

User's Guide **9** to:
Phoenix Vessel Technology Limited

400/1200 psi Side port pressure vessels (1.5",
2.0", 2.5", 76mm, 3.0"). Model
numbers: 3314, 3341, 3639, 3643,
2101, 3642, 3333, 2058, 3601,
3602, 2059, 3600

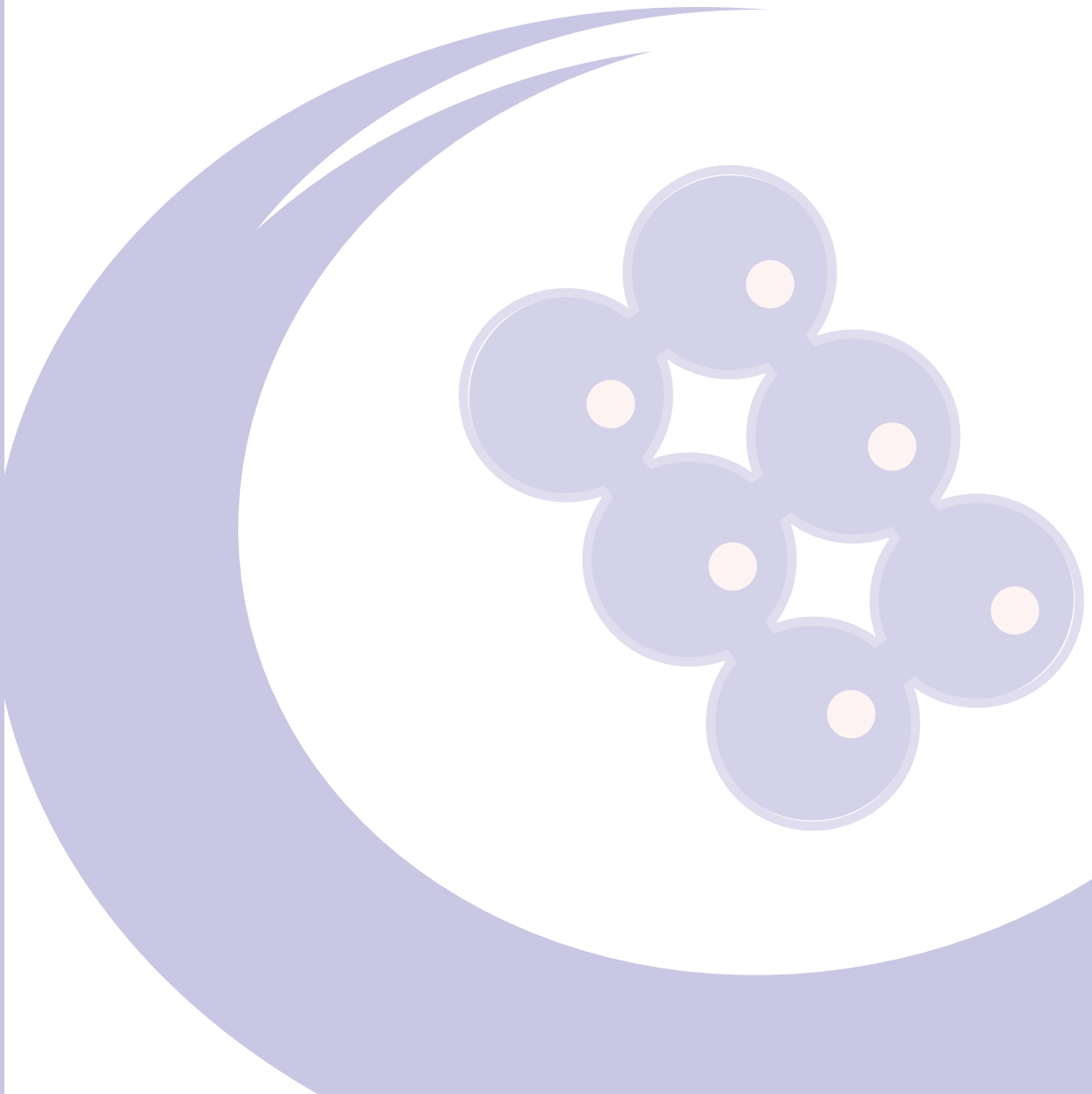


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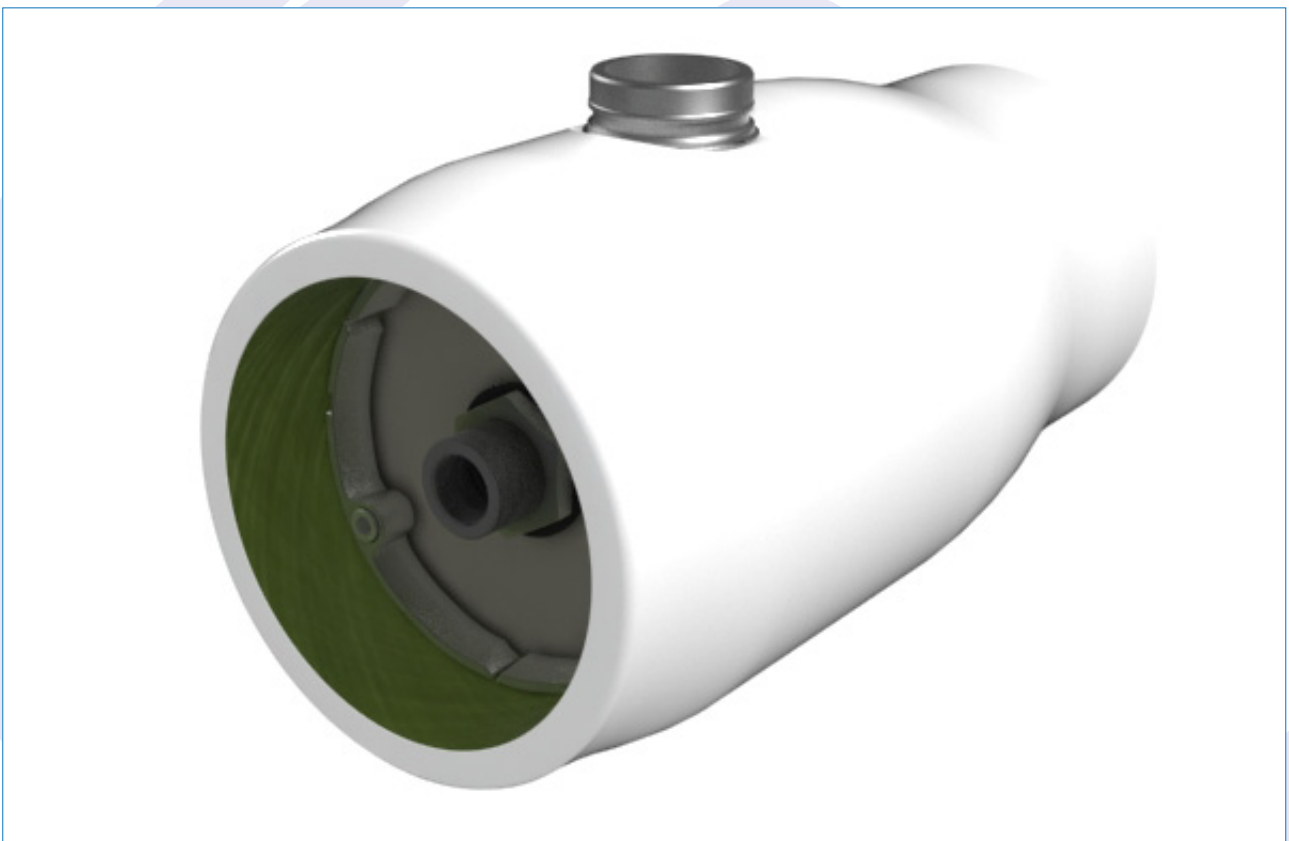
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FORWARD

Phoenix Vessel Technology is a major manufacturer of Glass Reinforced Plastic Pressure Vessels which are used as housings for reverse osmosis membrane elements. It is one of a small number of companies with Code X accreditation of the American Society of Mechanical Engineers.

Vessels are produced to cover a range of pressures upto 1200 psi and to house seven 40" or five 60" membrane elements.

Each vessel has a documented history in terms of the manufacturing process and the materials used. Before despatch, each vessel is tested to 1.1 times working pressure to ensure structural integrity.



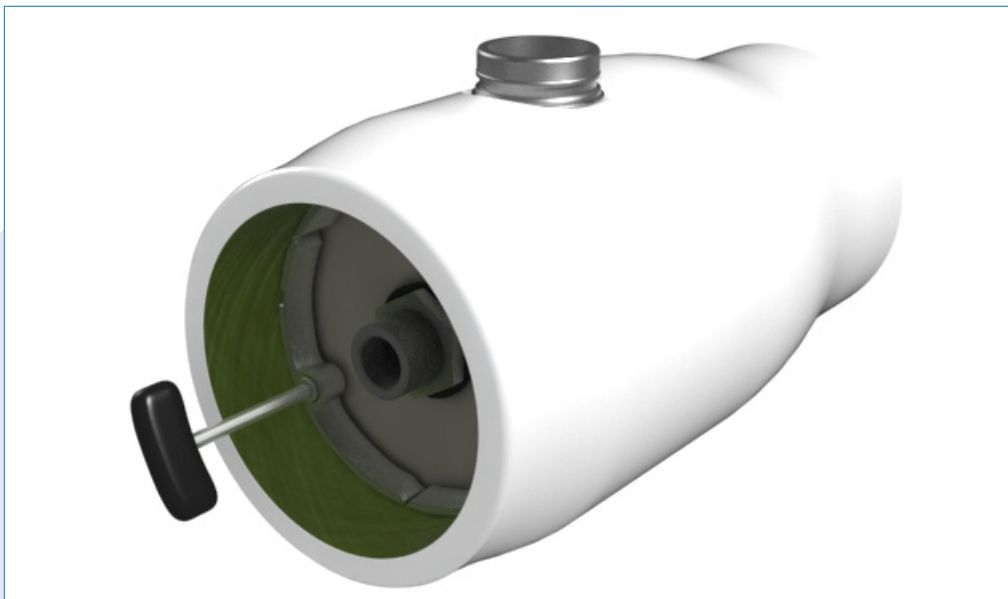
This User's Guide applies to the 8" side ported pressure vessel (1000 or 1200psi) which is currently available with 1.5", 2", 2 ½" and 3" Victaulic feed and concentrate ports. The permeate connection can be 1" BSP Female. The following Assembly Drawings are applicable:

- (1) 3639 1.5"/2.0" 1000 Psi
- (2) 3643 2.5"/3.0" 1000 Psi
- (3) 2101 1.5"/2.0" 1200 Psi
- (4) 3624 2.5" 1200 Psi
- (5) 3333 3.0" 1200 Psi

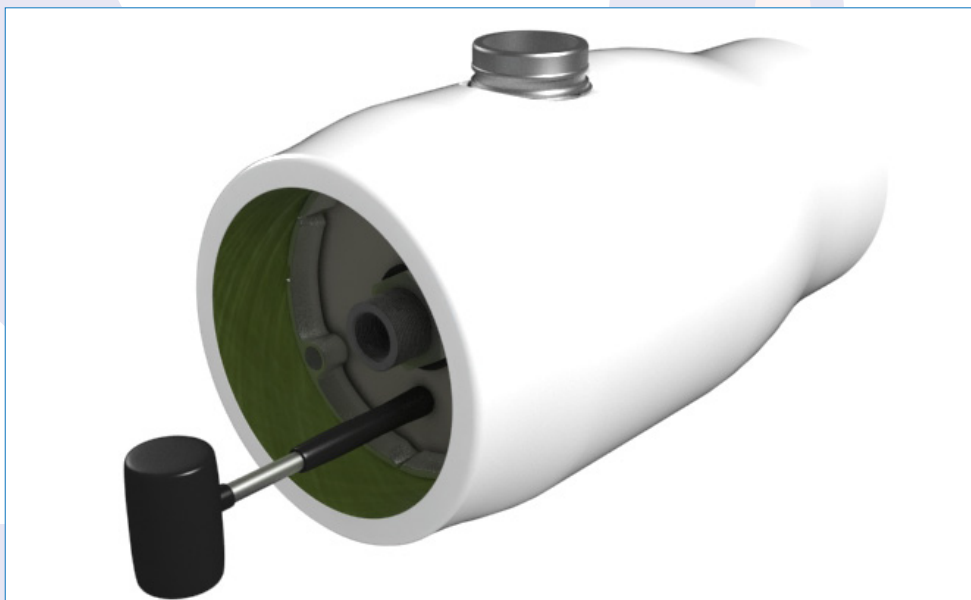
SECTION ONE MAINTENANCE GUIDE

1.1 REMOVING END CAP FROM VESSEL

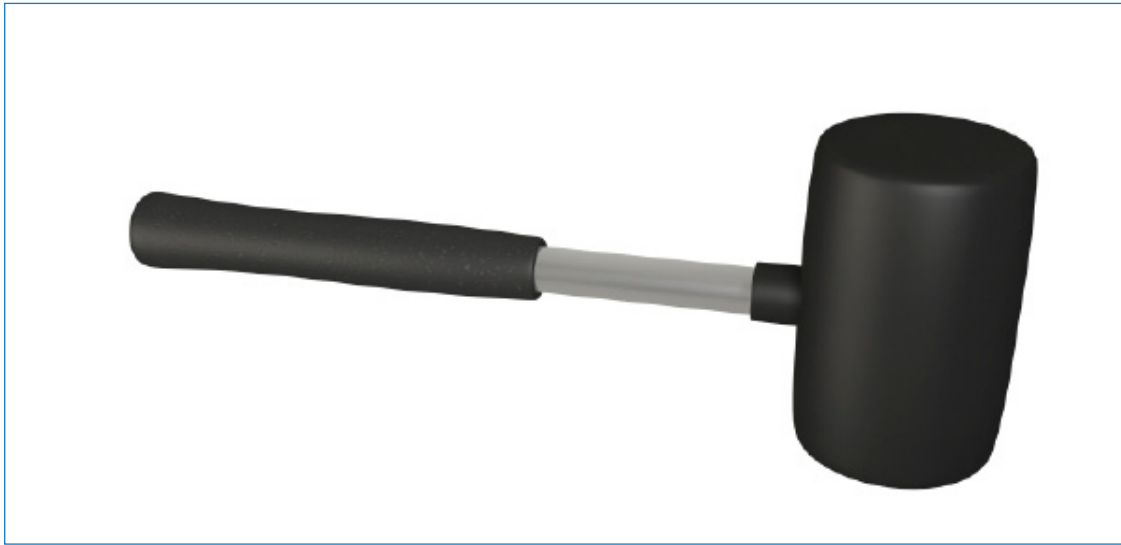
- 1.1.1 Ensure system is NOT pressurised before starting work.
- 1.1.2 Remove connections if fitted from the central product port.
- 1.1.3 Using an 8mm (A/Flats) hexagonal 'T' bar or Allen key remove the 3 Cap Head Screws located in recesses in the Retaining Rings.



- 1.1.4 Remove the 3 segments of the Retaining Ring. Each segment has a slot at one end to enable it to be levered out. If removal is difficult then start at the point where the gap between two segments is greatest. It may be of assistance to tap the End Cap with a soft mallet shaft to free the segments.

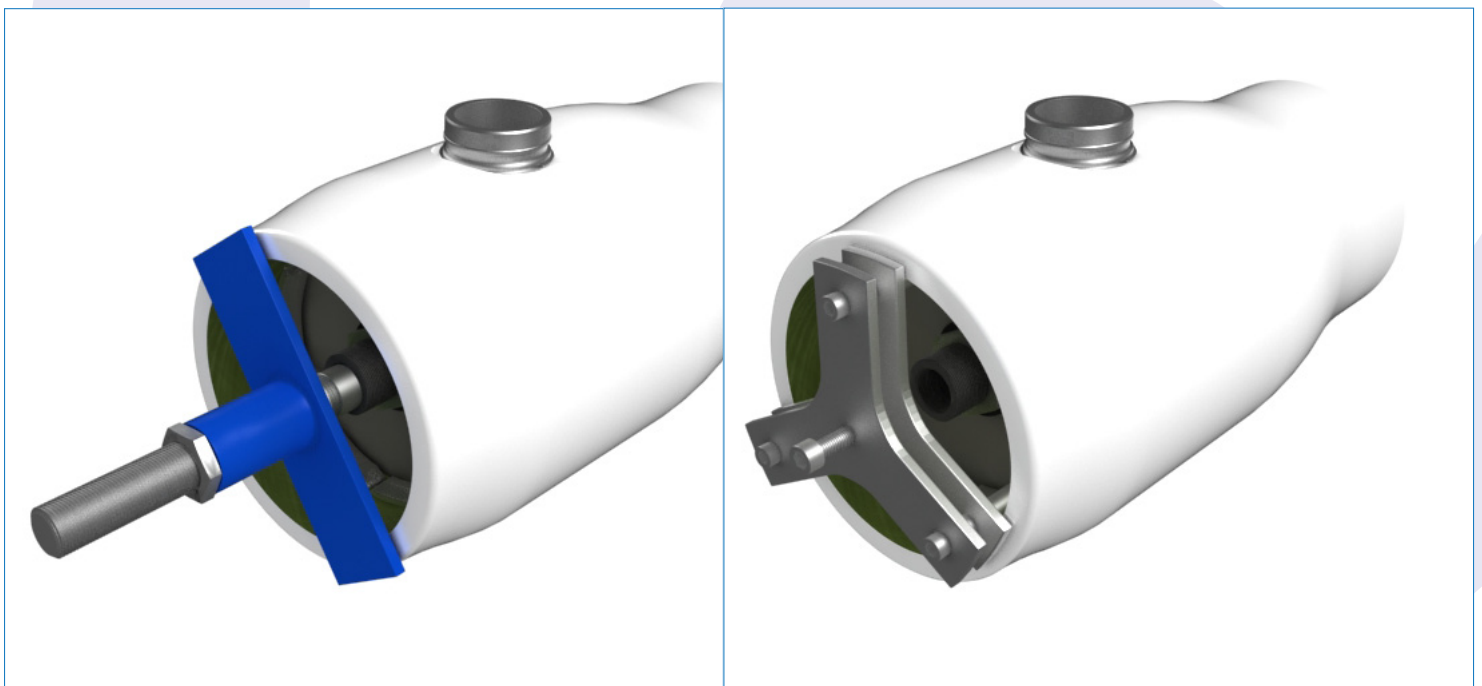


1.1.5 A soft mallet is a useful tool for removing and inserting the end fittings – however it should be used with discretion and have the following specification.



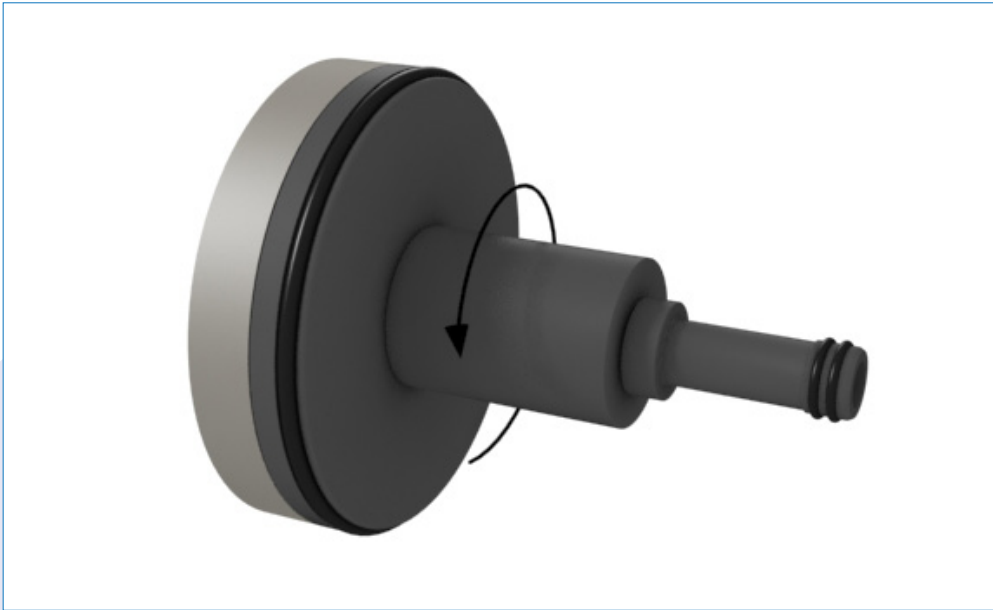
NOTE: A metal headed hammer is not recommended for use with these pressure vessels.

1.1.6 To remove the End Cap requires an extractor. There are two designs available. The lowest cost version exerts pull load onto the product connection thread, the alternative design (which is more universal, takes longer to assemble onto the end cap, but has a greater pull load) consists of two tripods and 3 long cap head screws (M10x1.5) – these are screwed into the securing screw threads of the End Cap. Extraction load is applied via the large threaded bolt at the centre axis. Both types are illustrated below.

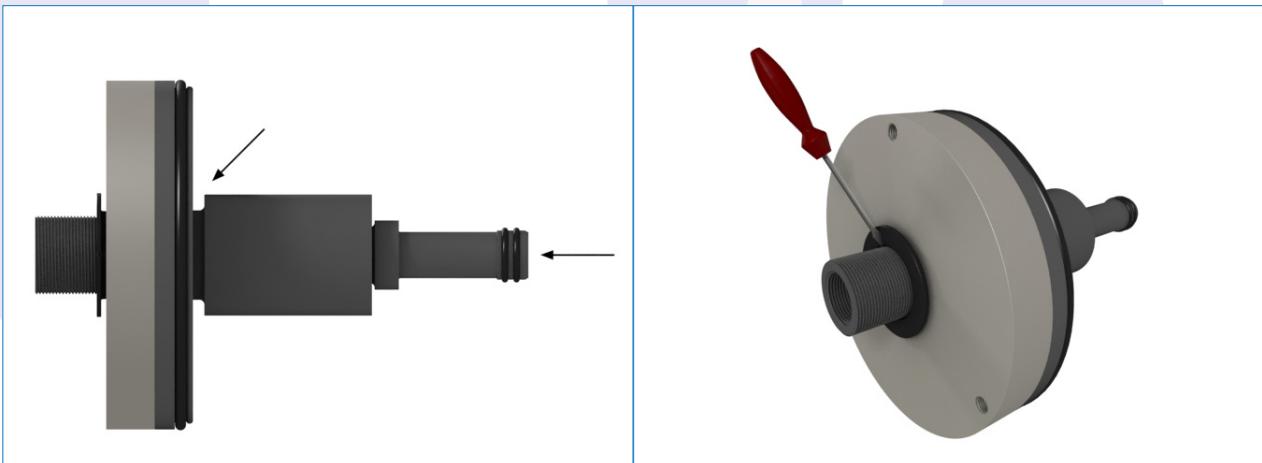


1.2 DISASSEMBLING END CAP

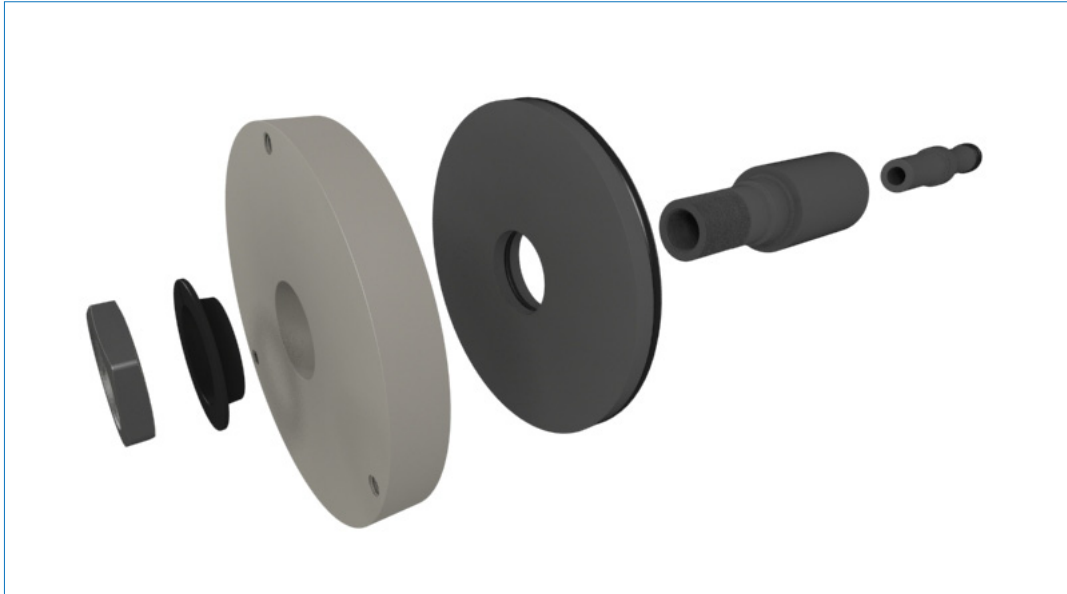
1.2.1 With the End Cap extracted. Unscrew the Backnut located on the Product Tube. Grasp the Product Tube and unscrew it from the End Cap approximately 2 turns until a gap of 5 to 10 mm appears.



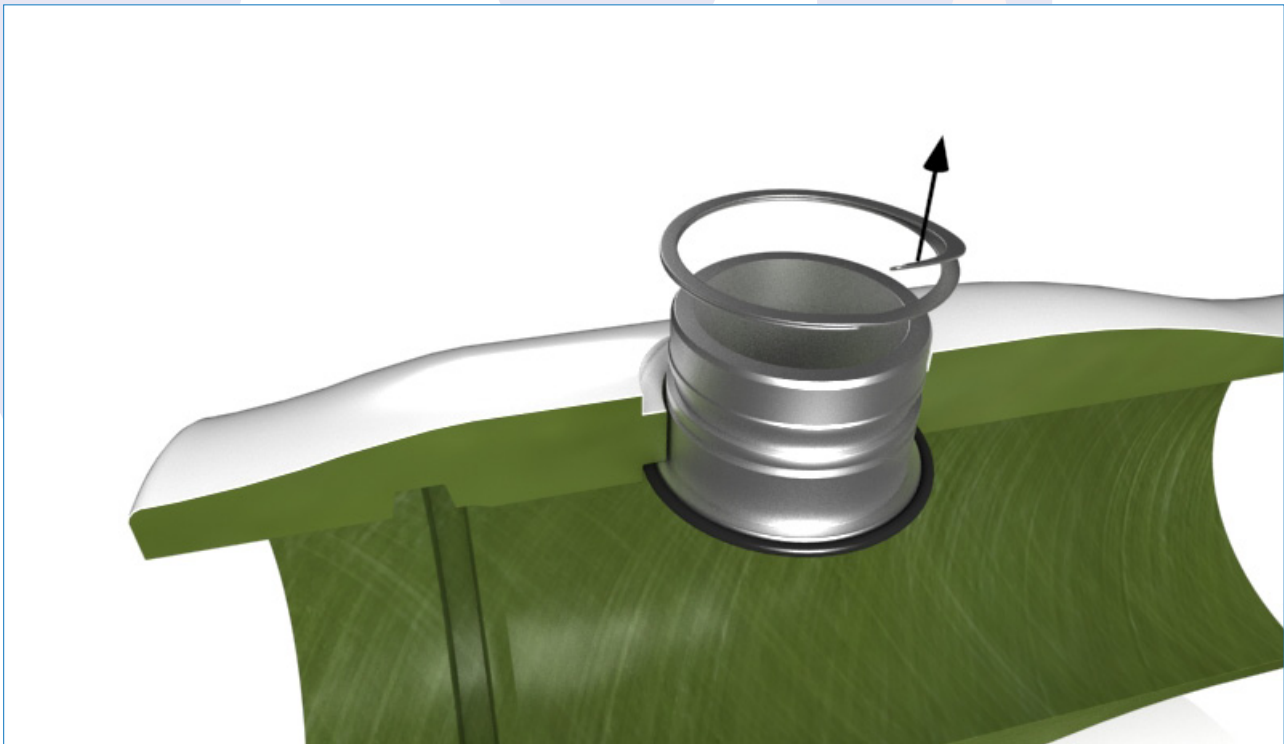
1.2.2 Push the Product Tube back into the End Cap and at the same time pull out the black coloured Collet at the other end of the Product Tube. The 5 to 10 mm gap should now appear on the other side of the end cap.



1.2.3 Using a small screwdriver prise open the Collet by pushing the blade of the screwdriver into the gap. This should enable the Product Tube to release cleanly and preserve the threaded portion of it for re-use later.



1.2.3 To remove the Feed Concentrate Port first remove the Port Clamp and Clip. Push the port into the vessel upto the shoulder of the Victaulic groove.





1.3 COMPONENT ASSEMBLY

1.3.1 Thoroughly clean all parts and check for the following.

- (a) O-Seals - cracked, worn or cut areas.
- (b) Feed Concentrate Port - bent or distorted, corroded.
- (c) Backing Plate - dented, anodising or locating threads for cap head screws damaged.
- (d) Segmented Retaining Ring - bent or distorted.
- (e) Cap Head Screws - bent, corroded or threads damaged.
- (f) Product Tube - threads damaged or sealing areas scratched.
- (g) End Plate - cracks or scratches in sealing areas.
- (h) Adaptor - cracks or scratches in sealing areas.
- (i) Anti-Rotation Collet - cracked or broken.
- (j) Backnut - cracked, broken or thread damaged.

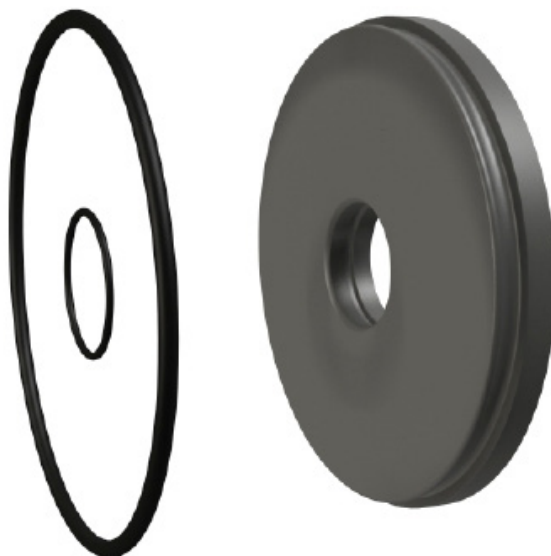
Components which show any of the above should be replaced.

1.3.2 CORROSION - Examine metal components for evidence of corrosion which might affect structural performance. Particularly pay attention to the Backing Plate and Segmented Retaining Ring set. The Backing Plate may be cleaned using fine grade waterproof silicone carbide paper (600 grade or finer). Components which cannot be restored to the 'as new' condition should be replaced.

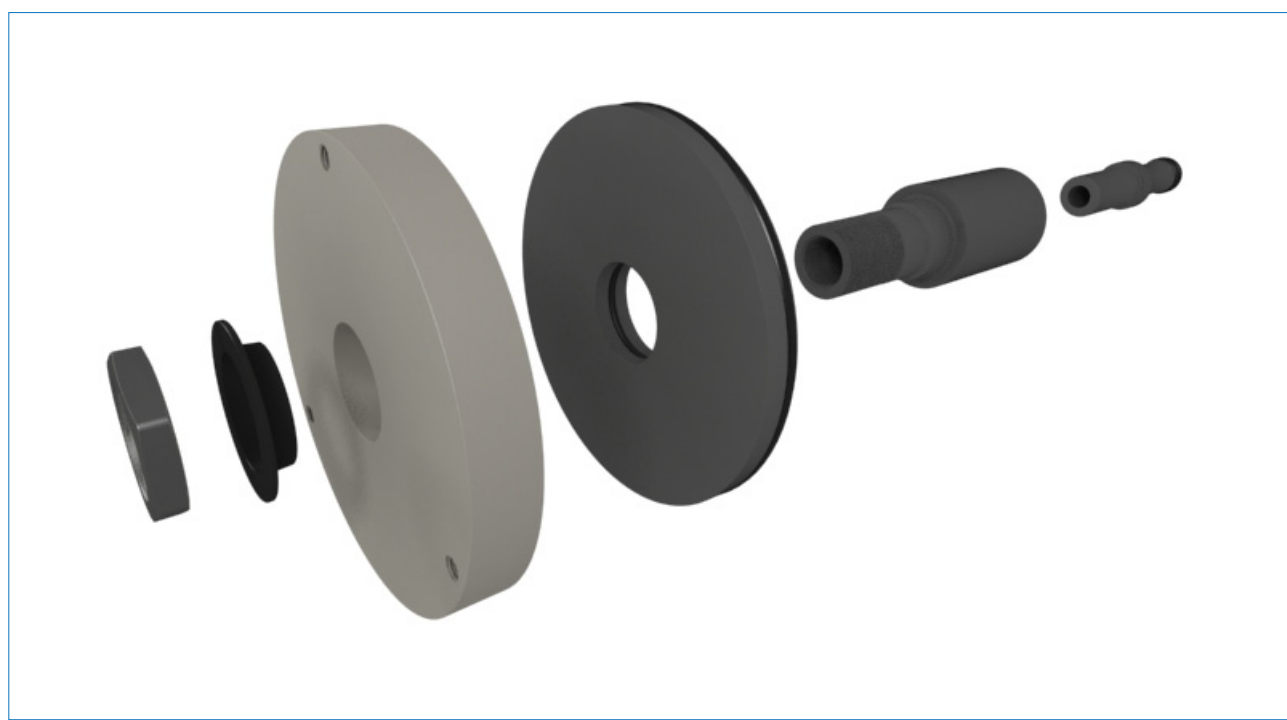
NOTE: It is recommended that O-seals are replaced every time the end cap is rebuilt.

NOTE: Damage to anodising may be temporarily repaired by sealing with epoxy paint.

1.3.3 Assemble the End Plate with its O-seals.

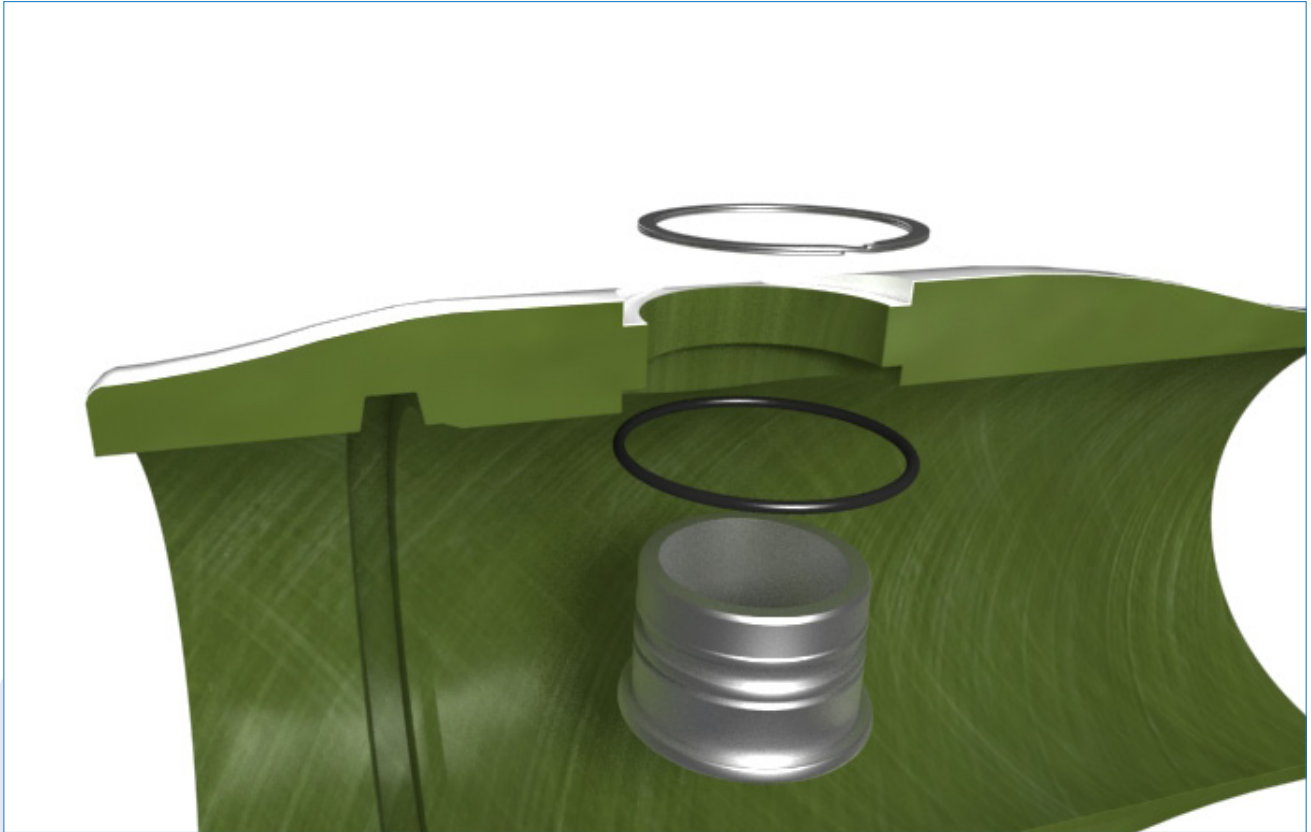


1.3.4 Assemble the End Cap as illustrated.



NOTE: Lubricate the O Seals with Glycerine. Do not use grease as this may impair the performance of the membrane elements.

1.3.5 If the Side Port was removed earlier then assembly is the reverse of disassembly see previous section. However, once the seal has been fitted to the port a locating-jack is required to engage the seal on its seat.



1.4 LOADING MEMBRANES

This Section is provided as a Guide only, reference should be made to the element manufacturers recommendations for loading.

1.4.1 UNLOADING MEMBRANE ELEMENTS

- (a) Ensure system is NOT pressurised before starting work.
- (b) Remove both end caps from vessel.
- (c) Remove thrust ring and adaptors from vessel.
- (d) Remove element from vessel following element manufacturers recommendations.

1.4.2 CHECKS BEFORE LOADING

- (a) Check the inside of the vessel for debris which may scratch the vessel. Remove any that is found by flushing with water or by using a clean cloth. Stubborn debris which adheres to the vessel may be removed by lightly polishing the area with waterproof silicone carbide paper. Use 400 Grade (fine) to start with and finish with 600 Grade (very fine). It will help to moisten the grit paper with water during use. Avoid continuously rubbing the same spot in the same direction. Afterwards remove any debris with water or by using a clean cloth.
- (b) Check that there are no sharp edges to the membrane element which could scratch the vessel. Contact the element manufacturer if these cannot be easily removed.
- (c) Check the element brine seal for wear and or cuts. Consult the element manufacturer for spares and advice.

NOTE: Sharp debris may scratch vessel bore. This should be removed before unloading elements.

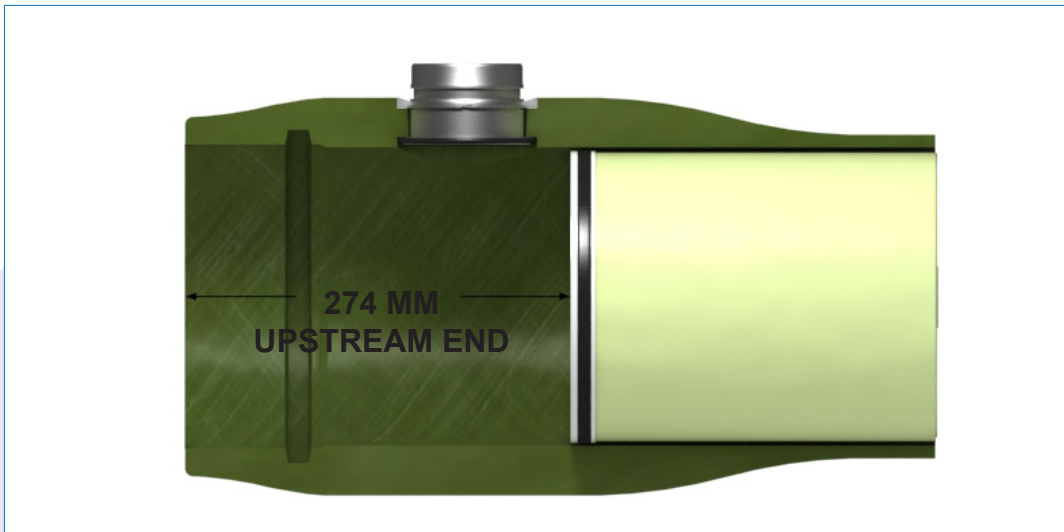
NOTE: Fine grade Scotchbrite may be substituted for waterproof silicone carbide paper.

1.4.3 LOADING MEMBRANE ELEMENTS

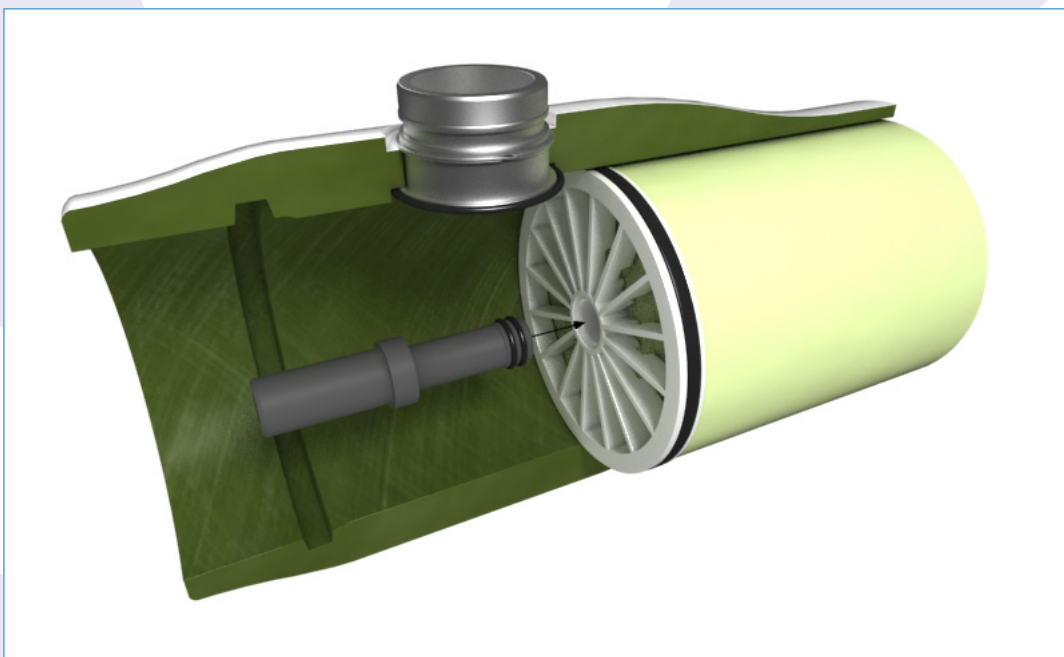
- (a) Lubricate the inside of the vessel with glycerine. If this is not available then flood vessel with clean water.
- (b) Check with the element manufacturer concerning the position of the brine seal. Normally this is placed on the upstream end of the element with the recessed part of the seal pointing upstream.
- (c) Push the elements into the vessel from the upstream end.

- (d) As each element is loaded insert the interconnector. To ease insertion glycerine should be applied to the O-seals.
- (e) Care should be taken to ensure that the weight of the element is not taken on the interconnectors during loading.
- (f) The final element should be inserted the following distances in from the end of the vessel.

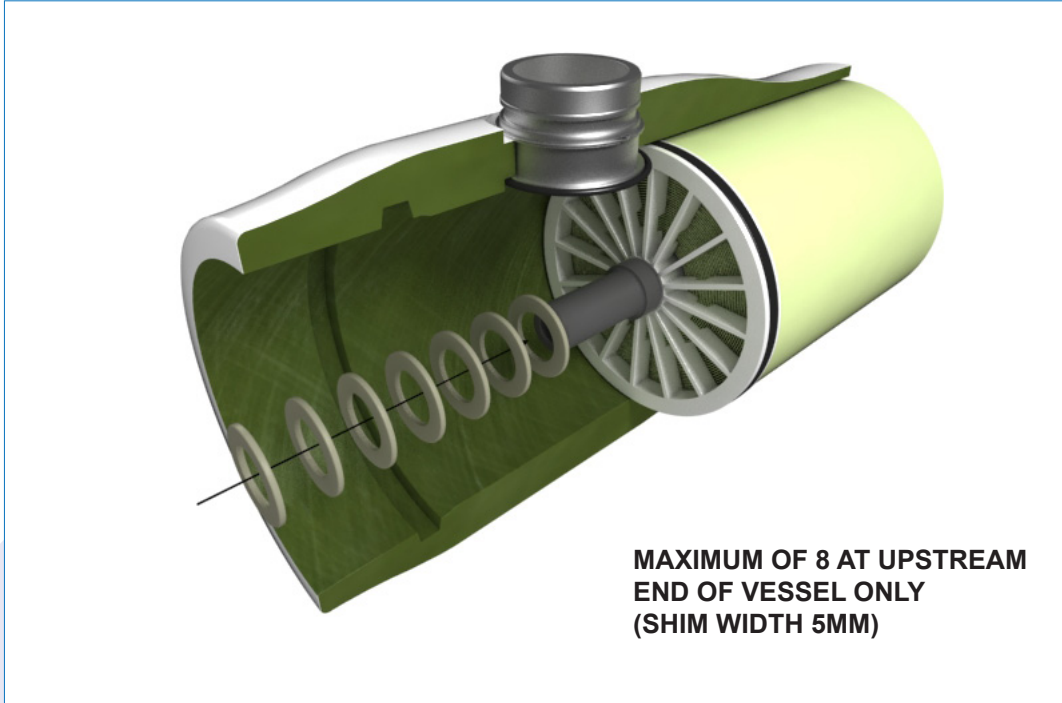
Vessel Type	Element Insertion Distance	
	MIN	MAX
8" 1000 psi Side Port	274mm	297mm
8" 1200 psi Side Port	290mm	305mm



- (g) If the elements are pushed too far then continue pushing until the first element emerges from the other end of the vessel. Take care to support its weight as it emerges.
- (h) Fit the adaptors provided with the vessel end cap to the core tube of the elements at both ends



Shims may be required to ensure that the element remains connected to the pressure vessel end fitting. These must be placed between the Adaptor and the Product Tube at the upstream end only - i.e. at the opposite end to the Thrust Ring. The Shim is a solid plastic washer: - OD 55mm; ID 33mm, by 5 mm thick. A maximum of 8 at the upstream end of the vessel may be used.

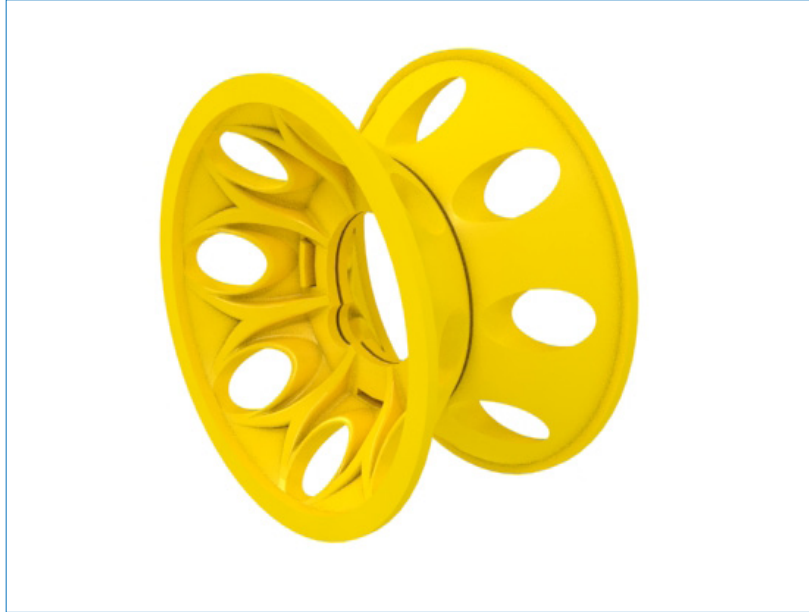


NOTE: Shims reduce wear on O-Seals by controlling the amount of free movement available to the element stack. They can be fitted on all element types but are only supplied for ‘spigotted’ element applications.

NOTE: Adaptors must be fitted to both ends of the stack of elements. Catastrophic failure of the product line can occur if adaptors are not fitted and pressure is applied.

The required number of Shims may vary between any two vessels loaded with elements due to tolerance build up, each will require measuring to find the exact number. The ideal situation is to have a working float of 5 – 10 mm at the upstream end of the vessel to allow for future thermal expansion and contraction. The best method of achieving this is to fit the maximum number of Shims (8 at 5mm thickness) and to keep subtracting Shims one at a time until the Segmented Retaining Ring fits into the groove in the vessel. Finally subtract one more Shim to ensure a safe float of 5 – 10 mm.

- (i) Normally only one Thrust Ring is provided per vessel, the correct location being at the downstream end of the vessel. The design of Adaptor and Thrust Ring ensures even loading over the face of the element.



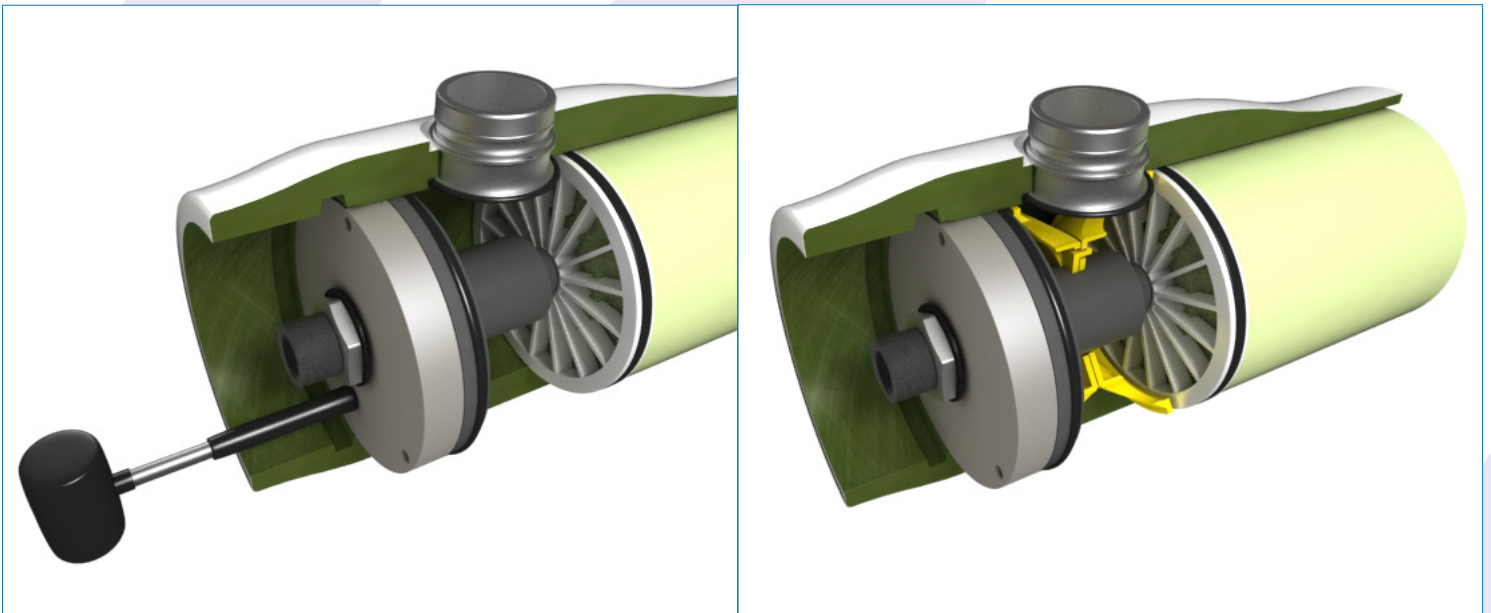
NOTE: Incorrect location of the thrust ring will damage the membrane elements.

NOTE: Please ensure the holes in the thrust ring are aligned with the ports in the vessel.

NOTE: Please ensure plastic screws in thrust ring are tightened sufficiently to avoid movement during operation.

1.5 CLOSING VESSEL

- 1.5.1 Check the inside of the vessel for debris which may scratch the vessel. Remove any that is found by flushing with water or by using a clean cloth. Stubborn debris which adheres to the vessel may be removed by lightly polishing the area with waterproof silicone carbide paper. Use 400 Grade (fine) to start with and finish with 600 Grade (very fine). It will help to moisten the grit paper with water during use. Avoid continuously rubbing the same spot in the same direction. Afterwards remove any debris with water or by using a clean cloth.
- 1.5.2 Lubricate the vessel inside surfaces with glycerine.
- 1.5.3 Lubricate the assembled end cap with glycerine, particularly the large 8" diameter O-seal.
- 1.5.3.1 Insert the end cap squarely into the Vessel Body sufficient to allow the Segmented Retaining Rings to be inserted fully into the groove in the end of the vessel. If the end cap is difficult to push into the vessel then use the shaft of a soft mallet (of appropriate type see Section 1.1) to tap it into position.

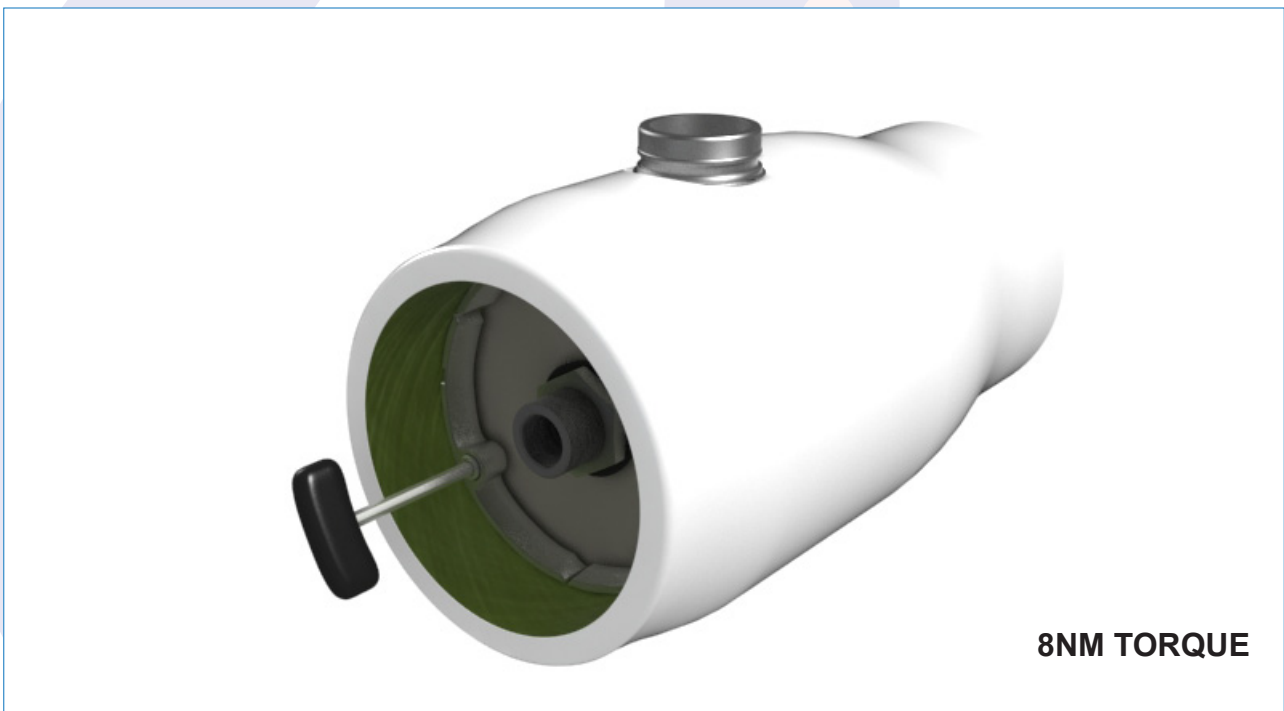


- NOTE:** If the end fitting is inserted at an angle ie not squarely then there is a risk that the large end plate seal may come off - resulting in seal damage and leaks on start up.
- NOTE:** Fine grade Scotchbrite may be substituted for waterproof silicone carbide paper.
- NOTE:** Do not use excessive force to insert the end cap. A light tap is sufficient.

1.5.4 If the end cap cannot be easily inserted then the following checks should be carried out.

- (i) Lubricate vessel surfaces with more glycerine and try again.
- (ii) The elements may have been pushed too far, proceed as follows:
Remove large 8" diameter O-Seal from end cap.
- (iii) Without the large O-Seal no effort should be required to insert the end cap, if there is still insufficient space to insert the Segmented Retaining Rings then the elements have been pushed too far during loading. Remove the last element by pushing it through the vessel taking care to support its weight as it emerges. Refer to Section 1.4 'Loading Membrane Elements' for further information.

1.5.4 With the end cap in place, insert one of the three Segmented Retaining Rings and fix with one of the three Cap Head Screws. Do not tighten yet, leave loose as this will make for easier location of the remaining Segmented Retaining Rings. Put the remaining Segmented Retaining Rings into position before inserting the Cap Head Screws. Finally tighten hand tight up to a maximum torque of 8Nm.



NOTE: Remember to refit all O-Seals, Thrust Ring and insert Adaptors into the central core tube of the first and last element in the stack.

NOTE: A partially or badly assembled pressure vessel is dangerous. Carry out visual inspection on vessel to check compliance with these instructions. Check working area for any items left unassembled.

SECTION TWO

INSTALLATION

2.1 HANDLING

2.1.1 Vessels may be stored horizontally in any warehouse where the temperatures are as follows:

Maximum 45^o C (113^o F)

Minimum 0^o C (32^o F)

2.1.2 DO NOT subject the vessel to sharp blows or impacts as this may damage the vessel wall.

2.1.3 DO NOT use the ports which project beyond the vessel as lifting or manoeuvring aids.

2.1.4 DO NOT scratch the vessel inside wall.

2.1.5 Slings wrapped around the vessel wall and suspended from the forks of a fork lift truck are safer and more stable than using forks alone.

2.1.6 Forks should always be padded before being brought into contact with any part of the vessel body.

VESSEL DAMAGE

This should be reported to the shipping company and Phoenix Vessel Technology Limited.

2.2 VESSEL SUPPORT POSITION

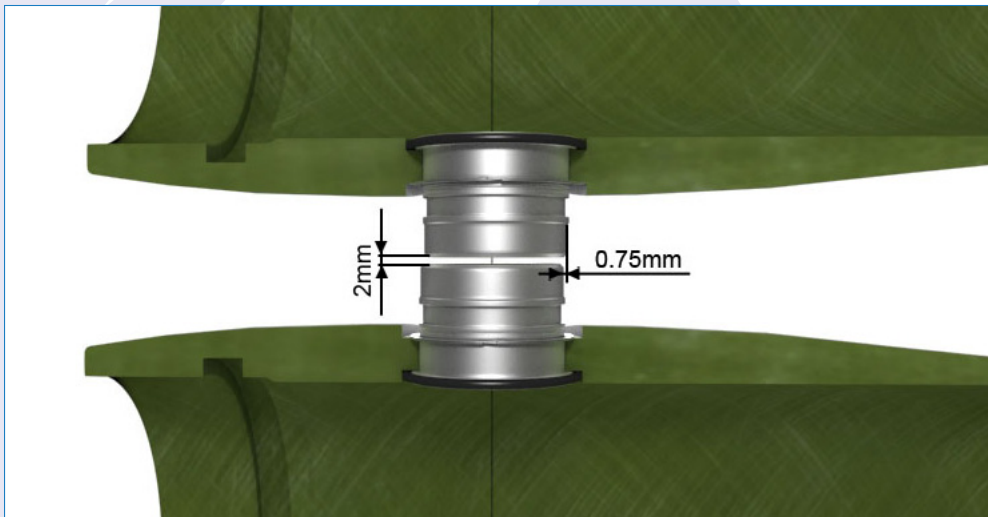
The bending stresses generated in a long pressure vessel can be considerable and should not be ignored. Careful choice of support position can minimise bending stresses to an acceptably low level. Always follow instructions stated on the Assembly Drawing for each particular vessel design and length ordered.

No. of 40" Elements	No. of Supports	Distance rtween Supports (mm)		Distance between Outer Supports (mm)	
		Max	Min	Max.	Min.
1	2	740	500		
1.5	2	1250	500		
2	2	1750	500		
3	2	2775	960		
4	2	3190	1970		
4.5	2	3375	2480		
5	3	centre support		3560	2990
6	3			4020	3800
7	3			6170	5090
7.5	3			6220	5330



2.3 CONNECTIONS TO VESSEL

- 2.3.1 Mount vessels using support saddles provided on horizontal surface at the recommended support position and tighten straps to eliminate movement, do not tighten to more than drawing recommended torque.
- 2.3.2 Provide pressure relief device. This should be set to no more than 105% of design pressure.
- 2.3.3 Allow for an expansion of 0.5mm per metre length of vessel at design pressure.
- 2.3.4 Victaulic clamps used for connection to vessel should be assembled tightly with bolt pads of clamp halves metal to metal.
- 2.3.5 It is recommended that two Victaulic couplings are used to connect the vessel to the manifold ie there is an intermediate pipe section between vessel and manifold which can take up vessel or manifold movement. This intermediate pipe section should be at least 4" in length. The vessel thermal expansion is typically 25×10^{-6} per C in the length direction.



NOTE: Excessive torque applied to the straps may damage the vessel wall and cause the strap nut to seize onto the threaded portion.

SECTION THREE

OPERATION

3.1 CORROSION

- Operational pH level 3 - 10
- Cleaning only pH level 2 - 12 for no longer than 30 mins. Immediately clean down & purge.

Whilst every effort has been taken to ensure that end fittings have adequate corrosion resistance it is the responsibility of the purchaser to assess that the materials offered are suitable for the specific corrosion environment.

Alternate materials are available with enhanced corrosion resistance, contact Phoenix Vessel Technology Limited for advice.

End fittings should be maintained dry and free from corrosion. Vessel leaks should be investigated and corrected.

3.2 OPERATING CONDITIONS

DESIGN SPECIFICATION

Internal Diameter:	To fit any 8" nominal diameter element.
Length:	Up to 300" of membrane elements.
Working Fluid:	Water (brackish).
Design Pressure:	1000-1200 psi.
Test Pressure:	1.1 times design pressure for upto 15 minutes maximum.
Design Temperature:	20 to 113 ⁰ F (-7 to 45 ⁰ C).
Expansion:	0.5 to 0.6 mm per metre length of vessel at design pressure.
Vacuum condition:	Down to -14.5 psi (0 bar absolute).
Support Position:	2 supports for 1 to 4.5 (40") elements. 3 supports for 5 to 7.5 (40") elements and any length supported outside of the recommended support range (refer to `Vessel Support Position` Section 2.2 this User`s Guide).

NOTE: The standard materials of construction may not be compatible with cleaning and preserving fluids. See Section 3.4 for further information. If in doubt, submit request to Phoenix Vessel Technology Limited.

NOTE: The vessel should not be allowed to freeze solid. This will damage the vessel wall and make replacement necessary.

3.3 SAFETY PRECAUTIONS

Fibreglass reinforced pressure vessels will provide years of safe service if properly installed and maintained. This section is for guidance only and should be used in conjunction with the recommendations in the previous sections. Attention is drawn to the `NOTES:` located at the bottom of the page which highlight potential problems areas and safety recommendations.

- 3.3.1 Provide pressure relief device. This should be set to no more than 105% of design pressure.
- 3.3.2 Before pressurisation visually check that the segmented retaining rings are in position and secured by the three cap head screws and that the backnut is fitted and is screwed up tightly.
- 3.3.3 DO NOT stand in line of end fitting while pressurisation takes place.

SECTION FOUR

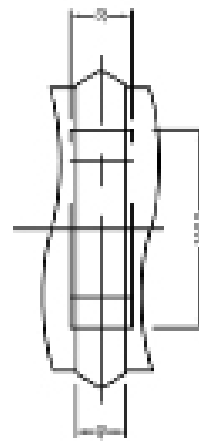
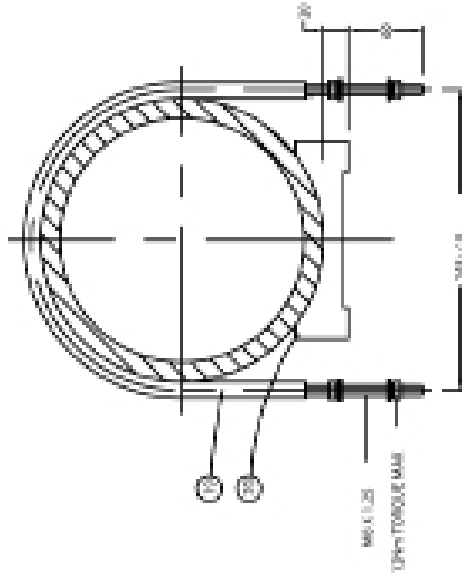
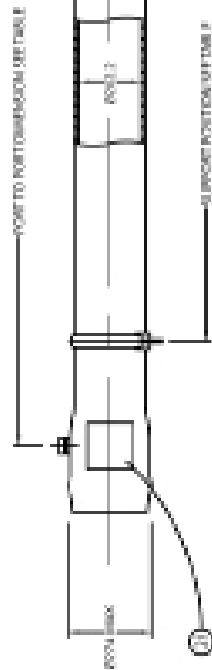
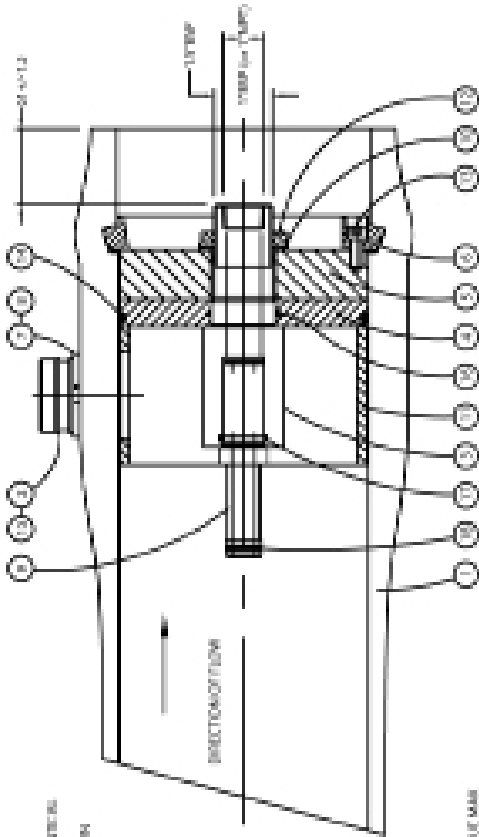
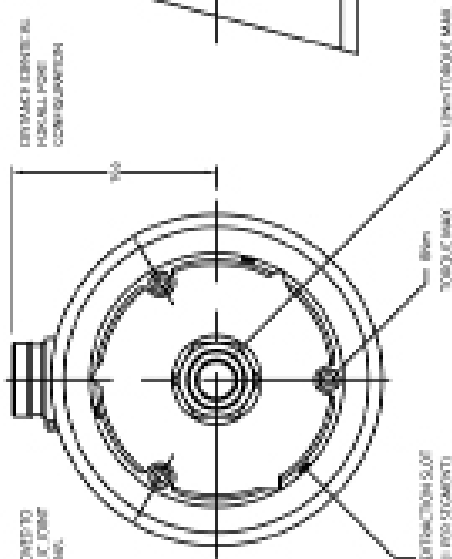
APPENDIX

4.1 SPARE PARTS LIST

For part numbers and descriptions please refer to the relevant Technical Information Sheet.



IF PORT CONNECTED TO SUPPORTABLE, TOP AND SIDE PORTS.



NOTES:

1. APPROX. 10% REDUCTION OF SEAL WIDTH TO REDUCE FRICTION.
2. TIGHTEN ALL CONNECTIONS TO 50% OF MAX TORQUE FOR ALL PORTS. DO NOT EXCEED TORQUE RECOMMENDATIONS.
3. REFER TO THE USER MANUAL FOR MORE DETAILS ON MAINTENANCE, INSULATION, OPERATION AND SAFETY.
4. EACH VESSEL TESTED UP TO 10 TIMES UNDER PRESSURE FOR 15 MINUTES TO ENSURE NO LEAKS.
5. OPERATE PRESSURE (RANGE) AS SHOWN IN USER MANUAL. DO NOT EXCEED 77°F (25°C) OR 100°F (38°C) FOR ALL OPERATIONS. CONTACT US TO REPORT.
6. DO NOT ALLOW OPERATING PRESSURE TO EXCEED 100 PSI (6.8 BAR) AT 45°C. DO NOT EXCEED 100 PSI (6.8 BAR) AT 77°F (25°C) OR 100 PSI (6.8 BAR) AT 100°F (38°C).
7. IF VESSEL SUPPORTS ARE PLACED OFF THE MAIN AS RECOMMENDED IN THE USER MANUAL FOR ADDITIONAL SUPPORTS.

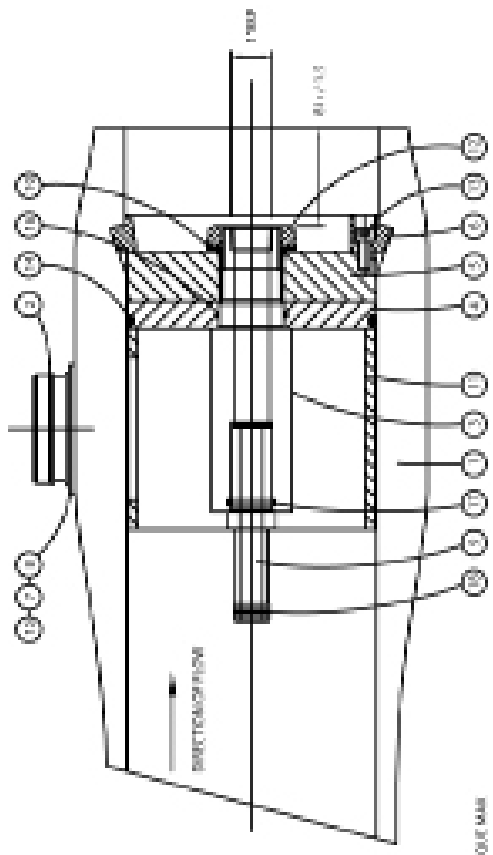
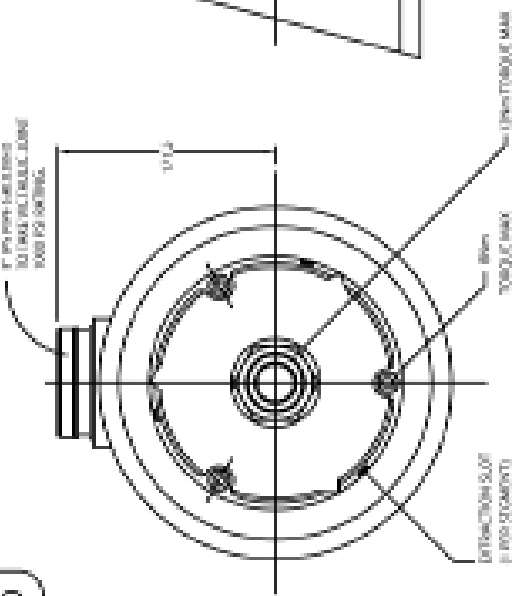
SIZE	SIDE PORT OPTIONS	
	1.5"	2.0"
1.5"	1.5" SAME SIZE - 0" 0"	2.0" COMPRESSING - 0" 1.00"
2.0"	2.0" COMPRESSING - 0" 1.00"	2.0" COMPRESSING - 0" 1.00"

NO. OF AIR PLUMES	PORT TO PORT DISTANCE (IN)	MAX. SUPPORT POSITION (MM)	MIN. SUPPORT POSITION (MM)	MAX. OPERATING PRESSURE (PSI)
1	11.41	400	0	81
3	18.81	1100	0	81
4	21.81	1400	0	81
5	24.81	1700	0	81
6	27.81	2000	0	81
7	30.81	2300	0	81
8	33.81	2600	0	81
9	36.81	2900	0	81
10	39.81	3200	0	81
11	42.81	3500	0	81
12	45.81	3800	0	81
13	48.81	4100	0	81
14	51.81	4400	0	81
15	54.81	4700	0	81
16	57.81	5000	0	81
17	60.81	5300	0	81
18	63.81	5600	0	81
19	66.81	5900	0	81
20	69.81	6200	0	81

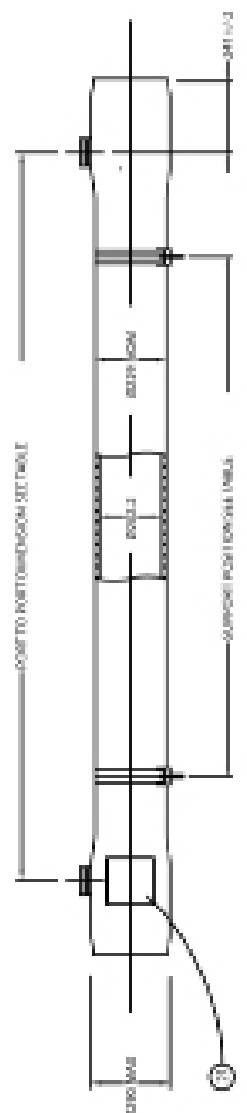
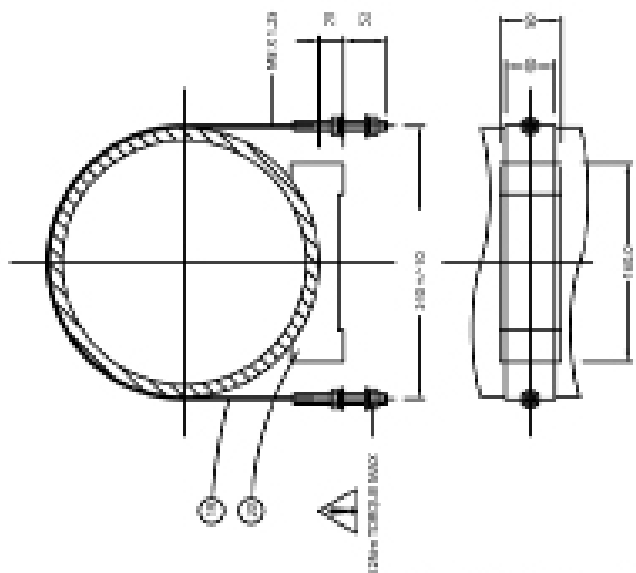
8" PRESSURE VESSEL (1000 PSI), SIDE PORT.

ITEM NO.	DESCRIPTION	QUANTITY (EACH)	UNIT	REMARKS
1	MAIN VESSEL	1	EA	
2	TOP PORT	1	EA	
3	TOP PORT	1	EA	
4	TOP PORT	1	EA	
5	TOP PORT	1	EA	
6	TOP PORT	1	EA	
7	TOP PORT	1	EA	
8	TOP PORT	1	EA	
9	TOP PORT	1	EA	
10	TOP PORT	1	EA	
11	TOP PORT	1	EA	
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98	TOP PORT	1	EA	
99	TOP PORT	1	EA	
100	TOP PORT	1	EA	

C CENTER SUPPORT ROD



- NOTES :**
1. REFER TO REVISIONS OF SPECIFICATIONS TO VERIFY FACTORS.
 2. AFTER ALL CORRECTIONS TO SPECIFICATIONS FOR THE VESSEL PROVIDED BY THE USER HAVE BEEN MADE.
 3. REFER TO THE SPECIFICATIONS FOR MORE DETAILED INFORMATION CONCERNING MATERIALS, DIMENSIONS, AND STRENGTH.
 4. THE VESSEL IS DESIGNED TO WITHSTAND DESIGN PRESSURE FOR THE PERIOD OF TIME INDICATED.
 5. DESIGN PRESSURE: 1000 PSI.
 6. DESIGN TEMPERATURE: -70°F TO 100°F.
 7. ALL PORTS SHALL BE PROVIDED WITH PROTECTIVE PLUGS OR CAPS WHEN NOT IN USE.
 8. IF PROBLEMS OCCUR DURING OPERATION OF THE VESSEL, AS DESCRIBED IN THE USER MANUAL, CONTACT THE MANUFACTURER FOR ASSISTANCE.

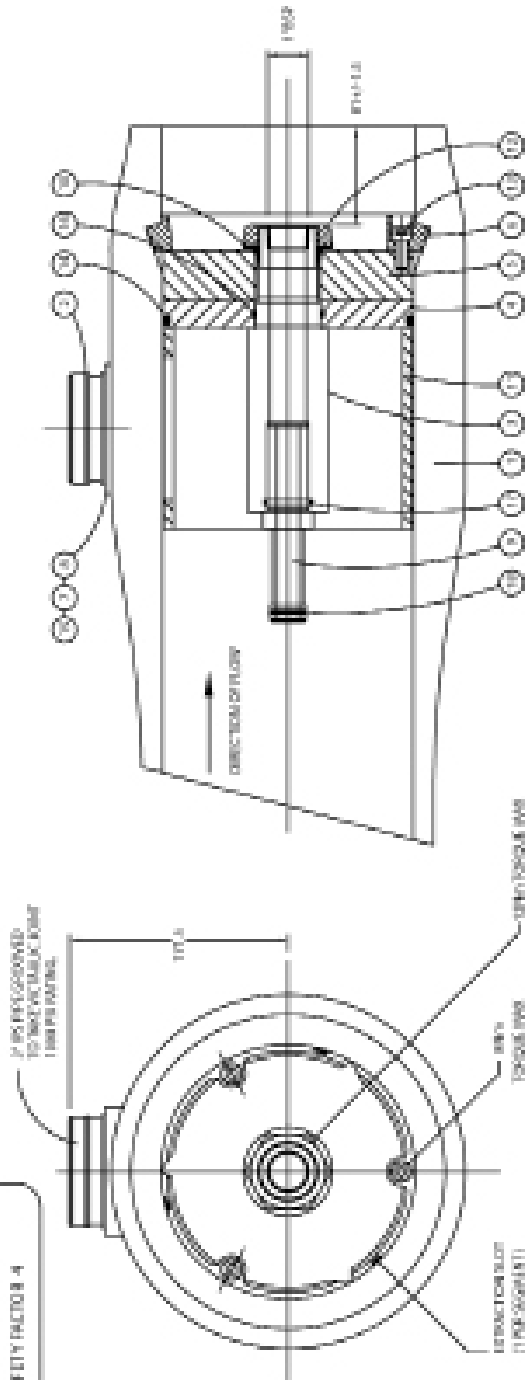


ITEM	DESCRIPTION	QUANTITY	UNIT
1	EXTRACTION SLIP (1000 PSI STAMP)	1	PC
2	1000 PSI HEAD	3	PC
3	1000 PSI HEAD	3	PC
4	1000 PSI HEAD	3	PC
5	1000 PSI HEAD	3	PC
6	1000 PSI HEAD	3	PC
7	1000 PSI HEAD	3	PC
8	1000 PSI HEAD	3	PC
9	1000 PSI HEAD	3	PC
10	1000 PSI HEAD	3	PC
11	1000 PSI HEAD	3	PC
12	1000 PSI HEAD	3	PC
13	1000 PSI HEAD	3	PC
14	1000 PSI HEAD	3	PC
15	1000 PSI HEAD	3	PC
16	1000 PSI HEAD	3	PC

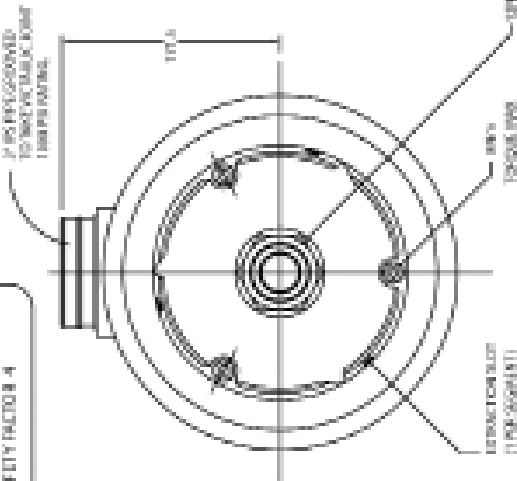
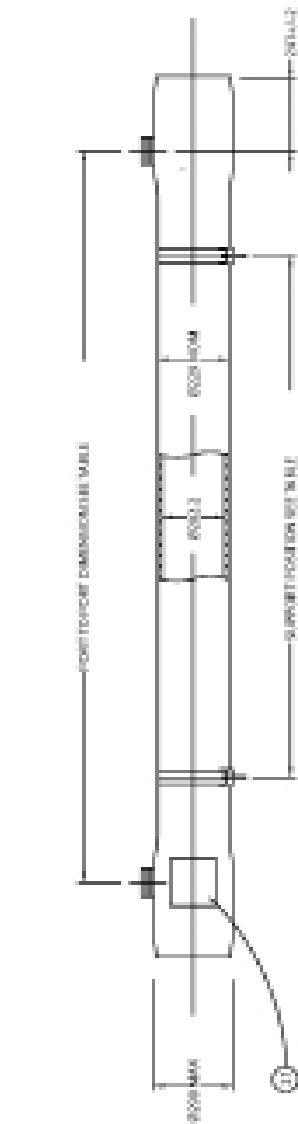
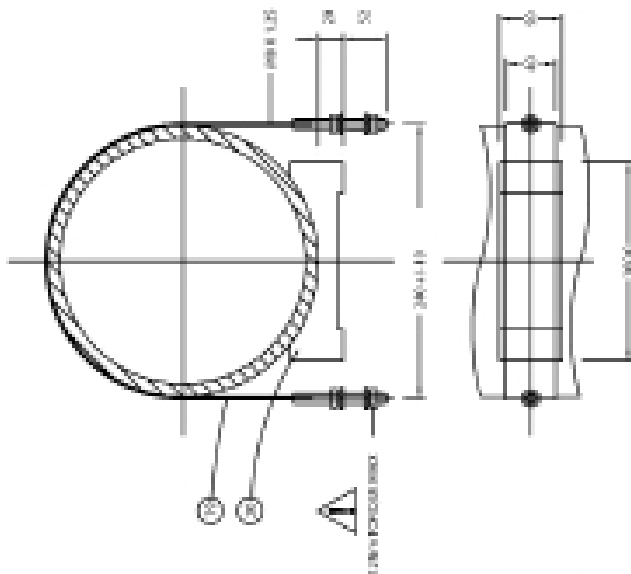
SIZE	SIDE PORT OPTIONS		MAXIMUM SUPPORT POSITION (MM)	MAXIMUM SUPPORT POSITION (IN)	MAXIMUM SUPPORT POSITION (MM)	MAXIMUM SUPPORT POSITION (IN)
	2.5"	3.0"				
1	11.4	11.4	150	5.9	150	5.9
2	11.4	11.4	150	5.9	150	5.9
3	11.4	11.4	150	5.9	150	5.9
4	11.4	11.4	150	5.9	150	5.9
5	11.4	11.4	150	5.9	150	5.9
6	11.4	11.4	150	5.9	150	5.9
7	11.4	11.4	150	5.9	150	5.9
8	11.4	11.4	150	5.9	150	5.9
9	11.4	11.4	150	5.9	150	5.9
10	11.4	11.4	150	5.9	150	5.9
11	11.4	11.4	150	5.9	150	5.9
12	11.4	11.4	150	5.9	150	5.9
13	11.4	11.4	150	5.9	150	5.9
14	11.4	11.4	150	5.9	150	5.9
15	11.4	11.4	150	5.9	150	5.9
16	11.4	11.4	150	5.9	150	5.9

8" PRESSURE VESSEL 1000PSI, SIDE PORT MACHINED

1000 SAFETY FACTOR @ 4



- NOTES:**
1. COUPLING TO BE 1/8 INCH TO SEAL BEHIND PRODUCT FRICTIION.
 2. TRAP ALL CONNECTIONS FROM PRESSURE OR VACUUM. GAUGES PERMITTED. DO NOT EXCEED MAXIMUM PRESSURE.
 3. REFLECTIVE COLORED POLYMER COATED OR ANTI-CORROSION COATING ON MAIN VESSEL, METALLICAL ORIENTATION AND GRAIN.
 4. EACH PORT, TESTED UP TO 1.1 TIMES DESIGN PRESSURE FOR 10 MINUTES TO INSURE LEAKAGE.
 5. DESIGN PRESSURE (1000 PSI) DESIGN TEMPERATURE (75°F) U.S.C. DO NOT ALLOW OTHER CONTENTS TO BE HEAT.
 6. DO NOT ALLOW INTERNAL PRESSURE TO EXCEED 100 PSI MAXIMUM AT ANY POINT. DO NOT EXCEED MAXIMUM CONNECTING TO PRODUCT TUBE OR ELECTRICAL.
 7. ALL VESSEL SUPPORTS ARE OUTSIDE OF THE VESSEL OR RECOMMENDED WITH THE FOLLOWING LIST OF MATERIALS.
 8. GAUGES TO MONITOR CHANGES IN PRESSURE AND TEMPERATURE. USE WITH PRESSURE TRANSDUCERS TO USE THE SMALLER DURING PRESSURE.



- NOTES:**
1. COUPLING TO BE 1/8 INCH TO SEAL BEHIND PRODUCT FRICTIION.
 2. TRAP ALL CONNECTIONS FROM PRESSURE OR VACUUM. GAUGES PERMITTED. DO NOT EXCEED MAXIMUM PRESSURE.
 3. REFLECTIVE COLORED POLYMER COATED OR ANTI-CORROSION COATING ON MAIN VESSEL, METALLICAL ORIENTATION AND GRAIN.
 4. EACH PORT, TESTED UP TO 1.1 TIMES DESIGN PRESSURE FOR 10 MINUTES TO INSURE LEAKAGE.
 5. DESIGN PRESSURE (1000 PSI) DESIGN TEMPERATURE (75°F) U.S.C. DO NOT ALLOW OTHER CONTENTS TO BE HEAT.
 6. DO NOT ALLOW INTERNAL PRESSURE TO EXCEED 100 PSI MAXIMUM AT ANY POINT. DO NOT EXCEED MAXIMUM CONNECTING TO PRODUCT TUBE OR ELECTRICAL.
 7. ALL VESSEL SUPPORTS ARE OUTSIDE OF THE VESSEL OR RECOMMENDED WITH THE FOLLOWING LIST OF MATERIALS.
 8. GAUGES TO MONITOR CHANGES IN PRESSURE AND TEMPERATURE. USE WITH PRESSURE TRANSDUCERS TO USE THE SMALLER DURING PRESSURE.

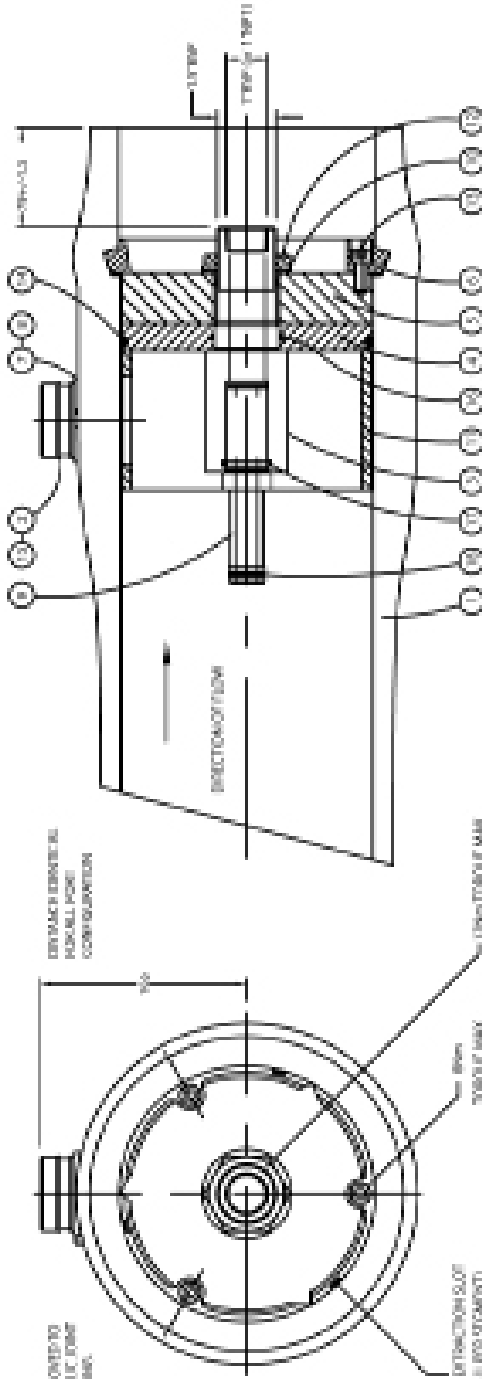
NO. OF PORTS/ILLUMINATED	PORT TO PORT DISTANCE (IN)	MAX SUPPORT POSITION (IN)	MIN SUPPORT POSITION (IN)	MAXIMUM PRESSURE (PSI)
1	11.91	500	500	78
1.5	15.90	1118	500	88
2	22.80	1438	500	85
3	32.80	1848	500	114
4	45.80	2118	812	111
4.5	49.80	2308	1000	102
5	55.80	2448	1000	116
6	62.80	2508	1000	101
7	70.80	2538	1000	90
2.5	17.90	4200	1000	90

SIDE PORT OPTIONS	
SIZE	STYLE
2.5"	
3.0"	

8" PRESSURE VESSEL 1000 PSI - SIDE PORT MACHINED

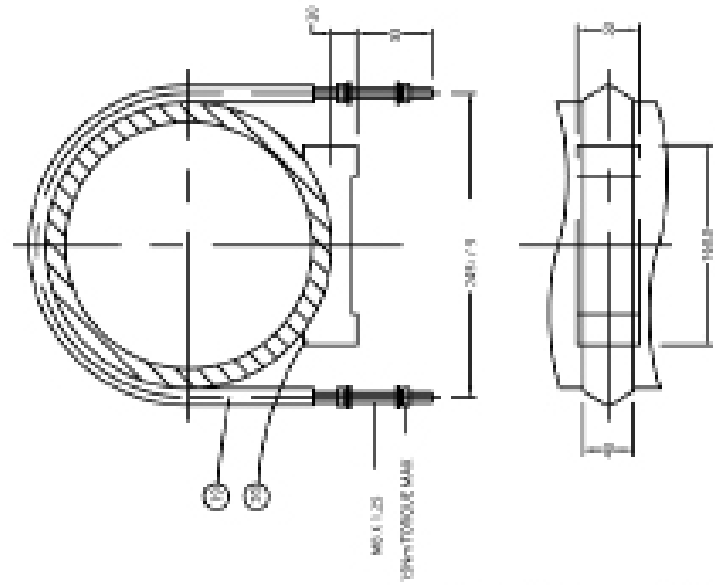
3643	SCALE: NONE
REV. B	REVISED: 08/11/11
REV. A	REVISED: 08/11/11

IF ANY CONNECTIONS TO THIS VESSEL ARE MADE, THEY MUST BE MADE IN ACCORDANCE WITH THE RELEVANT CODES AND STANDARDS.



NOTES:

1. GASKETS TO BE USED ON ALL SEAL WELDS TO AVOID LEAKAGE.
2. TIGHTEN ALL CONNECTIONS TO SPECS OF MANUFACTURER. POLAR PRODUCTS DOES NOT HAVE SPECIFICATIONS FOR THIS PRODUCT.
3. REFER TO POLAR FLUID FOR MORE DETAIL ON MATERIALS. SEPARATE TABLES, INSTALLATION, OPERATION AND SAFETY.
4. EACH MODEL TESTED TO DESIGN LOADS AS LISTED IN THIS DESIGN PRESSURE DETECTOR ITEM AT 1.1 TIMES DESIGN PRESSURE FOR 15 MINUTES.
5. DESIGN PRESSURE: 1200 PSI (82.73 BAR) (30.0 MPa) @ 37.8°C (90°F).
6. CHECK ALL INTERNAL COMPONENTS FOR DAMAGE.
7. DO NOT ALLOW OVERHEAT PRESSURE TO BE APPLIED TO ANY PART OF THIS VESSEL. DO NOT OPERATE AT ANY PRESSURES EXCEEDING THE PRODUCT RATED OUTPUT TORQUE.
8. IF MODEL SUPPORT LEGS DETACH UPON REMOVAL AS RECOMMENDED IN THIS TABLE, REASSEMBLY USE ADDITIONAL SUPPORTS.



M8 x 1.25
OPEN TORQUE BAR

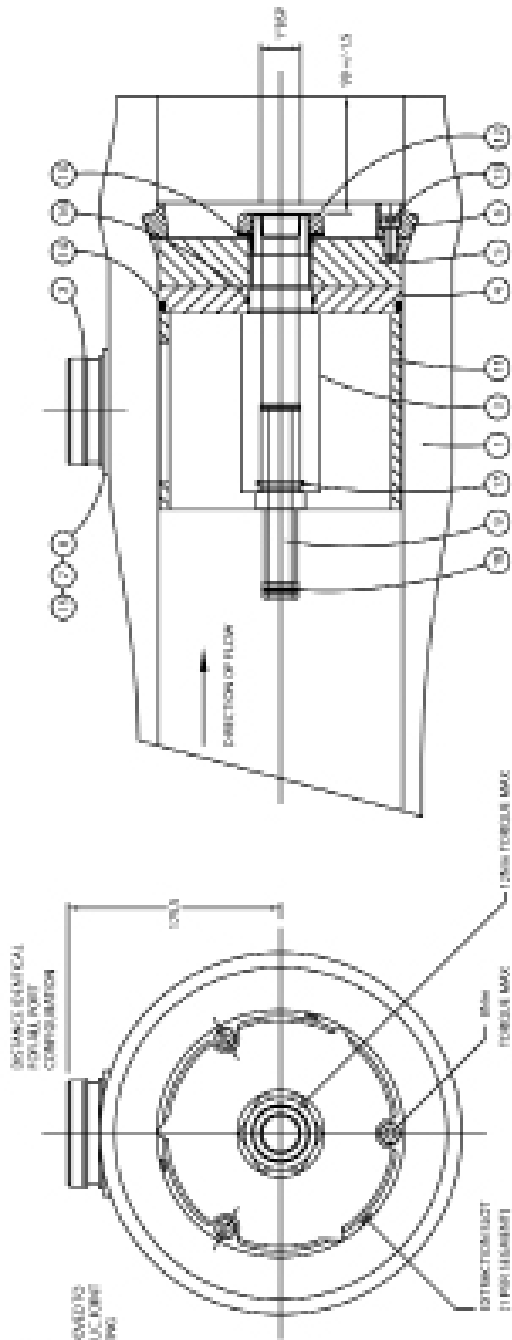
SIZE	STYLE	SIDE PORT OPTIONS	
		3.5" SAME SIZE	0.75"
1.5"	2.0"	0.75"	0.75"
2.0"	2.0"	0.75"	0.75"

NO. OF PORT PLUGS	PORT TO PORT DISTANCE (1.5")	MAX. SUPPORT POSITION (1.5")	MIN. SUPPORT POSITION (1.5")	MAX. SUPPORT POSITION (2.0")	MIN. SUPPORT POSITION (2.0")	MATERIAL	WEIGHT (LBS)
1	11.43	45.8	0.0	45.8	0.0	AL	3.4
2	11.43	11.43	11.43	11.43	11.43	AL	4.1
3	11.43	11.43	22.86	11.43	22.86	AL	4.8
4	11.43	11.43	34.29	11.43	34.29	AL	5.5
5	11.43	11.43	45.72	11.43	45.72	AL	6.2
6	11.43	11.43	57.15	11.43	57.15	AL	6.9
7	11.43	11.43	68.58	11.43	68.58	AL	7.6
8	11.43	11.43	80.01	11.43	80.01	AL	8.3
9	11.43	11.43	91.44	11.43	91.44	AL	9.0
10	11.43	11.43	102.87	11.43	102.87	AL	9.7
11	11.43	11.43	114.30	11.43	114.30	AL	10.4
12	11.43	11.43	125.73	11.43	125.73	AL	11.1
13	11.43	11.43	137.16	11.43	137.16	AL	11.8
14	11.43	11.43	148.59	11.43	148.59	AL	12.5
15	11.43	11.43	160.02	11.43	160.02	AL	13.2
16	11.43	11.43	171.45	11.43	171.45	AL	13.9
17	11.43	11.43	182.88	11.43	182.88	AL	14.6
18	11.43	11.43	194.31	11.43	194.31	AL	15.3
19	11.43	11.43	205.74	11.43	205.74	AL	16.0
20	11.43	11.43	217.17	11.43	217.17	AL	16.7
21	11.43	11.43	228.60	11.43	228.60	AL	17.4
22	11.43	11.43	240.03	11.43	240.03	AL	18.1
23	11.43	11.43	251.46	11.43	251.46	AL	18.8
24	11.43	11.43	262.89	11.43	262.89	AL	19.5
25	11.43	11.43	274.32	11.43	274.32	AL	20.2
26	11.43	11.43	285.75	11.43	285.75	AL	20.9
27	11.43	11.43	297.18	11.43	297.18	AL	21.6
28	11.43	11.43	308.61	11.43	308.61	AL	22.3
29	11.43	11.43	320.04	11.43	320.04	AL	23.0
30	11.43	11.43	331.47	11.43	331.47	AL	23.7
31	11.43	11.43	342.90	11.43	342.90	AL	24.4
32	11.43	11.43	354.33	11.43	354.33	AL	25.1
33	11.43	11.43	365.76	11.43	365.76	AL	25.8
34	11.43	11.43	377.19	11.43	377.19	AL	26.5
35	11.43	11.43	388.62	11.43	388.62	AL	27.2
36	11.43	11.43	400.05	11.43	400.05	AL	27.9
37	11.43	11.43	411.48	11.43	411.48	AL	28.6
38	11.43	11.43	422.91	11.43	422.91	AL	29.3
39	11.43	11.43	434.34	11.43	434.34	AL	30.0
40	11.43	11.43	445.77	11.43	445.77	AL	30.7
41	11.43	11.43	457.20	11.43	457.20	AL	31.4
42	11.43	11.43	468.63	11.43	468.63	AL	32.1
43	11.43	11.43	480.06	11.43	480.06	AL	32.8
44	11.43	11.43	491.49	11.43	491.49	AL	33.5
45	11.43	11.43	502.92	11.43	502.92	AL	34.2
46	11.43	11.43	514.35	11.43	514.35	AL	34.9
47	11.43	11.43	525.78	11.43	525.78	AL	35.6
48	11.43	11.43	537.21	11.43	537.21	AL	36.3
49	11.43	11.43	548.64	11.43	548.64	AL	37.0
50	11.43	11.43	560.07	11.43	560.07	AL	37.7
51	11.43	11.43	571.50	11.43	571.50	AL	38.4
52	11.43	11.43	582.93	11.43	582.93	AL	39.1
53	11.43	11.43	594.36	11.43	594.36	AL	39.8
54	11.43	11.43	605.79	11.43	605.79	AL	40.5
55	11.43	11.43	617.22	11.43	617.22	AL	41.2
56	11.43	11.43	628.65	11.43	628.65	AL	41.9
57	11.43	11.43	640.08	11.43	640.08	AL	42.6
58	11.43	11.43	651.51	11.43	651.51	AL	43.3
59	11.43	11.43	662.94	11.43	662.94	AL	44.0
60	11.43	11.43	674.37	11.43	674.37	AL	44.7
61	11.43	11.43	685.80	11.43	685.80	AL	45.4
62	11.43	11.43	697.23	11.43	697.23	AL	46.1
63	11.43	11.43	708.66	11.43	708.66	AL	46.8
64	11.43	11.43	720.09	11.43	720.09	AL	47.5
65	11.43	11.43	731.52	11.43	731.52	AL	48.2
66	11.43	11.43	742.95	11.43	742.95	AL	48.9
67	11.43	11.43	754.38	11.43	754.38	AL	49.6
68	11.43	11.43	765.81	11.43	765.81	AL	50.3
69	11.43	11.43	777.24	11.43	777.24	AL	51.0
70	11.43	11.43	788.67	11.43	788.67	AL	51.7
71	11.43	11.43	800.10	11.43	800.10	AL	52.4
72	11.43	11.43	811.53	11.43	811.53	AL	53.1
73	11.43	11.43	822.96	11.43	822.96	AL	53.8
74	11.43	11.43	834.39	11.43	834.39	AL	54.5
75	11.43	11.43	845.82	11.43	845.82	AL	55.2
76	11.43	11.43	857.25	11.43	857.25	AL	55.9
77	11.43	11.43	868.68	11.43	868.68	AL	56.6
78	11.43	11.43	880.11	11.43	880.11	AL	57.3
79	11.43	11.43	891.54	11.43	891.54	AL	58.0
80	11.43	11.43	902.97	11.43	902.97	AL	58.7
81	11.43	11.43	914.40	11.43	914.40	AL	59.4
82	11.43	11.43	925.83	11.43	925.83	AL	60.1
83	11.43	11.43	937.26	11.43	937.26	AL	60.8
84	11.43	11.43	948.69	11.43	948.69	AL	61.5
85	11.43	11.43	960.12	11.43	960.12	AL	62.2
86	11.43	11.43	971.55	11.43	971.55	AL	62.9
87	11.43	11.43	982.98	11.43	982.98	AL	63.6
88	11.43	11.43	994.41	11.43	994.41	AL	64.3
89	11.43	11.43	1005.84	11.43	1005.84	AL	65.0
90	11.43	11.43	1017.27	11.43	1017.27	AL	65.7
91	11.43	11.43	1028.70	11.43	1028.70	AL	66.4
92	11.43	11.43	1040.13	11.43	1040.13	AL	67.1
93	11.43	11.43	1051.56	11.43	1051.56	AL	67.8
94	11.43	11.43	1062.99	11.43	1062.99	AL	68.5
95	11.43	11.43	1074.42	11.43	1074.42	AL	69.2
96	11.43	11.43	1085.85	11.43	1085.85	AL	69.9
97	11.43	11.43	1097.28	11.43	1097.28	AL	70.6
98	11.43	11.43	1108.71	11.43	1108.71	AL	71.3
99	11.43	11.43	1120.14	11.43	1120.14	AL	72.0
100	11.43	11.43	1131.57	11.43	1131.57	AL	72.7

1200 PSI PRESSURE VESSEL 1200 PSI, SIDE PORT.

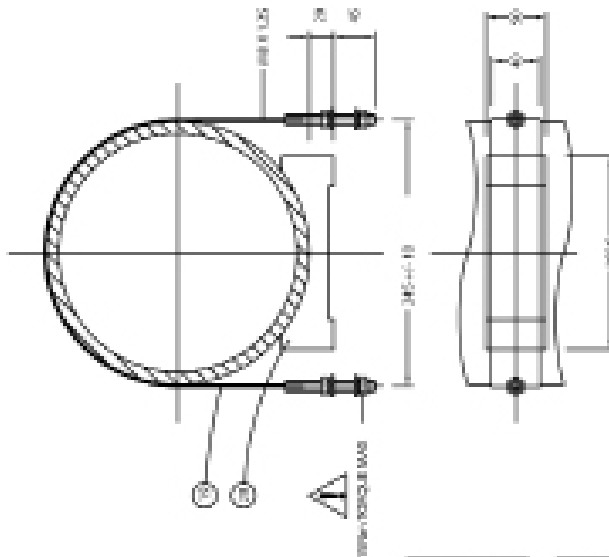
ITEM	DESCRIPTION	REF. NO.	QTY.	ASSEMBLY
1	ATTACHMENT CLIP (1 PORT OPTION)	1	1	1
2	FASTENING CLIP	2	1	2
3	FASTENING CLIP	3	1	3
4	FASTENING CLIP	4	1	4
5	FASTENING CLIP	5	1	5
6	FASTENING CLIP	6	1	6
7	FASTENING CLIP	7	1	7
8	FASTENING CLIP	8	1	8
9	FASTENING CLIP	9	1	9
10	FASTENING CLIP	10	1	10
11	FASTENING CLIP	11	1	11
12	FASTENING CLIP	12	1	12
13	FASTENING CLIP	13	1	13
14	FASTENING CLIP	14	1	14
15	FASTENING CLIP	15	1	15
16	FASTENING CLIP	16	1	16
17	FASTENING CLIP	17	1	17
18	FASTENING CLIP	18	1	18
19	FASTENING CLIP	19	1	19
20	FASTENING CLIP	20	1	20
21	FASTENING CLIP	21	1	21
22	FASTENING CLIP	22	1	22
23	FASTENING CLIP	23	1	23
24	FASTENING CLIP	24	1	24
25	FASTENING CLIP	25	1	25
26	FASTENING CLIP	26	1	26
27	FASTENING CLIP	27	1	27
28	FASTENING CLIP	28	1	28
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30	FASTENING CLIP	30	1	30
31	FASTENING CLIP	31	1	31
32	FASTENING CLIP	32	1	32
33	FASTENING CLIP	33	1	33
34	FASTENING CLIP	34	1	34
35	FASTENING CLIP	35	1	35
36	FASTENING CLIP	36	1	36
37	FASTENING CLIP	37	1	37
38	FASTENING CLIP	38	1	38
39	FASTENING CLIP	39	1	39
40	FASTENING CLIP	40	1	40
41	FASTENING CLIP	41	1	41
42	FASTENING CLIP	42	1	42
43	FASTENING CLIP	43	1	43
44	FASTENING CLIP	44	1	44
45	FASTENING			

PORTS ASSEMBLED TO SUPPORT CLASSIC LIGHT 1200 PSI MODEL



NOTES:

1. LOW DRAIN RATE USED ON 0.5 GAL. VESSEL TO REDUCE FRICTION.
2. FRESHEN ALL CONNECTIONS TO 2000 PSI. IF ANY CONICAL FINGER PROTRUSION DO NOT EXCEED 0.005 INCHES FROM THE SURFACE.
3. REFERTO LATEST ISSUE OF PERFORMANCE TESTED INFORMATION ON MAINTENANCE, INSTALLATION, OPERATIONS AND SERVICE.
4. ENCRYPTION TESTS TO CYCLE AND LEMPS. ULTIMATE DESIGN PRESSURE PORT 1.5 BAR (21.75 PSIA) ULTIMATE DESIGN PRESSURE FOR 1.5 BAR (21.75 PSIA).
5. DESIGN PRESSURE 1.288 PSI. DESIGN TEMPERATURE -70°C. DO NOT ALLOW PRESSURE CONTENTS TO EXCEED.
6. EXCESSIVE ALLOW PRESSURE TO EXCEED. THIS PRESSURE IS 1.474 C. COOL TO 1.288 PSI. WHEN CORRECTING TO PRODUCT TUBE IS NOT TO EXCEED.
7. IF POSSIBLE, SUPPORTS ARE OUTSIDE OF THE RANGE AS INDICATED IN THE TABLE (NONE USE OPTIONAL SUPPORTS).



SIZE	76.1mm	STYLE	2 SIDE PORT	2 SIDE PORT - 2" (50.8mm)	3 SIDE PORT	3 SIDE PORT - 2" (50.8mm)
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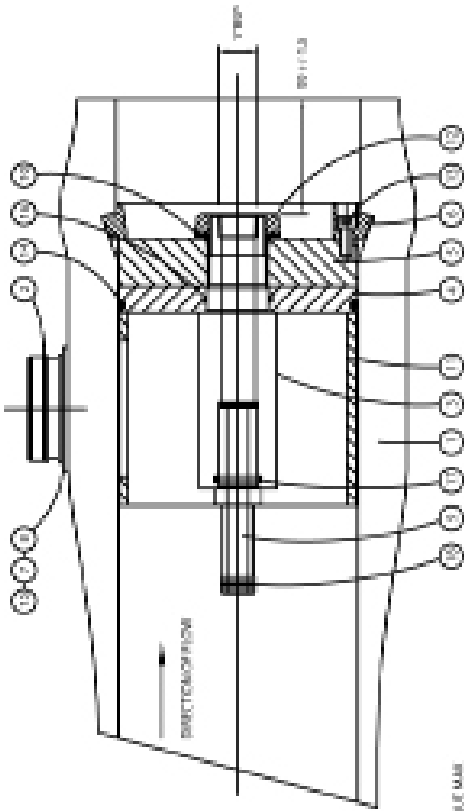
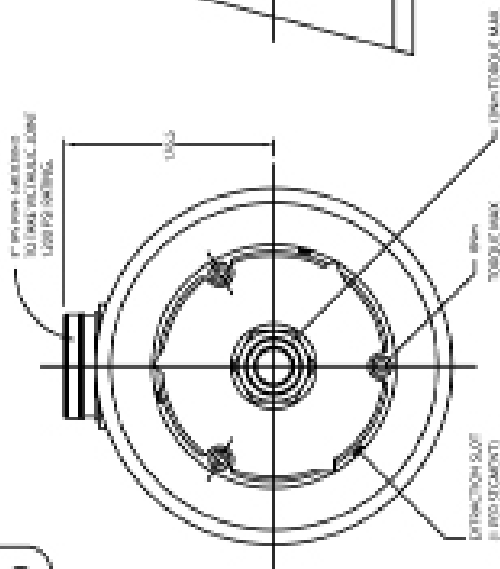
NO. OF PORT ELEMENTS	PORT POSITION (mm)	MAXIMUM PORT POSITION (mm)	MAXIMUM PORT POSITION (mm)	MAXIMUM PORT POSITION (mm)	MAXIMUM PORT POSITION (mm)
1	1194	1194	1194	1194	1194
2	1194	1194	1194	1194	1194
3	1194	1194	1194	1194	1194
4	1194	1194	1194	1194	1194
5	1194	1194	1194	1194	1194
6	1194	1194	1194	1194	1194
7	1194	1194	1194	1194	1194
8	1194	1194	1194	1194	1194
9	1194	1194	1194	1194	1194
10	1194	1194	1194	1194	1194
11	1194	1194	1194	1194	1194
12	1194	1194	1194	1194	1194

CENTRAL SUPPORT POS

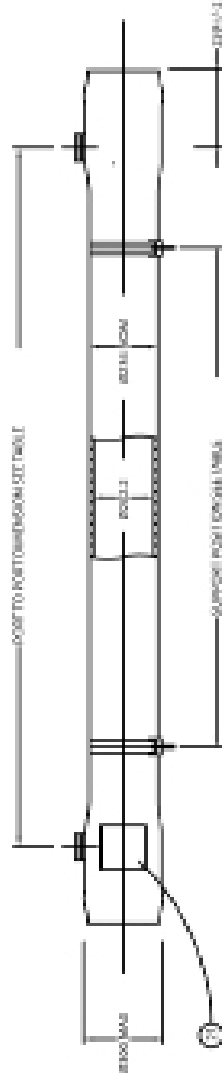
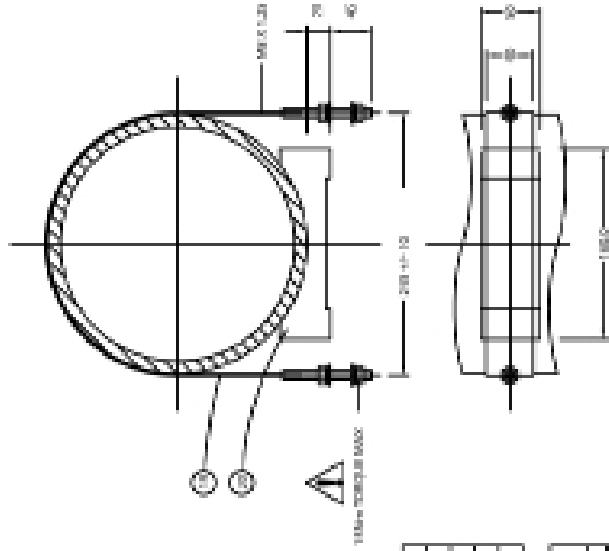
SIZE	PORT POSITION (mm)	MAXIMUM PORT POSITION (mm)	MAXIMUM PORT POSITION (mm)	MAXIMUM PORT POSITION (mm)	MAXIMUM PORT POSITION (mm)
1	1194	1194	1194	1194	1194
2	1194	1194	1194	1194	1194
3	1194	1194	1194	1194	1194
4	1194	1194	1194	1194	1194
5	1194	1194	1194	1194	1194
6	1194	1194	1194	1194	1194
7	1194	1194	1194	1194	1194
8	1194	1194	1194	1194	1194
9	1194	1194	1194	1194	1194
10	1194	1194	1194	1194	1194
11	1194	1194	1194	1194	1194
12	1194	1194	1194	1194	1194

8" PRESSURE VESSEL 1200 PSI, SIDE PORT.

DRG. NO. 3624	SCH. NO.
DATE: 1/14	REV: 1
DATE: 1/14	REV: 1
DATE: 1/14	REV: 1



- NOTES:**
1. REFER TO THE SECTION OF THE MANUAL FOR THE PORT INFORMATION.
 2. TESTED ALL CONNECTIONS TO 100% OF MAINTENANCE PRESSURE RECOMMENDED FOR THE MAINTENANCE PORTS.
 3. PORTS TO BE SUBJECT TO MAINTENANCE PRESSURE AND SPLICED TO THE MAINTENANCE PORTS.
 4. MAINTENANCE PORTS TO BE SUBJECT TO MAINTENANCE PRESSURE AND SPLICED TO THE MAINTENANCE PORTS.
 5. MAINTENANCE PORTS TO BE SUBJECT TO MAINTENANCE PRESSURE AND SPLICED TO THE MAINTENANCE PORTS.
 6. MAINTENANCE PORTS TO BE SUBJECT TO MAINTENANCE PRESSURE AND SPLICED TO THE MAINTENANCE PORTS.
 7. IF MAINTENANCE PORTS ARE OUTSIDE OF THE VESSEL AS RECOMMENDED IN THE MAINTENANCE PORT INFORMATION SUPPORTS.



NO.	DESCRIPTION	QUANTITY	PART NUMBER	NO.	DESCRIPTION	QUANTITY	PART NUMBER
1	HEAD CLAMP	1	1000	11	HEAD CLAMP	1	1000
2	PORT RETURN CLIP	1	2000	12	PORT RETURN CLIP	1	2000
3	PORT RETURN PIN	1	3000	13	PORT RETURN PIN	1	3000
4	PORT RETURN PIN W/LOCK	1	4000	14	PORT RETURN PIN W/LOCK	1	4000
5	PORT RETURN PIN	1	5000	15	PORT RETURN PIN	1	5000
6	PORT RETURN PIN	1	6000	16	PORT RETURN PIN	1	6000
7	PORT RETURN PIN	1	7000	17	PORT RETURN PIN	1	7000
8	PORT RETURN PIN	1	8000	18	PORT RETURN PIN	1	8000
9	PORT RETURN PIN	1	9000	19	PORT RETURN PIN	1	9000
10	PORT RETURN PIN	1	1000	20	PORT RETURN PIN	1	1000
11	PORT RETURN PIN	1	1100	21	PORT RETURN PIN	1	1100
12	PORT RETURN PIN	1	1200	22	PORT RETURN PIN	1	1200
13	PORT RETURN PIN	1	1300	23	PORT RETURN PIN	1	1300
14	PORT RETURN PIN	1	1400	24	PORT RETURN PIN	1	1400
15	PORT RETURN PIN	1	1500	25	PORT RETURN PIN	1	1500
16	PORT RETURN PIN	1	1600	26	PORT RETURN PIN	1	1600
17	PORT RETURN PIN	1	1700	27	PORT RETURN PIN	1	1700
18	PORT RETURN PIN	1	1800	28	PORT RETURN PIN	1	1800
19	PORT RETURN PIN	1	1900	29	PORT RETURN PIN	1	1900
20	PORT RETURN PIN	1	2000	30	PORT RETURN PIN	1	2000
21	PORT RETURN PIN	1	2100	31	PORT RETURN PIN	1	2100
22	PORT RETURN PIN	1	2200	32	PORT RETURN PIN	1	2200
23	PORT RETURN PIN	1	2300	33	PORT RETURN PIN	1	2300
24	PORT RETURN PIN	1	2400	34	PORT RETURN PIN	1	2400
25	PORT RETURN PIN	1	2500	35	PORT RETURN PIN	1	2500
26	PORT RETURN PIN	1	2600	36	PORT RETURN PIN	1	2600
27	PORT RETURN PIN	1	2700	37	PORT RETURN PIN	1	2700
28	PORT RETURN PIN	1	2800	38	PORT RETURN PIN	1	2800
29	PORT RETURN PIN	1	2900	39	PORT RETURN PIN	1	2900
30	PORT RETURN PIN	1	3000	40	PORT RETURN PIN	1	3000

SIZE	2.5"	3.0"	STYLE	SIDE PORT OPTIONS		3 SAME SIDE - 0°/0°		2 OPPOSING - 0°/180°		4 PORT - 0°/180°	
NO. OF PORT PLUGS	1	2	3	NO. OF PORT PLUGS	PORT POSITION (MM)	NO. OF PORT PLUGS	PORT POSITION (MM)	NO. OF PORT PLUGS	PORT POSITION (MM)	NO. OF PORT PLUGS	PORT POSITION (MM)
1	11.0	11.0	11.0	1	11.0	2	11.0	3	11.0	4	11.0
2	22.0	22.0	22.0	2	22.0	3	22.0	4	22.0	5	22.0
3	33.0	33.0	33.0	3	33.0	4	33.0	5	33.0	6	33.0
4	44.0	44.0	44.0	4	44.0	5	44.0	6	44.0	7	44.0
5	55.0	55.0	55.0	5	55.0	6	55.0	7	55.0	8	55.0
6	66.0	66.0	66.0	6	66.0	7	66.0	8	66.0	9	66.0
7	77.0	77.0	77.0	7	77.0	8	77.0	9	77.0	10	77.0
8	88.0	88.0	88.0	8	88.0	9	88.0	10	88.0	11	88.0
9	99.0	99.0	99.0	9	99.0	10	99.0	11	99.0	12	99.0
10	110.0	110.0	110.0	10	110.0	11	110.0	12	110.0	13	110.0