Exchanger

The Armfield range of small scale heat exchangers comprises units which represent the common types of heat exchanger found in industry and demonstrate different techniques for indirect transfer of heat from one fluid stream to another.

BENCH TOP DESIGN
SUPPLIED WITH COMPUTER CONTROL AND DATA-LOGGING AS STANDARD
SEVEN INTERCHANGEABLE HEAT EXCHANGER MODULES AVAILABLE
CAN BE CONFIGURED FOR COMPUTER CONTROLLED OR STAND ALONE (REQUIRES ACU) OPERATION



HT30X – Heat Exchanger Service Unit

The HT30X is a service unit, which allows the operation of one of the Armfield range of small scale heat exchanger systems.

Their small size produces a fast system response to changes in variables such as water flow rate and temperature, so that training exercises can be carried out in a relatively short space of time.

ArmBUS software comes standard with the HT30X, supporting all Armfield heat exchanger accessories.

Each exchanger has a dedicated program with multiple exercises.

armBUS NetCan

armBUS NetCan, connects up-to 20 users to one piece of equipment

CW-20 Water Chiller Unit

We understand that many of our customers operate in regions where water conservation is critical.

That's why we offer the CW-20 water chiller unit, a high-quality, low-noise solution that not only minimises water waste but also ensures a more stable and controllable steady-state operation.

With a 20L capacity, up to 1.8 kW cooling power, and temperatures as low as -30°C, it's the perfect companion for the HT30X in laboratory and classroom settings.

Requirements

1Ph

COLD

DRAIN

Computer Controlled Heat Exchanger Service Unit - HT30X

Software inc

The HT30X is a service unit which controls the operation of a broad range of Armfield interchangeable small scale heat exchanger modules.

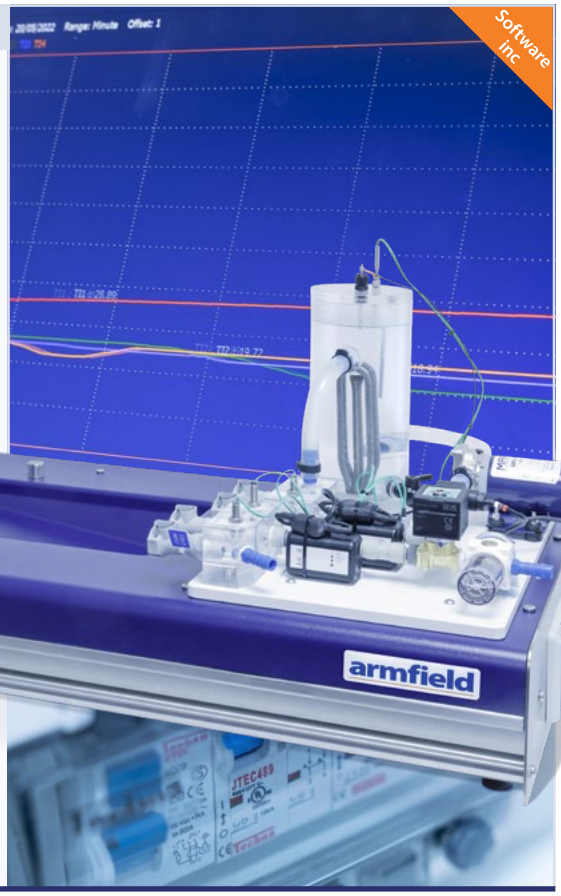
It provides controlled cold water flow, hot water direction can easily be reversed using software control, enabling co-current and counter-current investigations, and the required instrumentation for a series of in-depth investigations into heat exchanger performance.

The individual heat exchangers can be quickly changed over, to enable comparisons between different types of heat exchanger to be made.

The HT30X requires a user supplied personal computer for the operator interface. The computer connects the HT30X using a USB interface, providing a simple and straightforward installation and set up procedure.

Once the appropriate heat exchanger has been installed and set up, all other functions can be performed under computer control.

ACU-10 Screen
Touch screen, stand alone option



Requirements

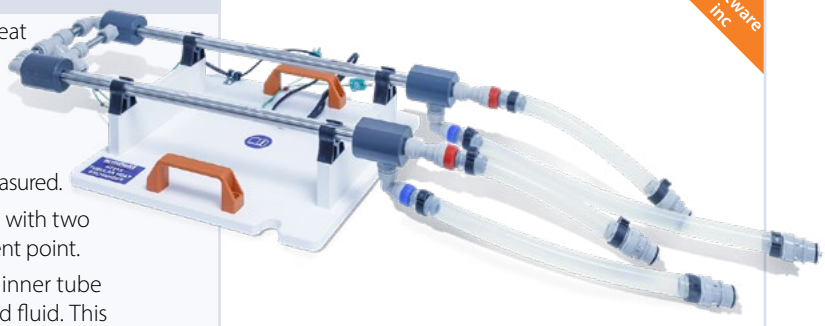
HT 30X

Tubular Heat Exchanger - HT31X

Software inc

The tubular heat exchanger is the simplest form of heat exchanger and consists of two concentric (coaxial) tubes carrying the hot and cold fluids.

In these miniature versions the tubes are separated into sections to reduce the overall length and to enable the temperature at points along both fluid streams to be measured.



Two versions are available, the HT31X is a basic version with two sections and a single interim temperature measurement point.

On both our HT31X and HT36X heat exchangers, the inner tube is used for the hot fluid and the outer annulus for cold fluid. This minimises heat loss from the exchanger without the need for additional insulation.

Features:

- A small-scale Tubular Heat Exchanger system for use with an Armfield Heat Exchange Service Unit to teach the fundamental concepts of heat exchangers
- Comprises a number of sections of concentric tubes, the outer section constructed from clear acrylic for visibility and the inner tube from stainless steel
- The tubes are easily dismantled for cleaning
- A comprehensive instruction manual is included

Software Inc

Plate Heat Exchanger – HT32X

Requirements

HT 30X

The plate heat exchanger is extremely versatile and commonly used in the food and chemical processing industries.

The HT32X has a single heating section configured for multi-pass operation with passes in series.

It comprises 10 individual plates. When being assembled, each second plate is rotated by 180°, thus forming two separately rotated flow chambers by the means of which the mediums being involved in the heat transfer are conducted in counter flow.

Features:

- A small scale plate heat exchanger system for use with an Armfield Computer Controlled Heat Exchange Service Unit to teach the fundamental concepts of heat exchangers
- Comprises a number of stainless steel plates, each with a pressed chevron pattern, soldered with copper using a vacuum soldering procedure
- A comprehensive instruction manual is included

Software Inc

Shell and Tube Heat Exchanger – HT33X

Requirements

HT 30X

The shell and tube heat exchanger is commonly used in the food and chemical process industries. This type of exchanger consists of a number of tubes in parallel enclosed in a cylindrical shell. Heat is transferred between one fluid flowing through the tubes and another fluid flowing through the cylindrical shell around the tubes.

The miniature exchanger supplied is designed to demonstrate liquid to liquid heat transfer in a 1-7 shell and tube heat exchanger (one shell and seven tubes with two transverse baffles in the shell).

Features:

- A miniature shell and tube heat exchanger for use with an Armfield Computer Controlled Heat Exchanger Service Unit
- Comprises an outer shell and seven internal tubes, there are two transverse baffles inside the shell
- The heat exchanger is constructed from stainless steel tube and clear acrylic. It is mounted on a PVC baseplate which is designed to be installed on the plinth of the Heat Exchanger Service Unit without the need for tools
- The stainless steel tubes can be removed from the heat exchanger for cleaning
- A comprehensive instruction manual is included

Requirements

HT 30X

Jacketed Vessel With Coil & Stirrer - HT34X

Vessel heating or cooling of a process liquid in a tank, either batchwise or with continuous product feed, is common practice throughout industry.

The characteristics of the heat transfer using an external jacket or internal coil can be demonstrated together with the effect of stirring the vessel contents.

Features:

- Miniature jacketed vessel heat exchanger system for use with an Computer Controlled Armfield Heat Exchanger Service Unit
- Comprises processing vessel with outer jacket, inner coil, variable speed stirrer and baffle
- Thermocouples measure the vessel contents and the inlet and outlet temperatures of both fluid streams (5 in total)
- The Heat Exchanger is designed to be installed on the service unit without the need for tools
- A comprehensive instruction manual is included

Requirements

HT 30X

Cross Flow Heat Exchanger - HT35X

The cross flow heat exchanger is commonly used in applications such as heating, ventilating and air conditioning. It is also encountered as vehicle engine radiator.

This type of heat exchange occurs when the flow direction of the two fluids cross each other. In the HT35X, hot water flows in and out of a radiator, perpendicular to the air stream, which is being pulled into the radiator by an axial fan.

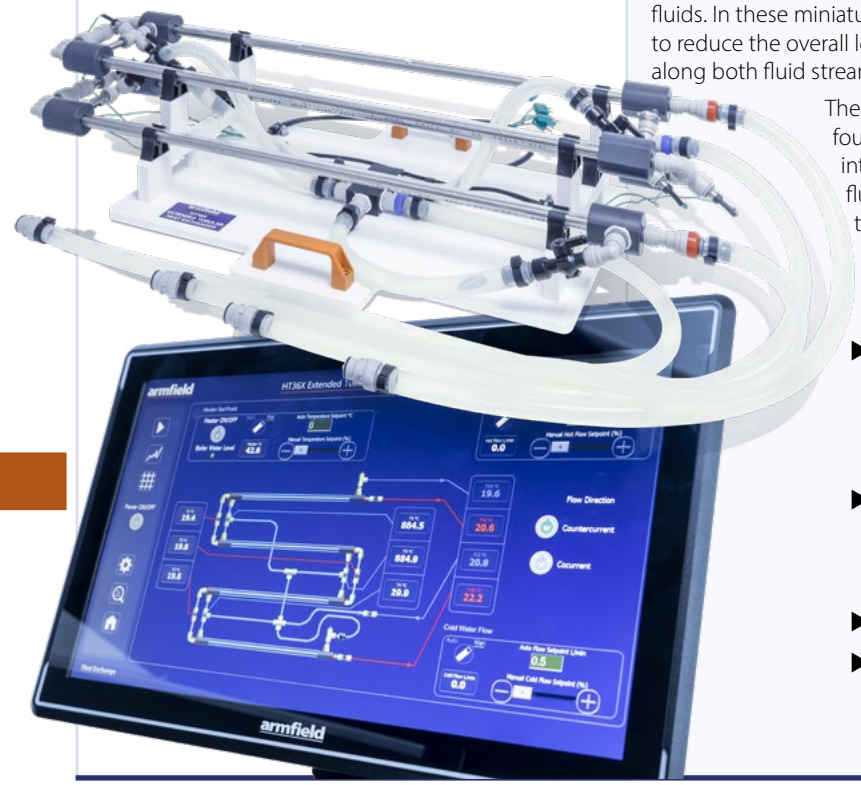
The convection between the two fluids through fins surface on the radiator implements the heat exchange.

Features:

A small scale cross flow heat exchanger system for use with the Armfield Computer Controlled Heat Exchanger Service Unit to teach the fundamentals concepts of heat transfer

- Some parts in the heat exchanger such as probes and axial fan can be easily removed for cleaning
- The HT35X enables variation of the parameters involved in the cross flow exchange process and therefore a complete analysis of the phenomena
- Thermocouples measure the inlet and outlet water from the base unit and air temperatures. The the air velocity sensor connects to the HT30X, 0-10m/s
- The air mass flow rate is derived using an air velocity sensor
- The HT35X is mounted on a PVC baseplate which is designed to be installed on the plinth of the Computer Controlled Heat Exchanger Service Unit without the need for tools
- A comprehensive instruction manual is included

Software inc



Extended Tubular Heat Exchanger - HT36X

Requirements

HT 30X

The tubular heat exchanger is the simplest form of heat exchanger and consists of two concentric (coaxial) tubes carrying the hot and cold fluids. In these miniature versions the tubes are separated into sections to reduce the overall length and to enable the temperature at points along both fluid streams to be measured.

The HT36X unit has four longer tube sections, giving four times the overall heat transfer area and three interim temperature measurement points in each fluid stream. The unit has sufficient heat transfer area to demonstrate the classic counter current flow conditions where the outlet of the heated stream is hotter than the outlet of the cooled stream.

Features:

- A small scale Tubular Heat Exchanger system for use with an Computer Controlled Armfield Heat Exchange Service Unit to teach the fundamental concepts of heat exchangers
- Comprises a number of sections of concentric tubes, the outer section constructed from clear acrylic for visibility and the inner tube from stainless steel
- The tubes are easily dismantled for cleaning
- A comprehensive instruction manual is included

Software inc

Extended Reconfigurable Plate Heat Exchanger – HT37X

Requirements

HT 30X

The HT37X is designed to be reconfigurable by the student and can accommodate up to four sections of heating. Each section provides an additional temperature measurement point for each fluid stream.

In order to make the unit easy to reconfigure, these sections are supplied as pre-assembled groups of plates complete with an intermediate plate (containing the temperature measurement points). Using the four heating sections provided, students can compare heat exchangers of different heat transfer area and different numbers of passes. A quick release clamp system enables the different arrangements to be changed quickly and easily without using tools.

Features:

- A small scale plate heat exchanger system for use with an Armfield Computer Controlled Heat Exchange Service Unit to teach the fundamental concepts of heat exchangers
- Comprises a number of stainless steel plates, each with a pressed chevron pattern and a food grade silicon rubber sealing gasket, mounted in a frame
- Easily dismantled for cleaning
- A comprehensive instruction manual is included

Link to remote access

Computer Control & Remote Access

Computer control is so much more than just datalogging a sensor!

Armfield's range of computer-controlled products, provide not only real time monitoring and datalogging, but additional computer control of multiple variables used when undertaking experimentation

This control is already available for remote access and distance learning in many Armfield products

Remotely enabling Armfield products

- Using standard IT equipment, such as a laptop or computer, it is relatively straight forward to extend the connectivity of the Armfield software to a remote location
- Distance learning is achieved by utilising TeamViewer, Microsoft teams or an alternative 3rd party collaboration software which allows the end user to take control of the local PC
- Using standard, IT hardware such as web camera's remote users and clearly see individual elements of the Armfield equipment, the only limitation to the number of cameras installed is the number of supported USB ports on the local PC/Laptop. Utilising standard USB Hubs can extend the number of USB devises if there is a hardware limitation on the local PC/Laptop
- The standard windows camera application is used to view the web camera feeds
- The collaboration software extends the capability of our existing software from a 1-to-1 local connection to 1-to-many network connections. **(The key benefit here would be to allow enhanced social distancing in a local environment with multiple local users able to view the Armfield software)**
- The onus is on the end user to install and provide support for any 3rd party collaborative software. Although Armfield can offer this as a chargeable professional service

HT SERIES

Link to HT Series

Heat Transfer

Computer Controlled Heat Transfer

A range of small scale heat transfer equipment to demonstrate the three basic modes of heat transfer *(conduction, convection and radiation).*

Full educational software :
Provided with the HT10X for all the Armfield heat transfer accessories

A full ArmBus educational software suite is provided with the HT10X for all the Armfield heat transfer accessories.

Individual experiment interfaces and displayed data types vary to match selected experiment accessories.

Embedded software based PID control of heater and water flow control enabling steady state to be achieved in less than two minutes.

armBUS NetCan, connects up-to 20 users to one piece of equipment

Software Inc

Computer-Controlled Heat Transfer Service Unit - HT10X

The Armfield HT10X PC controlled heat transfer service unit is utilised in conjunction with a wide range of modular, small-scale experiment accessories in order to demonstrate several modes of heat transfer.

The factors that affect heat transfer can be investigated and some of the practical problems associated with the transfer of heat can be visualised.

The modular heat transfer experiments may be individually connected to the HT10X service unit, which provides the necessary electrical supplies and measurement facilities for investigation and comparison of the different heat transfer characteristics.

Features:

- Small-scale, computer control bench top equipment
- Multiple accessories available covering a wide range of heat transfer investigations
- Educational software, including mimic diagrams, real-time control, data logging and graph plotting
- Connects armBUS via USB

Requirements

HT 10X
COLD
1Ph

Requirements

HT 10X

COLD

1Ph

Linear Heat Conduction - HT11X

The accessory comprises a heating section and a cooling section, which is clamped together or clamped with interchangeable intermediate sections between them, as required.

The temperature difference created by the application of heat to one end of the resulting wall and cooling at the other end results in the flow of heat linearly through the wall by conduction.

Demonstration Capabilities:

- Understanding the use of the Fourier rate equation
- Measuring the temperature distribution for steady-state conduction of energy through a uniform plane wall and a composite plane wall
- Overall heat transfer coefficient for differing materials in series
- Determining the constant of proportionality (thermal conductivity k) of different materials (conductors and insulators)
- Relationship of temperature gradient to cross-sectional area
- Effect of contact resistance on thermal conduction
- Understanding the application of poor conductors (insulators)
- Observing unsteady-state conduction (qualitative only)

Software inc

Requirements

HT 10X

COLD

1Ph

Radial Heat Conduction - HT12X

The arrangement, using a solid metal disk with temperature measurements at different radii and heat flow radially outward from the centre to the periphery, enables the temperature distribution and flow of heat by radial conduction to be investigated.

On the HT12X the heater power and the cooling water flow rate are regulated by PID controlled via the HT10X via the computer software.

The accessory comprises a solid disk of material, which is heated at the centre and cooled at the periphery to create a radial temperature difference with corresponding radial flow of heat by conduction.

Demonstration Capabilities:

- Understanding the use of the Fourier rate equation in determining rate of heat flow through solid materials
- Measuring the temperature distribution for steady-state conduction of energy through the wall of a cylinder (radial energy flow)
- Determining the constant of proportionality (thermal conductivity k) of the disk material

Software inc

Laws of Radiant Heat Transfer & Radiant Heat Exchange - HT13X

The equipment supplied comprises an arrangement of energy sources, measuring instruments, aperture plates, filter plates and target plates, which are mounted on a linear track, in different combinations to suit the particular laboratory teaching exercise chosen

Demonstration Capabilities:

- Inverse-square law using the heat source and radiometer or light source and light meter
- Stefan-Boltzmann law using the heat source and radiometer
- Determination of the View Factor
- Emissivity using the heat source, metal plates and radiometer
- The Inverse Square Law for Light
- Kirchhoff's circuit laws using the heat source, metal plates and radiometer
- Area factors using the heat source, aperture and radiometer
- Lambert's Cosine Law using the light source (rotated) and light meter
- Lambert's law of absorption using the light source filter plates and light meter

Requirements

HT 10X

COLD

1Ph

HT14X Heated Cylinder with Guard

Combined Convection and Radiation – HT14X

The HT14X is one of a range of small scale heat transfer laboratory teaching accessories which demonstrate the basic modes of heat transfer (conduction, convection and radiation).

The equipment consists of a centrifugal fan with a vertical outlet duct. At the top of the duct there is a heated cylinder.

The mounting arrangement for the cylinder in the duct is designed to minimise loss of heat by conduction to the wall of the duct.

Experimental Capabilities:

- Determining the combined heat transfer (Q radiation + Q convection) from a horizontal cylinder in natural convection over a wide range of power inputs and corresponding surface temperatures
- Measuring the domination of the convective heat transfer coefficient Hc at low surface temperatures and the domination of the radiation heat transfer coefficient Hr at high surface temperatures
- Determining the effect of forced convection on the heat transfer from the cylinder at varying air velocities

Requirements

HT 10X

COLD

1Ph

Requirements

HT 10X

COLD

1Ph

Extended Surface Heat Exchanger – HT15X

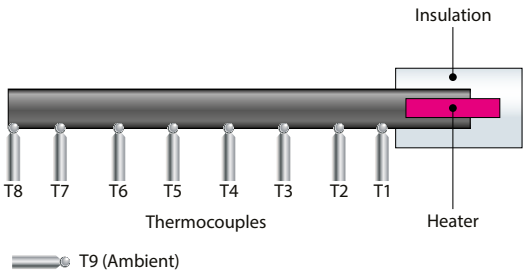
A long horizontal rod, which is heated at one end, provides an extended surface (pin) for heat transfer measurements.

Thermocouples at regular intervals along the rod allow the surface temperature profile to be measured.

The rod is manufactured from brass and coated with a heat-resistant matte black paint, which provides a consistent emissivity close to unity. It is mounted horizontally with support at both ends positioned to avoid the influence of adjacent surfaces.

Experimental Capabilities:

- Measuring the temperature distribution along an extended surface (pin) and comparing the result with a theoretical analysis
- Calculating the heat transfer from an extended surface resulting from the combined modes of free convection and radiation heat transfer and comparing the result with a theoretical analysis
- Determining the constant of proportionality of the rod material (Thermal Conductivity K)



Requirements

HT 10X

COLD

1Ph

Radiation Errors in Temperature Measurement – HT16X

The Radiation Errors in Temperature Measurement accessory comprises a tubular metal duct through which air, at ambient temperature, is blown vertically upwards by a centrifugal fan.

The velocity of the air can be changed by adjusting a throttle plate at the fan inlet and measured by an anemometer in the fan outlet duct.

Thermocouples indicate the wall temperature at the heated end of the duct and the temperature of the air stream before it reaches the heater section.

Three test thermocouples are suspended at the centreline of the heated section. A radiation shield may be positioned to shield these from the heated duct wall.

Experimental Capabilities:

- Errors associated with radiative heat transfer:
  - Effect of wall temperature on measurement error
  - Effect of air velocity on measurement error
  - Effect of thermocouple style on measurement error
- Methods for reducing errors due to radiation:
  - Design of a radiation-resistant thermometer
  - Use of a radiation shield to surround the thermometer

Heated Cylinder with Guard

Unsteady-State Heat Transfer – HT17X

Requirements: HT 10X | COLD | 1Ph

The HT17X equipment consists of a heated water bath together with a set of instrumented shaped test pieces. Each of the shapes incorporates a thermocouple to measure the temperature at the centre of the shape.

Analytical solutions are available for temperature distribution and heat flow as a function of time and position for simple solid shapes, which are suddenly subjected to convection with a fluid at a constant temperature.

Simple shapes are provided together with appropriate classical transient-temperature/heat-flow charts, which enable a fast analysis of the response from actual transient measurements. Each shape is allowed to stabilise at room temperature then suddenly immersed in a bath of hot water at a steady temperature.

Monitoring of the temperature at the centre of the shape allows analysis of heat flow using the appropriate transient-temperature/heat-flow charts provided.

Experimental Capabilities:

- To observe unsteady state conduction of heat to the centre of a solid shape, when a step change is applied to the temperature at the surface of the shape
- Using analytical transient-temperature/heat flow charts to determine the conductivity in cylinders with different conductivity
- Investigating the effect of shape, size and material properties on unsteady heat flow using analytical transient-temperature/heat flow charts

HT17X Sphere shape

Thermo-Electric Heat Pump - HT18X

Requirements: HT 10X | COLD | 1Ph

Based on a Peltier device, the Armfield HT18X Thermo-Electric Heat Pump demonstrates how electrical power can be used to extract heat from a cool surface and transfer it to a hot surface.

This effect is becoming widely used for point cooling (e.g. of semiconductor devices) and small-scale volumetric cooling.

Experimental Capabilities:

- Performance of a Peltier device as a cooler
- Heat transfer characteristics as a function of temperature and drive current
- Measurement of the coefficient of performance
- Energy balance
- Demonstration of a Peltier device as an electrical generator

HT18X Experiment chooser and calculation screens

Requirements

HT 10X

COLD

1Ph

Free and Forced Convection - HT19X

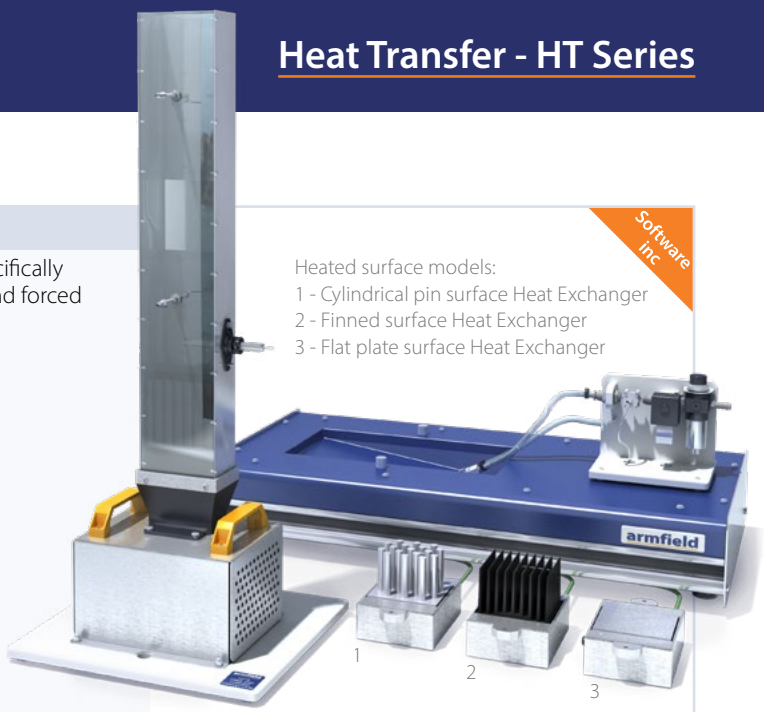
The Armfield Free and Forced Convection unit has been specifically designed to demonstrate the phenomena of natural (free) and forced convection.

Experimental Capabilities:

- Relationship between surface temperature and power input in free convection
- Relationship between surface temperature and power input in forced convection
- Understanding of the use of extended surfaces to improve heat transfer from the surface
- Determining the temperature distribution along an extended surface
- Comparing characteristics of a vertical and horizontal flat plate in free convection
- Determining the characteristic velocity, the Reynolds, Grashof and Rayleigh numbers for a flat plate in free convection
- Calculation of the average heat-transfer coefficient of the pinned heater in forced convection
- Comparing horizontal and vertical configurations for a finned exchanger in free convection

Software inc

Heated surface models:
1 - Cylindrical pin surface Heat Exchanger
2 - Finned surface Heat Exchanger
3 - Flat plate surface Heat Exchanger



Requirements

HT 10X

COLD

1Ph

Conductivity of Liquids and Gases - HT20X

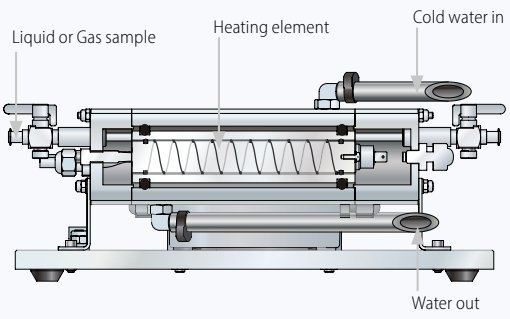
The Armfield Conductivity of Liquids and Gases unit has been specifically designed to enable students to measure and compare the thermal conductivities of various liquids and gases.

It's designed to facilitate quick and effective cleaning and to minimise thermal losses.

Experimental Capabilities:

- Understanding the use of the Fourier rate equation in determining the rate of heat flow by conduction through liquids or gases
- Measuring the constant of proportionality (the thermal conductivity k) of different liquids such as water and glycerol
- Calibrating the unit for heat losses using a gas, such as air with known thermal conductivity, then measuring the temperature difference across different gases, such as carbon dioxide and helium to determine their thermal conductivity k

Note: *Flammable, explosive, corrosive or toxic liquids and gases must not be used in the equipment.*



Software inc

Link to TH Series

TH SERIES

Thermodynamics

The TH range is designed to introduce the fundamental principles of thermodynamics to the student.

This range of equipment starts at basic concepts such as temperature and pressure measurement and leads on to introducing the relationships between these fundamentals, the first and second law of thermodynamics, the principles of reversibility, entropy, enthalpy etc.

The equipment allows the student to gain a true understanding of these principles.

and Dropwise Condensation Unit

armBUS Software Supplied with unit:
Screen shows mimic diagram and real time sensor information

Film and Dropwise Condensation Demonstration Unit - TH6

The unit has been designed as a highly visual means for students to observe the two condensation processes and study the effects of varying the vacuum and heat input whilst gathering data concerning temperatures, pressure and flowrates to be able to undertake a variety of calculations involved in the condensation process. Additionally, the unit will allow the operator to understand the influence of air as a non-condensable gas on the condensation processes.

Using the latest ArmBUS technology to collect, display and store data in a clear format as well as control certain parameters. Other parameters can be controlled manually by the student by manipulation of valves on the working face of the unit.

Safety features are also designed into both software and hardware to greatly reduce the risk of over-pressurisation and thus safeguard students undertaking experimental work.

Requirements

Requirements

1Ph

Temperature Measurement and Calibration - TH1

The Temperature Measurement and Calibration apparatus that has been designed to introduce students to temperature and how different techniques can be employed to measure this variable.

The system is supplied with three different heat sources and five different temperature sensors.

To demonstrate the thermometric properties of different temperature sensors and the use of fixed points for calibration.

Educational Software & Data logging is optionally available - **TH-DTA-ALITE**

Requirements

1Ph

Pressure Measurement and Calibration - TH2

The Pressure Measurement and Calibration apparatus has been designed by Armfield to introduce students to pressure and how different techniques can be employed to measure this variable.

Different fixed pressures are generated using a simple dead-weight pressure calibrator for calibrating the measuring devices. A Bourdon-type pressure gauge and electronic-type pressure sensor are connected to the calibrator to allow their characteristics, including accuracy and linearity, to be determined.

Educational Software & Data logging is optionally available - **TH-DTA-ALITE**

Requirements

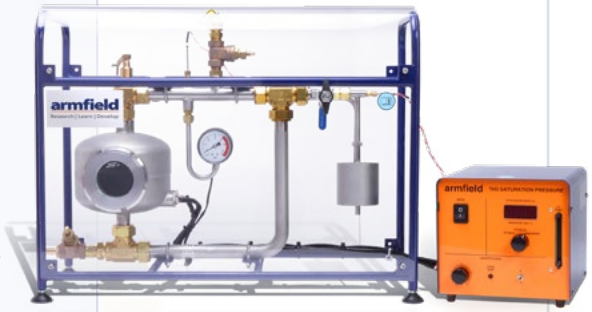
1Ph

Saturation Pressure - TH3

The Saturation Pressure apparatus that has been designed to introduce students to the concept of saturation pressure and how different techniques can be employed to measure this variable.

The system allows students to investigate the behaviour of a fluid at its boiling point and how the temperature varies with pressure. It also provides the capability to determine the condition of the wet steam produced by the apparatus. Saturation curves can be obtained and compared with published steam tables.

Educational Software & Data logging is optionally available - **TH-DTA-ALITE**



Requirements

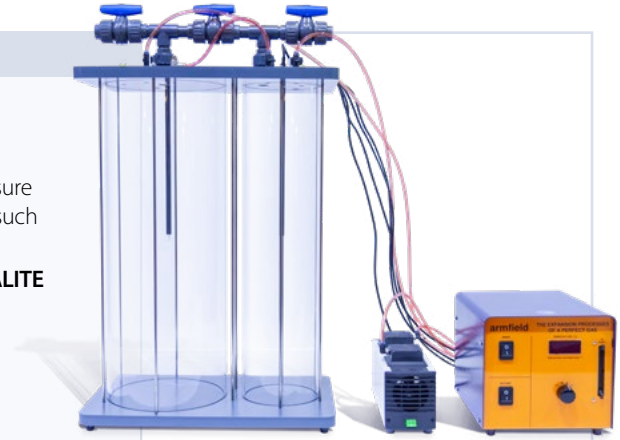
1Ph

Expansion Processes of a Perfect Gas - TH5

The TH5 Expansion Processes of a Perfect Gas apparatus that has been designed to introduce students to a range of basic thermodynamic processes using air as the working fluid.

The system enables investigation into the behaviour of a gas under pressure and vacuum, to determine the ratio of specific heats. Includes concepts such as Adiabatic, Isothermal, Reversible and Irreversible Processes.

Educational Software & Data logging is optionally available - **TH-DTA-ALITE**



RA SERIES Refrigeration & Air Conditioning

The Armfield RA series is designed to clearly demonstrate the principles behind modern refrigeration and air conditioning systems.

The series includes four separate units:

- RA1-MKII Vapour-Compression Refrigeration Unit
- RA2 Air Conditioning Unit
- RA3 Recirculating Air Conditioning Unit
- RA4 Air Conditioning Training Unit

Link to RA Series

Vapour-Compression Refrigeration Unit - RA1-MKII

The Vapour-Compression Refrigeration System is the most common refrigeration system used today.

RA1-MKII is a computer-controlled vapour-compression refrigeration unit with automatic recording of appropriate process variables using an integral USB interface device.

This allows the student to gain a thorough understanding of the refrigeration process by changing the operation of different parts of the process and recording the response of the complete system.

- Computer controlled with real time data logging of results

Requirements

- 1Ph
- PC
- USB

Requirements

1Ph

PC

USB

Air Conditioning Unit - RA2

The Armfield RA2 Unit represents a model of an Air Conditioning system by demonstrating the effects of essential Air Conditioning processes:

- Cooling
- Heating
- Humidifying
- Dehumidifying

The effect and relationships of the primary processes involved in air handling systems can be investigated. The RA2 Unit is designed so that the student can simulate different environments and perform measurements to allow psychrometric data analysis.

The unit is totally self-contained and is supplied with software and a computer interface device to allow remote control, on-line monitoring and logging of results. The software also includes an online Help Text detailing each of the exercises defined in this manual.

Computer controlled with real time data logging of results

Software inc

Requirements

1Ph

PC

USB

Recirculating Air Conditioning Unit - RA3

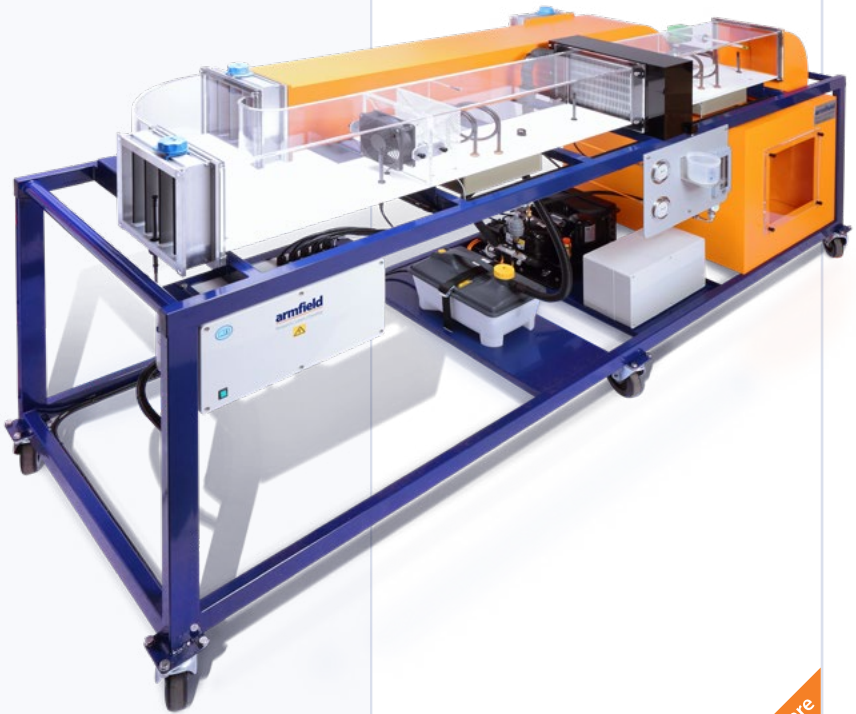
The Armfield RA3 unit represents a model of a recirculating air conditioning system by demonstrating the effects of essential air conditioning processes: cooling, heating, humidifying and dehumidifying.

The effect and relationships of the primary processes involved in air handling systems can be investigated.

The system additionally features an enclosed climate control chamber, adjustable recirculation of air leaving the chamber back into the conditioning duct and pressure gauges and temperature sensors to allow the refrigerant temperature change across the condenser and evaporator to be established.

The refrigerant flow rate is also measured using a variable area flow meter.

Computer controlled with real time data logging of results



Software inc

Link to CM Series

CM SERIES

Internal Combustion Engines

Armfield's range of internal combustion engines encompasses automotive and aviation power units, mounted on test beds they provide a complete engine learning system.

CM14 comes with ArmSoft software, which can be used to run the engine from a PC.

The software incorporates the full range of facilities as outlined in the ArmSoft software section.
CM20 has the armBUS control system integrated into the product see armBUS page.

CM14 Floor stand option

Software inc

Axial Flow Gas Turbine - CM14

The CM14 is a complete, aeronautical axial flow gas turbine engine with full instrumentation and sensors.

Those sensors measure the gas temperature and pressure at different stages within the engine, together with the thrust generated and the fuel consumption.

It features simple electric starting with no requirement for propane gas or compressed air.

The turbine itself can be bench mounted and incorporates a transparent safety guard for full visibility.

The unit's small size minimises the laboratory space required.

The control box can be located in an adjacent room if required.

Available Options: With Floor Stand **CM14-10**

Requirements

- 1Ph
- PC
- USB
- EXTRACTOR
- HEARING PROTECTION

CM20 – Single-Cylinder Combustion Engine

The Armfield CM20 Single Cylinder Engine Range provides a self-contained engine test rig that enables students to investigate a range of engine performance characteristics.

The unit is designed to be linked to the user's computer or touch screen, linked to Armfield's supplied software with sophisticated control and data acquisition.

Requirements

1Ph
PC
USB
EXTRACTOR
HEARING PROTECTION

Single Cylinder Combustion Engine - CM20 – armBUS integrated

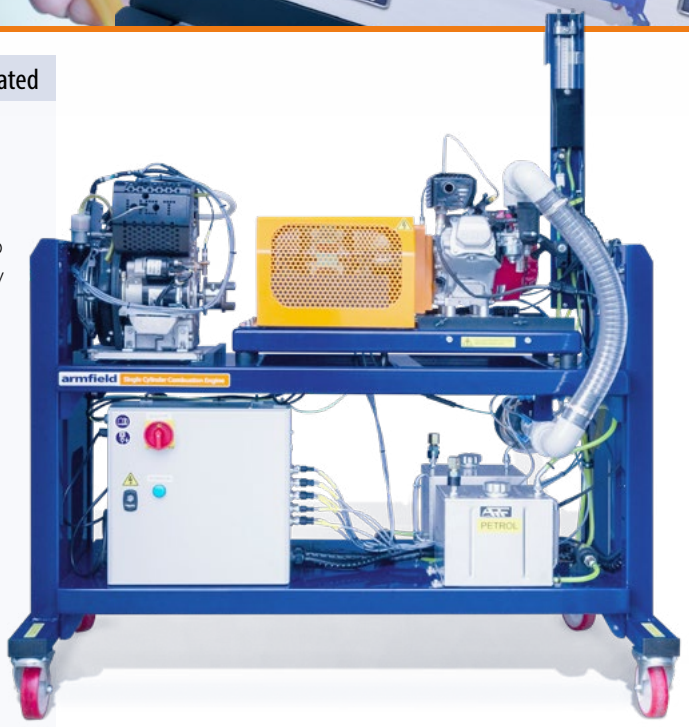
The Gasoline Engine Apparatus is a self-contained computer controlled engine test rig which has been designed to allow the study and comparison of the basic operating characteristics of modern spark ignition and compression ignition engines.

The unit consists of a selection of engines which can be coupled to an eddy current dynamometer which acts as a brake. This assembly is mounted on a painted steel framework. Fuel tanks, electrics and batteries are all mounted underneath the engine.

Available options include an engine indicator set which allows cyclic measurement of cylinder pressure.

Available Options:

- Petrol Engine with Electrical Start CM20-10-1
- Petrol Engine Indicator Set CM20-10-12
- Diesel Engine with Electrical Start CM20-20-1
- Diesel Engine Electrical Start Sensor Prep CM20-20-3
- Diesel Engine Indicator Set CM20-20-12
- Pressure Sensor Amp CM20-12-12
- Fuel Level CM20-30
- 5 Gas Analyser CM50



CM20 loaded with electric start dieseland petrol engines (shown with options)

Link to CE Series

CE SERIES

Chemical Engineering

Armfield's CE and UOP ranges of products, offer the most comprehensive, diverse and technically current group of products of any manufacturer.

The CE range brings the many principles of chemical engineering to the modern educational laboratory.

Computer Controlled Chemical Reactors Training Equipment - CEXC

The Armfield CEXC Computer Controlled Chemical Reactors Teaching Equipment demonstrates the characteristics of the important types of chemical reactors. The self-contained benchtop service unit is designed to provide services for up to five different chemical reactors:

- Continuous stirred tank reactor
- Tubular reactor with plug
- Transparent batch reactor
- Plug flow reactor
- Laminar flow reactor

Requirements

Requirements

CEXC

Continuous Stirred Tank Reactor - CEM-MKII

The continuous stirred tank reactor is used widely and is particularly suitable for liquid phase reactions. It is particularly used in the organic chemicals industry. Advantages include consistent product quality, straight forward automatic control and low manpower requirements.

The Continuous Stirred Tank Reactor is specially designed to allow detailed study of this important process. It is one of five reactor types which are interchangeable on the Reactor Service Unit (CEXC).

Reactions are monitored by a conductivity probe as the conductivity of the solution changes with conversion of the reactants to product and by temperature.

Chilled Water Circulating Unit - CW-17 (*Optional*)

Requirements

CEXC

Tubular Reactor - CET-MKII

Tubular reactors are often used when continuous operation is required but without back-mixing of products and reactants.

The Tubular Reactor is specially designed to allow detailed study of this important process. It is one of five reactor types which are interchangeable on the Reactor Service Unit (CEXC).

Reactions are monitored by a conductivity probe as the conductivity of the solution changes with conversion of the reactants to product.

This means that the inaccurate and inconvenient process of titration, which was formally used to monitor the reaction progress, is no longer necessary.

Transparent Batch Reactor - CEB-MKIII

Requirements

CEXC

Batch reactors are used widely in industry at all scales. Batch reactors are tanks, commonly provided with agitation and a method of heat transfer (usually by coils or external jacket).

This type of reactor is primarily employed for relatively slow reactions of several hours' duration, since the downtime for filling and emptying large equipment can be significant. Agitation is used to maintain homogeneity and to improve heat transfer.

The Transparent Batch Reactor is specially designed to allow detailed study of this important process. It is one of five reactors types which are interchangeable on the Computer Controlled Reactor Service Unit (CEXC).

Reactions are monitored by a conductivity probe as the conductivity of the solution changes with conversion of the reactants to product and visually due to the use of indicators.

Chilled Water Circulating Unit - CW-17 (*Optional*)

CEB-MKIII mounted on the service unit

Plug Flow Reactor - CEY

Requirements

CEXC

The Plug Flow Reactor is an example of an ideal tubular reactor.

It demonstrates step and pulse changes for plug flow characterisation and steady-state conversion for a second order reaction. It is a tubular packed column reactor made of clear acrylic and mounted on a steel frame.

A static premixer at the bottom of the column provides premixing of the reagents entering the reactor and improves the flow distribution. It is one of five reactor types which are interchangeable on the Computer Controlled Reactor Service Unit (CEXC).

Reactions are monitored as the conductivity of the solution changes with conversion of the reactants to product. In addition, all the experiments are followed visually by means of the reactor transparency and the use of colour indicators in all the experiments.

Laminar Flow Reactor - CEZ

The Laminar Flow Reactor is an example of an ideal tubular reactor.

It demonstrates step and pulse changes for plug flow characterisation and steady-state conversion for a second order reaction.

A tubular reactor made of clear acrylic and mounted on a floor standing steel frame, with two diffusers packed with glass beads located at the ends. A static premixer at the bottom of the column provides premixing of the reagents entering the reactor and improves the flow distribution. It is one of five reactor types which are interchangeable on the Computer Controlled Reactor Service Unit (CEXC).

Reactions are monitored as the conductivity of the solution changes with conversion of the reactants to product. In addition, all the experiments are followed visually by means of the reactor transparency and the use of colour indicators in all the experiments.

Chilled Water Circulating Unit - CW-17 (*Optional*)

Requirements

1Ph

PC

USB

Stirred Tank Reactors in Series - CEP-MKII

The Stirred Tank Reactors in Series unit is designed to demonstrate the mechanism of a chemical reaction in series connected continuous stirred tank reactors as well as the effects of varying the process conditions such as stirring rate and feed rate.

The conductivity of the reacting solution in the reactors changes with the degree of conversion and this provides a convenient method for monitoring the progress of the reaction either manually or by computer.

Experimental content:

- Investigation of dynamic behaviour of stirred tank reactors in series
- Effect of step input change
- Response to an impulse change
- Influence of flow rate
- Investigation of time constant using a dead time coil
- Investigation of chemical reaction in a three-tank system

Requirements

1Ph

PC

USB

Catalytic Reactors - CEU

The Armfield catalytic reactor demonstrates the principles of packed bed catalysis.

The unit is fitted with two reactor columns as standard which are used to demonstrate chemical catalysis. A third column, which is available as an option, uses a biological enzymic catalyst.

CEU can be used to examine steady state and unsteady state reactor performance, to compare chemical and biological catalysis (requires CEU-5 option), to characterise the flow in a packed bed, to determine the relative effects of rate of diffusion and reaction rate (Thiele modulus), and to demonstrate the principles of flow injection analysis (requires CEU-3 option).

The supplied software allows experimental data logging and also takes the student through each of the exercises defined in the Laboratory Teaching Exercises.

Available options: Flow Injection Analysis Accessory **CEU-3**
Third Reaction Column **CEU-5**

Fixed and Fluidised Bed Apparatus - CEL-MKII

Requirements: 1Ph, PC, USB, COMP. AIR

The Armfield CEL-MKII is designed to facilitate the study of flow through fixed and fluidised beds of solid granules.

Low flowrates allow the characteristics of a solid bed to be investigated. Increasing flowrates allow the onset of fluidisation and the characteristics of a fluidised bed to be investigated.

The CEL-MKII has three test columns, one for use with water and two for use with air.

With granules of the same size in the water column and one air column, the differences between 'particulate' and 'aggregative' fluidised beds can be demonstrated.

The two air columns allow the effect of different granule sizes to be demonstrated without having to remove, empty and re-pack a column.

Electronic instrumentation is incorporated allowing all relevant flowrates and differential pressures to be displayed.

A USB connector allows the measured variables to be viewed and logged on a PC using the software supplied.

Optional Accessory:
Air Compressor **AC1**

Software inc

Fluid Mixing Studies - CEK-MKII

Requirements: 1Ph, PC, USB, HOT

Mixing of liquid/liquid or solid/liquid systems is a complex operation to analyse and subject to many variables. The choice of mixer for a particular application depends on the degree of bulk movement or shear mixing required by the process.

The CEK-MKII can be used to predict the power consumption of a full-sized mixer by equating Reynolds' number and Froude number. The effect of blade size, geometry and the effect of baffles in the mixing vessel are also investigated.

Effect of change in liquid viscosity or liquid density can be demonstrated by changing the liquid in the mixing vessel. An optional heat transfer coil with temperature sensor and meter is available that can be used to vary the characteristics of the liquid by raising or lowering the temperature of the liquid.

A suitable hot water circulator (not supplied) or chiller (not supplied) can be connected to the coil using flexible tubing to affect the required change in temperature.

Optional Accessories: Heat Transfer Coil Option **CEK-MkII-3**
Chilled Water Circulating Unit **CW-17**

Requirements

1Ph

Corrosion Studies Kit - CEQ

The CEQ provides an introduction to corrosion, a significant factor in determining durability and safety of industrial processes.

The unit allows students to recognise and make provisions for potentially corrosive situations.

The equipment allows for the simultaneous study of up to eight corrosion cells. A pH meter and electrode are supplied to ensure the correct strength of initial test solutions.

For the study of electro-chemical corrosion effects, a low voltage supply is included, together with all necessary electrical connections.

Requirements

PC

USB

1Ph

Mass Transfer and Diffusion Coefficients - CERa-MKII

This item of laboratory equipment have been designed to enable measurement of molecular diffusivities. They are used to familiarise students with the basic notions of mass transfer theory.

The CERa-MKII utilises a high-definition digital microscope linked to a PC to observe and measure the movement of the phase boundary of the liquid inside a capillary tube as the liquid diffuses into stationary air. The time-lapse recording facility in the software and the use of a heated block rather than a water bath means that the equipment can be left unattended for extended periods.

This allows measurements to be carried out using different liquids to especially liquids such as water with a low diffusion coefficient.

Requirements

PC

USB

1Ph

Mass Transfer and Diffusion Coefficients CERb

This item of laboratory equipment have been designed to enable measurement of molecular diffusivities. They are used to familiarise students with the basic notions of mass transfer theory.

The CERb consists of a honeycomb of accurately dimensioned capillaries, positioned between two liquids of differing concentration of solute whose diffusion coefficient is to be determined.

The solute is stirred by a battery-operated magnetic stirrer. Conductivity of the vessel contents is monitored using the supplied conductivity meter and electrode. The change in conductivity with time is used to determine the Diffusion Constant for the salt solution tested.

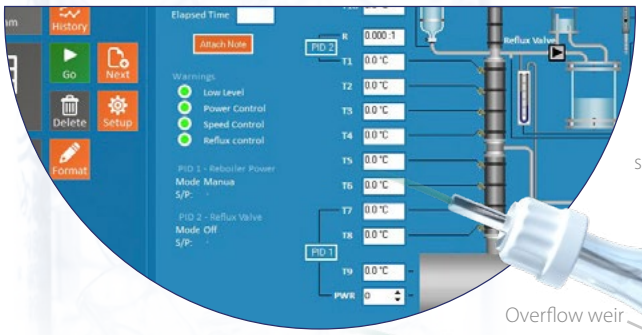
Link to UOP Series

UOP SERIES

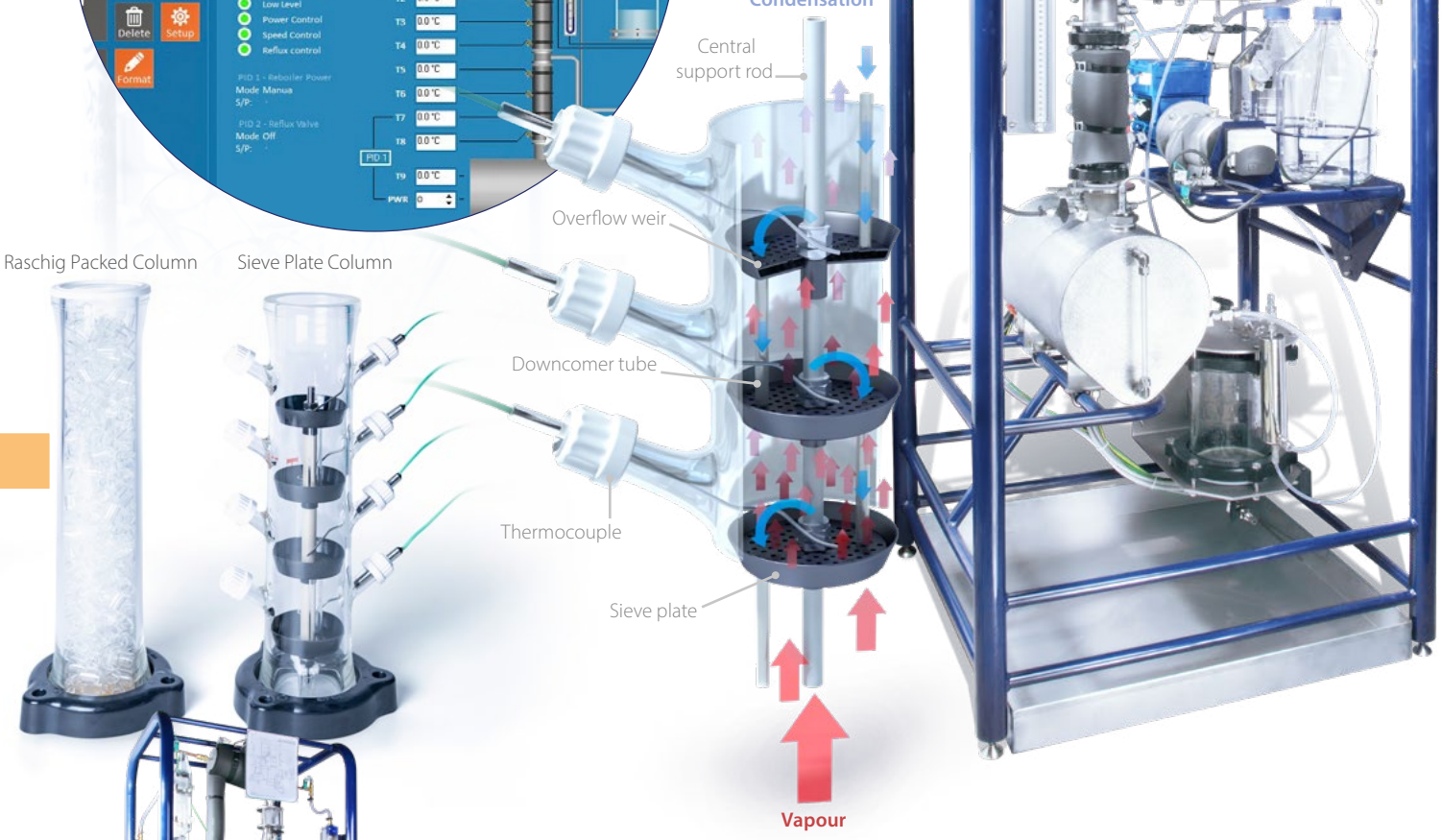
Unit Operations

The Armfield Unit Operations range provides a series of products designed to allow in depth teaching and investigation into the individual basic steps in a process relating to Chemical Engineering and associated fields.

Each product can be considered to have a single function in a process which potentially has multiple steps, involving a physical change or chemical transformation such as separation, crystallization, evaporation, filtration, distillation, extraction, absorption and drying.



Mimic software screen supplied with **UOP3CC**



Software inc

Distillation Columns - UOP3CC & UOP3BM

Two laboratory-scale distillation columns enabling safe operation of a real industrial process.

UOP3CC: A continuous distillation column, which also performs batch experiments, can be controlled manually or externally by a PC. Individual loops can be controlled using an industrial PLC or a PID controller.

UOP3BM: A batch-only version is suitable for teaching the fundamentals of distillation. Both versions incorporate flameproof devices and intrinsically safe circuits plus feature plate and packed columns together with the display of temperatures on each of the eight sieve plates in the column.

Requirements

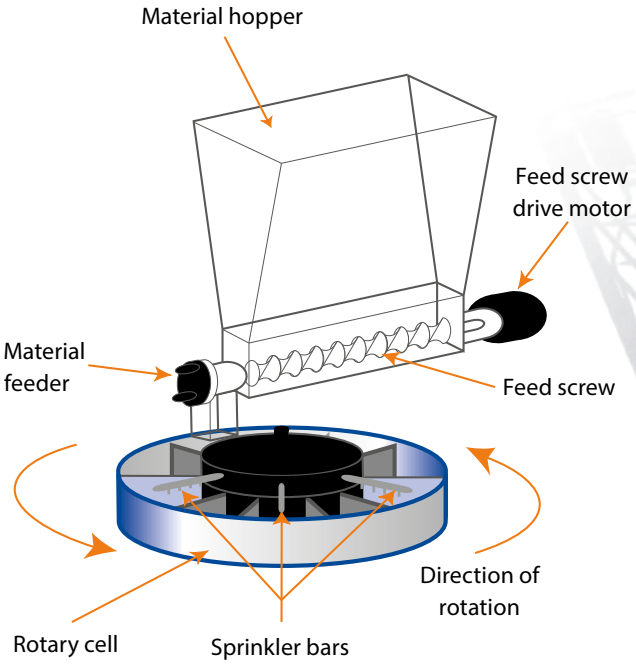
1Ph
PC
USB
COLD
SAFEVENTING

The Armfield UOP4-MKII - Laboratory-Scale Solid/Liquid Extractor System

The equipment utilises a sophisticated, continuous feed, counter-current flow, multiple-stage, rotary extractor system of the type frequently seen in industrial applications. This gives the student an insight into the practical implementation of the operation, including process economics and control problems.

Experimental Capabilities:

- Demonstration of the operation of a continuous multiple-stage process
- Closed-circuit percolation extraction (batch extraction)
- Open-loop percolation extraction (continuous operation)
- Investigation of continuous extraction in 1, 2 or 3 steps
- Investigation into effect of solvent temperatures
- Investigation into effect of solvent flow rates
- Investigation into effect of processing time
- Process economics
- Mass balances



Mimic software screen supplied with **UOP4-MKII**

Requirements

1Ph

PC

USB

COLD

Solid-Liquid Extraction Unit - UOP4-MKII

The Armfield unit is designed to demonstrate a simplified version of the moving-bed leaching process used by many industrial solid/liquid extraction systems.

The process used is a continuous multi-stage process, which gives counter current flow of the solvent and the solid phase.

A batch extraction vessel is also incorporated to allow demonstration of fixed-bed leaching with either open or closed loop circulation of the solvent.

The effects of temperature, throughput rate and the effect multiple stages can all be investigated.

Software inc

The Armfield UOP5-MKII - Liquid-Liquid Extraction Unit

Liquid/liquid extraction is an important operation in chemical engineering where the separation of one or more of the components from a liquid mixture is required. Traditionally this has been difficult to demonstrate in the laboratory, requiring the use of highly toxic, expensive and/or environmentally damaging solvents.

The Armfield UOP5-MkII introduces a system using 1-Octanol or Canola oil which are safe, readily available and inexpensive.

Experimental Capabilities:

- Hydrodynamics of a packed liquid/liquid extraction column
- Differences in extraction performance using the organic phase or the aqueous phase as the continuous phase
- Investigation into the effect of changes in aqueous and organic flow rate
- Mass balances and the calculation of mass transfer coefficient
- Mass balances

Mimic software screen supplied with **UOP5-MKII**

Software inc

Liquid-Liquid Extraction Unit - UOP5-MKII

This unit provides an introduction to the operation of an industrial type of liquid/liquid extraction system.

A vertical column is used to contact two essentially immiscible liquids flowing counter-currently through Raschig ring packing. Either liquid can be selected to be the continuous phase.

Traditionally this has been difficult to demonstrate in the laboratory, requiring the use of highly toxic, expensive and / or environmentally damaging solvents.

The Armfield UOP5-MKII introduces a system using Kerosene (Paraffin) which is simple, safe and inexpensive.

Option: **AC1** (Air compressor)

Requirements

- 1Ph
- PC
- USB
- COLD
- COMP. AIR

The Armfield UOP7-MKII - Gas Absorption Column

The Armfield Gas Absorption Column has been designed to demonstrate the principles of gas absorption and to provide practical training in the operation of a gas absorption plant.

In the process of gas absorption, a gas or mixture of gases is contacted with a liquid, typically using a packed column. One or more components of the gas stream is absorbed, (dissolved), into the liquid stream.

Experimental Capabilities:

- Study of basic principles of the absorption of a gas into a liquid using a packed column
- Determination of loading and flooding points
- Study of hydrodynamic characteristics of a packed column
- Demonstration of physical and chemical absorption
- Investigation of the effectiveness of CO_2 absorption in pure water and in an aqueous solution
- Demonstration of gas desorption
- Determination of the mass transfer coefficient

Mimic software screen supplied with **UOP7-MKII**

Requirements

1Ph
PC
USB
COLD
CO_2

Gas Absorption Column - UOP7-MKII

A pilot-scale apparatus enabling familiarity with the characteristics of packed tower hydrodynamics and absorption processes.

The gas absorption column has been designed to demonstrate the process of gas absorption, desorption and stripping.

The Absorption Column is scaled so that teaching exercises can be completed in a typical laboratory class period, while at the same time capable of demonstrating full-scale plant behaviour.

The system is supplied as standard with electronic control of fluid flow, electronic measurement of CO_2 concentration and full computer control and data logging.

Software inc

3-Phase Horizontal Separator - UOP30

The Armfield 3-Phase Horizontal Separator is a small-scale unit capable of demonstrating the principles and operation of gravity separation and the effect of viscosity, flow characteristics and density difference on separation.

The UOP30 comes with two horizontal separator configurations interface/weir and bucket/weir making the UOP30 a versatile teaching unit.

The separation of two immiscible liquids and a gas using density difference is one of the most important process operations in the oil and gas industry.

Examples include separation of produced water and condensate from gas and the separation of gas and produced water from crude oil.

UOP30 armBUS-LCD-15.6 Touchscreen (Optional)

Requirements

1Ph
PC
USB
COLD
OIL

Rising Film Evaporator - FT22 (Data Logging Included)

A floor-standing unit using the steam-heated, climbing film principle to concentrate small quantities of liquid foods, either continuously or in batches.

The important process parameters can be varied and monitored.

The rising film evaporator consists of a vertical tube within a shell. Steam in the shell increases the temperature of product entering the tube at the base.

As product boils, vapour rises up the tube, carrying a film of concentrated liquor up the inside walls of the tube. At the top of the tube the vapour is separated from the liquor in a cyclone separator and the vapour is then condensed.

Concentration of:

- Juices (fruit and vegetable)
- Milk and milk products
- Extracts (non-flammable)
- Effluents
- Nutritional products

Features & Benefits:

- Small quantities of liquid products can be concentrated
- Easily cleaned and maintained
- Low product usage eases the disposal of waste
- Nominal throughput only 10 l/hr
- Single tube heat exchanger
- Integral CIP system
- Integral control console
- Integrated data logging and analysis

Requirements

1Ph
PC
USB

Requirements

3Ph
PC
USB
COLD
COMP. AIR

Filtration Unit - UOP12

The Filtration Unit has been designed to demonstrate the application of Darcy's Law of Filtration.

The unit is equipped with a fully functional Plate and Frame filter unit, the most commonly used dead end, batch filter design. As an option, a continuous, tangential flow filter is available which uses an industry standard, hollow fibre cartridge system.

In the case of batch filtration, measurement of operating pressure, volumetric flow rate and optical absorbance enables, cake and medium filtration resistances, benefits of filter aid, mass balancing and washing regimes to be investigated.

For tangential flow filtration, similar measurements enable membrane flux and transmission relationships and washing regimes to be examined.

The plate and frame filter press can be readily switched for the hollow fibre, tangential flow unit enabling both methods of filtration to be investigated in a short period of time.

Tangential Flow Filter Accessory - UOP12-10

Option: AC1 (Air compressor)

Requirements

1Ph
PC
USB
COLD

Crystallisation Unit - UOP14-MKII

The Crystallisation Unit is a teaching unit which demonstrates the principles of crystallisation using batch cooling crystallisation. The system may also be used in a continuous mode when used with the Armfield Crystallisation Feed Unit UOP14-11. It is possible to run two basic modes of operation using the following units:

Batch operation - UOP14-MKII only

Continuous operation - UOP14-MKII with UOP14-11

Crystallisation takes place inside a jacketed vessel with a stirrer and baffle. The temperature of the crystallisation reaction is varied by changing the temperature of water circulated through the jacket. Heating to dissolve the crystals is affected by passing the hot water from the hot water vessel into the jacket whilst cooling is achieved using the mains cold water supply directly without heating. Alternatively, a chilled water supply (CW-17) may be necessary if the local cold-water supply is not sufficiently cold to form crystals in the saturated solution.

The unit is supplied with PC software and incorporates a USB computer interface to allow on-line control and monitoring as well as data logging.

The optional Armfield continuous Crystallisation Feed Unit UOP14-11 is totally self-contained and consists of a feed tank with PID controlled heater and a peristaltic pump. This option can be added at any time to turn the UOP14-MKII Batch Crystalliser into a continuous system.

An optional Buchner vacuum filtration system (UOP14-12) can be used to remove crystals suspended in the solution.

Available accessories:

Continuous Feed Accessory - UOP14-11

Buchner Filtration Accessory - UOP14-12

Chilled Water Circulating Unit - CW-17

Computer Controlled Tray Dryer - UOP8-MKIIe

The most commonly used industrial method of drying solids in bulk consists of passing a hot air stream over fixed trays of wet material.

This small pilot-scale tray dryer uses this method and is designed for laboratory training programmes. Operating conditions may be varied in a way that provides data demonstrating both theoretical and practical aspects of industrial drying practice.

This equipment is applicable to the unit operations laboratory and also to food technology education and research. Experimental content includes:

- Demonstration of drying rate regimes
- Heat and mass transfer
- Drying tests on solids for industrial use
- Effect of temperature and air velocity on drying rates
- Use of psychrometric charts

Requirements

1Ph

PC

USB

Spray Dryer - FT30-MKIII

A simple and effective laboratory scale spray dryer for product research and development. The spray dryer is designed to enable initial product trials and evaluation to be carried out quickly and efficiently.

The unit is supplied with a complete set of glassware comprising of main drying chamber, cyclone, sample collection and waste collection bottles, clamps, seals and all necessary tubing.

The chemically resistant housing includes the blower, heater and the controls for inlet temperature and pump speed. The drying air volume is fixed at 70m^3/hr.

AC1 - Air compressor (Optional)

Requirements

1Ph

COMP. AIR

Requirements

1Ph
PC
USB
HE
CO_2

Fixed Bed Adsorption Unit - UOP15

The unit demonstrates the adsorption of a solute, carbon dioxide, from a binary gas mixture onto the surface of a solid adsorbent, activated carbon.

The adsorption and desorption/regeneration processes take place in a fixed bed adsorption column.

Educational Content:

- To study the absorption of the CO2 in a packed column containing activated carbon.

Requirements

1Ph
PC
USB

Basic Water Cooling Tower - UOP6-MKII

This basic water cooling tower has been specifically designed to give students an appreciation of the construction, design and operational characteristics of a modern forced draught evaporative cooling system.

The unit is also an excellent example of an open system through which two streams of fluid (water and air) flow in counter-current directions, with heat and mass transfer from one stream to the other.

The system is supplied as standard 1/3 height and 2/3 height packing in addition to full height packing for comparison.

The tower is fully instrumented with electronic sensors and is operated and controlled via a USB port on a PC.

UOP6-MKII-23 Packing Characteristics accessory (Optional)

Link to BE Series

BE SERIES

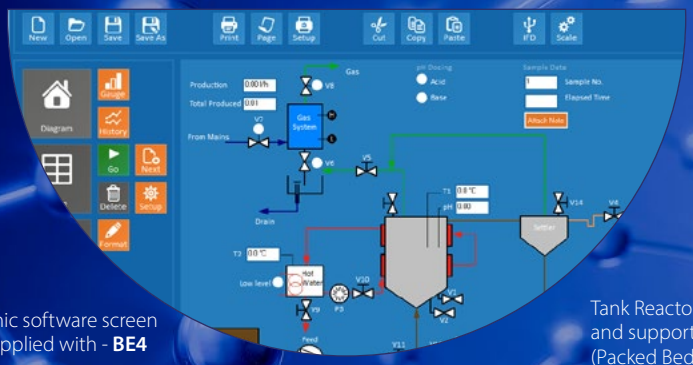
Biochemical Engineering

Biochemical Engineering is currently a growth area, attracting worldwide interest. Although many of the techniques and operations are common with Chemical Engineering, there are some important differences.

The BE series has four core products:

- BE1 Batch Enzyme Reactor
- BE2 Chromatography Unit
- BE3 Anaerobic Column Reactor
- BE4 Anaerobic Tank Reactor

Which together with CEU Catalytic Reactors from the CE series (pages 70-73), give students an introduction and understanding of important Biochemical Engineering principles.



Mimic software screen supplied with - **BE4**

Tank Reactor showing detail of bio-balls and supports, configured as **PBR** (Packed Bed Reactor)

Software inc

Anaerobic Tank Reactor - BE4

A self-contained, floor-standing anaerobic tank reactor, volume 20 litres, stirrer, motor and baffles are removable for non-stirred configurations.

- A self-contained, floor-standing anaerobic tank reactor, volume 20 litres
- Continuous stirred tank reactor (CSTR)
- Packed bed reactor (PBR)
- Upflow anaerobic sludge blanket reactor (UASB)
- Measures reactor temperature, jacket temperature and vessel pH
- Programmable logic controller (PLC) provides temperature control, pH control and gas collection (rate and totalisation) calculations
- Jacket heating system with pump and hot water vessel. Temperature is PID controlled room temperature to 55°C
- Automated volumetric gas collection system measures, which adds less than 10 mbar back pressure to the reactor
- Complete with automated pH dosing system to maintain the vessel pH within a predetermined range (user programmable)
- User calibration of pH and gas collection system
- Feed flow rates from 0.06-4.8 l/hr (using interchangeable peristaltic hoses)
- Gas sample point
- Data logger and software as standard (requires PC, not supplied)
- Stirrer, motor and baffles are removable for non-stirred configurations
- Variable depth liquid sampling point

Settling Reactor Tank BE4-1 (Optional)

An optional settler (BE4-1) is also available for the Anaerobic Tank Reactor BE4. Its function is to collect solid particles of biomass at the exit from the reactor for return to the reactor in the BE4. This biomass would otherwise be lost to the system.

Requirements

Requirements

1Ph

PC

USB

Batch Enzyme Reactor - BE1

A batch enzyme reaction system that utilises the industrially important glucose isomerisation reaction (converting glucose to fructose) catalysed by glucose isomerase.

The purpose of the unit is to demonstrate batch enzyme kinetics and enzyme characteristics.

The reaction takes place inside a stirred vessel where the stirrer itself is a porous basket inside which the enzyme is immobilised.

A polarimeter device, which is integral to the unit, monitors the glucose and fructose concentrations with time.

Requirements

1Ph

PC

USB

Chromatography Unit - BE2

Used to demonstrate the principles and practices of chromatography - an important operation for both small-scale analysis and large-scale production of biologics. BE2 features two chromatography columns of variable bed height, which are fed by a peristaltic pump.

An injection point enables samples to be introduced onto the column.

The unit has an on-line UV sensor for measuring protein concentration as it exits the column. The unit is also equipped with a timer-controlled fraction collector. Size exclusion chromatography is the primary separation technique used for the demonstrations.

Engineering principles, such as the effect of feed flow rate and bed height on process performance can be investigated.

Option:

Filtration/Degassing Assembly - BE2-1

Link to PCT Series

PCT SERIES

Process Control Technology

A range of process teaching equipment is available to demonstrate relevant measurement and control experiments using real engineering equipment.

The Armfield PCT range is designed on a building-block approach, which ensures that experimental set-ups can be assembled economically to meet individual course requirements.

Each practical work study system consists of a benchtop process demonstration unit and a control console, which contains the power supplies and interfacing for all measurement and actuation signals. Industrial controllers are available as accessories to further develop the practical instruction courses possible.

Additionally, the Essentials of Process Control (EPC) range of products takes students through the fundamentals and principles of process control, and progresses to give them a thorough grounding in the control of physical processes. Four independent process units demonstrate level, flow, temperature and pressure as the controlled variable.

The Process Plant Trainer incorporates an electrical console which provides access to the various signals associated with measurement and control of the process allowing a variety of control possibilities

Advanced educational software package included, which implements the control functions.

Process Plant Trainer - PCT23-MKII

The Process Plant Trainer can be used to demonstrate a complete range of process control methods and strategies.

Manual control, single feedback loops, through to sophisticated cascade loops and distributed supervisory control of the whole process by a remotely located computer can be demonstrated.

The system is a miniature replication of a true production process. The student is presented with real process control problems, with realistic dynamic behaviour and instabilities.

Requirements

PC

1Ph

USB

COLD

Requirements

PC

1Ph

USB

COLD

Multi-Function Process Control Teaching System - PCT40

The Armfield system is designed for use in teaching a wide range of process control methods. The PCT40 basic unit is used under computer control to demonstrate a variety of process control loops.

Processes such as level control, temperature control, flow control and pressure control can all be investigated, as can manual, on/off, proportional and PID control. The software included with the unit allows the student to change the control parameters and analyse the results from different configurations.

More advanced aspects of control can be addressed by adding optional extras to the basic system.

Requirements

PCT 40

Process Vessel Accessory - PCT41

The process vessel expands on the capabilities of the PCT40 with a wider range of control loops and strategies, including remote set points, dual loops and fluid property control (using conductivity as a representative example).

All these loops are under software control. It includes a stirrer with electric motor, as well as a second heating coil. It includes provision for the

pH probe accessory PCT42 (Optional)

Requirements

PCT 40

PCT 41

pH Sensor Accessory- PCT42

This conductivity probe can be used to demonstrate fluid property control systems, without the maintenance problems which can be experienced with pH probes.

However, as pH control is probably the most common industrial application of this type of control system, users may wish to implement true pH control loops.

This can easily be implemented by adding the PCT42 pH sensor accessory to the combined PCT40 + PCT41 system.

Requirements

PCT 40

PCT 41

1Ph

Electronic Control Console - PCT43

The PCT43 is an electronic control console that can be used to control the PCT40, PCT41 and PCT42 instead of a computer. It includes controls for the pumps, valves and heater, plus a display for the sensors.

It incorporates a commercial PID controller, complete with RS232 interface. Other facilities include 4-20mA interfaces and selector switches to enable many of the different configurations to be implemented without using external jumper connections.

Requirements

PCT 40

PCT 41

COMP. AIR

Pneumatic Valve Module Accessory - PCT44

The unit is a pneumatic control valve, plus associated components, for use with the PCT40/PCT41 system.

Retaining the flexible concept of the whole range, it can be plumbed into many of the flow control loops, and provides a good illustration of pneumatic valve technology.

AC1 - Air compressor **(Optional)**

Process Control Technology - PCT Series

Link to PCT Series

Armfield's Process Control training system represents an innovative approach to exploring the widely taught field of engineering.

Each product is designed to offer students a controlled, portable, and secure environment for in-depth exploration of industrial process control principles. They feature independent training systems focused on Temperature, Pressure, Flow, Level control.

The system is equipped with a common controller for all applications powered by an advanced 16-bit ds PIC processor with robust connectivity options, including USB, Wi-Fi, Bluetooth, and LAN communication.

In all products, data can be readily collected and displayed in graphical form in the software or saved for future analysis. Designed for effortless plug-and-play operation, compatible with power inputs ranging from 110V to 240V.

Comprehensive documentation accompanies each unit, comprising equipment manuals and comprehensive curriculum workbooks. These workbooks serve as a guide for students as they delve into the realm of process control systems and control functions. Additionally, students have the option to study transfer functions using MATLAB or similar software tools.

Software Inc

PCT60 Level Process Control System

Requirements

⚡ 1Ph

The Level system consists of a reservoir water tank, a variable speed pump, a pressure-based level sensor, and clear process vessel with a scale. A proportional valve provides the process vessel drain. An overflow pipe in the process vessel prevents it from being overfilled and the system allows students to adjust the pump speed and valve opening.

The system includes full control and datalogging hardware, which is USB, Bluetooth, LAN/Wi fi compatible. Three software applications allow students to understand Manual control, On/Off control and PID control.

The applications allow all parameters to be set, show a graphical representation of the performance of the system, and allow data to be logged to a file for further analysis.

A full suite of worksheets, teacher's notes and reference documentation is supplied.

Software Inc

PCT61 Flow Process Control System

Requirements

⚡ 1Ph

The Flow system consists of a water tank, variable speed pump, a turbine type flow sensor, an electrically operated proportional valve, and a variable area flow meter (rotameter). This allows students to adjust the flow rate via the pump speed and the valve opening to develop PID based control system.

The system includes full control and datalogging hardware, which is USB, Bluetooth, LAN/Wi fi compatible. Three software applications allow students to understand Manual control, On/Off control and PID control. The applications allow all parameters to be set, show a graphical representation of the performance of the system, and allow data to be logged to a file for further analysis.

A full suite of worksheets, teacher's notes and reference documentation is supplied.

Requirements

1Ph

PCT62 Temperature Process Control System

The temperature process control system includes a heated plate within a duct. Two thermocouples connect to the controller and an external meter to allow students to check and calibrate the controller input. A fan at one end of the duct blows the ambient air over the block, to change the control conditions and provide a disturbance to the system.

The system includes full control and datalogging hardware, which is USB, Bluetooth, LAN/Wi fi compatible. Three software applications allow students to understand Manual control, On/Off control and PID control. The applications allow all parameters to be set, show a graphical representation of the performance of the system, and allow data to be logged to a file for further analysis.

A full suite of worksheets, teacher's notes and reference documentation is supplied.

Requirements

1Ph

PCT63 Pressure Process Control System

The Pressure system consists of a variable speed reciprocating air pump (compressor), the speed of which can be adjusted by students, a pressure vessel and an outflow system.

The system includes full control and datalogging hardware, which is USB, Bluetooth, LAN/Wi fi compatible. Three software applications allow students to understand Manual control, On/Off control and PID control. The applications allow all parameters to be set, show a graphical representation of the performance of the system, and allow data to be logged to a file for further analysis.

A full suite of worksheets, teacher's notes and reference documentation is supplied.

Requirements

1Ph

PCT64 Servo Pendulum Process Control System

This unique system allows students to understand the control of motors in two respects: to control the speed of a motor – a servo control system - and to control the position of a motor's rotor – an inverting pendulum.

The system consists of a powerful DC motor mounted on a rugged frame. A disc with captive nuts is attached to the DC motor and students can screw in 100-gram weights to different parts of the disc to alter the characteristics of the system. A single weight at 0 degrees forms an inverting pendulum.

The system includes full control and datalogging hardware, which is USB, Bluetooth, LAN/Wi fi compatible. Three software applications allow students to understand Manual control, On/Off control and PID control. The applications allow all parameters to be set, show a graphical representation of the performance of the system, and allow data to be logged to a file for further analysis.

A full suite of worksheets, teacher's notes and reference documentation is supplied.

The system is shipped with a full API making it compatible with MATLAB or LabVIEW.

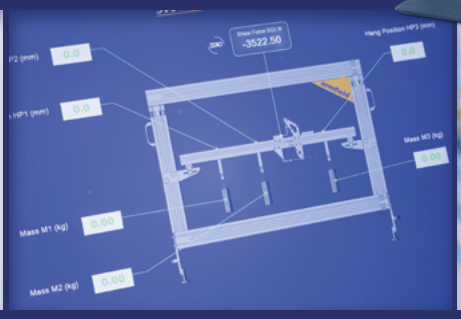
SV SERIES

Structures

Link to SV Series

A range of experiment frameworks that teach the principles of structures for Mechanical, Civil, and Structural Engineering. This allows the experimental investigation into Forces in a Truss, Strength of Materials, Forces & Moments, Bridges, Beams, Arches, Cables, Torsion & Buckling.

The experiments are easily attached to the frame with secure fixings. Weights in excess of 500 N can be applied safely



The Armfield SV structures range consists of a modular, highly stable frame-based range of teaching equipment for covering all the major principles of structural engineering. Covering topics such as forces in a truss, strength of materials, forces, moments, bridges, beams, arches cables, bulking and torsion.

The complete range consists of 23 individual kits and is supplied with armBUS software as standard.

Forces in a Truss

- SV200 - Pin Jointed Frameworks (Roof and Warren Truss)
- SV201 - Forces in a Truss and Redundant Truss
- SV202 - Deflection of Trusses

Bridges, Beams, Arches & Cables

- SV300 - Combined Shear Force and Bending Moment Apparatus
- SV301 - Shear Force in a Beam
- SV302 - Bending Moments in a Beam
- SV303 - Deflection of Beams and Cantilevers
- SV304 - Equilibrium of Forces
- SV305 - Suspension Cable
- SV306 - Bending Stress in a Beam

Forces & Moments

- SV400 - Simple Suspension Bridge
- SV401 - Deflection of a Frame
- SV402 - Suspended Centre Span Bridge
- SV403 - Three-Pinned Arch
- SV404 - Two-Pinned Arch
- SV405 - Semi Circular Arch

Strength of Materials

- SV500 - Continuous and Indeterminate Beams
- SV501 - Plastic Bending of Beams
- SV502 - Plastic Bending of Portals
- SV503 - Deflection of Curved Bars

Torsion and Buckling

- SV600 - Buckling of Struts
- SV601 - Unsymmetrical Bending and Shear
- SV602 - Torsion of Rods and Tubes

Structures Interface Unit (SV101)

The Armfield SV101 is a compact interface unit for the Armfield Structures range which can be placed in a convenient position beside the test equipment.

The unit provides direct integration between a compatible structures experiment and the Armfield armBUS software. Connection to the users computer is made through the front mounted USB socket.

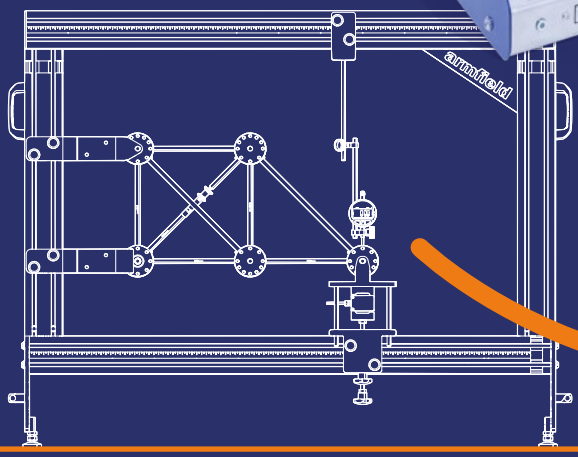
On the clearly defined front panel there are thirteen sockets for connecting strain-gauges, three sockets for connecting 5.4kg load cells and two sockets for connecting 100kg load cells.

If required, the number of strain-gauge and load cell sockets can be doubled by joining two SV101 consoles via the armBUS Multi Channel (ABMC) connection.

SV101 - Structures Interface Unit

armBUS NetCan, 20 users can connect to view the live readings within the local network

Connection to computer



Armfield Bench Mounted Frame (SV100)

Sensors on the connecting rods send load information to your computer via the Armfield Structures Interface Unit.

Automatically updating tables in real time, as you add load to the structure.

Armfield Structures Interface Unit (SV101)

PC or laptop

Choose your experiment in the Armfield software

Bench Mounted Frame – SV100

Requirements

A lightweight aluminium bench mounted frame that enables quick and easy attachment of the interchangeable experiment modules from the Armfield SV Structures range.

The frame is supplied with a fixing system that has been designed to be quick and easy to use. It allows students to change, position and secure each experiment.

Adjustable feet support the frame to allow students to level the apparatus before use.

The experiments are easily attached to the frame with secure fixings. Loads in excess of 50kg can be applied safely.

Structures Interface Unit – SV101

Requirements

1Ph
SV 100

The Armfield SV101 is a compact interface unit for the Armfield Structures range which can be placed in a convenient position beside the test equipment.

The unit provides direct integration between a compatible structures experiment and the Armfield armBUS software.

Features:

- 2 x 100kg Load Cell Ports
- 13 x Strain Gauge Ports
- 3 x 5.4kg Load Cell Ports

Pinned Support Kit - SV102

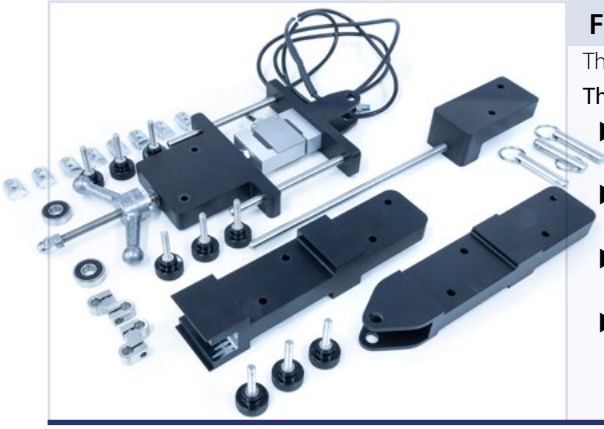
Requirements

1Ph
SV 100

This kit is required for four SV400 series kits.

The kit has the following components:

- Pivoting Support Assembly to act as a pinned support
- Horizontal Reaction Force Support Assembly which simulates a sliding support to measure horizontal thrust on arches and beams (up to 5.4kg)
- Frame connecting hardware



Frame Mounting Kit – SV103

Requirements

1Ph
SV 100

This kit is a requirement for all SV200 series truss frameworks.

The kit has the following components:

- Two supports - a pinned support and sliding support to hold the truss frameworks in position on the Bench Mounted Frame
- A load application assembly - capable of applying loads up to 100kg to the truss frameworks
- A DTI and DTI holder assembly to measure vertical deflection of truss frameworks under load
- Truss framework connecting hardware

Forces in a Truss

Requirements

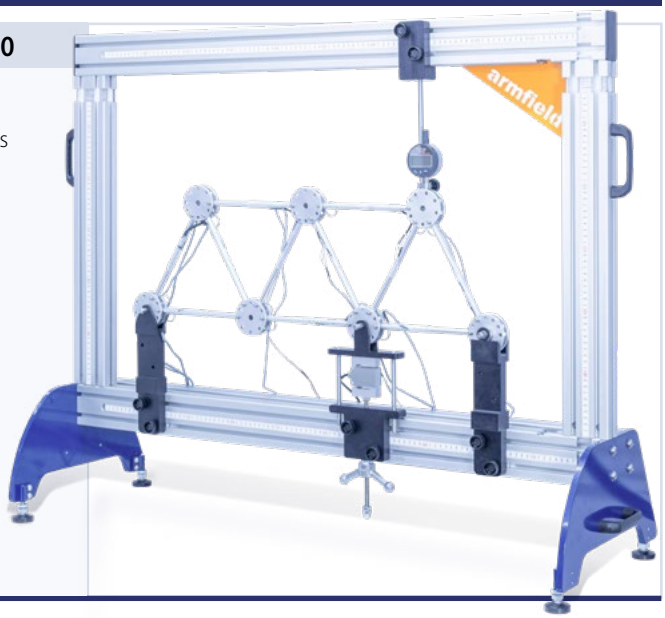
1Ph
SV 100
SV101 Interface
SV103 Mounting Kit

Pin-Jointed Frameworks (Roof and Warren Truss) – SV200

The Pin-Jointed Frameworks experiment is intended for use with the Armfield Universal Bench Mounted Frame and allows the experimental investigation of deflection of trusses under load. This then allows Castigliano theorems to be proven.

The experimental content has the following properties:

- Assembly of both a basic Roof and Warren Truss via various length members, detent pins and joint hubs
- Up to 10 members possible in one joint hub
- Members suitable for use with both trusses



Requirements

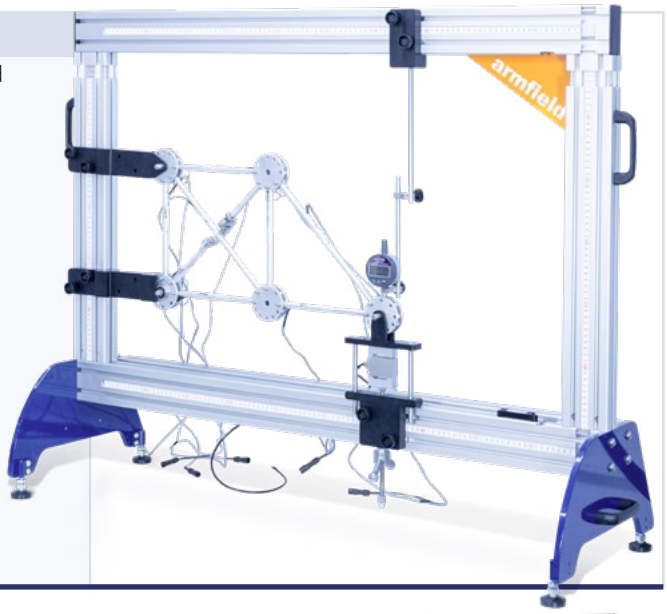
1Ph
SV 100
SV101 Interface
SV103 Mounting Kit

Forces in a Truss and Redundant Truss – SV201

The Forces in a Truss and Redundant Truss experiment is intended for use with the Armfield Universal Bench Mounted Frame and enables the experimental investigation of deflection of trusses under load. This then allows Castigliano theorems to be proven.

The experimental content has the following properties:

- Assembly of both a determinate and indeterminate truss framework via various length members, detent pins and joint hubs
- Quick and easy assembly of members via detent pins and joint hubs
- Up to 10 members possible in one joint hub
- Loading unit with spindle drive and universal load cell for force measurement
- Members suitable for use with both trusses



Requirements

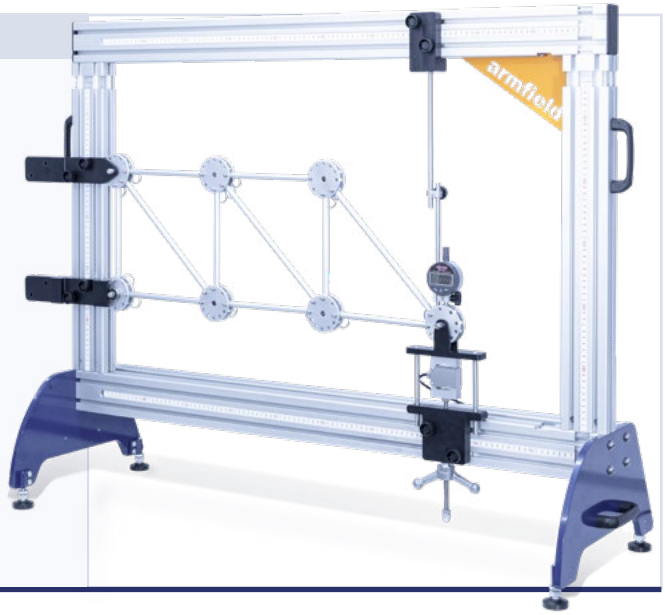
1Ph
SV 100
SV101 Interface
SV103 Mounting Kit

Deflection of Trusses – SV202

The Deflection of Trusses experiments allows the experimental investigation of deflection in trusses under load. This then allows Castigliano theorems to be proven.

The experimental content has the following properties:

- Assembly of three 3-bay trusses via various length members, detent pins and joint hubs
- Up to 10 members possible in one joint hub
- Common members between all three trusses
- Digital indicator used to measure frame deflection



Bridges, Beams, Arches and Cables

Combined Shear Force and Bending Moment Apparatus – SV300

The Shear Force and Bending Moment in a beam allows the experimental investigation of the internal shear force and bending moment of a simply supported beam under different point loads.

The experimental content has the following properties:

- Split beam allows the internal shear force and bending moment at the split to be measured
- Up to 3kg of point loads can be applied to the beam across three movable weight hangers
- Adjustable simple supports

Requirements

1Ph

SV 100

SV101 Interface

Shear Force in a Beam – SV301

The Shear Force in a Beam allows the experimental investigation of the internal shear force of a simply supported beam under different point loads.

The experimental content has the following properties:

- Split beam allows the internal shear force at the split to be measured
- Up to 3kg of point loads can be applied to the beam across three movable weight hangers
- Adjustable simple supports

Requirements

1Ph

SV 100

SV101 Interface

Bending Moments in a Beam – SV302

The Bending Moment in a Beam allows the experimental investigation of the internal bending moment of a simply supported beam under different point loads.

The experimental content has the following properties:

- Split beam allows the internal bending moment at the split to be measured
- Up to 3kg of point loads can be applied to the beam across three movable weight hangers
- Adjustable simple supports

Requirements

1Ph

SV 100

SV101 Interface

Bridges, Beams, Arches and Cables

Requirements

SV 100

Deflection of Beams and Cantilevers – SV303

The Deflection of Beams and Cantilevers allows the experimental investigation of the deflection of beams of different section sizes under different loads and types of support.

The experimental content has the following properties:

- Assembly of multiple different beam experiments via 2 adjustable supports, point load weight hangers and UDL weight sleeves
- 3 Different beam specimens of different section sizes and material

Requirements

SV 100

Equilibrium of Forces – SV304

The Equilibrium of Forces allows the experimental investigation of non-concurrent forces creating equilibrium in a system.

The experimental content has the following properties:

- Ability to show non-concurrent equilibrium in a system using an equilibrium beam
- Ladder type beam with multiple locations to add additional weight up to a total beam weight of 470g
- Adjustable simple supports allowing the angle of the ladder beam to be adjusted
- Up to 1500g of reaction weights to measure the vertical and horizontal reaction forces at each end of the beam

Requirements

SV 100

Suspension Cable – SV305

This Suspension Cable allows the experimental investigation of a cable free-hanging between 2 roller supports under its own dead-weight.

The experimental content has the following properties:

- Roller chain to simulate flexible cable
- Up to 4kg of additional weight to simulate increased dead-weight of chain
- Adjustable roller supports
- Moveable vertical scale

Requirements

1Ph

SV 100

SV101 Interface

Bending Stress in a Beam – SV306

The Bending Stress in a Beam allows the experimental investigation of the internal stresses of a simply supported beam placed into four-point bending.

The experimental content has the following properties:

- T section beam fitted with five strain gauges to measure the strain at various points on the section
- Load cell assembly to apply any load up to 500N via a load application bracket, evenly distributing the load over two points
- Adjustable simple supports

Forces and Moments

Simple Suspension Bridge – SV400

The Simple Suspension Bridge allows the experimental investigation of the tension in the main cable of a suspension bridge under different load conditions.

The experimental content has the following properties:

- Suspension bridge hung between 2 pulley supports with a rigid bridge deck
- Up to 1.35kg of additional weight to simulate UDLs (uniformly distributed loads) and point loads
- Load cell to measure tension in the main cable at the support

Requirements

- 1Ph
- SV 100
- SV101 Interface

Deflection of a Frame – SV401

The Deflection of Frames allows the experimental investigation of the horizontal thrust and deflection observed when loads are applied to different shaped frames.

The measurements taken can then also be used to validate calculated values for the horizontal thrust and deflections found using Castigliano's Theorem.

The experimental content has the following properties:

- Two different shaped frame specimens
- Up to 1kg of weight hangers to apply loads to the specimens
- Digital indicators to measure deflection at different points on the frame
- Pivoting support capable of measuring horizontal thrust

Requirements

- 1Ph
- SV 100
- SV101 Interface
- SV102 Pinned Support

Suspended Centre Span Bridge – SV402

The Suspended Centre Span Bridge allows the experimental investigation of different forces acting on a bridge with a central section suspended by the two outer cantilever sections of the bridge.

The experimental content has the following properties:

- Ability to show mechanical principles of a centre span bridge
- Ability to show reaction forces at the supports via three load cells covering half of the bridges span
- Point loads, UDLs (uniformly distributed loads) and rolling loads can be applied to the bridge

Requirements

- 1Ph
- SV 100
- SV101 Interface

Forces and Moments

Requirements

1Ph
SV 100
SV101 Interface
SV102 Pinned Support

Three-Pinned Arch – SV403

The Three-Pinned Arch allows the experimental investigation of the horizontal thrust observed when loads are applied to an arch with hinges at each end as well as at the peak of the arch.

The measurements taken can then also be used to validate calculated values for the horizontal thrust found using the static equilibrium equations.

The experimental content has the following properties:

- Ability to show mechanical principles of three hinged arches
- Point loads, UDLs (uniformly distributed loads) and rolling loads can be applied to the arch
- Pivoting support capable of measuring horizontal thrust

Requirements

1Ph
SV 100
SV101 Interface
SV102 Pinned Support

Two-Pinned Arch – SV404

The Two-Pinned Arch allows the experimental investigation of the horizontal thrust observed when loads are applied to an arch with hinges at each end.

The measurements taken can then also be used to validate calculated values for the horizontal thrust and deflections found using Castigliano's Theorem.

The experimental content has the following properties:

- Ability to show mechanical principles of two hinged arches
- Both point loads and UDLs can be simulated
- Pivoting support capable of measuring horizontal thrust
- Digital indicator used to measure arch deflection

Requirements

1Ph
SV 100
SV101 Interface
SV102 Pinned Support

Semi Circular Arch – SV405

The Semi Circular Arch allows the experimental investigation of the horizontal thrust observed when loads are applied to a semi circular arch with hinges at each end.

The measurements taken can then also be used to validate calculated values for the horizontal thrust and deflections found using Castigliano's Theorem.

The experimental content has the following properties:

- Ability to show mechanical principles of semi circular arches
- Both point loads and UDLs can be simulated
- Pivoting support capable of measuring horizontal thrust
- Digital indicator used to measure arch deflection

Strength of Materials

Continuous and Indeterminate Beams – SV500

The Continuous and Indeterminate Beams allows the experimental investigation of the deflection of beams and the resulting reaction forces at the supports for multiple different continuous and indeterminate set-ups.

The experimental content has the following properties:

- Assembly of multiple different beam experiments via two sinking and one fixed support capable of measuring reaction loads, a fixed support capable of measuring fixing moment, point load weight hangers and UDL weight sleeves
- 3 different beam specimens of different section sizes and material
- Measurement of beam deflection using a digital indicator

Requirements: 1Ph | SV 100 | SV101 Interface

Plastic Bending of Beams – SV501

The Plastic Bending of Beams allows the experimental investigation of how beams behave when placed under a vertical load that causes plastic bending.

The experimental content has the following properties:

- Assembly of a simply supported, propped cantilever or encastre beam set-up
- 3 different beam specimens with additional spare beam kits available
- Load cell assembly for applying vertical loading
- Linear scale to measure the deflection of the beam at the point of loading

Requirements: 1Ph | SV 100 | SV101 Interface

Plastic Bending of Portals – SV502

The Plastic Bending of Portals experiment allows the experimental investigation of portal frames placed under horizontal and/or vertical loads resulting in plastic deformation.

The experimental content has the following properties:

- Two load cell assemblies for independent vertical and horizontal loading
- Adjustable pulley assembly to maintain true vertical and horizontal loading
- Two different portal types, rectangular and pitched portals, 3 of each type supplied with each kit and additional portal kits available
- Linear scales to measure the deformation of the portal at each load point

Requirements: 1Ph | SV 100 | SV101 Interface

Deflection of Curved Bars – SV503

The Deflection of Curved Bars allows the experimental investigation of the deflection observed when a load is applied to different shaped curved bars as well as being able to validate calculated deflections found using Castigliano's Theorem.

The experimental content has the following properties:

- Six different curved bar specimens
- Up to 1.5kg of weight hangers to apply load to the specimens
- Two digital indicators to measure vertical and horizontal deflection

Requirements: 1Ph | SV 100

Torsion and Buckling

Requirements

1Ph
SV 100
SV101 Interface

Buckling of Struts – SV600

The experiment Buckling of Struts allows the experimental investigation of the loads needed to cause buckling between different fixing conditions and lengths of sample.

The sample material will remain the same throughout to encourage consistency.

The experimental content has the following properties:

- Buckling specimens secured between two fixing conditions that are attached to mounting blocks
- Load cell to measure the applied load and digital linear scale to measure the displacement caused by buckling. The digital linear scale can be placed anywhere along the strut to find maximum buckling

Requirements

1Ph
SV 100

Unsymmetrical Bending and Shear – SV601

This experiment allows the experimental investigation of the deflection observed when a load is applied to unsymmetrical bars as well as being able to assess the location of the shear centre of these beams.

The experimental content has the following properties:

- Three different bar section specimens
- Up to 1000g of weight hangers to apply load to the specimens
- Two digital indicators to measure total horizontal deflection

Requirements

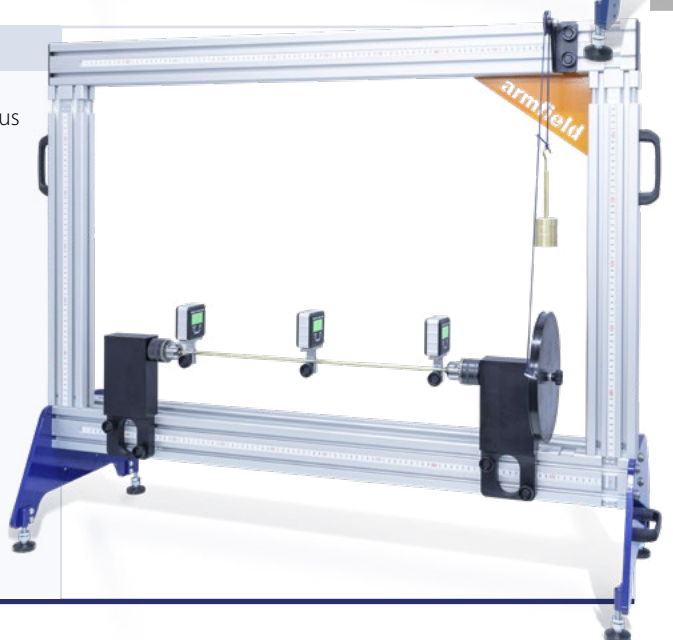
1Ph
SV 100

Torsion of Rods and Tubes – SV602

The experiment Torsion of Rods and Tubes allows the experimental investigation of the torsional differences between specimens of various material properties under different load conditions.

The experimental content has the following properties:

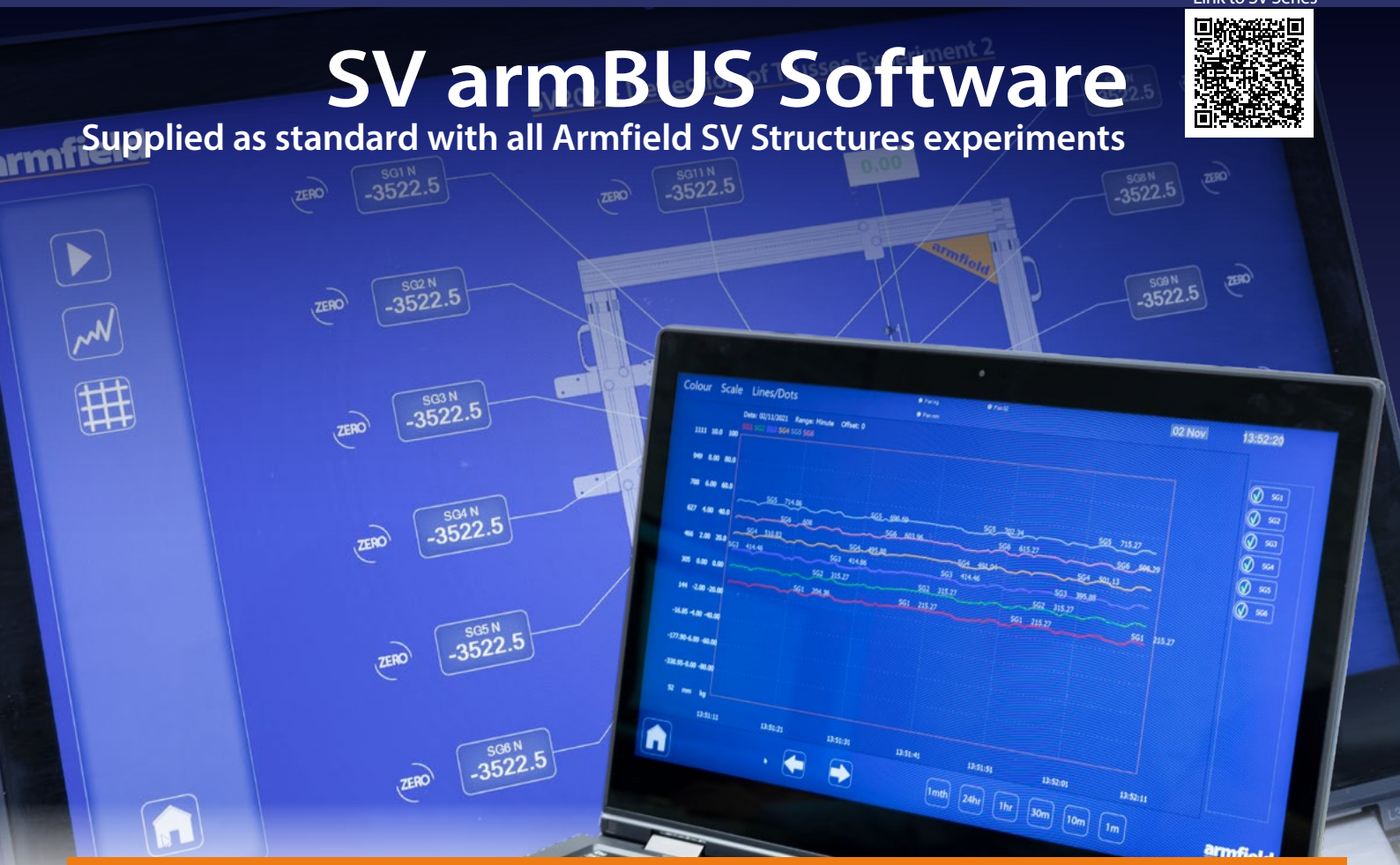
- Torsion specimens secured between 2 chucks fixed to a pair of supports
- Inclinometers to measure angular displacement of rod specimens at varying torsional loads, effective lengths and cross-sectional areas



Link to SV Series

SV armBUS Software

Supplied as standard with all Armfield SV Structures experiments



Features of the armSOFT SV Series Educational Software

The Structures range utilises the **Armfield armBUS** software system to collect, display and store the data from the instrumentation. Each experiment has its individual GUI called on from a simple to use menu system.

The details are exercise specific, but typically the following interfaces are available:

- Full Graphical User Interface (GUI) for each experiment with display screens tailored for each exercise
- Individual experiments of the utilised kit can be accessed without restarting the software
- All strain gauges and load cell assemblies are displayed on a diagrammatic representation of the equipment in real time
- Allows manual input of data from DTI gauges and digital callipers
- Sensor data is collated, and calculations are displayed in a data-log, a tabulation function provided with the armBUS software. The data is in tabulated format and can be saved and accessed through a .csv file compatible with software such as Microsoft Excel
- Data sampling intervals can be user defined in seconds when the automatic sampling method is chosen
- The data from the sensors is plotted and displayed in a user configurable graphing function of the software. It can be displayed separately from the data logging and each sensor output can be viewed independently. The power graphing software provides the following functionality:

  - **Date:** Displays the data log date
  - **Range:** Displays the current chart range (Minute/Hour/Day)
  - **Offset:** Displays the step number back from the measured timestamp
  - Sensor Selection Window
  - **Pan:** Allows users to change the scale for the chosen unit by scrolling up and down on the axis
  - **User defined scale:** Set the min and max values for axes of measured parameters
  - **Back:** Step backward through the chart from the latest timestamp
  - **Forward:** Step forward through the chart to the latest timestamp
  - **Time:** (Range)
  - User configuration of background colour
  - **Line/dots:** User definable line types

Contact Armfield

armfield Academy

At Armfield, we are committed to delivering innovative solutions that drive success for all our customers!

The Armfield academy is a testament to our dedication to excellence, the state-of-the-art facility is designed to provide an immersive and interactive experience for our valued customers and agents, allowing us to showcase our products/services.

Scheduling a visit to our Customer Demonstration Suite is easy.

Simply reach out to our dedicated team at sales@armfield.co.uk to book a convenient time slot.

We look forward to hosting you.

Armfield software

Strength of Materials - SV Series

Rotating Fatigue Machine - SV800

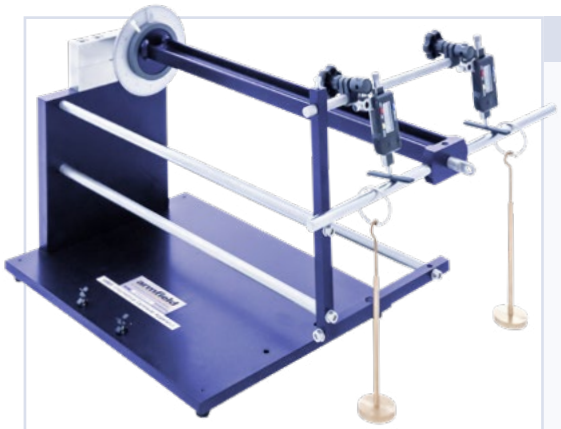
Requirements: 1Ph, PC, USB

The SV800 rotating fatigue machine has been designed to introduce students to the effects of material fatigue using a sinusoidal variation of bending stress.

Experimental Content:

- To make an introductory study of fatigue using a Wohler rotating fatigue apparatus, including the time to failure caused by various stress levels and materials
- Introducing students to S-N curves
- Material specification on fatigue limits
- Specimen geometry on fatigue limit

AIU - Armfield Interface Unit



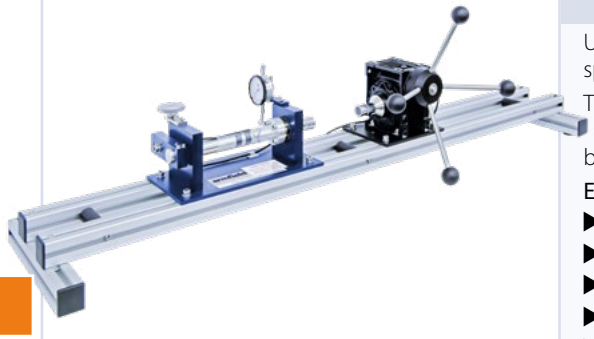
Unsymmetrical Cantilever Apparatus - SV801

Requirements

The SV801 Unsymmetrical Cantilever Apparatus allows the vertical and horizontal deflections of the free end of a test specimen to be measured when loading occurs along a principle axis or at a known angle. A solid compact base holds a rigid vertical end support for the clamping of three cantilevers.

Experimental Content:

- Vertical and horizontal deflection of unsymmetrical cantilevers
- Mohr's circle
- Moment of area
- Shear centre location
- Comparison between actual and theoretical results



Torsion Testing Machine 30Nm - SV802

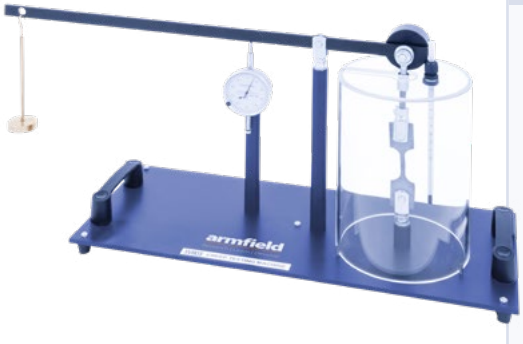
Requirements: 1Ph, PC, USB

Up to 30Nm torque is applied via the moment head to differing material test specimens using hand operated worm and wheel gearbox (60:1 ratio).

The unit can cater for test specimens of up to 750mm between the moment head and torsion head. The moment head is fixed but the torsion head can be moved along the base to allow for the different lengths of specimen.

Experimental Content:

- Torsional loading to failure of varying material specimens
- Torsional variation due to material, cross sectional area
- Comparison between actual and theoretical results
- Determination of the Modulus of Rigidity and Yield Shear Stress
- Working with the elastic torsion equation
- Hardness testing



Creep Testing Machine - SV803

Requirements

A sturdy bench top mounted unit for studying the effect of creep on different material test specimens. Necked test specimens are held vertically in position on special clamps, which do not induce bending during loading.

A lever arm transmits the load from a load hanger and weights into the specimen and the lever arm has a counter balance weight to ensure the lever arm self-weight is calibrated out.

Experimental Content:

- Creep fracture load
- Temperature effect on creep rate and failure
- Material variation on creep rate and failure
- Load variation on creep rate and failure

Requirements

1Ph

Pendulum Impact Tester 25J Impact Energy- SV804

A sturdy bench top mounted unit for the study of notched bar (Charpy) impact strength tests. A heavy base plate with protective guard surrounds all the components, the guard has a lockable door for ease of access when setting the test but also security whilst not in use.

The base plate has an anvil and pillar which have replicable impact profiles for supporting the notched specimens prior to testing.

Experimental Content:

- Tensile and Compression Testing
- Recording of Stress-Strain Diagrams
- Modulus of Elasticity Testing
- Percentage Elongation
- Deep Draw Testing
- Three-Point Bending
- Hardness Testing
- Shear (unsymmetrical, symmetrical shear both supported and unsupported)

Requirements

1Ph

PC

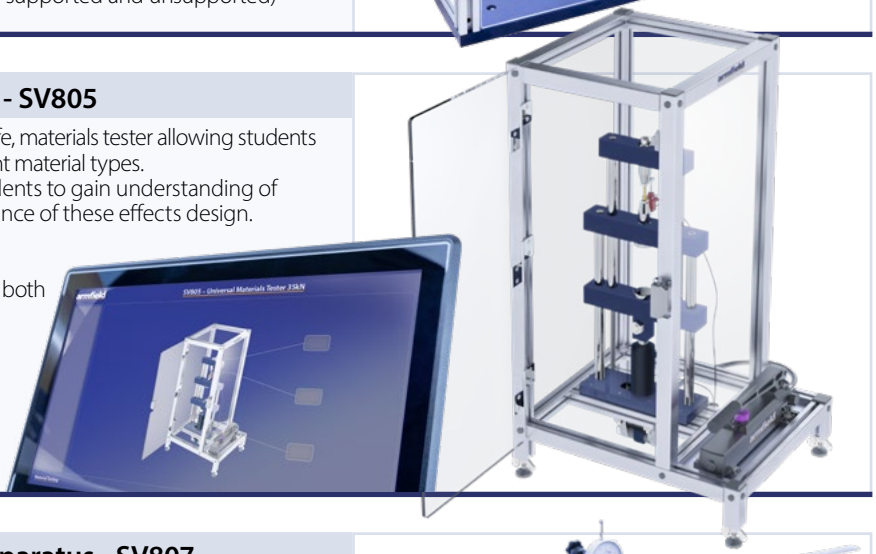
USB

Universal Materials Tester 35kN - SV805

The SV805 is a modular, flexible, compact, safe, materials tester allowing students to conduct up to 6 experiments on 7 different material types.
The results of these experiments allow students to gain understanding of materials properties and how the performance of these effects design.

Experimental Content:

- Tensile and compression testing
- Shear (unsymmetrical, symmetrical shear both supported and unsupported)
- Recording of stress-strain diagrams
- Modulus of elasticity testing
- Percentage elongation
- Deep draw testing
- Three-point bending
- Hardness testing



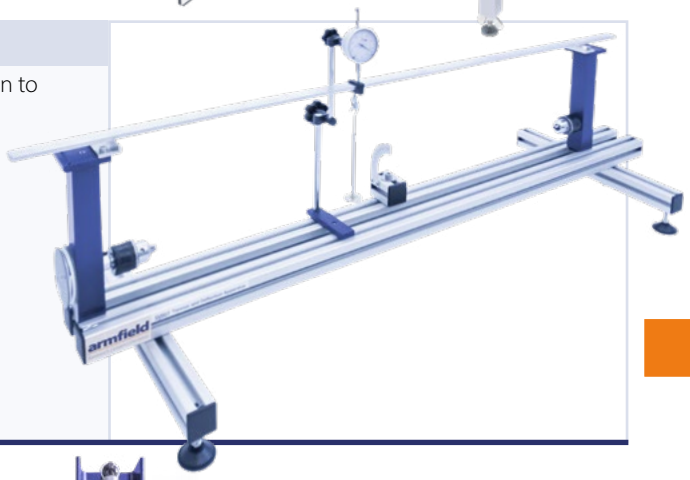
Requirements

Torsion & Deflection Testing Apparatus - SV807

This benchtop unit allows a variety of experiments to be undertaken to investigate test specimens under torsional loading and bending loading within their elastic limits.

Related Laws:

- Mechanical Engineering
- Structural Engineering
- Stress
- Bending
- Torsion
- Deflection
- Span
- Bending Theory
- Modulus of Rigidity
- Super-position



Requirements

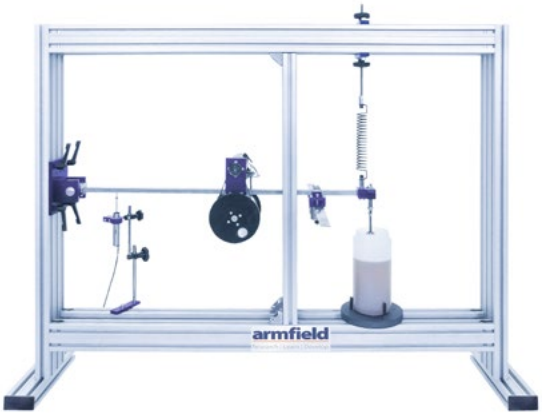
SV 100 (optional)

Extension of Springs Apparatus - SV808

Extension of Springs Apparatus, to test the relationship between the load applied and the change in length of a spring (Hooke's Law) also determine spring stiffness using measured spring data and load versus extension graphs, this devise will cater for a number of working with springs exercises.

Related Laws:

- Hooke's Law
- Spring rate
- Wire
- Extension



* Requires one INST063 PC USB Oscilloscope

Universal Vibration System - SD2

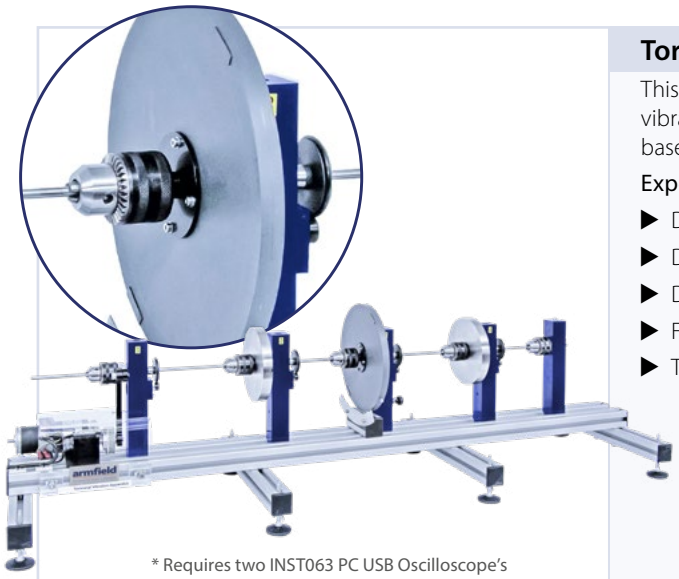
Requirements: 1Ph, PC, USB

This system contains all the necessary parts to undertake free and forced vibration, resonance and damping. A beam pivots at one end from a bracket and bearing attached to the Vibration Frame.

A spring is attached to the free end of the beam to enable the beam to vibrate. The horizontal position of the spring can be adjusted using the integral adjustment system, and vibration travel is restricted via factory set "stops".

Experimental Content:

- Spring stiffness
- Resonance frequency
- Active and inactive damping absorber
- Free vibration
- Forced vibration
- Damped vibration
- Damping ratio
- Tuning of damping absorber
- Amplitude response and phase response
- Specimen geometry on fatigue limit



* Requires two INST063 PC USB Oscilloscope's

Torsional Vibration Apparatus - SD3

Requirements: 1Ph, PC, USB

This benchtop mounted unit is used to study torsion and torsional vibration. The apparatus is constructed around a profiled aluminium base with levelling feet, onto which is mounted 4 vertical chuck pillars.

Experimental Content:

- Determination of the torsional stiffness of a torsion bar
- Determination of the mass moment of inertia
- Decay behaviour of torsional vibration
- Forced torsional vibration and resonance
- Torsional vibration system with three weights allowing single, two and three mass torsional vibration to be investigated
- Demonstration of the effect of frictional damping

Armfield Interface Unit - AIU

Requirements: 1Ph, PC, USB

The AIU4 Interface Console links sensors with electronic outputs to the laptop or PC. The console interprets the signals received into the correct output format for the armBUS software.

The console has a 24vDC power supply to reduce the risk of high voltage incidents with contact with water

Requirements

SV 100 (optional)

Wheel and Axle - SD-1.50

The dual diameter wheel has an axle supported on simple pivots in a sturdy wall mounting bracket. Each wheel has a cord wrapped around its periphery.

The cords can be wrapped in either direction around each wheel. A load hanger is added to each cord allowing loading of the wheels using the calibrated weights set provided.

Experimental Content:

- Experimental determination of velocity ratio and comparison with calculated value
- Determination of variation with load of effort
- Determination of variation with load of efficiency

Requirements

SV 100 (optional)

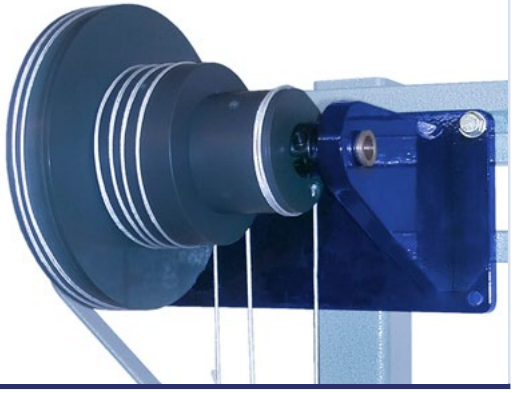
Wheel and Differential Axle Apparatus - SD-1.51

A wheel is attached to a differential axle assembly of Ø114mm (major axle) and Ø38mm (minor axle). The wheel and differential axle are secured to a shaft that runs in bearings within a sturdy wall mounting bracket.

All necessary cords, load hangers and weights are provided.

Experimental Content:

- Comparison with calculated values for simple wheel and differential axle machine
- Determination of variation with load of limiting efficiency of the machine
- Experimental determination of velocity ratio
- Determination of variation with load of effort
- Determination of variation with load of efficiency



Requirements

SV 100 (optional)

Efficiency of Screw Threads - SD-1.52

Three screw thread forms are supplied ('Vee' x 2 and square) each with an integral turntable mounted on the top side. Wrapped around the periphery of the turntable is a cord which allows the turntable to be rotated when loaded.

Experimental Content:

- Experimental determination of velocity ratio and comparison with calculated value
- Comparison of relative efficiency of Vee and Square thread forms
- Determination of variation with load of effort, friction and efficiency
- Limiting efficiency of the machine

Requirements

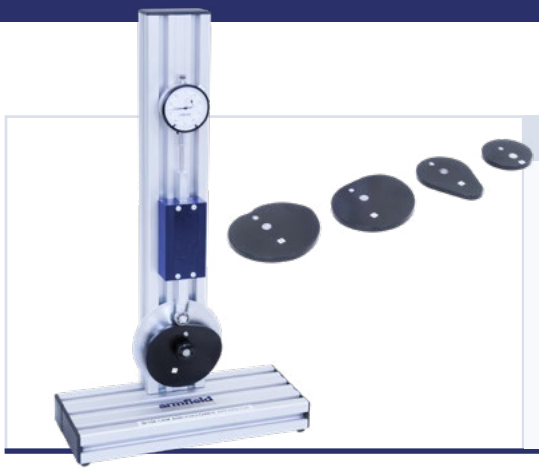
Gear Tooth Form Apparatus - SD-1.53

A bench top base plate contains all elements for this experiment.

Three gears are located onto the base plate. A large gear and small gear mesh together and can be rotated to produce analysis of ratios. A third gear is removable to allow students to review its tooth form, pitch circle diameter (PCD) and other key geometry of a tooth form.

Experimental Content:

- Experimental determination of shape and construction of an involute curve
- Explanation of Gear Form
- Explanation of Gear Ratios
- Explanation of Gear Modules
- Explanation of Gear Trains and Rotational Direction



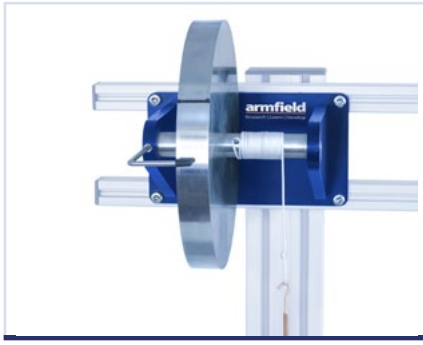
Cam and Follower Apparatus - SD-1.54

Requirements

A vertical pillar contains the main spindle for each cam to be rotated, whilst a dial gauge has its anvil resting on the top edge of the cam.

Experimental Content:

- To determine a graph of follower displacement against angular rotation of the cam
- To assess the effect of different cams and followers
- To derive the velocity and acceleration diagrams, and determine the maximum acceleration of the follower
- To compare experimental and calculated results



Simple Flywheel - SD-1.55

Requirements

SV 100 (optional)

Experiment to verify the second law of motion applied to a flywheel.

Experimental Content:

- To verify the second law of motion applied to a flywheel, i.e. the relationship between torque and angular acceleration
- To compare experimental and calculated moments of inertia of a disc
- To study the energy transformations and to demonstrate that a flywheel can be used to store energy

Epicyclic Gear Train - SD-1.56

Requirements

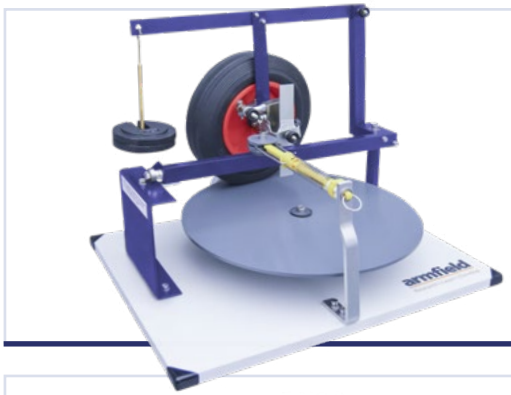
SV 100 (optional)

This apparatus consists of two standard epicyclic gear trains. Each gear train consists of a sun gear in the centre, three planet gears, a planet linkage and an internal or ring gear.

The sun gear, ring gear and planet carrier all rotate about the same axis.

Experimental Content:

- Calculate and experimentally observe the angular velocity ratios of gear trains
- Calculate the efficiencies of gear trains and draw efficiency curve
- Experimentally obtain the torque ratios of gear trains, gear ratios, efficiencies and velocity ratios can be calculatedcan be used to store energy



Castor, Camber and King Pin Inclination - SD-1.57

Requirements

This apparatus shows precisely how castor, camber and king pin inclination are set up and how centre point steering is achieved.

Experimental Content:

- To show how castor, camber and king pin inclination are set up
- To show how the steering linkage is related to toe-in
- To demonstrate the effect of wheel offset
- To observe the dynamic stability of the wheel under running conditions
- To measure the forces on the steering link
- To show how the weight of the car affects self centring

Relation Between Angular and Linear Speeds - SD-1.58

Requirements

To find the relationship between angular rotation and the peripheral movement of the stepped shaft.

Experimental Content:

- To find the relationship between angular rotation and the peripheral movement of the stepped shaft
- Compare actual results with theory

Requirements

SV 100 (optional)

Disc Brake Apparatus - SD-1.59

Through the load hanger and calibrated weights the force is applied to the brake disc and the parameters of braking force, braking torque and normal force can be assessed.

Experimental Content:

- To determine the most effective brake pad material
- To determine the most efficient radial placing of the brake pad

Requirements

1Ph

Static & Dynamic Balancing Apparatus - SD-1.60

A bench mounted enclosure contains all the electronics and safety guard for this apparatus.

Experimental Content:

- Static balancing of non-coplanar masses
- Dynamic balancing of non-coplanar masses
- Comparison between theoretical and actual results
- Use of vector diagrams, vector resolution, resultant forces, moment polygons and turning moments

Requirements

1Ph

Governor Apparatus - SD-1.61

Compact, bench top apparatus to demonstrate the principle of operation of various centrifugal force governors.

Experimental Content:

- Geometry and operation of a Porter, Proell and Hartnell governor
- To observe the lift off speed of the three different types of governor
- To observe the stability of a governor
- To observe the affect of varying sleeve weight or spring force on the operation of a governor
- To compare actual results with calculated theoretical values

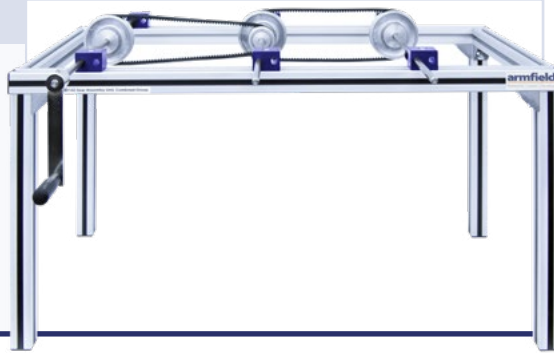
Requirements

Gear Assembly Unit Combined Drives - SD-1.62

Introduction to gear trains, transmissions, ratios and velocities and also spur gears, drive belts, pulleys, chains, tensioners, worm and wheel, bevel gears, rack and pinions, compound drives.

Related Laws:

- Automotive
- Assembly of different drive mechanisms, layout and meshing
- Industry standard drives
- To compare actual results with calculated theoretical values



Requirements

SV 100 (optional)

Single Epicyclic Gear Train - SD-1.63

The apparatus can be operated in one of a variety of modes. This gives the user different options on gear ratios that can be applied between the input and output shafts.

Experimental Content:

- Calculate and experimentally observe the angular velocity ratios of gear trains
- Experimentally obtain the torque ratios of gear trains
- Compute the efficiencies of gear trains

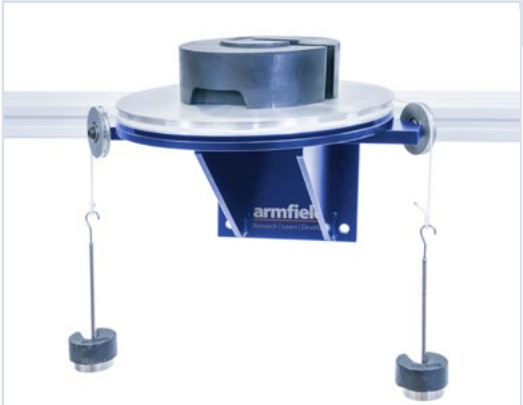
Friction on an Inclined Plane - SV900

Requirements

The Armfield SV900 Friction on an Inclined Plane is a compact bench top unit supplied with a sturdy aluminium base plate, non-slip feet and central vertical pillar. Pivoting on this base is a ground steel plane which can be locked in any angular position between ±45°, indicated on a semicircular protractor scale.

Experimental Content:

- To determine the coefficient of friction under static and sliding conditions between various materials and steel
- To verify the angle of friction for the material
- To measure the force required to move a body up an inclined plane against gravity and friction
- To show the equilibrium of forces on an inclined plane



Clutch Plate Friction Apparatus - SV901

Requirements

SV 100 (optional)

The wall mounted apparatus comprises a lower stationary plate attached to a sturdy wall mounting bracket. On top of this stationary disc sits an upper aluminium alloy plate whose shaft rotates in ball bearings but which is in direct contact with the stationary plate.

Experimental Content:

- To determine the coefficient of friction of the plate material
- To show that the minimum torque to maintain rotation is proportional to the axial load and diameter of the friction disc

Pivot Friction Apparatus - SV902

Requirements

SV 100 (optional)

The apparatus consists of a rotating circular turntable attached onto the end of a vertical shaft. The shaft is held vertical within a sturdy wall bracket that must be attached to a rigid vertical surface, i.e. a wall or the SV100 Bench Mounted Frame.

Experimental Content:

- To investigate the relationship between frictional torque and axial thrust
- To determine the influence of the bearing cone angle
- To obtain the coefficient of friction for different bearings

Journal Friction Apparatus - SV903

Requirements

1Ph

This apparatus is designed to determine the friction torque in a plain journal bearing under varying conditions of load, speed and lubrication.

Related Laws:

- Automotive
- Friction
- Machines
- Clutches
- Brakes
- Bearing
- Wear
- Torque
- Slip
- Lubrication

Requirements

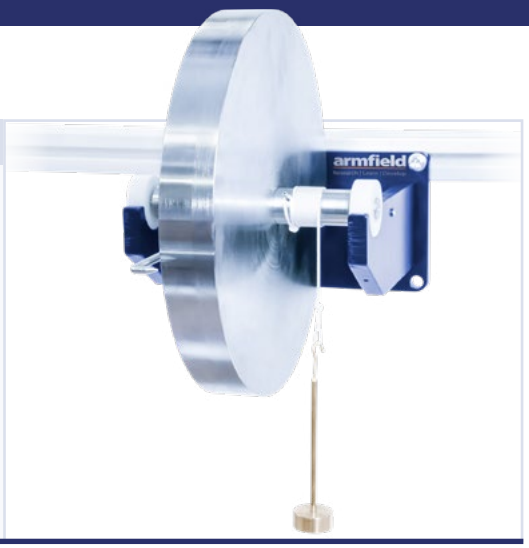
SV 100 (optional)

Bearing Friction Apparatus - SV904

Allows students to compare the frictional losses of bearings by measuring the coefficient of sliding friction between pairs of materials.

Experimental Content:

- Allows students to compare the frictional losses of bearings by measuring the coefficient of sliding friction between pairs of materials
- Allows students to measure the compare and contrast losses when comparing different bearing types



Requirements

SV 100 (optional)

Rope Belt Friction Apparatus - SV905

A wall mounted fixed pulley with a loaded belt. Four different pulleys are supplied with different vee groove angles; flat rim, 60°, 90° and 120°.

Demonstration Capabilities:

- To investigate the ratio of belt tensions when a rope passes over pulleys of different Vee angle
- To determine the coefficient of friction between the steel pulley and cotton rope
- To assess the variation of belt tension ratio with lap angle

Requirements

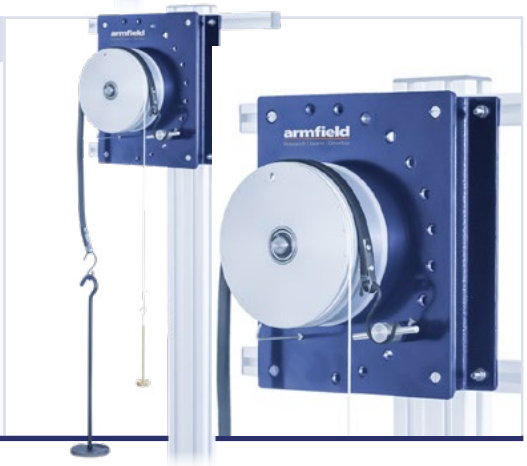
SV 100 (optional)

Friction of Belts Apparatus - SV906

Wall or frame mounted apparatus to observe the relationship between the tensions in the two sides of a belt.

Experimental Content:

- To observe the relationship between the tensions in the two sides of a belt
- To assess the differences between vee, rope and flat belts
- To determine the coefficient of friction between the pulley and belt for the belt sections
- To investigate the effect of angle of lap



Requirements

Brake Drum Friction Apparatus - SV907

Bench top mounted brake drum. Torque is applied to the brake drum by using the calibrated weights set provided and load hanger.

Demonstration Capabilities:

- To determine experimentally the variation of tangential force with braking load
- To obtain the coefficient of friction between the aluminium drum and the brake shoe
- To compare leading and trailing shoes

Link to ME Series

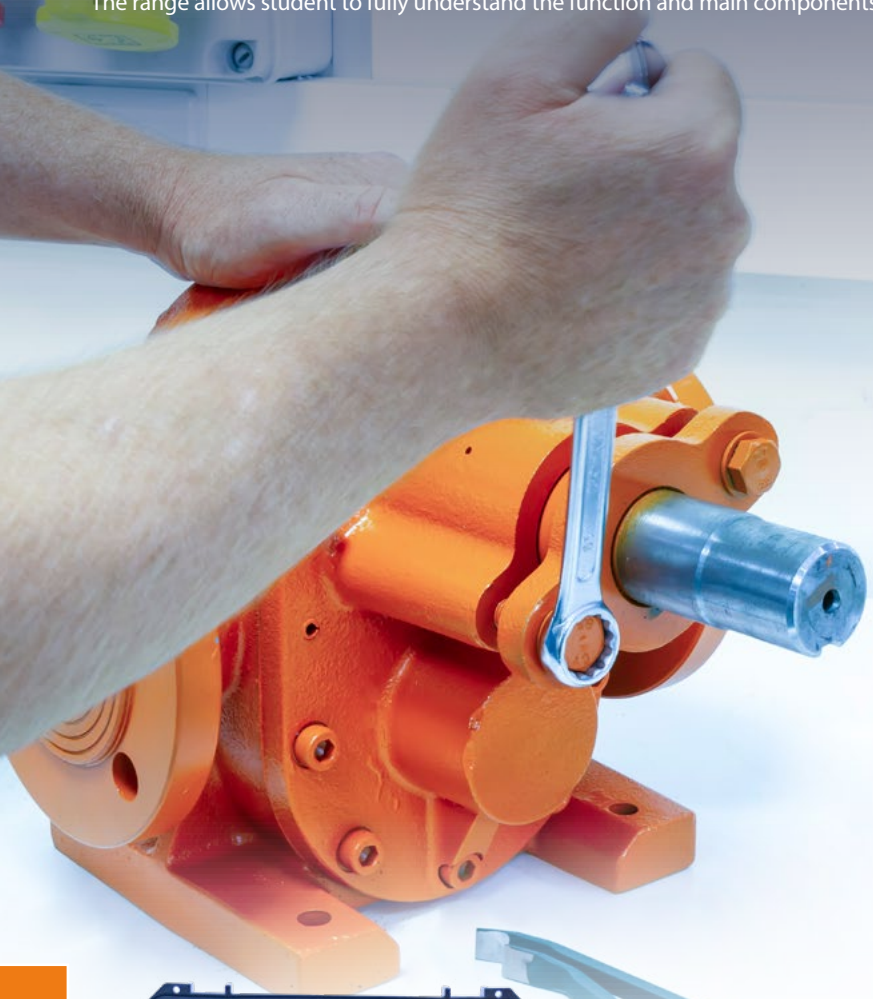
ME SERIES

Dissectible Pumps & Valves

Our dissectible maintenance training kits use new industrial pumps and valves that are commonly used in industrial parts

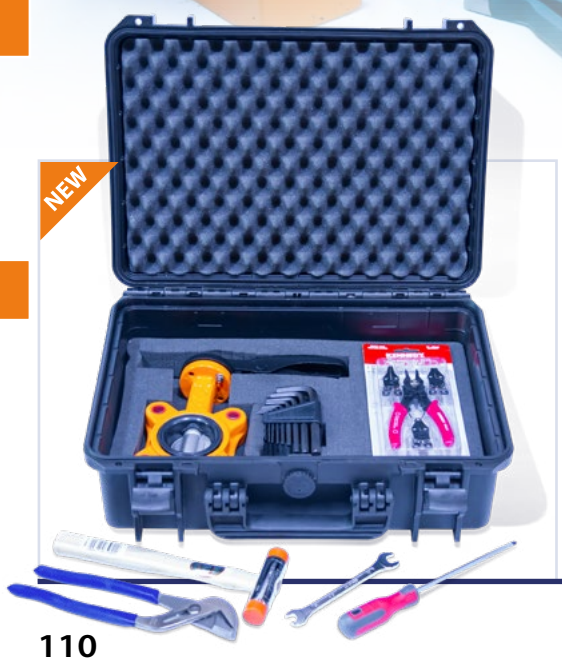
The Armfield Machine Elements product range has been designed to teach hands-on industrial skills, to prepare students for work in real industrial jobs. From stripping and repairing real industrial pumps, valves and equipment to understanding the construction and operation of heat exchangers.

The range allows student to fully understand the function and main components of universally used machine elements.



ME61: 2"/DN50 Single Stage Centrifugal Pump
ME62: 2"/DN50 Long Coupled Single-Stage Centrifugal Pump
ME63: 2"/DN50 4 Stage Centrifugal Pump
ME64: 2"/DN50 Internal Gear Pump
ME65: 2"/DN50 External Gear Pump
ME66: 1.5"/DN40 Vane Pump
ME67: 2"/DN50 Multi-Screw Pump
ME68: 2"/DN50 Lobe Pump
ME69: 2"/DN50 Diaphragm Pump
ME70: 2.5"/DN65 Tri-Rotor Rotary Piston Pump
ME81: 2"/DN50 Ball Valve
ME82: 2"/DN50 3-Way Ball Valve
ME83: 2"/DN50 Gate Valve
ME84: 2"/DN50 Globe Valve
ME85: 2"/DN50 Right-Angled Globe Valve
ME86: 2"/DN50 Diaphragm Valve
ME87: 2"/DN50 Butterfly Valve
ME88: 1"/DN25 Needle Valve
ME89: 2"/DN50 2-Port Plug (Cock) Valve
ME90: 2"/DN50 Ball Check Valve
ME91: 2"/DN50 Swing Check Valve
ME92: 2"/DN50 Disc Check Valve
ME93: 2"/DN50 Lift Check Valve
ME94: 2"/DN50 Electrically Actuated Ball Valve
ME95: 2"/DN50 Pneumatically Actuated Ball Valve
ME96: 2"/DN50 Control Valve without Positioner
ME97: 2"/DN50 Control Valve With Smart Positioner
ME98: 2"/DN50 Dissectible 3-Way Control Valve
ME99: 2"/DN50 Solenoid Valve
ME100: 2"/DN50 Pressure Reducing Valve
ME101: 2"/DN50 Spring Safety Relief Valve

NEW

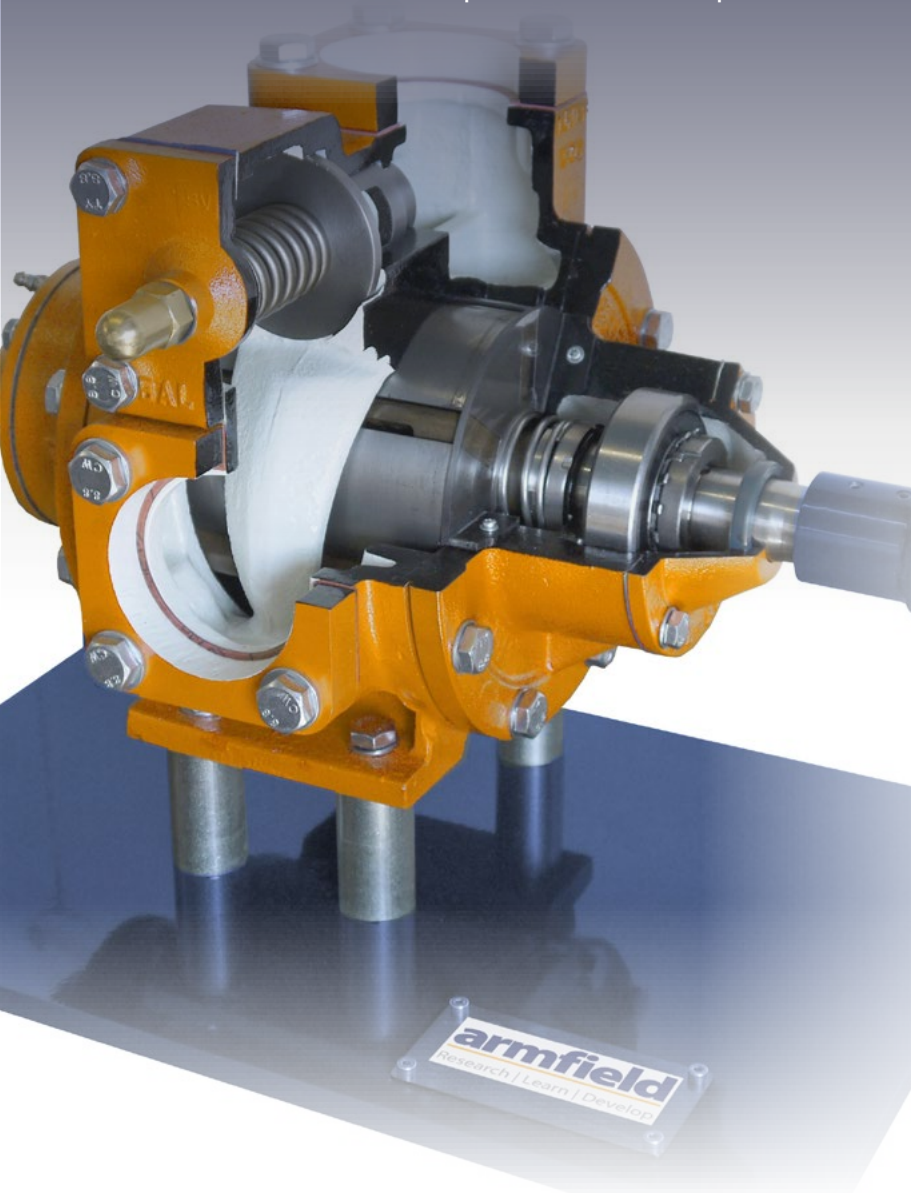


ME65 - External Gear Pumps

ME SERIES

Cutaway Pumps & Valves

Our cutaway pumps and valves are manufactured using brand new industrial pumps, sectioned, and mounted for easy visualisation of the internal pump's components such as impellers, shafts, bearings and flow paths.



ME1: 2"/DN50 Cutaway Centrifugal Pump, Close-Coupled
ME2: 2.5"/DN65 Cutaway Centrifugal pump, Long Coupled
ME3: 2"/DN50 Cutaway 4-Stage Centrifugal Pump
ME4: 2"/DN50 Cutaway Internal Gear Pump
ME5: 2"/DN50 Cutaway External Gear Pump
ME6: 2"/DN65 Cutaway Vane Pump
ME7: 2"/DN50 Cutaway Triple Screw Pump
ME8: 2"/DN50 Cutaway Triple Lobe Pump
ME9: 1.5"/DN40 Cutaway Diaphragm Pump (Ductile Iron)
ME10: 3/8"/DN10 Cutaway Diaphragm Metering/Dosing Pump
ME21: 2"/DN50 Cutaway Ball Valve
ME22: 2"/DN50 Cutaway 3 – way Ball Valve
ME23: 2"/DN50 Gate Valve
ME24: 2"/DN50 Globe Valve
ME25: 2"/DN50 Cutaway Right-Angle Globe Valve
ME26: 2"/DN50 Cutaway Weir Diaphragm Valve
ME27: 2"/DN50 Cutaway Butterfly Valve
ME28: 1"/DN25 Cutaway Needle Valve
ME29: 2"/DN50 Cutaway 2-Port Plug Cock Valve
ME30: 2"/DN50 Cutaway Ball Check Valve
ME31: 2"/DN50 Cutaway Swing Check Valve
ME32: 2"/DN50 Cutaway Disc Check Valve
ME33: 2"/DN50 Cutaway Lift Check Valve
ME34: 2"/DN50 Cutaway Electrically Actuated Ball Valve
ME35: 2"/DN50 Cutaway Pneumatically Actuated Ball Valve
ME36: 2"/DN50 Cutaway Control Valve without Positioner
ME37: 2"/DN50 Cutaway 3-Way Control Valve without Positioner
ME38: 2"/DN50 Cutaway Solenoid Valve
ME39: 2"/DN50 Cutaway Pressure reducing Valve
ME40: 2"/DN50 Cutaway Spring Safety Relief Valve

ME30 - Cutaway Ball Check Valve

M40 - Cutaway Spring Safety Relief Valve

M21 - Cutaway Ball Valve

FS SERIES

Fluid Science

Link to FS Series

Introduce students to engineering early with Armfield's Fluid Science range

Armfield's Fluid Science range provides hands-on experimentation in Fluid Mechanics and Thermo Fluids, from basic flow measurements to advanced heat exchanger processes. Using the service unit with a multi-functional work panel, students can conduct individual or group experiments.

A user-friendly guide with visual illustrations enhances learning, while the modular tray system ensures easy access and storage.

Suitable for student home learning

User friendly quality experiments

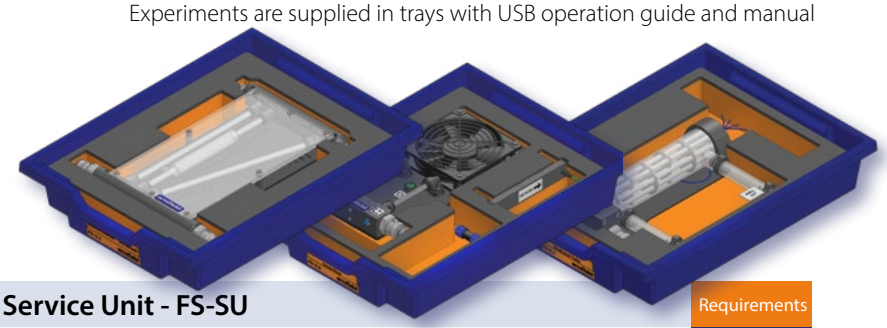
Accurate temperature and flow gauges

Experiments are supplied in trays with USB operation guide and manual

NEW

FS-5.1 Flow Visualiser

Flow visualisation brings the beauty of fluid mechanics to life. Art and science come together to inspire and inform. Give students a transformative moment where they see for themselves key physical phenomena and connect theory to intuition.

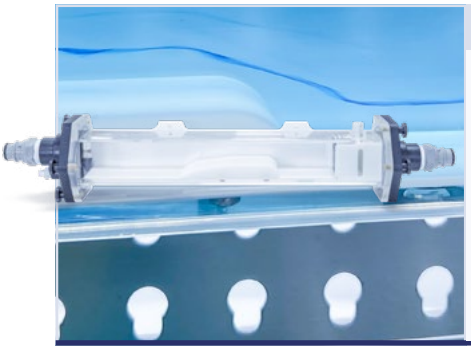


Fluid Science Service Unit - FS-SU

The Fluid Science Service Unit is designed to be used in conjunction with the fluid science experiments offered by Armfield. The unit incorporates a pump and rotameter to vary the water flow rate and a heating system. The built-in safety features of the unit include a thermal cut-out that prevents the hot water circuit exceeding 55°C and a low voltage water resistant power supply unit.

The high precision elements are supplied as modular tray-based systems which operate in conjunction with the Fluid Science Service Unit, multifunctional work panel and instrumentation enabling the student to conduct their individual or group experiments

Requirements



Flow Visualiser - FS-5.1

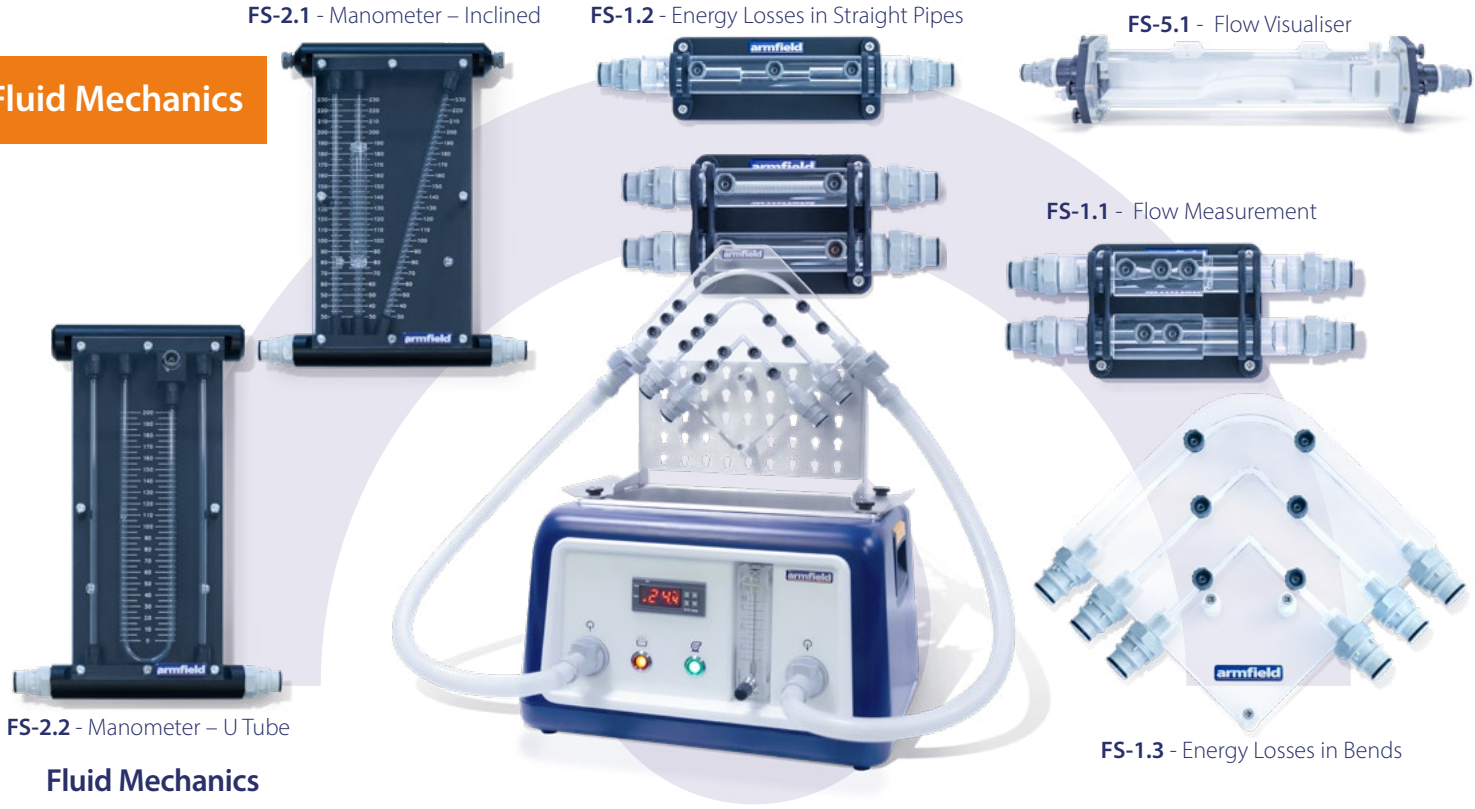
The Flow Visualisation accessory features a transparent working section within a water flow loop, offering students a hands-on approach to fluid mechanics. Designed for educational experiments, it provides excellent optical access and fits the FS-BU.

Its clear design allows real-time observation of fluid flow patterns, while adjustable release points for coloured water enable students to create their own streak lines. It features interchangeable bodies in the working section, encouraging exploration based on individual interests.

Students can visualise streamlines, streak lines, path lines, boundary layers, wakes, and creeping flow, supporting both qualitative and quantitative analysis, helping them connect concepts with real-world observations.

Requirements

Fluid Mechanics



FS-2.1 - Manometer – Inclined

FS-1.2 - Energy Losses in Straight Pipes

FS-5.1 - Flow Visualiser

FS-1.1 - Flow Measurement

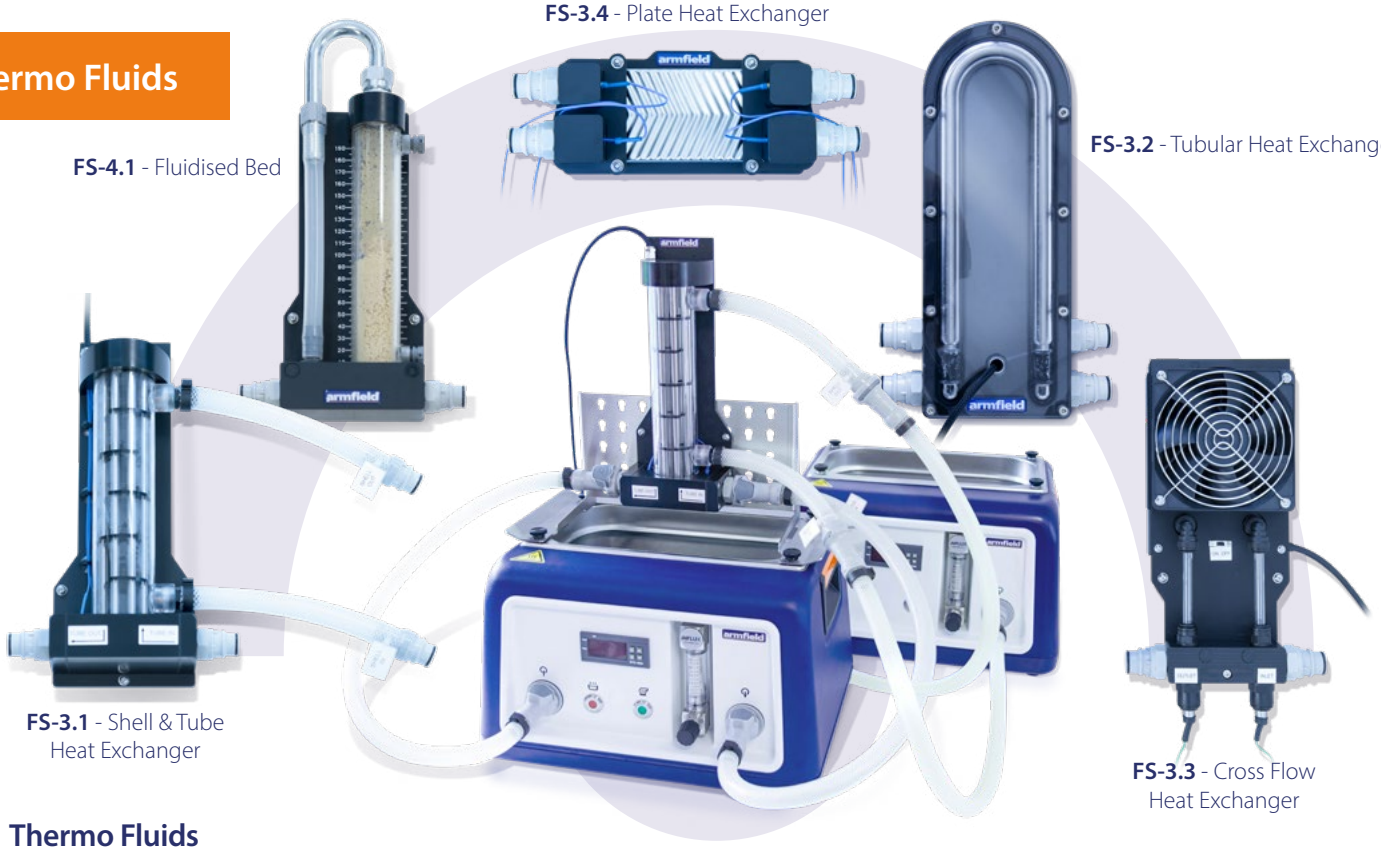
FS-2.2 - Manometer – U Tube

FS-1.3 - Energy Losses in Bends

Fluid Mechanics

Explore energy losses in pipes with three experiments trays covering the curriculum as well as studying flow using manometers.

Thermo Fluids



FS-3.4 - Plate Heat Exchanger

FS-4.1 - Fluidised Bed

FS-3.2 - Tubular Heat Exchanger

FS-3.1 - Shell & Tube Heat Exchanger

FS-3.3 - Cross Flow Heat Exchanger

Thermo Fluids

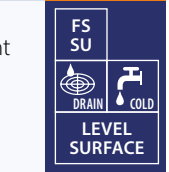
Using two base units to provide a hot and cold system to study entry level heat transfer, this series includes a fluidised bed tray.

Fluid Science Flow Measurement - FS-1.1

Combined with the Fluid Science Service Unit, the Fluid Science Flow Measurment Tray, provides hands on experimentation designed to demonstrate flow measurement and the relationship between velocity and pressure drop.

Utilising the FS-SU service unit the flow meters experiment rapidly mounts onto the multifunctional work panel and is connected to the built-in water supply via quick connect couplings. Differential pressure reading is taken using a digital manometer against varying flow rates.

Requirements



Energy Losses - Straight Pipes - FS-1.2

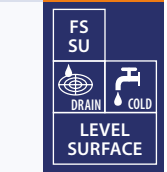
The Fluid Science Energy Losses in Straight Pipes Tray provides hands on experimentation designed to demonstrate energy losses due to the geometry of the flow path at different flow rates.

Utilising the service unit the experiments rapidly mount onto the multifunctional work panel and is connected to the built-in water supply via quick connect couplings. Differential pressure reading is taken using a digital manometer against varying flow rates.

The tray includes the following Hydraulic Circuits:

- **Smooth and Roughened pipe 6mm diameter**
- **Contraction and expansion 8mm – 4mm – 8mm diameters**

Requirements



Energy Losses - Bends - FS-1.3

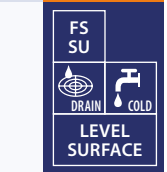
The Fluid Science Energy Losses in Bends Tray provides hands on experimentation designed to demonstrate energy losses due to the geometry of the flow path at different flow rates.

Utilising the service unit the experiments rapidly mount onto the multifunctional work panel and is connected to the built-in water supply via quick connect couplings. Differential pressure reading is taken using a digital manometer against varying flow rates.

The tray includes the following Hydraulic Circuits:

Energy losses in bends - Shallow bend radii 75mm, 6mm bore
- Tight bend radii 25mm, 6mm bore
- Mitre bend, 6mm bore

Requirements

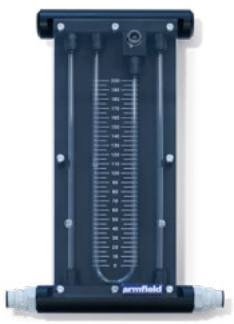


Fluid Science Manometer - Inclined - FS-2.1

The Fluid Science Inclined Manometer tray includes experiments to measure small pressure differences and the effect of change in manometer inclination.

The tray additionally includes a stepped manometer that incorporates changes in cross section to demonstrate that the level of a free surface is not affected by the size or the shape of the tube.

Requirements



Fluid Science Manometer - U Tube - FS-2.2

The Fluid Science U-Tube Manometer tray includes experiments to compare the pressure created with varying flow rates against atmospheric pressure for both ends of a straight pipe.

It also demonstrates how the differential pressure changes as flow rate changes across a straight pipe.

Requirements

Requirements

FS SU

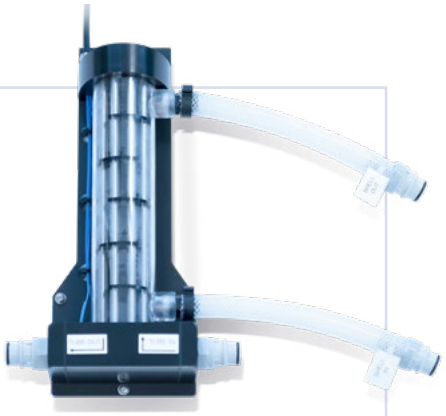
DRAIN COLD

LEVEL SURFACE

Fluid Science Shell and Tube Heat Exchanger - FS-3.1

The Fluid Science Shell and Tube Heat Exchanger tray includes experimentation to demonstrate indirect heating or cooling by transfer of heat from one fluid stream to another when separated by a solid wall (fluid to fluid heat transfer) in a shell and tube heat exchanger.

The tray introduces students to concepts such as heat transfer coefficients, thermal resistances, controlling resistance and heat transfer driving forces. The heat exchanger can be used in a co-current or countercurrent configuration.



Requirements

FS SU

DRAIN COLD

LEVEL SURFACE

Fluid Science Tubular Heat Exchanger - FS-3.2

The Fluid Science Tubular Exchanger tray includes experimentation to demonstrate indirect heating or cooling by transfer of heat from one fluid stream to another when separated by a solid wall (fluid to fluid heat transfer) in a tubular heat exchanger.

The tray introduces students to concepts such as heat transfer coefficients, thermal resistances, controlling resistance and heat transfer driving forces. The heat exchanger can be used in a co-current or countercurrent configuration

Requirements

FS SU

DRAIN COLD

LEVEL SURFACE

Fluid Science Cross Flow Heat Exchanger - FS-3.3

The Fluid Science Cross Flow Heat Exchanger tray includes experimentation to demonstrate indirect heating or cooling by transfer of heat from hot water to air (fluid to air heat transfer) in a cross flow heat exchanger.

The tray introduces students to concepts such as heat transfer coefficients, thermal resistances, controlling resistance and heat transfer driving forces. The heat exchanger can be used in a co-current or countercurrent configuration.

Requirements

FS SU

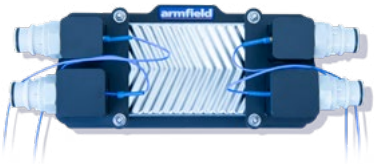
DRAIN COLD

LEVEL SURFACE

Fluid Science - Plate Heat Exchanger - FS-3.4

The Fluid Science Plate Heat Exchanger tray includes experimentation to demonstrate indirect heating or cooling by transfer of heat from one fluid stream to another when separated by a solid wall (fluid to fluid heat transfer) in a plate heat exchanger.

The tray introduces students to concepts such as heat transfer coefficients, thermal resistances, controlling resistance and heat transfer driving forces. The heat exchanger can be used in a co-current or countercurrent configuration.



Requirements

FS SU

DRAIN COLD

LEVEL SURFACE

Fluid Science - Fluidised Bed - FS-4.1

The Fluidised Bed tray introduces students to the concepts of bed fluidisation commonly encountered both in nature and in industry.

Natural occurrences include the movement of ground water, the movement of crude petroleum or the movement of natural gas through porous media.

Industrial occurrences include operations such as back-washing filters, ion-exchange processes, extraction of soluble components from raw materials and certain types of chemical reactor.

EF SERIES

Renewable Energy

Link to EF Series

Part of a comprehensive range of renewable energy studies

The Engineering Fundamentals (**EF**) renewable energy range is designed specifically for the High school and Technical college curriculums.

EF-6.3 - Anemometer

Photovoltiac Energy kit - EF-6.1

Covers the principles of Photovoltaics (PV) and the direct conversion of light into electrical energy through solar cells.

The modular tray based kit is supplied with a plug and play base unit which allows the students to create a variety of supplied experiments.

Related Curriculum's:

- Physics
- Electrical Engineering
- Renewable Energies

Requirements

EF-6.8

Wind Energy kit - EF-6.2

Covers the principles of wind power generation.

This allows students to understand the functions of wind power plants. Including practical experiments into how wind speed, wind direction or rotor type influences the power output.

Related Curriculum's:

- Physics
- Electrical Engineering
- Renewable Energies

Requirements

EF-6.3

EF-6.8

Requirements

EF-6.8

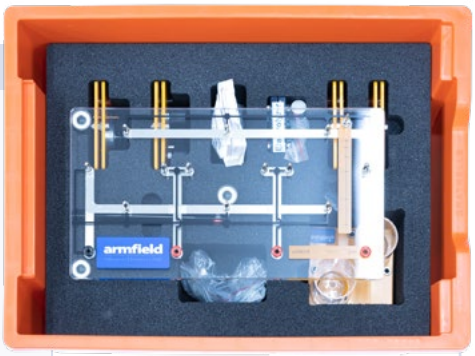
Hydrogen Fuel Cell Technology - EF-6.4

The kit covers the principles of electrolysis and fuel cells. Containing PEM-fuel cells and the components of a complete solar-hydrogen cycle (electrolyzer, PEM fuel cell and solar module). The electrical consumer (motor) allows for realistic and demonstrative experiments.

Can be optionally expanded with an SOFC cell to demonstrate a second fuel cell technology.

Related Curriculum's:

- Physics, Chemistry, Electrical Engineering, Renewable Energies



Requirements

EF-6.8

BURNER

Clamp Stand

Biomass Fuel Technology - EF-6.5

Covering the entire process of producing biofuels. It starts with the biological step of alcoholic fermentation. Afterwards the produced mash will be distilled with the help of the supplied condenser.

The final stage is the conversion of the produced biofuel into usable energy, such as electrical energy, using the provided Ethanol-fuel cell.

The tray additionally covers production of biodiesel through transesterification of fats.

Related Curriculum's:

- Physics, Chemistry, Biology, Electrical Engineering, Renewable Energies

Requirements

EF-6.8

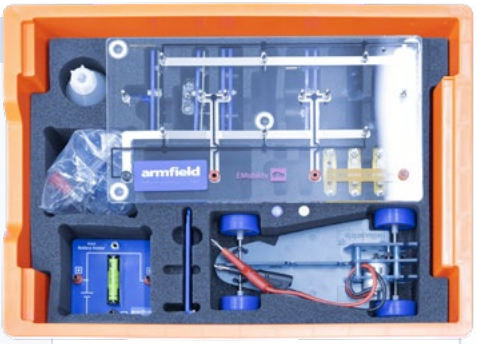
Battery Technology Kit - EF-6.6

The kit teaches students the physical and technical principles and applications of different battery technologies. The highly topical issue of electric mobility is explored with an electric model car.

The characteristics of various battery types are analyzed with qualitative and quantitative experiments.

Related Curriculum's:

- Physics
- Electrical Engineering
- Renewable Energies



Requirements

EF-6.8

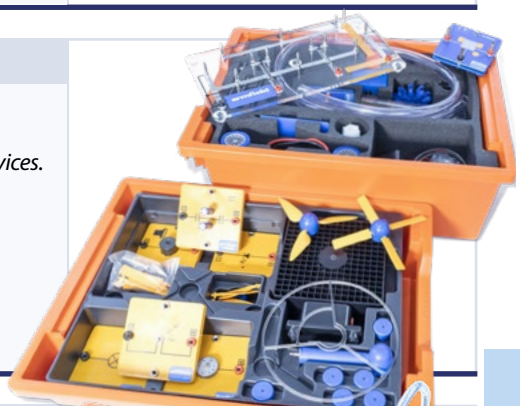
Renewable Energy - EF-6.7

The Renewable Energies kit has been specifically adapted for basic introduction to photovoltaic, wind power, hydro power, battery and fuel cells technology.

The kit is supplied with all accessories including power supply, cables and measuring devices.

Related Curriculum's:

- Physics
- Chemistry
- Electrical Engineering
- Renewable Energies



Requirements

EF-6.8

Accessories Kit - EF-6.8

The Accessories Kit comprises of all the essential items required by students to operate the engineering fundamentals renewable energy kits.

Supplied in a modular tray the kits include:

Power Module's, power supply's, test leads, digital multi meters, a light source, an anemometer and a Laboratory thermometer.

RE SERIES Renewable Energies Range

A suite of specialised learning systems for technical education in universities and vocational training centres and technical colleges.

The advanced renewable energy series encompasses the following new energies technologies:

- Photo-voltaic Energy
- Wind Energy
- Fuel cell Technology
- Thermal Energy
- Wind Energy
- Smart Grid Technology
- Energy Efficiency & Saving
- Bio Fuel
- Bio Energy
- Battery Technology
- Renewable Energy
- Hydro-power

RE12 - Advanced Wind Energy

RE10 - Advanced Photovoltaic Energy

RE14 - Advanced Fuel Cell Technology

RE16 - Advanced Thermal Energy

RE18 -Advanced Smart Grid Technology

RE20 - Biofuel

RE22 - Advanced BioEnergy

RE24 - Advanced Battery Technology

RE26 - Hydropower

The kits are supplied including all the necessary ancillary and measuring equipment, student and teacher instructions and are supplied in a custom designed aluminium case with heavy-duty foam inserts.

Requirements

1Ph

Advanced Photovoltaic Energy - RE10

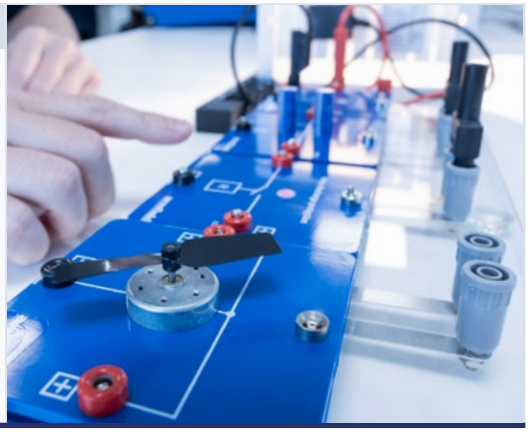
The case provides students with a self-contained modular system, covering the physical fundamentals of photovoltaics, the analysis of the components of PV-Systems, and the ability to design.

Experimental Content:

- Electrical engineering basic experiments
- Photovoltaic basic experiments
- Photovoltaic system experiments

Related Curriculums:

- Electrical Engineering
- Renewable Energies



Requirements

1Ph

Advanced Wind Energy - RE12

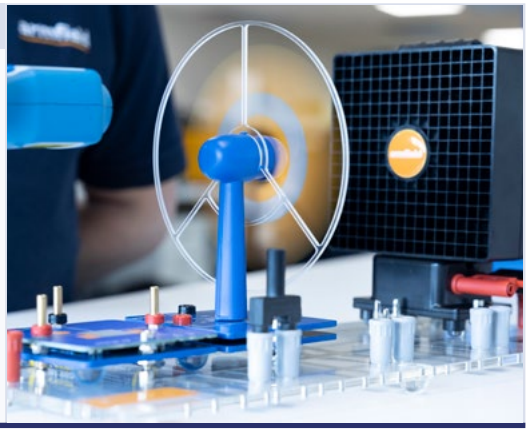
The case provides students with a self-contained modular system, covering the physical fundamentals of wind energy productions, covering wind power fundamentals, controlling a typical wind tunnel and different rotor types.

Experimental Content:

- Basic electronic experiments
- Basic wind experiments
- Influence of a consumer

Related Curriculums:

- Electrical Engineering
- Renewable Energies



Requirements

1Ph

Advanced Fuel Cell Technology - RE14

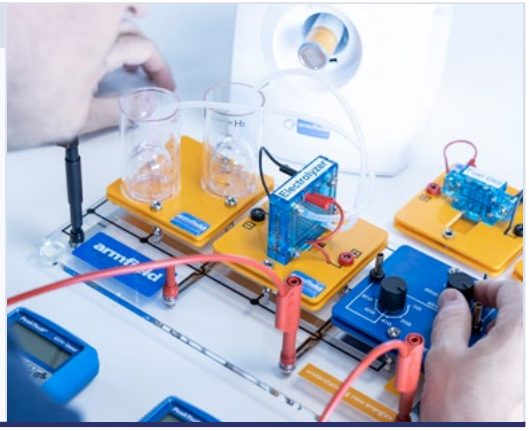
The case provides students with a self-contained modular system, covering current fuel cell technology on a laboratory scale.

Using the system students can undertake experiments covering working principles, efficiency, and characteristics curves of electrolysers and fuel cells.

In addition to a PEM-fuel cell, it also contains an ethanol-fuel cell to compare the different technologies.

Related Curriculums:

- Chemical Engineering
- Electrical Engineering
- Renewable Energies



Requirements

1Ph

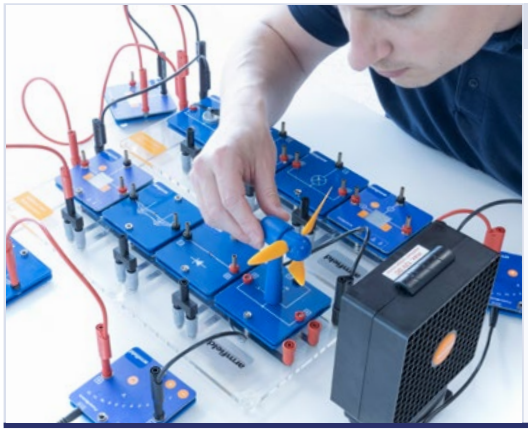
Advanced Thermal Energy - RE16

The case provides students with a self-contained modular system, covering the different technologies for solar thermal energy transformation on a laboratory scale. Included in the system are various solar collector systems (including Parabolic reflector and Absorber tube) which can be operated with or without the supplied pump.

Additionally supplied are CSP-technology (Concentrated Solar Power) and a Peltier element for the direct transformation into electric energy.

Related Curriculums:

- Renewable Energies
- Air-conditioning
- Heating
- Energy Efficiency



Advanced Smart Grid Technology - RE18

Requirements

1Ph

The case provides students with a self-contained modular system, allowing an in-depth understanding of the complex interactions between renewable energies, energy storage and consumers on a laboratory scale.

Experimental Content:

- Smart grid experiments
- Fundamental experiments in: **Photovoltaics / Wind energy / Fuel cell and electrolyzer / Storage technologies**

Related Curriculums:

- Electrical Engineering
- Renewable Energies

Advanced Biofuel - RE20

Requirements

1Ph

The case provides the entire process of producing biofuel is demonstrated with the Armfield Bio-Fuel kit in the form of student experiments. The suitcase contains all necessary parts and components and can be used from any location. Our first step is resource selection and fermentation. The resulting mash is then distilled with the custom-built condenser and the resulting ethanol will be characterized.

Lastly, the produced bio fuel needs to be converted into usable energy – for example into electricity with the provided ethanol fuel cell.

Related Curriculums:

- Electrical Engineering
- Chemical Engineering
- Environmental Engineering

Feed their curiosity by encouraging an exploration...

Requirements

1Ph

Advanced BioEnergy - RE22

The extensive experiment system brought to you by the Armfield BioEnergy kit enables you to reconstruct and understand the whole biomass cycle without any additional equipment.

Experimental Content: BioEnergy experiments

- Germination of plant seeds
- Plant growth in a hydroculture
- Consumption of water and nutrients
- Aerobic degradation of biomass in a compost
- Anaerobic degradation of biomass to form hydrogen
- Anaerobic degradation of biomass to form methane

Related Curriculums:

Renewable Energies, Chemical Engineering, Environmental Engineering

Requirements

1Ph

Advanced Battery Technology - RE24

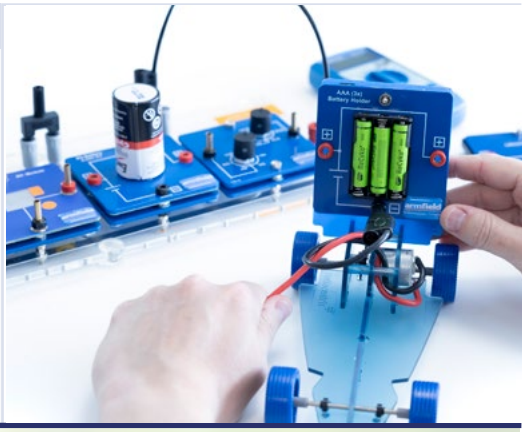
Provides a comprehensive experimentation system for battery technology.

With the equipment students will fully understand which battery technologies is required and how this decision is made based on capacity, loading and durability.

The kit is supplied with different battery technologies such as lead, NiMH, or Lithium-Polymer (LiPo) as well as a PEM-fuel cell.

Related Curriculums:

- Renewable Energies
- Electrical Engineering
- Automotive Engineering



Requirements

1Ph

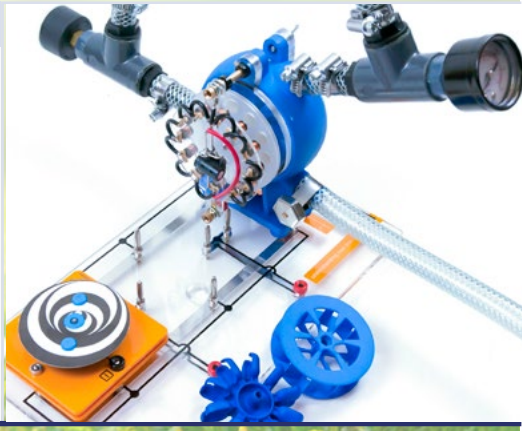
Advanced Hydropower - RE26

The RE26 Hydropower provides an introduction into hydropower renewable energy generation and usage.

The system is supplied with different types of turbines, from a simple water wheel to a modern, highly efficient Pelton turbine.

Related Curriculums:

- Volume flow, flow velocity and power as a function of the height
- Flow rate depending on different hose diameters.
- Volume flow, flow velocity and power as a function of the pipe cross-section
- Comparison of the functionality of Pelton turbine, crossflow turbine and waterwheel
- Comparison of the performance of the Pelton turbine, crossflow turbine and waterwheel in dependence to the volume flow and pressure



CA SERIES

Control & Acquisition Systems

Link to armSOFT

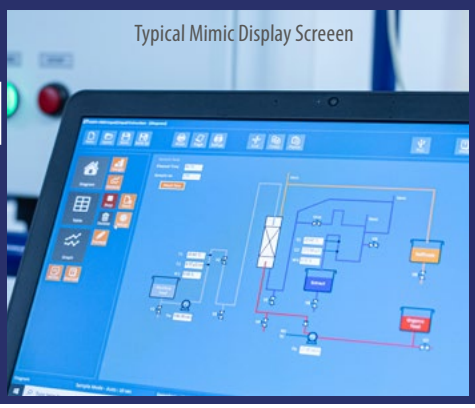
armSOFT

armSOFT data entry, data logging, acquisition and control software

Typical armSOFT aSUITE Controller Screen

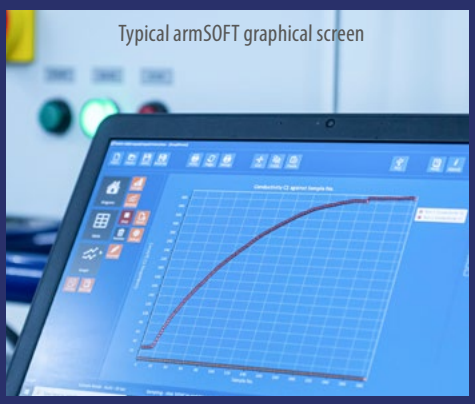
Available for many Armfield products, with a wide range of features

- Remote access
- Remote control
- Data logginig
- Realtime display
- Graph plotting
- Process results
- Export results to Excel
- Manual & automatic data entry
- Spreadsheet format
- Mimic diagrams
- Graphs
- Controller screen
- Intuitive interface
- Online help available
- Comes standard with many items



Typical Mimic Display Screeen

Typical Tabular Display



Typical armSOFT graphical screen

The armSOFT™ suite of software from Armfield delivers an intuitive and simple to use range of computer applications. The user interface is generic across the range providing powerful data entry, data logging, acquisition and control software with a wide range of features which is available for many Armfield products.

Requirements

PC

USB

Manual Data Entry - aBASIC

Some products are not suitable for data logging, and require the results to be input manually from primary instrumentation such as manometers or thermometers.

For these products the armSOFT aBASIC software offers a powerful tool for displaying and processing the results.

Requirements

PC

USB

Data logging Facilities - aLITE

Powerful data logging software with automatic or manual sampling.

The data is stored in spreadsheet format, which also contains any calculated values.

The software includes powerful graph plotting tools enabling numerous display options, including dual y axes, points or lines.

Requirements

PC

USB

Acquisition and Control - aSUITE

This package has all the data logging and general features of the armSOFT aLITE package, but also includes computer control.

A mimic diagram is used where set points and output values can be specified, PID loops can be tuned, and on-off switches can be controlled.

Hardware

armSOFT data logging products connect to the computer using USB interfaces. The USB interface is either built into the main equipment or via a separate control unit such as the IFD7.

The interface details can be seen in the requirements section for each individual product, to utilise the USB interface a computer is essential.

CA SERIES

Hardware/Software Control & Acquisition Systems

Link to armBUS

armBUS

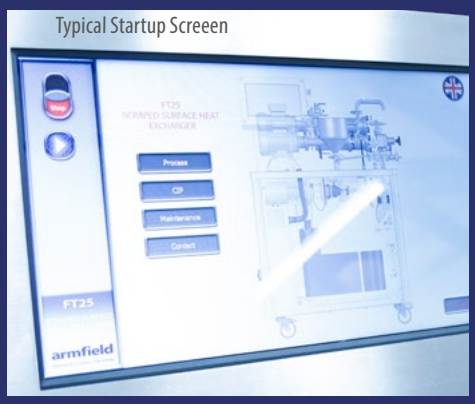
A revolutionary integrated hardware/software ecosystem, enabling the connection of teaching and research equipment to the modern world

The armBUS standardised interface makes operating Armfield products easy for teaching and research, producing reliable data or product across multiple area's of industry.

armBUS a radical system for integrating electronic measurement sensors and control devices onto teaching and research equipment. armBUS is a universal, single-wire interface which enables all peripheral sensors and control mechanisms to be connected to a digital bus with common ports. Connectivity is completely port independent, eliminating errors in the configuration of the system as well as enabling seamless integration of new sensors at any point in time.

armBUS can be interfaced to a variety of devices via a USB port, network port or wireless connection enabling the equipment to be operated with a PC, PC with touchscreen, optional LCD touchscreen or a mobile device such as a tablet.

Advantages of the armBUS system include improved reliability, improved interchangeability and improved accuracy. All sensors are pre-calibrated, eliminating the need for further calibration after installation or if a sensor is replaced.



Typical Startup Screeen

Typical Control Display


Graphing screen

Standard controls for all basic functions such as start-up & shut down

Data logging as standard, results can be analysed in armBUS or exported to a spreadsheet

Multiple languages are available

** Language options are product dependant*

Requirements

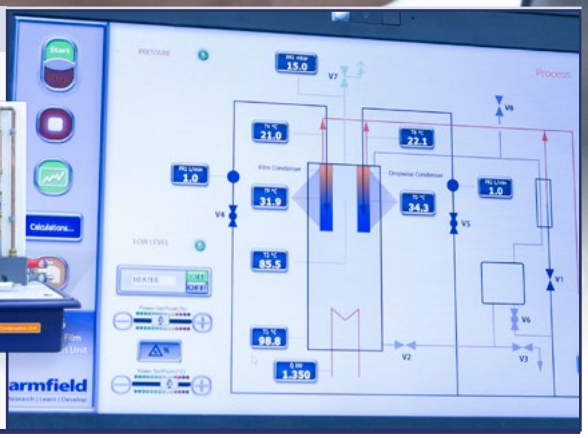
PC

USB

Hardware Acquisition and Control - armBUS TH6

TH6 Film and Dropwise Condensation Demonstration Unit

- Total control and monitoring of process parameters
- Can view trends in current parameters
- Comparison of current data to previous process runs possible in real time
- Quick save feature for data recovery



Requirements

PC

USB

Hardware Acquisition and Control - armBUS FT74XA

FT74XA Miniature-scale HTST/UHT processing system

- Total control and monitoring of process parameters
- Can view trends in current parameters
- Comparison of current data to previous process runs possible in real time
- Quick save feature for data recovery

Requirements

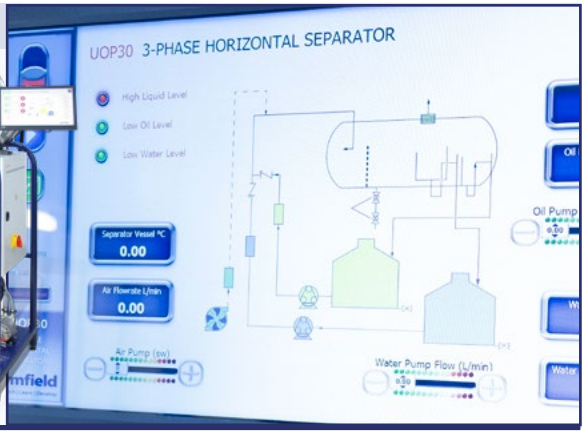
PC

USB

Hardware Acquisition and Control - armBUS UOP30

UOP30 3-Phase Horizontal Separator

- 3-Phase horizontal separator
- Visual demonstration of the entire separation process
- Software Control, PID and data logging via PC



armfield
Industrial Processing & Food Technology

Link to IFT Series

Research | Development | Production | Industry

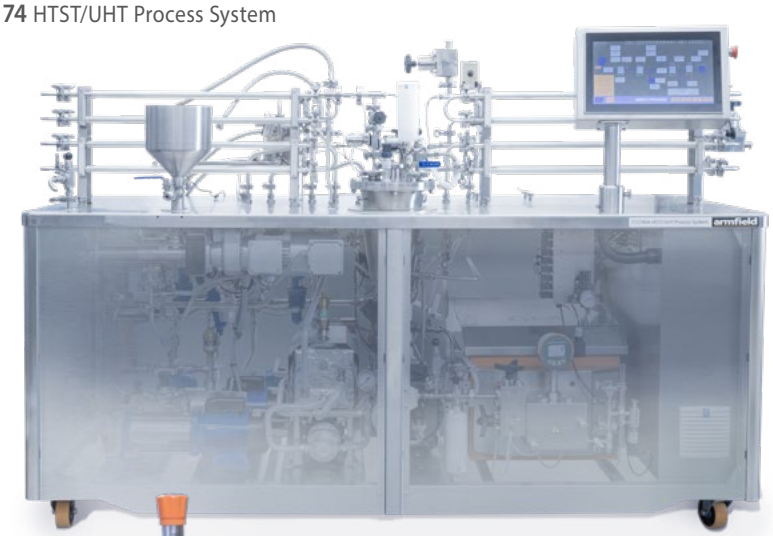
Armfield can provide a complete solution to your requirements, offering not just the equipment but processing line advice, planning, installation, commissioning and training.

This range includes industry rated equipment for vocational training, research and development, small scale pilot and batch production for applications in the following fields:

- ▶ Dairy
- ▶ Ingredients
- ▶ Flavours & fragrances
- ▶ Edible & essential oils
- ▶ Liquid foods
- ▶ Beverages
- ▶ Plant based beverages
- ▶ Pharmaceuticals
- ▶ Nutraceuticals

FT25XA Margarine Crystalliser

FT174 HTST/UHT Process System



FT18-MKII Cross Flow Filtration

FT17 Cross Flow Membrane Filtration

Products listed by process

Batch Heat Treatment/Pasteurisation

- FT19
- FT140X

HTST/UHT Thermal Processing

- FT43
- FT75
- FT94X
- FT94LT
- FT174
- FT74XA

Homogenisation

- FT90
- FT91

Filling

- FT83XA
- FT102XA

Carbonation/Filling/Capping

- FT102XA

Drying

- FT30
- FT31
- FT32
- FT80/81 (Also has chilling capability)

Margarine Crystallisation

- FT21
- FT25XA (20 & 40 bar Units)

Ice Cream Processing

- FT25XA
- FT140X

CIP (clean in place)

- FT52

Mixing

- FT140X

Filtration - Microfiltration/Ultrafiltration/Nanonfiltration & Reverse Osmosis

- FT18-MKII - Different membranes available
- FT17 - Different membranes available

Chilling

- FT63 or FT64

Pressure Extraction

- FT2
- FT14
- FT28
- FT110DP - 1 litre
- FT111X - 5, 10 & 20 litres available

Solvent Extraction

- FT29

Oil Neutralisation, Washing, Bleaching and Refining

- FT66

Oil Deodorisation

- FT68

Hydrogenation

- FT67

Cheese Making

- FT20

STERILE PROCESSING LINES

HTST/UHT System Options

- FT74XA - Plate + Tubular heat exchanger
- FT174 - Plate, Tube, Scraped surface H.E. + DSI
- FT94X - Up to 200l/h (option)
- FT94LT - Up to 100l/h

Homogeniser Options

- FT91

Mixing Tanks

- FT140X - Various sizes and configurations available

Sterile Filling Station

- FT83XA - Optional UV

Chiller Options

- FT63 or FT64

Steam Generator

- UOP10

Industrial Processing & Food Technology

IFT SERIES

Laboratory Pasteurisation

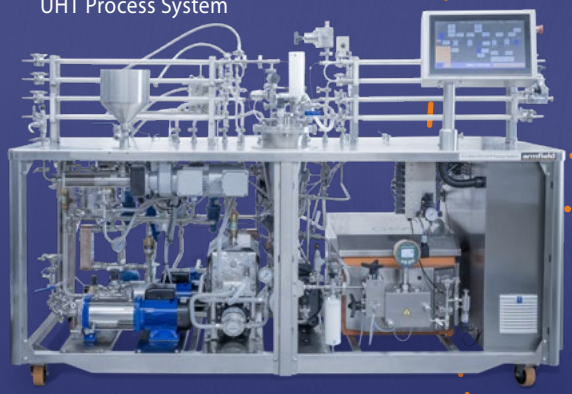
Link to IFT Dairy

The HTST/UHT processing equipment from Armfield allows you to create a modular heat treatment process line that can be reconfigured at any time.

From mixing and preparing the ingredients, through heat treating the product, storing it safely and filling it in a sterile environment, our equipment can safely simulate your processing needs.

FT140X Mixing Vessel

FT174 Modular Miniature Scale HTST/ UHT Process System



FT63 Laboratory Process Chiller

UOP10 Laboratory Steam Generator

FT83XA Sterile Filling System

The FT174 is a modular HTST/UHT processing system designed to treat products at flow rates of 10-40 l/h or up to 60 l/h for water (or similar low viscosity products)

Standard modules for direct heating (steam injection) or indirect heating (using tubular and/or plate heat exchangers), SSHE, aseptic processing, upstream or downstream homogenisation and additional chilling are available.

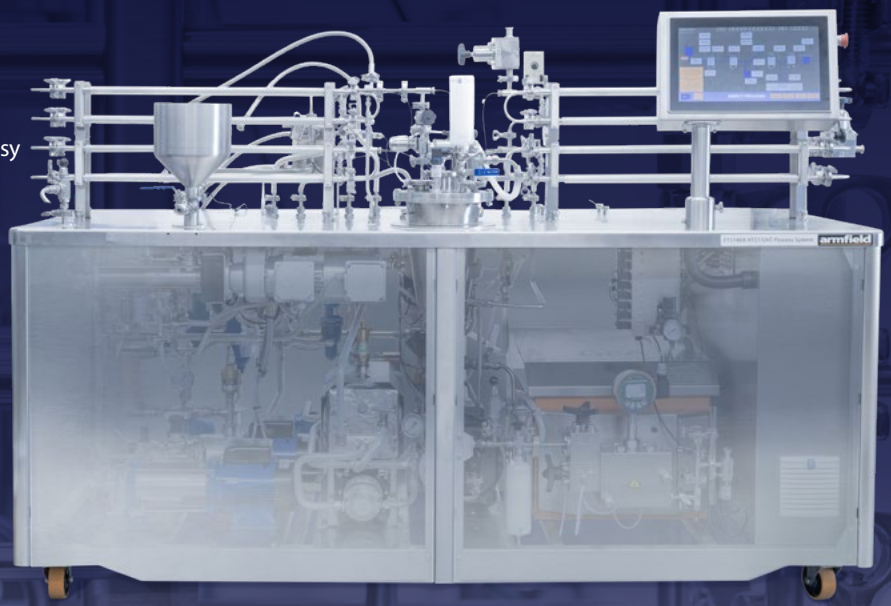
The touch-screen control panel makes it extremely user friendly and easy to configure and monitor processing parameters.

The operator is prompted at every stage whenever intervention is required.

These, along with many other options, enable multiple modules to be included in the same system, giving high process adaptability by reconfiguration of flexible product hoses, using quick-release connections. The sterilisation options enable it to be linked to an Armfield sterile filling bench to produce sterile product, even when using long holding tubes and/or downstream homogenisation.

Options for increasing the automation of different sections are available.

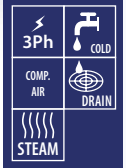
- High degree of user configuration
- Rapid start-up and shut down
- Maximum product temperature setting of 150°C
- Switch-over between heat exchangers is quick & easy
- Links directly to sterile filling bench
- Standard throughputs from 10-60 l/h
- Direct and/or indirect heating
- Low product hold-up
- Totally modular system
- Full sterile capability options
- Touchscreen control panel
- Hygienic fittings as standard
- Integral homogeniser option
- Controllable preheat and cooling
- Built-in CIP facility
- Live graphing and datalogging
- Electronic flow meter option
- Small footprint can contain tubular & plate heat exchangers, scraped surface heat exchangers (SSHE),



Can be linked to **FT83XA Sterile Filler** for ESL products

Link to FT174

Requirements

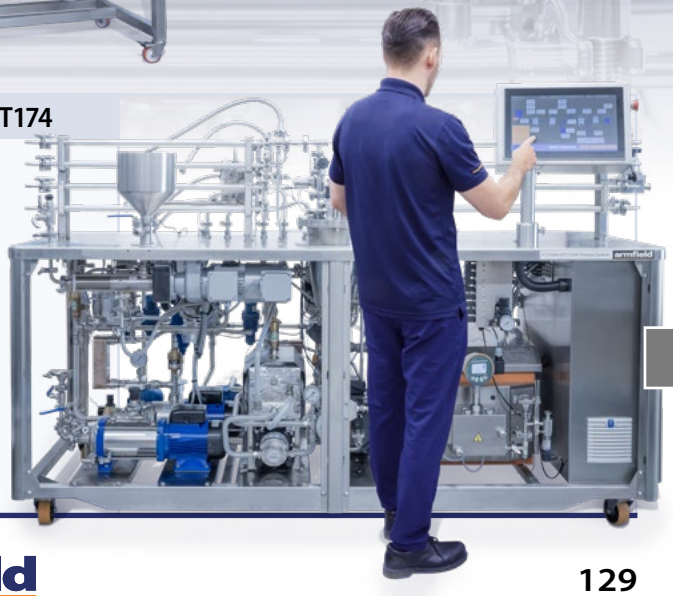


Modular Miniature-Scale HTST/UHT Process System - FT174

Indirect and direct processing using plate, tubular and scraped surface heat exchangers as well as DSI (or any combination).

The system is capable of SIP and CIP and optional in line homogenisation for use upstream or downstream.

- Flow rates between 10-60 l/h
- Multiple option are available to enhance your processing requirements



Industrial Processing & Food Technology

Link to FT74XA

The FT74XA is compact, mobile and easy to install. It has an integral pressurised hot water generator and requires only electricity and cooling water to operate making it ideal for confined spaces with limited services available.

Operation with either plate or tubular heat exchangers means a wide range of product viscosities can be handled.

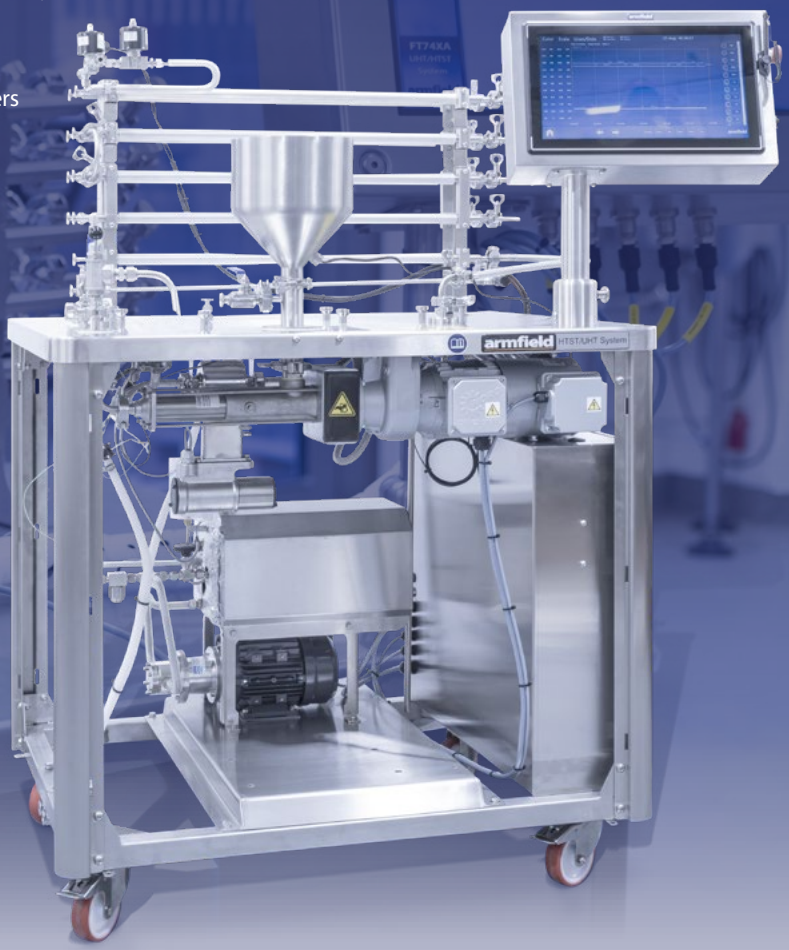
A progressive cavity feed pump ensures that flow rates are independent of viscosity/backpressure changes and allow a maximum operating pressure of 10 bar.

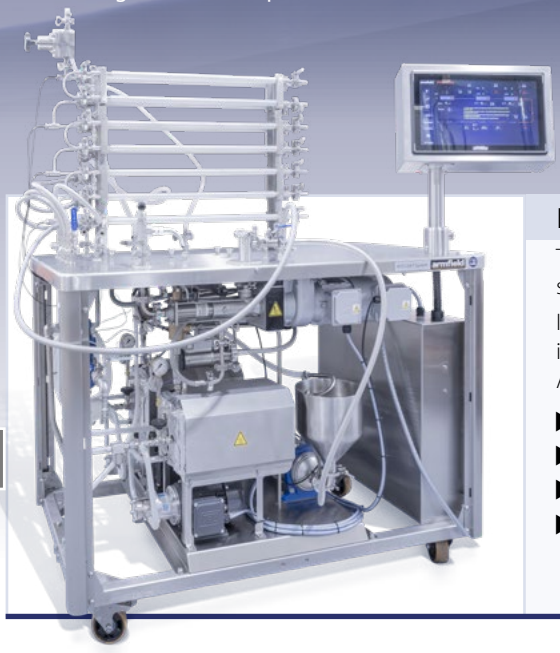
Typical processing flow rates are 10-20 L/h with holding temperatures up to 150°C.

At pasteurisation temperatures flow rates of up to 60 L/h are achievable.

Cleaning is in place (CIP) utilises the feed pump in high flow rate mode and there is a centrifugal pump CIP option FT74XA-52 which generates very high cleaning velocities to deal with products that are particularly difficult to clean.

- Platinum resistance (PT100) temperature sensors for high accuracy
- Variable holding tube options
- Fully instrumented: product pressure and flowrate
- Two-stage cooling capability for plate & tubular heat exchangers
- Rapid switch-over between heat exchanger types
- Tests can be made with a few litres of product
- Suction feed capability to operate in conjunction with an external feed tank
- Independent operation or within a continuous process in both aseptic and non-aseptic modes
- Automated SIP capability
- Touchscreen control of all operations
- Independent pre-heat hot water loop and product temperature control
- Seamless homogenisation integration upstream or downstream with automatic speed control through the touchscreen
- Recipes saved in the system for instant set-up of operating parameters for particular products
- Backpressure control using a sprung diaphragm valve or pinch valve for products containing particals
- Controlled cooling
- On-screen calculation of holding times from flow meter reading and display of Fo value based on holding time and temperature





HTST/UHT System - FT74XA

The FT74XA is a highly flexible, miniature-scale HTST/UHT processing system which makes it ideal for new liquid product development.

It has a wide range of options to suit all needs and can be operated independently or as part of a continuous-operation process with other Armfield equipment.

- Platinum resistance temperature sensors for high accuracy
- Touchscreen control of all operations
- Two-stage cooling capability for plate and tubular heat exchangers
- armBUS control/instrumentation system increases reliability

Requirements

1Ph

3Ph

COLD

Requirements

1Ph
COMP. AIR
COLD
STEAM GENERATOR

HTST/UHT Mini Pilot System - FT94X

The Armfield FT94X Mini Pilot System is a compact HTST (High-Temperature Short-Time) and UHT (Ultra-High Temperature) processing unit designed for research and development applications. It allows users to test and optimize liquid-based food, beverage, and pharmaceutical products under controlled thermal processing conditions.

The system offers flexibility with both plate and tubular heat exchangers, enabling seamless transitions between different processing setups. It is equipped with touchscreen controls, integrated data logging, and automation, making it a powerful tool for pilot-scale production, product formulation, and process validation.

The FT94X is widely used in food and beverage, dairy, pharmaceuticals, and biotechnology industries for sterile processing and aseptic packaging.

Key Features:

- **Versatile Heat Exchange Options** – Supports plate and tubular heat exchangers, allowing adaptation to different product types and viscosities.
- **Wide Throughput Range** – Standard capacities from 30 to 100+ liters per hour, with options up to 200 L/hr.
- **Precise Temperature Control** – Operates up to 150°C, with automated product divert for temperature deviations.
- **Advanced Data Logging** – Integral USB data logging and real-time process monitoring for quality control.
- **CIP & SIP Cleaning** – Built-in Clean-In-Place (CIP) and Sterilization-In-Place (SIP) functions ensure hygienic operation.
- **Easy Integration** – Can link directly to aseptic filling systems or process lines.
- **User-Friendly Touchscreen Interface** – Simplifies operation with intuitive control over temperature, flow rate, and system settings.
- **Options** up to 200 l/h can be provided on special request.

See **FT64** for suitable chiller

Requirements

1Ph
COMP. AIR
COLD
STEAM GENERATOR

HTST/UHT Mini Pilot System - FT94LT

FT94LT is a cost effective HTST/UHT processing system, capable of throughputs of 30-100 l/h and process temperatures up to 150°C with a range of options, to tailor the product to your requirements.

Designed with flexibility in mind, the FT94LT Mini Pilot System is suitable for a wide range of applications, from fruit juices to ice cream, and pet food to pharmaceuticals.

See **FT64** for suitable chiller

Industrial Processing & Food Technology

Link to FT83XA

The Armfield FT83XA Sterile Filling System is a cost-effective and reliable solution for R&D teams looking to produce sterile packaged samples with an extended shelf life. Designed for use with Armfield UHT systems (FT74XA, FT174, and FT94X), the FT83XA provides a controlled, ultra-clean filling environment that meets Federal Standard 209E Class 100 (ISO Class 5) air quality requirements.

The system utilises a vertical laminar airflow cabinet with a high-efficiency HEPA filter to maintain sterility. It includes integrated Clean-In-Place (CIP) and Sterilisation-In-Place (SIP) capabilities, allowing easy sterilization of product pathways before filling.

A nitrogen nozzle ensures low-oxygen filling, further improving product stability and shelf life.

Key Features

- **Ultra-Clean Environment** – Maintains Class 100 (ISO 5) air quality using a HEPA filtration system.
- **Seamless UHT Integration** – Compatible with FT74XA, FT174, and FT94X UHT systems.
- **Hands-Free Operation** – Foot pedal control allows for hygienic, hands-free product filling.
- **Sterilisation & Cleaning Capabilities** – Built-in CIP and SIP systems ensure full sterilization before use.
- **Nitrogen Purging for Low Oxygen Filling** – Enhances shelf life and product stability.
- **Flexible Packaging Options** – Accommodates various container types for filling.
- **Optional UVC Lamp** – Additional disinfection inside the cabinet for enhanced sterility.
- **Large Working Area** – Provides an open front design for easy access and user convenience.

Benefits

- **Ensures Product Sterility** – Reduces the risk of contamination and maintains high product quality.
- **Ideal for R&D and Small-Scale Production** – Allows for low-volume sterile sample production before full-scale manufacturing.
- **Enhances Shelf Life** – The nitrogen headspace evacuation minimises oxidation, improving product longevity.
- **User-Friendly Design** – Simple controls and a foot pedal system make operation intuitive and efficient.
- **Compatible with Various Applications** – Suitable for food & beverage, dairy, pharmaceuticals, and biotechnology industries.

Applications & Industries

- **Food & Beverage** – Dairy, fruit juices, sauces, soups, nutritional drinks.
- **Pharmaceuticals & Biotechnology** – Sterile culture media, health supplements, and liquid formulations.
- **Dairy Industry** – Milk, yogurt, and other UHT-treated dairy products.

Sterile Filling System - FT83XA

The FT83XA is the most cost-effective solution for R&D departments to produce sterile packaged samples with an excellent shelf life.

As well as a working chamber with a controlled, clean environment, the unit includes the facilities to enable all the product paths to be sterilised and for the filling to be controlled in a simple manner.

A nitrogen nozzle is included, which can be directed over the container while filling, to give low oxygen content in the packaged product. N_2 is supplied via a sterile filter.

- Integrated UV lamp option is available for increased environment sterility

Requirements

Requirements

1Ph

3Ph

COLD

Homogenisation Sub-Systems - FT90

The FT90 has been specifically designed as a seamless, in-line homogenisation solution for use with the Armfield range of miniature-scale processing equipment. This complete homogenisation subsystem ensures efficient and reliable performance, enhancing the capabilities of Armfield's miniature-scale food processing systems.

The **FT90** is based on an APV LAB 1000 homogeniser and has been specifically optimised for this application.

- Can be operated upstream or downstream of HTST/UHT process or stand alone.
- The FT90 is supplied with all necessary equipment, interconnecting hoses, homogeniser tools etc. for trouble free integration and operation.

Requirements

1Ph

3Ph

COLD

Homogenisation Sub-Systems - FT91

The FT91 has been specifically designed as a seamless, in-line homogenisation solution for use with the Armfield range of miniature-scale processing equipment. This complete homogenisation subsystem ensures efficient and reliable performance, enhancing the capabilities of Armfield's miniature-scale food processing systems.

FT91 is based on a Niro Twin Panda.

- Can be operated upstream or downstream of HTST/UHT process or stand alone
- Can do 10-30l/h and up to 600 bar
- The FT91 is supplied with all necessary equipment, interconnecting hoses, homogeniser tools etc. for trouble free integration and operation.

Requirements

1Ph

3Ph

COLD

DRAIN

Mixing Vessels- FT140X

Armfield FT140X Multipurpose Mixing Vessels are designed and constructed using high quality hygienic industry standard materials. These tanks are available in three models in varying configurations (see table) and are available in 50l and 100l volumes.

All three models have an internal surface made of AISI 316 stainless steel. Available with or without heating / high shear emulsifier.

Options are available with Colour Touch Screen and PLC control enables easy operation of stored recipes.

Requirements

1Ph

Cheese Vat - FT20

A stainless steel jacketed vat for the production of cheese by the traditional method. A separate electrical console provides control of paddle agitator speed, temperature and pH indication.

Now offered in 10 litre or 20 litre variants: **FT20-10/FT20-20**

- FT20A Cheese Making Accessories

FT20-20

FT20-10

Link to Oils

Oil Preparation & Processing

Armfield is proud of its unique oils preparation and refining line of processing equipment. Using this equipment, you can take a raw seed from the plant, extract the oil and refine it to the purity you desire.

These units can create oils that are ready for sale or further downstream processing in various forms depending on your requirement.

FT29 Batch Solvent Extraction & Desolventising Unit

UOP10 Laboratory Steam Generator

FT66 Neutraliser/Washer/ Bleacher

FT68 Deodorising Unit

FT67 Hydrogenation Unit

FT25XA Margarine Crystalliser

Edible oils have such a wide variety of forms and functions and are used in such a range of consumer products that constant redeveloping of new products and refining of the manufacturing process is becoming more of a necessity in modern manufacturing environment.

Link to FT25

The FT25XA range of miniature-scale scraped surface heat exchangers has built-in control and flexibility with a graphic representation of the process on the touch screen control panel.

The operator can choose the parameters required for any particular formulation, these include margarine/ice cream/crystallisation processes.

The FT25XA has a number of configurations according to the required use. Armfield miniature-scale technology is well established at offering developers the opportunity to run small trials, which provide enough information to enable scale-up to larger plant with confidence.

The formulations go through similar physico-chemical changes as they would in production plant and real time data logging permits results to be recorded and repeated.

FT25XA - 40 bar

FEATURES & BENEFITS

- Duplicates full-scale process
- Fast, accurate new product development
- All process parameters under operator control for maximum flexibility
- Rugged and reliable units
- Only requires electricity and water to function
- Full control of barrel speeds to over 1400rpm
- Temperature control system incorporated
- Integral control panel enabling simple control and monitoring of all major variables
- Enclosed self-contained, mobile, stainless steel service cabinet for easy cleaning and wash down with removable panels
- Stainless steel barrel with PEEK scrapers
- Hygienic design
- Made from 316 stainless steel
- In cabinet refrigeration

FT25XA - 20 bar

Requirements

Scraped Surface Heat Exchanger Systems - FT25XA

Various configurations of heat exchangers, pin workers and air incorporation are available to fulfil a wide range of process requirements. All options provide variable control of the process throughput. With controllable process speed and up to two independent controls for rotational speed, a wide range of process variations can be explored.

Typical configurations:

- Margarine Crystalliser
- Continuous Ice Cream Freezer
- Combined Margarine Crystalliser & Ice Cream Freezer
- Margarine/Spreads/Shortening Crystalliser

Neutraliser/Washer/Bleacher - FT66

A floor-standing 25 litre batch processing vessel capable of carrying out the important pre and post refining stages of crude edible oils.

The three stages (neutralising, washing and bleaching) will:

- Turn the free fatty acids (FFA) into salt and water
- Remove any salt water and soaps generated during this process
- Filter the remaining material through a pressure leaf filter using diatomaceous earth as catalysts and filter aids

This will leave a clean oil of increased clarity and shelf stability.

Requirements

3Ph
COLD
COMP. AIR

Hydrogenation Unit - FT67

This floor-standing unit enables efficient gas/liquid mixing under controlled conditions for the study of 'hardening' of edible oils.

Hydrogen is added under temperature controlled conditions with a Nickel Raney Catalyst.

By breaking the double bonds in the unsaturated oils, they become less reactive and therefore more shelf-stable. The trade-off in product shelf-life and ease of manipulation can then be explored.

The FT67 is a floor-standing batch processing vessel, used to adjust the degree of saturation of 25-litre batches of edible oils. An integral part of the edible oil processing line, for use in teaching/training and research and development.

Requirements

3Ph
COLD
COMP. AIR
STEAM GENERATOR
DRAIN

Deodorising Unit - FT68

A vacuum steam distillation unit, suitable for demonstrating the removal of aromatic compounds from edible oils.

Using a combination of vacuum evaporation and steam stripping, extremely low pressures can be reached. This rapidly encourages the removal of volatile compounds, leaving an aroma-free oil.

The deodorising process vessel has a batch size of 25 litres and is mounted in a floor-standing stainless steel framework, which also houses the high-vacuum equipment, control console, discharge pump and polishing filter.

Requirements

3Ph
COLD
STEAM GENERATOR
DRAIN

Requirements

3Ph
COLD
STEAM GENERATOR
DRAIN

Batch Solvent Extraction & Desolventising Unit - FT29

A floor standing, self-contained 25kg batch process unit demonstrating a variety of solid/liquid extractions.

It is particularly suitable for 'leaching' edible oil from oil-bearing seeds and desolventising both the extracted solids and the miscella.

- Single extraction/desolventiser vessel
- Solvent/water recovery tank
- All flameproof construction
- ATEX approved
- Operation of small-scale version of industrial processes
- A wide variety of solid/liquid extractions may be processed
- Small quantities (25kg) can be processed
- Low waste disposal rate

Requirements

3Ph
COLD
COMP. AIR

Modular Cross Flow Filtration System - FT18-MKII

A small pilot-scale cross-flow filtration system designed to operate with a range of membrane module configurations.

It can be operated with as little as 5-10 litres of material to give data that is useful for process scale-up. It can be used over the full range of cross-flow filtration applications from microfiltration through to reverse osmosis.

- Integral data logging of all parameters
- Capable of Microfiltration / Ultrafiltration / Nanofiltration & Reverse Osmosis
- Ceramic, Spiral Wound, Tubular and Hollow Fibre membrane modules available

Requirements

1Ph
PC
USB

Cross Flow Membrane Filtration - FT17

A lab-scale system for evaluating membranes in a cross flow filtration application enabling rapid determination of cross flow filtration performance using a range of membrane types with small product volumes (1 litre).

It can also be used in teaching applications to demonstrate features of different membrane types and the effect of varying filtration variables.

- Variable retentate cross flow velocity over the filtration membrane
- Data logging of filtration pressure, permeate mass, retentate flow rate, retentate temperature
- Electronic balance to measure filtration performance
- Buffer addition / Diafiltration capabilities
- Optional retentate temperature control (FT17-15) with operating temp range of 5-60 °C

Link to IFT Brochure

Link to IFT Beverages

Pilot Line

Armfield equipment has been designed to be modular and can be sourced as a flexible solution that can be expanded upon as your business grows.

When a specific process is required, Armfield has the expertise and capability to create bespoke designs for a wide variety of products.

These are created based on Armfield's existing equipment or from first principals to give you the solution you need.

UHT special process line

Raw product

Continuous and Batch Deaeration

200l/h Homogenisation

200 l/h U

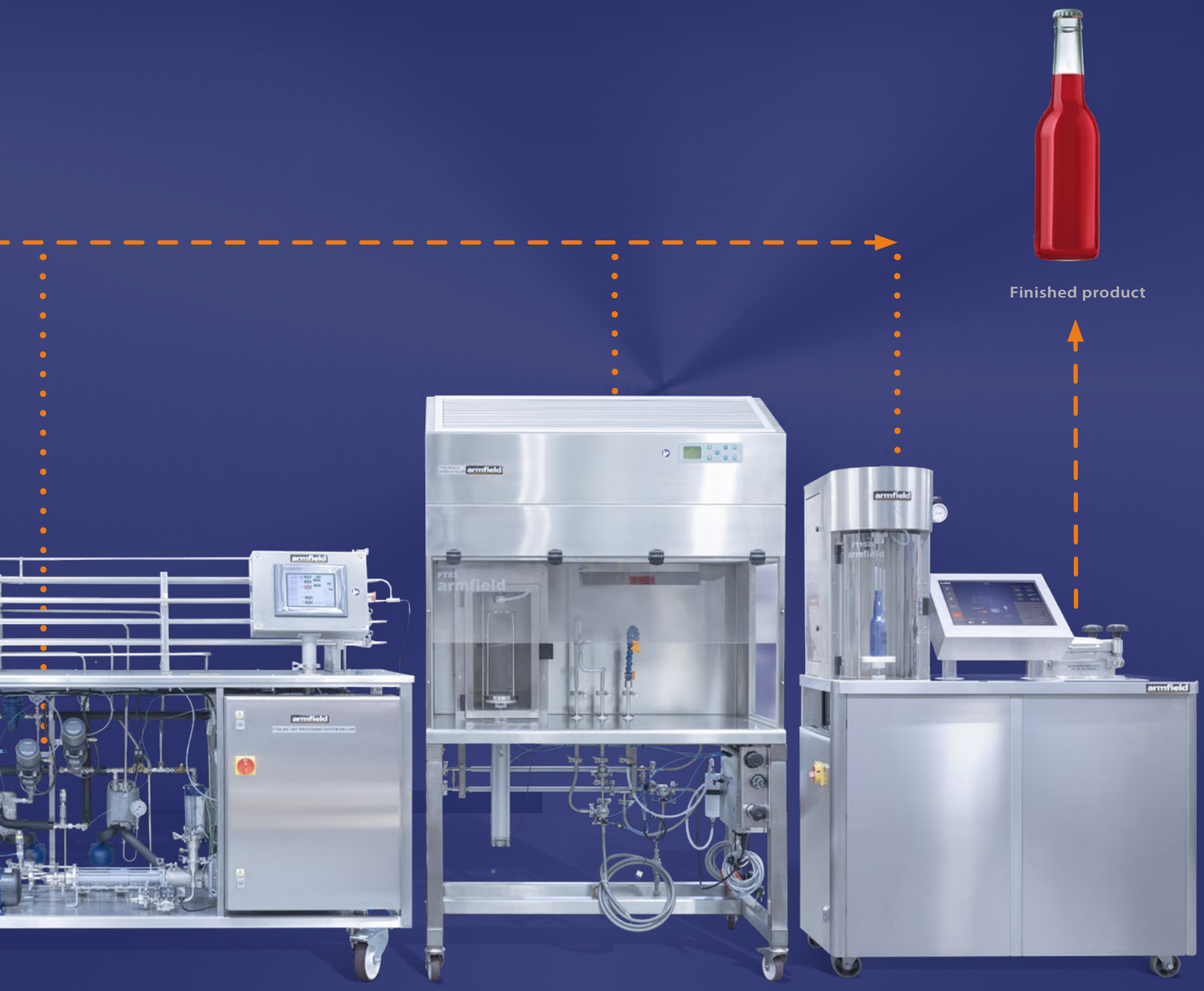
Example Process Lines

Here, the customer had a very specific processing requirement that Armfield could meet and provide a complete installation and detailed training package.

This system required integration with other equipment on site with seamless communication and accuracy.

Raw pomegranate juice is fed into the process line where it is deaerated, homogenised, heat-treated, and filled in a sterile environment (or carbonated and filled).

The resulting product is a shelf stable juice processed to the detailed parameters required by the end user.



 Industrial Processing & Food Technology

The FT102XA design is highly versatile, boasting a large number of features to replicate a production scale process.

Both premix and postmix operations are available from the standard machine, and an option is available to add the syrup for postmix automatically. Other options enable deaeration of the product and evacuation of the bottles, continuous processing capability, and filling and capping (screw and/or crown) at a single station without removing the bottle.
The FT102XA Carbonator Filler is easy to install, set up and use.

Colour touch screen control is used with a new graphical interface, enabling different carbonating and filling scenarios to be set and stored. The improved semi-automated cleaning programme takes the user step by step through the cleaning process and enables the unit to be made ready for another product or formulation.

The FT102XA is ideally suited as a general purpose filling and carbonation installation for small laboratory applications. Used in conjunction with one of Armfield's FT74XA UHT/HTST units, a complete drinks line can be created in the laboratory; consisting of heat treatment, carbonation, filling and capping.

Spray Ball

Link to IFT

Carbonator/Filler - FT102XA

The Armfield FT102XA has a well deserved reputation for being simply the best Carbonator-Filler on the market.

The Armfield FT102XA utilises the same technology and most of the features and benefits, in a smaller, more cost effective package.

Features:

- Carbonates in excess of 11g/l
- Deaerates
- Fills & caps PET & glass
- Fills and seams cans
- In-bottle pressure measurement
- 15 or 30 litre feed vessel

Requirements

Requirements

1Ph | COLD | COMP. AIR | N_2

Benchtop Rapid Extractor - FT110DP

The Armfield FT110DP uses high pressure and a combination of both static and dynamic extraction phases to achieve a rapid extraction of the active materials with minimum degradation to the product.

In the dynamic phases, the solvent is passed through the material providing a forced percolation and agitation.

Requires manual solvent priming:

- Computer Controlled
- Fast response. Results in hours rather than days
- Small scale, only one litre of raw material is required
- Simple cleaning and maintenance procedures
- Uses ethanol, glycerol, water or similar safe polar solvents
- Reproducible results
- Data logging
- Accurate scale up
- Remote Control via VPN
- Touch Screen Membrane Control Panel

Requirements

1Ph | COLD | COMP. AIR | N_2

Laboratory-Scale Rapid Extractor - FT111X

The Armfield FT111X uses high pressure and a combination of both static and dynamic extraction phases to achieve a rapid extraction of the active materials with minimum degradation to the product.

In the dynamic phases, the solvent is passed through the material providing a forced percolation and agitation.

Features automatic solvent priming:

- Uses ethanol, glycerol, water or similar safe solvents
- Reproducible results
- Touch screen control
- Built in solvent tank
- Data logging recovery
- Remote control via VPN
- Fast, efficient solid/liquid extraction of active constituents from plants, herbs, fruits and other similar materials
- High pressure, room temperature extraction, excellent for sensitive materials

Requirements

3Ph | COLD | DRAIN

Mixing Vessels - FT140X

Armfield's Multipurpose Mixing Vessels are designed and constructed using high quality hygienic industry standard materials. These tanks are available in three models in varying configurations (see table) and are available in 50l and 100l volumes.

All three models have an internal surface made of AISI 316 stainless steel:

- Available with or without heating / high shear emulsifier.
- Electronic control speed for mixing agitator (20-60 rpm)
- Data logging to record process data
- 50l or 100l tanks available as standard
- CIP spray ball as standard

Options are available with Colour Touch Screen and PLC control enables easy operation of stored recipes.

Link to IFT Ingredients

Ingredient Preparation

Ingredients and constituents of the final products must sometimes travel large distances to where they are fully assembled.

To reduce the cost of this transportation some ingredients can be dehydrated at the source and rehydrated upon arrival at the final assembly site.

Products with a base of a common oil can be filtered to increase the concentration of the required ingredient, then diluted at the destination to the appropriate concentration.

FT32 Laboratory Drum Dryer

UOP10 Laboratory Steam Generator

FT140X Mixing Vessel

FT80 Tall Form Spray Dryer

Requirements

3Ph

COMP. AIR

Tall Form Spray Dryer/Chiller FT80/81

The Armfield Tall Form Spray Dryer has been specifically designed to enable small quantities of product to be processed. The functional properties of the powders produced are comparable to large-scale production dryer capabilities.

The FT80 can be quickly and easily configured as a Spray Chiller (FT81) capable of handling products such as bakery shortening mixes containing high melting point fats to be converted from liquid to powder.

- Temperatures up to 250°C
- Max flow rate 7l/h
- Max evaporation rate 3l/h
- Measures relative humidity and all relevant chamber pressures.

Requirements

3Ph

DRAIN

STEAM GENERATOR

Drum Dryer - FT32

A steam-heated, nip-fed twin cylinder roller dryer.

- Simple drying of a material to give moisture content and the drying time (or residence time) required
- Determination of drying curves to assess the feasibility of fluidised bed drying of a material on an industrial-scale. Drying curves are relevant to the mechanism of drying - they may be used as a basis for heat and mass balance, thermal efficiency of drying and dryer design
- Calculation of heat transfer coefficients for different conditions - important in dryer design and comparison of fluidised beds with other drying methods

Requirements

1Ph

PC

USB

Computer Controlled Tray Dryer - UOP8-MKIIe

The most commonly used industrial method of drying solids in bulk consists of passing a hot air stream over fixed trays of wet material.

This small pilot-scale tray dryer uses this method and is designed for laboratory training programmes.

Operating conditions may be varied in a way that provides data demonstrating both theoretical and practical aspects of industrial drying practice.

This equipment is applicable to the unit operations laboratory and also to food technology education and research.

Large Laboratory Process Chiller - FT64

Requirements

1Ph

The FT64 is a recirculating process chiller, providing a continuous supply of chilled liquid to serve as the cooling fluid when used with an Armfield miniature-scale processing unit.

The FT64 is particularly suitable for larger cooling duties and for use with the Armfield FT174XA, FT94LT & FT94X systems.

Features:

- Low refrigerant charge
- Low running costs
- Easily cleaned and maintained

Laboratory Process Chiller - FT63

Requirements

1Ph

The unit is a recirculating process chiller, providing a continuous supply of chilled liquid to serve as the cooling fluid when used with an Armfield miniature-scale processing unit. The FT63 is particularly suitable for use with an Armfield FT74XA UHT and FT174XA systems.

Features:

- Low refrigerant charge
- Low running costs
- Easily cleaned and maintained

CIP Unit - FT52

Requirements

1Ph

The Armfield FT52 has been designed to provide additional cleaning performance for Armfield FT units and other equipment.

It consists of a high flow rate stainless steel centrifugal pump mounted on a mobile frame

- Mobile unit with small footprint providing local CIP capability for pilot scale equipment
- Produces cleaning velocities in excess of the industry standard 1.5 m/s in Armfield systems
- Capable of flow rates up to 4.0 m^3/h
- High pressure hygienic flexible hoses and fittings for quick connection to Armfield equipment
- 5l stainless steel hopper for cleaning solutions

.

IFT SERIES Industrial Food Trials Laboratory

Armfield's purpose built IFT laboratory can be used for testing, trial purposes and training

Trial:
- Filtration
- Homogenisation
- UHT and HTST Processing
- Sterile Filling
- Carbonation, Filling and Capping
- Spray Drying
- Solvent Extraction
- Crystallisation

Trials in the USA

Our subsidiary Armfield Inc In New Jersey, USA, also has a trials facility for UHT/HTST processing and carbonation, filling and capping.

Contact us to find out more about developing your future successes:

sales@armfield.co.uk

Fluidised Bed Dryer - FT31

A range of materials from fine powders to food particulates can be used on this versatile laboratory-scale unit.

- High rates of heat and mass transfer
- Less than 15 minutes drying time
- Digital readout display

Requirements

1Ph

Spray Dryer - FT30-MKIII

A bench top all-glass construction unit enabling continuous observation and measurement of this rapid drying process.

- 0-1.5 l/h product flow rate
- Air inlet temperature 200°C
- Can be used for beverages, heat sensitive material, dairy, plants, cereal and egg products

Requirements

1Ph

COMP. AIR

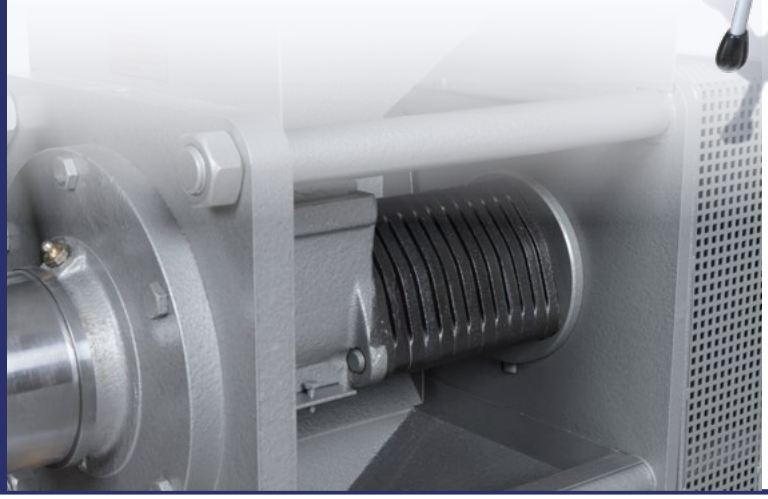
Requirements

3Ph

Oil Extraction Screw Press - FT28

A small capacity continuous press suitable for extracting edible oils from a variety of oil bearing seeds.

- Oil extraction screw press suitable for use in the laboratory
- Complete with feed hopper, manual feed chute and oil discharge
- 4kW electric motor
- Suitable for use with a wide range of seeds or ground meals



Requirements

1Ph

COLD

PC

USB

Laboratory Pasteuriser - FT43

A bench top unit duplicating the industrial HTST process on a practical scale for teaching. Holding times can be varied with throughput and temperature controlled from a separate comprehensive control console.

Low viscosity food samples as small as one litre can be processed in batches, or continuously processed with a throughput of 20 l/h.

- Tests can be carried out quickly and easily
- Data logging system FT43-DTA-ALITE
- Simulates the conditions used in a production plant
- Small quantities of liquid product can be processed

IFT SERIES

Food Technology

Link to FT22

Rising Film Evaporator FT22

The Armfield evaporator processes samples as small as 2.0 litres under conditions identical to those in production, sufficient to reveal the effect of heating on any ingredients newly introduced to the recipe.

As well as investigation of the effect on organoleptic and physico-chemical properties, the equipment can be used to prepare product for taste trials on a daily basis to ensure the quality of incoming raw material is consistent.

Only 0.65m² of floor space is required to install the evaporator and it has been designed to fit easily into a room of standard height.

Applications include the concentration of:

- Juices (fruit and vegetable)
- Milk and milk products
- Extracts (non-flammable)
- Effluents
- Nutritional products

Features and Benefits

- Small quantities of liquid products can be concentrated
- Easily cleaned and maintained
- Low product usage eases the disposal of waste
- Nominal throughput of 10 l/hr
- Single tube heat exchanger
- Integral CIP system
- Integral control console
- Integrated data logging and analysis

Rising Film Evaporator - FT22

A floor-standing unit using the steam-heated, climbing film principle to concentrate small quantities of liquid foods either continuously or in batches.
This unit has an integrated data logger. The important process parameters can be varied and monitored.

- Only 2 litres of raw material required to test new products
- Max evaporation rate - 10 l/hr
- Integral CIP system.

Requirements

Requirements

1Ph

Butter Churn - FT21

The Butter Churn provides practical training in the preparation of butter by the traditional method, and allows the investigation of the effect of process temperature and agitation time.

- 'Phase inversion' of the oil/water emulsion which occurs in churning
- Investigation of process temperature and agitation time in the agitation process
- Production of butter by various methods for quality and analytical determinations
- Mass balance quantitative yield of butter from various types of raw milk

Requirements

1Ph

Autoclave - FT19

A batch sterilising unit designed primarily for in-bottle production of sterilised milk.

- Highly portable autoclave requiring no plumbing to operate
- Time/temperature cycles can be defined to suit specific applications
- Sanitary 316 stainless steel construction and easily wiped down
- Lid is removable for full-width access

Requirements

1Ph

Disc Bowl Centrifuge - FT15

A self-contained centrifugal separator, demonstrating all aspects of cream/milk separation. Instrumentation is provided to measure varying bowl speeds and throughput rates.

Ancillary equipment for investigation into this type of separation consists of:

- Optical tachometer
- Product collecting vessels
- Stop clock
- Tools

The backboard includes a sectioned diagram detailing the component parts of the separator bowl and describing its mode of operation.

Requirements

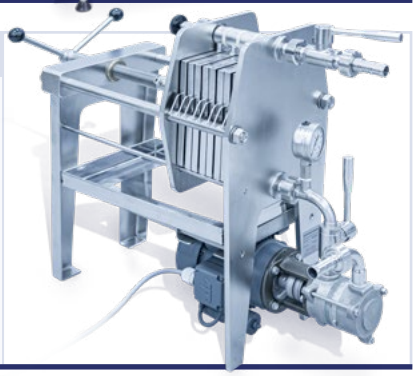
1Ph

Plate and Frame Filter Press - FT14

A small plate pack conveniently mounted on a stainless steel framework, enabling clear demonstration of mode of operation.

This type of filter is widely used in the food, pharmaceutical, brewing and distilling industries.

Several grades of filter media are supplied.



Requirements

1Ph

3Ph

Hammer/Beater Mill - FT2

A hammer mill, that is safe to operate and can be easily dismantled for cleaning. Designed for general laboratory grinding, the bench top unit is supplied with eight perforated plate screens.

Applications

- Seeds
- Nuts
- Other Biomass

Armfield Support - 24 Hour Portal

Link to Support Desk

armfield support

Armfield Support is here to help, we have a 24hr online support desk where you can raise a ticket for technical support or a spares quotation.

After raising a ticket, register or log in to our Armfield Support page to view or edit it at any time.

Tickets can be created by either:

- Visiting our Support Page www.armfield.com/armfield-support
- Calling our Support Team on +44 1425 478 781

Trial Facility's

Armfield have trials facilities in both Europe and the United States

Each facility has a selection of our equipment for industrial trials, check for availability or to arrange your trial now.

To book your trial with our experts:
Europe : +44 (0)1425 478781
USA: +1 (609) 208-2800

Installation and Commissioning

Armfield offer global installation, commissioning and training by our highly experienced experts.

If you need assistance please contact our professional services team.

Contact us at sales@armfield.com

Customer Training

Depending on your requirements, we can train individuals or groups, either on site or at our training facility.

Contact us at sales@armfield.com

Custom Projects, Design, Software and Aesthetics

Armfield's team of Engineers continue to build on a comprehensive portfolio of original and innovative designs.

We are world leaders in educational products and flume technology for teaching and research and pioneers of the "Pilot Scale System that allows industrial food technologists small-scale simulation of large scale performance".

Our cutting-edge production facilities, talented engineers, software designers and installation team all work to ensure that top quality products are delivered to your facility, every time.

Custom projects

Advancements in technology ensure that Armfield's portfolio continues to develop and evolve.

We are keen to collaborate with universities and specialists to create bespoke production solutions against complex requirements and client concepts.

Our Project Management team are on hand to see your requirement through to completion.

Manufacturing

As an ISO 9001:2015 certified business, Armfield strives for quality.

We work continuously with our suppliers, contractors and production facilities to ensure that your product arrives on time, on budget and to specification.

Design

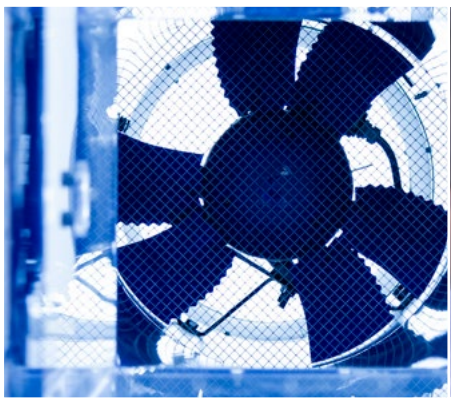
Products are conceptualised, developed and detailed using the latest computer-aided design software.

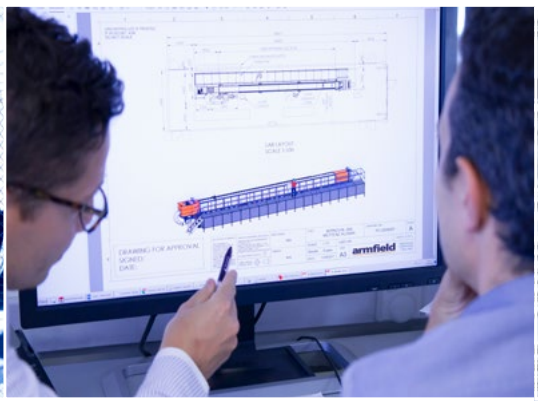
Coupled with computational fluid dynamics (CFD) & Finite Element Analysis (FEA) and 3D-print prototyping, our design process helps to ensure products are right first time.

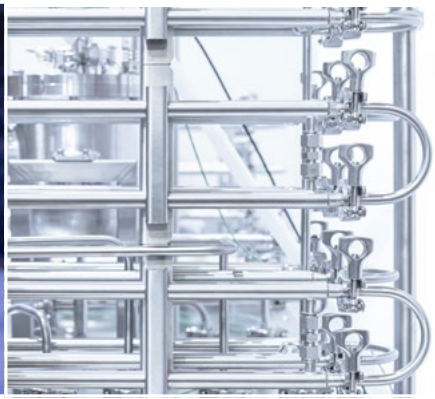
Aesthetics

Armfield is extremely proud of its brand identity: finished in striking blue and orange, each of our products are easily recognisable.

High quality materials including, composites, stainless steels and engineering plastics are used throughout our product range to ensure reliability in the harshest environments.







armfield

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Support

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Armfield Agents

Armfield products are distributed throughout the world. It is our policy in most countries to deal direct or through proven and accredited sales agents, who after suitable approval, may become exclusive representatives.

In exchange for this exclusivity they are required to offer a comprehensive service including the highest degree of after sales support.

Customer Demonstration

To arrange a demonstration please contact your local Armfield representative. Details can be found on our website: **www.armfield.com**

Contact Armfield HQ directly using the information below:

Your local Armfield Agent:

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