# INSTRUCTIONS FOR BEL 8” END PORT

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# 1-SAFETY PRECAUTIONS

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## 1.- Safety Precautions

i. BEL pressure vessels are designed for high pressure operations. Improper installation, operation service or maintenance may cause severe damage to property, physical injury or death.

ii. BEL pressure vessels are designed for water treatment only.

iii. PRESSURE AND TEMPERATURE DESIGN LIMITS - Operation of a vessel outside the design limits will make void the warranty and may result in vessel fatigue with possible eventual explosive head failure. Although each vessel is tested at 110% of the design pressure **LONG-TERM OPERATION ABOVE DESIGN PRESSURE MUST BE PREVENTED**.

iv. The pressure vessel should not be use as a support. Piping manifolds and other fittings should be properly designed system framework. **OPERATING PERSONNEL SHOULD BE DISCOURAGED FROM APPLYING UNDUE FORCE TO ANY FITTINGS CONNECTED DIRECTLY TO A PRESSURE VESSEL.**

v. Only qualified mechanics, experienced in working with high pressure hydraulic systems, should be allowed to disassemble or assemble the vessel.

vi. Regularly inspect the system so as to ensure that the various components have not deteriorated or been damaged. Replace any faulty component, make sure the reason for the fault has been found and fixed as well.

vii. Make sure that vessels and associated pipe systems are fully depressurized before attempting any service or maintenance operation.

viii. Be careful not to scratch the inside wall of the shell, especially at the inner sealing area near the groove.

ix. Corroded parts may cause difficulties in removing the head or other components. Do not try to force remove components before all visible signs of corrosion have been eliminated.

x. Never attempt to repair or disassemble the feed/concentrate port in a side port vessel without consulting BEL.

xi. Inspect end closures regularly; replace components that have deteriorated and correct causes of corrosion.

xii. Do not tolerate Leaks, or allow end closures to be routinely wetted in any way.

# 2-INSTALLATION NOTES

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## 2.- Installation notes

i. Provide adequate room for serving at both ends of vessel. Elements are installed from the upstream end, pushed through towards the downstream end and eventually removed from the downstream end.

ii. Make sure that the vessel is horizontally installed on support saddles.

iii. The vessels must not be rigidly clamped in place, mounting design must allow for both radial and axial expansion (typically up to 0.5 mm radial and up to 2-3 mm axial). Restriction can result in damage to the vessel and other system components.

iv. Straps should be tightened enough to hold the vessel onto the support pads, but never so tightly as to restrict expansion.

v. A flexible piping connection should be provided in order to prevent unwanted loads transfer from the manifolds to the permeate connection and to permit decoupling the header from the vessel.
The recommended permeate port connection is a U-bend pipe with flexible connections at each end.

vi. The piping system must be connected to the ports using flexible connectors in order to allow relative movement of the vessels and the piping system. (Victaulic or equivalent connections are recommended).

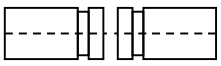
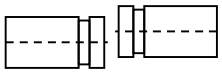
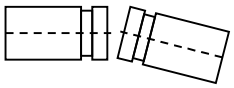
| Side Port |  Spacing [mm]- X |  Max Offset* [mm] |  Max Angle [Deg] |
|---|---|---|---|
| 1.5" | 2 + 0.5 | 3 | 2.5 |
| 2" | 2 + 0.5 | 3 | 2 |
| 2.5" | 3 - 0.5 | 3 | 2 |
| 3" | 3 - 0.5 | 3 | 1.5 |
| 4" | 3 ± 0.5 | 3 | 1.5 |

Table 2.1

# 3-MAINTENANCE HEAD DISASSEMBLY/ REASSEMBLY

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# MAINTENANCE

## Head disassembly

i. **Pressure relieve -** Stop all pumps and relieve pressure.

ii. Disconnect all pipes from ports connecting the vessel's heads with the manifolds.

iii. Engage your forefinger in the hook of the retaining ring, lift it up and pull it out of the groove, by running your fingers behind the retaining ring as it continues to exit the groove. As shown in Fig A

Fig 4-A

iv. Remove the three locker segments from the groove starting from the small segment.

v. **head extraction** -
**a** - Tight the puller legs to the vessel wall as shown in Fig B to support the puller to the vessel.

Fig B

**b**- Screw in fully the cup to the to the Permeate port (clockwise) while supporting the back side of the puller.
As shown in Fig C

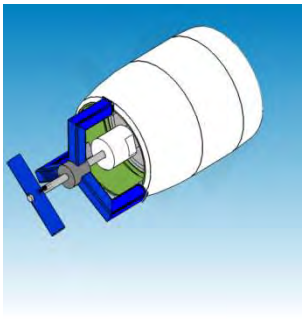

Fig C

**c**- Screw out the Puller's handle (counterclockwise) until the Head assembly is extracted, after that pull out the Puller with the Head assembly.

## Visual inspection

Once the head have been disassembled perform a visual inspection of the vessel head and fittings, to locate any signs of corrosion or salt concentrations if corrosion or salt concentrations are found, follow the following steps:

### Component inspection

- Use a small wire brush to loosen any large deposits.
- Place components in a shallow container of soapy water and scrub their surfaces with medium-grade Scotch-Brite until all corrosion is removed.
- Rinse components with clear water.
- Blow components dry with compressed air.
- Examine components for damage that may affect structural strength or sealing properties.

### Vessel inspection

- If any case of deposit of foreign material has been discovered scrub surface with a fine Scotch-Brite and a mild detergent solution, clean both ends of the vessel, up to 20 cm into the vessel.
- If during inspection scratches are found on the inner surface of the vessel up to 20 cm depth, grind the area carefully with sand paper until it is smooth

## 4.3 Head Reassembly

i. Apply a layer of Lubricant on the O-ring (the amount of the Lubricant should be just enough to give a lustre to the O-ring) and on the bell internal groove.

ii. Place the pusher carefully inside the Base Plate Permeate Port as shown in Fig D. **To avoid property damage do not bend the tool inside the Base Plate Permeate port.**

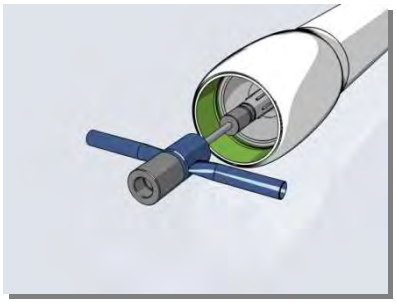

**Fig D**

iii. Push the sliding hammer quickly towards the pusher until it strikes the Head assembly to its place as shown in Fig E. **To avoid personal injury, always grasp the pusher puller handle with both hands.**

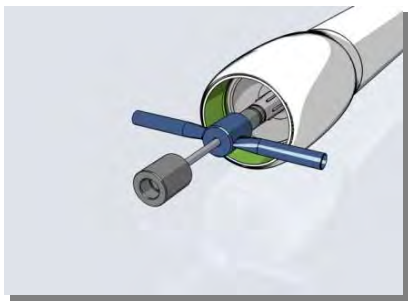

**Fig E**

iv. With the head assembly inserted into the vessel (once the head is in the correct position, the support ring groove is exposed) slide the three segments into the locking groove and

Insert the retaining ring as shown in Figs F, G, H.

**Fig F**

**Fig G**

Fig H

v. Insert the retaining ring into the groove of the Support ring and continue running your fingers behind the retaining ring as it continues to enter the groove.
As shown in Figs I, J.

Fig I

Fig J

## Permeate Port disassembly

i. Use a screwdriver in order to remove the retaining ring which holds the Permeate Port to its place As shown in Fig K

**Fig K**

ii. Disassemble the Permeate port from the Base/Seal Plate by pressing the threaded end of the permeate port as shown in Fig L In case of High pressure vessel (1000-1200 psi) remove the Sealing Plate from the Base plate.

**Fig L**

iii. Use a screwdriver in order to remove the retaining ring that installed at the inner side of the Base Plate, as shown in Fig M.

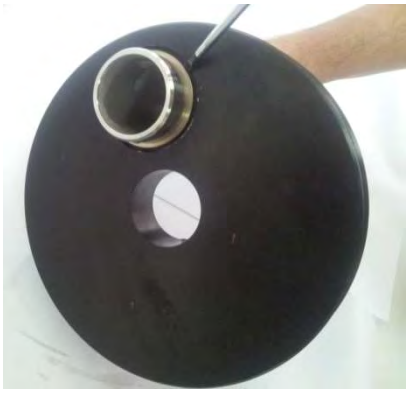

**Fig N**

## Permeate Port reassembly

i. Apply a small amount of lubricant (Molykote 111 or equivalent, Glycerin can be used as well) on the seals Seal for End port, Seal for Permeate Port as shown in Fig O.

**Fig O**

ii. Install Seals on the base plate and Permeate port for 300-600 psi or on the sealing plate and Permeate port for 1000-1200 psi. Visually check the seals for any mechanical damage. As shown in Fig P.

**Fig P**

iii. Insert the End port into the Base Plate As shown in Fig Q and install the retaining ring in the direction of the arrow until it fits the End port groove.

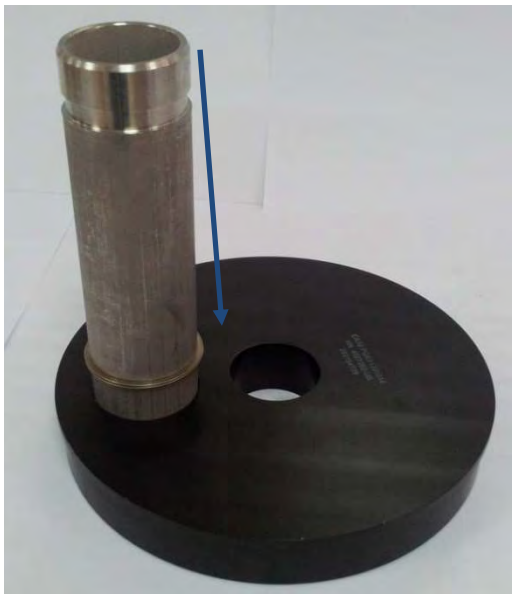

**Fig Q**

iv. Place the base plate as shown in Fig R and use a screwdriver to install the retaining ring until it fits the End port groove.

**Fig R**

v. Align the base plate and the End port installed in it with the sealing plate opening, couple both parts by pushing them together until they touch each other as shown in Fig S.

Fig S

vi. Insert the Permeate port from the inner side of the base plate and carefully push it all the way, as shown in Fig T.

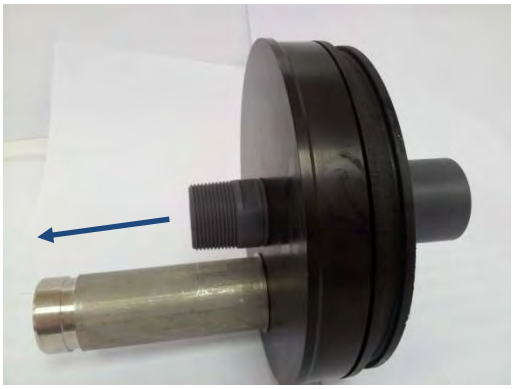

Fig T

vii. Install the retaining ring as shown in Fig U in order to secure the Permeate port to place.

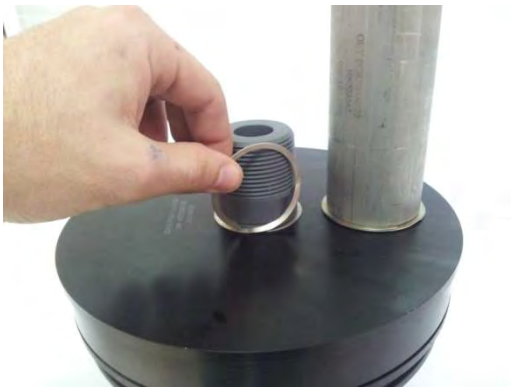

Fig U

viii. Insert the O-ring seal into the groove of the Plate (Base plate at 300-600 psi or sealing plate at 1000-1200 psi) in the direction of the arrow as shown in Fig V Until it fits into the groove.

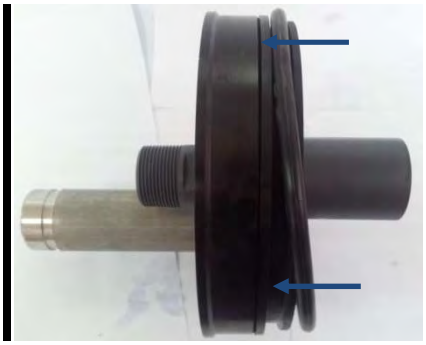

Fig V

ix. Apply a thin layer of Lubricant on the Adapter seal thereafter insert the Adapter into the Permeate port (with a plastic mallet) as shown in Fig W.

Fig W

# 4-LOADING THE MEMBRANE ELEMENT

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## Loading the membrane element

i. Flush the vessel with fresh water to remove dust and debris.

ii. Install a thrust ring in the downstream of the vessel.

iii. Insert Head assembly**, without the O-ring** into the downstream end of the vessel.

iv. Install the segments of the support ring into the locking groove.

v. Inspect the membrane element surface to find any imperfections that could scratch the vessel bore element loading. If a defect is found, which cannot be easily corrected contact the element manufacturer.

vi. Apply a thin layer of lubricant (see 4.5.i) to lubricate the inside of the vessel near the groove. **This will assist membrane element loading and reduce the risk of inadvertently scratching the vessel bore.**

vii. Install the brine seal on the upstream end of the membrane element so that the seal's open side faces upstream (if it is not already installed by the manufacturer).

viii. Load the first element into the upstream of the vessel .Leave 10 cm of the element projecting out of the vessel to facilitate connection with the next element.

ix. Apply a small amount of Lubricant (see 4.5.i) onto the O-ring of the interconnector

and connect the interconnector to the projected end of the loaded element.

x.

x. Line up the next element and assemble it to the inter connector which is already on the first element.
**Carefully maintain element alignment during assembly, misalignment may result damage to the membrane and vessel parts.**

xi. Line up the next element and assemble it to the interconnector which is already on the first element.

xii. Carefully push the two elements into the vessel until the second element is projecting from the vessel approximately 10 cm. Repeat the above steps until all membrane elements have been assembled.

xiii. Calculate the correct shimming distance (see Annex 2) in order to avoid impact damage on the membrane and head parts during pressure drop.

xiv. Insert the shimming spacers on the upstream head assembly (Membrane adapter) so that the sum of their lengths will be equal to the shimming distance.

xv. Install the upstream head assembly as described in section 3.3.

xvi. Remove the downstream head assembly and reassemble it with the O-ring.

# 5-SHIMMING PROCEDURE

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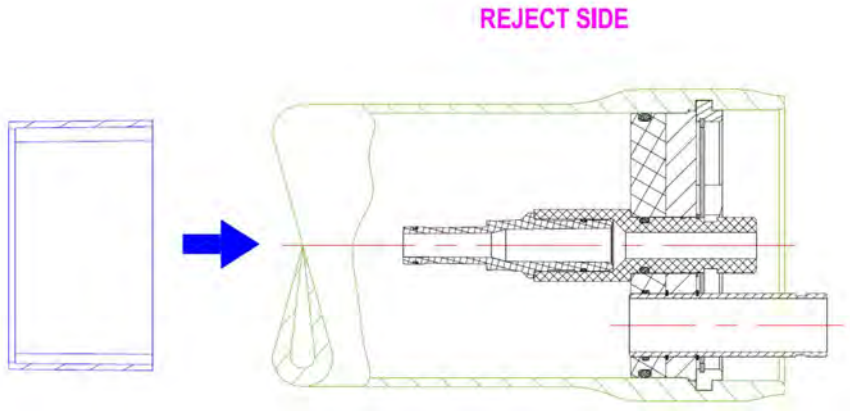
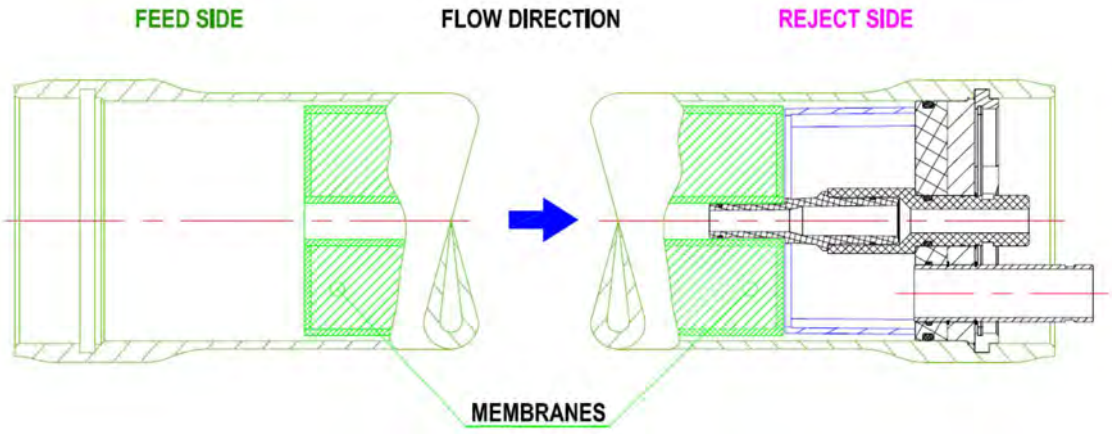
# SHIMMING PROCEDURE

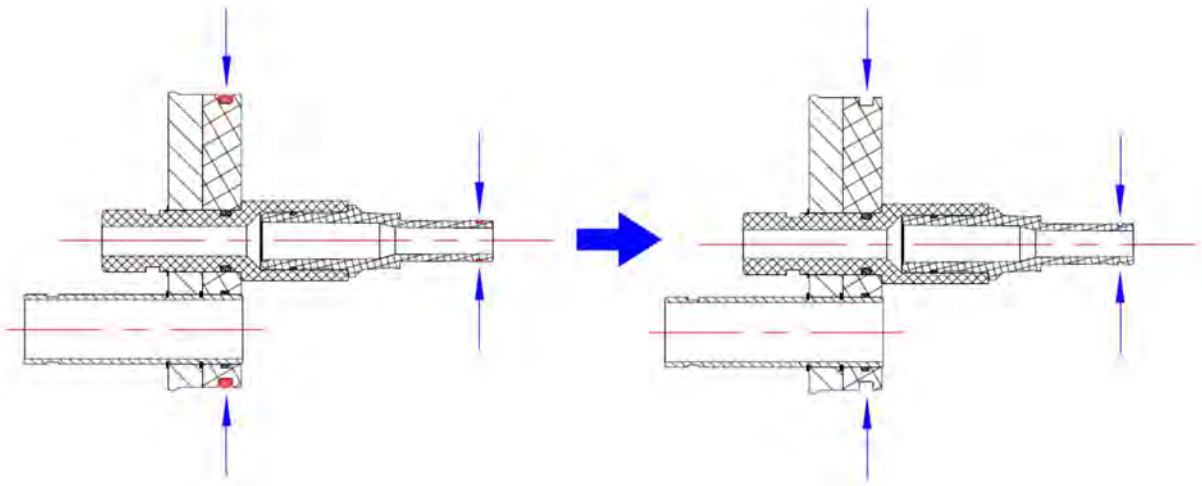
**1.- CLOSE THE VESSEL ON THE REJECT SIDE AND SET THE THRUST RING IN THE VESSEL (REJECT SIDE)**



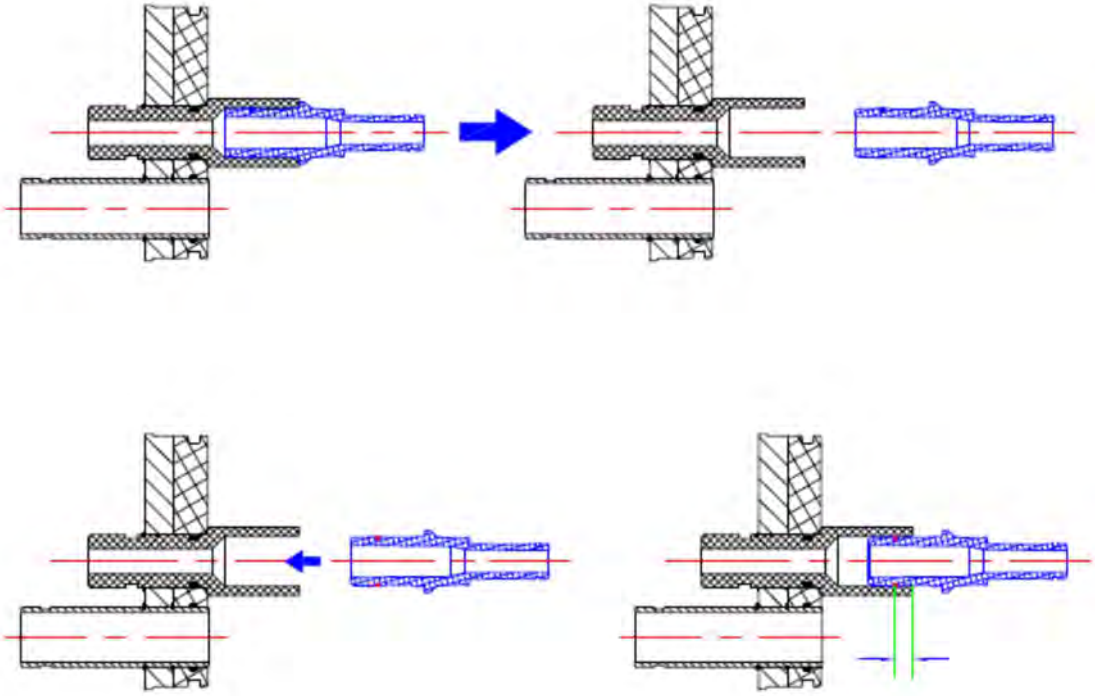

**2.- LOAD THE MEMBRANES FROM FEED SIDE TO REJECT SIDE.**



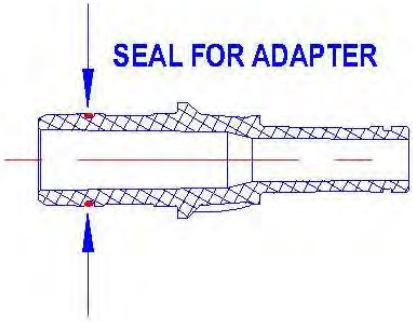

**3.- REMOVE THE O-RINGS FROM THE ADAPTER (membrane side) AND O-RING FROM THE SEALING PLATE OF THE END CAP.**



**4.- REMOVE THE ADAPTER WITHOUT O-RINGS (*in the membrane side of the adapter*) FROM THE END CAP AND RE-INSERT IT AGAIN, PUSHING IT UNTIL THE EDGE OF THE SEAL FOR ADAPTER REACH THE END CAP HOLE TO PLACE IT.**

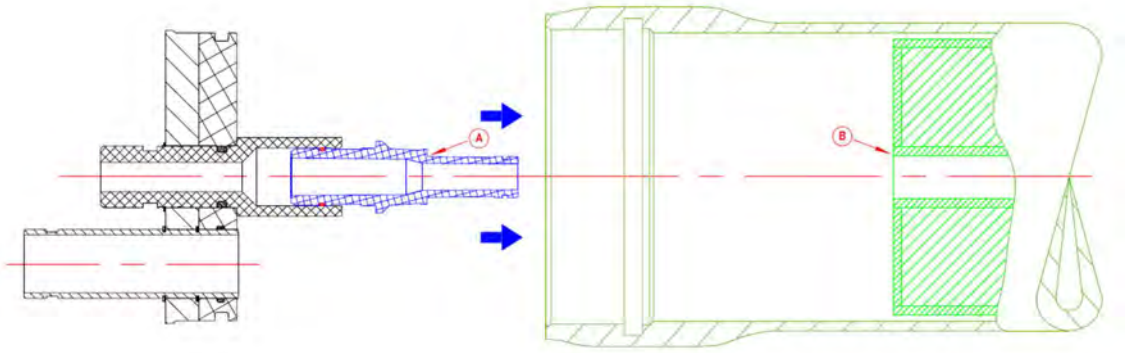


***NOTE 1: KEEP THE ADAPTER O-RING AT THE END CAP SIDE.***
***NOTE 2: APPLY SOME LUBRICANT (GLYCERIN) ON THE ADAPTER O-RING, AT THE END CAP SIDE, AS IT IS SHOWN IN THE NEXT FIGURE.***



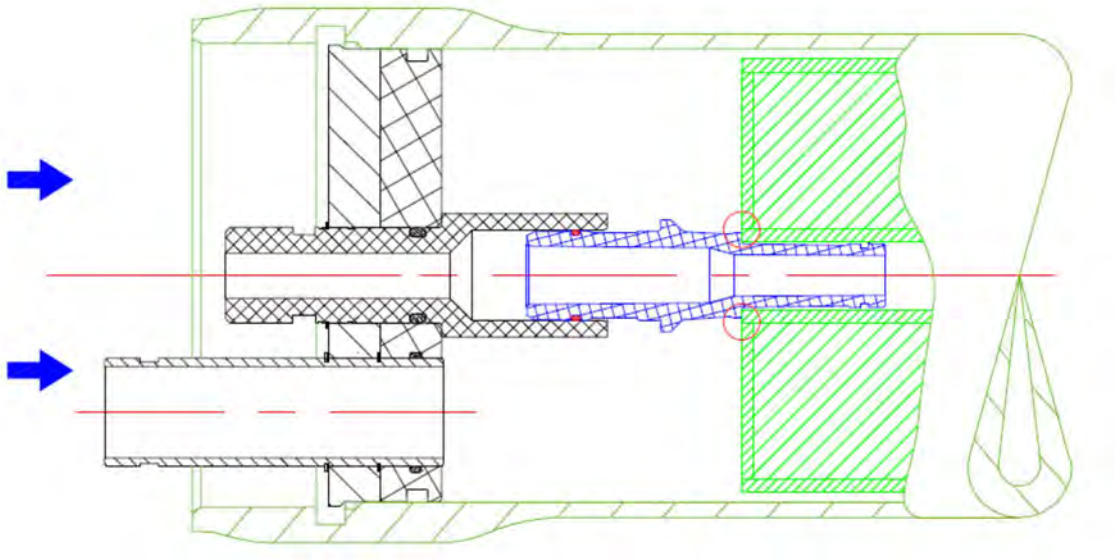

***NOTE 3: DO NOT PUSH THE ADAPTER TOO MUCH INTO THE END CAP HOLE***

**5.- INSERT THE KIT END CAP – ADAPTER INTO THE VESSEL.**



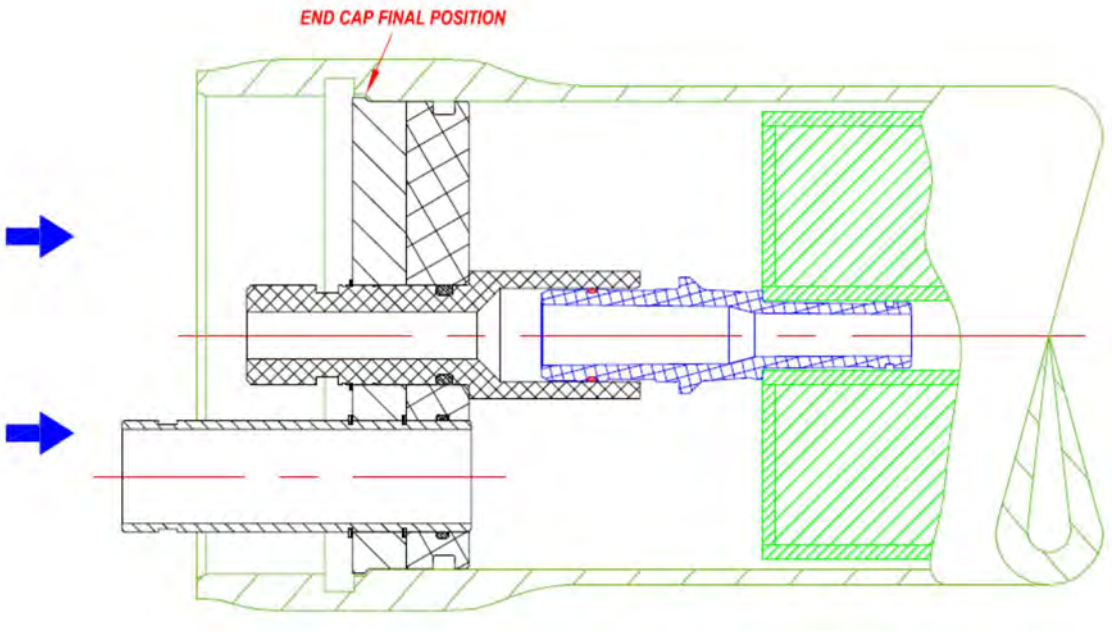

***NOTE 4: INSERT THE KIT SLOWLY UNTIL THE POINT "A" BE IN CONTACT WITH POINT "B", AS IT IS SHOWN IN THE ABOVE FIGURE.***

**6.- AS THE ADAPTER HAS NO O-RING IN THE MEMBRANE SIDE, THE ADAPTER WILL BE PLACED INTO THE MEMBRANE PERMEATE TUBE WITHOUT ANY RESISTANCE.**



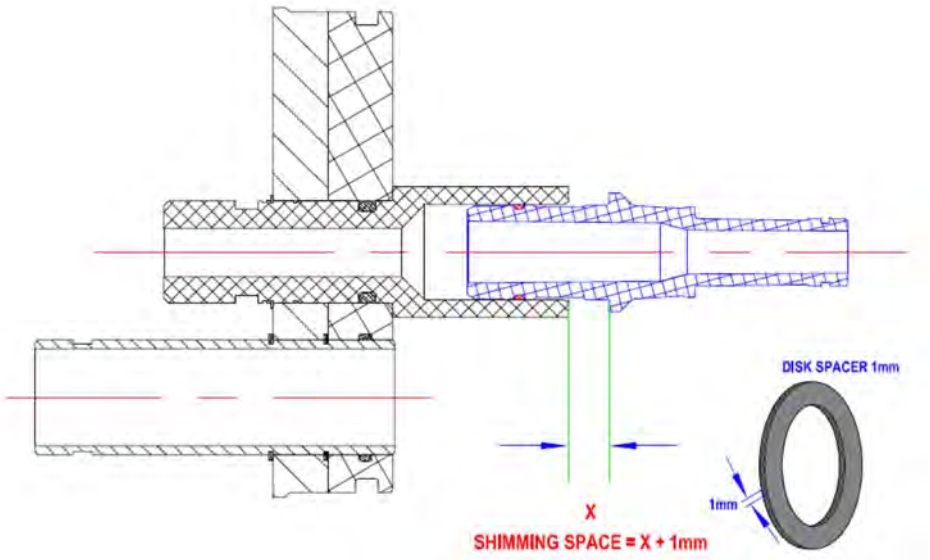
***NOTE 5: THE ADAPTER WILL KEEP THE SAME POSITION INTO DE END CAP HOLE***

**7.- KEEP ON PUSHING THE END CAP UNTIL IT REACH ITS FINAL POSITION INTO THE VESSEL.**




***NOTE 6: IN THE PROCESS OF PUSHING THE ADAPTER WILL MOVE INTO THE END CAP HOLE.***

**8.- REMOVE THE KIT END CAP – ADAPTER AND MEASSURE THE DISTANCE "X".**




***IN ORDER TO AVOID ANY POSSIBLE MISMATCH WITH THE TOLERANCES OF THE PIECES INVOLVED, WE WILL ADD ONE ADDITIONAL 1 mm SHIMMING DISK.***

**THE DISTANCE "X+1mm" IS THE REAL SPACE TO BE SHIMMED WITH DISK SPACERS**

**11.- REPEAT THE OPERATION WITH EVERY VESSEL TO OBTAIN THE REAL SHIMMING DISTANCE FOR EVERY VESSEL.**

# 6-REPAINTING PROCEDURE

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# VESSEL'S RE-PAINTING PROCEDURE

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# Vessel's Re-painting procedure

1. Use acetone in order to clean the vessel surface and reduce the stickiness of the vessel's surface.
2. Polish/remove the vessel's paint layer with sand-paper (grain size 220).
3. Use putty filler to fill and cover the defects on the surface.
4. Let the putty dry for at least 30 min, and grind again the surface until it is totally smooth
5. Clean the vessel with dry rugs.
6. Paint the vessel with the polyurethane high gloss white paint (RAL9010), hardener agent and thinner, better to use air compressed painting system.
7. In case the damage is located in small areas, is suitable the use of high gloss polyurethane spray paint.
8. One or two layers are enough to have a smooth surface.
9. The time between the application of painting layers should be minimum 20 min.
10. Wait 24h before manipulating the vessel to allow fully curing of the painting.

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# 12-SPARE PARTS

Parque Tecnológico Fuente Alamo Ctra. Del Estrecho-Lobosillo, Km2 – 30320 Fuente Alamo, Murcia (Spain)
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| Recommended spare part list for ongoing operation (End Port vessels) | | |
|---|---|---|
| **For exact part number please refer to the drawing or consult BEL** | | |
| **item** | **type** | **quantity** |
| Seal for Sealing plate | EPDM seal | 20% |
| seal for adapter | EPDM seal | 20% |
| membrane seal | EPDM seal | 30% |
| Adapter | Eng. plastic | 10% |
| Sealing Plate | Eng. plastic | 3% |
| Retaining Ring 8" for support ring | Stainless Steel | 5% |
| Seal for End Port | EPDM seal | 5% |
| Retaining Ring for End Port | Stainless Steel | 5% |
| Seal for Permeate Port | EPDM seal | 5% |
| Retaining Ring for Permeate Port | Stainless Steel | 5% |
| other parts - per needs | | |

*performing maintenance with proper and recommended tooling and procedures is important*

*to the final quality and proper functionality of the work, please contact BEL for special tools purchasing*

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