# FILMTEC™ Membranes

Troubleshooting: Symptoms of Trouble, Causes and Corrective Measures

## High Solute Passage

### High Solute Passage and Normal Permeate Flow

High solute passage at normal permeate flow may have different causes.

#### a. Leaking O-Ring

Leaking O-rings can be detected by the probing technique (see *Probing - Section 8.3*). Inspect O-rings of couplers, adapters and end plugs for correct installation and as-new condition. Replace old and damaged O-rings. Also see *Interconnector Technology (Section 4.5)*.

O-rings may leak after exposure to certain chemicals, or to mechanical stress, e.g. element movement caused by water hammer. Proper shimming of the elements in a pressure vessel is essential to minimize the wear to the seals (see *Shimming Elements – Section 4.3*). Sometimes, O-rings have simply not been installed, or they have been improperly installed or moved out of their proper location during element loading. For replacement O-rings, see Table 4.1: FILMTEC™ interconnector summary in *Interconnector Technology (Section 4.5)*.

#### b. Telescoping

FILMTEC elements can be mechanically damaged by an effect called telescoping, where the outer membrane layers of the element unravel and extend downstream past the remaining layers. A modest telescoping does not necessarily damage the membrane, but in more severe cases the glue line and/or the membrane can be ruptured.

Telescoping is caused by excessive pressure drop from feed to concentrate. Make sure that a thrust ring is used with eight inch elements to support the elements' outer diameters.

The operating conditions that lead to excessive pressure drop are detailed in *High Differential Pressure (Section 8.5.3)*. Telescoping damage can be identified by probing and by a leak test (see *Vacuum Decay Test – Section 8.4.4*). Replace the damaged element(s) and correct the causes.

#### c. Membrane Surface Abrasion

Crystalline or sharp-edged metallic particles in the feed water may enter into the feed channels and scratch the membrane surface. This would cause salt passage increase from the lead elements. Check the incoming water for such particles. Microscopic inspection of the membrane surface will also reveal the damage. Damaged membranes must be replaced. The prefiltration must be verified to cope with this problem. Ensure that no particles are released from the pump and the high pressure piping, and the piping has been rinsed out before the start-up.

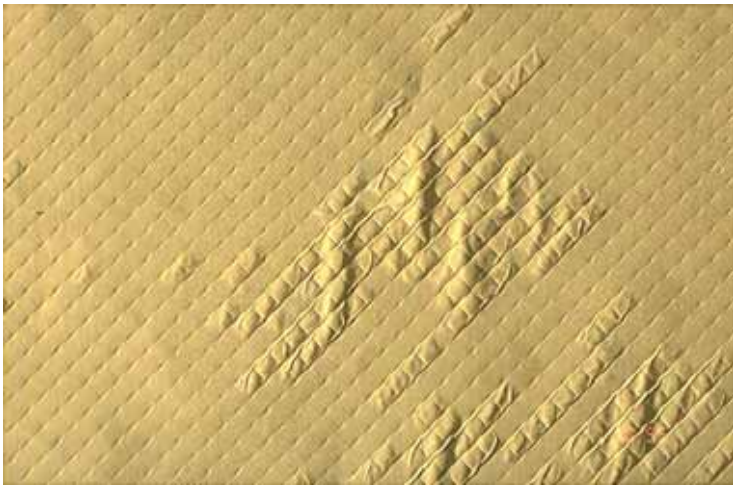
#### d. Permeate Backpressure

When the permeate pressure exceeds the concentrate pressure by more than 5 psi (0.3 bar) at any time, the membrane may tear. The damage can be identified by probing and by the leak test (see *Vacuum Decay Test – Section 8.4.4*) and confirmed by a visual inspection during autopsy.

## High Solute Passage (cont.)

When a leaf of a backpressure damaged element is unrolled, the outer membrane typically shows creases parallel to the permeate tube, usually close to the outer glue line. The membrane delaminates and forms blisters against the feed spacer (see Figure 8.8). The rupture of the membrane occurs mostly in the edges between the feed-side glue line, the outer glue line, and the concentrate-side glue line.

Figure 8.8 Picture of membrane with permeate backpressure damage



### High Solute Passage and High Permeate Flow

#### a. Membrane Oxidation

A high salt passage in combination with a higher than normal permeate flow is mostly due to oxidation damage. When free chlorine, bromine, ozone or other oxidizing chemicals are present in the incoming water, the front end elements are typically more affected than the others. A neutral to alkaline pH favors the attack to the membrane.

Oxidation damage may also occur by disinfecting with oxidizing agents, when pH and temperature limits are not observed, or when the oxidation is catalyzed by the presence of iron or other metals (see *Sanitizing RO and NF membrane systems (Section 6.7*). In this case, a uniform damage is likely.

A FILMTEC™ element with just oxidation damaged membrane is still mechanically intact when tested with the *vacuum decay test (Section 8.4.4)*. The chemical membrane damage can be made visible by a dye test on the element or on membrane coupons (see *Autopsy – Section 8.4.7*). Autopsy of one element and analysis of the membrane can be used to confirm oxidation damage. No corrective action is possible. All damaged elements must be replaced.

#### b. Leak

Severe mechanical damage of the element or of the permeate tubing can allow feed or concentrate to penetrate into the permeate, especially when working at high pressures. The vacuum test will show a distinct positive response. Possible causes are discussed in the next section.

FILMTEC™ Membranes

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