Purified Water Systems
Comparison of Mixed Bed Service Exchange and Electro-deionization

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*Used to achieve higher resistivity than Reverse Osmosis alone
*Various Water Specifications require minimum Resistivity levels
  ASTM Type I, II, III
  Electronics grades E-I, II and III
  USP and WFI Water
  Various CAP and NCCLS Specifications
*Used in Universities, Hospitals, Pharmaceutical and Research Facilities
Ion Exchange Principle
General Commercial Methods of De-ionization

- In-place Regenerable Separate and Mixed Bed DI
- Service Exchange (Off-site) Separate and Mixed Bed DI
- Electro-Deionization
- Combination of EDI and Resin DI
In-Place Regenerable DI
In-place Regeneration Considerations

- Assures better quality control over off-site “regen” facilities
- Viewed as “older” technology
- Must have acid and caustic supplies in-house
- Requires Trained Personnel for Proper Operation
- Can require frequent PM due to acid/caustic environment
- Waste can be hazardous and incur surcharges
- Quality production limited by quality of “regen” process
- Useful in “Remote” Plant locations requiring Pure Water
In-Place Regeneration Considerations
(Example: 70 GPM Duplex unit)

* Initial capital cost ~ $160,000
* Most in-place units used for high flow rates
* Uses ~ 6,000 gallons per regeneration
* Uses ~ 30 gallons HCL and ~ 20 gallons NaOH per “regen” cycle
* Regeneration cycle takes ~ 3.5 – 4 hours
* Capacity here is 300,000 grains (240,000 “usable”)
* Ensure capacity exceeds regeneration time
Portable Units of Various Sizes are available
Size and quantity of Vessel(s) depends upon flow rate
Can achieve highest water quality
Does not require RO for pure water production
No waste stream during operation
Can be installed Post RO and/or in Distribution Loop
Water Quality does decline over time
Handling considerations
Off-site quality control
Mixed Bed Service Exchange Costs

Cubic foot of DI Resin has ~ 8,000 grain “usable” capacity for USP Water (10,000 Grain Total)

RO water ~ 1.25 Grains/Gallon

1 Cubic Foot of Resin handles ~ 6,400 Gallons of Water

1,200 Gallons per day Usage (5 days per week)

24,000 Gallons per month

~ 3.75 ft³ Resin per month usage (“14-47” vessel holds ~ 3.6 ft³)

Price for Cubic Foot of Resin: ~ $100.00 delivered

Monthly Cost: ~ $360.00 (“14-47”)

Yearly cost: ~ $4,320.00

Linear Usage Cost: 3,600 Gallons per day equates to $12,960.00/year
Electro-deionization Units
Utilizes Ion exchange, membrane and electrical principles

Ion exchange resin “capture” ions from RO feed stream

DC current is applied across the cell, attracting cations and anions to the appropriate positive or negative terminal

Ions pass through selective membranes to waste streams

This process provides “continuous” resin regeneration

Electrical current minimizes bacteria growth in dynamic cell areas

~ 97% Efficient
EDI Technology
Electro-Deionization Considerations

- Requires single-pass RO Feed water supply
- Can be free standing or integrated into RO unit
- Sized to match RO permeate flow rate
- Can not be installed in distribution loop
- Minimal power consumption: $0.06/1,000 gallons processed
- Minimal maintenance: 6 – month bolt torque
- Consistent quality: 12 – 15 Meg-ohm-cm
- Long life: 10 + years under normal operation
- Designs can be hot water sanitized
Electro-Deionization Costs

- RO-Integrated Units: ~ $8,000 for 1, 2, and 3 GPM flows (~ $11,000 for 10 GPM)
- Operating cost of ~ $0.06/1000 gallons processed (this can be considered regeneration cost)
- Cost effectiveness beginning at ~ 1,200 GPD usage
- Low usage rates more applicable to service exchange
- Cost remains fixed for full range of RO operation (Client can increase usage without significant additional costs)
DI/EDI Design Considerations

* Determine Water Quality Requirements
* Determine Water Usage (Maximum and Average)
* Equipment: is RO unit part of Design?
* Calculate Generation and Distribution Flow Rates
* Equipment location (facility and geographically)
* Equipment space allotment and access
* Client Maintenance Personnel experience and capability
How can we help in the Design of your Pure Water System