AdEdge water technologies

ROTEC by WFI Group

ULTRA-HIGH RECOVERY FLOW REVERSAL REVERSE OSMOSIS

MORE WATER.
SIMPLIFIED CONCENTRATE MANAGEMENT.
SAVINGS.

CHALLENGE THE FLOW.

A REVERSE OSMOSIS PROCESS THAT MAKES SENSE.

A 550 gallons per minute (feed) Flow Reversal RO system for removal of nitrate and TDS from groundwater located in Arizona, United States. The plant also includes pretreatment for removal of iron and manganese.

AdEdge Water Technologies, in collaboration with ROTEC LTD, offers ultra-high recovery desalination via its patented Flow Reversal Reverse Osmosis (FR-RO) optimization process challenging the status quo of conventional Nanofiltration (NF) and Reverse Osmosis (RO) desalination.

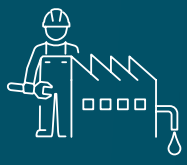
FR-RO is engineered to optimize desalination performance by maximizing recovery while minimizing concentrate volume, resulting in simplified concentrate management. Flow Reversal enables the use of conventional RO equipment to better handle high concentrations of sparingly soluble ions and operate successfully at supersaturated concentrate conditions.

In combination with other low-waste pre-treatment solutions, ultra-high recovery desalination empowers municipal and industrial consumers to cope with the growing challenges of limited access to an adequate supply of safe drinking water and/or the need to commission alternative water sources that were previously abandoned, such as multiple-contaminant or brackish water sources.

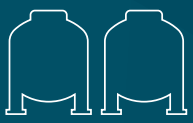
90% - 98%	20% - 38%	50% - 79%	100%
RECOVERY RATE	INCREASED PERMEATE	DECREASED CONCENTRATE	PROVEN TECHNOLOGY

END-TO-END SOLUTIONS:
DESIGN, MANUFACTURING, START-UP, & SERVICE

HIGH RECOVERY DESALINATION PLANTS



HIGH RECOVERY RETROFIT PACKAGES



PRE-TREATMENT SOLUTIONS

RECOVERY RO SYSTEMS (CONCENTRATOR)

WHAT APPLICATIONS ARE A GOOD FIT FOR FLOW REVERSAL RO?

The Flow Reversal technology is designed to be implemented in new and existing reverse osmosis plants for a variety of municipal and industrial applications, including:

- Contaminated Groundwater
- Brackish Water
- Surface Water
- Water Reuse
- Ultra-Pure Water (UPW)
- Industrial Process Water
- Seawater Desalination (SWRO) to improve the recovery rate of the 2nd pass

Application	Recommended Capacity	Details
New RO Plants	> 50 gpm	New high recovery FR-RO systems.
Existing RO Plants	> 250 gpm	Retrofitting an existing conventional RO system with with FR-RO technology.
Recovery RO Systems (Concentrators)	> 30 gpm	Feed water is primary RO concentrate

KEY MARKETS

MUNICIPALITIES

HEAVY & LIGHT INDUSTRY

AGRICULTURE

FOOD & BEVERAGE

OIL & GAS

PHARMACEUTICAL

SIMPLICITY MATTERS

Flow Reversal RO employs conventional, non-proprietary RO equipment that simplifies installation, training, operation, and maintenance. All FR-RO systems are fully automated and include remote controlled and monitoring software, ensuring optimal performance and constant communication channels with the plant operators. What makes Flow Reversal an intriguing alternative to conventional RO, is the fact that the innovation is based on an optimization of the well-established conventional RO process. The Flow Reversal technology does not require any special training and it is considered low-risk because FR-RO systems can operate as a conventional RO at any point in time, if needed.

HOW IT WORKS

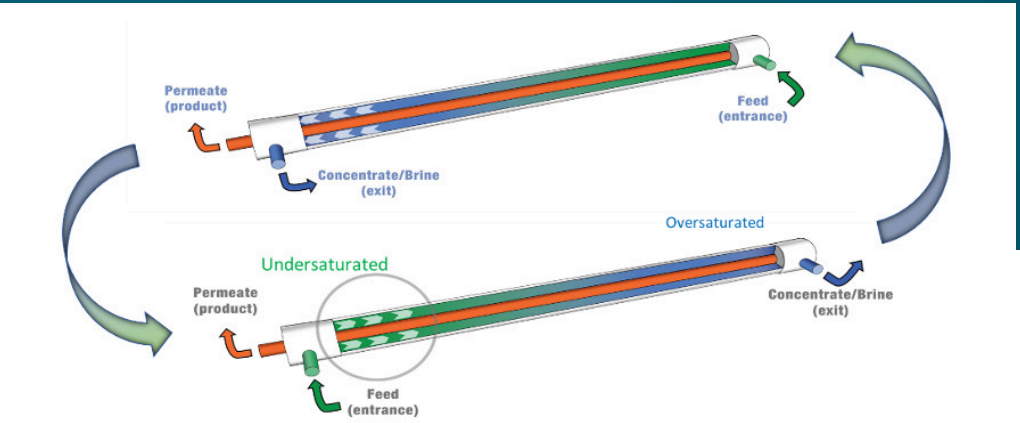
It's all about optimization. Flow Reversal is a **continuous** process designed to inhibit mineral scaling and biofouling, two of the limiting factors for high-recovery using two unique functions:

- **Flow Reversal** - periodically reversing the direction of the feed stream through each one of the pressure vessels (PVs), which functions as a built-in flushing feature that reduces the adverse effects of scaling.
- **Block Rotation** - allowing each array of RO vessels ("block") to periodically function as the last stage in the process. Individual blocks are repositioned between each stage to help prevent fouling of colloids, biomaterials, and organics, while also helping to lower the intensity of salts on the membrane surface.

The Flow Reversal solution was adjusted to meet modern desalination settings. These are ruled by multi-stage RO frameworks that use a tapered flow arrangement of the PVs to maintain correct hydraulic flows in the sequential stages. In addition to an increased recovery rate, the fluctuations in water chemistry, osmotic pressure, and hydraulic conditions between the front and tail elements results in reduced biofouling.

Not only does the FR technology outperform conventional RO by continuously producing more high quality and stable permeate while reducing concentrate volume, chemical consumption, CIP frequency, and membrane replacement.

FLOW REVERSAL



An illustration of the continuous Flow Reversal process in a single pressure vessel. The circled area marks a part of the membrane that, thanks to Flow Reversal, is being continuously flushed by undersaturated water.

A TURNKEY APPROACH

Just like conventional RO technology, the Flow Reversal RO system requires pre-treatment and/or post-treatment stages. AdEdge Water Technologies is a water treatment solution provider with an impressive resume of more than 900 treatment systems installed worldwide, treating more than 20 different contaminants with more than 20 different treatment approaches. This experience translates into AdEdge's unique ability to craft cost-effective pre-treatment solutions and address specific design requirements. AdEdge, in collaboration with ROTEC, designs, fabricates, commissions, and provides training, remote and onsite support, and service to our customers.

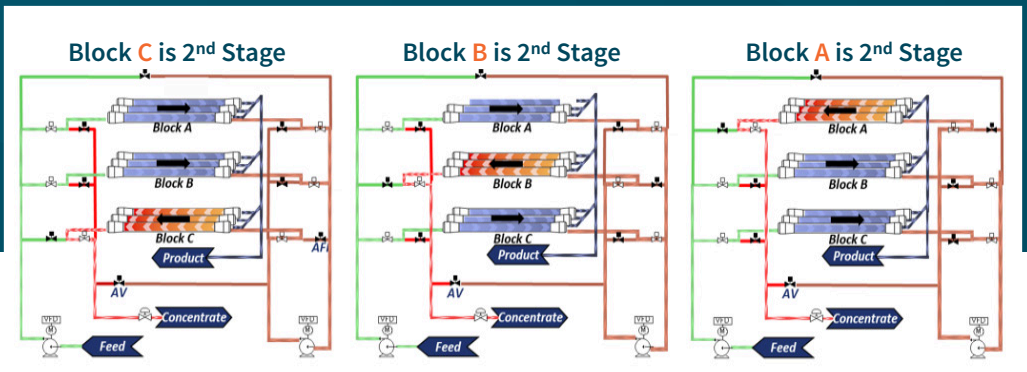
PILOTING PROGRAM

AdEdge has been offering an extensive piloting program lead by a team of dedicated engineers. This program includes piloting opportunities for the Flow Reversal technology. We offer, on a first-come-first serve basis, a sophisticated Flow Reversal pilot system to demonstrate water treatment performance at conventional RO mode of work, Flow Reversal mode, and a Flow Reversal recovery RO mode (treating concentrate from a primary RO). We work closely with our customers on the development of a customized pilot plan and treatment goals. The typical pilot duration is between three and four months.

RETROFITTING AN EXISTING SYSTEM

The retrofit solution works with existing RO desalination systems to help improve the recovery rate of medium and large operational facilities. This solution transforms an underperforming asset to one that delivers one of the highest performing metrics in the industry. For larger plants, the cost of performing a retrofit is significantly lower than replacing an existing system, and the cost of the project can be recouped from the savings generated by the FR retrofit with an anticipated breakeven period of 18 - 48 months, depending on the specific project.

BLOCK ROTATION



An illustration of the block rotation. In FR-RO, whether it is a 2-stage, or 3-stage system, the pressure vessels are divided into functional rotating blocks. Shown here is a FR-RO adaptation to tapered flow array in a two-stage RO System. The blue pressure vessels are stage one, and the red pressurve vessels are stage two.

A PROVEN WATER TREATMENT INNOVATION

Flow Reversal has been successfully implemented in more than forty RO plants worldwide treating a variety of feed water qualities. A few examples are described below.

RECOMMISSIONING AN ALTERNATIVE GROUNDWATER SOURCE WITH MULTIPLE CONTAMINANTS

Customer
Arizona, United States

Application

Brackish Water Desalination Plant

Flow Rate

800 gallons per minute

A tribal community faced a tough challenge to identify an alternative water source in a very short period and provide potable water for the community during the temporary shutdown of the existing surface water treatment plant. They decided to recommission an idle well that was contaminated with iron, nitrate, and TDS. The new treatment plant included a pre-treatment stage for removal of iron followed by a 550 gpm Flow Reversal RO system (250 gpm bypass). Compared to conventional RO with 75% recovery, the Flow Reversal RO operates at 88% recovery rate and facilitates concentrate management due to the reduction in the concentrate volume.

ACHIEVING A HIGH RECOVERY RATE WITH SUPERSATURATED CONCENTRATE

Customer

Bottling Company
United States

Application

Retrofitted High-Recovery RO

Flow Rate

150 gallons per minute

A U.S. bottling company was seeking the highest recovery for their water plant despite extremely high silica concentrations in the source water. An existing conventional recovery RO system that was supposed to treat the concentrate from the primary RO systems was decommissioned due to severe scaling and the need to conduct frequent flush cycles. It was decided to retrofit the RO system with the Flow Reversal technology which resulted in a 55% recovery rate. The overall plant recovery rate increased from 71% to 86%.

CASE STUDIES

INCREASED REVENUE AND WATER PRODUCTION

Customer

Public Utility Board (PUB), Singapore National Water Agency, Kranji, Singapore

Application

Retrofit of Existing RO Desalination Facility

Flow Rate

1955 gallons per minute

PUB, a world leader in the water desalination field, and innovation hub, needed to increase the water production from their NEWater wastewater treatment desalination plants. The Flow Reversal technology was used to retrofit the 3 RO trains in the existing RO plant. The retrofit resulted in increasing the recovery from 75% to 90%, and 60% reduction in the concentrate volume. The retrofit project was design to minimize interruption in the plant operation and downtime during the installation phase.

HIGHEST RECOVERY & HIGHEST PERMEATE QUALITY

Customer

Fujian Yanjing Huiquan Brewery
Fujan Province, China

Application

Brackish Water Desalination Plant

Flow Rate

245 gallons per minute

A brewery built a new high recovery water treatment plant using industrial brackish water as feed water to achieve the highest permeate quality that is required for the production process. The Flow Reversal RO facility has been operating successfully since 2016. Compared to the 75% recovery rate of the conventional RO, Flow Reversal RO operated at 90% recovery, and demonstrated lower CIP frequency and reduced energy consumption due to low feed pressure operation (145 psi).

A complete project reference list is available. Please contact us at sales@adedgetechnologies.com for more information.