

Fluid Friction in Pipes Unit, with Hydraulics Bench (FME00)



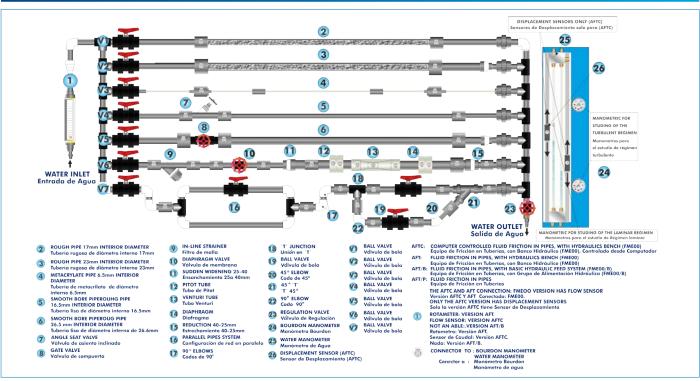
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⇒PRODUCTS

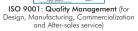
\$8.- FLUID MECHANICS



PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



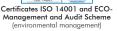














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GENERAL DESCRIPTION

The knowledge of pressure losses occurring in pipes as well as in different hydraulic accessories is very important in the design and dimensioning of pipes systems. The Fluid Friction in Pipes Unit, with Hydraulics Bench (FME00), "AFT", is designed to determine the friction coefficient in pipes of several diameters and roughness, to study the pressure losses in different types of valves and different fittings and to compare different methods to measure the flow.

The unit contains five straight pipe sections made of different materials and with different diameters and roughness. Additionally, a wide range of accessories are included for the study of losses in straight pipes, several types of valves (gate, ball, angle seat, etc.), pipe fittings (in-line strainer, elbows, sudden widening, contraction, etc.).

The different pipe sections, valves and pipe fittings include several pressure measurement points with quick action connections to fit the tubing that is connected to the corresponding pressure measuring device.

With this unit friction pressure losses can be investigated over a wide range of Reynolds numbers, thereby covering the laminar, transitional and turbulent flow regimes. Two water manometric tubes allow to study the pressure losses in the laminar regimen. Two Bourdon manometers allow to obtain the pressure losses in the turbulent regimen. Additionally, it includes a flowmeter to measure and to compare measurements of flow with the Venturi tube and the Pitot tube.

The unit includes the Hydraulics Bench, "FME00", which incorporates a sump tank and a centrifugal pump to make water flow in a close circuit and to supply it to the AFT unit.

SPECIFICATIONS

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

Diagram in the front panel with distribution of the elements similar to the real one.

This unit allows the detailed study of fluid friction pressure losses, which occur when a non-compressible fluid flows through pipes, valves, pipe fittings and flow metering devices.

Five pipes of different diameter, material and roughness:

Rough pipe (PVC): external diameter: 25 mm and internal diameter: 17 mm. Rough pipe (PVC): external diameter: 32 mm and internal diameter: 23 mm. Smooth pipe (PMMA): external diameter: 10 mm and internal diameter: 6.5 mm.

Smooth pipe (PVC): external diameter: 20 mm and internal diameter: 16.5 mm.

Smooth pipe (PVC): external diameter: $32\ \text{mm}$ and internal diameter: $26.5\ \text{mm}$.

Types of valves:

Angle-seat valve: internal diameter: 20 mm. Gate valve: internal diameter: 20 mm. Diaphragm valve: internal diameter: 20 mm. Ball valve: internal diameter: 20 mm.

Types of couplings:

In-line strainer, internal diameter: 20 mm.

Sudden widening. Its section changes from 25 mm to 40 mm. Sudden contraction. Its section changes from 40 mm to 25 mm.

90° elbow: inner diameter: 20 mm. "T" junction: inner diameter: 20 mm. 45° elbow: inner diameter: 20 mm. 45° "T" junction: inner diameter: 20 mm.

Symmetrical "Y" branch: inner diameter of each pipe: 20 mm.

Double 90° elbow: inner diameter: 20 mm.

Special couplings (PMMA):

Pitot tube: length: 30 mm, external diameter: 4 mm and internal diameter: 2.5 mm. Venturi tube: length: 180 mm, larger section: 32 mm and smaller section: 20 mm. Diaphragm with measuring plate: larger diameter: 25 mm and smaller diameter: 20 mm.

The unit includes several ball valves to conduct the water flow through a certain pipe of the circuit and a regulation valve to regulate the flow that runs through such pipe.

Thirty four pressure tappings with quick action connections.

Two water manometers, range: 0-1000 mm. Two Bourdon manometers, range: 0 - 2.5 bar

Flowmeter, range: 600 - 6000 I/h.

The unit is designed for use with the Hydraulics Bench "FME00":

Mobile hydraulic bench, made of fibreglass reinforced polyester, and mounted on wheels for its mobility.

Centrifugal pump, 0.37 kW, 30 – 80 I/min, at 20.1 – 12.8m. Sump tank, capacity: 165 I. Small channel, capacity: 8 I.

Flow measurement: volumetric tank gauged from 0 to 7 I for low flow values and from 0 to 40 I for high flow values.

Control valve to regulate the flow.

Cables and accessories, for normal operation.

Manuals: This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.



AFT detail

EXERCISES AND PRACTICAL POSSIBILITIES

- Determination of pressure loss due to friction in a rough pipe with an internal diameter of 17 mm.
- 2.- Determination of pressure loss due to friction in a rough pipe with an internal diameter of 23 mm.
- Determination of pressure loss due to friction in a smooth pipe with an internal diameter of 6.5 mm.
- Determination of pressure loss due to friction in a smooth pipe with an internal diameter of 16.5 mm.
- 5.- Determination of pressure loss due to friction in a smooth pipe with an internal diameter of 26.5 mm.
- 6.- Study of the influence of the diameter in the pressure loss due to friction in rough pipes.
- 7.- Study of the influence of the diameter in the pressure loss due to friction in smooth pipes.
- 8.- Study of the influence of the roughness in the pressure loss.
- 9.- Determination of the friction coefficient in a rough pipe with an internal diameter of 17 mm.
- 10.-Determination of the friction coefficient in a rough pipe with an internal diameter of 23 mm.
- 11.-Determination of the friction coefficient in a smooth pipe with an internal diameter of 6.5 mm.
- 12.-Determination of the friction coefficient in a smooth pipe with an internal diameter of 16.5 mm.
- 13.-Determination of the friction coefficient in a smooth pipe with an internal diameter of 26.5 mm.
- 14.-Study of the influence of the diameter in the friction coefficient in rough pipes.
- 15.-Study of the influence of the diameter in the friction coefficient in smooth pipes.
- 16.-Comparison of the friction coefficient in smooth and rough
- 17.-Determination of pressure loss in an angle-seat valve.
- 18.-Determination of pressure loss in a gate valve.
- 19.-Determination of pressure loss in a diaphragm valve.
- 20.-Determination of pressure loss in a ball valve.
- 21.-Comparison of pressure loss in different types of valves.
- 22.-Determination of pressure loss in an in-line strainer.
- 23.-Determination of pressure loss in a 90° elbow.
- 24.-Determination of pressure loss in a double 90° elbow.
- 25.-Determination of pressure loss in a 45° elbow.
- 26.-Determination of pressure loss in a 45° "T".
- 27.-Determination of pressure loss in a symmetrical "Y" branch.
- 28.-Determination of pressure loss in a narrowing.

- 29.-Determination of pressure loss in a gradual widening.
- 30.-Determination of pressure loss in a diaphragm.
- 31.-Comparison of pressure loss in the different fittings.
- 32.-Measurement of the flow with the Venturi tube.
- 33.-Determination of the discharge coefficient, $C_{\rm d}$, in the Venturi tube.
- 34.-Measurement of the flow with the Pitot tube.
- 35.-Determination of the discharge coefficient, C_{ar} in the Pitot tube.
- 36.-Comparison between the flow measured in the Venturi and Pitot tubes.

Additional practical possibilities:

- 37.-Study of the relationship between pressure losses due to fluid friction and the water flow rate.
- 38.-Determining the relationship between the pipe friction coefficients and Reynolds number for flow through a pipe with roughened bore.
- 39.-Determining of the resistance coefficients for bends, enlargements and contractions.
- 40.-Determining of characteristic curves of valves and fittings.

REQUIRED SERVICES

- Electrical supply: single-phase, 220 V/50 Hz or 110 V/60 Hz.
- Water supply and drain.

DIMENSIONS AND WEIGHTS

AFT:

Unit:

-Dimensions: 2100 x 850 x 1000 mm approx.

(82.67 x 33.46 x 39.37 inches approx).

-Weight: 150 Kg approx.

(330.7 pounds approx).

Hydraulics Bench (FME00):

-Dimensions: 1130 x 730 x 1000 mm approx.

(44.48 x 28.74 x 39.37 inches approx).

-Weight: 70 Kg approx.

(154.32 pounds approx).



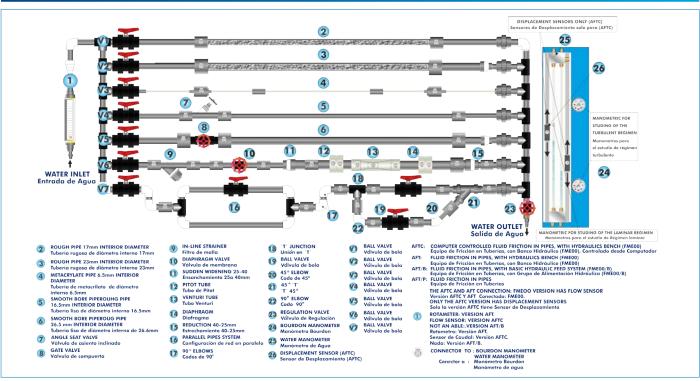
Fluid Friction in Pipes Unit, with Basic Hydraulics Feed System (FME00/B)

AFT/B

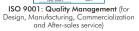
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S8.- Fluid Mechanics



PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

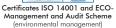














GENERAL DESCRIPTION

The knowledge of pressure losses occurring in pipes as well as in different hydraulic accessories is very important in the design and dimensioning of pipes systems. The Fluid Friction in Pipes Unit, with Basic Hydraulics Feed System (FME00/B), "AFT/B", is designed to determine the friction coefficient in pipes of several diameters and roughness, to study the pressure losses in different types of valves and different fittings and to compare different methods to measure the flow.

The unit contains five straight pipe sections made of different materials and with different diameters and roughness. Additionally, a wide range of accessories are included for the study of losses in straight pipes, several types of valves (gate, ball, angle seat, etc.), pipe fittings (in-line strainer, elbows, sudden widening, contraction, etc.).

The different pipe sections, valves and pipe fittings include several pressure measurement points with quick action connections to fit the tubing that is connected to the corresponding pressure measuring device.

With this unit friction pressure losses can be investigated over a wide range of Reynolds numbers, thereby covering the laminar, transitional and turbulent flow regimes. Two water manometric tubes allow to study the pressure losses in the laminar regimen. Two Bourdon manometers allow to obtain the pressure losses in the turbulent regimen. Additionally, it includes (in the Basic Hydraulic Feed System "FME00/B" a flowmeter to measure and to compare measurements of flow with the Venturi tube and the Pitot tube.

The unit includes the Basic Hydraulic Feed System "FME00/B", which incorporates a tank and a centrifugal pump to make water flow in a close circuit and to supply it to the AFT/B unit.

SPECIFICATIONS

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

Diagram in the front panel with distribution of the elements similar to the real one.

This unit allows the detailed study of fluid friction pressure losses, which occur when a non-compressible fluid flows through pipes, valves, pipe fittings and flow metering devices.

Five pipes of different diameter, material and roughness:

Rough pipe (PVC): external diameter: 25 mm and internal diameter: 17 mm. Rough pipe (PVC): external diameter: 32 mm and internal diameter: 23 mm. Smooth pipe (PMMA): external diameter: 10 mm and internal diameter: 6.5 mm. Smooth pipe (PVC): external diameter: 20 mm and internal diameter: 16.5 mm. Smooth pipe (PVC): external diameter: 32 mm and internal diameter: 26.5 mm.

Types of valves:

Angle-seat valve: internal diameter: 20 mm. Gate valve: internal diameter: 20 mm. Diaphragm valve: internal diameter: 20 mm. Ball valve: internal diameter: 20 mm.

Types of couplings:

In-line strainer, internal diameter: 20 mm.

Sudden widening. Its section changes from 25 mm to 40 mm. Sudden contraction. Its section changes from 40 mm to 25 mm.

90° elbow: inner diameter: 20 mm. "T" junction: inner diameter: 20 mm. 45° elbow: inner diameter: 20 mm. 45° "T" junction: inner diameter: 20 mm.

Symmetrical "Y" branch: inner diameter of each pipe: 20 mm.

Double 90° elbow: inner diameter: 20 mm.

Special couplings (PMMA):

Pitot tube: length: 30 mm, external diameter: 4 mm and internal diameter: 2.5 mm. Venturi tube: length: 180 mm, larger section: 32 mm and smaller section: 20 mm. Diaphragm with measuring plate: larger diameter: 25 mm and smaller diameter: 20 mm.

The unit includes several ball valves to conduct the water flow through a certain pipe of the circuit and a regulation valve to regulate the flow that runs through such pipe.

Thirty four pressure tappings with quick action connections.

Two water manometers, range: 0-1000 mm. Two Bourdon manometers, range: 0-2.5 bar

The unit is designed for use with the Basic Hydraulic Feed System "FME00/B":

Centrifugal pump: 0.37 kW, 30 – 80 I/min, at 20.1 – 12.8 m.

Tank capacity: 140 l.

Flowmeter, range: 600 – 6000 l/h. Cables and accessories, for normal operation.

Manuals: This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.



AFT/B detail

EXERCISES AND PRACTICAL POSSIBILITIES

- Determination of pressure loss due to friction in a rough pipe with an internal diameter of 17 mm.
- 2.- Determination of pressure loss due to friction in a rough pipe with an internal diameter of 23 mm.
- Determination of pressure loss due to friction in a smooth pipe with an internal diameter of 6.5 mm.
- Determination of pressure loss due to friction in a smooth pipe with an internal diameter of 16.5 mm.
- 5.- Determination of pressure loss due to friction in a smooth pipe with an internal diameter of 26.5 mm.
- 6.- Study of the influence of the diameter in the pressure loss due to friction in rough pipes.
- 7.- Study of the influence of the diameter in the pressure loss due to friction in smooth pipes.
- 8.- Study of the influence of the roughness in the pressure loss.
- 9.- Determination of the friction coefficient in a rough pipe with an internal diameter of 17 mm.
- Determination of the friction coefficient in a rough pipe with an internal diameter of 23 mm.
- 11.-Determination of the friction coefficient in a smooth pipe with an internal diameter of 6.5 mm.
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- 14.-Study of the influence of the diameter in the friction coefficient in rough pipes.
- 15.-Study of the influence of the diameter in the friction coefficient in smooth pipes.
- 16.-Comparison of the friction coefficient in smooth and rough
- 17.-Determination of pressure loss in an angle-seat valve.
- 18.-Determination of pressure loss in a gate valve.
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- 29.-Determination of pressure loss in a gradual widening.
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- 33.-Determination of the discharge coefficient, $C_{\rm d}$, in the Venturi tube.
- 34.-Measurement of the flow with the Pitot tube.
- 35.-Determination of the discharge coefficient, C_{ar} in the Pitot tube.
- 36.-Comparison between the flow measured in the Venturi and Pitot tubes.

Additional practical possibilities:

- 37.-Study of the relationship between pressure losses due to fluid friction and the water flow rate.
- 38.-Determining the relationship between the pipe friction coefficients and Reynolds number for flow through a pipe with roughened bore.
- 39.-Determining of the resistance coefficients for bends, enlargements and contractions.
- 40.-Determining of characteristic curves of valves and fittings.

REQUIRED SERVICES

- Electrical supply: single-phase, 220 V/50 Hz or 110 V/60 Hz.
- Water supply and drain.

DIMENSIONS AND WEIGHTS

AFT/B:

Unit:

-Dimensions: 2100 x 850 x 1000 mm approx.

(82.67 x 33.46 x 39.37 inches approx).

-Weight: 150 Kg approx.

(330.7 pounds approx).

Basic Hydraulic Feed System "FME00/B":

-Dimensions: 1000 x 600 x 700mm approx.

(39.37 x 23.62 x 27.55 inches approx).

-Weight: 40 Kg approx.

(88.18 pounds approx).



Fluid Friction in Pipes Unit



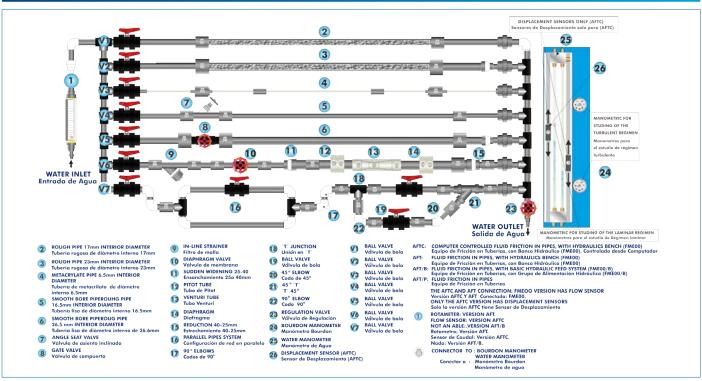
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PRODUCTS

8.- FLUID MECHANICS



PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION















GENERAL DESCRIPTION

The knowledge of pressure losses occurring in pipes as well as in different hydraulic accessories is very important in the design and dimensioning of pipes systems. The Fluid Friction in Pipes Unit, "AFT/P", is designed to determine the friction coefficient in pipes of several diameters and roughness, to study the pressure losses in different types of valves and different fittings and to compare different methods to measure the flow.

The unit contains five straight pipe sections made of different materials and with different diameters and roughness. Additionally, a wide range of accessories are included for the study of losses in straight pipes, several types of valves (gate, ball, angle seat, etc.), pipe fittings (in-line strainer, elbows, sudden widening, contraction, etc.).

The different pipe sections, valves and pipe fittings include several pressure measurement points with quick action connections to fit the tubing that is connected to the corresponding pressure measuring device.

With this unit friction pressure losses can be investigated over a wide range of Reynolds numbers, thereby covering the laminar, transitional and turbulent flow regimes. Two water manometric tubes allow to study the pressure losses in the laminar regimen. Two Bourdon manometers allow to obtain the pressure losses in the turbulent regimen. Additionally, it includes a flowmeter to measure and to compare measurements of flow with the Venturi tube and the Pitot tube.

SPECIFICATIONS

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

Diagram in the front panel with distribution of the elements similar to the real one.

This unit allows the detailed study of fluid friction pressure losses, which occur when a non-compressible fluid flows through pipes, valves, pipe fittings and flow metering devices.

Five pipes of different diameter, material and roughness:

Rough pipe (PVC): external diameter: 25 mm and internal diameter: 17 mm.

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Smooth pipe (PMMA): external diameter: 10 mm and internal diameter: 6.5 mm.

Smooth pipe (PVC): external diameter: 20 mm and internal diameter: 16.5 mm.

Smooth pipe (PVC): external diameter: 32 mm and internal diameter: 26.5 mm.

Types of valves:

Angle-seat valve: internal diameter: 20 mm. Gate valve: internal diameter: 20 mm. Diaphragm valve: internal diameter: 20 mm.

Ball valve: internal diameter: 20 mm.

Types of couplings:

In-line strainer, internal diameter: 20 mm.

Sudden widening. Its section changes from 25 mm to 40 mm. Sudden contraction. Its section changes from 40 mm to 25 mm.

90° elbow: inner diameter: 20 mm. "T" junction: inner diameter: 20 mm. 45° elbow: inner diameter: 20 mm. 45° "T" junction: inner diameter: 20 mm.

Symmetrical "Y" branch: inner diameter of each pipe: 20 mm.

Double 90° elbow: inner diameter: 20 mm.

Special couplings (PMMA):

Pitot tube: length: 30 mm, external diameter: 4 mm and internal diameter: 2.5 mm.

Venturi tube: length: 180 mm, larger section: 32 mm and smaller section: 20 mm.

Diaphragm with measuring plate: larger diameter: 25 mm and smaller diameter: 20 mm.

The unit includes several ball valves to conduct the water flow through a certain pipe of the circuit and a regulation valve to regulate the flow that runs through such pipe.

Thirty four pressure tappings with quick action connections.

Two water manometers, range: 0 – 1000 mm. Two Bourdon manometers, range: 0 – 2.5 bar

Flowmeter, range: 600 - 6000 I/h.

Manuals: This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.



AFT/P detail

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EXERCISES AND PRACTICAL POSSIBILITIES

- Determination of pressure loss due to friction in a rough pipe with an internal diameter of 17 mm.
- 2.- Determination of pressure loss due to friction in a rough pipe with an internal diameter of 23 mm.
- Determination of pressure loss due to friction in a smooth pipe with an internal diameter of 6.5 mm.
- 4.- Determination of pressure loss due to friction in a smooth pipe with an internal diameter of 16.5 mm.
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- 6.- Study of the influence of the diameter in the pressure loss due to friction in rough pipes.
- 7.- Study of the influence of the diameter in the pressure loss due to friction in smooth pipes.
- 8.- Study of the influence of the roughness in the pressure loss.
- 9.- Determination of the friction coefficient in a rough pipe with an internal diameter of 17 mm.
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- 14.-Study of the influence of the diameter in the friction coefficient in rough pipes.
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- 16.-Comparison of the friction coefficient in smooth and rough
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- 23.-Determination of pressure loss in a 90° elbow.
- 24.-Determination of pressure loss in a double 90° elbow.

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- 26.-Determination of pressure loss in a 45° "T".
- 27.-Determination of pressure loss in a symmetrical "Y" branch.
- 28.-Determination of pressure loss in a narrowing.
- 29.-Determination of pressure loss in a gradual widening.
- 30.-Determination of pressure loss in a diaphragm.
- 31.-Comparison of pressure loss in the different fittings.
- 32.-Measurement of the flow with the Venturi tube.
- 33.-Determination of the discharge coefficient, $C_{\rm d}$, in the Venturi tube
- 34.-Measurement of the flow with the Pitot tube.
- 35.-Determination of the discharge coefficient, $C_{a'}$ in the Pitot tube.
- Comparison between the flow measured in the Venturi and Pitot tubes.

Additional practical possibilities:

- 37.-Study of the relationship between pressure losses due to fluid friction and the water flow rate.
- 38.-Determining the relationship between the pipe friction coefficients and Reynolds number for flow through a pipe with roughened bore.
- 39.-Determining of the resistance coefficients for bends, enlargements and contractions.
- 40.-Determining of characteristic curves of valves and fittings.

REQUIRED SERVICES

- Water supply and drain.

DIMENSIONS AND WEIGHTS

AFT/P:

-Dimensions: 2100 x 850 x 1000 mm approx.

(82.67 x 33.46 x 39.37 inches approx).

-Weight: 150 Kg approx.

(330.7 pounds approx).

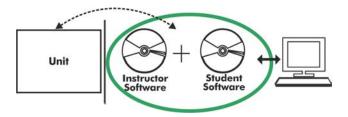
REQUIRED ELEMENTS (Not included)

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- FME00. Hydraulics Bench, or
- FME00/B. Basic Hydraulic Feed System.

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AFT-AFT/B-AFT/P/ICAI. Interactive Computer Aided Instruction Software System:



With no physical connection between unit and computer, this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

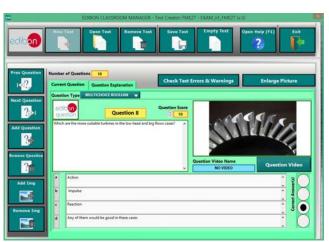
Instructor Software

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.



ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question



ECM-SOF. EDIBON Classroom Manager (Instructor Software)
Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

Student Software

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

- Student Log-In & Self-Registration.
- · Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- Test self-correction.
- Calculations computing and plotting.
- Equation System Solver Engine.
- User Monitoring Learning & Printable Reports.
- Multimedia-Supported auxiliary resources.

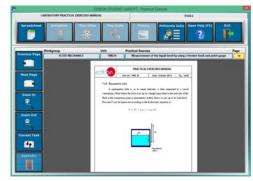
For more information see ICAI catalogue. Click on the following link: www.edibon.com/en/files/expansion/ICAI/catalog



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ECAL. EDIBON Calculations Program Package Main Screen

* Specifications subject to change without previous notice, due to the convenience of improvement of the product.



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Edition: ED01/18 Date: October/2018

