
Zero Process Water Discharge for a Two-stage Washer

Ace Plating, Part IV

By: Jerry Brown

Introduction

Ace Plating Company is a small Chicago job shop offering a variety of decorative electroplating finishes including various types of brass, nickel, bronze and copper. In 1993, Ace Plating used about five million gallons of water annually. In light of new discharge fees and what appeared to be ever-changing environmental regulations, Ace Plating sought assistance from the Illinois Sustainable Technology Center (ISTC) to reduce disposal costs and minimize environmental liability. In 1995, the management at Ace - with ISTC's assistance - launched an aggressive effort to use environmentally responsible processes and procedures in all of its business operations. By October 2000, Ace had become a zero process water discharger. For additional information about how this was achieved, see ISTC publications TN13-066, TN13-071 and TN13-078.

Powder Coating

In May 1997, Ace entered the powder coating business by installing a small batch powder coating system. By October 1999, Ace was operating the small system two shifts, five days per week, in order to keep up with production demands.

In April 2000, Ace Plating decided to expand

its powder coating business to meet client demand. Ace purchased a used powder coating system that included a powder coating spray booth, a two-pass oven and a two-stage washer. The first stage housed an iron phosphate cleaner bath and the second stage was a rinse bath. The system was originally designed to have a continuous overflow of cleaner and rinse water to the sewer. Since Ace had previously achieved zero process water discharge at its plating operation using recycle technology and evaporation, the overflows from the washer became a concern for Ace.

If the system were operated as designed, the added discharge would be more than Ace's 17-gallons-per-hour (gph) evaporator could process. Ace contacted ISTC in order to obtain assistance with minimizing the amount of water discharged from the two-stage washer.

Design

An ISTC engineer worked with Ace's fabricator to design ways to limit water discharge. Overflow from the cleaner tank (stage 1) was eliminated. This design change meant that the first stage would be recycled continuously. Some contaminants would be removed along with cleaner dragout. If build-up of contaminants in the cleaner became too great, the cleaner would be dumped regularly until a small ultrafiltration unit could be installed to keep the cleaner free of oil and particulates.

The design of the existing nozzles at both the first stage and the second stage were not changed. The cleaner stage housed six spray headers and the rinse stage housed four spray headers. A new intermediate spray header had to be installed to keep parts wet because the distance between the cleaner and the rinse tank is ten feet. The new spray header was installed in the transition section where the washer floor drained back to the cleaner section. This spray header was designed to spray the parts with fresh water after the parts leave the cleaner section of the washer. The water draining into the cleaner tank would be make-up water for dragout and evaporation losses. A new nozzle was specified for this service. Although the header was designed for a full complement of nozzles, the number of nozzles initially installed was calculated to provide make-up water only for evaporation losses. After empirically determining dragout and other losses, some of the spray header plugs could be replaced with spray nozzles.

Results

The make-up water to the two-stage washer system was designed for manual addition instead of automatic. This would allow operators to gauge daily water addition and alert supervisory personnel to any abnormalities. Ace Plating started up its powder coating line in January 2001.

The submerged serpentine heater at the cleaner tank requires 30 to 60 minutes to heat the cleaner to 120 degrees F. The cleaning of parts begins as the system continues to heat the cleaner tank to 130 degrees F. The system operates eight to nine hours daily.

Since start-up, Ace has not dumped the cleaner tank or the rinse water tank. The rinse water tank did develop an odor after about six months of operation. One gallon of bleach (0.5% sodium hypochlorite) was added to the 600-gallon rinse water tank. The system has operated four additional months since that time with no repeat of the odor problem.

At the start of each day, water is pumped from the rinse tank to the cleaner tank to make up for evaporation and dragout losses. On average, about 140 gallons of make-up water is required daily to bring the level in the 1300-gallon cleaner tank back to full. This is in addition to the water that is continuously sprayed from the rinse tank to the cleaner tank via the transition header. After rinse water is pumped to the cleaner tank, fresh water is added to the rinse tank.

Ace operating personnel have experienced no problems coating parts after ten months of operation. The cleaner concentration is checked weekly and additional cleaner is added as necessary. If the cleaner becomes unusable in the future, it will be hauled off site and the rinse water (stage 2) will be used to make up new cleaner solution. Ace Plating officials report they are extremely pleased to have implemented zero process water discharge at their two-stage washer.

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