



Hydra-Cell[®]

Seal-less Pump Technology

Reverse Osmosis,
Nano Filtration and Ultra Filtration

Simplicity - Reliability



Hydra-Cell® Reverse Osmosis Pumps

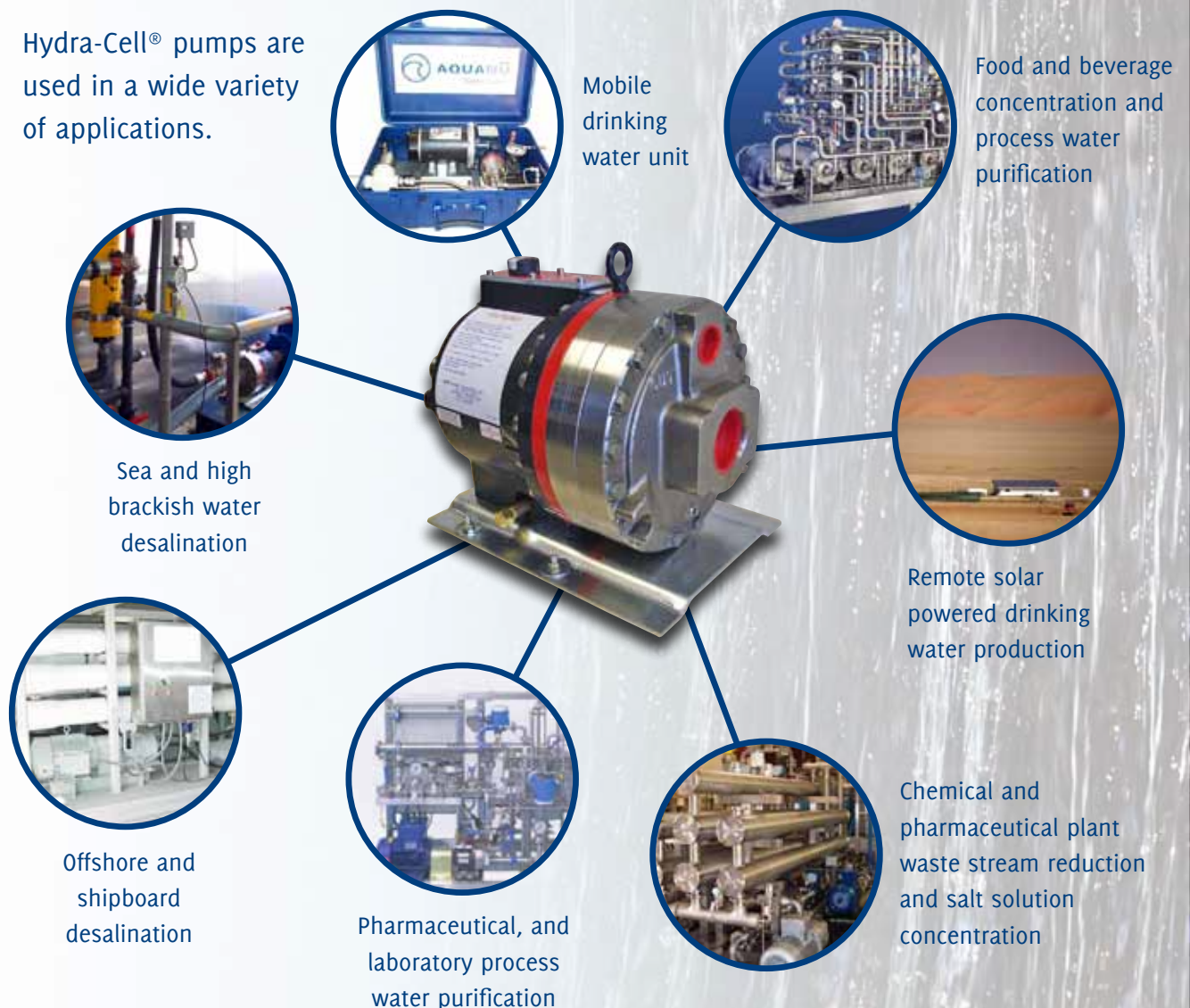
Seal-less pumps for long life, high reliability and low total life-cycle costs



High efficiency, high pressure pumps for seawater and high brackish water desalination, process water conditioning and purification, waste water reduction, solvent/acid recovery and solute concentration.

- Reverse Osmosis
- Nano Filtration
- Ultra Filtration

Hydra-Cell® pumps are used in a wide variety of applications.



Typical Liquids Pumped	Challenges in Pumping	The Hydra-Cell® Advantage
<p>Seawater... 30 – 65k TDS</p>	<ul style="list-style-type: none"> • Corrosive. Corrosion increases with increase in salt content • Salt crystallization can occur on internal surfaces when pump is not in operation. Crystallised solids can cause premature wear of dynamic seals or tight tolerances • Non-lubricating • Raw feed water contains solids which may get through pre-filtration, causing problems with pumps with dynamic seals and tight tolerances in the pumped liquid • Poorly maintained pre-filtration can cause high pressure pumps to run dry 	<ul style="list-style-type: none"> • Corrosion resistant liquid head materials available • No tight tolerances to be damaged by salt crystals • No dynamic seals to wear • No need for lubrication from pumped liquid
<p>Brackish Water... 18 – 25k TDS</p>	<ul style="list-style-type: none"> • Solid particles may be present from poorly attended pre-filtration • Remote units may run dry 	<ul style="list-style-type: none"> • Seal-less design can pump solids up to 500 µm dia. • Run-dry indefinitely
<p>Waste Solvent Streams... mixture of water and a range of solvents</p>	<ul style="list-style-type: none"> • May be corrosive and non-lubricating 	<ul style="list-style-type: none"> • Corrosion resistant liquid head materials available • No need for lubrication from pumped liquid
<p>Waste Water Streams... from food and beverage process</p>	<ul style="list-style-type: none"> • Undissolved solids can be abrasive / non-lubricating / aggressive 	<ul style="list-style-type: none"> • Seal-less design can pump solids up to 1.5mm dia.
<p>Chemicals... acids, salt solutions and proprietary chemicals</p>	<ul style="list-style-type: none"> • Potentially corrosive • Leaks can be harmful 	<ul style="list-style-type: none"> • Corrosion resistant liquid head materials available • 100% Sealed unit prevents leaks
<p>Beverages, Juices and Foodstuffs... for concentration</p>	<ul style="list-style-type: none"> • Solids may crystallise and cause wear • May contain difficult to pump solids that can be abrasive • Potentially corrosive 	<ul style="list-style-type: none"> • Seal-less design can pump solids up to 500 µm dia. • Seal-less pump chamber for high reliability

Hydra-Cell® advantages

Designed for 24/7 continuous use, Hydra-Cell® Seal-less Pumps are robust, reliable, efficient and highly tolerant of operator error.

These positive displacement pumps are used extensively in a wide variety of reverse osmosis applications where their high reliability, high efficiency and outstanding controllability are valued greatly.

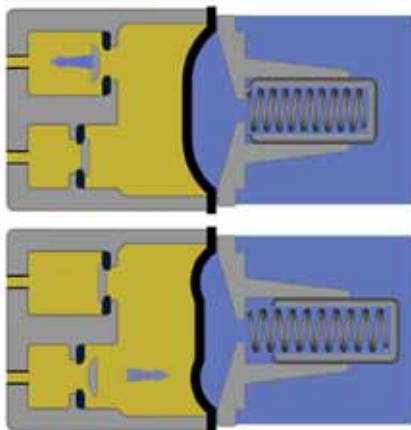


Pharmaceutical process plant – RO treatment of waste streams

High Reliability... low maintenance

Having **No Dynamic Seals** means high reliability.

- Runs dry indefinitely
- No seals to wear and leak
- No tight tolerances that could be susceptible to corrosion or damaged by particles
- Pumps liquids with viscosities from 0.01 to 6000 cSt
- Pumps liquids with up to 1.5mm dia. particulate matter
- No 'drop off' in performance due to seal wear



High efficiencies

- A true positive-displacement pump, Hydra-Cell® is one of the most efficient RO pumps available in the market

Reduced power usage and cost.

Pump Flow rate m ³ /hr	Discharge Pressure (bar)	Pump Power use (kW)
7.2	80	19.2
4	70	9.5
1.5	80	4.1
1.0	80	2.74

With ERI PX® Energy Recovery Device

	Pump Flow rate m ³ /hr	Discharge Pressure (bar)	Pump Power use (kW)
G25 + PX-30S*	10.4	70	11.8
G35 + PX-70S*	18.2	70	22.3

*PX Pressure Exchanger, PX and Pressure Exchanger are registered trademarks of Energy Recovery Inc.

Constant flow rate... independent of pressure

- An increase in salt concentration results in an increase in osmotic pressure. Hydra-Cell®'s controllable flow rate means that efficiencies and yields can be maintained if feed water TDS increases, especially important in bore hole applications

Wide range of operating pressures

Discharge Pressure Range		Inlet Pressure Range	
Minimum	Maximum	Minimum	Maximum
0 bar	70, 80 or 172 bar (Model dependent)	-0.3 bar	17 or 34 bar (Model dependent)

Ultimate controllability ►

- Hydra-Cell® Pumps exhibit a linear relationship between pump shaft speed and flow rate better than +/- 3%.
- The speed of the pump can be adjusted from 10 rpm to 1500 rpm (or 1000 rpm depending on model) for accurate flow control

Energy saving

- Very economical to run compared with centrifugal pumps
- Smaller, more compact motors required

Compared with multi-stage centrifugal pumping water at 20 bar:

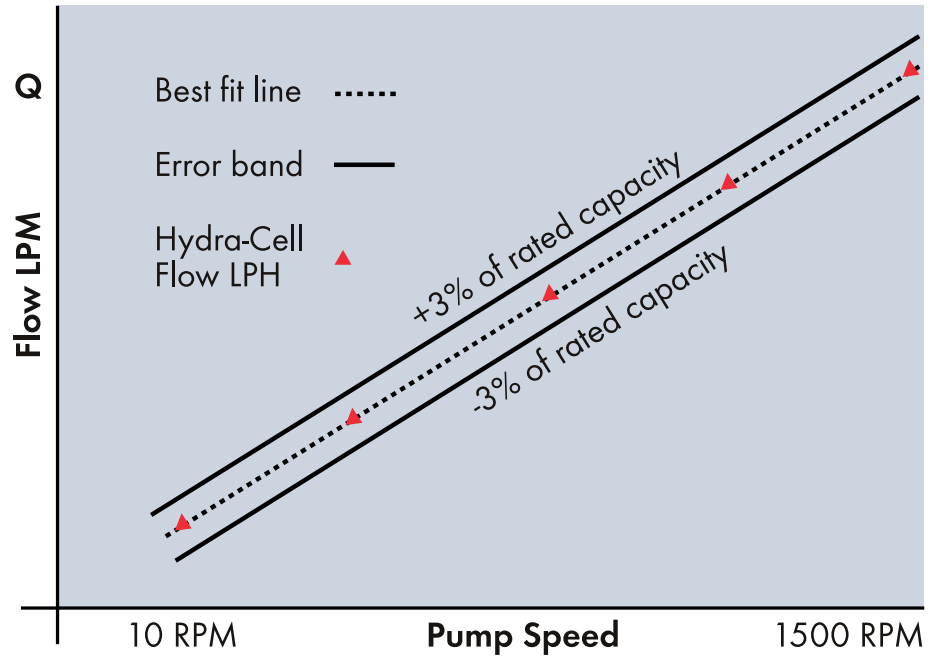
Flow (m³/hr)	Energy used (kw)		Energy saving	Potential annual euro saving
	Centrifugal	Hydra-Cell		
0.6	1.54	0.5	67%	€945
1.5	2.0	1.44	28%	€470

Compared with multi-stage centrifugal pumping water at 40 bar:

Flow (m³/hr)	Energy used (kw)		Energy saving	Potential annual euro saving
	Centrifugal	Hydra-Cell		
4.2	9.34	6.1	35%	€2,830
7.6	15.4	11.0	28%	€3,840

Minimal filtration to protect the pump

- No mechanical seals or tight tolerances that need protection by fine filtration. 300µm filtration is sufficient. (Some pumping technologies, such as axial piston pumps may need costly 5µm absolute filters for protection. These blind easily and may need replacing after 15 – 20 days use.)
- The level of filtration can be determined by what the membrane needs and not the needs of the high pressure pump, saving operating costs.



Simple robust design

- Designed and built for long service life
- Simple maintenance with no special tool requirements
- No critical tolerances to be aware of during maintenance
- In-situ repair possibilities... no costly removal and transportation to workshops or special clean environment

Membrane flushing

- Forward flushing and chemical treatment are made easier because the chemicals can readily pass through a Hydra-Cell® pump at a pressure of 2 bar, removing the need for extra pump bypass pipe work and control valves

Energy recovery compatible

- Suitable for use with PX® Pressure Exchanger® energy recovery technology. ▼



Pump selection



Food additive manufacture –
Ultra filtration of intermediary products.

Liquid Head Materials

For brackish or seawater applications the choice of liquid head material will depend on the level of dissolved solids (TDS).

TDS Level	Liquid End Material
<15,000 ppm	Brass
<25,000 ppm	316L Stainless Steel
>25,000 ppm	Duplex Alloy 2205

For RO systems that are used to treat chemical waste streams, a wide range of materials is available, including:

- Hastelloy® CW12MW
- Polypropylene
- Kynar®
- PVDF

Diaphragm Materials

A variety of materials is available to suit varying performance conditions, including:

- EPDM
- FKM
- PTFE
- Neoprene
- Buna
- Aflas

Treated Internal Surfaces

- Internal surfaces in contact with the liquid can be polished to the following specifications:
 - 0.8 Ra
 - 0.6 Ra
 - 0.4 Ra
- Stainless Steel internal surfaces in contact with the liquid can be supplied passivated.

Pipe Connections

Simple threaded connections.



Flanged connections.



Specialised flange connections e.g. Tri-Clamp® for pharmaceutical and food applications.



Hydra-Cell® Performance Advantages



Waste stream reduction with Energy Recovery Device

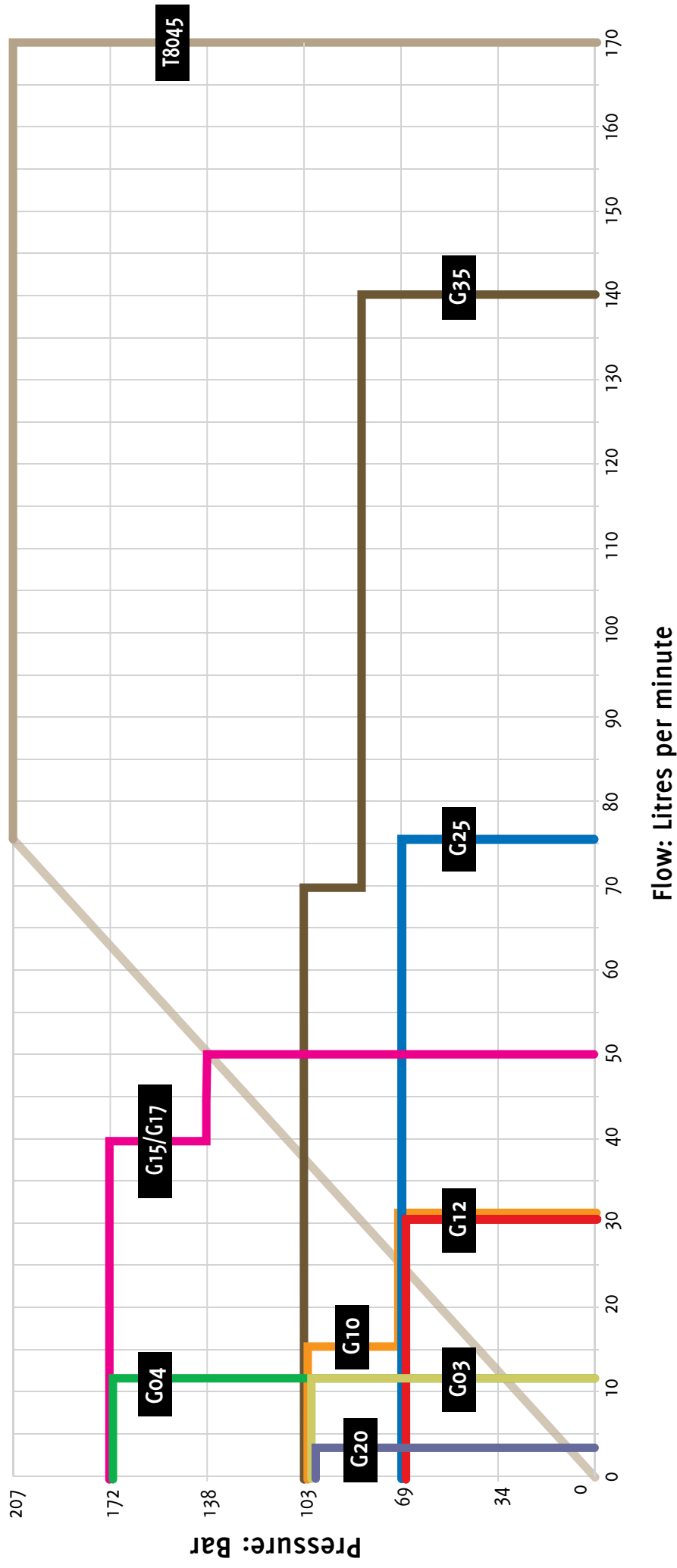
Axial Piston Plunger Pump	Hydra-Cell® Advantages
<ul style="list-style-type: none"> Requires a pressure feed to maintain the hydrodynamic film between the piston foot and swash plate 	<ul style="list-style-type: none"> The seal-less design of the Hydra-Cell® eliminates the requirement of pressure feed, saving costs
<ul style="list-style-type: none"> Requires careful operational monitoring so filters do not blind and cause damage 	<ul style="list-style-type: none"> 200 micron filtration is adequate to protect the pumps
<ul style="list-style-type: none"> Tight manufacturing tolerances can be degraded by the smallest of particles (5 micron absolute filters are often recommended (Cost \$500)) 	<ul style="list-style-type: none"> Hydra-Cell® can pump liquids with particles
<ul style="list-style-type: none"> Maintenance requires a clean environment to ensure the integrity of the tight tolerances 	<ul style="list-style-type: none"> Hydra-Cell® offer simple design and maintenance of the liquid end and can often be done in-situ

Multistage Centrifugal Pumps	Hydra-Cell® Advantages
<ul style="list-style-type: none"> Large footprint required to achieve high pressure 	<ul style="list-style-type: none"> Hydra-Cell® can meet these same flows and pressures with a much smaller footprint, saving space and costs
<ul style="list-style-type: none"> Mechanical seals and packing require adjustment, maintenance or replacement 	<ul style="list-style-type: none"> The seal-less design of Hydra-Cell® means that there are no seals or packing to maintain or replace
<ul style="list-style-type: none"> Requires carefully balancing to reduce levels of vibration, seal failure and premature wear 	<ul style="list-style-type: none"> Hydra-Cell® can be easily maintained in-situ
<ul style="list-style-type: none"> Efficiency quickly reduces when pump is operated away from its best efficiency point (Discharge pressure / fluctuations, Impellor or Seal wear) 	<ul style="list-style-type: none"> Highly efficiency give significant energy savings

Reciprocating Plunger Pumps	Hydra-Cell® Advantages
<ul style="list-style-type: none"> Have dynamic seals that are design to leak to lubricate the pistons and plungers 	<ul style="list-style-type: none"> The seal-less design of Hydra-Cell® mean that the pumped liquid and lubricating liquid are kept completely separate
<ul style="list-style-type: none"> Requires careful operational monitoring so filters do not blind and cause damage 	<ul style="list-style-type: none"> Hydra-Cell® pumps do not require filtration
<ul style="list-style-type: none"> Valve closure by operator leading to liquid starvation, will cause immediate damage to the pump 	<ul style="list-style-type: none"> Hydra-Cell®'s Kel-Cell technology protects the pump, allowing the operator to rectify the error without causing damage.

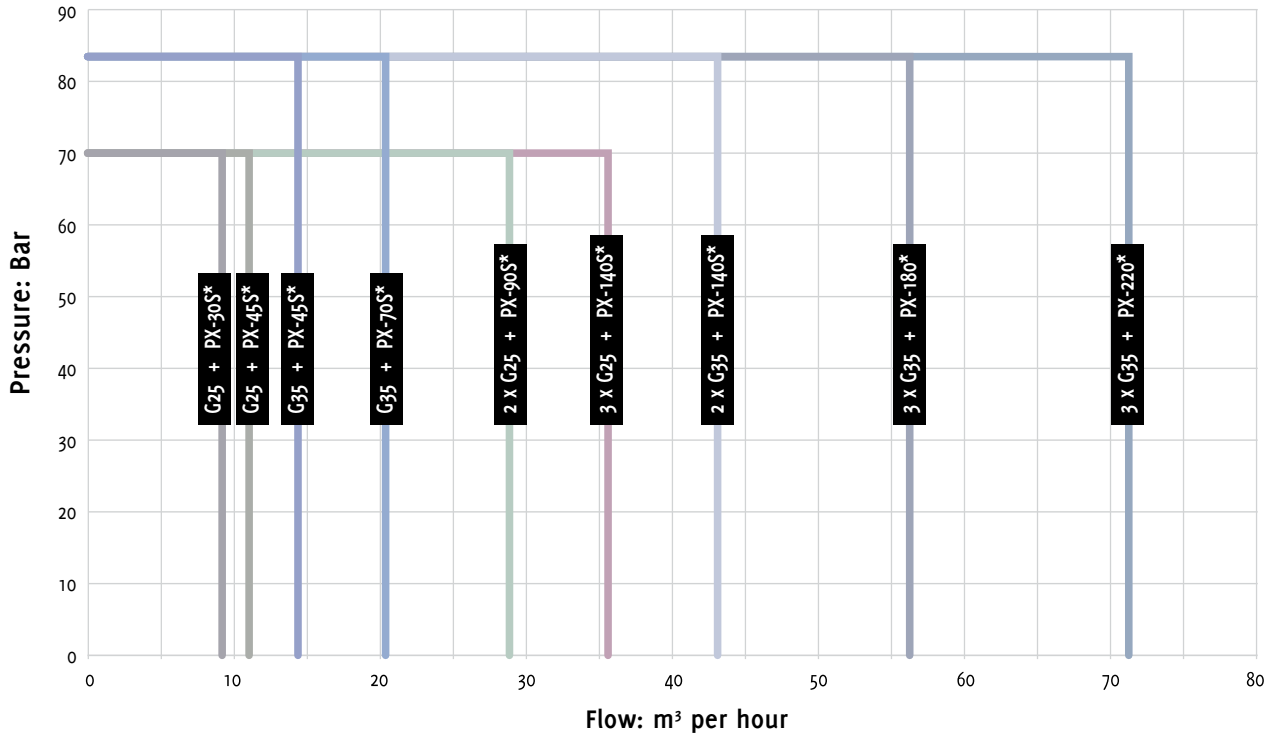
Pump flow and pressure rates

G Series and T80 Series Seal-less Pumps

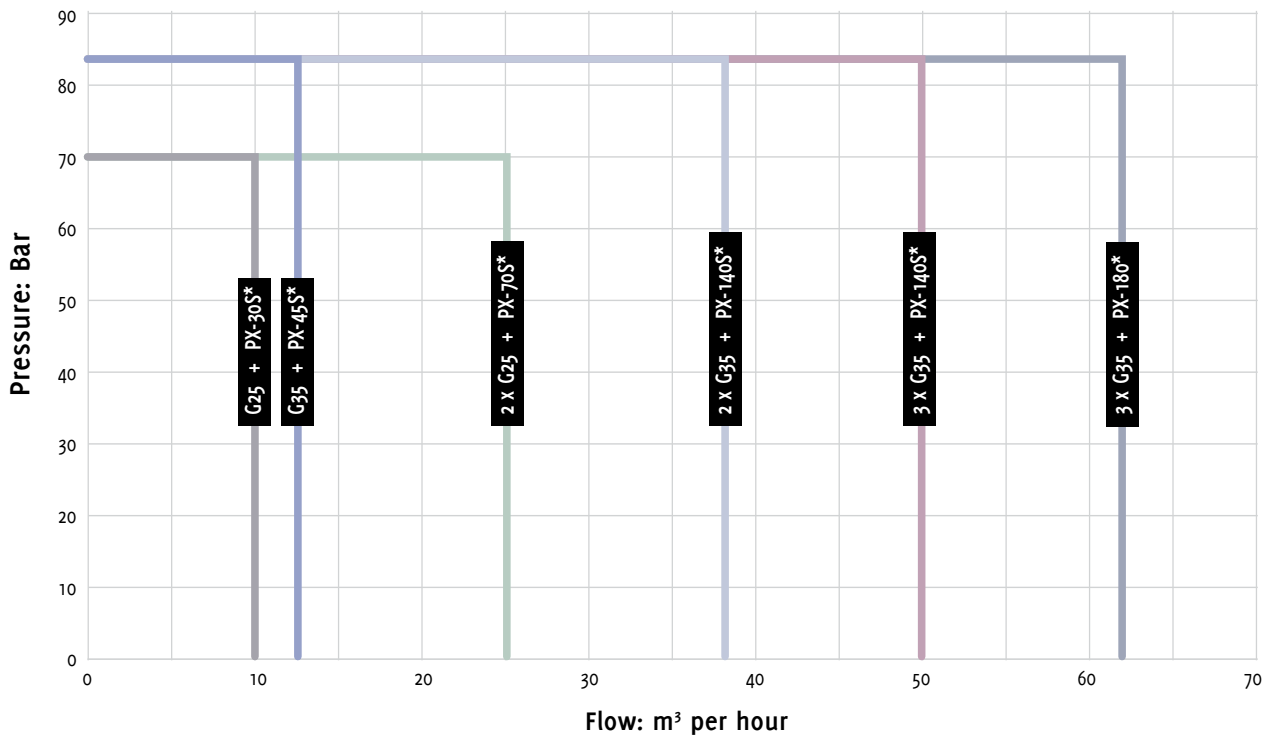


Hydra-Cell[®] + ERI PX[®] Energy Recovery Device

At 35% Recovery

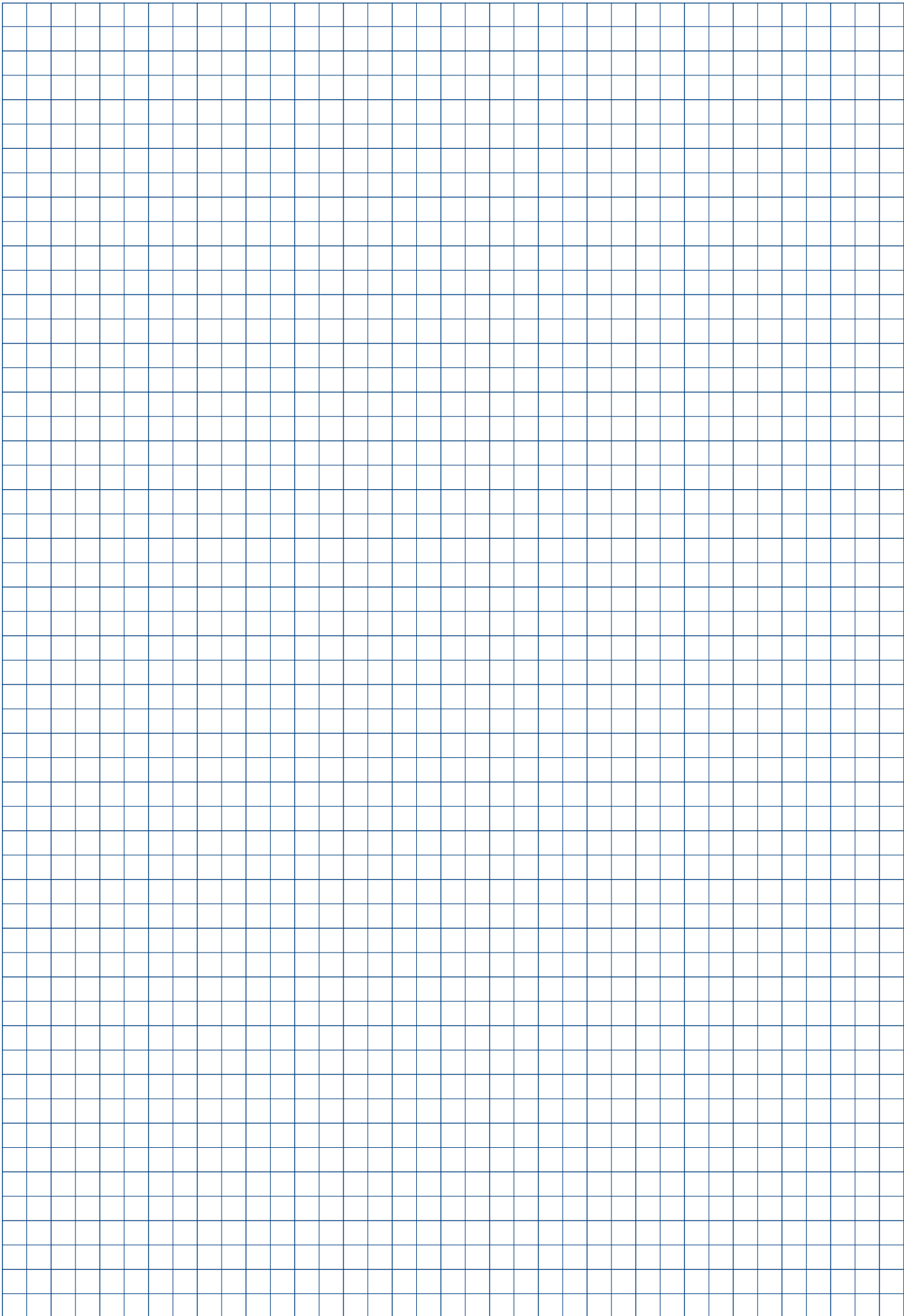


At 40% Recovery



*PX Pressure Exchanger, PX and Pressure Exchanger are registered trademarks of Energy Recovery Inc.

Notes





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