ERIDĒS
ENGINEERING & MANUFACTURING

BCFA 10

SOLAR ABSORPTION REFRIGERATION

USE

The training equipment consists of an absorption refrigeration machine which functions on a mixture of ammonia and water and of which the principal source of energy is hot water, coming from solar thermal collectors or a water heater (optional).
The exchangers (condenser and evaporator) operate with water. The energy produced is dissipated on a plate exchanger and any surplus thermal energy is evacuated via an air heater exchanger.
Start-up is simple and done through an interface where each element is clearly identified.
All components are visible and accessible. The temperature, pressure and flow measuring instruments allow for the analysis and plotting of the refrigeration cycle on an Oldham diagram, measuring the energy from the primary circuit (refrigerant). The secondary circuit (hot and cold water) is also equipped with instrumentation for measuring temperature and flow.
Primary energy is measured by temperature and hot water flow sensors.
Once in permanent mode, all necessary measurements can be taken and analysed later after the machine has been turned off.
The fluid used is a mixture of ammonia and water which is not harmful to the environment.

EDUCATIONAL CAPACITIES

❑ Study of an absorption refrigeration machine
- Case of hot water supply (solar heated)
- Use of a mixture of NH_3 and H_2O
- Theoretical refrigeration graph
- Dimensioning of components

❑ Start-up of installation
- Understanding of security measures
- Start-up
- Equipment handling
- Operation in transition and stable modes

❑ Use of diagram (-1/T, logP)
- Taking different measurements
- Relating measurement points to the diagram
- Plotting the real refrigeration graph on the diagram
- Deduction of concentrations, enthalpies in characteristic places

❑ Calculation of thermal performance
-Condenser, evaporator, absorber and generator thermal energy
- Calculation of Performance Coefficient
- Calculation of overall output

INTERESTED PUBLIC

This equipment is principally designed for technical energy training courses notably those specialising in air conditioning/heating. The equipment may also be useful for courses covering renewable energy, process and chemical engineering and physical measurements.
The training level targeted is from Technician and Technologist degree to Engineer degree.

Detailed technical specification available on demand

ERIDĒS
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ERIDĒS
ENGINEERING & MANUFACTURING

BCFN 10

NEGATIVE COLD CHAMBER

USE

The equipment is set-up on an anodised aluminium trolley and is composed of three joined parts: the cold chamber (1.8m^3) including an evaporator (assembled); the refrigerator (to assemble) which accommodates the liquid; and the electrical component (to be wired, all variants possible). On delivery, the cold chamber is able to function. The components are of good quality, industrial brand. Regulation is assured by a logical, digital, programmable sequencer equipped with alarm control and temperature display.

INTERESTED PUBLIC

This equipment is principally designed for technical energy training courses, notably those specialising in air-conditioning/heating. The training level covers Technician degree to technologist degree.

EDUCATIONAL CAPACITIES

- ❑ Study of a single-stage compression refrigeration machine
  - Case of a cold chamber
  - Use of R404A
  - Plotting of the theoretical refrigeration cycle
- ❑ Study of refrigeration circuit
  - Definition of needs – design of refrigeration schema
  - Set-up of the components of the liquid line
  - Accomplishment of the liquid line via tube expansion, soldering, screwing…
  - Search for leaks – running a vacuum
  - Filling with fluid
- ❑ Study of electrical layout
  - Definition of needs
  - Selection and discovery of electrical components and regulation
  - Design of electrical layout
  - Plate wiring in the power, signal/ command section.
- ❑Start-up of installation
  - Understanding of security measures
  - Start-up
  - Equipment handling
  - Settings for regulation controls
  - Operation in stable mode
- ❑ Use of enthalpy diagram
  - Taking different measurements
  - Relating measurement points to enthalpy diagram
  - Plotting of the real refrigeration cycle on the diagram
  - Deduction of enthalpies in characteristic places
  - Deduction of under-cooling and over-heating
  - Determination of the coefficient of performance

The unit comes with full technical documentation including teaching theory and experiment notes.

Detailed technical specification available on demand

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ERIDĒS
ENGINEERING & MANUFACTURING

BCFP 10

POSITIVE COLD CHAMBER

USE

The equipment is set-up on an anodised aluminium trolley and is composed of three joined parts: the cold chamber (1.8m^3) including an evaporator (assembled); the refrigerator (to assemble) which accommodates the liquid; and the electrical component (to be wired, all variants possible). On delivery, the cold chamber is able to function. The components are of good quality, industrial brand. Regulation is assured by a logical, digital, programmable sequencer equipped with alarm control and temperature display.

INTERESTED PUBLIC

This equipment is principally designed for technical energy training courses, notably those specialising in air-conditioning/heating. The training level covers Technician degree to technologist degree.

EDUCATIONAL CAPACITIES

❑ Study of a single-stage compression refrigeration machine
- Case of a cold chamber
- Use of R134a
- Plotting of the theoretical refrigeration cycle

❑ Study of refrigeration circuit
- Definition of needs – design of refrigeration schema
- Set-up of the components of the liquid line
- Accomplishment of the liquid line via tube expansion, soldering, screwing…
- Search for leaks – running a vacuum
- Filling with fluid

❑ Study of electrical layout
- Definition of needs
- Selection and discovery of electrical components and regulation
- Design of electrical layout
- Plate wiring in the power, signal/ command section.

❑Start-up of installation
- Understanding of security measures
- Start-up
- Equipment handling
- Settings for regulation controls
- Operation in stable mode

❑ Use of enthalpy diagram
- Taking different measurements
- Relating measurement points to enthalpy diagram
- Plotting of the real refrigeration cycle on the diagram
- Deduction of enthalpies in characteristic places
- Deduction of under-cooling and over-heating
- Determination of the coefficient of performance

The unit comes with full technical documentation including teaching theory and experiment notes.

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ERIDĒS
ENGINEERING & MANUFACTURING

BCSS 05

STUDY OF AN INVERTED MONO SPLIT AIR CONDITIONING UNIT

Interior view Exterior view

USE

The installation is set up on a trolley whose structure is made from anodised aluminium and furnished with auto-directional, blockable castors.
An electricity supply is necessary and a recipient collects the condensation such that no output drain is necessary.
The interior unit is installed on one side of the trolley wall and connected by insulated, copper pipes to the exterior unit, installed on the other side of the trolley panel. An infrared remote control is used to regulate the interior unit (security, air flow, operation mode).
The unit is turned on simply by clearly identifiable switches.
The refrigerant used is R410A which universally accepted by the new European regulation.
A two way manifold with valves and pressure gauges is included to allow for the adjustment of the cooling tools.

EDUCATIONAL ACTIVITIES

❑ Study of the concept of a mono split air conditioner
- Case of reversibility
- Case of R410A refrigerant
- Case of cooling and heating

❑ Operation of air conditioning unit
- Understanding of security measures
- Operation and handling
- Settings of the regulation instruments
- Operation in stable mode

❑ Practical intervention on operating parts
- Use of cooling tools
- Collection of fluid – Accomplishment of refrigerator connections
- Running a vacuum and installation pressure

❑ Use of enthalpy diagram
- Taking different measurements
- Relating measurement points to the enthalpy diagram
- Plotting of real refrigeration cycle on the diagram
- Deduction of enthalpies in characteristic places
- Deduction of under-cooling and over-heating
- Coefficients of performance

Appearance of exterior unit:
Exterior wood finishing
Fuse box
Hydraulic lift pump
Collection of condensates
Plug 230V for tools

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is principally designed for technical energy training courses, notably those specialising in air-conditioning/heating. The equipment can also be used for chemical and process engineering courses and physical measurements.
The training level covers Technician degree to technologist degree.

Detailed technical specification available on demand

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BCSS 10

STUDY OF A SPLIT SYSTEM AIR CONDITIONER

USE

The unit structure is made from anodised aluminium which is raised on a trolley with auto-directional, blockable castors.
An electricity supply is required and a receiving tray is installed under the unit to collect condensates such that an output drain is not necessary.
The interior unit is installed in a transparent cabinet and is connected by copper pipes to the exterior unit which is directly accessible by the control panel. An infrared remote control sends commands (security, air flow, operation mode) to the interior unit through the transparent casing.
The unit is turned on simply via clearly identifiable switches. The transparency of the casing allows the student to understand the operation by observation.
A heat load can be applied from the exterior to demand increased energy from the air conditioner Meanwhile, measurements can be taken to be analysed later.
The refrigerant used is R410A which is universally accepted by the new European regulation.
Thermometers, pressure gauges, flow meters and thermo-hygrometers are included in the installation to allow for plotting and analysis of measurement points on humidity and enthalpy diagrams.

EDUCATIONAL CAPACITIES

- ❑ Study of concept of a split system air conditioner
  - Case of reversibility
  - Case of R410A refrigerant
  - Case of cooling with disturbance
  - Case of heating
- ❑ Operation of air conditioner
  - Understanding of security measures
  - Start-up, handling
  - Control of settings
  - Operation in stable mode
- ❑ Use of enthalpy diagram
  - Taking different measurements
  - Relating measurement points to the enthalpy diagram
  - Plotting of real refrigeration cycle on the diagram
  - Deduction of enthalpies in characteristic places
  - Deduction of under-cooling, over-heating
  - Coefficients of performance
- ❑ Use of air humidity diagram
  - Taking measurements (T° et %HR)
  - Relating measurement points to the air humidity diagram
  - Deduction of enthalpies in characteristic places
- ❑ Study of regulation
  - Settings and regulator parameters
  - Reaction of the system to disturbance

INTERESTED PUBLIC

This equipment is principally designed for technical energy training courses, notably those specialising in air-conditioning/heating. The equipment can also be used for chemical and process engineering courses and physical measurements.
The training level covers Technician degree to technologist degree.

Detailed technical specification available on demand

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BDPF 10

REFRIGERATION FAULT DIAGNOSIS

USE

The equipment consists of a trolley with a anodised aluminium structure raised on auto-directional, blockable castors.
An electricity supply is required and a receiving tray is installed under the equipment to collect the condensate which flows down under gravity.

The unit can be put into fault mode by the teacher, either via solenoid valves to simulate faults originating from the actual refrigeration process, or via relay to simulate electrical faults. The valves and relays are controlled via remote control and the student cannot know before hand, what type of break down has occurred.

It is up to the student to investigate the cause of malfunction or breakdown, to determine the origin and to diagnose the correct solutions.

All the component parts of the installation are of industrial origin and are easily accessible. The fuse box is at the correct height to allow for ease of visibility through its transparent door. The refrigerant used is R134a which is universally accepted by the new European regulation. Pressure gauges and a portable probe thermometer are provided to allow for the analysis and plotting of the refrigeration cycle. A multi-meter is provided to allow for the measurement of tension, intensity, power, cosφ, and to assist the student in diagnosis.

EDUCATIONAL CAPACITIES

❑ Study of the concept of a single-stage compressor refrigeration unit
- Case of a double evaporation cold chamber
- Use of R134a refrigerant
- Plotting of the real and theoretic refrigeration cycle

❑ Start-up of unit
- Understanding of security measures
- Start-up - handling
- Settings for regulation instruments
- Operation in stable mode

❑ Use of enthalpy diagram
- Taking different measurements
- Relating measurement points to the enthalpy diagram
- Plotting of the real refrigeration cycle on the diagram
- Deduction of enthalpies in characteristic places
- Deduction of under-cooling and over-heating
- Determination of power exchange
- Determination of the coefficient of performance

❑ Diagnosis of refrigeration and electrical faults
- Oil separator fault
- Fault due to lack of refrigerant
- Fault due to an excess of refrigerant
- Excessive condensation pressure
- Lack of evaporation pressure
- Constant pressure valve fault
- Capacity regulator fault
- Leak from the electromagnetic *pump down* regulation valve
- Fault in the spool of the electromagnetic valve
- Obstructed dryer
- Fault in the pressure switch combining high and low pressure
- Defective pressure valve (oversized opening, misplaced bulb)
- Shut off in one phase of the compressor motor
- Shut off in two phases of the compressor motor
- Thermostat regulation fault
- Compressor valve fault
- Condenser fouling fault
- Evaporator fouling fault

INTERESTED PUBLIC

This equipment is principally designed for technical energy training courses, notably those specialising in air-conditioning/heating. The equipment can also be used for chemical and process engineering courses and physical measurements.
The training level covers Technician degree to technologist degree.

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CCFN-CKFN 10

REFRIGERATION COMPONENTS KIT INSTALLED IN A NEGATIVE COLD CHAMBER

USE

This cold chamber is designed for use with the CKFN 10 refrigeration kit.
Once the refrigeration kit has been assembled and wired, it can be wheeled beside the cold chamber, into which the evaporator is inserted, filled with fluid and turned on.
The chamber includes an opening into which the evaporator can be inserted and held ensuring the chamber is air tight. Once the refrigeration kit is inserted into the cold chamber, the final settings for various types of experiment can be selected.

Refrigeration kit CKFN10

Assembly with chamber CCFN10

The chamber sits on the ground. The refrigeration units are mobile and each student can attach their unit to the chamber to then manipulate the thermostat, pressure valve and regulator.
Such a chamber can be used for a group of students. The most important part of the practical is the assembly of the refrigeration kit and the connection to the chamber is only carried out at the end for the designation of settings. The chamber is of industrial origin and conforms to existing Directive legislation. The teacher is provided with a control box, attached to the cold chamber (CCFN 10) so that it is the teacher who authorises the powering up of each students kit (CKFN 10) thereby guaranteeing security (emergency stop function is always operational as well as the shut down of the combined pressure valve).
The condenser group, evaporator and fuse box are assembled in the factory. Most of the remaining refrigeration components are provided for installation on a perforated pate to facilitate assembly. Equally, the electrical components are provided for assembly on a plate inside the fuse box. The student must complete the wiring up to the terminal block and then connect the box up to the external electricity source. The HFC-R404A refrigerant is used which is accepted by European regulation.

EDUCATIONAL CAPACITIES

❑ Study of the refrigeration cycle
- Definition of need – design of refrigeration layout
- Set-up of the components of the liquid line
- Completion of the liquid circuit via tube expansion, soldering, screwing…
- Search for leaks – running a vacuum
- Filling with fluid

❑ Study of the electric schema
- Definition of needs
- Selection and discovery of electrical components and regulation
- Layout of electric schema
- Plate wiring of the power and signalling part

❑ Start-up of installation
- Wiring of fuse box to exterior components
- Evacuation of condensates
- Insertion of the evaporator in the chamber
- Settings for the instruments of regulation
- Settings for the pressure valves
- Study in transition and stable modes
- Write-up of an installation report sheet

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is principally designed for technical energy training courses, notably those specialising in air-conditioning/heating.
The training level covers Technician degree to technologist degree.

Detailed technical specification available on demand

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CCFP-CKFP 10

REFRIGERATION COMPONENTS KIT INSTALLED IN A COLD CHAMBER

USE

This cold chamber is designed for use with the CKFP 10 refrigeration kit.
Once the refrigeration kit has been assembled and wired, it can be wheeled beside the cold chamber, into which the evaporator is inserted, filled with fluid and turned on.
The chamber includes an opening into which the evaporator can be inserted and held ensuring the chamber is air tight. Once the refrigeration kit is inserted into the cold chamber, the final settings for various types of experiment can be selected.

Refrigeration kit CKFP10

Assembly with chamber CCFP10

The chamber sits on the ground. The refrigeration units are mobile and each student can attach their unit to the chamber to then manipulate the thermostat, pressure valve and regulator.
Such a chamber can be used for a group of students. The most important part of the practical is the assembly of the refrigeration kit and the connection to the chamber is only carried out at the end for the designation of settings. The chamber is of industrial origin and conforms to existing Directive legislation. The teacher is provided with a control box, attached to the cold chamber (CCFP 10) so that it is the teacher who authorises the powering up of each students kit (CKFP 10) thereby guaranteeing security (emergency stop function is always operational as well as the shut down of the combined pressure valve).
The condenser group, evaporator and fuse box are assembled in the factory. Most of the remaining refrigeration components are provided for installation on a perforated pate to facilitate assembly. Equally, the electrical components are provided for assembly on a plate inside the fuse box. The student must complete the wiring up to the terminal block and then connect the box up to the external electricity source. The HFC-R134a refrigerant is used which is accepted by European regulation.

EDUCATIONAL CAPACITIES

❑ Study of the refrigeration cycle
- Definition of need – design of refrigeration layout
- Set-up of the components of the liquid line
- Completion of the liquid circuit via tube expansion, soldering, screwing…
- Search for leaks – running a vacuum
- Filling with fluid

❑ Study of the electric schema
- Definition of needs
- Selection and discovery of electrical components and regulation
- Layout of electric schema
- Plate wiring of the power and signalling part

❑ Start-up of installation
- Wiring of fuse box to exterior components
- Evacuation of condensates
- Insertion of the evaporator in the chamber
- Settings for the instruments of regulation
- Settings for the pressure valves
- Study in transition and stable modes
- Write-up of an installation report sheet

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is principally designed for technical energy training courses, notably those specialising in air-conditioning/heating.
The training level covers Technician degree to technologist degree.

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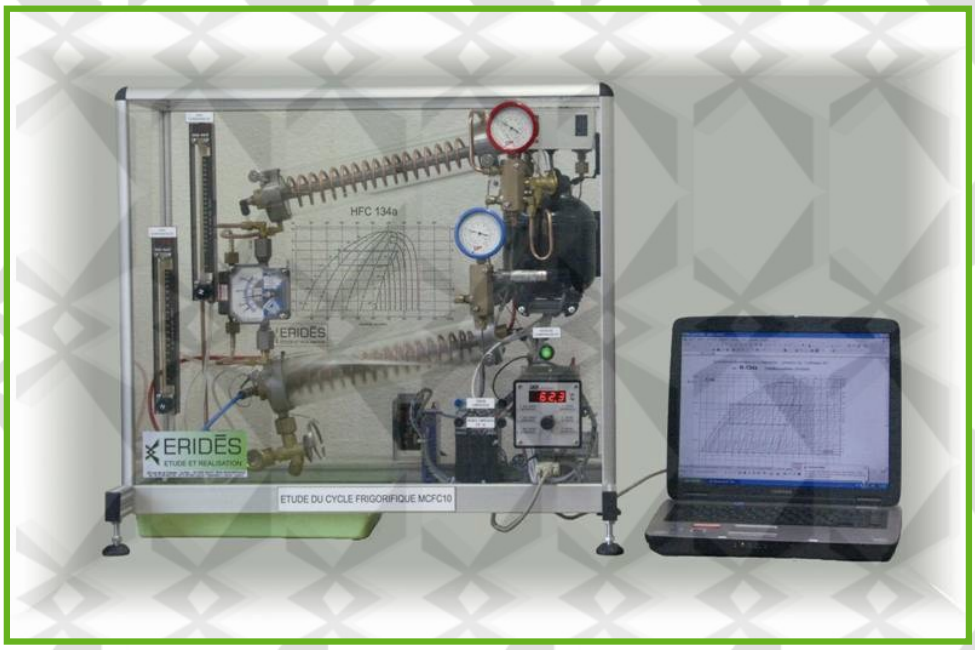
MCFC 10

REFRIGERATION CYCLE DEMONSTRATION UNIT



USE

The equipment is composed of a transparent unit edged with anodised aluminium and elevated on feet. The transparent walls allow visibility on all sides whilst protecting both the equipment and its users. Once plugged in and connected to the water input and output, the machine works automatically. The visible condensation and evaporation allow for the understanding of the cycle processes. Once the machine has reached steady state, measurements can be taken and can be used even after the machine has been turned off. The fluid used is R134a which is universally accepted by the new European regulation.
The regulation is controlled by a thermostatic depressure valve **of equalized internal pressure**. The unit allows for measurement of flow rate, pressure, temperature and more, depending on the option chosen. The fluid enthalpy chart is transposed onto a transparency at the centre of the unit allowing for rapid analysis of the fluid state parameters at any given point.

EDUCATIONAL CAPABILITIES

❑ Study of the concept of vapour compression refrigeration
- **Case of** hermetic compressor
- Use of R134a
- Plot of the theoretical refrigeration cycle
- **Proportioning of components**

❑ Unit installation
- Understanding of security measures
- Unit operation
- Equipment handling
- Use during steady state
- Understanding of cycle via visualisation of changes of state.

❑ Use of enthalpy chart
- Plots the different points of measurement
- Records points on the chart
- Traces the real refrigeration cycle on the chart
- **Deduction of enthalpies** at characteristic points
- **Determination of under-cooling, overheating**

❑ Measurement of thermal power
- Condenser thermal power, to evaporator, to compressors
- Calculation of performance coefficient
- Calculation of **global return**

The unit comes with full technical documentation including teaching theory and experiment notes.

DESTINATION

Energy departments of technical training institutes, notably those specialising in cooling/air-conditioning equally for process engineering, physical measurement, chemical engineering etc..
Level of training from Technician and Technologist degree to Engineer degree

OPTIONS

Plotting of the cycle on PC, reservoir and pump for autonomous function, parameter acquisition, reversible cycle…

Detailed technical specification available on demand

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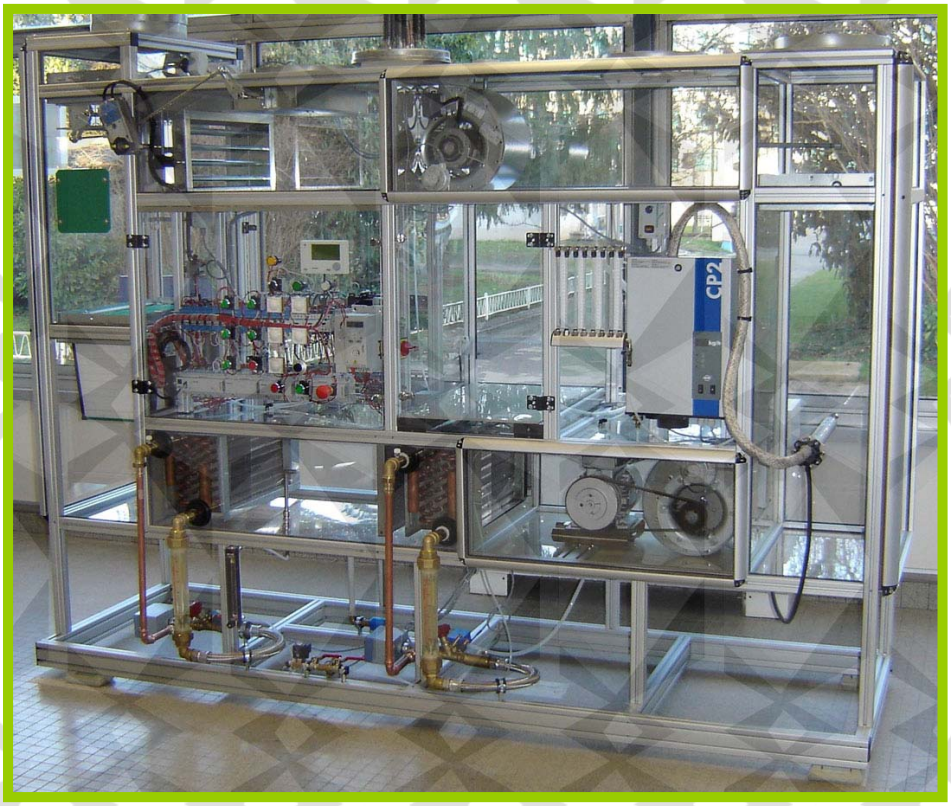
PCCA 50

AIR CONDITIONING UNIT



USE

The adjustment of the air conditioner parameters (three-way air mixing, cooling, heating, humidification, fan) can be done manually or using the regulator. The important characteristic of this unit is the association of the air conditioning control base with the water/water heat pump (PPAC 50) which supplies freezing and hot water to the batteries. A computer supervises the overall network system. Screen pages and sub-programmes allow for the progressive study of a simple system (heating only for example) to more complex systems including heating, cooling, dehumidification, humidification, free cooling, etc. Seven combination probes are included: temperature/hygrometer, 3 air flow meters, 2 for water (freezing and hot allowing for analysis and plotting on diagrams of air humidity), and a multi pressure gauge on a water pipe (indicates static rise and fall of pressure in characteristics places of the installation).

EDUCATIONAL CAPACITIES

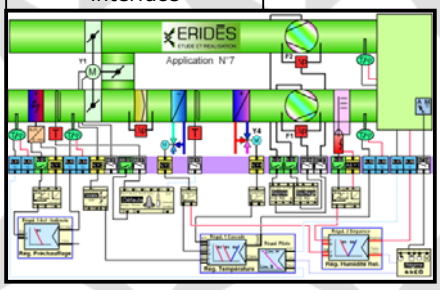
❑ Concept of an air conditioning system
- Case of air mixture: three way valve and servomotor
- Case of cooling / de-humidification: cold battery to freezing water
- Case of heating: preheating electric battery and hot water for heating
- Case of humidification: by steam and by water spray

❑ Operation in manual or automatic mode
- Understanding of security measures
- Start-up - handling
- Settings for regulation instruments
- Operation in transition and stable mode

❑ Use of humidity diagram (air conditioning section)
- Taking different measurements (T° et %HR)
- Relating measurement points to the humidity diagram
- Deduction of enthalpies in characteristic places
- Determination of heat exchanges
- Efficiency – Coefficients of performance

Study of regulation (the installation should be connected to a room to control the air environment)
- Different levels of complexity addressed by selection of pre-established macros in the regulator programme
- Concept of influence – limitations – priorities …
- Settings of the instruments of regulation
- Effect of disturbance on the system
- Set-up of a digital network dialogue between the heat pump platform and a distant computer

View of PC user interface



INTERESTED PUBLIC

This equipment is principally designed for technical energy training courses, notably those specialising in air-conditioning/heating It may also be of interest for chemical and process engineering.
The training level covers Technician and Technologist degree to Engineer degree

Detailed technical specification available on demand

The unit comes with full technical documentation including teaching theory and experiment notes.

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PPAC 50

HEAT PUMP WATER/WATER

USE

The heat pump unit is designed to be connected to a central air conditioning platform. The heat pump provides heating and cooling energy to the air conditioning platform. The energy is provided by a vapour compression heat pump and is stored in buffer reservoirs. The pumps can then tap these reservoirs for their energy needs for air conditioning.
The unit's temperature and pressure can be adjusted. The freezing and hot water controllers can also be adjusted. The regulator operates on the network with that of the central air conditioning platform such that all data can be retrieved and analysed on an external computer.

A plate exchanger (optional) allows for the exchange of hot and cold energy and therefore simulates heat loading. This unit can therefore operate autonomously.

EDUCATIONAL CAPACITIES

❑ Study of the concept of a heat pump
- Case of single-stage vapour compression – R404a refrigerant
- Hydraulic study of primary and secondary circuits
- Equipment start-up and handling
- Operation in transition and stable mode

❑ Use of enthalpy diagram
- Taking different measurements
- Relating measurement points to the enthalpy diagram
- Plotting of the real refrigeration cycle on the diagram
- Deduction of enthalpies in characteristic places
- Deduction of under-cooling and over-heating
- Determination of heat exchanges
- Efficiency - coefficient of performance

❑ Study of regulation
-The study is carried out on a computer connected by bus to the regulator on the user interface
- Definition of need, analysis of inputs/outputs, analogue/digital
- Settings for regulation controls
- Programming by function blocks
- Concept of influence – limitations – priorities
- Effect of disturbance on the system
- Set-up of a digital network dialogue with the central air conditioning platform.

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is principally designed for technical and professional energy training courses. It would also be of interest for chemical and process engineering.
The training level covers Technician and Technologist degree to Engineer degree.

Detailed technical specification available on demand

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V1RMU

STUDY OF AN AIR CONIDTIONING REGULATOR 1 PID loop

USE

The equipment consists of a suitcase in which a display panel represents a typical air conditioning system. Each temperature probe is identified and its signal simulated by a potentiometer. The 'all or nothing' inputs (anti-freeze, probe fault, comfort settings) are identified and their 'all or nothing' signal is activated by a switch. Equally the analogue outputs and 'all or nothing' signals are identified and displayed by bar graphs and indicators.
The student defines the configuration of the central air conditioning base. Programming is possible via the interface on the regulator.
Once the settings on the regulator have been set, the student can modify the measurements coming from the regulator to see what effect this has on the different actuators. This provides a good understanding of the handling of a regulator on a system without thermal inertia, in such a way that no discomfort can be caused by an erroneous regulation.

INTERESTED PUBLIC

This equipment is principally designed for climatic and energy training courses.
The level of training targeted: Technician and Technologist degree to Engineer degree

EQUIPMENT

Siemens Synco RMU 710 model
Interface RMZ 790
Modem OCI 700

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Detailed technical specification available on demand

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V3RMU

STUDY OF AN AIR CONIDTIONING CONTROLLER 3 PID LOOPS

USE

The equipment consists of a suitcase in which a display panel represents a typical air conditioning system. Each temperature and relative humidity probe are identified and its signal simulated by a potentiometer. The 'all or nothing' inputs (anti-freeze, probe fault, comfort settings) are identified and their 'all or nothing' signal is activated by a switch. Equally the analogue outputs and 'all or nothing' signals are identified and displayed by bar graphs and indicators.
The student defines the configuration of the central air conditioning base. Programming is possible via the interface on the controller.
Once the settings on the regulator have been set, the student can modify the measurements coming from the regulator to see what effect this has on the different actuators. This provides a good

Once the parameterized control, the pupil can modify measurements managing to the controller in order to note the actions that this one generates on the various actuators, that allows him a good catch in hand of the controller on a system without thermal inertia, without a bad adjustment not involving discomfort.

INTERESTED PUBLIC

This equipment is principally designed for climatic and energy training courses.
The level of training targeted: Technician and Technologist degree to Engineer degree

EQUIPMENT

Siemens Synco RMU 730, 787, 788 models
Interface RMZ 791
Modem OCI 700

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BEPC 23

BALANCING, PUMPS, HEATING

The unit is a representation of a radiator heating system. It is composed of a group of double security heaters (regulated immersion heaters), two different technology pumps, a network of double pipelines and three radiators.

The unit provides the opportunity for practical handling of the equipment relating to heating, regulation, balancing and diagnosis.

EDUCATIONAL CAPACITIES

- Viewing of hydraulic interactions within the network
- Demonstration of the effect of disequilibrium on the emission from radiators
- Execution of balancing procedure (with the use of flow meters or a measurer)
- Study of a parallel series pump installation
- Study of fixed and variable speed pumps
- Choice of equipment and dimensioning of components
- Search for faults
- Regulation

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This unit is principally designed for training in the fields of plumping and heating.
Training level: Technician degree to Technologist degree.

Detailed technical specification available on demand

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BISP 10

DOMESTIC SANITARY INSTALLATION BENCH

EDUCATIONAL CAPACITIES

Theoretical

- Study of sanitary hot water network
- Calculation of thermal energy
- Power transformation (electric/thermal)
- Mixing temperature
- Dimensioning of components
- Components of a sanitary hot water network
- Electric water heater supply to a sanitary hot water network
- Study of a circulation pump
- Understanding of user and material security: components

Practical

There are many practical applications including:

- System management: understanding of components, their roles and characteristics
- Preparation for putting into service: operational planning, safety and use instructions
- Putting into service:

Hydraulic settings: flow adjustment, system balancing
Settings and management of electrical components
Settings and management of circulation pump
-System operation: function verification, detection of derivatives, taking measurements (hydraulic, electrical on double port sockets), balancing (thermal and mass).

The practical exercises are done using instruments present on the unit (flow meters, thermometers, pressure gauges). An electronic multi-meter is provided for electrical readings and an electronic meter (optional) can be used to measure flow through the balancing valve (choice possible between QUITUS de DANFOSS or TA HYDRONIC balancing valves).

INTERESTED PUBLIC

This installation is designed for the Technician of 'sanitary installation' training program.

Detailed technical specification available on demand

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BITP 10
DOMESTIC HEATING DEMONSTRATION INSTALLATION

EDUCATIONAL CAPACITIES

Theoretical

- Demonstrates heat transfer: temperatures and heat exchange from a heat emitter
- Heat transfer by natural convection
- Study of a water heated network
- Calculation of thermal energy
- Dimensioning of components
- Component parts of a heating network
- Study and role of a heating regulator
- Understanding of user and material security: components

Other theoretical notions can be applied as a function of level of training.

Practical

There are many practical applications including:

- System management: understanding of components, their roles and characteristics
- Preparation for putting into service: operational planning, safety and use instructions
- Putting into service:

Hydraulic settings: flow adjustment, system balancing
Settings and control of electrical components
Settings of the regulator, heat regulator parameters (heating curve)

- System operation: function check, detection of derivatives, taking measurements (hydraulic, electrical on double port sockets), thermal and mass balance.

The practical exercises are done using instruments present on the unit (flow meters, thermometers, pressure gauges). An electronic multi-meter is provided for electrical readings and an electronic meter (optional) can be used to measure flow through the balancing valve (choice possible between QUITUS de DANFOSS or TA HYDRONIC balancing valves).

INTERESTED PUBLIC

This installation is designed for the Technician of 'sanitary installation' training program.

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BRBM 10

SINGLE AND TWIN TUBE RADIATOR DEMONSTRATION TROLLEY

The unit provides an example of real water circulation within a central heating system.
The student learns about the constituent components of the system. The presence of transparent flow meters throughout the pipe work allows for the observation of water circulation across the network. The unit has been designed to facilitate the understanding of the complex phenomenon of balancing within a water circulation system. Both single and twin tube systems are present (use of both sides of the trolley). The unit can function independently but may also be connected to a hot water supply.

EDUCATIONAL CAPACITIES

- Demonstration of hydraulic interaction within the network
- Dimensioning of the distribution of single and twin tube set-ups (balancing at base of pipe)
- Demonstration of the effect of disequilibrium on the heat emission from radiators
- Implementation of a balancing procedure (with the use of flow meters)
- Completion of balancing with the use of TA CBI II measurer (optional)
- Choice of equipment and dimensioning of components

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

The unit is principally designed for sanitary, heating and energy training courses.
Training level targeted: Technician degree to Technologist degree

Detailed technical specification available on demand

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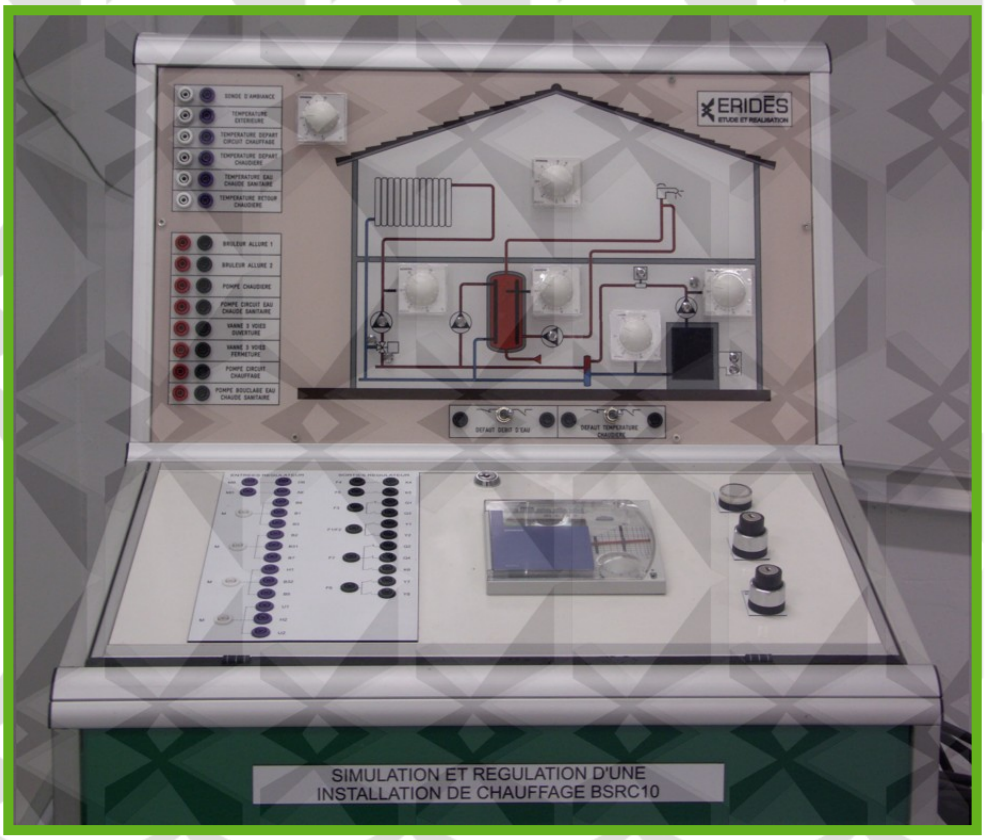
BSRC 10

SIMULATION OF HEATING INSTALLATION REGULATION



Often heating installations appear to work well without a regulator. However when energy saving, comfort, flexibility of use and system maintenance are considered, it becomes obvious that a regulator is an invaluable component of any modern heating installation.
It is therefore essential that once the energy and hydraulic settings are decided, the system operation should be optimised with the help of a regulator. Unit BSRC 10 is designed to allow the student to understand, observe and subsequently manage the operation of a regulator. The student can then practice these skills on a real heating installation (such as PCCF 10).

EDUCATIONAL CAPACITIES

- Implementation of regulation of a heating installation
- Program a heating regulator following a given schema
- Check the impact of a change in temperature on the regulation
- Check the effect of security information
- Program a heating rule
- Wiring of a regulator

The unit comes with full technical documentation including teaching theory and experiment notes.

DESTINATION

The unit is principally designed for sanitary, heating and energy training courses.
Training level targeted: Technician degree to Technologist degree

Detailed technical specification available on demand

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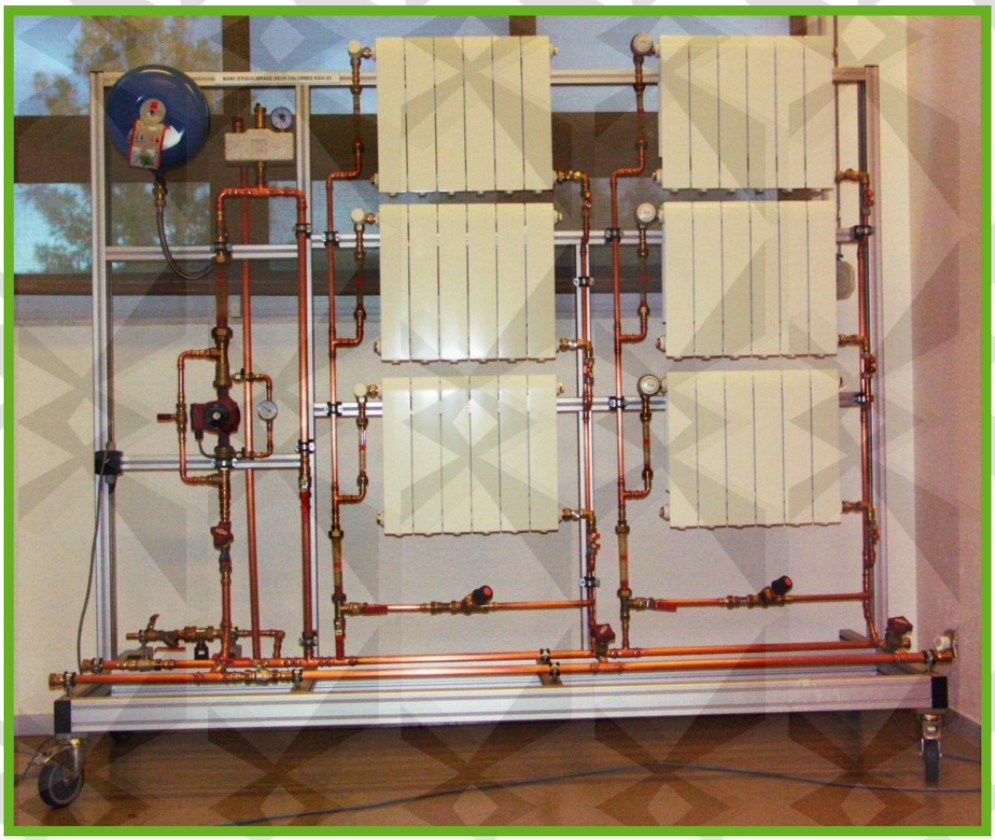
EQUI 23

BALANCING UNIT
2 PIPES 3 RADIATORS



Hydraulic balancing represents a complex problem in the installation of heating and sanitary units and is also one of the main causes of malfunction. Malfunctioning is characterised by an unequal distribution of heat, noises and pump overdrive. In the interest of comfort and energy efficiency, hydraulic balancing within installations is essential.
In the interest of lucidity, the EQUI 23 demonstration unit allows the student to develop an understanding of the interaction of flow between different circuits and their radiators.
The unit can function independently but may also be connected to a hot water supply group.

EDUCATIONAL CAPACITIES

- Demonstration of hydraulic interaction within the network
- Dimensioning within a twin tube installation
- Demonstration of the effect of disequilibrium on the heat emission from radiators
- Implementation of a balancing procedure (with the use of flow meters)
- Completion of balancing with the use of TA CBI II measurer (optional)
- Choice of equipment and dimensioning of components

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

The unit is principally designed for sanitary, heating and energy training courses.
Training level targeted: Technician degree to Technologist degree

Detailed technical specification available on demand

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EV3V 10

STUDY OF A THREE WAY VALVE

Three way valves are very common in thermal equipment especially in heating installations, whether they be individual or multi-user.

These valves form part of the heating control circuit and serve to deliver the amount of energy necessary to compensate for disturbances within the system.

Flawed regulation is very often the result of the wrong choice of valve authority (given in Kvs) or unsound balancing (preference given to one section).

We suggest a standard assembly, for this unit, using a three-way mixing valve which allows the student to study the valve Kv value, valve authority, balancing and control.

EDUCATIONAL CAPACITIES

- Identification and role of components
- Study of the specific installation of a three-way mixing valve.
- Calculation of valve Kv for both direct and bypass routes.
- Notion of valve authority on a circuit. Demonstration of change in authority.
- Balancing of a three way valve and its effect on flow.
- Regulation of heating temperature
- Heating curve
- Effect of different settings on the output temperature

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

The unit is principally designed for energy and process engineering, and physical measurement.
Training level targeted: Technician and Technologist degree to Engineer degree

Detailed technical specification available on demand

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KMST

SANITARY AND HEATING INSTALLATION KIT

In real sanitary installations, the professional is commonly confronted with environmental constraints (space, access, security) which are often more restrictive than the task of choice and assemblage of parts that is required when practicing installation on a demonstration unit.

The demonstration kits provided are designed to allow the student achieve kitchen (KMST CU), shower (KMST DO), bathroom (KMST SB) and toilet (KMST WC) installations. These kits are delivered with all the necessary material to complete the installation in copper piping as well as in cross-linked polyethylene pipes.
The kits (2m x 1m h=2m) are raised on four mobile corner units to allow mobility.

EDUCATIONAL CAPACITIES

- Networks and piping
- Completion of piping in copper or in cross-linked polyethylene pipes.

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

The unit is principally designed for sanitary and heating installation training.
Training level targeted: Technician degree to Technologist degree

Detailed technical specification available on demand

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MEQC 10

FOUR TUBE BALANCING MODEL

This unit is part of a range of products aimed at heating and sanitary training courses. The MEQC 10 unit allows the student to address simply, the complex subject of balancing. When not taken into account, inadequate balancing produces losses at all levels: financial; comfort; and premature usage of equipment.
The balancing method for this unit is via flow rate.

EDUCATIONAL CAPACITIES

The educational capacities of this unit are essentially related to the technical and scientific know-how for installations, notably:
- DETERMINATION of static pressure
- DETERMINATION of flow rate
- MEASUREMENT of pressure loss
- DETERMINATION of total head
- USE of an nomogram
- CONTROL of pump characteristics
- DETERMINATION of the positioning and conditions of an installation and the components of a hydraulic network
- APPLICATION of the flow rate balancing method

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This unit is principally designed for sanitary and heating training courses.
Type of course: Technician degree to Technologist degree

Detailed technical specification available on demand

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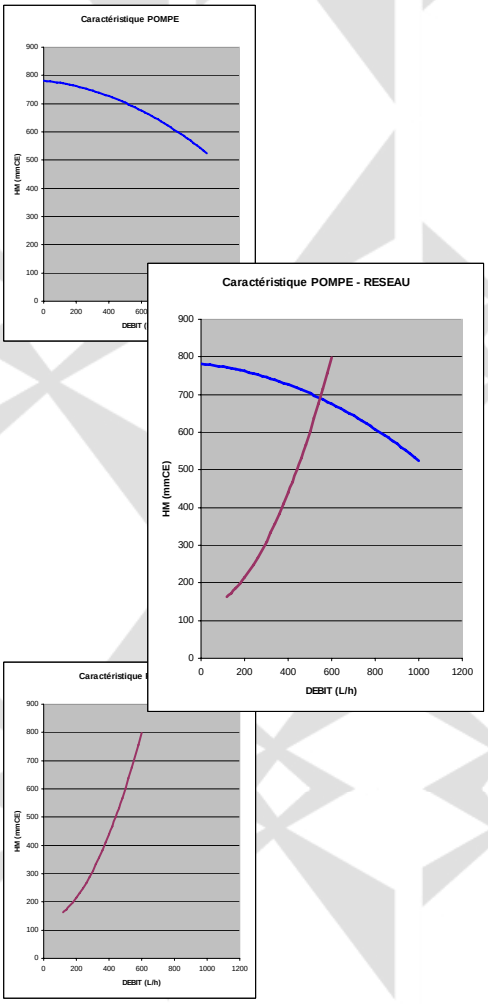
MTRP 10

MODEL STUDY OF A CIRCUIT NETWORK PUMP



EDUCATIONAL CAPACITIES

The educational capacities of this unit are essentially related to the technical and scientific know-how for installations, notably:

- DETERMINATION of static pressure
- DETERMINATION of flow rate
- MEASUREMENT of pressure loss
- DETERMINATION of total head
- USE of a nomogram
- CONTROL of pump characteristics

Equally, the know-how relating to technical installations such as:

- EXPLANATION of the operation mode of the various installation components
- READING and EXPLOITING the technical notes and nomograms in relation to the physical characteristics of the products

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This unit is principally designed for sanitary and heating training courses.
Type of course: Technician degree to Technologist degree

Detailed technical specification available on demand

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PCCB 10

HEATING UNIT
WOOD PELLET BOILER

Wood pellet or wood-chip boilers are increasingly in demand as renewable sources of energy are becoming more popular. This popularity is in part due to the low cost in relation to energy efficiency (assuming that the supply of wood remains cheap and available).
This unit is designed to demonstrate the installation and use of a wood pellet boiler.
Once installed, the boiler is ready for use as all the necessary elements for its function are integrated into the equipment.
Heat dispersal is ensured by the presence of an external air heater.

EDUCATIONAL CAPACITIES

The equipment is complete and allows for the study of the production and transfer of heat.

Beyond the standard theoretical concepts and observations (comparison of the combustion of different wood derivatives), the unit allows students to get practical experience in the start-up, settings and operation optimisation of the boiler.

INTERESTED PUBLIC

This unit is principally designed for sanitary, heating and energy training courses.
Level of training targeted : Technician and Technologist degree to Engineer degree.

Detailed technical specification available on demand

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PCCF 10

HEATING UNIT
OIL FUELED BOILER

This unit provides a classic example of heating installation for an individual home or small co-owed property. The installation is complete enabling demonstration of the functioning of the principal components of a central heating system.
Once installed, the boiler is ready for use as all the necessary elements for its function are integrated into the equipment.
The components of the installation (boiler, pumps and valves) can be turned on and off manually by buttons located on the electrical control box.
The unit can also function in automatic mode by simply connecting it to the BSRC 10 regulation unit (provided) via cables equipped with banana type double port sockets. All the command points for the actuators (burner, valve, circulators) and the measuring points (Ni 1000 probe) are accessed from the control box.

EDUCATIONAL CAPACITIES

The unit is well furnished and allows for a complete study of the production and transfer of heat.

Beyond the standard theoretical notions and observations, the unit allows students to get practical experience in the start-up, control of settings and operation optimisation of the boiler.

INTERESTED PUBLIC

This unit is principally designed for sanitary, heating and energy training courses.
Level of training targeted: Technician and Technologist degree to Engineer degree

Detailed technical specification available on demand

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PCMG 10

HEATING PILOT PLANT
MURAL BOILER GAS

This unit provides a classic example of heating installation for an individual home. It is equipped with a mural boiler gas allowing a production of instantaneous warm water, the installation is complete enabling demonstration of the functioning of the principal components of a central heating system.
Once installed, the boiler is ready for use as all the necessary elements for its function are integrated into the equipment.
The components of the installation (boiler, pumps and valves) can be turned on and off manually by buttons located on the electrical control box.
The unit is also designed to be connected to the bench of radiators (standard BRBM or EQUI) which represents the emission part of the circuit of heating.

EDUCATIONAL CAPACITIES

The instrumentation is very complete and makes it possible to carry out a product engineering and transfer of the calorific energy.
In addition to the activities of a theoretical nature or observation, this plant also allows to the pupils practical handling of startup, adjustment, optimization of operation.

INTERESTED PUBLIC

This unit is principally designed for sanitary, heating and energy training courses.
Level of training targeted: Technician and Technologist degree to Engineer degree

Detailed technical specification available on demand

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PCST 20

SOLAR POWERED HEATING

EDUCATIONAL CAPACITIES

Theoretical:

- Composition and operation of solar thermal collectors: energy yield, proportion of solar cover
- Choice of type of solar collector
- Dimensioning of components (number of collectors, diameter of tubes, choice of circulator
- Security equipment
- Overall optimisation of the installation
- Hydraulic schematics (particular case of the production of hot water from two energy sources topped-up with energy from a buffer reservoir of primary water)
- Control of different circuits, operation modes

Practical:

- Recognition of components and their roles
- Validations using a check list
- Start-up of equipment
- Flow settings
- Supervision of operation
- Rise in temperature
- Regulation operations (actions at different stages of operation)
- Manipulation of regulator
- Shut down
- Maintenance (preventative and curative)
- Solar fluid filling operation

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This unit is principally designed for energy and process engineering and physical measurement courses.
Level of training targeted: Technician and Technologist degree to Engineer degree

Detailed technical specification available on demand

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PTCC 10

HEATING PILOT PLANT
CASCADE BOILERS

This unit is the image of a traditional installation of heating of a small type collective or collective per boiler in cascade. It is voluntarily very complete because it has as a will to show in their operation, the principal components of a heating installation.
Once installed, the equipment is ready to use because it integrates the whole of the elements enabling it to work. The boilers can be fuel or gas.
The operation of the plant is automatic and control by a controller of which it is equipped (manual mode accessible by the controller)

EDUCATIONAL CAPACITIES

The instrumentation is very complete and makes it possible to carry out a product engineering and transfer of the calorific energy.
In addition to the activities of a theoretical nature or observation, this plant also allows to the pupils practical handling of startup, adjustment, optimization of operation.

INTERESTED PUBLIC

This unit is principally designed for sanitary, heating and energy training courses.
Level of training targeted: Technician degree to Technologist degree.

Detailed technical specification available on demand

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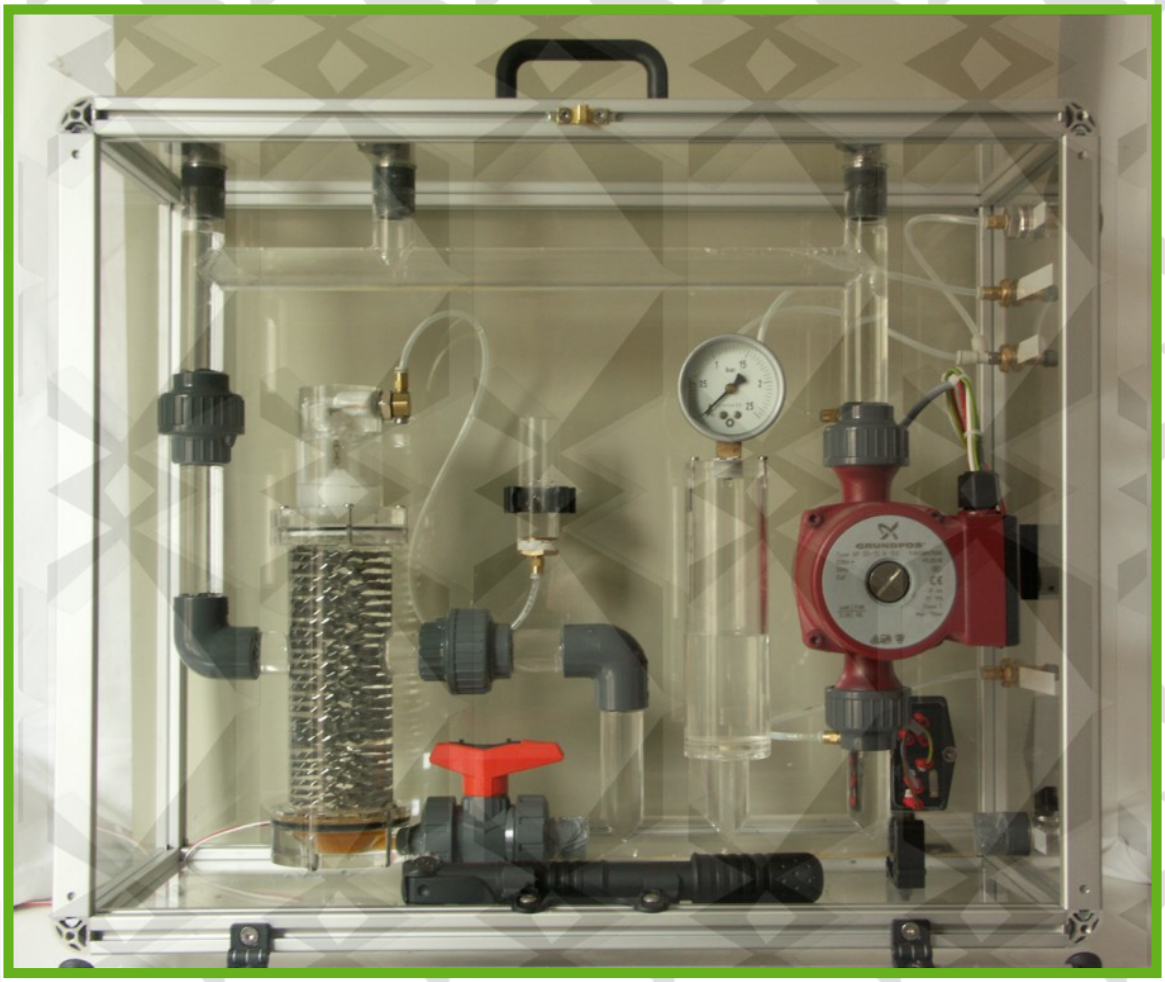
VDDD 10

DEGASER AND UNBLOCKER DEMONSTRATION CASE



EDUCATIONAL CAPACITIES

The demonstration case can be used in two ways:
- Use by the teacher: this excellent tool can be used in the classroom to promote understanding of the need for unblocking and de gasing of heating circuits. Easy to use, it is possible to observe the circulation of air and sediment within the circuit (the tubes are transparent). The use of a manual pump makes it possible to inject air upstream and downstream of the circulator and to understand the mechanism of air purging in the upper section. A valve, located at the base of the filter, allows the sediment to be recycled and demonstrates the operation of the filter (via backlighting of the filter).
- Use by the student:
The exercises carried out by the student are qualitative (no measuring instruments used). The student describes the processes observed when sediment or air is injected into the circuit. With the use of a controller, it is possible to reduce or increase the flow of water in the circuit and thereby observe the impact on the circuit operation. It is also possible to test the efficiency of different types of purging instruments.

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This unit is principally designed for sanitary and heating training courses.
Type of training: Technician degree to technologist degree.

Detailed technical specification available on demand

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BCET 12

STUDY OF A CONCENTRIC TUBE EXCHANGER

EDUCATIONAL CAPACITIES

- Demonstration of heat transfer: temperatures and heat exchange in an exchanger.
- Calculation of heat exchanged
- Study of conduction transfer
- Study of convection transfer, convection correlations
- Calculation of theoretic overall heat transfer coefficient of a concentric tube exchanger
- NUT method
- Internal set-up of an exchanger
- Thermal efficiency of an exchanger
- Determination of the overall heat transfer coefficient of an exchanger
- Influence of flow type on the efficiency of the exchanger (laminar or turbulent flow)
- Concurrent and counter-current set-up

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This unit is principally designed for energy and process engineering as well as physical measurement.
Training level: Technician and Technologist degree to Engineer degree

Detailed technical specification available on demand

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BCET 20

STUDY OF 2 EXCHANGERS: CONCENTRIC TUBE AND PLATE EXCHANGERS

EDUCATIONAL CAPACITIES

- Demonstration of heat transfer: temperatures and heat exchange in an exchanger.
- Calculation of heat exchanged
- Study of conduction transfer
- Study of convection transfer, convection correlations
- Calculation of theoretic overall heat transfer coefficient of a concentric tube exchanger and a plate exchanger
- NUT method
- Internal set-up of an exchanger (concentric tube and plate exchangers)
- Thermal efficiency of an exchanger
- Determination of the overall heat transfer coefficient of an exchanger
- Influence of flow type on the efficiency of the exchanger (laminar or turbulent flow)
- Concurrent and counter-current set-up
- Comparison of efficiency between concentric tube exchanger and plate exchanger

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This unit is principally designed for energy and process engineering as well as physical measurement.
Training level: Technician and Technologist degree to Engineer degree

Detailed technical specification available on demand

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ENGINEERING & MANUFACTURING

BCET 30

STUDY OF 3 EXCHANGERS

EDUCATIONAL CAPACITIES

- Demonstration of heat transfer: temperatures and heat exchange in an exchanger.
- Calculation of heat exchanged
- Study of conduction transfer
- Study of convection transfer, convection correlations
- Calculation of theoretic overall heat transfer coefficient of a concentric tube exchanger, multitubular exchanger and a plate exchanger
- NUT method
- Internal set-up of an exchanger (concentric tube and plate exchangers)
- Thermal efficiency of an exchanger
- Determination of the overall heat transfer coefficient of an exchanger
- Influence of flow type on the efficiency of the exchanger (laminar or turbulent flow)
- Concurrent and counter-current set-up
- Comparison of efficiency between concentric tube exchanger, multitubular exchanger and plate exchanger

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

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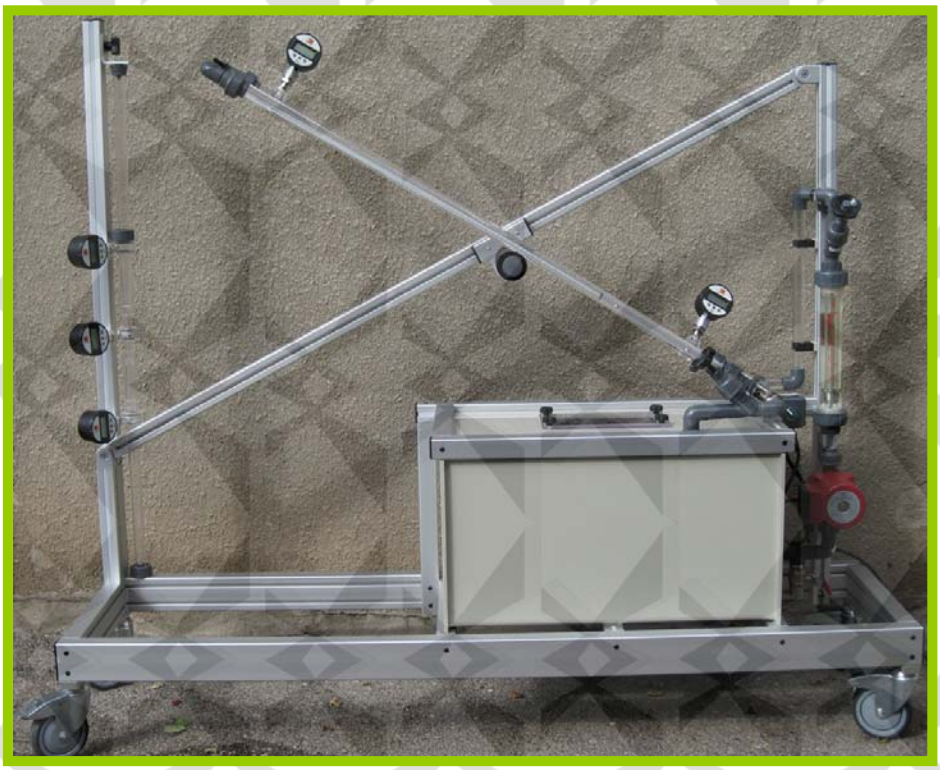
BELB 10
STUDY OF BERNOULLI'S LAW



USE

This unit allows water to circulate, by means of a centrifugal pump, within a closed annular circuit. Flow rate, measured by a flow meter allows the student to determine the equation term relative to the kinetic energy.
Pressure within the pipe can be adjusted via the two valves situated at the output end of the pump and at the entrance to the reservoir.
This pressure affects the potential energy and is measured via two digital display sensors located upstream and downstream of the conduit being tested.

The pipe can be positioned horizontally or vertically by using a combination of the hydraulic screw fittings and clamps which can be screwed into position. This change in height is measured and is important as it affects another equation term related to the potential energy.
Finally, it is necessary to calculate any regular pressure loss along the pipe.

EDUCATIONAL CAPACITIES

- Observe and understand a hydraulic installation
- Installation start-up
- Taking measurements (flow, height, pressure)
- Write Bernoulli's law
- Identify the energy terms
- Determine the impact of the installation parameters on each of the energy terms
- Calculate the important parameters in terms of the scale of measurement used
- Verification using Bernoulli's law
- Determine regular pressure loss within a closed annular circuit

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This unit is principally designed for energy and process engineering.
Training level: Technician and Technologist degree to Engineer degree

Detailed technical specification available on demand

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BESP 10

PUMPING STATION DEMONSTRATION UNIT

EDUCATIONAL CAPACITIES

- Study of operation of a pumping station (multi-user)
- Study of fluid transfer via centrifugal pump
- Study of level detection by a resistance detector
- Study of an automatic relay operation (possible with the **BESP 10_REL** base unit)
- Study of an automated automate (possible with **BESP 10_AUT** unit)
- Study of control of level via PID regulator (variation of pump flow via control of speed of induction motor) (possible with **BESP 10_REG** unit)
- Study of supervision (possible with **BESP 10_REG_SUP** unit)
- Set-up and management of unit operation
- Breakdown repair

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This unit is principally designed for electrical technical training courses
Training level: Technician and Technologist degree to Engineer degree

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BESU 10

STUDY OF A BOOSTER

Boosters are commonly found in sanitary installations. They serve to increase the pressure on water, emitted from a buffer reservoir, such that it is sufficiently pressurised to pass correctly through the piped network.

The power of the booster depends on the amount demanded as well as the peaks in demand for water. The choice of the booster also depends on the reason for its use and as such, can consist of one or several pumps.

The choice of a booster installation composed of several pumps provides the benefit of a back-up in the event of breakdown.

USE

The mobile unit consists of a structure edged in aluminium. Once the unit is filled with water, only connection to an electricity supply is needed.
A rotameter and pressure gauge allow for the measurement of optimal output.
A regulation valve allows for flow control and observation during operation.
All necessary practical work can be carried out on the unit without the need for further instrumentation.

EDUCATIONAL CAPACITIES

- Demonstration of operation of a booster unit with several pumps
- Identification and role of the different elements of the booster group
- Study of the operation of regulation (operational management and swapping of pumps as a function of water demand)
- Plotting of the pressure-flow relationship of the booster unit

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This unit is principally designed for energy and process engineering and physical measurements.
Training level: Technician degree to technologist degree.

Detailed technical specification available on demand

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BGMP 10

PRESSURE MAINTENANCE PUMPS

USE – EDUCATIONAL CAPACITIES

MANUAL MODE

The manual mode allows the student to access the pump set-up (choice of pumps available). For the pump set-up, the student uses the rotameter and Bourdon tube pressure gauges. Speed is controlled by potentiometer and servo-controlled by the variator (loop by speed and motor by inductive sensor). The student plots the pressure-flow relationship.

AUTOMATIC MODE

The automatic mode provides access to the control of level or pressure:

- Level control: A sensor controls the water level in the basin to continually ensure productive flow (this is programmable through the software). In this mode, it is possible to manually program the solenoid valve for the consumption flow rate.
- Pressure control: the regulator controls the installation using the pressure level prescribed by the piezometric sensor. The actuators are the solenoid valves which pressurise and evacuate the air (hot/cold type regulation). The user inputs the chosen pressure level on the regulator. It is possible to test several types of regulation. In this mode is it possible to manually order the pumps and solenoid valves as to the consumption flow rate.

The total flow rate and the energy absorbed by the motor(s) in operation are always displayed.

INTERESTED PUBLIC

This unit is principally designed for climatic and energetic engineering courses.
Level of training targetted: Technician and Technologist degree to Engineer degree

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BQPC 40

STUDY OF FOUR CENTRIFUGAL PUMPS

USE

The installation consists of an anodised aluminium structure raised on auto-directional, blockable castors. Once the unit has been filled with water, only connection to an electricity supply is necessary (100-240 Vac – 16 A monophase).
This unit allows for the study of three different types of pump, pumps which are installed to be configured in loading or suction mode via quarter turn valves. The pump/network circuit can then be tested (H(Q) circuit, H(Q) pump curves) simply by selecting the switch of the pump to be evaluated and turned on by a push button. A potentiometer controls the rotation speed of the pump being tested by variation of pulse frequency and amplitude. The two identical pumps can be associated, in parallel or in series, to allow for the study of pump association.
Indication of the active power and pump rotation speed allows for the calculation of pump output and as well as verification of the equations which associate flow, pressure, rotation speed and power.

The flow in the line is easily adjusted via a flow meter and membrane control valve. The pressures, suction and return from each pump are indicated on the grouped pressure gauges.

EDUCATIONAL CAPACITIES

- Study of three different centrifugal pump technologies
  - closed impeller pump
  - open impeller pump
  - multi-stage pump
- Plotting of the flow/pressure curves of the three pumps
- Plotting of the flow/pressure curves of each of the pump networks
- Determination of optimum operation output
- Study of the influence of rotation speed
- Study of the reduction of impeller diameter
- Study of powers– hydraulic– electricity consumed– calculation of outputs
- Characterisation of NPSH required by different pumps
- Notion of cavitation
- Association of identical pumps
  - in series
  - in parallel

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is designed for technical energy training courses (Electrotechnology subjects, equally for process and chemical engineering and can be used for all other technical training courses where necessary).
The level of training is from Technician and Technologist degree to Engineer degree

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MEPC 10

Dynamics of fluids Bench

EDUCATIONAL CAPACITIES

• Study of regular pressure loss
- Smooth pipes of varied diameters, rough pipes
- Use of the terms absolute and relative roughness
- Calculations of speed in an annular space
- Determination of Reynolds number (Re) knowing the physical properties of the water
- Use of Moody diagram
- Determination of theoretical pressure loss as a function of flow
- Comparison of experimental and theoretic values

• Study of occasional pressure loss
- Sudden enlargement, sudden restriction, 90° angles, 45° angles
- Use of nomogram to determine Zeta (ζ) the pressure loss coefficient of the element under consideration
- Determination of theoretical pressure loss as a function of flow
- Comparison of theoretical and experimental values

• Evaluation of pressure reducing instruments according to ISO 5167
- Expression of Venturi relationship linking the diameters and the flow, using the Bernoulli equation
- Comparison of diaphram and Venturi
- Confirmation by experimentation of the calculated theoretical values

• Evaluation of Cv of valves
- Calculation of Cv of an angle valve, membrane valve and ball valve
- Comparison of calculated Cv value with that provided by the manufacturer

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is designed for technical energy training courses as well as process and chemical engineering. The training level is from Technician and Technologist degree to Engineer degree ..

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MTRF 10

STUDY OF A COOLING TOWER

USE

The equipment consists of an anodised aluminium structure which is raised on a mobile bench. It is equipped with feet to allow for installation on a table.
The unit is connected to an electricity supply and is filled with water using a container. During the labs, the water reservoir can be filled without the need to turn off the machine and the top-up is controlled automatically.
The student works alone or in pairs:
- To start-up the machine and enter the settings (temperature, water flow and air flow).
Temperature, relative humidity and water consumption values are recorded and adjustment to the operational settings are made accordingly.
During the labs, it is possible to change the packing in the tower as well as the type of spray nozzle.
The student can then compare his results to theoretical expectations.

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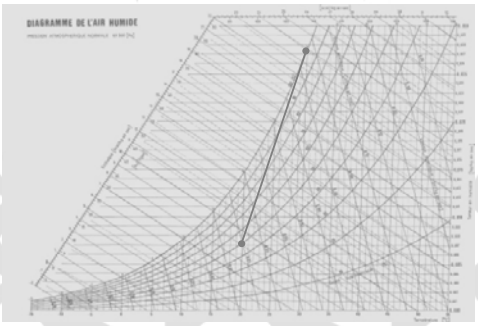
The user interface is a touch screen which displays several pages. The functioning of various elements within the unit is controlled via a representative diagram. One page gives the measurement information (temperature, humidity), another informs the user in the event of a problem (lack of water, excessive temperature, excess current, etc.).
An automaton controls temperature and air flow and gathers all analogue and digital measurements.

EDUCATIONAL ACTIVITIES

- Study of the component parts of a cooling tower. Technology
- Operating modes of a cooling tower
- Study of heat transfer by evaporation
- Study of heat transfer by convection
- Mass transfer
- Calculation of heat exchange
- Efficiency of the tower
- Influence of the type of exchange surface in the tower
- Influence of the type of spray nozzle



- Plotting of humidity evolution on a humidity graph
- Start up and operational control
- Settings

INTERESTED PUBLIC

This equipment is designed for technical energy training courses as well as for process and chemical engineering and physical measurement, etc.
The level of training is from Technician and Technologist degree to Engineer degree.

Detailed technical specification available on demand

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MCMD 10

STUDY OF FLOW SENSORS

USE

The equipment consists of a unit which is installed on a table and raised on four legs of adjustable height. The unit structure is made of anodised aluminium.
The unit needs connection to both water and electricity supplies and requires an output drain (during open circuit function). All the analogue inputs and outputs of the indicators and sensors are 4/20mA type and are provided on double insulated banana sockets. This provides access without the need to open the fuse box and allows for the possible connection to a plotting table or other data acquisition systems. In accordance with standard flow metering, the MCMD 10 unit simulates four different principles of flow measurement. It teaches the importance of the quality of measurement from each of the sensors, whether in terms of metering, conditions of use or material constraints.

In accordance with existing standards (notably NF X 10-100, 102, 120 and 138), the concepts of accuracy, repeatability and reproducibility are addressed.
The unit is designed to measure the flow of normal tap water (not softened) within a closed pipe and, in the interest of lucidity, teaches the importance of the choice of method of flow measurement as a function of fluid parameters, environmental parameters, the required level of accuracy, price, etc.

EDUCATIONAL CAPABILIITES

- Evaluation of the measurement protocol configuration
- Study of evaluation methods:
  - –By the choice of referenced flow meter (considered as exact) on a given flow rate
  - –By weighed reservoir during filling time for an averaged flow rate
- Calculation of uncertainties related to each method
- Plotting of graphs for each sensor to determine precision (accuracy, repeatability, etc.)
- Comparison of sensors for each of the characteristics of precision
- Review of different flow metering technologies, conditions of use, etc.

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is suitable for all types of technical education institute, college, universities: technician degree to BA Degree and Engineer Degree.

OPTIONS

Different types of sensor are available. Please contact us.
Reservoir and pump for closed circuit function (without use of water) which also serves as a support for the equipment (see photo).

Detailed technical specification available on demand

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MCMN 10

STUDY OF LEVEL SENSORS

USE

The equipment consists of a mobile unit, edged in anodised aluminium, standing on four auto-directional, blockable castors. Once the unit has been filled with water, it only needs to be plugged in to start working. All the analogue inputs and outputs of the indicators and sensors are 4/20mA type and are provided on double insulated banana type sockets. This provides access without the need to open the fuse box and allows for the potential connection to a milliammeter, a plotting table or other data acquisition systems.
A system of shut-off valves means that the reservoir containing the sensors can be agitated allowing for an appreciation of the influence of turbulence. A metal rule provides the reference measurement and assists in calibration of the equipment.
In accordance with existing standards (notably NF X 10-100, 102, 120 and 138), the concepts of accuracy, repeatability, hysteresis and zero point are addressed.
The unit is designed to measure the flow of normal tap water (not softened) within an atmospheric reservoir and, in the interest of lucidity, introduces the importance of choice of level measurement as a function of fluid and environmental parameters, the level of accuracy required, price, etc.

EDUCATIONAL CAPACITIES

- Evaluation of the measurement protocol configuration
- Evaluation of different sensors: hydrostatic pressure, radar, capacity.
- Plotting of graphs for each sensor to determine the terms of precision (accuracy, repeatability, etc.)
- Comparison of sensors for each of the terms of precision.
- Review of different level measuring technologies as a function of fluid and environmental parameters, conditions of use, desired level of accuracy, price, etc.

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is suitable for all types of technical education institute, college, universities: technician degree to BA Degree and Engineer Degree.

OPTIONS

Different types of sensor are available. Please contact us.

Detailed technical specification available on demand

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MCMP 10

STUDY OF PRESSURE SENSORS

USE

The equipment consists of a unit that is set up on a table and elevated on legs of adjustable height. The structure is made of anodised aluminium.
The unit requires connection to water and electricity supplies and needs an output drain (during open circuit function). All the analogue inputs and outputs of the indicators and sensors are 4/20mA type and are provided on double insulated banana sockets. This provides access without the need to open the fuse box and allows for the connection to a plotting table or other data acquisition systems.
In accordance with equipment standards, the MCMP 10 unit, demonstrates four different principles of pressure measurement. It allows for the understanding of the quality of measurement of each of the sensors whether in terms of metering, conditions of use or material constraints. In accordance with existing standards (notably NF X 10-100, 102, 120 and 138), the concepts of accuracy, repeatability, reproducibility, hysteresis and zero point are addressed. The unit is designed to measure the pressure of normal tap water in a pipeline which is fitted with a valve to control flow and therefore pressure. This teaches the importance of the choice of method of pressure measurement as a function of fluid and environmental parameters, the level of accuracy required, price, etc.

EDUCATIONAL CAPACITIES

- Terminology relating to pressure (relative, effective, absolute, differential)
- Evaluation of measurement protocol configuration
- Study of evaluation methods
  - By the choice of referenced pressure meter (considered as exact)
  - By comparison of pressure balance (Pressure = Mass.g/Piston area)
- Calculation of inaccuracies related to each method
- Plotting of graphs for each sensor to determine the terms of precision (accuracy, repeatability, etc.)
- Comparison of sensors for each of the terms of precision
- Review of different pressure metering technologies, conditions of use, etc.

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is suitable for all types of technical education institute, college, universities: technician degree to BA Degree and Engineer Degree.

OPTIONS

Different types of sensor are available.
Reservoir and pump for closed circuit function (without use of water) which also serves as a support for the equipment.

Detailed technical specification available on demand

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MCRD 10

STUDY OF FLOW RATE CONTROL

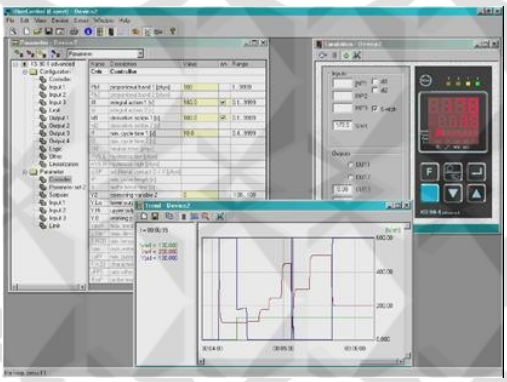
USE

The equipment, whose structure is made from anodised aluminium, consists of a mobile unit standing on four auto-directional, blockable castors.
Once the reservoir has been filled with water, the unit needs to be connected to an electricity and pneumatic pressure supply. All the analogue inputs and outputs of the actuators, sensors and regulators are 4/20mA and are provided on double insulated banana type sockets. This provides access without the need to open the fuse box and allows for the potential connection to a plotting table or other data acquisition systems.
The pump is turned on and off via push buttons and start-up is simple.
The regulator can be configured via a computer. The user interface is accessed at the front of the unit. The software provides all necessary information relating to the settings, allowing the parameters to be changed at distance while plotting the required graphs on the screen. The valve is an anti return type valve with or without a positioner (optional), I/P converter.

EDUCATIONAL CAPACITIES

- Study of simple control loops
- Configuration of the measurement protocol
- Process identification
  - In open loop
  - In closed loop
- Control settings
  - Successive adjustment approach
  - Adjustment by process identification
  - Ziegler & Nichols adjustment method
- Response to disturbance

Use and configuration of regulator



The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is suitable for all types of technical education institute, college, universities: technician degree to BA Degree and Engineer Degree.

OPTIONS

Different types of sensor are available (electromagnetic flowmeter, axial turbine, coriolis …)
Valve positioner.

Detailed technical specification available on demand

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MCRN 10

STUDY OF LEVEL RATE CONTROL

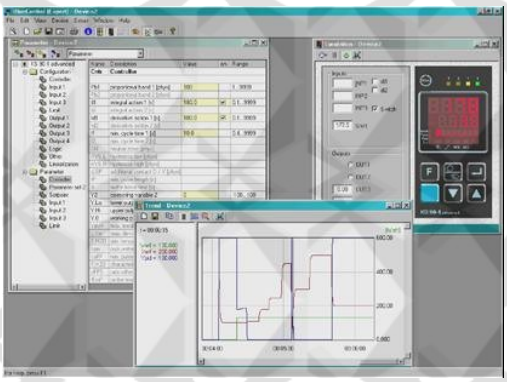
USE

The equipment, whose structure is made from anodised aluminium, consists of a mobile unit standing on four auto-directional, blockable castors.
Once the reservoir has been filled with water, the unit needs to be connected to an electricity and pneumatic pressure supply. All the analogue inputs and outputs of the actuators, sensors and regulators are 4/20mA and are provided on double insulated banana type sockets. This provides access without the need to open the fuse box and allows for the potential connection to a plotting table or other data acquisition systems.
The pump is turned on and off via push buttons and start-up is simple.
The controller can be configured via a computer. The user interface is accessed at the front of the unit. The software provides all necessary information relating to the settings, allowing the parameters to be changed at distance while plotting the required graphs on the screen. The valve is an anti return type valve with or without a positioner (optional), I/P converter.

EDUCATIONAL CAPACITIES

- Study of simple control loops
- Configuration of the measurement protocol
- Process identification
  - In open loop
  - In closed loop
- Control settings
  - Successive adjustment approach
  - Adjustment by process identification
  - Ziegler & Nichols adjustment method
- Response to disturbance

Use and configuration of regulator



The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is suitable for all types of technical education institute, college, universities: technician degree to BA Degree and Engineer Degree.

OPTIONS

Different types of sensor are available.
Valve positioner.

Detailed technical specification available on demand

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MCRT 10

STUDY OF TEMPERATURE CONTROL

USE

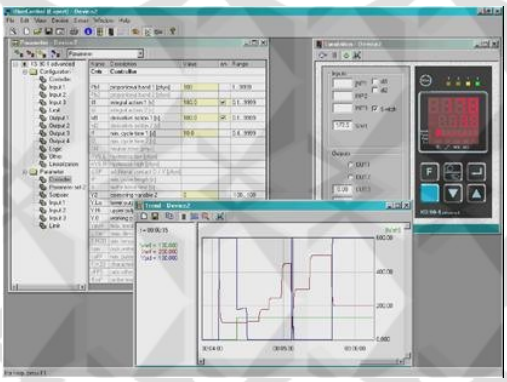
The equipment, whose structure is made from anodised aluminium, consists of a mobile unit standing on four auto-directional, blockable castors.
Once the reservoir has been filled with water (only a low cool water flow is necessary), the unit needs to be connected to an electricity and pneumatic pressure supply. All the analogue inputs and outputs of the actuators, sensors and regulators are 4/20mA and are provided on double insulated banana type sockets. This provides access without the need to open the fuse box and allows for the potential connection to a plotting table or other data acquisition systems.
The pump and the heating are turned on and off via push buttons and start-up is simple.
The controller can be configured via a computer. The user interface is accessed at the front of the unit. The software provides all necessary information relating to the settings, allowing the parameters to be changed at distance while plotting the required graphs on the screen. The valve is an anti return type valve with or without a positioner (optional), I/P converter.

EDUCATIONAL CAPACITIES

- Study of simple control loops
- Configuration of the measurement protocol
- Process identification
  - In open loop
  - In closed loop
- Control settings
  - Successive adjustment approach
  - Adjustment by process identification
  - Ziegler & Nichols adjustment method
- Response to disturbance

The unit comes with full technical documentation including teaching theory and experiment notes.

Use and configuration of regulator



INTERESTED PUBLIC

This equipment is suitable for all types of technical education institute, college, universities: technician degree to BA Degree and Engineer Degree.

OPTIONS

Different types of sensor are available.
Valve positioner.
Second Controller and Flowmeter for the study of the cascade control.

Detailed technical specification available on demand

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MEDR 10

STUDY OF MULTI-PARAMETER CONTROL

USE

The equipment, whose structure is made of anodised aluminium, consists of a mobile unit standing on four multi-directional, blockable castors. Once the water reservoir has been filled with water, a small flow of cold water is needed but this is only necessary for the study of temperature regulation.
All the analogue inputs and outputs of the actuators, sensors and regulators are 4/20mA type and are provided on double insulated banana sockets. This provides access without the need to open the fuse box and allows for the potential connection to a plotting table or other data acquisition systems. The turning activation of the pump and water heater is done via push buttons. Start-up is simple and the choice of practical is made by the use of a quarter turn valve.
The various modes of regulation are described on the following page.
A further (optional) use of the unit is the study of the regular and occasional pressure loss (smooth and rough tubing of varied diameters). This provides a review of some important principles (enlargement and restriction of tube diameter, angles, valves, etc.).

The element to be evaluated passes through the tubing, which is linked up using screw couplings, and connects to the differential pressure sensor. The flow along the line is easily adjusted via the use of a flow meter and a control valve. The pump is turned on and off via push buttons. Start-up is simple.
The regulator can be configured via a computer which is accessible on the front of the unit. The software provides all necessary information relating to the settings allowing the parameters to be changed at distance while plotting the required graphs on the screen. The value is an anti-return type valve with or without a positioner (optional), I/P converter.

EDUCATIONAL CAPACITIES

- Study of simple control loops
  - Flow, level, pressure and temperature
  - Characterisation of a measurement protocol
  - Process identification
  - Wiring of a control loop
  - Adjustment to the means of control via the response to an increment system (Broïda method) or oscillation system (Ziegler et Nichols method) or by successive adjustment approach.
  - Response to disturbance
- Study of a cascade control loop
  - Temperature of water leaving the exchanger according to a fixed value
  - Process identification , wiring of the cascade control loop
  - Adjustment to the means of regulation via appropriate methods
- Study of regular loss of charge
  - Smooth and rough tubes with varied diameters
  - Use of the terms relative and absolute roughness
  - Calculation of speeds within an annular space
  - Determination of Reynolds number (Re) knowing the physical properties of the water
  - Use of Moody diagram
  - Determination of the theoretic loss of charge as a function of flow
  - Comparison of experimental and theoretic values
- Study of occasional loss of charge
  - Effect of varying pipe diameter, 90° angles
    Use of conversion tables for the determination of zeta (ζ), the loss of charge coefficient for the element under consideration
  - Determination of loss of charge as a function of flow rate
  - Comparison of experimental and theoretic values.

INTERESTED PUBLIC

This equipment is suitable for all types of technical education institute, college, universities: technician degree to BA Degree and Engineer Degree.

OPTIONS

Different types of sensors are available.
Valve positionner.

Detailed technical specification available on demand

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ENGINEERING & MANUFACTURING

MEVR 10

STUDY OF A CONTROL VALVE

USE

The equipment consists of a unit edged with anodised aluminium and raised on legs of adjustable height.
The unit requires an electricity supply (mono-phase), pneumatic pressure supply (compressed air) and water supply. All the analogue inputs and outputs are 4/20mA type and are provided on double insulated banana type sockets. This provides access without the need to open the fuse box and allows for the potential connection to a milliammeter or other data acquisition systems. Start-up is simple.
The pressure and water flow rates are adjustable and their readings from the sensors are displayed locally. Equally, the pressure of the compressed air is adjustable and measured on a gauge.
The differential pressure sensor provides a measure of the difference in pressure upstream and downstream of the valve. In this way, all the valve parameters can be evaluated: flow coefficient; loss of charge; linearity; hysteresis; repeatability; etc.

EDUCATIONAL CAPACITIES

- Review of definitions: metering; control valve parameters; and conditions of use.
- Study of valve theory, analysis of manufacturer notes, characteristic techniques from the manufacturer's calculation sheet, dimensioning in relation to process.
- Valve configuration – with or without positioner according to valve.
- Experimental determination of the K_V flow coefficient.
- Plotting of graphs
  Flow Q = f (water pressure Pe) constant displacement of valve
  Flow Q = f (displacement of C valve) at constant water pressure
  Flow Q = f (differential pressure ΔP)
- Study of the importance of the positioner
  Linearity, repeatability, hysteresis, etc.
- Study of valve behaviour under control or under servo-control
  Case of pressure control
  Identification of process
  Adjustment to means of control

The unit comes with full technical documentation including teaching theory and experiment notes.

INTERESTED PUBLIC

This equipment is suitable for all types of technical education institute, college, universities: technician degree to Beng Degree and Engineer Degree.

OPTIONS

Reservoir and pump for closed circuit (without water use) which also serves as an equipment support.
Numerical positioner.

Detailed technical specification available on demand

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PPDV 50

VAPOUR PRODUCTION & DISTRIBUTION

USE

Operation takes place with water in a closed circuit. This means that once the vapour is produced, it is 'de-vesiculed', depressurised, flow regulated and finally condensed. The water (in liquid form) is then pumped and returned to the supply tank and treated. Any other excess water produced in the system is also recycled.
This unit requires the exterior dissipation of energy via the presence of a glycol water loop and an air heater.
The specific vapour components are varied thereby allowing for their evaluation and comparison. Generally, branded components are used such as Spirax Sarco.
Temperature, flow and pressure are controlled and adjustable.

EDUCATIONAL CAPACITIES

❑ Study of vapour production
- Vapour heater using natural gas
- Supply reservoir and level control
- Water treatment
- Two different vapour control posts, temperature control
- Three different depressurising posts
- Five different types of purging methods (glass body optional)
- Recycling of condensates
- Glycol water cooling circuit

❑ Start-up
- Operation in manual mode
- Understanding of security measures
- Start-up of the boiler
- Use of vapour components: valves, pressure reducing valves

❑ Evaluation of components
- Evaluation of pressure reducing valves
- Evaluation of regulation systems
- Evaluation of purge valves

❑ Heat balance
- Measure of flow, pressure, temperature (water, vapour)
- Determination of energy received by cooling water
- Boiler energy consumption (natural gas)
- Outputs – efficiency – global budget - losses

INTERESTED PUBLIC

This equipment is principally designed for technical and professional energy training courses (*ETE*, *F2E*, *Froid/clim*, *GTE…)* It would also be of interest for chemical and process engineering.
The training level covers Technician and Technologist degree to Engineer

Detailed technical specification available on demand

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