SelectNF

Selective Nanofiltration

- Nanofiltration (NF) membranes permeate water and monovalent ions (Na^+, Li^+, H^+) while rejecting multivalent ions (Ca^{2+}, Mg^{2+}, SO_4^{2-}) and large organics
- SelectNF enables targeted monovalent separations, effectiveness varies based on membrane type and operating conditions
- Performance is influenced by pH, pressure, and recovery—requiring expert system design and membrane selection
- Saltworks' SelectNF systems are modular, factory-built, and integrated with our Uni-RO architecture, enabling rapid deployment and scalable infrastructure

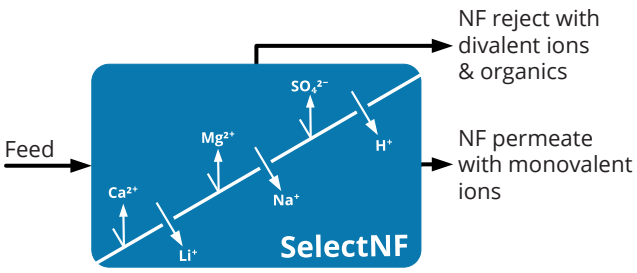
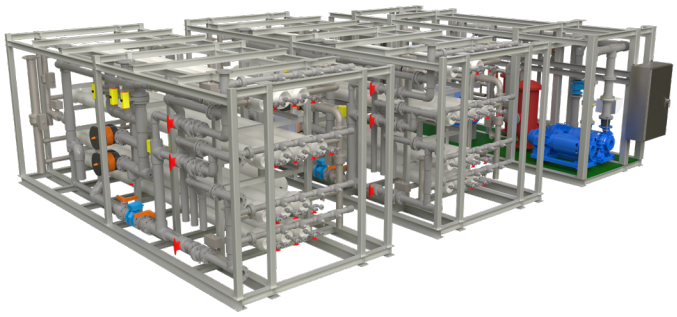


Diagram showcasing multivalent ion rejection



3D render showing SelectNF with UniRO structure

Uni-RO: Standardized, Repeatable Systems

SelectNF is built with Saltworks' Uni-RO expandable modular structure.

Uni-RO is a modular, factory-built and tested architecture shared with XtremeRO and FusionRO.

All systems share the same core skid, frame, and components—only pressure ratings and membrane types differ.

This design enables rapid deployment, simplified scalability, and lower installation costs while delivering economies of reliability, operation, and maintenance.

Organics Water Treatment

Extract color and high molecular weight organics to improve water quality and meet treatment goals.

Lithium Refining & Recovery

Produces a permeate rich in lithium chloride (LiCl), and reject multivalent ions - sulfate, calcium, & silica.

Sulfate Rejection

Targeted removal of sulfates from oil & gas injection water or mine discharge to meet discharge limits and protect downstream assets.

Hardness Injection & Softening

Adjusts brine hardness or softens water via membrane pretreatment for reuse across industrial applications.

Monovalent Salt Recovery

Recover monovalent salts (Na^+, Li^+) and water from complex brines for reuse in manufacturing processes.

Membrane Concentration Options

Supports ultra-high brine concentration when hybridized with ultra-high-pressure reverse osmosis in systems such as FusionRO.

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Advantages of Nanofiltration

- Enables higher water recovery when permeate can accept monovalent salts
- Rapid development of new NF membranes is expanding separation capabilities
- Operates at lower pressures than RO for similar brine concentrations
- Diverts significant ion mass away from a brine discharge in ZLD and recycle applications, provided permeate tolerates monovalent salts

XtremeRO pipework on full-scale plant

NF is a Unique Tool Requiring Specialized Expertise

Nanofiltration (NF) systems offer powerful separation capabilities but require expert design to perform effectively. The following notes outline key considerations—from membrane selection and brine management to automation and testing—that support high-performance NF applications.

Membrane Selection	• Expert membrane selection and operational conditions are critical to system performance
Membrane Health Considerations	• NF membranes are susceptible to scaling & fouling, including in the permeate channel • Membrane health must be actively preserved through pretreatment and operational controls
Optimized Operation	• Operating conditions (pH, pressure, & recovery) strongly influence separation effectiveness
Ion Rejection Characteristics	• Most NF membranes are positively charged, enhancing rejection of multivalent anions • Multivalent cation rejection (Ca^{2+}, Mg^{2+}) can be improved by adjusting pH and operating conditions
Performance	• NF can achieve higher brine concentrations than RO at equivalent pressures due to saline permeate
Brine Management	• NF produces brine reject and management must be considered • Novel configurations can minimize brine volumes compared to conventional RO systems
Flow Sheet Optimization	• Custom flow sheets can unlock selective separations and manage NF brine in a cost-effective and beneficial manner
Automation	• Automated self-cleaning, start, stop, and capacity control maximize uptime • Programmed to remove scale before it becomes irreversible • High-quality instrumentation and sensors package • User-friendly graphical interface offering remote login, data logging, and trend analysis
Testing	• NF membrane process can be modeled, but pilot-testing may be prudent due to varying separation effectiveness based on membrane type and operations

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