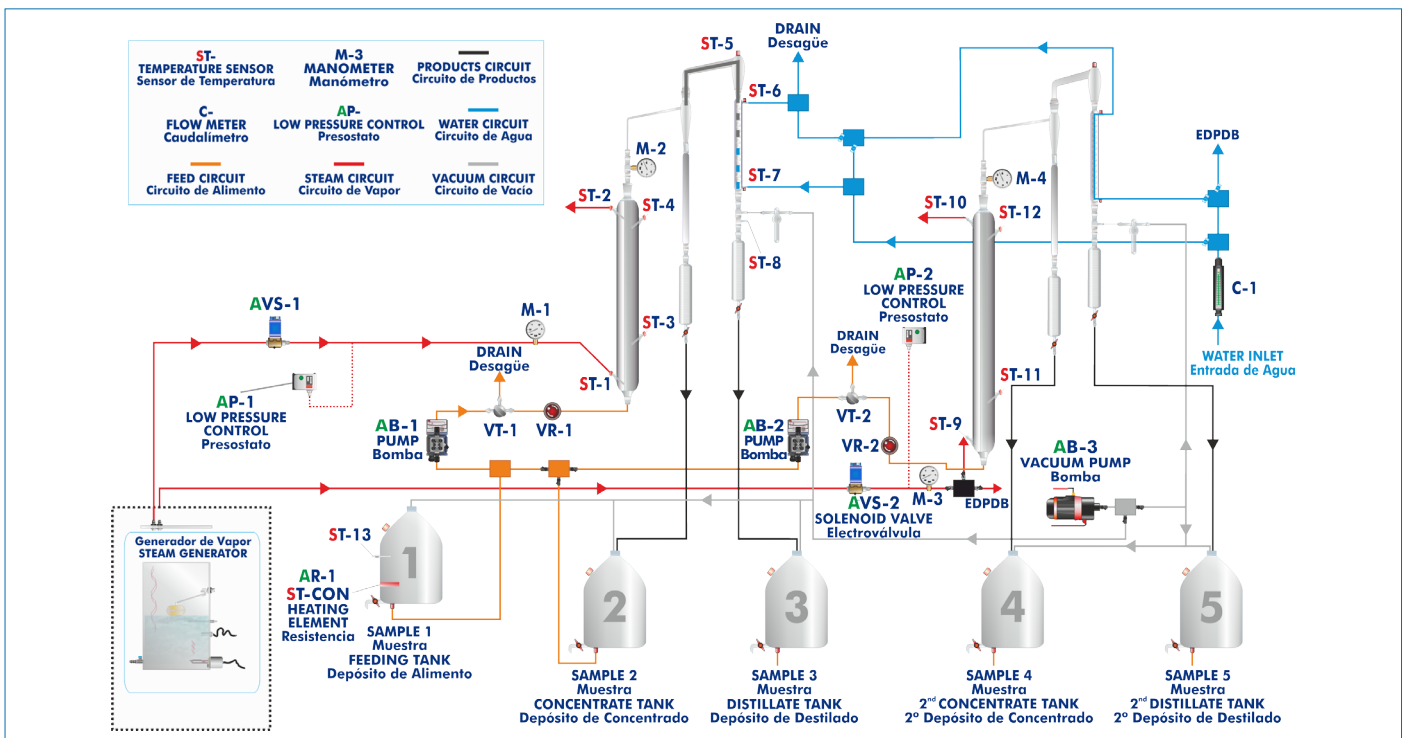


Electronic console

### 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

The objective of the evaporation is to concentrate a solution containing a non-volatile solute and a volatile solvent. In most evaporation processes the solvent is water. Evaporation means vaporizing part of the solvent to obtain a concentrate solution of thick liquor.

Rising or falling film evaporators are very useful if the product to be concentrated breaks down easily when subjected to high temperatures for a long period of time, since these evaporators work at a lower temperature. These evaporators can be used to concentrate, for example, juices, milk and dairy products, etc.

The multiple effect method is used to improve the global thermal economy of the process without increasing the capacity of the plant.

## GENERAL DESCRIPTION

The Double Effect Rising Film Evaporator, "EDPAB", designed by EDIBON, allows to observe and control a serial, parallel or double effect evaporation process.

The unit consists of two evaporators with a single glass tube, allowing the student to observe all the processes that take place in the unit.

The solution to be concentrated enters the evaporator and, as it flows along the tube, it is progressively evaporated since an annular flow or rising film flow is generated internally, keeping that film thanks to the friction induced by the vapour nucleus, which moves at high speed with regard to the liquid film. The supply enters the rising tube in liquid state for a short distance, receiving heat from the steam.

Steam introduced in the first evaporator can be introduced again in the second evaporator (serial operation mode) or either two different steam flows can be introduced (parallel operation mode).

The unit also allows the steam generated in the first evaporator to be introduced as heating medium in the second evaporator and the concentrated product obtained can be used as supply for the second column. Thus, one of the main premises of a double effect evaporator, which is the economy of the heat employed, can be evaluated.

## SPECIFICATIONS

Anodized aluminum frame and panels made of painted steel.

The unit includes wheels to facilitate its mobility.

Main metallic elements made of stainless steel.

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

Two evaporation double jacket columns, with a heating area of 0.122 m<sup>2</sup>, 30 mm inner diameter, 60 mm outer diameter and length of 1300 mm.

Two membrane dosing pumps, with maximum flow of 15 l/h.

Simple effect vacuum pump, with maximum flow of 3 m<sup>3</sup>/h and maximum vacuum of 150 microns.

Five tanks, capacity: 10 l (for feeding, concentrated and evaporated).

Four graduated vessels for storage of concentrated and evaporated product, capacity: 500 ml.

Immersion heating element, range: 300 W.

Two coil coolants with length of 400 mm.

Two high safety pressure cut out for pressure control in the columns.

Thirteen temperature sensors, "J" type.

Flowmeter.

Four manometers.

Two solenoid valves.

The unit allows to work with several configurations:

- Double-effect: the steam generated in the first stage of the evaporation is introduced in the second column.
- Steam from the first column's jacket can be used to heat the second column.
- Columns receive steam from the generator in an independent way.

Electronic console:

Metallic box.

Temperature sensors connections. Digital display for temperature sensors. Selector for temperature sensors.

Pumps switches.

Heating element controller.

High pressure cut out connections.

Solenoid valves connections.

Main switch.

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.

Required elements (Not included):

- TGV/6KW. Steam Generator (6 kW).

Additional recommended elements (Not included):

- EDPDC. Double Effect Falling Film Evaporator.



EDPAB detail

**Additional Recommended elements (Not included):**

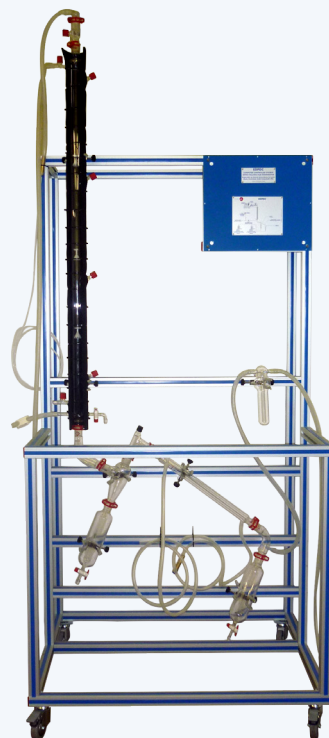
**EDPDC. Double Effect Falling Film Evaporator**

Basically, it consists of the following elements:

- Falling film evaporation column with jacket for the steam and temperature takings. It has a heating area of  $0.122 \text{ m}^2$ , 30 mm of inner diameter, 60 mm of outer diameter and length of 1300 mm.
- Cyclone to favor the separation of the most volatile component from the least volatile component.
- Graduated vessel of 500 ml to collect the concentrated product, located under the cyclone.
- Liebig-Wet refrigerant to condense the distilled product (useful length of 400 mm).
- 500 ml graduated vessel to collect the evaporated.

The operation with the falling film column is by replacing the second rising film column for the falling film column. For it, the falling film equipment is connected to the corresponding takings: supply, steam, water, vacuum, and sensors which come from the second rising film column.

The temperature sensors are removed from the second rising film column and are placed at the falling film column.



## EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Heating efficiency calculation.
- 2.- Sugared solution concentration.
- 3.- Evaporation velocity determination.
- 4.- Study of the evaporation velocity in function of the working conditions.
- 5.- Study of the relation between condensed and evaporated product.
- 6.- Study of the mass balance of the solute.
- 7.- Study of the mass balance of the solvent.
- 8.- Energy balance of the evaporation unit.
- 9.- Energy balance of the tubular refrigerator.
- 10.-Heat transfer global coefficient determination.
- 11.-Heat transfer coefficient determination of a tubular refrigerator.
- 12.-Study of the mass balance of the solute in one column.
- 13.-Fruit juices and vegetable extracts concentration.
- 14.-Concentrated milk obtaining.
- 15.-Efficiency determination of the steam used in the process.
- 16.-Steam generator efficiency determination.
- 17.-Investigation of effect of varying process parameters such as: vacuum, flow rate, temperature, recycle rate.

### REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.
- Water supply and drain.

### DIMENSIONS AND WEIGHTS

#### EDPAB:

##### Unit :

- Dimensions: 2300 x 1000 x 2300 mm approx.  
(90.55 x 39.37 x 90.55 inches approx.)
- Weight: 100 Kg approx.  
(220 pounds approx.).

##### Electronic console:

- Dimensions: 490 x 450 x 470 mm approx.  
(19.29 x 17.71 x 18.50 inches approx.).
- Weight: 15 Kg approx.  
(33 pounds approx.).

### REQUIRED ELEMENTS (Not included)

- TGV/6KW. EDIBON Steam Generator (6 kW), or similar steam generator.
- Stopwatch.

### ADDITIONAL RECOMMENDED ELEMENTS (Not included)

- EDPDC. Double Effect Falling Film Evaporator.

### SIMILAR UNITS AVAILABLE

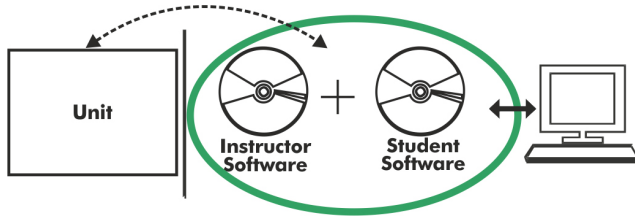
#### Offered in this catalog:

- EDPAB. Double Effect Rising Film Evaporator.

#### Offered in other catalogs:

- EDPAC. Computer Controlled Double Effect Rising Film Evaporator.
- EPAC. Computer Controlled Rising Film Evaporator.
- EPAB. Rising Film Evaporator.
- EPDC/C. Computer Controlled Falling Film Evaporator.

**EDPAB/ICAI. Interactive Computer Aided Instruction Software:**



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.

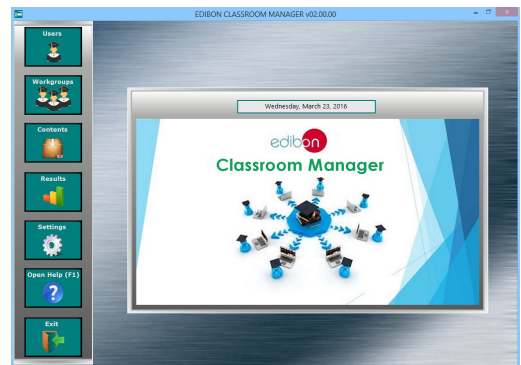
Instructor Software

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

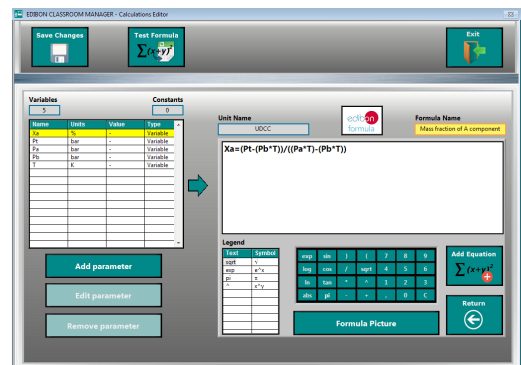
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

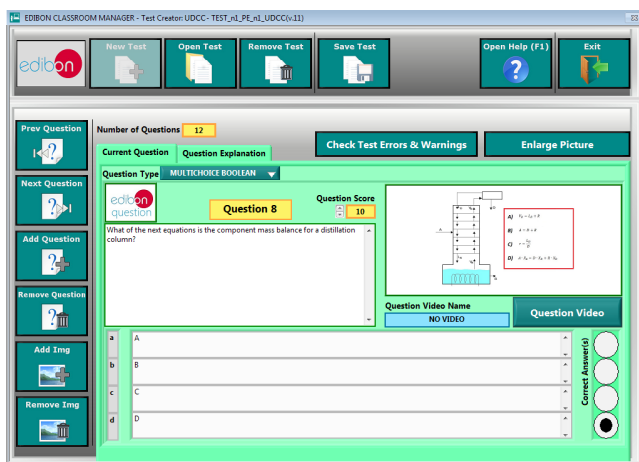
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.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



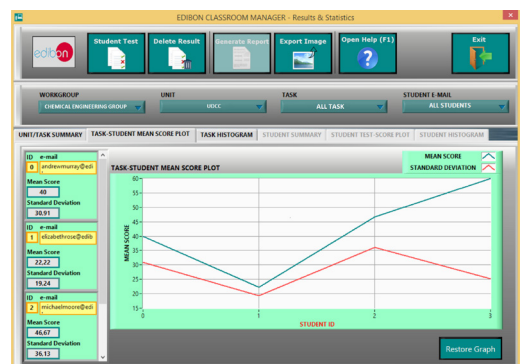
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



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).

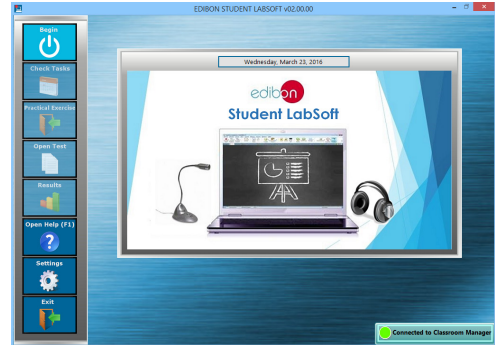
ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are 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:

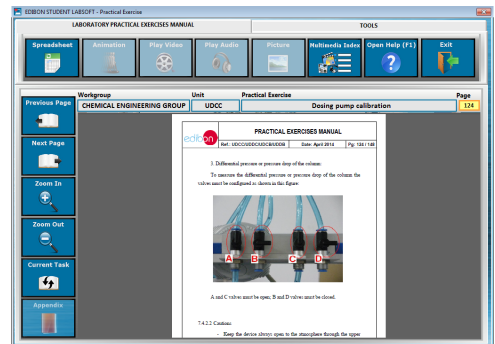
- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- 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:

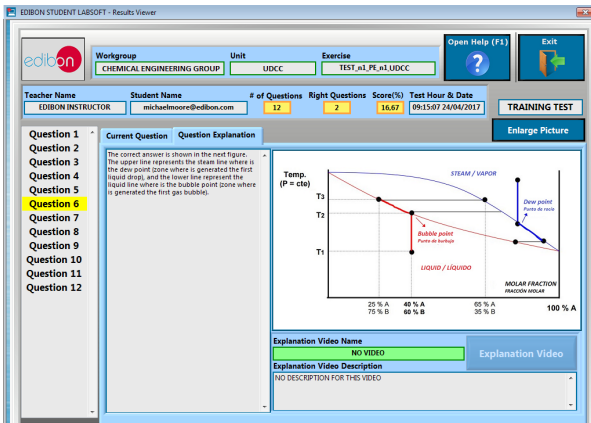
[www.edibon.com/en/files/expansion/ICAI/catalog](http://www.edibon.com/en/files/expansion/ICAI/catalog)



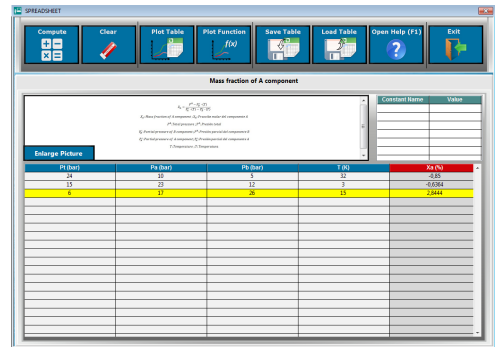
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



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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REPRESENTATIVE:

