

# RECOFLO® TRIFLO DEMINERALIZER

## *Do more with less . . .*

The Recoflo® TriFlo Demineralizer produces the very high purity water (conductivity of less than 0.1 microseimens/cm) often required to feed critical and super critical boilers. It can do this economically and simply in a single process unit from feedwaters containing up to 450 ppm of total dissolved solids. The high ion exchange efficiency of the demineralizer system results in a reduction in chemical usage and waste generation. The shorter cycles make the Recoflo® demineralization systems more resistant to organic fouling and allow for the more effective removal of colloidal and ionic silica.

The compact, skid-mounted design requires less floor space and headroom than other demineralization systems and no elaborate civil work is required for installation.

## *Basic Principle . . .*

Standard two-bed Recoflo® demineralizers with short, compressed beds of fine mesh resin, using counter current regeneration produces water purity in the range of 1.0 - 0.15 microseimens-cm conductivity (1 - 6.7 megohm/cm resistivity) from a wide range of feedwater purities. The inability to produce much higher purity water is limited by the presence of sodium ions that have either slipped off the cation resin, or remain in trace amounts in the anion bed after regeneration with caustic.

Ultra-pure water can be achieved by simply adding an additional cation resin bed as a polisher after the usual two-bed demineralizer to remove the contaminating sodium ions. This is the design principle of Eco-Tec's TriFlo Demineralizer.



**RECOFLO® TRIFLO DEMINERALIZER** Simple, economical production of very high purity water in a single process operation. A single equipment skid may produce 10 - 15 megohm resistivity water from a feed source containing up to 450 ppm of TDS.

# performance...

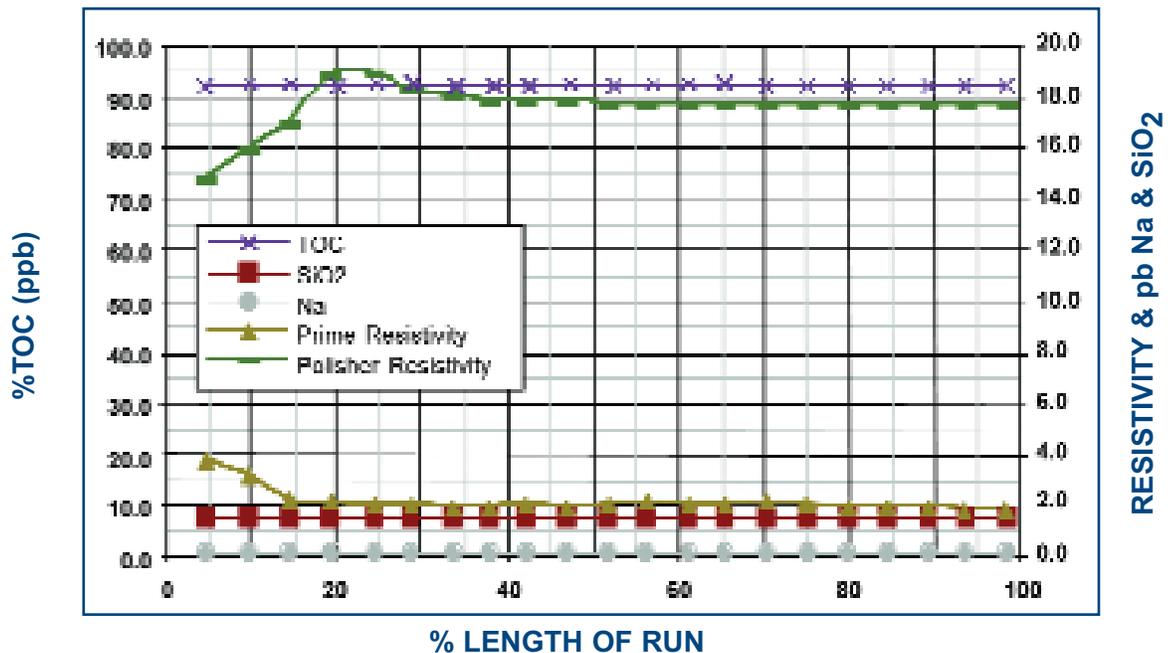
The TriFlo Demineralizer eliminates the need for mixed bed polishers or electro-demineralization systems to provide high purity water for applications requiring high purity water in the range of 10 - 17.5 megohm resistivity. The remarkable capabilities of a Recoflo® Demineralizer are shown in Figures 1 and 2.

This improvement requires only an incremental (less than a 5%) increase in operating cost compared to a two bed demineralizer. Since the final cation bed only polishes traces of sodium, it only requires periodic regeneration.

Figure 1

Quality Parameter	Feed	Product
Resistivity	900 $\mu$ S-cm	17.5 megohm/cm
TDS	450 ppm TDS	< 0.1 ppm
Silica	25 ppm SiO <sub>2</sub>	< 2 ppb SiO <sub>2</sub>
Sodium	116 ppm Na	< 1 ppb Na
TOC	1.6 ppm TOC	< 100 ppb TOC

Figure 2 - Capabilities of the Recoflo® Demineralizer



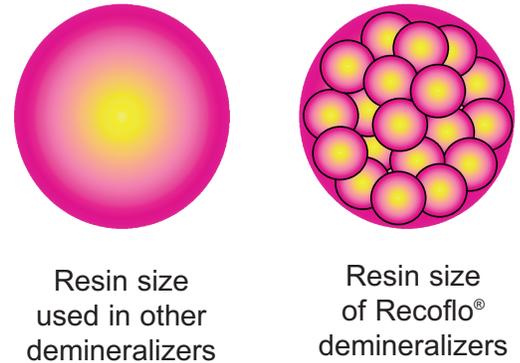
# features...

## Fine mesh resin

Since exchange kinetics and regeneration efficiency is improved by using only the exchange sites at surface of the resin beads, a fine mesh resin is used to increase the total surface area that is available for exchange.

The size of these resin beads is approximately one quarter the size of the resin used in other demineralizers (Figure 3). This resin is uniformly sized to maximize the efficiency of rinsing and promote uniform distribution of flow through the bed.

Figure 3

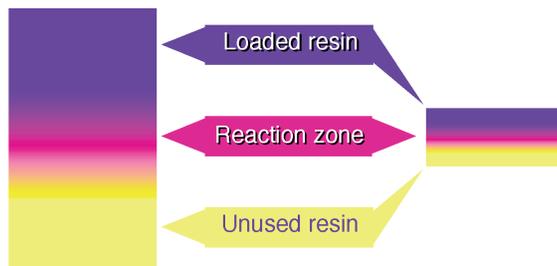


# features...

## Short bed height/small resin volume

The resin beds in the Recoflo® Demineralizer are only 6 inches (15 cm) in depth and have approximately 10% of the resin volume of other demineralizers (Figure 4). A shallow bed is made possible by the rapid ion exchange kinetics that result from the use of fine mesh resins and low resin loading.

Figure 4



## Shorter cycle times

The combination of high flowrates, low resin loading and small resin beds result in short cycle times, both in service and regeneration. Whereas other demineralizers are onstream for approximately 20 hours and require several hours to regenerate, the Recoflo® Demineralizer is typically onstream for less than 30 minutes and is regenerated in less than 7 minutes.

The shorter cycles allow for the continuous supply of the required flow with only one unit since during the short regeneration period, water can be drawn from the product storage tank. This buffer volume and the demineralized water used for regeneration is then replaced during the subsequent onstream cycle. The shorter cycles also facilitate troubleshooting since many cycles can be witnessed in a single shift after the remedial action has been performed.

## Higher throughput rates

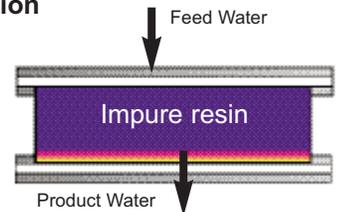
The rapid ion exchange kinetics and short resin beds allow for high throughput rates, typically 3 to 5 times higher than other demineralizers. The high flowrates result in a smaller resin bed diameter and hence a reduction in the required amount of floor space.

## Counter-current regeneration

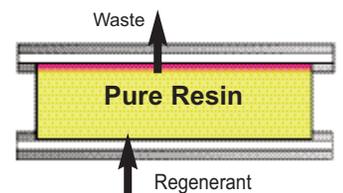
To maintain the cleanest resin at the bottom of the resin beds after regeneration, the regenerant is passed through the bed in the opposite direction of the feed flow (Figure 5). Counter-current regeneration minimizes regenerant usage and maximizes product water quality.

Figure 5

### Before Regeneration



### After Regeneration



## Compressed resin beds

The resin beds in the Recoflo® Demineralizer are fully packed such that no freeboard exists. In fact, the resin beds are compressed by adding an excess of resin prior to closing the vessel (Figure 4). Packed resin beds maximize regeneration efficiency by maintaining the exchange zone profile and ensuring proper flow distribution through the bed. Eliminating the freeboard reduces rinse requirements by minimizing intermixing and liquid dilution.

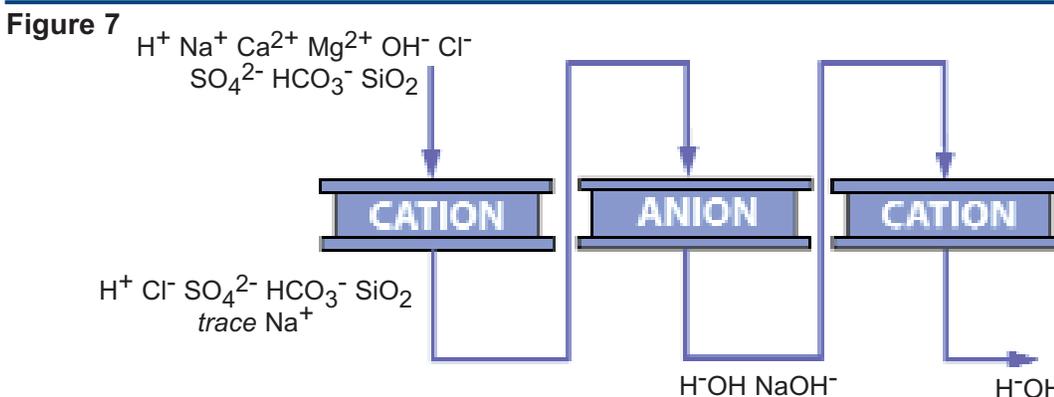
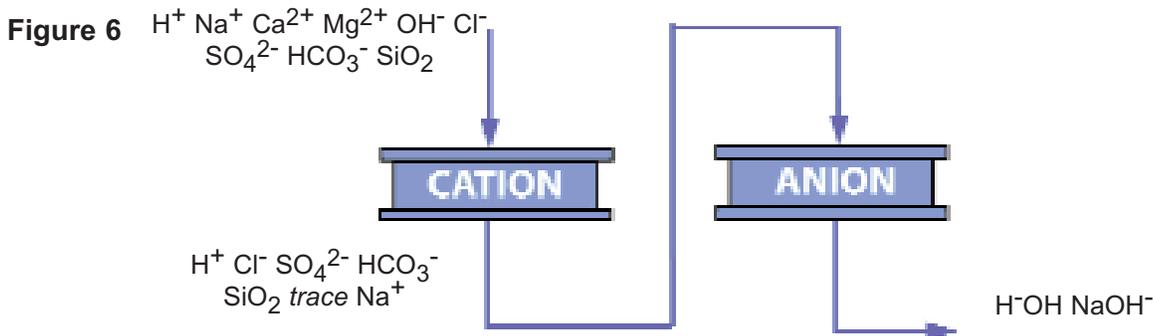
## Low resin loading

Unlike other demineralizers that load the resin to near exhaustion, the Recoflo® demineralizer uses less than 20% of the total exchange capacity of the resin. By using only the most accessible exchange sites at the surface of the resin beads, the exchange kinetics are improved and regenerant usage is reduced since the sites that most readily accept an ion are those most easily regenerated. In addition, the low resin loading does not force the resin to undergo large changes in size that cause resin fragmentation in other demineralizers.

# operation...

Operation of the TriFlo Demineralizer is very simple. Figure 6 shows the typical operation of a two bed demineralizer. The quality of the final effluent is limited by the passing of a small amount of sodium through the cation exchanger.

Figure 7 shows the operation of a TriFlo unit which incorporates an additional cation exchange resin after the anion exchanger. This third bed removes the trace levels of sodium and allows for the dramatic improvement in resistivity of the water.



# service ...

The Eco-Tec Customer Service Program begins with strict quality assurance as demanded by ISO 9001. Resin is tested to confirm particle size distributions and ion exchange characteristics are acceptable. The filter vessels and piping systems are constructed in accordance with ASME guidelines. Prior to shipment, the demineralizer is tested with regenerant chemical to produce the specified water quality. A Supervisor, Technical Service can be on-site during start-up and offer operator training. Service Representatives are available 24/7 to assist with any aspect of the system.

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