

Pall SBC Crossflow Unit for Piloting and Small Batch Production

Description

The SBC Crossflow Unit is a semi-automated pilot and small batch production system for use with liquid applications in the ink jet and microelectronics industries. This system is designed with the flexibility to run a full length Microza¹, Membralox[®], or Schumasiv[®] crossflow module in a number of different operating modes, including diafiltration, concentration, and purification.

User-friendly and simple to operate, the SBC Crossflow Unit allows easy retrieval of process data² with minimal operator involvement. Values for critical parameters are selected using a simple two-step process that involves a touch screen and pop-up keypad.

Data acquired during a piloting run can be easily pulled and transferred to a .CSV file, which can then be opened in a standard spreadsheet for analysis.² Data transfer can be accomplished on-site or remotely, using either a wireless connection or the unit's designated IP address.

Specifications

Materials of construction

- Tanks and vessels: 304 stainless steel
- Frame: 304 stainless steel
- Piping: 304/304L stainless steel

Dimensions (nominal)

- 1.3 m W x 2.0 m L x 2.2 m H
(4 ft 4 in W x 6 ft 8 in L x 7 ft 3 in H)

Weight (nominal)

- Dry: 773 kg (1700 lbs)
- Wet (in operation): 1090 kg (2400 lbs)

Operating volume (nominal)

- 87–226 L (23–60 gal)

Recirculation capacity

- 70 gpm @ 60 psi



Pall SBC Crossflow Unit

Utilities

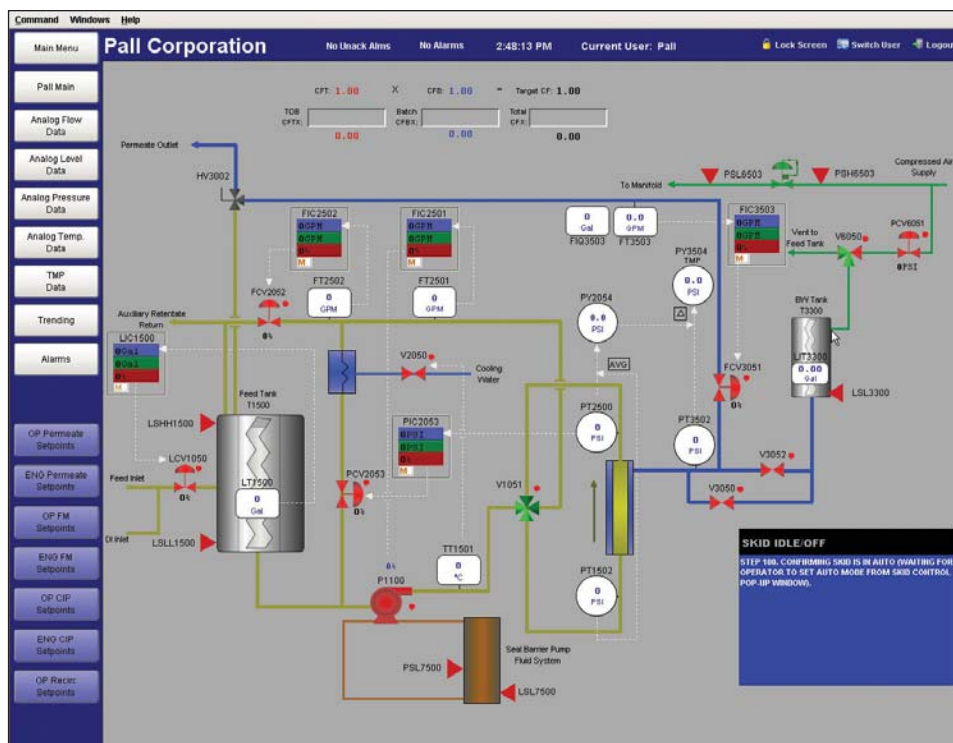
- Power supply: 480 VAC, 3 phase, 60 HZ, 25 Amp breaker
- Air supply: .62 MPa –.68 MPa (90 psig –100 psig)
- Cooling water : Up to 19 lpm @ 4 -18 °C
(5 gpm @ 40-65 °F)

¹ Microza is a trademark of Asahi Kasei Corporation.

² This data is typically used for evaluation and scale-up purposes, as well as optimization of the in-process cleaning protocol.

Collection and Analysis of Data

Optimal filtration of a particular liquid using a crossflow system depends on determining the appropriate specifications for flow rate, pressure, and frequency and duration of in-process flux maintenance. On the SBC Pilot Unit, settings for these parameters correspond to specific values and can be adjusted. Using the pilot unit, testing is conducted at various settings, and data is collected on permeate rate, permeate decay over time, and membrane fouling. Analysis of the data enables optimum system settings to be established, with the ultimate goal of maximizing the average permeate rate and maintaining that permeate rate.



Pall SBC crossflow unit main screen shot

Test data collected from the pilot system can be used to determine the specifications for, and predict the performance of, a full-size, large production system. Specifications include sizing (number of modules), flow rate, pump capacity, and operational guidelines. Crossflow production systems typically require a significant capital investment, and pilot test data is generally indicative of large production system performance. After the specifications have been determined, the economics of the production system, including the customer's return on investment (ROI), can be calculated.

Applications

Crossflow is an ideal filtration method for certain liquid applications commonly used in the ink jet and microelectronics industries. The SBC Crossflow System can be used to successfully remove:

- molecular weight impurities smaller than the desirable pigment particle size distribution during diafiltration of CMYK pigmented dispersions
- pigment and other particulate from wastewater streams so that the water can be reused
- low-molecular-weight contaminants during diafiltration of conductive polymers
- silicon and other substrate materials from various grinding, sawing and shaping processes to enable the reuse of carrier fluids

Modes of Operation for the SBC Crossflow System

The SBC Crossflow System is designed to operate in four different modes: continuous diafiltration, discontinuous diafiltration, batch concentration, and fed-batch concentration.

Continuous Diafiltration

Continuous diafiltration, also known as constant volume diafiltration, is a membrane separation process whereby the diafiltration liquid is continuously added to the feed tank at the same rate as permeate is being generated. The liquid level in the feed tank remains constant during this process.

The permeate volume generated is usually referred to as the number of *diafiltration volumes*. A single diafiltration volume (DV) is the volume of retentate when diafiltration is started. When the volume of permeate collected equals the starting retentate volume, 1 DV has been processed.

In continuous diafiltration, the concentration of particulate and dissolved molecular weight species smaller than the membrane pores decreases with each successive DV added. The concentration of particulate larger than the membrane pores remains constant in the retentate.

Discontinuous Diafiltration

Discontinuous, or stepped, filtration is similar to continuous diafiltration, except that a fixed volume of diafiltration liquid is added in steps, rather than continuously. The level in the feed tank increases with the addition of diafiltration fluid at each step. It gradually decreases as a portion of the feed liquid passes through the crossflow membrane as permeate.

Batch Concentration

Batch concentration is used to concentrate the targeted component in a liquid from an initial volume to a smaller final volume. This is accomplished by passing the fluid through a membrane while retaining the targeted component. The degree to which a fluid is volumetrically concentrated is known as the concentration factor. This factor can be calculated by dividing the initial feed volume by the final concentrated volume.

Fed-batch Concentration

Fed-batch concentration is a membrane separation process that enables the volumetric concentration of a larger volume of liquid than the feed tank can contain. (The SBC System is equipped with a 60-gallon feed tank.) Feed from a larger auxiliary storage tank is transferred to the SBC System feed tank at the same rate as permeate is generated. A constant level of liquid is maintained in the 60-gallon feed tank.

In-process Membrane Flux Maintenance

The SBC Crossflow System is capable of three different automated in-process membrane flux maintenance modes: flow reversal, backwash (reverse filtration) and backpulse.

Flow Reversal

In flow reversal, the direction of the feed flow through the membrane fibers or channels is reversed. This flow reversal changes the direction of shear across the membrane surface, dislodging the fouling layer and restoring the membrane flux. Flow reversal occurs for a short duration periodically during the process (60 seconds every 15-30 minutes).

Backwash (Reverse Filtration)

In this mode, previously generated permeate is driven back through the membrane, dislodging the fouling layer and restoring the membrane flux. Backwash occurs for a short duration periodically during the process (30 seconds every 30 minutes).

Backpulse

Backpulse is used for ceramic modules only. To clean the surface, a small volume of previously generated permeate is quickly driven back through the membrane at high pressure. Typically the backpulse sequence occurs more frequently and for a shorter duration than backwash (1 second every 2-5 minutes).

Membrane Options³

Part Number	Membrane Type	Membrane Pore Size / Area	Channel Inside Diameter mm (in)
USP-343 (PVDF)	Microza	0.1 µm / 3.7 m ² (39.8 ft ²)	1.4 (0.055)
UMP-353 (PVDF)	Microza	0.2 µm / 2.2 m ² (23.7 ft ²)	2.6 (0.102)
XUGP-3043 (PVDF)	Microza	100 kDa / 4.8 m ² (51.7 ft ²)	1.1 (0.043)
ACV-3050 (PAN)	Microza	13 kDa / 3.1 m ² (33.4 ft ²)	1.4 (0.055)
SLP-3053 (PS)	Microza	10 kDa / 4.5 m ² (48 ft ²)	1.4 (0.055)
EP3730/M-3P-SD	Membralox	0.1 µm / 1.05 m ² (11.3 ft ²)	3 (0.118)
EP1940/M-3P-SD	Membralox	0.1 µm / 0.72 m ² (7.75 ft ²)	4 (0.157)
Schumasiv TI 31030 x 04	Schumasiv	0.1 µm / 1.16 m ² (12.5 ft ²)	3 (0.118)
Schumasiv TI 60022 x 01	Schumasiv	0.1 µm / 0.63 m ² (6.8 ft ²)	3.3 (0.130)

³ Not included with system. Must be purchased separately.



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