



PRESSURE VESSELS

8" SIDE PORT

TECHNICAL

MANUAL

BEL COMPOSITE IBERICA S.L.

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Introduction

BEL, founded in 1966, specializes in the design and manufacture of a variety of products made from advanced composite materials. With over 50 years of experience, the company has developed and mastered the innovative technologies necessary to manufacture the highest quality composite products. Combining innovation, technology, responsibility and dedication, our goal is to become the leader in providing commercial and industrial composite vessels for our clients needs.

BEL pressure vessels are manufactured from filament wound fiber reinforced plastic (FRP), wound over precision mandrels, using a superior epoxy resin, which results in the ultimate combination of physical strength and an ultra smooth inside surface. Vessels are tested according to the requirements of ASME code section X, the internationally recognized standard for pressure vessel construction.

BEL holds ISO 9001 quality systems certification, and its quality assurance is also approved for in-house final inspection by many of its customers.

The BEL family of pressure vessels is designed to be used as housings for all 4" ,8" ,9" and 16" spiral-wound Reverse Osmosis (RO), Nanofiltration (NF) and Ultra filtration (UF) membrane elements.

The pressure vessels are manufactured in different configurations, according to the required operating pressures, filtration type, and piping layout. In order to enhance interchangeability and facilitate the use and maintenance of the vessels, the utilization of identical parts and sub-assemblies has been maximized throughout the design of the vessel. For better performance and longer service life, each model is manufactured from the highest quality and highest performing materials of construction.

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1.- SAFETY PRECAUTIONS

- *.- 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.
- *.- BEL pressure vessels are designed for water treatment only.
- *.- 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. Permeate port pressure MUST NOT EXCEED 125 psi. Other options are available, please, consult BEL
- *.- Vessels should NOT BE CONTINUOUSLY OPERATED AT TEMPERATURES ABOVE 150°. (65°C).
- *.- 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.
- *.- Only qualified mechanics, experienced in working with high pressure hydraulic systems, should be allowed to disassemble or assemble the vessel.
- *.- Regularly inspect the system to ensure that 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.
- *.- Make sure that vessels and associated pipe systems are fully depressurized before attempting any service or maintenance operation.
- *.- Be careful not to scratch the inside wall of the shell, especially at the inner sealing area near the groove.
- *.- 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.
- *.- Never attempt to repair or disassemble the feed/concentrate port in a side port vessel without consulting BEL.
- *.- Inspect end closures regularly; replace components that have deteriorated and correct causes of corrosion.
- *.- Do not tolerate Leaks, or allow end closures to be routinely wetted in any way.

2.- INSTALLATION NOTES

- *.- 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.
- *.- Make sure that the vessel is horizontally installed on support saddles. For other installation ways, please consult BEL.
- *.- 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.
- *.- Straps should be tightened enough to hold the vessel onto the support pads, but never so tightly as to restrict expansion.
- *.- 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.

- *.- 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). Dimensions according to the following table 2.1

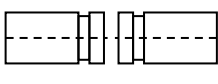
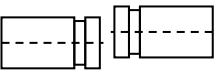
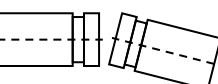
Side Port	 Spacing [mm]- X	 Max Offset (Note*) [mm]	 Max Angle [Deg]
1.5"	2 + 0.5	3	2.5
2"	2 + 0.5	3	2
2.5"	3 - 0.5	3	2
3"	3 - 0.5	3	1.5
4"	3 ± 0.5	3	1.5

Table 2.1

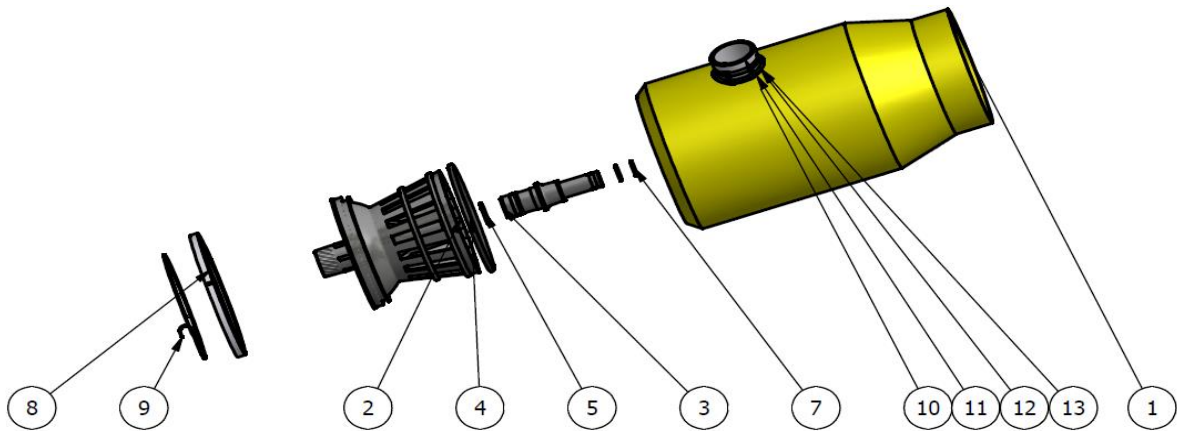
***Note:**

1.- Values shown in table 2.1 correspond to the Maximum Offset between ports connected Port to Port and in multiport configuration.

2.- Maximum offset between connecting piping alignment to feed, concentrate and permeate ports should not exceed 0.75 mm (0.03 inch).

3.- COMPONENT LIST

3.1.1.- BEL 8" Pressure Vessel 300 psi – NON CODE - Side Port assembly



ITEM	UDS	DESCRIPCION	Material	Part Number
1	1	Body of Pressure Vessel	Glass/Epoxy, acc. F.I.202	8 / 1-5 / 300 / 1-8
2	2	End cap	Engineering plastic	2857709010 / g / i / ig / iv / v
3	2	Adapter	Engineering plastic	See Table 3.3
4	2	O-Ring	EPDM	007-080-0092
5	2	Seal for Adapter	EPDM	285773918
7	2-4	Membrane seal	EPDM	55413912 / 55412357 (1.5")
8	2	Support ring	Engineering plastic	285034015
9	2	Retaining ring (finger hook)	Stainless steel	011-801-1202
10	1-4	Side port 1.5"/2"/2.5"/3"/4"	Stainless steel	See Table 3.2
11	4-8	Retaining ring	Stainless steel	See Table 3.2
12	1-4	Seal for side port	EPDM	See Table 3.2
13	1-4	Disk for side port	Stainless steel	See Table 3.2
*14	2-3	Saddle	Engineering plastic	55410351
*15	2	Strap Assy.	Stainless steel	55410310
*16	0-3	Disk spacer - 1mm	Engineering plastic	285779231
*17	0-7	Disk spacer - 3mm	Engineering plastic	285779233

*-These parts are not shown on the drawing assembly

Table 3.1

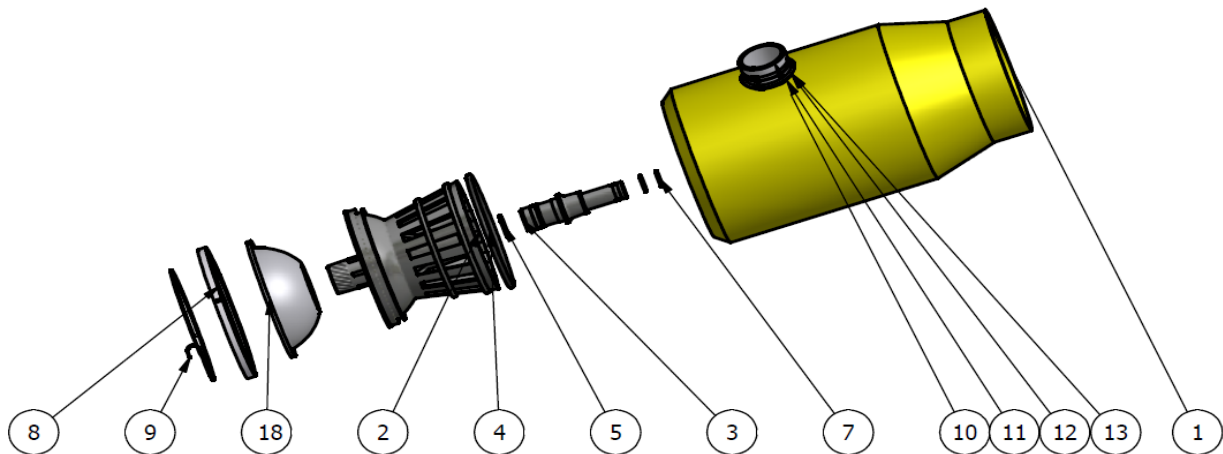
Diameter	Side port	Disk for side port	Seal	Retaining ring
1.5"	040-156-0458	006-156-0452	014-150-0506	011-150-1202
2"	041-206-0458	006-206-0452	014-200-0605	55412392
2.5"	042-256-0458	006-256-0452	014-250-0805	011-250-1212
3"	043-306-0450	006-306-0302	014-300-0807	011-300-1202
4"	044-406-0450	006-406-0302	014-400-0709	285772409

Table 3.2

Part description	Part number
Adapter 1.125" / Adapter 1.125" blind	001-112-0452 / 001-112-1228
Adapter 1.5" / Adapter 1.5" blind	285349324 / 001-150-0458

Table 3.3

3.1.2.- BEL 8" Pressure Vessel 300 psi – CODE - Side Port assembly



ITEM	UDS	DESCRIPCION	Material	Part Number
1	1	Body of Pressure Vessel	Glass/Epoxy, acc. F.I.202	8 / 1-5 / 300A / 1-8
2	2	End cap	Engineering plastic	2857709010 / g / i / ig / iv / v
3	2	Adapter	Engineering plastic	See Table 3.6
4	2	O-Ring	EPDM	007-080-0092
5	2	Seal for Adapter	EPDM	285773918
7	2-4	Membrane seal	EPDM	55413912 / 55412357 (1.5")
8	2	Support ring	Aluminum	55410299
9	2	Retaining ring (finger hook)	Stainless steel	011-801-1202
10	1-4	Side port 1.5"/2"/2.5"/3"/4"	Stainless steel	See Table 3.5
11	4-8	Retaining ring	Stainless steel	See Table 3.5
12	1-4	Seal for side port	EPDM	See Table 3.5
13	1-4	Disk for side port	Stainless steel	See Table 3.5
*14	2-3	Saddle	Engineering plastic	55410351
*15	2	Strap Assy.	Stainless steel	55410310
*16	0-3	Disk spacer - 1mm	Engineering plastic	285779231
*17	0-7	Disk spacer - 3mm	Engineering plastic	285779233
18	2	Metal cap	Stainless Steel	285453003

*-These parts are not shown on the drawing assembly

Table 3.4

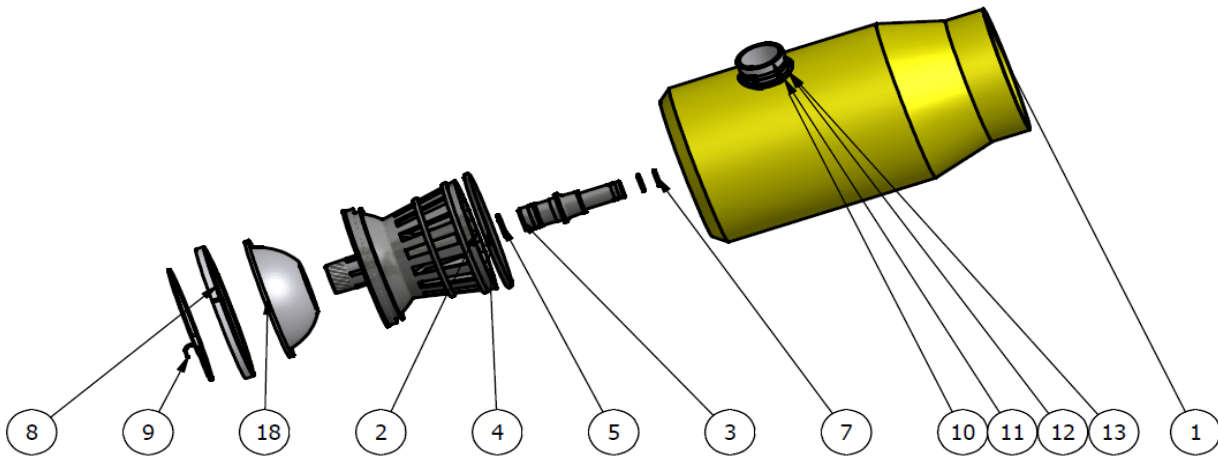
Diameter	Side port	Disk for side port	Seal	Retaining ring
1.5"	040-156-0458	006-156-0452	014-150-0506	011-150-1202
2"	041-206-0458	006-206-0452	014-200-0605	55412392
2.5"	042-256-0458	006-256-0452	014-250-0805	011-250-1212
3"	043-306-0450	006-306-0302	014-300-0807	011-300-1202
4"	044-406-0450	006-406-0302	014-400-0709	285772409

Table 3.5

Part description	Part number
Adapter 1.125" / Adapter 1.125" blind	001-112-0452 / 001-112-1228
Adapter 1.5" / Adapter 1.5" blind	285349324 / 001-150-0458

Table 3.6

3.2.- BEL 8" Pressure Vessel 450 psi Side Port assembly



ITEM	QTY	DESCRIPTION	Material	Part Number
1	1	Body of Pressure Vessel	Glass/Epoxy, acc. .I.227	8 / 1-5 / 450-450A /1-8
2	2	End cap	Engineering plastic	2857709010 / g / i / ig / iv / v
3	2	Adapter	Engineering plastic	See Table 3.9
4	2	O-Ring	EPDM	007-080-0092
5	2	Seal for Adapter	EPDM	285773918
7	2-4	Membrane seal	EPDM	55413912 / 55412357 (1.5")
8	2	Support ring	Aluminum	55410299
9	2	Retaining ring (finger hook)	Stainless steel	011-801-1202
10	1-4	Side port 1.5"/2"/2.5"/3"/4"	Stainless steel	See Table 3.8
11	4-8	Retaining ring	Stainless steel	See Table 3.8
12	1-4	Seal for side port	EPDM	See Table 3.8
13	1-4	Disk for side port	Stainless steel	See Table 3.8
*14	2-3	Saddle	Engineering plastic	55410351
*15	2	Strap Assy.	Stainless steel	55410310
*16	0-3	Disk spacer - 1mm	Engineering plastic	285779231
*17	0-7	Disk spacer - 3mm	Engineering plastic	285779233
18	2	Metal cap	Stainless Steel	285453003

*-These parts are not shown on the drawing assembly

Table 3.7

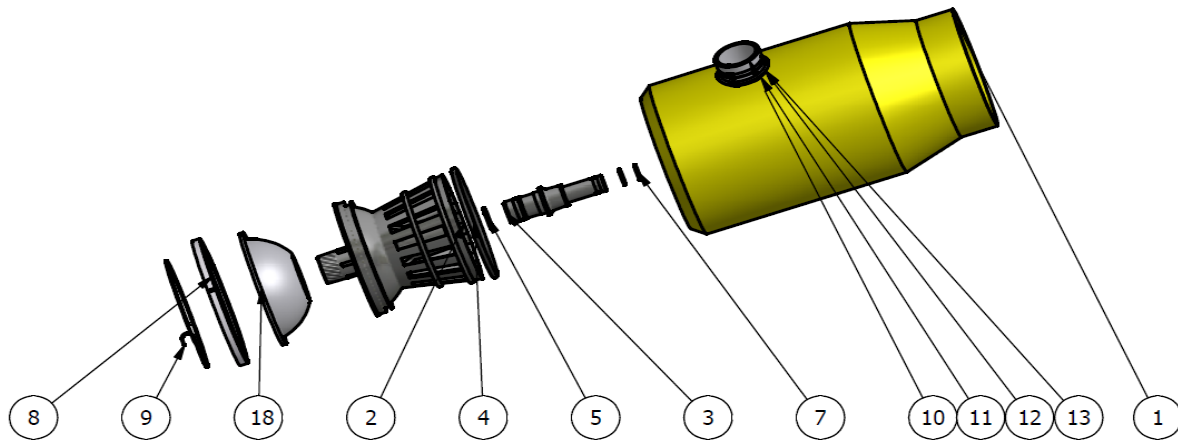
Diameter	Side port	Disk for side port	Seal	Retaining ring
1.5"	040-156-0458	006-156-0452	014-150-0506	011-150-1202
2"	041-206-0458	006-206-0452	014-200-0605	55412392
2.5"	042-256-0458	006-256-0452	014-250-0805	011-250-1212
3"	043-306-0450	006-306-1203	014-300-0807	011-300-1202
4"	044-406-0450	006-406-1203	014-400-0709	285772409

Table 3.8

Part description	Part number
Adapter 1.125" / Adapter 1.125" blind	001-112-0452 / 001-112-1228
Adapter 1.5" / Adapter 1.5" blind	285349324 / 001-150-0458

Table 3.9

3.3.- BEL 8" Pressure Vessel 600 psi Side Port assembly



ITEM	QTY	DESCRIPTION	Material	Part Number
1	1	Body of Pressure Vessel	Glass/Epoxy, acc. F.I.202	8 / 1-5 / 600-600A /1-8
2	2	End cap	Engineering plastic	2857709010 / g / i / ig / iv / v
3	2	Adapter	Engineering plastic	See Table 3.12
4	2	O-Ring	EPDM	007-080-0092
5	2	Seal for Adapter	EPDM	285773918
7	4	Membrane seal	EPDM	55413912
8	2	Support ring	Aluminum	55410299
9	2	Retaining ring (finger hook)	Stainless steel	011-801-1202
10	1-4	Side port 1.5"/2"/2.5"/3"/4"	Stainless steel	See Table 3.11
11	4-8	Retaining ring	Stainless steel	See Table 3.11
12	1-4	Seal for side port	EPDM	See Table 3.11
13	1-4	Disk for side port	Stainless steel	See Table 3.11
*14	2-3	Saddle	Engineering plastic	55410351
*15	2	Strap Assy.	Stainless steel	55410310
*16	0-3	Disk spacer - 1mm	Engineering plastic	285779231
*17	0-7	Disk spacer - 3mm	Engineering plastic	285779233
18	2	Metal cap	Stainless Steel	285453003

*-These parts are not shown on the drawing assembly

Table 3.10

Diámetro	Side port	Disk for side port	Seal	Retaining ring
1.5"	040-156-0600	006-156-1203	014-150-0506	011-150-1202
2"	041-206-0600	006-206-1203	014-200-0605	55412392
2.5"	042-256-0600	006-256-1203	014-250-0805	011-250-1212
3"	043-306-0600	006-306-1203	014-300-0807	011-300-1202
4"	044-406-0608	006-406-1203	014-400-0709	285772409

Table 3.11

Part description	Part number
Adapter 1.125" / Adapter 1.125" blind	001-112-1220 / 001-112-1228

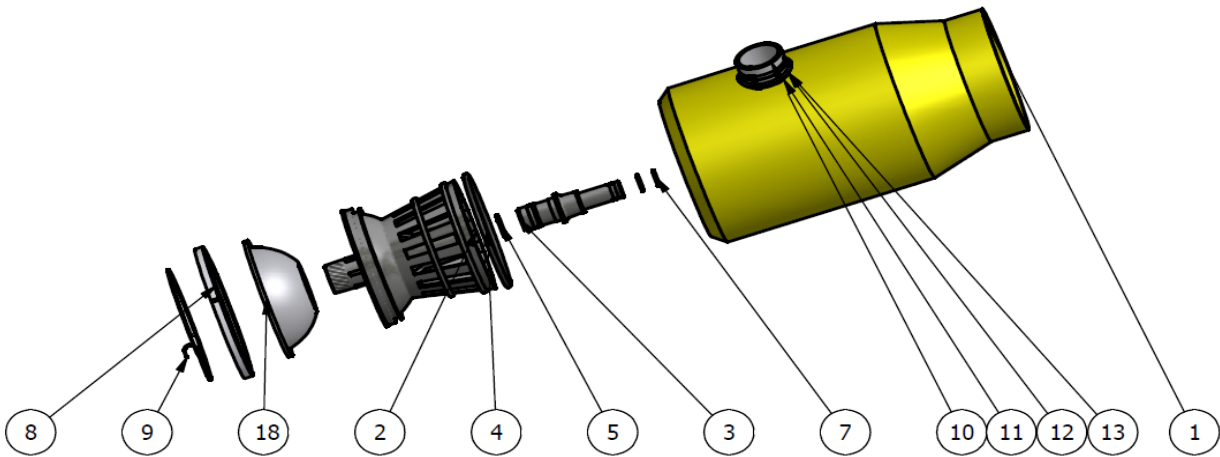
Table 3.12

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3.4.- BEL 8" Pressure Vessel 1000/1200 psi Side Port assembly



ITEM	QTY	DESCRIPTION	Material	Part Number
1	1	Body of Pressure Vessel	Glass/Epoxy, acc. F.I.202	8 / 1-5 / 1000-1200 – 1000A-
2	2	End cap	Engineering plastic	2857709010 / q / i / ig / iv / v
3	2	Adapter	Engineering plastic	See Table 3.15
4	2	O-Ring	EPDM	007-080-0092
5	2	Seal for Adapter	EPDM	285773918
7	4	Membrane seal	EPDM	55413912
8	2	Support ring	Aluminum	005-861-1200
9	2	Retaining ring (finger)	Stainless steel	011-801-1202
10	1-4	Side port	Super duplex Stainless	See Table 3.14
11	4-8	Retaining ring	Stainless steel	See Table 3.14
12	1-4	Seal for side port	EPDM	See Table 3.14
13	1-4	Disk for side port	Stainless steel	See Table 3.14
*14	2-3	Saddle	Engineering plastic	55410351
*15	2	Strap Assy.	Stainless steel	55410310
*16	0-3	Disk spacer - 1mm	Engineering plastic	285779231
*17	0-7	Disk spacer - 3mm	Engineering plastic	285779233
18	2	Metal cap	Stainless Steel	285213006

*-These parts are not shown on the drawing assembly

Table 3.13

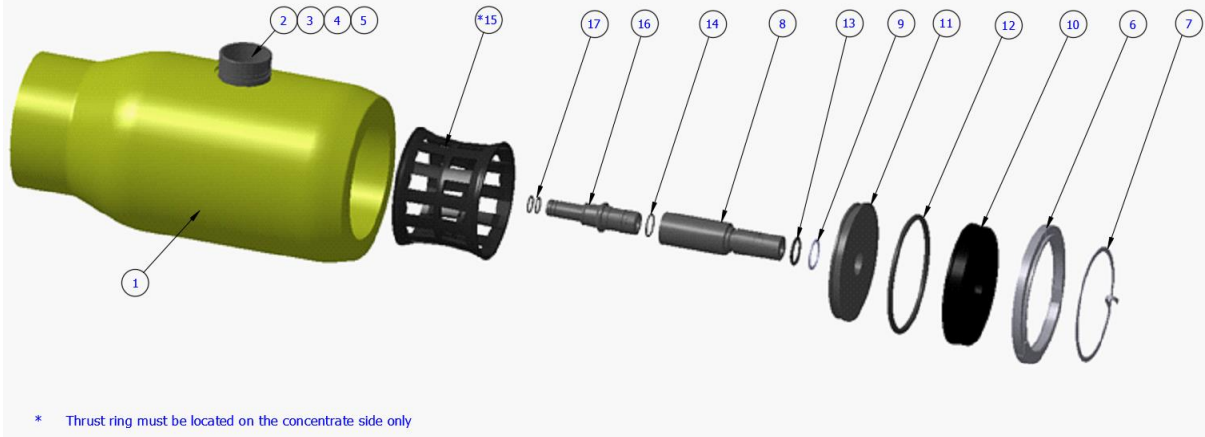
Diámetro	Side port	Disk for side port	Seal	Retaining ring
1.5"	040-155-1200	006-156-1203	014-150-0506	011-150-1202
2"	041-205-1208	006-206-1203	014-200-0605	55412392
2.5"	042-255-1200	006-256-1203	014-250-0805	011-250-1212
3"	043-305-1200	006-306-1203	014-300-0807	011-300-1202
4"	044-405-1208	006-406-1203	014-400-0709	285772409

Table 3.14

Part description	Part number
Adapter 1.125" / Adapter 1.125" blind	001-112-1220 / 001-112-1228

Table 3.15

3.5.- BEL 8" Pressure Vessel 1500 psi Side Port assembly



* Thrust ring must be located on the concentrate side only

ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER
1	1	Body of Pressure Vessel	Glass/Epoxy, acc. F.I.202	8 / 1-5 / 1500-1500A
2	1-4	Side port	Super duplex stainless	See table 3.17
3	1-4	Disk for side port	Stainless steel	See table 3.17
4	1-4	Seal for side port	EPDM	See table 3.17
5	2-8	Retaining ring for side port	Stainless steel	See table 3.17
6	2	Support ring	Stainless steel	285154226
7	2	Retaining ring (finger hook)	Stainless steel	011-801-1202
8	2	Permeate port 1.25" BSP male	Engineering plastic	008-811-0125
9	2	Retaining ring for permeate port	Stainless steel	283772336
10	2	Base plate	Aluminum	003-861-1205
11	2	Sealing plate	Engineering plastic	013-800-1205
12	2	Seal for sealing plate	EPDM	007-080-0092
13	2	Seal for permeate port	EPDM	283776342
14	2	Seal for adapter	EPDM	285773918
15	1	Thrust ring	Engineering plastic	004-830-0150
16	2	Adapter	Engineering plastic	See table 3.18
17	2-4	Membrane seal	EPDM	55413912
*18	0-3	Disk spacer - 1mm	Engineering plastic	285779231
*19	0-7	Disk spacer - 3mm	Engineering plastic	285779233
*20	2-3	Saddle	Engineering plastic	55410351
*21	2	Strap assy.	Stainless steel	55410310

*-These parts are not shown on the drawing assembly

Table 3.16

Diámetro	Side port	Disk for side port	Seal	Retaining ring
1.5"	040-155-1500	006-156-1203	014-150-0506	011-150-1202
2"	041-205-1500	006-206-1203	014-200-0605	55412392
2.5"	042-255-1500	006-256-1203	014-250-0805	011-250-1212
3"	043-305-1500	006-306-1203	014-300-0807	011-300-1202
4"	044-405-1500	006-406-1506	014-400-0709	285772409

Table 3.17

Part description	Part number
Adapter 1.125" / Adapter 1.125" blind	001-112-1220 / 001-112-1228

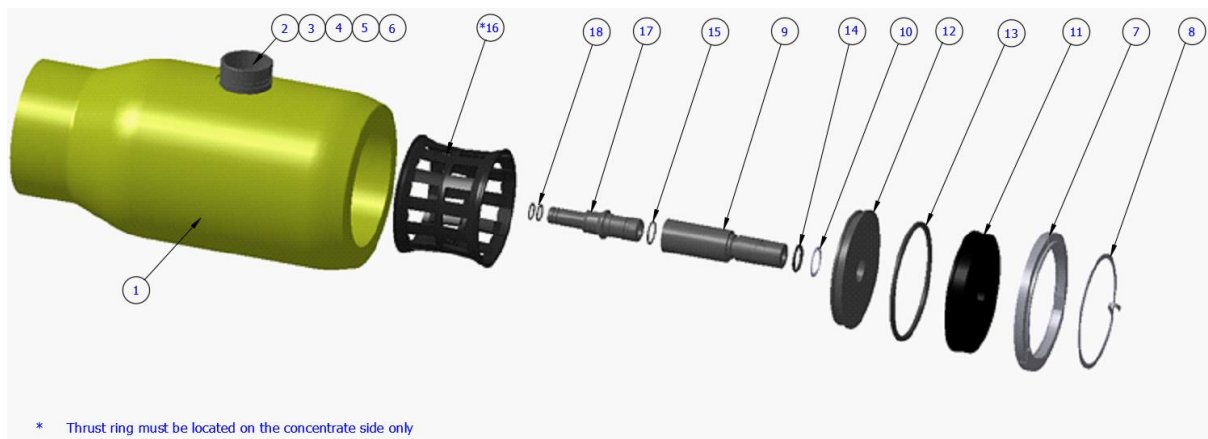
Table 3.18

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3.6.- BEL 8" Pressure Vessel 1800 psi Side Port assembly



* Thrust ring must be located on the concentrate side only

ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER
1	1	Body of Pressure Vessel	Glass/Epoxy, acc. F.I.202	8 / 1-5 / 1800 /1-8
2	1-4	Side port	Super duplex stainless steel	See table 3.20
3	1-4	Disk for side port	Stainless steel	See table 3.20
4	1-4	Seal for side port	EPDM	See table 3.20
5	2-4	Retaining ring for side port	Stainless steel	See table 3.20
6	2-4	Retaining ring for side port	Stainless steel	See table 3.20
7	2	Support ring	Stainless steel	285154226
8	2	Retaining ring (finger hook)	Stainless steel	011-801-1202
9	2	Permeate port 1.25" BSP male	Engineering plastic	008-811-0125
10	2	Retaining ring for permeate port	Stainless steel	283772336
11	2	Base plate	Aluminum	003-861-1205
12	2	Sealing plate	Engineering plastic	013-800-1205
13	2	Seal for sealing plate	EPDM	007-080-0092
14	2	Seal for permeate port	EPDM	283776342
15	2	Seal for adapter	EPDM	285773918
16	1	Thrust ring	Engineering plastic	004-830-0150
17	2	Adapter	Engineering plastic	See table 3.21
18	2-4	Membrane seal	EPDM	55413912
*19	0-3	Disk spacer - 1mm	Engineering plastic	285779231
*20	0-7	Disk spacer - 3mm	Engineering plastic	285779233
*21	2-3	Saddle	Engineering plastic	55410351
*22	2	Strap assy.	Stainless steel	55410310

*. - Estas piezas se muestran en el plano de montaje de los tubos de presión

Tabla 3.19

Diámetro	Side port	Disk for side port	Seal	Retaining ring
1.5"	040-155-1800	006-156-1806	014-150-0506	011-150-1202 & 011-150-1806
2"	041-205-1800	006-206-1806	014-200-0605	55412392 & 011-150-1806

Table 3.20

Part description	Part number
Adapter 1.125" / Adapter 1.125" blind	001-112-1220 / 001-112-1228

Table 3.21

4.- Maintenance

4.1.- Head disassembly

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

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

3.- 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 4-A



Fig 4-A

4.- Move the three locker segments from the groove starting from the small segment.

5.- Head extraction.

5.1.- Tight the puller legs (see annex 1) to the vessel wall as shown in Fig 4-B to support the puller to the vessel.

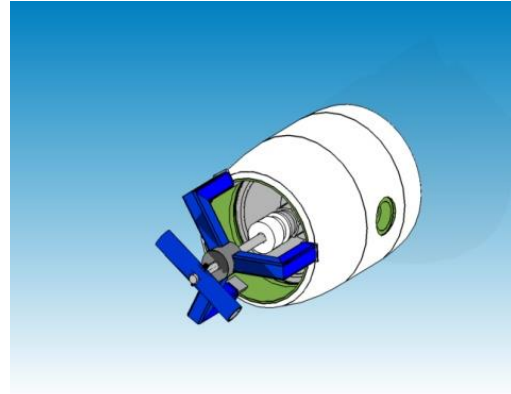


Fig 4-B

5.2.1.- If connection, screw in fully the permeate exit cap (clockwise) to the back side of the puller.

5.2.2.- 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 4-C.

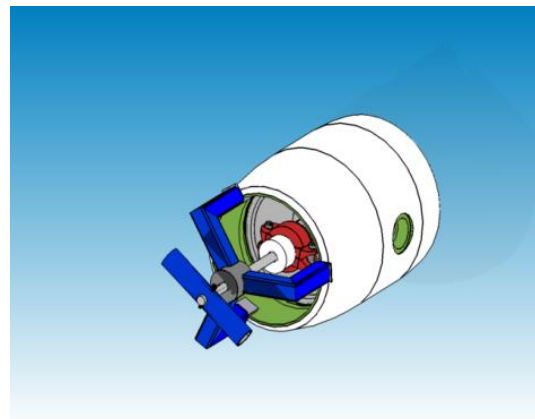


Fig 4-C

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

4.2.- 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

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

Vessel inspection

- 1.- 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.
- 2.- 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 for vessel up to 1200 psi

1.- Insert the O-ring seal into the groove of the End cap in the direction of the arrow as shown in Fig 4-D. Until it fits into the groove.



Fig 4-D

2.- 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 as shown in Fig 4-E.



Fig 4-E

3.- Apply a layer of lubricant (see 4.3.ii) 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.

ii.
iii.

4.- Place the Threaded/Victaulic pusher (see Annex 1) carefully inside End cap Permeate Port as shown in Fig 4-F. **To avoid property damage do not bend the tool inside the End cap Permeate Port.**



Fig 4-F

5.- Push the sliding hammer quickly towards the NPT/ Victaulic pusher until it strikes the End cap to its place as shown in Fig 4-G. **To avoid personal injury, always grasp the pusher puller handle with both hands.**

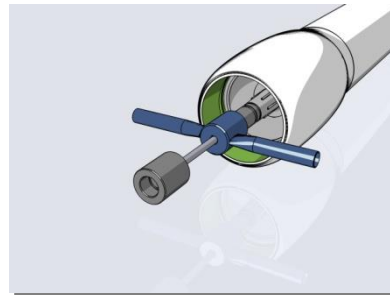


Fig 4-G

i. 6.- Insert the Metal cap into the outer side of the End Cap as shown in Fig 4-H.



Fig 4-H

7.- 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 4-I, 4-J, 4-K.

8.- 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 it is shown in Figs 4-L, 4-M.



Figure 4-I



Figure 4-J



Fig 4-K



Figure 4-L



Figure 4-M

4.4.- Head reassembly for vessel 1500 psi and 1800 psi

1.- 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.

2.- Place the pusher, carefully inside the Base Plate Permeate Port as shown in Fig 4-N. **To avoid property damage do not bend the tool inside the Base Plate Permeate port.**

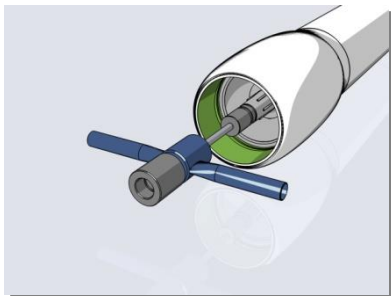


Fig 4-N

3.- Push the sliding hammer quickly towards the pusher until it strikes the Head assembly to its place as shown in Fig 4-O. **To avoid personal injury, always grasp the pusher puller handle with both hands.**

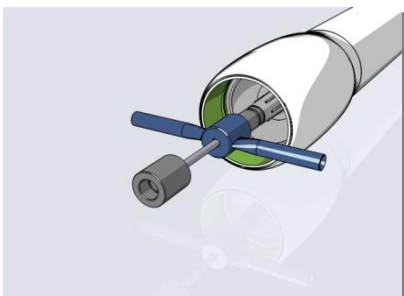


Fig 4-E8

4.- 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 4-P, 4-Q, 4-R.



Fig 4-P



Fig 4-Q



Fig 4-R

5.- 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 Fig 4-S.



Fig 4-S

4.5 Permeate Port reassembly

1.- 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 4-T.



Fig 4-T

2.- Install Seals on the sealing plate and Permeate port for models 1500 psi & 1800 psi. Visually check the seals for any mechanical damage. As shown in Fig 4-U.



Fig 4-U

3.- Insert the Permeate port from the inner side of the base plate and carefully push it all the way, as shown in Fig 4-V.



Fig 4-V

4.- Install the retaining ring as shown in Fig 4-X in order to secure the Permeate port to place.



Fig 4-T

4.6 Permeate Port disassembly

1.- Use a screwdriver in order to remove the retaining ring which holds the Permeate Port to its place As shown in Fig 4-Y

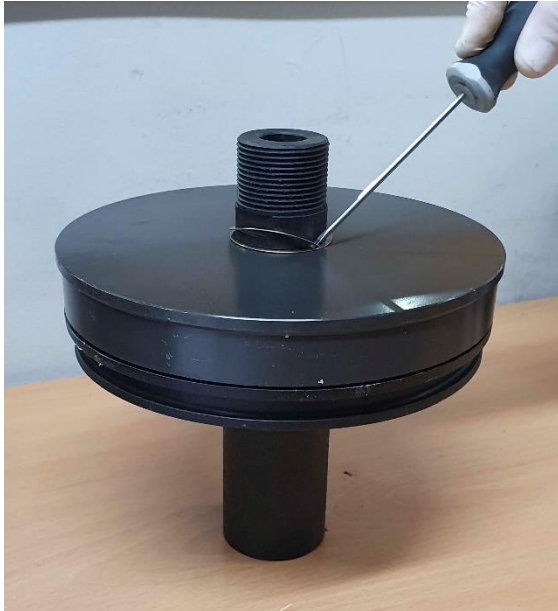


Fig 4-Y

2.- Disassemble the Permeate port from the Base/Seal Plate by pressing the threaded end of the permeate port as shown in Fig 4-Z



Fig 4-L

4.7.- Loading the membrane elements.

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

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

3.- Install the segments of the support ring into the locking groove.

4.- 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.

5.- Apply a thin layer of lubricant 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.**

6.- 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).

7.- 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.

8.- Apply a small amount of Lubricant onto the O-ring of the interconnector.

9.- Connect the interconnector to the projected end of the loaded element.

10.- 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.

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

12.- 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.

13.- Calculate the correct shimming distance (see Annex 3 or 4) in order to avoid impact damage on the membrane and head parts during pressure drop.

14.- 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.

15.- Install the upstream head assembly as described in section 3.3.

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

5.- PRESSURE VESSELS STORAGE AND PRESERVATION.

Vessels likely to be stored several weeks or more prior to installation on the skid. In order to maximize vessel performance as well as cosmetic external appearance the following actions should be taken:

- A. Vessels must be stored indoor

- B. In case that the site conditions prevent indoor storage, the below measures must be kept:
 1. In case that the vessels are unpacked from the original packing (supplied by BEL) keep vessels supported by three equally spaced points as required in the vessels drawing. Short vessels, i.e. three membranes elements or less, may be supported by two points.
 2. In case these unpacked vessels have to be stored in columns, one over each other, use the supports beams supplied in the original BEL packing, to avoid unwanted contact between the ports and follow same original structure of “head crossed”.
 3. Do not lean on vessels or over its original packing any other materials. It cannot be used as a storage area.
 4. It is strictly forbidden to walk on the vessels.
 5. Laminate can dissolve when exposed to direct sunlight, therefore, avoid exposing the vessels to direct sunlight for a long period of time.
It is recommended (if possible) to store the vessels in the same packing as delivered by BEL.
 6. Protect vessels from extreme weather conditions, as well as the dust.
 7. FRP vessels cannot withstand direct or indirect hit. Therefore, Delimit and highlight properly the area where the vessels will be stored to avoid crushes and or hits with machinery, which can damage the vessels.
 8. For long-term outdoor storage, it is highly recommended to remove the plastic bags, located inside to the vessels, which contain seals, adapters, etc, and store them indoor.
 9. The plastic packing cannot last under direct UV, in case of unshaded storage the vessels must be covered with tarpaulin or any other suitable cover.
 10. Prevent all contact with aggressive chemicals that may affect the outer coating of the pressure vessel.

ANNEX 1 - BEL Puller For 8" pressure vessels heads installation

This tool designated to extract BEL head assembly for 8" pressure vessels.

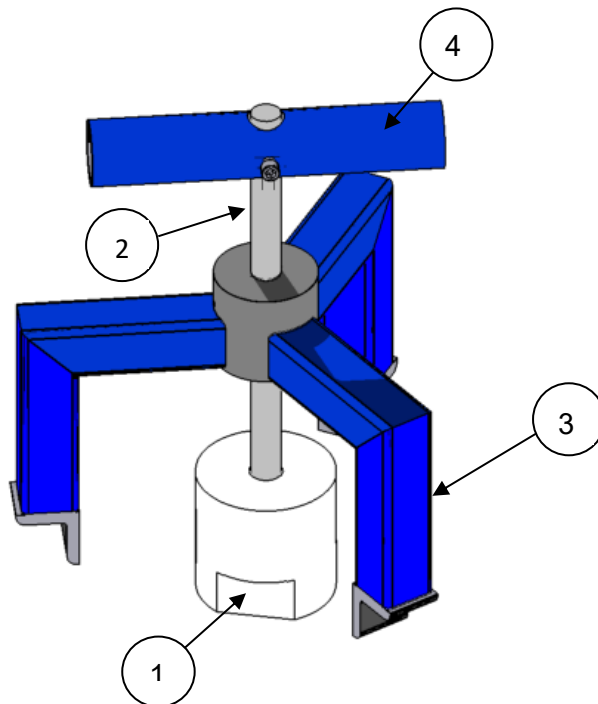
Before disassemble any of the vessels parts ensure internal pressure has been released. Otherwise, DO NOT PROCEED to disassemble any part until the elimination of any internal pressure inside the pressure vessel is verified.

NOTE:

It is highly recommended to replace all seals each time the head is reassembled.
A seal replacement kit is available from **BEL's** Customer Service.

Part number:	069-080-0101	+ 069-080-1000 (for 1" NPT adapter) or
		+ 069-080-1250 (for 1.25" NPT adapter) or
		+ 069-080-1500 (for 1.5" NPT adapter) or
		+ 069-080-1510 (for 1.5" Victaulic adapter).
		+ 069-080-2010 (for 2" Victaulic adapter for 9" PV)
		+ 069-080-1258 (for 1.25" BSP adapter (1500 / 1800 psi))

Kit assembly: Tool must be assembled as shown on illustration 1.



(1) Threaded/ Victaulic Puller cap, (2) Threaded Rod

(3) NPT/ Victaulic Puller (4) Handle

BEL COMPOSITE IBERICA S.L.

Parque Tecnológico Fuente Álamo. Ctra. del Estrecho-Lobosillo, km 2.0,3
30320 Fuente Álamo, Murcia, Spain – CIF B30781215

Tel.: +34 968 197 501 | FAX: + 34 968 197 502 | www.belvessels.com | iberica@bel-g.com

ANNEX 2 - BEL Pusher For 8" and pressure vessels heads installation

This tool designated to install BEL head assembly for 8" and pressure vessels.

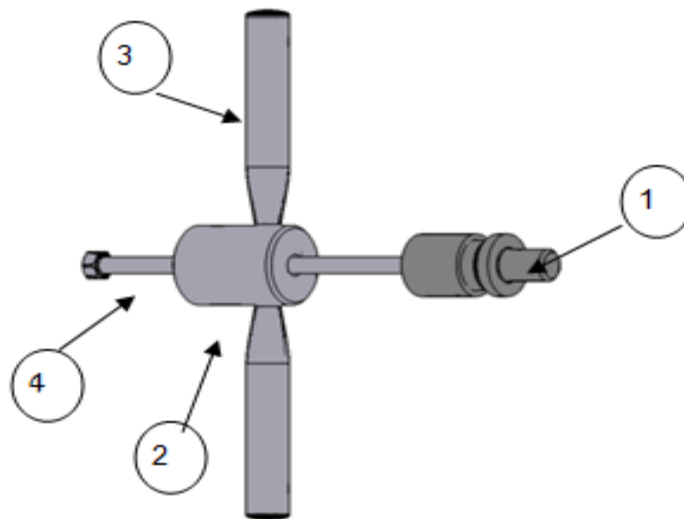
NOTE:

It is highly recommended to replace all seals each time the head is reassembled.
A seal replacement kit is available from **BEL's** Customer Service.

Part number:	069-080-0100	Vessels up to 1200 psi
	069-080-0200	Vessels 1500 & 1800 psi

Kit assembly: Tool must be assembled as shown on illustration

NOTE: Ensure tool's handle is located far from the pusher adapter (piece 1).

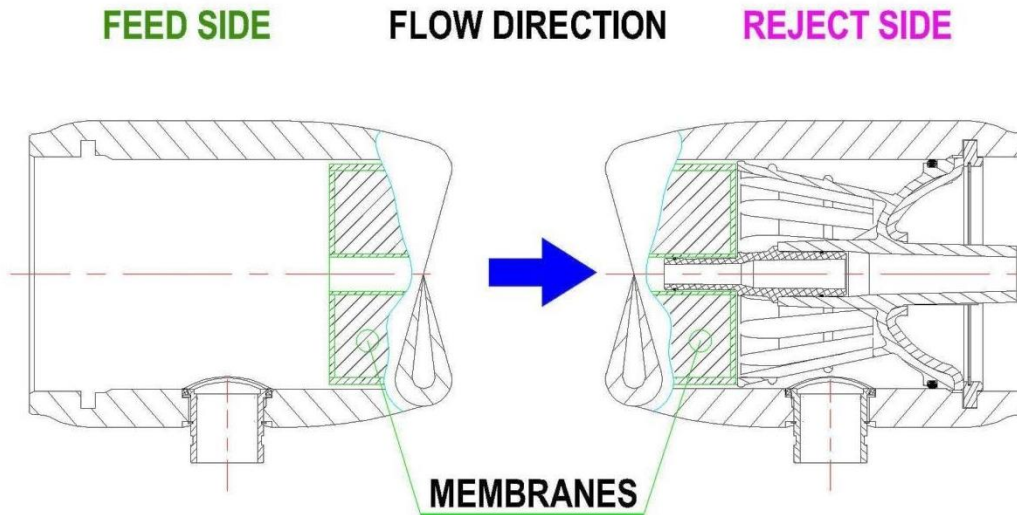


(1) Adapter, (2) Sliding hammer (3) Handles (4) Rod

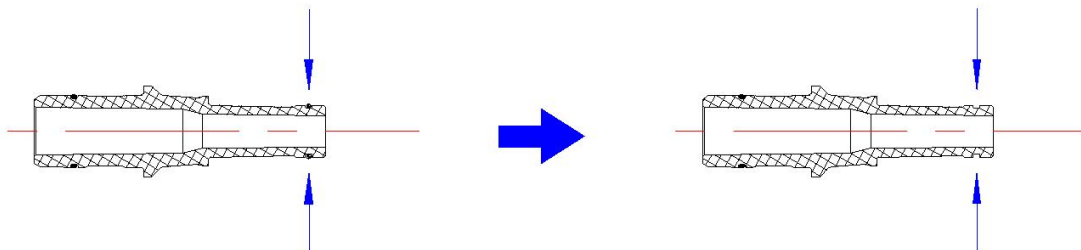
ANNEX 3 – Shimming procedure

Side / Multiport vessels up to 1200 psi

- 1.- Close the vessel on the reject side.
- 2.- Load the membranes from feed side to reject side.



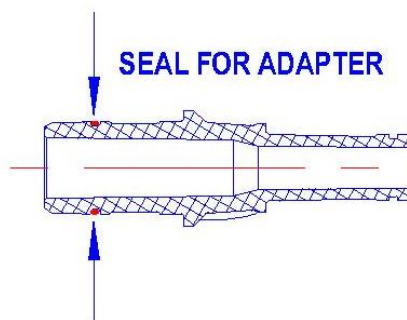
- 3.- Remove the adapter from the end cap and remove the o-rings of the membrane side.



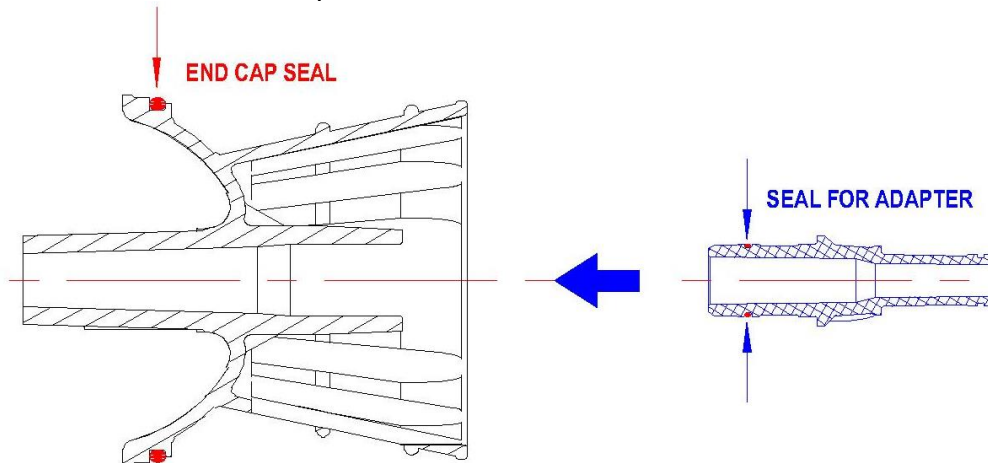
- 4.- Settle the adapter without o-rings (*in the membrane side of the adapter*) into the end cap.

NOTE 1: Keep the adapter o-ring at the end cap side

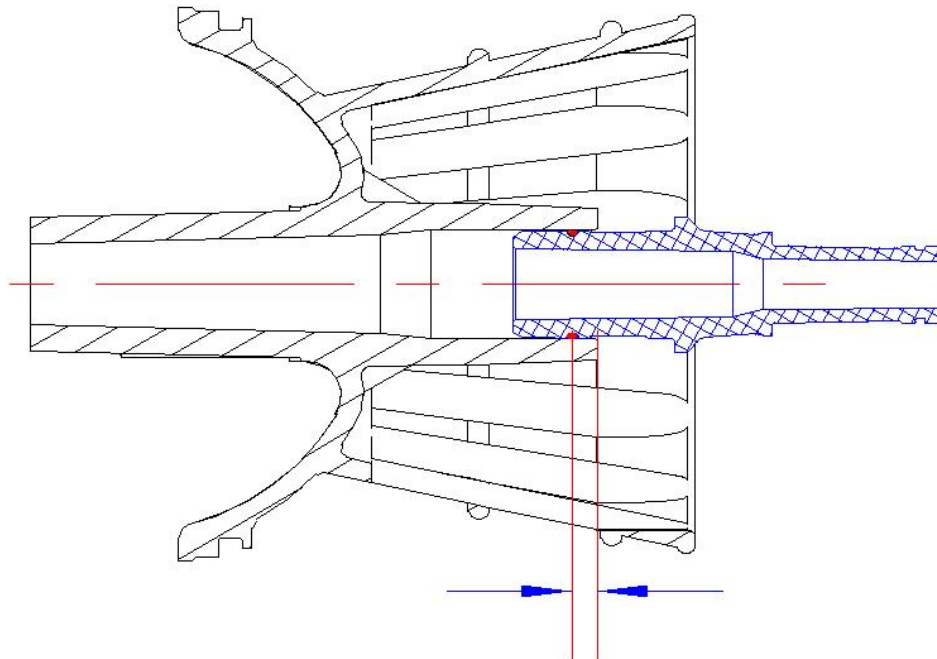
NOTE 2: Apply some lubricant (glycerin) on the adapter o-ring, at the end cap side, as it is shown in the next figure.



5.- Remove the seal for end cap.

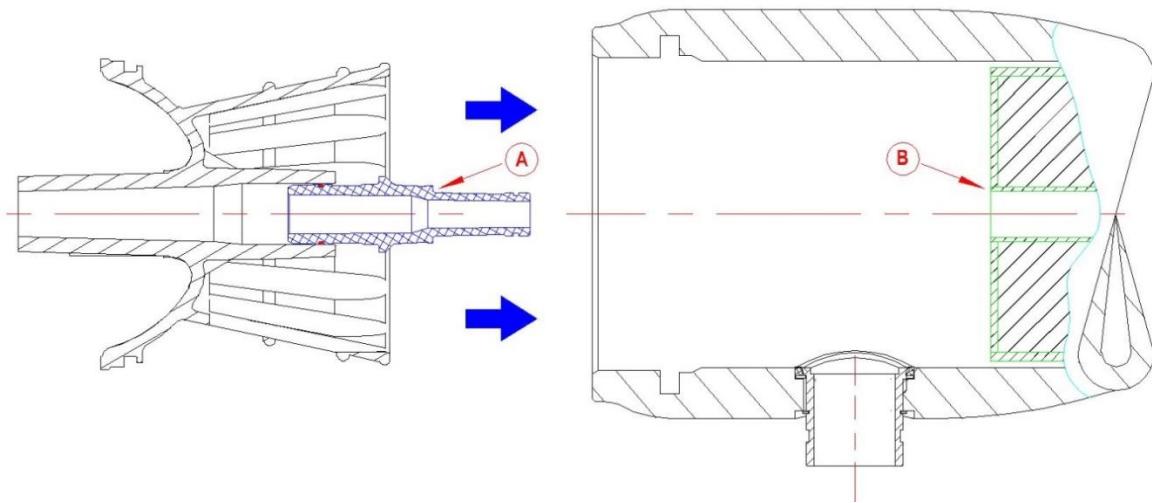


6.- Push the adapter into the end cap until the edge of the seal for adapter reach the end cap hole to place it.

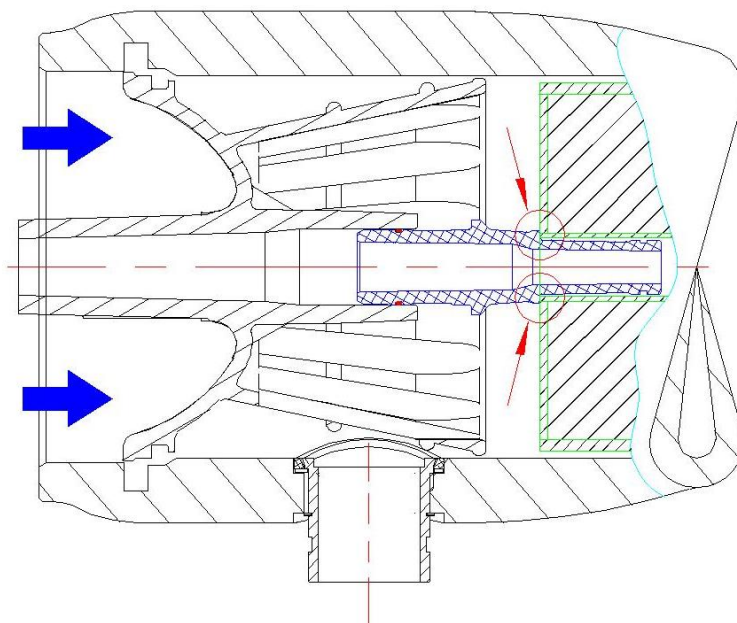


NOTE 3: Do not push the adapter too much into the end cap hole

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.



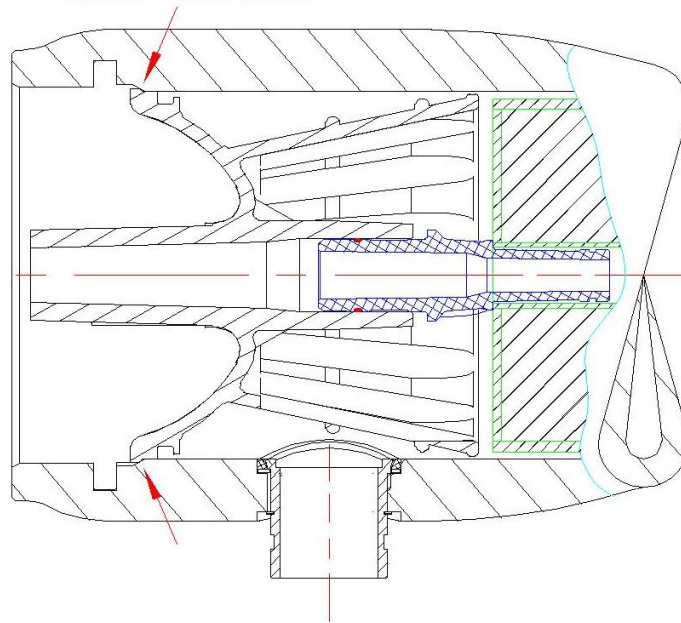
8.- As the adapter has no o-ring in the membrane side, the adapter will be placed into the membrane permeate tube without any resistance.

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.

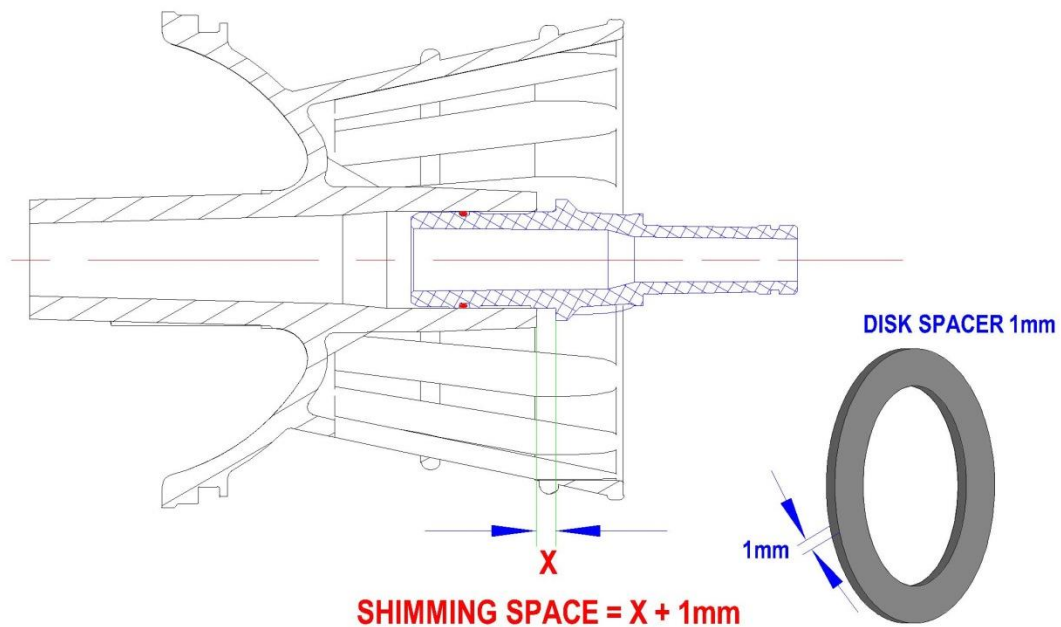
END CAP FINAL POSITION



10.- Remove the kit end cap – adapter and measure 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

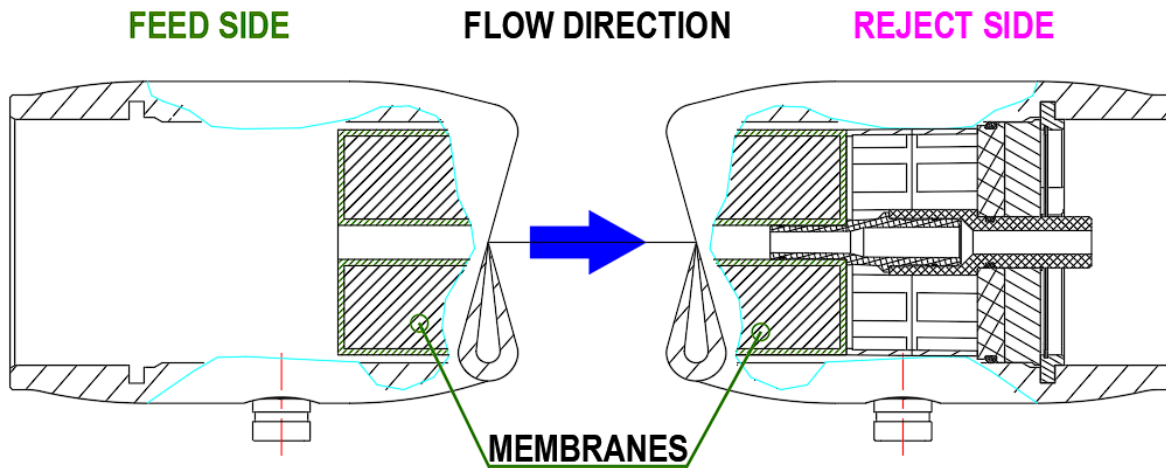


11.- Repeat the operation with every vessel to obtain the real shimming distance for every vessel.

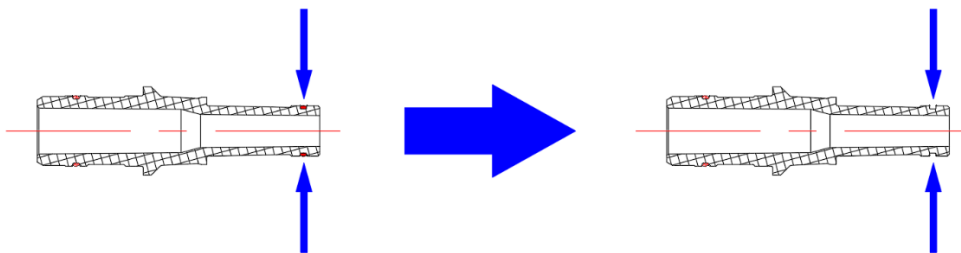
ANNEX 4 – Shimming procedure

Side / Multiport vessels 1500 psi and 1800 psi

- 1.- Close the vessel on the reject side.
- 2.- Load the membranes from feed side to reject side.



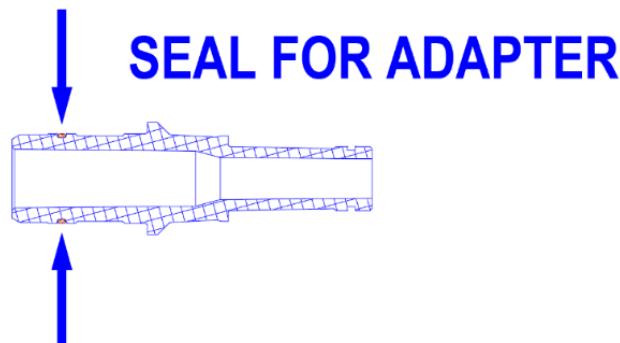
- 3.- Remove the adapter from the end cap and remove the o-rings of the membrane side.



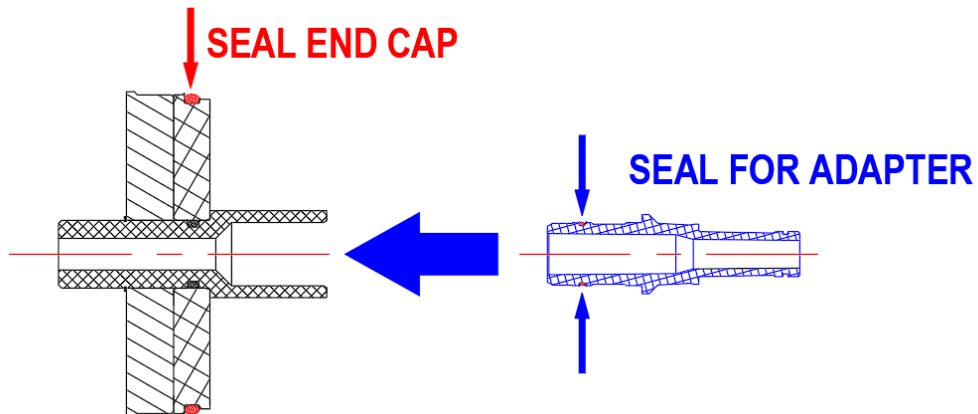
- 4.- Settle the adapter without o-rings (*in the membrane side of the adapter*) into the end cap.

NOTE 1: Keep the adapter o-ring at the end cap side

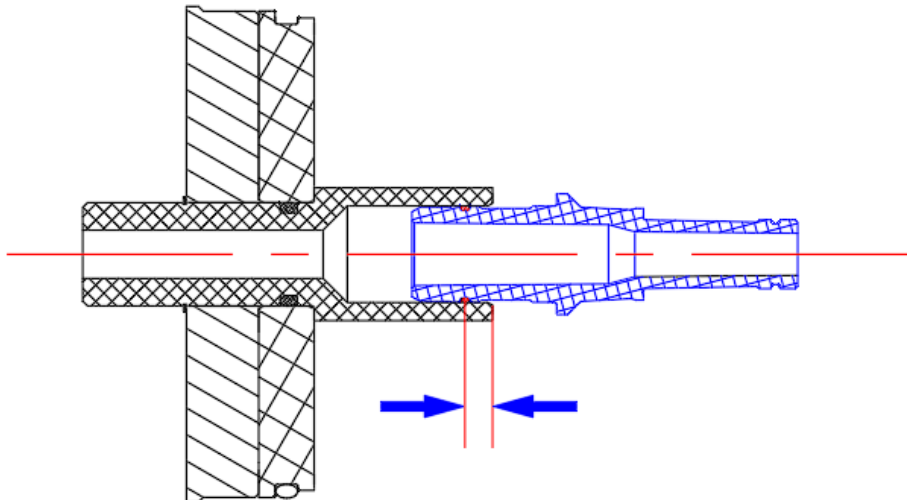
NOTE 2: Apply some lubricant (glycerin) on the adapter o-ring, at the end cap side, as it is shown in the next figure.



5.- Remove the seal for end cap.

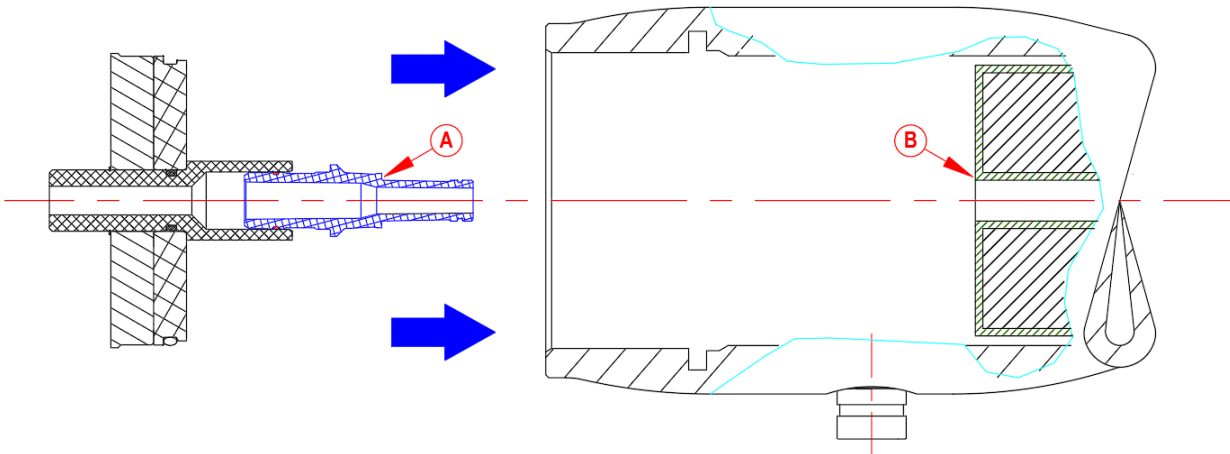


6.- Push the adapter into the end cap until the edge of the seal for adapter reach the end cap hole to place it.

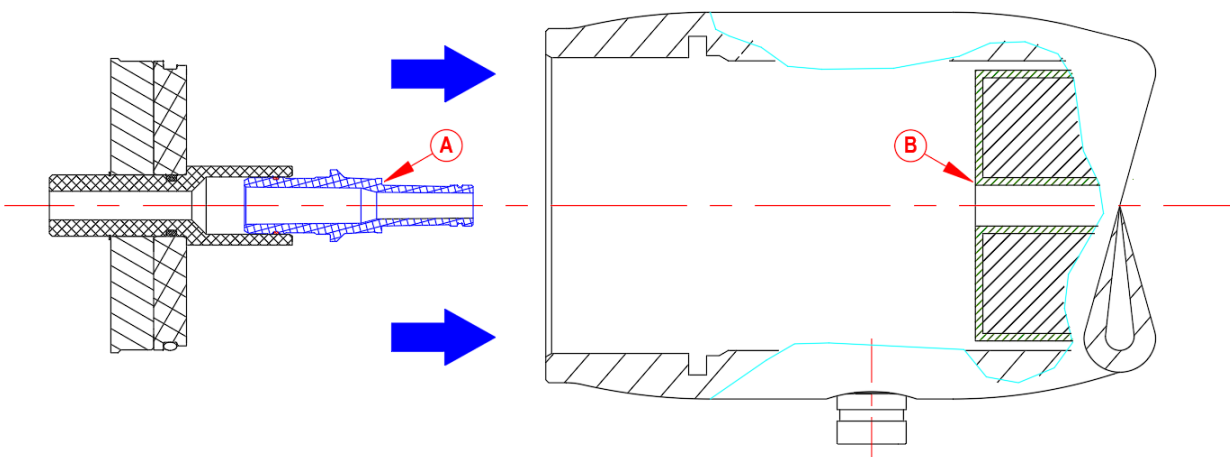


NOTE 3: Do not push the adapter too much into the end cap hole

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.

ANNEX 5 - O-Ring replacement and scratches treatment procedure

1. Preparations

Please prepare the following items before procedure:

- 1.1.- New intact O-Ring seal suitable with End-Cap type.
- 1.2.- BEL End-Cap. Ensure O-Ring groove is clean and free of scratches.
- 1.3.- Clean cloth.
- 1.4.- Lubricant.
- 1.5.- BEL Pusher-Puller (optional).

2. O-Ring Replacement procedure

- 2.1.- Clean vessel internal surface at sealing area (O-Ring area) with clean damp cloth after the disassembling of the head assembly from the vessel.
- 2.2.- Ensure vessel sealing area is smooth and free of scratches. See next procedure for scratch treating.
- 2.3.- Assemble End-Cap parts (e.g. End-Cap, Adapter, O-Rings and Shims) and apply full and reach layer of lubricant on seals, vessel's groove and vessel's sealing area.
- 2.4.- Install End-Cap using BEL's pusher-puller.

3. Scratches treatment procedure

- 3.1.- Clean vessel internal surface at sealing area (O-Ring area) with clean damp cloth.
- 3.2.- Locate the scratch at the O-Ring sealing area. Scratches out of this area will not cause leaks, therefore will not be treated.
- 3.3.- Grind out the scratch using Extra-Fine sand paper (P400) until scratch is flat and smooth. DO NOT grind deep into the vessel, this might cause permanent damage to the vessel.

Note: In case of deep scratches or layers delamination please consult BEL engineering department.

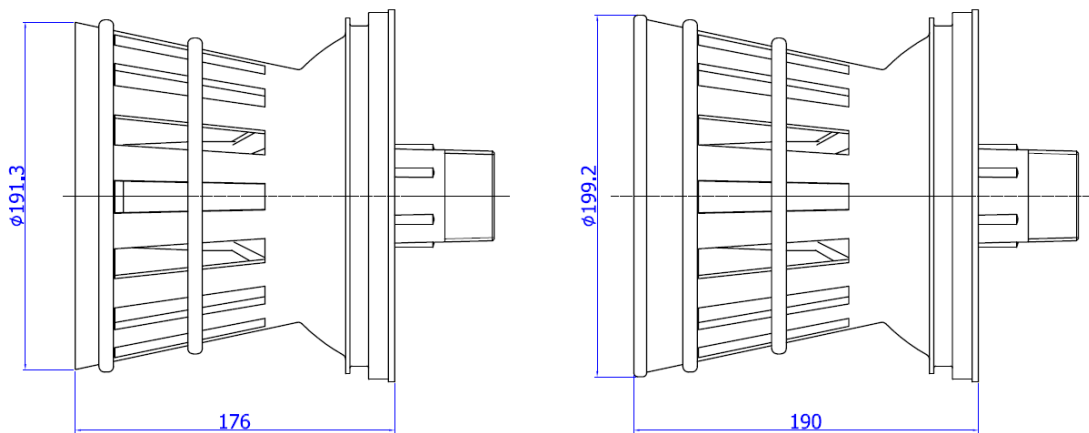
ANNEX 6 – End Caps with iLec Membranes (up to 1200 psi vessels)

In pressure vessels which will be installed iLec system membranes, End caps supplied will be of two different kinds. End caps reference number, with iLec system membranes, will show the “i” at the end of their reference number as it shown in the following table.

DESCRIPTION	Material	Part Number
End cap 1,5" NPT-M	Engineering plastic	2857709010
End cap 1,5" NPT-M iLec	Engineering plastic	2857709010i
End cap 1" BSP-F	Engineering plastic	2857709010g
End cap 1" BSP-F iLec	Engineering plastic	2857709010ig
End cap 1,5" vict.	Engineering plastic	2857709010v
End cap 1,5" vict. iLec	Engineering plastic	2857709010iv

This kind of “i” end shown the particularity to be shorter than standard (no iLec) to fit with the special dimension of these kind of membranes.

MEMBRANE	LENGTH
Membranes 8040 standard	40" - (1.016 mm)
Membranes 8040 iLec	40,5" - (1.029 mm)



END CAP SHORT

STANDARD END CAP

The proper way to install them in the pressure vessel is shown in the next figure.

