

# CODELINE® - 80E SERIES

## 8 INCH END ENTRY MEMBRANE HOUSING FOR RO APPLICATIONS

USER GUIDE

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ARTICLE CODE: 523004



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## **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 in this bulletin 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. This section is a guide to proper operation and maintenance of CodeLine® 80E Series 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 information on application and installation, refer to 80E Series Application and Installation sections. For technical specifications and dimensions, refer to the Engineering Drawing of each specific model. The information in all sections must be carefully adhered to in order for the vessels to provide 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. The guidelines outlined herein should be carefully followed; however, they are intended only as guidelines and 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 the CodeLine® for clarification.

## **Important Safety Precautions**

### **Do's**

- Read, understand and follow every part of this section. Failure to take every precaution may void warranty and could result in catastrophic 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.
- Verify that 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 on pg.9 -10).

### **Don'ts**

- Operate vessel at pressures in excess of specific rating or temperatures over 120°F.
- Service any component until you verify that vessel pressure is fully relieved from the vessel.
- Use corroded components. Use of such components may result in catastrophic failure.
- Pressurize vessels without element in place, unless permeate ports are plugged properly.
- Pressurize vessel until after visually inspecting to insure that the retaining ring is correctly installed in the stainless steel groove in the vessel.
- Tolerate leaks or allow end closures to be routinely wetted in any way.
- Use excessive silicone lubricant or allow petroleum or silicon based products to come in contact with the membrane element during installation or maintenance (**DO NOT USE PETROLEUM PRODUCTS ON NORYL COMPONENTS**).
- Use vessel at negative pressure.

## **Preface**

### **The 80E Series family of pressure vessels**

The CodeLine® 80E Series is a standardized family of fiberglass pressure vessels designed for the continuous, long-term use as housings for reverse osmosis membrane elements. Any make of eight-inch nominal diameter spiral-wound element is easily accommodated.

The 80E Series includes five models of different pressure ratings. They are unified in design and have maximum number of parts in common. Each model has the appropriate strength and materials of construction to provide years of continuous use in typical service when properly maintained.

Each model is available in lengths to house, from one to eight, 40-inch long elements and two, four or five 60-inch long elements.

The 80E Series is designed and built in accordance with the engineering standards of the Boiler and Pressure Vessel Code of the American Society of Mechanical Engineers (ASME Code). A vessel marked with an ASME Code stamp is accepted worldwide as being built to the highest standards of safety.

Each model in the CodeLine® 80E Series has passed rigorous ASME Code qualification tests which require that the vessels do not burst at less than six times their design pressure. Safe use is further assured in that vessels will not fail catastrophically; overpressure is relieved by weeping through the fiberglass shell. Also, every production vessel is hydro-tested to verify structural integrity.

While undertaking regular maintenance/repair/replacement of a pressure vessel it may be necessary to remove the pressure vessel from the bank. Also ensure sufficient spares are available for replacement. Care must be taken in installation/removal of the vessel to avoid damage to the shell. Damage to the shell can result in catastrophic failure and possible injury to personnel. Any corrections or recommendation for improvement for this manual should be addressed to:

### **CodeLine® Division**

Pentair Water India Pvt. Ltd.  
L/52-55, Verna Industrial Area,  
Verna, Goa – 403722, INDIA  
Tel: +91-832-2883300  
Fax: +91-832-2883312

### Installation notes

Even though your vessel may have been installed by others, there are a few quick checks on installation you should make before use. Vessels must be installed correctly to ensure safe use and long service life.

- Vessel mounted on horizontal support frame using compliant black urethane saddles; hold-down straps tightened just snug.
- Vessel free to expand under pressure; shell not clamped rigidly in place; piping to vessel ports not made with rigid connections.
- Vessel not used in any way to support other components, such as piping manifolds hanging from ports.

**WARNING:** Failure to allow expansion in diameter or length will result in vessel damage.

If you have any questions about the installation of the vessels in your unit, contact your supplier. For installation guidelines, refer to the 80E Series Installation Guide.

Vessel information chart					
Shell					
	80E30	80E45	80E60	80E100	80E120
Max operating pressure (psi)	300	450	600	1000	1200
Operating temperature range	20°F - 120°F				
Test PR	330	495	660	1100	1320
ASME(1.1X) (PSI) ; CE (1.5X)	450	675	900	1500	1800
Prototype min. burst Pressure (PSI)	1800	2700	3600	6000	7200
Engineering drawing number	99111	99112	99109	99108	99110
80E series user guide number	523004				

**CODELINE®****Pre-pressurization checklist****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 in this bulletin 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 a qualified mechanic, experienced in servicing high-pressure hydraulic systems, open, close and service this vessel.

This checklist is an operational aid intended to augment detailed guidelines given in the **80E Series 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 recommendation.
- Feed flow direction correctly noted and elements correctly oriented.
- Column of elements centered inside shell

**Element interface**

- Adapters installed at both ends of element column.
- Thrust ring installed downstream from element column.

**Head**

- All components in as-new condition clean and free of damage or corrosion.
- All components are properly assembled with new, freshly lubricated seals.
- Port retainer for feed/concentrate port in correct position.
- Port nut snug - 80E45 / 60 (Note: left-hand thread)
- Permeate port snap ring installed – 80E30

**Head assembly Interlock**

- Locking groove at each end of the shell is clean, free of corrosion and / or delamination with outboard face of groove true and is in sound condition.
- All components in as-new condition, clean and free of damage or corrosion.
- Retaining ring is fully seated in the retaining ring groove.

**Piping connections**

- Properly secured.
- Leak free.

Assembly by: \_\_\_\_\_

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

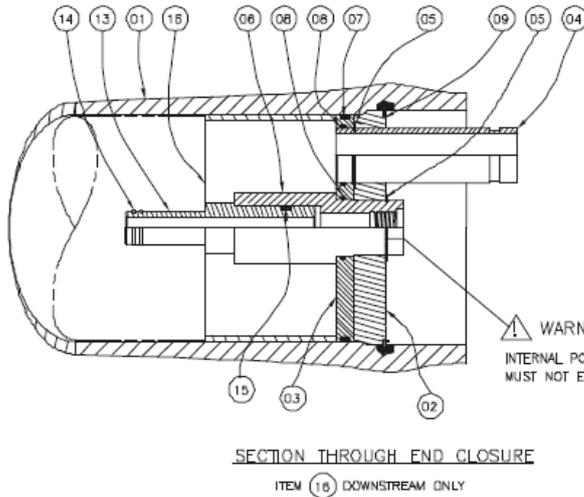
Checked by: \_\_\_\_\_

Date of Inspection: \_\_\_\_\_

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

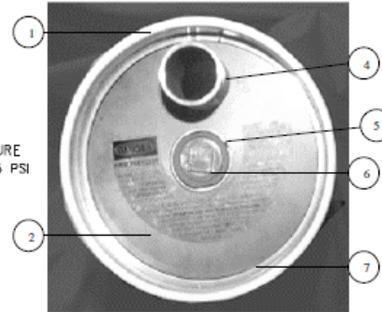
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**Component Identification 80E30**



BOTH ENDS ARE IDENTICAL  
EXCEPT ITEM 16  
-DOWNSTREAM ONLY-

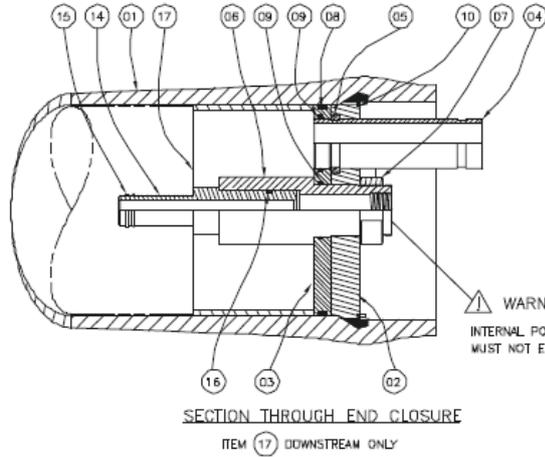
WARNING !  
INTERNAL PORT PRESSURE  
MUST NOT EXCEED 125 PSI



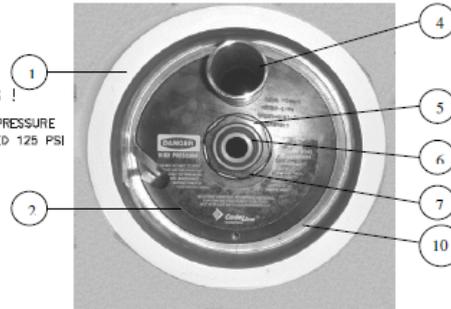
End closure component identification

Dwg Ref	Qty.	Part Number	Part Name	Materials/ Remarks
<b>Shell</b>				
1	1	Order section	Shell Length	Filament wound epoxy/ glass composite SS – Head locking groove, integrally wound in place
<b>Head</b>				
2	2	51050	Bearing Plate	6061-T6 aluminium alloy-hard anodized
3	2	96003	Sealing Plate	Engineering Thermoplastic
4	2	50607	Feed/Conc Port	316L Stainless Steel
5	4	45247	Port Retainer	304 Stainless Steel
6	2	50608	Permeate Port	Engineering Thermoplastic
7	2	96000	Head Seal	Ethylene Propylene, O-Ring (442)
8	4	45312	Port Seal	Ethylene Propylene, O-Ring (225)
<b>Head Interlock</b>				
9	2	47336	Retaining Ring	316 Stainless Steel
<b>Vessel Support</b>				
10	*2	52169	Saddle	Engineering Thermoplastic
11	*2	45042	Strap Assy	304 Stainless Steel-PVC cushion
12	4	46265	Strap Screw	5/16-18 UNC, 18-8 Stainless Steel
<b>Element Interface</b>				
13	2	A/R	Adapter	Engineering Thermoplastic
14	4	A/R	PWT Seal	Ethylene Propylene, O-Ring
15	2	52245	Adapter Seal	Ethylene Propylene, O-Ring
16	1	45069	Thurst Ring	Engineering Thermoplastic
* 3 each furnished with length code 4 - 7				

**Component Identification 80E45, 80E60, 80E100, 80E120**



**BOTH ENDS ARE IDENTICAL  
EXCEPT ITEM 17  
-DOWNSTREAM ONLY-**



*End closure component identification*

Dwg Ref	Qty.	Part Number	Part Name	Materials/ Remarks
<b>Shell</b>				
1	1	Order section	Shell Length	Filament wound epoxy/ glass composite SS – Head locking groove, integrally wound in place
<b>Head</b>				
2	2	80E45 : 51051	Bearing Plate	6061-T6 aluminium alloy-hard anodized
		80E60: 51052		
		80E100/120: 47317		
3	2	96003	Sealing Plate	PVC Thermoplastic
4	2	80E45/60: 50567	Feed/Conc Port	For 80E45/60 – 316L Stainless Steel, Two piece set
		80E100/120: 50556		For 80E100/120 – Super Duplex Stainless steel
5	4	45090	Port Retainer Set	CF8M Cast SS, Two-piece set
6	2	80E45/60: 50569	Permeate Port	Engineering Thermoplastic
		80E100/120: 50558		
7	2	45066	Port Nut	Engineering Thermoplastic
8	2	96000	Head Seal	Ethylene Propylene, O-Ring
9	4	45312	Port Seal	Ethylene Propylene, O-Ring
<b>Head Interlock</b>				
10	2	47336	Retaining Ring	316 Stainless Steel
<b>Vessel Support</b>				
11	*2	52169	Saddle	Engineering Thermoplastic
12	*2	45042	Strap Assy	304 Stainless Steel-PVC cushion
13	4	46265	Strap Screw	5/16-18 UNC, 18-8 Stainless Steel
<b>Element Interface</b>				
14	2	A/R	Adapter	Engineering Thermoplastic
15	4	A/R	PWT Seal	Ethylene Propylene, O-Ring
16	5	52245	Adapter Seal	Ethylene Propylene, O-Ring
17	1	45069	Thrust Cone	Engineering Thermoplastic

\* 3 each furnished with length code 4 - 7

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### Opening vessel Step-By-Step Guide

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

#### Step 1 Relieve pressure

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

#### 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®.



*Loosening Deposits*

#### Step 4 Remove head retaining ring

1. No special tools are required for this operation. Engage your fore finger in the end tab of the retaining ring, lift it up and out of the stainless steel groove in the shell.

- B. Flush away loosened deposits with clean water.

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

**WARNING:** Do not attempt to service any component without first verifying that vessel pressure is fully relieved from the vessel. Attempting to remove any component before pressure is relieved may result in explosive release of the head.

2. Remove the retaining ring from the stainless



steel groove in the shell. This is accomplished by running your fingers behind the retaining ring as it continues to exit the groove.

3. If the retaining ring is difficult to remove, try soaking with a warm release agent such as LPSTM or WD40TM, being careful to avoid any contamination of a membrane element. Take care to avoid hitting or levering against the vessel, as this could result in delamination.

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- Remove the retaining ring from the stainless steel groove in the shell. This is accomplished by running your finger behind the retaining ring as it continues to exit the groove.



*Removing the retaining ring from the groove*

### Step 5 Remove head

**CAUTION:** Do not strike or apply undue force on ports to remove heads.

#### Step 5A Removal by hand

- Gently tap the Head Assembly with a rubber mallet.
- Grasp feed/concentrate port and pull head straight out. A sharp forceful tug may be required to start head assembly moving.
- If the head seal remains in the vessel bore, it should be removed at this time.

Repeat above procedure for the opposite end of the vessel.



*Head assembly removal – by hand*

**NOTE:** If vessel has been in service for sometime, head may be difficult to remove. For assistance in head removal, 80E Series head tool (p/n 94101) is available from CodeLine®.

#### Step 5B Removal using head tool

- The Head Removal Tool (P/N 94101) is made up of 3 components:
  - Plate
  - Bolt
  - Nut with handle Grip
- Hold the plate against the face of the vessel. With the Feed/Concentrate port projecting out of the hole provided on the plate, engage the bolt of the head puller in the 1" FNPT connection of the permeate port.
- Run the Nut with the handle grip on the head puller bolt and continue to tighten the nut till the head comes out.

Repeat the procedure for the opposite end

of the vessel.

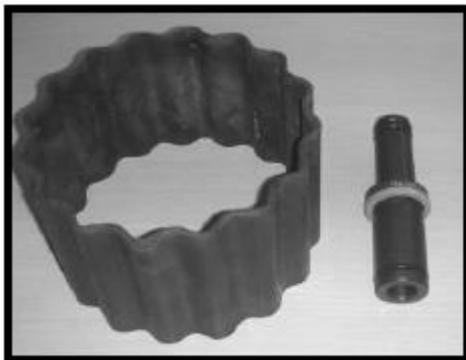


*Removing Head Assembly using Head Tool*

## 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 end of vessel, using the adapters supplied. Pressurizing vessel without elements and both adapters installed could result in catastrophic failure. Do not scratch or damage the vessel bore when removing or installing elements.



Thrust Ring

Adapter

### Preliminary Steps

**DO NOT** proceed with step by step instructions until:

1. All pressure has been relieved from the vessel, following system manufacturer's recommendations.
2. Both heads have been removed from vessel following step by step instructions in Opening Vessel:

### Step 1 Remove element interface hardware

1. Remove thrust ring from downstream 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.

**WARNING:** Do not pressurize vessel without 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:** A record of element serial number and locations should be made and checked during loading.

### Step 3 Element loading

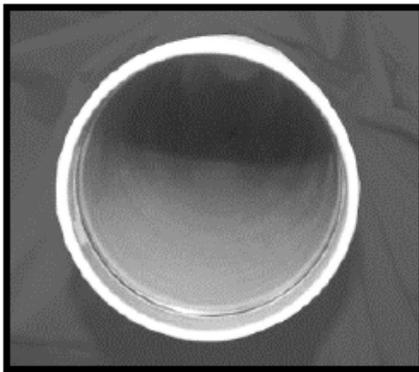
1. Flush out vessel with clean water to remove all dust and debris.
2. Examine inside diameter of the vessel for scratches or imperfections that may affect sealing capability of head or element seals. Corrosion deposits or other foreign matter, including any excess lubricant, should be removed as described in Closing Vessel, Step 1 on pg.12.

\* PVC Permeate Port

3. Examine membrane element surfaces for any imperfection which could scratch the vessel bore. Pay particular attention to edges of antitelescopic device (ATD/brine seal carrier). If any defects are found which cannot easily be corrected, contact the element manufacturer for corrective action.

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- 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.



*Examine bore for scratches*

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

- Load the first element into upstream end of the vessel. Leave a few inches of the element projecting from the vessel to facilitate interconnection to next element.
- Apply O-lube sparingly to O-ring of interconnector (amount of O-lube should be sufficient to give a luster to the O-ring. Excess O-lube must be removed to prevent possibility of element contamination).
- Assemble the interconnector to the loaded element.

**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.

- Line up the next element to be loaded and assemble it to the interconnector already assembled on the first element.
- Push both elements into the vessel until a few inches are projecting from the vessel. Repeat loading process until all elements are installed.

### Step 3 Install element interface hardware

- Assemble adapter to element permeate tube at each end of the vessel.

**WARNING:** Pressurizing vessel without both adapters installed could result in catastrophic failure.

- Install thrust ring at downstream end.

**CAUTION:** Install the thrust ring at the downstream end. Serious damage may result if thrust ring is not installed in correct location.



*Installing thrust ring*

**NOTE:** Ensure thrust ring is clean before installation. Thrust ring required no orientation; simply push into shell. For step-by-step instructions on vessel closure, refer to the Closing Vessel on pg.12

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### Closing the vessel

**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.

Keep port nut snug (80E45/80E60, 80E100/80E120 only – nut has left hand thread). If nut loosens, feed/concentrate port retainers may fall out of position resulting in catastrophic release of port.

Do not pressurize the vessel until after visually inspecting to ensure that retaining ring is fully seated.



#### Preliminary Steps

**DO NOT** proceed until:

1. Elements and adapters have been installed in vessel following guidelines in Replacing Elements.
2. Head has been checked for correct component assembly by following step-by-step instructions in Head Rebuilding.
3. Vessel has been shimmed to prevent movement of the membrane elements if required. See pg.21-22 of the

troubleshooting section for a description of when shimming is required.

#### Step 1 Inspect shell inside surface

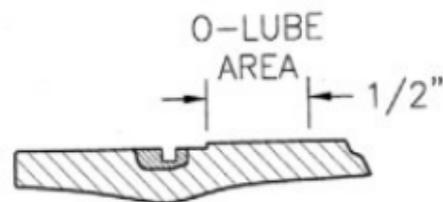
1. Inspect the vessel inside surface for any corrosion deposits or other foreign matter. If any are found, clean the surface as follows:
  - A. Using a medium or finer grade of Scotchbrite™ and a mild soap solution clean each end of the vessel liner surface up to 8" in from each end of vessel.
  - B. Rinse away all loosened deposits from shell inside surface.
2. Inspect vessel inside surface for scratches or other damage which could cause leaks. Vessels that leak must be replaced.

**CAUTION:** Never attempt to repair a fiberglass shell.

#### Step 2 Shell and head seal lubrication

1. Work O-ring lubricant into shell area behind the retaining ring groove and approximately ½" into the vessel I.D. (See figure 3).
2. Ensure entire head seal is covered with a thin layer of O-ring lubricant, with no dirt or dust contamination.

**NOTE:** Glycerin is a commercially available lubricant that will not foul membranes. However, silicone lubricant will better assist correct performance and ease head assembly, installation and removal. Do not use petroleum based lubricants.



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**NOTE:** Any remaining lubricant should be cleaned from vessel before applying fresh lubricant.

### Step 3 : Install head

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

**CAUTION:** Do not overtighten a component into thermoplastic permeate port more than one turn past hand tight.

### Step 3A Installation of head assembly

1. Align any previously placed index marks on head assembly and vessel body. This will ensure correct alignment for port connections. Do not rotate head assembly after insertion into vessel as this may cause head seal to become detached.
2. Hold head assembly square to axis of shell and slide it straight in until a slight resistance is felt.
3. Using both hands, firmly push head in as far as it will go (a sharp, forceful thrust may be necessary to push head seal into vessel bore.) When head is in correct position, entire retaining ring groove will be exposed.



*Installing head assembly – by hand*

**CAUTION:** If head is allowed to rock side to side during installation, head seal may become detached.

### Step 3B Installation using tool

1. Align any previously placed index marks on head assembly and vessel body. This will ensure correct alignment for port connections. Do not rotate head assembly after insertion into vessel as this may cause head seal to become detached.
2. Hold the head assembly square to axis of the shell and slide it straight in until a slight resistance is felt.
3. Slide tool (p/n 50733) into shell just behind the head.
4. Tap tool alternating around circumference with a dead-blow hammer until retaining ring groove is fully exposed.
5. Remove tool by pulling straight out. Do not rotate.



*Installing head assembly – using head insertion tool*

### Step 4 Install Interlock

1. With the head assembly installed in shell, place the tip of the head retaining ring in the stainless steel groove.
2. Begin pushing the retaining ring into the groove as you rotate your hand around the I.D. of the shell.
3. Continue until the entire retaining ring is installed in the groove.
4. Verify that the retaining ring is fully seated in the groove before proceeding.

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*Installing retaining ring*

**WARNING:** Retaining ring must be correctly installed. Incorrect assembly or installation can result in explosive head failure.

### Step 5 Reconnect Ports

**NOTE:** Using teflon tape or anaerobic sealant on all threaded connections will help ensure a leak-free assembly.

1. Reconnect piping manifold to the vessel.

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

### 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 (Pg-4) be used to systematically verify that all steps have been performed.

### Head Assembly

Verify that:

1. Head assembly is in good condition, with no evidence of damage or corrosion. See the sections on Head Rebuilding and Maintenance.

2. Port nut is snug (80E45/80E60, 80E100/80E120 lefthanded thread) or snap ring is in position (80E30).
3. Port retainers are correctly installed.
4. Retaining ring is seated in groove.

### Membrane elements

Verify that:

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

### Piping connections

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

### Step 7 Pressurization

**WARNING:** Do not pressurize vessel without elements installed.

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

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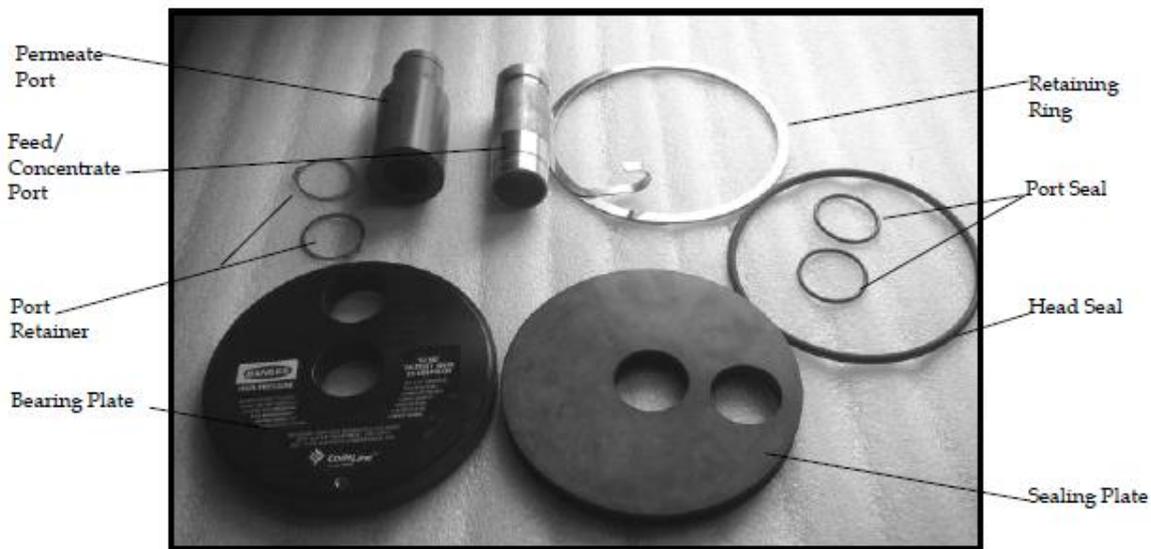
### Head Rebuilding – 80E30 only Step-By-Step Guide

**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 parts can scratch inner surfaces and cause leakage.

**WARNING:** Do not service any component until you verify that pressure is fully relieved from the vessel. Replace any components not in 'ass-new' condition. Reusing corroded or damaged components can result in catastrophic failure.

Snap rings must be fully seated at bottom of grooves provided. Incorrect assembly can result in catastrophic release of port.



Head component identification (80E30) – head disassembled

#### Preliminary steps

**DO NOT** proceed 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 guidelines in Opening Vessel.

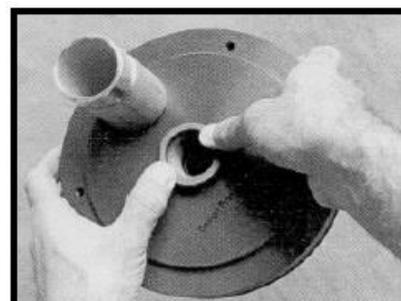
#### To disassemble head

**NOTE:** Refer to pg.14 for head component identification.

**CAUTION:** It is recommended that safety glasses be worn during removal of snap ring.

#### Step 1 Remove permeate port

1. Remove snap ring using snap ring pliers

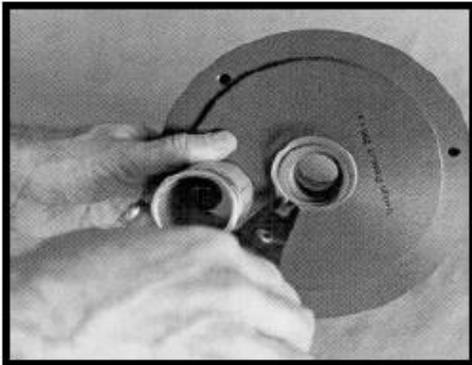


Snap ring removal using snap ring pliers

**CODELINE®**

**NOTE:** If necessary, ports may be tapped with a rubber mallet to ease removal.

2. Remove permeate port by pressing out from small end.



*Pressing out permeate por*

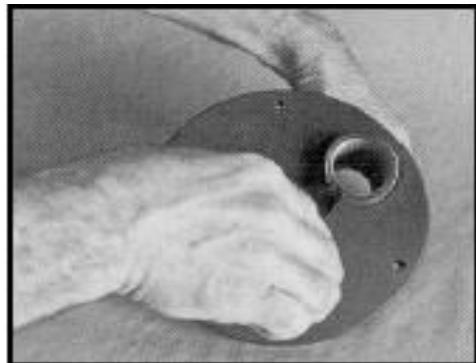
**Step 2 Remove sealing plate**

1. Hold feed/concentrate port and bearing plate stationary and rotate sealing plate slightly to break seal. Remove sealing plate

**Step 3 Remove feed/ concentrate port**

1. Remove snap ring using snap ring pliers.
2. Remove feed/concentrate port from bearing plate.

Steps for rebuilding the heads of the 80E30 continue on pg.19.



## Head Rebuilding – 80E45/80E60, 80E100/80E120

### 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 parts can scratch inner surfaces and cause leakage.

**WARNING:** Do not service any component until you verify that pressure is fully relieved from the vessel. Replace any components not in 'ass-new' condition. Reusing corroded or damaged components can result in catastrophic failure. Snap rings must be fully seated at bottom of grooves provided. Incorrect assembly can result in catastrophic release of port.



Head component identification (80E45/60, 80E100/120) – head disassembled

#### Preliminary steps to disassemble head

Do not proceed 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 guidelines in Opening Vessel

**NOTE:** Refer to pg.6 and pg.16 for head component identification

#### Step 1 Remove permeate port\*

1. Remove port nut by unscrewing left-hand thread.



Removing port nut (Left-hand threaded)

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**NOTE:** If necessary, ports may be tapped with a rubber mallet to ease removal

2. Remove permeate port by pressing out from threaded end.



*Pressing out permeate port*

### Step 2 Remove sealing plate

1. Hold feed/ concentrate port and bearing plate stationary and rotate sealing plate slightly to break seal. Remove sealing plate.

### Step 3 Remove feed/ concentrate port

1. Press long, exposed end of feed/concentrate port further into bearing plate to free the port retainer set.
2. First remove port retainer set (2 pieces), then feed/concentrate port from bearing plate.



*Removing port retainer set*

Steps for rebuilding the heads of the 80E45/80E60, 80E100/80E120 continue on pg.19.

### Step 4 Remove seals : All Models

1. Carefully remove 3 seals from the sealing plate.



*Removing Seals*

**NOTE:** A small screwdriver or similar tool may be used to remove O-rings. However, do not damage the sealing plate surfaces in any way or leakages may result.

It is recommended that all seals be replaced each time the heads is assembled. It is recommended that on 80E30 vessels, the snap ring be replaced each time head is assembled.

### Component cleaning and examination

#### Step 1 Wash components

1. Wash all components in fresh water.
2. Blow components dry with compressed air, if available.

#### Step 2 Initial component inspection

1. Examine all components for any damage that could affect structural strength or sealing properties.

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

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2. Replace any parts considered to be structurally unacceptable.

The following examples indicate when replacement is required.

A. Feed/concentrate port bent or distorted

B. Permeate port or nut stripped or overstrained.

C. Permeate port internal thread stripped or overstrained.

D. Bearing plate dented or distorted or with anodizing removed (possibly from being dropped or hit).

E. Sealing plate cracked, distorted or with sealing area damaged.

F. Retaining ring bent or damaged.

Any other detail consideration to be a potential problem should be referred to CodeLine®.

**NOTE:** Alternate materials are available for high corrosion environments. Call CodeLine for information.

### Step 3 Evaluating corroded metal components

This procedure applies to the following parts:

A. Retaining Ring

B. Bearing Plate

C. Feed/Concentrate port

D. Port Retainers

**CAUTION :** This procedure 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.

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.

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

**CAUTION :** The following procedure 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, it must be replaced.

### Step 4 Removing deposits from plastic

This procedure applied to the following components:

A. Port Nut (80E45/60/100/120 only)

B. Permeate Port

C. Sealing Plate

D. Adapter

1. Examine all plastic 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 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.

**NOTE :** If any components are cracked, softened or discolored this may indicate a chemical resistance problem. These components must be replaced. Alternate materials may be required in these applications

## CODELINE®

### To reassemble head

**WARNING :** head must be carefully assembled following these instructions. Incorrect assembly can result in catastrophic failure.

**CAUTION:** Use Parker Super-O-lubetm sparingly on all seals each time the head is Assembled. Excessive lubricant may foul membrane.

**NOTE :** It is recommended that all seals be replaced each time the head is assembled. A seal replacement kit is available from your supplier

### Step 1 Lubricate and install seals

1. Cover each seal with a thin, even layer of O-ring lubricant.

**NOTE :** Glycerine is a commercially available lubricant that will not foul membranes. However, silicone lubricant, correctly used, will better assist correct performance and ease head assembly and disassembly. Do not use petroleum based lubricants.

2. Install port seals in sealing plate .



*Installing port seals*

### Step 2 Install feed/concentrate port

1. Hold the bearing plate so that the counter bore in the off center hole is facing toward you. From the other side, insert the smaller, machined end of the stainless steel feed/concentrate port through the off-center hole.



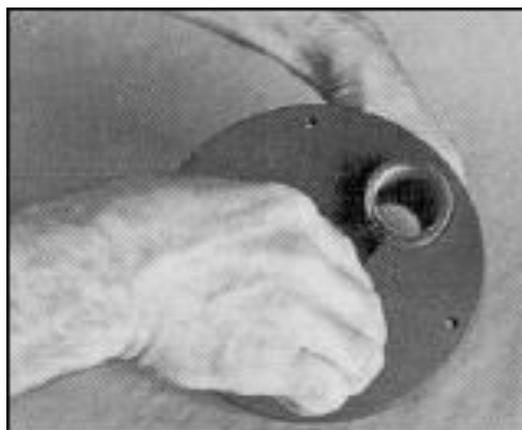
*Installing Feed/ concentrate port*

**NOTE** Steps for rebuilding the head of the 80E30 only continue on pg.19. Steps for rebuilding the head of the 80E45/60, 80E100/120 continue on pg.20.

### 80E30 only :

**CAUTION:** It is recommended that safety glasses be worn during installation of snap ring.

2. Install snap ring into groove in feed/concentrate port using snap ring pliers.



*Port being fitted using snap ring pliers*

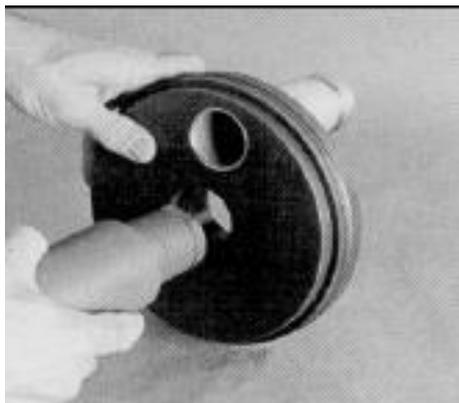
### Step 3 Install sealing plate

1. With its larger diameter facing the bearing plate, press the sealing plate onto the machined end of the feed/concentrate port.
2. Rotate sealing plate until the two center holes are aligned.

## CODELINE®

### Step 4 Install permeate port

1. From sealing plate side, insert threaded end of permeate port through bearing/sealing plate combination. Press firmly until permeate port bottoms on sealing plate.
2. Install snap ring into groove on outer end of permeate port using snap ring pliers.



*Permeate port being inserted*

**WARNING :** snap ring must be fully seated at bottom of groove provided. Incorrect assembly can result in catastrophic failure.

**NOTE :** Head rebuilding of the 80E30 is now complete.

### 80E45/60, 80E100/120 only :

(\*Cont'd from page. 16 )

2. Install the port retaining set into the groove in the machined end of the feed/concentrate port. Pull port back until retaining ring set bottoms in bearing plate recess.



*Installing port retaining set*

### Step 3 Install sealing plate

1. Hold these components together so that the retaining ring set remains firmly seated. With its larger diameter facing the bearing plate, press the sealing plate onto the machined end of the feed/concentrate port.
2. Rotate sealing plate until the two center holes are aligned.

### Step 4 Install permeate port

1. From sealing plate side, insert threaded end of permeate port through bearing/sealing plate combination. Press firmly until permeate port bottoms on sealing plate.



*Installing permeate ports*

2. Thread port nut (left-hand thread) onto permeate port. Tighten until snug.

**WARNING :** with the port nut tightened, the sealing plate must sit flush against the bearingplate. If any gap is evident, The components have not been assembled correctly. Incorrect assembly can result in catastrophic failure.

**NOTE :** Head rebuilding of the 80E45/60, 80E100/120 is now complete.

## CODELINE®

### Preventive maintenance

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

- 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.

### Troubleshooting

This section is intended only to provide guidelines for dealing with problems that might arise while working with CodeLine® 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



*Loosening Deposits*

2. Flush away loosened deposits with clean water.
3. Proceed with instructions given in **Opening Vessel** section

#### Difficulty in opening vessel

**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 CodeLine for technical assistance.

#### Retaining ring

1. Will not release from groove and or bearing plate:
  - A. Apply penetrating fluid (such as WD-40TM or LPS-1TM) around retaining ring at the retaining ring groove and bearing plate interfaces.



*Applying penetrating fluids*

- B. Use a cushioned mallet or hammer in conjunction with a wood block to tap the face of the bearing plate and retaining ring.
  - C. Again attempt to remove the retaining ring.

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### 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 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. 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 adapters 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 the membrane properly loaded, install the adapters and place the thrust ring in the downstream end of the vessel. (See REPLACING ELEMENTS on pg.9&10 ).
2. Install a head in the downstream end of the vessel following Steps 1 through 4 of the section entitled CLOSING VESSEL on pg.12 ).
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 adapter that fits into the permeate port. Add enough spacers so that when the head is installed, it is not possible to install the retaining ring in the groove. This will normally require 2 to 3 spacers.



*Sliding spacers onto adapter*

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 on pg. 12.

### Installation guide

Proper vessel handling and installation are important to safe use and long vessel life. These guidelines outlined herein should be carefully followed; however, they are intended only as guidelines and 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 **Installation Guide** section. Should any information in this guide not agree with the system supplier's instructions, call the CodeLine® for clarification.

### Contents

- Handling and Receiving
- Mounting Shell
- Piping Connections

## CODELINE®

### Handling and receiving

Fibreglass 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 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 the shell.
5. Before using a forklift to handle the vessel, pad the forks to lessen the chance of damaging the shell. Severe scratched or gouging of the vessel can result in failure of the vessel wall.
6. DO NOT allow undue stress to act on the Feed/Concentrate port, which might cause impact damage to port area, leading to leakage. Do not use the Feed/Concentrate port or the permeate port as a tool to lift the pressure vessel or as a support to manifolds. Manifolds should be self-supporting.

#### **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 scratched that go no deeper than the paint may be acceptable. Call CodeLine® Customer Service for advice if in doubt.

### Mounting shell

This section is concerned with the mounting of 80E Series pressure vessels only. These guidelines must be integrated with any additional procedures required for specific installation.

### Installation Guidelines:

2. Provide adequate room for servicing at both ends of vessel. Elements are installed from the upstream end, pushed through towards the downstream end and, eventually, removed from downstream end.
3. Follow all applicable handling guidelines.
4. 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 the tubing which connects a vessel to a header. Normally each vessel should be placed such that dimension from the vessel retaining ring groove to U bend/header connection point be equal at both ends. However, if U-bends are not symmetrical at both ends, the vessel may need to be positioned off center such that connections can be made easily, without undue strain, at both ends of the vessel.

1. Mount vessel on urethane saddles positioned in line with pre-drilled frame holes for -1 through -5 vessels. The holes should be drilled at approximate centre span 'S'. For -6, -7, -7.5 and -8 vessels, holes should be drilled within 10" to 30" from ends of vessel and a third saddle and strap, should be placed at mid span. These dimensions are shown on the 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.
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. Using a wrench, tighten mounting bolts one additional full turn. This should result in 25-50 lbs-in. of torque.

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

### Piping connections

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

1. Support the header independently; support the branch with the header and the vessel.
2. Include an expansion loop in the branch connection to allow for:
  - A. Elastic growth in vessel length
  - B. Thermal growth in vessel length
  - C. Sagging of the vessel (which can occur even when supported at recommended span)
3. The recommended branch connection is a U-bend pipe with flexible connections at each end, or a flexible hose.
4. The total weight of the branch connection and fittings should not exceed 16 lbs. for feed/concentrate and 8lbs. for permeate port for 80E Series vessels.

### Application guide

This Application Guide, together with the Installation Guide and the Operation and Maintenance Guide, outlines the general conditions for safe use of 80E 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 80E vessel selected is appropriate to that application. CodeLine® 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.

### Contents

- Suitability for Intended Use
- Elasticity and Mounting Requirements
- Corrosion
- Safety

### Suitability for intended use

80E Series RO pressure vessels are designed for continuous, long-term use as housings for reverse osmosis membrane elements. Models are available for 300, 450, 600, 1000 and 1200 PSI. Any make of eight inch nominal diameter spiral wound element is easily accommodated. In an RO system there is considerable potential for catastrophic failure, with consequent 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 back pressure 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 CodeLine® pressure vessel for other than its intended application will void the warranty.

CodeLine® 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.

### Elasticity and mounting requirements

Mounting design must allow for the 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 0.20 inch in diameter and up to 0.007 inch per foot in length. A six-element vessel, for example, would expand approximately 0.150 inch in length. The following suggestions will help to ensure the

## CODELINE®

vessel is allowed to expand and will ease servicing.

1. Mount the vessel on the 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 connection to permit decoupling the header from the vessel. The recommended branch connection is a U-bend pipe with flexible connections at each end, or a flexible hose.
5. Do not hard plumb either end of the vessel.
6. Support the header independently; support the branch with the header and the vessel.
7. Include an expansion loop in the branch connection to allow for:
  - A. Elastic growth under pressure
  - B. Thermal growth in vessel length
  - C. Sagging of the vessel (which occurs even when supported at two points at recommended span)
8. The total weight of branch connection and fittings should not exceed 16 lbs for feed/concentrate ports and 8 lbs for the permeate port for 80E 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 longterm 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 atmospheres (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 typical list of CodeLine® pressure vessel components on pages OM-5 & 5A 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 on request.

### Safety

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 CONSIDERATIONS FOR SAFETY

#### Fluid Compatibility

The materials of construction selected must be compatible with the 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 catastrophic failure. Although each 80E 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). Vessels should not be continuously operated at temperatures above 120oF.

#### 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

## CODELINE®

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 vessels should be positioned within the system such that the 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).

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

### Appendix Contents

- Limited Warranty

#### Limited Warranty

Pentair Water India Pvt. Ltd., a division of “Pentair Water” manufactures its products (“Products”) and parts (“Parts”) under the highest standards of workmanship using quality materials. Accordingly, Pentair Water expressly warrants these Products and Parts as follows:

#### Warranty coverage

- All the “CodeLine” & “Pentair” branded membrane housing products are warranted to the original owner to be free of defects in material and/or workmanship under normal use for a period of one (1) year from date of Invoice.
- Any replacement Product or Part 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

#### Exclusions from this limited warranty

This warranty does not cover:

- Defects not reported to Pentair Water within the above described warranty period.

- Any items manufactured by other companies. Such items may carry warranties offered by the original manufacturers.

- Problems resulting from failure to comply with installation instructions or drawings, or improper installation.

- Damage caused by acts of nature or problems resulting from abuse, misuse, negligence or accident by any party other than Pentair Water.

- Problems resulting in whole or in part from alteration, modification or attempted repair of these Products or Parts by any party other than Pentair Water.

- Normal wear of replaceable components, including elastomeric Seals, Spacers etc. These parts require maintenance as part of a yearly service schedule.

- Noncompliance with applicable codes, and ordinances including without limitation, plumbing codes.

- Damage due to chemical attack.

- Warranty applied only to original owner at the original installation location.

- Shortages in receipt of spares/components/products not intimated to the seller within 60 days of the receipt by buyer.

#### Warranty obligation of Pentair

Should a defect in workmanship and/ or material in Products or Parts covered by this warranty become evident during the term of the warranty, then upon compliance with the procedures, as set forth below, Pentair Water, at its option, will: In the case of Products, issue a credit in the amount of the original purchase price of the product, or repair or replace the defective Products. Pentair Water will consider, in good faith customer preference in making a determination whether to issue a credit or repair or replace a Product. In the case of Parts, whether purchased new or exchanged on a Product by other parts, Parts may not be returned for credit or repair. Pentair Water will only be responsible for the replacement of defective parts.

**CODELINE®****Procedure for obtaining warranty performance**

Workmanship, the buyer must promptly notify Pentair Water in writing. In no event may that notification be received by Pentair Water 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 Pentair Water factory for examination. However, upon request of the buyer, Pentair Water may, at its discretion, agree to examine the goods in the field. If, upon examination by Pentair Water, any goods sold under this agreement or purchase order do fail to conform to CodeLine / Pentair-specifications, or prove to be defective in material or workmanship, Pentair Water will supply an identical or substantially similar part F.O.B., Pentair Water factory; or Pentair Water, 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 Pentair Water determines that they do conform to CodeLine/Pentair-specifications, the buyer will be responsible to pay to Pentair Water, a \$750 field service charge, plus travel expenses and a \$750 per diem charge.

**No other warranties.** To the maximum extent permitted by applicable law, PENTAIR WATER DISCLAIMS ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, with regard to the Product(s), Part(s) and/or any accompanying written materials. This limited warranty gives you specific legal rights. You may have others, which vary from state/jurisdiction to state/jurisdiction.

**No liability for consequential damages.** To the maximum extent permitted by applicable law, in no event shall Pentair Water be liable for any damages whatsoever (including without limitation, loss of time, inconvenience, expenses such as telephone calls, labor or material charges incurred in connection with the removal or replacement of the Product(s) or Part(s), special, incidental, consequential, or indirect damages for personal injury, loss of business profits, business interruption, loss of business information, or any other pecuniary loss) arising out of the use of or inability to use the defective Product(s) or Part(s), even if Pentair Water has been advised of the possibility of such damages. In any case, Pentair Water entire liability under any provision of this Limited Warranty shall be limited to the amount actually paid for the Product(s) or part(s). PLEASE NOTE: Because some states/ jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, the above limitation or exclusion may not apply.

**Warranties or representations by others** - No dealer or other person has any authority to make any warranties or representations concerning Pentair Water or its products. Accordingly, Pentair Water is not responsible for any such warranties or representations.

**Other rights** - This warranty gives specific legal rights, and other rights may apply.

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