



FILMTEC Membranes

Basics of RO and NF: Element Construction

Element Construction

FILMTEC™ membranes are thin film composite membranes packed in a spiral wound configuration. Spiral wound designs offer many advantages compared to other module designs, such as tubular, plate and frame and hollow fiber module design for most of the reverse osmosis applications in water treatment. Typically, a spiral wound configuration offers significantly lower replacement costs, simpler plumbing systems, easier maintenance and greater design freedom than other configurations, making it the industry standard for reverse osmosis and nanofiltration membranes in water treatment.

The construction of a spiral wound FILMTEC membrane element as well as its installation in a pressure vessel is schematically shown in Figure 1.13. A FILMTEC element contains from one, to more than 30 membrane leaves, depending on the element diameter and element type. Using FilmTec's unique automated manufacturing process, each leaf is made of two membrane sheets glued together back-to-back with a permeate spacer in-between them. FilmTec's automated process produces consistent glue lines about 1.5 in (4 cm) wide that seal the inner (permeate) side of the leaf against the outer (feed/concentrate) side. There is a side glue line at the feed end and at the concentrate end of the element, and a closing glue line at the outer diameter of the element. The open side of the leaf is connected to and sealed against the perforated central part of the product water tube, which collects the permeate from all leaves. The leaves are rolled up with a sheet of feed spacer between each of them, which provides the channel for the feed and concentrate flow. In operation, the feed water enters the face of the element through the feed spacer channels and exits on the opposite end as concentrate. A part of the feed water – typically 10-20 % – permeates through the membrane into the leaves and exits the permeate water tube.

When elements are used for high permeate production rates, the pressure drop of the permeate flow inside the leaves reduces the efficiency of the element. Therefore FILMTEC elements have been optimized with a higher number of shorter membrane leaves and thin and consistent glue lines. The FILMTEC element construction also optimizes the actual active membrane area (the area inside the glue lines) and the thickness of the feed spacer. Element productivity is enhanced by high active area while a thick feed spacer reduces fouling and increases cleaning success. Such precision in element manufacture can only be achieved by using advanced automated precision manufacturing equipment. A cross-section of a permeate water tube with attached leaves is shown in Figure 1.14.

In membrane systems the elements are placed in series inside of a pressure vessel. The concentrate of the first element becomes the feed to the second element and so on. The permeate tubes are connected with interconnectors (also called couplers), and the combined total permeate exits the pressure vessel at one side (sometimes at both sides) of the vessel.

Figure 1.13 Construction of spiral wound FILMTEC RO membrane element

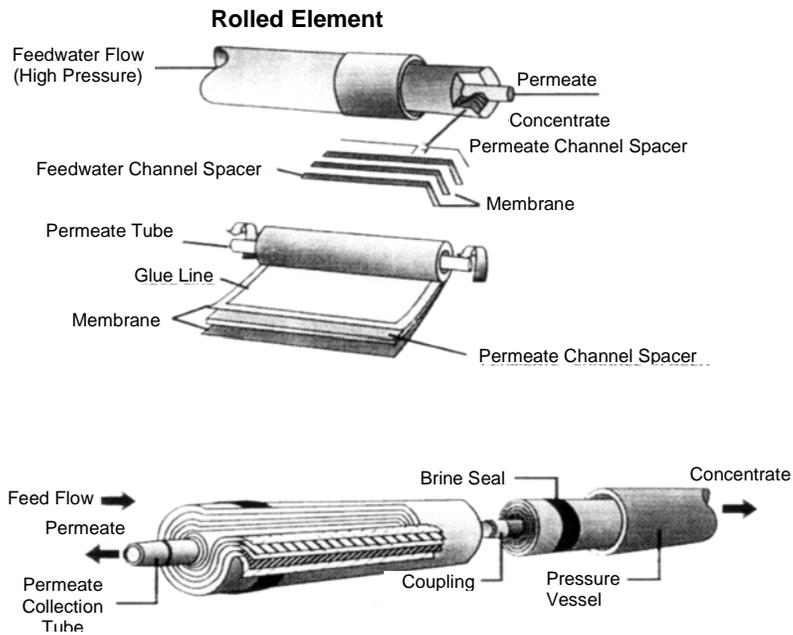
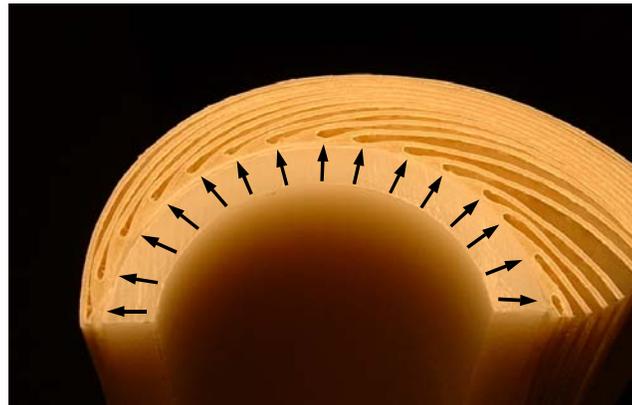


Figure 1.14 Cross-section of a permeate water tube through the side glue lines of the leaves (arrows indicate even spacing of leaves)



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