INSTRUCTIONS
FOR
BEL 8” SIDE 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).

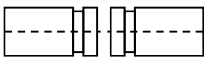
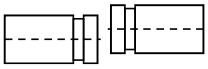
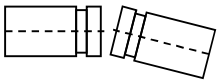
Side Port	 Spacing [mm]- X	 Max Offset* [mm]	 Max Angle [Deg]
1.5"	2 + 0.5	3	2.5
2"	2 + 0.5	3	2
2.5"	3 - 0.5	3	2
3"	3 - 0.5	3	1.5
4"	3 ± 0.5	3	1.5

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 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 A

iv. Move the three locker segments from the groove starting from the small segement.

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

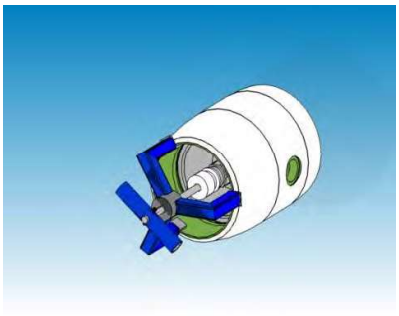

Fig B

b.1 - if **NPT connection -** Screw in fully the NPT cap (clockwise) to the back side of the puller.

b.2 - if **Victaulic connection -** place the Victaulic puller cap carefully inside the End-Cap permeate port (rotate clockwise) and connect it to the End-Cap Victaulic port as shown in Fig C.

c.2 There after Screw out the Puller's handle (counterclockwise) until the End-cap is extracted,

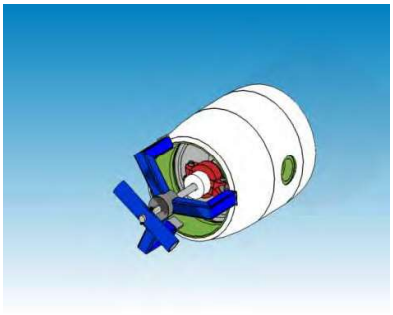

Fig C

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

i. Use a small wire brush to loosen any large deposits.

ii. Place components in a shallow container of soapy water and scrub their surfaces with medium-grade Scotch-Brite until all corrosion is removed.

iii. Rinse components with clear water.

iv. Blow components dry with compressed air.

v. Examine components for damage that may affect structural strength or sealing properties.

Vessel inspection

i. 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.

ii. 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

Head Reassembly

i. Insert the O-ring seal into the groove of the End cap in the direction of the arrow as shown in Fig D. Until it fits into the groove.

Fig D

ii. Apply a small amount of lubricant (Molykote 111 or equivalent, Glycerin can be used as well) on the Adapter seal thereafter insert the Adapter into the End cap.

Fig E

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

iv. Place the NPT/ Victaulic pusher (see Annex 1) carefully inside End cap Permeate Port as shown in Fig F. **To avoid property damage do not bend the tool inside the End cap Permeate Port.**

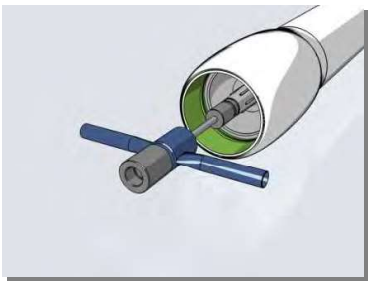

Fig F

v. Push the sliding hammer quickly towards the NPT/ Victaulic pusher until it strikes the End cap to its place as shown in Fig G. **To avoid personal injury, always grasp the pusher puller handle with both hands.**

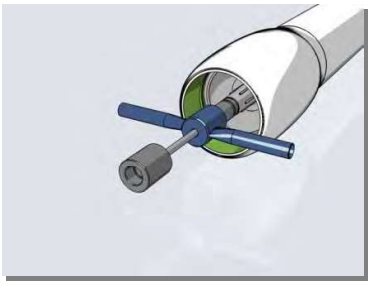

Fig G

vi. Insert the Metal cap into the outer side of the End Cap as shown in Fig H.

Fig H

vii. With the head assembly inserted into the shell (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 I, J, K.

Figure I

Figure J

Fig K

viii. 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 L, M.

Figure L

Figure M

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

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

iv. 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.

v. Apply a thin layer of lubricant (see 4.3.ii) 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.**

vi. 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).

vii. 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.

viii. Apply a small amount of Lubricant (see 4.3.ii) onto the O-ring of the interconnector.

ix. Connect the interconnector to the projected end of the loaded element.

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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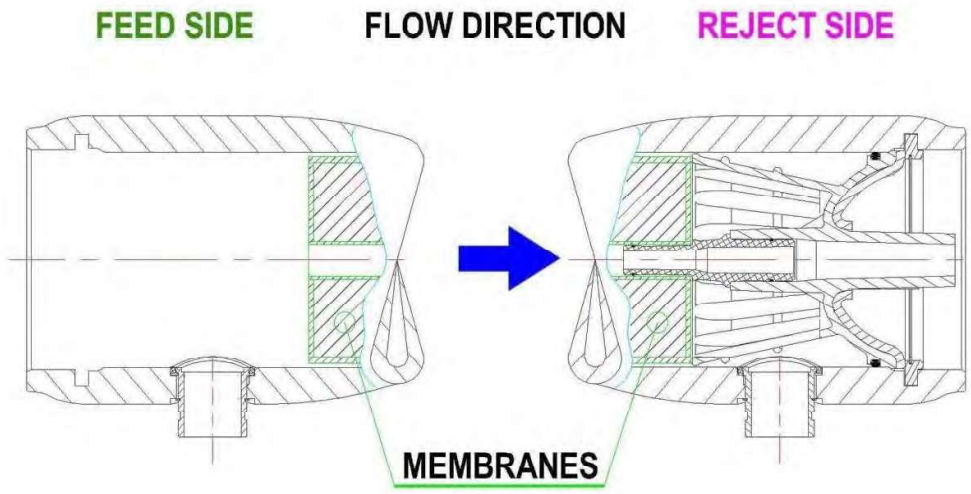
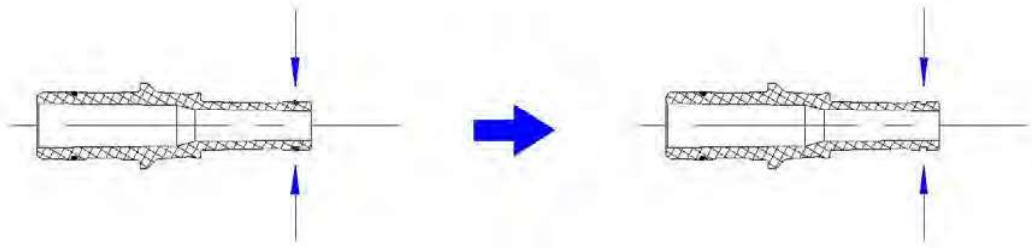
SHIMMING PROCEDURE

1.- CLOSE THE VESSEL ON THE REJECT SIDE.

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

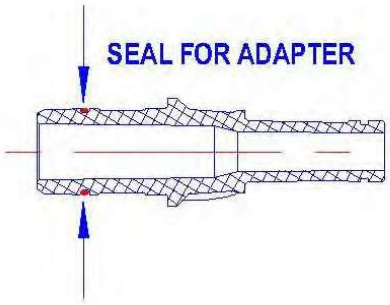


3.- REMOVE THE ADAPTER FROM THE END CAP AND REMOVE THE O-RINGS OF THE MEMBRANSE SIDE.

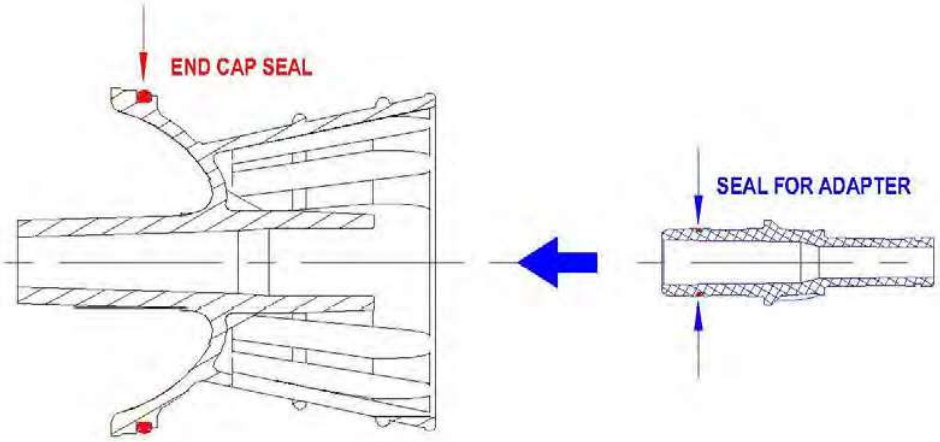


4.- SETTLE ADAPTER WITHOUT O-RINGS (*in the membrane side of the adapter*) INTO THE END CAP.

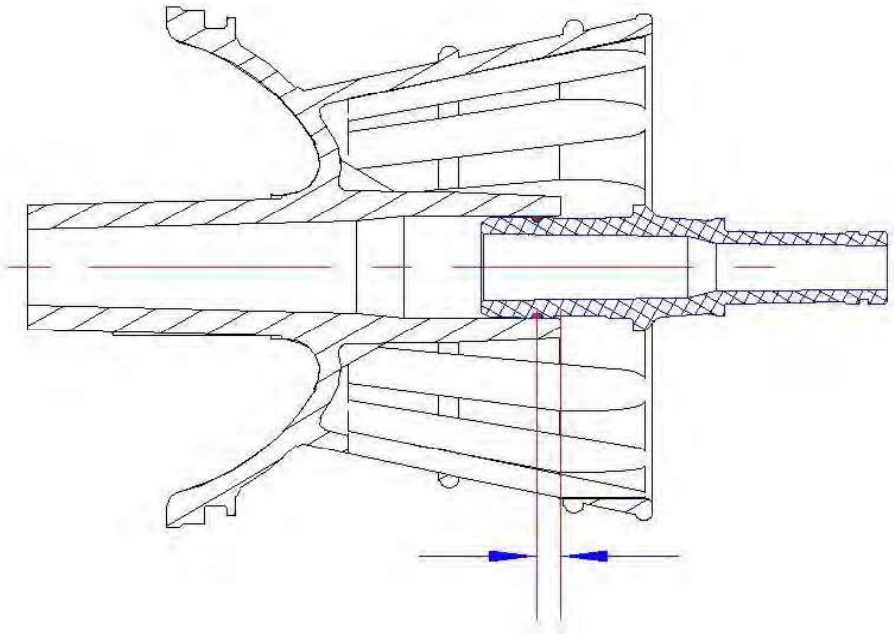
NOTE 1: KEEP THE ADAPTER O-RING AT THE END CAP SIDE.
NOTE 2: APPLY SOME LUBRICANT (GLYCERIN) ON THE ADAPTER O-RING, AT THE END CAP SIDE, AS IT IS SHOWN IN THE NEXT FIGURE.



5.- REMOVE THE SEAL FOR END CAP.

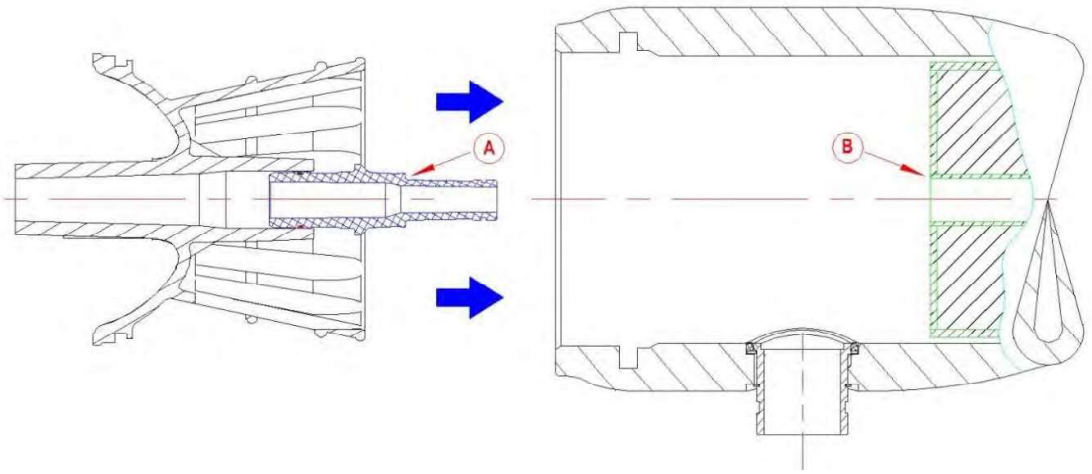


6.- PUSH THE ADAPTER INTO THE END CAP UNTIL THE EDGE OF THE SEAL FOR ADAPTER REACH THE END CAP HOLE TO PLACE IT.

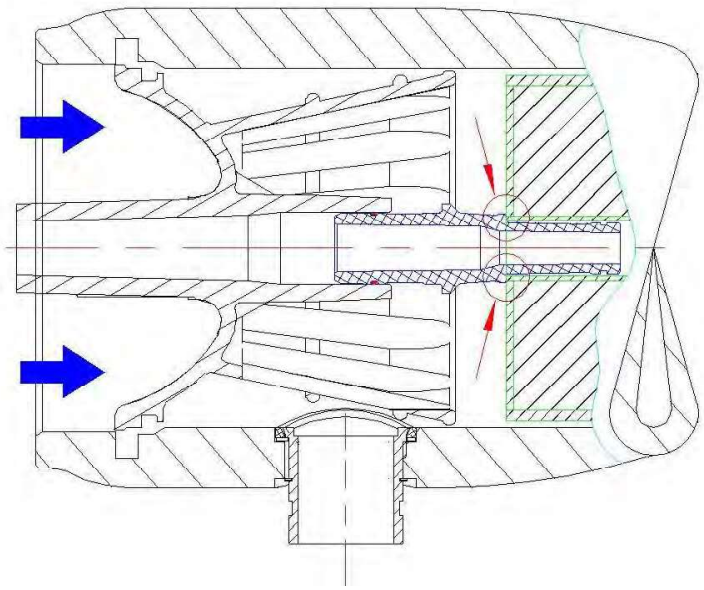


NOTE 3: DO NOT PUSH THE ADAPTER TOO MUCH INTO THE END CAP HOLE

7.- 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 NEXT FIGURE.

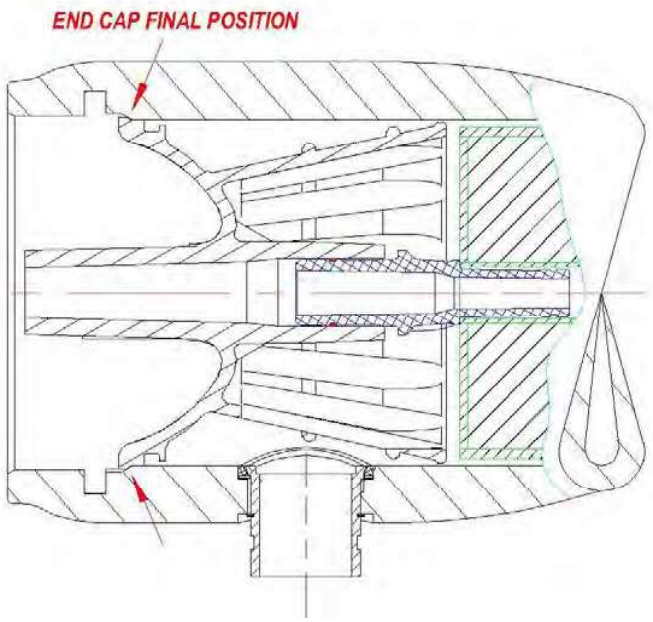


8.- AS THE ADAPTER HAS NO O-RING IN THE MEMBRANE SIDE, THE ADAPTER WILL BE PLACED INTO THE MEMBRANE PERMEATE TUBE WITHOUT ANY RESISTANCE.

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

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

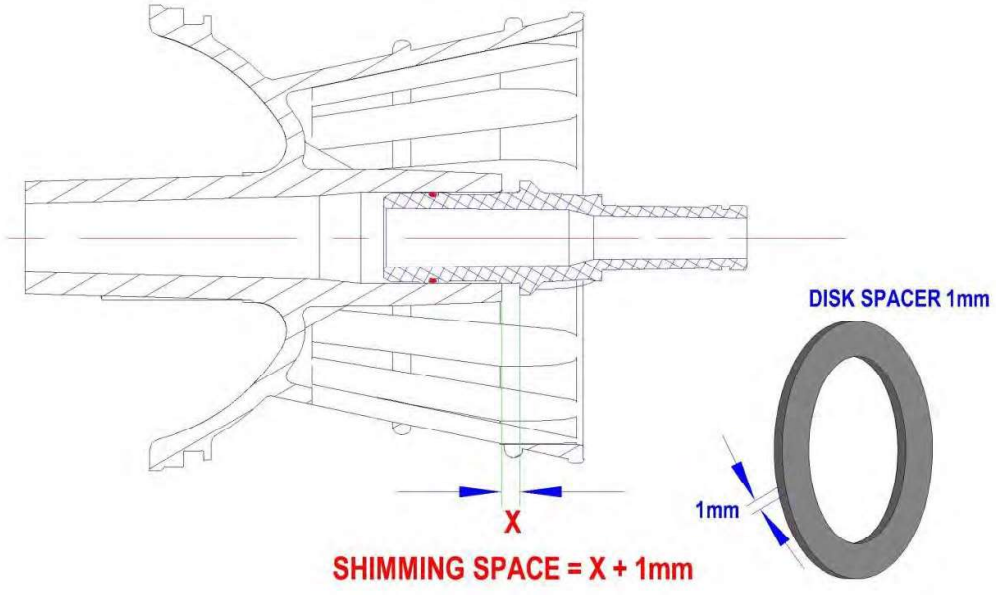
NOTE 6: IN THE PROCESS OF PUSHING THE ADAPTER WILL MOVE INTO THE END CAP HOLE.



10.- 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-ILEC SYSTEM

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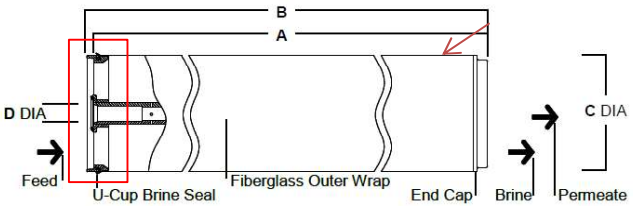
iLEC SYSTEM - DOW MEMBRANES

The iLEC connection system from DOW FILMTEC Membranes are unique in its kind cause their dimensions are 40,5" in length while the other manufacturers provide the dimension of 40".

This particularity of +0,5" corresponds to the connection system of iLEC as it can be clearly observed from the following figure.

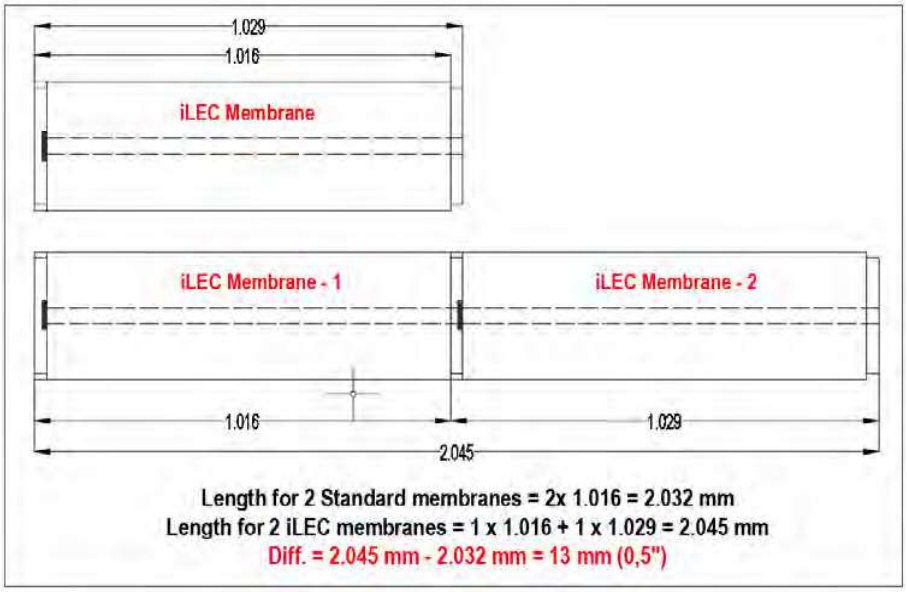
Figure 1



Product	Dimensions – inches (mm) A	B	C	D
HRLE-440*i*	40.0 (1,016)	40.5 (1,029)	7.9 (201)	1.125 ID (29)

1. Refer to DOW FilmTec Design Guidelines for multiple-element applications and recommended element recovery rates for various feed sources. 1 inch = 25.4 mm
2. Element to fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Individual elements with *iLEC* endcaps measure 40.5 inches (1,029 mm) in length (B). The net length (A) of the elements when connected is 40.0 inches (1,016 mm).

If we bear in mind that in the point 3 of the previous figure its indicated that, once all the elements are interconnected, each membrane fits in its following of the added measure 0,5" which this membrane have, the last membrane would sum up the total length of 40,5".



This fact will imply that in order to close the End caps of the pressure vessels, two types of End caps should necessarily be supplied:

- Standard End Cap– Attached to the rejecting side of the pressure vessel – given that this End Cap provides the Thrust Ring in order to distribute the force of the membranes under operation over its own surface.

- Short End Cap- Must be located on the pressure vessel's feed side.

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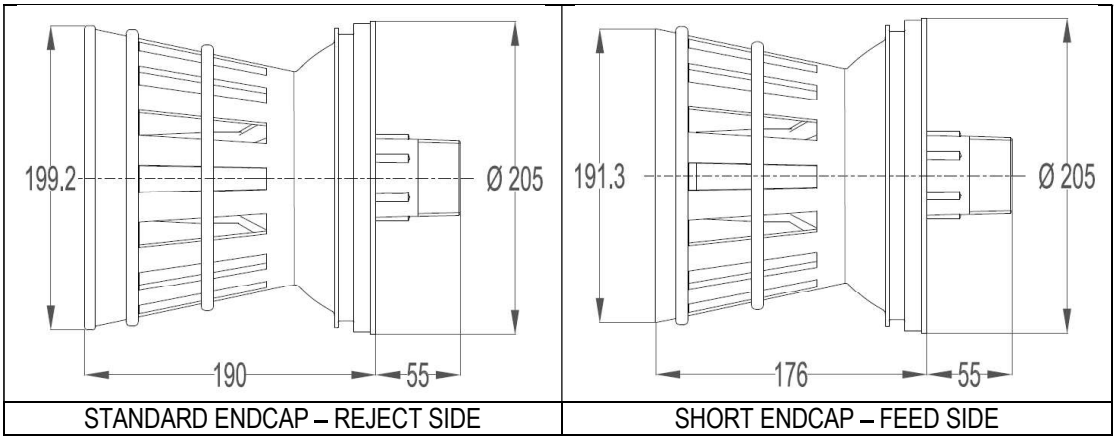
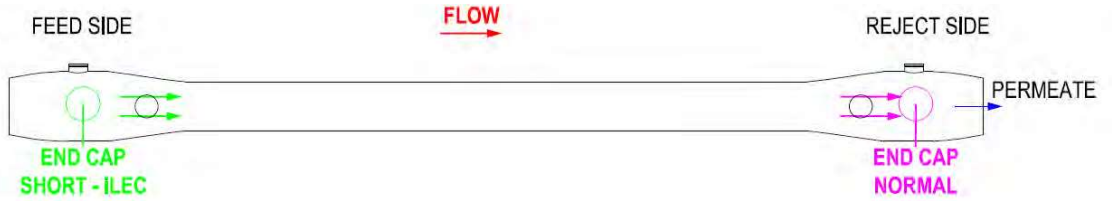
The inappropriate placement of the End Caps mentioned could produce negative effects such as damage in the membranes during membranes operation.

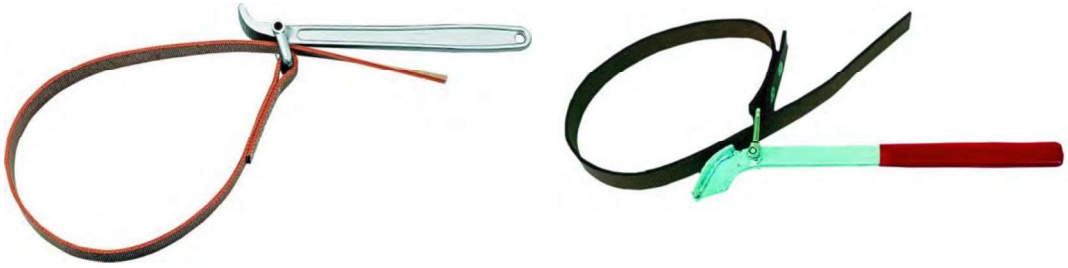


STANDARD ENDCAP – REJECT SIDE	SHORT ENDCAP – FEED SIDE

NOTE.- BEL Solution, use strictly BEL Standard Adapters



As an additional note, and in order to simplify membranes loading, given that the membranes are installed by turning, it's recommended the use of grip wrench-a tool which will help much during the membranes loading, taking in consideration that the operator's hands will be soaked in glycerin (lubricant). For your more detailed information, please note the Figure displayed further below this document.



Warning: the size of Grip Wrench must be enough to tighten 8" membrane

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7- END CAP OPTIONS

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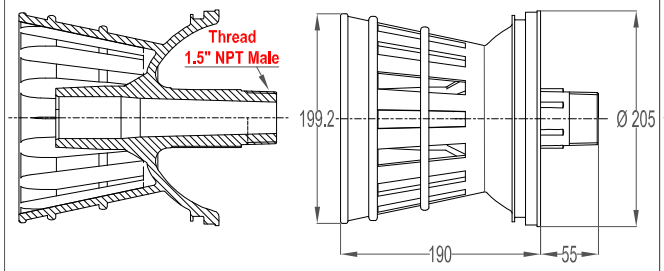
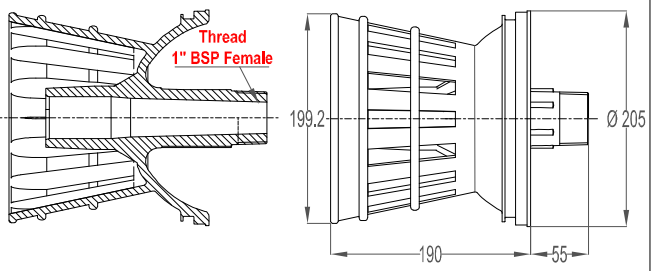
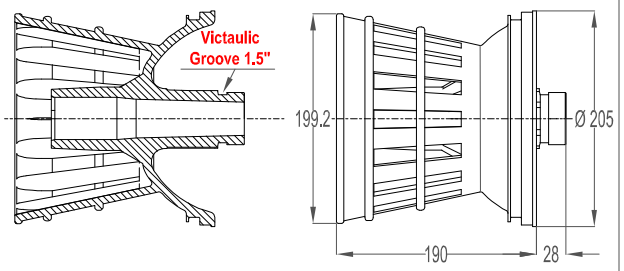
END CAP 1,5" NPT Male
Part number: 285779010



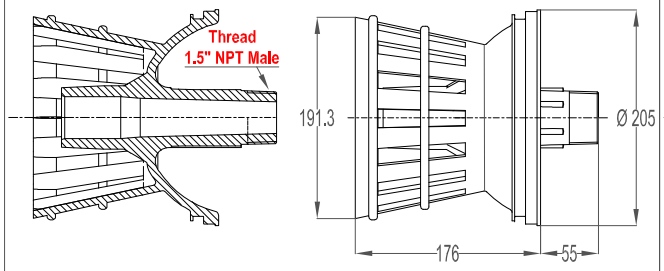
END CAP 1" BSP Female
Part number: 285779010g



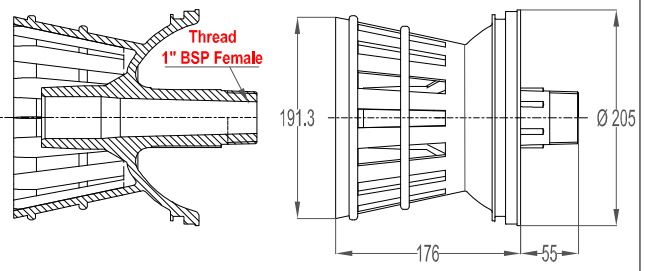
END CAP 1.5" Victaulic
Part number: 285779010v



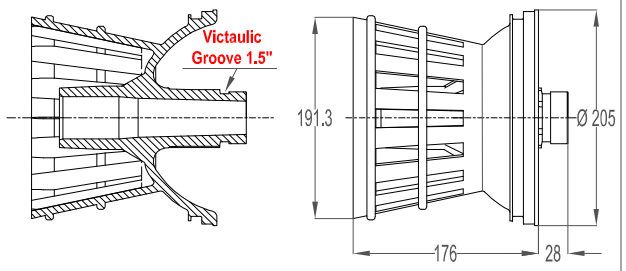
END CAP 1,5" NPT Male iLec
Part number: 285779010i



END CAP 1" BSP Female iLec
Part number: 285779010ig

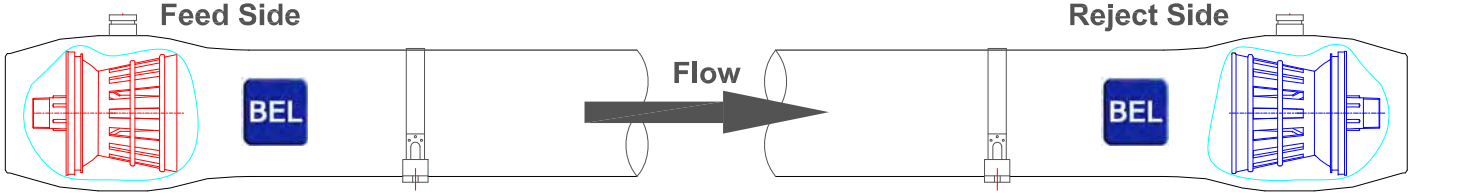


END CAP 1.5" Victaulic iLec
Part number: 285779010iv



WARNING

iLec´s END CAPS (Short End Caps) MUST be located in FEED side of the Pressure Vessels.



8-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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9-REMOVAL, REPAIR AND REASSEMBLY SIDE PORT

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REMOVAL, REPAIR, AND REASSEMBLY SIDE PORT

1. GENERAL

This instruction is intended to provide support for the proper assembly and dismantling of ports.

2. OBJECTIVE

Proper installation of ports determines the quality of the final product and prevent future occurrence of leaks. Improper installation of these can cause damage to the vessel.

3. TOOLS

3.1 Manual piston.

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3.2 Piston adapter ports 1.5 ", 2", 2.5 "& 3".

3.3 Port adapter

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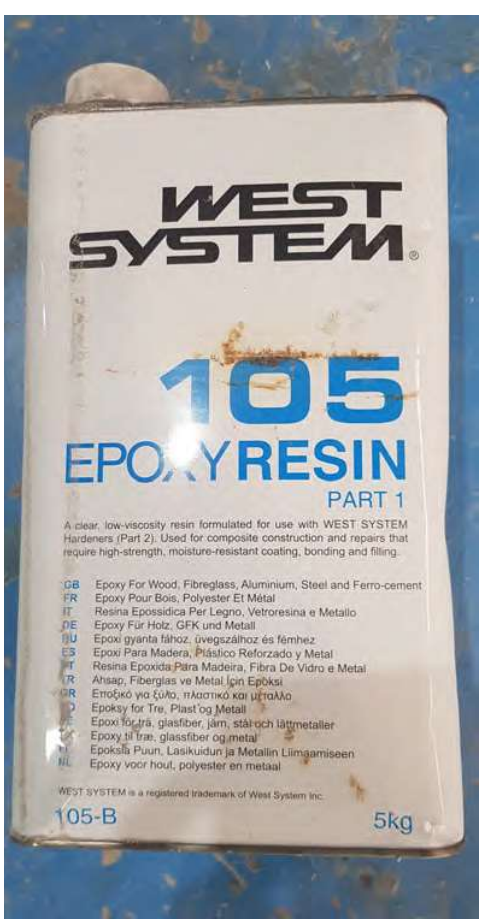
3.4 Glycerin lubrication.

3.5 Epoxy for joint area (105 West Coating resin and fast hardener 205 in proportion 5:1 respectively)



3.6 Flathead screwdriver - To remove the seals.

3.7 Lockpick.

3.8 Sandpaper - fine grain.

3.9 Parts to install: Port, retaining ring, gasket and disk 1.5 ", 2" 2.5 "& 3".

3.10 Industrial dryer

3.11 Latex gloves

3.12 Nylon hammer

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4. REMOVING THE PORT

4.1 Remove the retaining ring using a flathead screwdriver.

4.2 Remove the gasket of the side port with the lockpick.

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4.3 Remove the side port taking a few hits with the nylon hammer. Be aware the side port does not hit the vessels when it dropped.

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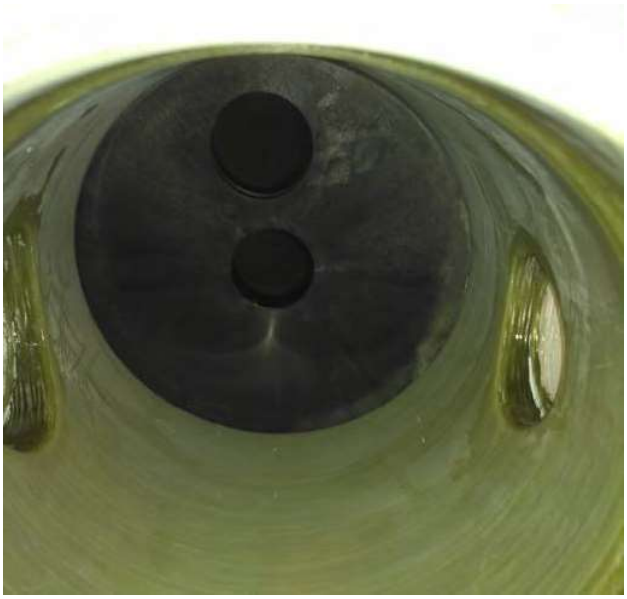
5. DRYING

5.1 Block access to water in the work area. Inwardly, using a sealing plate and a gasket for sealing plate to stop the water from the membranes.



5.2 Block access to water from neighboring ports with rags or plastic.

5.3 Use industrial dryer to dry completely work area. Should take care not to damage the tube or membranes.

6. REPAIR

6.1 Sand the area where was placed the gasket of the port with a coarse-grained P80 sandpaper.

6.2 Clean the sanded area using a cloth moistened with acetone or solvent.

6.3 Re-sand the area where is located the gasket of the port with a coarse-grained P220 sandpaper.

6.4 Clean the sanded area using a cloth moistened with acetone or solvent.

6.5 Using the resin and catalyst (West Coating resin 105 and fast hardener 205), making the mixture in a separate container, using the following ratio:

5 parts resin to 1 part hardener.

6.6 Using hand with a latex glove, applying a uniform hand in the port seal.

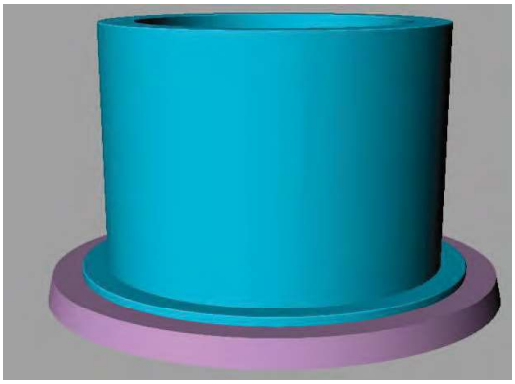
6.7 Let dry for at least 24 hours or complete drying.

6.8 Once the time has elapsed, check that the epoxy is completely dry, and its surface is completely smooth before proceeding with the assembly.

6.9 Otherwise we must repeat the steps from 6.1 onwards.

7. INSTALLATION USING THE HANDTOOL PISTON

7.1 Place the gasket as shown in the picture.



Please keep in mind the position of the gasket (bigger diameter of the cone looking downside)

7.2 Place the piston adapter as shown in the picture.

7.3 Impregnate with glycerin / soap the side of the gasket.

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7.4 Impregnate with glycerin / soap the inner surface of the port adapter.

7.5 Assemble the port adapter and the side port as shown in the picture.

7.6 Rotate the entire block, and pull out the piston adapter in order to view and check if the seal is still in its correct place.

If the port gasket is not in its proper place, use your hands or a non-sharped tool to put it on its correct place. Then, reinstall the piston adapter.

7.7 Rotate the vessel in order the port hole you are going to install is looking face down (to the ground) Place the port with all the items in the port hole using both hands.

*It's important to use both hands to install it because if not the seal could pull out.

*Not much force must be done during this part.

*The port adapter shall be placed so that the form adapts with the internal form of the vessel

7.8 Place the manual piston as shown in the picture.

*It is very important to install it with the port hole looking face down because, if the installation is made directly with the hole looking face up, the metal disk could fall, or bend and then when we use the piston we could break the inside of the hole.

7.9 Turn gradually the handle of the manual piston till the port is placed.

7.10 Remove the manual piston, the piston adapter and the adapter port. Check that all the surface of the gasket is below the level of the inner surface of the vessel, to avoid problems during the assembly of the membrane. Push the gasket using the tool and the manual piston if is necessary.

7.11 Place a retaining ring in the side port.

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10-REPAIR PROCEDURE FOR LEAKING END CAPS

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REPAIR PROCEDURE FOR LEAKINGS END-CAPS

General.

This instruction is designed to describe the repairing procedure for leaking end caps.

Objetives.

Most of the times the leaks in the end caps are related to small imperfections in the surface where the seal is placed inside the vessel.

Tools.

- Replacement endcaps with seal 9.2 mm
- Sandpaper

Surface preparing.

- Check is the surface where the O-Seal of the end cap must to be placed is smooth all around the vessel.
- Clean the surface carefully using water and sandpaper (Use the sandpaper always wet).
- Make sure that the surface is clean of chips, delaminations, foreign particles etc…

Place the new endcaps in the vessel according to the BEL Manual.

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PROCEDURE FOR APPLICATION OF MIX HARDENER-EPOXY

General

This instruction is designed to support the application of transparent lacquer on surfaces that have been grinded, engraved… like sideports holes or endcap grooves.

Objetive

- Sealing of surfaces.

Materials

- Epoxy
- Hardener
- Acetone for cleaning.

Tools

- Brush according to the size of the surface.

Surface preparing

- Clean the surface using cleaning paper and acetone.
- Make sure that the area is clean of chips, delaminations, foreign particles.
- Be sure that the surface is completely dry.

Spreading

- Mix one part of hardener with four parts of epoxy (You can use a plastic glass).
- Use a brush to Apply a thin layer of the mix hardener-epoxy over the entire surface and some milimeter beyond his edges.
- Let dry for at least 40 minutes.
- Check than the sourface is “hand touch” dry.

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Mix hardener-epoxy application using a brush

If the side port is deep into the vessel and you can see the wall of the hole, you must apply mix hardener-epoxy in this “wall” without dismount the sideport

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11-GASKET ASSEMBLY WITH SIDE PORT ASSEMBLED

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GASKET ASSEMBLY WITH SIDE PORT ASSEMBLED REV.2

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Tools:

Tool Nº 1 lockpick

Tool Nº 2

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Tool Nº 3

Tool Nº 4

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Tool Nº 5

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Procedure

1-Remove the gasket from the middle port with the tool Nº 1 lockpick.

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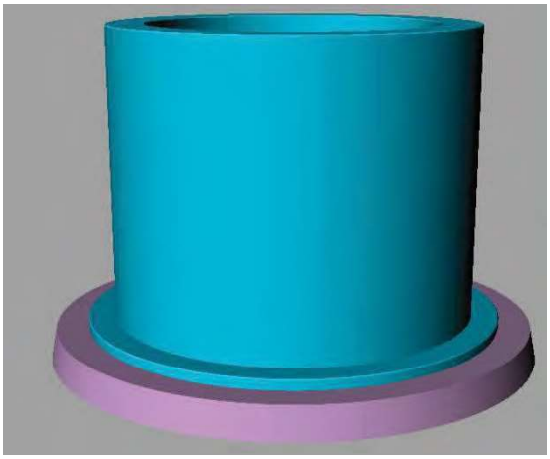
2-Assemble the new gasket in the tool Nº 2.



Please keep in mind the position of the gasket (bigger diameter of the cone looking downside).

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3- Impregnate with soap the side of the gasket.

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4- Assemble the tool Nº 3 as shown.

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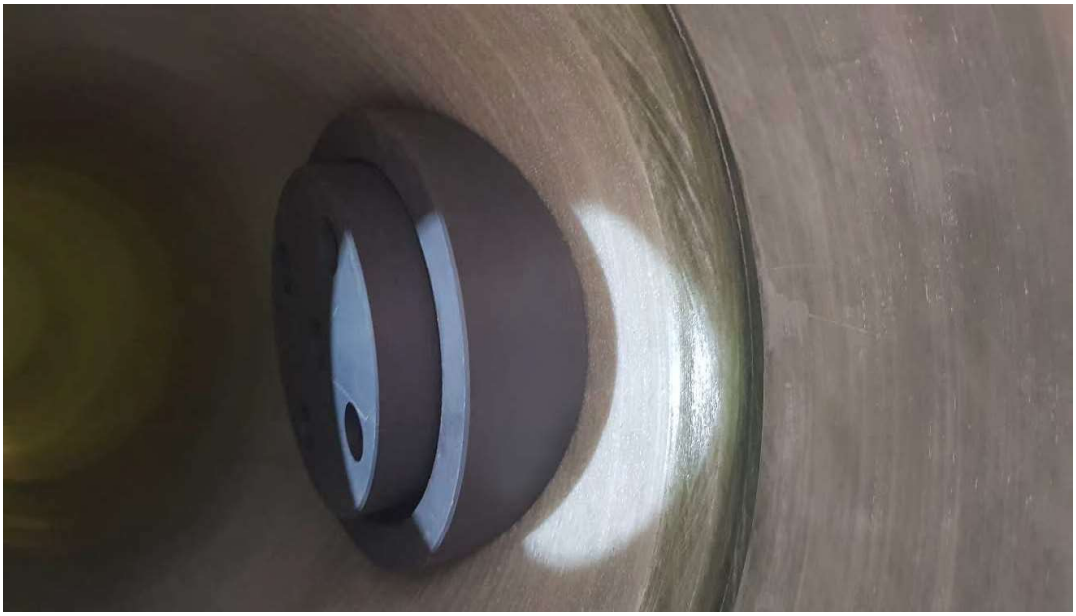
5- Place the assembly tool Nº 2-new gasket-tool Nº 3 inside the side port hole.

6-Place the tool Nº 4 in the bottom of the tool Nº 2-new gasket-tool Nº 3.



7-Place the tool Nº 5 as shown in the picture.

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8-Turn gradually the handle of the tool Nº 5 till the gasket is assembled.

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12-SPARE PARTS

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Recommended spare part list for ongoing operation		
For exact part number please refer to the drawing or consult BEL		
item	**type**	**quantity**
Seal for EndCap	EPDM seal	20%
seal for adapter	EPDM seal	20%
membrane seal	EPDM seal	30%
Adapter	Eng. plastic	10%
EndCap	Eng. plastic	3%
Retaining Ring 8" for support ring	Stainless Steel	5%
Seal for Side Port	EPDM seal	5%
Retaining Ring for Side Port	Stainless Steel	5%
other parts - per need		

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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