

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	1 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

AL-INN-3320-ME-DSH-ROM01

Membranas para Osmose Inversa-SWM.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	

Cliente 		Empreiteiro EPC 		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	2 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Índice

1. INTRODUÇÃO	3
2. FOLHA DE CARACTERÍSTICA.....	4
3. CATÁLOGO TÉCNICO	93

Cliente 		Empreiteiro EPC 		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	3 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

1. INTRODUÇÃO

Este documento contém as especificações técnicas dos Membranas para Osmose Inversa.

Cliente 		Empreiteiro EPC 		
Projeto n.º	Projeto Sistema de dessalinização na região do Algarve	Data 20/02/2025	Rev. 01.0	Pág. 4 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

2. FOLHA DE CARACTERÍSTICA

	MEMBRANAS PARA OSMOSE INVERSA - SWM	FOLHA DE CARACTERÍSTICAS N.º 29
	OSMOSE INVERSA	FOLHA 1 DE 4

Empreitada de Conceção-Construção e Exploração do Sistema de Dessalinização na Região do Algarve	N.º de unidades 3.752
ÁGUAS DO ALGARVE Grupo Águas de Portugal	Posição da Lista de Preços Unitários a que respeita EQ115.A0

REFERÊNCIAS

Número de bobinas de membrana por rack de osmose inversa: 3.752 Uds.

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

Fabricante/ Marca: LG Chem ou equivalente

Tipo/ Modelo: Membrana de osmose inversa/ LG SW 400 R G2

Certificações / Homologações: ISO9001, ISO 14001, ISO 45001/ Norma NSF/ANSI 61

Catálogo técnico n.º: Anexo

CARACTERÍSTICAS

Número de bobinas de membrana por tubo de pressão: 7

Superfície de membrana por bobina de membrana: 37 m²

Superfície de membrana por rack de osmose inversa: 34.706 m²

Diâmetro da bobina de membrana: 200 mm

Tolerância do diâmetro da bobina de membrana: ± 1 mm

Diâmetro do tubo central de recolha de permeado: 28,6 mm

Tolerância do diâmetro do tubo central de recolha de permeado: ± 0,10 mm

Comprimento da bobina de membrana: 1.015 mm

Tolerância do comprimento da bobina de membrana: ± 1 mm

Espaçadores de alimentação das membranas: 34 mil

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data 20/02/2025	Rev. 01.0	Pág. 5 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

  	MEMBRANAS PARA OSMOSE INVERSA - SWM	FOLHA DE CARACTERÍSTICAS Nº 29
	OSMOSE INVERSA	FOLHA 2 DE 4

Empreitada de Conceção-Construção e Exploração do Sistema de Dessalinização na Região do Algarve	Nº de unidades 3.752
<i>ÁGUAS DO ALGARVE</i> <i>Grupo Águas de Portugal</i>	Posição da Lista de Preços Unitários a que respeita EQ115.A0

CARACTERÍSTICAS FUNCIONAIS EM OPERAÇÃO

Fluxo membrana 13,10 LMH

Taxa de conversão do sistema: 45%

Caudal de permeado por bobina de membrana: 0,48 m³/h

Caudal de permeado por rack de osmose inversa: 455 m³/h

Aumento máximo da passagem de sais para o permeado: 7 %/ano

Redução máxima do caudal de permeado: 6 %/ano

Contra pressão máxima dinâmica do permeado: 1 bar

Perda de carga máxima dinâmica do permeado: 0,3 bar

Taxa média de substituição das bobinas de membrana durante os 5 primeiros anos de funcionamento da EDAM:

Primeiro ano: 0%

Segundo ano: 0%

Terceiro ano: 14,3%

Quarto ano: 14,3%

Quinto ano: 8,0%

EM FLUSHING

Volume total de permeado necessário para assegurar que a condutividade do concentrado iguala a da água de alimentação (sem contar com o volume das condutas): 2 x 30,35 m³/rack.

Cliente 		Empreiteiro EPC 		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data 20/02/2025	Rev. 01.0	Pág. 6 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

	MEMBRANAS PARA OSMOSE INVERSA - SWM	FOLHA DE CARACTERÍSTICAS Nº 29
	OSMOSE INVERSA	FOLHA 3 DE 4

Empreitada de Conceção-Construção e Exploração do Sistema de Dessalinização na Região do Algarve	Nº de unidades 3.752
<i>ÁGUAS DO ALGARVE</i> <i>Grupo Águas de Portugal</i>	Posição da Lista de Preços Unitários a que respeita EQ115.A0

EM LAVAGEM CIP

Número de lavagens CIP:	3 nº/ano (por rack)
Volume necessário de solução CIP:	32 L/ bobina de membrana
Volume necessário de solução CIP para efetuar uma lavagem completa de um rack (sem contar com o volume das condutas):	37,11 L/ membrana
Caudal necessário por tubo de pressão:	9 m ³ /h
Caudal necessário por rack de osmose inversa:	1.206 m ³ /h
Pressão necessária na entrada dos tubos de pressão:	4 bar
Perda de carga máxima durante a lavagem CIP:	3 bar/tubo de pressão
Temperatura da solução de lavagem CIP:	35 °C
pH da solução alcalina de lavagem CIP:	11-13 unidades de pH
pH da solução ácida de lavagem CIP:	2 -4 unidades de pH

MATERIAIS

Da membrana	Poliamida
Do tubo central de recolha de permeado:	ABS
Da película de selagem das bobinas de membrana:	Fibra de vidro

Cliente 		Empreiteiro EPC 		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	7 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

	MEMBRANAS PARA OSMOSE INVERSA - SWM	FOLHA DE CARACTERÍSTICAS Nº 29
	OSMOSE INVERSA	FOLHA 4 DE 4

Empreitada de Conceção-Construção e Exploração do Sistema de Dessalinização na Região do Algarve	Nº de unidades 3.752
<i>ÁGUAS DO ALGARVE</i> <i>Grupo Águas de Portugal</i>	Posição da Lista de Preços Unitários a que respeita EQ115.A0

NORMAS

De controlo de fabricação: EN 13443 – filtros de osmose inversa

De receção em fábrica: EN 13443 – filtros de osmose inversa

OUTROS:

Incorporação de materiais reciclados:

Incorporação de Resíduos: Não

Percentagem de incorporação Não aplicável

Compras Ecológicas

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

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

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	8 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

ESPECIFICAÇÃO DETALHADA DAS MEMBRANAS PROPOSTAS:



LG Water Solutions

Data Sheet



Seawater
Reverse Osmosis (RO) Membranes
LG SW 400 R G2

Overview

The next generation LG SW G2 membranes have achieved record-breaking salt rejection, improving the product quality up to 45% compared with the conventional technology. With enhanced Thin Film Nanocomposite (TFN) technology, LG SW G2 membranes can significantly reduce the cost of desalination.

LG SW R (High Rejection) membranes offer a combination of high rejection and low energy requirements to reduce the total cost of desalination; suitable for medium to high salinity seawater applications.

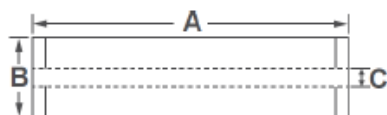
LG SW G2 Benefits

- **Improved permeate quality** without increasing operating pressure
- **Reduced energy cost** without sacrificing the permeate quality
- **Reduced capital and operation costs** for multi-pass SWRO systems

Product Specifications

Active Membrane Area, ft ² (m ²)	Permeate Flow Rate, GPD (m ³ /d)	Stabilized Salt Rejection, %	Minimum Salt Rejection, %	Boron Rejection, %	Feed Spacer, mil
400 (37)	9,000 (34.1)	99.88	99.75	93	34

Test Conditions : 32,000 ppm NaCl, 5 ppm boron at 25°C (77°F), 800 psi (55 bar), pH 8, Recovery 8%.
Permeate flows for individual elements may vary +/-15%.



A, mm (in.)	B, mm (in.)	C, mm (in.)	Weight, kg (lbs.)
1,016 (40)	200 (7.9)	28.6 (1.125)	16 (35)

All dimensional information is indicative and for reference purpose only. Please contact LG Chem for detailed technical specification.

Operating Specifications

For more information and operating guidelines, visit www.lgwatersolutions.com

Max. Applied pressure	1,200 psi (82.7 bar)
Max. Chlorine concentration	< 0.1 ppm
Max. Operating temperature	45°C (113°F)
pH Range, Continuous (Cleaning)	2-11 (2-13)
Max. Feedwater turbidity	1.0 NTU
Max. Feedwater SDI (15 mins)	5.0
Max. Feed flow	75 gpm (17 m ³ /h)
Min. Ratio of concentrate to permeate flow for any element	5 : 1
Max. Pressure drop (ΔP) for each element	15 psi (1.0 bar)

The Membrane Elements performance is expressly conditioned on Buyer's storing, installing, operating, and maintaining Product in accordance with industry-accepted good practices and Seller's written instructions provided in the Seller's Technical Manual, which consists of LG Chem, Ltd [Technical Service Bulletins \("TSB"\)](#) and [Technical Applications Bulletins \("TAB"\)](#) and may be viewed and downloaded at www.lgwatersolutions.com.

The information and data contained herein are deemed to be accurate and reliable and are offered in good faith, but without guarantee of performance. LG Chem assumes no liability for results obtained or damages incurred through the application of the information contained herein. Customer is responsible for determining whether the products and information presented herein are appropriate for the customer's use and for ensuring that customer's workplace and disposal practices are in compliance with applicable laws and other governmental enactments. Specifications subject to change without notice. NanoH₂O is the Trademark of The LG Water Solutions or an affiliated company of LG Chem. All rights reserved. © LG Chem, Ltd.

Contact LG Water Solutions www.lgwatersolutions.com | waterinfo@lgchem.com

(08.21)
NanoH₂O™

Cliente 		Empreiteiro EPC   		
Projeto n.º	Projeto Sistema de dessalinização na região do Algarve	Data 20/02/2025	Rev. 01.0	Pág. 9 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

CERTIFICAÇÕES/ HOMOLOGAÇÕES



The Public Health and Safety Organization

NSF Product and Service Listings

These NSF Official Listings are current as of **Tuesday, January 7, 2025** at 12:15 a.m. Eastern Time. Please [contact NSF](#) to confirm the status of any Listing, report errors, or make suggestions.

Alert: NSF is concerned about fraudulent downloading and manipulation of website text. Always confirm this information by clicking on the below link for the most accurate information:
<http://info.nsf.org/Certified/PwsComponents/Listings.asp?Company=C0248673&Standard=061&>

NSF/ANSI/CAN 61

Drinking Water System Components - Health Effects

NOTE: Unless otherwise indicated for Materials, Certification is only for the Water Contact Material shown in the Listing. Click [here](#) for a list of Abbreviations used in these Listings. Click [here](#) for the definitions of Water Contact Temperatures denoted in these Listings. Products certified to NSF/ANSI/CAN 61 comply with the health effects criteria in NSF/ANSI/CAN 600.

LG Chem, Ltd.

LG Twin Towers
 128, Yeouidaero, Yeongdeungpo-gu
 Seoul 150-721
 Korea, Republic of
 82 43 261 7532
[Visit this company's website](#)

Facility : Chungbuk, Republic of Korea

Mechanical Devices

Trade Designation	Size	Water Contact Temp	Water Contact Material
Filtration Devices/Components			
LG BW AFR[G]	[1]	CLD 23	OTHER
LG BW ES[G]	[1]	CLD 23	OTHER
LG BW R[G]	[1]	CLD 23	OTHER
LG BW UES[G]	[2]	CLD 23	OTHER
LG SW ES[G]	[3]	CLD 23	OTHER
LG SW GR[4] [5] [G]	[6]	CLD 23	OTHER
LG SW R[4] [5] [G]	[6]	CLD 23	OTHER
LG SW SR[4] [5] [G]	[6]	CLD 23	OTHER
LG TWFS-80[G]	[2]	CLD 23	OTHER

[1] Certified for a maximum surface area of 462.04 sq.ft

[2] Certified for a maximum surface area of 506 sq.ft

[3] Certified for a maximum surface area of 497.58 sq.ft

[4] All models should receive a pre-service flush to be conducted at a low rate of 2.628 liters per minute for 1 hour using deionized water.

[5] Certified for a minimum daily flow of 3,785 liters.

[6] Certified for a maximum surface area of 462.04 sq. ft.

[G] Product is Certified to NSF/ANSI 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Cliente		Empreiteiro EPC		
				
Projeto n.º	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	10 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

Reverse Osmosis Element [7] [G]			
BW 400 FHG[4] [5]	8" x 40"	CLD 23	OTHER
BW 400 HG[4] [5]	8" x 40"	CLD 23	OTHER
BW 400 Pro	8" x 40"	CLD 23	OTHER
BW 400 RS[4] [5]	8" x 40"	CLD 23	MLTPL
BW 400 RX[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 A[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 AFES[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 AFES+[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 AFR[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 AFR (L)[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 AFR G2[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 AFR+[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 AFR++[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 ES[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 ES (L)[4] [5]	8" x 40"	CLD 23	OTHER
LG BW 400 ES L[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 ES+[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 F[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 N[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 Q[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 R[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 R (L)[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 R +[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 R Dura[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 R G2[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 R G2 L[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 R+[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 R++[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 UES[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 UP[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 400 X[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 4040 ES[8] [9] [10]	4" x 40"	CLD 23	MLTPL
LG BW 4040 R[8] [9] [10]	4" x 40"	CLD 23	MLTPL
LG BW 4040 UES[8] [9] [10]	4" x 40"	CLD 23	MLTPL
LG BW 440 A[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 ES[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 ES L[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 ES+[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 F[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 N[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 Q[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 R[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 R[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 R[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 R Dura[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 R G2[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 R+[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 R++[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 UES[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 UP[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW 440 X[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW MOST[4] [5]	8" x 40"	CLD 23	MLTPL
LG BW MOST+[4] [5]	8" x 40"	CLD 23	MLTPL
LG CW 4040 SF[8] [9] [10]	4" x 40"	CLD 23	MLTPL
LG MaxRO R[4] [5]	8" x 40"	CLD 23	MLTPL
LG NF 400[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 11040 GR[11] [12]	11" x 40"	CLD 23	MLTPL
LG SW 400 ES[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 400 ES +[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 400 GR[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 400 GR G2[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 400 R[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 400 R G2[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 400 SR[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 400 SR G2[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 440 ES[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 440 ES +[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 440 GR[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 440 GR G2[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 440 R[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 440 R G2[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 440 SR[4] [5]	8" x 40"	CLD 23	MLTPL
LG SW 440 SR G2[4] [5]	8" x 40"	CLD 23	MLTPL
LG UHP RO[4] [13]	8" x 40"	CLD 23	MLTPL
SW 400 HG[4] [5]	8" x 40"	CLD 23	OTHER

- [4] All models should receive a pre-service flush to be conducted at a low rate of 2.628 liters per minute for 1 hour using deionized water.
- [5] Certified for a minimum daily flow of 3,785 liters.
- [7] End of Trade name may include customer and inventory management information with letters or numbers.
- [8] Certified for a minimum flow of 7,570 L per day.
- [9] Flushing Procedure: All models should receive a pre-service flush to be conducted at a flow rate of 6.55 liters per minute for 1 hour using de-ionized water.
- [6] Product is Certified to NSF/ANSI 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	11 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

- [10] Certified for municipal treatment facility end use.
- [11] Certified for a minimum daily flow of 11,200 gallons.
- [12] Product requires a pre-service flush to be conducted at a flow rate of 66 gallons per minute for 1 hour using de-ionized water.
- [13] Certified for a minimum daily flow of 32,176 liters.

NOTE: Only products bearing the NSF Mark on the product, product packaging, and/or documentation shipped with the product are Certified.

LISTA DE REFERÊNCIAS, DO FABRICANTE, RELATIVAS À UTILIZAÇÃO DAS MEMBRANAS PROPOSTAS

References with SW G2 Membranes

Customer	Project	Location	Size (m ³ /day)	Installation	Model
Metito	Jubail 2	Saudi Arabia	400,000	2021/2022	440GRG2+440R
GES	Ashdod Rehabilitation	Israel	300,000	2023	440 GR G2
GS Inima-Fisia JV	Ghubrah3	Oman	300,000	2025	440 GR G2
Via Maris Desalination & Construction	Palmachim Expansion	Israel	216,000	2020/2019/2015/ 2013/2012	440SR+440GRG2
GS Inima	Barka5	Oman	100,000	2023	440 GR G2
Metito	Al Arish	Egypt	100,000	2021	440 GR G2
Chennai Water Desalination Ltd.	Seawater Desalination Plant, Minjur	India	100,000	2020	400 GR G2
Metito	Corso	Algeria	82,000	2022	440 GR G2
EMALSA	Las Palmas III	Spain	80,000	2022/2021/2020/ 2019/2018/2017	440 SR + 440 GR G1&G2
AquaSwiss	Red Sea	Saudi Arabia	45,000	2023	440SRG2+GRG2
Cannon Artes	SOPC	Egypt	40,000	2023/2024	400GRG2+400RG2
MCDOMC	Al Ghubrah	Oman	30,000	2020	440 GR G2
Aqualia	Guaymas	Mexico	18,235	2019	440 GR G2
Coastal Gujarat Pvt Ltd (Tata Power)	Seawater Desalination	India	10,000	2022	440 GR G2
Udipi Power (Adani Power)	Seawater Desalination	India	10,000	2020	400 R G2
SWCC	Confidential	Saudi Arabia	5,000	2020	400 GR G2
Lientech	Taichung seawater desalination urgent sys	Taiwan	1,000	2021	400 GR G2
Vedanta Alumina	Waste Water Reuse	India	840	2020	GR G2
			1,838,075		

Cliente		Empreiteiro EPC			
		  			
Projeto nº.	Projeto		Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve		20/02/2025	01.0	12 de 95
Código AdA			Código ACE		
AL-ACE-3320-ME-DSH-ROM01			AL-INN-3320-ME-DSH-ROM01		



SWRO References List

Confidential

Customer	Project	Location	Size (m³/day)	Installation	Model
Minera La Escondida	Desalination plant for mining	Chile	24,000	2022	SW400SR/R
Gold Corp	Desalination plant for mining	Colombia	1,000	2021	SW400ES
Berrymex	Desalination plant for Agriculture	Mexico	4,198	2022	SW440RG2
Elmasa	ITC Demonstration Project	Spain	2,500	2023	440R, 440 SR
Tedagua	Escombreras	Spain	10,000	2023	400 SR, 440 R
Aqualia	LA Gomera _ SWRO mobile units	Spain	2,000	2023	
Aqualia	Mar de Alborán	Spain	60,000	2023	440 R
Chemipol _ ATL	ETAP La Tordera SWRO (Partial replacement)	Spain	60	2022	400 GR
SDEM Benisaf O&M UTE	Benisaf SWRO	Algeria	50,000	2023/2021	440 R
				2023/2022/2021/2 020/2019/ 2018/	440SR, 440GR G2&G1
EMALSA	Las Palmas III	Spain	70,000	2017	
Tedagua	Roque Prieto	Spain	10,000	2022/2018/2017	440 R
Elmasa	Puerto Rico	Spain	5,500	2023/2018	SR, GR
					440R, 440GR,
Desaladora Carboneras UTE	Carboneras retrofit	Spain	40,000	2023/2016	400GR
Ionios Iberica (Veolia)	Maspalomas 2	Spain	10,000	2023/2021/2016	GR
Saur	Saint Martin	France	5,000	2023	440SRG2
Culligan Italiana	Elba	Italy	5,000	2023/2024	440GRG2
Aqualatina	Ventotene	Italy	1,500	2023	440GR
Sychem	Syros	Greece	2,500	2023	440GR
Strongflow	Starkos	Brazil	10,000	2023	440 R
L*	Red Sea	Saudi Arabia	20,000	2023	440RG2/SRG2
Caldic Italia	Lipari	Italy	4,000	2023	440GR
Balass Bros	Mekorot Cohen/Lahat Sabha	Israel	3,000	2022	440R/440GR
MN Limassol	Limassol Desalination Plant	Cyprus	15,000	2023	440GR/440SR
Cannon Artes	SOPC	Egypt	40,000	2023/2024	400GRG2/RG2
Hangzhou Jiangrongdao Environment T	Yulong Petrochemical	China	78,000	2023	440 R
SHANGHAI HAOJIN ENVIRONMENTAL PRO	Zhongxin Guoan project	China	400	2023	400 R
ETERNAL ASIA SUPPLY CHAIN	Yu chemical	China	2,200	2023	400 GR
Shanghai Gloves and Headwater I/E Co. Ltd.	CHN Energy Pengjia	China	7,000	2023	400 R
Yantai Shunda Polyurethane Co.,Ltd.	Tianwan Nuclear plant	China	40,000	2023	400 GR
Beijing Daking Eastern Technology Co., Ltd		China	12,000	2023	400 GR
SHING CHUNG HONG CO., LTD.	Co Tech Phase 2 UPW	Taiwan	3,300	2022	400 SR, G2
WEI SHUNG TECHNOLOGY CORPORATION	Micron LSR waste water project	Taiwan	3,800	2022	400 ES
KUO TOONG INTERNATIONAL CO., LTD.	Jinmen Desalination plant	Taiwan	3,800	2022	440 ES
SHING CHUNG HONG CO., LTD.	PSMC WWR	Taiwan	600	2022	400 GR
SHANGHAI CHENSHU FLUID	salt lake-based lithium project	China	62,000	2022	440 R
QT Enviro-Tech (Suzhou) Ltd	Sadi City Mobile Desalination Plant Phase 1 PJT	China	24,000	2022	400 GR
Shanghai Aqua-til Environment Technology CO., LTD	CSOT T9 WWR	China	720	2022	400 R, G2
Zhiyi Environmental Technology	Zange Di and WWT project	China	21,600	2022	400 R
ETERNAL ASIA SUPPLY CHAIN	Yu energy ZLD system extend project	China	33,600	2022	400 R
SHANGHAI HAOJIN ENVIRONMENTAL PRO	salt lake-based lithium project	China	1,600	2022	400 R, 400 GR
ETERNAL ASIA SUPPLY CHAIN	Yunnan Yu Energy WWT Project	China	24,000	2022	400 R
BEIJING PRITT WATER TREATMENT	UZ Project	China	2,400	2022	400 R
Nanjing Skypro	Huaneng Power	China	300	2022	400 R
Kindasa Water Service Factory Co.	Kindasa, Jeddah Sea Port	Saudi Arabia	23,616	2022	400 GR
IWS	Sh.Mansour Bin Zayed Office	UAE	5,000	2021	400 R
Metto	Al Arish	Egypt	100,000	2021	440 GR G2
Metto	Corso	Egypt	82,000	2022	440 GR G2
Coastal Gujarat Pvt Ltd (Tata Power)	Seawater Desalination	India	10,000	2022	440 GR G2
Udipi Power (Adani Power)	Seawater Desalination	India	10,000	2000	400 R, G2
Tecnica Reunidas	Hamriyah IPP	UAE	9,400	2021	440 R
Veolia	Multiple refineries Italy	Italy	4,800	2021	440 R
MES	Reghaia	Algeria	60,000	2022	400 R
MES	Bateau Cassé	Algeria	10,000	2022	400 R
Mekorot	Ashdod	Israel	20,000	2022	440 R
GES	Nirobox	Israel	1,200	2021	440 R
Esil	Morocco	Morocco	16,000	2023	400 SR
Esil/Akasu	İçdaş SWRO plant 2nd part	Turkey	12,000	2021	440 R
Aka su	Sançam Municipal	Turkey	5,000	2021	440 R
Veolia Turkey	CENAL	Turkey	3,500	2023	440 GR
Chemipol _ ATL	ETAP La Tordera SWRO (Partial replacement)	Spain	60	2022	400 GR
JY	Qingdao Befesa SWRO Plant	China	100,000	2022	440GR
TL	Tangshan Haigang seawater desalination	China	50,000	2022	440GR
XGP	Huaneng weihai power plant seawater desalination n	China	9,000	2021	400 GR
Xinhe	Pakistan coal plant	China	3,500	2021	400 R
RXR	Qinshan steel Indonesia plant	China	10,000	2021	400 GR
Lientech	Taichung seawater desalination urgent system	Taiwan	1,000	2021	400GR G2
Tedagua	CAAF Mobile units	Spain	6,000	2,021	440 GR
UTE Ampliación Melilla (FCC Aqualia & ARPO)	Melilla SWRO Expansion project	Spain	16,000	2,021	440 R
SDEM Benisaf O&M UTE	Benisaf SWRO	Algeria	30,000	2,021	440 R
Seta PH Technology	Cuacala	Brasil	1,250	2,021	440 R
Suez	Hamma Desalination Plant	Algeria	100,000	2019/2021	400 R
Mekorot	Lahat Station	Israel	8,000	2021	440R
Mekorot	Sabha B	Israel	5,000	2021	440SR
ADOM	Ashkelon replacemnet	Israel	90,000	2020/2021	440GR
Fluence	Multiple Nirobox systems	Israel	2,000	2020/2021	440gr/ES/R

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	13 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		



SWRO References List

Confidential

SOFIP	Lampedusa	Italy	2,000	2021	440GR
SOFIP	Pantelleria	Italy	1,000	2021	440GR
Fildrop	Caprala	Italy	500	2021	440GR
Caldio Italy	Lipari	Italy	1,000	2021	440GR
Euraqua Europe	Manure water	Belgium	2,000	2019/2020/2021	400R
Norwater	Multiple watermakers	Norwater	5,000	2021	440ES
Temak	Syros	Greece	2,500	2021	440R
Esil	İçdağ SWRO plant	Turkey	15,000	2020/2021	440 R
Esil / ARC	Avşa SWRO WTP	Turkey	5,000	2021	440 R
Esil	MMK	Turkey	4,800	2021	440 R
SWCC	DTRI	Saudi Arabia	5,000	2020	400GR G2
Kindasa Water Service Factory Co.	Kindasa, Jeddah Sea Port	Saudi Arabia	4,200	2021	400 GR
Suez Middle East	Bahrain Steel	Bahrain	6,500	2021	400 R
Chenfull	Penghu seawater desalination plant	Taiwan	3,750	2019/2020	400 GR
Lientech	Hsinchu urgent seawater desalination plant	Taiwan	6,000	2021	400 GR
KenMec	Hsinchu urgent seawater desalination plant	Taiwan	4,000	2021	400 R
Shanxi Rutxin	wastewater reuse	China	18,000	2020	400 R
Qidi	Lithium extraction project	China	12,000	2020	440 R
G & F	Mazu seawater desalination plant	Taiwan	1,600	2020 / 2021	400 GR, R
GS Inima	Atacama	Chile	40,000	2021	440R+440ES
GIS AQUA	Nuweiba SWRO	Egypt	15,000	2021	400GR + 440GR
Norwater	Multiple Watermakers	Norway	7,000	2020	400 ES
Sychem	Syros	Greece	2,500	2020	440GR
Prentec	Twefontein	South Africa	5,000	2020	400R, GR, SR
Fluence	Mansoura	Egypt	40,000	2021	400GR+440R
Aqualia	Modular Plant Gulmar (Tenerife)	Spain	1,000	2020	400 GR
EMALSA	Las Palmas III	Spain	70,000	2021/2020/2019/	440SR,440GR
Mostaganem O&M UTE	Mostaganem	Algeria	150,000	2018/ 2017	G2&G1
Kurita Singapore	Semiconductor	Singapore		2020/2019/2016	440R
Kurita Singapore	Taiwan Display maker	Singapore		2019	SW440GR G2
S*	Major Semiconductor in Korea	Korea		2019	SW440R
Acciona Agua SA	Al Khobar 2	Saudi Arabia	636,300	2022	440 R
Acciona Agua SA	Shuqaiq 3	Saudi Arabia	453,150	2021	440 R
Via Maris Desalination & Construction	Palmachim Expansion	Israel	216,000	2020/2019/2015/	
Jauhara	Tifert	Tunisia	12,000	2013/2012	440 SR, GR G2
Chemipol	Las Galletas	Spain	4,800	2020/2017	GR
Qingdao Befesa	Qingdao Befesa SWRO Plant	China	49,000	2020/ 2018	GR, R
Sembcorp Gulf O&M Company	Fujairah 1	UAE	38,000	2019/2018/2017	440 GR
WTMI, Inc	Evonik	USA	1,700	2019 / 2020	440 GR
ML Ball	Milliken Chemicals	USA	250	2018/2019	440 SR
Tedagua	Roque Prieto	Spain	7,500	2018/2017	440 R
Degremont	Santa Barbara	Curacao	28,000	2018/2015/2012	R
ELMASA	Maspalomas 1	Spain	7,500	2018/2013	SR, GR
Juliano Bonny Gomez	Las Salinas	Spain	3,750	2017/2016/2014/201	R, SR
Suez-Tractebel O&M Oman (STOMO)	Banka II	Oman	40,000	2017/2016	R
Zhejiang FLR Environment	Luheng SWRO	China	20,000	2017/2016	400GR,400R
Korea Electric Power Co.	Samchuk Power Plant	Korea	2,000	2017/2016	R
Aritim	Famagusta	North Cyprus	6,000	2017/2015	R, GR
Degremont	Pto del Rosario IV, Train 2	Spain	7,200	2017/2015	R, SR
Pioneer Water Co.	Provo Water Plant	Turks & Caicos	2,600	2015/2013	R, SR
Rochem India	Multiple Effluent Polishing Sites	India	500	2014/2011	GR, R, ES
Chennai Water Desalination Ltd.	Seawater Desalination Plant, Minjur	India	100,000	2011-2013	ES, R
Reliance Industries	Waste Water Reuse	India	6,000	2020	400 GR G2
Vedanta Alumina	Waste Water Reuse	India	840	2020	400 R
Kamataka Power Corporation Ltd.	Power Plant, CTBO reuse	India	432	2020	GR G2
IOCL	IOCL Paradip	India	5,500	2020	R
Melito	SWRO on Barges	Saudi Arabia	3X51,000	2020	440 R
Melito	Jubail 2	Saudi Arabia	400,000	2021/2022	440 GRG2+440R
SWCC	DTRI	Saudi Arabia	2,000	2020	440 R
Esil	Nuh Cement	Turkey	2,000	2020	440 R
Tedagua _ CAAF	Portable units CAAF	Spain	6,000	2020	LG SW 440 GR
Indonesia South seawater treatment plant	Indonesia South seawater treatment project	China	3,000	2020	400GR
Datang Leizhou power plant	DaTang Leizhou power plant replacement project	China	20,000	2020	400GR
TianJin DaGang seawater treatment plant	TianJin DaGang seawater treatment project	China	90,000	2020	400R
Huanun Halfeng power plant CO., LTD (To be shipped)	Huanun Halfeng seawater desalination project	China	5,400	2020	400 GR
Huaneng Changxing power plant	Huaneng Changxing power plant	China	800	2020	400 GR
Fluence	J. Park project	Philippines	500	2020	400 GR, R
Fluence	Matsu project	Taiwan	1000	2020	440 SR, R
Acciona Agua SA	Arucas-Moya SWRO	Spain	7,500	2020	440 GR
Norwater	Fish farm	Norway	2,400	2020	400 ES
UNIDRO	Singapore	Singapore	1,000	2020	440 GR
SOFIP	Lampedusa	Italy	1,500	2020	440 GR
AST	Gozo SWRO	Malta	9000	2020	440 SR, GR
Akond	Socar SWRO	Azerbaijan	1500	2020	400 R
Suez	Adeje-Arona	Spain	7,500	2020	440 GR
Posco O&M	Gwangyang SWRO Project	Korea	5,520	2020	440 R
MCDOMC	Al Ghubrah	Oman	30,000	2020	440 GR G2
Joseph Gachia	Gozo	Malta	1,200	2019	440SR
Euraqua Europe	SW Belgium Aquifer recharge	Belgium	1,500	2019	400 R
Water Tech & Consulting	NAWASA	Grenada	800	2019	400 R
Qushan seawater desalination company	Qushan SWRO project	China	6,000	2019	400 GR
Gouqi Island seawater desalination company	Gouqi SWRO project phase 2	China	1,000	2019	400 GR
Gouqi Island seawater desalination company	Gouqi SWRO project phase 3	China	2,000	2019	400 GR

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	14 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		



SWRO References List

Confidential

Datang corporation	Datang Dongying power plant	China	10,000	2019	400 GR
Sichuan railway group	Malaysia SWRO project	Malaysia	1,000	2019	400GR
Sichuan Yibin waste treatment company	Yibin landfill leachate recycling system	China	290	2019	400 GR
Hunan Loudi waste treatment company	Loudi landfill leachate recycling system	China	230	2019	400 GR
Tianjin Shuangkou waste treatment company	Shuangkou landfill leachate recycling system	China	340	2019	400 GR
ZKB seawater plant	ZKB SWRO project	China	16,800	2019	400 R
Mettito	Duba	Saudi Arabia	125,000	2019	440 R
Mettito Overseas	Vlpingo SWRO	Oman		2019	400 R
Intech	Nabq	Egypt		2019	400 SR
Sidem	Sur Extension	Oman	5,000	2019	440 GR, R
Desalia	Four Seasons	Egypt	7,500	2019	400 R
Aqualia	Guaymas	Mexico	18,235	2019	440 GR G2
Consolidated Water Company of Cayman	Northside WTP	Cayman Islands	4,400	2019	440 R
Seven Seas*		Caribbean	2,500	2019	440 R
TSG Water	Bakers Bay	Bahamas	2,200	2019	440 R
Safon Water Technology*		Caribbean	2,500	2019	400 R
Agua de Antofagasta	Xylem la Chimba Plant	Antofagasta	2,093	2019	400 ES
Tampa Industrial	Bepensa (Coca-Cola DR)	Dominican Republic	3,200	2019	400 R
Drace	Lanzarote III	Spain	20,000	2019	440 SR, GR
Aclona Agua SA	Al Khobar 1	Saudi Arabia	210,000	2020	440 R
SOFIP	Pantelleria	Italy	1,500	2019	440 GR
Archean Chemicals	Seawater Desalination	India	7,500	2019	400 GR
Al Kawther	Duba	Saudi Arabia	2,650	2019	400 R
Aquatech Eastern	Emirates Global Aluminium	UAE	6,750	2019	440 GR
Entemanser	La Caleta	Spain	6,240	2019	440 GR, R
Evao Oy	Costa-1	Finland	2,500	2019	440 R, ES
Elmasa	Adeje municipality	Spain	2,000	2019	440 GR
Elmasa	El Cangrejo	Spain	2,000	2019	440 GR
Tedagua	Doraleh	Djibouti	22,600	2019	440 SR, GR
TAM Environment	Dabaa	Egypt	40,000	2019	400 R
AFJV	Salalah	Oman	120,000	2019	440 SR, GR
Mettito	East Port Said I	Egypt	150,000	2019	400GR+440GR
TOWC	Provo Water Plant	Turks & Caicos	2,000	2018	400 SR, R
Water Tech Sales & Consulting	APUA - Crabos Plant	Antigua	9,500	2018	400 R
Huadian Laizhou power plant	Laizhou power plant	China	3,600	2018	400 R
TAM Environment	Aln Elsohna Phase II	Egypt	100,000	2018	400 R
TAM Environment	Baghoush	Egypt	24,000	2018	400 R
Nirma Ltd.	Seawater Desalination	India	25,000	2018	400 SR
ONGC	Water Treatment Plant	India	120	2018	400 ES
Veolia	Fishing products Plant	Sonora	600	2018	440 R
Veolia	Hotel Westin	Cancun	710	2018	400 R
Chemipol	Playas de Jandia	Spain	1,800	2018	440 GR
Brenntag	MMK	Turkey	4,800	2018	440 R
Ecolab	Marina de Cope	Spain	11,760	2018	440 GR, R
Mettito Overseas	King Abdullah Economic City	Saudi Arabia	30,824	2018	440 R
Mettito Overseas	Shama Complex	Saudi Arabia	24,000	2018	400 R
Valoriza Agua	Sohar desalination plant	Oman	250,000	2018	400SR+440GR
Aqualia	El Alamein	Egypt	150,000	2018	440GR+440R
Mettito	El Galalah	Egypt	150,000	2018	440GR
PSR	Hebei Fengyue Energy seawater desalination project	China	75,000	2018	440 R
JV Aqualia-GS Inima	Cap Djinet	Algeria	25,000	2018	440 R
Tedagua	Al Hoesma	Morocco	17,000	2018	R
Proxa	Cape Town Municipality	South Africa	15,000	2018	R, ES
Elmasa	Puerto Rico	Spain	5,500	2018	SR, GR
Proxa	Saldaña	South Africa	2,160	2018	R
Safon Water Technology*		Mexico	1,900	2018	GR
TAM Environmental Services	NCIC	Egypt	64,000	2017	R
Aqualia	Janubio	Spain	12,000	2017	440 GR
Fluence	Richards Bay	South Africa	10,000	2017	G, R, ES
Advanced Equipment & Services*		Caribbean	7,200	2017	R
Wabag	Koh Samui Replacement	Thailand	7,200	2017	R
Fluence		Mauritania	5,000	2017	GR, R, ES
Sadyt	Formentera	Spain	5,000	2017	GR
Fluence	Vinci	Mayotte Island	3,000	2017	SR, GR
JSW Steel	ETP Recycle Plant for CRM-II	India	2,880	2017	GR
Veolia	Qulvira Hotel Resort	Mexico	2,000	2017	R
WATERA		Greece	2,000	2017	GR
Water Tech Sales & Consulting	CCA Limited	Saint Vincent	2,000	2017	GR/R
PT Asian Tec Indonesia	Petrochem Plant	Indonesia	1,800	2017	R
Water Tech Sales & Consulting	Saint George's University	Grenada	1,300	2017	R
Suez	Fuert Can	Spain	1,000	2017	SR
Sonelgaz	Tergua	Algeria	600	2017	ES
Advanced Equipment & Services*		Caribbean	600	2017	R
Republic of Korea NAVY	Incheon desalination Plant	Korea	500	2017	R
Sea Level System*		Caribbean	200	2017	SR/ES
Sea RO*		Caribbean	200	2017	R
Sea RO*		Caribbean	200	2017	R
Water Services Corporation	Pembroke	Malta	35,000	2016	440SR+440GR
GS Inima	Ensenada Plant	Mexico	26,000	2016	400R+440R
Desaladora Carboneras UTE	Carboneras retrofit	Spain	20,000	2016	440R
Water Services Corporation	Lapsi	Malta	19,000	2016	SR
Water Services Corporation	Cirkewwa	Malta	9,000	2016	SR
Ionios Iberica	Maspalomas 2	Spain	5,000	2016	GR
REQ	Phuket Replacement	Thailand	3,840	2016	R
Degremont	Gran Tarajal	Spain	2,500	2016	SR
Temak		Kuwait	2,400	2016	R, SR

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	15 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		



SWRO References List

Confidential

Degremont	Corralejo	Spain	2,200	2016	SR
Chuja-do	Chuja purification plant	Korea	1,000	2016	SR
TAM Environmental Services	Matrouh Remela Phase 1	Egypt	24,000	2015	400 R
TAM Environmental Services	Matrouh Remela Phase 2	Egypt	24,000	2015	400 R
Mekorot	Lahat Station	Israel	23,000	2015	R, ES
Mekorot	Sabha B	Israel	16,000	2015	GR, SR
UTE Canaragua-Eimasa	EDAM Bocabarranco	Spain	10,000	2015	GR
Codelisa	Ibiza SWRO	Spain	6,960	2015	GR
Codelisa	San Antonio SWRO	Spain	6,840	2015	GR
AES Arabia	Eastern Province Housing	Saudi Arabia	4,500	2015	R
AES Arabia	Ras AlMishaab	Saudi Arabia	4,500	2015	R
Inexa	ASRY	Bahrain	3,500	2015	SR
Canaragua Concesiones	La Aldea	Spain	2,800	2015	SR
WatMan	Mein Schiff 4	Finland	2,145	2015	ES, R
Gama Kimya		Turkmenistan	1,500	2015	ES, R
Eolica del Sureste SL	Finca San Antonio	Spain	1,440	2015	R, GR
Desalia	Majlis Industrial Estate	Oman	3,000	2014	R
Agua de Bayovar	Agua de Bayovar	Peru	2,500	2014	R
TAM Environmental Services	Sahel Hashish, Hurghada	Egypt	2,000	2014	R
Mustique Co.		Mustique	950	2014	
TAM Environmental Services	Egyptian Resorts co., Hurghada	Egypt	700	2014	
TAM Environmental Services	Oriental Resort, Sharm-el-Sheik	Egypt	700	2014	
Acclona Agua SA	Lanzarote V	Spain	18,000	2013	400SR+400R
WEB Aruba	WEB Aruba Plant #2	Aruba	14,000	2013	ES, R, SR
Veolia	WEB Aruba Plant #1	Aruba	8,500	2013	ES
Comunidad Agrícola Los Roques	El Sobradillo	Spain	1,100	2013	SR
Nirosoft	Chanavayit	Chile	1,000	2013	ES, SR
ELMASA	La Restinga Expansion	Spain	1,000	2013	R, SR
Wasser	BWRO Cancun Project	Mexico	500	2013	
Atacama Water & Technology	La Chimba Expansion	Chile	7,560	2012	ES, SR
Ion Exchange Inc*	Industrial Client	India	1,000	2012	ES, R
Xylem	La Chimba SWRO Plant	Chile	1,000	2012	R, SR
IDE	Progreen	Israel	1,000	2012	R
St. Kitts Sewer & Water	Marriott Hotel	St. Kitts	1,000	2012	
Advanced Watertek LLC	BWRO, Camel Milk Dairy Farm	UAE	800	2012	
TAM Environmental Services	Radamis, Sharm-el-Sheik	Egypt	700	2012	
Bairregos	Agua de Ponta Preta	Cape Verde	625	2012	
Mahogany Run	Mahogany Run Golf Course	USVI	575	2012	
Yonsan Engineering	Maldives Hotel/Resort	Maldives	500	2012	
Veolia Water	Waller Marine	Venezuela	4,500	2011	ES
TSG Water Anguilla	Cushart Golf Course	Anguilla	3,785	2011	ES
Indian EPC (Confidential)*	>25 SWRO Plate & Frame Plants	India	1,000	2011	ES, R
Water Authority Cayman	Cayman Brac	Cayman Islands	550	2011	
Agua de Antofagasta	Taitai SWRO Plant	Chile	500	2011	
Rochem India	Patron Tequila Plant	Mexico	500	2011	
SoiWater	Mobile Unit	Spain	500	2011	

* Customer does not permit LG Chem to identify by name.

Updated July, 2023

FOLHAS DE CÁLCULO RELATIVAS AO DESEMPENHO DAS MEMBRANAS PORPOSTAS PARA, PELO MENOS, AS COMBINAÇÕES REFERIDAS NA ALÍNEA 4 DO PONTO 1.1 DO ANEXO VI- Projeto a apresentar com a Proposta, do Programa do Procedimento

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
Stage 1	134	7	m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
				10,801.73	13,198.27	57.68	56.95	0.73	0	0	0	12.91	64.11

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,564.02	11,852.04	21,533.17	23.00
Potassium	402.64	412.67	749.63	0.94
Magnesium	1,314.09	1,346.82	2,448.62	0.57
Calcium	432.07	442.84	805.11	0.19
Strontium	8.13	8.33	15.14	0.00
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,500.00	21,010.60	38,175.29	0.17
Sulfate	2,950.00	3,023.48	5,497.51	0.54
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.06	3.09	5.62	0.00
Bicarbonate	125.00	128.11	232.50	0.56
Boron	4.84	4.96	8.64	0.47
Bromide	89.00	91.22	165.74	0.16
Silica	0.20	0.20	0.37	0.00
CO2	1.27	1.27	1.27	1.27
TDS	37,395.13	38,326.49	69,641.20	64.11
pH	8.10	8.10	8.34	5.93

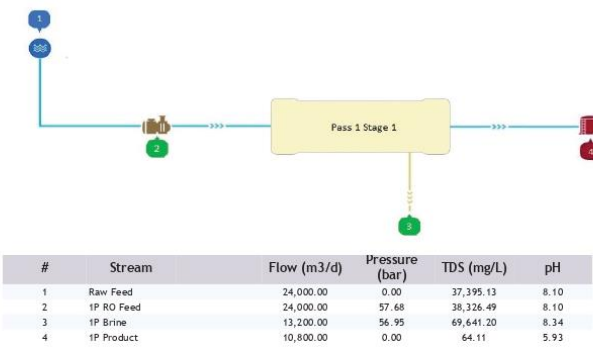
		Position	RO feed	Permeate	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
			flow m3/d	flow m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1											
LG SW 400 R G2	1		179.10	21.05	23.60	11.75	0.16	23.96	1.20	38,322.50	27.67
LG SW 400 R G2	2		158.00	16.98	19.04	10.75	0.13	20.25	1.18	43,421.54	37.91
LG SW 400 R G2	3		141.07	13.41	15.04	9.51	0.11	16.82	1.15	48,644.76	52.27
LG SW 400 R G2	4		127.66	10.42	11.68	8.16	0.10	13.78	1.13	53,750.19	72.20
LG SW 400 R G2	5		117.25	8.00	8.97	6.82	0.08	11.17	1.10	58,518.71	99.48
LG SW 400 R G2	6		109.25	6.10	6.84	5.59	0.08	9.00	1.08	62,795.19	136.29
LG SW 400 R G2	7		103.15	4.65	5.21	4.51	0.07	7.21	1.07	66,503.02	185.23

	Solubility calculation	
	Feed	Conc.
LSI	0.82	1.87
CaSO ₄	24.49 %	52.86 %
SrSO ₄	15.51 %	40.71 %
BaSO ₄	0 %	0 %
CaF ₂	52.13 %	330.41 %
SiO ₂	0 %	0 %
Stiff Davis Index	-0.73	0.32

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	17 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk. When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure. LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design. Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
		  			
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	18 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

			2024-05-13 10:51:22
Project name:	Water type: Algarve Ave Inima*	Membrane age: 3.6	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 60.84 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 37,395.13 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 25.72 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 47.87 bar	
System - Pass1		
Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 13 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 20.67 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 38,326.49 mg/L	Specific energy: 2.7 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 26.36 bar	Feed pressure: 60.84 bar
Number of elements: 938	Concentrate osmotic pressure: 47.87 bar	Permeate TDS: 80.96 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 0.8
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,795.92	13,204.08	60.84	60.09	0.75	0	0	0	12.91	80.96

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,564.02	11,852.04	21,518.74	29.06
Potassium	402.64	412.67	749.10	1.18
Magnesium	1,314.09	1,346.82	2,447.42	0.72
Calcium	432.07	442.84	804.71	0.24
Strontium	8.13	8.33	15.14	0.00
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,500.00	21,010.60	38,150.38	47.58
Sulfate	2,950.00	3,023.48	5,494.98	0.68
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.06	3.09	5.62	0.00
Bicarbonate	125.00	128.11	232.28	0.71
Boron	4.84	4.96	8.55	0.57
Bromide	89.00	91.22	165.63	0.21
Silica	0.20	0.20	0.37	0.00
CO2	1.27	1.27	1.27	1.27
TDS	37,395.13	38,326.49	69,596.77	80.96
pH	8.10	8.10	8.34	6.03

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	19.51	21.87	10.89	0.16	27.75	1.18	38,322.50	37.36
LG SW 400 R G2	2	159.60	16.31	18.28	10.22	0.14	24.19	1.17	43,002.10	49.31
LG SW 400 R G2	3	143.29	13.36	14.99	9.33	0.11	20.76	1.15	47,890.10	65.63
LG SW 400 R G2	4	129.93	10.77	12.08	8.29	0.10	17.58	1.13	52,809.42	87.73
LG SW 400 R G2	5	119.16	8.57	9.61	7.19	0.09	14.73	1.11	57,574.67	117.41
LG SW 400 R G2	6	110.59	6.75	7.57	6.11	0.08	12.25	1.09	62,025.35	156.77
LG SW 400 R G2	7	103.84	5.30	5.94	5.10	0.07	10.13	1.08	66,049.33	208.31

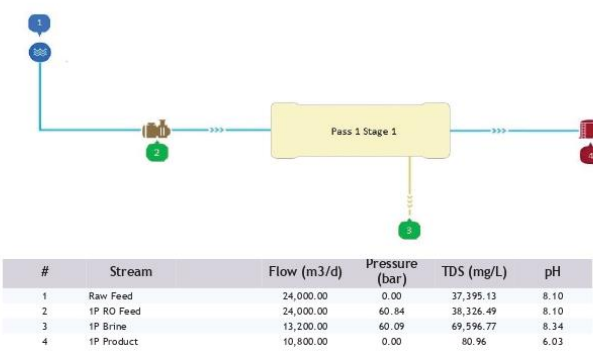
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.82	1.86
CaSO4	24.49 %	52.83 %
SrSO4	15.51 %	40.68 %
BaSO4	0 %	0 %
CaF2	52.13 %	329.69 %
SiO2	0 %	0 %
Stiff Davis Index	-0.73	0.32

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	19 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk. When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure. LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design. Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
					
Projeto n.º	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	20 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

			2024-05-13 10:51:23
Project name:	Water type: Algarve Ave Inima*	Membrane age: 0	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 55.9 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 37,396.18 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 26.26 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 48.91 bar	

System - Pass1

Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 19 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 14.92 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 38,327.55 mg/L	Specific energy: 2.49 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 26.91 bar	Feed pressure: 55.9 bar
Number of elements: 938	Concentrate osmotic pressure: 48.91 bar	Permeate TDS: 102.96 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 1
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,807.52	13,192.48	55.9	55.19	0.72	0	0	0	12.92	102.96

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,564.52	11,852.55	21,532.09	36.97
Potassium	402.66	412.68	749.53	1.51
Magnesium	1,314.15	1,346.88	2,449.52	0.92
Calcium	432.09	442.85	805.40	0.30
Strontium	8.13	8.33	15.15	0.00
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,500.00	21,010.60	38,173.29	60.54
Sulfate	2,950.00	3,023.48	5,499.66	0.86
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.52	3.56	6.47	0.00
Bicarbonate	125.00	128.11	232.33	0.90
Boron	4.84	4.96	8.48	0.67
Bromide	89.00	91.22	165.73	0.26
Silica	0.20	0.20	0.37	0.00
CO2	1.15	1.15	1.15	1.15
TDS	37,396.18	38,327.55	69,641.86	102.96
pH	8.10	8.10	8.34	6.13

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	23.04	25.83	12.86	0.16	21.22	1.20	38,323.71	40.86
LG SW 400 R G2	2	156.06	17.77	19.92	11.38	0.13	17.27	1.17	43,975.38	58.81
LG SW 400 R G2	3	138.30	13.38	15.00	9.67	0.11	13.77	1.14	49,617.54	84.98
LG SW 400 R G2	4	124.92	9.91	11.11	7.93	0.09	10.83	1.11	54,921.08	122.50
LG SW 400 R G2	5	115.01	7.28	8.16	6.33	0.08	8.44	1.09	59,642.37	175.31
LG SW 400 R G2	6	107.73	5.34	5.99	4.96	0.07	6.54	1.07	63,661.90	248.12
LG SW 400 R G2	7	102.39	3.94	4.41	3.84	0.07	5.06	1.05	66,972.16	346.67

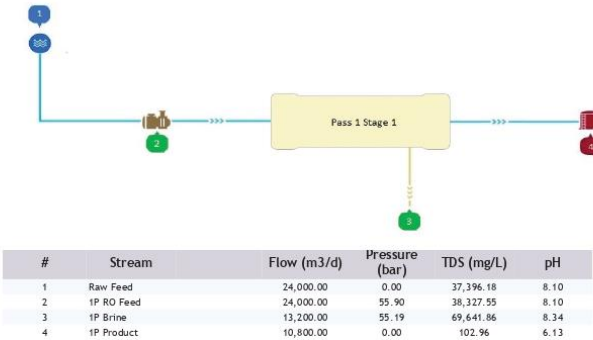
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.91	1.95
CaSO4	24.49 %	52.9 %
SrSO4	15.51 %	40.75 %
BaSO4	0 %	0 %
CaF2	51.64 %	327.31 %
SiO2	0 %	0 %
Stiff Davis Index	-0.65	0.4

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	21 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk. When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure. LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design. Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
					
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	22 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

			2024-05-13 10:51:23
Project name:	Water type: Algarve Ave Inima*	Membrane age: 3.6	
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%	v3.3.0.1	

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 58.32 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 37,396.18 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 26.26 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 48.87 bar	

System - Pass1

Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 19 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 17.61 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 38,327.55 mg/L	Specific energy: 2.59 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 26.91 bar	Feed pressure: 58.32 bar
Number of elements: 938	Concentrate osmotic pressure: 48.87 bar	Permeate TDS: 129.81 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 0.8
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,803.14	13,196.86	58.32	57.59	0.73	0	0	0	12.91	129.81

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,564.52	11,852.55	21,517.04	46.63
Potassium	402.66	412.68	748.96	1.90
Magnesium	1,314.15	1,346.88	2,448.50	1.16
Calcium	432.09	442.85	805.07	0.38
Strontium	8.13	8.33	15.14	0.01
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,500.00	21,010.60	38,147.68	76.35
Sulfate	2,950.00	3,023.48	5,497.65	1.09
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.52	3.56	6.47	0.00
Bicarbonate	125.00	128.11	232.06	1.14
Boron	4.84	4.96	8.36	0.81
Bromide	89.00	91.22	165.62	0.33
Silica	0.20	0.20	0.37	0.00
CO2	1.15	1.15	1.15	1.15
TDS	37,396.18	38,327.55	69,596.76	129.81
pH	8.10	8.10	8.34	6.23

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	21.19	23.76	11.83	0.16	24.38	1.18	38,323.71	55.45
LG SW 400 R G2	2	157.92	17.05	19.12	10.80	0.13	20.59	1.16	43,458.09	76.30
LG SW 400 R G2	3	140.86	13.42	15.05	9.53	0.11	17.07	1.14	48,710.64	105.72
LG SW 400 R G2	4	127.44	10.38	11.64	8.15	0.10	13.96	1.12	53,830.05	146.75
LG SW 400 R G2	5	117.06	7.94	8.90	6.78	0.08	11.29	1.09	58,591.59	203.13
LG SW 400 R G2	6	109.12	6.04	6.77	5.54	0.08	9.08	1.08	62,840.64	279.31
LG SW 400 R G2	7	103.08	4.59	5.15	4.46	0.07	7.27	1.06	66,506.63	380.37

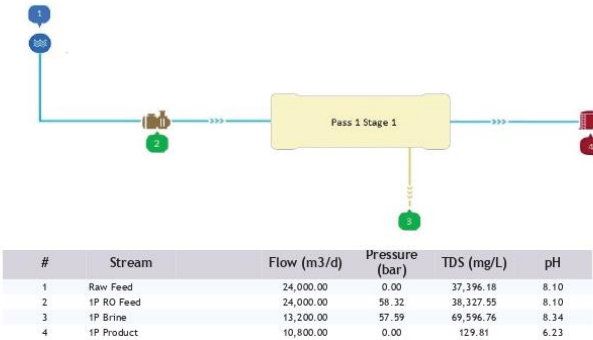
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.91	1.95
CaSO4	24.49 %	52.88 %
SrSO4	15.51 %	40.72 %
BaSO4	0 %	0 %
CaF2	51.64 %	326.58 %
SiO2	0 %	0 %
Stiff Davis Index	-0.65	0.4

Cliente		Empreiteiro EPC		
				
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	23 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk. When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure. LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design. Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
		  			
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	24 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

			2024-05-13 10:51:24
Project name:	Water type: Algarve Ave Inima*	Membrane age: 0	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System		
Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 55.09 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 37,396.95 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 26.62 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 49.56 bar	
System - Pass1		
Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 23 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 13.65 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 38,328.34 mg/L	Specific energy: 2.45 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 27.28 bar	Feed pressure: 55.09 bar
Number of elements: 938	Concentrate osmotic pressure: 49.56 bar	Permeate TDS: 139.81 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 1
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,809.66	13,190.34	55.09	54.38	0.71	0	0	0	12.92	139.81

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,564.88	11,852.92	21,525.37	50.24
Potassium	402.67	412.70	749.23	2.05
Magnesium	1,314.19	1,346.92	2,449.72	1.25
Calcium	432.11	442.87	805.47	0.41
Strontium	8.13	8.33	15.15	0.01
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,500.00	21,010.60	38,161.65	82.26
Sulfate	2,950.00	3,023.48	5,500.29	1.17
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.86	3.90	7.10	0.00
Bicarbonate	125.00	128.11	232.10	1.23
Boron	4.84	4.96	8.36	0.82
Bromide	89.00	91.22	165.68	0.36
Silica	0.20	0.20	0.37	0.00
CO2	1.08	1.08	1.08	1.08
TDS	37,396.95	38,328.34	69,624.33	139.81
pH	8.10	8.10	8.34	6.26

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	24.50	27.48	13.68	0.16	19.69	1.21	38,324.59	52.44
LG SW 400 R G2	2	154.60	18.26	20.47	11.81	0.13	15.57	1.17	44,390.88	78.30
LG SW 400 R G2	3	136.34	13.27	14.88	9.73	0.11	12.06	1.13	50,325.57	117.06
LG SW 400 R G2	4	123.07	9.51	10.66	7.72	0.09	9.21	1.10	55,739.02	173.93
LG SW 400 R G2	5	113.57	6.78	7.60	5.97	0.08	6.98	1.08	60,390.28	255.40
LG SW 400 R G2	6	106.79	4.85	5.44	4.54	0.07	5.27	1.06	64,208.02	369.19
LG SW 400 R G2	7	101.94	3.50	3.92	3.43	0.07	3.99	1.04	67,245.87	524.18

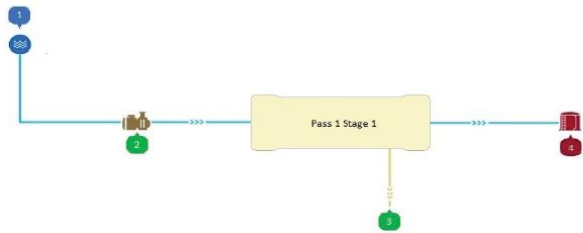
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.97	2.02
CaSO4	24.49 %	52.91 %
SrSO4	15.51 %	40.76 %
BaSO4	0 %	0 %
CaF2	51.46 %	325.86 %
SiO2	0 %	0 %
Stiff Davis Index	-0.6	0.45

Cliente		Empreiteiro EPC			
					
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	25 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

Warnings - Pass1

-Polarization exceeds recommended maximum value of 1.2 for Seawater-Open Intake (SOI+S) water type.
Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk.
When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure.
LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design.
Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



#	Stream	Flow (m3/d)	Pressure (bar)	TDS (mg/L)	pH
1	Raw Feed	24,000.00	0.00	37,396.95	8.10
2	1P RO Feed	24,000.00	55.09	38,328.34	8.10
3	1P Brine	13,200.00	54.38	69,624.33	8.34
4	1P Product	10,800.00	0.00	139.81	6.26

Cliente		Empreiteiro EPC		
		  		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	26 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

			2024-05-13 10:51:24
Project name:	Water type: Algarve Ave Inima*	Membrane age: 3.6	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 57.1 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 37,396.95 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 26.62 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 49.53 bar	
System - Pass1		
Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 23 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 15.98 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 38,328.34 mg/L	Specific energy: 2.54 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 27.28 bar	Feed pressure: 57.1 bar
Number of elements: 938	Concentrate osmotic pressure: 49.53 bar	Permeate TDS: 176.1 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 0.8
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,806.54	13,193.46	57.1	56.38	0.72	0	0	0	12.92	176.1

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,564.88	11,852.92	21,509.59	63.30
Potassium	402.67	412.70	748.62	2.58
Magnesium	1,314.19	1,346.92	2,448.87	1.58
Calcium	432.11	442.87	805.19	0.51
Strontium	8.13	8.33	15.15	0.01
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,500.00	21,010.60	38,135.13	103.64
Sulfate	2,950.00	3,023.48	5,498.74	1.48
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.86	3.90	7.10	0.00
Bicarbonate	125.00	128.11	231.78	1.55
Boron	4.84	4.96	8.22	0.98
Bromide	89.00	91.22	165.56	0.45
Silica	0.20	0.20	0.37	0.00
CO2	1.08	1.08	1.08	1.08
TDS	37,396.95	38,328.34	69,578.17	176.10
pH	8.10	8.10	8.34	6.36

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	22.44	25.16	12.53	0.16	22.53	1.19	38,324.59	71.36
LG SW 400 R G2	2	156.67	17.55	19.68	11.20	0.13	18.57	1.16	43,802.64	101.29
LG SW 400 R G2	3	139.12	13.40	15.03	9.63	0.11	15.01	1.13	49,315.47	144.57
LG SW 400 R G2	4	125.72	10.06	11.28	8.00	0.09	11.96	1.11	54,556.63	206.13
LG SW 400 R G2	5	115.66	7.49	8.40	6.47	0.08	9.44	1.08	59,285.15	292.07
LG SW 400 R G2	6	108.17	5.56	6.24	5.14	0.07	7.42	1.07	63,369.05	409.45
LG SW 400 R G2	7	102.61	4.15	4.65	4.04	0.07	5.82	1.05	66,782.01	565.87

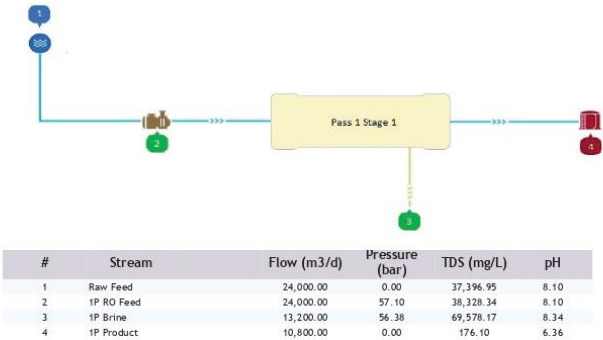
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.97	2.01
CaSO4	24.49 %	52.9 %
SrSO4	15.51 %	40.74 %
BaSO4	0 %	0 %
CaF2	51.46 %	325.11 %
SiO2	0 %	0 %
Stiff Davis Index	-0.6	0.45

Cliente		Empreiteiro EPC		
				
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	27 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk.
When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure.
LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design.
Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC		
		  		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	28 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

			2024-05-13 10:51:49
Project name:	Water type: Algarve Max Inima*	Membrane age: 0	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System		
Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 58.88 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 38,192.89 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 26.3 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 48.99 bar	
System - Pass1		
Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 13 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 17.58 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 39,144.13 mg/L	Specific energy: 2.62 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 26.96 bar	Feed pressure: 58.88 bar
Number of elements: 938	Concentrate osmotic pressure: 48.99 bar	Permeate TDS: 65.57 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 1
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,800.88	13,199.12	58.88	58.15	0.73	0	0	0	12.91	65.57

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,816.89	12,111.20	22,002.58	23.53
Potassium	411.44	421.69	765.98	0.96
Magnesium	1,342.83	1,376.27	2,502.00	0.59
Calcium	441.52	452.52	822.66	0.19
Strontium	8.30	8.51	15.47	0.00
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	21,000.00	21,523.06	39,103.88	38.56
Sulfate	2,950.00	3,023.48	5,497.16	0.54
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.00	3.03	5.51	0.00
Bicarbonate	122.00	125.04	226.91	0.55
Boron	4.84	4.96	8.64	0.47
Bromide	89.80	92.04	167.22	0.16
Silica	0.20	0.20	0.37	0.00
CO2	1.24	1.24	1.24	1.24
TDS	38,192.89	39,144.13	71,122.22	65.57
pH	8.10	8.10	8.34	5.93

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	21.18	23.75	11.83	0.16	24.34	1.20	39,140.15	28.14
LG SW 400 R G2	2	157.92	17.04	19.10	10.79	0.13	20.54	1.18	44,387.05	38.69
LG SW 400 R G2	3	140.88	13.41	15.03	9.52	0.11	17.04	1.15	49,749.63	53.53
LG SW 400 R G2	4	127.48	10.38	11.63	8.14	0.10	13.95	1.13	54,975.55	74.14
LG SW 400 R G2	5	117.10	7.95	8.91	6.79	0.08	11.31	1.10	59,840.25	102.37
LG SW 400 R G2	6	109.16	6.05	6.79	5.54	0.08	9.11	1.08	64,188.60	140.47
LG SW 400 R G2	7	103.11	4.60	5.16	4.47	0.07	7.31	1.07	67,947.83	191.08

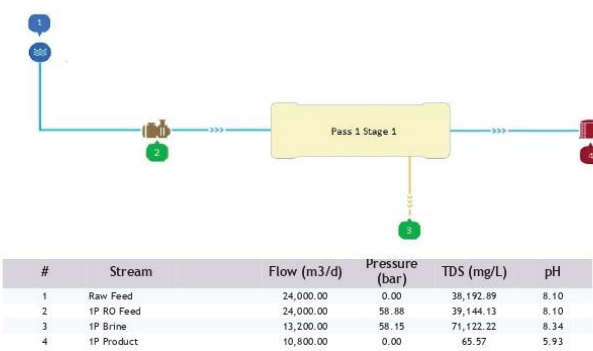
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.83	1.88
CaSO4	24.63 %	53.26 %
SrSO4	15.66 %	41.43 %
BaSO4	0 %	0 %
CaF2	53.13 %	340.22 %
SiO2	0 %	0 %
Stiff Davis Index	-0.73	0.34

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	29 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk. When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure. LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design. Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
					
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	30 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

			2024-05-13 10:51:49
Project name:	Water type: Algarve Max Inima*	Membrane age: 3.6	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 62.08 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 38,192.89 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 26.3 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 48.96 bar	

System - Pass1

Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 13 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 20.99 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 39,144.13 mg/L	Specific energy: 2.76 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 26.96 bar	Feed pressure: 62.08 bar
Number of elements: 938	Concentrate osmotic pressure: 48.96 bar	Permeate TDS: 82.8 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 0.8
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,795.62	13,204.38	62.08	61.33	0.75	0	0	0	12.9	82.8

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,816.89	12,111.20	21,988.77	29.72
Potassium	411.44	421.69	765.47	1.21
Magnesium	1,342.83	1,376.27	2,500.87	0.75
Calcium	441.52	452.52	822.29	0.24
Strontium	8.30	8.51	15.47	0.00
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	21,000.00	21,523.06	39,080.03	48.71
Sulfate	2,950.00	3,023.48	5,494.85	0.68
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.00	3.03	5.51	0.00
Bicarbonate	122.00	125.04	226.70	0.69
Boron	4.84	4.96	8.55	0.57
Bromide	89.80	92.04	167.11	0.21
Silica	0.20	0.20	0.37	0.00
CO2	1.24	1.24	1.24	1.24
TDS	38,192.89	39,144.13	71,079.84	82.80
pH	8.10	8.10	8.34	6.03

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	19.64	22.02	10.96	0.16	28.19	1.19	39,140.15	37.98
LG SW 400 R G2	2	159.47	16.36	18.35	10.26	0.14	24.53	1.17	43,955.15	50.30
LG SW 400 R G2	3	143.11	13.37	14.99	9.34	0.11	21.03	1.15	48,974.96	67.15
LG SW 400 R G2	4	129.74	10.74	12.04	8.28	0.10	17.79	1.13	54,013.53	90.02
LG SW 400 R G2	5	119.00	8.52	9.55	7.16	0.09	14.90	1.11	58,878.99	120.74
LG SW 400 R G2	6	110.49	6.70	7.51	6.06	0.08	12.39	1.09	63,408.33	161.50
LG SW 400 R G2	7	103.79	5.25	5.88	5.06	0.07	10.26	1.07	67,490.68	214.84

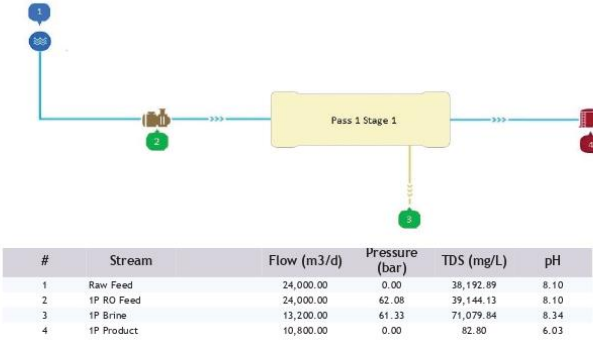
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.83	1.88
CaSO4	24.63 %	53.23 %
SrSO4	15.66 %	41.4 %
BaSO4	0 %	0 %
CaF2	53.13 %	339.52 %
SiO2	0 %	0 %
Stiff Davis Index	-0.73	0.34

Cliente		Empreiteiro EPC		
				
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	31 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk.
When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure.
LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design.
Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
		  			
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	32 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

			2024-05-13 10:51:50
Project name:	Water type: Algarve Max Inima*	Membrane age: 0	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 57.1 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 38,193.93 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 26.85 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 50.02 bar	

System - Pass1

Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 19 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 15.17 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 39,145.18 mg/L	Specific energy: 2.54 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 27.52 bar	Feed pressure: 57.1 bar
Number of elements: 938	Concentrate osmotic pressure: 50.02 bar	Permeate TDS: 105.29 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 1
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,807.51	13,192.49	57.1	56.38	0.72	0	0	0	12.92	105.29

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,817.38	12,111.71	22,002.85	37.81
Potassium	411.46	421.71	765.92	1.54
Magnesium	1,342.88	1,376.33	2,503.06	0.95
Calcium	441.54	452.54	823.01	0.31
Strontium	8.30	8.51	15.48	0.00
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	21,000.00	21,523.06	39,104.33	61.98
Sulfate	2,950.00	3,023.48	5,499.65	0.87
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.45	3.48	6.34	0.00
Bicarbonate	122.00	125.04	226.75	0.88
Boron	4.84	4.96	8.48	0.67
Bromide	89.80	92.04	167.22	0.27
Silica	0.20	0.20	0.37	0.00
CO2	1.12	1.13	1.13	1.13
TDS	38,193.93	39,145.18	71,127.30	105.29
pH	8.10	8.10	8.34	6.13

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	23.20	26.01	12.95	0.16	21.56	1.20	39,141.34	41.54
LG SW 400 R G2	2	155.91	17.81	19.97	11.43	0.13	17.52	1.17	44,958.82	60.04
LG SW 400 R G2	3	138.09	13.36	14.98	9.67	0.11	13.96	1.14	50,750.82	87.07
LG SW 400 R G2	4	124.74	9.86	11.06	7.91	0.09	10.97	1.11	56,176.32	125.88
LG SW 400 R G2	5	114.87	7.23	8.11	6.29	0.08	8.55	1.09	60,988.62	180.52
LG SW 400 R G2	6	107.65	5.30	5.94	4.92	0.07	6.63	1.07	65,072.20	255.81
LG SW 400 R G2	7	102.35	3.90	4.37	3.81	0.07	5.14	1.05	68,426.67	357.60

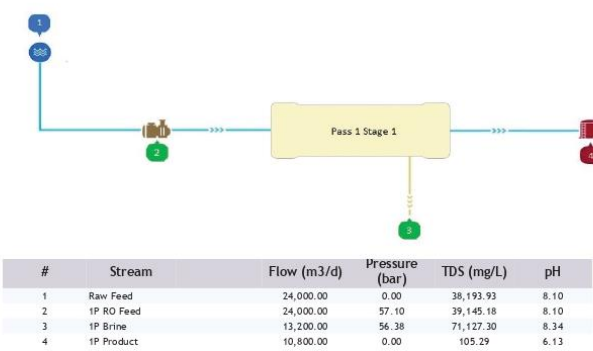
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.92	1.97
CaSO4	24.63 %	53.3 %
SrSO4	15.66 %	41.47 %
BaSO4	0 %	0 %
CaF2	52.64 %	337.1 %
SiO2	0 %	0 %
Stiff Davis Index	-0.65	0.42

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	33 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk. When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure. LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design. Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC		
				
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	34 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

			2024-05-13 10:51:51
Project name:	Water type: Algarve Max Inima*	Membrane age: 3.6	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 59.55 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 38,193.93 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 26.85 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 49.98 bar	
System - Pass1		
Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 19 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 17.9 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 39,145.18 mg/L	Specific energy: 2.65 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 27.52 bar	Feed pressure: 59.55 bar
Number of elements: 938	Concentrate osmotic pressure: 49.98 bar	Permeate TDS: 132.76 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 0.8
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,802.91	13,197.09	59.55	58.82	0.73	0	0	0	12.91	132.76

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,817.38	12,111.71	21,987.11	47.69
Potassium	411.46	421.71	765.32	1.94
Magnesium	1,342.88	1,376.33	2,501.99	1.20
Calcium	441.54	452.54	822.66	0.39
Strontium	8.30	8.51	15.47	0.01
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	21,000.00	21,523.06	39,077.48	78.17
Sulfate	2,950.00	3,023.48	5,497.55	1.09
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.45	3.48	6.33	0.00
Bicarbonate	122.00	125.04	226.48	1.11
Boron	4.84	4.96	8.36	0.81
Bromide	89.80	92.04	167.10	0.33
Silica	0.20	0.20	0.37	0.00
CO2	1.12	1.13	1.13	1.13
TDS	38,193.93	39,145.18	71,080.08	132.76
pH	8.10	8.10	8.34	6.23

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	21.33	23.92	11.91	0.16	24.78	1.19	39,141.34	56.36
LG SW 400 R G2	2	157.77	17.11	19.18	10.84	0.13	20.89	1.16	44,426.13	77.86
LG SW 400 R G2	3	140.66	13.41	15.04	9.54	0.11	17.30	1.14	49,819.90	108.24
LG SW 400 R G2	4	127.25	10.34	11.60	8.13	0.10	14.13	1.12	55,060.75	150.68
LG SW 400 R G2	5	116.91	7.89	8.84	6.75	0.08	11.43	1.09	59,918.26	209.04
LG SW 400 R G2	6	109.02	5.99	6.71	5.49	0.08	9.20	1.07	64,238.25	287.89
LG SW 400 R G2	7	103.03	4.55	5.10	4.41	0.07	7.38	1.06	67,954.54	392.37

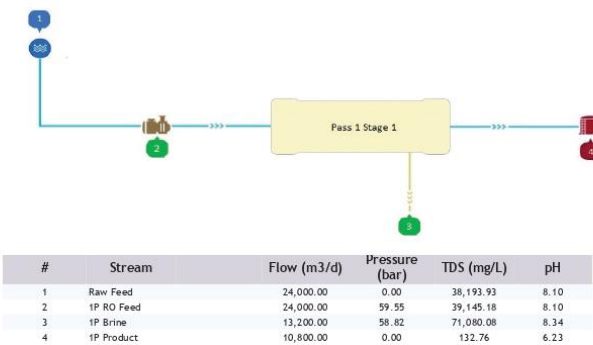
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.92	1.97
CaSO4	24.63 %	53.28 %
SrSO4	15.66 %	41.44 %
BaSO4	0 %	0 %
CaF2	52.64 %	336.33 %
SiO2	0 %	0 %
Stiff Davis Index	-0.65	0.42

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	35 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk. When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure. LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design. Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
		  			
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	36 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			



2024-05-13 10:51:51

v3.3.0.1

Project name:	Water type: Algarve Max Inima'	Membrane age: 0
Customer:	Flux loss per year: 6.00%	Safety factor: 1
Username:	Salt passage increase: 7.00%	

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 56.28 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 38,194.69 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 27.22 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 50.69 bar	
System - Pass1		
Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 23 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 13.89 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 39,145.95 mg/L	Specific energy: 2.5 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 27.9 bar	Feed pressure: 56.28 bar
Number of elements: 938	Concentrate osmotic pressure: 50.69 bar	Permeate TDS: 142.99 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 1
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,809.48	13,190.52	56.28	55.58	0.7	0	0	0	12.92	142.99

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,817.74	12,112.08	21,995.68	51.38
Potassium	411.47	421.72	765.60	2.09
Magnesium	1,342.93	1,376.37	2,503.23	1.30
Calcium	441.55	452.55	823.07	0.42
Strontium	8.30	8.51	15.48	0.01
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	21,000.00	21,523.06	39,091.95	84.22
Sulfate	2,950.00	3,023.48	5,500.22	1.18
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.79	3.82	6.96	0.00
Bicarbonate	122.00	125.04	226.52	1.20
Boron	4.84	4.96	8.36	0.82
Bromide	89.80	92.04	167.16	0.36
Silica	0.20	0.20	0.37	0.00
CO2	1.05	1.06	1.06	1.06
TDS	38,194.69	39,145.95	71,108.45	142.99
pH	8.10	8.10	8.34	6.26

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	24.67	27.66	13.77	0.16	20.01	1.21	39,142.21	53.32
LG SW 400 R G2	2	154.43	18.30	20.52	11.85	0.13	15.80	1.17	45,386.60	79.97
LG SW 400 R G2	3	136.13	13.24	14.85	9.73	0.11	12.22	1.13	51,476.90	120.00
LG SW 400 R G2	4	122.89	9.46	10.60	7.69	0.09	9.33	1.10	57,011.32	178.81
LG SW 400 R G2	5	113.44	6.73	7.54	5.93	0.08	7.07	1.08	61,748.63	263.08
LG SW 400 R G2	6	106.71	4.81	5.39	4.50	0.07	5.35	1.06	65,624.59	380.72
LG SW 400 R G2	7	101.90	3.47	3.89	3.40	0.07	4.06	1.04	68,701.29	540.37

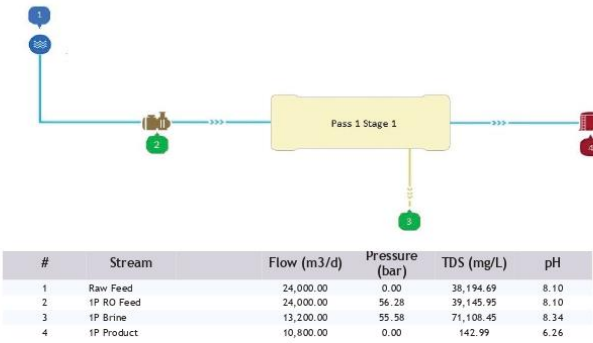
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.98	2.03
CaSO4	24.63 %	53.32 %
SrSO4	15.66 %	41.48 %
BaSO4	0 %	0 %
CaF2	52.45 %	335.59 %
SiO2	0 %	0 %
Stiff Davis Index	-0.6	0.47

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	37 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

-Polarization exceeds recommended maximum value of 1.2 for Seawater-Open Intake (SOI+S) water type.
Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk.
When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure.
LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design.
Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
					
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	38 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

			2024-05-13 10:51:52
Project name:	Water type: Algarve Max Inima*	Membrane age: 3.6	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 58.32 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 38,194.69 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 27.22 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 50.65 bar	

System - Pass1

Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 23 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 16.25 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 39,145.95 mg/L	Specific energy: 2.59 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 27.9 bar	Feed pressure: 58.32 bar
Number of elements: 938	Concentrate osmotic pressure: 50.65 bar	Permeate TDS: 180.1 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 0.8
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,806.46	13,193.54	58.32	57.6	0.72	0	0	0	12.92	180.1

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	11,817.74	12,112.08	21,979.71	64.74
Potassium	411.47	421.72	764.98	2.64
Magnesium	1,342.93	1,376.37	2,502.38	1.63
Calcium	441.55	452.55	822.79	0.53
Strontium	8.30	8.51	15.48	0.01
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	21,000.00	21,523.06	39,065.07	106.11
Sulfate	2,950.00	3,023.48	5,498.71	1.48
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.79	3.82	6.95	0.00
Bicarbonate	122.00	125.04	226.22	1.51
Boron	4.84	4.96	8.22	0.98
Bromide	89.80	92.04	167.05	0.45
Silica	0.20	0.20	0.37	0.00
CO2	1.05	1.06	1.06	1.06
TDS	38,194.69	39,145.95	71,061.77	180.10
pH	8.10	8.10	8.34	6.36

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	22.59	25.33	12.61	0.16	22.90	1.19	39,142.21	72.54
LG SW 400 R G2	2	156.51	17.60	19.73	11.24	0.13	18.85	1.16	44,781.53	103.41
LG SW 400 R G2	3	138.91	13.39	15.01	9.64	0.11	15.22	1.13	50,441.81	148.12
LG SW 400 R G2	4	125.53	10.02	11.23	7.98	0.09	12.12	1.11	55,804.73	211.82
LG SW 400 R G2	5	115.51	7.43	8.34	6.44	0.08	9.57	1.08	60,625.39	300.78
LG SW 400 R G2	6	108.08	5.51	6.18	5.10	0.07	7.52	1.07	64,774.78	422.20
LG SW 400 R G2	7	102.57	4.11	4.61	4.01	0.07	5.91	1.05	68,233.29	583.78

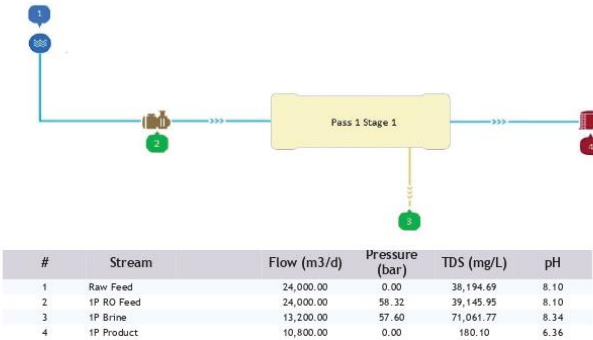
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.98	2.03
CaSO4	24.63 %	53.31 %
SrSO4	15.66 %	41.46 %
BaSO4	0 %	0 %
CaF2	52.45 %	334.81 %
SiO2	0 %	0 %
Stiff Davis Index	-0.6	0.47

Cliente		Empreiteiro EPC		
				
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	39 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk.
When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure.
LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design.
Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
					
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	40 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

			2024-05-13 10:50:21
Project name:	Water type: Algarve Min Inima ^a	Membrane age: 0	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 55.8 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 35,765.08 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 24.8 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 46.19 bar	

System - Pass1

Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 13 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 16.89 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 36,655.85 mg/L	Specific energy: 2.48 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 25.42 bar	Feed pressure: 55.8 bar
Number of elements: 938	Concentrate osmotic pressure: 46.19 bar	Permeate TDS: 61.31 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 1
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,801.89	13,198.11	55.8	55.07	0.73	0	0	0	12.91	61.31

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	10,962.45	11,235.49	20,413.27	21.78
Potassium	412.64	422.92	768.27	0.96
Magnesium	1,323.77	1,356.74	2,466.62	0.64
Calcium	438.50	449.42	817.07	0.21
Strontium	8.71	8.92	16.23	0.00
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,100.00	20,600.64	37,431.49	36.16
Sulfate	2,320.00	2,377.79	4,323.52	0.42
Nitrate	0.07	0.07	0.13	0.00
Carbonate	2.66	2.68	4.88	0.00
Bicarbonate	110.00	112.74	204.61	0.48
Boron	5.19	5.32	9.26	0.50
Bromide	78.90	80.87	146.93	0.14
Silica	0.20	0.20	0.37	0.00
CO2	1.12	1.12	1.12	1.12
TDS	35,765.08	36,655.85	66,606.38	61.31
pH	8.10	8.10	8.34	5.92

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	20.82	23.34	11.62	0.16	23.38	1.20	36,651.57	26.70
LG SW 400 R G2	2	158.28	16.90	18.95	10.68	0.13	19.81	1.18	41,469.04	36.37
LG SW 400 R G2	3	141.39	13.42	15.05	9.49	0.11	16.49	1.15	46,421.29	49.89
LG SW 400 R G2	4	127.96	10.48	11.75	8.19	0.10	13.53	1.13	51,284.95	68.60
LG SW 400 R G2	5	117.49	8.08	9.06	6.88	0.08	10.98	1.10	55,852.17	94.18
LG SW 400 R G2	6	109.41	6.19	6.94	5.66	0.08	8.84	1.08	59,970.11	128.70
LG SW 400 R G2	7	103.22	4.73	5.30	4.58	0.07	7.08	1.07	63,557.61	174.62

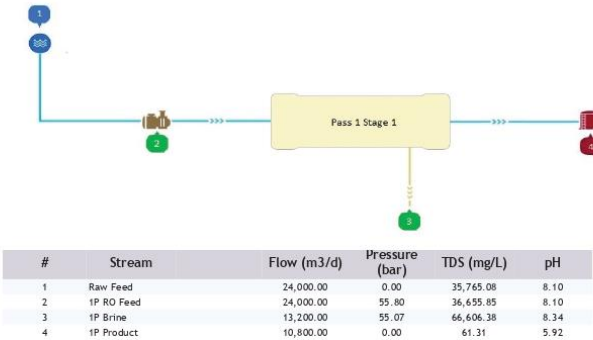
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.76	1.79
CaSO4	20.18 %	43.42 %
SrSO4	13.39 %	34.62 %
BaSO4	0 %	0 %
CaF2	53.22 %	330.47 %
SiO2	0 %	0 %
Stiff Davis Index	-0.78	0.23

Cliente		Empreiteiro EPC		
				
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	41 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk.
When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure.
LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design.
Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
		  			
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	42 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

			2024-05-13 10:50:22
Project name:	Water type: Algarve Min Inima ^a	Membrane age: 3.6	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 58.9 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 35,765.08 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 24.8 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 46.16 bar	
System - Pass1		
Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 13 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 20.18 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 36,655.85 mg/L	Specific energy: 2.62 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 25.42 bar	Feed pressure: 58.9 bar
Number of elements: 938	Concentrate osmotic pressure: 46.16 bar	Permeate TDS: 77.42 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 0.8
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,796.29	13,203.71	58.9	58.16	0.75	0	0	0	12.91	77.42

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	10,962.45	11,235.49	20,399.93	27.51
Potassium	412.64	422.92	767.74	1.21
Magnesium	1,323.77	1,356.74	2,465.44	0.81
Calcium	438.50	449.42	816.68	0.27
Strontium	8.71	8.92	16.22	0.00
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,100.00	20,600.64	37,407.84	45.67
Sulfate	2,320.00	2,377.79	4,321.60	0.53
Nitrate	0.07	0.07	0.13	0.00
Carbonate	2.66	2.68	4.88	0.00
Bicarbonate	110.00	112.74	204.42	0.61
Boron	5.19	5.32	9.16	0.62
Bromide	78.90	80.87	146.84	0.18
Silica	0.20	0.20	0.37	0.00
CO2	1.12	1.12	1.12	1.12
TDS	35,765.08	36,655.85	66,564.97	77.42
pH	8.10	8.10	8.34	6.02

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	19.30	21.64	10.78	0.16	27.08	1.18	36,651.57	36.06
LG SW 400 R G2	2	159.80	16.22	18.18	10.15	0.14	23.65	1.17	41,074.26	47.35
LG SW 400 R G2	3	143.59	13.36	14.98	9.30	0.12	20.34	1.15	45,707.82	62.70
LG SW 400 R G2	4	130.23	10.82	12.13	8.31	0.10	17.25	1.13	50,390.70	83.46
LG SW 400 R G2	5	119.41	8.65	9.69	7.24	0.09	14.47	1.11	54,949.62	111.28
LG SW 400 R G2	6	110.76	6.84	7.67	6.18	0.08	12.03	1.09	59,230.14	148.17
LG SW 400 R G2	7	103.92	5.38	6.04	5.18	0.07	9.94	1.08	63,119.92	196.50

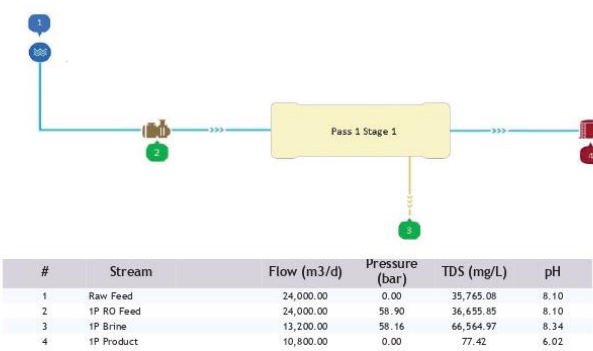
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.76	1.79
CaSO4	20.18 %	43.4 %
SrSO4	13.39 %	34.59 %
BaSO4	0 %	0 %
CaF2	53.22 %	329.78 %
SiO2	0 %	0 %
Stiff Davis Index	-0.78	0.23

Cliente 		Empreiteiro EPC 		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	43 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk. When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure. LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design. Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC		
		  		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	44 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

			2024-05-13 10:50:22
Project name:	Water type: Algarve Min Inima ^a	Membrane age: 0	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 54.03 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 35,766.05 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 25.32 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 47.16 bar	
System - Pass1		
Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 19 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 14.54 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 36,656.83 mg/L	Specific energy: 2.41 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 25.95 bar	Feed pressure: 54.03 bar
Number of elements: 938	Concentrate osmotic pressure: 47.16 bar	Permeate TDS: 98.45 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 1
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,807.28	13,192.72	54.03	53.31	0.72	0	0	0	12.92	98.45

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	10,962.92	11,235.97	20,411.63	35.00
Potassium	412.66	422.94	768.14	1.54
Magnesium	1,323.82	1,356.80	2,467.42	1.03
Calcium	438.52	449.44	817.33	0.34
Strontium	8.71	8.93	16.23	0.01
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,100.00	20,600.64	37,428.76	58.11
Sulfate	2,320.00	2,377.79	4,325.07	0.68
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.05	3.09	5.61	0.00
Bicarbonate	110.00	112.74	204.46	0.78
Boron	5.19	5.32	9.09	0.72
Bromide	78.90	80.87	146.92	0.23
Silica	0.20	0.20	0.37	0.00
CO2	1.02	1.02	1.02	1.02
TDS	35,766.05	36,656.83	66,604.89	98.45
pH	8.10	8.10	8.34	6.12

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	22.79	25.55	12.72	0.16	20.69	1.20	36,652.69	39.44
LG SW 400 R G2	2	156.32	17.69	19.84	11.32	0.13	16.88	1.17	41,989.94	56.38
LG SW 400 R G2	3	138.63	13.40	15.03	9.67	0.11	13.50	1.14	47,341.01	81.01
LG SW 400 R G2	4	125.23	9.98	11.19	7.97	0.09	10.63	1.11	52,398.89	116.24
LG SW 400 R G2	5	115.24	7.37	8.26	6.39	0.08	8.29	1.09	56,928.06	165.77
LG SW 400 R G2	6	107.88	5.42	6.08	5.03	0.07	6.42	1.07	60,804.88	234.16
LG SW 400 R G2	7	102.45	4.00	4.49	3.90	0.07	4.96	1.05	64,010.66	326.79

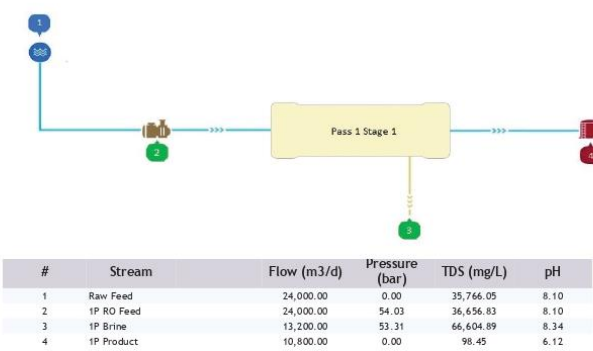
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.85	1.88
CaSO4	20.18 %	43.45 %
SrSO4	13.4 %	34.64 %
BaSO4	0 %	0 %
CaF2	52.73 %	327.33 %
SiO2	0 %	0 %
Stiff Davis Index	-0.7	0.3

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data	Rev.	Pág.
		20/02/2025	01.0	45 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk. When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure. LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design. Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
					
Projeto nº.	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	46 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			

			2024-05-13 10:50:23
Project name:	Water type: Algarve Min Inima ^a	Membrane age: 3.6	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 56.41 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 35,766.05 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 25.32 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 47.13 bar	

System - Pass1

Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 19 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 17.17 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 36,656.83 mg/L	Specific energy: 2.51 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 25.95 bar	Feed pressure: 56.41 bar
Number of elements: 938	Concentrate osmotic pressure: 47.13 bar	Permeate TDS: 124.12 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 0.8
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,803.18	13,196.82	56.41	55.68	0.73	0	0	0	12.91	124.12

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	10,962.92	11,235.97	20,397.83	44.14
Potassium	412.66	422.94	767.58	1.94
Magnesium	1,323.82	1,356.80	2,466.43	1.30
Calcium	438.52	449.44	817.01	0.43
Strontium	8.71	8.93	16.23	0.01
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,100.00	20,600.64	37,404.76	73.29
Sulfate	2,320.00	2,377.79	4,323.59	0.86
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.05	3.09	5.61	0.00
Bicarbonate	110.00	112.74	204.23	0.98
Boron	5.19	5.32	8.96	0.87
Bromide	78.90	80.87	146.83	0.29
Silica	0.20	0.20	0.37	0.00
CO2	1.02	1.02	1.02	1.02
TDS	35,766.05	36,656.83	66,563.26	124.12
pH	8.10	8.10	8.34	6.22

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	20.95	23.50	11.70	0.16	23.77	1.18	36,652.69	53.52
LG SW 400 R G2	2	158.15	16.97	19.03	10.73	0.13	20.12	1.16	41,502.08	73.20
LG SW 400 R G2	3	141.18	13.43	15.06	9.51	0.11	16.72	1.14	46,481.10	100.87
LG SW 400 R G2	4	127.75	10.45	11.71	8.18	0.10	13.69	1.12	51,357.94	139.35
LG SW 400 R G2	5	117.30	8.03	9.00	6.84	0.08	11.09	1.10	55,919.27	192.19
LG SW 400 R G2	6	109.28	6.13	6.87	5.61	0.08	8.91	1.08	60,012.14	263.59
LG SW 400 R G2	7	103.15	4.67	5.24	4.53	0.07	7.13	1.06	63,560.48	358.44

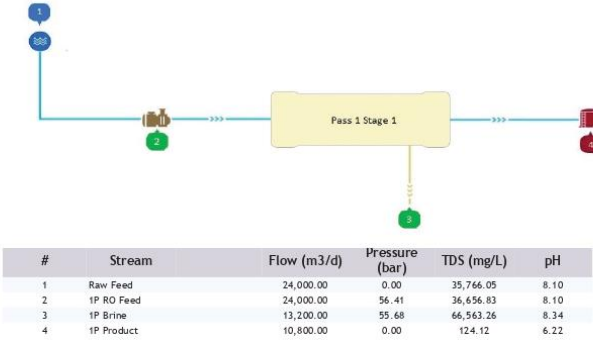
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.85	1.87
CaSO4	20.18 %	43.43 %
SrSO4	13.4 %	34.62 %
BaSO4	0 %	0 %
CaF2	52.73 %	326.63 %
SiO2	0 %	0 %
Stiff Davis Index	-0.7	0.3

Cliente		Empreiteiro EPC		
				
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	47 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk.
When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure.
LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design.
Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC			
					
Projeto n.º	Projeto	Data	Rev.	Pág.	
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	48 de 95	
Código AdA		Código ACE			
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01			



2024-05-13 10:50:23
v3.3.0.1

Project name:	Water type: Algarve Min Inima'	Membrane age: 0
Customer:	Flux loss per year: 6.00%	Safety factor: 1
Username:	Salt passage increase: 7.00%	

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 53.22 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 35,766.75 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 25.67 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 47.79 bar	

System - Pass1

Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 23 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 13.29 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 36,657.55 mg/L	Specific energy: 2.37 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 26.31 bar	Feed pressure: 53.22 bar
Number of elements: 938	Concentrate osmotic pressure: 47.79 bar	Permeate TDS: 133.68 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 1
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,809.52	13,190.48	53.22	52.52	0.71	0	0	0	12.92	133.68

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	10,963.26	11,236.32	20,405.43	47.56
Potassium	412.67	422.95	767.84	2.09
Magnesium	1,323.87	1,356.84	2,467.61	1.40
Calcium	438.53	449.45	817.40	0.46
Strontium	8.71	8.93	16.23	0.01
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,100.00	20,600.64	37,418.02	78.97
Sulfate	2,320.00	2,377.79	4,325.61	0.92
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.35	3.39	6.16	0.00
Bicarbonate	110.00	112.74	204.26	1.06
Boron	5.19	5.32	8.96	0.88
Bromide	78.90	80.87	146.88	0.31
Silica	0.20	0.20	0.37	0.00
CO2	0.95	0.96	0.96	0.96
TDS	35,766.75	36,657.55	66,588.61	133.68
pH	8.10	8.10	8.34	6.25

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	24.24	27.18	13.53	0.16	19.19	1.20	36,653.51	50.61
LG SW 400 R G2	2	154.87	18.19	20.40	11.75	0.13	15.23	1.17	42,381.78	75.01
LG SW 400 R G2	3	136.68	13.31	14.92	9.74	0.11	11.82	1.13	48,013.10	111.47
LG SW 400 R G2	4	123.37	9.59	10.75	7.77	0.09	9.03	1.10	53,180.90	164.84
LG SW 400 R G2	5	113.78	6.86	7.70	6.03	0.08	6.85	1.08	57,648.85	241.32
LG SW 400 R G2	6	106.91	4.92	5.52	4.60	0.07	5.17	1.06	61,334.76	348.30
LG SW 400 R G2	7	101.99	3.56	3.99	3.49	0.07	3.90	1.04	64,278.08	494.24

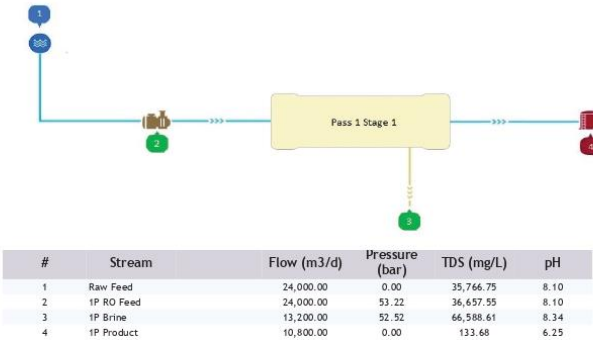
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.91	1.94
CaSO4	20.18 %	43.46 %
SrSO4	13.4 %	34.65 %
BaSO4	0 %	0 %
CaF2	52.54 %	325.88 %
SiO2	0 %	0 %
Stiff Davis Index	-0.64	0.36

Cliente		Empreiteiro EPC		
				
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	49 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk.
When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure.
LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design.
Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente		Empreiteiro EPC		
		  		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	50 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

			2024-05-13 10:50:24
Project name:	Water type: Algarve Min Inima ^a	Membrane age: 3.6	v3.3.0.1
Customer:	Flux loss per year: 6.00%	Safety factor: 1	
Username:	Salt passage increase: 7.00%		

Overall System

Total permeate flow: 10,800 m3/d	Water source: Seawater-Open Intake (SDI<5)	Feed pressure: 55.2 bar (1P)
Raw water flow: 24,000 m3/d	Raw water TDS: 35,766.75 mg/L	
Total concentrate flow: 13,200 m3/d	Feed osmotic pressure: 25.67 bar	
Overall recovery: 45 %	Concentrate osmotic pressure: 47.76 bar	
System - Pass1		
Permeate flow: 10,800 m3/d	Average flux: 12.91 lmh	Temperature: 23 °C (max 23 °C)
RO feed flow: 24,000 m3/d	Water source: Seawater-Open Intake (SDI<5)	Average NDP: 15.57 bar
Concentrate flow: 13,200 m3/d	Feed TDS: 36,657.55 mg/L	Specific energy: 2.46 kWh/m³
Recovery: 45 %	Feed osmotic pressure: 26.31 bar	Feed pressure: 55.2 bar
Number of elements: 938	Concentrate osmotic pressure: 47.76 bar	Permeate TDS: 168.36 mg/L
ERD type: Isobaric	Pump efficiency: 80 %	Fouling factor: 0.8
Recirculation:		

	# of vessels	# of elements	RO feed flow	Permeate flow	Conc. flow	RO feed pressure	Conc. pressure	Vessel DP	Boost pressure	Back pressure	Inter-stage pressure loss	Average flux	Perm. TDS
			m3/d	m3/d	m3/d	bar	bar	bar	bar	bar	bar	lmh	mg/L
Stage 1	134	7	24,000	10,806.48	13,193.52	55.2	54.48	0.72	0	0	0	12.92	168.36

Water Analysis - Pass1

Species	Raw water	Adjusted feed	Conc. Stage1	Permeate Stage1
Ammonium	0.00	0.00	0.00	0.00
Sodium	10,963.26	11,236.32	20,390.63	59.92
Potassium	412.67	422.95	767.22	2.63
Magnesium	1,323.87	1,356.84	2,466.74	1.77
Calcium	438.53	449.45	817.11	0.58
Strontium	8.71	8.93	16.23	0.01
Barium	0.00	0.00	0.00	0.00
Fluoride	2.00	2.05	3.72	0.01
Chloride	20,100.00	20,600.64	37,392.63	99.48
Sulfate	2,320.00	2,377.79	4,324.42	1.16
Nitrate	0.07	0.07	0.13	0.00
Carbonate	3.35	3.39	6.16	0.00
Bicarbonate	110.00	112.74	203.99	1.33
Boron	5.19	5.32	8.81	1.06
Bromide	78.90	80.87	146.78	0.39
Silica	0.20	0.20	0.37	0.00
CO2	0.95	0.96	0.96	0.96
TDS	35,766.75	36,657.55	66,544.93	168.36
pH	8.10	8.10	8.34	6.35

Within Vessels - Pass1

	Position	RO feed flow	Permeate flow	Flux	Element recovery	Element DP	Net driving pressure	Polarization	Feed TDS	Perm. TDS
		m3/d	m3/d	lmh	%	bar	bar		mg/L	mg/L
Stage 1										
LG SW 400 R G2	1	179.10	22.19	24.88	12.39	0.16	21.95	1.18	36,653.51	68.89
LG SW 400 R G2	2	156.92	17.47	19.59	11.13	0.13	18.15	1.16	41,826.09	97.14
LG SW 400 R G2	3	139.45	13.42	15.05	9.62	0.11	14.71	1.13	47,053.01	137.83
LG SW 400 R G2	4	126.03	10.13	11.36	8.04	0.09	11.73	1.11	52,049.53	195.60
LG SW 400 R G2	5	115.90	7.57	8.49	6.54	0.08	9.26	1.09	56,584.03	276.17
LG SW 400 R G2	6	108.32	5.64	6.33	5.21	0.07	7.27	1.07	60,521.89	386.28
LG SW 400 R G2	7	102.68	4.22	4.73	4.11	0.07	5.70	1.05	63,827.64	533.34

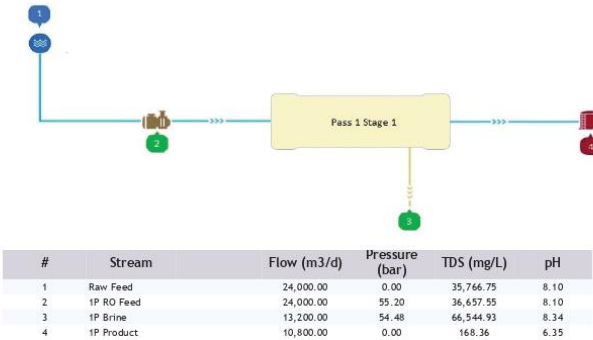
Solubility - Pass1

	Solubility calculation	
	Feed	Conc.
LSI	0.91	1.93
CaSO4	20.18 %	43.45 %
SrSO4	13.4 %	34.64 %
BaSO4	0 %	0 %
CaF2	52.54 %	325.15 %
SiO2	0 %	0 %
Stiff Davis Index	-0.64	0.35

Cliente		Empreiteiro EPC		
				
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	51 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

Warnings - Pass1

Disclaimer: LG Chem Design is intended to be used by persons having the requisite technical skill, at their own discretion and risk.
When using LG Chem Design, it is the user's responsibility to make provisions against fouling, scaling and chemical attacks, to account for piping and valve pressure losses, feed pump suction pressure and permeate backpressure.
LG Chem shall not be liable for any error or miscalculation in results obtained by using LG Chem Design.
Because use conditions and applicable laws may differ from one location to another and may change with time, users are responsible for determining whether products are appropriate for their use.



Cliente 		Empreiteiro EPC   		
Projeto n.º	Projeto Sistema de dessalinização na região do Algarve	Data 20/02/2025	Rev. 01.0	Pág. 52 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

MANUAL DE MANUTENÇÃO, MONTAGEM, ARMAZENAMENTO E ACONDICIONAMENTO DAS MEMBRANAS PROPOSTAS. MANUAL DE ARRANQUE E PARAGEM DOS RACKS DE OSMOSE INVERSA COM AS MEMBRANAS PROPOSTAS. MANUAL DE LIMPIEZA



LG Water Solutions



Version 2.2.1

March 2024

Nano:H₂O™

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	53 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin

Contents

TSB 101	Receipt of Elements, Short-Term Storage, and Disposal of Used Elements
TSB 102	Element Loading Guidelines
TSB 103	Vessel Shimming Procedures
TSB 104	Element Start-Up / Shutdown Procedures
TSB 105	Membrane Storage Inside Pressure Vessel
TSB 106	Membrane Element Operating Precautions
TSB 107	Silt Density Index (SDI15) Procedure
TSB 108	Vessel Probing
TSB 109	Membrane Element Flushing
TSB 110	Return Merchandise Authorization Procedure (RMA)
TSB 111	Data Logging and Performance Normalization
TSB 112	Biocides for Disinfection and Storage
TSB 113	Membrane Cleaning
TSB 114	Brine Seal Replacement
TSB 115	RO Element Start-Up Considerations and Checklist
TSB 116	Spare Parts

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	54 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 101

Receipt of Elements, Short-Term Storage, and Disposal of Used Elements

Receiving Inspection

After a shipment arrives, conduct a visual inspection of all packages to confirm that:

1. Shipment arrived without damage to the packaging or its contents.
2. All packages listed on the packing list arrived in good order.

LG Chem strongly recommends inspecting the product for any visible damage or defects immediately upon receipt. If any issues are encountered, please contact an LG Chem Customer Service representative before accepting the delivery to ensure that your rights are protected. In such cases, LG Chem will promptly identify possible causes of the damage and determine whether it occurred during transit.

Please notify your carrier or freight forwarder and a LG Chem Customer Service Representative IMMEDIATELY of any damaged merchandise or product shortages. Each RO element box contains an element with one brine seal installed and one interconnector with four O-rings installed. It is expected that the RO element boxes will only be opened right before loading. Should any brine seals, interconnectors, or O-rings be missing, please notify LG Chem for immediate shipment of replacement.

Storage

After factory performance testing, elements are preserved in a 0.5 wt% sodium metabisulfite solution and vacuum sealed in oxygen barrier plastic bags.

Maintain elements in their original shipping containers and store in a protected area that is NOT subject to extreme heat (greater than 35°C / 95°F).

LG Chem elements should NOT be stored in areas exposed to direct sunlight.

Elements stored in 0.5% SMBS solution will freeze below -2°C, however this will not affect the membrane's performance as long as it is thawed in room temperature before installation.

LG Chem elements should NOT be stored in areas where damage can occur from moving equipment such as forklifts and pallet jacks.

A full standard pallet contains a maximum of 40 (8-inch) diameter element boxes (5 elements wide by 8 elements high). Full standard pallets cannot be stacked on top of each other. A single 8-inch diameter element box can only be stacked 8 boxes high or less.

For long-term storage (greater than 60 days), periodically re-inspect the shipping containers to ensure that there is no physical damage or leakage. Any leakage may indicate a loss of integrity of the membrane element preservative.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	55 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 101

Receipt of Elements, Short-Term Storage, and Disposal of Used Elements

For storage lasting longer than 6 months, preserved elements should be visually inspected for biological growth and periodically examined every 3 months thereafter. If the preservation solution appears to be murky, the elements should be re-preserved and vacuum sealed. Another method for checking the integrity of the preservative is through pH measurements. The bisulfite in the preservative can oxidize into sulfuric acid which will cause the pH to drop. If the pH of the preservative drops below 3, the elements must be re-preserved. Please contact LG Chem Technical Service for instructions and supplies for re-preserving the elements.

Elements stored per the conditions listed in this bulletin, with original factory packaging and vacuum seal intact, are likely to meet expected performance for storage periods up to 12 months and possibly longer.

Disposal of Used Elements

Used LG Chem elements should be disposed of in accordance with all local and federal regulations. Used elements can be disposed of as municipal waste provided that no preservation solution or other hazardous liquids remain within the element and there are no deposition of hazardous substances on the membranes at concentrations exceeding regulatory standards.

If the user wants to recycle the elements, the material components by weight of an unused element can be found below:

Material	Weight (kg)	Weight (lb)
Polysulfone	0.81	1.78
Polyester	6.73	14.8
Polypropylene	1.59	3.51
Polyurethane (2Part)	0.83	1.65
Epoxy (2Part)	0.71	1.57
E Glass Roving	1.73	3.81
ABS (Acrylonitrile-Butadiene-Styrene)	0.99	2.18
Polyamide Layer including Nanomaterials	0.05	0.11
EPDM (ethylene propylene diene monomer) Rubber	0.03	0.08

The information and data contained herein are deemed to be accurate and reliable and are offered in good faith, but without guarantee of performance. LG Chem assumes no liability for results obtained or damages incurred through the application of the information contained herein. Customer is responsible for determining whether the products and information presented are appropriate for the customer's use and for ensuring that customer's workplace and disposal practices are in compliance with applicable laws and other governmental enactments. Specifications subject to change without notice. NanoH₂O is the Trademark of LG Chem. All rights reserved. © LG Chem, Ltd.

Contact Us
 • America +1 424 218 4000 • Europe, Africa +39 366 57 55 474 • Middle East, Egypt +971 50 558 4168
 • Korea +82 2 3773 6619 • China +86 21 60872900 • India +91 98 10013345 • South East Asia +82 2 3773 3013

Version 2.2.1

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	56 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 102

Element Loading Guidelines

Element loading guidelines provide recommendations to ensure proper and safe installation of LG Chem RO membrane elements in reverse osmosis (RO) system pressure vessels.

System Flushing

Prior to loading the membrane elements, new systems should be thoroughly flushed with pretreated feedwater to ensure the absence of construction debris, solvents, chlorine or other contaminants that may be harmful to the elements.

Pressure Vessel Preparation

The interior walls of the pressure vessels must be thoroughly cleaned prior to loading membrane elements in order to prevent dust, construction debris or other foreign matter from being deposited onto the membrane surface during start-up. Simply hosing down the interior of the vessels with freshwater is NOT adequate to clean the vessels thoroughly. LG Chem recommends the use of a sponge ball wrapped in a cloth or towel that has been soaked in a 50% solution of glycerin and chlorine-free water. The cleaning ball may either be pulled through the vessel when attached to a rope or pushed through the vessel when mounted to a PVC flange affixed to an appropriate length of PVC pipe. Use appropriate CAUTION to ensure that the inside surface of the vessel is not scratched or damaged during cleaning.

Membrane Element Storage

LG Chem RO elements should be maintained in their original shipping packaging and stored in accordance with "Receipt of Elements, Short-Term Storage, and Disposal of Used Elements - TSB 101" and "Membrane Storage Inside Pressure Vessel – TSB 105" guidelines.

CAUTION

DO NOT use oil, grease, petroleum jelly or other petroleum-based compounds to lubricate O-rings or brine seals. Food-grade glycerin may be used for O-ring and brine seal lubrication either directly or in a water-based solution. Approved lubricants for interconnector O-rings, end adapter O-rings or membrane element brine seals include glycerin, silicon-based Molykote III, or other silicone-based lubricants that do not contain hydrocarbons. Contact Technical Support at LG Chem for further assistance.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	57 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 102

Element Loading Guidelines

Materials Required

- Eye protection
- Safety Shoes
- Protective gloves, (for jobs with post startup bacteria testing of RO permeate, use sterile, powder free exam gloves)
- Other safety equipment and clothing as required by jobsite regulations
- Lubricant (Food grade glycerin and/or approved silicone lubricant)
(NOTE: Do not use silicon lubricant for ultrapure water applications.)
- Clean towels and rags
- Plastic sheeting to protect and keep clean all permeate piping, endcap adapters, and any system part that will be in contact with RO permeate
- Water for flushing
- Tools and equipment necessary to clean and prepare pressure vessels
- Tools and equipment necessary to remove and replace pressure vessel components and attached piping (NOTE: Refer to pressure vessel manufacturer's literature for correct parts and procedures.)
- Critical spare pressure vessel parts and pipe fittings that might break during unloading and loading process
- Endcap adapter shims (See LG Chem TSB 103 Vessel Shimming)

Element Loading

1. Make sure that pressure vessel parts, fittings and connecting piping (especially permeate piping) are removed for RO element installation are protected from dirt and airborne dust and debris. Keep floors and parts clean during the RO element loading process. For jobs where bacteria sampling of RO permeate after startup is required it is good practice to remove endcaps and place on unused, clean plastic sheeting, away from heavy traffic. Cover the endcaps to minimize exposure to airborne debris. Remember, the center port of the endcap carries RO permeate. Do not handle the endcap by touching the inside of the center port.

2. It is good practice to stage RO elements for each pressure vessel prior to loading. RO Elements with standard u-cup brine seals are loaded in the direction of process flow, so the first elements loaded is the concentrate end element. The feed end element will be the last to be loaded. It is strongly recommended to keep RO elements in their plastic bags during the staging process. While the elements are staged for each pressure vessel, record the elements serial numbers and the corresponding pressure vessel number. Make note of the position of each element in each pressure vessel. Later, transfer the loading sequence to Excel spreadsheets.

(NOTE: Many RO systems undergo partial element replacement over the warranted life of the system. It is important to keep accurate and up to date loading sequences by serial number and element age.)

3. Install endcap assembly in the concentrate (brine) end of the pressure vessel. Make sure the retaining ring is properly installed and the thrust cone installed downstream. Refer to pressure manufacturer's literature for installation instructions. Determine if it is preferable to install the concentrate endcap/element adapter into the concentrate endcap or concentrate element before loading. The adapter is supplied by the pressure vessel manufacturer. If it is preferred to have the adapter inserted in the endcap, make sure it is properly inserted and lubricated before installing the concentrate endcap assembly. Secure the concentrate endcap per the manufacturer's instruction.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	58 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 102

Element Loading Guidelines

Element Loading (Continued)

4. Load the first element (concentrate end element) approximately 2/3rd of its length into the feed end of the pressure vessel. If the concentrate endcap/element adapter was not inserted into the concentrate endcap, make sure that it is properly lubricated and inserted in the concentrate face of the concentrate element before loading in the pressure vessel. Make sure that the u-cup brine seal is properly installed on the upstream (feed end) ATD (anti-telescoping device) of the RO element. (See TB 114 Brine Seal Placement).

(NOTE: Only one u-cup seal is required per element. Never put u-cup seals at both ends of the RO element. U-Cups will only seal if properly oriented on the ATD. See TB 114 for proper orientation.)

5. Lubricate the u-cup seal with 50% glycerin / and chlorine-free water solution.

(NOTE: If silicone based lubricant is used, only a small amount is needed. Use sparingly as excess amounts could foul the membrane surface.)

6. The product water tubes of each RO element are connected by an interconnector with pre-installed o-rings. Make sure that all o-rings are installed and lubricated properly. Firmly insert the interconnector in the product water tube of the first element with a gentle twisting motion. The interconnector will seat on a shoulder that is recessed about 3 inches inside the product water tube. Never use a hammer or pounding motion to insert interconnectors.

7. With another person holding the first elements stationary, slide the next element on to the interconnector of the first element. Make sure that the ATDs of the two elements touch each other and the interconnector is fully seated within each element.

8. Slowly push the element stack into the vessel so that 1/3rd of the next element being loaded is overhanging the feed end of the pressure vessel.

(NOTE: Be careful to not push elements too fast as the ATDs can be damaged if they slide roughly over the retaining ring grooves in the pressure vessel.)

(NOTE: Never allow an interconnector to support the weight of an element.)

9. Repeat the steps above until the last element has been connected and is extending only 1/3rd beyond the feed end of the pressure vessel. Make sure that concentrate endcap assembly is installed and secured.

10. Firmly push the entire element stack so that the concentrate end element seats against the concentrate endcap assembly.

11. In most cases, there will be space between the shoulder of the feed endcap adapter and the feed endcap itself that will allow movement of the elements during startups and shutdowns. Excessive movement can lead to o-ring leaks. Shims can easily be added to prevent excessive movement of the elements stack. (Refer to TSB 103 Vessel Shimming)

12. Follow pressure vessel manufacturer's and RO unit fabricator's instructions for installation of feed endcap assemblies and all interconnecting piping.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	59 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 103

Vessel Shimming Procedures

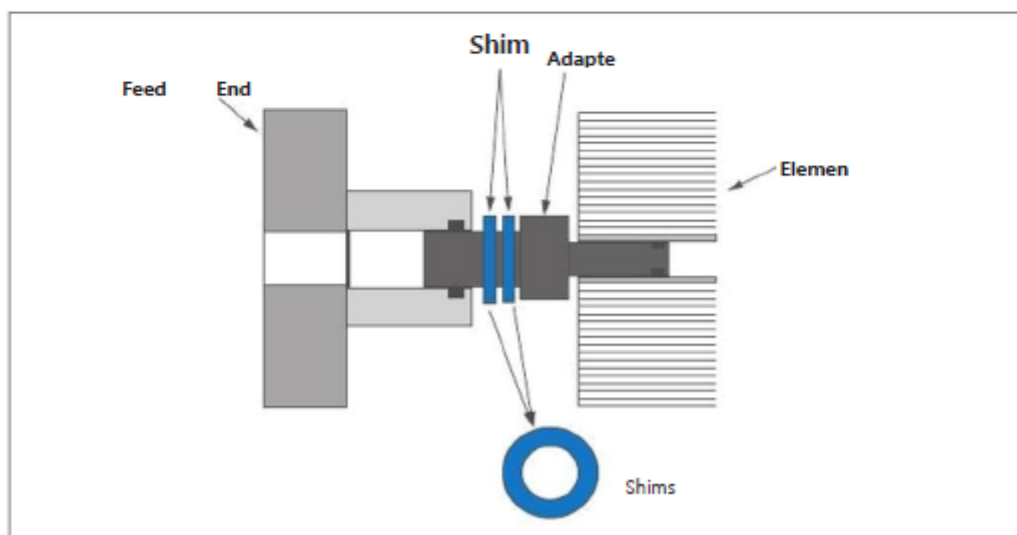
Vessel Shimming

Because the face-to-face end plate dimensions may vary among pressure vessel manufacturers, LG Chem strongly recommends that the element stack within the pressure vessel be shimmed to remove any excess slack. This slack can result in interconnector uncoupling and excessive stack movement during shutdown and start-up.

To ensure the removal of excess slack from the element stack within each pressure vessel, LG Chem recommends the following method:

1. Install the REJECT-side end plate and thrust ring (if part of reject-side end-plate assembly), and push the element stack all the way toward the REJECT-end until the element stack is well seated against the REJECT-end end plate.
2. Prepare PVC spacers of varying thickness ranging from 3.17 to 9.52 mm (1/8 to 3/8 inches). These may be cut from a length of PVC pipe with a diameter that will fit over the feed-side adapter.
3. Install as many shims as necessary over the FEED-side inboard adapter until the end plate fits snugly against the shims while allowing the end plate to be installed. A gap of approximately 6.34 mm (1/4 inch) between the end plate and the shims is permissible and should not result in interconnector decoupling or other performance issues (Figure 103.1).
4. During the first month of system operation after startup, it is recommended to check the status of the membrane shimming and add shims if there is any space for shimming.

Figure 103.1



Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	60 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 104

Membrane Element Start-up/Shutdown Procedures

The first time LG Chem RO elements are placed in service and during normal operational start-up and shutdown, certain precautions MUST be observed to help ensure stable long-term performance from the elements. Below are the normal procedures and precautions for initial start-up and subsequent operation.

Feedwater Requirements

• Free Chlorine

Qfx membrane elements show some resistance to short-term chlorine (hypochlorite) exposure. The free chlorine tolerance of the membrane is < 0.1 ppm. Continuous exposure, however, may damage the membrane and should be avoided. Under certain conditions, the presence of free chlorine and other oxidizing agents will cause premature membrane failure. Since oxidation damage is not covered under warranty, LG Chem recommends removing residual free chlorine by pretreatment prior to membrane exposure.

⚠ CAUTION

Confirm that feedwater introduced to the membrane elements contains no more than 0.1 ppm of free chlorine. Membrane element damage resulting from operation beyond this limit is irreversible and will void the LG NanoH2O product or performance warranty.

• Turbidity

Confirm that RO feedwater turbidity and fouling potential, as measured by a 15-minute silt density index (SDI15), are within the limits specified on the Qfx product data sheet or in the LG Chem product or performance warranty. Please refer to "Silt Density Index Procedure (SDI15) - TB 107" for more information. During system start-up, spikes of high turbidity water may pass through the pretreatment system until the pretreatment system stabilizes. These spikes will result in membrane fouling that decreases permeate flow and requires operation at higher pressures to compensate for the decreased flow.

⚠ CAUTION

Membrane elements that have been fouled will suspend and may void (if the foulants cannot be completely removed by chemical cleaning) any product or performance warranty issued by LG Chem related to permeate flow and/or operating pressure.

• Temperature

Confirm that RO feedwater temperature is within the limits specified on the LG Chem product data sheet. Operation at temperatures exceeding 45°C (113°F) under the high pressure conditions required for SWRO can result in the weakening and compression of the porous polysulfone layer supporting the thin-film membrane. This compression can result in compaction that permanently reduces the permeate flow through the membrane. Please contact a LG Chem sales representative or technical support team member if you are considering system operation with feedwater temperatures that exceed these limits.

⚠ CAUTION

Impaired membrane permeability caused by high temperature compaction will void any product or performance warranty issued by LG Chem related to permeate flow and/or operating pressure.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	61 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 104

Membrane Element Start-up /
Shutdown Procedures

• Other Feedwater Conditions

Prior to introducing the feedwater to the membrane elements, confirm that all other feedwater composition, properties and limiting conditions are in full compliance.

CAUTION

Failure to comply with limiting conditions may void any product or performance warranty issued by LG Chem.

Initial Start-up Requirements

• Pre-Flushing

Prior to installing the membrane element(s), the system or train MUST be flushed to remove any entrained air in the pressure vessel ("Membrane Element Flushing - TSB 109").

• Element Loading

Confirm that the LG Chem elements were correctly loaded and that all O-rings and brine seals were properly installed. Confirm that the elements in each pressure vessel were properly shimmed to remove excess slack in the pressure vessel ("Vessel Shimming Procedures - TSB 103")

• Vent Entrained Air

Initiate a low pressure flush at 1 - 1.4 bars (15 - 20 psig) to ensure that all air is purged from the membrane elements and pressure vessels prior to ramping to normal operating pressures. The low pressure flush should be performed with the permeate valves open to drain, the concentrate control valve (the valve that controls the ratio of concentrate flow to permeate flow) fully open, and with a soft-start mechanism or variable speed drive.

• Membrane Flushing

The permeate produced for the first 10 minutes of plant operation should be discharged to waste. To ensure the highest quality permeate stream, discard the permeate for the first 1 hour of operation after the initial start-up. Furthermore, prolonged flushing may be necessary depending on the application and required water quality.

CAUTION

Failure to remove entrained air can result in mechanical damage to the membrane elements due to high hydraulic forces resulting from water hammer.

Notes:

When flushing a membrane element, the permeate valves should be open to drain and the concentrate control valves should also be fully open to avoid damaging the membrane elements. For any flushing operation to be effective, the volume used for flushing should exceed the liquid hold-up volume of the membrane elements. For standard 8-inch x 40-inch elements, assume the hold-up volume is 37.85 liters (10 gallons) for each membrane element. For standard 4-inch x 40-inch elements, assume the hold-up volume is 11.35 liters (3 gallons) for each membrane element. To ensure the highest quality permeate stream, discard the first hour's worth of permeate after initial start-up.

Cliente 		Empreiteiro EPC   		
Projeto n.º	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	62 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 104

Membrane Element Start-up /
Shutdown Procedures

Operating Requirements – System Start-up

• Concentrate Control Valve Operation

Prior to train or system start-up, confirm that the concentrate control valve is in the fully open position.

⚠ CAUTION

NEVER start up a train or system with the concentrate control valve fully or partially closed. After feedwater is introduced to the train or system with the concentrate control valve fully open, slowly close the valve until the desired recovery is achieved. Starting a train or system with the concentrate control valve fully or partially closed can over-pressurize the system, damage the membrane elements, burstpiping and create a safety hazard. Train or system permeate recovery should NEVER exceed the maximum safe permeate recovery as recommended by LG Chem or by its Q+ Projection Software.

• Control Rate of Pressurization During Start-up

No train or system should be brought online (pressurized) at a rate faster than 0.7 bar (10 psig) per second.

⚠ CAUTION

Rapid pressurization of a train or system can cause mechanical damage to the membrane elements. Such damage can include: cracking of the outer fiberglass shell, failure of the anti-telescoping device and membrane telescoping. Mechanical damage to membrane elements caused by overly rapid pressurization or over-pressurization will void any product or performance warranty.

Operating Requirements – System or Train Shutdown

• Element Flush

Following system or train shutdown, it is required that the membrane elements be flushed with RO feedwater to remove the high concentration of salts contained in the membrane elements. An RO system or train should NEVER be shut down without immediately flushing the high TDS concentration from the membrane elements.

⚠ CAUTION

Failure to remove the high TDS concentration of the hold-up volume in the membrane elements may result in damage to the elements.

Notes:

When flushing a membrane element, the permeate valves should be open to drain and the concentrate control valves should also be fully open to avoid damaging the membrane elements. For any flushing operation to be effective, the volume used for flushing should exceed the liquid hold-up volume of the membrane elements. For standard 8-inch x 40-inch elements, assume the hold-up volume is 37.85 liters (10 gallons) for each membrane element. For standard 4-inch x 40-inch elements, assume the hold-up volume is 11.35 liters (3 gallons) for each membrane element. To ensure the highest quality permeate stream, discard the first hour's worth of permeate after initial start-up.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	63 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 105

Membrane Storage Inside Pressure Vessel

Short-Term Storage Procedure

If RO system is to remain offline for less than 7 days, then follow the procedure below.

1. When RO system is shutdown, flush with permeate or filtered feedwater while keeping the concentrate valve fully opened to completely displace concentrated feed water within RO elements. The maximum pressure and recommended flow rate for membrane element flushing have been described in TSB 109 – Membrane Element Flushing.
2. If chemical injection is typically used during normal operating condition, the chemical injection must be stopped before flushing begins.
3. Once flushing is complete, RO elements must remain submerged in flush water at all times and not be exposed to air.
4. Flush RO system at least once every 24 hours with filtered feedwater. If the operator suspects potential problem due to biofouling during down periods, then flushing frequencies should be increased or start flushing unit with RO permeate.
5. If feed water for flushing every 24 hours is not available, see Long-Term Storage with Preservative Procedure below.

Notes:

Contact with air will dry out the elements. Dry elements will irreversibly lose flux.

Long-Term Storage with Preservative Procedure

If the RO system is to remain off line for more than 7 days, then follow the procedure below.

1. If decline in normalized performance is observed prior to long term storage, performing a clean-in-place (CIP) on the RO system is recommended.
2. Flush the system with permeate or filtered feedwater while keeping the concentrate valve fully opened. The maximum pressure and recommended flow rate for membrane element flushing have been described in TSB 109 – Membrane Element Flushing.
3. Flush the system with a 0.5% solution of sodium metabisulfite (SMBS) solution. Once flushing is completed, RO elements must remain submerged in preservation solution at all times and not be exposed to air.
4. Check preservation solution pH every 30 days. When solution falls below pH 3.0, repeat steps 2 and 3 to re-preserve the elements.

Notes:

Any contact with oxygen will oxidize SMBS and reduce effectiveness of preservative.

In certain situations where the polyamide (PA) membranes have been fouled with heavy metals (e.g., Iron (Fe), Cobalt (Co), or Copper (Cu)), the membrane may be oxidized when stored using SMBS. The oxidation can be prevented by adding chelating agents into the preservative. Please contact LG Chem for advice.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	64 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 106

Membrane Element Operation Precautions

To obtain the maximum service life from your LG Chem membrane elements, certain precautions should be followed to avoid element damage or impaired performance. Additional requirements may be outlined in your product or performance warranty and in other sections of this technical manual. Should there be a conflict between the values and information provided in this manual and in your warranty, the values and information provided in your warranty supersede those outlined in this manual.

Cautions Regarding Feedwater Quality, Operating Limits and Recommended Good Practices

Failure to observe any of the following may result in irreversible damage to your membrane elements, shorten the membrane element's useful life and void the product warranty.

- The maximum applied pressure shall NEVER exceed the value outlined in the LG Chem product data sheet.
- The maximum permeate water recovery shall NEVER exceed the maximum safe water recovery specified by LG Chem's Q+ Projection Software.
- The RO feedwater shall contain NO more than 0.1 ppm of free chlorine.
- The RO feedwater shall contain NO concentration of oil or grease.
- The RO feedwater shall NEVER exceed a 15-minute Silt Density Index (SDI15) of 5 or an NTU of 1. Please refer to "Silt Density Index (SDI15) Procedure - TB 107" in this manual for more information on how to measure SDI.
- The RO feedwater shall NOT exceed a temperature of 45°C (113°F).
- The membrane elements shall be taken offline and chemically cleaned when the pressure differential (ΔP) reaches 1 bar (15 psi) per element and/or 3.8 bar (55 psi) for the housing.
- Only chemicals approved by LG Chem should be used in conjunction with the operation and maintenance of your membrane.
- The pH operating range shall be 2-11 pH. The pH cleaning range shall be 2-12 pH.
- If a more aggressive cleaning is required (ie. pH 13), please contact the LG Chem Tech Service Team before proceeding.

Cautions Regarding Permeate Valve Operation

RO membrane elements should **NEVER** be exposed to permeate backpressure exceeding the feed or concentrate static pressure. This potential issue is most frequently encountered during system or train shutdown. The permeate valves **must remain open** during all phases of train or system operation including pre-start-up, flushing, cleaning and normal operation.

CAUTION

Closing the permeate valves during any phase of system or train operation will create a pressure differential across the tail-end membrane elements that can result in ruptured glue lines and an immediate increase in salt passage. Ruptured glue lines cannot be repaired.

The permeate valves may be closed after flushing and cleaning, following a complete system or train shutdown. It is good practice to fully close the permeate valves during extended periods of shutdown to prevent an aerobic environment in the pressure vessels that can lead to biological growth. Be sure to reopen the permeate valve(s) prior to introducing feedwater back into the system or train.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	65 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 106

Membrane Element Operating

Cautions Regarding Concentrate Valve Operation

Prior to train or system start-up, confirm that the concentrate control valve (the valve that controls the ratio of concentrate flow to permeate flow) is in the fully open position.

CAUTION

NEVER start up a train or system with the concentrate control valve fully or partially closed. After feedwater is introduced to the train or system with the concentrate control valve fully open, slowly close the valve until the desired recovery is achieved. Starting a train or system with the concentrate control valve fully or partially closed can over-pressurize the system, damage the membrane elements, burst piping and create a safety hazard. Train or system permeate recovery should NEVER exceed the maximum safe permeate recovery as recommended by LG Chem or by its Q+ Projection Software.

Cautions Regarding the Rate of Pressurization During Start-up

No train or system should be brought online (pressurized) at a rate faster than 0.7 bars (10 psig) per second.

CAUTION

Rapid pressurization of a train or system can cause mechanical damage to the membrane elements. Such damage can include cracking of the fiberglass outer-shell, failure of the anti-telescoping device and membrane telescoping. Mechanical damage to membrane elements caused by overly rapid pressurization or over-pressurization will void any product or performance warranty.

Chlorine Tolerance

LG Chem membrane elements show some resistance to short-term chlorine (hypochlorite) exposure. The free chlorine tolerance of the membrane is < 0.1 ppm. Continuous exposure, however, may damage the membrane and should be avoided. Under certain conditions, the presence of free chlorine and other oxidizing agents will cause premature membrane failure. Since oxidation damage is not covered under warranty, LG Chem recommends removing residual free chlorine by pretreatment prior to membrane exposure.

CAUTION

Membrane damage caused by oxidation is irreversible and will void your product or performance warranty.

Cautions Regarding the Use of Lubricants

Petroleum-based lubricants should **NEVER** be used in conjunction with LG Chem RO membrane elements. Approved lubricants for interconnector O-rings, end adapter O-rings or membrane element brine seals include glycerin, silicon-based Molykote III, or other silicone-based lubricants that do not contain hydrocarbons.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data 20/02/2025	Rev. 01.0	Pág. 66 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 106

Membrane Element Operating

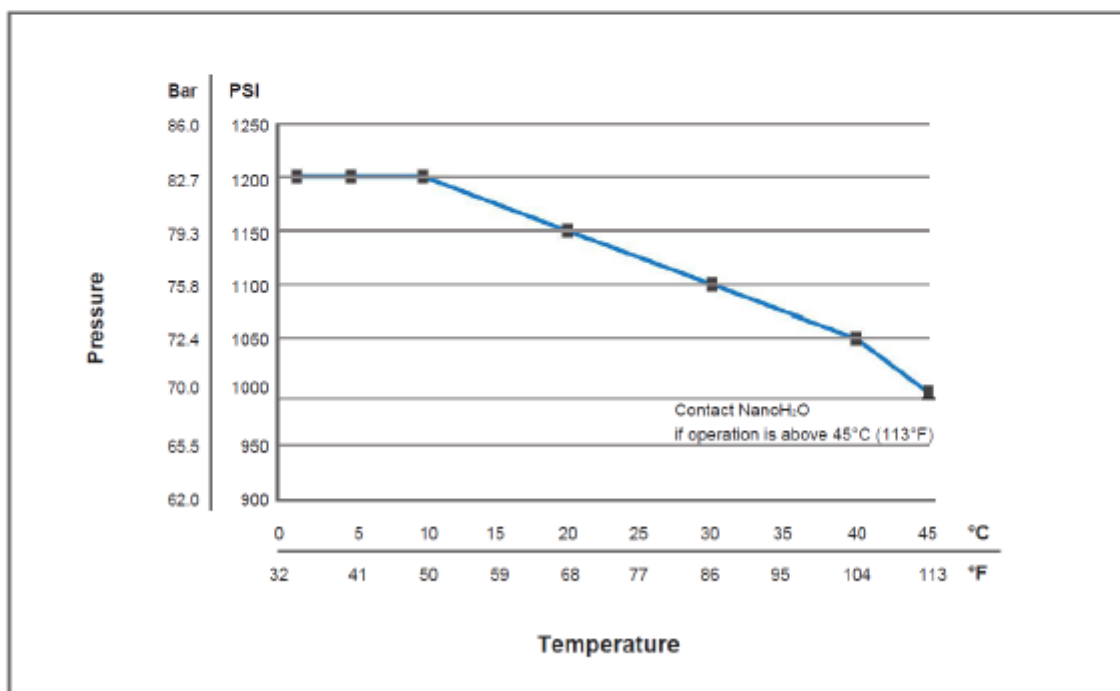
Cautions When Operating at High Temperature and High Pressure

Operation at certain high temperature and high pressure may result in compaction of the polysulfone support layer. Membrane compaction reduces permeability, resulting in higher feed pressure to maintain permeate flow.

⚠ CAUTION

Reduction in permeability from compaction caused by operation at feedwater temperatures and pressures that exceed LG Chem's recommended limits will void your product or performance warranty. LG Chem membrane elements should be operated in compliance with the temperature and pressure recommendations outlined in the following graphs. Please contact LG Chem Technical Support for additional information.

Temperature vs. Pressure Operation Limits for LG Chem Membranes



Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	67 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 107

Silt Density Index (SDI15) Procedure

Protecting the LG Chem membrane elements from particulate fouling minimizes energy use and allows stable long-term product performance. One of the most common methods to determine acceptable RO feedwater quality is the Silt Density Index (SDI). The SDI was developed to assess the membrane fouling potential of RO feedwater. An SDI test measures the time required to filter a specific volume of RO feedwater through a 0.45-micron filter paper at a feed pressure of 2.1 bars (30 psig). The following provides procedures required to determine RO feedwater SDI.

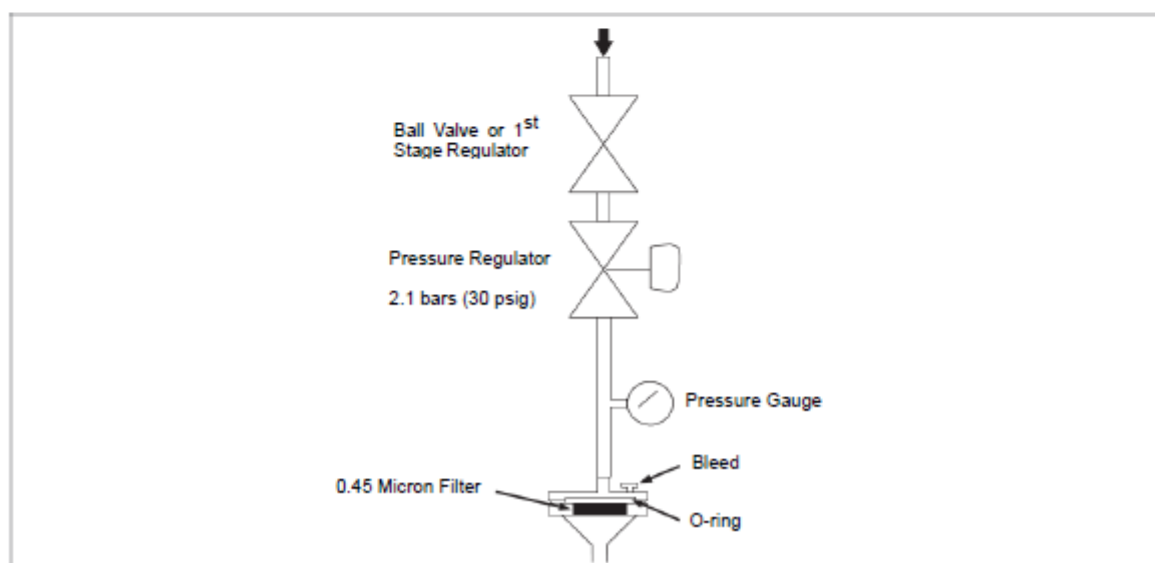
Test Equipment Setup

- SDI kits may be purchased or assembled in accordance with Figure 107.1 below. Follow the SDI instructions on equipment setup.
- Install the test equipment on a sample tap located on the feedwater piping. The sample should be downstream from all chemical dosing points, cartridge filters and immediately before the RO inlet manifold.
- Install a new 0.45-micron filter pad in the filter housing and adjust the pressure regulator to 2.1 bars (30 psig).

Tips:

- Prior to use, thoroughly flush the test equipment to remove any contaminants to ensure an accurate result.
- Do not touch the filter pad. Use a dull pair of tweezers (to avoid puncturing the filter pad) to remove the pad from the package and place it in its proper position in the filter pad holder.
- Ensure that the O-ring is clean and properly seated

Figure 107.1



Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	68 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 107

Silt Density Index (SDI15)

Test Procedures

1. Measure the feedwater temperature, the temperature should not vary more than $\pm 1^{\circ}\text{C}$ (34°F) during the duration of the test.
2. Remove any entrained air from the filter holder housing by either opening the bleed valve or loosening the filter holder (depending on the model used) while slightly opening the ball valve. Once the air has bled from the housing, close the bleed valve or the filter housing.
3. Place a 500 ml (17 fl oz.) graduated cylinder under the filter housing to collect the volume of water that passes through the filter pad.
4. Fully open the ball valve and measure the time required (use a good quality stopwatch) to collect 100 ml (3.4 fl oz.) and 500 ml (17 fl oz.).
5. After five minutes, repeat the test. As before, measure the time required to collect a 100 ml (3.4 fl oz.) sample and a 500 ml (17 fl oz.) sample. Record the time intervals with the flow continuing to run through the filter housing.
6. Repeat the test at the 10-minute interval and again at the 15-minute interval.
7. If the time required to collect a 100 ml sample is greater than 60 seconds, plugging will be about 90% and it will not be necessary to continue the test.
8. After the 5, 10 and 15-minute samples have been collected, measure the water temperature to confirm that the temperature has not varied by more than $\pm 1^{\circ}\text{C}$ (34°F).
9. Upon the completion of the test, the spent filter pad should be sealed in a plastic bag, labeled with the time and date of the test and filed for future references.

Calculations

SDI is calculated using the following formula :

$$\text{SDI} = P_{30}/T_t = 100 \times (1 - T_i / T_f) / T_t$$

SDI	Silt Density Index
P₃₀	% plugging at 2.1 bars (30 psig) feed pressure ²
T_t	Total test time in minutes ²
T_i	Time in seconds required to obtain the initial 500 ml (17 fl oz.) sample
T_f	Time in seconds to obtain the final 500 ml (17 fl oz.) sample

Notes:

1. The time required to collect a 500 ml (17 fl oz.) sample should be approximately 5-times greater than the time required to collect a 100 ml (3.4 fl oz.) sample. If the 500 ml (17 fl oz.) sample time is much greater than 5-times that of the 100 ml (3.4 fl oz.) sample, the SDI should be calculated using 100 ml (3.4 fl oz.) sample collection times.
2. The total test time is usually 15 minutes. However, it may be less than 15 minutes if 75% plugging occurs in less than 15 minutes. To obtain accurate SDI measurements, P₃₀ should not exceed 75%. If P₃₀ does exceed 75%, the test should be repeated to obtain T_f in a shorter period of time (T).

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	69 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 108

Vessel Probing

A useful diagnostic method to identify membrane performance problems within a pressure vessel is to probe the elements within the pressure vessel in order to identify O-ring or interconnector leaks, locate poorly performing elements, or to identify other problems. Vessel probing involves inserting a length of polyethylene tubing into the vessel permeate channel so that conductivity measurements can be taken from each element within the pressure vessel. If abnormally high conductivity is observed at any individual element, this may be an indication of a poorly performing membrane element, O-ring leak, decoupled interconnector, or other problem.

Setting Up the Equipment

1. Shut down the RO system or train containing the pressure vessel(s) to be probed.
2. Remove the permeate cap from the opposite end of the pressure vessel from where you intend to measure permeate conductivity.
3. Connect a 1¼ inch threaded coupling to the permeate port and thread a 1¼ inch x ½ inch threaded reducer bushing into the coupling. Next, thread onto the coupling a ½ inch nipple and DN 15 (½ inch) ball valve onto the assembly. Finally, thread a ½ inch Parker Fast & Tight male connector for use with DN 10 (¾ inch) tubing. Remove the metal collar and O- ring from the Fast & Tight fitting.
4. Obtain a length of DN 10 (¾ inch) O.D. polyethylene tubing. The length of tubing needs to be significantly longer than the length of the pressure vessel being probed.
5. Using a marking pen with permanent ink (non water-soluble ink), place a mark at the point where the furthest membrane element connects to the end adapter. This is the "total length" mark. Then, mark the tubing in 508 mm (20-inch) increments from that point forward. (Black tubing is not recommended as you must be able to observe the markings)
6. Close the ball valve on the probe fitting and restart the RO system or put the train back in service.
7. Allow the system or train to run for approximately 15 minutes to stabilize performance.
8. After performance has stabilized, insert the tubing into the Fast & Tight fitting while opening the ball valve. Insert the tubing down the length of the permeate channel until the "total length" mark is reached.
9. After approximately one minute, measure the conductivity of the water coming out of the tubing. Repeat the reading several times to confirm that the values are consistent. Record the conductivity and the location from which it was taken.
10. Retract the tubing 508 mm (20 inches) to the next mark, wait one minute, repeat the conductivity measurement and record the data and the position from which the data was taken. Repeat this procedure until all element positions have been probed. You may want to slightly close the ball valve to better hold the tubing in place. Once the tubing has been removed from the vessel permeate channel, close the ball valve and continue to the next vessel.

Evaluate the conductivity values along the length of the permeate channel for each individual pressure vessel, then compare the trends of vessels operating in parallel. A sudden increase in conductivity where two elements interconnect indicates a feed to permeate leak that may be caused by a leaking O-ring or a disconnected interconnector. Replacing the faulty O-ring or reseating the interconnector can easily resolve the issue. If interconnectors become decoupled, shim the element stack within the pressure vessel. Please refer to "Vessel Shimming Procedures - TSB 103"

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	70 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 109

Membrane Element Flushing

Prior to first use, it is strongly recommended that the membrane elements be flushed. Seawater RO membrane elements must also be flushed following system or train shutdown to remove highly concentrated salts from the membrane elements.

Remove Membrane Preservatives

The membrane elements are shipped after being immersed in a 0.5 wt% sodium metabisulfite solution and drained. After installation, the permeate produced for the first 10 minutes of plant operation should be discharged.

Pre-Flush of RO System at Start-up

Prior to installing the membrane element(s), the system or train MUST be flushed to remove any entrained air in the pressure vessel.

Prior to initial flushing, please ensure that the elements are correctly loaded and that all O-rings and brine seals are properly installed.

Ensure that the elements in each pressure vessel have been properly shimmed to remove any excess slack in the pressure vessels.

Initiate a low pressure flush at 1 - 1.4 bars (15-20 psig) to ensure that all air is purged from the membrane elements and pressure vessels prior to ramping up the pressure to achieve normal operation. The low pressure flush should be carried out with the permeate valves open to drain, the concentrate control valve fully open and a soft-start mechanism or variable speed drive.

The permeate produced for the first 10 minutes of plant operation should be discharged. To ensure the highest quality permeate stream, discard the permeate for the first hour of operation after initial start up. Furthermore, prolonged flushing may be necessary depending on the application and required water quality.

⚠ CAUTION

Failure to remove entrained air can result in mechanical damage to the membrane elements due to high hydraulic forces resulting from water hammer.

Notes:

When flushing a membrane element, the permeate valves should be open to drain and the concentrate control valves should also be fully open to avoid damaging the membrane elements. For any flushing operation to be effective, the volume used for flushing should exceed the liquid hold-up volume of the membrane elements. For standard 8-inch x 40-inch elements, assume the hold-up volume is 37.85 liters (10 gallons) for each membrane element. For standard 4-inch x 40-inch elements, assume the hold-up volume is 11.35 liters (3 gallons) for each membrane element. To ensure the highest quality permeate stream, discard the first hour's worth of permeate after initial start-up.

⚠ CAUTION

System pressurization and depressurization should be accomplished slowly and should not exceed 0.7 bar/sec (10 psig/sec).

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	71 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 109

Membrane Element Flushing

Post-Flush of RO System at Shutdown

For seawater systems, it is *strongly recommended* that highly concentrated salts be removed from the system by flushing after every shutdown.

Following system or train shutdown, it is **REQUIRED** that the membrane elements be flushed with RO feedwater to remove the high concentration of salts contained in the membrane elements. An RO system or train should never be shut down without immediately flushing the high TDS concentration from the membrane elements

CAUTION

Failure to remove the high TDS concentration of the hold-up volume in the membrane elements may result in damage to the elements.

Notes:

When flushing a membrane element, the permeate valves should be open to drain and the concentrate control valves should also be fully open to avoid damaging the membrane elements. For any flushing operation to be effective, the volume used for flushing should exceed the liquid hold-up volume of the membrane elements. For standard 8-inch x 40-inch elements, assume the hold-up volume is 37.85 liters (10 gallons) for each membrane element. For standard 4-inch x 40-inch elements, assume the hold-up volume is 11.35 liters (3 gallons) for each membrane element.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	72 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 110

Customer Claim and Complaint Procedure

This procedure is for customers whom LG Water Solutions ("Manufacturer") have advised to return their purchased product for evaluation in support of a warranty claim ("Return Merchandise").

Before returning the Return Merchandise, customers are required to complete the 'Request for Return Merchandise Authorization Form' (see a copy at the end of this bulletin, or download from our website www.LGwatersolutions.com) and email the completed form to the email corresponding to your region listed below:

Region	E-mail
Americas	nasales@lgchem.com
Europe, Africa	eumanasales@lgchem.com
Middle East, Egypt	mesales@lgchem.com
Korea	krsales@lgchem.com
China	cnsales@lgchem.com
India	insales@lgchem.com
Southeast Asia	seasales@lgchem.com

Customers will receive a Return Merchandise Authorization (RMA) number by email within 48 hours after submitting the Request for Return Merchandise Authorization form. The RMA number MUST appear on all shipping documents accompanying Return Merchandise to ensure that Return Merchandise is identified, accepted, and routed to the proper department for processing and evaluation. Any Return Merchandise received without an identifiable RMA number will be refused at the expense of delivery charges to the sender.

Please ship all Return Merchandise corresponding to the RMA claim to the Manufacturer immediately upon confirmation of your RMA number by the Manufacturer. Immediate shipping allows for a more accurate analysis of Return Merchandise claims. The Manufacturer must receive the Return Merchandise within 30 days for domestic shipments and 60 days for international shipments from when the RMA number is issued. Failure to comply with this requirement may void your warranty claim, and the Manufacturer will not be liable for any incurred costs (i.e., shipping).

Shipping of Return Merchandise to Manufacturer does not mean that the Manufacturer accepts all responsibility of a warranty claim. The sole purpose of returning the Return Merchandise to the Manufacturer is to carefully inspect the Return Merchandise to determine whether it falls within or outside of the warranty terms. Before any conclusions are determined through analysis of the Return Merchandise, all expenses will be the customer's responsibility.

Merchandise should be prepared for shipment and packaged per the Packing and Shipping Requirements detailed below :

**DO NOT RETURN MERCHANDISE UNTIL YOU HAVE
RECEIVED A WRITTEN AUTHORIZATION AND A VALID
RMA NUMBER FROM LG WATER SOLUTIONS**

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	73 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 110

Customer Claim and Complaint Procedure

Packing and Shipping Requirements:

- Flush membrane elements with RO permeate for a minimum of 30-minutes at pH 6-8 to ensure that any hazardous liquids contained in the Return Merchandise are flushed out and for safe handling of the Return Merchandise.

LIQUIDS CONTAINING A STRONG ACID OR AN ALKALI CLEANING SOLUTION ARE CONSIDERED TO BE HAZARDOUS FOR TRANSPORT AND MUST BE FLUSHED OUT BEFORE SHIPMENT.

- Before shipping, please follow the Manufacturers' Membrane Element Storage Procedure (see "Receipt of Elements, Short-Term Storage, and Disposal of Used Elements – TSB 101") to preserve the Return Merchandise

- Before shipping, the Return Merchandise must be vacuum-sealed in a leak-proof polyethylene bag and securely packaged in a cardboard box to keep the RO element hydrated and protect it from physical damage during shipment

DURING SHIPMENT, TAKE PRECAUTIONS TO ENSURE THAT MEMBRANE ELEMENTS ARE PROTECTED FROM FREEZING OR PROLONGED EXPOSURE TO TEMPERATURES EXCEEDING 35°C (95°F).

Please ship Return Merchandise to the following address :

LG Chem / LG Water Solutions Cheongju Plant

RO Filter QA Team 39, Baekbong-ro, Heungdeok-gu, Cheongju-si,
Chungcheongbuk-do, 28441, Republic of Korea.

Attention : YunBum Chung, QA Manager

Phone : +82 043 261 9973

Email : ybchung@lgchem.com

RMA# : _____.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	74 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 110

Customer Claim and Complaint Procedure

Warranty Claim Validation Procedure

Return Merchandise submitted under a warranty claim are evaluated according to the following procedure:

1. Initial Element Inspection

- Visual inspection of the core tube, anti-telescoping device (ATD), and element's fiberglass outer wrap – to determine if the Return Merchandise components sustained damage due to improper handling, installation, or operation.
- The Return Merchandise will be weighed to determine any variances in weight, indicating fouling or scaling.
- If the Return Merchandise fails to pass either of the initial inspections stated above, the warranty replacement will not be approved. The customer will be billed for any expenses incurred for analysis of the Return Merchandise.
- A vacuum or air leak test will be performed to determine if the Return Merchandise has a mechanical leak. Return Merchandise failing the vacuum or air leak test will be autopsied to determine whether the leak is covered under the Material and Workmanship Warranty, or was caused by improper use, operation, or handling of the Return Merchandise.
- Elements passing the initial inspection will be wet tested to determine current membrane performance.

2. Element Wet Test:

- The Return Merchandise will be wet tested to determine the current salt rejection and permeate flux under Manufacturer's standard test conditions.
- The wet test data will be compared with performance data at initial release of the merchandise (ex-works LG Chem CJ plant) and warranted performance values.
- Based on the wet test data results, the Manufacturer will proceed with further analysis as decided by the customer.

3. Determination

- Return Merchandise found to comply with warranted performance values will be returned to the customer at the customer's expense ("freight collect"). The customer will be billed the evaluation fee for each Return Merchandise evaluated.
- Return Merchandise found to be defective based on the Material and Workmanship Warranty will be replaced or credited to the customer according to the applicable warranty terms and conditions.
- Return Merchandise performing below warranted performance values regarding salt rejection, permeate flow, or both, will be replaced or credited to the customer according to the applicable warranty terms and conditions.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	75 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 110

Customer Claim and Complaint Procedure

General Conditions

The customer is responsible for prepaying the shipping charges of the Return Merchandise. The Manufacturer will not accept any Return Merchandise unless it is prepaid. The Manufacturer may request that the customer issue a valid purchase order covering all work related to the warranty inspection, such as analytical work.

When inspection of the Return Merchandise by the Manufacturer concludes that a defect did not cause the warranty claim in material and workmanship:

- The Return Merchandise shall be returned to the customer at the expense of the customer (freight collect); and
- The customer will be billed for the Return Merchandise evaluated including autopsy and house analysis.

When inspection of the Return Merchandise by the Manufacturer concludes that a defect caused the warranty claim in material and workmanship:

- The Return Merchandise will be shipped to the customer free of charge. Please review your warranty for the terms and conditions applicable to your purchase order.

All terms, conditions, and specific remedies outlined in the customer's applicable warranty shall apply in processing all warranty claims. Please contact LG Water Solutions through the email address corresponding to your region listed above for further questions.

The customer is responsible for returning the Return Merchandise to the Manufacturer for membrane analysis. The warranty claim will not be accepted unless the membrane analysis is complete.

The Manufacturer advises the customer to complete the Request for Return Merchandise Authorization Form, including "The option for prior compensation request" on the form if replacement RO membrane elements are required to prevent the shutdown of your RO system while the Manufacturer conducts the warranty claim inspection.

When the customer receives replacement membrane elements by prior compensation request, the Return Merchandise must be shipped immediately to the Manufacturer following membrane replacement. If the Return Merchandise is not returned within two months, the customer is responsible for the compensation membrane elements at current pricing plus shipping charges.

The membrane elements delivered under prior compensation will be billed to the customer at their recent purchase price if the conclusion of the analysis of the used membrane elements is that the problem has not been caused by the membrane supplier.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	76 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 110

Customer Claim and Complaint Procedure

RO Element RMA Request Form

New or Used Elements Removed from Original Packaging

Section 1				
TO BE FILLED OUT BY REQUESTOR				
Name of Requestor		Date of Request		
CUSTOMER INFORMATION				
Company Name				
Address/ Region				
Contact Person				
Phone/ Mobile		Email		
REPORTED PROBLEM				
☐ Low Flow (High Feed Pressure)		☐ High Permeate Conductivity (Low Rejection)		
☐ High Differential Pressure		☐ Visual Product Defect		
☐ Other:				
TIME WHEN PROBLEM FIRST OCCURRED				
☐ Before Element Installation				
☐ At Startup (Less than 24 hours of continuous operation)				
☐ After Startup (2 to 14 days)				
☐ Other: Months After Startup				
ELEMENT INFORMATION				
Element Model				
No. Returned Element(s)		No. Elements Affected		
Please note the element serial number and location within the system (e.g. 140XXXXX- Vessel B7- Position 1-8)				
1.	Serial (FRP) No.		Position/PV	
2.	Serial (FRP) No.		Position/PV	
3.	Serial (FRP) No.		Position/PV	
4.	Serial (FRP) No.		Position/PV	
NOTES				
Has the element(s) to be returned been exposed to Hazardous Materials? ☐ Yes ☐ No				
If Yes, Please provide details below (or attach to this document) and advise customer that MSDS sheets for all hazardous materials have to be submitted along with this RMA request. If approved, the same MSDS sheets are to be included with the returned elements.				
COMMERCIAL CLASSIFICATION				
☐ Warranty Claim		☐ Non Warranty Replacement		
☐ Non Warranty Credit		☐ Billable Technical Service Evaluation		
☐ No Charge Technical Service Evaluation		☐ Application Engineering		

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	77 de 95
Código AdA		Código ACE		
AL-ACE-3320-ME-DSH-ROM01		AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Section 2				
SYSTEM INFORMATION				
Plant Location:				
☐ New		☐ Replacement		
Plant Configuration / Array				
System Recovery (%)				
Start-Up Date				
Project Capacity				
Total Number of Elements				
Application				
CIP conditions/ Period				
Pretreatment				
Feed Water Source:	☐ Well	☐ Surface Intake	☐ Seawater	☐ Municipal Waste
	☐ Municipal Supply	☐ Industrial Waste	☐ Other ()	
Permeate Use:	☐ Drinking	☐ Reclamation	☐ 2 nd Pass RO Feed	
	☐ Ion Exchange Feed	☐ Other		
OPERATING DATA INFORMATION				
Data Collection frequency	☐ Daily	☐ Per Shift	☐ Other	
Data Format	☐ Hand Written	☐ Excel Spreadsheet	☐ Normalization	☐ SCADA
Normalization Used	☐ LG NanoH2O	☐ DOW	☐ TorayTrak	☐ Hydranautics

Section 3	
TO BE FILLED OUT	
REQUIRED TEST	
☐ As Received Visual Inspection	
☐ Re-Wet Test	
☐ Autopsy	
☐ Dye Test- Rhodamine B (Pink)	
☐ Other:	

Section 4	
INFORMATION FOR CUSTOMER SERVICE	
No of Elements to be Returned:	
Serial Numbers or Customer PO:	
Commercial Classification:	☐ Credit ☐ Replacement
Further Instructions:	
RMA NUMBER	

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	78 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Commercial Invoice

Sender :			Recipient :			
Email Address :			LG Chem Cheongju Plant, RO Filter QA Team 39,			
Phone Number :			Baekbong-ro, Heungdeok-gu, Cheongju-si, Chung cheong			
			buk-do, 28441, Republic of Korea			
			Attn: YunBum Chung			
			Email : Address : ybchung@lgchem.com			
			Phone Number : +82-43-261-9973			
			Tax ID/VAT/EIN Number : 107-81-98139			
Invoice Date :			Invoice Number :			
Waybill Number :			Sender's Reference :			
Carrier :			Recipient's Reference :			
Quantity	Country of Origin	Description of Contents	Harmonized Code	Unit Weight	Unit Value	Sub Total
Total Net Weight:			Total Declared Value: (USD)			
Total Gross Weight			Freight & Insurance Charges: (USD)			
Total Shipment Pieces:			Other Charges: (USD)			
Currency Code:			Total Invoice Amount: (USD)			
Type of Export :			Terms of Trade :			
Reason for Export :						
General Notes :						

The exporter of the products covered by this document declares that, except where otherwise clearly indicated, these products are of Korea, Republic Of preferential origin.

I/We hereby certify that the information on this invoice is true and correct and that the contents of this shipment are as stated above.

Name : Position in Company : Signature : _____	Company Stamp
---	---------------

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	79 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 111

Data Logging and Performance Normalization

In order to properly troubleshoot membrane performance issues, identify system operational issues, develop cleaning and maintenance procedures and ensure the validity of the product/system warranty, it is critical that feedwater quality and system performance data be recorded and filed on a regular basis so that such information is readily available for review in the event of a performance problem or a warranty claim.

Why is Data Collection Important?

Because RO membrane performance can be affected by a variety of factors, such as a change in feedwater quality or a change in operating conditions, the only way to determine whether your membranes are performing as expected is through regular collection and routine analysis of feedwater quality and system performance data. This information can then be evaluated over time to determine whether membrane performance is tracking as expected or if adverse trends develop which then require corrective action. All data collected should be systematically logged and filed for future access to allow analysis of longer-term performance trends that may require troubleshooting or support a warranty claim.

CAUTION

Failure to maintain the minimum data logging requirements identified herein or to make such data available to LG Chem upon request may result in voiding your product/system warranty.

Why Normalize Data?

RO membrane performance will vary depending on feedwater characteristics, feedwater composition and operating conditions. Parameters such as feedwater temperature, feedwater TDS, membrane fouling, or system recovery will change key membrane performance characteristics such as feed pressure, permeate flow and permeate quality.

To determine whether changed performance is the result of changed feedwater or operating conditions, or whether it is due to a change in actual membrane performance, operating data must be taken at regular intervals and then "normalized" to baseline reference conditions. Whether changed performance is apparent or actual can only be determined by comparing "normalized" performance over time with baseline performance. To ensure optimized membrane performance and a long service life, it is important that any changes in membrane performance be identified and corrective action be taken as quickly as possible. A complete record of normalized data is therefore essential for users to realize the best performance and longest operating life of LG Chem RO membrane elements.

Causes for Changes in Apparent Membrane Performance

Certain changes in the operating parameters of the RO system or train will result in changes in RO membrane performance. Such changes can result in an apparent or actual change in permeate flow or quality. Below is a list of the changed conditions that typically affect RO membrane performance.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	80 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 111

Data Logging and Performance Normalization

Conditions Resulting in Reduced Permeate Flow:

1. A reduction in feedwater temperature will result in a reduction in permeate flow if there is no corresponding increase in the feed pressure. An increase in the feedwater temperature will likewise result in an increase in permeate flow if there is no corresponding decrease in the feed pressure.
2. Decreasing the RO feed pressure will result in a reduction in permeate flow as a consequence of reducing the net driving pressure (NDP) across the membrane elements. NDP is the available effective pressure required to drive permeate through RO membranes. NDP is a function of the applied feed pressure, pressure losses, feed/concentrate osmotic pressure and permeate pressure.
3. Increasing the permeate backpressure will result in a reduction in permeate flow, due to a reduction in the available NDP.
4. An increase in the feedwater TDS will increase the osmotic pressure and result in a loss of permeate flow due to a reduction in the available NDP, unless the feed pressure is also increased.
5. Increasing the system recovery (the ratio of permeate flow to feed flow) will result in an increase in osmotic pressure, which will reduce the NDP, thus a reduction in permeate flow.
6. Membrane surface fouling will cause a decrease in membrane permeability and a subsequent reduction in permeate flow.
7. Fouling of the membrane element's feed/brine spacer will increase the feed/concentrate pressure drop across the membrane elements operating in series, causing a decrease in NDP for the elements at the end of the system and resulting in a reduction in permeate flow.

Conditions Resulting in Increased Permeate Salinity:

8. An increase in the feedwater temperature without a corresponding change in permeate flow will result in an increase in permeate salinity.
9. A reduction in the plant/train permeate flow reduces the rate of water flux through the membrane, causing an increase in permeate salinity because there is less permeate to dilute the salts that have passed through the membrane.
10. An increase in the feedwater salinity will result in an increase in permeate salinity because an RO membrane rejects a fixed percent of the total salts.
11. An increase in the system recovery (the ratio of permeate to feed) will increase permeate salinity because this has the effect of increasing the average salinity of the feed/brine in the system.
12. Membrane surface fouling results in less permeate flow and thereby less permeate to dilute the salts that have passed through the membrane.
13. Mechanical leaks caused by O-ring leaks or failure can allow high TDS feed/brine to leak into the permeate without passing through the membrane or allow feed to bypass an element's brine seal.
14. Membrane surface damage can be caused by exposure to free chlorine.

By normalizing plant data, the reviewer can determine if changes in membrane performance (in either permeate flow or quality) result from operating under different feed pressure, salinity or temperature conditions and, therefore, conclude if changes in performance are only apparent or actual. Actual changes require corrective action to remove surface foulants, locate and correct O-ring leaks, or prevent further membrane damage due to oxidation.

Graphing normalized data over time provides a useful picture of RO system performance and will identify how and when performance may have changed. Adverse changes in performance trends can then be reviewed in light of other data and plant operation logs to determine what happened, when it happened, and what can be done to correct the problem.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data 20/02/2025	Rev. 01.0	Pág. 81 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 111

Data Logging and Performance Normalization

Data Collection Procedures

The following tables identify the data to be regularly collected and the frequency of collection.

LG Chem RO Membrane Minimum Logging Requirements

RO Feedwater Characteristics - Required Data:

Parameter	Frequency of Collection	Comment or Unit of Measure
Salt Density Index (SDI)	Once per day (every 24 hours)	Please refer to "SDI Procedure TSB 107"
Turbidity	Once per shift (every 8 hours)	Nephelometric Turbidity Units
Temperature	Once per day (every 24 hours)	°C or °F
Conductivity (µS)	Once per day (every 24 hours)	
Feedwater Chemical Analysis	Once per month	

RO Permeate System or Each Train – Required Data:

Parameter	Frequency of Collection	Comment or Unit of Measure
Conductivity (µS)	Once per day (every 24 hours)	
Flow	Once per shift (every 8 hours)	
Pressure	Once per shift (every 8 hours)	

RO Concentrate System or Each Train – Required Data:

Parameter	Frequency of Collection	Comment or Unit of Measure
Conductivity (µS)	Once per day (every 24 hours)	
Flow	Once per shift (every 8 hours)	
Pressure	Once per shift (every 8 hours)	

Operating Conditions for RO System or Each Train:

Parameter	Frequency of Collection	Comment or Unit of Measure
Pressure Differential for each stage	Once per day (every 24 hours)	
Cumulative Hours of Operation	Once per day (every 24 hours)	

Operating or Maintenance Events for RO System or Each Train:

Parameter	Frequency of Collection	Comment or Unit of Measure
System or Train Start-up	As applicable	Record date and time
System or Train Shutdown	As applicable	Record reason for shutdown, date, and time
Membrane Cleaning or Flushing	As applicable	Record reason for cleaning, chemical(s) used, method or procedure, concentration, date and time. Record results following cleaning.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	82 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 111

Data Logging and Performance Normalization

Data Normalization Equations

To obtain normalized permeate flow, use the following equation :

$$Q_n = Q_a * (NDP_n / NDP_a) * (TCF_n / TCF_a)$$

Q_n	Rate of permeate flow (vol/t) normalized to standard conditions
Q_a	Actual flow rate (vol/t)
NDP_n	Net Driving Pressure at standard conditions (expressed as units of pressure)
NDP_a	Actual Net Driving Pressure (expressed as units of pressure)
TCF_n	Temperature Correction Factor for temperature at standard conditions
TCF_a	Temperature Correction Factor for temperature at the actual conditions

To obtain the Net Driving Pressure, use the following equation:

$$\text{Net Driving Pressure} = P_f - \frac{1}{2} \Delta P_{fb} - P_{osm} - P_p$$

P_f	Feed pressure
ΔP_{fb}	Pressure drop between the feed and brine systems
P_{osm}	Osmotic pressure - weighted average
P_p	Permeate pressure

To obtain the Osmotic Pressure, use the following equation:

$$P_{osm} = CF_{lm} * C_f * 11/1000 * K_{p-cond}$$

CF_{lm}	Log mean concentration factor
C_f	Feed conductivity ($\mu S\text{-cm}$)
K_{p-cond}	Conductivity to Pressure conversion factor (this constant is a function of the TDS of the sample)

To obtain the Log Mean Concentration Factor, use the following equation

$$CF_{lm} = \ln [1 / (1-R)] / R$$

R	System Recovery (% expressed in decimal)
-----	--

To obtain the Temperature Correction Factor (TCF), use the following equation

$$TCF = \exp \{ K * [1 / 298 - 1 / (273 + t)] \}$$

CF_{lm}	Log mean concentration factor
C_f	Feed conductivity ($\mu S\text{-cm}$)

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	83 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 111

Data Logging and Performance Normalization

To obtain normalized Salt Passage, use the following equation:

$$\%SP_n = (EPF_a / EPF_n) * (STCF_n / STCF_a) * \%SP_a$$

%SP_n	Percent Salt Passage normalized to standard conditions
SP_a	Percent Salt Passage at actual conditions
EPF_a	Element Permeate Flow rate at standard test conditions
EPF_n	Element Permeate Flow rate at actual conditions
STCF_n	Salt Transport Temperature Correction Factor at standard conditions
STCF_a	Salt Transport Temperature Correction Factor at actual conditions

To obtain the actual Salt Passage, use the following equation :

$$\%SP_a = C_p / C_{fb}$$

C_p	Permeate concentration (expressed in ppm)
C_{fb}	Feed/brine concentration (expressed in ppm) which = the feed concentration (expressed in ppm) multiplied by the log mean

To obtain the Salt Transport Temperature Correction Factor, use the following equation :

$$STCF = \exp \{ K * [1 / 298 - 1 / (273 + t)] \}$$

t	degrees Celsius
K	5030 for composite RO membranes

To obtain the Normalized Differential Pressure, use the following equation :

$$NDP = DP * ((QF_n + QC_n) / (QF_a + QC_a))^{(1.5)}$$

DP	Differential Pressure
QF_n	Feed flow at standard test conditions
QF_a	Feed flow at actual conditions
QC_n	Concentrate flow at standard conditions
QC_a	Concentrate flow at actual conditions

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	84 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 112

Biocides for Disinfection and Storage

The periodic use of biocides may be required to control or eliminate biological growth in the feed/brine spacer or on the membrane surface, especially in cases of long-term storage. The following is general information on the application, use and handling of generic biocides that are suitable for use with LG Chem's membrane products.

Specialty chemical biocide products are formulated and distributed by a number of independent companies and marketed under various trade names. These products have typically been qualified by the chemical manufacturer for safe and effective use with composite polyamide seawater RO membranes. LG Chem makes no representations as to either the efficacy or safety associated with such use and any such use by LG Chem Customers is done at the sole risk of the Customer and the chemical manufacturer.

Below is a list of generic biocides approved for use.

CAUTION

Prior to use, review all applicable Material Safety Data Sheets (MSDS) and follow all manufacturer instructions and applicable governmental regulations with regard to the use, handling and disposal of biocides.

- Isothiazolin

Many manufacturers of water treatment chemicals distribute Isothiazolin under the trade name Kathon. Commercially available solutions typically contain 1.5 wt% of the active ingredient Isothiazolin. Please check the product literature to confirm the active ingredient concentration. Kathon is an effective biocide to maintain sanitary conditions in LG Chem membrane elements at concentrations of 15 ppm to 25 ppm and may be used for system or train disinfection, or for long-term storage.

- Sodium Bisulfite

Sodium Bisulfite may be used to inhibit biological growth in the system or train when dosed daily at concentrations of 500 ppm for 30 to 60 minutes. Sodium Bisulfite at a concentration of 1 wt% may also be used to inhibit biological growth during long-term storage.

- Hydrogen Peroxide

A 0.1% to 0.2% solution of hydrogen peroxide (or a solution of hydrogen peroxide with paracetic acid) may be used for system or train disinfection. See caution statement below.

- DBNPA

The standard method to apply DBNPA is slug (intermittent) dosing. The amount of DBNPA used depends on the severity of the biological fouling. With a water less prone to biological fouling, using 10 – 30 ppm of the active ingredient for 30 minutes to 3 hours every 5 days can be effective.

CAUTION

Hydrogen Peroxide is a strong oxidizing agent and should not be used when transition metals such as iron or manganese are present in the feedwater. Oxidation of transition metals on the membrane surface will result in irreversible damage causing a reduction in salt rejection. Feedwater temperature should never exceed 25°C (77°F) when exposing membrane elements to a Hydrogen Peroxide solution. Hydrogen Peroxide should NOT be used for disinfection during long-term storage as its efficacy degrades with time.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	85 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 113

Membrane Cleaning

To maintain the performance and efficiency of LG Chem elements, the membranes should be cleaned periodically according to LG Chem's specifications and requirements. Chemical cleaning is helpful in removing contaminants that have accumulated on the membrane surface or in the feed channel either from normal operation or an unexpected increase in feed water fouling potential.

Operating data should be collected and normalized frequently as described in LG Chem TSB 111. Trends of normalized data are the best indicators for determining when a membrane cleaning is required. A membrane cleaning should be performed when one or more of the following changes have occurred:

- Normalized permeate flow has decreased 10% since startup or last cleaning
- Normalized salt passage has increased 10% since startup or last cleaning
- Normalized pressure drop from feed to concentrate has increased 15% since startup or last cleaning.

Under certain conditions, cleanings may not be needed until changes greater than those listed above have occurred. Please contact LG Chem for possible site specific cleaning guidelines prior to any cleaning.

Cleaning Chemicals

In many cases, RO elements can be effectively cleaned with a high pH sodium hydroxide solution (NaOH) followed by a low pH citric acid/HCl solution. The common chelating agent, EDTA, can be added to the sodium hydroxide solution if necessary. The recommended concentrations and allowable temperature and pH limits are provided below.

Allowable pH / Temperature Limits

pH Limit	Corresponding Maximum Temperature (°C)	
	Seawater RO	Brackish Water RO
≥ 2	40	40
≤ 11	35	35
≤ 12	30	25

Data Collection

It is important to collect the following data during the cleaning process:

Date & Time	Chemical(s) Used	Starting & Ending pH	Starting & Ending Temperature
Recirculation Flow & Time	Soak Time	Observations	

⚠ CAUTION

When using ANY chemical, follow accepted safety practices and read all manufacturer's instructions. Consult the chemical manufacturer for further details on handling and disposal. When preparing cleaning solutions, ensure that all chemicals are dissolved and well mixed before circulation the solutions through the elements.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	86 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 113

Element Cleaning Procedure

Recommended Concentrations

Grade	Solution	Concentration	Recommended pH Range	Recommended Temperature Range (°C)
BW R BW ES BW UES	NaOH / RO permeate	Up to 0.1% by weight	10-12	25 - 30
	NaOH, EDTA / RO permeate	NaOH: Up to 0.1% by weight EDTA: Up to 1.0% by weight	10-12	25 - 30
	Citric Acid, HCl / RO Permeate	Citric Acid: Up to 2.0% by weight HCl: Up to 0.1-0.2% by weight	2-4	25 - 30
BW R G2 BW R Dura BW AFR G2	NaOH / RO permeate	Up to 0.1% by weight	11-13	25 - 30
	NaOH, EDTA / RO permeate	NaOH: Up to 0.1% by weight EDTA: Up to 1.0% by weight	11-13	25 - 30
	Citric Acid, HCl / RO Permeate	Citric Acid: Up to 2.0% by weight HCl: Up to 0.1-0.2% by weight	1-3	25 - 30
SW R / R G2 SW GR / GR G2 SW SR / SR G2	NaOH / RO permeate	Up to 0.1% by weight	11-13	25 - 30
	NaOH, EDTA / RO permeate	NaOH: Up to 0.1% by weight EDTA: Up to 1.0% by weight	11-13	25 - 30
	Citric Acid, HCl / RO Permeate	Citric Acid: Up to 2.0% by weight HCl: Up to 0.1-0.2% by weight	2-4	25 - 30
SW ES	Citric Acid, HCl / RO Permeate	Citric Acid: Up to 2.0% by weight HCl: Up to 0.1-0.2% by weight	2-4	25 - 30

Notes:

- Cleaning LG SWRO membranes at pH 13 is generally not recommended. However if a more aggressive cleaning is required, please contact the LG Chem Tech Service Team before proceeding
- HCl can be used for making a low pH cleaning solution. Please keep in mind the HCl is a strong acid and it is easy to overshoot the pH well below the recommended limit. LG Chem recommends starting the low pH solution with citric acid and making final adjustments with HCl.
- Use of generic or proprietary chemical cleaners other than those listed above may be necessary or desired. Please contact LG Chem and/or the chemical provider to verify the cleaning chemical's compatibility with LG Chem membranes and for its use in many site specific applications.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	87 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 113

Element Cleaning Procedure

Cleaning Procedure

1. If the unit does not have an adequate amount of permeate flush at shutdown, flush all vessels with RO permeate until the feed-concentrate process water is completely displaced. RO permeate used for flushing and mixing of cleaning chemicals must be free of any chlorine or other oxidizing agent.
2. Prepare a high pH NaOH solution per the allowable pH and temperature guidelines.
3. Introduce cleaning solution at a rate of 75 liters per minute (20 gallons per minute) per 8-inch diameter vessel.
4. Do not allow any feed-concentrate process water displaced from the introduction of cleaning solution to enter the cleaning tank. If the initial volume of cleaning solution returning to the tank is extremely dirty, discard that as well.
5. Recirculate the cleaning solution at a rate of 151 liters per minute (40 gallons per minute) per 8-inch diameter vessel for a period of 45 minutes.
6. Allow solution to soak if it has been determined that an extended soak time is beneficial to the cleaning process. Extended soak times typically range from 1-12 hours.

Notes:

Soak times are usually established based on operator knowledge of previous results or a detailed foulant analysis.

7. Flush the high pH cleaning solution from the vessels using RO permeate until the flush water pH exiting the vessel is close to the flush water pH entering the vessel. (Be sure to have an adequate amount of RO permeate stored before cleaning is initiated). If a soak period was introduced, recirculation of cleaning solution may also be required prior to flushing.
8. Closely monitor the pH of the cleaning solution during the cleaning process and adjust the pH as needed.
9. Measure the temperature and flow of the cleaning solution during the start, middle and end of the recirculation periods.
10. Never allow the vessel pressure drop to exceed 4 bar (60 psi) during any point in the cleaning. This applies to each pressure vessel housing FIVE OR MORE elements. If vessels contain less than five elements, contact LG Chem for pressure limit guidelines.
11. Once the high pH solution has been rinsed from all pressure vessels and piping as described in Step 7, proceed with a low pH cleaning using citric acid. HCl or the combination of Citric Acid and HCl can be used for making the low pH cleaning solution. Follow the appropriate pH and temperature limits. Flows, recirculation time, and maximum differential pressure for the low pH cleaning are the same as the high pH cleaning.
12. Once the low pH cleaning is complete, flush the spent solution from the vessels using RO permeate until the flush water pH exiting the vessel is close to the flush water pH entering the vessel.
13. Cleaning chemicals may be present in the permeate after cleaning. Upon restart (post-cleaning), RO permeate should be directed to drain for a minimum of 10 minutes. Please note that the permeate conductivity is usually elevated after a cleaning and may take some time to stabilize.
14. Contact LG Chem with the RO operating data taken prior to and 48 hours after cleanings.

Notes:

Direction of cleaning flow through the pressure vessels must always be in the same direction as feed flow during normal operation. Cleaning equipment, supply piping and return piping MUST be free of any contaminants or free standing water before beginning the cleaning process

Cliente 		Empreiteiro EPC   		
Projeto n.º	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	88 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions



Technical Service Bulletin 114

Brine seal Replacement

All LG Chem NanoH2OTM RO elements are shipped with brine seals installed. If for some reason the brine seal is missing or damaged, installation of a new brine seal will be required. Brine seals, which prevent feed water from bypassing the RO element, need to be properly oriented in relation to the direction of feed flow. The standard brine seal installed on all LG Chem NanoH2OTM RO elements is the U-Cup shaped style. Also available on a special order basis is the bi-directional seal which allows installation of the elements from either end of the pressure vessel. Instructions for installation of each type of brine seal are provided below.

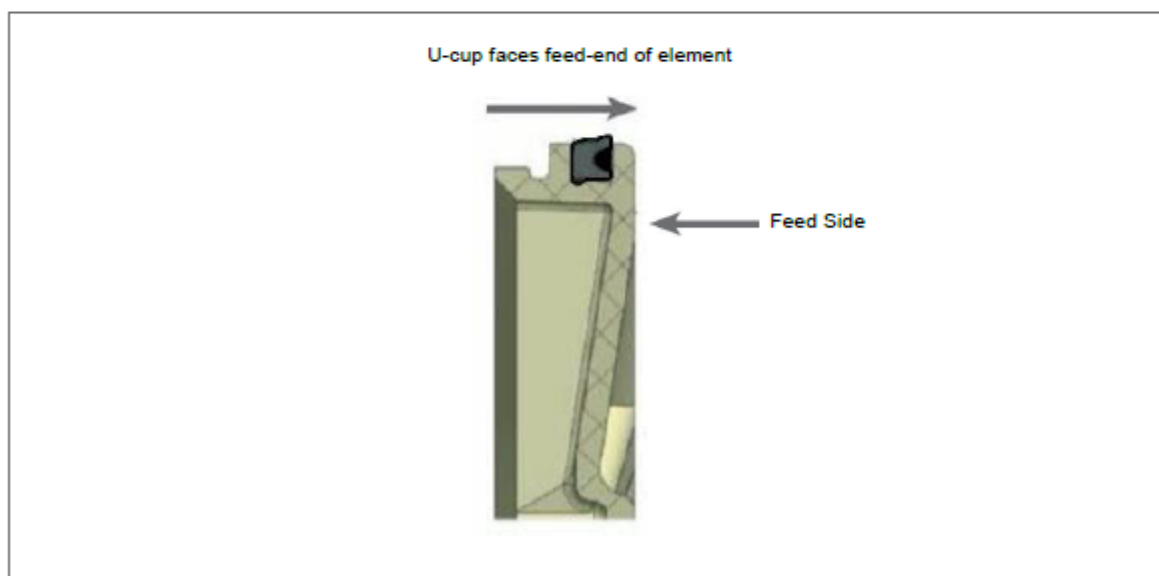
U-Cup Style Brine Seal

Install brine seal with the U-cup facing the feed end of the element as shown in Figure 114.1. Feed water flow will cause the seal to expand and seal against the inside diameter of the pressure vessel. For loading, lubricate the seal with either glycerin or silicone lubricant and load only in the direction of flow.

CAUTION

DO NOT use oil, grease, petroleum jelly or other petroleum-based compounds to lubricate O-rings or brine seals. (See TB-102 Element Loading Guidelines).

Figure 114.1 Orientation of U-cup seal



Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data 20/02/2025	Rev. 01.0	Pág. 89 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

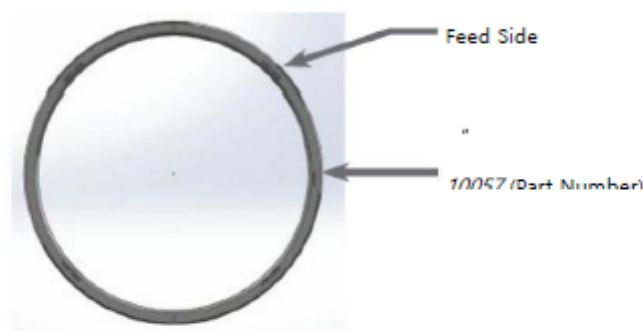
Technical Service Bulletin 114

Brine Seal Replacement

Bi-Directional Style Brine Seal

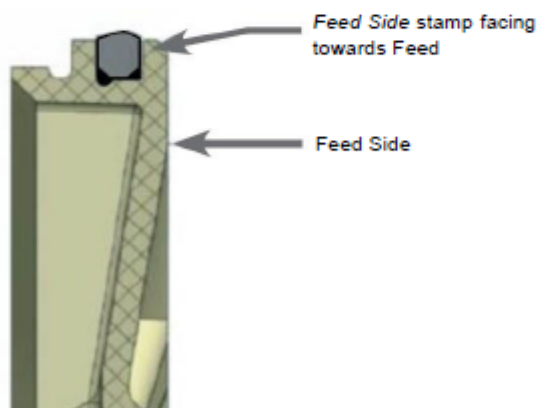
Bi-directional brine seals are stamped on one side with the part number and the words "Feed Side". See Figure 114.2 below.

Figure 114.2 Bi-directional Brine Seal Stamping



Install bi-directional brine seal with the side stamped "feed side" facing the feed end of the element as shown in Figure 114.3. The bi-directional seal prevents bypass flow by squeezing against the inside diameter of the pressure vessel. The element can be loaded in either end of the pressure vessel however; extra lubrication may be required for installation in multi element pressure vessels.

Figure 114.3 Orientation of Bi-directional Seal



Notes:

Bi-directional seals can only be used on elements that were made AFTER 2013. In this case, the nine-digit serial number will start with "14" or higher.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	90 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 115

RO Element Start-Up Consideration and Checklist

Successful RO element performance, both short term and long term, depends on handling, operation, and maintenance in accordance with all published guidelines and limits. Specific guidelines and limits can be found in:

- Performance projection software, Q+
- Element Specification Sheets
- Standard and Custom Warranties
- Tech Service Bulletins

Please refer to all appropriate documents to become familiar with the guidelines and limits for a specific project. As an RO element manufacturer, LG Chem's scope of supply and liability is limited. The considerations and items presented below are intended as a general reference and are not to be considered all inclusive for any specific project.

Feedwater Source and Pretreatment

- New wells are properly flushed and within SDI and turbidity limits.
- Intake or well flows are able to provide continuous design feed flow to all RO units.
- All pretreatment processes are ready as designed and will meet SDI targets.
- New depth filtration media and carbon are properly installed, backwashed, and rinsed.
- New cartridge filters are properly installed, sealed, rinsed, and free of any chemical leachate.
- Chemical tanks are filled with proper chemicals.
- Chemical injection points are properly located.
- Chemical suction and discharged piping are installed as designed.
- Provisions exist for proper chemical mixing and draw-down measurement.
- If dechlorination is part of pretreatment process, carefully review design, operation, and means of detecting chlorine residuals.

Instrumentation, Sampling, and Monitoring

- Each RO stage requiring monitoring and performance tracking contains provision for reporting: permeate flow, concentrate flow, feed pressure, concentrate pressure, permeate pressure, feed conductivity, permeate conductivity, feed temperature, and feed pH. (Note: This includes individual stages of a multi-stage RO unit)
- Instruments are properly located and installed.
- Instruments are calibrated to the manufacturer's specifications.
- SCADA (Supervisory Control and Data Acquisition) if provided is functioning and available for retrieval of historic operating data.
- Data collection routine for startup and long term operation has been established.
- Data normalization and analysis routine has been established.
- Arrangements have been made to use either LG Chem's QSee normalization program or direct transmission of data (inspreadsheet form) to LG Chem for review and entry into QSee.
- Sample valves are located in the feed, permeate, and concentrate piping of each RO stage to be monitored
- Sample valves, or taps, are located in the permeate piping of each RO pressure vessel. (Note: sampling must occur at the end of the vessel where the permeate is collected and sent to the RO array permeate piping header)
- Sampling valves and piping exist to allow permeate flow path probing of each pressure vessel.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	91 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 115

Start-Up Consideration and Checklist

RO Element Handling

- Elements have been stored in their original packaging.
- Elements have been stored in a freeze-protected area, not exposed to direct sunlight, or temperatures that exceeded 35°C at any time.
- Preservative of elements stored more than 60 days has been spot checked
(Note: Elements are preserved in a sodium bisulfite solution which may weaken over time. If the pH level of the preservative solution is less than pH 3, contact LG Chem for re-preserving instructions)
- Only approved lubricants are to be used for element loading.
- For RO units requiring permeate bacteria testing at start-up, special handling and protection should be used to prevent contamination of permeate flow path parts and fittings.
- All pressure vessels are shimmed in accordance with vessel manufacturer guidelines.
- Element serial numbers and loading sequence have been recorded.

Auxiliary and Support Systems

- Shutdown and start-up flush systems are ready as designed.
- Proper flush water source is available.
- Flush lines and tanks have been pre-flushed and sanitized as required
- CIP system is ready as designed.
- All CIP lines have been properly flushed.
- All CIP temporary spool piping is ready.
- Energy recovery devices, associated instrumentation and sample valves are properly installed.
- Piping to and from the ERDs has been properly flushed.
- Provisions have been made to direct design permeate flow to drain without back pressure, if needed during initial start-up.
- Provisions have been made for concentration discharge at design flow without backpressure that exceeds design.

RO Unit Startup and Operation

- Functional testing has been performed to assure that control logic, RO unit shutdowns, and alarms will function as designed.
- All feed piping to the RO stage entry point has been flushed and sanitized as required.
- Permeate pressure relief is operational and installed as designed.
- Permeate piping is open, free, and clear of any restrictions causing a backpressure that exceeds the limits of the RO elements.
- Feed pressure will be applied at a rate that does not exceed 10 psi (0.7 bar) per sec.
- Provisions have been made to vent entrapped air from all feed, concentrate and permeate piping prior to start of the high pressure pump.
- Anti-siphon protection has been provided to assure that all RO stages remain full of flush water upon shutdown. RO elements will not be exposed to air when off line.
- Provisions have been made to allow RO units to run continuously during the first 48 hours of operation.
- Critical spares parts (RO elements, O-rings, adapters, interconnectors, rupture discs) are available on site.

Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	92 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

LG Water Solutions

Technical Service Bulletin 116

Spare Parts

LG Chem recommends using spare parts as shown in the table below. Please contact LG Water Solutions through the email address or region TS engineer for the details.

Part-Number	Description	Description/Application	Quantity (percentage as a total membranes)	Note
3443396	8" SW Interconnector	8" SW Interconnector, $\phi 17.3(0.68")$ ID Tube. Use with all other 8" diameter Sea water elements. Uses 3579970 O-rings.		No need as the customer will have one extra per Pressure Vessel
3603395	8" BW Interconnector	8" BW Interconnector, $\phi 20.5(0.81")$ ID Tube. Use with all other 8" diameter brackish water elements. Uses 3579970 O-rings.		No need as the customer will have one extra per Pressure Vessel
3579970	8" Interconnector O-ring	O-ring for 3443396 and 3603395, Size 3-912, 4 required per interconnector.	0.5%	Percentage in a total number of membranes
TROSUB0001	8" Brine Seal	Used for all 8" diameter elements	0.5%	Percentage in a total number of membranes
3605452	4" Interconnector	4" element Interconnector- $\phi 20.5(0.81")$ ID Tube. Use with all other 4" diameter elements. Uses 3607354 o-rings		No need as the customer will have one extra per Pressure Vessel
3607354	4" Interconnector O-ring	O-ring for 305452, Size 2-116, 4 required per Interconnector	0.5%	Percentage in a total number of membranes
3607350	4" Brine Seal	Used for all 4" diameter elements	0.5%	Percentage in a total number of membranes

Cliente 		Empreiteiro EPC   		
Projeto n.º	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	93 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

3. CATÁLOGO TÉCNICO



LG Water Solutions

Data Sheet



Seawater
Reverse Osmosis (RO) Membranes
LG SW 400 R G2

Overview

The next generation LG SW G2 membranes have achieved record-breaking salt rejection, improving the product quality up to 45% compared with the conventional technology. With enhanced Thin Film Nanocomposite (TFN) technology, LG SW G2 membranes can significantly reduce the cost of desalination.

LG SW R (High Rejection) membranes offer a combination of high rejection and low energy requirements to reduce the total cost of desalination; suitable for medium to high salinity seawater applications.

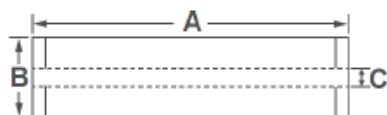
LG SW G2 Benefits

- ▶ Improved permeate quality without increasing operating pressure
- ▶ Reduced energy cost without sacrificing the permeate quality
- ▶ Reduced capital and operation costs for multi-pass SWRO systems

Product Specifications

Active Membrane Area, ft ² (m ²)	Permeate Flow Rate, GPD (m ³ /d)	Stabilized Salt Rejection, %	Minimum Salt Rejection, %	Boron Rejection, %	Feed Spacer, mil
400 (37)	9,000 (34.1)	99.88	99.75	93	34

Test Conditions : 32,000 ppm NaCl, 5 ppm boron at 25°C (77°F), 800 psi (55 bar), pH 8, Recovery 8%.
Permeate flows for individual elements may vary +/-15%.



A, mm (in.)	B, mm (in.)	C, mm (in.)	Weight, kg (lbs.)
1,016 (40)	200 (7.9)	28.6 (1.125)	16 (35)

All dimensional information is indicative and for reference purpose only. Please contact LG Chem for detailed technical specification.

Operating Specifications

For more information and operating guidelines, visit www.lgwatersolutions.com

Max. Applied pressure	1,200 psi (82.7 bar)
Max. Chlorine concentration	< 0.1 ppm
Max. Operating temperature	45°C (113°F)
pH Range, Continuous (Cleaning)	2-11 (2-13)
Max. Feedwater turbidity	1.0 NTU
Max. Feedwater SDI (15 mins)	5.0
Max. Feed flow	75 gpm (17 m ³ /h)
Min. Ratio of concentrate to permeate flow for any element	5 : 1
Max. Pressure drop (ΔP) for each element	15 psi (1.0 bar)

The Membrane Elements performance is expressly conditioned on Buyer's storing, installing, operating, and maintaining Product in accordance with industry-accepted good practices and Seller's written instructions provided in the Seller's Technical Manual, which consists of LG Chem, Ltd [Technical Service Bulletins \("TSB"\)](#) and [Technical Applications Bulletins \("TAB"\)](#) and may be viewed and downloaded at www.lgwatersolutions.com.

The information and data contained herein are deemed to be accurate and reliable and are offered in good faith, but without guarantee of performance. LG Chem assumes no liability for results obtained or damages incurred through the application of the information contained herein. Customer is responsible for determining whether the products and information presented herein are appropriate for the customer's use and for ensuring that customer's workplace and disposal practices are in compliance with applicable laws and other governmental enactments. Specifications subject to change without notice. NanoH₂O is the Trademark of The LG Water Solutions or an affiliated company of LG Chem. All rights reserved. © LG Chem, Ltd.

(08.21)

Contact LG Water Solutions www.lgwatersolutions.com | waterinfo@lgchem.com



Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto	Data	Rev.	Pág.
	Sistema de dessalinização na região do Algarve	20/02/2025	01.0	94 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

Confidential

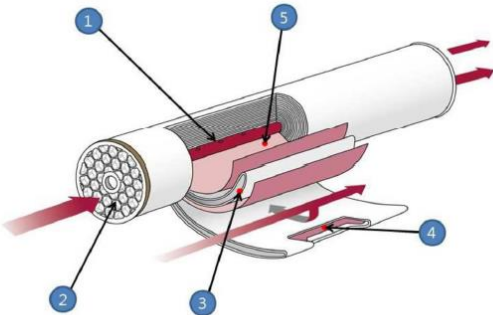
8inch RO Element Drawings (28mil)

Element dimension

: All dimensional information is indicative and for reference purpose only. Please contact LG Chem for detailed technical specification.



Parts schematics



Item No.	DESCRIPTION	QTY
1	CORETUBE	1
2	END CAP (ATD)	2
3	SHEET, MEMBRANE	26
4	PERMEATE SPACER	26
5	FEED SPACER	26

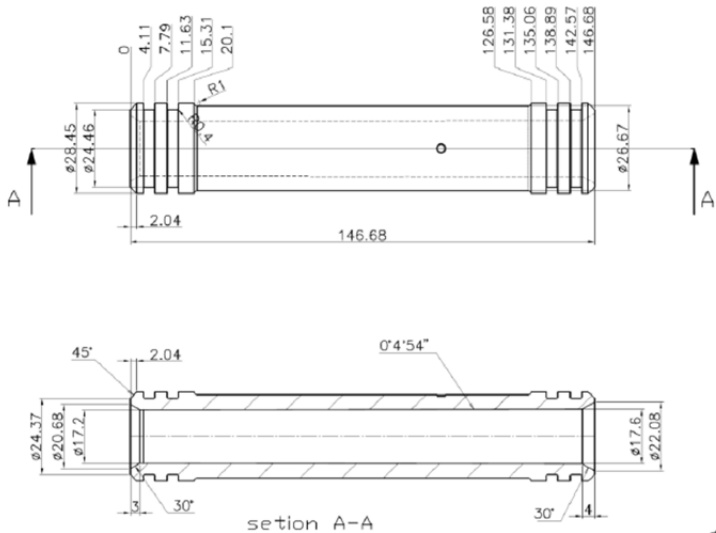
※ This drawing is for Buyer's information purpose only



© 2023 LG Chem, Ltd. All rights reserved.

Cont

Interconnector(SW) Drawings

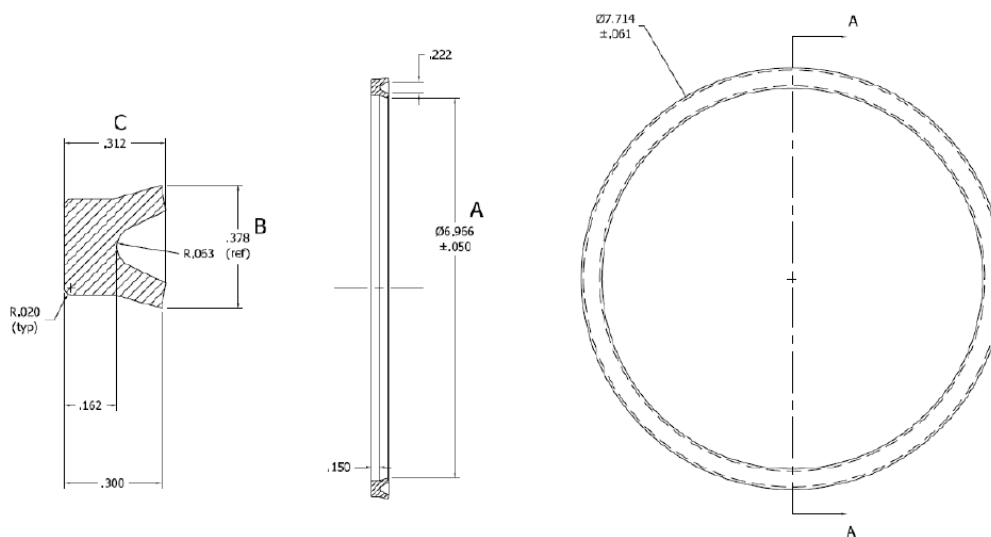


※ This drawing is for Buyer's information purpose only



Cliente 		Empreiteiro EPC   		
Projeto nº.	Projeto Sistema de dessalinização na região do Algarve	Data 20/02/2025	Rev. 01.0	Pág. 95 de 95
Código AdA AL-ACE-3320-ME-DSH-ROM01		Código ACE AL-INN-3320-ME-DSH-ROM01		

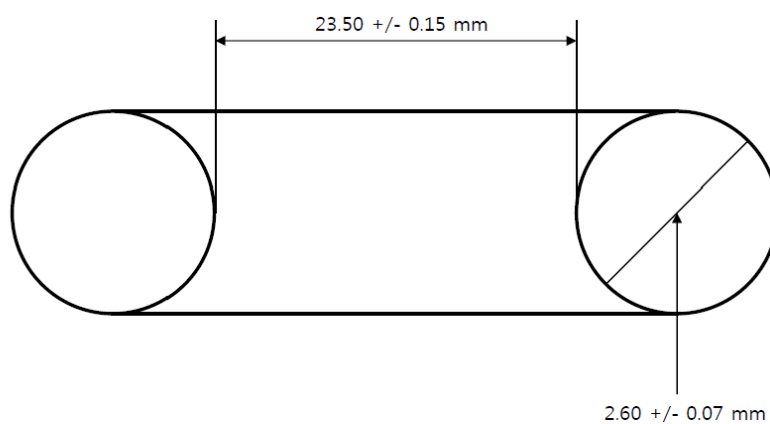
8inch Brine Seal Drawings



※ This drawing is for Buyer's information purpose only



O-ring Drawings



※ This drawing is for Buyer's information purpose only

