

# **CodeLine**<sup>TM</sup>

PRESSURE VESSELS

## USER'S GUIDE

### E8H/SP & E8S/SP

Side Ported Pressure Vessels  
For Reverse Osmosis

MODEL E8S/SP



MODEL E8H/SP



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## **PREFACE**

E8 Series Sidewall Ported RO pressure vessels are designed for continuous long term use as housings for reverse osmosis membranes. Typically, the pressure rating, overall length and total number of vessels is determined by calculations used during membrane element selection.

Vessels are installed into a system frame that provides the recommended support points and then strapped snugly to the frame using provided mounting hardware. Vessel installation and piping connections should allow for expansion due to change in temperature and pressure in both length and diameter as the vessel is operated.

During maintenance, it may be necessary to remove a pressure vessel from a bank for repair or replacement. Sufficient space must be available for this to happen.

Care must be taken in installation and in removal of the vessels to not damage the shell. Damage to the shell can result in explosive head failure of the vessel and possible injury to personnel.

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**E 8 SERIES – SIDEPORT  
OPERATION AND MAINTENANCE GUIDE**

**MODEL E8S/SP  
SEA WATER RO**

**1000  
PSI**

**MODEL E8H/SP  
SEAWATER RO**

**1200  
PSI**

**DANGER – HIGH PRESSURE DEVICE**

This vessel may cause loss of life, severe bodily harm, and / or property damage if not correctly installed, operated and maintained. Read and understand all guidelines given before attempting to open, operate or service this vessel.

Failure to follow these guidelines and observe every precaution may result in malfunction and could result in catastrophic failure.

Misuse, incorrect assembly or use of damaged or corroded components can result in high-velocity release of the end closure.

We recommend that only qualified mechanic experienced in servicing high-pressure hydraulic systems, open, close and service this vessel.

This section is a guide to proper operation and maintenance of Pentair Water E8S/SP, E8H/SP pressure vessels. Good industrial practice must be used in applying this information to assure safe vessel use. These guidelines are not intended to relieve the user from full responsibility for correct operation and maintenance of the vessels.

For technical specifications and dimensions, refer to the Engineering Department Drawing of each specific model.

The information in all sections must be carefully followed for the vessels to provide the safe, long service life for which it is designed.

## OPERATION AND MAINTENANCE GUIDE

Proper vessel handling and installation are important to safe use and long vessel life. These guidelines should be followed carefully; however, they do not relieve the purchaser from full responsibility for proper inspection, handling and installation. Damage due to improper handling or installation is the sole responsibility of the purchaser.

Improper assembly, misuse or corrosion damage can result in mechanical failure, property damage and serious injury or death. ***Read and follow all instructions carefully.*** Pay particular attention to the safety precautions given in this **Operation and Maintenance** section. Should any information in this guide not agree with the system supplier's instructions, call Pentair Water for clarification.

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- Safety Precautions
- Installation Notes
- Pre-Pressurization Checklist
- Opening Vessel
- Replacing Elements
- Closing Vessel
- Head Rebuilding
- Preventive Maintenance
- Troubleshooting

## SAFETY PRECAUTIONS

### DO

- Read understand and follow every part of this section. Failure to take every precaution may void warranty and could result in explosive head failure.
- Install in an area where water leakage resulting from a vessel or piping malfunction would not damage sensitive or expensive equipment, such as electronic components.
- Install protective covering over equipment located below pressure vessels when performing maintenance.
- Verify head locking components are properly placed and secured.
- Inspect end closures regularly; replace deteriorated components and correct causes of corrosion.
- Follow membrane element manufacturer's recommendations for loading elements into vessel (see **Replacing Elements**).

### DO NOT

- Operate vessel at pressure in excess of specific rating or temperatures over 120°F.(See vessel information chart )
- Service any component until you verify that vessel pressure is fully relieved from the vessel.
- Stand or climb on the pressure vessels, or the feed / concentrate or permeate ports.
- Use corroded components. Use of such components may result in explosive head failure.
- Allow force in excess of 15 lbs to be applied laterally to feed, concentrate or permeate ports.
- Pressurize vessels until after visually inspecting to insure that all interlock components (locking ring set, securing ring and securing screws) are correctly installed and secured.
- Tolerate leaks or allow end closures to be routinely wetted in any way.
- Allow petroleum or silicone based products to come in contact with membrane elements during installation or maintenance.

## INSTALLATION NOTES

Even though your vessel may have been installed by others, there are a few installation checks that you should make before system start up.

Vessels must be installed correctly to ensure safe use and long service life.

- Check that vessels mounted on horizontal support frame using compliant black urethane saddles; hold-down straps snug, not tight.
- Check that each vessel is free to expand under pressure; shell is not clamped rigidly in place; piping vessel ports not connected using rigid connections.

### WARNING

**FAILURE TO ALLOW EXPANSION IN  
DIAMETER OR LENGTH WILL RESULT IN  
VESSEL DAMAGE**

- Check that each vessel does not support any other component; that piping manifolds are specially mounted, and that interconnecting piping is self supported and connected to the pressure vessel with Victaulic® couplings (Use of Victaulic® couplings is recommended.)

If you have any questions about the installation of the vessel in your unit, contact your supplier. For installation guidelines, refer to the **Installation Guide**.

<b>VESSEL INFORMATION CHART</b>		
	<b>MODEL E8S/SP</b>	<b>MODEL E8H/SP</b>
<b>MAX OPERATING PRESSURE (PSI)</b>	<b>1000</b>	<b>1200</b>
<b>OPERATING TEMPERATURE RANGE</b>	<b>20<sup>o</sup>F. to 120<sup>o</sup> F.</b>	
<b>FACTORY TEST PRESSURE (PSI)</b>	<b>1500</b>	<b>1800</b>
<b>PROTOTYPE MIN. BURST PRESSURE (PSI)</b>	<b>6000</b>	<b>7200</b>
<b>ENGINEERING DRAWING NUMBER</b>	<b>507030</b>	<b>507031</b>
<b>USER'S GUIDE</b>	<b>507020</b>	

# PRE-PRESSURIZATION CHECKLIST

## DANGER – HIGH PRESSURE DEVICE

Operation of this vessel may cause loss of life, severe bodily harm, and /or property damage if not correctly installed operated and maintained. Read and understand all guidelines given before attempting to open, operate or service this vessel.

Failure to follow these guidelines and observe every precaution may result in malfunction and could result in explosive head failure.

Misuse, incorrect assembly or use of damaged or corroded components can result in explosive release of the end closure.

We recommend that only a qualified mechanic experienced in servicing high-pressure hydraulic systems, open, close and service this vessel.

This checklist is an aid intended to remind servicing and operating personnel of the detailed guidelines given in the E8H/SP and E8S/SP **Operation and Maintenance Guide**.

The checklist alone does not include all the details needed for safe vessel operation. Use the checklist each time any service operation is carried out to ensure that each step is completed before pressurizing the vessel.

### MEMBRANE ELEMENTS

Installed per manufacturer's recommendations

Feed flow direction correctly noted and elements  
Correctly oriented.

### HEAD ASSEMBLY INTERLOCK

Locking groove at each end of shell clean, free of corrosion and / or delimitation with outboard face of groove true and in sound condition.

All components in as-new condition, clean and free of damage or corrosion.

All three segments of the locking ring set fully seated and held in place by securing ring and screws.

### ELEMENT INTERFACE

Adapters installed at both ends of element column.

Thrust ring installed downstream (Concentrate or brine end) of the element column and indexed correctly around the brine ports.

### PIPING CONNECTIONS

Properly aligned (strain free) and secured.

Leak free.

### HEAD

All components in as-new condition clean and free of damage or corrosion.

All components properly assembled with new, freshly lubricated seals.

Permeate port snap ring installed.

Assembled By: \_\_\_\_\_

Date of Assembly: \_\_\_\_\_

Checked By: \_\_\_\_\_

Date of inspection: \_\_\_\_\_

The following vessels listed by serial number below were serviced under this checklist:

\_\_\_\_\_  
\_\_\_\_\_



**OPENING VESSEL  
Step-By-Step Guide**

**NOTE**

*Read all guidelines in this section before attempting to open the vessel.*

**WARNING**

**DO NOT ATTEMPT TO SERVICE ANY COMPONENT WITHOUT FIRST VERIFYING THAT VESSEL PRESSURE IS FULLY RELIEVED FROM THE VESSEL.**

**WARNING**

**ATTEMPTING TO REMOVE ANY COMPONENT BEFORE PRESSURE IS RELIEVED MAY RESULT IN EXPLOSIVE RELEASE OF HEAD.**

**CAUTION**

Corroded products can cause difficulty in removing head and/or other components. Do not attempt to remove components until all apparent corrosion is removed.

**STEP 1 RELIEVE PRESSURE**

1. Shut off all sources of pressure and relieve pressure from the vessel, following the system manufacturer's recommendations.

**STEP 2 DISCONNECT PERMEATE PORT**

1. Disconnect and remove permeate piping from the permeate port of the vessel.

**STEP 3 EXAMINE END CLOSURE**

1. Examine end closure of vessel for corrosion. If any is evident, proceed as follows:
  - A. Loosen any deposits with a small wire brush and/ or a medium grade piece of Scotchbrite®.
  - B. Flush away loosened deposits with clean water.

**CAUTION**

Do not tap directly on the bearing plate face with a metal tool.

**CAUTION**

Do not strike or apply undue force on the Permeate port / plug.

**NOTE**

If vessel has been in service for some time, the head may be difficult to remove. For assistance in head removal, E8 Series head tool (p/n 107028-1) is available from Pentair Water.

**STEP 5 REMOVE HEAD**

**STEP 5A REMOVAL BY HAND**

1. Thread a short length (12-in.) of 1 in. I.D. pipe into the Permeate port and pull the head straight out. A sharp forceful tug may be required to start the head assembly moving.
2. If the head seal remains in the vessel bore, it should be removed at this time.

## STEP 5B REMOVAL USING E8 SERIES HEAD TOOL

1. Insert the tool into the shell with threaded rods in line with bearing plate holes.
2. Thread the rods into the bearing plate holes and turn until the knobs bottom out.
3. Grasp tool with hands and pull straight out to remove the head. If the head will not release from the shell refer to the **Troubleshooting** section.
4. To remove the tool from the head, reinstall the head part-way into the shell so that the tool is compressed, then unscrew the rods.
5. If the head seal remains in the vessel bore, it should be removed at this time.

### CAUTION

It may be helpful to rock head slightly to break head seal bond, however, **excessive side force while attempting to rock the head may damage the permeate port.**

## REPLACING ELEMENTS

### NOTE

*Read all parts of this section before replacing elements. These procedures are provided for general information only. Elements should be installed in accordance with the element manufacturer's recommendations.*

### WARNING

**DO NOT ATTEMPT TO SERVICE ANY COMPONENT WITHOUT FIRST VERIFYING THAT VESSEL PRESSURE IS FULLY RELIEVED FROM THE VESSEL.**

**MAKE SURE THAT THE CENTRAL (PERMEATE) TUBE OF MEMBRANE ELEMENT STACK IS CONNECTED TO THE PERMEATE PORTS INSIDE BOTH ENDS OF VESSEL, USING THE ADAPTERS SUPPLIED. PRESSURIZING VESSEL WITHOUT ELEMENTS AND BOTH ADAPTERS INSTALLED COULD RESULT IN EXPLOSIVE HEAD FAILURE.**

#### PRELIMINARY STEP

**DO NOT PROCEED WITH STEP BY STEP INSTRUCTIONS UNTIL...**

1. All pressure has been relieved from the vessel, following system manufacture's recommendation.
2. Both heads have been removed from vessel following step by step instructions in the **Opening vessel** section.

#### STEP 1 REMOVE ELEMENT INTERFACE HARDWARE

1. Remove thrust ring from downstream (Concentrate) end.
2. Remove adapters from elements at each end.

#### STEP 2 ELEMENT REMOVAL

1. Remove elements from vessel following element manufacturer's instructions. Clean off any excess lubricant from vessel inside diameter before removing elements. Elements must be removed in direction of feed flow.

### CAUTION

Do not scratch or damage vessel bore when removing or installing elements.

### WARNING

**DO NOT PRESSURIZE VESSEL WITH OUT ELEMENTS INSTALLED OR OTHERWISE OPERATE VESSEL WITH PERMEATE PORT PRESSURE IN EXCESS OF 125 PSI. OPERATION IN EXCESS OF THIS PRESSURE COULD RESULT IN CATASTROPHIC PORT FAILURE.**

### NOTE

- Always remove and install elements in the direction of the feed flow. The feed end (upstream end) is the end plumbed most directly to the pump.
- Seal lubricant must be applied sparingly. Excess lubricant may foul the element.
- Flooding the vessel with clean water or 50/50 glycerine/ water mixture will ease element assembly.
- A record of element serial numbers and locations should be made and checked during loading

## STEP 3 ELEMENT LOADING

1. Examine the inside diameter of the vessel for scratches or imperfections that may affect sealing capability of head or element seals. Corrosion deposits or other foreign matter, including any excess lubricant, should be removed as described in **Closing Vessel, Step 1**.
2. Flush out the vessel with clean water to remove all dust and debris.
3. Examine membrane element surfaces for any imperfection which could scratch the vessel bore. Pay particular attention to edges of anti-telescope device (ATD/brine seal carrier). If any defects found which cannot easily be corrected, contact the element manufacturer for corrective action.
4. Using an approximate 50% mixture of glycerine in water, lubricate the inside of the vessel. This may best be accomplished using a suitably sized swab soaked in the mixture. This procedure will ease membrane element loading and reduce chance of scratching the vessel bore.

### NOTE

If the brine seal is not installed on the element and the element supplier does not specify otherwise, a brine seal should be placed on the upstream end of the elements. Open side of a seal must face upstream

### CAUTION

Maintain element alignment carefully during assembly process. Do not allow element weight to be supported by interconnector. Misalignment can result in damage to interconnectors or permeate tubes or to element outer surface.

### NOTE

Take care to avoid pushing elements too far as it can be difficult to push the stack in a reverse direction

5. Load the first element into the upstream end of the vessel. Leave a few inches of the element projecting from the vessel to facilitate interconnection to the next element.
6. Apply a light film of a non – petroleum based Lubricant, such as Parker Super O-Lube, to the interconnector O-ring. (The amount of O-lube should be just be just enough to give a luster to the O-ring. Excess O-lube must be removed to prevent possibility of element contamination).
7. Assemble the interconnector to the loaded Element.
8. Line up the next element to be loaded and assemble it to the interconnector already assembled on first element.
9. Push both elements into the vessel until a few inches are projecting from the vessel. Repeat loading process until all elements are installed.
10. When the final element is installed, push the element stack forward.

### NOTE

#### Alternate To Measurement Method

Insert a clean thrust ring into downstream end of vessel.

Insert head assembly without quad seal or adapter, into downstream end of vessel.

Place the two square ended sections of locking ring into locking ring groove (with squared ends together, stepped side outwards.)

Load elements as described in 5. through 9.

Install upstream adapter per Step 4 “Replacing Elements” and head assembly, per section on **“Closing Vessel.”**

Remove downstream head assembly. Reinstall head assembly plus adapter, per section on **“Closing Vessel.”**

## WARNING

**CONNECT THE CENTRAL (PERMEATE) TUBE OF THE MEMBRANE ELEMENT STACK, WITH AN ADAPTER ON EACH END, TO THE PERMEATE PORT IN THE HEAD AT BOTH ENDS OF VESSEL. PRESSURIZING VESSEL WITHOUT BOTH ADAPTERS INSTALLED COULD RESULT IN EXPLOSIVE HEAD FAILURE.**

### STEP 4 INSTALL ELEMENT INTERFACE HARDWARE

1. Assemble adapter to element permeate tube at each end of vessel.
2. Install the thrust ring at the downstream (Concentrate) end.

## NOTE

Ensure thrust ring is clean before installation.

Thrust ring stainless steel positioning clips must seat on top of the Concentrate port seal. The clips must not be allowed to stand in the port orifice,

For step by step instructions on vessel closure, refer to the **Closing Vessel** section.

## CAUTION

Install the thrust ring at the downstream (Concentrate) end. Serious damage may result if the thrust ring is not installed in the correct location.

## **CLOSING VESSEL** **Step- By- Step guide**

### **NOTE**

*Read all guidelines in this section  
before attempting to close the vessel.*

### **WARNING**

**CHECK THE HEAD ASSEMBLY FOR CORROSION AS DESCRIBED IN THE HEAD REBUILDING SECTION. CORRODED PARTS CAN RESULT IN CATASTROPHIC FAILURE.**

**DO NOT PRESSURIZE THE VESSEL UNTIL AFTER VISUALLY INSPECTING TO ENSURE THAT ALL THREE SEGMENTS OF THE LOCKING RING SET ARE FULLY SEATED AND HELD IN PLACE BY SECURING RING AND SCREWS.**

## **PRELIMINARY STEPS**

Do not proceed until .....

1. Elements and adapters have been installed in vessel following guidelines in the **Replacing Elements** section.
2. Head has been checked for correct component assembly by following step-by –step instructions in the **Head Rebuilding** section.
3. Vessel has been shimmed to prevent movement of the membrane elements if required. See **Trouble Shooting** Section for a description of when shimming is required.

## **STEP 1 INSPECT SHELL INSIDE SURFACE**

1. Inspect the vessel inside surface for any corrosion deposits or other foreign matter. If any are found, clean the surface as follows:
  - A. Using a medium or finer grade of Scotchbrite<sup>®</sup> and a mild soap solution, clean each end of the vessel liner surface up to 8” in from each end of vessel.
  - B. Rinse away all loosened deposits from the shell inside surface using clean fresh water.
2. Inspect the vessel inside surface for scratches or other damage, which could cause leaks. Vessel that leaks must be replaced.
3. Inspect Feed and Concentrate port seals and attachments for internal and external damage or deterioration.



**NOTE**

Contact Pentair Water for guidance, if damage to the vessel's internal surface or Feed/Concentrate port, seals or attachments are discovered during inspection.

**NOTE**

Never attempt to repair a fiberglass shell

**STEP 2 SHELL AND HEAD SEAL LUBRICATION**

1. Work O-ring lubrication into the shell from half way up the bevel to approximately ½” in from the bevel.
2. Ensure the entire head seal is covered with a thin layer of O-ring lubricant, with no dirt or dust contamination.

**NOTE**

Any remaining lubricant should be cleaned from the vessel bore before applying fresh lubricant

**NOTE**

Glycerin is a commercially available lubricant that will not foul membranes. However, silicone lubricant will better ease head assembly, installation and removal.

**NOTE**

In some installations it may be advisable to tighten a system-required permeate port nipple or fitting into the Permeate port before the head is assembled into the vessel.

**CAUTION**

Do not tighten a component into the thermoplastic Permeate port more than one turn past hand tight.

## CAUTION

Do not allow the head assembly to rotate or to rock side to side after insertion into the vessel as this may cause the head seal to become detached.

### STEP 3 INSTALL HEAD

#### STEP 3A INSTALLATION BY HAND

1. Hold the head assembly square to the axis of the shell and slide it straight in until a slight resistance is felt. Do not rotate the head assembly after insertion into the vessel as this may cause the head seal to become detached.
2. Using both hands, firmly push the head in as far as it will go. (A sharp, forceful thrust may be necessary to enter the head seal into the vessel bore). When the head is correctly positioned, approximately ½” of the locking ring groove will be exposed.

## NOTE

If an E8 series head tool (p/n 107028-1) is available, it can be used to ease head installation. (The tool can be obtained from Pentair Water). If a tool is not available, proceed as follows.

## WARNING

INTERLOCKING COMPONENT MUST BE CORRECTLY INSTALLED. INCORRECT ASSEMBLY OR INSTALLATION CAN RESULT IN EXPLOSIVE HEAD FAILURE.

#### STEP 3B INSTALLATION USING TOOL

1. Hold the head assembly square to the axis of the shell and slide it straight in until a slight resistance is felt.
2. Slide the head tool into the shell just behind the head. Do not engage threaded rods.
3. Give a sharp, forceful thrust on the head tool to enter the head into the vessel bore. Then push into the shell as far as it will go. When the head is correctly positioned, approximately ½” of the locking ring groove will be exposed.
4. Remove the tool by pulling straight out. Do not rotate.

#### STEP 4 INSTALL INTERLOCK

1. Install a segment into the bottom of the shell groove, with the stepped edge facing outwards.
2. Slide this segment counter clockwise, making room to install another segment into the bottom of the shell groove.
3. The ends of the segment should meet at the 5 o'clock position.
4. Now install the final segment by placing its internally beveled end into the groove at the 8 o'clock position.  
You should now be able to lift the segment up and into the groove.

**NOTE**

Before inserting securing screws, it is advisable to lightly coat the screw threads with anti-seize compound, to ease later disassembly.

**NOTE**

If holes in securing ring and bearing plate do not align precisely, reversing the securing ring should improve alignment.

**NOTE**

It may be necessary to lightly tap around the circumference of the securing ring using the handle of a screwdriver or similar object to fully seat the ring.

8. Tighten all three mounting screws until snug. Over tightening may cause disassembly problems.
9. Visually inspect locking ring set to ensure it is correctly positioned between shell and bearing plate.
10. Verify that securing ring is fully seated and held in place by securing screws.

**WARNING**

**INTERLOCKING COMPONENTS MUST BE CORRECTLY INSTALLED. INCORRECT ASSEMBLY OR INSTALLATION CAN RESULT IN EXPLOSIVE HEAD FAILURE**

**NOTE**

Using Teflon tape or anaerobic sealant on all threaded connections will help ensure a leak free assembly.

**NOTE**

Do not tighten a component into thermoplastic permeate port more than one turn past hand tight

## STEP 5 RECONNECT PERMEATE PIPING

1. Reconnect manifold piping to the vessel Permeate port.

## STEP 6 PRE-PRESSURIZATION CHECKS

It is vitally important that the following checks be carried out before any attempt is made to pressurize the vessel.

It is recommended that the **Pre-Pressurization Checklist** be used to systematically verify that all steps have been performed.

## HEAD ASSEMBLY

Verify the following at each end of the vessel:

1. Head assembly is in good condition, with no evidence of damage or corrosion. See the section on **Head Rebuilding and Maintenance**.
2. Locking ring set is properly in place and yellow securing ring is snugly held in place by the securing screws.

## MEMBRANE ELEMENTS

Verify that...

1. Elements are installed in the vessel.
2. Elements and adapters are installed at each end of the vessel.
3. Thrust ring is installed at downstream end of the vessel.

## PIPING CONNECTIONS

1. Check all piping connections to ensure that they will provide a leak-free seal.

## STEP 7 PRESSURIZATION

1. After following the above pre-pressurization checks, pressurize vessel in accordance with the element manufacturer's specification.
2. Vessel should be filled slowly to assist trapped air to escape.
3. Vessel should be pressurized slowly to avoid damage to membrane elements and vessel components.

### WARNING

DO NOT PRESSURIZE THE VESSEL WITHOUT ELEMENTS INSTALLED.

**HEAD REBUILDING – E8S/SP AND E8H/SP**  
**Step- By- Step guide**

**NOTE**

Read all guidelines in this section  
before attempting to rebuild the head.

Head rebuilding should be performed in a clean work area. Dust or dirt on O-rings or other part can scratch inner surface and cause subsequent leakage.

**WARNING**

**DO NOT SERVICE ANY COMPONENT UNTIL YOU VERIFY THAT VESSEL PRESSURE IS FULLY RELIEVED FROM THE VESSEL.**

**REPLACE ANY COMPONENTS NOT IN “AS-NEW” CONDITION. RESUING CORRODED OR DAMAGED COMPONENTS CAN RESULT IN EXPLOSIVE HEAD FAILURE.**

**PRELIMINARY STEPS**

Do not process with step by step guidelines until ...

1. All pressure has been relieved from the vessel, following system manufacturer’s recommendations.
2. Head has been removed from the vessel following guideline in the **Opening Vessel** section.

**TO DISASSEMBLE HEAD**

**STEP 1 REMOVE PERMEATE PORT / PLUG**

1. Remove the Permeate Port Membrane Adapter from the Permeate Port.
  - a. Grasp the end to the adapter in one hand and the Permeate port in the other and pull them apart.
2. Remove two “O”-rings from the small end of the Permeate Port-Adapter.
3. Remove the adapter seal “O”-ring from the Permeate port bore.

**NOTE**

It may be necessary to twist the two parts in opposite directions to break a seal between them.

### NOTE

A small screwdriver or similar tool may be used to remove O-rings. However, do not damage the sealing surfaces in any way or leakage may result. It is recommended that all seals be replaced each time the head is assembled.

### CAUTION

Be sure to wear eye protection when removing any parts under tension. The permeate port retaining ring could cause harm if released from the removal tool prematurely. Do not damage the outer end of the Permeate port during removal.

### NOTE

A new retaining ring should be used when the head is reassembled.

## STEP 2 REMOVE PERMEATE PORT RETAINING RING

1. Remove the Permeate port retaining ring located on the external side of the bearing plate.
  - a. A retaining ring removal tool is available from Pentair Water part number 6MM001-2.

## STEP 3 REMOVE THE PERMEATE PORT

1. Remove the Permeate port by pressing it out from the external side of the bearing plate.
  - a. It may be necessary to lightly tap on the external end using a rubber mallet to start movement.
2. Remove the square cut Permeate port seal from the internal side of the sealing plate.
  - a. It may be necessary to use a wooden stick or small screw driven to loosen the seal for removal.

### CAUTION

Do not scratch, gouge or otherwise damage the sealing plate surfaces during removal.

## STEP 4 REMOVE THE SEALING PLATE

1. Separate the Sealing Plate from the Bearing Plate.
  - a. It may be necessary to break free the flat surface seal between the two plates by rotating the two plates in opposite direction.

### **CAUTION**

Read all guidelines in this section before making decisions on component structural or corrosion problems and treatment.

This section is intended only to provide guidelines in dealing with corrosion or component damage. In combination with good industrial practice, these guidelines provide a basis for safe system operation.

Any condition not covered in this section should be referred to Pentair Water.

Corrosion in this context includes metal oxidation products and mineral deposits.

### **CAUTION**

Feed and Concentrate ports and attachments to the shell must be carefully inspected to ensure that connections and sealing materials are sound and tight. Any questions or evidence of deterioration of these areas should be referred to Pentair Water engineers. Other than seal replacement, field repair should not be attempted by user maintenance personnel without first contacting the manufacturer for guidance.

### **CAUTION**

If any components are cracked, softened or discolored, it may indicate a chemical resistance problem. These components must be replaced. Alternate materials may be required in these applications. Contact Pentair Water for resolution.

## **COMPONENT CLEANING AND EXAMINATIONS**

### **STEP 1 WASH COMPONENTS**

1. Wash all components in fresh water.
2. Blow components dry with compressed air, if available. Otherwise wipe dry with a dry, lint-free cloth.

### **STEP 2 INTIAL COMPONENT INSPECTION**

1. Examine all components for any damage that could affect structural strength or sealing properties.
2. Replace any parts considered to be structurally unacceptable.

**THE FOLLOWING EXAMPLE INDICATE WHEN REPLACEMENT IS REQUIRED.**

- A. **PERMEATE PORT** internal thread stripped or over-strained.
- B. **BEARING PLATE** dented or distorted or with anodizing removed (possibly from being dropped or hit).
- C. **SEALING PLATE** cracked, distorted or with sealing area damaged.
- D. **PORT RETAINER RING** bent or distorted.
- E. **SECURING RING** cracked.
- F. **SECURING SCREWS** with stripped head or thread.
- G. **LOCKING RING SEGMENTS** bent or damaged.

Any other detail considered to be a potential problem should be referred to Pentair Water.

**CAUTION**

This procedure for evaluating corroded components is to be used on any corroded metal parts. If this fails to bring any component to “as-new” standards, the part must be replaced.

**NOTE**

Damage to anodized or plated parts may be temporarily sealed with epoxy paint while waiting for replacement parts.

**NOTE**

Alternate materials are available for high corrosion environments. Call Pentair Water for information.

**STEP 3 EVALUATING CORRODED METAL COMPONENTS**

This procedure applies to the following parts:

- A. Locking ring set.
- B. Bearing plate.
- C. Port retainer ring
- D. Securing screws



1. Examine all components for corrosion. For any components not in “as-new” condition, proceed as follows:
  - A. Loosen any large deposits with small wire brush.
  - B. Place components in shallow container of soapy water and scrub entire surface with medium grade Scotchbrite® until all corrosion is removed.
  - C. Rinse components clean with fresh water.
  - D. Blow components dry with compressed air, if available.
  - E. Re-examine components for damage that could affect structural strength or sealing properties. Any components not in “as-new” condition must be replaced.
  - F. Inspect components for any condition that may have promoted corrosion (e.g gouged anodizing, inappropriate material selection, etc).

<b>CAUTION</b>
----------------

This procedure for removing deposits from plastic components should be used on all plastic components contaminated by mineral deposits or other foreign matter. If any component cannot be brought to “as-new” standards, the part must be replaced.
--

#### **STEP 4 REMOVING DEPOSITS FROM PLASTIC COMPONENTS**

This procedure applies to the following components:

- A. Securing ring
  - B. Permeate Port
  - C. Sealing plate
  - D. Adapter
1. Examine all plastic and PVC components for mineral deposits or other foreign matter. If any are found proceed as follows:
    - A. Place components in shallow container of soapy water and scrub the entire surface with medium grade Scotchbrite® until all foreign matter is removed.
    - B. Rinse components clean with fresh water.
    - C. Blow components dry with compressed air, if available.
    - D. Re-examine components for any damage that could affect structural strength or sealing properties. Any component not in “as-new” condition must be replaced.

## WARNING

**HEAD MUST BE CAREFULLY ASSEMBLED FOLLOWING THESE INSTRUCTIONS. INCORRECT ASSEMBLY CAN RESULT IN EXPLOSIVE HEAD FAILURE.**

## CAUTION

Use Parker Super-O-Lube® sparingly on all seals each time the head is assembled. Excessive lubricant may foul the membrane. Do not use petroleum-based lubricant.

## NOTE

It is recommended that all seals must be replaced each time the head is assembled. A seal replacement kit is available from Pentair Water.

## NOTE

Lubricate seals using non-petroleum based lubricants, i.e Parker Super O-Lube®, Glycerin or suitable silicone based lubricants. (Silicone based lubricants, correctly used, will ease head assembly and disassembly) (Glycerin is a commercially available lubricant that will not foul membrane.

### **TO REASSEMBLE HEAD.**

#### **STEP 1 INSTALL PERMEATE PORT SEALS AND O-RINGS.**

1. Lubricate and install any “O”-rings on the product water tube (PWT).
2. Lubricate and install the adapter seal “O”-ring in the larger diameter bore of the Permeate port.
3. Lubricate and install the square cut port seal in the larger diameter bore of the sealing plate.

#### **STEP 2 ASSEMBLE PERMEATE PORT AND SEALING PLATE.**

1. Press the smaller diameter bore of the permeate port through the sealing plate bore.
  - a. The larger diameter bore and square cut seal should be flush against the end of the Permeate/ Plug larger diameter.

### **STEP 3 ASSEMBLE THE BEARING PLATE AND SEALING PLATE.**

1. Fit the Bearing Plate over the smaller diameter end of the Permeate port and press to fully seat against the sealing plate.
  - a. The Bearing Plate side with slightly smaller diameter should face the Sealing Plate.
  - b. When installed correctly, the smallest outside diameter and the danger label should face outward.
  - c. When the Bearing Plate and Sealing Plate are fully seated, the retaining ring groove in the Permeate Port will be fully exposed on the external side of the assembly.
2. Install the retaining ring in the exposed groove (adjacent to the bearing plate) in the Permeate Port.

#### **WARNING**

Retainer snap rings must be fully seated in the Permeate port groove provided. Incorrect assembly can result in explosive head failure.

#### **NOTE**

Head assembly should be accomplished in a clean, dust free environment to ensure dirt/dust particles are not trapped within the assembled head.

### **STEP 4 INSTALL HEAD SEAL**

1. Lubricate and install the head seal (quad ring) around the sealing plate.
  - a. Clean excess lubricant from the quad ring prior to installation.

## PREVENTIVE MAINTENANCE

Corrosion prevention is essential for the maintenance of safe operating conditions and to ease membrane element servicing.

Attention to the points listed below will enhance long-term safe operation and will ease servicing.

For suggestions on cleaning corrosion deposits from the vessel inside surface, refer to **Closing Vessel**.

For suggestions on cleaning corrosion deposits from head components, refer to **Head Rebuilding**.

### PREVENTION CHECKLIST

- End closures. Inspect for components that may have deteriorated. Replace as needed.
- Keep external head assembly components as dry as possible.
- Do not tolerate leaks.
- Ensure that protective coatings are intact. Exposed metal may promote corrosion.

### CAUTION

Any leakage indicates a potentially dangerous condition. Failure to eliminate leakage may void the warranty and could result in vessel failure.

## TROUBLE SHOOTING

This section is intended only to provide guidelines for dealing with problems that might arise while working with Pentair Water pressure vessels.

These guidelines are not in any way a replacement for the good industrial practice required to ensure safe operation. We recommend that only a qualified mechanic experienced in servicing high-pressure hydraulic systems carry out the following tasks.

### PRELIMINARY INSPECTION

Inspect the vessel at each end for corrosion, which may interfere with head assembly removal. If corrosion is evident, proceed as follows.

1. Loosen any deposits with a small wire brush and / or a medium grade piece of Scotchbrite™.
2. Flush away-loosened deposits with clean water.
3. Proceed with instructions given in Opening Vessel section.

#### CAUTION

Do not use a wire brush on components made from plastic, fiber glass or PVC materials

#### NOTE

Recommendations listed below are intended only as a guide. If the head assembly is still difficult to remove after all recommendations have been followed call Pentair water for technical assistance

#### CAUTION

When applying penetrating fluid, be careful to avoid element contamination.

### DIFFICULTY IN OPENING VESSEL

#### SECURING RING

1. Will not release from bearing plate after securing screws are turned ¼ turn:
  - A. Apply penetrating fluids (such as WD-40® or LPS-1®) to interfacing areas of securing ring. (Securing ring may have bonded to locking ring set and/or bearing plate).
  - B. With a screwdriver handle or similar tool, tap the securing ring to release the bond.
  - C. Again attempt to remove ring by turning the jacking screws an additional ¼ turn.

2. Jacking screws cannot be threaded through the securing ring due to excessive corrosion or damage.
  - A. Clean any corrosion from the Jacking screw holes and thread a 5/16-18 bottoming tap into the hole.
  - B. If the securing ring still does not break lose repeat step 1.

**CAUTION**

When applying penetrating fluid, be careful to avoid element contamination.

**CAUTION**

Do not tap directly on the bearing plate or locking ring with a metal tool.

**CAUTION**

Exercise extreme caution to avoid damaging the vessel shell.

### **LOCKING RING SET**

1. Will not rotate in shell.
  - A. Apply penetrating fluids (such as WD-40<sup>®</sup> or LPS-1<sup>®</sup>) around locking ring set at the shell and bearing plate interfaces.
  - B. Use a cushioned mallet or hammer in conjunction with a wood block to tap the face of the bearing plate and/or locking ring segments.
  - C. Again attempt to rotate the locking ring set.
2. Will not rotate after above steps;
  - A. Abandon attempts to rotate the locking ring set and concentrate on direct segment removal. This will require extreme caution to avoid damage to vessel.
3. Direct segment removal.
  - A. Apply penetrating fluid to segment interface areas.
  - B. Allow fluid to penetrate.
  - C. Insert blade of a small flat-head screwdriver between key locking ring segment and shell inside diameter.
  - D. Tap screwdriver handle gently. This should release the segment from the shell. Repeat on other segments from the shell. Repeat on other segments if necessary.

**CAUTION**

In the following step, exercise extreme caution to avoid damaging inner vessel surface.

**NOTE**

If the head assembly will not release from the shell after all recommendations have been followed, call Pentair Water for technical assistance.

**HEAD ASSEMBLY**

1. Will not release from shell even with use of head puller tool (p/n 107028-1):
  - A. Thread a 1” ID pipe approximately 2 feet long into the Permeate port.
  - B. Carefully rock the head assembly back and forth to release the shell.
  - C. Once the head seal has been broken, complete removal as instructed in the **Opening Vessel** section.

**FEED/CONCENTRATE PORT**

1. Seal (P/N 6ER006-224) leaks.
  - A. Carefully remove the square-cut seal, ensuring that the tool used for removal does not scratch or mar the port or vessel seal surface.
  - B. Clean the groove surface.
  - C. Lubricate and install the new square-cut seal (P/N 6ER006-224), ensuring that the “O”-ring is completely seated into the groove.

## **SUDDEN DROP IN PERMEATE QUALITY**

If a system is started and stopped frequently and no provision is made to raise the pressure slowly, movement of the membrane column may damage O-ring seals and reduce permeate quality.

If the quality of the permeate suddenly drops off, and poor membrane performance is not suspected, remove the head as per instructions in the User's Guide (See OPENING VESSEL section). Remove the adapters from each end of the vessel. Remove the PWT seals from the adapters and the adapter seal from each of the permeate ports. (See HEAD REBUILDING section) Inspect these O-ring seals carefully for breakage or other damage. If the seals have rolled out of the groove, or are damaged, this may indicate excessive movement is occurring during startup and shutdown. To overcome this problem, the vessel should be shimmed to minimize this movement. Follow the procedure for shimming as given below:

### **SHIMMING**

Shimming is accomplished by placing spacers between the adapter and the hub on the permeate port on the up-stream end of the vessel. When done properly, shimming will prevent excessive movement of the membrane elements and the adapters, thus preventing potential damage of the O-ring seals. The spacers used for shimming are shaped like a plastic washer and are 0.20 inches thick.

The suggested procedure for shimming is as follows:

1. With membrane properly loaded, install the adapters and place the thrust ring in the downstream end of the vessel. (See REPLACING ELEMENTS section).
2. Install a head in the downstream end of the vessel following steps 1 through 4 of the section entitled CLOSING VESSEL.
3. Remove the adapter seal and head seal from the remaining head. Install the head far enough into the upstream end of the vessel so that you can place a locking ring segment in the locking ring groove. This will assure that there is no interference in any of the components and establish the force required to seat the head.
4. Remove the head and slide some spacers over the end of the adapters that fits into the permeate port. Add enough spacers so that when the head is installed, it is not possible to install the locking segments in the groove, This will normally require 2 to 3 spacers.
5. Remove one spacer at a time until it is just possible to install the retaining ring in the shell groove with the head in place.
6. Remove the head and reinstall the adapter seal and head seal.
7. Now close the vessel according to the VESSEL CLOSING section.



## INSTALLATION GUIDE

Proper vessel handling and installation are important to safe use and long vessel life. These guidelines outlined herein should be followed carefully; however, they are intended only as guidelines and do not relieve the purchaser from full responsibility for proper inspection, handling and installation is the sole responsibility of the purchaser.

Improper assembly, misuse or corrosion damage can result in mechanical failure, property damage and serious injury or death. ***Read and follow all instructions carefully.*** Pay particular attention to the safety precautions given in this **Operation and Maintenance section**. Should any information in this guide not agree with the system supplier's instruction, call Pentair Water.

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Handling and Receiving  
Mounting Shell  
Piping Connections

## HANDLING AND RECEIVING

Fiberglass reinforced plastic (FRP) pressure vessels are extremely rugged and durable. They are designed for safe, long-term service when they are handled and installed properly. However, damage to the vessel shell or related components from improper handling or installation could result in malfunction or catastrophic failure while in service. Therefore, exercise the following precautions whenever handling vessels.

1. Never lift or move a vessel by placing anything inside it. The vessel is durable and ideally suited to its purpose, but it can be permanently damaged by careless handling.
2. Be careful not to scratch the inside wall of the shell, especially in the O-ring sealing area inboard of retaining ring groove near each end.
3. DO NOT drop vessel or allow it to hit hard on the ground or against other objects.
4. DO NOT apply undue stress to shell.
5. Before using forklift to handle the vessel, pad the forks to lessen the chance of damaging the shell. Severe scratches or gouging of the vessel can result in failure of the vessel wall.

### NOTE ON IMPACT DAMAGE

Exterior vessel damage can lead to early vessel failure. Damage received in shipment should be reported to the shipping company immediately upon receipt. Minor damage such as scratches that go no deeper than the paint may be acceptable. Call Pentair Water for advice if in doubt.

## MOUNTING SHELL

### NOTE

If mounting vessel for the first time, see “Piping Recommendations for CodeLine E8 Series Sideport Vessels”.

*This section is concerned with the mounting of E8S/SP and E8H/SP Series pressure vessels only.*

These guidelines must be integrated with any additional procedures required for specific installation.

#### Installation Guidelines:

1. Provide adequate room for servicing at both ends of vessel. Elements are installed from the upstream end (feed), pushed through towards the downstream end (concentrate) and, eventually, removed from downstream end.
2. Follow all applicable handling guidelines
3. Position each vessel on its mounting frame such that it is centered between headers.

### NOTE

It is important that each vessel be placed to minimize any strain on piping / tubing that connects a vessel to a header. Normally each vessel should be centered in the frame with the feed and concentrate ports positioned such that piping / tubing connections can be made easily, without undue strain at each end of vessel.

4. Mount vessels on urethane saddles (provided with vessels) positioned in line with pre-drilled frame holes for –1 through –3 vessels. The holes should be drilled at approximate center span ‘S’. For –4 and –8 vessels, holes for the mounting straps should be drilled within 10” to 30” from ends of vessel and third saddle without a strap, should be placed at mid span. These dimensions are shown on corresponding engineering drawing.

### WARNING

**DO NOT MOUNT VESSEL RIGIDLY. RESTRICTED EXPANSION CAN RESULT IN DAMAGE TO THE VESSEL. SEE ELASTICITY AND MOUNTING REQUIREMENTS IN THE APPLICATION SECTION FOR FURTHER DETAILS.**

5. Place mounting straps over vessel with cork strip against vessel.
6. Provide adequate room for servicing at both ends of vessel. Elements are installed and removed in the direction of feed flow.
7. Position screw through the frame mounting holes into strap nuts and run up to the frame finger tight.
8. Connect vessel feed piping (see Piping Connections).
9. Using a wrench, tighten mounting bolts one additional full turn. This should result in 25-50 lbs-in. of torque.

**CAUTION**

To avoid damage to vessel shell  
DO NOT over-tighten mounting nuts.

**CAUTION**

E8 straps are designed to secure the vessel during operation. They are not designed to handle all loads that might occur during shipment. Appropriate vessel restraint should be employed considering such factors as the mode of shipment, distance to be traveled and the design of the system. The vessels and frame should be blocked to prevent any differential movement, which could be caused by the forces experienced during shipment.

## PIPING CONNECTIONS

The following are suggested guidelines to ensure that the vessel is allowed to expand and is easily serviced.

1. Support the header and interconnecting piping in a manner that they are self-supporting.
2. Connecting piping alignment to feed, Concentrate and Permeate ports should not exceed 0.030-in. misalignment.
3. Piping connections to the vessel should be via flexible Victaulic® couplings. Two Victaulic® couplings per vessel port should be used for best results.

## APPLICATION GUIDE

This **Application Guide**, together with the **Installation Guide** and the **Operation Maintenance Guide**, outlines the general conditions for safe use of E8S/SP & E8H/SP Series pressure vessels. Because of the considerable risk inherent in high-pressure systems, it is the purchaser's responsibility to evaluate carefully each specified application to ensure that the E8S/SP & E8H/SP series vessel selected is appropriate to that application.

Pentair Water will assist the purchaser in determining the suitability of the standard vessel for their specific operating conditions. For non-standard applications, alternate materials are available on special order. The final determination, however, including evaluation of the standard materials of construction for compatibility with the specific environment, is the responsibility of the purchaser.

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Suitability for intended use  
Elasticity and mounting requirements  
Corrosion  
Safety

## **SUITABILITY FOR INDENTED USE**

E8H/SP, E8S/SP Series RO pressure vessels are designed for continuous, long-term use as housing for reverse osmosis membrane elements. Models are available for 1000 & 1200 psi. Any make of eight-inch nominal diameter spiral wound element is easily accommodated.

In an RO system there is considerable potential for explosive head failure, which could result in serious injury or loss of life. All decisions as to suitability for use must include full consideration of the various safety aspects involved. These include, but are not limited to:

- Process fluid compatibility (e.g chemical and temperature considerations).
- External environmental factors (e.g corrosive atmosphere; remote or special environments where plastics might be undesirable; etc).
- Abnormal backpressure which might result in pressurizing permeate port above 125 psi (alternate materials are available).
- Capability of the user to maintain vessel properly.
- Requirement for increased fire resistance in some circumstances (e.g may preclude use of PVC for permeate ports)

Use of a Pentair Water pressure vessel other than its intended application will void the warranty.

Pentair Water will assist the purchaser in determining the suitability of the standard vessel for their specific operating conditions. For non-standard applications alternate materials are available on special order. The final determination, however, including evaluation of the standard material of construction for compatibility with the specific environment, is the responsibility of the purchaser.

## ELASTICITY AND MOUNTING REQUIREMENTS

Mounting design must allow for vessel expansion both axially and radially. Although the expansion under pressure is slight, undue restriction can result in damage to the vessel and to other system components. Expansion is typically up to .020 inch in diameter and up to 0.007 inch per foot in length. A six-element vessel, for example, would expand approximately .150 inch in length. The following suggestions will help to ensure the vessel is allowed to expand and will ease servicing.

1. Mount the vessel on urethane support pads furnished. Do not mount directly to any rigid structure.
2. Use the stainless steel straps furnished. Straps should be tightened sufficiently to hold the vessel on the urethane support pads, but not so tightly as to restrict expansion. (A torque of 25-50 lbs-in is sufficient).
3. U-bolts should not be used for vessel mounting under any circumstances.
4. Provide a flexible piping connections to permit decoupling the header from the vessel. The recommended Permeate Port connection is a U-bend pipe with flexible connections at each end, or a flexible hose. Recommended Feed and Concentrate connection are via two flexible Victualic<sup>®</sup> couplings.
5. Do not hard plumb any piping connection to the vessel.
6. Support the header independently. Piping should be self supporting or supported by the headers.
7. Include an expansion loop in the branch connection to allow for:
  - A. Elastic growth under pressure.
  - B. Thermal growth in vessel length.
8. The total weight of branch connection and fittings should not exceed 16lbs for feed / concentrate ports and 8 lbs for either Feed/Concentrate ports or the Permeate port for E8 series vessels.

The above suggestions are intended to help prevent damage in typical applications. Unusual or special applications may involve other considerations, to be determined by the system designer.



## CORROSION

Considerations relating to corrosion are an important factor in vessel application. Corrosion can result in catastrophic failure and / or cause difficulty in removing head components from the shell. Correct component material selection is essential for safe long-term use. Although the process fluid is the main consideration, external environmental conditions should also be taken into account.

All reasonable precautions should be taken to protect head assemblies from external wetting, particularly in corrosive atmosphere (e.g salt water areas or acidic atmospheres such as near lead acid battery arrays etc.) Leaks from vessel or nearby components, which allow head parts to be routinely wetted, should not be tolerated.

The following typical list of Pentair pressure vessel components shows the standard material of construction of each part. An evaluation of the possibility of corrosion damage to metal head interlock components is of critical importance. Alternate materials are available upon request.

### E8S/SP

Dwg Ref	Qty Per	Part Name	Materials/Remarks
<b>SHELL</b>			
1	1	Shell	Filament wound epoxy / glass composite. Head locking grooves integrally wound in-place, Superaustenitic Stainless steel – (6% MO) F/C side ports.
<b>HEAD</b>			
2	2	Bearing Plate	6061-T6 aluminum alloy-hand anodized.
3	2	Sealing Plate	PVC Thermoplastic
4	2	Permeate Port	PVC Thermoplastic
5	2	Port Retainer	316 stainless steel
6	2	Head seal	Ethylene Propylene, Quad Ring
7	2	Port Seal	Ethylene Propylene , Square cut seal
<b>HEAD INTERLOCK</b>			
8	2	Locking Ring	316 stainless steel
9	2	Securing ring	Reinforced plastic – color yellow
10	6	Securing screw	316 stainless steel
<b>VESSEL SUPPORT</b>			
11	3	Universal Saddle	Engineering Thermoplastic
12	3	Strap Assy	304 Stainless steel PVC cushion
13	4	Strap Screw	5/16-18 UNC 18-8 stainless steel
<b>ELEMENT INTERFACE</b>			
14	2	Adapter	Engineering Thermoplastic
15	1	Thrust Ring	PVC Thermoplastic white
16	2	Adapter seal	Ethylene Propylene – O-ring
17	A/R	PWT Seal	Ethylene Propylene – O-ring
*2 each furnished with length code 1, 2 & 3			

### E8H/SP

Dwg Ref	Qty Per	Part Name	Materials/Remarks
<b>SHELL</b>			
1	1	Shell	Filament wound epoxy / glass composite. Head locking grooves integrally wound in-place, Superaustenitic Stainless steel – (6% MO) F/C side ports.
<b>HEAD</b>			
2	2	Bearing Plate	6061-T6 aluminum alloy-hand anodized.
3	2	Sealing Plate	PVC Thermoplastic
4	2	Permeate Port	PVC Thermoplastic
5	2	Port Retainer	316 stainless steel
6	2	Head seal	Ethylene Propylene, Quad Ring
7	2	Port Seal	Ethylene Propylene , Square cut seal
<b>HEAD INTERLOCK</b>			
8	2	Locking Ring	316 stainless steel
9	2	Securing ring	Reinforced plastic – color yellow
10	6	Securing screw	316 stainless steel
<b>VESSEL SUPPORT</b>			
11	3	Universal Saddle	Engineering Thermoplastic
12	3	Strap Assy	304 Stainless steel PVC cushion
13	4	Strap Screw	5/16-18 UNC 18-8 stainless steel
<b>ELEMENT INTERFACE</b>			
14	2	Adapter	Engineering Thermoplastic
15	1	Thrust Ring	PVC Thermoplastic white
16	2	Adapter seal	Ethylene Propylene – O-ring
17	A/R	PWT Seal	Ethylene Propylene – O-ring
*2 each furnished with length code 1, 2 & 3			

## SAFETY

### CAUTION

Pressure vessels may cause loss of life, severe bodily harm or property damage if not correctly installed, operated and maintained.

Safety in service of fiberglass pressure vessels depends on proper application, installation, operation and maintenance. This section is intended to provide guidance towards safe system design. The safety information given in the **Installation** and **Operation and Maintenance** sections should also be studied and used appropriately in conjunction with the precautions listed below.

## DESIGN CONSIDERATION FOR SAFETY

### Fluid Compatibility

The materials of constructions selected must be compatible with process fluid and with proposed preserving and cleaning fluids. Standard materials are listed on the engineering drawings. In cases where the standard materials are unacceptable, suitable alternates may be available.

### Pressure and Temperature Design Limits

Operation of a vessel outside its design limits will void the warranty and could result in vessel fatigue with possible eventual explosive head failure. Although each E8 vessel is tested to 1.5 times design pressure, long term operation above design pressure must be prevented. Permeate port pressure **must not exceed 125 psi** (with standard materials). Vessel should **not be continuously operated at temperatures above 120°F**.

### Overpressure Protection

It is essential that over-pressure protection be provided such that the pressure to which any vessel is subjected cannot exceed 105% of design pressure.

### Mounting

The pressure vessel should not be used as a support. Piping manifolds and other fittings should be supported by properly designed system framework. Operating personnel should be discouraged from applying undue force to any fittings connected directly to a pressure vessel.

### Accessibility

Pressure vessel should be positioned within the system such that elements can be inserted at the upstream end and removed from the downstream end (i.e elements are installed and removed in the direction of feed flow).

**APPENDIX**

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Pre-Pressurization Checklist  
Piping Recommendations  
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# PRE-PRESSURIZATION CHECKLIST

## Danger – High Pressure Device

Operation of this vessel may cause loss of life, severe bodily harm, and /or property damage if not correctly installed or maintained. Read and understand all guidelines given before attempting to open, operate or service this vessel.

Failure to follow these guidelines and observe every precaution may result in malfunction and could result in explosive head failure.

Misuse, incorrect assembly or use of damaged or corroded components can result in explosive release of the end closure.

We recommend that only a qualified mechanic experienced in servicing high-pressure hydraulic systems, open, close and service this vessel.

This checklist is an aid intended to remind servicing and operating personnel detailed guidelines given in the E8S/SP & E8H/SP **Operation and Maintenance Guide**.

Note that the checklist alone does not include all the details needed for safe vessel operation. Use the checklist each time any service operation is carried out to ensure that each step is completed before pressurizing the vessel.

### MEMBRANE ELEMENTS

Installed per manufacturer's recommendations

Feed flow direction correctly noted and elements correctly oriented.

### HEAD ASSEMBLY INTERLOCK

Locking groove at each end of shell clean, free of corrosion and / or delimitation with outboard face of groove true and in sound condition.

All components in as-new condition, clean and free of damage or corrosion.

All three segments of the locking ring set fully seated and held in place by the securing rings and screws.

### ELEMENT INTERFACE

Adapters installed at both ends of element column.

Thrust ring installed downstream (Concentrate or brine end) of the element column and indexed correctly around the brine ports.

### PIPING CONNECTIONS

Properly secured.

Leak free.

### HEAD

All components in as-new condition clean and free of damage or corrosion.

All components properly assembled with new, freshly lubricated seals.

Permeate port snap ring installed.

Assembled By: \_\_\_\_\_

Date of Assembly: \_\_\_\_\_

Checked By: \_\_\_\_\_

Date of inspection: \_\_\_\_\_

The following vessels listed by serial number below were serviced under this checklist:

\_\_\_\_\_  
\_\_\_\_\_

---

## Piping Recommendations for CodeLine E8 Series Side ported Vessels

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Various methods of connecting sideport vessels to manifolds are possible. The recommended method is to connect each vessel side port to the manifold using two flexible Victaulic® joints and an intermediate piping section. A 90°-elbow would be ideal, however, a straight piping connection would also be acceptable. This two-joint method is preferred over a single Victaulic® connection because it does not require as much care in vessel alignment and manifold weldment accuracy. Figures 1 & 2 illustrate the preferred method.

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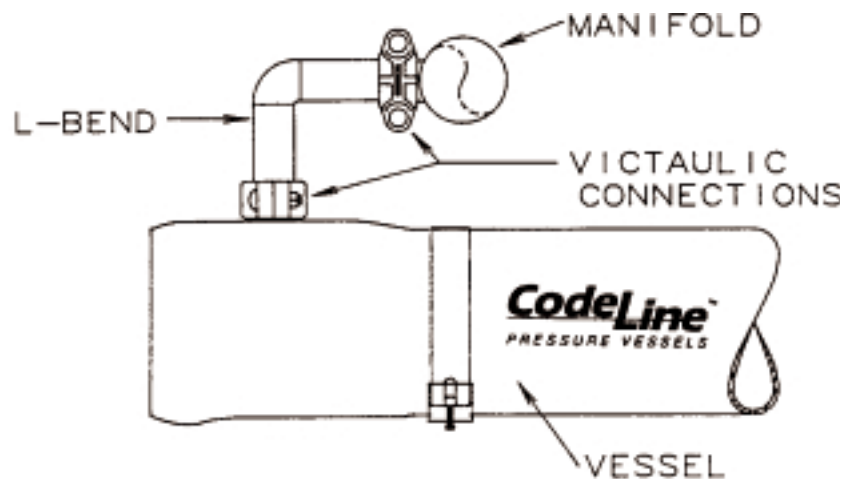


Figure 1

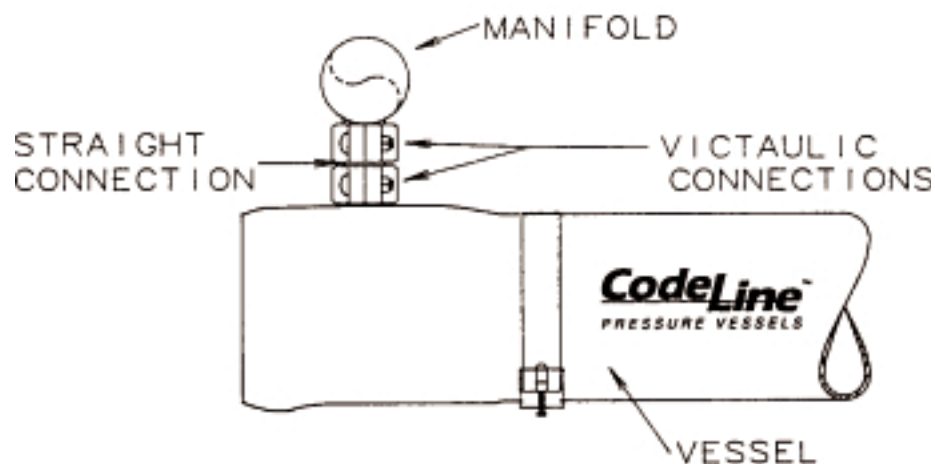


Figure 2

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## Piping Recommendations continued

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An alternate method using a single Victaulic® is acceptable but requires more thoughtful execution. The manifold must be fabricated using close tolerances to help ensure correct alignment. Installation must follow a sequence of assembly steps to initially ensure correct shell to manifold alignment. First, the vessel should be set into the rack and secured loosely into position using the mounting straps. Then connect the vessels to the manifold, which is also loosely secured one port at a time, while adjusting the shell and manifold position for the best alignment possible. At this time set the side port to manifold clearance at .125 in. per Victaulic® recommendations for cut groove applications. After proper alignment is achieved, secure the shell and fix the manifolds into position. (See figures 3 & 4 for reference).

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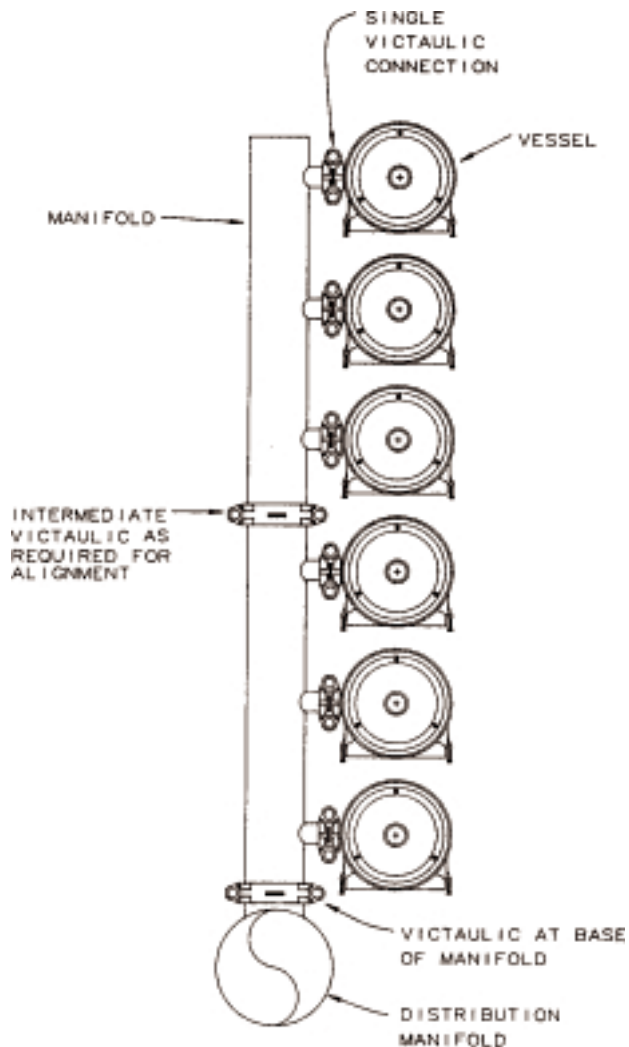


Figure 3

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## Piping Recommendations continued

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Even though a single Victaulic® coupling arrangement may be the choice for low cost and compactness, it brings with it the necessity to provide the required amount of flexibility in some other way.

A Victaulic® coupling allows angular but not lateral misalignment. Two rigidly restrained pipes not lying on a common axis can be forced to align if the fit is close enough to allow the two halves of the coupling to be pulled together by the bolts. This practice is not recommended. The resulting stresses are complex and have leveraged intensity. Any misalignment must therefore be kept to an absolute minimum.

Figure 3 illustrates how Victaulic® couplings might be incorporated in the manifolds to alleviate misalignment where a line of vessels is connected to a common manifold header and only one flexible Victaulic® joint is used between the vessel and the manifold.

In checking for correct alignment, the maximum axial misalignment from port to manifold should be .030 in. in any direction. (see figure 5) While exceeding .030 in. misalignment should not significantly reduce vessel safety, it may decrease vessel service life. A recommended method of checking for acceptable alignment is to test for coupler rotation.

To use the rotation method, install the Victaulic® coupling between the vessel side port and the manifold. With the two coupling bolts tightened until snug, you should be able to rotate the coupling by hand. If hand rotation is possible, the alignment will be acceptable.

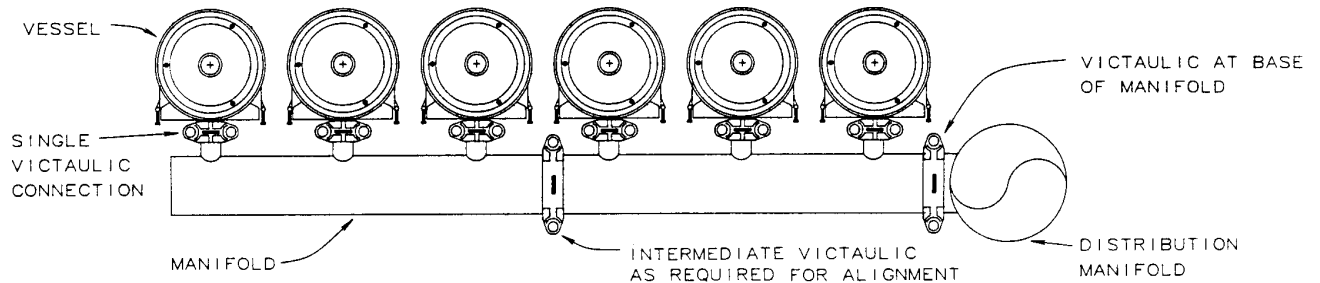


Figure 4

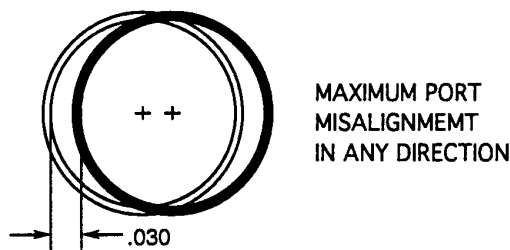


Figure 5

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## WARRANTY

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The seller warrants that the goods supplied shall conform to CodeLine™ specifications and shall be free from defect in material or workmanship. The warranty expires one (1) year from the date of invoice. If the buyer discovers within this period a failure of the product to conform to specifications, or a defect in material or workmanship, the buyer must promptly notify the seller in writing. In no event may that notification be received by the seller more than 30 days after the end of the warranty period. Any goods that the buyer believes to be defective are to be returned to the seller's factory for examination. However, upon request of the buyer, the seller may, at his discretion, agree to examine the good in the field. If, upon examination by the seller, any goods sold under this agreement or purchase order do fail to conform to CodeLine™ specifications, or prove to be defective in material or workmanship, the seller will supply an identical or substantially similar part F.O.B., the seller's factory; or the seller, at its option, will repair such part or give credit to the buyer for the original cost of such goods. However, if the goods were examined in the field and the seller determines that they do conform to CodeLine™ specifications, the buyer will be responsible to pay to the seller, a \$750 field service charge, plus travel expenses and a \$75 per diem charge. Any replacement goods provided hereunder will be warranted against defects in material and workmanship for the unexpired portion of the one-year warranty period applicable to the goods. Normal wear of replaceable components, including elastomeric seals, is excluded from this warranty. These remedies are the purchasers only remedies for breach of warranty.

This warranty will not be applicable if the goods have been subject to any accident, damage caused by disasters, faulty installation, misapplication, mishandling, chemical attack, unauthorized attachments or modifications, abuse or misuse, if the buyer has used the goods after discovery of a defect without sellers written consent, or if the buyer refused to permit the seller to examine the goods to ascertain the nature of the defect.

This warranty is expressly in lieu of any and all other expressed or implied warranties with respect to the goods or their installation, use, operation, replacement or repair, including any implied warranty of merchantability or fitness of purpose. This agreement constitutes the entire contract and exclusively determines the rights and obligations of the seller and the buyer, any prior course of dealing, custom or usage or trade or course of performance notwithstanding. Seller will not be liable by virtue of this warranty or otherwise for any special, incidental or consequential loss or damage resulting from the use or loss of use of the goods based on breach of warranty, breach of contract, negligence, strict tort, or any other legal theory. Damages that the seller will not be responsible for include, but are not limited to, loss of profits, loss of the use of the product or any associated equipment, cost of removing or installing the product; downtime; the claims of third parties including customers; and injury to property. This limitation does not apply to damages caused by breach of the warranty of title or the warranty against infringements or to claims for personal injury. Any action for breach of warranty must be commenced within 60 days of the end of the warranty period.



# REGISTRATION CARD

Vessel Model:	<p><u>Serial Numbers</u></p> <p>Numbers are located at one end of vessel. (If more than 30 numbers, please attach.)</p> <table style="width: 100%; border: none;"> <tr><td style="border: none;">_____</td><td style="border: none;">_____</td><td style="border: none;">_____</td></tr> <tr><td style="border: none;">_____</td><td style="border: none;">_____</td><td style="border: none;">_____</td></tr> <tr><td style="border: none;">_____</td><td style="border: none;">_____</td><td style="border: none;">_____</td></tr> <tr><td style="border: none;">_____</td><td style="border: none;">_____</td><td style="border: none;">_____</td></tr> <tr><td style="border: none;">_____</td><td style="border: none;">_____</td><td style="border: none;">_____</td></tr> <tr><td style="border: none;">_____</td><td style="border: none;">_____</td><td style="border: none;">_____</td></tr> <tr><td style="border: none;">_____</td><td style="border: none;">_____</td><td style="border: none;">_____</td></tr> <tr><td style="border: none;">_____</td><td style="border: none;">_____</td><td style="border: none;">_____</td></tr> <tr><td style="border: none;">_____</td><td style="border: none;">_____</td><td style="border: none;">_____</td></tr> <tr><td style="border: none;">_____</td><td style="border: none;">_____</td><td style="border: none;">_____</td></tr> </table>	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
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<input type="checkbox"/> Membrane Softening <input type="checkbox"/> Ultrafiltration <input type="checkbox"/> Brackish RO <input type="checkbox"/> Seawater RO <input type="checkbox"/> Other: _____																															
Size of System: _____ GPD/No. of Vessels: _____																															
Date of Installation: _____																															
Location of System:																															
_____ _____ _____																															

**CodeLine Division  
Verna Industrial Estate  
Verna, Goa - INDIA**

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