FILMTEC Membranes
System Design: System Components

Tanks

Storing water in tanks should be generally kept at a minimum. When tanks are used, the inlet and outlet should be placed that no stagnant zones are permitted. The tanks should be protected from dust and microbiological contamination. In critical applications tanks are closed and vented through a HEPA-filter.

A feed tank is needed to provide the reaction time (20–30 min) when chlorine is used. The free volume of media filters can be used for this purpose as well. Feed tanks are also frequently used as a buffer to allow continuous operation of the RO or NF system (e.g., during backwash of filters). Systems that are operated in the batch or semi-batch mode require a feed tank.

A permeate tank is typically employed when the permeate is the product. Plant start-ups and shutdowns are initiated by low-level and high-level signals from the permeate tank. The system capacity and the tank size should be designed so that the RO or NF plant is allowed to run for several hours continuously. The less frequently the plant is shut down; the better the system performance.

A draw-back tank is a small tank in the permeate line that provides enough volume for natural osmosis back-flow when the system shuts down. It is typically employed in seawater systems, but not in brackish water systems. An empty draw-back tank can cause air to be sucked back into the FILMTEC™ elements. This may create the following problems:

- Contamination of the permeate side of the membrane by airborne microbes and fungi.
- Hydraulic shocks and slugs of air that upset meters and set point controllers when the air is expelled from the system on the next start-up.
- Drying of the membrane (flux loss).
- If the feed water is in a reduced status and contains H_2S, Fe^{2+}, Mn^{2+}, etc., the air intrusion may cause fouling of the membrane by oxidized and precipitated colloidal matter (see *Treatment of Feedwater Containing Hydrogen Sulfide - Section 2.11*).

If the product water from an RO system is chlorinated, care must be exercised to ensure that the chlorine does not migrate back to the membrane. Air breaks should be employed appropriately.

If a draw-back tank is used, its water level should be higher than the highest pressure vessel, but not exceeding 9.8 ft (3 m) from the lowest vessel. To prevent contamination, the flow is in at the bottom and out at the top, and the tank must be covered. Post-chlorination if performed must be done downstream of this tank.

The volume of a draw-back tank can be sized as follows:

$$V_{DBT} = (25T_E) - V_{PP}$$

where:

V_{DBT} = Volume of draw-back tank (in liters)
T_E = Number of installed elements
V_{PP} = Volume of permeate piping between pressure vessels and draw-back tank (in liters)

Tanks (cont.)

Dosing tanks are required when chemicals are added to the feed water. They should be sized typically for a daily refill.

A cleaning tank is part of the equipment described in *Cleaning Equipment (Section 6.4)*.

Optional Equipment

Various optional equipment and features are useful in operating and monitoring the system:

- A shutdown flush system flushes the feed-concentrate line with pre-treated feed water or with permeate after shutdown. When antiscalants are used, a flush system is mandatory.
- Alarms for
  - High permeate conductivity
  - High concentrate conductivity
  - Low feed pH
  - High feed pH
  - High feed hardness
  - High feed temperature
  - Low level in dosing tank
- Continuous recorder for
  - Feed temperature
  - Feed pH
  - Feed and permeate conductivity
  - Feed SDI
  - Feed ORP
  - Feed, permeate and concentrate pressure
  - Permeate and concentrate flow

Ideally, a monitoring system is installed that allows on-line recording and processing of the important operating data of the system. More information is available in *Record Keeping (Section 5.6)*.

Control and motor starter panel with automation ensuring a safe plant operation. Automation for filter backwash, membrane cleanings and plant flush outs can be incorporated.

- Clean, dry air system including compressor, air dryer, air control stations and complete pipe systems.
- Spare parts for 1 or 2 years of normal operation.
- Tools for general and special services.
- Options such as training, supervision and maintenance.

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