HYDRAULİC LABORATORY EXPERİMENTS AND SETS

FME00. HYDRAULİCS BENCH

DESCRIPTION

Unit for the study of fluid behaviour, hydraulic theory and the properties of fluid mechanics. It is formed by a movable hydraulics bench used to hold a wide variety of modules, which allow the student to experiment with the problems presented by fluid mechanics. Autonomous unit (tank and pump included). Innovative water saving system consisting of a high capacity sump tank and spillway that sends the excess of water back to the tank. Easy access drain valve. The volumetric measuring tank is stepped to accommodate for low or high flow rates. A measuring cylinder (1 l.-capacity) is included in the supply for the measurement of very small flow rates. Level tube with scale that shows the water level in the upper tank. Flow adjusted by means of a membrane valve. Flow stilling baffle for reducing the turbulence rate. Specially designed channel, in the upper part, to support the modules on test. The modules are easily mounted on its top without the use of tools. This ensures its simplicity. Manufactured with corrosion resistant materials, ensuring a long and useful life of the unit. Centrifugal pump. Pump breaker starting, safety and contact light. Each module is supplied as a complete piece of equipment with easy and quick coupling to the bench, maximizing the available student's time to perform the demonstrations or the experimental measurements. To be used with the different units of Fluid Mechanics Area: "FME" type modules, Fluid Friction in Pipes Equipment "AFT", etc., to increase the profitability.

FME02. FLOW OVER WEİRS

DESCRIPTION

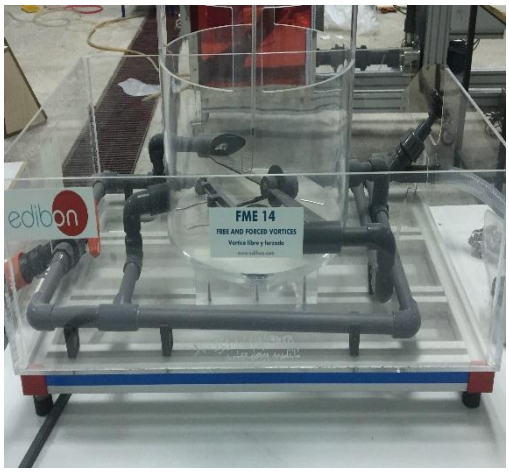
This module has many elements that are used in combination with the Hydraulics Bench (FME00): A special mouthpiece is coupled to the outlet mouthpiece for water in the Hydraulics Bench (FME00). Two soothing screens that, together with the previous element, provide a slow streamflow in the channel. A level meter consisting of a "nonius" adjusted to a mast, where the heights are pointed out on a caliber coupled to it. A small hook or point is attached to the bottom of the mast to carry out the measures. Two drains (a rectangular neckline and a V-shape) are attached to the final part of the channel of the
Hydraulics Bench (FME00).

FME04. ORİFİCE DİSCHARGE

DESCRIPTION

The module consists of a transparent cylindrical tank that is fed from the top by the Hydraulics Bench (FME00) or the Basic Hydraulic Feed System (FME00/B). The water flows through an interchangeable mouthpiece (a set of 5 mouthpieces is supplied, representing orifices of different characteristics) located in the base center. The liquid flowing vein goes directly to the volumetric tank of the Hydraulics Bench or from the Basic Hydraulic Feed System. A Pitot's tube can be placed in any point of the flowing vein to determine its total height of load. A transverse device, joined to the Pitot's tube, allows to determine the diameter of the liquid flowing vein. It´s possible to measure the height of the Pitot's tube and the total height through

FME14. FREE AND FORCED VORTEX



DESCRIPTION

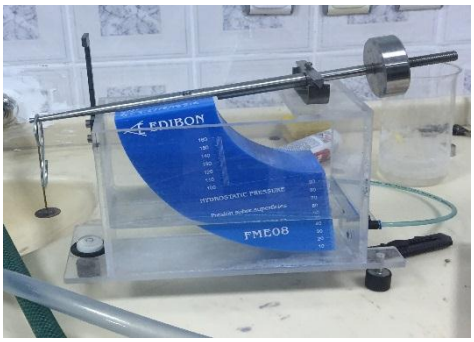
The module has a cylindrical and transparent deposit with two inlet pipes diametrically opposed, slightly inclined to produce a whirl. This deposit has an outlet in the center of its base, where 3 mouthpieces with orifices of different diameters can be coupled. These mouthpieces generate the free vortex and a rotor blade creates the forced vortex acting like a flux strangler shaker. The profile of the formed vortex is determined by a vortex height meter, placed in the cylinder's upper part, which measures the diameter of the vortex at different depths. The total pressure can be measured by placing a Pitot's tube in the bridge of measurement. It also has adjustable legs to level the module.

FME01. IMPACT OF A JET

DESCRIPTION

The module consists of a cylindrical tank with lateral transparent surfaces where a nozzle, connected to the Hydraulics Bench (FME00), is aligned with a device in which the problem surface is fitted. The vertical force made by the water against the surface is measured using calibrated weights that balance this force. Taking as a reference a gauge, which has been previously adjusted to a zero reference, we measure the force thanks to a mark that appears on the surface where the masses were placed. Adjustable supports that let the device balance. Holes made on the tank base in order to drain the water. In this way, splashes are avoided.

FME08. HYDROSTATİC PRESSURE



DESCRIPTION

The module consists of a quadrant assembled to the arm of a scale that swings around an axis.
When the quadrant is immersed in the water tank, the force that acts on the flat rectangular front surface exerts a momentum with respect to the supporting axis. The swinging arm is fitted with a tray and an adjustable counter balance. The tank has adjustable supporting legs for levelling. It has a drainage valve.
The level reached by the water inside the tank is indicated by a graduated scale.

FME10. DEAD WEİGHT CALİBRATOR

DESCRIPTION

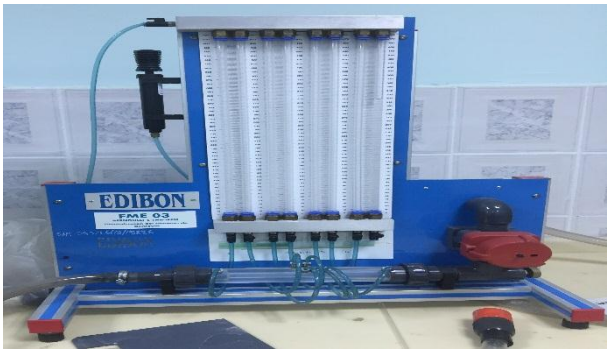
The module consists of a hollow cylinder in whose interior a precision piston moves. Using a system of calibrated weights, we produce predetermined pressures inside the cylinder.
The Bourdon manometer that must be contrasted is connected to the cylinder by means of a flexible pipe. Module levelling through adjustable feet.

FME26. DEPRESSİON MEASUREMENT SYSTEM (vacuum gauge)

DESCRIPTION

Anodized aluminum structure that supports a vacuum gauge whose reading gives us the measurement. Two quick connections at both sides of the vacuum gauge allow connecting reinforced flexible pipes.

FME03. BERNOULLİ'S THEOREM DEMONSTRATİON



DESCRIPTION

Bernoulli's Theorem Demonstration module is mainly composed of a circular section conduit with shape of a truncated cone, transparent and with seven pressure taps to measure, simultaneously, the static pressure of each section. All the pressure taps are connected to a manometer with a water collector (water might be pressurized). The ends of the conduits are removable, enabling to be placed in either convergent or divergent form with respect to the stream direction. There is also a probe (Pitot's tube) moving along the conduit for measuring the height in every section (dynamic pressure). The flow rate and the pressure in the module can be modified by adjusting the control valve located at the end of the module. A flexible hose attached to the outlet pipe is directed to the volumetric measuring tank. For the operation, the module is placed on the Hydraulics Bench (FME00). It has adjustable legs for levelling. The inlet pipe ends in a female coupling which may be directly connected to the bench supply.

FME22. VENTURİ, BERNOULLİ AND CAVİTATİON UNİT

DESCRIPTION

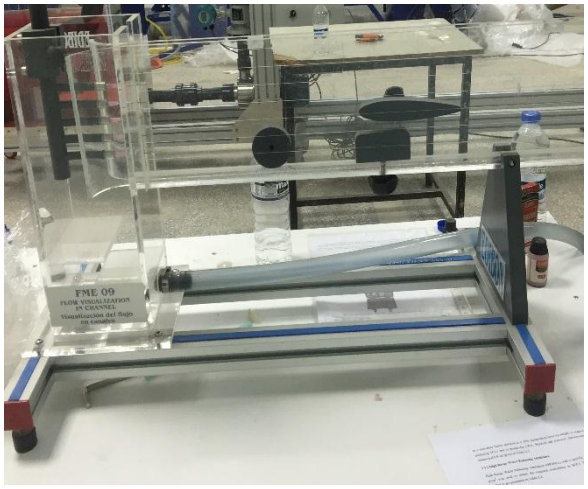
This module is designed for demonstrating some practical possibilities with the Venturi's tube. This Venturi is made of transparent methacrylate for a better visualization. It consist of a circular transverse section Venturi tube with 6 taps (Divergent/Convergent). Being transparent, it gives a better visualization of the cavitation phenomenon. It includes a manometer and a vacuum gauge, as well as 5 manometric tubes.

FME06. OSBORNE-REYNOLDS' DEMONSTRATİON

DESCRIPTION

The module consists of a cylindrical tank endowed with a nozzle, that is fitted to a methacrylate pipe, which allows the fluid visualization. A spillway guarantees the homogeneity of the flow and a
needle fitted to the deposit provides the dye. Water is supplied by the Hydraulics Bench (FME00) or the Basic Hydraulic Feed System (FME00/B). The visualization of the laminar or turbulent

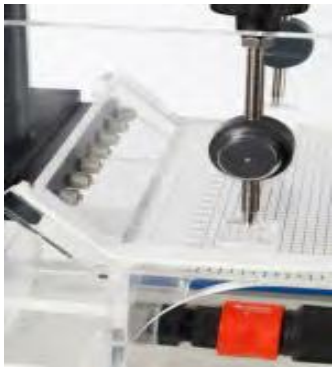
FME09. FLOW VİSUALİZATİON İN CHANNELS



DESCRIPTION

The module consists of a transparent methacrylate channel with an overflow pipe on top and an adjustable plate in the discharge end. This plate allows for regulating the flow level. The water is supplied to the channel by the pulse mouth of the Hydraulics Bench (FME00) or the Basic Hydraulic Feed System (FME00/B), by means of a flexible pipe, passes through a damping tank that eliminates the turbulences. It has a colouring injection system consisting of a tank, a flow control valve and some needles that allow a better visualization of the flow around the different hydrodynamic models, which have to be placed in the middle of the channel. Module levelling through adjustable feet . Several hydrodynamic models are given to study the flow around them.

FME20. LAMİNAR FLOW DEMONSTRATİON



DESCRIPTION

This module allows a complete study of the bi-dimensional problems associated with laminar flow. Thanks to an efficient system of dye injection we can observe the different models of flow. It consists on an enlargement of the device of Hele- Shaw. Water is supplied to the accessory from the driving mouth of the Hydraulics Bench (FME00) or from the Basic Hydraulic Feed System (FME00/B), by a flexible pipe. Then, water passes through a damping deposit that eliminates the turbulence. It has a dye injection system, which consists of a deposit, a flow control valve and some needles that allow for a better visualization of the flow around the different hydrodynamic models, placed in the central part of the channel. The module can be levelled with the adjustable legs.

FME19. CAVİTATİON PHENOMENON

DESCRIPTION

The module consists of a rectangular transversal section Venturi-pipe, with transparent wall for a better observation of the Cavitation Phenomenon. It includes a manometer and a vacuum meter that are respectively connected to the inlet section and to the reduction throat section. The existing pressure in the Venturi sections is transmitted by thin capillary tubes placed at the back of the frame.

FME18. FLOW METER DEMONSTRATİON

DESCRIPTION

The module consists of a Venturi meter, a flowmeter and an orifice plate, installed in a series configuration to permit a direct comparison. Several pressure taps are connected to a panel of eight tubes. The flow control valve allows the variation of the flow rate through the circuit, and its adjustment, along with the bench control valve, allows for varying the system static pressure. The pressure taps of the circuit are connected to an eight-bank manometer, which incorporates an air inlet valve at the top manifold which facilitates the connection to the hand pump. This enables to adjust the levels in the manometer bank to a convenient level to suit the system static pressure.

FME05. ENERGY LOSSES İN BENDS

DESCRIPTION

Hydraulic Feed System (FME00/B). This module consists of a hydraulic circuit with a set of elements that disrupt the normal flow of the fluid that circulates by the pipe, due to sudden section and direction variations, as well as friction. These elements are: Two 90º elbows, a short one and a middle one. A 90º curve or long elbow. A broadening. A sudden narrowing section. A sudden direction change, miter type. The module has two manometers, Bourdon type: 0 - 2.5 bar and twelve manometric pipes of pressurized water. The system pressurization is carried out with a manual air pump. The hydraulic circuit has pressure tappings along the whole system, which enable to measure the local load losses in the system. This module has two membrane valves, a valve which enables the regulation of the outlet flow, and a valve placed in series with the rest of accessories of the hydraulic circuit.

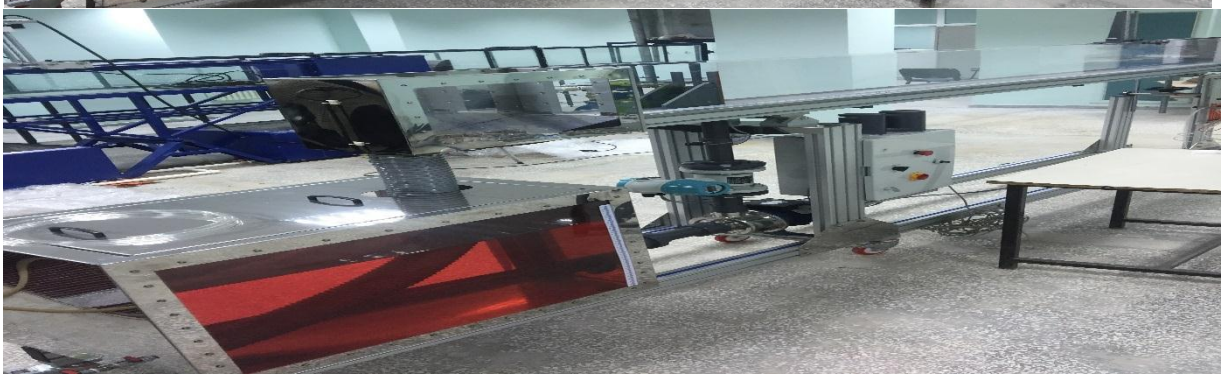
FME07. ENERGY LOSSES İN PİPES

DESCRIPTION

The module consists of the following elements, used in combination with the Hydraulics Bench (FME00) or the Basic Hydraulic Feed System (FME00/B): Pipe with quick connector to be coupled to the water outlet's mouthpiece at the Hydraulics Bench (FME00) or the Basic Hydraulic Feed System (FME00/B). 6 mm external/4

mm inner diameter metallic test pipe. One water column differential manometer. Constant height tank. Two Bourdon type manometers.

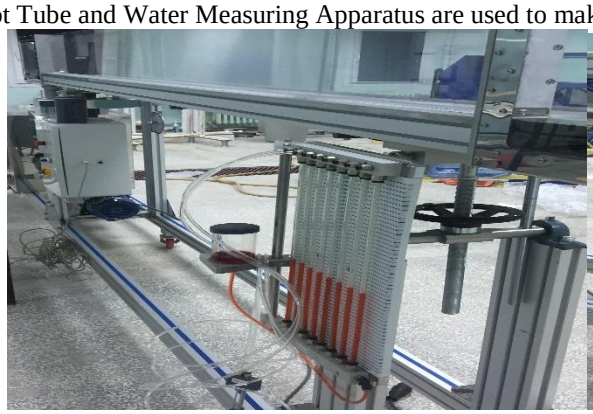
OPEN CHANNEL FLOW TEST AND TRAİNİNG KİT



DESCRIPTION

It is an open channel with a length of 5 meters and the sluices in the flow of water in the channels; allows all experiments to be carried out on flow characteristics. The channel has its own water reservoir and a powerful pump that provides water flow. For this reason, it is a type that works independently of other experimental sets. The measurement of the water flow rate is measured gravimetrically and weights are required for measurements. The inner section of the open channel has a total length of 5 meters and a width of 7 cm.

Pitot Tube and Water Measuring Apparatus are used to make measurements on open channel.



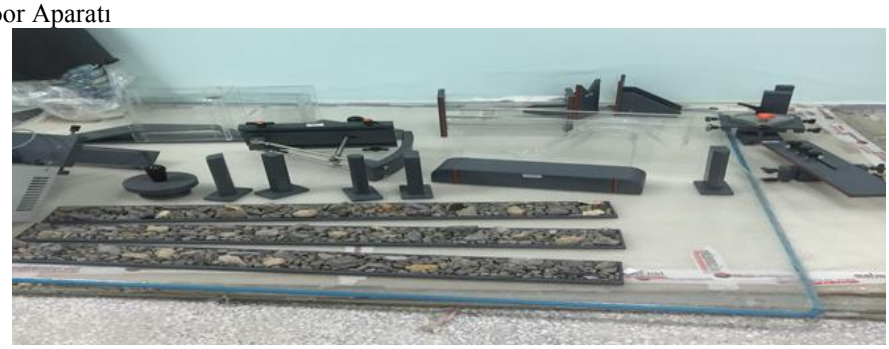
In open channels, it allows to carry out all experiments related to flow characteristics and sluices in water flow. There is a 5 meter canal with transparent edges and no joints for students to see. The canal is located at eye level on the iron feet.

All parts that come in contact with water are made of corrosion resistant materials (stainless steel, GRP). The slope of the channel is adjusted by means of an arm and a screw system, allowing water flow experiments to be carried out on the sloped channels.

Experiments such as hydraulic experiments on channels, specific energy, sluice experiments, effect of sluice profiles on water flow and venturi on canals are done.

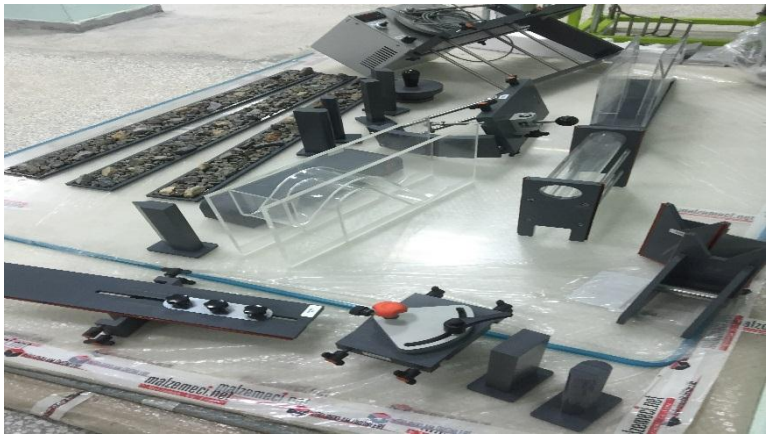
With set; Friction in uniform channel flow, flow under bent cover, Venturi channel, Flow around set with pointed top, Wide top channel, Crump spear, Flow around the spout.

Cylindrical Door Aparatı



• It is used as an axis of the five-meter Open Channel Training Set and mounted in an open channel to conduct experiments together.
• Cylindrical Shell; simple type door which can be positioned at any point along the flow channel.

Full Sweep, Flat Apron, Ski Jumping Apparatus
• It is used as an accessory for the 5-meter Open Channel Training set and for testing together by mounting it in an open channel.
Parşal Aparatları



• Designed to avoid flow conditions and energy loss by being positioned at any point in the channel
• Parshall measure is produced from transparent acrylic material to monitor the flow, and is used to show students how to measure the flow.
Culvert Aparatı

It is used as an accessory of the 5-meter Open Channel Training Set and mounted in an open channel to conduct experiments together.