



CONDENSATE POLISHING TECHNOLOGIES FOR COMBINED CYCLE POWER GENERATION



CONDENSATE POLISHING POWERS COMBINED CYCLE OPERATIONS INCLUDING NGCCS

Condensate polishing (CP) is an essential component of combined cycle plant design and operation because high purity condensate maximizes uptime. CP safeguards high-value plant assets by reducing startup/downtime, stabilizing cycle chemistry, minimizing corrosion transport and optimizing operations. CP is particularly important for air-cooled condenser (ACC) systems, once-through steam generators and plants with frequent startups. Utilities can't afford to ignore this vital and economical system that consumes a tiny portion - typically 1% - of plant construction budgets.

Graver Technologies and Graver Water Systems (Graver) provide the world's best CP for combined cycle operations of all sizes, footprints, locations, equipment types, flow rates, chemistry profiles and condensers. Nobody else in the world treats water as well as we do.



**// Graver has supplied
more critical CP systems
around the globe than
any other company."**

POWDEX®: ULTIMATE CP WITH IMPRESSIVE DURABILITY

The Powdex® precoat filter demineralizer system removes both suspended solids and ionic contaminants in a single compact unit. These proven high performance systems are customized to any power plant design and quickly achieve target chemistry for fast online operation. Powdex systems are particularly suited for ACC facilities' higher condensate temperatures and corrosion product transport levels.

Powdex stands alone as the most economical and effective CP choice for all types of combined cycle plant operations. These systems:

- **Fit any footprint:** New and retrofit Powdex systems fit vessels, precoat septa, piping, state-of-the-art process controls and ion exchange resins into very compact spaces.
- **Install quickly:** Off-site construction and skid-mounting mean quick installation and rapid start-up.
- **Remove soluble and suspended contaminants:** Systems capture suspended particles, iron, copper silica, activated corrosion products and salts, and more.
- **Meet tough challenges:** Systems address flow rates, particulate types and chemistries including unusual heavy metals.
- **Operate at higher temperatures:** Powdex anion is not subject to the same 60°C temperature limit as bead anion exchange resin to avoid degradation. New Powdex resin is applied with every precoat.



- **Offer septa flexibility:** Aegis® premium wound polypropylene precoat septa with stainless steel cores and fittings are used world wide. Aegis DualGuard® septa represent the latest technology advance, combining the benefits of precoat septa and pleated filters; these septa may be operated with or without a precoat.
- **Perform effectively and are easily maintained:** Systems do not require regeneration chemicals. They feature automatic backwashing. We train operators and support our systems for life.
- **Lead the industry:** We perfect equipment and products through continual development investments, a robust R&D pipeline and frequent pilot testing.

// Graver invented
the first precoat filter
demineralizer more than
half a century ago."

BACKWASHABLE AND DISPOSABLE FILTERS: EXCEPTIONAL PARTICLE FILTRATION

Two types of filters meet CP filtration needs: backwashable and disposable. Standalone filtration is not recommended for ACC facilities due to high oxidation and degradation rates at shutdown.

Aegis® AFA® Pleated Backwashable Filters:

These filters require Powdex® housings and last many years with proper backwashing. They remove particles but do not remove dissolved contaminants. For a small additional cost over AFA filters alone, full Powdex systems remove both particles and dissolved contaminants.

Aegis® TurboGuard® Pre Filters: In Graver's custom housing, these disposable filters exhibit high dirt-holding capacity before replacement is required. They exhibit low pressure drops at specified flow rates. Easy-to-replace TurboGuard filters are available in a range of micron ratings.

DEEP BED ION EXCHANGE SYSTEMS: BEST SUITED FOR HIGH TDS WATERS

Graver pioneered regenerable deep bed ion exchange systems for fossil and nuclear plants. Deep beds remain the recommended technology for treating high levels of dissolved solids. However, deep bed systems in combined cycle facilities have the following limitations:

- **High system cost:** With regenerant chemical and disposal expenses, deep beds can cost twice as much as precoat filter demineralizers.
- **Increased operator attention:** Maintenance tasks include chemical application, disposal management, resin replacement and system adjustments.
- **Inflexibility:** Deep bed resins are costlier and difficult to adjust or replace to address condensate variability. Powdex® systems easily accommodate resin adjustments.
- **Bead resin degradation:** High condensate temperatures, particularly at ACC plants, can prematurely degrade deep bed anion exchange resins, whose recommended maximum operating temperature is 60°C. Continuous exposure to elevated temperatures degrades anion beads, thus reducing capacity, shortening bead life and requiring more frequent resin purchases.



THE WORLD'S COMBINED CYCLE CONDENSATE POLISHING EXPERTS

Part of Berkshire Hathaway Company's Marmon Water Group, Graver pioneered high-performance condensate polishing and water treatment for power generators around the globe. We offer the world's most complete, durable, high-performance solutions for combined cycle CP and filtration needs.

Graver excels in ion exchange and filtration expertise, meeting today's tough requirements for high-purity condensates and process waters. Our revolutionary powdered resins, precoat septa and filters treat more than 6.5 billion gallons of process water daily in over 38 countries.

Graver also designs, engineers, manufactures, installs and maintains water treatment equipment and control systems for customers worldwide. We offer exceptional service and parts for condensate polishers, filters, ion exchange systems and much more.

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