Point of Use Reverse Osmosis and Electrodeionization: An Alternate to Service Deionization

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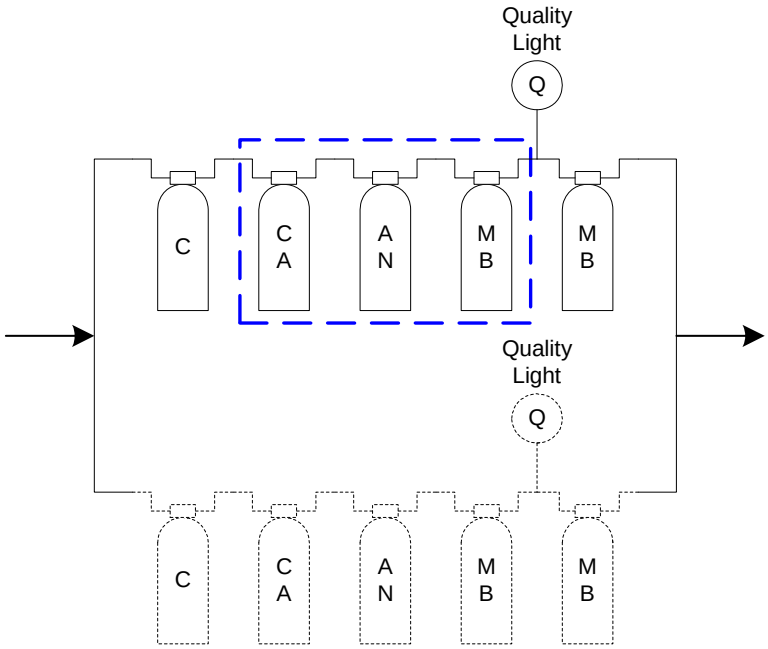
Electrodeionization (EDI) is a chemical free water treatment technology that eliminates the need for off line chemical regeneration. EDI has gone from an unproven and unknown commodity to one that has revolutionized the industry in the past 20 years. Much has been written and discussed about the use of EDI systems for industrial applications such as power plants and semiconductors, where flows are typically over 50 gpm. EDI is also an acceptable technology in smaller pharmaceutical systems where hot water sanitization, USP validation and FDA certification are required. However, recent Point of Use (POU) developments have created new opportunities for EDI to be a cost competitive alternate to service deionization (SDI) in applications with flow rates as low as 86 gpd (15 lph). These new opportunities apply to traditional water treatment "dealers" who can offer EDI and service contracts at more competitive rates, or more profitable rates than traditional service exchange DI (SDI). The new users of low-flow rate EDI will be

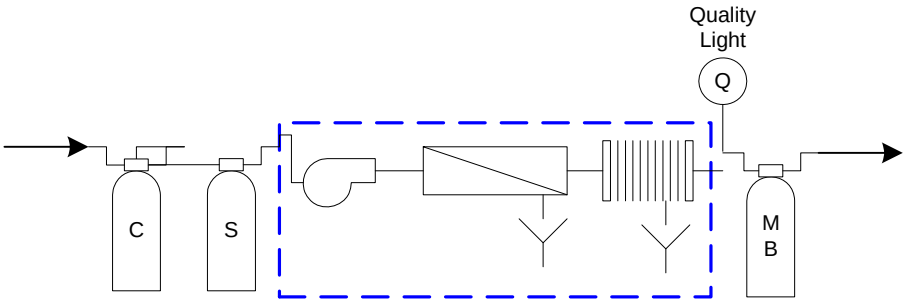
- laboratories
- universities
- hospitals
- small electronics companies
- other users of small volumes of pure or ultrapure water.

Many past articles have explained how EDI works. This article will focus on the application of EDI. If more information is desired, the June 2006 article in Water Technology magazine is recommended. In summary, EDI uses electrical power to split water molecules which regenerate resin rather than acid and caustic hazardous chemicals. The contaminates are continuously removed as they are attracted to one of the two electrical charges, and then migrate through the resin bed, through ion exchange membranes and into the concentrate stream where they are removed from the device.

EDI is replaces on-site regenerated mixed beds resin where end users do not wish to store, handle and neutralize chemicals. EDI also replaces Service Deionization (SDI) or off-site regenerated mixed beds as EDI is more reliable, cost effective and requires little maintenance. Under environmental pressures and increased chemicals, companies are turning away from their traditional regeneration facility and electing instead to provide a service contract and lease EDI systems. (See Flow Diagrams 1 & 2)



Flow Diagram #1 – Blue box shows tanks to be replace by RO/EDI, dotted tanks indicates tanks removed/no longer required



Flow Diagram #2 – Blue box shows RO/CDI (with optional softener tank). Only 1 train is required as the system does not exhaust and does not require shut down.

With the rising cost of chemicals required for regeneration, fuel prices, market pricing and labor rates, the profitability and efficiency of exchange tank business is not as attractive as it used to be. While the SDI business is very profitable, there are several factors that affect the business potential:

- Customer Radius from the regeneration facility
- Efficiency of the Service tech
- Cost of Regeneration and Utilities (chemicals, water, gas, etc)
- Competition (SDI can be provided by many others)

EDI or RO-EDI systems improve the dealer's business potential in all four categories. There is no limitation of offsite regeneration, so the dealer's service radius is increased.

With consistent DI water quality produced by the EDI skid, the exchange frequency of any polishing MBDI can be predicted. This equates to more efficient scheduling/routing of the service tech who can now service more customers within a small area once they are "synchronized", reducing travel and service cost. Bulk acid and caustic cost have increased almost 300%, while more environmental discharge limits are getting stricter. By reducing the amount of regenerations required, regeneration plant costs can be less dependent on outside vendors and more cost effective. Currently, there is little competition in providing RO-EDI systems in place of SDI. Dealers offering RO-EDI systems will now have a competitive advantage.

EDI has been proven cost competitive in what would be considered large applications by the typical water dealer. Now, a new low flow rate EDI module has created opportunities in very small systems, as low as 86 gpd (15 lph). A picture of this new module is attached. The series is available in the following designs. Note the size of the system is compact and can easily fit in small spaces and replace SDI bottles or disposable cartridges. Wall mounted units are also available.

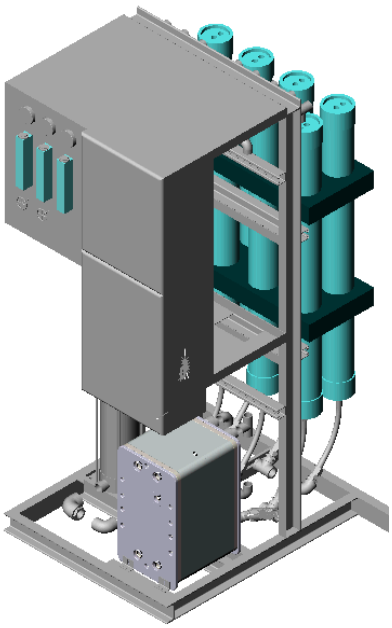
Floor Mounted POU Systems	Min Product Flow (gpm)	Nominal Product Flow	Maximum Product Flow	System Size
EDI-MX030	0.06	0.13	0.19	18" x 26" x 36"
EDI-MX060	0.13	0.26	0.39	18" x 26" x 36"
EDI-MX125	0.27	0.55	0.825	24" x 26" x 48"
EDI-MX250	0.55	1.1	1.65	24" x 26" x 60"
EDI-MX500	1.1	2.2	3.3	24" x 26" x 60"

In larger applications, slightly larger designs are available.

	Min Product Flow (gpm)	Nominal Product Flow	Maximum Product Flow	System Size
EDI-LXM4	1.0	2.0	3.0	33" x 40" x 80"
EDI-LXM10	2.5	5.0	7.5	33" x 40" x 80"
EDI-LXM18	4.5	9.0	13.5	33" x 40" x 80"
EDI-LXM24	6.0	12.0	18.0	33" x 40" x 80"
EDI-LXM36	7.5	15.0	22.5	33" x 40" x 80"
EDI-2LXM30	15.0	30.0	45.0	33" x 40" x 80"
EDI-3LXM30	22.5	45.0	62.5	75" x 40" x 80"

These sizes are for complete systems which include EDI module, power supplies, valves, piping and instrumentation required. A typical P&ID is shown in Figure 1. The installer simply connects the electrical wiring and plumbing. The plumbing connects inlet piping to the reverse osmosis system or permeate storage tank, and the two outlet connection – product and drain. The EDI modules last 3-5 years or longer, so there is no need for frequent changes of bottle or cartidges. The user payback cycle is usually short (1.5 years or less) or alternatively, the system may be leased. This creates monthly income for the dealer, and also an opportunity for service contracts with minimal effort.

EDI is a polishing technology and requires Reverse Osmosis (RO) as pretreatment. The combination of RO-EDI provides the customer with a continuous, chemical-free system. For new installations, both cost and space can be saved by utilizing Reverse Osmosis (RO) and EDI combination systems. A sample picture is shown in Figure 2. The combined RO-EDI skids include 5 micron prefilters, RO membranes, pumps, instrumentation and EDI components.



RO-EDI skid for 2-15 gpm:

Ultimately, the end user will benefit from RO-EDI systems in place of SDI. The benefits to the end user are:

- Smaller footprint (most cases)
- Less supplier intrusions
- Eco friendly / Green technology
- Consistent production with less downtime

RO-EDI system (5 gpm):

For more information on products, contact Agape Water Solutions, Inc. or visit www.agapewater.com.