Membrane Technologies for Industrial Applications
Membrane Technologies

Membrane equipment – technologies that are widely used for the removal of various impurities and contaminants from the feed water to steam-generating boilers or other process equipment. Typical impurities are suspended solids, dissolved solids, and organics, which can cause fouling, scaling, and oxidation damage.

Purpose
- To remove suspended solids, TSS, turbidity, SDI, dirt, sand, and sediment
- Suspended solids are abrasive and can easily damage plumbing, valves, and downstream equipment
- Suspended solids will plug filters and foul RO membranes
- Suspended solids are harmful to boilers and can cause fouling and thermal efficiency loss

Microfiltration/Ultrafiltration

Construction
- Frame: Painted carbon steel or stainless steel
- Membranes: Hollow fiber, tubular, and flat sheet
- Controls: Customized for the end user
- Piping: PVC, 304 SS or 316 SS
- Instrumentation: Customized for the end user
- Cleaning System: Integral to the skid or stand alone
- Controls: Customized PLC controls

Advantages
- Provides effective suspended solids filtration to 0.01 microns
- Very consistent permeate quality
- Can accommodate a wide range of feed water qualities
- Recoveries up to 98%
- Automatic cleaning cycles
- Permeate flow rate controlled by VFD
- Small footprint
- Modular – can have several units together to account for variations in flow rates
- Skid mounted for easy installation
- Automatic Control – minimizes operator labor

Principle of Operation
Feed water is pumped or drawn via vacuum into the membrane skid. The water moves through the hollow fiber membranes. The suspended solids are retained by the membrane as the water passes through the membrane. The suspended solids build up on the surface of the membrane and need to be periodically cleaned from the surface of the membrane.

The removal of the residual suspended solids is accomplished by brief back pulsing, brief chemical cleanings, and thorough chemical cleanings depending on the increase in the transmembrane pressure. These cleanings are automatic and are initiated in the control panel of the water treatment system. Permeate is sent to a storage tank when it exits the membrane skid.
Reverse Osmosis

Construction
Frame: Painted carbon steel or stainless steel
Membranes: Thin film composite
Membrane Housings: FRP or stainless steel
Controls: Customized for the end user
Piping: PVC, 304 SS, 316 SS, Duplex SS or Superduplex SS
Instrumentation: Customized for the end user
Cleaning System: Integral to the skid or stand alone
Controls: Customized PLC controls

Advantages
• Provides effective, continuous dissolved solids removal
• Very consistent permeate quality
• Can accommodate a wide range of feed water qualities
• Recoveries up to 80%+
• Permeate flow rate controlled by VFD
• Small footprint
• Modular – can have several units together to account for variations in flow rates
• Skid mounted for easy installation
• Automatic Control – minimizes operator labor

Purpose
• Remove dissolved solids
• Dissolved solids increase boiler blow down
• Dissolved solids can cause scaling
• Dissolved solids can contaminate processes

Principle of Operation
Feed water is pumped into the membrane skid. The filtered and pressurized water flows through the membrane array rejecting the majority (99%+) of the dissolved solids. The dissolved solids build up in the concentrate stream of the membrane skid. The concentrate is disposed of as it leaves the membrane skid. Permeate is sent to a storage tank when it exits the skid. A second pass of reverse osmosis can be applied to the permeate to further improve the water quality to meet process requirements.

Nanofiltration

Construction
Frame: Painted carbon steel or stainless steel
Membranes: Thin film composite
Membrane Housings: FRP or stainless steel
Controls: Customized for the end user
Piping: PVC, 304 SS, 316 SS, Duplex SS or Superduplex SS
Instrumentation: Customized for the end user
Cleaning System: Integral to the skid or stand alone
Controls: Customized PLC controls

Advantages
• Provides effective, continuous dissolved solids removal
• Very consistent permeate quality
• Can accommodate a wide range of feed water qualities
• Recoveries up to 80%+
• Permeate flow rate controlled by VFD
• Small footprint
• Modular – can have several units together to account for variations in flow rates
• Skid mounted for easy installation
• Automatic Control – minimizes operator labor

Purpose
• Remove dissolved solids, specifically hardness
• Dissolved solids increase boiler blow down
• Dissolved solids can cause scaling
• Dissolved solids can contaminate processes
• Hardness reduction

Principle of Operation
Specifically targeting multivalent ions, the feed water is pumped into the membrane skid. The filtered and pressurized water flows through the membrane array rejecting the majority of the multivalent dissolved solids allowing a portion of the monovalent ions to pass. The rejected dissolved solids build up in the concentrate stream of the membrane skid. The concentrate is disposed of as it leaves the membrane skid. Permeate is sent to a storage tank when it exits the skid.
**Sea Water Reverse Osmosis**

**Construction**
- **Frame:** Painted carbon steel or stainless steel
- **Membranes:** Thin film composite
- **Membrane Housings:** FRP
- **Controls:** Customized for the end user
- **Piping:** PVC, Duplex SS or Super Duplex SS
- **Instrumentation:** Customized for the end user
- **Cleaning System:** Integral to the skid or stand alone
- **Controls:** Customized PLC controls

**Advantages**
- Provides effective, continuous dissolved solids reduction
- Very consistent permeate quality
- Can accommodate a wide range of feed water qualities
- Recoveries up to 50%
- Permeate flow rate controlled by VFD
- Small footprint
- Modular – can have several units together to account for variations in flow rates
- Skid mounted for easy installation
- Automatic Control – minimizes operator labor
- Energy recovery systems reduce electrical costs

**Principle of Operation**
Feed water is pumped into the membrane skid. The filtered and high pressure seawater flows through the membrane array rejecting the majority of the dissolved solids. The dissolved solids build up in the concentrate stream of the membrane skid. The concentrate is disposed of as it leaves the membrane skid. Permeate is sent to a storage tank when it exits the skid. Due to the high pressures required to overcome the osmotic pressure of the seawater, energy recovery devices are frequently applied to reduce the operating costs of the equipment. 

**Electrodeionization (EDI)**

**Construction**
- **Cells:** Modular cell stack in plate and frame, cylindrical, spiral configurations
- **Membranes:** Cation and anion membranes, spacers, mixed bed resin, electrodes
- **Plumbing:** Schedule 80 PVC, 316 SS
- **Skid:** Two coat epoxy carbon steel
- **Controls:** Customized PLC controls

**Advantages**
- Provides extremely low total dissolved solids
- Effluent service water is near neutral pH
- Continuous operation with no regeneration or hazardous chemicals required
- Modular units that can be combined for larger flow rates
- Inlet/outlet pressure gauges
- Minimum energy and maintenance requirements
- Smaller footprint compared to mixed bed demineralization
- Stand alone modular skid mounted (pre-piped & pre-wired)

**Purpose**
- To polish RO product water to remove nearly all cations and anions
- Total dissolved solids are considered contaminates in some industrial processes
- Total dissolved solids will scale and foul boiler tubes inhibiting heat transfer

**Principle of Operation**
Electrodeionization (EDI) is a continuous electrically driven membrane and resin ion separation technology used to polish RO product water to extremely low levels of dissolved solids. EDI systems offer an alternative to mixed bed demineralization without the need for regeneration chemicals and waste neutralization. RO product water enters the EDI module through an inlet valve and then enters stack of cells with cation and anion membranes separated by spacers. On opposite ends of the stack is a cathode and anode respectively providing an electrical potential to drive the cations and anions through the respective one way membranes to a waste channel.

The product and waste channels contain a thin layer of mixed bed resin to provide a conductive path to facilitate the process. The result is a highly efficient system that removes all dissolved solids with very close to neutral pH. The purified water is then piped out of the stack. Modules of different flow rates can be plumbed together to provide higher flow rate capacities.
A Global Water Technology Leader

newterra is recognized as a leader in the development of modular treatment solutions for water, sewage, wastewater and groundwater remediation for industrial, municipal, land development, commercial & residential markets. Our heritage of innovation in providing clean water solutions dates all the way back to 1863. Over that time, newterra has grown to over 200 people and we’ve installed thousands of treatment systems – some of which operate in the most extreme conditions on the planet.

Full Control from Start to Finish

At newterra, we take full control of virtually every aspect of the treatment systems we build – from process design and engineering to manufacturing, installation, operations and ongoing parts & service support. That also includes manufacturing our own MicroClear® UF membranes in newterra's ISO 9001:2008 certified facility. This award-winning approach ensures newterra treatment systems meet our high standards for quality and on-time delivery.