

AST'S DOUBLE-PASS SWRO DESALINATION SOLUTIONS MAKE A REAL DIFFERENCE

GLOBAL PRESSING WATER CHALLENGES

With the advancement of seawater desalination technologies, this water source has become both affordable and viable and can potentially solve all water problems humanity faces.

Worldwide reuse programs dictate higher quality of the desalinated water for agriculture use and desalination of seawater by reverse osmosis (RO) is the leading technology today.

In seawater reverse osmosis (SWRO) process, saline water is forced through semi-permeable membranes. The membranes work like filters: They allow the smaller water molecules to pass through, but block the bigger salt molecules and other impurities that are later discharged.

The SWRO - reverse osmosis process is usually a single pass process. Large scale SWRO projects are usually designed as double (or second) pass. In the first pass, seawater is desalinated by RO, in the second pass—the product quality of the first pass is usually refined in order to reduce treated Boron level or water hardening. The Boron removal importance is growing as the desalinated water ends in the water cycle as wastewater reuse. The need to control the Boron has to be at the desalination plant which is the first step. Several SWRO membrane suppliers like LG can deliver as low as 0.8 ppm in the permeate.

In most cases, one pass is enough to meet the EU drinking water requirements, which set the boron content at 1 mg/L. But to meet **the WHO boron requirement of 0.5mg/L, a second pass is often necessary**

Double-pass SWRO desalination is more expensive for the majority of desalination water systems and facilities — but the growing demand for reuse is pushing the limits and more and more regulators are looking to reduce the Boron levels according to WHO standards.

AST, a business unit of the WFI Group took up the challenge to transform the latest water regulations into opportunities for growth and provide clean drinking water to those who were denied it until now.

ROTEC FLOW REVERSAL - THE GOLD STANDARD IN DESALINATION

ROTEC, another business unit of the WFI Group, has an in-house R&D team with decade-long expertise. In accordance with the WFI vision, ROTEC focuses on finding and delivering game-changing water treatment solutions to enhance public health and sustainability, making a real difference.

ROTEC's industry-leading proprietary Flow Reversal (FR) RO desalination technology delivers unmatched desalinated water recovery rate and thus offers significant cost savings.

While typical SWRO recovery rate is 40%-50% for the first pass and the standard goal of recovery rate is ~ 90% for the second pass, ROTEC's FR technology achieves a recovery rate of up to 98% while increasing permeate production by 15-20% and reducing brine by 50-70% . This enable AST to lower the water cost for customers.

In the proprietary double-pass SWRO method, the flow direction of the saline stream in RO pressure

vessel arrays is periodically switched thus preventing scales from forming on membranes. Additionally, the company developed a patented approach in which individual blocks of pressure vessels can be repositioned between the stages, so that the blocks can be switched.

WATER, COST, AND ECO SAVINGS

Besides increasing second pass recovery rate up to 98%, the use of AST SWRO complete plant designed with the **ROTEC double-pass technology** allows the total recovery rate to reach 5% in long term operation like BOT or BOO long-term project life cycle. This advancement is extremely cost-effective.

By pushing the boundaries of recovery, this game-changing technology enables huge water and cost savings while decreasing environmental footprint. The company's solutions demonstrate a 20% increase in water recovery, setting the golden industry standard of boosting water recovery.

ROTEC Flow Reversal technology can also be retrofitted into the facility's existing SWRO systems resulting in little downtime during the upgrade, as successfully implemented by Mekorot, the Israeli National Water Company, as well as a variety of international companies.



AST'S HOLISTIC APPROACH

AST's experienced and dedicated team of water specialists provides SWRO plants with optimal double-pass seawater treatment solutions. Combining its proven abilities and expertise gained from many successfully completed projects, AST delivers holistic integrated water solutions that push the boundaries of water treatment including desalination, while saving water, time, and cost.

The use of ROTEC's technology with AST's knowledge coupled for SWRO projects allows maximum production along with cost saving and environmental benefits. The integrated design saves CAPEX and OPEX in SWRO desalination in comparison with other second pass desalination engineering solutions either by producing more permeate related to the high recovery rate, or by reducing the amount of feed water in the first pass. And less feed water means less footprint, less energy and less anti-scalant used in the process.

AST with ROTEC's Flow Reversal technology offers the most optimal solutions to treat all types of water including seawater packaged plants, integrating the best available technology (BAT). Besides concept and deployment, AST team handles project management and constructs a compact SWRO plant of up to 15,000 m³/day.

Spanning a decade, our track record includes successful projects with strategic partners in the US, South Africa and China, as well as a global customer base.

AST's global customers benefit from reduced OPEX, lower energy and water consumption, as well as the highest levels of quality and service.

SWRO 2ND PASS CASE STUDY RESULTS

Parameter	Description	Units	Typical Double Pass SWRO	Double Pass SWRO with Flow Reversal Technology
Recovery rate	Pass 1	[%]	42%	42%
	Pass 2	[%]	78-88%	95-98%
	Total	[%]	36%	41%
Intake	Flow rate	[m ³ /hr]	100	100
RO Pass 1	Feed	[m ³ /hr]	110	102
	Brine	[m ³ /hr]	64	59
	Permeate	[m ³ /hr]	46	43
RO Pass 2	Feed	[m ³ /hr]	46	43
	Brine	[m ³ /hr]	10	2
	Permeate	[m ³ /hr]	36	41
Chemical Usage			Significant reduction in the process of the double pass phase (AS, Alkaline dosage)	

Utilizing the Flow Reversal technology in a double pass SWRO project decreased CAPEX for the first pass (SWRO) and increased total production capacity