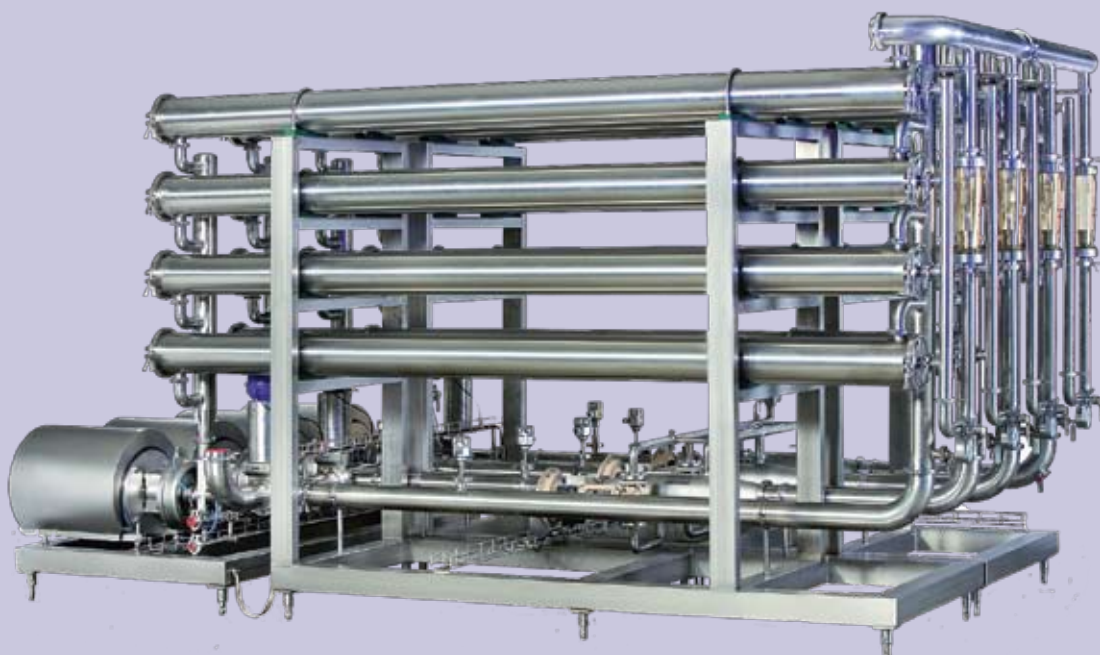




Alfa Laval Membrane-UF system

Ultrafiltration system for continuous concentration and purification



Section of Alfa Laval Membrane-UF 10 system

The Alfa Laval Membrane-UF system is a cross-flow ultrafiltration system designed for automatically controlled continuous product concentration. These systems provide cost-effective standardized solutions for specific concentration requirements and are designed with minimal hold-up volume and with a stringent focus on hygiene throughout.

Applications

The Alfa Laval Membrane-UF system is normally used as a concentration and purification stage within other processes, reducing the volume of a liquid by removing water and other low-molecular substances.

The system can be used for the cost-effective concentration of proteins, gums and other feeds prior to further evaporation. Units of this type are in considerable demand for

installations that process blood plasma, gelatine, egg, pectin extract, carrageenan and chitosane, as well as in the production of natural colours and the recovery of protein from waste streams.

The actual process temperature is related to the particular feed product being treated. Typical temperatures lie in the range 5–90°C (41–194°F).

Design

Alfa Laval Membrane-UF systems are supplied as a frame-mounted unit featuring pre-assembled component items and prefabricated piping. The unit is ready for operation as soon as it is installed and connected to the supply systems for upstream and downstream product, utilities and power.

The piping, pumps, strainers, valves and fittings, as well as the control panel, are all manufactured by Alfa Laval, providing users with a significant advantage in terms of effective service and reduced spare parts inventory.

This pre-assembled, frame-mounted set-up also results in easy, reliable operation along with straightforward maintenance that helps keep downtime to a minimum.

All piping and equipment in contact with the product or with CIP (Cleaning In Place) liquids are of sanitary-level design, and steel parts are made of AISI 316L stainless steel. The spiral membranes also comply with sanitary-level requirements and with all relevant food and dairy standards.

The system is controlled and monitored via a PLC operator panel that includes a motor control centre equipped with frequency drivers on pumps to keep energy consumption down. The system uses 3 x 400 VAC/50 Hz power, with enclosures for motors and a combined control/motor control centre with IP54-standard protection.



Heating/cooling section

The control and operation of the Alfa Laval Membrane-UF system are intended to provide automatically controlled continuous product concentration and purification. Cleaning is based on CIP procedures, controlled and monitored by the operator via the local PLC operator panel.

Operating principle

Alfa Laval Membrane-UF units feature completely automated operation via the easy-to-use MemProC® control system. This includes separate modes for selecting production, cleaning, disinfection and water recirculation operations, complete with all the necessary sub-sequences. This ensures safe, reliable operation of the entire system.

The feed product is introduced into the feed tank system by the level control feed valve. The feed pump then pumps the product to a number of membrane filtration stages connected in series – the so-called loops. Each loop consists of a number of spiral housing modules, containing the unique Alfa Laval spiral ultrafiltration membranes. These membranes permit salts and water to pass into the permeate stream, while the proteins, gums, etc. are rejected and thus become increasingly concentrated as they pass through one loop after another.

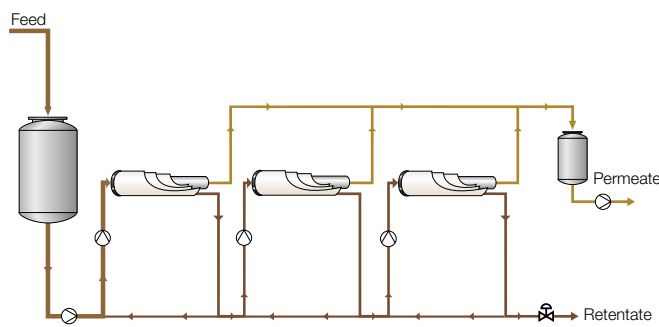
In each loop, the recirculation pump system provides these membranes with the cross-flow rate that is appropriate for keeping fouling to the minimum, balanced against the overall capacity of the system. The unit also contains a cooling system for removing any heat generated by the pumps.

The permeate collected from the loops enters the permeate tank system, where the level control permeate pump discharges it upstream or downstream for either recycling or disposal via a drain system.

The retentate flow rate output is normally controlled by a flow ratio system – the so-called Volumetric Concentration Factor (VCF) value – or by an optional refractometer/density in-line instrument to obtain the desired product concentration or volume reduction.

When a production cycle has been completed, the product is displaced out of the system using water, to ensure maximum product recovery. This displacement sequence is followed by a water flushing step to remove any product left behind on the membrane surface.

The next step is a CIP sequence, the details of which depend on the specifications of the individual feed product concentration process.



Overview of system layout

Additional systems and equipment

The following systems and equipment are available as optional extras.

1. A special heating/cooling section for the feed solution and to recover the heat from the outgoing streams. These sections are equipped with a retentate pump. The heat exchanger incorporates three sections – one for heating incoming product, one as a heat exchanger for the permeate/incoming product, and one as a heat exchanger for the retentate/incoming product.
2. In-line refractometer instrument of the K-Patent type to control product concentration in the final loop.
3. Loop plug-flow system for reducing the quantities of flushing water needed in the CIP sequence, by having a valve system in each loop. This makes it possible to include a clearly defined flushing-out sequence when using cleaning agents.
4. Heating section for CIP solution. This section uses low-pressure steam as the source of heat and is equipped with a heat exchanger, a temperature transmitter and a control valve system.
5. External CIP valve system with three diverting valves. This is used for cleaning external feed, retentate and permeate lines.

Specifications

| | Alfa Laval Membrane-UF 2 | Alfa Laval Membrane-UF 4 | Alfa Laval Membrane-UF 7 | Alfa Laval Membrane-UF 10 |
|---|-----------------------------|-----------------------------|-----------------------------|------------------------------|
| Operating time (hours/day) | 12–20 | 12–20 | 12–20 | 12–20 |
| CIP (hours/day) | 3–4 | 3–4 | 3–4 | 3–4 |
| Number of loops | 2 | 2 | 3 | 4 |
| Number of modules (housings) | 6 | 12 | 18 | 24 |
| Type of modules (housings) | M6.3-3-PN16 | M6.3-3-PN16 | M6.3-3-PN16 | M6.3-3-PN16 |
| Type of spiral | 6338 | 6338 | 6338 | 6338 |
| Number of spirals | 18 | 36 | 54 | 72 |
| Installed power (kW) | 52 | 81 | 113 | 146 |
| Water consumption m ³ / CIP sequence (US gal) | 15 (3,963) | 20 (5,283) | 25 (6,604) | 30 (7,925) |
| Pump seals m ³ /day (GPD) | 0.2 (52.83) | 0.3 (79.25) | 0.4 (105.7) | 0.5 (132.1) |
| CIP chemicals kg/sequence (lb) | 7–12 (15 - 26) | 10–15 (22 - 33) | 15–20 (33 - 44) | 20–25 (44 - 55) |
| Plant dimension required, L x B x H (m) | 4.5 x 4.5 x 2.5 | 4.5 x 4.5 x 2.5 | 5.5 x 4.5 x 2.5 | 6.5 x 4.5 x 2.5 |
| Plant dimension required, L x B x H (ft) | 14.76x14.76x8.20 | 14.76x14.76x8.20 | 18.04x14.76x8.20 | 21.33x14.76x8.20 |
| Space required, L x B x H (m) | 5 x 6 x 2.5 | 6 x 6 x 2.5 | 7 x 6 x 2.5 | 8 x 6 x 2.5 |
| Space required, L x B x H (ft) | 16.4x19.69x8.20 | 19.69x19.69x8.20 | 22.97x19.69x8.20 | 26.25x19.69x8.20 |
| Weight kg (lb) | 3200 (7,055) | 4400 (9,700) | 6300 (13,890) | 7900 (17,420) |
| Noise level | < 80 dB (A) | < 80 dB (A) | < 80 dB (A) | < 80 dB (A) |
| Feed operation pressure bar (psi) | 2–4 (29-58) | 2–4 (29-58) | 2–4 (29-58) | 2–4 (29-58) |

How to contact Alfa Laval

Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com.

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