

ELEMENT



INSTALLATION

**Installation and
Start-up of a Reverse
Osmosis Plant**

X Lewabrane®

LANXESS
Energizing Chemistry

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Notice: Please note that the information and recommendations provided in this technical brochure do not claim to be universally valid; in particular, they are not meant to substitute, amend or supplement the information and/or instructions provided by the OEM of the RO membrane system and/or the facility operator. In fact, LANXESS strongly recommends to obtain written confirmation from the OEM of the RO system and/or the facility operator before using the chemicals described in our technical brochure, installation of the RO elements and operation of the RO membrane system, and to verify the advice and information provided herein in each case as to its compatibility with the overall water treatment facility and RO membrane system.

1. Installation and Start Up of Lewabrane® RO elements

1.1 Installation of Lewabrane® RO elements in pressure vessels

The installation of the RO elements is one of the most important steps in preparing the RO membrane system for operation. Lanxess strongly recommends reading these instructions carefully, and speaking with our technical staff should there be any question.

1.1.1 Delivery and preparation

Damaged packages can be an evidence of damaged elements. Please check the integrity of the cardboard boxes and compare the delivered articles with your order. The elements are wet tested and vacuum packed in an oxygen barrier bag. The box includes an interconnector with O-ring, an end-plug with O-ring and an RO element with a brine seal.

The Lewabrane® RO membrane elements are packaged with a preservation solution (1% sodium hydrogen sulfite). The preservation fluid helps to maintain the membrane during shipment and storage, but needs to be removed prior to first usage. It is important that the below safeguards are followed and observed.

Please use appropriate protective clothing, including eye protectors and gloves when handling the RO element at the time of installation. If the preservative solution should come in contact with the eyes or skin, wash immediately with copious quantities of running water. Seek medical attention as necessary.

Before the RO elements are installed in the pressure vessel, we recommend to ensure that the interior of the pressure vessels and the piping are free of dust, dirt, oil, metal, etc. If not, clean the vessel carefully.

Avoid any harsh cleaning materials, which could cause damages or scratches to internal surfaces of the pressure vessel.

It may be necessary to wash the RO system and the vessels with a chemical solution or provide scrubbing with a soft brush.

Flush the RO system before the installation with feed water for at least 30 min at low pressure. The feed water should meet the recommended specifications of the elements. After the RO system is flushed, open each pressure vessel, clean the end plates, and check whether the vessels are clean.

Lubricate the O-rings with glycerine prior to insertion of the interconnectors into the RO element center pipe. Petroleum based lubricants are not allowed as may damage element components.

1.1.2 Loading of pressure vessel

1. Take out from boxes and plastic bags the quantity of RO elements required for filling the pressure vessel.
2. Lubricate with glycerine the brine seal of the RO element which will be loaded.
3. Look at the Flow Direction Arrow on the RO element to select the right direction of element insertion into the pressure vessel. The brine seal must be on the feed side of the element. Carefully insert the RO element into the feed side of the pressure vessel until 2/3 of the element length is inside the pressure vessel (Figure 1.1).
4. Lubricate the O-rings of the interconnector with glycerine, and insert half of its length by gentle twisting into the permeate tube (Figure 1.2).
5. In the case of a 4" Lewabrane® RO element, the outside of the permeate tube is lubricated with glycerine, and the interconnector is placed over (onto) the element stub tube.

6. Note the serial number and document the position of the RO elements which are installed in the pressure vessel.
7. Take the next RO element, lubricate the brine seal with glycerine and push it with gentle twisting onto the second half of the interconnector of the previously installed RO element. The two elements must touch each other (Figure 1.3 and 1.4). During this procedure the weight of the second RO element is supported by the interconnector, therefore the RO elements must be aligned to avoid damage to the permeate tube. Then, push the RO elements into the vessel until 2/3 of the second RO element length is inside.
8. Insert all RO elements into the pressure vessel as described in steps 2 to 7. The last RO element will not get an interconnector on its feed side, instead the end-plug adaptor is inserted in the permeate tube after lubrication with glycerine.
9. Push the last RO element into the vessel, so that the RO element and the thrust ring are behind of the lock ring groove. The distance between the RO element and the end of the pressure vessel depends on the vessel type, and whether the pressure vessel has side ports or end ports. Put the thrust ring on the RO element.
10. Downstream of the pressure vessel, the connector adapter, which connects the permeate tube with the cap of the pressure vessel is installed. The O-rings of the connector adapter are lubricated with glycerine. Insert the thrust ring. Please notice that the connector adapter is part of the pressure vessel. Lanxess recommends to contact the pressure vessel supplier to ensure that the adapter fits to the RO elements installed.
11. When installing the elements, it sometimes occurs that there may be too much freedom for RO element movement after the vessel is closed. A strong indication for this movement is the distance between the end cap and the end-plug. If this distance is $> 5\text{mm}$, it is strongly recommended to install shim rings on the end plugs. The free space for movement inside of the pressure vessel depends on manufacturing tolerances of the pressure vessel producer. In this case, the shims must be installed to avoid that any movement of the RO elements on pressurization will damage the O-rings. These plug's shims are plastic spacer rings, often called washers, with different thickness. They are placed on the upstream end of the pressure vessel, between the adapter hub and the endcap of the vessel. The shimming rings can be purchased from your pressure vessel supplier, or requested from Lanxess.
12. Finally, insert a thrust ring (according to pressure vessel assembly instructions) and close the pressure vessel on both sides. Ensure that the connector adapter and the end plug are connected to the vessel caps. The procedure to close the vessel depends on the vessel supplier. Please contact the PV supplier for details.

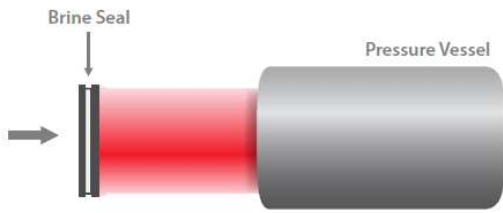


Figure 1.1: Insertion of element

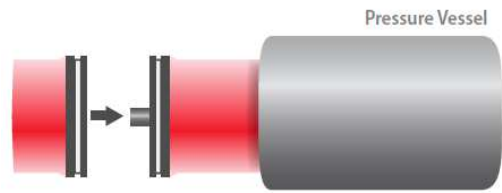


Figure 1.3: Connecting with the next element

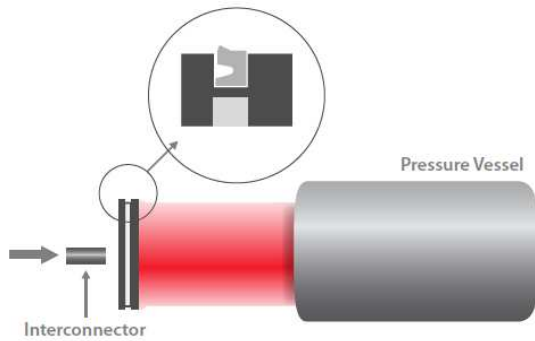


Figure 1.2: Insertion of the interconnector

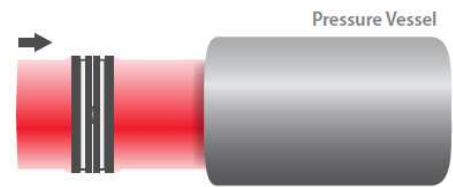


Figure 1.4: Pushing the elements into the vessel

	Interconnector 8" Element
	End-plug 8" Element is available if requested to LANXESS
	Adapter 4" Element
	End-plug with shims 4" Element are available if requested to LANXESS

Table 1.1: Adapters

1.2 Start-up sequences

After the RO elements are installed, and all start-up checks are completed, the initial RO system start-up can be performed.

As a first step, it is strongly recommended that the RO elements be flushed for 30 min. under low pressure (2-4 bar or 30-60 psi) to remove any residuals and to flush the preservation liquid from the new elements. This flushing procedure also removes air entrained in the RO system and elements.

Next, ensure that the all flows are collected and discharged in proper manner during the flushing.

While flushing check all pipe connections and valves for leaks and tighten them, if necessary.

Adjust the feed pressure carefully below 4 bar or 60 psi, and start the high pressure pump. Open the feed pressure valve slowly to increase the feed pressure and the feed flow rate until the design conditions of these parameters are reached. The feed pressure increase should not exceed 0.7 bar/sec.

Next, adjust the recovery rate to the value given by the design condition by closing the concentrate control valve. Check the ratio of concentrate and feed. Repeat the procedure of opening the feed valve and closing the concentrate valve until the design conditions are reached. During this procedure take care not to exceed the design limits of pressure and system flow rates.

Check the chemical dosing of acids and scaling inhibitors. Measure the pH and the conductivity. Next, evaluate the scaling conditions. We recommend to calculate the Langelier Saturation Index (LSI) or the Stiff & Davis Stability Index (SDSI). Therefore, additional measurements for the Ca and alkalinity concentration are necessary.

After 1hr of operation, we recommend to make the first documentation of the operating parameters. We recommend to check the permeate conductivity of each pressure vessel to ensure that the elements perform as expected. New elements change their operating characteristics after the initial start since the membrane is stabilized by the high pressure. Therefore, the performance data must be checked again after the first two days of operation. Monitor and record the parameters.

Finally, switch the permeate flow from drain to normal operating conditions, and start the automatic operation (as long as the RO system performs as expected from the OEM design manual).

Make sure the permeate back pressure never exceeds feed pressure during operation, and remains lower than 0,5 bar during standby of the RO system. Otherwise membrane delamination may occur.

Special Notice: for two pass RO systems, please contact your local LANXESS representative for the start-up procedure.

DISCLAIMER

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