



Leopold[®] Desalination Pretreatment Systems

RELIABLE PROTECTION FROM MEMBRANE-FOULING, PERFORMANCE-INHIBITING SEAWATER CONTAMINANTS



Why Leopold for Your Desalination Pretreatment Solution?

Leopold® desalination pretreatment systems can significantly reduce membrane-fouling contaminants—color, organics, soluble metals, oil, algae—before they reach your reverse osmosis (RO) membranes. These seawater contaminants can affect effluent quality, damage the membranes, and even cause membrane failure because RO membrane filters are intended for removing only salt and dissolved ions when producing potable water from seawater.

Solutions for Every Desalination Pretreatment Application

We offer two desalination pretreatment system technologies—Leopold® FilterWorx™ rapid gravity media filtration and Leopold® Clari-DAF® dissolved air flotation—that can be used individually or in combination to provide the cleanest influent to feed the RO membrane filters. As a result, our desalination pretreatment systems have the potential to reduce RO membrane chemical cleaning and increase RO membrane life.

Every system is custom-designed to the specific requirements of your RO membrane plant. For instance, either a Leopold Clari-DAF or FilterWorx system can be used alone in a single-stage process. Or a Clari-DAF or FilterWorx system can be followed by a FilterWorx system in a two-stage process, depending on raw seawater influent conditions. And both the Leopold Clari-DAF and FilterWorx systems can handle changing source water conditions to provide consistent protection for your RO membranes.

Complete Protection

Leopold offers the only desalination pretreatment system that removes harmful algae blooms (HABs/red tide).



Proven Reliability

Leopold desalination pretreatment systems have been in place and operating since 1985 in RO membrane filtration plants located in the Middle East and Australia. They are treating raw water supplies with an SDI of 8 to 10, with excursions as high as 15. Using iron-based coagulants, and passing through a dual-media anthracite/sand gravity filter at loading rates of 3 to 4 gpm/ft² (7.5 to 10 m/hr), the effluent SDI is consistently below 3 . . . within the SDI required by RO membrane suppliers.

PERFORMANCE

- High loading rates
- Lower backwash frequency
- Low SDI, <3.0
- Removes >90 percent of algae
- Removes up to 99 percent of turbidity
- Removes TSS, free oil, color, and organics

Leopold® Clari-DAF® (Dissolved Air Flotation) System

Effective Removal of Low-Density Solids

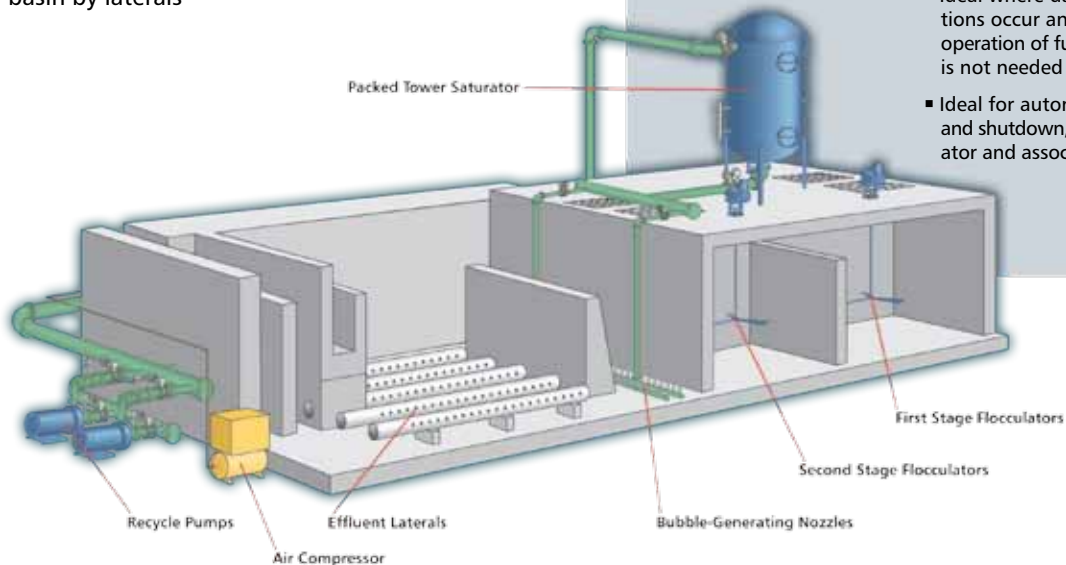
Leopold Clari-DAF system high-rate dissolved air flotation clarification is a particularly effective desalination pretreatment for seawater.

The process is designed on the concept that it is easier to float low-density solids created with inorganic coagulants than to settle them. Normally, solids that are hundreds of microns in size are required to settle while particles that are only tens of microns in size can be floated.

Source water contaminants such as HABs/red tide and free or emulsified oil that are naturally buoyant are also best removed by flotation.

How It Works

- Air under pressure is dissolved into water according to Henry's Law of Dissolution
- Releasing the pressure via a special device creates millions of microbubbles approximately 30 to 100 microns in diameter
- The microbubbles attach to floc in the water and float it to the surface for removal
- The floated sludge is removed from the surface of the water by mechanical or hydraulic means
- Clarified water is removed from the bottom of the basin by laterals



FEATURE

BENEFIT

No Polymer Required

High Loading Rate

Up to 8 gpm/ft² (20 m/hr), 15 to 20 times that of conventional clarification tanks

Compact Design

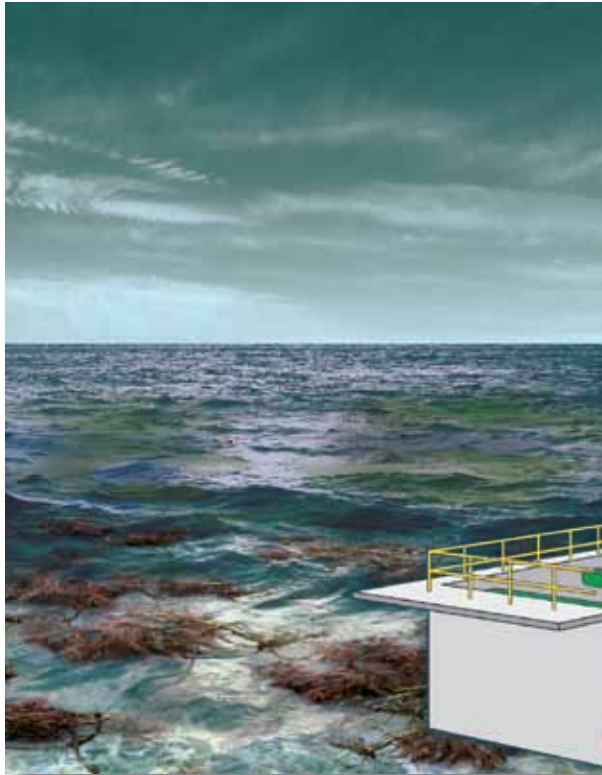
One-fourth to 1/10th the footprint of conventional clarification

Installation in Concrete Tank

Rapid Start-Up

- Membrane protection
- Compact design
- Increased flow-through
- Improved land use, especially in existing plants with no room for expansion
- 600 million approximately 40-micron bubbles per gallon (160 million per liter) increases the chance of bubbles attaching themselves to suspended floc
- Eliminates increased chemical addition and mixing—reducing operational expense—necessary with conventional clarification to achieve larger, heavier floc that will settle
- Contributes to keeping capital costs low and to minimizing corrosion
- Good-quality effluent achievable within 45 minutes of start-up vs. several days for other high-rate processes
- Ideal where daily flow variations occur and continuous operation of full plant capacity is not needed
- Ideal for automatic start-up and shutdown, minimizing operator and associated labor costs

Leopold® FilterWorx™ Rapid Gravity Media Filter System

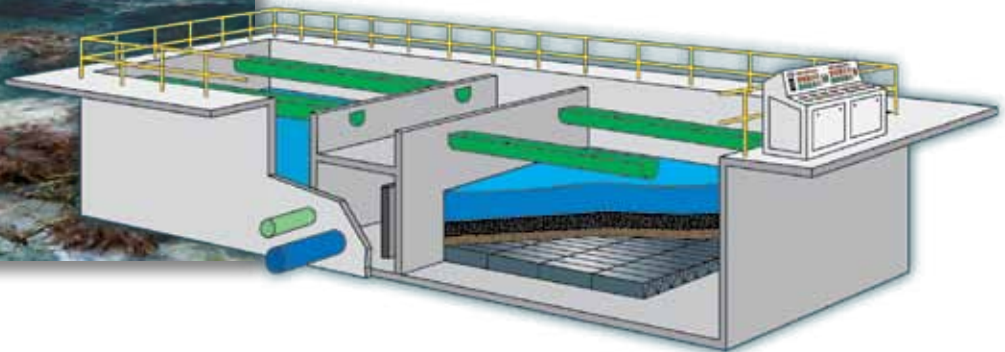


Effective Pretreatment for Desalination Plants

With the correct coagulation chemistry, a Leopold FilterWorx rapid gravity media filter system can remove clays, colloidal silica, precipitated metal hydroxides, humic and fulvic acids, and some levels of algae and bacteria.

The FilterWorx rapid gravity media filter system is a complete system comprised of a filter underdrain, filter media, backwash troughs, backwash pumps and blowers for air/water media cleaning, and valves, as well as instruments and controls. The control system can be adapted to an existing SCADA or to a PC-based SCADA system provided by Leopold.

Gravity filtration eliminates the need for high-pressure pumps, reducing operation and maintenance costs versus comparable pressure filter systems.

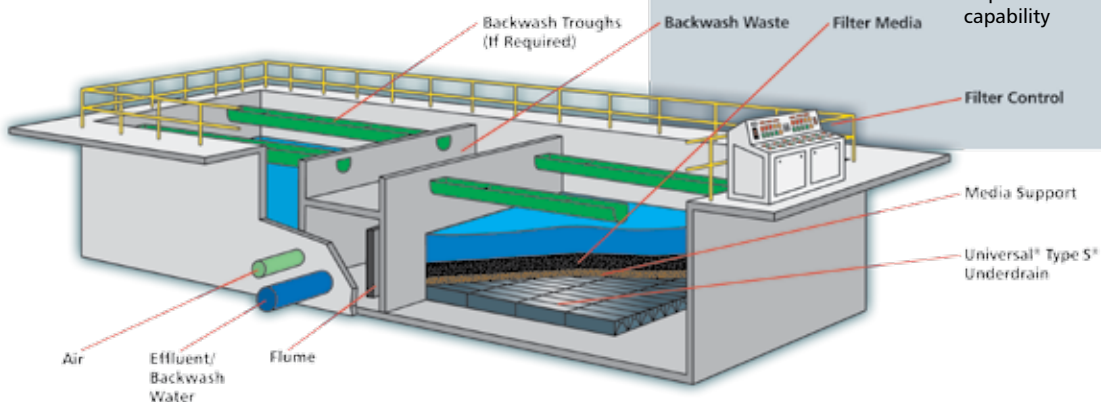


The concurrent air/water backwash system provides “collapse pulse” cleaning of the media bed to remove compacted solids that penetrated deep into the media, while Leopold® Type S® dual parallel lateral underdrain provides equal water pressure and uniform air/water backwash flow throughout the media bed. This ensures thorough and efficient cleaning of the media throughout the entire bed and return to filtration shortly after backwashing. The volume of water for backwashing is reduced up to 60 percent compared to conventional, water-only cleaning systems because the excess water is replaced by air.

How It Works

- Suspended particulates are removed from water by flowing the water via gravity at a high rate down through the filter media where they are removed within the depth of the granular material
- Filtered water is removed from the filter through an underdrain system
- Cleaning the filter media is accomplished with an up-flow water wash with either full bed fluidization or sub-fluidization, depending upon the media
- Air scour is also used to ensure thorough cleaning resulting from higher shear forces in the media bed and abrasion between grains of media
- Both the backwash water and air scour are introduced into the bottom of the media bed through the underdrain system
- During high-rate backwash, the volume of water above the filter media bed increases to just above the backwash trough edge
- Dirt is dislodged and flushed out of the media, pushed to the surface of the water by the upward flow, and captured via water overflow into the backwash troughs
- Dirty backwash water is evacuated from the filter for recovery

FEATURE	BENEFIT
Downflow Design	■ Works with gravity, eliminating the need—and cost—to pump influent through the media
Depth Filtration	■ Efficiently stores solids ■ Handles wide swings in solids loading ■ Provides long filter runs ■ Versatile in meeting a variety of source water conditions
Rapid Rate Filtration	■ High production rate
Flexible Filter Design	■ Can be designed to a variety of site conditions or existing filter basins
Type S® Dual Parallel Lateral Underdrain	■ Superior uniformity of backwash distribution ■ Cost-effective, efficient media cleaning ■ Ensures full use of the filter bed
Engineered Filter Media® Products	■ Sand or sand/antracite media—available in a variety of sizes and shapes—provides efficient performance ■ Filter bed particle size and depth are engineered to specific effluent requirements ■ Other media designed specifically for desalination pretreatment are available
FilterWorx® Control System	■ PLC-based controls developed exclusively for optimum filter operation ■ Unparalleled data logging capability

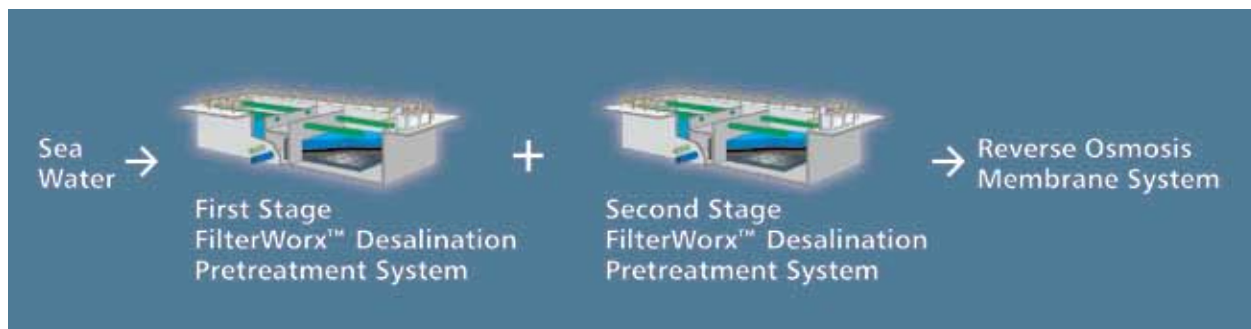


Leopold Desalination Pretreatment Systems Are Custom-Designed to Provide the Cleanest Influent to Feed Your RO Membrane Filters



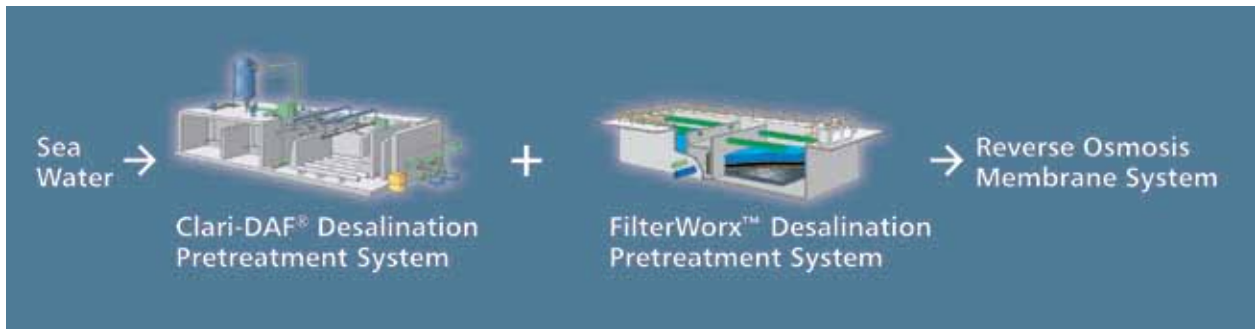
A Leopold FilterWorx rapid gravity granular media filter system can remove clays, colloidal silica, precipitated metal hydroxides, humic and fulvic acids, and

some levels of algae and bacteria to achieve an SDI consistently below 4.



A two-stage Leopold FilterWorx rapid gravity granular media filter system can remove clays, colloidal silica, precipitated metal hydroxides, humic and fulvic acids,

and some levels of algae and bacteria just like a single-stage system. But a two-stage Leopold FilterWorx system can achieve an SDI consistently below 3.



A Leopold Clari-DAF dissolved air flotation system followed by a Leopold FilterWorx rapid gravity granular media filter system can effectively remove a wide variety of contaminants from source water. The Clari-DAF dissolved air flotation system can remove low-density solids and naturally buoyant HABs/red tide, free or emulsified oil, and

organics (with chemical feed), while the FilterWorx rapid gravity granular media filter system can remove clays, colloidal silica, precipitated metal hydroxides, and humic and fulvic acids to achieve an SDI consistently below 3.5. (Adding an additional FilterWorx system as a third stage can achieve an SDI consistently below 2.5.)



A single, high-rate Leopold Clari-DAF dissolved air flotation system can remove source water contaminants more effectively than sedimentation. A Clari-DAF system can

remove source water contaminants such as HABs/red tide, free or emulsified oil, organics (with chemical feed), and low-density solids.

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to www.xyleminc.com



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