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The Correct Way To Do A

Membrane Change Out

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The objective of this article is to go through the steps of a successful membrane change out from a service technician's point of view. We will look at the preparation, end cap removable, membrane removable, new membrane installation, end cap reinstallation, startup, and some helpful hints.

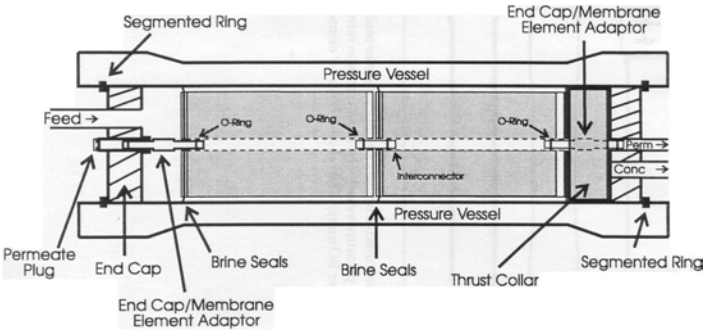
Preparation

You will improve your efficiency while installing new membranes if you take time initially to look over the RO and understand the flow direction on each individual housing. Record your current flows, pressures, and qualities. This gives you a good reference point when you start the RO back up. Think safety and start by de-energizing and locking out the feed power and water. Remember an RO has the potential to run at extremely high pressures. Isolate the concentrate and the permeate valves. At this point, lay out your membranes for each individual housing. Place the new interconnectors with the membranes and make sure they have new O-rings installed. Record each membrane's serial number and their location in the array. If there are any issues with the new membranes, this information will be useful for troubleshooting.

End Cap Removal

Remove the piping on each end of the RO housings as necessary. Put piping pieces in a safe place and in an order you can re-install easily. The typical end-cap has a locking ring that needs to be removed. Once the locking ring has been detached, the end cap is ready to come off. Sometimes it will fall off, but more often than not, you will find that it is stuck. Your first instinct may be to start prying, but be mindful that aged materials break easily. Some end caps have a place to thread pull handles, and this gives you even leverage on both sides. Another tool that works

well is a slide hammer threaded into the end cap. When you pull off the end caps, lay them out in the order that they are removed for an easier re-install. Pull the end connector off of the membrane and place it into the proper end cap. If the end connector is in good condition it can be reused. Pull the end seal out and lay it with the end cap.



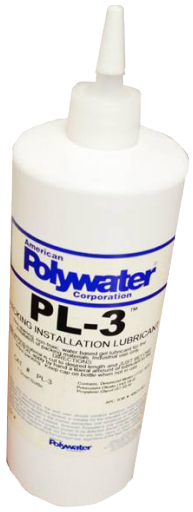
Membrane Removal

Probably the toughest and dirtiest part of membrane change out is getting the old membranes out of the housing. If you are fortunate, they will pull or push right out, but that is typically not the case. As membranes age, they can expand and almost lock themselves in the housing. With longer housings it is harder to remove the membranes. If you are using a full-fit membrane, you should be able to remove it from either end. If you are using a membrane with a brine seal, then you will want to push it in the same direction as the feed water flow. It works well to use a piece of pipe the length of your housing to push the membrane out, PVC works well, but you may need the force of something heavier. Again, remember safety and be mindful that the membrane will be heavy and potentially

slick. You may have to apply a lot of pressure to get the membrane out. Membrane housings can shift under these conditions and cause leaks at connection points. Tools are available that can pull the membrane while pushing against the housings. You may need to think creatively to remove membranes successfully.

Membrane Installation

The membranes with the new inter-connectors should be laid out in the order that you are going to install them. You will need some type of lubricant for re-installation. A water-based lubricant is acceptable in most applications, but a silicone based lubricant works better if it is acceptable to use in the process. Place a small amount of lubricant on the O-rings of the inter-connectors for install preparation. Full-fit membrane can usually be installed in either direction unless marked otherwise. Membranes with a brine seal will always be directional. Water should always push against the brine seal. When installing a full-fit membrane, be mindful that the netting around the membrane doesn't roll as you push it in, as this can be problematic. As you start placing the membranes in the housing, make sure they have their thrust collar. (Some membranes include the collar as part of the membrane, and some membranes need collars installed on each end.) Place the first membrane approximately ¾ of the way in being mindful of direction. Place the new inter-connector on the membrane. It should go on smoothly. If it doesn't pull it out and check the O-rings. This is an important step that will save time when you start up the RO. Connect the next membrane to the inter-connector. Continue these steps until all membranes have been installed. Push the membranes far enough toward the other end of the housing in preparation for the end cap installation. You will be installing the end cap on the other end first so make sure you have pushed them in far enough to install the end cap.

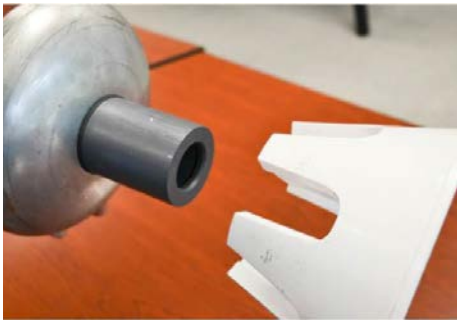


PL-3 Lubricant for O-rings

End-Cap Installation

In preparation to install the end caps, first pull the end connectors out of the end cap and inspect the O-ring and end seals. Replace them if necessary. Put a small amount of lubricant on the O-rings. A water based lubricant such as PL-3 will work but is rinsed away over time and will cause the seals to adhere to the housing. (A silicone based lubricant, such as O-Lube, will keep the O-Rings lubricated longer and will be beneficial on the next membrane replacement.) Make sure the end connector is in the proper location. Some connectors are solid and do not allow water

to pass. Before the end cap goes on, apply a small amount of lubricant to the end seal and place the seal in the RO housings on both ends. Reinstall the thrust collar, which is used to prevent telescoping, on the end that the water is pushing against. Install the end cap and secure the locking ring. From the other end, push the membrane tight against the thrust collar. One of the goals of a good installation is having the membranes tight in the housing. You do not want the membranes moving when the RO stops and starts because an O-ring could roll out. On the other side of the RO housing, add shims between the end connector and the end cap to prevent any movement of the membrane. Once the membranes are tight, place the end cap back on and re-secure the locking ring. Re-install piping on both ends. End caps may need to be rotated for proper alignment.



A thrust collar is a component which is put at the downstream end of a pressure vessel in order to reduce forward motion when the high pressure pump is energized.

This is a permeate port. Permeate from each envelope flows through the perforations then leaves the element through the open-ended tube.

Start–Up

New membranes can be packed dry or with a preservative. Make sure the RO unit concentrate and permeate flows are going to a safe drain. If possible, bleed air from the housings. Most ROs will have sample ports on the permeate end. Open each one. Open the supply water valve to the RO. Manually open the feed valve which allows feed pressure to push the air out of the housings. Once you are getting water out of each sample port, close each port and close the feed valve. Re-energize power to the RO. Open the concentrate valve all the way which allows the majority of water to exit the concentrate path. You are now ready to start the RO. As the RO comes up to pressure, watch for leaks. It might be necessary to shut the RO down and re-seat an O-ring or two. Continue rinsing the RO until it meets your TOC or conductivity specifications. The time can vary per application. Some membranes have a recommended rinse time based on your application. All flows will need to be set according to the manufacture's specifications.

Wrap-Up and Tips

In order to have a smooth change out, keep the following spare parts on hand: at least one end cap, end seal, end connectors, shims, and extra O-rings. It is best practice to always have a good handheld conductivity meter for trouble shooting. As you are installing membranes it is easy to roll an O-ring on the interconnectors. As you push the connectors together they should make a smooth connection, if you get resistance pull the connector back out and examine the O-ring. You will know if conductivity is running higher than it should be. Use your handheld meter to verify each individual housing, and keep in mind that it may be necessary to pull membranes and replace an O-ring. A common mistake is not shimming the membranes. Take the time to shim them properly and save yourself a headache later. Spend time before starting to make sure you understand the flow path of your RO. Never take for granted that your membranes were installed correctly the last time or that the thrust collars are on the correct end and membranes are installed in the correct direction. If you follow the steps in this article, you will achieve trouble-free start up.

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Purpose

Efforts and courage are not enough without purpose and direction.

~ John F. Kennedy

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