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AL-INN-3323-ME-DSH-ERD01

Dispositivo de Recuperação de energia. Osmose inversa

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

Editado para:

Informação		Compra	
Aprovação	X	Construção	
Pedido de licitação		Conforme construído	

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1. INTRODUÇÃO

Este documento contém as especificações técnicas dos Dispositivos de Recuperação de energia de osmose inversa.

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2. FOLHA DE CARACTERÍSTICA

	DISPOSITIVO DE RECUPERAÇÃO DE ENERGIA - ERD	FOLHA DE CARACTERÍSTICAS Nº 28
	OSMOSE INVERSA	FOLHA 4 DE 4

Empreitada de Conceção-Construção e Exploração do Sistema de Dessalinização na Região do Algarve	Nº de unidades 28
ÁGUAS DO ALGARVE <i>Grupo Águas de Portugal</i>	Posição da Lista de Preços Unitários a que respeita EQ115.A0

REFERÊNCIAS

Número de unidades:	28 unidades totales (7 unidades / rack)
Serviço/ Local de instalação:	Osmose Inversa/ Edifício de Osmose Inversa
Fabricante / Marca:	Energy Recovery Inc ou equivalente
Tipo / Modelo:	Pressure Exchanger PX-Q400
Catálogo Técnico	Anexo

CARACTERÍSTICAS

Gama de caudais de alta pressão:	65,9 – 90,8 m³/h
Gama de caudais de baixa pressão	65,9 – 90,8 m³/h
Pressão máxima de admissão de salmoura (alta pressão):	82,7 bar
Pressão mínima de saída de água a dessalinizar (baixa pressão):	0,8 bar
Eficiência máxima do EDR:	97,8%
Dimensões gerais:	1.156 x 356 mm (diâmetro máximo)
Tipo de uniões / conexões externas	Grooved-End
Diâmetro da conexão de entrada da baixa pressão:	4"
Diâmetro da conexão de saída da baixa pressão:	4"

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	DISPOSITIVO DE RECUPERAÇÃO DE ENERGIA - ERD	FOLHA DE CARACTERÍSTICAS Nº 28
	OSMOSE INVERSA	FOLHA 2 DE 4

Empreitada de Conceção-Construção e Exploração do Sistema de Dessalinização na Região do Algarve	Nº de unidades 28
<i>ÁGUAS DO ALGARVE</i> <i>Grupo Águas de Portugal</i>	Posição da Lista de Preços Unitários a que respeita EQ115.A0

Diâmetro da conexão de entrada da alta pressão: 4"

Diâmetro da conexão de saída da alta pressão: 4"

Peso: 164 kg (peso seco), 184,6 kg (peso molhado)

Velocidade de rotação nominal (rpm) 480rpm @ 400gpm (velocidade máxima).

MOTOR

Potência nominal (kW) Não aplicável

Tensão de alimentação (V) Não aplicável

Classe de proteção Não aplicável

MATERIAIS (com especificação do PREN e CF no caso dos aços)

Corpo PRFV

Rotor Ceramic-alumina

Veio Não aplicável

Uniãos / conexões externas (entrada e saída da baixa pressão + entrada e saída da alta pressão) 2507 Super Duplex

União / conexão interna da baixa pressão: Titanium

Parafusos e Porcas 316SS

Vedações EPDM (gaskets)

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	DISPOSITIVO DE RECUPERAÇÃO DE ENERGIA - ERD	FOLHA DE CARACTERÍSTICAS Nº 28
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Empreitada de Conceção-Construção e Exploração do Sistema de Dessalinização na Região do Algarve	Nº de unidades 28
<i>ÁGUAS DO ALGARVE</i> <i>Grupo Águas de Portugal</i>	Posição da Lista de Preços Unitários a que respeita EQ115.A0

NORMAS:

Dimensionais Manufacturer Standards

Normas de controlo de qualidade: ISO 9001

Normas de fabrico e ensaio em fábrica: ASME X (Pressure Vessel) design and test.

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

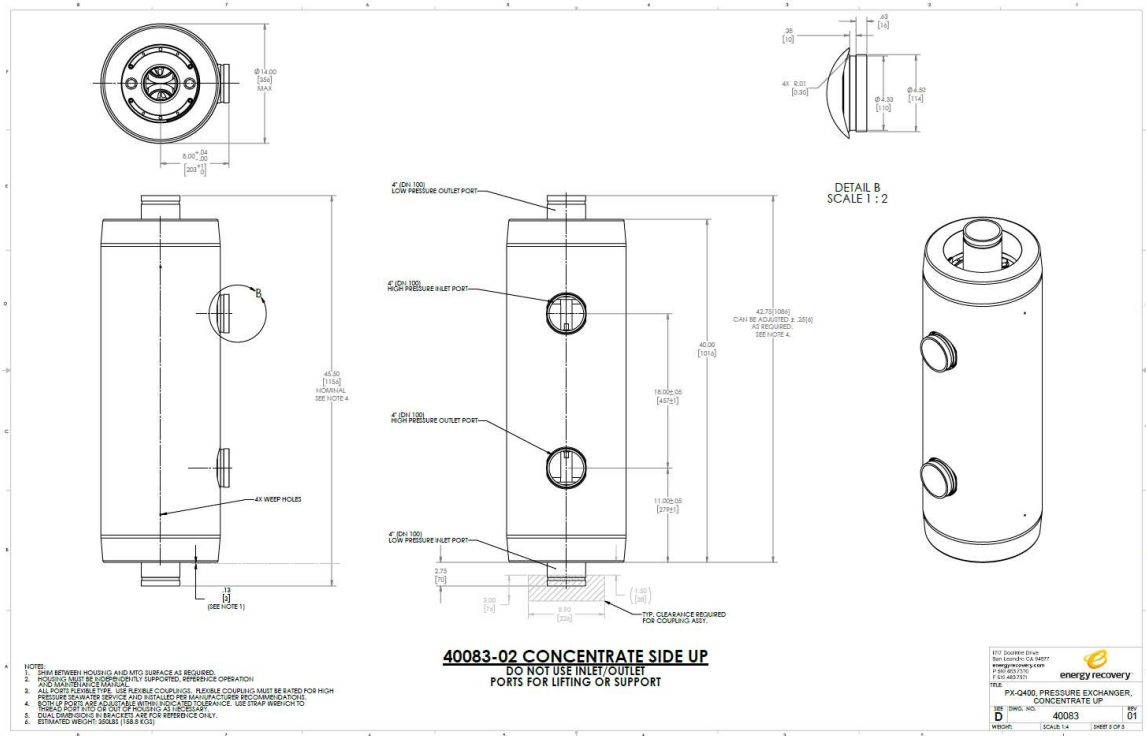
Evidências do cumprimento em anexo (Sim/Não): Não aplicável

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  	DISPOSITIVO DE RECUPERAÇÃO DE ENERGIA - ERD	FOLHA DE CARACTERÍSTICAS Nº 28
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Empreitada de Conceção-Construção e Exploração do Sistema de Dessalinização na Região do Algarve	Nº de unidades 28
<i>ÁGUAS DO ALGARVE</i> <i>Grupo Águas de Portugal</i>	Posição da Lista de Preços Unitários a que respeita EQ115.A0

DESENHO DIMENSIONAL



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CERTIFICAÇÕES/ HOMOLOGAÇÕES

IAPMO RESEARCH AND TESTING, INC.

5001 E. Philadelphia Street, Ontario, CA 91761 • Phone (909) 472-4100 • Fax (909) 472-4244 • www.iapmort.org



CERTIFICATE OF LISTING



IAPMO Research and Testing, Inc. is a product certification body in which its product certification system includes inspection and testing of samples taken from the supplier's stock or from the market or a combination of both to verify compliance to the requirements of applicable codes and standards. This activity is coupled with periodic surveillance of the supplier's factory and/or warehouses as well as the assessment of the supplier's Quality Assurance System. This listing is subject to the conditions set forth in the characteristics below and is not to be construed as any recommendation, assurance or guarantee by IAPMO Research and Testing, Inc. of the product acceptance by Authorities Having Jurisdiction.

Issued To:

ENERGY RECOVERY, INC

1717 DOOLITTLE DR SAN LEANDRO, CA 94577, United States

Product:

Drinking Water System Components - Health Effects

Products are certified to the following standard(s)

NSF/ANSI/CAN 61-2022

File Number: N-8485

Effective Date: December 2019

Void After: December 2024*


Chairman, Product Certification Committee




Chief Technical Service Officer

*This certificate is not evidence of current listing. To verify listing status, visit the IAPMO R&T Product Listing Directory at pld.iapmo.org

This listing period is based upon the last date of the month indicated on the Effective Date and Void After Date shown above. Any change in material, manufacturing process, marking or design without having first obtained the approval of the Product Certification Committee, or any evidence of non-compliance with applicable codes and standards or of inferior workmanship, may be deemed sufficient cause for revocation of this listing. Production of or reference to this form for advertising purposes may be made only by specific written permission of IAPMO Research and Testing, Inc. Any alteration of this certificate could be grounds for revocation of the listing. This document shall be reproduced in its entirety.

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IAPMO RESEARCH AND TESTING, INC.

CERTIFICATE OF LISTING



Issued To: ENERGY RECOVERY, INC

Effective Date: December 2019

File Number: N-8485

Product: Drinking Water System Components - Health Effects

Void After: December 2024

This certificate is not evidence of current listing. To verify listing status, visit the IAPMO R&T Product Listing Directory at pld.iapmo.org

Identification:

Each product shall be permanently and legibly marked with the manufacturer's name or trademark. The product may also be marked with the standard designation "NSF/ANSI/CAN 61".

Listed products shall also bear the IAPMO R&T mark.

Characteristics:

Materials or products that come into contact with drinking water and/or drinking water treatment chemicals. Products and materials may include process media, protective materials, joining and sealing materials, pipes and related products, mechanical devices used with treatment/transmission/distribution systems, and mechanical plumbing devices. To be installed in accordance with the manufacturer's instruction. Lead free requirements are addressed under a separate certificate of listing.

Products listed on this certificate have been tested by an IAPMO R&T recognized laboratory. This recognition has been granted based upon the laboratory's compliance to the applicable requirements of ISO/IEC 17025.

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IAPMO RESEARCH AND TESTING, INC.
CERTIFICATE OF LISTING



Issued To: ENERGY RECOVERY, INC
File Number: N-8485
Product: Drinking Water System Components - Health Effects
Effective Date: December 2019
Void After: December 2024

This certificate is not evidence of current listing. To verify listing status, visit the IAPMO R&T Product Listing Directory at pld.iapmo.org

Models

PX-260 Series

Model Number	Description
40018-01	PX-260 PRESSURE EXCHANGER, MET LP
40018-02	PX-260 PRESSURE EXCHANGER CON UP
40023-01	PX-260B PRESSURE EXCHANGER
40024-01	PX-260 PRESSURE EXCHANGER, BLACK
40033-01	PX-260 PRESSURE EXCHANGER SW UP, SS
40033-02	PX-260 PRESSURE EXCHANGER CON UP, SS
40034-01	PX-Q260, PRESSURE EXCHANGER, SW UP
40034-02	PX-Q260, PRESSURE EXCHANGER, CON UP
40035-01	PX-Q260, PRESSURE EXCHANGER, SW UP, SS
40035-02	PX-Q260, PRESSURE EXCHANGER, CON UP, SS
40040-01	ASSY, PX-Q260, BLACK, LABELED FOR FEEDWATER SIDE UP
40040-02	ASSY, PX-Q260, BLACK, LABELED FOR CONCENTRATE SIDE UP

PX-300 Series

Model Number	Description
40030-01	ASSY, PX-300, FW UP
40030-02	ASSY, PX-300, CON UP
40031-01	ASSY, PX-300, BLACK
40036-01	ASSY, PX-Q300,FW UP
40036-02	ASSY, PX-Q300,CON UP
40037-01	ASSY, PX-Q300,FW UP
40037-02	ASSY, PX-Q300,CON UP
40039-01	ASSY PX-Q300, BLACK, LABELED FOR FEEDWATER SIDE UP
40039-02	ASSY PX-Q300, BLACK, LABELED FOR CONCENTRATE SIDE UP

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IAPMO RESEARCH AND TESTING, INC.

CERTIFICATE OF LISTING



Issued To: ENERGY RECOVERY, INC

Effective Date: December 2019

File Number: N-8485

Product: Drinking Water System Components - Health Effects

Void After: December 2024

This certificate is not evidence of current listing. To verify listing status, visit the IAPMO R&T Product Listing Directory at pld.iapmo.org

PX- Q400 Series

Model Number	Description
40083-01	PX- Q400 , Pressure Exchanger , FEEDWATER SIDE UP
40083-02	PX- Q400 , Pressure Exchanger , CONCENTRATE SIDE UP

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Certificate of Registration

This certifies that the Quality Management System of

Energy Recovery Inc.

1717 Doolittle Drive
San Leandro, California, 94577, United States

has been assessed by NSF-ISR and found to be in conformance to the following standard(s):

ISO 9001:2015

Scope of Certification:

Design and Manufacture of Energy Recovery devices and equipment

Sameer Vachani
Senior Director, NSF-ISR

Certificate Number:	C0217291-ISO
Certificate Decision Date:	13-OCT-2023
Certificate Issue Date:	13-OCT-2023
Cycle Effective Date:	18-OCT-2023
Certificate Expiration Date*:	15-OCT-2026

Issued by:
NSF International Strategic Registrations (NSF-ISR)
789 N. Duroso Road, Ann Arbor, MI 48105 USA

Authorized Certification and/or Accreditation Marks. This certificate is property of NSF-ISR and must be returned upon request.

*Company is audited for conformance at regular intervals. To verify certification call (888) NSF-9000 or visit our web site at www.nsf-iso.org



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Certificate of Registration

ANNEX PAGE FOR CERTIFICATE NUMBER: C0217291-IS6

This Annex is only Valid in connection with the above-mentioned certificate issued by NSF-ISR

CERTIFICATE ISSUE DATE:
 13-OCT-2023
CERTIFICATE EXPIRATION DATE:
 15-OCT-2028

Energy Recovery Inc.
 1717 Doolittle Drive
 San Leandro, California, 94577, United States

Location:
 Energy Recovery Inc.- C0569834
 2000 Chabot Court
 Tracy, California, 95304, United States

Scope:
 This location is part of site C0217291. Supporting processes include: Manufacture of Energy Recovery devices and equipment.

Location:
 Energy Recovery Inc.- C0696503
 25430 Clay Road,
 Katy, Texas, 77493, United States

Scope:
 This location is part of site C0217291. Supporting processes include: Support site operations for Headquarters.

Issued by:
 NSF International Strategic Registrations (NSF-ISR)
 789 N. Dixboro Road, Ann Arbor, MI 48105 USA

Authorized Certification and/or Accreditation Marks. This certificate is property of NSF-ISR and must be returned upon request.

*Company is audited for conformance at regular intervals. To verify certification call (888) NSF-9000 or visit our web site at www.nsf-isr.org



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MANAGEMENT SYSTEM CERTIFICATE

Certificate no.:
10000451201-MSC-ANAB-USA

Initial certification date:
15 September, 2021

Valid:
15 September, 2024 – 14 September, 2027

This is to certify that the management system of
Energy Recovery Inc.
1717 Doolittle Dr, San Leandro, CA, 94577-2231, USA
and the sites as mentioned in the appendix accompanying this certificate

has been found to conform to the Occupational Health and Safety Management System standard:
ISO 45001:2018

This certificate is valid for the following scope:
The design and manufacturing of pumps, pressure exchangers, and other energy recovery systems

Place and date:
Katy, TX, 06 September, 2024

For the issuing office:
DNV - Business Assurance
1400 Ravello Drive, Katy, TX, 77449-5164, USA



Sherif Mekkawy
Management Representative

Lack of fulfillment of conditions as set out in the Certification Agreement may render this Certificate invalid.
ACCREDITED UNIT: DNV Business Assurance USA Inc., 1400 Ravello Drive, Katy, TX, 77449, USA - TEL: +1 281-396-1000. www.dnv.com

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Certificate no.: 10000451201-MSC-ANAB-USA
Place and date: Katy, TX, 06 September, 2024

Appendix to Certificate

Energy Recovery Inc.

Locations included in the certification are as follows:

Site Name	Site Address	Site Scope
Energy Recovery Inc.	1717 Doolittle Dr, San Leandro, CA, 94577-2231, USA	The design and manufacturing of water pumps, water desalination plant pressure exchangers, Vorteq and other energy recovery devices
Energy Recovery Inc.	2000 Chabot CT Suite, Tracy, CA, 95304, USA	The design and manufacturing of water pumps, water desalination plant pressure exchangers, Vorteq and other energy recovery devices

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MANAGEMENT SYSTEM CERTIFICATE

Certificate no.:
C534Z78

Initial certification date:
13 September, 2022

Valid:
13 September, 2022 – 12 September, 2025

This is to certify that the management system of
Energy Recovery Inc.
 1717 Doolittle Dr, San Leandro, CA, 94577-2231, USA
 and the sites as mentioned in the appendix accompanying this certificate

has been found to conform to the Environmental Management System standard:
ISO 14001:2015

This certificate is valid for the following scope:
The design and manufacturing of energy recovery devices, pressure exchangers and the design of Vorteq products

Place and date:
Katy, TX, 13 September, 2022

For the issuing office:
 DNV - Business Assurance
 1400 Ravello Drive, Katy, TX, 77449-5164, USA



Sherif Makkawy
Management Representative

Lack of fulfillment of conditions as set out in the Certification Agreement may render this Certificate invalid.
 ACCREDITED UNIT: DNV Business Assurance US A Inc., 1400 Ravello Drive, Katy, TX, 77449, USA - TEL: +1 281-336-1000. www.dnv.com

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Certificate no.: 10000451201-MSC-ANAB-USA
Place and date: Katy, TX, 15 September, 2021

Appendix to Certificate

Energy Recovery Inc.

Locations included in the certification are as follows:

Site Name	Site Address	Site Scope
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Lack of fulfillment of conditions as set out in the Certification Agreement may render this Certificate invalid.

ACCREDITED UNIT: DNV Business Assurance USA Inc., 1400 Ravello Drive, Katy, TX, 77449, USA - TEL: +1 281-396-1000. www.dnv.com

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1717 Doolittle Dr.
San Leandro, CA
94577, USA
Phone: 1-510-483-7370

Energy Recovery, Inc.
Specifications Sheet
PX-Q400

REV	BY	CKD	REVISION	DATE
00	AKP	CD	Initial Release	12-Dec-22
01	AKP	KYK	Updated Shipping Weights and dim. Added Interconnect Spacer Material	8-May-23

DESCRIPTION:
TECHNICAL DATA SHEET, POSITIVE
DISPLACEMENT ENERGY RECOVERY
DEVICE

Sheet
Page 1 of 1

Document number:
80872-01

1. Part number 40083 & 40085			2. Service SWRO		3. Reference	
OPERATING CONDITIONS	4	Liquid	Seawater	45	Performance	Standard
	5	Operating Temperature	33°F-120°F (0.6-49°C)	46	Case Hydrotest	Standard
	6	Max. Temperature	120°F (49°C)	47	Rotation Speed Test	Standard
	7	Specific Gravity	1.03	48	Die Penetrant Test (ceramics)	Standard
	8	Viscosity	1.060 cP @ 70°F (21.1°C)	49	Witnessed Test	Optional
	9	Flow range	290 - 400 gpm (65.9-90.8 m3/h)	50		
	10	Maximum High-Pressure Inlet Flow	400 gpm (90.8 m3/h)	51		
	11	Maximum Low-Pressure Outlet Flow	400 gpm (90.8 m3/h)	52		
	12	Maximum Inlet High Pressure	1200 psi (82.7 bar)	53		
	13	Maximum Inlet Low Pressure	145 psi (10 bar)	54		
PERFORMANCE	14	Minimum Discharge Pressure	12 psi (.8 bar)	55		
	15	Filtration Requirement (Nominal)	20 µm	56		
	16			57	Outside Dimensions	Standard
	17			58	Internal Components	Standard
	18			59	Housing Dimensions	Standard
	19			60	Ceramic Dimensions	Standard
	20	Peak Efficiency*	97.8%	61	Material Certificates	Standard
	21	Maximum High Pressure Differential*	10.1 psi (.70 bar)	62	Visual	Standard
	22	Maximum Low Pressure Differential*	9.29 psi (.64 bar)	63	Packing and Crating	Standard
	23	Maximum Lubrication Flow*	5.0 gpm (1.1 m3/hr)	64		
MATERIALS	24	Maximum Rotational Speed*	480 rpm @ 400 gpm	65		
	25	Maximum Salinity Increase at Membranes*	See ERI projections	66		
	26	Noise Per ISO 3744*	Less Than 85 dB(A)	67		
	27	Housing**	GRP	68		
	28	Rotor, Sleeve, Endcover Assembly	Ceramic-alumina	69	PX Q400 unit Shipping Dimensions	49.5X18X18 inch 125.7X45.7X45.7cm
	29	Low Pressure Inlet Port Fitting	2507 Super Duplex	70	PX Q400 unit Shipping Weight	370 lbs (167.8kg)
	30	Low Pressure Outlet Port Fitting	2507 Super Duplex	71	Dry PX Q400 unit weight	360 lbs. (164 kg)
	31	High Pressure Inlet Port Fitting	2507 Super Duplex	72	Wet PX Q400 unit weight	407 lbs. (184.6kg)
	32	High Pressure Outlet Port Fitting	2507 Super Duplex	73	Cartridge Shipping Dimensions	14X14X22 inch 35.6X35.6X55.8 cm
	33	Internal Low Pressure Interconnector	Titanium	74	Cartridge Weight	50 lbs. (22.7 kg)
PIPING CONNECTIONS	34	Fasteners/Hardware (non-wetted)	316SS	75	Shipping and Storage Temperature	33°F-120°F (0.6-49°C)
	35	Tension Rod Assembly	2507 Super Duplex	76		
	36	Interconnect Spacers	Noryl™ GFN2F	77		
	37	O-rings	EPDM	78		
	38	Low Pressure Inlet Port Fitting	4" Pipe Grooved-End	79		
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	40	High Pressure Inlet Port Fitting		81		
	41	High Pressure Outlet Port Fitting		82		
	42					
	43					
	44					

*Refer to document 80871-01 & 80008-06 for performance curves and definitions.

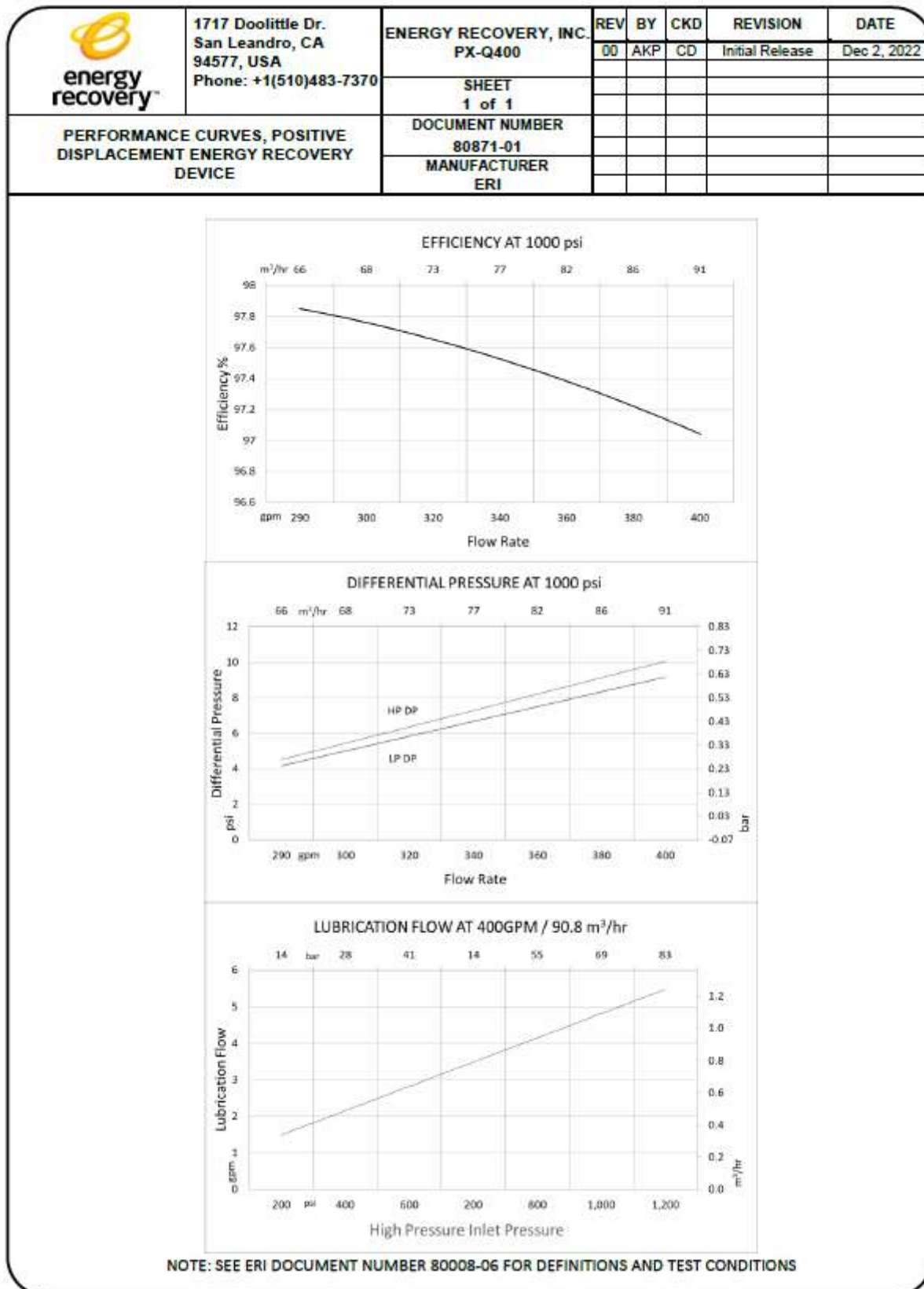
**Housing designed in accordance with the engineering standards of the Boiler and Pressure Vessel Code of the American Society of Mechanical Engineers.

PRICE: sales@energyrecovery.com

MANUFACTURER: Energy Recovery Inc

MODEL: PX-Q400

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	Energy Recovery, Inc 1717 Doolittle Drive San Leandro CA 94577 USA Tel: +1 510 483 7370	PERFORMANCE CURVES DEFINITIONS, PX-Q400		REV	BY	CKD	REVISION	DATE	
				00	AKP	CD	INITIAL RELEASE	12/2/22	
		Doc. No.		80008-06					
		Sheet No.		Page 1 of 2					

Efficiency:

Energy transfer efficiency in the Pressure Exchanger (PX Series) unit as calculated with the following equation:

$$Efficiency = \frac{\sum (Pressure \times Flow)_{OUT}}{\sum (Pressure \times Flow)_{IN}} \times 100 \%$$

High Pressure Flow Differential Pressure (HP DP):

The pressure at the high-pressure inlet port of the PX minus the pressure at the high-pressure outlet port of the PX.

Low Pressure Flow Differential Pressure (LP DP):

The pressure at the low-pressure inlet port of the PX minus the pressure at the low-pressure outlet port of the PX.

Lubrication Flow:

The flow rate of high-pressure fluid required to lubricate the PX's hydrodynamic bearing measured as a difference in flow rates according to any of the following equivalent methods:

- Low-pressure feed water to the main high-pressure pump minus the membrane permeate
- High-pressure inlet flow to the PX unit minus the high-pressure outlet flow from the PX unit
- Low-pressure outlet flow from the PX unit minus the low-pressure inlet flow to the PX unit

Minimum Discharge Pressure (MDP):

The minimum allowable pressure at the low-pressure outlet port of the PX unit.

Salinity Increase:

The increase in salinity of the membrane feed with respect to the feed water due to mixing within the PX device. Salinity increase varies with membrane recovery rate. It is calculated with the following equation:

$$SalinityIncrease = \frac{membrane\ feed\ salinity - feedwater\ salinity}{feedwater\ salinity} \times 100 \%$$

Sound:

Sound Level Pressure (dBA) measured at a distance of 1 meter from the PX device

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 Energy Recovery, Inc 1717 Doolittle Drive San Leandro CA 94577 USA Tel: +1 510 483 7370	PERFORMANCE CURVES DEFINITIONS, PX-Q400		REV	BY	CKD	REVISION	DATE
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	Doc. No.		80008-06				
	Sheet No.		Page 2 of 2				

PX Device (PX-Q400) Test Conditions:

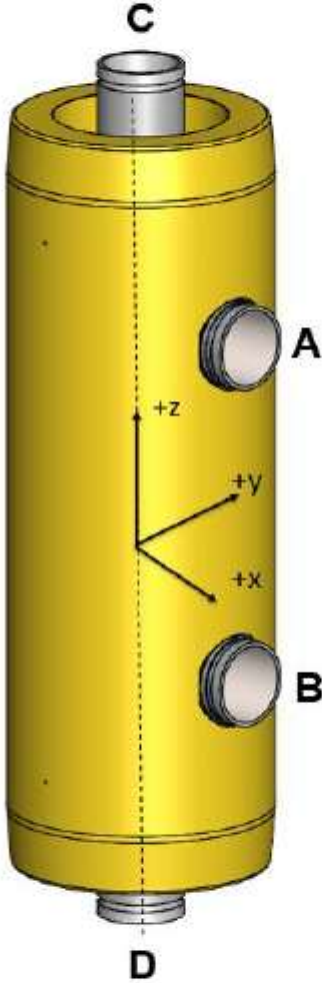
Pressure Exchanger (PX-Q400) performance data collected in ERI's wet test facility in San Leandro, California. Mixing data collected at confidential ERI test facilities and customer site.

- ERI facilities test conditions:

- Process fluid: Municipal Drinking Water: 70 ppm TDS, 68±5 degF / 20 degC (nominal).
- Efficiency and Differential Pressure data collected at 1,000±10 psig / 69 bar high-pressure inlet pressure, 13±1 psig / .89 bar low-pressure outlet pressure with Pressure Exchanger in horizontal orientation.
- Salinity Increase calculated from data collected at 1,000±10 psi / 69 bar high-pressure inlet pressure, 13±1 psig / .89 bar low-pressure inlet pressure at balanced flow (i.e.: LPin flow = HPout flow) and 40% membrane recovery.
- Minimum Discharge Pressure: data collected at 1200±12 psi / 82.7 bar high-pressure inlet pressure and maximum rated flow.
- Lubrication flow curve: data collected at indicated flow rate and high pressure inlet.

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	1717 Doolittle Dr. San Leandro, CA 94577, USA Phone: +1(510)483-7370	ENERGY RECOVERY, INC.	REV	BY	CKD	REVISION	DATE
		PX-Q400	00	AKP	CD	Initial Release	Dec 12, 2022
		SHEET 1 of 1					
		DOCUMENT NUMBER 80887-01					
ALLOWABLE LOADS AND VIBRATION		MANUFACTURER ERI					



Allowable External Loads, LBS

	Port A, 4"	Port B, 4"	Port C, 4"	Port D, 4"
Fx	6	6	6	6
Fy	6	6	6	6
Fz	6	6	6	6

Note:

- Nozzle Loads represent +/- range of stated value.
 - Example: -6 LBS to +6 LBS
- The PX is not designed to support connecting piping loads, misalignment forces, and bending moments prior to and during operations

Average Vibration, in/s (mm/s)

Port A	Port B	Port C	Port D
0.21	0.15	0.31	0.16
(5.21)	(3.68)	(7.87)	(4.06)

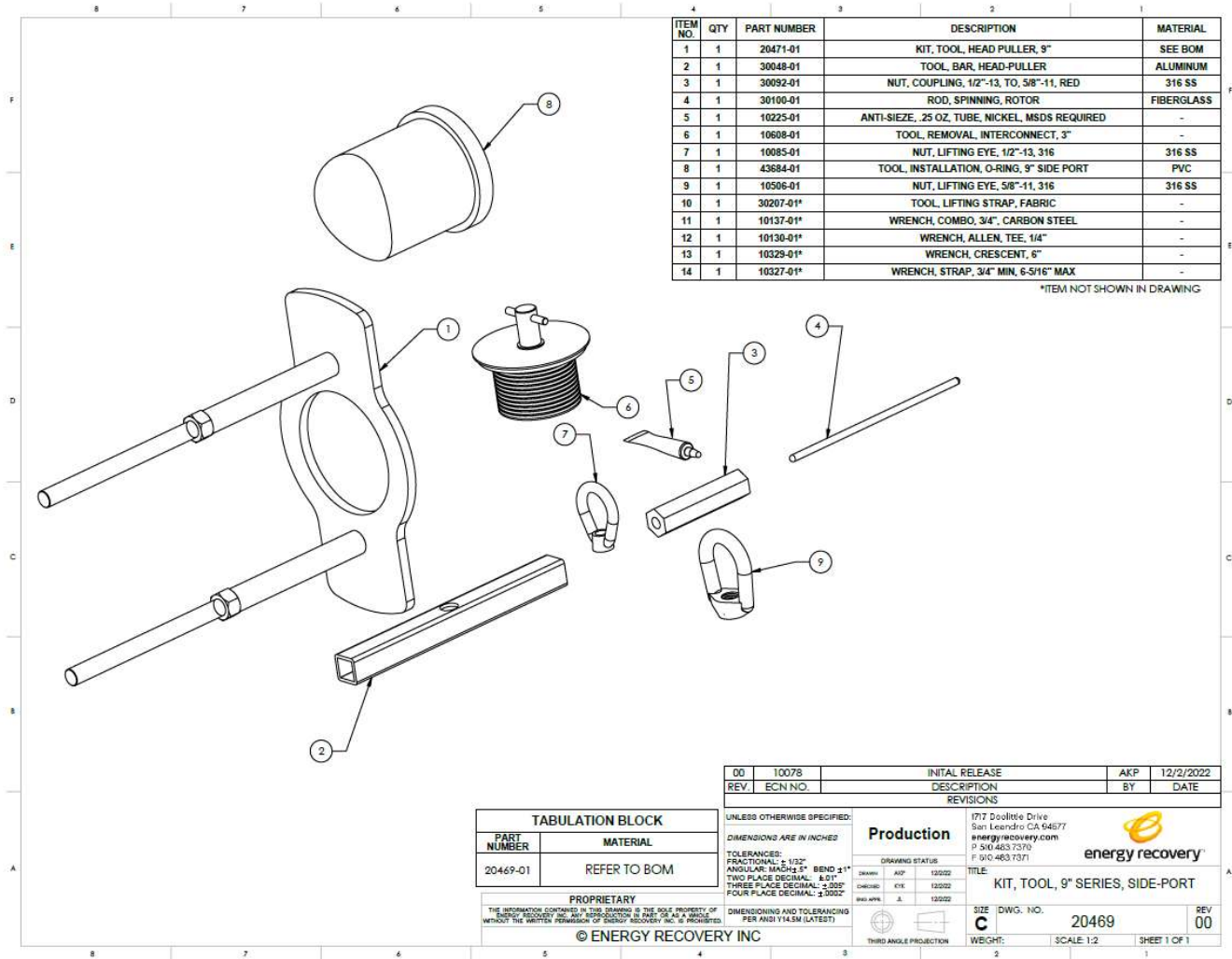
Average Displacement Vibration, mils (microns)

Port A	Port B	Port C	Port D
0.14	0.10	0.21	0.11
(3.45)	(2.44)	(5.33)	(2.79)

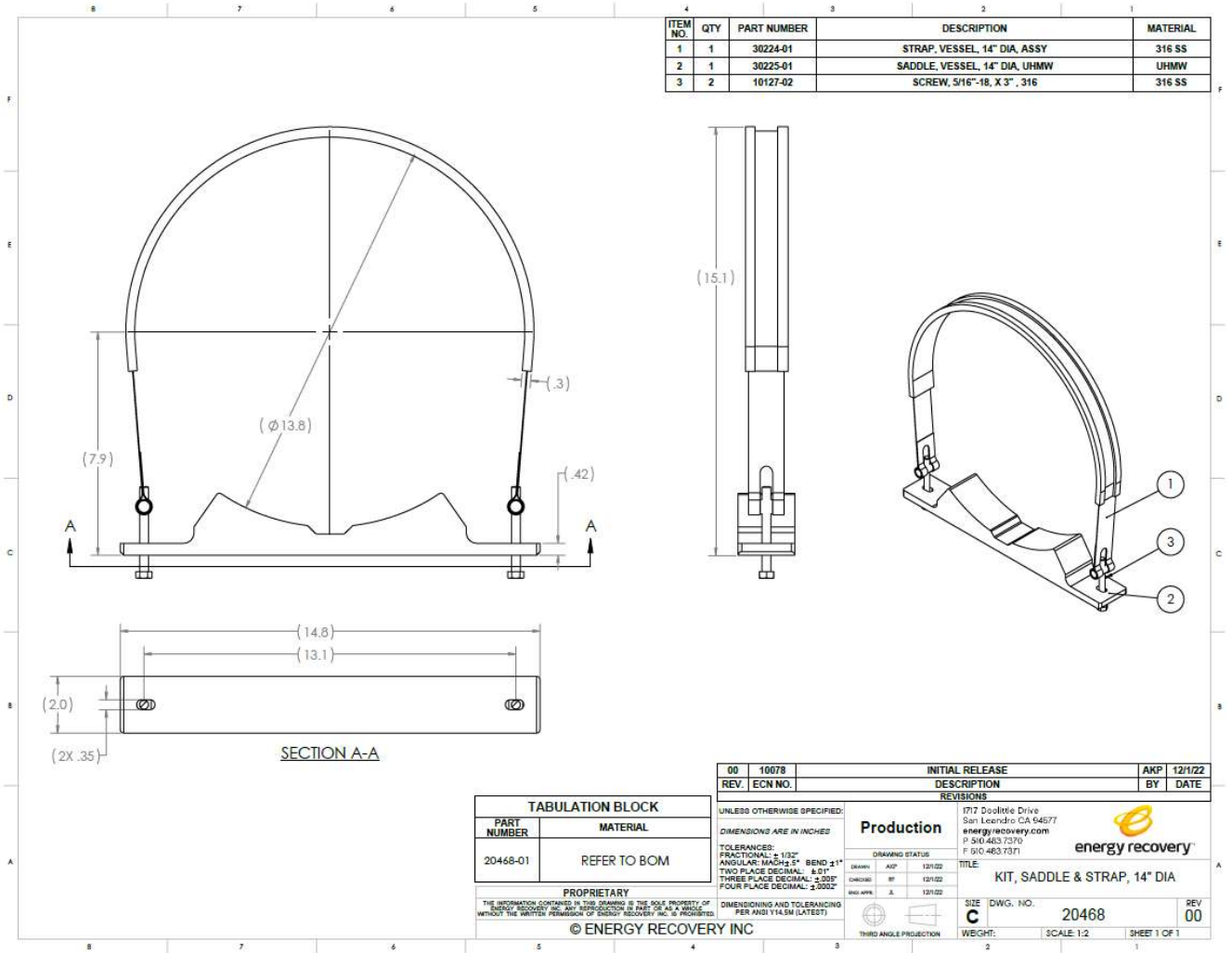
Note:

- Test Conditions: 400 GPM, 1000psi HP in, 18psi LP out, and 73F
- PX Tested in vertical orientation
- Port Description
 - Port A - High Pressure Outlet
 - Port B - High Pressure Inlet
 - Port C - Low Pressure Inlet
 - Port D -Low Pressure Outlet

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	Energy Recovery, Inc 1717 Doolittle Drive San Leandro CA 94577 USA Tel: +1 510 483 7370 Fax: +1 510 483 7371	INSPECTION POINTS PROGRAM FOR PRESSURE EXCHANGER		REV	BY	CKD	REVISION	DATE
				00	JMP	RLS	Issued for Review	3/8/07
				01	RLS	JMP	Issued for Distribution	3/19/07
				02	JMP	RLS	Updated	11/28/07
				03	TDR	JGM	Changed Ref doc # from 80009-01 to 80009-02	10/13/10
		Doc. No.	80065-03	04	DN	YR	Updated Format & Detail	05/13/21
		Sheet No.	1 of 2	05	DN	SB	Renumbered items on table & edited columns	08/27/21
				06	RAB	YR	Updated Performance and MC descriptions	10/28/21
				07	RT		Updated standard inspection quantity	12/15/23

Inspection and Test Plan:

1.0 Scope

- The Inspection Test Plan (ITP) is an engineering and quality control document that describes the inspections and tests to be performed on Energy Recovery, Inc. (ERI) Pressure Exchanger (PX) energy recovery devices.
- Inspections are performed in accordance with ERI quality standards.
- Any test required by customer out of the scope of this ITP, shall be carried out at Customer's cost and responsibility and must be approved by ERI prior to the test and documented in a custom ITP.

The ITP includes the following descriptions:

- List of test and quality procedures to be conducted.
- Main equipment to be tested.
- Reference to ERI internal procedures.

2.0 Acceptance and Conditions

- All equipment and materials are to be inspected and tested in accordance with the requirements of this ITP and ERI's quality standards.
- Standard inspection quantity not to exceed 2% of the total order quantity.

3.0 Notification for Witnessed Test

- Upon request, the customer will be notified prior to testing or inspection to allow customer representatives to witness testing activities. Such notification will be issued by ERI by email least 21 days in advance of the testing or inspection. It will include the following details:
 - Date of inspection
 - Inspection place
 - Contact person
 - Inspection or test plan procedure
 - Equipment to be inspected
 - QMS 3020 Witness Test Process

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 energy recovery [™]	Energy Recovery, Inc 1717 Doolittle Drive San Leandro CA 94577 USA Tel: +1 510 483 7370 Fax: +1 510 483 7371		INSPECTION POINTS PROGRAM FOR PRESSURE EXCHANGER			REV	BY	CKD	REVISION	DATE
						00	JMP	RLS	Issued for Review	3/8/07
						01	RLS	JMP	Issued for Distribution	3/19/07
						02	JMP	RLS	Updated	11/28/07
						03	TDR	JGM	Changed Ref doc # from 80009-01 to 80009-02	10/13/10
	Doc. No.		80085-03		04	DN	YR	Updated Format & Detail	05/13/21	
	Sheet No.		2 of 2		05	DN	SB	Renumbered items on table & edited columns	08/27/21	
					06	RAB	YR	Updated Performance and MC descriptions	10/28/21	
					07	RT		Updated standard inspection quantity	12/15/23	

Project / Reference:	Customer:	Equipment Type:	Qty
		PX Pressure Exchanger model	

Process No	Process Description / Scope	Specification / Reference Document	Acceptance Criteria	Verification Type		Acceptance			
				ERI	Client / Rep.	ERI Signature	Date	Client / Representative Signature	Date
1	Material Conformance	Supplier MTR ASME BPVC Section X for GRP housing.	ERI Material Spec	R	R				
2	Dimensional and Visual Inspection	ERI drawings	Visual	S	R				
3	Performance Test (Efficiency, cavitation, rotational speed and rotor stall test)	ERI Document Number 80009-02	ERI Internal Quality Specification	S	W				
4	Packaging Inspection	ERI Drawings	Visual	S	W				
5	QC Release	Project-specific compilation of inspection and test results	Certificate of Conformance	R	R				
6	Shipping Authorization	Client shipment release	Customer Conformation	R	H				
Notes:									

Legend of Inspections and Test Verifications:
 R - Review and approval required.
 S - Review and verify compliance with specified document.
 W - Notification required prior to test or inspection to allow for procedure to be witnessed.
 H - Inspection, testing and/or other activities shall be held and shall not proceed without written authorization

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 energy recovery	Energy Recovery, Inc 1717 Doolittle Drive San Leandro CA 94577 USA Tel: +1 510 483 7370 Fax: +1 510 483 7371	FACTORY PERFORMANCE TEST PROCEDURE				REV	BY	CKD	REVISION	DATE
						00	JMP	ST	INITIAL RELEASE	10/05/09
						01	RAB	EK	Updated Section 2.5	10/13/15
Doc. No.		80009-02								
Sheet No.		1 of 3								

PURPOSE

To test performance of PX Series Pressure Exchanger (PX) equipment. Unless otherwise noted, all PXs shipped are to be tested according to this procedure.

2.0 GENERAL NOTES

- 2.1 Deviation from test method or procedure must be approved by the Engineer Department and/or the Quality Manager prior to conducting test.
- 2.2 Except as otherwise specified, a signature, initials, or inspectors stamp of the Test Technician on the Test Form (example attached) will indicate that the procedure was completed satisfactorily based on personal observation or objective evidence.
- 2.3 Entries in this test procedure are to be made in ink only. To correct an entry, draw a single line through the error, write the correction, sign and date correction.
- 2.4 Data acquired by the test stand programmable logic controller (PLC) is automatically printed and saved to ERI's testing database. Performance calculations and the final disposition of each PX unit are done automatically using the equations presented in this document.
- 2.5 This procedure refers to the Production Test Stand Process and Instrument Diagram ERI Document Number 80196-01 and the Factory Performance Specifications ERI Document Number 80051.

3.0 PREPARATIONS

- 3.1 The Test Technician shall ensure that the PX device has met all required specifications prior to commencement of the test.
- 3.2 The Test Technician shall brief all pertinent personnel associated with this test on valve locations, electric power arrangements, and emergency shutdown procedures.
- 3.3 The Test Technician shall identify hazards and hazardous areas during the test to all pertinent personnel associated with this test.
- 3.4 The Test Technician shall examine test equipment for damage, excessive leak, and frayed electrical cords.
- 3.5 The Test Technician shall ensure that PX device components have passed all required inspections prior to testing.
- 3.6 The Test Technician shall don appropriate personal protective equipment, including ear and eye protection.

4.0 PROCEDURE

- 4.1 Connect PX to the test stand.
- 4.2 Assure that valves V624, V625 are open for PX testing.
- 4.3 Open valve V623 to fill test stand.
- 4.4 Visually ensure all air is purged from the system.
- 4.5 Close valve V626 and V627.
- 4.6 Close valve V623.
- 4.7 Position Noise Meter at 3.3 feet [1 meter] from PX and turn on Meter.
- 4.8 Attach magnetic sensor of Vibration Meter to PX LP out coupling and turn on Meter.
- 4.9 Select operator on the PLC screen.

™ PX, PX Pressure Exchanger, ERI and the ERI logo are registered trademarks of Energy Recovery, Inc.

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- 4.10 Press "PX test menu" on the Programmable Logic Controller's (PLC's) screen to go to the Operational Set-Points screen.
- 4.11 Select the test to be run on the PX test menu options screen.
- 4.12 Press "run PX test to return to the Main Testing screen.
- 4.13 Enter serial numbers into the serial numbers pane of the screen.
- 4.14 Ensure all operations are in the auto mode on the screen. If the operations are not in the auto mode, convert them to auto mode prior to starting the test.
- 4.15 Reset the E-Stop button(s).
- 4.16 Clear any alarms by pressing the Alarm History button, the Reset Alarms button, and the Back button to return to the Main Testing screen.
- 4.17 Press Start on the screen. The PLC will operate the test stand at the selected flows and pressures in step number 4.12
- 4.18 Enter sound level (dB) at the rated high flow rate in the Noise pane of the screen.
- 4.19 Enter Rotor Speed (cpm) at the rated high flow in the RPM pane of the screen.
- 4.20 Visually check the unit for external leakage.
- 4.21 Press the Test Complete Button when prompted.
- 4.22 The PLC and associated testing programs will record pressure, unit flow, lubrication flow, and temperature data at the specified flows for each unit to be tested.
- 4.23 Enter PASS/FAIL Disposition for the Cavitation Noise Test.
- 4.24 Enter PASS/FAIL Disposition for the 1200 psi Rotor Stall Test.
- 4.25 Enter PASS/FAIL Disposition for the External Leakage Test.
- 4.26 Enter PASS/FAIL Disposition for the Outside Dimension Check.
- 4.27 Press the Test Complete button after steps 4.28-4.31 have been satisfied.
- 4.28 Wait for the system to complete shutdown procedure.
- 4.29 Open V626 and V627 to release pressure from the system.
- 4.30 Close V624 and V625.
- 4.31 Disconnect unit from the test stand.
- 4.32 The PLC and associated testing programs will calculate pressures and efficiency according to:

$$\text{HP OUT. PRESS.} = \text{HP IN PRESS.} - \text{HP DIFF PRESS.}$$

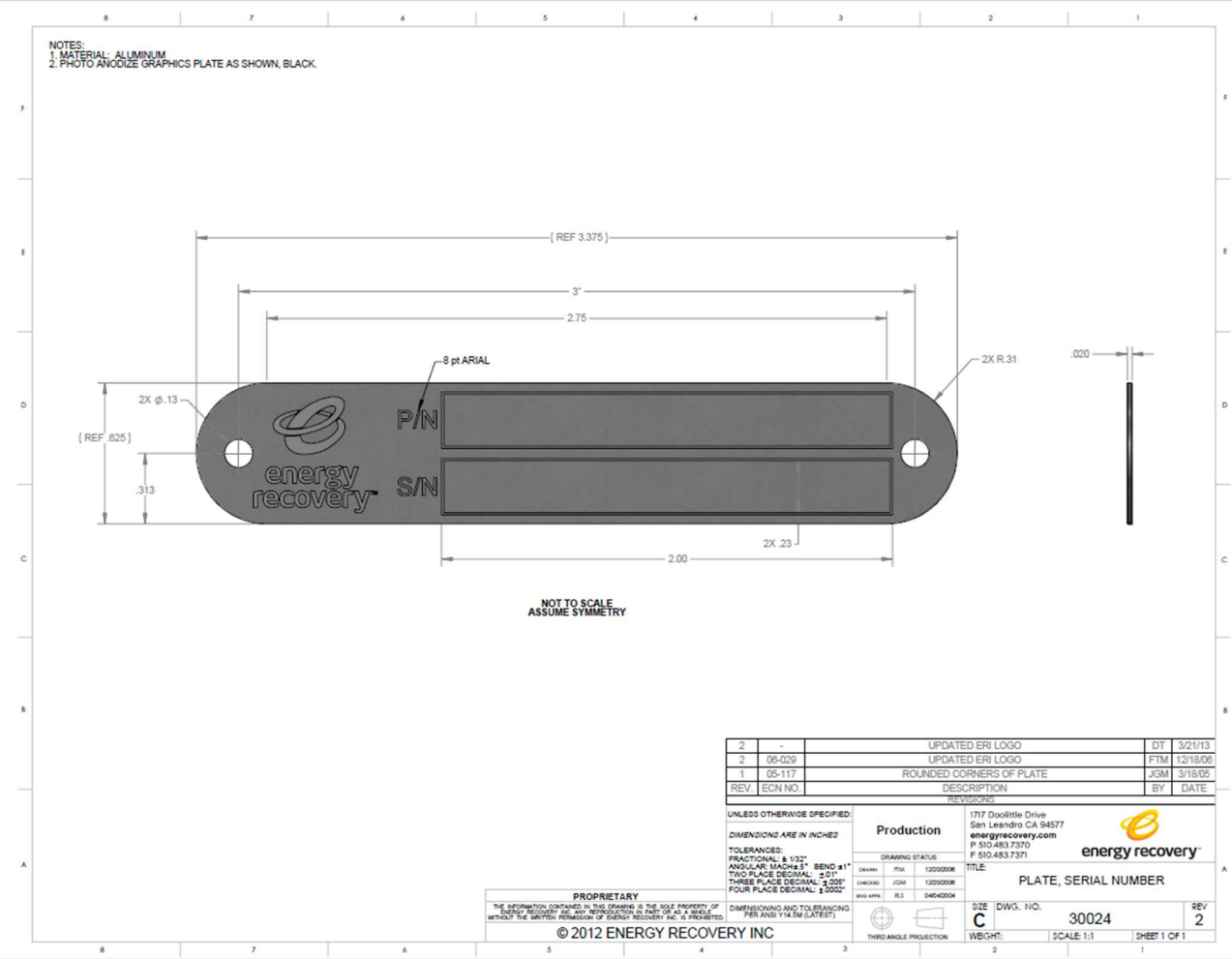
$$\text{LP IN. PRESS.} = \text{LP OUT PRESS.} + \text{LP DIFF PRESS.}$$

$$\text{EFFICIENCY} = 100\% * (\text{F}_{\text{HPout}} * \text{P}_{\text{HPout}} + \text{F}_{\text{LPout}} * \text{P}_{\text{LPout}}) / (\text{F}_{\text{HPin}} * \text{P}_{\text{HPin}} + \text{F}_{\text{LPin}} * \text{P}_{\text{LPin}})$$
- 4.33 The PX unit will be automatically dispositioned by the PLC and associated testing programs based on PX Factory Performance Specifications as listed in ERI Document Number 80051 current revision.

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	Energy Recovery, Inc. 1717 Doolittle Dr. San Leandro, CA 94577, USA Phone: 510-483-7370 Fax: 510-483-7371		PX SINGLE ROTOR FACTORY PERFORMANCE TEST FORM Doc. No. 80108-01		REV	BY	CHK	REVISION	DATE			
					000	LD	SO	As-Built	4/28/2009			
					001	EB	AS		9/1/2016			
					002	EB	JL		4/20/2018			
PERFORMANCE TEST FORM												
Date: 5/17/2018					Time: 11:50:03 AM		Technician: Cheng Saepanh (CS)					
External Serial #: HC E1805071												
Internal Serial #: HCI 1805071												
SW Endcover #: 180430003					Brine Endcover #: 180508017							
Model: PX-Q300												
HP FLOW	LP FLOW	LP IN PRESS.	LP OUT PRESS.	LP DIFF PRESS.	HP IN PRESS.	HP OUT PRESS.	HP DIFF PRESS.	ROTOR SPEED	NOISE*	LUBE FLOW	TEMP	EFFICIENCY
gpm	gpm	psi	psi	psi	psi	psi	psi	cpm	dB	gpm	° F	%
200.0	200.5	17.3	12.2	5.1	1005.2	1000.3	4.9			1.7	66.9	98.2
250.2	250.2	21.1	12.3	8.8	1000.3	991.9	8.4			2.1	66.7	97.5
299.9	300.2	25.4	12.1	13.3	998.1	985.6	12.5	17071	84	2.4	66.9	96.7
Cavitation Noise Test * ☒ PASS ☐ FAIL 1200.5 psi Rotor Stall Test ☒ PASS ☐ FAIL External Leakage Test ☒ PASS ☐ FAIL Visual Inspection ☒ PASS ☐ FAIL												
Observations/Notes: (STEP 1: Passed) (STEP 2: Passed) (STEP 3: Passed)												
* This test is not intended to determine sound pressure levels emitted by this equipment. It does not follow the ISO 3744 standard.												
Final Disposition ☒ PASS ☐ FAIL												

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Technical Bulletin- CE Marking – Applicability to PX

PX

External circulation

JUAN CIFUENTES

REV	ECO	BY	CKD	REVISION	DATE
000	[-]	[RLS]	[IBC]	Initial Release	[08-10-2007]
001	[-]	[TDR]	[JGM]	Updated to add PX 300	[03-17-2010]
002	[10196]	[JC]	[RAB]	Updated to add PX Q400	[06-01-2024]

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This bulletin considers the requirement for CE marking of PX® Pressure Exchanger® energy recovery devices for seawater and brackish water reverse osmosis processes.

CE MARKING APPLICABILITY



The requirements for CE marking for pressure equipment are presented in Directive 2014/68/UE of the European Parliament and of the Council of 15 May 2014 ("the Directive"). The Directive concerns manufacturers of items such as pressurized storage containers, heat exchangers, steam generators, boilers, industrial piping, safety devices and pressure accessories. The article of the Directive that is potentially applicable to PX Pressure Exchanger devices is that for vessels: Article 4, Section 1.a.ii.

Applicability is based upon the type, volume and pressure of the fluid contained in the vessel. PX Pressure Exchanger devices contain non-hazardous seawater or brackish water. The maximum internal volume of the largest PX Pressure Exchanger device currently manufactured by ERII (the PX Q400) including the volume of the nozzles is approximately 20 liters. The specified maximum pressure for which PX Pressure Exchanger devices are designed is 83 bar.

The specified maximum pressure for which the Ultra PX Pressure Exchanger devices are designed is 120 bar, and the internal volume of the largest Ultra PX Pressure Exchanger device currently manufactured by ERII (the PX U250) including the volume of the nozzles is approximately 21 liters.

Based upon these characteristics, the Directive indicates that PX Pressure Exchanger devices "must not bear the CE marking." Therefore, we conclude that **CE marking is not applicable to PX Pressure Exchanger and Ultra PX Pressure Exchanger energy recovery devices used for seawater, brackish water, and industrial waste water reverse osmosis processes.**

For additional information about PX device, contact Energy Recovery at sales@energyrecovery.com or call +1 (510) 483-7370.

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PX Codes and Standards

Pressure Containing

Housing	ASME BPVC Section X
Housing Ring	ASTM SA351 or SA479
Head	ASME BPVC Section II SB-221
Lock Rings	ASTM SA351 (material)
	ASTM A744 (heat treatment)
Ports	ASTM A790
Coupling Connections	AWWA C-606

Internal, Wetted, Non-pressure containing

Interconnects	ASTM B861
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Miscellaneous Certifications	NSF/ANSI 61, Certificate N-8485
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[Escriba aquí]

Energy Recovery, Inc. | 1717 Doolittle Drive | San Leandro, CA 94577 | +1 (510) 483-7370 | +1 (510) 483-7371(fax) |
www.energyrecovery.com

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	Energy Recovery, Inc. 1717 Doolittle Dr. San Leandro, CA 94577, USA Phone: 510-483-7370 Fax: 510-483-7371	Pressure Exchanger™ Vessel Paint Data		REV	BY	CKD	REVISION	DATE
				00	JL		Issued for Ref	20 Sep 18
				00	AKP	JL	Added dual units for paint thickness	19 Jan 23
				01	AKP	JL	Updated per ROPV review	02 Feb 23
		Doc. No.	80682-01					
		Sheet No.	1 of 1					

Pressure Exchanger™ Vessel Paint

The following is for informational purposes only. Pressure Exchanger™ vessels should only be painted and repaired by ERI approved facilities.

- Clean surface of vessel with cotton cloth and paint thinner.
- Primer coat:
 - Acrylic polyurethane primer
 - 1 Heavy coat
 - 0.25 mm (10 mils) thick, total DFT (*Approximate Thickness*)
- After cure, sand primer with 180 grit sand paper until smooth. Finish with wet sanding 320 grit.
- Base coat:
 - Acrylic polyurethane
 - 1-2 coats
 - 0.025 mm (.98 mils) thick, total DFT (*Approximate Thickness*)
 - RAL1003, yellow
- Cure at 80°C (176°F) for 1 hour.
- After Cure, move to outside for 30 minutes and then sand with 320 grit.
- Top coat:
 - Acrylic polyurethane
 - 1-2 coats
 - 0.025 mm (.98 mils) thick, total DFT (*Approximate Thickness*)
 - RAL1003, yellow
- Cure at 80°C (176°F) for 1 hour.
- After Cure, move to outside for 30 minutes and then sand with 320 grit.
- Finish Coat:
 - Acrylic polyurethane
 - 1-2 coats
 - 0.025 mm (.98 mils) thick, total DFT (*Approximate Thickness*)
 - RAL1003, yellow
- Cure at 80°C (176°F) for 1 hour.
- Check color against standard RAL1003 paint chip.

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CUSTOMER REFERENCE LIST



MPD Reference List

Q3 - 2024



Worldwide



All Products



energy recovery™

YEAR	COUNTRY	CUSTOMER	CAPACITY (M3/DAY)	PROJECT NAME	PRODUCT	Application	Industry
2024	Morocco	Aciona	822,000	Casablanca desal plant	PX-Q400	Seawater RO	Municipal
2024	United Arab Emirates	SIDEM	820,000	Hassyan SWRO	PX-Q400	Seawater RO	Municipal
2024	Saudi Arabia	WETICO	600,000	Rasjigh 4	PX-Q400	Seawater RO	Municipal
2024	United Arab Emirates	Orascom Construction, Metito L.L.C JV	520,000	Abu Dhabi ADNOC - NF	PX-Q300	Seawater RO	Municipal
2024	India	VA TECH WASAG	450,000	Perur SWRO	PX-Q300	Seawater RO	Municipal
2024	United Arab Emirates	GS INIMA ENVIRONMENT, S.A.U	360,000	Shuweihat 4 IWP	PX-Q400	Seawater RO	Municipal
2024	Oman	GS INIMA ENVIRONMENT, S.A.U	300,000	Ghurah 3	PX-Q300	Seawater RO	Municipal
2024	Morocco	MMSA Water	246,000	Jorf Lasfar Wave 2	PX-Q400	Seawater RO	Municipal
2024	Australia	Alkimos Seawater Joint Venture (ACA, AGUA & JACOBS)	150,000	Alkimos Desalination Plant	PX-Q400	Seawater RO	Municipal
2024	Spain	Sacyr Water	120,000	Carboneras SWRO	PX-Q300	Seawater RO	Municipal
2024	United Arab Emirates	Tecton	100,000	Floating Barge	PX-Q300	Seawater RO	Municipal
2024	India	AQUATECH INTERNATIONAL CORPORATION	100,000	Mandvi Desal Plant	PX-Q300	Seawater RO	Municipal
2024	Saudi Arabia	Tecton	95,400	Jafurah Gas Oil field	PX-Q300	Seawater RO	Oil and Gas
2024	Morocco	Fisla Italmipiamb	92,000	Dakhia SWRO	PX-Q400	Seawater RO	Agriculture
2024	Chile	IDE WATER TECHNOLOGIES LTD	75,000	Radomiro Tomic Codeico	PX-Q300	Seawater RO	Municipal
2024	India	AQUATECH INTERNATIONAL CORPORATION	70,000	Bhavanagar Desal Plant	PX-Q300	Seawater RO	Municipal
2024	India	AQUATECH INTERNATIONAL CORPORATION	70,000	Dwarka Desal plant	PX-Q300	Seawater RO	Municipal
2024	Morocco	SYCHEM SA	60,000	Wave 2	PX-Q300	Seawater RO	Municipal
2024	Morocco	Ion Exchange (India) Ltd.	60,000	Wave 3	PX-Q400	Seawater RO	Municipal
2024	Kazakhstan	SNK	50,000	Kindrei SWRO	PX-Q300	Seawater RO	Municipal
2024	China	Qingdao Ankixin Electromechanical Equipment Co., Ltd	50,000	Tangshan Port SWRO	PX-Q300	Seawater RO	Municipal
2024	Morocco	SYCHEM SA	30,000	Wave 3 Extension 1	PX-Q300	Seawater RO	Municipal
2024	Morocco	SYCHEM SA	30,000	Wave 3 Extension 2	PX-Q300	Seawater RO	Municipal
2023	Saudi Arabia	Doosan Enerbility Co., Ltd.	650,000	Shoalab III	PX-Q300	Seawater RO	Municipal
2023	United Arab Emirates	SIDEM	570,000	Mirfa 2 IWP	PX-Q300	Seawater RO	Municipal
2023	Israel	IDE TECHNOLOGIES LTD.	400,000	Western Galilee	PX-Q300	Seawater RO	Municipal
2023	Qatar	Aciona Agua	377,000	North Field Expansion	PX-Q300	Seawater RO	Oil and Gas
2023	Algeria	WETICO	300,000	Bejaia SWRO	PX-Q300	Seawater RO	Municipal
2023	Algeria	WETICO	300,000	Cap Djinet SWRO	PX-Q300	Seawater RO	Municipal
2023	Algeria	WETICO	300,000	El Tarf SWRO	PX-Q300	Seawater RO	Municipal
2023	Algeria	Metito (Overseas) Limited	300,000	Fouka SWRO	PX-Q300	Seawater RO	Municipal
2023	Algeria	HANGZHOU WATER TREATMENT TECHNOLOGY DEVELOPMENT	300,000	Cap Blanc SWRO	PX-Q300	Seawater RO	Municipal
2023	Chile	ACCOONA AGUA S.A.U.	114,000	Colihueas SWRO	PX-Q300	Seawater RO	Mining
2023	South Korea	GS INIMA ENVIRONMENT, S.A.U	110,000	K-Water	PX-Q300	Seawater RO	Municipal
2023	Chile	IDE WATER TECHNOLOGIES LTD	86,000	Angio America	PX-Q300	Seawater RO	Mining
2023	China	Qingdao Ankixin Electromechanical Equipment Co., Ltd	75,000	Tianjin Nangang SWRO	PX-Q300	Seawater RO	Municipal
2023	China	SUEZ Infrastructure Company Limited (SUZ Hong Kong)	74,000	Penglai Wanhua SWRO	PX-Q300	Seawater RO	Municipal
2023	Singapore	VA TECH WASAG	50,000	Marmelizer SWRO	PX-Q300	Seawater RO	Municipal
2023	India	VA Tech Wabag Pune	50,000	Reliance Jamnagar Expansion	PX-Q300	Seawater RO	Oil and Gas
2023	China	QINGDAO FTZ GEM-IN INTERNATIONAL	33,000	Shandong Lubel	PX-Q300	Seawater RO	Municipal
2022	Saudi Arabia	Metito (Overseas) Limited	998,000	JUBAIL II	PX-Q300	Seawater RO	Municipal
2022	Saudi Arabia	ACCOONA AGUA S.A.	560,000	Jubail 3B	PX-Q300	Seawater RO	Municipal
2022	Saudi Arabia	Doosan Heavy Industries & Construction CO, LTD.	450,000	Yanbu 4	PX-Q300	Seawater RO	Municipal
2022	India	Corbatacton Pvt Ltd	150,000	Nemmeli II	PX-Q300	Seawater RO	Municipal
2022	Chile	IDE WATER TECHNOLOGIES LTD	144,000	Miners Escondido - Phase 3	PX-Q300	Seawater RO	Municipal
2022	Tseung Kwan O	ACCOONA AGUA S.A.U.	144,000	Tseung Kwan O	PX-Q300	Seawater RO	Municipal
2022	Tunisia	Metito (Overseas) Limited	100,000	SFAH	PX-Q300	Seawater RO	Municipal
2022	Oman	Fisla & GS INIMA JV	100,000	Barka V	PX-Q300	Seawater RO	Municipal
2022	Algeria	Metito (Overseas) Limited	80,000	CORSO	PX-Q300	Seawater RO	Municipal
2022	China	Qingdao Ankixin Electromechanical Equipment Co., Ltd	80,000	Yulong Petrochemical SWRO	PX-Q300	Seawater RO	Chemical
2022	Egypt	TAM ENVIRONMENTAL SERVICES	65,000	East Matrouh	PX-Q300	Seawater RO	Municipal
2022	Spain	AQUALIA INTECH S.A.	60,000	Mar de Alboran	PX-Q300	Seawater RO	Agriculture
2022	Algeria	MES (Mechanical Electrical Services)	60,000	El Marza SWRO	PX-Q300	Seawater RO	Municipal
2021	Saudi Arabia	Rawafid Industrial Co Ltd	600,000	Shoalab 3	PX-Q300	Seawater RO	Municipal
2021	Saudi Arabia	Abengoa	600,000	Jubail 3A	PX-Q300	Seawater RO	Municipal
2021	Israel	IDE PROJECTS LTD	572,000	Soreq 2	PX-Q300	Seawater RO	Municipal
2021	Saudi Arabia	Metito (Overseas) Limited	420,000	Jubail I	PX-Q300	Seawater RO	Municipal
2021	Saudi Arabia	ACCOONA AGUA S.A.	400,000	Shuqaiq 4	PX-Q300	Seawater RO	Municipal
2021	India	Larsen & Toubro - Tecton JV	108,205	Dahaj desalination plant	PX-Q300	Seawater RO	Municipal
2021	China	QINGDAO FTZ GEM-IN INTERNATIONAL	100,000	Qingdao Befesa	PX-Q300	Seawater RO	Municipal
2021	Taiwan	IDE PROJECTS LTD	100,000	Taiwan Formosa SWRO plant	PX-Q300	Seawater RO	Municipal
2021	Indonesia	Aquatech Systems (Asia) Pvt. Ltd	98,820	Pertamina	PX-Q300	Seawater RO	Oil and Gas
2021	China	QINGDAO FTZ GEM-IN INTERNATIONAL	50,000	Tangshan Port SWRO	PX-Q300	Seawater RO	Municipal
2021	Tunisia	VA Tech Wabag Pune	50,000	Zarat	PX-Q300	Seawater RO	Municipal
2020	United Arab Emirates	Abengoa	936,000	Taweeleh SWRO plant	PX-Q300	Seawater RO	Municipal
2020	Saudi Arabia	ACCOONA AGUA S.A.	700,000	Khoar 2 MSF replacement	PX-Q300	Seawater RO	Municipal
2020	United Arab Emirates	SIDEM	681,600	Umm Al Qwain	PX-Q300	Seawater RO	Municipal
2020	Saudi Arabia	Abengoa	670,000	Rasjigh III	PX-Q300	Seawater RO	Power Plant
2020	Qatar	ACCOONA AGUA S.A.	364,000	Facility D Expansion(Umm Al Houf)	PX-Q300	Seawater RO	Oil and Gas
2020	Morocco	Abelma (EPC)	275,000	Ohtouka SWRO	PX-Q300	Seawater RO	Municipal
2020	Saudi Arabia	Metito (Overseas) Limited	151,200	Barge 3 x 50,000 m3/day	PX-Q300	Seawater RO	Marine - Commercial
2020	China	QINGDAO FTZ GEM-IN INTERNATIONAL	141,120	Shijiang Longsheng	PX-Q300	Seawater RO	Chemical
2020	Chile	IDE PROJECTS LTD	125,000	Miners Escondido retrofit	PX-Q300	Seawater RO	Mining
2020	Egypt	METITO WATER TREATMENT SAE	100,000	El-Areesh SWRO	PX-Q300	Seawater RO	Municipal
2020	Egypt	RWIL Water Middle East FZE	40,500	Mansour SWRO	PX-Q300	Seawater RO	Municipal
2020	Chile	IDE PROJECTS LTD	25,000	Miners Escondido retrofit - first phase	PX-Q300	Seawater RO	Mining
2019	Saudi Arabia	ACCOONA AGUA S.A.	450,000	Shuqaiq 3	PX-Q300	Seawater RO	Municipal
2019	Bahrain	SIDEM	240,000	AL Dur 2	PX-Q300	Seawater RO	Municipal
2019	Saudi Arabia	Rawafid Industrial Co Ltd	238,000	Satellite Project	PX-Q300	Seawater RO	Municipal
2019	Saudi Arabia	ACCOONA AGUA S.A.	235,020	South Dhahran	PX-Q300	Seawater RO	Municipal
2019	United Arab Emirates	Aciona - Bexiv JV	210,816	Jebel Ali Power & Desalination complex	PX-Q300	Seawater RO	Municipal
2019	Saudi Arabia	Metito (Overseas) Limited	153,840	DUBA SWCC	PX-Q300	Seawater RO	Municipal
2019	Singapore	IDE TECHNOLOGIES LTD.	136,000	Jurong Island	PX-Q300	Seawater RO	Municipal
2019	Oman	UTE Abeima Fisla Salalah	110,000	Salalah OPWP	PX-Q300	Seawater RO	Municipal
2019	Chile	IDE PROJECTS LTD	102,300	Quebrada Blanca	PX-Q300	Seawater RO	Mining
2019	Chile	TEDAGUA	87,000	Spence - BHP Billinton (BOOT)	PX-Q300	Seawater RO	Mining

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2019	Egypt	TAM ENVIRONMENTAL SERVICES	80,000	Ain Sokhna SWRO	PX-Q300	Seawater RO	Municipal
2019	Oman	ACCOONA AGUA S.A.	80,000	Shargiyah	PX-Q300	Seawater RO	Municipal
2019	Tunisia	Abengoa	50,000	Sousse	PX-Q300	Seawater RO	Municipal
2019	China	QINGDAO FTZ GEM-IN INTERNATIONAL	33,340	Shandong Lubai	PX-Q300	Seawater RO	Municipal
2019	China	QINGDAO FTZ GEM-IN INTERNATIONAL	17,642	Zhejiang Longsheng	PX-Q300	Seawater RO	Chemical
2018	Saudi Arabia	ACCOONA AGUA S.A.	400,000	Shoelob 4	PX-Q300	Seawater RO	Municipal
2018	Saudi Arabia	UTE Abeyma Faisa Shulobah	278,000	Shoelobah III exp II	PX-Q300	Seawater RO	Power Plant
2018	Singapore	KEPPEL SEGHERS ENG. SINGAPORE PTE	160,000	Marine East Desalination Plant	PX-Q300	Seawater RO	Municipal
2018	Egypt	Meitbo (Overseas) Limited	150,000	East Port Said SWRO	PX-Q300	Seawater RO	Municipal
2018	United Arab Emirates	TEDAQUA	121,968	Ras Al Khaimah	PX-Q300	Seawater RO	Municipal
2018	Egypt	TAM ENVIRONMENTAL SERVICES	105,000	Ain Sokhna SWRO	PX-Q300	Seawater RO	Municipal
2018	Saudi Arabia	Meitbo (Overseas) Limited	31,000	KAEK King Abdulaziz Economic City	PX-Q300	Seawater RO	Hospitality
2018	China	QINGDAO FTZ GEM-IN INTERNATIONAL	21,000	Hebei Fengyue SWRO	PX-Q300	Seawater RO	Municipal
2017	Kuwait	ACCOONA AGUA S.A.	284,736	Doha SWRO	PX-Q300	Seawater RO	Municipal
2017	Egypt	AQUALIA INFRASTRUCTURAS S.A.	150,000	El Alamein SWRO	PX-Q300	Seawater RO	Municipal
2017	Egypt	METITO WATER TREATMENT SAE	150,000	El Goleia SWRO	PX-Q300	Seawater RO	Municipal
2017	China	HANGZHOU WATER TREATMENT TECHNOLOGY DEVELOPMENT	82,250	Zhejiang Longsheng	PX-Q300	Seawater RO	Chemical
2017	Saudi Arabia	VA Tech Wasag Pune	82,250	JAZAN Economic city	PX-Q300	Seawater RO	Hospitality
2017	Spain	CADAGUA S.A.	72,000	Valdelentisco Retrofit	PX-Q300	Seawater RO	Municipal
2017	India	BGR ENERGY SYSTEMS LIMITED	34,200	Sri Damodaran TPS Ash Handling Water	PX-Q300	Seawater RO	Power Plant
2016	Oman	SADYT, S.A.	250,000	SOHAR	PX-Q300	Seawater RO	Municipal
2016	Singapore	TEDAQUA	153,000	Tuas III	PX-Q300	Seawater RO	Municipal
2016	China	QINGDAO FTZ GEM-IN INTERNATIONAL	106,872	Dongjiakou Jisonan	PX-Q300	Seawater RO	Municipal
2016	Saudi Arabia	Advanced Water Technology & Rawafid Industrial Co Ltd	73,152	Al Khafji Solar	PX-Q300	Seawater RO	Municipal
2016	Saudi Arabia	AES ARABIA LIMITED	68,000	JAZAN SWRO Plant	PX-Q300	Seawater RO	Chemical
2016	Tunisia	U.T.E. GROUPEMENT SOLIDAIRE JERBA	50,250	Djerba	PX-Q300	Seawater RO	Municipal
2016	China	BEIJING SINOIR WATER TECHNOLOGY	50,000	Cangzhou New Bohai	PX-Q300	Seawater RO	Municipal
2016	India	VA TECH WASAG INTERNATIONAL BUSINESS GROUP	26,640	Reliance Jamnagar	PX-Q300	Seawater RO	Oil and Gas
2015	Qatar	ACCOONA AGUA S.A.U.	336,000	Facility D (Umm Al Houli Power and Water project)	PX-Q300	Seawater RO	Oil and Gas
2015	Oman	HYFLUX - HYDROCHEM (S) PTE LTD	223,080	Quryayyat	PX-Q300	Seawater RO	Municipal
2015	Qatar	ACCOONA AGUA S.A.U.	200,200	RAS ABU FONTAS A3	PX-Q300	Seawater RO	Power Plant
2015	United Arab Emirates	DEGREMONT - HEADQUARTER	161,710	Mirfa	PX-Q300	Seawater RO	Municipal
2015	Oman	VEOLIA WATER SOLUTIONS (MAIN ACCOUNT)	60,960	Sur	PX-Q300	Seawater RO	Municipal
2015	United States	BIWATER AEW7	37,860	San Antonio Water BWRD	AT-1500 Duplex	Brackish Water RO	Municipal
2015	China	QINGDAO FTZ GEM-IN INTERNATIONAL	22,500	Cangzhou New Bohai	PX-Q300	Seawater RO	Municipal
2014	India	IDE TECHNOLOGIES LTD.	188,343	Reliance Jamnagar 170,000 cmd	PX-Q300	Seawater RO	Oil and Gas
2014	Trinidad and Tobago	HYFLUX - HYDROCHEM (S) PTE LTD	50,004	Beetham WRP	LPT-1000 Duplex	Brackish Water RO	Municipal
2013	Oman	CADAGUA S.A.	248,024	Al Ghubrah	PX-Q300	Seawater RO	Municipal
2013	Saudi Arabia	VEOLIA WATER SOLUTIONS (MAIN ACCOUNT)	224,884	Sadara Petro	PX-Q300	Seawater RO	Chemical
2013	United States	IDE TECHNOLOGIES LTD.	189,000	Carlsbad	PX-Q300	Seawater RO	Municipal
2013	United Arab Emirates	ACCOONA AGUA S.A.U.	146,880	Fujairah 1	PX-Q300	Seawater RO	Municipal
2013	Saudi Arabia	ACCOONA AGUA S.A.U.	129,816	Jubail 4 - MARAFIQ	PX-Q300	Seawater RO	Municipal
2013	Spain	CADAGUA S.A.	121,000	VALDELENTISCO RETROFIT	PX-Q300	Seawater RO	Municipal
2013	Ghana	BEPESA WATER (ABEIMA)	60,600	Nungua, Accra SWRO Plant Ghana	PX-300	Seawater RO	Municipal
2013	Chile	ACCOONA AGUA S.A.U.	17,480	CAP Phase II - Punta Totoralillo	PX-Q300	Seawater RO	Mining
2012	Israel	SADYT, S.A.	417,600	Achdod	PX-Q300	Seawater RO	Municipal
2012	Australia	SADYT, S.A.	165,600	Perth II - expansion	PX-260	Seawater RO	Municipal
2012	Israel	GES-GLOBAL ENVIRONMENTAL SOLUTIONS	142,518	Palmachim Expansion	PX-Q260	Seawater RO	Municipal
2012	Morocco	CADAGUA S.A.	96,684	Jorf Lasfar	PX-Q300	Seawater RO	Mining
2012	United Arab Emirates	Aquatech Systems (Asia) Pvt. Ltd	68,400	Ghailiah	PX-260	Seawater RO	Municipal
2012	Israel	GES-GLOBAL ENVIRONMENTAL SOLUTIONS	60,000	Palmachim Expansion	PX-Q260	Seawater RO	Municipal
2012	Oman	BEPESA WATER (ABEIMA)	50,000	Barka I	PX-300	Seawater RO	Municipal
2012	Chile	ACCOONA AGUA S.A.U.	17,280	CAP - Punta Totoralillo	PX-Q300	Seawater RO	Mining
2011	India	IDE TECHNOLOGIES LTD.	126,000	Nemmel	PX-220	Seawater RO	Municipal
2011	Cyprus	IDE TECHNOLOGIES LTD.	60,000	Vasilikos	PX-260	Seawater RO	Municipal
2011	Spain	UTE DESALADORA MARINA BAJA	50,000	Marina Baja	PX-260	Seawater RO	Municipal
2010	Australia	THIESSE DEGREMONT JOINT VENTURE	504,000	Victoria Desalination Plant - Melbourne	PX-260	Seawater RO	Municipal
2010	Algeria	HYDROCHEM (S) PTE LTD	500,000	Magtas	AT-7800	Seawater RO	Municipal
2010	Australia	ACCOONA AGUA S.A.U.	150,000	Adelaide Desalination Project	PX-260	Seawater RO	Municipal
2010	China	UTE DESALADORA QINGDAO (Befesa)	100,000	Qingdao	PX-260	Seawater RO	Municipal
2010	Spain	UTE IDAM MOINGOA (Inima)	60,000	IDAM Moncofa	PX-260	Seawater RO	Municipal
2010	Spain	UTE DESALADORA GROPEA (Technicas Reunidas)	50,000	IDAM Gropea del Mar	PX-300	Seawater RO	Municipal
2009	Algeria	BEPESA AGUA S.A.U.	200,000	Tenes	PX-260	Seawater RO	Municipal
2009	Algeria	HYFLUX - HYDROCHEM (S) PTE LTD	200,000	Tiemecen Souk Tieta	PX-220	Seawater RO	Municipal
2009	Algeria	UTE MOSTAGANEM (Inima/Aqualis)	200,000	IDAM MOSTAGANEM, Argelia	PX-220	Seawater RO	Municipal
2009	Australia	ACCOONA AGUA S.A.U.	150,000	Adelaide Desalination Project	PX-260	Seawater RO	Municipal
2009	Australia	Sothern Sewer Joint Venture (Valoniza /Sadyt)	137,000	Perth II	PX-260	Seawater RO	Municipal
2009	Algeria	Cap D'Jinet UTE (Inima/Aqualis)	90,000	Cap D'Jinet	PX-260	Seawater RO	Municipal
2009	Venezuela	ACCOONA AGUA S.A.U.	74,000	Desalinizadora CRP Paraguana, Venezuela	PX-260	Seawater RO	Oil and Gas
2009	Israel	IDE TECHNOLOGIES LTD.	40,000	Hadera Expansion I	PX-260	Seawater RO	Municipal
2008	Israel	IDE TECHNOLOGIES LTD.	388,368	Hadera	PX-220	Seawater RO	Municipal
2008	Algeria	UTE DESALADORA HONAINA	200,000	Honaine Desalination Plant	PX-220	Seawater RO	Municipal
2008	United Arab Emirates	AQUA ENGINEERING AUSTRIA GMBH	200,000	Hamriyah Power Station	PX-260	Seawater RO	Power Plant
2008	Spain	UTE DESALADORA BARCELONA (Degremont)	200,000	Desaladora Barcelona	PX-220	Seawater RO	Municipal
2008	Australia	IDE TECHNOLOGIES LTD.	140,004	Cape Preston	PX-220	Seawater RO	Mining
2008	Kuwait	ACCOONA AGUA S.A.	140,000	Shuwaikh	PX-220	Seawater RO	Municipal
2008	Algeria	FOUKA EPC UTE (Acciona)	121,248	Algeria Zeralda - Fouka	PX-220	Seawater RO	Municipal
2008	China	HYFLUX - HYDROCHEM (S) PTE LTD	100,000	Tianjin Dagang Desalination Plant	PX-220	Seawater RO	Industrial
2008	Spain	Bajo Almazora Desalination Plant U.T.E. (Befesa/Aqualis)	65,000	Bajo Almazora	PX-220	Seawater RO	Municipal
2008	Spain	AMPLIACIÓN I.T.A.M. TORDERA U.T.E. (Befesa/Aqualis)	64,000	Desaladora de La Tordera	PX-260	Seawater RO	Municipal
2008	Namibia	KEYPLAN (PTY) LTD	63,000	Uranmin -Zwiskopmund	PX-220	Seawater RO	Mining
2008	Cyprus	IDE TECHNOLOGIES LTD.	20,000	Larnaca	PX-260	Seawater RO	Municipal
2007	Spain	UTE IDAM TORREVIEJA (Acciona)	240,000	IDAM Torrevieja	PX-220	Seawater RO	Irrigation
2007	Algeria	GEIDA - UTE DESALADORA BENI SAF	200,000	Beni Saf Desalination Plant	PX-220	Seawater RO	Municipal
2007	Saudi Arabia	Doosan Heavy Industries & Construction CO. LTD.	150,000	Shoelobah III IWPP Expansion RO Plant	PX-220	Seawater RO	Municipal
2007	India	UTE DESALADORA CHENNAI (Befesa)	100,000	Chennai Minjur	PX-220	Seawater RO	Municipal
2007	Spain	UTE IDAM ALICANTE II (Inima)	66,500	Alicante II	PX-220	Seawater RO	Municipal
2006	Algeria	GEIDA - UTE DESALADORA SKIKDA CONSTRUCCION	100,000	Skikda Desalination Plant	PX-220	Seawater RO	Municipal
2006	Spain	TEDAQUA	50,050	IDAM Escombreras (Cartagena)	PX-220	Seawater RO	Industrial
2005	Algeria	GE WATER & PROCESS TECHNOLOGIES	200,000	Hamma Seawater Desalination Plant	PX-220	Seawater RO	Municipal
2005	Australia	MULTIPLEX DEGREMONT J.V.	140,000	Perth I - Seawater Desalination Plant	PX-220	Seawater RO	Municipal