

## Datasheet

# LAB SCALE PERVAPORATION TEST UNITS

Pervatech lab scale pervaporation test units have been developed to conduct laboratory scale pervaporation process experiments using Pervatech membranes and modules.

### TECHNICAL SPECIFICATIONS

#### Scope of supply

The scope of supply for these lab scale pervaporation test units:

- Pervaporation benchtop system: skid mounted on wheels, with leak reservoir
- Vessels, heat exchangers, circulation pump, vacuum pump, chiller, valves, sensors
- Manual, documentation and CE certificate
- All-in-one PC
- Software for control & logging of process parameters, experimental set-up and data acquisition
- FAT and SAT

#### Not included:

- Membranes, modules, seals (these are quoted separately)
- Electricity supply, nitrogen supply
- Site works

#### General specifications

- Feed flow rate: 100-300 liter/h
- Feed pressure range: maximum 10 barg
- Feed operating temperature: 40 °C to 80-150-190 °C.
- In-line heating
- Tubing and vessel material: stainless steel 1.4404 (SS316L), isolated
- Sealing material: EPDM-PC or FFKM
- Vacuum: minimum 3 mbar
- Feed vessels: 5-50 liter, isolated, under nitrogen atmosphere, with forced cooling
- Fractionated condensation:
  - Condenser: cooling by for example chilled water/ glycol
  - Glass permeate collection vessel or SS316L vessel with level control
  - Followed by: Cold trap with dry ice or liquid nitrogen for collection of low boiling permeates

- Feed composition includes water, solvents, organic acids
- Measurement of feed flow rate, pressure, vacuum and temperature
- Pressure safety valve
- Emergency stop
- Possibility to flush with nitrogen
- Skid mounted, to be placed in a fume hood.
- Electrical: 400 V / 50 Hz
- Dimensions L x W x H: to be determined, typically 1500x700x1500 mm

### SYSTEM DESCRIPTION

The pervaporation lab scale test unit consists of

- i) a circulating feed loop, and
- ii) a permeate side under vacuum.

The pervaporation membrane allows the separation of two or more components that are difficult to separate using common thermal separation processes such as distillation.

**Figure 1:** An example of a lab scale pervaporation system; model Pervatech - Low Temperature. This specific system is equipped with a 50-liter feed tank and a 25-liter permeate tank, and is suitable for an operation temperature of maximum 70 °C at atmospheric pressure.

The feed line is heated by an in-line heat exchanger system.



Figure 1

A nitrogen line is to be connected to the feed tank and controlled with a pressure controller to apply a user-defined pressure. When the system is off or in alarm state, the pressure is automatically released.

During the pervaporation process, the vapor of the permeating component is collected from the permeate side of the membrane. The continuous removal of the vapor permeate with a vacuum pump creates a concentration gradient over both sides of the pervaporation membrane. This concentration gradient is the driving force for the separation process.

A fractionated permeate collection is included. In the first step, the vapor is condensed via an in-line heat exchanger (condenser) and is collected in a glass permeate collection vessel or SS316L vessel with level indicator. In this process, tap water cooling is sufficient for operation at around 50 mbar absolute pressure. Chilled water should be used to e.g. 1 °C at a vacuum of 10 mbar. Any non-condensable compounds in this first stage are condensed in a cold trap, cooled by either liquid nitrogen or dry ice (solid CO<sub>2</sub>).

When the permeation process is stopped, the feed tank can be cooled quickly by using the connection to the chiller.

The units require typically 400 V (50 Hz) electrical utilities.

The unit is mounted on a skid on wheels and has a leak collection device.

**Figure 2:** An example of a lab scale pervaporation system (in construction); previous model Pervatech - Combi Organophilic-Hydrophilic. This system is also equipped with a 50-liter feed tank (atmospheric pressure), a 5-liter feed tank (maximum operating pressure 10 barg) and a 15-liter permeate tank.

Figure 2



## SOFTWARE AND SUPPORT LICENSE

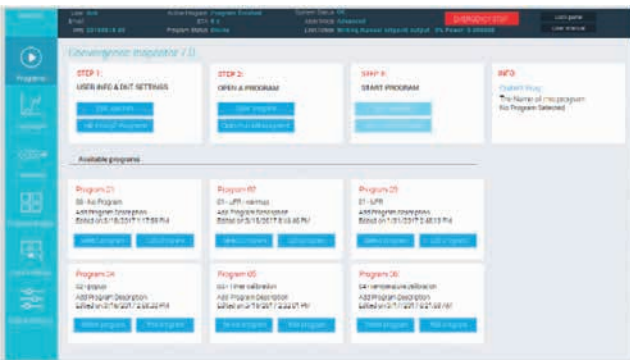
With the Convergence software interface, the users can create their own experiments at different flow rates, temperatures and vacuum pressures. Data collection is a standard feature of the software. An ethernet connection is present for any assistance or remote troubleshooting.

The Software License & Support contains the following services:

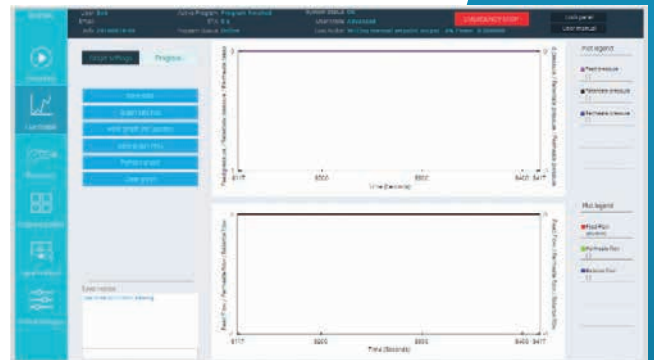
- The use of software delivered by Convergence over the systems lifetime.
- Updates of the Convergence Software
- Support of the Helpdesk for Convergence Inspector related questions and problems (3 non-accumulating support hours per calendar year)
- Remote assistance when software issues arise.

The Helpdesk is available from Monday to Friday from 8:30 – 17:00 (CEST) via email [helpdesk@con-vergence.com](mailto:helpdesk@con-vergence.com) or by telephone via +31 53 461 55 57.

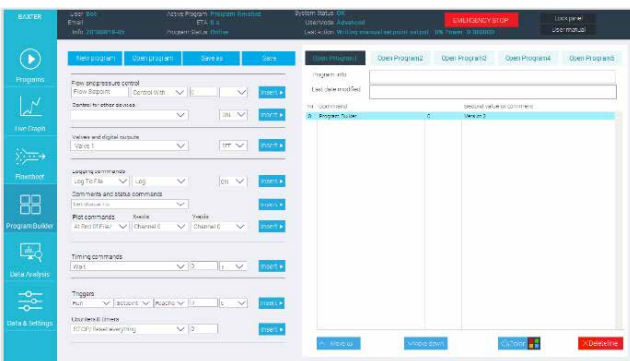
Features and overview of the Convergence Inspector software:



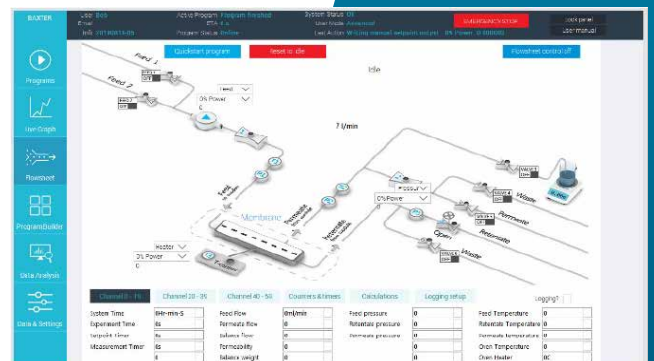
Quick selection of saved programs



Live data monitoring



Program builder



Flowsheet and status overview

## SOME EXAMPLES OF PERVATECH LAB SCALE PERVAPORATION TEST UNIT CONFIGURATIONS (CUSTOM-MADE MODELS AVAILABLE)

Type / Specification	Food	Standard Low-Temperature	Standard	Combi Organophilic-Hydrophilic	Top grade
<b>Description and application</b>	Low-temperature dewatering or organic recovery	Medium-temperature dewatering or organic recovery	Standard-temperature dewatering or organic recovery	Standard- and low-temperature applications in one unit	High-temperature dewatering (e.g. glycols)
<b>Feed</b>	Food products, e.g. vinegar, whiskey	Solvents, aqueous, organic acids	Solvents, aqueous, organic acids	Combi for e.g. butanol recovery followed by butanol dewatering	Glycols, solvents, organic acids
<b>Membrane types (supplied separately)</b>	Pervatech Hybrid Silica HybSi® Acid Resistant Pervatech PDMS, POMS, PEBA (all up to 80 °C) Pervatech Zeolite NaA				
<b>Max. T (°C)</b>	80	130	150	150	190
<b>Max. P (bar)</b>	Atmospheric pressure	10	10	10	10
<b>Feed vessel 1 (liter)</b>	50	5	5	5 (high pressure)	5
<b>Feed vessel 2 (liter)</b>	N.A.	N.A.	N.A.	50 (atmospheric pressure)	N.A.
<b>Permeate vessel</b>	15 L SS316L	Glass	Glass	15 L SS316L	Glass
<b>Minimum vacuum (mbar)</b>	2	2	2	2	2
<b>Sensors / controls / software / data acquisition / automation / FAT / SAT</b>	Included	Included	Included	Included	Included
<b>EX version</b>	Optional	Optional	Optional	Optional	Optional

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