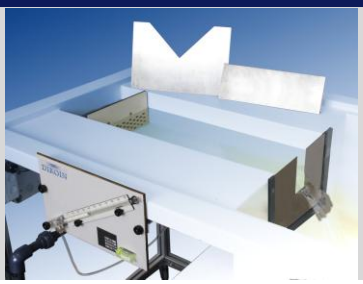
FL 01.1 - HYDRAULIC UNIT (pag. A - 1)



FL 01.2 - FLOW BY WEIRS (pag. A - 1)

FL 01.3 - HYDROSTATIC BENCH (pag. A - 1)

FL 01.4 - HYDRAULIC BENCH (pag. A - 2)

FL 01.6 - HYDRAULIC BASIC BENCH (pag. A - 2)

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FL 02.1 - LOSSES IN PIPES PANEL (pag. A - 3)

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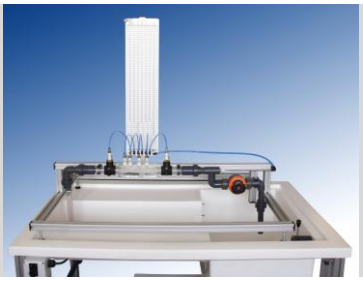
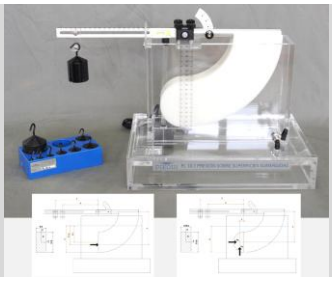
FL 06.1 - VENTURI, BERNOULLI AND CAVITATION EFFECTS (pag. A - 3)



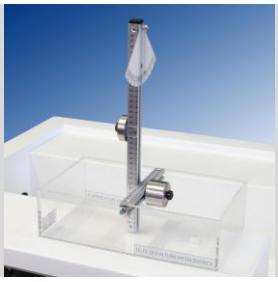
FL 06.2 - BERNOULLI (pag. A - 4)

FL 06.3 - CAVITATION STUDY (pag. A - 4)

FL 09.2 - HYDRAULIC RAM (pag. A - 4)



FL 10.1 - HYDROSTATIC PRESSURE ON SUBMERGED SURFACES (pag. A - 5)



FL 10.2 - METACENTRIC HEIGHT (pag. A - 5)

FL 11.1 - WATER JET FORCES (pag. A - 5)

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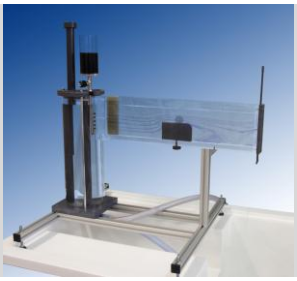

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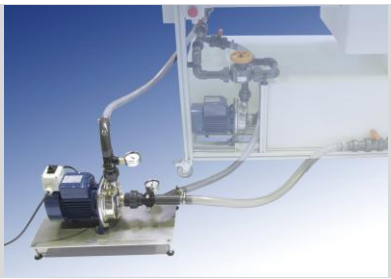
FL 28.1 - PASCAL APPARATUS (pag. A - 11)

FL 29.1 - FLUID STATICS AND MANOMETRY (pag. A - 11)

FL 30.1 - FLUID PROPERTIES (pag. A - 12)



FLB 03.1 - SERIES AND PARALLEL PUMP MODULE (pag. A - 12)

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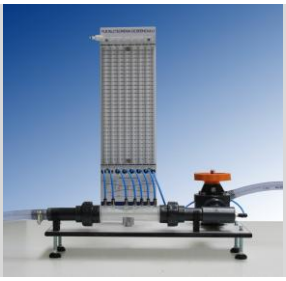

FLB 06.2 - BERNOULLI`s THEOREM (pag. A - 13)

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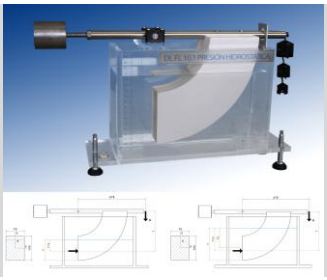


FLB 10.1 - HYDROSTATIC PRESSURE (pag. A - 13)

FLB 11.1 - JET STREAM FORCES (pag. A - 14)

FLB 13.1 - DEAD WEIGHT CALIBRATOR (pag. A - 14)

FLB 14.2 - OSBORNE REYNOLDS DEMONSTRATOR (pag. A - 14)

FLB 23.1 - FLOW METER DEMONSTRATION (pag. A - 15)

FL 01.1 - HYDRAULIC UNIT

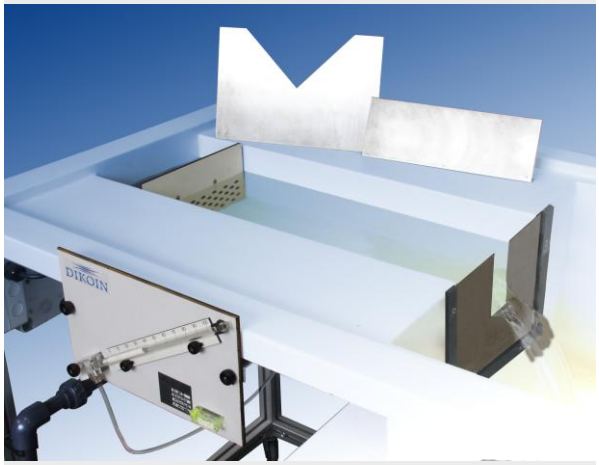
This power pack has been designed with the aim of establishing an independent, portable and economic hydraulic power supply unit.

The intended aim of this approach is to provide autonomy to the teaching equipment of laboratory, so that they can perform several practices simultaneously, without the equipment depend on the availability of a hydraulic bench.

HIGHLIGHTS

- Economic.
- Easily manageable.
- Storage tank with lid to prevent the entry of impurities into water.
- Backwater compartment to prevent air from entering the

FL 01.2 - FLOW BY WEIRS



Built on the surface of "Hydraulics Bench FL 01.4" (not included), for which dumps different ways that engage in the same plates are supplied channel is used.

The height of the upstream weir plate is measured by an inclined manometer connected by a pipe to the channel bottom.

FL 01.3 - HYDROSTATIC BENCH

This equipment is designed for the study of both properties, and the most important in the static fluid phenomena.

Achievable stydies:

- Density Measurement
- Demonstration of Pascal's law
- Study and demonstration of the capillary
- Viscosity determination
- Measurement of pressure
- Calibration of pressure gauges
- Archimedes law
- Stability of a floating body
- Pressure energy, potential and kinetic
- Pressure on submerged surfaces
- metacentric height

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FL 01.4 - HYDRAULIC BENCH

The hydraulic bench is designed as a table of work, for a great variety of didactic equipment is possible to be used, where a water flow is necessary. It has two volumetric tanks with different sizes, for the measurement of small and large volumetric flows with high exactitude.

The bench has union nuts and a fast plug connections (provided with 2 meters of flexible hose), so that the installation of the different work parties is agile and simple.

Another characteristic of the bench is that the inferior deposit of water storage, has a cover to avoid the accumulation of dust and particles, maintaining therefore the water in better conditions during a long period of time.

The bank has also an interchangeable section, where high number of DIKOIN equipment can be connected.

FL 01.6 - HYDRAULIC BASIC BENCH

The hydraulic bench is designed as a desk, on which you can use a variety of teaching equipment, in which an input flow needed. It has two volumetric tanks of different sizes, for the measurement of small and large flows with high accuracy.

The bench has connections with union nuts, so that the installation of the different items is quick and easy.

Another feature of the bench is that the lower water storage tank has a lid to prevent the accumulation of dust and particles, thus keeping the water in better condition for a longer period of time.

The bench also has an interchangeable section, where you can attach lots of accessories.

FL 01.7 - HIGH FLOW HYDRAULIC BENCH

The Gran Caudal Hydraulic Bench is designed as a work table, on which a great variety of teaching equipment can be used, in which a large contribution of flow is necessary.

This version of Hydraulic Bench has two pumps connected in parallel. With them we obtain the double amount of work obtained with the traditional hydraulic bench.
It also has two volumetric tanks of different sizes, for the measurement of small and large flows.

This equipment is specially designed to work with hydraulic turbines, although it allows the operation as a normal bench, allowing to connect the pumps independently.

The bench has connections by connecting nuts and a quick plug (supplied with 2 meters of flexible hose), so that the installation of the different work equipment is agile and simple. It also has a drain that allows a faster discharge when working with high flows.

The Gran Caudal Hydraulic Bank also has an interchangeable section, where an electronic flowmeter can be optionally coupled for the accurate and quick reading of the working flow rates.

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FL 02.1 - LOSSES IN PIPES PANEL

The FL02.1 equipment has been designed for the study of both friction losses in pipes, and the losses of characteristic elements of facilities such as; fittings, valves and measuring elements.

The equipment is designed to be as flexible as possible and can be built into the new fittings and straight pipe of different materials and roughness. The change operation is simple and clean, it is only necessary to use the quick links to unscrew the original section and replace with the new.

The channel on the bottom of the panel's mission is to collect the residual water left in the pipes, so that no wet adjacent equipment and enabling this work is to make the students themselves.

In this same line to avoid water leakage circuit, installing pressure taps has called "ecological", which does not leak water when connecting or disconnecting the gauge jacks. · Are treated as self-sealing connections.

The equipment can be connected to both the bank and the hydraulic power pack with flowmeter.

FL 04.1 - PIPELINE NETWORKS

The pipeline networks equipment FL 04.1 has been developed for the study and analysis of the flow through pipe networks.
During the design we've thought on a complete and flexible equipment, so that the user can study the higher possible number of configurations and as complex or simple as they wish.

The change operation settings is quick, clean and simple, with no opening or closing valves, without installing or removing any pipe or fitting.
To avoid water leakage from the circuit, and having to work with many manometer tubes, the facility has dual shutter pressure taps which do not leak water when connecting or disconnecting.

So, we have a complete equipment that covers all configurations that can occur in a pipe system, which also has the opportunity to learn from the most complex to the simplest system, all in an easy and simple operation and null maintenance.

FL 06.1 - VENTURI, BERNOULLI AND CAVITATION EFFECTS

The objectives to be achieved with the learning of the objectives with this equipment are the study of the venturi effect from its initial theoretical conception, the Bernoulli's theorem, and the observation and use of some of its practical applications; applications that we can find in diverse fields as industry, agriculture, leisure, etc.

Another objective to be covered is the study and observation of the phenomenon of cavitation, and it is also possible to change the pressure conditions in the aspiration tank, so that we can study the phenomenon for different flow rates and pressures.

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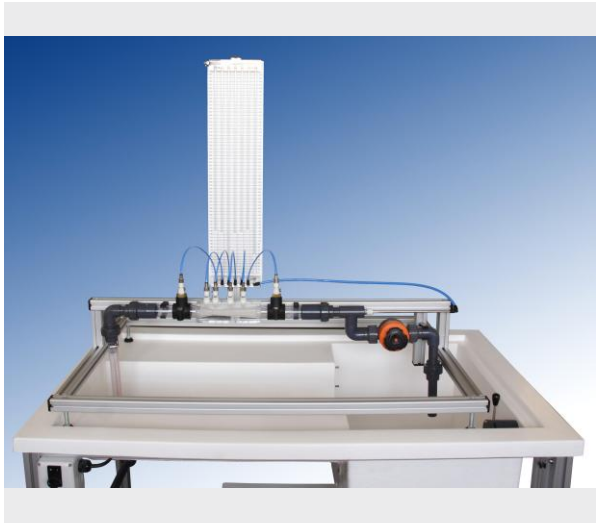
FL 06.2 - BERNOULLI



The equipment FL 06.2 is a simple equipment that further explore the Bernoulli equation and its proof.

The machine has a multi-tube manometer in which we can read simultaneously the different pressures along the canal.

The connection to hydraulics bench (not included) is performed with a threaded link standing without tools, and the conexions are self-sealants, fast connections that keep the water out when you disconnect.

FL 06.3 - CAVITATION STUDY

The demonstration equipment of the CAVITATION phenomenon is a simple equipment that is coupled to a hydraulic bench or any other source of hydraulic power supply.

It consists of a venturi tube in which throat occurs the phenomenon of cavitation due to the depression created in it by the acceleration of the flow (Venturi effect).
For a correct observation of the phenomenon, the methacrylate venturi has been constructed.

The equipment also has two pressure gauges with which we can measure the overpressures and depressions produced. A regulating valve is used to regulate the flow rate, which allows fine adjustment of the flow.

REMARKABLE ASPECTS

- The equipment can be connected to the hydraulic bank and to the hydraulic group with flow meter.
- Optimal visualization of the phenomenon under study, for the manufacture of the venturi tube in transparent material and black background.

FL 09.2 - HYDRAULIC RAM

The FL09.2 is a equipment that aims to demonstrate and study the phenomenon known as water hammer, this phenomenon is the one that occurs due to the rapid closure of the passage of water through a pipe. The design of the equipment is made with special emphasis on the didactic field, so it is supplied with variable elements, to achieve a greater number of tests for a better understanding of the student.

The set has three different tanks which are located at different heights. One of them is used to make the water supply constant, for that we use a tank with pressurized air that homogenizes the water supply to the raised tank. In order that the fluid does not return to this tank this is supplied with a non-return valve. In the case of the other two tanks one has a fixed level overflow and the other an adjustable level overflow which is the tank which is situated at a higher height.

The equipment has a quick-closing valve which allows the flow generated by the overpressure to be cut in the pipe that causes the water hammer phenomenon.

In addition, the equipment has two lengths of pipes of different lengths (one section will be of a length of 1m and the other section will have a length of 3m), which allows to perform different tests , exchanging the hoses and performing a greater number of tests.

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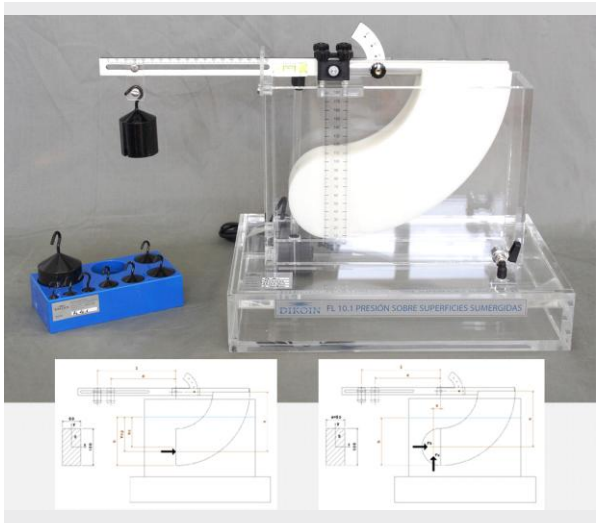
FL 10.1 - HYDROSTATIC PRESSURE ON SUBMERGED SURFACES



This equipment aims the study and determination of the pressure force acting on a submerged surface in a liquid.

It is a simple and completely autonomous equipment that can be located anywhere in the laboratory without any installation.

Liquids of different densities can be used to determine the influence of this on the exerted pressure force.

HIGHLIGHTS

- Independent operating equipment.
- Calculation of the pressure force exerted on both flat and curve surfaces.
- Possibility of varying the angle of the surface on which the study is made.

FL 10.2 - METACENTRIC HEIGHT

The principle of Archimedes says that: **"Every body submerged in a liquid experiences a vertical thrust and upward equal to the weight of the liquid dislodged".**
With this equipment is intended to study and calculate the metacentric height of a floating body, which pretends to be a boat.

It is called ***metacenter*** to the point of intersection of the vertical axis of the boat or floating object, with the vertical drawn from the center of hull.

The ***metacentric height*** is the distance between the metacenter and the center of gravity of the floating body.

In the study of the equilibrium of a floating object, such as a boat, we can distinguish three cases, are the following:
- ***Stable equilibrium*****:** If the metacenter is above the center of gravity of the body, it will remain in balance.
- ***Unstable equilibrium*****:** If the metacenter is under the center of gravity of the body, the deviation of the line of force from the weight of the floating object with respect to the thrust of the fluid in which it floats form a torque, and therefore the deviation tends to increase further.
- ***Neutral equilibrium*****:** If the metacenter coincides with the center of gravity of the body, the metacentric height will be equal to zero.

FL 11.1 - WATER JET FORCES

This equipment has been designed to verify the validity of the theoretical expressions that determine the force exerted by a jet on different types of blades.

HIGHLIGHTS

- The equipment can be connected to the hydraulic bank and the hydraulic group with flow meter.
- Simple and quick blade change system, without using any type of tool.
- Three different types of blades, 90, 105 and 180º.

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FL 12.1 - FLOW BY ORIFICES

The FL12.1 equipment has been designed for the study of everything related to the phenomenon of contraction that occurs when a jet of fluid passes through a orifice. It has been designed with special emphasis on its didactic use and that is why the equipment has three nozzles whose geometry differ between them, being able to perform tests in different conditions, facilitating to the student the compression of the phenomenon that is produced.

In order to perform the test successfully, the equipment has a Pitot tube through which it is possible to measure the velocity of the fluid at the outlet.

In addition, the equipment has a measuring instrument of the jet diameter, which can be regulated, which allows the measurement of the diameter of the jet of the fluid to the exit obtaining results of a greater accuracy.

Finally, the equipment has a water column manometer through which the measurements of the water level in the tank can be made and the height of the water jet speed.

FL 12.2 - HORIZONTAL FREE JET FLOW FROM A TANK

This equipment, has been designed for the study of all concerning the outlet of flow through orifices.

The water tank has adjustable height, reason why flow tests can be made in different conditions of pressure. The deposit has a scale that indicates the height of the level of liquid at every moment.

The equipment includes a panel with 8 indicating gauges, easily adjustable to the trajectory of the jet paths, and very simple to take the data.

The different nozzles are adjusted to the inner surface of the tank, obtaining the minimum possible disturbances.

On the other hand, the equipment has a built-in bubble level that allows us to know if the equipment has been correctly leveled, as well as vertically adjustable feet, to easily level the equipment.

The construction of the equipment in materials as aluminum or stainless steel, in all its metallic parts, guarantees the durability of it.

FL 13.1 - MANOMETER CALIBRATION

The objective of this equipment is the study and calibration of manometers, as well as the visualization and understanding of its operation.

HIGHLIGHTS

- Completely autonomous equipment without water supply.
- Very didactic equipment because it has a transparent manometer.
- It has a cylinder with flywheel to introduce pressure in the circuit.
- Possibility of working in parallel with a digital manometer (Manometer not supplied).

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FL 14.1 - VISCOSITY AND RESISTANTE COEFFICIENT DETERMINATION

This equipment has been designed for the determination of the viscosity of several liquids, and the study and verification of the resistance coefficients of various geometric shapes.

HIGHLIGHTS

- Versatile equipment that can be used for the study of fluid properties and resistance coefficients of particles.
- Autonomous equipment which requires only one elctrical outlet.

FL 14.2 - REYNOLDS NUMBER

The goal of this equipment is to try to reproduce the experiment by Osborne Reynolds visualizing laminar, turbulent and transitional setting the Reynolds number corresponding to each flow.

The equipment comprises a water supply system for feeding a constant load center calibrated glass tube where the different types of flow are displayed studied.

In this central glass tube, a colorant from the container at the top of the device is injected, the dye is that it allows the perfect visualization of the phenomena referred to above.

Both the dye and deposit the glass tube equipped with valves for adjusting the amount of injected dye in the first case and the second flow.

FL 14.3 - BALL DROP VISCOSITY TEST

The FL 14.3 equipment is designed to determine in a quickly and easy way the dynamic viscosity of a fluid.

The equipment consists of a transparent tube, a ball and a magnet. The operation is simple and consists of filling the tube with the fluid we want to study, we drop the steel ball and we time the time it takes to fall to the bottom, as we know the radius of the ball, we can calculate the viscosity of the fluid.

The magnet serves to recover the ball from the bottom of the container without having to empty it.

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FL 15.1 - FORCED VORTEX

The objective of this equipment is the visualization and study of the paraboloid that is generated in a liquid when it is subjected to a uniform rotation.

The equipment is autonomous and easily located in the laboratory because it does not require any type of installation.

Liquids of different densities can be used to determine the influence of this in the formation of the parabola.

FL 15.2 - FORCED AND FREE VORTEX

The objective of this team is the visualization and study of the formation of free and forced vortices. Is called **Forced Vortex** to the rotation of a fluid that moves like a solid with respect to an axis. By definition, in the forced vortex each fluid particle has the same angular velocity.

With this equipment the creation of a forced vortex is achieved by the entrance of water through the nozzles that, with a certain inclination, get the beginning of the movement of a propeller. This propeller rotates the fluid forming the curve of the parabola under study. Once the vortex is obtained, the parabola described can be represented by the measuring rods. These allow you to take the height of the parabola for each point at a fixed radial distance.

The Free Vortex is one of the elementary types of irrotational flow. This movement is distinguished from the forced vortex in that, each particle moves in a circular path at a rate that varies. This variation will be inversely proportional to the distance to the center of rotation. In this case, the other pair of nozzles will be responsible for getting the fluid to the reservoir. The inclination of those allows the formation of the free vortex.

Different outlet nozzles are available with which we analyze the influence of the outlet diameter on the described vortex, as well as pitot tubes, with different tapping radii, with which the pressure recorded readings can be taken for different depths.

FL 16.1 - FLOW VISUALISATION

The flow visualization table allows to study the flow behaviour through different objects by flow lines, besides being able to simulate sources and sinks.

Upstream, the ink is supplied through needles generating current lines. The ink flow is controlled by a **regulating valve**.

Handeling the needle valves, we can introduce in the current **sinks** (points where water leaves the stream), **sources** (points where water enters the stream) or a combination of both.

Different models are supplied with the equipment: car profile, aerodynamic profile, circle, rectangle, square, teardrop, etc., with which we can clearly see the flow of current lines passing aroung these.

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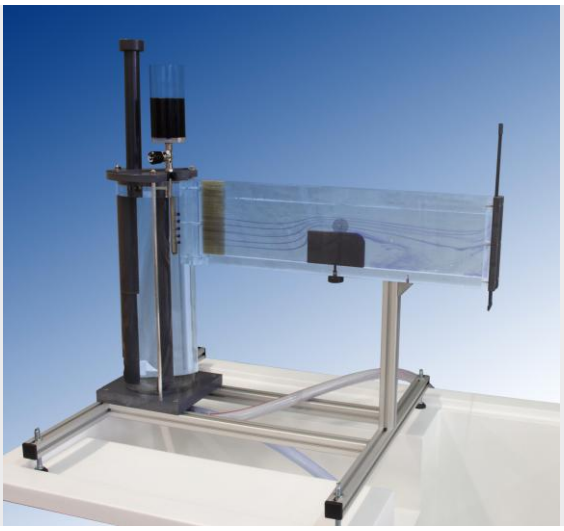
FL 16.2 - STREAMLINES VISUALIZATION IN A CHANNEL



This equipment allows the study of the behavior of fluids in open channels and flow lines that form around different submerged objects.

The service for the experiments is the flowing water. So that the flow lines are visible during the experiments, diluted ink is used in water. This combination of elements with the feature that the channel is completely transparent allows optimal viewing of the flow lines .

Different bodies of landfill and profiles are provided as varied forms.

FL 17.1 - PIPE FRICTION

The objective to be achieved with this equipment is the study of primary pressure losses produced along a pipeline in both laminar and turbulent regimen.

This equipment has a horizontal pipe in which perform readings of the pressure loss produced for different flow rates. It also has, with the possibility to study the friction in the same pipe for both laminar and turbulent regime.

To get this last, we feed pipe from a tank of constant height. For readings of upstream and downstream of the pressure test pipe, we have two differential pressure gauges, one of water and other of mercury.

For regulation of the flow use two valves, one located at the begin of the installation and another place at the exit of the test pipe. The flow through into the pipe is measured using the volumetric tank of the hydraulic bench.

FL 17.2 - LOSSES IN PIPES

The objective to be achieved with this equipment is the study of the primary losses of load that occur along a pipe, in two regimenes: **laminar and turbulent**.

This equipment counts on a vertical pipe, in which we make the readings of the loss of load produced for different flows; Flow rates that we obtain through the regulating valve with which the equipment counts.

The study of the different regimes is achieved by modifying the way in which the water reaches the test pipe, so that, in order to achieve the laminar regime, the pipe is fed from a tank of constant height while for the turbulent regime the supply will be made directly from the water supply equipment.

For the readings of upstream and downstream pressures of the test line, we have two differential pressure gauges, one of water and one of mercury.

Measurements of the flow rates obtained with the control valve are performed using the supplied test tube or the volumetric reservoir of the hydraulic bank (required), which also studies the **relationship between the pressure drop and the fluid velocity**.

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FL 18.1 - SECONDARY LOAD LOSSES

This installation for the study of the **head losses** has straight sections of pipe, which allows the study of the primary loss generated in it. It also has elements such as elbows of different diameters at 90º and 45º, tees, widening, narrowing, different types of valves (ball, gate, diaphragm, non-return,...) with upstream and downstream pressure tappings arranged for determination of the head lodd between shots produced with different flow rates.

All pressure taps have quick plugs double sealed. The equipment has a water differential manometer of 1000 mm and an electronic differential manometer for the measurement of the resulting pressures.

FL 18.2 - LOSSES IN ELBOWS

In order to calculate the secondary **load losses produced by the fittings of an installation**, we take data of the difference of pressures between the gauges upstream and downstream of the element to be measured, in addition, we must subtract the existing primary load losses due to the straight sections of a pipe.

When we want to obtain the **pressure loss that occurs between two pressure ports located in pipes of different diameter**, we must take into account that not all the difference of static pressures read corresponds to losses of load, that part is due to the transformation of static pressure in dynamic pressure by the increase of the speed.

The equipment has **all possible configurations of 90 ° elbows**, in addition to widening and abrupt narrowing, and a gate valve. These load losses are read simultaneously by means of a water column multimanometer, which allows to **visualize with maximum clarity the difference between the different types of bends**, and additionally, of widening and narrowing, and valve.
In addition, the equipment has an **electronic differential pressure gauge**, which allows the measurement with a greater range, of the pressure loss produced in the gate valve with different openings.

FL 23.1 - FLOW METER STUDY

The goal of this item is the study and comparison of some of the different types of existing **flow meters**. The equipment incorporates gauges for more teaching and representative flow.

These flowmeters are a **Venturi tube, rotameter, diaphragm, angle seat valve and a Pitot tube** placed in series to allow direct comparison of results.

Through the realization of some of the practices of this item has failed to understand the behavior of fluids against certain **laws of statics, dynamics, thermodynamics**.

They may implement general principles such as the **conservation of mass, or energy** in a simplified and easily.

Besides regulating valve with variable flow rates allow you to work according to the needs of the practice.

The results are displayed in both the water column manometer and the supplied electronic differential. Through these gauges pressure values are extracted at different strategic points of the equipment.

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FL 27.2 - FLOW NETWORKS

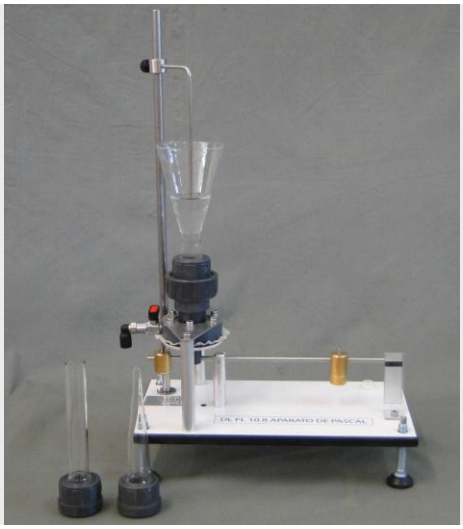
The "Flow networks" equipment reflects in scale the problem that usually appears for the calculation of pressures and flows in pipes that interconnect each other. These pipes usually have different diameters and lengths and form different systems (serial, parallel, mesh ...) which severely complicates the calculation.

These pipe interconnections are known as **flow networks**. An example of this could be the **village water supply network** or the fire-fighting system of a building.

It is essential to know the behavior of these pipes and the pressure and flow readings they record for their good design. For example, by **modelling the system** we can know at any moment the flow rate that flows through each of the pipes.

With this equipment will be possible to realize the experimental practices that allow us to verify the behavior of the network of flow in front of diverse situations. The equipment consists of a series of transparent pipes with different diameters, as well as a series of valves placed in strategic points of the network. The quick connections that the equipment has, allow to interchange the different pipes. This, together with the actuation of the valves, allows the **different network study configurations** to be achieved quickly.

FL 28.1 - PASCAL APPARATUS



Equipment designed for the study and demonstration of Pascal's law.

This law was enunciated by the physicist and mathematician Blaise Pascal (1623-1662) and says that **"The pressure exerted on a point of a fluid in equilibrium is transmitted in full in all senses."**

Also with this equipment we can study the called **"hydrostatic paradox"**, which is a consequence of Pascal's Law **"The pressure inside a liquid at rest depends only on the height of water, regardless of the amount".**

There are numerous applications based on Pascal's law, one of the best known is the hydraulic press.

FL 29.1 - FLUID STATICS AND MANOMETRY

Equipment designed for the study of fluid static and pressure measurement with different types of piezometric tubes and level measuring elements such as graduated scales and limnimeter.

The equipment has a transparent deposit, in which we will pour water, and through the different valves and pipes, the water is sent to the different columns.

One of the columns of water has a system to be able to tilt it, so that you can clearly visualize the effect of different inclinations.

In both columns and in the tank, there is a graduated scale to directly visualize the height of the water.

In addition, a limnimeter is included for precise measurement of the level of water.

The equipment is delivered with a complete workbook.

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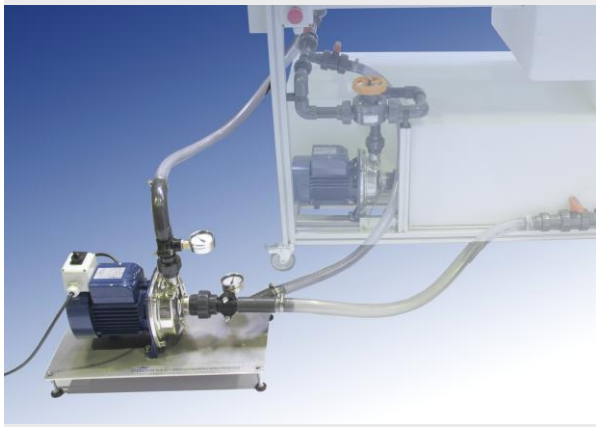
FL 30.1 - FLUID PROPERTIES

Equipment designed for the study of the properties of fluids. A wide range of practices and experiences can be realized, some of which are listed below:

- Measurement of densities using densimeters.
- Measurement of densities using a pycnometer.
- Study and demonstration of the capillarity in tubes.
- Study and demonstration of capillarity between plates.
- Determination of viscosity.
- Measurement of atmospheric pressure using an anaerobic barometer.
- Law of Archimedes.

FLB 03.1 - SERIES AND PARALLEL PUMP MODULE



Pumps are included in a piping system to convert mechanical energy into hydraulic energy. This additional energy allows the transmission of a fluid from one place to another when it is not feasible to flow by gravity, raise it to a certain height on the pump or recirculate it in a closed system. In general, the effect of a pump on a system is to **increase the total energy by an amount H.**

The efficiency of a pumping system depends in great extent on the placement of different **pump configurations** both in series and in parallel according to the needs of the system.

In addition, the flow **regulating valve** manages to operate the pump at different points of operation, with we obtain experimentally its working curves. These work curves can be compared with those supplied by the manufacturer, as well as those obtained by mathematical calculation.

With this equipment it is intended to carry out a large part of the operations of both commissioning and of operation and regulation required in a pumping installation. In addition, the characteristics of a pump operating individually and in groups will be studied.

FLB 03.2 - PUMP CHARACTERISTICS MODULE

Pumps are included in a pipe system to convert mechanical energy into hydraulic energy. This additional energy allows the transmission of a fluid from one place to another when it is not feasible to flow by gravity, raise it to a certain height on the pump or recirculate it in a closed system. In general, the effect of a pump on a system is to **increase the total energy** by an amount H.

In the case of the **centrifugal pump** its operation is based on the input of the fluid through the center of the impeller, which has blades for conducting the fluid, and as a result of the centrifugal force is driven outwards. There it is collected by the pump casing, which by the outline its shape leads it to the outlet pipes or to the next impeller.

With this equipment is intended to study the characteristics of a pump running individually at **different speeds of rotation**. This is possible thanks to the frequency inverter that incorporates which modifies the working speed of the pump according to the case study.

In addition, the flow **regulating valve** manages to operate the pump at different points of operation, which we experimentally obtain its **working curves**. These work curves can be compared with those supplied by the manufacturer, as well as those obtained by mathematical calculation.

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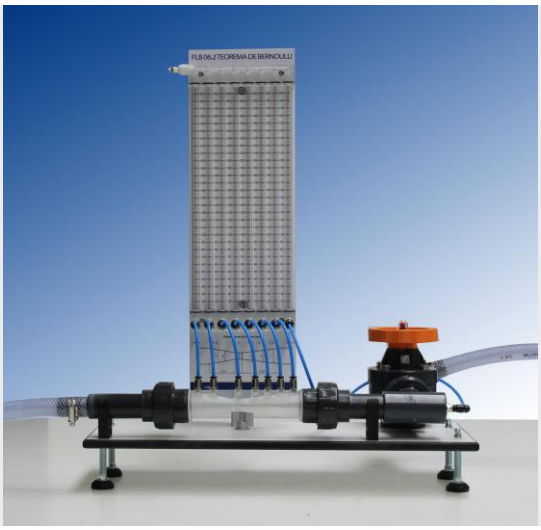
FLB 06.2 - BERNOULLI`s THEOREM



The objective to reach with this simple equipment is the study in depth of the **equation of Bernoulli** and its demonstration.

This equipment is based on the principle of Bernoulli in which the behavior of a laminar flow is described moving throughout a conduit and considers that in an ideal fluid (without viscosity nor friction) in regime of circulation by a closed conduit, the energy remains constant throughout its route.

The equipment has a Venturi with which in an experimental way, it could be demonstrated its theoretical procedure based in the theorem of the conservation of the mechanical energy.

The regulation valve allows to work with different flow rates giving different scales in the differential pressure.

The pressure measurements are obtained in the tube manometers that has the equipment, so in a simple way the different pressure readings throughout the conduit can be obtained.

The measures of flow rates are done by means of the volumetric tank of the hydraulic bench (required), with which also the relation between the pressure drop and the speed of the fluid can be studied.

FLB 09.2 - HYDRAULIC RAM STUDY

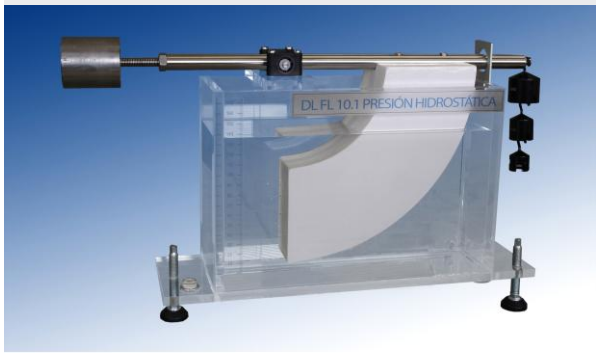
With this equipment is intended to study and demonstrate the operation of a hydraulic ram, a system by which we can raise a liquid to a height higher than the height of supply, without external energy input.

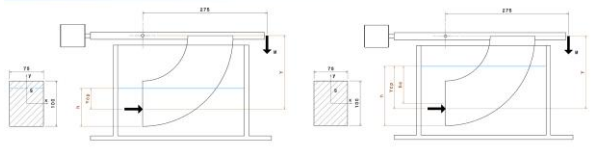
The ram uses more water in its process than the one that drives, the proportion driven is between 10-15%. But as it operates all the time, this small amount will always be useful.

The practices and experiences that will be realized with this equipment are the following:

- Visualization and analysis of the water hammer phenomenon caused by the closing of a valve.
- Study and understanding the operation of the hydraulic ram.
- Obtaining the flow ratio.
- Water hammer efficiency.

FLB 10.1 - HYDROSTATIC PRESSURE





This equipment is designed for the study of the pressure exerted by a fluid on a surface submerged in it.

The shape of the sector or quadrant that is submerged in the water, allows the only pressure exerted by the water on its surfaces that is balanced by the weight we place in the practices, is the lower rectangular vertical surface.

An indicator rule shows the water height from the lower point of the submerged rectangular face on which the phenomenon is studied.

To avoid any friction that deflects the measurement, the entire quadrant system and its support (where we place the balance weights) are supported on bearings with glass spheres, which provide a clear advantage in the accuracy of the test.

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FLB 11.1 - JET STREAM FORCES

This equipment has been designed to verify the validity of the theoretical expressions that determine the force applied by a jet stream on different types of deflectors.

The equipment, operating on the hydraulic bench, allows a perfect visualization of the impact of the jet stream on the studied deflector thanks to its transparent housing.

The bubble level allows the correct leveling of the equipment for improvement of the precision in the results.

REMARKABLE ASPECTS

- System for simple and fast change of deflectors.
- Four different deflector types: 30º, 90º, 120º and 180º.

FLB 13.1 - DEAD WEIGHT CALIBRATOR

There are different methods to measure the pressure, for example by means of the pressure gauges.

One is due to consider that the pressure can be expressed in reference to an arbitrary origin. The scale of the pressure gauge indicates zero when the measurer is open to the atmospheric pressure and, over zero, is calibrated generally in pascals (as in the case of the pressure gauge provided with this equipment) or in other units of pressure.

The objective that is tried to reach with this equipment is to determine the read error of a Bourdon pressure gauge, since, to guarantee the exactitude and precision of these pressure gauges, it is necessary to make processes of calibration and continuous evaluation of the instrument.

For that procedures will be made destined to verify this exactitude and precision using a dead weight calibrator.

FLB 14.2 - OSBORNE REYNOLDS DEMONSTRATOR

The goal of this equipment is to try to reproduce the experiment by Osborne Reynolds visualizing laminar, transitional and turbulent flows, and establishing the Reynolds number corresponding to each of them.

The equipment is designed to work on the hydraulic bench (FL01.4, FL FL01.5 or 01.6).

A glass tube through which the equipment available, we pass a water flow together with ink metered by a needle to the inlet of the duct.

Depending on the flow rate through this tube, you can clearly see how the ink is mixed or not with water, forming a line clearly viewable current in case of laminar flow, or can visualize how the ink it is mixed with water in transitional regimes. After reaching the turbulent regime, the ink will be completely mixed with the water, and can not distinguish.

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FLB 23.1 - FLOW METER DEMONSTRATION

The goal of this equipment is the study and comparison of some of the different types of existing **flow meters**. The equipment is intended as a basic, so incorporating more didactic meters and representative flow.

These flowmeters are a **venturi, a rotameter and a diaphragm** placed in series will allow direct comparison of results.

Through the realization of some of the practices of this team has failed to understand the behavior of fluids against certain **laws of statics, dynamics, thermodynamics**. They may implement general principles such as the **conservation of mass, or energy** in a simplified and easily.

Besides regulating valve with variable flow rates allow you to work according to the needs of the practice.

The pattern of the flow measurements are made using the volumetric tank of the hydraulic bench (required), so that the **relationship between the pressure drop and the fluid velocity** is also studied.

Pressure readings are displayed on a multi-tube manometer 8 outlets through which values are extracted on 8 strategic points of the equipment.

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