| STANDARD OPERATING PROCEDURE | | | |
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| **Department:** Engineering | | | |
| **Title:** RO Membrane Loading & Replacements | | | |
| **SOP No.** | | **Revision No.** | |
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## RO Membrane Loading & Replacements:

This section provides guidelines for loading and unloading reverse osmosis (RO) elements. For additional loading instructions, contact the individual pressure vessel manufacturer.

**Preparation:**

A schematic diagram of the RO system should be prepared for recording pressure vessel and element locations. It should show the entire piping system for the skid as well. To identify individual element locations, use the serial numbers written on each label. This diagram will help you keep track of each individual element in the system.

The following equipment is recommended:

- Safety shoes
- Safety glasses
- Rubber gloves
- Silicone lubricant
- Allen wrench
- Clean rags
- Glycerine
- Hose and water to flush vessel
- Sponge/swab, long stick and rope to clean vessel

**Procedure:**

1. Load RO elements into the pressure vessels just prior to start-up.
2. Before assembling all components, check the parts list and make sure all items are present and in the right quantities.
3. Carefully remove all dust, dirt, and foreign matter from the pressure vessels before opening.
4. Remove all end cap assemblies from all pressure vessels in the system.
5. Spray clean water through the open pressure vessels to remove any dust or debris present in the vessels.

*Note:* If additional cleaning is required, create a swab large enough to fill the inside diameter of the pressure vessel. Soak the swab in a glycerine/water solution (50 vol %) and move it back and forth through the pressure vessel until the vessel is clean and lubricated.

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**RO membrane loading:**

1. Install the thrust ring in the concentrate discharge end of the vessel. Consult the manufacturer's drawing for specific information on the thrust ring positioning. This has to be done before the loading of any elements, there is a risk of not installing it properly.
2. It's recommended to stage the elements prior to loading and record each serial number by position so that in the future you will know where each element is located inside the pressure vessel.
3. Place the leading end of the first RO element into the feed water end of the first pressure vessel and slide it in approximately one-half of the element length. *Note:* Always load RO elements into the feed water end of the pressure vessel. Verify that the U-cup brine seal is properly seated in the end cap groove of the element such that the brine seal opens in the upstream direction.
4. To Load Standard elements: Lubricate the o-ring seals on the interconnector and the inside of the product water tube with a very thin layer of silicone lubricant. Install the interconnector into the permeate tube of the element. Glycerine may be used but is not recommended. Although glycerine lubricates during the initial installation, it quickly washes out during normal operation.
5. Apply a thin layer of silicone lubricant to each brine seal. When silicone is applied, as each element is installed and pushed into position this will act as a lubricant on the inside of the pressure vessel which will remain during the operation of the system making removal much easier.
6. Lift the next element into position and install the trailing end on the interconnector. Be very careful to hold the next element so that the weight is not supported by the interconnector, and push the element into the pressure vessel until about one-half of the elements extend outside the vessel.
7. Repeat these steps until all elements are loaded into the pressure vessels. The number of elements loaded into an individual vessel will depend on the length of the elements and the vessel itself. *Note:* Do not push the elements in too far, if you do, then the end plate may not fit properly and the elements may have to be reinstalled.
8. Install the downstream end cap assembly on each end of the pressure vessel
9. Carefully position the downstream end cap assembly in the vessel and push the end cap assembly as a unit squarely into the end of the element. Use care when seating the O-rings seal on the adapter into the element and avoid pinching or rolling O-rings. *Note:* Make sure that the O-rings and product water tube are lubricated.
10. Rotate the end cap assembly to ensure proper alignment with the connecting piping.

11. Push the element stack from the feed end (upstream) towards the downstream end.
12. Install the feed end cap assembly on each of the pressure vessels like the downstream end cap assembly. Close each pressure vessel with the parts from the same vessel. Re-install any piping that was previously removed for element loading.

**RO membrane removal:**

Standard elements: Two operators are recommended when removing RO elements from a system. Remove the element from each pressure vessel as follows:

1. Disconnect the hard plumbing at each end of the pressure vessel. Mark or tag all removed items for return to the same location. *Note:* Numbering of the endplates and reinstalling in the same vessel is very important, this makes reinstallation much easier and all the connections will line up properly.
2. Remove the heads assemblies from each end of the pressure vessel.
3. Push the RO elements from the pressure vessel in the same direction as feed water flows. Push the elements out one at a time. Support each element as it is being pushed out of the vessel until the element is free of the pressure vessel.
4. With the element supported, de-couple the element with a counter-clockwise twist. Sometimes, it works best to face away from the vessel when unlocking.
5. Repeat this operation until the vessel is emptied. As an alternative to pulling the elements from the vessel, the entire stack can be pushed from the opposite end of the vessel with a push rod, or with replacement elements.

Installing an Element Spacer

In some instances it is desirable to reduce the amount of water that a membrane system produces. In large systems, this is often done by turning off banks of elements. In other systems the feed pressure is reduced, but reducing the feed pressure will lower the overall water quality. Therefore, it may be necessary to remove the lead elements from a system and install element spacers instead.

An element spacer, also called a “dead man,” is simply a standard product water tube without permeate holes. Proper installation is critical to both performance and safety. Only one element spacer can be installed per pressure vessel, and it must always be installed in the first or lead element position. If placed in any other position it may crack or break due to the force being put on the product water tube.

To install the spacer:

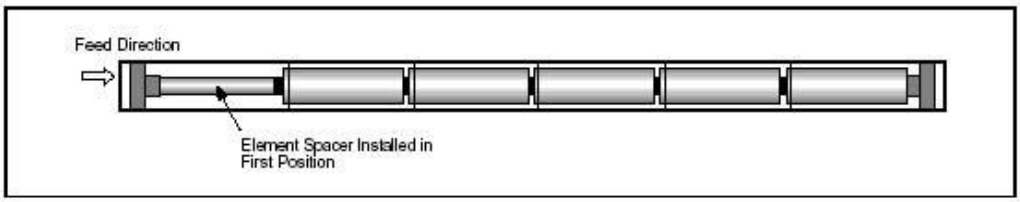
1. Remove the first or lead position element.
2. Remove and inspect the adapter and first interconnector, making certain that the O-rings are not rolled, compression set (flat on one side), or otherwise damaged. Replace the O-

rings if necessary.

3. Insert the interconnector in the spacer and push the spacer/interconnector into the second position element.
4. Insert the adapter and then replace the pressure vessel head. It may be helpful to only partially insert the interconnector and adapter to leave room to line up the parts. Alternately, a guide stick can be inserted through the permeate port on the vessel head to hold the spacer in line while the parts are pushed together.

Figure shows an element spacer properly installed in a pressure vessel.

**Figure Element spacer properly installed in a pressure vessel**




## Approval

Standard Operating procedure for RO membrane Loading & Replacements has been verified, found ok.