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AL-INN-0000-ME-DSH-ROR02

Tubos de pressão e racks para osmose inversa

01.0	20/02/2025	Documento inicial	INN	GSI	ACE
Rev.	Dados	Descrição	Criado	Revisto	Aprovado

Editado para:

Informação		Compra	
Aprovação	X	Construção	
Pedido de licitação		Conforme construído	

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1. INTRODUÇÃO

Este documento contém as especificações técnicas dos tubos de pressão e racks para osmose inversa.

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2. FOLHA DE CARACTERÍSTICAS

	TUBOS DE PRESSÃO E RACKS PARA OSMOSE INVERSA	FOLHA DE CARACTERÍSTICAS Nº 28
	OSMOSE INVERSA	FOLHA 1 DE 6

Empreitada de Conceção-Construção e Exploração do Sistema de Dessalinização na Região do Algarve	Nº de unidades 536
ÁGUAS DO ALGARVE Grupo Águas de Portugal	Posição da Lista de Preços Unitários a que respeita EQ115.A0

REFERÊNCIAS

Número de tubos de pressão por rack de osmose inversa: 134 uds

Número de racks de osmose inversa 4

Serviço/ Local de instalação: Osmose inversa / Edifício de Osmose Inversa

Fabricante / Marca: BEL ou equivalente

Tipo: Tubo de pressão. 5 & 3 portas

Modelo: 400 Uds. BEL8-S(2x2,5"+2x2")-1200-7M

136 Uds. BEL8-S(1x2,5"+1x2")-1200-7M

Certificações / Homologações: ASME Section X – Class I

Catálogo Técnico anexo Nº: Anexo

CARACTERÍSTICAS

Número de tubos de pressão do tipo 1 (5 portas: 2 entradas 2,5" e 2 saídas 2" + 1 permeado): 400 Uds.

Número de tubos de pressão do tipo 2 (3 portas: 1 entradas 2,5" e 1 saída 2" + 1 permeado): 136 Uds.

Número máximo de tubos de pressão possíveis instalar por rack de osmose inversa: 160 uds

Diâmetro nominal dos tubos de pressão: 202,2 ± 0,4 mm

Diâmetro exterior dos tubos de pressão: 229 ± 2 mm

Comprimento total de cada tubo de pressão: 7.778 mm

Variação longitudinal máxima do comprimento dos tubos de pressão: ± 3 mm

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	TUBOS DE PRESSÃO E RACKS PARA OSMOSE INVERSA	FOLHA DE CARACTERÍSTICAS Nº 28
	OSMOSE INVERSA	FOLHA 2 DE 6

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Número de bobinas de membrana por tubo de pressão: 7 Uds

Pressão de cálculo dos tubos de pressão: 1200 psi/ 82,74 bar

Pressão de ensaio em fábrica dos tubos de pressão: 91,01 bar

Número de soportes e amarrações por tubo de pressão: 3

Peso da cada tubo de pressão vazio: 206 Kg.

Peso da cada tubo de pressão cheio: 440 Kg.

Peso de um rack vazio: 38.604 Kg approx.

Peso de un rack cheio: 69.960 Kg approx.

Posição das ligações de saída de permeado: Através do centro

Posição das ligações de entrada de água salgada e saída de concentrado: 2,5" / 2" Lateral

Tipo de ligação de entrada de água salgada: 2,5" Vitaulic

Tipo de ligação de saída de permeado: 1" NPTf

Tipo de ligação de saída de concentrado: 2" Vitaulic

MATERIAIS

Do corte/ tubo de pressão: Vidro/Epoxy acc F.I. 202

Da ligação de entrada de água salgada: Super duplex PREN≥42 (SMO254)

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	TUBOS DE PRESSÃO E RACKS PARA OSMOSE INVERSA	FOLHA DE CARACTERÍSTICAS Nº 28
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Da ligação de saída de permeado: Engenharia de plástico

Da Ligação de saída de concentrado: Super duplex PREN $\geq$ 42 (SMO254)

Dos tampões/ placas de vedação das extremidades de cada tubo de pressão:

Tampa da extremidade: Engenharia de plástico

Placas de vedação de cada tubo de pressão: StSt16

Da parafusaria: Não são necessários parafusos na montagem da cabeça

Das peças interiores em contacto com a água:

Adaptadores Engenharia de plástico

Selas Termoplástico

Correiras StSt316 coberto com plástico

Selos EPDM

NORMAS

De controlo de fabricação: ASME X & European Directive CE

De receção em fábrica: ASME X & European Directive CE

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	TUBOS DE PRESSÃO E RACKS PARA OSMOSE INVERSA	FOLHA DE CARACTERÍSTICAS Nº 28
	OSMOSE INVERSA	FOLHA 4 DE 6

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<i>ÁGUAS DO ALGARVE</i> <i>Grupo Águas de Portugal</i>	Posição da Lista de Preços Unitários a que respeita EQ115.A0

OUTROS:

Incorporação de materiais reciclados

Incorporação de Resíduos (Sim/Não) Não

Percentagem de incorporação Não aplicável.

Certificado (Sim/Não) Não aplicável.

Compras Ecológicas

Abrangido pela RCM 38/2016, de 29 de julho (Estratégia Nacional para as Compras Ecológicas 2020) (S/N) Não.

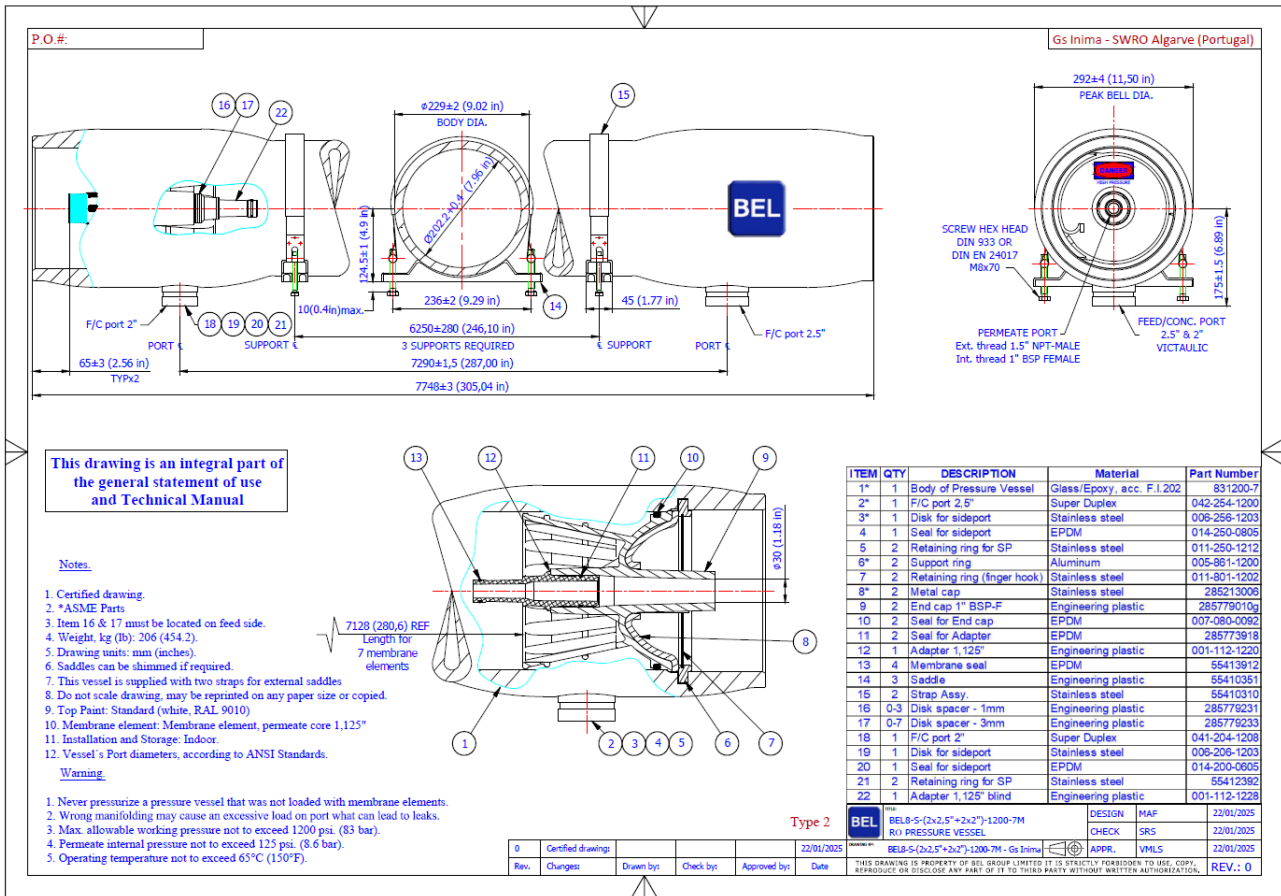
Evidências do cumprimento em anexo (Sim/Não) Não aplicável.

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	TUBOS DE PRESSÃO E RACKS PARA OSMOSE INVERSA	FOLHA DE CARACTERÍSTICAS
	OSMOSE INVERSA	Nº 28 FOLHA 6 DE 6

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DESENHO DIMENSIONAL TIPO 2



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FICHA TÉCNICA



TECHNICAL DATA SHEET

Pressure Vessel
SWRO Plant – Algarve - Portugal



GS Inima
LUSÁGUA

TECHNICAL DATASHEET		
CUSTOMER:		GS INIMA - LUSAGUA
Customer PO:		SWRO Plant – Algrave - Portugal
GENERAL		
Number of Units		400
Manufacturer		BEL COMPOSITE IBERICA S.L. – SPAIN - EU
Model/Type		BEL8-S(2x2,5"+2x2")-1200-7M
Service		Membrane housings
Membrane		TBD (To be defined)
Settlement in plant		Reverse Osmosis
TECHNICAL SPECIFICATIONS		
Capacity		7 membranes per vessel
Head Diameter	mm	292 ± 4
Body Diameter	mm	229 ± 2
Internal Diameter	mm	202,2 ± 0,4
Design Pressure	psi/bar	1.200 psi / 82,74 bar
Maximum Operating Pressure	psi/bar	1.200 psi / 82,74 bar
Minimum Operating Pressure	psi/bar	14,5 psi / 1,00 bar
Nominal Pressure	psi/bar	1.200 psi / 82,74 bar
Test Pressure		1.320 psi / 91,01 bar
Burst Pressure	psi/bar	7.200 psi / 496,42 bar
Maximum & Minimum Operating Temperature	°F/°C	Max. 150 °F / 65 °C — Min. 41 °F / 5 °C
Internal Volume	Liters	236,90
Total Length	mm	7.748 ± 3
Distance between ports	mm	7.290 ± 1,5
Height of ports	mm	175 ± 1,5
Support Spam	mm	6.250 ± 280
Approx. empty weight:	kg	206,0
Connection type		
Feed - Inlet		2 Units Lateral for victaulic connection 2,5"
Brine - Exit		2 Units Lateral for victaulic connection 2"
Permeate Exit		2 Units Frontal Central - Ext. thread 1,5" NPT male - Int. thread 1" BSP female
MATERIALS		
Body		Glass/Epoxy acc F.I. 202
Feed / Reject ports		Super duplex PREN ₂ 42 (SMO254)
Permeate Exit		Plastic Engineering (Embedded in End Cap)
End Caps		Plastic Engineering
Metal Caps		StSt316
Support Rings		Hard Anodized Aluminum.
Retaining Rings		StSt316
Adapters		Plastic Engineering
Saddles		Thermoplastic
Straps		StSt316 covered with plastic
Seals		EPDM
DESIGN CODE		
Standard for Manufacture		ASME Section X – Class I
Pressure Test	psi/bar	ASME Section X (1,1 the design pressure, for >1 min)
Certificate of Conformity CE	yes	Included
CE Mark		Applicable
ACCESSORIES		
Vessel's support / saddles		Yes
End caps		Yes
Adapters		Yes – Standard & blind
Disc Spacers		Yes / 3 Units of 1 mm & 7 Units of 3 mm thickness, per vessel.
Retaining ring & support rings		Yes
Number of saddles	Units	3
Number of Straps	Units	2
Pressure vessel manufactured according to ASME Section X requirements, for pressure vessels manufactured by Filament-winding process, Class I.		

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TECHNICAL DATA SHEET

Pressure Vessel
SWRO Plant – Algarve - Portugal



TECHNICAL DATASHEET		
CUSTOMER:		INNICE – GS INIMA - LUSAGUA
Project:		SWRO Plant Algarve - Portugal
GENERAL		
Number of Units		136
Manufacturer		BEL COMPOSITE IBERICA S.L. – SPAIN - EU
Model/Type		BEL8-S(1x2,5"+1x2")-1200-7M
Service		Membrane housings
Membrane		TBD (To be defined)
Settlement in plant		Reverse Osmosis
TECHNICAL SPECIFICATIONS		
Capacity		7 membranes per vessel
Head Diameter	mm	292 ± 4
Body Diameter	mm	229 ± 2
Internal Diameter	mm	202.2 ± 0.4
Design Pressure	psi/bar	1.200 psi / 82,74 bar
Maximum Operating Pressure	psi/bar	1.200 psi / 82,74 bar
Minimum Operating Pressure	psi/bar	14,5 psi / 1,00 bar
Nominal Pressure	psi/bar	1.200 psi / 82,74 bar
Test Pressure		1.320 psi / 91,01 bar
Burst Pressure	psi/bar	7.200 psi / 496,42 bar
Maximum & Minimum Operating Temperature	°F/°C	Max. 150 °F / 65 °C — Min. 41 °F / 5 °C
Internal Volume	Liters	236,90
Total Length	mm	7.748 ± 3
Distance between ports	mm	7.290 ± 1,5
Height of ports	mm	175 ± 1,5
Support Spam	mm	6.250 ± 280
Approx. empty weight:	kg	206,0
Connection type		
Feed - Inlet		1 Units Lateral for victaulic connection 2,5"
Brine - Exit		1 Units Lateral for victaulic connection 2,5"
Permeate Exit		2 Units Frontal Central - Ext. thread 1,5" NPT male - Int. thread 1" BSP female
MATERIALS		
Body		Glass/Epoxy acc F.I. 202
Feed / Reject ports		Super duplex PREN-42 (SMO254)
Permeate Exit		Plastic Engineering (Embedded in End Cap)
End Caps		Plastic Engineering
Metal Caps		StSt316
Support Rings		Hard Anodized Aluminum.
Retaining Rings		StSt316
Adapters		Plastic Engineering
Saddles		Thermoplastic
Straps		StSt316 covered with plastic
Seals		EPDM
DESIGN CODE		
Standard for Manufacture		ASME Section X – Class I
Pressure Test	psi/bar	ASME Section X (1,1 the design pressure, for >1 min)
Certificate of Conformity CE	yes	Included
CE Mark		Applicable
ACCESSORIES		
Vessel's support / saddles		Yes
End caps		Yes
Adapters		Yes – Standard & blind
Disc Spacers		Yes / 3 Units of 1 mm & 7 Units of 3 mm thickness, per vessel.
Retaining ring & support rings		Yes
Number of saddles	Units	3
Number of Straps	Units	2
Pressure vessel manufactured according to ASME Section X requirements, for pressure vessels manufactured by Filament-winding process, Class I.		

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PROGRAMA DE PONTOS DE INSPECÇÃO

Client		EPC Contractor		
Project No,	Project ALGARVE – RO Desalination Plant	Date	Rev,	
Document n°/Title AL-GSI-IT-QC-0000-PLV01_IPP for Pressure Vessel		02/01/2025	00A	

ITEM Nº	ITEM DESCRIPTION	TEST	REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	QUALITY RECORDS	INSPECTION RESPONSIBILITY (HOLD/WITNESS/REVIEW)				
						Supplier	EPC	Owner	Others	Remarks
1	DOCUMENTS									
1.1	Test procedure, Hydrostatic test, Barcol test, visual & dimensional test, volumetric expansion	Check of documents	Manufacturer procedure	Technical Specification - Data sheet	Documents	T1	AR	R		
1.2	Painting Procedure	Check of documents	Manufacturer procedure and instruction	Technical Specification	Documents	T1	AR	R		
2	MATERIAL									
2.1	epoxy resin, fiber glass, plastic, elements	Chemical analysis	Reference standard for material	Reference standard for material ASTM codes / ASME X	Certificate EN 10204:2004, Type 2.1/2.2 for NON- metallic parts	R	R	R		Hardener: ANALYSIS CERTIFICATE Resin and Reinving fiber: CERTIFICATE OF ANALYSIS Seals and caps etc: TECHNICAL DATASHEET or CERTIFICATE OF ANALYSIS
2.2	Quality certificates of ports, spiral rings and cap/ plates	Chemical analysis	Reference standard for material	Reference standard for material	Material certificate	R	R	R		Retaining rings: CERTIFICATE OF CONFORMANCE Support, side port, disk for side port, metal cap: 3.1 CERTIFICATE
3	MANUFACTURING									
3.1	Manufacturing process of housing	Visual Inspection	ASME X	ASME X (6-100-1)	Manufacturing report	T1	R	R		
4	TEST									
4.1	Volume expansion test	Volumetric expansion, Min 10% of bodies	ASME X article RQ	ASME Sec X/2021 Article RQ and supplier procedure	Test report	T2	RQ	RQ		Information included in the attached inspection certificate Acc. EN 10204/A.1. Only One document for all information and per pressure vessels model and its serial number
4.2	Visual examination, Assembly of housing, caps and seals	Visual Inspection	Test procedure (ASME Sec. X 2023)	ASME Sec X/2023 (Part RT Article RT-410)	Test report	T2	W2	R		Information included in the attached inspection certificate Acc. EN 10204/A.1. Only One document for all information and per pressure vessels model and its serial number
4.3	Barcol Harness Control	Barcol Hardness	Test procedure (ASME Sec. X 2023)	ASME Sec X/2023 (Part RT Article RT-440)	Test report	T2	R	R		

BEL Composite Ibérica SL
 C.I.F. B 30781215
 Parque Tecnológico de Fuente Álamo
 Ctra. de Fuente Álamo a Losada, Km 2.
 30320 Fuente Álamo, Murcia (Spain)
 Tel. +34 968 197 601 / 15

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Project No.	Project	Date	Rev.
	ALGARVE – RO Desalination Plant		
Document n°/Title		02/01/2025	00A
AL-GSI-IT-QC-0000-PLV01_IPP for Pressure Vessel			

ITEM Nº	ITEM DESCRIPTION	TEST	REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	QUALITY RECORDS	INSPECTION RESPONSIBILITY (HOLD/WITNESS/REVIEW)				
						Supplier	EPC	Owner	Others	Remarks
1	DOCUMENTS									
4.4	Dimensional control after machining of housing and caps. Verification of thickness and linearity of tubes	Body Dimension (Thickness, partial and total dimension)	Test procedure (ASME Sec. X 2023)	ASME Sec.X/2023 (Part RT Article RT-420)	Test report	T2	R	R		Information included in the attached inspection certificate Acc. EN 10204/3.1. Only One document for all information and per pressure vessels model and its serial number
4.5	Weight of the housing	Weight	Test procedure (ASME Sec. X 2023)	ASME Sec.X/2023 (Part RT Article RT-430)	Test report	T2	R	R		Information included in the attached inspection certificate Acc. EN 10204/3.1. Only One document for all information and per pressure vessels model and its serial number
4.6	Hydrostatic pressure test	Hydrostatic test	Test procedure (ASME Sec. X 2023)	ASME Sec.X/2023 (Part RT Article RT-450.1)	Test report	T2	R	R		Information included in the attached inspection certificate Acc. EN 10204/3.1. Only One document for all information and per pressure vessels model and its serial number
4.7	Painting quality, cleanliness, thickness, finishing and adhesives	Painting control	Manufacturer procedure	Manufacturer procedure	Test report	One for batch	One for batch	R		
5	FINAL CHECK									
5.1	Final and visual inspection	Visual and Dimensional examination	Technical specification – drawings	Technical specification – drawings	Inspection report	W1	W2	R		
5.2	Marking and labelling	Labelling check	Technical specification – drawings ASME X	Technical specification – drawings ASME X	Inspection report	W1	W2	R		
5.3	Completeness supply check according to the purchase order	Check of material	Technical specification Purchase Order	Technical specification Purchase Order	Inspection report	W1	W2	R		
5.4	Packed material	Preservation and packing inspection	Packing procedure	Packing procedure	Inspection report	W1	W2	R		
5.5	Guarantee certificate	Guarantee	Technical specification	Technical specification	Guarantee certificate	R	R	R		
5.6	Compliance certificate (Agreement to Contract or PO)	Compliance	Technical specification	Technical specification	Compliance Certificate	R	R	R		
5.7	Manufacturing Data record	Check of document	Quality documents	Quality documents	MOR	R	AR	R		
5.8	Acceptation Note	Check of document	Quality documents	Quality documents	Acceptance Note		R			
5.9	Logistics Dossier	Check of document	Logistics documents	Logistics documents	Logistic Dossier	R	AR			
5.10	Delivery Authorisation		Documents	Documents		H				

Legend:

BEL Composite Ibérica SL
 C.I.F. B 30781215
 Parque Tecnológico de Fuente Álamo
 Ctra. de Fuente Álamo a Cádiz, Km 2.
 30320 Fuente Álamo, Murcia (Spain)
 Tel. +34 998 197.601 / 15

ITEM Nº	ITEM DESCRIPTION	TEST	REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	QUALITY RECORDS	INSPECTION RESPONSIBILITY (HOLD/WITNESS/REVIEW)				
						Supplier	EPC	Owner	Others	Remarks
1	DOCUMENTS									

T: Test – R: Review of doc.(Doc. to send) – AR: Approval required – W: witness – H: hold – S: surveillance
 1 = 100% • 2 = min, 1%

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CERTIFICADOS

The American Society of Mechanical Engineers



CERTIFICATE OF AUTHORIZATION

The named company is authorized by The American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the ASME Single Certification Mark and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with the ASME Single Certification Mark shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

BEL Composite Iberica S.L.
 Parque Tecnológico Fuente Alamo
 Ctra. del Estrecho-Lobosillo, km. 2
 Fuente Alamo, Murcia 30320
 Spain

SCOPE:

Manufacture of Class I reinforced plastic pressure vessels at the above location only

AUTHORIZED: **June 14, 2022**

EXPIRES: **June 14, 2025**

CERTIFICATE NUMBER: **39649**

Board Chair, Conformity Assessment

Managing Director, Standards & Engineering Services



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TEST CERTIFICATE

NSF Report Reference MAT/LAB 410A

Client: BEL Composite Iberica S.L.

Product: BEL VESSEL (EPOKUKDO YD-128)

Manufacturer: BEL Composite Iberica S.L.

Tests Undertaken: BS 6920 Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water

Compliance: This product has satisfied the criteria set out in BS 6920: Part 1: 2014 "Specification" and thus is suitable for use with hot (up to 50 °C) and cold water.

Date of Testing: 29/08/17 to 31/10/17



Mr Michael Bustin, Materials Testing Manager

Date 9th April 2018



NSF Wales Ltd
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 w: nsf.org

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REFERÊNCIAS



MANUFACTURER REFERENCES Pressure Vessels

BEL Composite Ibérica REFERENCES & CASE STUDY.

<i>BEL VESSELS GENERAL REFERENCES.</i>				
<i>PLANT NAME</i>	<i>COUNTRY</i>	<i>CONTRACTOR</i>	<i>CAPACITY</i>	
Perth II	Australia	TRSA / Valoriza Agua	250.000	m³/d
Az-Zour South SWRO	Kuwait	Veolia	136.000	m³/d
Gold Coast	Australia	Veolia / J. Holland	125.000	m³/d
Al Jubail phase 4	Saudi Arabia	PCMC / Acciona	103.500	m³/d
Al Jubail phase 2	Saudi Arabia	Al Fatah Water & Power	100.000	m³/d
Pacific Rubiales	Colombia	Nirosoft	79.500	m³/d
Larnaca	Cyprus	LWP / IDE	64.000	m³/d
Escombreras	Spain	Cobra / Tedagua	60.000	m³/d
Valisikos	Cyprus	I. D. E.	60.000	m³/d
El Agodor	Spain	Aqualia	58.400	m³/d
Trekkopje Mine	Namibia	Keyplan	55.000	m³/d
Bajo de Almanzora	Spain	Aqualia/Befesa/FCC	50.000	m³/d
Paphos	Cyprus	Protecno	45.000	m³/d
Limassol	Cyprus	Mekorot / Netcom Group	40.000	m³/d
Mossel Bay skids	South Africa	Veolia Ibérica	37.500	m³/d
YuHuan	China	Siemens	36.000	m³/d
MODEC Offshore	Angola	VWS Westgarth	31.800	m³/d
Eemshaven RWE	Netherlands	Veolia Deutschland	30.000	m³/d
Medupi Power Station	South Africa	Ovivo (Aqua Eng.)	30.000	m³/d
Blue Hills	Bahamas	Consolidated Water	26.500	m³/d
Emirates Steel	UAE	Danieli	28.800	m³/d
Suministros	Algeria	M. S. D.	25.500	m³/d
Rincón de León	Spain	Cadaqua	25.000	m³/d
W.E.B. Aruba	Aruba	VWS / OTV	24.000	m³/d
Sagunto	Spain	Grupo Seta	23.000	m³/d
Moncofa	Spain	Inima	23.000	m³/d
Moni	Cyprus	Nirosoft /Subsea Infraest.	22.000	m³/d
Pal Technology Services	UAE	Fluid Technology Int'l Pvt Ltd	20.900	m³/d
La Caleta	Spain	Aqualia	20.000	m³/d
Consol Energy	USA	H2O Innovation	18.900	m³/d
Point Fortin	Trinidad	Seven Seas. Inc.	17.400	m³/d
Costa del Sol	Spain	Endesa	16.000	m³/d
Agua's Ponta Preta	Cape Verde	TCA	15.000	m³/d
Petrobras Offshore	Brazil	VWS Westgarth	15.000	m³/d
Puerto del Rosario	Spain	Degremont	14.000	m³/d
PTOI Placilla	Chile	Hidrosan	14.000	m³/d
NieuWater Emmen	Netherlands	Logisticon	13.200	m³/d
Komati	South Africa	Ovivo (Aqua Eng.)	12.000	m³/d
Owassa	USA	Befesa	11.000	m³/d
Doolittle	USA	Befesa	11.000	m³/d
Hilton Head	USA	Water & Power Technologies	11.000	m³/d

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<i>BEL VESSELS GENERAL REFERENCES.</i>				
<i>PLANT NAME</i>	<i>COUNTRY</i>	<i>CONTRACTOR</i>	<i>CAPACITY</i>	
Mantoverde	Chile	Sadyt	10.400	m³/d
Adeje Arona	Spain	GE Ionics	10.000	m³/d
Enlarg Ceuta	Spain	Cadaqua	10.000	m³/d
Aguas Porto Novo	Cape Verde	TCA	10.000	m³/d
Marsa Alam	Egypt	Metito Overseas	10.000	m³/d
Curaçao Water Plant	Curaçao	Seven Seas Water	9.400	m³/d
St. Croix Water	US Virgin Is.	Seven Seas Water	9.400	m³/d
Altona, Melbourne	Australia	Tedagua / Drace	9.000	m³/d
Power Station La Spezia	Italy	T.M.E.	9.000	m³/d
Shat Al Basra	Iraq	VWS Gulf	9.000	m³/d
Saint John's	Antigua	Enerserve / Veolia	8.500	m³/d
Estate Richmond Power Plant	St. Croix	Seven Seas Inc.	8.325	m³/d
Randolph E Harley Power Plant	St. Thomas	Seven Seas Inc.	8.300	m³/d
Engelse Werk	Netherlands	Vitens / VWS Rossmark	8.250	m³/d
C.C.C. Campo de Gibraltar	Gibraltar	Onde Degremont	8.000	m³/d
Donna	USA	Befesa	7.500	m³/d
Paguera, Malaga	Spain	Cadagua	7.500	m³/d
South Coast Steam	USA	Aquatech International	7.500	m³/d
Baiji Power Plant	Iraq	VWS Gulf	7.100	m³/d
Tortola, BVI Plant	Virgin Is.	DesalCo	5.440	m³/d
C.T.C.C. Tarragona	Spain	Endesa	5.400	m³/d
Lei Ji Power Plant	China	GZ AsianTec	5.000	m³/d
Reliance	Algeria	Veolia	4.600	m³/d
Las Galletas	Spain	GE Ionics	4.000	m³/d
Pepsico Baghdag	Iraq	Bekerfeld	3.900	m³/d
Boleo	Mexico	Aquatech International	3.750	m³/d
New York Power	USA	Veolia Water	3.750	m³/d
SWRO	Libya	Metito Overseas	2.750	m³/d
North Sound. Cayman	Cayman Is.	DesalCo	2.640	m³/d
Sharm el-Sheikh	Egypt	WWWS	2.600	m³/d
Masar Alam	Egypt	Metito Overseas	2.500	m³/d
SWRO	Libya	Metito Overseas	2.500	m³/d
Syros Island	Greece	TEMAK	2.500	m³/d
CTCC Sagunto	Spain	Sadyt	2.500	m³/d
La Ranilla	Spain	Aqualia	2.000	m³/d
Isla San Andrés	Colombia	Crupo CORSA	2.160	m³/d
Bir Shalateyn	Egypt	ISO	2.000	m³/d
Sohar	Oman	Berkefeld	1.730	m³/d
Al Dibba bottling plant	UAE	Berkefeld	1.500	m³/d
Pepsico Arabia bottling plant	Saudi Arabia	Veolia	1.500	m³/d
Brabant Water	Netherlands	Logisticon	1.200	m³/d
Sohar	Oman	Berkefeld	1.000	m³/d
EMPOWER Dubai Health Care City	UAE	VWS Gulf	1.000	m³/d

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MANUFACTURER REFERENCES
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<i>BEL VESSELS GENERAL REFERENCES.</i>				
<i>PLANT NAME</i>	<i>COUNTRY</i>	<i>CONTRACTOR</i>	<i>CAPACITY</i>	
Al Yassat Island	UAE	Waterworks	750	m³/d
Al Yassat Island	UAE	Waterworks	750	m³/d
Containerised SWRO	Oman	Veolia	500	m³/d
Mobile water treatment	Iraq	Waterworks	500	m³/d
Containerised SWRO	Tunisia	Lenntech	500	m³/d
Containerised SWRO	Oman	Veolia	500	m³/d
Containerised SWRO	Tunisia	Lenntech	500	m³/d
Ajman Labour Camp	UAE	Aquastar	400	m³/d
Karachi Industrial	Pakistan	Fluid International	400	m³/d
Karachi Industrial	Pakistan	Aquastar	400	m³/d
Sharjah Labour Camp	UAE	Extraco	400	m³/d
Ajman Labour Camp	UAE	Aquastar	400	m³/d
Um al Quwain labour camp	UAE	Seven Seas	400	m³/d
Al Ain Irrigation	UAE	Al Shottan	300	m³/d
Al-Saad Irrigation	UAE	Haader Agricultural	325	m³/d
Al Ain Irrigation	UAE	Al Shottan	300	m³/d
Ras al Khaimah irrigation	UAE	Al Mawrid	300	m³/d
Ras al Khaimah irrigation	UAE	Al Mawrid	300	m³/d
Containerised SWRO	Kenya	Gulf Water Treatment	300	m³/d
Abu Samra Irrigation	UAE	Haader Agricultural	170	m³/d
Containerised SWRO	Kenya	Gulf Water Treatment	60	m³/d

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MANUFACTURER REFERENCES

Pressure Vessels

Pressure Vessels Project No. 1

No.	Information Required	Response
1.	Name of Project	Al Jubail phase 2 & 4
2.	Location of Project	Saudi Arabia
3.	Type of Project (SWRO, Brackish RO, wastewater reclamation plant, potable water treatment plant, etc.)	SWRO
4.	Name of Project Company (Owner)	Al Jubail phase 4
5.	Capacity of Project (product water)	100.500 + 103.500 (204.000 m³/d)
6.	RO system recovery (%)	
7.	Number of RO trains	
8.	Capacity of RO trains (nominal)	
9.	Number of passes	2 passes
10.	Number of pressure vessels per train (1 st /2 nd pass)	
11.	Total number of pressure vessels installed (1 st /2 nd pass)	1.550 units + 1600 units (3.150 units)
12.	Number of membranes per pressure vessels	7 units
13.	Nominal pressure (1 st /2 nd pass)	
14.	Design pressure (1 st /2 nd pass)	1200 psi / 450 psi / 300 psi
15.	Pressure vessel diameter (inches)	8"
16.	Materials	BEL Standard*
17.	Hours of operation per year	
18.	Starts	
19.	Year of commissioning	Phase 2 – 2013 Phase 4 – 2015
20.	Start of commercial operation (month/year)	Phase 2 – 2013 Phase 4 – 2015

*BEL Standard materials:

- ✓ Body: Glass/Epoxy acc F.I. 227
- ✓ F/C Ports high pressure – Super Duplex / SMO254 (under request)
- ✓ F/C Ports Low pressure – StSt316 / Duplex(under request)
- ✓ Permeate exit: Polibuthylen – Plastic Engineering
- ✓ End Caps - Polibuthylen – Plastic Engineering + StSt316.
- ✓ Support ring - Aluminum
- ✓ Retaining ring (finger hook) - StSt316
- ✓ Seals - EPDM

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MANUFACTURER REFERENCES

Pressure Vessels

Pressure Vessels Project No. 2

No.	Information Required	Response
1.	Name of Project	Perth I & II
2.	Location of Project	Australia
3.	Type of Project (SWRO, Brackish RO, wastewater reclamation plant, potable water treatment plant, etc.)	SWRO
4.	Name of Project Company (Owner)	Perth I & II
5.	Capacity of Project (product water)	250.000 m3/d
6.	RO system recovery (%)	
7.	Number of RO trains	
8.	Capacity of RO trains (nominal)	
9.	Number of passes	2 passes
10.	Number of pressure vessels per train (1 st /2 nd pass)	
11.	Total number of pressure vessels installed (1 st /2 nd pass)	5.000 Units
12.	Number of membranes per pressure vessels	7 units
13.	Nominal pressure (1 st /2 nd pass)	
14.	Design pressure (1 st /2 nd pass)	1000 psi / 450 psi
15.	Pressure vessel diameter (inches)	8"
16.	Materials	BEL Standard*
17.	Hours of operation per year	
18.	Starts	
19.	Year of commissioning	Phase I & II - 2006
20.	Start of commercial operation (month/year)	2006

*BEL Standard materials:

- ✓ Body: Glass/Epoxy acc F.I. 227
- ✓ F/C Ports high pressure – Super Duplex / SMO254 (under request)
- ✓ F/C Ports Low pressure – StSt316 / Duplex(under request)
- ✓ Permeate exit: Polibuthylen – Plastic Engineering
- ✓ End Caps - Polibuthylen – Plastic Engineering + StSt316.
- ✓ Support ring - Aluminum
- ✓ Retaining ring (finger hook) - StSt316
- ✓ Seals - EPDM

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MANUFACTURER REFERENCES

Pressure Vessels

Pressure Vessels Project No. 3

No.	Information Required	Response
1.	Name of Project	Az Zour South
2.	Location of Project	Kuwait
3.	Type of Project (SWRO, Brackish RO, wastewater reclamation plant, potable water treatment plant, etc.)	SWRO
4.	Name of Project Company (Owner)	Az Zour South
5.	Capacity of Project (product water)	136.000 m3/d
6.	RO system recovery (%)	
7.	Number of RO trains	
8.	Capacity of RO trains (nominal)	
9.	Number of passes	1 pass
10.	Number of pressure vessels per train (1 st /2 nd pass)	
11.	Total number of pressure vessels installed (1 st /2 nd pass)	1.300 units
12.	Number of membranes per pressure vessels	8 units
13.	Nominal pressure (1 st /2 nd pass)	
14.	Design pressure (1 st /2 nd pass)	1.200 psi
15.	Pressure vessel diameter (inches)	8"
16.	Materials	BEL Standard*
17.	Hours of operation per year	
18.	Starts	
19.	Year of commissioning	2014
20.	Start of commercial operation (month/year)	2015

***BEL Standard materials:**

- ✓ Body: Glass/Epoxy acc F.I. 227
- ✓ F/C Ports high pressure – Super Duplex / SMO254 (under request)
- ✓ F/C Ports Low pressure – StSt316 / Duplex(under request)
- ✓ Permeate exit: Polibuthylen – Plastic Engineering
- ✓ End Caps - Polibuthylen – Plastic Engineering + StSt316.
- ✓ Support ring - Aluminum
- ✓ Retaining ring (finger hook) - StSt316
- ✓ Seals - EPDM

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MANUFACTURER REFERENCES

Pressure Vessels

Pressure Vessels Project No. 4

No.	Information Required	Response
1.	Name of Project	Gold Coast
2.	Location of Project	Australia
3.	Type of Project (SWRO, Brackish RO, wastewater reclamation plant, potable water treatment plant, etc.)	SWRO
4.	Name of Project Company (Owner)	Gold Coast
5.	Capacity of Project (product water)	125.000 m3/d
6.	RO system recovery (%)	
7.	Number of RO trains	
8.	Capacity of RO trains (nominal)	
9.	Number of passes	2 passes
10.	Number of pressure vessels per train (1 st /2 nd pass)	
11.	Total number of pressure vessels installed (1 st /2 nd pass)	2.161 units
12.	Number of membranes per pressure vessels	7 units
13.	Nominal pressure (1 st /2 nd pass)	
14.	Design pressure (1 st /2 nd pass)	1200 psi / 450 psi
15.	Pressure vessel diameter (inches)	8"
16.	Materials	BEL Standard*
17.	Hours of operation per year	
18.	Starts	
19.	Year of commissioning	2009
20.	Start of commercial operation (month/year)	2009

*BEL Standard materials:

- ✓ Body: Glass/Epoxy acc F.I. 227
- ✓ F/C Ports high pressure – Super Duplex / SMO254 (under request)
- ✓ F/C Ports Low pressure – StSt316 / Duplex(under request)
- ✓ Permeate exit: Polibuthylen – Plastic Engineering
- ✓ End Caps - Polibuthylen – Plastic Engineering + StSt316.
- ✓ Support ring - Aluminum
- ✓ Retaining ring (finger hook) - StSt316
- ✓ Seals - EPDM

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MANUFACTURER REFERENCES

Pressure Vessels

Pressure Vessels Project No. 5

No.	Information Required	Response
1.	Name of Project	Escombreras
2.	Location of Project	Spain
3.	Type of Project (SWRO, Brackish RO, wastewater reclamation plant, potable water treatment plant, etc.)	SWRO
4.	Name of Project Company (Owner)	Escombreras
5.	Capacity of Project (product water)	60.000 m3/d
6.	RO system recovery (%)	
7.	Number of RO trains	
8.	Capacity of RO trains (nominal)	
9.	Number of passes	1 pass
10.	Number of pressure vessels per train (1 st /2 nd pass)	
11.	Total number of pressure vessels installed (1 st /2 nd pass)	672 Units
12.	Number of membranes per pressure vessels	8 units
13.	Nominal pressure (1 st /2 nd pass)	
14.	Design pressure (1 st /2 nd pass)	1000 psi
15.	Pressure vessel diameter (inches)	8"
16.	Materials	BEL Standard*
17.	Hours of operation per year	
18.	Starts	
19.	Year of commissioning	2007
20.	Start of commercial operation (month/year)	2008

***BEL Standard materials:**

- ✓ Body: Glass/Epoxy acc F.I. 227
- ✓ F/C Ports high pressure – Super Duplex / SMO254 (under request)
- ✓ F/C Ports Low pressure – StSt316 / Duplex(under request)
- ✓ Permeate exit: Polibuthylen – Plastic Engineering
- ✓ End Caps - Polibuthylen – Plastic Engineering + StSt316.
- ✓ Support ring - Aluminum
- ✓ Retaining ring (finger hook) - StSt316
- ✓ Seals - EPDM

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MANUFACTURER REFERENCES

Pressure Vessels

Pressure Vessels Project No. 6

No.	Information Required	Response
1.	Name of Project	Bajo Almanzora
2.	Location of Project	Spain
3.	Type of Project (SWRO, Brackish RO, wastewater reclamation plant, potable water treatment plant, etc.)	SWRO
4.	Name of Project Company (Owner)	Bajo Almanzora
5.	Capacity of Project (product water)	60.000 m3/d
6.	RO system recovery (%)	
7.	Number of RO trains	
8.	Capacity of RO trains (nominal)	
9.	Number of passes	1 pass
10.	Number of pressure vessels per train (1 st /2 nd pass)	
11.	Total number of pressure vessels installed (1 st /2 nd pass)	729 Units
12.	Number of membranes per pressure vessels	7 units
13.	Nominal pressure (1 st /2 nd pass)	
14.	Design pressure (1 st /2 nd pass)	1000 psi
15.	Pressure vessel diameter (inches)	8"
16.	Materials	BEL Standard*
17.	Hours of operation per year	
18.	Starts	
19.	Year of commissioning	2011
20.	Start of commercial operation (month/year)	2013

*BEL Standard materials:

- ✓ Body: Glass/Epoxy acc F.I. 227
- ✓ F/C Ports high pressure – Super Duplex / SMO254 (under request)
- ✓ F/C Ports Low pressure – StSt316 / Duplex(under request)
- ✓ Permeate exit: Polibuthylen – Plastic Engineering
- ✓ End Caps - Polibuthylen – Plastic Engineering + StSt316.
- ✓ Support ring - Aluminum
- ✓ Retaining ring (finger hook) - StSt316
- ✓ Seals - EPDM

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MANUFACTURER REFERENCES Pressure Vessels



It's known worldwide about shortage of potable water in Australia. That's why it became one of the biggest markets with the greatest demand for desalination plants.

Tugun is a beachside suburb on the Gold Coast in Queensland, Australia, with a population above 5.000 habitants.



Tugun was selected as the preferred site for the proposed plant for a number of reasons. It has the least environmental impact when compared to the other short-listed sites. It has the lowest comparative net present value cost. The site is the only one to which sufficient power can be provided to enable the facility to be operational within the required timeframe. It is aligned with community values and expectations – community consultation conducted late last year highlighted that environmental impacts and cost were the most important issues when considering the location of the proposed plant. It is compatible with surrounding land use, is within close proximity to the ocean and hence requires the shortest intake and outtake pipelines of the three site options and the inlet and outlet pipes cross a minor fault line.

The Gold Coast desalination project is a reverse osmosis, water desalination plant that supplies water to the Gold Coast and South East Queensland via the South East Queensland Water Grid, located in Tugun.

After investigations by the Gold Coast Desalination Alliance, the Gold Coast City Council chose Tugun as the most suitable site for the desalination plant. The cost is expected to be in excess of \$1 billion. The GCD Alliance consists of Veolia Water, John Holland Group, and SureSmart Water, representing the State of Queensland.

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MANUFACTURER REFERENCES Pressure Vessels



Initial plans were for a \$260 million plant producing 55 megalitres a day. The State Government then contributed \$869 million to increase the output to 125 megalitres a day to share with the rest of southeast Queensland.

There is potential to increase output to 167 megalitres a day, however the plant is currently a reserve site on the Queensland Water Commission's list of possible sites for future desalination plants. Lytton and either Maroocha or Brisbane Island are the priority sites.

DESALINATION PLANT



Project name: Gold Coast Desalination
Plant Location: Tugun, Queensland AUSTRALIA
Capacity: 125,000 m³/day [33 mgd]
Source of Water: Sea Water
Operation Date: Feb. 2009
Technology: Reverse Osmosis
Contractor: GCD Alliance (Veolia Water, John Holland Group, and SureSmart Water)

BEL, world specialist manufacturer and vendor of composite made Pressure Vessels and other equipment for the water industry.

With more than 40 years of experience in the world of composite materials and winding driven products, BEL is serving the process and water industries holding unique wealth of expertise and skilled resources necessary for design, development and manufacturing of advanced composite products from cutting-edge technologies for the chemical and food industries, waste water treatment and water supply was the selected supplier for the Pressure vessels of this plants with:

- 1.713 Units of High Pressure Vessels model BEL8-S(2x1.5")-1200-8M
- 448 Units of Low Pressure Vessels model BEL8-S(2x2")-450-8M

Skid Configuration: Standard Sideports
Membranes: Hydranautics

For more information,
 contact BEL by e-mail: composite@bel-g.com
www.belvessels.com

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MANUFACTURER REFERENCES Pressure Vessels

SAGUNTO DESALINATION PLANT

BEL

Within the actions of the program A.G.U.A in the Mediterranean basins entrusted to ACUAMED society, whose main goals are to increase water resources, improve the management of water and restore the environment, is the construction of the desalination plant of SAGUNTO.



The contract for the construction of this new plant was awarded to the J.V. Lubasa-Pasaval. Grupo SETA, being the Spanish company specializing in water treatment, also responsible for the engineering and installations.

This new desalination plant is settled on the Port of Sagunto – industrial area - near the combined cycle power plant of Gas Natural Union Fenosa.

Sagunto Plant uses the same infrastructure of this combined Cycle plant as seawater intake and to discharge the brine, minimizing the environmental impact of the action.



With a total production of 22.900 m³/day, the plant consists of three skids with 2 stages and a total recovery of 55%. The facilities were built with enough space to double the production in future expansion if it is needed.

This plant shows the particularity that the skids were fully built in pieces (including pipes and vessels) and transported from Madrid to Valencia to be assembled in situ by elastic clamps.

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MANUFACTURER REFERENCES Pressure Vessels



2,352 units of Toray membranes were used in a hybrid design to assure a quantity of Boron lower than 1 mg/l in the permeate flow.

The configuration of vessels chosen was BEL multiple port vessels with a total amount per skid of 64 units in the 1st stage with ports of Ø3" and 48 units in the 2nd stage with ports of Ø2", all of them in 1.200 psi and 7 elements and connect in horizontal

DESALINATION PLANT



Project name: Sagunto
Plant Location: Sagunto Port, Valencia - SPAIN
Capacity: 22.900 m³/day
Source of Water: Sea Water
Technology: Reverse Osmosis
Contractor: J.V. Lubasa-Pasaval - Grupo SETA

BEL, world specialist manufacturer and vendor of composite made Pressure Vessels and other equipment for the water industry.

With more than 40 years of experience in the world of composite materials and winding driven products, BEL is serving the process and water industries holding unique wealth of expertise and skilled resources necessary for design, development and manufacturing of advanced composite products from cutting-edge technologies for the chemical and food industries, waste water treatment and water supply was the selected supplier for the Pressure vessels of this plants with:

First Stage

- 144 Units of High Pressure Vessels model BEL8-S(4x3")-1200-7M
- 48 Units of High Pressure Vessels model BEL8-S(2x3")-1200-7M

Second Stage

- 96 Units of High Pressure Vessels model BEL8-S(4x2")-1200-7M
- 48 Units of Low Pressure Vessels model BEL8-S(2x2")-1200-7M

Skid Configuration: Multiple ports

Membranes: Toray Membranes

For more information,
 contact BEL by e-mail: composite@bel-g.com
www.belvessels.com

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MANUFACTURER REFERENCES

Pressure Vessels

BAJO ALMANZORA DESALINATION PLANT

BEL



Within the actions of the program A.G.U.A in the Mediterranean basins entrusted to ACUAMED society, whose main goals are to increase water resources, improve the management of water and restore the environment, is included the construction of the desalination plant of Bajo Almanzora.

The desalination plant of Bajo Almanzora is located in the Almeria municipality of Cuevas de Almanzora between the towns of Palomares and Villavieja and provides its 15 Hm³ of irrigation water and 5 Hm³ for the urban water supply of several districts in Levante almeriense.

This plant, with a production capacity of 60.000 m³/d, in 4 reverse osmosis lines, was awarded to the joint venture formed by FCC Construcción, BEFESA Agua, AQUALIA Infraestructuras y AQUALIA Gestión Integral del Agua with a total investment of 73 million euros and co-financed by the European Union.

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MANUFACTURER REFERENCES Pressure Vessels



DESALINATION PLANT



Project name: Cuevas de Almanzora
Plant Location: Villaricos, Almería, SPAIN
Capacity: 60,000 m3/day
Source of Water: Sea Water
Operation Date: June. 2011
Technology: Reverse Osmosis
Contractor: J.V. - FCC Construcción, BEFESA
 Agua, AQUALIA Infraestructuras y AQUALIA
 Gestión Integral del Agua.

BEL, world specialist manufacturer and vendor of composite made Pressure Vessels and other equipment for the water industry.

With more than 40 years of experience in the world of composite materials and winding driven products, BEL is serving the process and water industries holding unique wealth of expertise and skilled resources necessary for design, development and manufacturing of advanced composite products from cutting-edge technologies for the chemical and food industries, waste water treatment and water supply was the selected supplier for the Pressure vessels of this plants with:

First Stage

- 378 Units of High Pressure Vessels model BEL8-S(3x2,5')-1200-7M
- 192 Units of Low Pressure Vessels model BEL8-S(4x2,5")-1200-7M

Second Stage

- 159 Units of High Pressure Vessels model BEL8-S(3x2,5')-1200-7M

Skid Configuration: Multiports Ø2,5"

Membranes: Hydranautics

For more information,
 contact BEL by e-mail: composite@bel-g.com
www.belvessels.com

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MANUFACTURER REFERENCES Pressure Vessels

ESCOMBERAS DESALINATION PLANT

BEL

Due to the needs to obtain high quality potable water for human consumption, the Public Agency of Water of the Region of Murcia – Spain, promoted the construction of the SWRO Plant of Escomberas.

This plant is located in the valley of the same name of the plant, in the Murcia municipality of Cartagena and supplies water for urban uses to 20 Councils in the Region.



The construction project was carried out by Hydromanagement S.L., partially owned by the company TEDAGUA S.A. (Grupo Cobra). The facilities are designed and built for a production of 63.000 m³/d, with an operation for a period of 25 years, with an investment approximately of 117 M€.



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MANUFACTURER REFERENCES Pressure Vessels



DESALINATION PLANT



Project name: Escombras
Plant Location: Escombras Valley, Cartagena, SPAIN
Capacity: 63,000 m³/day – facilities ready for expansion to 72,000 m³/day
Source of Water: Sea Water
Operation Date: 2007-2008
Technology: Reverse Osmosis
Contractor: TEDAGUA S.A.

BEL, world specialist manufacturer and vendor of composite made Pressure Vessels and other equipment for the water industry.

With more than 40 years of experience in the world of composite materials and winding driven products, BEL is serving the process and water industries holding unique wealth of expertise and skilled resources necessary for design, development and manufacturing of advanced composite products from cutting-edge technologies for the chemical and food industries, waste water treatment and water supply was the selected supplier for the Pressure vessels of this plants with:

RO-Skids – End Port pressure vessels

- 576 Units of High Pressure Vessels model BEL8-E-1000-8M

RO-Skids – Side Port pressure vessels

- 96 Units of High Pressure Vessels model BEL8S(2x1,5")-1000-8M

Membranes manufacturer: Hydranautics

For more information,
 contact BEL by e-mail: composite@bel-g.com
www.belvessels.com

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Ensaio de estanquidade para recipientes sob pressão



BEL COMPOSITE IBÉRICA, S.L.

I.T.215.Revision 6

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Fabrication Instruction No 215

Leakage Test for Pressure Vessels

1. General

- 1.1. This instruction is designed to support the execution of leakage testing for pressure vessels during final testing, as required within part RT-450.1 of sec. X of the ASME code.
- 1.2. During the pressure test each vessel shall be subjected to a leakage test of 110% over the design pressure using water at ambient temp for vessels manufactured according to ASME code.
- 1.3. The pressure testing system (according to the requirements of parts RT-510 of Sec. X of the ASME code) consists in: water supply, low pressure pump and high pressure pump, manually operated pressure regulators, mechanical test gauge and electronic pressure transmitter connected to a programmable controller that samples the pressure every one tenth of a second as well as two controlled valves for pressurizing and draining water.
- 1.4. The pressure test will perform twice on each tube. The duration of each of the tests will be at least one minute according to ASME Section X.
- 1.5. The worker performing the test will be certified by the quality control department in accordance with the standards.

2. Objective

- 2.1. The test is intended to dispose of or send to repair those products in which a leak is detected.

3. Tools.

- 3.1 End parts for specific model - 2 sets
- 3.2 Tools for closing / opening the tubes before / after the completion of the test.
- 3.3 Blind Victaulic couplings in accordance with the model of vessels that have been tested.
- 3.4 Pressure test machine.
- 3.5 Workbenches.

Date	checked	Signature	approved	Signature
10.01.2024	Víctor López		Juan Carlos Fernandez	

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4. Actions to be performed before the test.

- 4.1. The pressure tube is placed on the work benches of the pressure test station.
- 4.2. The caps are installed on both ends of the tube with the necessary accessories depending on the model. One of the covers will be connected to the hydraulic testing machine by means of flexible connections.
- 4.3. If the tube is of the side port model using blind Victaulic joints all ports except one are covered. The tube will be placed so that the port that is not covered is in the highest position possible. For this port it will be for which we will fill it with water.
- 4.4. If the tube is of the final port model in one of the covers, we will mount a relief valve and keep it elevated by filling the tube with the cap located at a lower height.
- 4.5. The water tube is filled to overflow so that no air is accumulated inside.
- 4.6. The tube is closed completely.
- 4.7. If the model is a side port, the tube should always be placed so that the Victaulics look towards the ground or towards the reinforced walls, so that in the event of an accident no metal part can be thrown out of the test area.
- 4.8. The tube is ready to start the pressure test.

5. Leakage Test.

During the pressure test no worker may remain in the testing area.

5.1 Description of the tests:

Every vessel shall be subjected to two leakage tests at 1.1 times the design pressure.

For all models, two tests with a duration of 5 minutes each will be carried out in which the tubes will be subjected to a pressure 1.1 times higher than the design pressure according to ASME RT-450.1

- BEL8S from 1 to 8 membranes
- BEL8S-450 from 1 to 8 membranes
- BEL8S-600 from 1 to 8 membranes
- BEL8S-1000 from 1 to 8 membranes
- BEL8S-1200 from 1 to 8 membranes
- BEL8S-1500 from 1 to 8 membranes
- BEL8S-1800 from 1 to 8 membranes

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5.2 Select in the Touch-screen browser the predefined pressure in accordance with the model of vessel that we wish to test (300 psi, 450 psi, 600 psi, 1000 psi, 1200 psi, 1800...).

5.3 Connect to the pressure machine the proper pressure gauges.

5.4 Set duration of the test (*check time*) according to sub-paragraph 5.1.

5.5 Press Start to activate the high pressure pump.

5.6 The leakage test will start.

5.7 When the leakage test has been finishes, the system will display the result.

5.8 When removing the end caps, pay special attention to not placing your hands in the radius of action when using the tool for this purpose.

6. Troubleshooting.

6.1 In case of lack of air or water the leakage test will be aborted.

6.2 A test that that has been stopped cannot re-run. The test must be restarted.

6.3The System access code is: 1234

7. Maintenance.

7.1 Once a month the pneumatic installation shall be checked.

7.2 Once a month the hydraulic installation shall be checked.

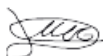
7.3Once a month the electrical box shall be checked / cleaned.

7.4 Q.A department will qualify the personal allowed to perform these maintenance operations.

8. Safety Equipment.

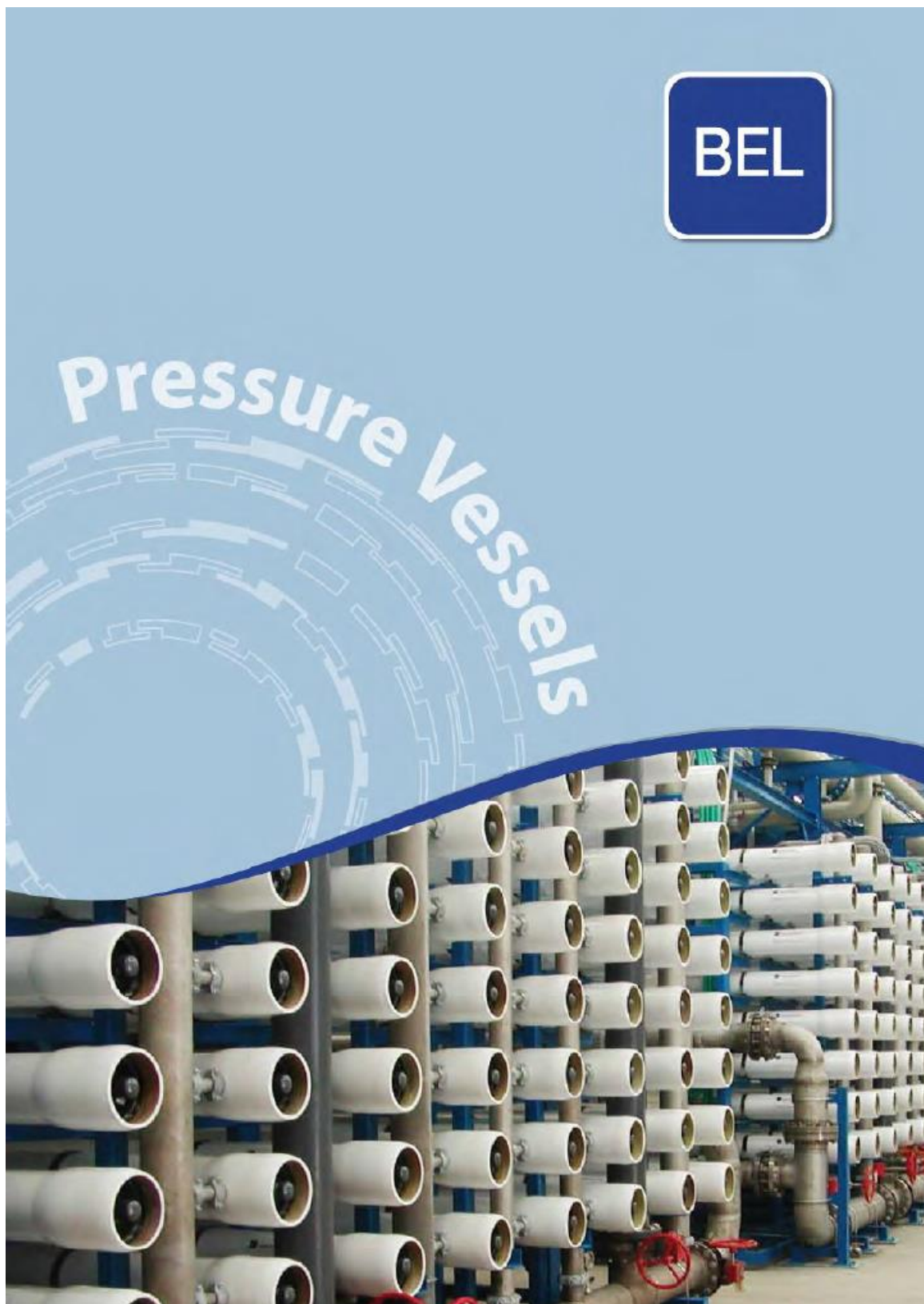
8.1 Safety shoes.

8.2 Working Gloves.

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3. CATÁLOGO TÉCNICO



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PROFILE

BEL is a world specialist manufacturer and vendor of composite made Pressure Vessels (Membrane Housing) and other equipment for the water industry.

Founded in 1966, BEL Group built over the years a strong customers base, first in the process industry and since 1999 in the sea water and brackish water desalination industry with its Composite Material production expertise.

With more than 50 years of experience in the world of composite materials and winding driven products, BEL Group is serving the process and water industries, holding unique wealth of expertise and skilled resources necessary for design, development and manufacturing of advanced composite products from cutting-edge technologies for the chemical and food industries, waste water treatment and water supply.

BEL offers worldwide sales and support services from its state of the art manufacturing plant in Spain and a well-established global chain of logistics and distributors centers.

To date BEL Group supplied more than 100,000 of Pressure Vessels to thousands of projects worldwide from mega-size sea water desalination projects to smaller industrial solutions of different applications, providing a total solution of detailed design, production and installation.



PERFIL

BEL es especialista mundial en fabricación y proveedor de recipientes a presión (tubos de presión para membranas) así como otros equipamientos para la industria del agua.

Fundada en 1966, El Grupo BEL ha desarrollado a lo largo de los años un fuerte vínculo con sus clientes, primeramente en el campo de los procesos industriales y desde 1999 en el campo de la industria de desalación de aguas de mar y salobres, mediante su experta producción de materiales composite. Con una experiencia probada de más de 50 años en el campo de los materiales composite y productos de la tecnología de hilado, el Grupo BEL provee de los expertos y cualificados recursos necesarios para el diseño, desarrollo y fabricación de productos avanzados, mediante tecnologías de vanguardia a las empresas del ramo químico, alimentaria, tratamiento de aguas residuales y suministro de agua.

BEL ofrece servicios de venta y soporte en todo el mundo desde su vanguardista instalación en España y desde su red global de centros de logística y distribuidores.

A día de hoy, BEL ha suministrados más de 100.000 tubos de presión en miles de proyectos a lo largo del planeta, desde mega instalaciones de plantas desaladoras de agua de mar, hasta pequeñas soluciones industriales para diferentes tipos de aplicaciones específicas, proporcionando una solución total de detallados diseños, fabricación e instalación.



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Quality and Reliability

ISO 9001:2000 Certification
 BEL Quality System strictly complies with the ISO 9001: 2000 International Quality standards.

ASME Code Section X Certification
 BEL Pressure Vessels are designed, manufactured and tested according to the strict requirements of the Boiler and Pressure Code of the American Society of Mechanical Engineers (A.S.M.E.) section X, "Fiber Reinforced Plastic Pressure Vessels", the internationally recognized standard for composite Pressure Vessel construction.
 ASME Code Sec. X stamped and NB (National Board) registered Vessels are available upon request.

CE Mark
 BEL's Pressure Vessels are approved to carry the **CE mark** as a proof of the compliance with the **European Pressure Equipment**, Directive 2014/68/EU, replacing Directive P.E.D. 97/23/EC.

Calidad y Fiabilidad

Certificación ISO 9001:2000
 El sistema de calidad del Grupo BEL se ajusta estrictamente a los Estándares Internacionales de Calidad ISO 9001:2000.

Certificación ASME Code Sección X
 Los tubos de presión del Grupo BEL se diseñan, se fabrican y se prueban según los requisitos estrictos de "Boiler and Pressure Code of the American Society of Mechanical Engineers" (ASME), sección X, "Fiber Reinforced Plastic Pressure Vessels", el estándar internacionalmente reconocido para la construcción de recipiente de presión plásticos.
 Estampado ASME Sección X y Registro de tubos de presión en el NB (National Board) disponibles bajo petición.

Marcado CE
 Los tubos de presión de BEL están aprobados para llevar el Marcado CE, como prueba de conformidad con Directiva Europea de Equipos a Presión Directiva 2014/68/EU, que sustituye a la Directiva P.E.D. 97/23/EC.

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Product General Information - Full range of 16", 8" and 4" Pressure Vessels fits all type membranes that are available in the market. - Designed for wide range of operation pressure up to 1,500 psi / 102 Bar. - Available in all configurations, from standard End Port to Side Port and Multiple Port design. - Multiple Port vessels are available with 1.5", 2", 2.5", 3" & 4" port diameters. 9" and 4.6" diameter Pressure Vessel for specific applications. 16", 8" & 9" Pressure Vessels, accommodates from 1 to 8 or 40" membranes or 1 to 5 of 60" membranes. 4.6" & 4" Pressure Vessels, accommodates from 1 to 6 or 40" membranes or 1 to 4 of 60" membranes. Información general de productos - Rango completo de tubos de presión de 16", 8" y 4", para todos los tipos de membranas disponibles actualmente en el mercado. - Diseñados para el amplio espectro de presiones de operación, hasta 1500 psi / 102 bar. - Disponibles en todas las posibles configuraciones, desde los estándar Tubos de alimentación/rechazo Frontal (End Port) hasta los de alimentación / rechazo Lateral (Side Port) y las configuraciones alimentación / rechazo Múltiples (Multi Port). - Tubos de presión Multi Port con puertos disponibles en diámetros de 1.5", 2", 2.5", 3" y 4" - Tubos de presión de 9" y 4.6" de diámetro para aplicaciones específicas. - Los tubos de presión de 16", 8" y 9", disponibles para acomodar desde 1 a 8 membranas de 40" o de 1 a 5 membranas de 60" de longitud. - Los tubos de presión de 4.6" y 4", disponibles para acomodar desde 1 a 6 membranas de 40" o de 1 a 4 membranas de 60" de longitud.	Product Range GRP 16", 8" and 4" Pressure Vessels (Membrane Housing) for Reverse Osmosis, Nano-Filtration, Ultra-Filtration and general membrane process: 16" Side / Multiple Port vessels, 1 to 8 M, from 300 psi to 1,200 psi 16" End Port vessels, 1 to 8 M, from 300 psi to 1,200 psi 8" Side / Multiple Port / Central Port vessels, 1 to 8 M, from 300 psi to 1,500 psi 8" End Port vessels, 1 to 8 M, from 300 psi to 1,500 psi 4" Side / Multiple Port vessels, 1 to 6 M, from 300 psi to 1,200 psi 4" End Port vessels, 1 to 6 M, from 300 psi to 1,200 psi 9" & 4.6" Vessels for Special Applications, ER Devices, U.F. housings, etc., according to specific design. Rango de productos Tubos de presión de Poliéster reforzado con fibra de vidrio de 16", 8" y 4", para aplicaciones de Osmosis Inversa, Nano-filtración, Ultra-filtración y en general para cualquier proceso de membrana: - Tubos de presión de 16" de diámetro, configuración Side Port o Multi port desde 1 a 8 membranas y presiones desde 300 psi hasta 1,200 psi. - Tubos de presión de 16" de diámetro, configuración End Port desde 1 a 8 membranas y presiones desde 300 psi hasta 1,200 psi. - Tubos de presión de 8" de diámetro, configuración Side Port / Multi Port o configuración de puerto central, desde 1 a 8 membranas y presiones desde 300 psi hasta 1,500 psi. - Tubos de presión de 8" de diámetro, configuración End Port, desde 1 a 8 membranas y presiones desde 300 psi hasta 1,500 psi. - Tubos de presión de 4" de diámetro, configuración Side Port o Multi Port desde 1 a 6 membranas y presiones desde 300 psi hasta 1,200 psi. - Tubos de presión de 4" de diámetro, configuración End Port desde 1 a 6 membranas y presiones desde 300 psi hasta 1,200 psi. - Tubos de presión de 9" y 4.6", para aplicaciones especiales, equipos ER, UF, etc., conforme a diseños específicos.
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Efficient Pressure Vessel Design

■ **Unique and simple End Cap design:**

- Easy locking system with no contact of metal with salted water.
- Fewer parts in the head assembly, therefore less spare parts are required.
- Less sealing points, therefore less maintenance is required.
- 30 mm ID free flow permeate ports on both sides with 3 connections options:
1.5" NPT (M) / 1.5" Victaulic grooved connection / 1" BSP (F) / Any other (by request)

■ **No metal inserts embedded inside the F.R.P. laminate:**

- Corrosion Free. ■ Secured structural Strength.

■ **Mechanical connection of the Side Ports to the vessel body:**

- Not glued and not threaded ports connection.
- Flexible and without dead zone.
- Replaceable and easy to handle.

■ **Multiple Ports connection:**

- Efficient, flexible and cost effective design.
- Cost reduction on plant construction material such as steel frame, pipes, fittings, labor and accessories.
- Smaller foot-print.
- Lower Long-Term maintenance expenses.



Tubos de presión con diseño Eficiente

■ **Sencillo y Exclusivo Diseño de tapa**

- Sencillo Sistema de cierre sin contacto alguno de partes metálicas con agua salina.
- Mínimas partes en conjunto de cierre del tubo de presión, lo cual implica menores requerimientos de piezas de repuesto.
- Menores puntos de sellado, lo cual reduce los requerimientos de mantenimiento.
- Puertos de permeado con 30 mm de diámetro interior libre en ambos lados del tubo de presión, con 3 opciones de conexión: 1.5" NPT Macho / 1.5" ranurado victaulic / 1" BSP Hembra. Otras posibilidades, bajo petición expresa.

■ **Inexistencia de insertos metálicos en la fibra**

- Libre de corrosión. ■ Refuerzo estructural asegurado.

■ **Conexión totalmente mecánica entre los puertos y el cuerpo del tubo de presión**

- Conexión de los puertos no pegados o roscados en la fibra.
- Flexible y sin zonas muertas.
- Remplazable y de fácil manejo.

■ **Conexiones multipuerto:**

- Diseño eficiente, flexible y rentable en el cómputo general del diseño de la instalación.
- Reducción de costes en fabricación de la planta en materiales tales como bastidores metálicos, tuberías, conexiones, accesorios y mano de obra asociada.
- Reducción de espacio necesario para la instalación.
- Menores costes de mantenimiento a largo plazo.



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