

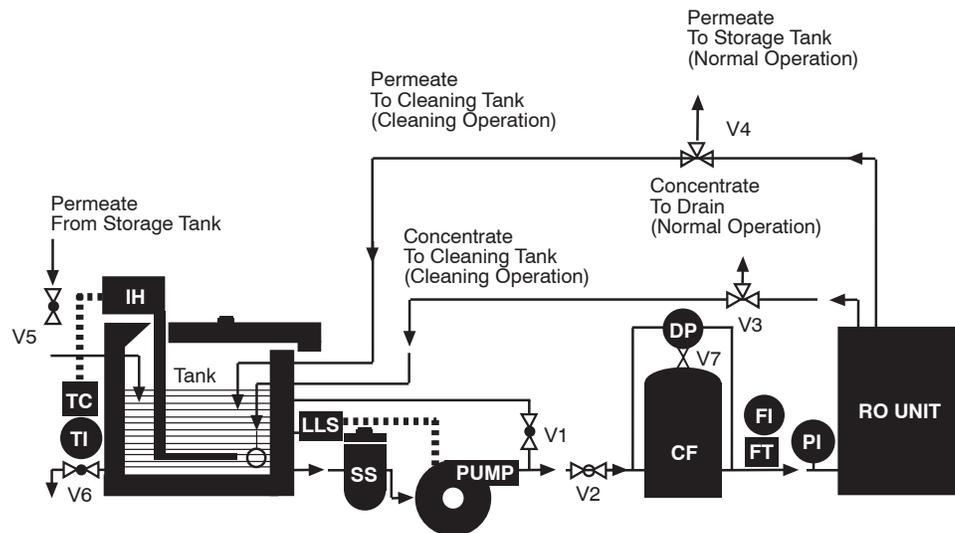


FILMTEC Membranes Cleaning and Sanitization: Cleaning Equipment

Cleaning Equipment

The equipment for cleaning is shown in the cleaning system flow diagram (Figure 6.1). The pH of cleaning solutions used with FILMTEC™ elements can be in the range of 1–13 (see Table 6.1), and therefore, non-corroding materials of construction should be used in the cleaning system.

Figure 6.1 Cleaning system flow diagram



- | | |
|--|---|
| TANK Chemical Mixing Tank, polypropylene or FRP | DP Differential Pressure Gauge |
| IH Immersion Heater (may be replaced by cooling coil for some site locations) | FI Flow Indicator |
| TI Temperature Indicator | FT Flow Transmitter (optional) |
| TC Temperature Control | PI Pressure Indicator |
| LLS Lower Level Switch to shut off pump | V1 Pump Recirculation Valve, CPVC |
| SS Security Screen-100 mesh | V2 Flow Control Valve, CPVC |
| PUMP Low-Pressure Pump, 316 SS or non-metallic composite | V3 Concentrate Valve, CPVC 3-way valve |
| CF Cartridge Filter, 5-10 micron polypropylene with PVC, FRP, or SS housing | V4 Permeate Valve, CPVC 3-way valve |
| | V5 Permeate Inlet Valve, CPVC |
| | V6 Tank Drain Valve, PVC, or CPVC |
| | V7 Purge Valve, SS, PVC, or CPVC |

Table 6.1 pH range and temperature limits during cleaning

Element type	Max Temp 50°C (122°F) pH range	Max Temp 45°C (113°F) pH range	Max Temp 35°C (95 °F) pH range	Max Temp 25°C (77°F) pH range
BW30, BW30LE, LE, XLE, TW30, TW30HP, NF90	Please contact Dow for assistance	1 - 10.5	1 - 12	1 - 13
SW30HR, SW30HR LE, SW30XLE, SW30	Please contact Dow for assistance	1 - 10.5	1 - 12	1 - 13
NF200, NF270	Not allowed	3 - 10	1 - 11	1 - 12
SR90	Not allowed	3 - 10	1 - 11	1 - 12

- The mixing tank should be constructed of polypropylene or fiberglass-reinforced plastic (FRP). The tank should be provided with a removable cover and a temperature gauge. The cleaning procedure is more effective when performed at a warm temperature, and we recommend that the solution be maintained according to the pH and temperature guidelines listed in Table 6.1. We do not recommend using a cleaning temperature below 15°C because of the very slow chemical kinetics at low temperatures. In addition, chemicals such as sodium lauryl sulfate might precipitate at low temperatures. Cooling may also be required in certain geographic regions, so both heating/cooling requirements must be considered during the design. **A rule of thumb in sizing a cleaning tank is to use the approximate volume of the empty pressure vessels and then add the volume of the feed and return hoses or pipes.** For example, to clean ten 8-inch-diameter pressure vessels with six elements per vessel, the following calculations would apply:

A. Volume in Vessels

$$V_{\text{vessel}} = \pi r^2 l; \text{ where } r = \text{radius}; l = \text{length}$$

$$V_{\text{vessel}} = \frac{3.14(4 \text{ in.})^2(20 \text{ ft})(7.48 \text{ gal/ft}^3)}{144 \text{ in.}^2/\text{ft}^2}$$

$$V_{\text{vessel}} = 52.2 \text{ gal/vessel}$$

$$V_{10 \text{ vessels}} = 52 \times 10 = 522 \text{ gal (2.0 m}^3\text{)}$$

B. Volume in Pipes, assume 50 ft length total; 4-in. SCH 80 pipe

$$V_{\text{pipe}} = \pi r^2 l; \text{ where } r = \text{radius}; l = \text{length}$$

$$V_{\text{pipe}} = \frac{3.14(1.91 \text{ in.})^2(50 \text{ ft})(7.48 \text{ gal/ft}^3)}{144 \text{ in.}^2/\text{ft}^2}$$

$$V_{\text{pipe}} = 30 \text{ gal}$$

$$V_{10 \text{ vessels} + \text{pipe}} = 522 + 30 = 552 \text{ gal (2.1 m}^3\text{)}$$

Therefore, the cleaning tank should be about 550 gal (2.1 m³).

- The cleaning pump should be sized for the flows and pressures given in Table 6.2, making allowances for pressure loss in the piping and across the cartridge filter. The pump should be constructed of 316 SS or nonmetallic composite polyesters.

Table 6.2 Recommended feed flow rate per pressure vessel during high flow rate recycle

Feed pressure ¹		Element diameter inches	Feed flow rate per pressure vessel	
psig	bar		gpm	m ³ /h
20 - 60	1.5 - 4.0	2.5	3 - 5	0.7 - 1.2
20 - 60	1.5 - 4.0	4 ²	8 - 10	1.8 - 2.3
20 - 60	1.5 - 4.0	6	16 - 20	3.6 - 4.5
20 - 60	1.5 - 4.0	8	30 - 40	6.0 - 9.1
20 - 60	1.5 - 4.0	8 ³	35 - 45	8.0 - 10.2

¹ Dependent on number of elements in pressure vessel.

² 4-inch full fit elements should be cleaned at 12 - 14 gpm (2.7 - 3.2 m³/hr).

³ For full fit and 440 sq. ft. area elements.

3. Appropriate valves, flow meters and pressure gauges should be installed to adequately control the flow. Service lines may be either hard-piped or hoses. In either case, the flow rate should be a moderate 10 ft/s (3 m/s) or less.
4. Ensure that the concentrate and permeate return lines are submerged in the cleaning tank to minimize foaming.

FILMTEC Membranes

For more information about FILMTEC membranes, call the Dow Liquid

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