POWERLINE®

Graver Technologies

KEEPING THE LINES OF COMMUNICATION OPEN | WINTER 2014

PRECOAT BASICS FOR POWDERED PRECOAT DEMINERALIZERS

Proper precoating ensures high performance and extends element life.

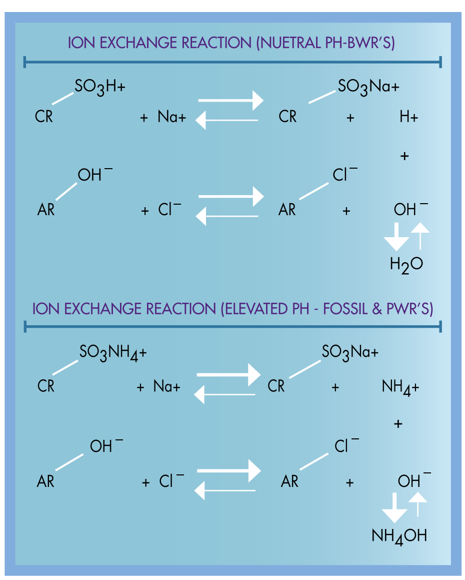
Powdered precoat demineralizer systems remain a gold standard condensate polishing technology for removing dissolved and suspended impurities from fluid streams in fossil and nuclear power generating facilities. Because these systems rely on correct precoating procedures for optimal performance, we provide a review of those steps below as a refresher for experienced facility personnel and a primer for newer personnel. We also present a question and answer section that addresses common precoating inquiries.

> *Stay tuned for email blasts during the first half of 2014 that discuss each precoating step in detail. Contact your Graver representative for more information.*

CHOOSE PRECOAT ELEMENTS (SEPTA) WISELY: Remember that the predominant force keeping the precoat material on the element is flow, though rough, irregular surfaces help keep precoat material in place on the element surface. A continuously wound precoat element design ensures consistent differential pressures and, in turn, uniform precoats. Elements that are not made in a continuous process can result in uneven differential pressures and precoat distribution; individual segments making up a single element must match as closely as possible to approach a good precoat but they often cannot equal that of a continuously wound element.

ENSURE PRECOAT ELEMENT CLEANLINESS: Fouled or partially fouled precoat elements cause unevenly distributed precoats, leading to short run cycles for both ion exchange and differential pressure endpoints. If possible, inspect elements and remove samples for analysis annually. Chemical cleaning of non-radioactive elements can improve precoat uniformity and extend element life. Further, high energy backwash systems minimize element fouling.

CHOOSE PROPER PRECOAT MATERIALS: Precoat composition can be tailored to the contaminant level found in the condensate stream. Different ratios of cation to anion resin or resin fiber mixtures will remove specific contaminants or groups of contaminants. See the following sample ion exchange reaction equations for general guidance:



Top photo: Environmentally conscious Graver properly handles all waste from powdered resin processing. Bottom photo: Septum showing evenly distributed, uniform precoat layer across entire length.

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PRECOAT BASICS

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PREPARE PRECOAT PROPERLY:

When mixing powdered cation and anion resins, monitor $V15_{15}/V_0$ and supernatant turbidities to ensure mix acceptability. When necessary, add polyacrylic acid to each mix to ensure proper floc size for complete element coating and to prevent resin reflocculation. Minimally mix premixed or fiber-containing precoat materials as they are applied to the elements; these products are already floc-size adjusted and thoroughly mixed during manufacturing/packaging.

> *Graver offers its Powdex® powdered resins in three ionic forms: hydrogen form cation, or PCH (H+); ammonium form action or PCN (NH4+) and hydroxide form anion or PAO (OH-). In addition to Ecodex® with its own wide range of fiber and charge properties, Graver also offers Powdex Premix options.*

APPLY PRECOAT PROPERLY:

A minimum and uniform depth of precoat material is necessary to allow enough retention time for the ion exchange reaction to occur; precoat flow rate is critical to good precoating. Lower flow rates do not provide sufficient velocity to carry precoat to the tops of the elements. Conversely, excessive flow rates can scour the precoat materials from the bottoms of the elements. Precoat addition (clearing) time is also important; adherence starts on the ends of the elements closest to the tube sheet and migrates to the opposite end as differential pressure builds on the precoated portions. If the resin is added too quickly, the differential rise could prevent an adequate precoat on the opposite end of the precoat element.

Q: How can I manage the powdered resin slurry concentration to ensure proper precoating?

A: In nearly all cases, the more dilute the concentration the better. This is true for a number of reasons:

- As the resin slurry enters the precoat vessel, velocity drops and the more dilute concentration of properly size flocced particles adhere more consistently to the precoat septum. This leads to a very consistent, uniform depth precoat across the entire surface of each cartridge precoat septum.

- Longer precoating cycle time also reduces the concentration and further enhances the precoat uniformity.

However, there are practical limits to managing cycle times and concentration levels:

- You should complete the precoat addition within 25 to 45 minutes.

- Standard precoat resin dosage is 0.2 pound per ft^2 of surface area.

- Typical septa are 2 to 2.5 inches in diameter and 60, 70, or 80 inches in length.

> *Facilities must follow proper precoating procedures to obtain the best condensate polishing performance from powdered precoat demineralizer systems. Proper precoating also extends element life.*

All precoat system designs can achieve dilute concentrations:

- Single precoat tank systems: precoat inlet, outlet, and recycle valve ratios define concentration entering the precoat vessel.

- Advanced precoat systems: small precoat mix tank feeds a large precoat dilution tank, metering resin mix at a set rate to control concentration entering the precoat vessel.

- Manual addition to the one precoat tank system: add one bag of resin precoat product at intervals of one to two minutes between additions. Intervals can be extended to three to five minutes, depending on the number of bags added and the overall expected precoat time.

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PRECOAT BASICS

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A sample of Powdex® Premix 22N, one of many Powdex products for precoat demineralizer systems that disperse easily for even precoating.

Q: Why is the backwash step that removes spent precoat vital to maintaining good system performance?

A: All of the powdered resin must be removed so a clean surface is available for the next precoat. This clean surface ensures the precoat step proceeds without disruption, provides consistent, uniformly distributed precoat. Further, rigorous backwashing maintains septa cleanliness over many cycles and greatly improves the life of the septa.

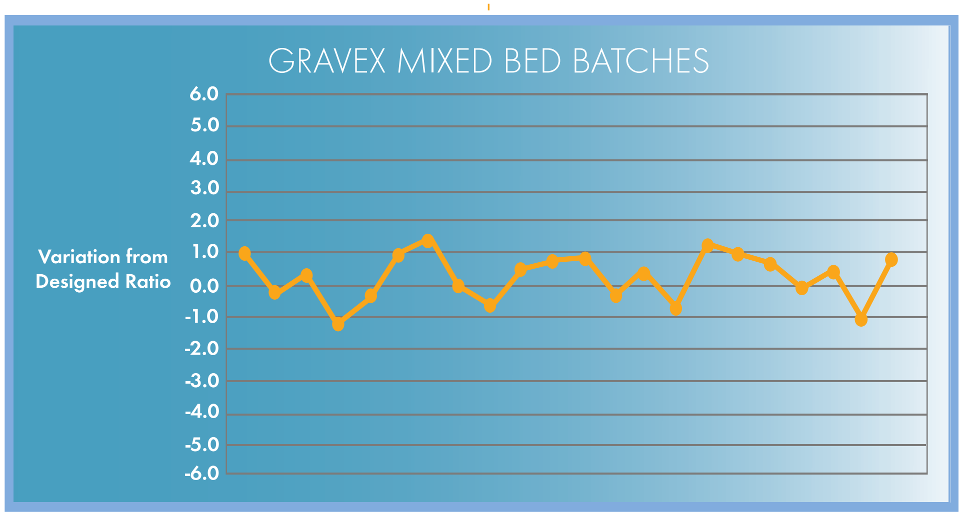
Backwashing uses a mixture of air and water; the air is the most effective cleaning agent while the water is primarily a transport medium that removes the spent precoat from the vessel. An air surge system maximizes instantaneous air flow and pressure, ensuring maximum cleaning while limiting water consumption. However, standard backwash systems work well when properly maintained and operated; ensure that air flow is set at the system design maximum and that sufficient water is used to remove the spent precoat. ■

MIXED BEDS: UNIFORM BLENDING ENSURES TOP PERFORMANCE

Graver's Innovative Equipment Ensures Superior Blending

Graver employs state-of-the-art blending techniques to mix cation and anion resins for mixed beds featuring Gravex® Nuclear Grade Resins. The blender tank in the top right photo rotates on its axis to thoroughly mix resins without the aid of water. Dry blending yields an exceptionally uniform mix with a typical ratio value of +/- 1% throughout a process batch; every drum has the same ratio. Conversely, the industry standard wet blending used by many resin suppliers has a typical ratio allowance of +/-3% in every drum, with a possible delta of 6% drum to drum. Wet blending, which bubbles air through a mixture of water and resin, can cause resin settling before packaging; the heavier cation settles to the bottom when water is drained prior to packaging.

Graver prepares many mixed beds with the dry blending technique but has also revolutionized wet blending for larger batches. The tank shown in the bottom right photo, employs a proprietary air and water mixing process that also eliminates resin separation. The chart below shows the typical ratios of mixed bed batches produced by both tanks. ■



CONDENSATE POLISHING AND FILTRATION FOR COMBINED CYCLE UNITS

Graver recently advertised its combined cycle gas turbine condensate polishing (CP) and filtration services in Combined Cycle Journal. The ad complements our Summer 2013 Powerline® that discussed CP technologies for these facilities. CP is vital to CCGT performance: it safeguards assets, stabilizes cycle chemistry, protects steam turbines and HRSG, and optimizes operations. Options include:

- **Precoat filter demineralizers:** This innovative technology – using powdered resins in custom-built equipment – economically removes suspended and dissolved contaminants. Facilities can spec in or retrofit these low-maintenance systems.
- **Disposable and backwashable filters:** Filters trap suspended contaminants. These short-term solutions don't remove dissolved contaminants, but are better than no CP treatment.
- **Deep bed ion exchange systems:** Often ideal for fossil and nuclear power facilities, this technology doesn't suit CCGT plants. The systems require regular maintenance and don't offer reins flexibility for changing contaminant profiles.

Contact your Graver representative for more information about Combined Cycle CP needs.

Click here to view more information about CCGT condensate polishing in our summer 2013 Powerline.

SALES & SERVICES

UNITED STATES

Graver Technologies, LLC
200 Lake Drive
Glasgow, DE 19702
P (800) 533.6623
P (302) 731.1700
F (302) 731.1707
E info@gravertech.com
W www.gravertech.com

Anand Harohalli
Director Business Development
P (302) 731.3543
C (302) 319.0353
E anand@gravertech.com

Seth Kaufman
Regional Manager NW/Canada
P (704) 854.3422
C (704) 904.5168
E skaufman@gravertech.com

Charlie Mosser
Technical Service Manager
P (817) 326.3626
C (817) 233.9358
E cmosser@gravertech.com

Wayne Norwood
Regional Manager Southeast
P (301) 953.7731
C (301) 332.7934
E wnorwood@gravertech.com

Brian Raab
Utility Filter Product Manager
P (302) 731.3512
C (443) 907.9113
E braab@gravertech.com

Gil Royal
Utility Sales Manager, North America
P (302) 731.3554
C (302) 668.4163
E groyal@gravertech.com

Al Tavares
Ion Exchange Product Manager
P (973) 690.5290 ext 2370
C (201) 787.3696
E atavares@gravertech.com

Maureen Vollinger
Global Customer Service/Inside Sales
P (302) 731.3516
P (800) 533.6623
F (302) 369.8356
E mvollinger@gravertech.com

Dr. Peter Yarnell
Ion Exchange Development Group Leader
P (302) 731.3529
C (302) 731.1707
E pyarnell@gravertech.com

Mark Koster
President, International Utilities Division
P (302) 731.3513
C (302) 463.5896
E mkoster@gravertech.com

CHINA

Graver Technologies, LLC
RM 16D, Building B
No.1118, Changshou Road
Shanghai, China 200042
P (86) 21.5238.6576.608
F (86) 21.5238.6579

Xiaoyun Huang
Regional Sales Manager
C (86) 186.2800.1300
E xhuang@gravertech.com

Xiaoyun Li
Customer Service
P (86) 21.5238.6576
F (86) 21.5238.6579
C (86) 139.1896.1206
E xli@gravertech.com

Qingyuan Liu
Regional Sales Engineer
C (86) 136.2371.4398
E qliu@gravertech.com

Pei Tao
Sales Representative
C (86) 187.2174.7242
E ptao@gravertech.com

Xiangdong Xu
Regional Sales Manager
C (86) 139.1058.0025
E xuxd@gravertech.com

Erbao Zhang
Chief Representative
C (86) 137.0188.2885
E ezhang@gravertech.com

EUROPE

Graver Technologies, LLC
Koenigstrasse, 10c
D-70173 Stuttgart, Germany
P (49) 711.3154.7160
C (33) 6.19.33.11.10
F (49) 711.3154.7170

Robert Schiedlbauer
European Sales Manager
P (49) 711.3154.7160
C (33) 6.19.33.11.10
E rschiedlbauer@gravertech.com

Graver Technologies
The Marmon Group
A Berkshire Hathaway Company

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