TECQUIPMENT

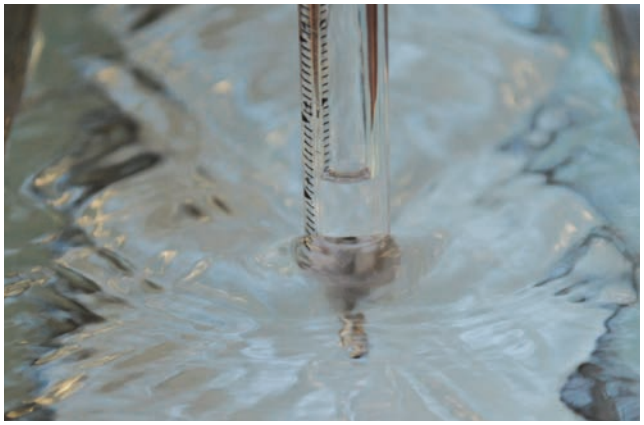
FLUID MECHANICS

The Fluid Mechanics range offers a wide scope of teaching equipment for the delivery of complete courses in fluid dynamics.

BASE UNIT AND MODULES FOR FLEXIBILITY

In many settings, the modular Digital Hydraulic Bench (H1F) acts as a base unit, allowing tutors to swap out individually mounted experiment modules on these self-contained benches, reducing laboratory set-up time, space requirements, the need to be near a water source and cost. Modules include experiments for exploring Bernoulli's theorem, the function and dynamics of weirs, pressure and flow measurement, pipe friction and energy loss, and much more.

YouTube **FLUID MECHANICS PLAY LIST**



UNDERSTANDING FLOW

The impressive flow and sediment channels, for demonstrating the mechanics of flow, also enable the practical teaching and demonstration of phenomena such as critical and sub critical flow, hydraulic jump, and dune formation. There are many ancillaries available for use with the flow channels, enabling them to be used as both teaching and research aids.

MODULAR FLUID POWER RANGE

The Fluid Mechanics range includes a sub-section of Modular Fluid Power products (pages 134–148) to demonstrate real-world applications of fluid mechanics. They include pumps and turbines, which also provide a link to renewable energy.

FEATURES AND BENEFITS

- **LONGEVITY:** Long-lasting equipment to teach principles that do not go out of date.
- **WATER AND SPACE SAVING:** Many experiments work with the self-contained, mobile hydraulic bench to save water and laboratory space.
- **LARGE CHOICE OF EXPERIMENTS:** A huge range of experiments for a complete course in fluid mechanics, from simple flow and pressure measurements to advanced studies of vortices and open channel flow.

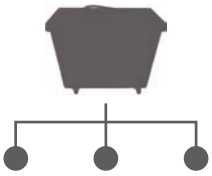
DIGITAL HYDRAULIC BENCH

H1F

A mobile, self-contained bench with recirculating water supply. It provides water at variable flow rates direct to experiments and includes digital flow display for hydraulic and fluid mechanics experiments.

EXPERIMENT MODULES POSTER

ESSENTIAL BASE UNIT (H1F)



EXPERIMENT MODULES

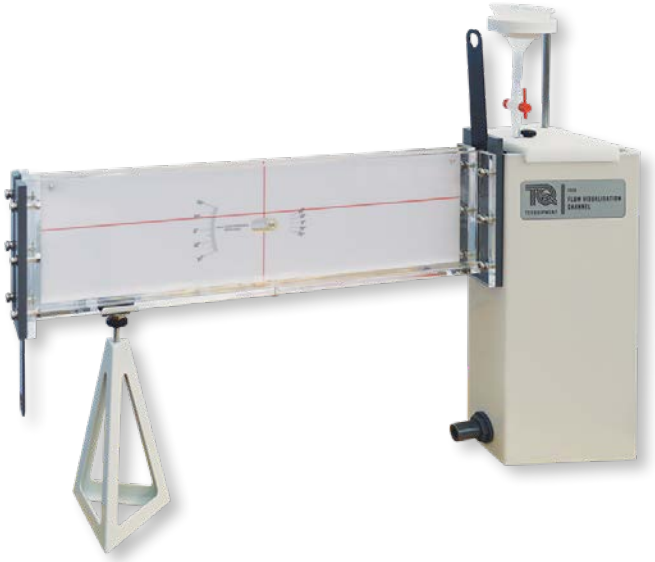
EXPERIMENT MODULES:

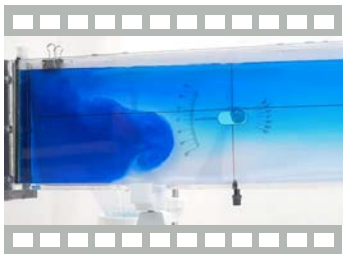
- Flow Visualisation FC15
- Flow Through an Orifice H4
- Bernoulli's Theorem H5
- Discharge Over a Notch H6
- Friction Loss in a Pipe H7
- Impact of a Jet H8
- Flow Measurement Methods H10
- Vortex Apparatus H13
- Francis Turbine H18
- Pelton Turbine H19
- Hydraulic Ram Pump H31
- Jet Trajectory and Orifice Flow H33
- Pipework Energy Losses H34
- Flow Meter Calibration H40
- Losses in Piping Systems H16
- 2.5 Metre Flow Channel FC50-2.5
- Pipe Surge And Water Hammer H405
- Fluid Friction Apparatus H408

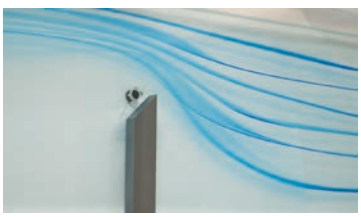
FLOW VISUALISATION

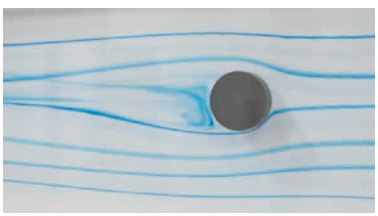
FC15

A compact, entry-level piece of equipment for visualising flow patterns around weirs and other objects in an open channel. Can also be used with the included lock gates to perform wave flow experiments.









CASE STUDY

OLD EQUIPMENT GETS AN UPGRADE AT NOTTINGHAM TRENT UNIVERSITY

A Hydraulic Bench Upgrade Kit (H1X) that electronically measures flow rates was recently purchased by Nottingham Trent University. It delivered a 15–30 per cent time saving when carrying out experiments.

The separate electronic flow measurement instrument can be retrofitted by a laboratory technician onto older models of TecQuipment's Hydraulic Bench that use manual measurement methods; this reduces experiment time while retaining the learning experience.

James Cooper, a technical specialist working for the School of Architecture, Design and the Built Environment at Nottingham Trent University, explains: "Students have commented on how much time is spent calculating flow rates on the gravimetric benches using the original method of volume/time. To help improve this, I recently fitted an H1X conversion kit to one of the benches."

Each kit is supplied with the core electronic measurement device, all the parts necessary to carry out the upgrade and a comprehensive installation guide.

"The fitting was simple, with clear, concise instructions. It included everything needed for the conversion. The fitting time was around four hours including the checking and testing of the accuracy of the flow meter read-out," explained Cooper.

When running the loss in pipe and impact of a jet experiments, the students save around 10–20 minutes in a one-hour laboratory session (depending on the flow rate and the volume of water that was previously measured).

Cooper went on to explain the benefits: "This allowed for more time being spent working towards the desired learning outcomes. The student feedback about the conversion was very positive. The students previously felt that their time doing manual calculations of flow rates was a waste of the practical time available to them."

CALIBRATION OF A BOURDON PRESSURE GAUGE

H3A

A Bourdon pressure gauge with visible working mechanism to demonstrate how this type of pressure gauge works and how to calibrate it.

DISCHARGE OVER A NOTCH HDMS

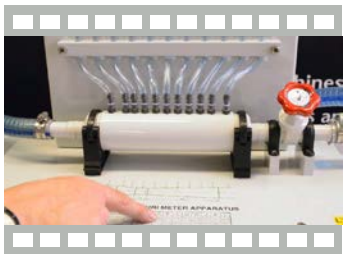
H6

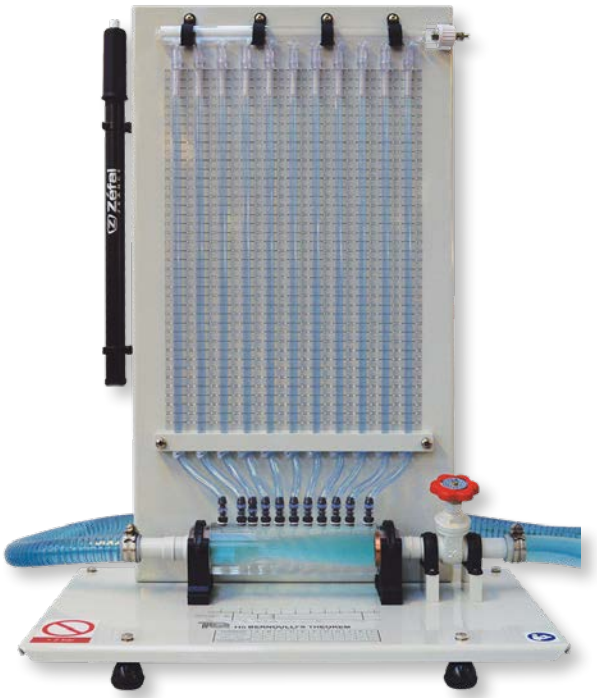
A tank and set of notch weirs for the study of flow regulation and measurement devices.

BERNOULLI'S THEOREM HDMS

H5

A benchtop Venturi tube that allows students to study Bernoulli's theorem by measuring the complete static head distribution along the horizontal tube.

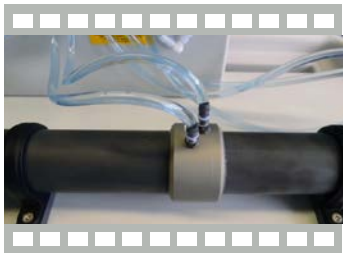




FLOW MEASUREMENT METHODS HDMS

H10

A Venturi meter, an orifice plate meter and a rotameter that demonstrate typical methods of measuring the flow of an incompressible fluid and show applications of Bernoulli's equation.



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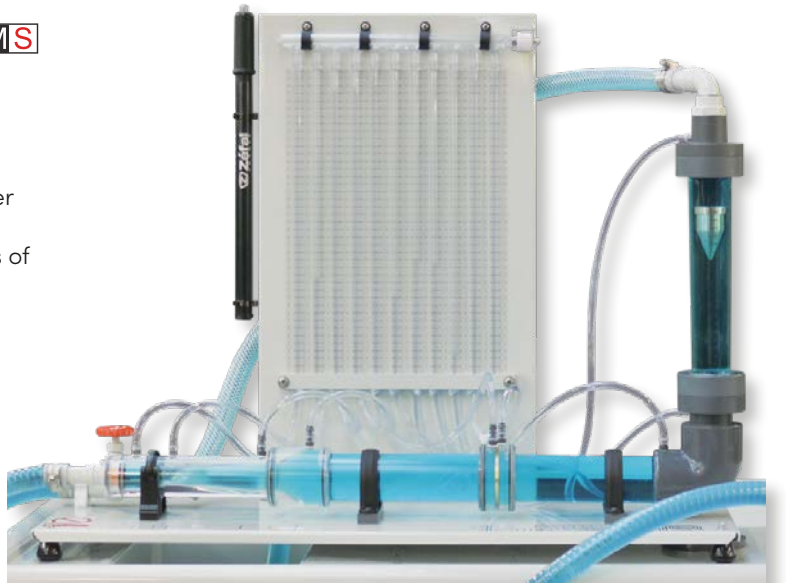


PRESSURE MEASUREMENT BENCH

H30

A self-contained, benchtop apparatus that enables a range of practical investigations into manometer and Bourdon gauge pressure measurement techniques, including inclined and U-tube manometers, and Bourdon-type vacuum and pressure gauges.

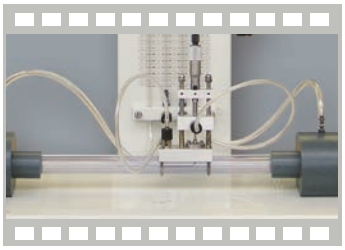
PDF

FLOW METER CALIBRATION HDMS

H40

A compact manometer and nozzle flow meter that compares and demonstrates the accuracy, losses and use of fundamental flow meters.

PDF



EXPERIMENT MODULES:

- PDF Pitot Tube
- PDF Venturi Flow Meter
- PDF Orifice Flow Meter

FRICTION LOSS IN A PIPE HDMS

H7

A small-bore straight test pipe on a base plate for measuring friction loss in a horizontal pipe, to study laminar and turbulent flow. Also to find the critical Reynolds number and demonstrate the flow transition point.

PDF

PIPEWORK ENERGY LOSSES HDMS

H34

Compact, benchtop apparatus compares pressure losses and k value of popular fittings in small-bore pipework

PDF

LOSSES IN PIPING SYSTEMS

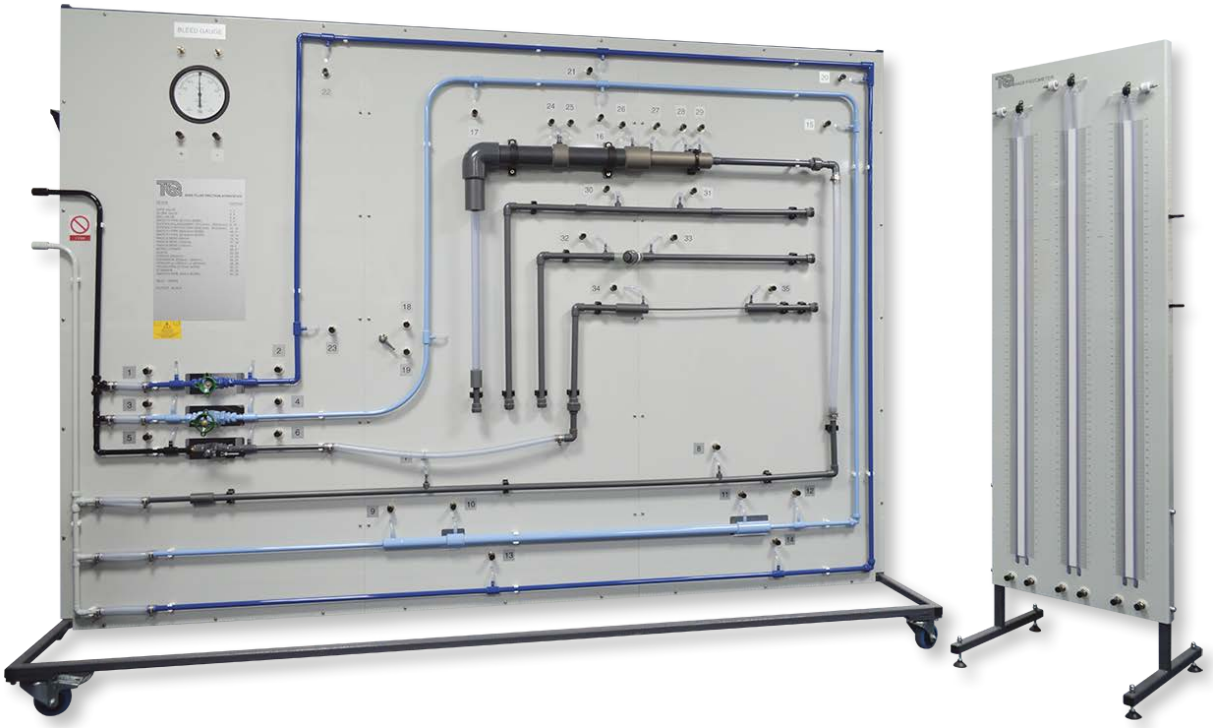
H16

Free-standing, mobile apparatus demonstrates pressure losses in several small-bore pipe circuit components, typical of those found in central heating systems.

PDF

FLUID FRICTION APPARATUS HDMS

H408



A mobile vertical panel featuring various pipe configurations to demonstrate flow and losses in different pipes, fittings and valves. Includes Pitot tube, Venturi and orifice meters for flow measurement.

PDF

LAMINAR AND TURBULENT FLOW

OSBORNE REYNOLDS APPARATUS

H215

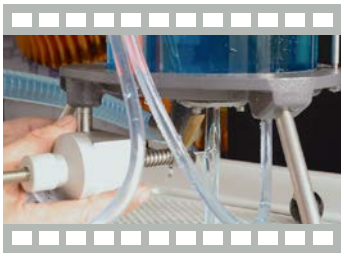
Free-standing apparatus that gives a visual demonstration of laminar and turbulent flow. It also allows students to investigate the effect of varying viscosity and investigate Reynolds numbers.

PDF

FLOW THROUGH AN ORIFICE HDMS

H4

A cylindrical tank with an adjustable diffuser that demonstrates flow through different orifices for different flow rates.



IMPACT OF A JET HDMS

H8

A cylindrical tank for investigating the force generated by a jet striking plates (representing turbine vanes) to aid in the understanding of how turbines work.

JET TRAJECTORY AND ORIFICE FLOW HDMS

H33

A constant head device, backboard, set of nozzles and Pitot tube. This apparatus demonstrates vertical flow and horizontal jet trajectories through different orifices (nozzles) and allows students to study the trajectory profiles of water jets from the nozzles when mounted horizontally.

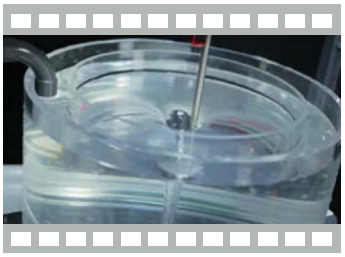
VORTEX APPARATUS

HDMS

H13

A transparent, double-walled vessel that demonstrates the phenomena of free and forced vortices with measuring devices for calculating the water surface profile.

PDF

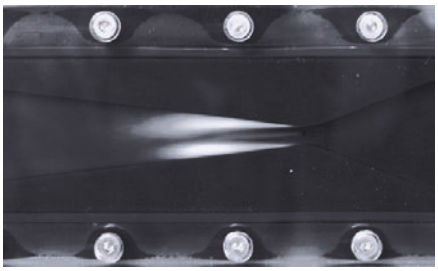


CAVITATION IN A VENTURI

H400

A floor-standing, self-contained apparatus to demonstrate and observe the basic principles of cavitation and its implications on the performance of hydraulic machines and systems.

PDF



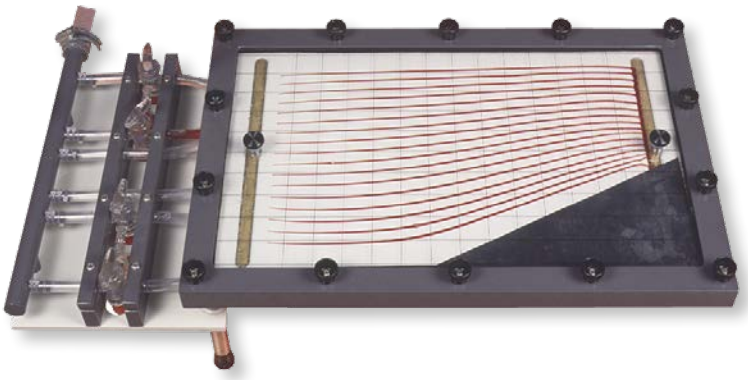
CAVITATION IN THE VENTURI

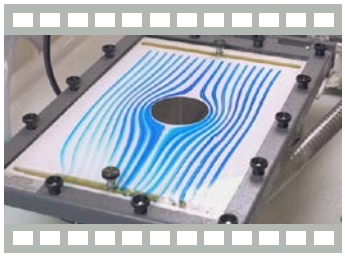
FLOW VISUALISATION

HELE-SHAW APPARATUS

H9

A benchtop apparatus to demonstrate two-dimensional laminar flow around differently shaped models, allowing the study of various source and sink arrangements.





PDF

PIPE SURGE AND WATER HAMMER VDAS®

H405

A self-contained unit for teaching the transient effects of pipe surge and water hammer caused by sudden flow rate changes in pipes.

WATER HAMMER APPARATUS

TE86

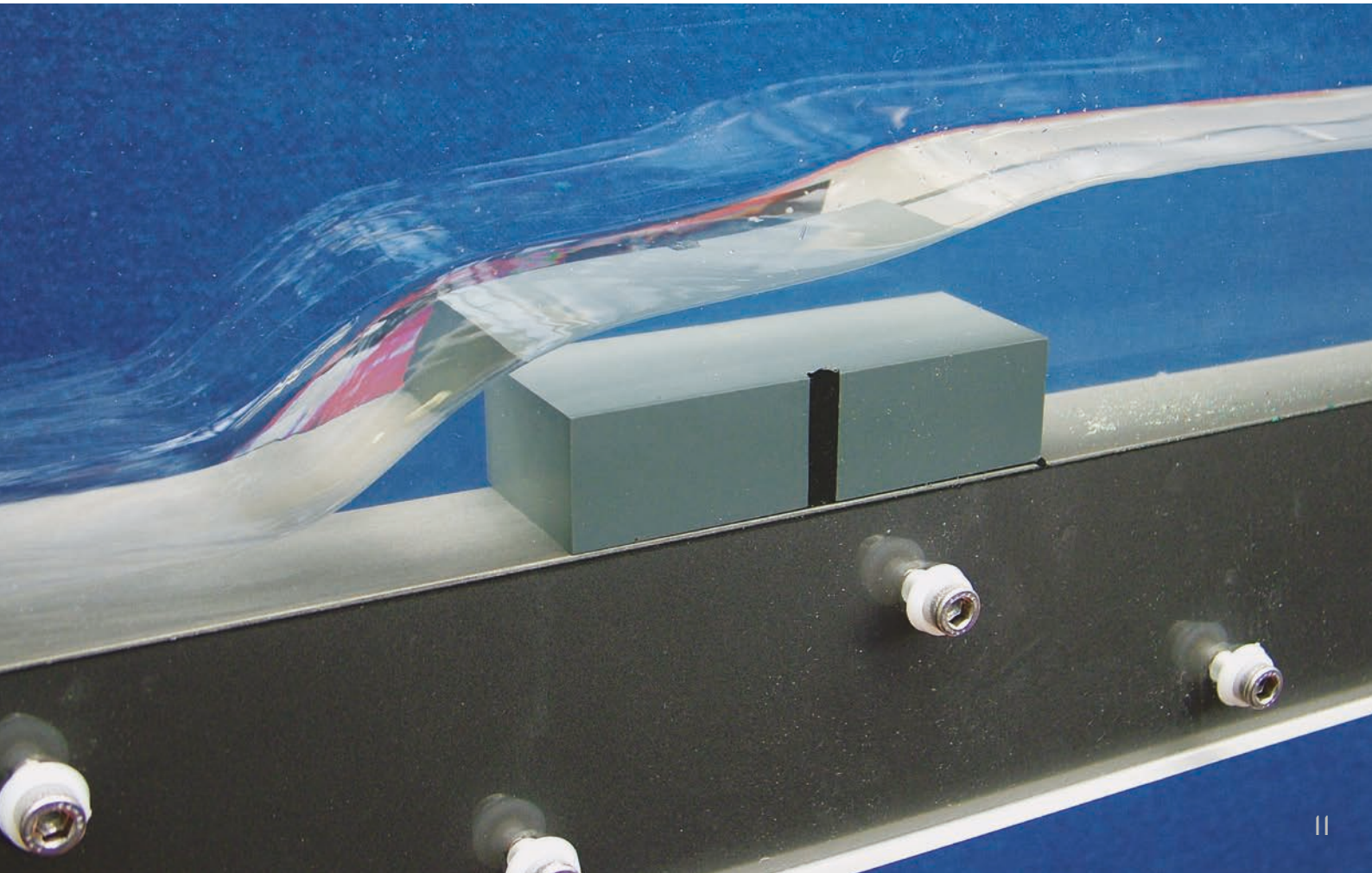
A 60-metre copper coil that demonstrates water hammer and cavitation and the propagation of shock waves at sonic velocity in water.

2.5-METRE FLUME HDMS

FC50-2.5

A 53 mm wide, 2.5 metre long flume complete with models and instruments for demonstrating flow around weirs and other objects in an open channel.

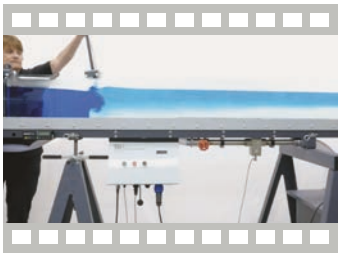
MODELS POSTER



FLOW AND SEDIMENT TRANSPORT CHANNELS

FC80 (2.5 AND 5)

An 80 mm wide, 2.5 or 5-metre long flow and sediment transport channel with a starter kit of models and instruments. It provides students with the ability to study the varying effects of sediment transport, bedform dynamics and fluid flow around weirs and other objects in an open channel.



MODELS POSTER

SEDIMENT FEEDER

FLOW VISUALISATION

FLUMES VDAS®

FC300 (5, 7.5, 10, 12.5 AND 15 METRES)

A 300 mm wide, 5 to 15-metre long flume for student study and advanced research into a wide range of fluid flow topics. A huge range of ancillaries are available to extend learning potential and offers the opportunity for innovative experimentation.

MODELS POSTER

HYDROSTATICS AND PROPERTIES OF FLUIDS

H314

Self-contained mobile unit for many experiments in fluid mechanics. Among other experiments it covers: properties of fluids, hydrostatic principles and buoyancy/floatation and Archimedes principle.

METACENTRIC HEIGHT AND STABILITY

H2 MKII

A benchtop apparatus to determine the stability of a pontoon with its centre of gravity, metacentric height and metacentre at various heights.

VISCOSITY AND PARTICLE DRAG

H410

Floor-standing, simple falling sphere viscometer that demonstrates the drag coefficient of different sized particles (spheres) and the viscosity of liquids.

CENTRE OF PRESSURE

H11

A pivoted, clear plastic assembly which students use to find the centre of pressure of a totally or partially submerged plane surface. Compact, self-contained and excellent for classroom demonstrations.

HYDROLOGY

LIQUID SEDIMENTATION APPARATUS

H311

A self-contained, benchtop apparatus of transparent sediment columns for studies into the settling characteristics of suspended solids and the display of particle wall effects.

PERMEABILITY, FLOW NETS AND DARCY'S LAW

H312

A self-contained, floor-standing unit consisting of a tank with tappings connected to a bank of piezometer tubes. It demonstrates flow through permeable media with common structures, such as dams and walls.

HYDROLOGY AND RAINFALL APPARATUS

H313

A self-contained, floor-standing unit consisting of a water reservoir and a tank for sand with overhead spray nozzles that simulate rainfall, both stationary and moving. It is for studying hydrology principles, including rainfall, throughflow and the movement of water over land and rivers.

PDF

ADVANCED HYDROLOGY AND RAINFALL APPARATUS

VDAS® ONBOARD

H313V

This is the latest version of the Hydrology and Rainfall Apparatus, the H313, with new functionality for more detailed and advanced study including VDAS On Board.

PDF

FRANCIS TURBINE HDMS

H18

A compact experiment for use with the Hydraulic Bench (H1F) to demonstrate how a Francis turbine works and to test its performance.

PDF

PELTON TURBINE HDMS

PDF

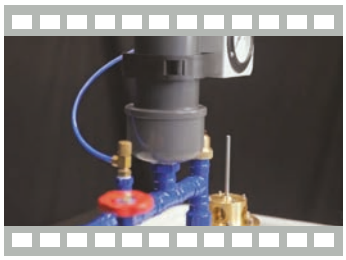
H19

A compact experiment for use with the Hydraulic Bench (H1F) to demonstrate how a Pelton turbine works and to test its performance.

HYDRAULIC RAM PUMP

H31

A compact experiment for use with the Hydraulic Bench (H1F) to demonstrate the use of water hammer to create a pumping action.



PDF

CENTRIFUGAL PUMP TEST SET VDAS®

H47

A self-contained, floor-standing, mobile unit consisting of a water reservoir, pump, motor and Venturi meter for a comprehensive range of investigations into the performance and characteristics of a centrifugal pump. Demonstrates cavitation and the use of a Venturi tube.

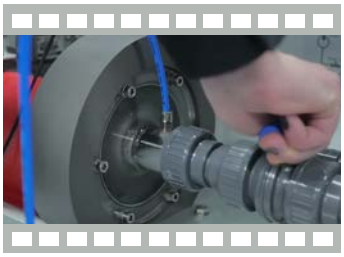
PDF

TWO-STAGE (SERIES AND PARALLEL) PUMPS

VDAS®

H83

A self-contained, floor-standing mobile unit consisting of a water reservoir, two pumps and motors and a Venturi meter for a comprehensive range of investigations into the performance and characteristics of two centrifugal pumps in both series and parallel.



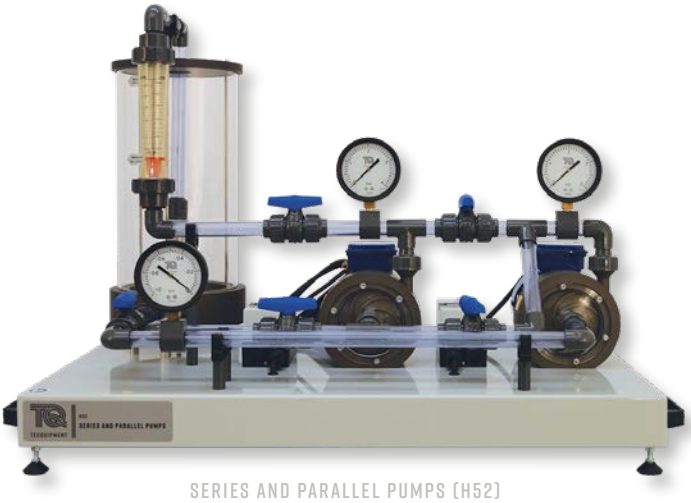
PDF

SERIES AND PARALLEL PUMPS

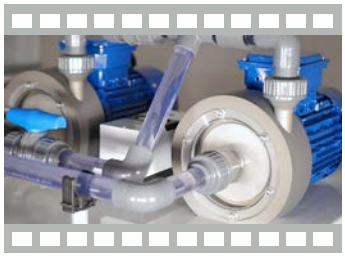
VDAS® ONBOARD

H52 / H53V

Two benchtop test sets that allow students to investigate the operation and performance of a single centrifugal pump and two centrifugal pumps configured in series or parallel. The H53V features a variable speed pump, speed, torque, power measurement and has VDAS® Onboard for automatic data acquisition.



SERIES AND PARALLEL PUMPS (H52)



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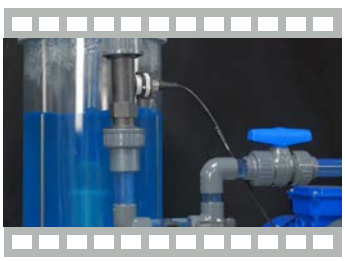
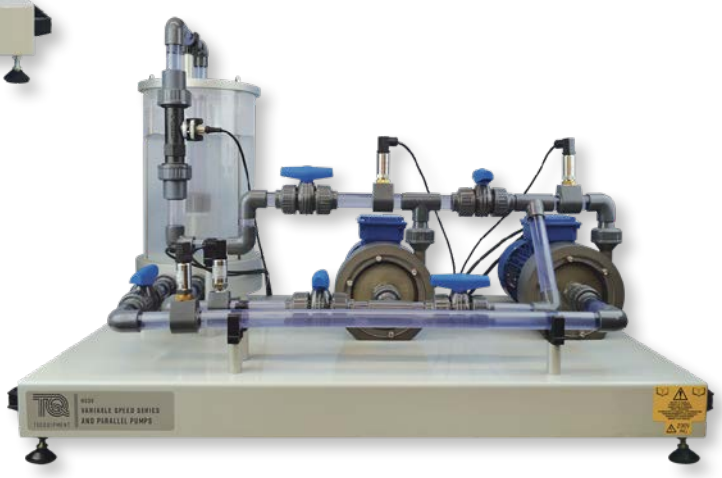
H52



PDF

H53V



VARIABLE SPEED SERIES AND PARALLEL PUMPS (H53V)

MULTI-PUMP TEST SET

VDAS® ONBOARD

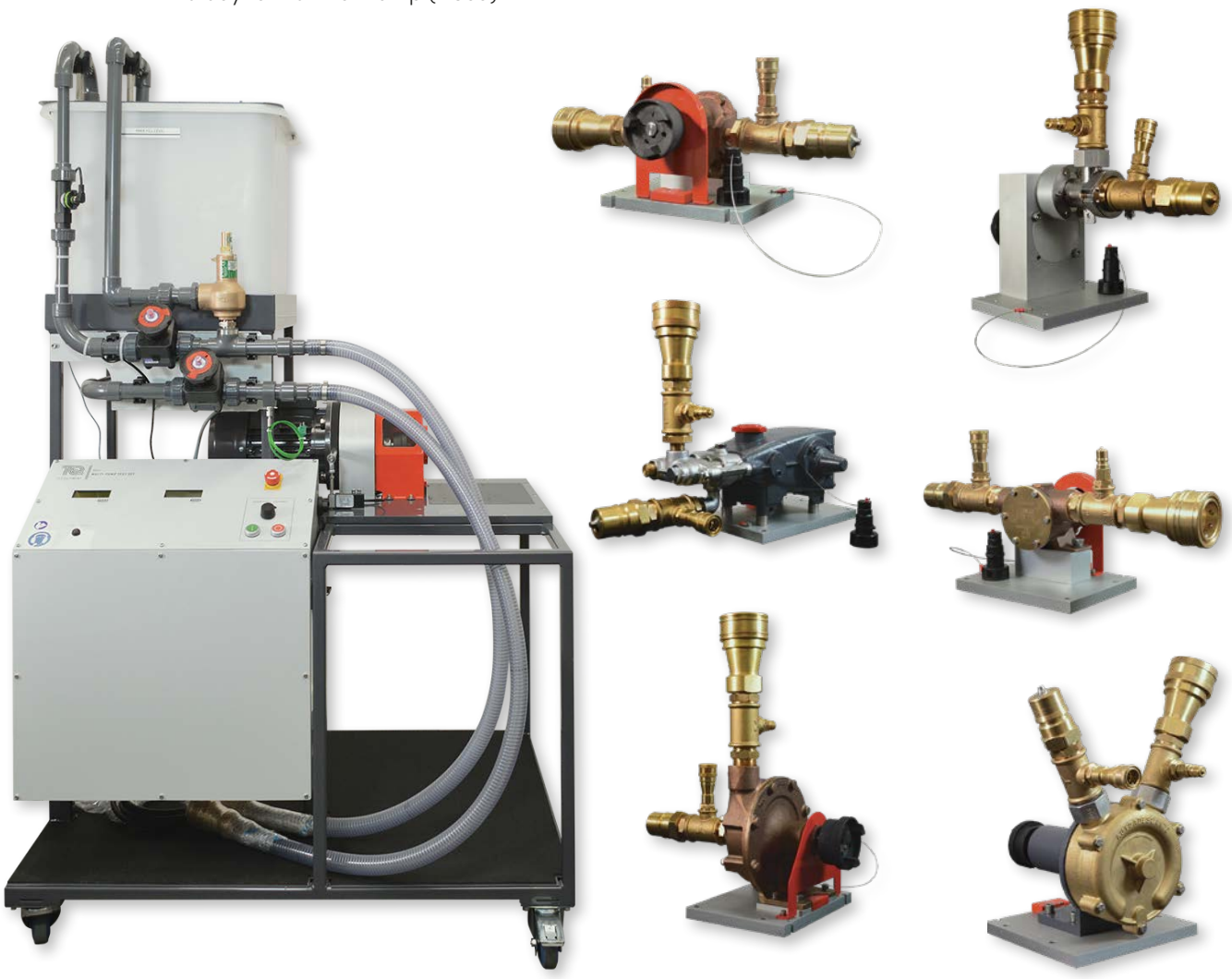
H85V

A versatile, self-contained mobile unit designed to investigate and demonstrate the performance characteristics of a range of different pump types, including positive displacement gear and piston pumps, rotodynamic centrifugal, axial and channel impeller pumps.

PDF

EXPERIMENT MODULES:

- Gear Pump (H85a)
- Piston Pump (H85b)
- Centrifugal pump (H85c)
- Rotodynamic Axial Pump (H85d)
- Vane Pump (H85e)
- Lobe Pump (H85f)
- Channel Impeller (H85g)



PRODUCT DEVELOPMENT

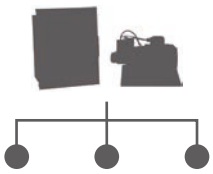
Products are continually being improved. For the latest up-to-date specifications refer to the digital datasheets on

TECQUIPMENT.COM

UNIVERSAL DYNAMOMETER

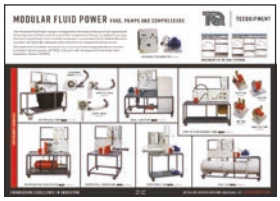
MFP100

A dynamometer with sensors for measuring power, speed and torque. For use with the Modular Fluid Power range.

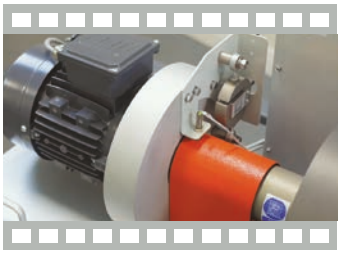


EXPERIMENT MODULES:

- Centrifugal Pump Module MFP101
- Axial Flow Pump Module MFP102
- Positive Displacement Pump Module MFP103
- Reciprocating Compressor Module MFP104
- Centrifugal Compressor Module MFP105
- Centrifugal Fan Module MFP106
- Axial Fan Module MFP107



EXPERIMENT MODULES POSTER



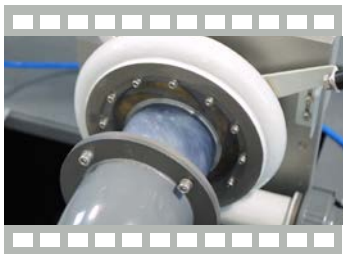
CENTRIFUGAL PUMP MODULE VDAS®

MFP101

A self-contained, floor-standing mobile unit with full instrumentation for studying and performing tests on a centrifugal pump and optional turbines, to understand how they work and calculate performance.

EXPERIMENT MODULES:

- Turbine Dynamometer
- Pelton Wheel (Turbine)
- Propeller Turbine



AXIAL FLOW PUMP MODULE

VDAS®

MFP102

A self-contained, floor-standing, mobile unit consisting of a water reservoir, pump, calibrated nozzle and valves. It allows students to study and perform tests on an axial flow pump, to understand how it works and calculate its performance.

POSITIVE DISPLACEMENT PUMP MODULE

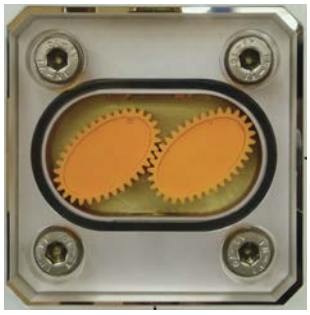
VDAS®

MFP103

A self-contained, floor-standing, mobile unit with full instrumentation consisting of an oil reservoir, a positive displacement flow meter, valves and instruments to measure positive displacement pump performance.

EXPERIMENT MODULES:

- Piston Pump
- Gear Pump
- Vane Pump
- Swash Plate Pump



RECIPROCATING VDAS® COMPRESSOR MODULE

MFP104

A self-contained, floor-standing, mobile unit that includes a small compressor with an air receiver and instrumentation. It allows students to study and perform tests on a reciprocating compressor, to understand how it works and calculate its performance.

PDF

CENTRIFUGAL VDAS® COMPRESSOR MODULE

MFP105

A self-contained, floor-standing, mobile unit that includes a small compressor and instrumentation. It allows students to study and perform tests on a centrifugal compressor, to understand how it works and calculate its performance.

PDF

CENTRIFUGAL FAN MODULE VDAS®

MFP106

A self-contained, floor-standing, mobile unit that includes a fan and instrumentation to allow students to study and perform tests on a centrifugal fan, to understand how it works and calculate its performance.

PDF

RECOMMENDED ANCILLARY:

PDF Pipe Flow and Nozzle Kit

AXIAL FAN MODULE VDAS®

MFP107

A self-contained, floor-standing, mobile unit that includes an axial fan, duct and instrumentation. It allows students to study and perform tests on an axial fan, to understand how it works and calculate its performance.

PDF

RECOMMENDED ANCILLARY:

PDF Pitot Static Traverse (450 mm)

TECQUIPMENT