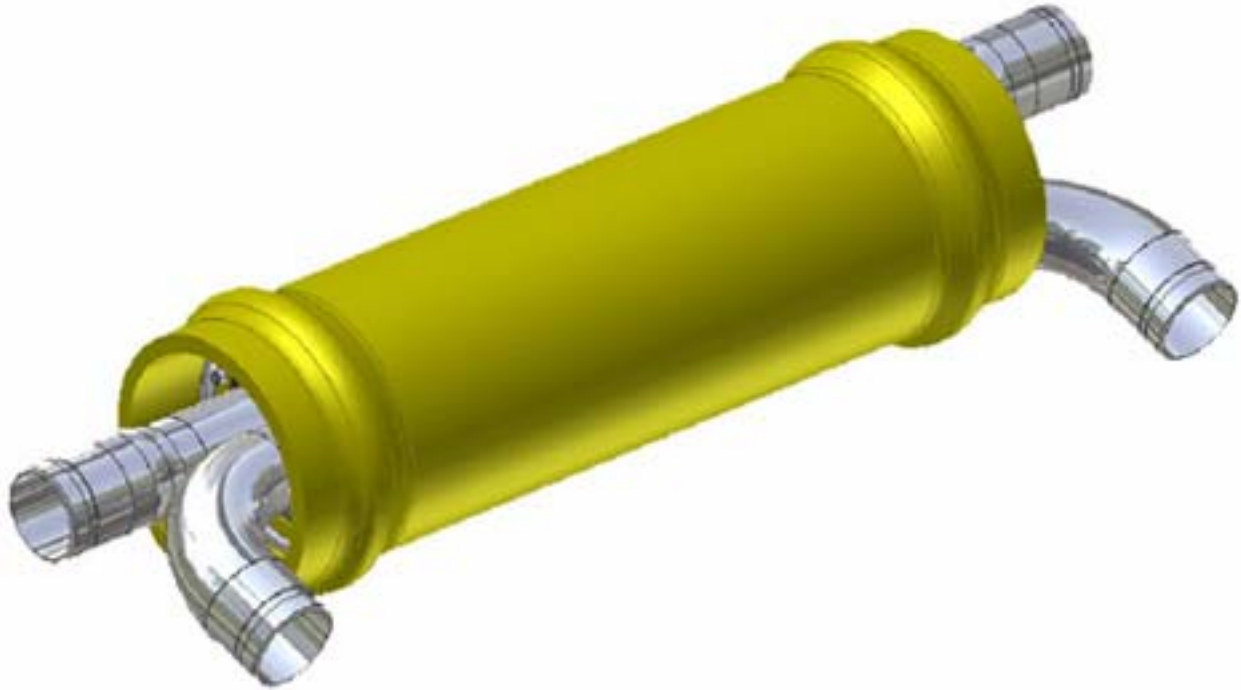




ENERGY RECOVERY, INC.



INSTALLATION AND STARTUP PROCEDURE

ERI DOCUMENT NUMBER 80058-01-0

**ERI™
65 Series Pressure Exchanger™
Energy Recovery Device**

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Introduction

This procedure contains instructions for the installation and commissioning of the Energy Recovery, Inc.[™] ERI[™] 65 Series PX Pressure Exchanger[™] energy recovery device in seawater reverse osmosis (SWRO) systems. Complete instructions on PX device installation, operation and maintenance are provided in the Installation, Operation, & Maintenance Manual - ERI document number 80019-01 available on ERI's website: www.energy-recovery.com.

PX Handling

Prior to installation, the PX device should be maintained at a storage temperature of between 33-113 °F or 1-45 °C. Prolonged exposure of PX unit crates to direct sunlight should be avoided.

Individual PX-180 and -220 units weigh 175 pounds or 78 kilograms. Therefore, an overhead crane should be used for hoisting PX units when possible. Smaller, portable cranes such as engine hoists can also be used. If a crane is not being used, at least two people are required to position the PX units on the support structure. Use heavy gloves to protect the hands from "pinch points" when lifting.

The external fittings on the PX energy recovery device are made with AL-6XN[®] or equivalent stainless steel. The vessel is made of glass-reinforced plastic. Proper piping, piping support, and vessel support must be employed to minimize external stresses on all PX pipe fittings. Avoid resting the PX on the ports. Support the PX only by the vessel. Bearing pads should be used to avoid abrasion of the vessel. ERI can supply a drawing of a stand designed to support the PX unit when it is being serviced upon request.

Keep a few PX shipping crates and packing material in "as new" condition to be used in the event that a unit must be returned to ERI.

Pre-Commissioning Activities

Prior to installation and initial start up, all piping associated with the PX energy recovery device should be thoroughly flushed to assure that no debris enters and/or damages the PX unit. Most problems associated with a PX installation result from inadequate pre-flushing. ERI recommends installation of strainers at both inlets to the PX device or PX device array. Strainers protect the PX unit(s) from damage caused by debris coming from upstream failures that sometimes occur as a result of corrosion, worn parts, or filter failures. As an alternative, ERI recommends installation of temporary startup strainers during startup and commissioning activities. ERI can provide a list of strainer vendors upon request.

Each PX unit should be flushed and the rotor turned prior to installation on the support structure. PX units should not be loaded onto the support structure until the membranes are being loaded into their pressure vessels to avoid any collateral damage.

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[®] AL-6XN is a trademark of Allegheny Ludlum Corp.

PX Unit Installation

The 65 Series Pressure Exchanger has four connections labeled HP IN, HP OUT, LP IN, and LP OUT.

- **HP IN** is the high-pressure reject/brine inlet.
- **HP OUT** is the high-pressure seawater outlet.
- **LP IN** is the low-pressure seawater inlet.
- **LP OUT** is the low-pressure reject/brine outlet.

Lift or place the PX unit on the support structure. It is good practice to use strips of rubber as shims between the PX vessel and the support structure to prevent unnecessary damage to the vessel.

Flexible couplings should be used for joining fittings and piping. The couplings should be of the "flexible style" (an example is a Victaulic Style 77 coupling). The coupling gaskets should be the "standard" or flush seal" variety. Use only water-soluble lubricants such as glycerin or soap on all O-rings and seals. Do not use grease.

ERI recommends loosely coupling the two LP ports (straight ports) first - then rotate the entire PX and swivel the two HP ports (elbow ports) as necessary to get the best fit-up to the piping. The port bearing plate assembly cannot be rotated within the PX unit vessel. Once all four connections are made loosely, tighten the four connections. Do all things possible to eliminate strain on the ports as this can cause the sealing o-ring to distort and cause leaks.

When loading multiple PX arrays, ERI recommends starting in the middle of the support structure, installing the middle PX units, and working out to the ends of the support structure. It maybe necessary to loosen the piping manifolds that the PX units will be connected to get the best fit-up. After connecting the PX units, the manifolds can be re-secured to the support structure.

Commissioning Activities

The entire SWRO system must be mechanically complete.

1. Fill the piping to and from the PX array and vent all air. This includes the pumps and the membrane array.
2. Circulate feedwater through the PX array and check for leaks. Repair any leaks found. Set the PX low-pressure flowrate to the design flowrate. NOTE: The maximum flowrate through each PX unit is limited. The table below provides a summary of system performance limits.
3. Verify that all instrumentation, valve and pumps are working properly. Valving should be checked for proper operation.
4. Verify that the PX high-pressure side piping is full and all air has been removed from the system or that a valve is open to allow air to vent.

65-SERIES PRESSURE EXCHANGER ENERGY RECOVERY DEVICES

5. Start the PX booster pump and establish circulation. Set the PX HP flowrate to the design flowrate.
6. Check for leaks. Repair any leaks found. Verify that all instrumentation, valves and pumps are working properly.
7. Verify all air has been vented from the SWRO system. Start the high pressure pump. The system pressure will slowly rise and permeate will be produced. Re-check the PX low pressure and high pressure flowrates. Vent any remaining air. Check for leaks. Repair any leaks found. The sound coming from the PX rotors will change – it will likely become deeper and louder. Extremely loud noise - over 95 dB would indicate high flows or air flowing through the PX.
8. Verify that all instrumentation, valves and pumps are working properly.
9. Complete an operating log (a sample log is attached) and transmit to ERI.

System Performance Limits

Parameter	Specification	
	English Units	SI Units
Maximum high pressure (HP IN or HP OUT)	1,200 psig	82.7 bar
Maximum seawater inlet pressure (LP IN)	150 psig	10.3 bar
Minimum seawater inlet pressure (LP IN)	20 psig	1.4 bar
Minimum brine discharge pressure (LP OUT) ⁽¹⁾	8 psig	0.6 bar
Minimum filtration requirement (nominal)	10 micron	
Seawater temperature range	33-113 °F	1-45 °C
pH range	1-12 (short term at limits)	
Allowable flow rates ⁽²⁾		
PX-180	140-180 gpm	32-41 m ³ /hr
PX-220	180-220 gpm	41-50 m ³ /hr

- (1) The low pressure discharge stream from the PX must be constricted to provide backpressure on the unit. Operation with insufficient backpressure will cause destructive cavitation.
- (2) Unlimited system capacities are achieved by using multiple units in parallel.

