

# Technical Service Bulletin 102

## Element Loading Guidelines

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Element loading guidelines provide recommendations to ensure proper and safe installation of NanoH<sub>2</sub>O RO membrane elements in reverse osmosis (RO) system pressure vessels.

### System Flushing

Prior to loading the membrane elements, new systems should be thoroughly flushed with pretreated feedwater to ensure the absence of construction debris, solvents, chlorine or other contaminants that may be harmful to the elements.

### Pressure Vessel Preparation

The interior walls of the pressure vessels must be thoroughly cleaned prior to loading membrane elements in order to prevent dust, construction debris or other foreign matter from being deposited onto the membrane surface during start-up. Simply hosing down the interior of the vessels with freshwater is NOT adequate to clean the vessels thoroughly. NanoH<sub>2</sub>O recommends the use of a sponge ball wrapped in a cloth or towel that has been soaked in a 50% solution of glycerin and chlorine-free water. The cleaning ball may either be pulled through the vessel when attached to a rope or pushed through the vessel when mounted to a PVC flange affixed to an appropriate length of PVC pipe. Use appropriate CAUTION to ensure that the inside surface of the vessel is not scratched or damaged during cleaning.

### Membrane Element Storage

NanoH<sub>2</sub>O RO elements should be maintained in their original shipping packaging and stored in accordance with "Receipt of Elements, Short-Term Storage, and Disposal of Used Elements - TSB 101" and "Membrane Storage Inside Pressure Vessel – TSB 105" guidelines.

 CAUTION

DO NOT use oil, grease, petroleum jelly or other petroleum-based compounds to lubricate O-rings or brine seals. Food-grade glycerin may be used for O-ring and brine seal lubrication either directly or in a water-based solution. Approved lubricants for interconnector O-rings, end adapter O-rings or membrane element brine seals include glycerin, silicon-based Molykote III, or other silicone-based lubricants that do not contain hydrocarbons. Contact Technical Support at NanoH<sub>2</sub>O for further assistance.

# Technical Service Bulletin 102

## Element Loading Guidelines

---

### Materials Required

- Eye protection
- Safety Shoes
- Protective gloves, (for jobs with post startup bacteria testing of RO permeate, use sterile, powder free exam gloves)
- Other safety equipment and clothing as required by jobsite regulations
- Lubricant (Food grade glycerin and/or approved silicone lubricant)  
(NOTE: Do not use silicon lubricant for ultrapure water applications.)
- Clean towels and rags
- Plastic sheeting to protect and keep clean all permeate piping, endcap adapters, and any system part that will be in contact with RO permeate
- Water for flushing
- Tools and equipment necessary to clean and prepare pressure vessels
- Tools and equipment necessary to remove and replace pressure vessel components and attached piping  
(NOTE: Refer to pressure vessel manufacturer's literature for correct parts and procedures.)
- Critical spare pressure vessel parts and pipe fittings that might break during unloading and loading process
- Endcap adapter shims (See NanoH<sub>2</sub>O "Vessel Shimmiing Procedures-TSB 103")

### Element Loading

1. Make sure that pressure vessel parts, fittings and connecting piping (especially permeate piping) are removed for RO element installation are protected from dirt and airborne dust and debris. Keep floors and parts clean during the RO element loading process. For jobs where bacteria sampling of RO permeate after startup is required it is good practice to remove endcaps and place on unused, clean plastic sheeting, away from heavy traffic. Cover the endcaps to minimize exposure to airborne debris. Remember, the center port of the endcap carries RO permeate. Do not handle the endcap by touching the inside of the center port.

2. It is good practice to stage RO elements for each pressure vessel prior to loading. RO Elements with standard u-cup brine seals are loaded in the direction of process flow, so the first elements loaded is the concentrate end element. The feed end element will be the last to be loaded. It is strongly recommended to keep RO elements in their plastic bags during the staging process. While the elements are staged for each pressure vessel, record the elements serial numbers and the corresponding pressure vessel number. Make note of the position of each element in each pressure vessel. Later, transfer the loading sequence to Excel spreadsheets.

(NOTE: Many RO systems undergo partial element replacement over the warranted life of the system. It is important to keep accurate and up to date loading sequences by serial number and element age.)

3. Install endcap assembly in the concentrate (brine) end of the pressure vessel. Make sure the retaining ring is properly installed and the thrust cone installed downstream. Refer to pressure manufacturer's literature for installation instructions. Determine if it is preferable to install the concentrate endcap/element adapter into the concentrate endcap or concentrate element before loading. The adapter is supplied by the pressure vessel manufacturer. If it is preferred to have the adapter inserted in the endcap, make sure it is properly inserted and lubricated before installing the concentrate endcap assembly. Secure the concentrate endcap per the manufacturer's instruction.

# Technical Service Bulletin 102

## Element Loading Guidelines

---

4. Load the first element (concentrate end element) approximately 2/3rd of its length into the feed end of the pressure vessel. If the concentrate endcap/element adapter was not inserted into the concentrate endcap, make sure that it is properly lubricated and inserted in the concentrate face of the concentrate element before loading in the pressure vessel. Make sure that the u-cup brine seal is properly installed on the upstream (feed end) ATD (anti- telescoping device) of the RO element. (See "Brine Seal Replacement-TSB 114").

(NOTE: Only one u-cup seal is required per element. Never put u-cup seals at both ends of the RO element. U-Cups will only seal if properly oriented on the ATD. See "Brine Seal Replacement-TSB 114" for proper orientation.)

5. Lubricate the u-cup seal with 50% glycerin / and chlorine-free water solution.

(NOTE: If silicone based lubricant is used, only a small amount is needed. Use sparingly as excess amounts could foul the membrane surface.)

6. The product water tubes of each RO element are connected by an interconnector with pre-installed o-rings. Make sure that all o-rings are installed and lubricated properly. Firmly insert the interconnector in the product water tube of the first element with a gentle twisting motion. The interconnector will seat on a shoulder that is recessed about 3 inches inside the product water tube. Never use a hammer or pounding motion to insert interconnectors.

7. With another person holding the first elements stationary, slide the next element on to the interconnector of the first element. Make sure that the ATDs of the two elements touch each other and the interconnector is fully seated within each element.

8. Slowly push the element stack into the vessel so that 1/3rd of the next element being loaded is overhanging the feed end of the pressure vessel.

(NOTE: Be careful to not push elements too fast as the ATDs can be damaged if they slide roughly over the retaining ring grooves in the pressure vessel.)

(NOTE: Never allow an interconnector to support the weight of an element.)

9. Repeat the steps above until the last element has been connected and is extending only 1/3rd beyond the feed end of the pressure vessel. Make sure that concentrate endcap assembly is installed and secured.

10. Firmly push the entire element stack so that the concentrate end element seats against the concentrate endcap assembly.

11. In most cases, there will be space between the shoulder of the feed endcap adapter and the feed endcap itself that will allow movement of the elements during startups and shutdowns. Excessive movement can lead to o-ring leaks. Shims can easily be added to prevent excessive movement of the elements stack. (Refer to "Vessel Shimming Procedures-TSB 103")

12. Follow pressure vessel manufacturer's and RO unit fabricator's instructions for installation of feed endcap assemblies and all interconnecting piping.

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