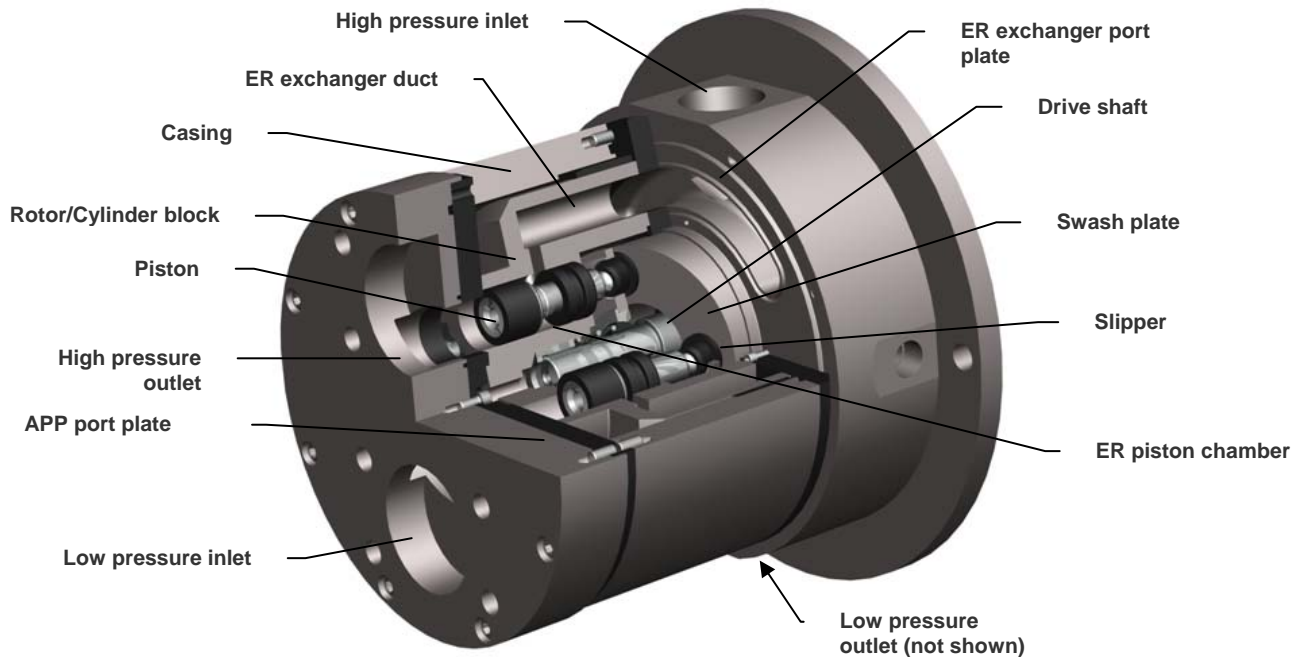


Ocean X-pumps™

Ocean Pacific Technologies (OPT™) is developing a unique line of axial piston pump and energy recovery (ER) products specifically designed for reverse osmosis applications.

“...one of the breakthrough technologies that the desal industry has been waiting for.”

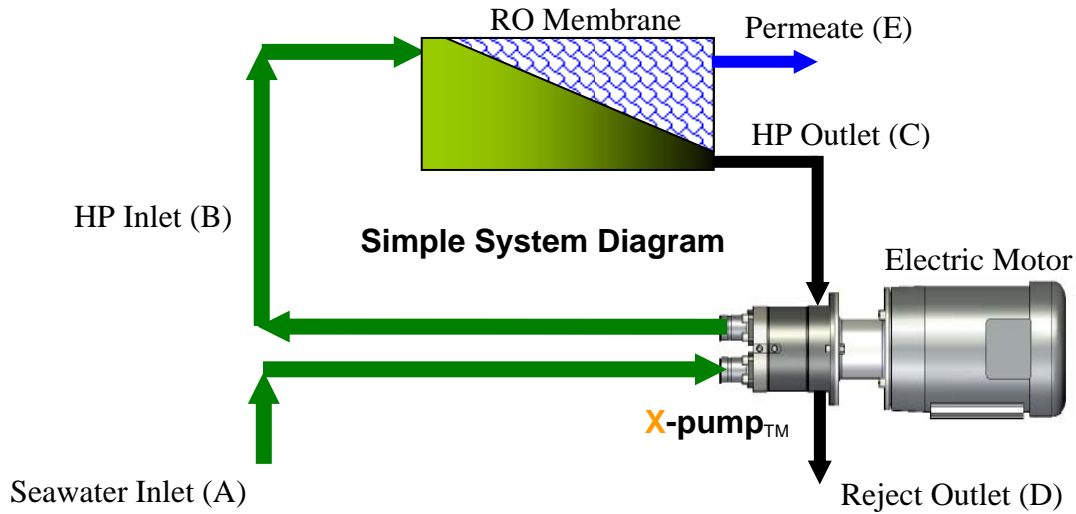
Ted Kuepper former director and founder of US Navy Seawater Desalination Test Facility



The axial piston pump (APP) design has been used in the oil hydraulics industry for over 70 years with tens of thousands of units operating in thousands of different applications. In the early 1980's through a public-private partnership with the British Government, a line of axial piston products that used **plain water as the hydraulic fluid instead of oil** was developed and water hydraulic axial piston pumps, motors and other products have been applied to various industries **since 1987**. The **Ocean Exchanger™ Pump (X-pump™)** combines the **proven principles** of water hydraulic axial piston pump and pressure exchanger energy recovery technology to produce a unique **axial piston pressure exchanger pump (patents pending)**. The **X-pump** combines the main high pressure pump and energy recovery pressure exchanger in a **single unit and does not require any additional pumps or controls**. In fact, the unit precisely regulates the product flow and RO recovery rate of the system and thereby **eliminates the need for many of the instruments and controls** typically required in reverse osmosis applications. The **X-pump** has been **specifically designed for reverse osmosis applications** and may be the **most efficient and simplest** pump and energy recovery solution that exists today.

Some features and benefits include:

- **Simplest application** – Only one **X-pump**, product flow meter and high pressure gauge are required
- **Lowest energy consumption** - Combined high efficiency positive displacement pump and pressure exchanger design
- **Ultra low maintenance water hydraulic design** - No oil or other lubricants to be changed or replaced and water lubricated hydrodynamic bearings provide long life
- **Smooth flow operation** - Axial piston rotary design requires no pulsation dampeners even at high flows
- **Corrosion resistant in seawater and brine environments** - Constructed from Duplex stainless steel and polymer materials
- **No mixing or overflush** – A physical barrier/piston seals the brine from the seawater
- **Compact design** - Requires approximately 50% less space and weight than other pump and ER solutions



Typical X-pump System Parameters

Stream →		A	B	C	D	E
X-pump Flows	gpm	26.6	26.6	18.1	18.1	8.50
	gpd	38,250	38,250	26,010	26,010	12,240
	m ³ /hr	6.04	6.04	4.11	4.11	1.93
	m ³ /day	145	145	99	99	46
X-pump Pressures	psi	20	850	835	5	5
	bar	1.4	58.6	57.6	0.3	0.3
RO Membrane Parameters						
Membrane differential	PSI	15				
Recovery	%	32%				
X-pump Parameters						
Exchanger efficiency	%	92%				
APP-HP pump efficiency	%	87%				
Electric Motor Information						
Electric motor efficiency	%	92%				
Electric motor power	kW	4.73				
X-pump Savings Calculations						
% Power savings						61%
Annual savings @ \$0.10/kWh						\$ 6,610
X-pump Total System Power Consumption						
Total RO process (kW)						4.73
kWh/1000 gal permeate						9.3
kWh/m ³ permeate						2.45

X-pump Performance Specifications

Model #	XP™-23	XP-27	XP-31	XP-35
Pump displacement (in ³ /rev)	1.56	1.82	2.1	2.3
RPM max	3500	3500	3500	3500
Min	1500	1500	1500	1500
Max inlet (A & B) flow (lpm/gpm)	89 / 23	102 / 27	118 / 31	133 / 35
Max product (E) flow (lpm/gpm)	27 / 7	31 / 8	36 / 10	40 / 11
RO recovery ratio %	33%	33%	33 %	33 %
Min inlet (A) press (bar/psi)	1 / 15	1 / 15	1 / 15	1 / 15
Max inlet (A) press (bar/psi)	7 / 100	7 / 100	7 / 100	7 / 100
kW @ max flow and 69 bar (1000 psi)	4.6	5.2	6.5	7.2
Weight (kg / lbs)	34 kg / 75 lbs			
Feed Inlet and outlet ports	1-1/2" Grooved			
Reject inlet and outlet ports	1" BSPP			

(PRELIMINARY)