

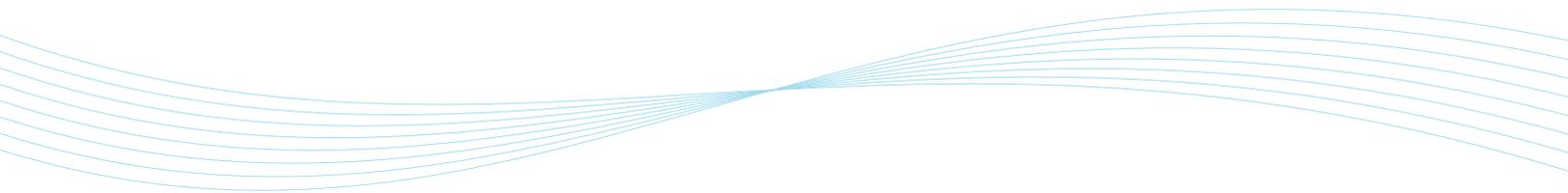


eVOQUA

WATER TECHNOLOGIES

IONPURE® CONTINUOUS  
ELECTRODEIONIZATION  
(CEDI) MODULES

**CHEMICAL FREE, HIGH-PURITY  
WATER FOR BOILER FEED AND  
STEAM GENERATION**



# Power Generation

Power generation is one of the largest-water consuming industries globally. High purity water is essential for maintaining and optimizing plant efficiency.

Today's highly critical boilers and steam turbines require consistent high-quality water with only trace levels of sodium, chloride, sulfate and silica to ensure maximum effectiveness and prolonged life. Allowing for breakthrough of these ions can lead to a pitting of turbines and scale build up on boiler heating elements.

Traditionally, power plants have relied on chemically regenerated ion-exchange resin to produce high-purity water after reverse osmosis (RO).

Ion-exchange is a traditional technology that has been in use for over half a century but has the disadvantage and associated cost of requiring the use of hazardous chemicals for regeneration of the ion exchange resins or hiring a service provider to exchange tanks. Regeneration chemicals produce a considerable amount of waste, which require neutralization before it can be discharged.

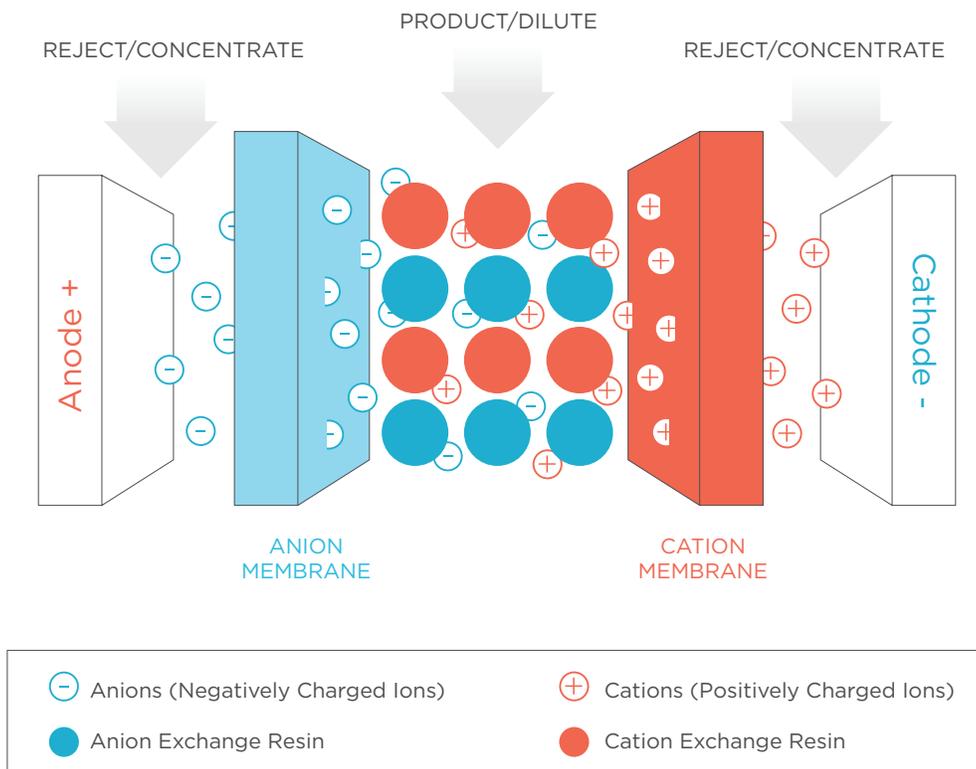
## BULK DEIONIZATION/GENERAL INDUSTRIAL

IONPURE® CEDI modules are used in a variety of general industrial applications to provide high-quality demineralized water.



Industry Needs	Ionpure CEDI Performance
≤ 0.1 μS/cm conductivity (10+ MΩ-cm resistivity)	Typically ≤ 0.06 μS/cm (17+ MΩ-cm)
Minimal downtime	Continuous production, no regeneration
Silica, < 10 ppb as SiO <sub>2</sub>	> 95% Silica removal
Sodium, chloride and sulfate < 3 ppb	> 99.5% removal of each
Safety, trend is to reduce chemical usage	Chemical-free process, just uses electricity
Low operating costs	Cost of electricity
Low maintenance	Minimal maintenance
High-flow rate	Up to 100 gpm (22.7 m <sup>3</sup> /h) per Ionpure CEDI module

Note: Actual performance may be determined using the IP-Pro projection tool available from Evoqua.



## What Is Continuous Electrodeionization (CEDI)?

CEDI is a chemical-free, self-regenerating technology used to provide a consistent flow of high-quality deionized water.

With the growing costs of chemicals for regeneration and waste neutralization, and heightened safety concerns with handling hazardous chemicals, many industrial customers began seeking an alternative to cost-prohibitive, on-site regenerable ion exchange for creating ultrapure water. Evoqua's IONPURE® modules offer that solution. The first to commercialize CEDI in 1987, we have provided thousands of modules that deliver ultrapure water at capacities ranging from 0.013 m<sup>3</sup>/h (0.06 gpm) to 22.7 m<sup>3</sup>/h (100 gpm).

In short, CEDI is a water treatment process that uses a combination of ion-exchange resins, ion-exchange membranes, and direct current to continuously deionize water without the need for chemicals. The avoidance of chemicals helps to reduce the systems' operating and maintenance costs and, therefore, improve your bottom line.



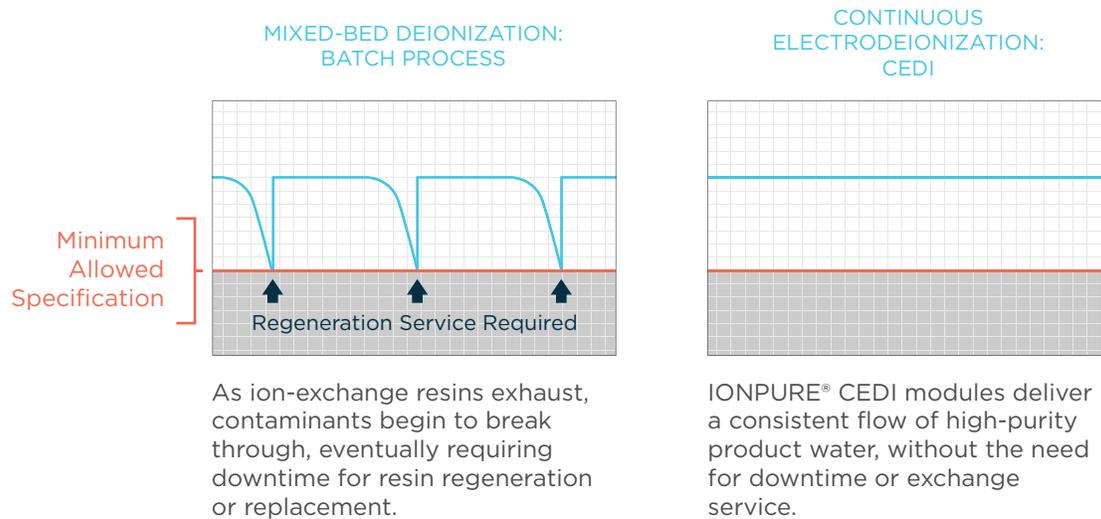
# CEDI vs Chemically Regenerated Mixed-bed Deionization (MBDI)

Since its commercialization, the use of CEDI technology has grown in popularity. Some of the major advantages of CEDI over traditional mixed-bed deionization systems include:

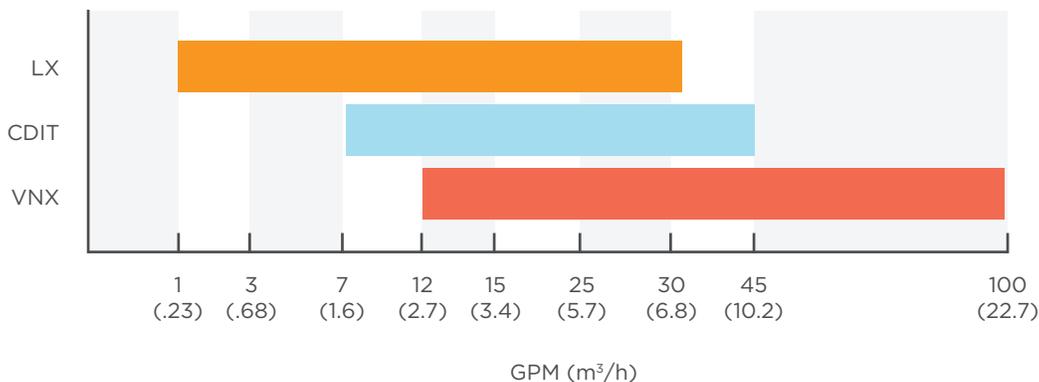
- No acid or caustic bulk storage, pumping, waste neutralization, or disposal issues
- Lower operating costs due to lower manpower requirements, as well as lack of chemical regeneration
- Smaller footprint
- Safer, more consistent operation
- Less downtime compared to regeneration or exchange cycles

While both ion exchange and EDI use ion-exchange resins, the removal mechanisms are quite different. Conventional ion exchange utilizes chemically regenerated ion-exchange resins, which function in a capture (exhaustion cycle) and discharge (regeneration cycle) mode. This results in a breakthrough of ions at the end of the service cycle and a rinse out of regenerant at the beginning of the next service cycle. Capacity and selectivity are the most important resin properties in this mode of operation.

CEDI uses a reaction/transport mechanism to remove ions through resin under the influence of a DC field. This requires a continuous path of like-charge resin beads. The transport is largely across the surface of the resin beads. Transport through resin bead (particle diffusion) can be limiting.



### IONPURE® CEDI MODULE FLOW RANGE



## IONPURE Product Overview

We have a full line of products varying in size to meet your requirements. Our product lines include:

- **LX**—medium-flow applications; flow rates of 0.23 m³/h (1 gpm) to 7.7 m³/h (33.8 gpm)
- **CDIT**—high feed water challenge applications up to 100 µS/cm FCE; flow rates from 1.7 m³/h (7.5 gpm) to 10.2 m³/h (45 gpm)
- **VNX**—high-flow applications; flow rates of 5.7 m³/h (25 gpm) to 22.7 m³/h (100 gpm)

Whether you want to eliminate chemical handling and regenerant waste or just need a system to help purify water for your supercritical boiler, rest assured that one of our CEDI modules will meet your needs. In addition, we’re continuously developing new products or improving our existing modules to better serve our customers’ needs. We also have an entire team of technical support experts available to troubleshoot any problems you may run into.

### DISTRIBUTION

IONPURE CEDI modules and power products are distributed through a large base of highly trained and knowledgeable Original Equipment

Manufacturers (OEMs), who know the ins and outs of our technologies. Our OEMs bid on projects and provide in-depth project specifications detailing the predicted performance of IONPURE CEDI modules for the application.

### OEM PACKAGED SYSTEMS

IONPURE prefabricated systems use the latest VNX and LX products for simple integration into a new or existing water system.

### ADVANTAGES

**Product**—The most robust CEDI device with the simplest operation and maintenance

- The best product for your application

**Experience**—33+ years of innovation, IONPURE CEDI modules have been adopted worldwide in many Power, Microelectronics, Pharmaceutical and other high-purity applications

**Support**—A global network of trained and knowledgeable OEMs and regional support personnel

- The support you need when you need help

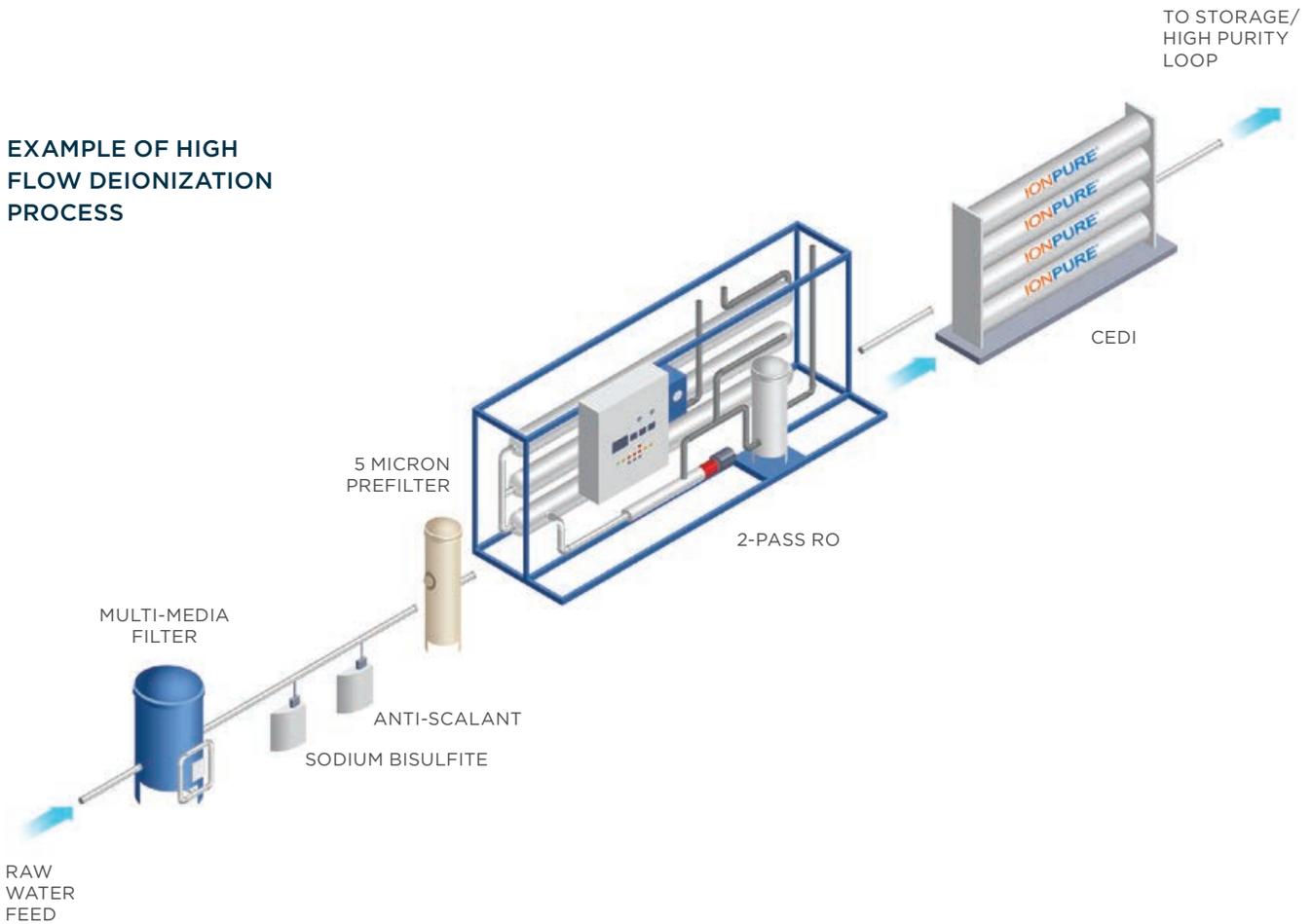
## LX & VNX PRODUCT SPECIFICATIONS

Feed Water Specifications		Typical Product Performance	
Feed Water Conductivity Equivalent (FCE)	< 40 $\mu\text{S}/\text{cm}$	Product Resistivity at Nominal Flow Rate	15-18 $\text{M}\Omega\text{-cm}$
Operation Temperature	41-113°F (5-45°C)	Product Conductivity at Nominal Flow Rate	0.066-0.055 $\mu\text{S}/\text{cm}$
Inlet Pressure	< 100 PSI (6.9 bar)	Recovery	90-95%
		Silica ( $\text{SiO}_2$ ) Removal	95-97%

## VNX-CDIT PRODUCT SPECIFICATIONS

Feed Water Specifications		Typical Product Performance	
Feed Water Conductivity Equivalent (FCE)	< 100 $\mu\text{S}/\text{cm}$	Product Resistivity at Nominal Flow Rate	> 10 $\text{M}\Omega\text{-cm}$
Operation Temperature	41-113°F (5-45°C)	Product Conductivity at Nominal Flow Rate	< 0.1 $\mu\text{S}/\text{cm}$
Total Hardness ( $\text{CaCO}_3$ )	Up to 4 ppm	Recovery	80-90%
Silica ( $\text{SiO}_2$ )	Up to 2 ppm		

## EXAMPLE OF HIGH FLOW DEIONIZATION PROCESS



# CEDI Power Products

## PROVIDING TOTAL SOLUTIONS FOR ORIGINAL EQUIPMENT MANUFACTURERS (OEMS)

### IONPURE® DC3 POWER SUPPLY

For your convenience, we're proud to provide a complete CEDI solution—including the power supply required to power your system. The IONPURE DC3 Power Supply provides constant control of current, voltage and/or power to our CEDI modules. To put it simply, the DC3 Power Supply is designed to optimize performance, which ultimately allows for a more cost-effective and simplified solution for electrical system design. Some of the benefits of the DC3 include, but are not limited to:



- Allows direct connection from power line, so no separate isolation transformer is required
- Features a high-efficiency, 3-phase switch mode design to reduce power consumption vs. traditional SCR power products
- Features on-board diagnostics and alarms
- Features LED power and status indicators
- MODBUS® TCP ethernet connection

### DIGITAL COMMUNICATION RECTIFIERS AVAILABLE

In addition to the DC3 Power Supply, Evoqua offers Digital Communication Rectifiers (DCRs). Like the DC3, these products also allow for constant control of power of CEDI modules. The DCR is a compact, reliable, single-phase DC power controller designed with a high-performance microprocessor. It also features on-board digital communication to ensure easy integration with existing PLC/HMI with the use of MODBUS RTU or 4-20mA signals. A separate external isolation transformer is required for the DCR.



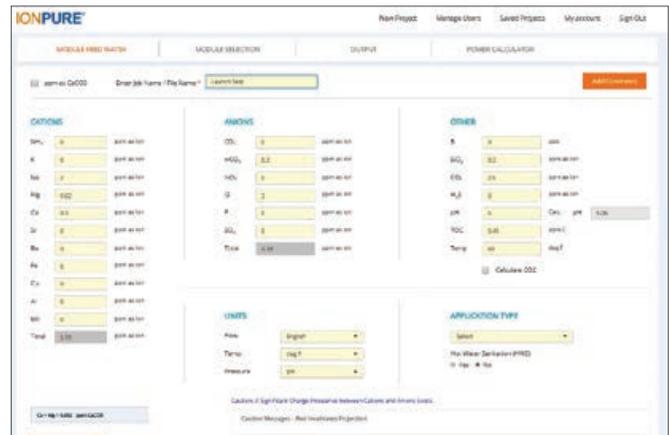
#### Touch Panel Display

An optional 4.3" touchscreen HMI is available for use with the DCR-M or DC3. The touch panel display is pre-programmed to operate up to 16 power controllers.

## IP-Pro Online

### ACCURATELY PREDICT MODULE PERFORMANCE WITH AN ONLINE TOOL

In addition to manufacturing and providing the products needed to power CEDI modules, Evoqua has developed a tool—IP-Pro Online—to help you predict the performance of our modules. Simply enter the information, including anions, cations, flow rate, application type, etc., and our online projection software will determine which module(s) will best suit your needs. To use the tool, you must first register for an account. Existing users must login prior to use.



TRANSFORMING  
**WATER**  
— ENRICHING —  
LIFE



210 Sixth Avenue, Suite 3300, Pittsburgh PA 15222 USA

[ionpure@evoqua.com](mailto:ionpure@evoqua.com)    [evoqua.com/ionpure](https://evoqua.com/ionpure)

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