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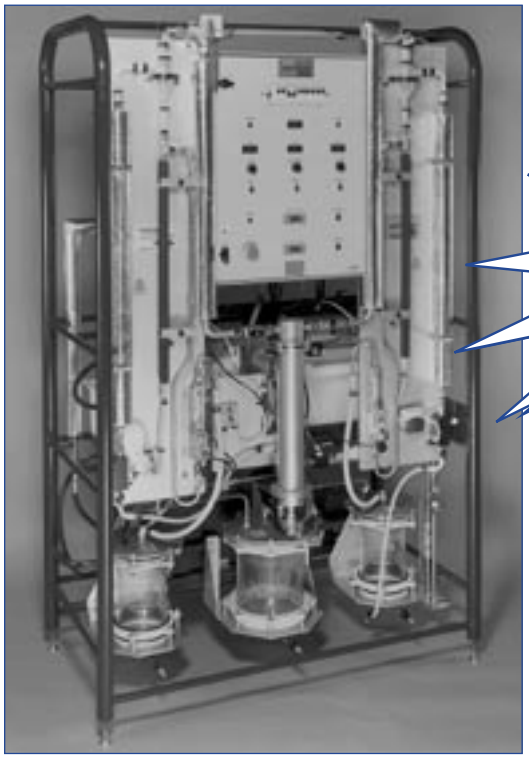
armfield

MODULAR EVAPORATOR SERIES



UOP20
issue 4

Now with NEW USB interface and software

- ***Rising or Falling Film***
- ***Double or Single Effect***
- ***Steam or Electric Heating***
- ***Computer Data Logging and Control***

The UOP20 family is a modular system of teaching evaporators for chemical engineering departments. Using the various modules a wide range of configurations can be implemented: rising or falling film; single or double effect; forward, backward or parallel feed.
The evaporators are fully computer compatible, supplied with educational software including process control and data logging facility, suitable for use with a personal computer.

FEATURES

- *Service unit capable of housing one or two evaporator columns*
- *Either a rising or falling film column may be installed in each position*
- *Service units are available using externally supplied steam as the heating medium or incorporating an internal electric powered pressurised hot water system*
- *Controllable recirculation on each evaporator*
- *High vacuum capability for low temperature evaporation*
- *Built in USB interface to PC for data logging*
- *Most functions are controllable by software or manual control*
- *Educational software is included with the UOP20, giving details of the equipment, evaporation theory, laboratory worksheets, logging of results and analysis of results*
- *Process control investigations may be performed using a PC to control the equipment. The software includes fully configurable PID controllers*
- *Fully instrumented to read product concentration (directly displayed by the software)*

Heat and Mass Transfer Unit Operations

UOP

EXPERIMENTAL CAPABILITIES

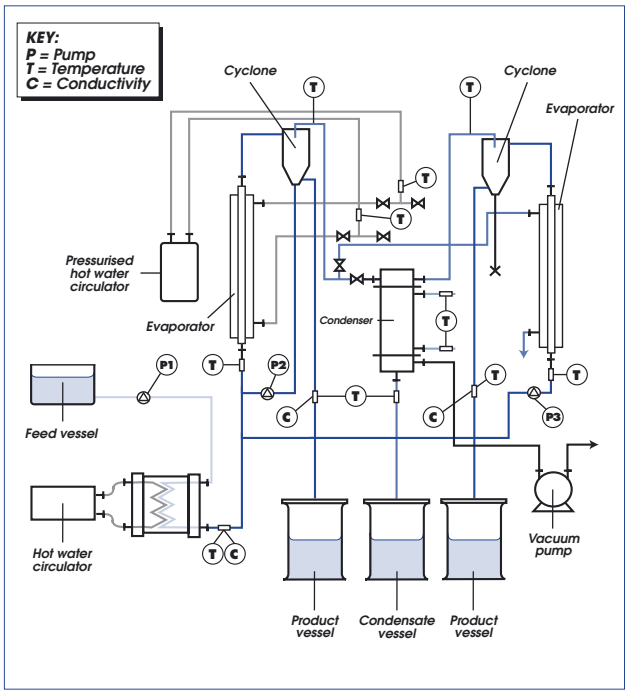
- *mass balances*
- *energy balances*
- *comparison of economies for single effect and double effect evaporation*
- *comparison of economies for forward, backward and parallel feed*
- *variation of evaporation rate with heating medium temperature*
- *variation of evaporation rate with system pressure*
- *dependence of heat transfer co-efficient on circulation rate*
- *dependence of heat transfer co-efficient of condenser on flowrate*
- *process control exercises*

DESCRIPTION

Evaporator Service Unit (UOP20X)

The Evaporator Service Unit (UOP20X) contains all the services and facilities to implement a laboratory evaporation system. It comprises a feed pump and pre-heat system, vacuum pump, condenser, collection vessels and control console containing a full set of instrumentation, all mounted in a sturdy steel framework.

Two mounting positions are provided for the modular evaporation columns.



Process flow diagram UOP20-PHW double effect rising film - parallel feed

Two basic variants of the UOP20X are available, dependent on whether it is required to use steam as the process heating source or pressurised hot water:

*The **UOP20X-STM** includes a steam control valve and steam pressure gauge. It is powered from an external steam source such as the Armfield UOP10 or any other suitable laboratory steam supply.*

*The **UOP20X-PHW** includes a pumped recirculating pressurised hot water system complete with integral 3 term temperature controller. Therefore service requirements are simply an appropriate electrical supply and a cooling water supply.*

Each UOP20X includes a control console, containing all of the electrical components, controls and displays for the evaporator. Twelve process temperatures, three conductivity readings and the vacuum level can be displayed.

It also includes pre-heat temperature controller, speed controls for the feed pump and recirculation pumps, the computer interface and electric mains switching controls.

When coupled to a suitable PC, using the two USB interfaces, a wide range of sophisticated data logging and educational software facilities is available. Furthermore the UOP20 can be operated in remote control mode, whereby the majority of the control panel functions can be implemented directly from the PC. Although a wide range of products may be concentrated in the evaporator, the software includes algorithms so that when potassium chloride is used the computer display indicates the product concentrations directly. These are calculated in real-time from the temperature and conductivity readings. The computer software also includes a fully configurable PID controller for performing process control experiments.

The vacuum pump and display can be used to show the effect of vacuum on evaporation temperature. In a double effect system the vacuum is applied to the second stage.

EVAPORATOR COLUMNS

Each evaporator column contains a stainless steel evaporation tube, within an insulated heated jacket for the hot water or steam. These are mounted on a back plate together with a glass cyclone to separate the concentrated product from the evaporated steam.

Also included on the back plate of each evaporation column is a recirculation pump and associated pipework, together with thermocouples to measure the temperatures of the product and heating fluid at a number of points. Two basic types of evaporation column are available: UOP22, a rising film evaporation column and UOP23, a falling film evaporation column.

A number of variants are defined for each column type, dependent on whether it is a first or second effect unit, and whether it is located in the first or the second position on the UOP20X service unit.

- ***UOP22-11** Rising Film Evaporation Column (1st effect, 1st position)*
- ***UOP22-22** Rising Film Evaporation Column (2nd effect, 2nd position)*
- ***UOP23-11** Falling Film Evaporation Column (1st effect, 1st position)*
- ***UOP23-22** Falling Film Evaporation Column (2nd effect, 2nd position)*
- ***UOP23-12** Falling Film Evaporation Column (1st effect, 2nd position)*

ORDERING INFORMATION

The choice of the evaporator service unit is dependent on whether steam or pressurised hot water is required as the primary heating medium.

The steam powered unit requires an external supply of steam (e.g. the Armfield UOP10), whereas the hot water unit is fully self contained, using an electrically heated recirculating pressurised water system.

***UOP20X-PHW-A:** Evaporator Service Unit*
Services required:
Electricity: 220-240Vac/35A@50Hz

***UOP20X-PHW-G:** Evaporator Service Unit*
Services required:
Electricity: 220-240Vac/35A@60Hz

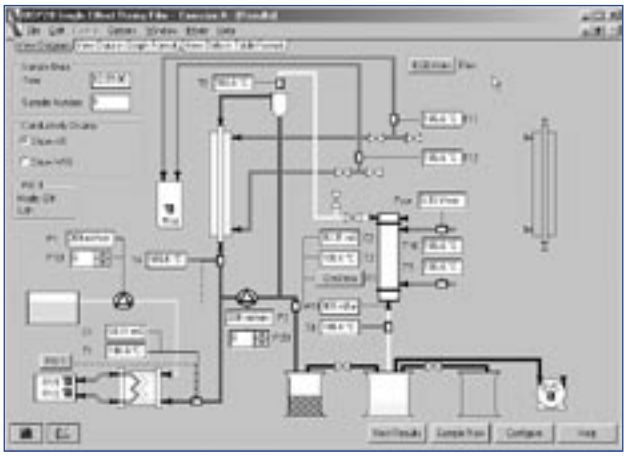
***UOP20X-STM-A:** Evaporator Service Unit*
Services required:
Electricity: 220-240Vac/25A@50Hz
Steam: 10Kg/hr at 2 barg

***UOP20X-STM-G:** Evaporator Service Unit*
Services required:
Electricity: 220-240Vac/25A@60Hz
Steam: 25Kg/hr at 2 barg

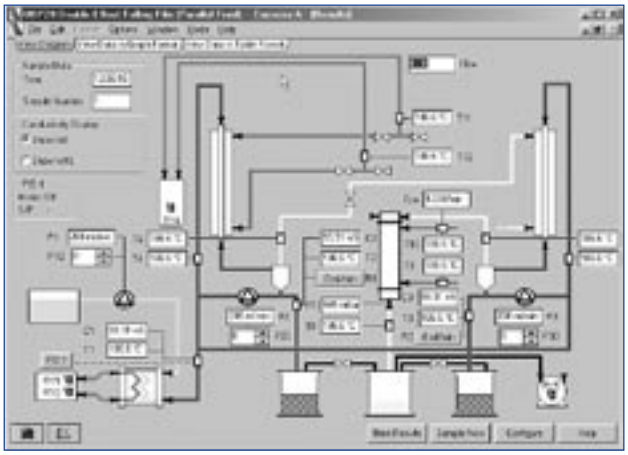
All units require cooling water flow at up to 10 l/min

In addition to the service unit, at least one evaporator column is required, dependent on the required configuration. The following table defines which modules are required in order to implement each configuration:

	MODULES REQUIRED					
Configuration	*UOP20X (PHW or STEAM)*	*UOP22-11*	*UOP22-22*	*UOP23-11*	*UOP23-12*	*UOP23-22*
Single Effect Rising Film	✔	✔				
Double Effect Rising Film	✔	✔	✔			
Single Effect Falling Film	✔			✔		
Double Effect Falling Film	✔			✔		✔
Single Effect Rising Film and Single Effect Falling Film mounted in the same chassis	✔	✔			✔	
Reconfigurable, Single/Double effect Rising Film or Single/Double effect Falling Film	✔	✔	✔	✔		✔



Mimic diagram of single effect rising film evaporator



Mimic diagram of double effect falling film parallel feed evaporator

ORDERING SPECIFICATION

- ***A laboratory evaporation system capable of being configured as rising or falling film, single or double effect.***
- ***Temperature controlled pre-heat stage.***
- ***Adjustable re-circulation on each evaporation stage.***
- ***Manual control console.***
- ***Integral USB interface for computer data logging and control.***
- ***Contains vacuum pump, condenser and condensate vessel.***
- ***Options to operate from external steam supply, or integral electrically heated pressurised hot water circulator.***

SPECIFICATION

Evaporator column length:	*1m*
Pressurised water heater:	*4KW*
Feed pre-heater:	*2KW*
Conductivity displays:	*0-100mS*

ACCESSORIES

UOP10:
If it is required to operate the system from an external steam supply, Armfield can provide a laboratory steam generator with a heat output of 30KW.

Computer (not supplied by Armfield)
A Windows 98, 2000 or XP PC can be used for data logging and control. Two USB ports are required on the PC.

OVERALL DIMENSIONS

Height:	*2.5m*
Width:	*1.5m*
Depth:	*0.9m*

SHIPPING SPECIFICATION

UOP20X:
including up to two evaporation columns:

Volume:	*5m³*
Gross weight:	*450Kg max.*

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