



**TECHNICAL  
ARTICLE  
SERIES**

# **Critical selection factors for thermoplastic pumps**

**ARTICLE #** TL-132

**INDUSTRY:**

**ENTITY:** Various

**SOLUTION(S) PUMPED:**

**PUMP TYPE(S):**

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# Pumps Play Critical Role in Zero Discharge

*Reprinted from Pumps & Systems  
Ken Comerford*

The pumps used in the recovery system behind this nickel/chromium plating operation must handle acidic and alkaline plating and cleaning solutions over a broad pH range, commingled chemical waste streams, and DI high purity water recovered from the ion exchange system. Here's how they do it.

When the process engineers at Columbia Manufacturing, Inc. (Westfield, MA) decided to upgrade their chromium plating line, they were determined to take advantage of the latest and most innovative developments in quality manufacturing procedures while simultaneously serving the growing demand to protect the environment by minimizing or eliminating the discharge of chemical wastes.

According to Ali Salehi, senior vice president of manufacturing and engineering, the company set these specific goals:

Find a way to recover and reuse a major portion of the 150,000-gpd of municipal water required for cleaning, plating and rinsing the thousands of feet of metal tubing used in the manufacture of school furniture and bicycle components.

Install process systems to recover and reuse the costly chemicals required for the chromium and nickel plating solutions involved in applying decorative and corrosion resistant coatings to the structural tubular components of the products.

Create a waste treatment system that would eliminate costs related to securing and maintaining exemption from the Massachusetts DEP air and wastewater discharge permits.

These goals have been consistently met by the installation of an automated, return-type nickel/chromium Napco plating system, and a "zero discharge" resource recovery treatment system designed, built and installed by CASTion Corporation (Worcester, MA) and Columbia.

This system is a custom-engineered Controlled Atmosphere Separation Technolog (CAST) packaged concentrated wastewater and valuable chemicals recovery system. CAST can be furnished as a stand-alone wastewater and chemical recovery system, or as part of an integrated plant-wide program to minimize or completely eliminate costly disposal of hazardous waste or process effluent.

This patented program recovers close to 100 percent of valuable chemical resources or wastewater and permits their immediate recycling or reuse at the facility. Because of the wide variety and pH values of process chemicals and waste fluids being treated and transferred, pump design and material selection are critical and must be integrated into the specifications of the custom-engineered wastewater and chemistry recovery system.

Critical to the success of the innovative design features of this new system was the ability to achieve safe and dependable recovery and recirculation of the many costly chemicals used in the automated plating systems, substantial reduction in the huge volume of municipal water required in cleaning and rinsing operations, and the capability of economically providing the large quantities of distilled water required from the counter current ion exchange system. The pumps selected had to be able to handle acidic and alkaline plating and cleaning solutions over a broad pH range commingled chemical waste streams, and DI high purity water recovered from the ion exchange system.

To handle this variety of aggressive fluids, including sodium hydroxide, hydrochloric acid, sulfates, dissolved inorganic contaminants, distilled water and other waste chemicals, the system designers ruled out metal pumps and specified that the pump casing, impeller, flanges and other components coming in contact with the fluids must be made of solid homogeneous Kynar® polyvinylidene fluoride (PVDF) from Arkema, Inc. (Philadelphia, PA).

The specific pump construction selected for handling these corrosive and aggressive fluids was the Chem-Gard CGA horizontal centrifugal design from Vanton Pump & Equipment (Hillside, NJ) that meets ANSI-B-73 and international DIN standards for process pumps.

These end suction centrifugal pumps combine low maintenance centerline discharge and back pullout features and are constructed with a unique wide open seal, sliding bar pedestal configuration that simplifies seal inspection and maintenance.

The system utilizes three of these ANSI thermoplastic centrifugal pumps: one pump for flows of 400-gpm against a 100-ft total dynamic head, and two other pumps for flows of 200-gpm. All fluid contact components are made of Kynar PVDF. Even the stainless steel shafts in these pumps are isolated from the corrosive fluids by thick shaft sleeves made of the same chemically inert thermoplastic.

The turnkey wastewater and product recovery system has resulted in the following advantages:

All recovered wastewater is returned to the rinse baths, and plating solutions that are recovered are returned directly to the plating tanks.

Concentrated wastewater from the cleaning and plating lines have their own CASTion ion-recovery systems and are recovered as DI water and are then recycled for use in the rinse tanks.

98 percent of the nickel and chromic acid plating chemicals are recovered and re-used.

There is no discharge into sewer or air, so the company needs no permits from DEP, and is exempt from RCRA permits.

Six hundred pounds of chromium trioxide are recovered each week and returned to the plating tank.

As a result of these changes and installation of the recovery systems, Columbia dramatically reduced its overall municipal water use from 150,000-gpd to 3000-gpd. The completely automated process and

wastewater treatment systems, using rugged, nonmetallic, chemically-inert thermoplastic recirculation pumps, have substantially increased productivity while reducing maintenance costs.

This closed loop plating facility and the CASTion zero-discharge flash distillation wastewater and chemistry recovery system not only resulted in appreciable cost savings, but also brought the company the Governor of Massachusetts "Green Seal" award for service to the state in its drive to improve the environment.

Captions:

One of the three centrifugal pumps used to circulate corrosive fluids at Columbia Manufacturing. All fluid contact parts, including the shaft sleeve isolating the stainless steel, are made of Kynar® PVDF.

Diagram of the CASTion zero-discharge flash distillation system installed at Columbia Manufacturing.