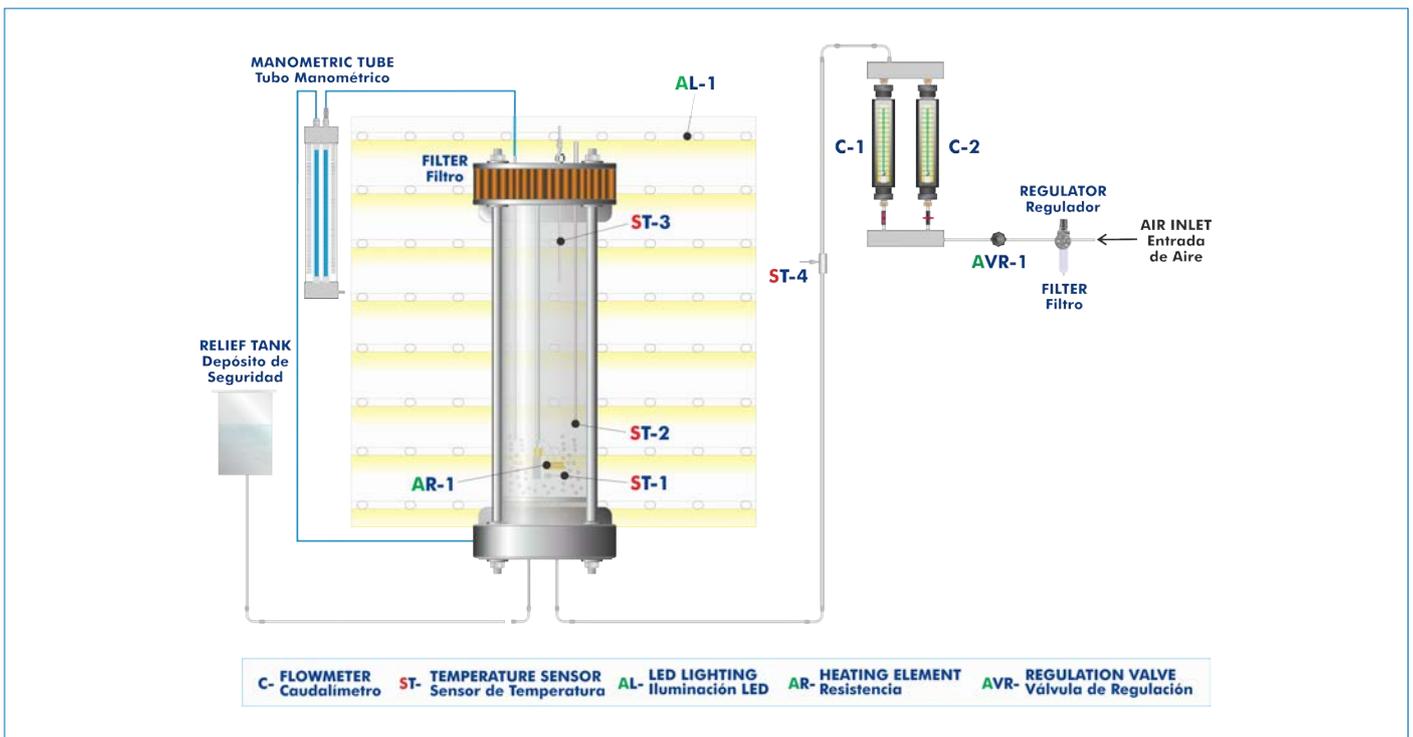




Electronic console

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)



European Union Certificate (total safety)



Certificates ISO 14001 and ECO-Management and Audit Scheme (environmental management)



"Worlddidac Quality Charter" and Platinum Member of Worlddidac

INTRODUCTION

When a current of fluid (gas or liquid) flows through a bed of particles, the growing friction between them and the fluid makes the particles of the bed, from a specific flow rate, be suspended in the fluid, not resting on one another. The bed takes a volume larger than the volume it has when that fluid does not flow. Under these conditions, it can be considered that a fluid bed has been formed, since the solid particles behave as the fluid particles, moving freely by gravity effect or being pumped. The main characteristic is that the temperature in every point of the bed is constant, due to the fact that heat transfer is very effective.

Thanks to this property, the drying process fluidized beds is nowadays an efficient alternative for food products dehydration, granular solids drying, such as grains, fertilizers, chemicals and minerals, etc.

GENERAL DESCRIPTION

The Fluidization and Fluid Bed Heat Transfer Unit, "TTLFB", has been designed to provide visual and quantitative results related to the flow of air through a packed bed and a fluidized bed made of granular material. It provides clear experimental possibilities for the research of the heat transfer in a fluidized bed.

The main element is a glass chamber, lit from behind, where a granular material is contained. A fluid (air), supplied to the bed through the bottom thanks to a distributor, passes through that material. Nine different distributors are provided so that they can be compared during the process. They have different number of orifices, different sizes of orifices and different distribution of orifices.

Air is expelled through the upper side of the chamber, crossing a filter that removes the particles that may have been dragged by the air when crossing the bed before releasing it to the atmosphere.

When the air speed is slower than the so-called expansion rate, the flow only crosses the fixed bed. When the speeds are faster than that expansion rate, the bed is softened, so that the state of the solid particles change, being suspended and forming a fluidized bed.

To regulate this flow of air the unit has a regulation valve at the inlet and flow meters to measure that flow of air.

The chamber of the bed has a heating element for the study of the heat transfer in the fluidized bed, measuring the temperature of the inlet air, the temperature of the outlet air, the temperature of the fluidized bed, the temperature of the heating element surface and the supplied heating power. Both the temperature sensors of the bed and the heating element as the heating element itself may be vertically displaced, enabling to perform the practical exercises at different heights of the chamber.

The pressure drop in the bed can be determined with a U-shaped manometer.

Two types of granular material of different size are supplied to form the bed.

SPECIFICATIONS

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

Main metallic elements made of stainless steel.

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

Pressure regulator and filter. It is supplied fixed to 3 Bar.

Regulation valve to regulate the flow of air at the inlet of the bed chamber.

Bed chamber:

Cylinder made of glass where the granular material that forms the bed is contained.

Back light to facilitate the visualization of the fluidized bed.

It includes:

Heating element:

Cylindrical heating element with copper coating:

Transfer area: 20.4 cm².

Maximum power: 150 W.

Potentiometer that regulates the current to the heating element.

Heating power measurement with a wattmeter.

"J" type temperature sensor on the surface of the heating element.

Filter at the top of the chamber.

Distributor at the bottom of the bed chamber. Nine different distributors are included with different number of orifices, different sizes of orifices and different distribution of orifices.

Graduated scale to measure the height of the bed.

Two "J" type temperature sensors to measure:

Bed temperature.

Air temperature at the outlet of the chamber.

Granular material:

1 Kg (170 – 300 microns).

1 Kg (250 – 420 microns).

Safety tank made of PMMA to prevent overpressures in the chamber.

Two ball valves to select the flowmeter in function of the working range.

"J" type temperature sensor to measure the air temperature at the inlet of the chamber.

Two flowmeters to measure the inlet air flow of the bed chamber:

Flowmeter 1, range: 22 – 130 l/min.

Flowmeter 2, range: 1 – 5.5 l/s.

Differential pressure U-shaped manometer to measure the pressure drop in the bed. Range: 0 – 500 mm H₂O.

"J" type temperature sensor to measure the air temperature at the inlet of the chamber.

Pressure sensor to measure the air pressure at the inlet of the chamber. Range: 0 – 100 PSI.

Cables and Accessories, for normal operation.

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

EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Study of the behavior of particles in a bed when an ascending airflow is applied.
- 2.- Study of the particles' segregation into size and density.
- 3.- Study of the relation between bed's height, drop of pressure and ascending air's velocity through the particle bed.
- 4.- Study of the variation of the heat's transference coefficient in a fluidized bed caused by the effect of the following parameters:
 - Superficial velocity.
 - Depth of the hot surface in the bed.
 - Particle's granulometry.
- 5.- Study of the distributor's effect on the bed's behavior.

REQUIRED SERVICES

- Electrical supply: single-phase, 220 V/50 Hz or 110 V/60 Hz.
- Compressed air supply.

DIMENSIONS AND WEIGHTS

TTLFB:

Unit:

- Dimensions: 700 x 600 x 800 mm approx.
(27.55 x 23.62 x 31.49 inches approx.)
- Weight: 40 Kg approx.
(88 pounds approx.)

Electronic console:

- Dimensions: 490 x 330 x 310 mm approx.
(19.29 x 12.99 x 12.20 inches approx.)
- Weight: 15 Kg approx.
(33 pounds approx.)

AVAILABLE VERSIONS

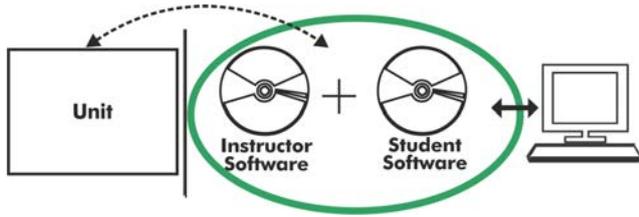
Offered in this catalog:

- TTLFB. Fluidization and Fluid Bed Heat Transfer Unit.

Offered in other catalog:

- TTLFC. Computer Controlled Fluidization and Fluid Bed Heat Transfer Unit.

TTLFB/ICAI. Interactive Computer Aided Instruction Software System:



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

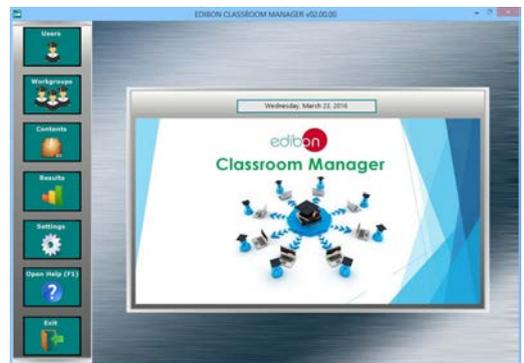
Instructor Software

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

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

Innovative features:

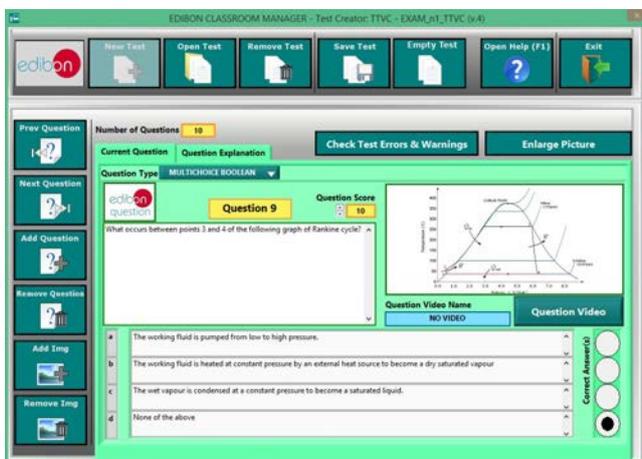
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.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



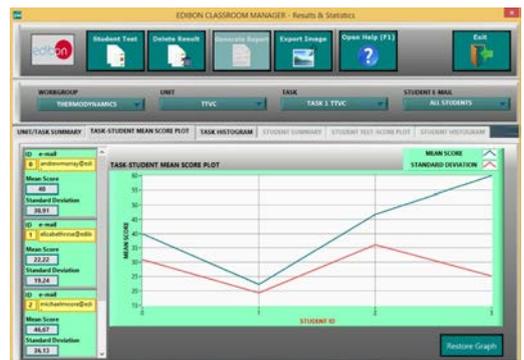
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



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



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

Optional
Student Software

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

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

Innovative features:

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

For more information see ICAI catalogue. Click on the following link:

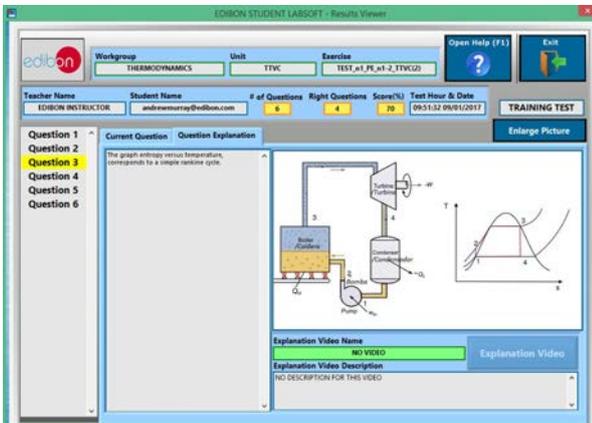
www.edibon.com/en/files/expansion/ICAI/catalog



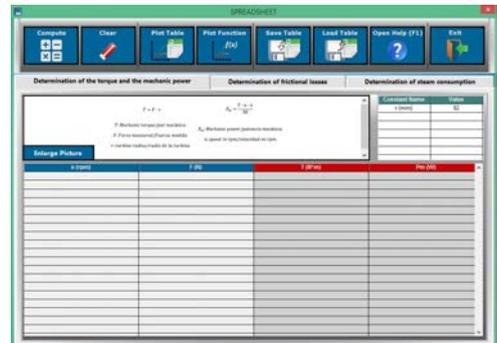
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

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



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Edition: ED01/18
Date: June/2018

REPRESENTATIVE:

