Introduction

Probing is a means of determining individual membrane product quality from membranes operating in a system. It is used to identify problematic areas from within a vessel, and to determine if a high conductivity reading is due to "o" ring failures or to membrane fouling or damage.

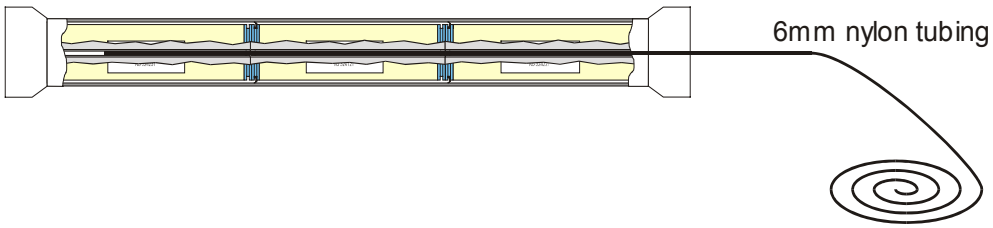


Figure 1

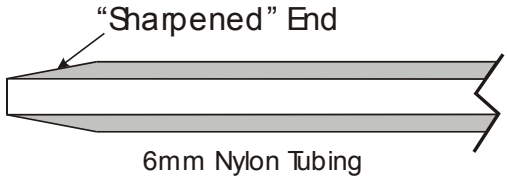
Method

By inserting a length of flexible tubing into the permeate tube, the permeate at points along the vessel can be sampled. A simple conductivity check is normally sufficient to measure the water quality and determine if the vessel is performing properly. By marking specific lengths on the flexible tubing, the distance into the permeate tube can be estimated and the point at which the sample is being taken be estimated.

The points of failure are most likely to be at each end of the element, caused by o-ring failure on the interconnectors. Therefore the points 100mm either side of the inteconnectors are the most important to probe to determine where the failure has occurred.

Any flexible tubing will suffice, providing it can be easily inserted into the permeate tube without producing a significant obstruction to flow. $^{1}/_{4}$ inch (6mm) nylon tubing is the most commonly used. A semi rigid tube is more suitable as this is easier to push along the permeate tube. A tube gland can be used to prevent leakage from the piping system.

A method to prevent the end of the tube snagging on the interconnectors is recommended. Either the end of the tube is "sharpened" to provide a sloped leading edge to the tube, or a test tube brush is fixed to the end of the tubing to hold the end of the tube away from the inner walls.



The quality of water an element produces is dependent, amongst other parameters, on its position within a vessel. As the feed water passes through the vessel, its salt concentration increases. The permeate quality from an element is proportional to the feed water concentration, therefore the permeate from successive elements in a vessel will have a higher salt concentration.

The conductivity of the water can be plotted against the distance along the permeate tube. The shape of the curve will depend on whether permeate is being drawn from the feed end or the concentrate end of

the vessel, as shown in Figure 3. The overall permeate quality is not affected, and

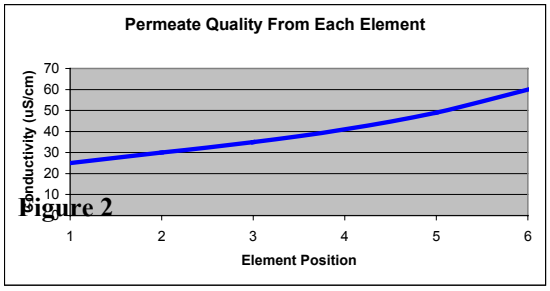


Figure 2

in the example shown the final water conductivity is 38uS.

If a problem has occurred, the curve will have an unusual shape, or the conductivity will be higher over the whole vessel.

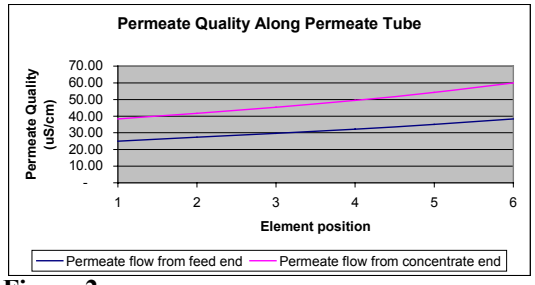


Figure 2

If an o-ring on an interconnector has failed, then the curve will show a sudden increase at the point of failure, then a decline along the rest of the vessel as the permeate produced by the remaining elements dilutes the effect of the failed o-ring. Figure 4 shows the effect of a failed o-ring at the third element, on a system on which the permeate is being taken from the concentrate end.

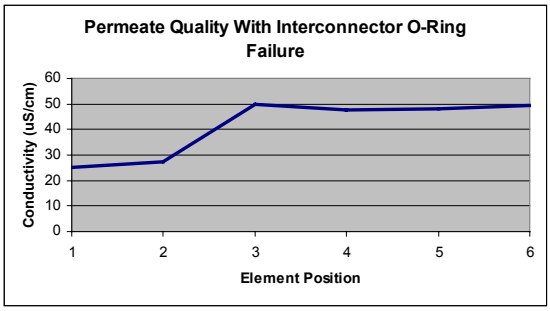


Figure 4

Figure 5 shows the effect of an o-ring failure on the interconnector between the vessel end assembly and the lead element. The permeate produced from the remaining elements dilutes the leakage, reducing the conductivity through the vessel. If the permeate is taken from the system at the end of the vessel where the leak has occurred, then the probing will not show

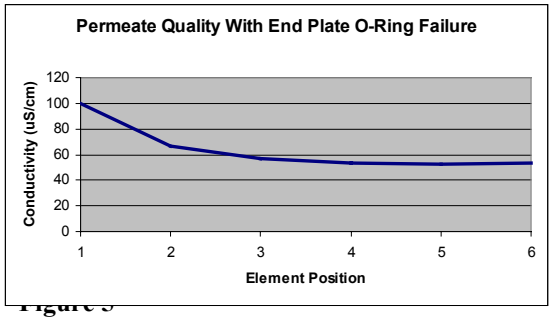


Figure 3

any increase in conductivity through the length of the permeate tube. Instead, there will be a significant discrepancy between the conductivity produced by the whole vessel, and the conductivity produced by the probe.

Once an o-ring failure has been identified as the likely cause of an increase in permeate conductivity, remedial action may be taken.

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