



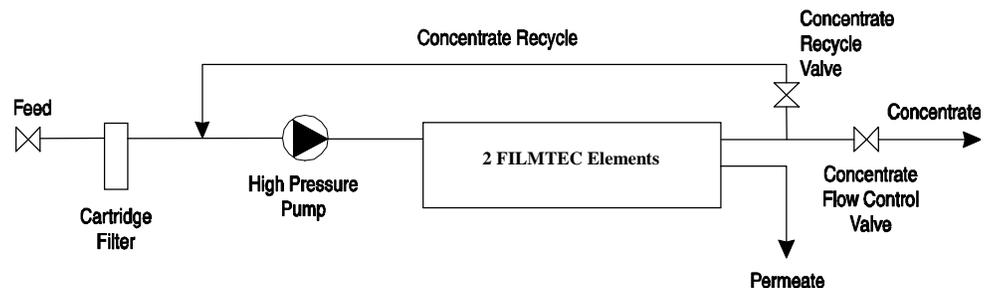
## FILMTEC Membranes System Design: Single-Module System

### Single-Module System

A module consists of a pressure vessel with up to eight membrane elements, which are connected in series. The concentrate of the first element becomes the feed to the second, and so on. The product tubes of all elements are coupled and connected to the module permeate port. The permeate port may be located on the feed end or on the concentrate end of the module.

Single-module systems are chosen when only one or a few membrane elements are needed for the specified permeate flow. Figure 3.3 shows a module containing two FILMTEC™ elements. Feed water enters the system through the feed valve and flows through the cartridge filter to the high-pressure pump. Alternate means of controlling pump discharge pressure are described in [High Pressure Pump \(Section 3.13.1\)](#).

Figure 3.3 Single-module system



From the high-pressure pump, the feed water flows to the feed inlet connection of the module. The product stream should leave the module at no more than 5 psi (0.3 bar) over atmospheric pressure. However, higher permeate pressure is sometimes required, e.g., to feed the post-treatment section or to distribute the product without further pumping. Then the feed pressure must be increased by the required value of the permeate pressure, but the specified maximum feed pressure must be observed. In this case, extreme care must be exercised so that at any time, especially at emergency shutdowns, the permeate pressure does not exceed the feed pressure by more than 5 psi (0.3 bar). The maximum permissible permeate pressure is discussed in the [Pressure Vessels \(Section 3.13.2\)](#).

The concentrate leaves the concentrate outlet connection at essentially the feed pressure. Pressure drop will usually amount to 5–30 psi (0.3–2 bar) from feed inlet to concentrate outlet, depending on the number of membrane elements, the feed flow velocity and the temperature. The concentrate flow rate is controlled by the concentrate flow control valve. The system recovery is controlled by this valve and must never exceed the design set value.

## Single-Module System (cont.)

In single-module systems, concentrate recycling is usually required to comply with the guidelines for element recovery. To achieve system recovery of more than 50%, a part of the concentrate leaving the module goes to drain, while the other part is recycled and added to the suction side of the high-pressure pump, thus increasing the feed flow to the module. A high fraction of the concentrate being recycled helps reduce element recovery and thus the risk of fouling. On the other hand, it has the following drawbacks:

- Larger (more expensive) high pressure pump.
- Higher energy consumption.
- Permeate quality decreases with more concentrate being recycled and added to the feed water.
- The rinse-out time at start-up after preservation or cleaning can be long. Preferably, no concentrate should be recycled during the rinse-out period.

### FILMTEC Membranes

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