DE DIETRICH PCR VACUUM EVAPORATOR
For PLATING CHEMICAL RECOVERY

De Dietrich “PCR” Vacuum Evaporators are designed for point source recovery of plating bath drag-out and associated rinse water for direct return to the plating process. They are also ideal for end-of-pipe volume reduction of pretreated wastewater and for brine concentration.

To accommodate the greatest number of plating bath chemistries, some of which are thermally sensitive, De Dietrich provides three series of evaporators for low, medium or high vacuum operation so the vacuum and maximum evaporation temperature can be matched to the chemistry being recovered and concentrated. To assure long, dependable service, each evaporator is constructed of materials that are carefully selected for compatibility with the bath chemistry being processed.

Diagram No.1 illustrates one of several hydraulically effective arrangements for connecting a DDPS PCR Evaporator to a multi-stage, counter-current rinse system for effective point source recovery of both dragged out bath and associated rinse water.

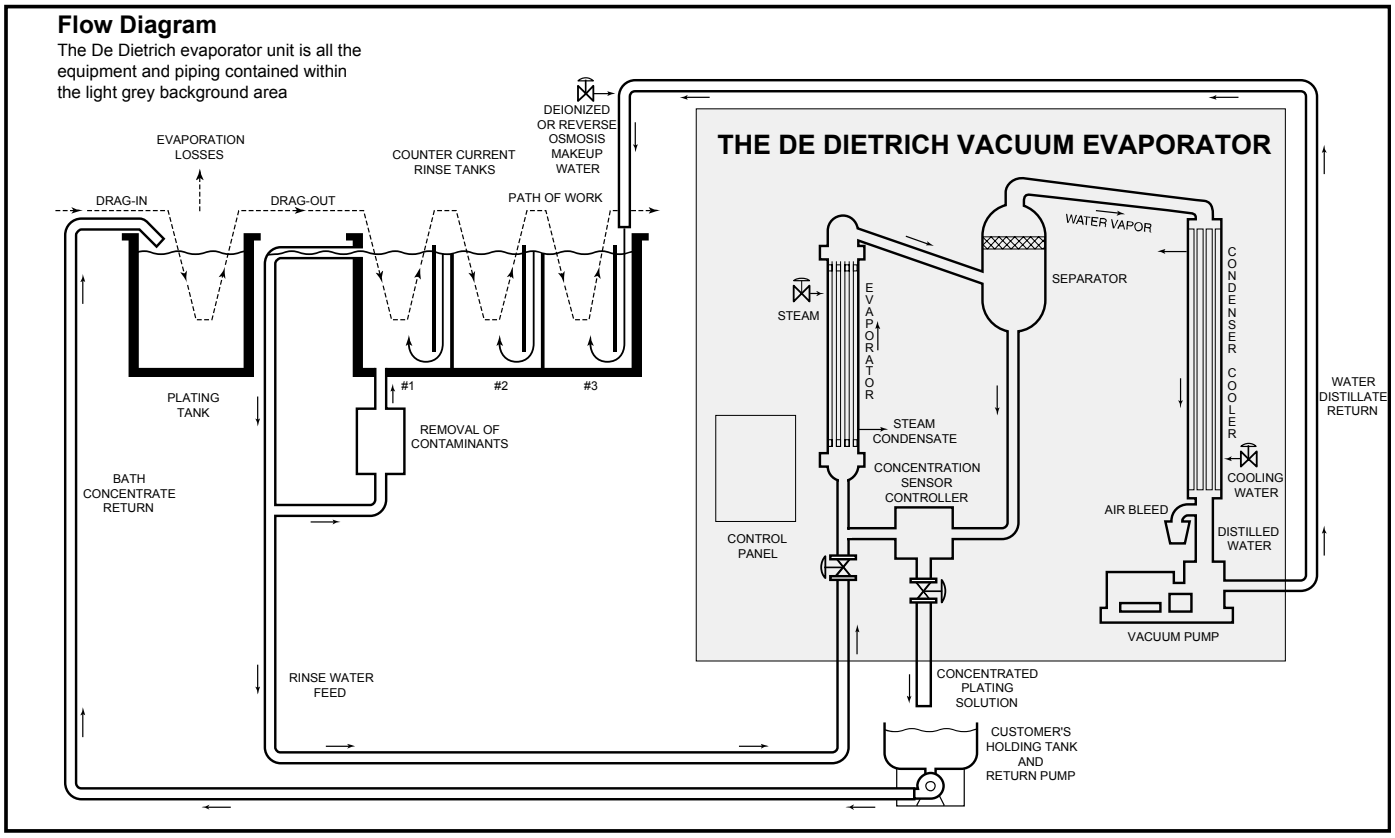

Diagram No.1

The equipment depicted within the shaded rectangle on the diagram constitutes the De Dietrich PCR Evaporator. Each evaporator is comprised of a heated boiler section, a vapor/liquid separation chamber, a water-cooled condenser, a vacuum system with liquid seal reservoir and a PLC operated, electro-pneumatic control system.

Of all the separation technologies used by the surface finishing industry to minimize waste and recover plating bath chemistry or plating bath components from rinse waters, vacuum evaporation, combined with an intelligently designed and operated counter-current rinse system, effectively serves to ***reverse plating bath drag-out*** and minimize rinse water usage. No other separation method can claim that capability.

FUNCTIONAL DESCRIPTION

The De Dietrich PCR Vacuum Evaporator is classified as a single stage, fully automatic, semi-continuous vacuum concentration system. It features a time-tested design that utilizes natural circulation heating and, on the process side, requires only two valves (a feed valve and a drain valve) and only one pump (a liquid ring vacuum pump).

The overall design of the De Dietrich PCR Evaporator is purposely simple. It automatically processes plating rinse water streams to continually separate and discharge water as a distillate, while internally accumulating and concentrating the recovered bath drag-out. When the fixed volume of recovered concentrate reaches the programmed density value (usually the bath concentration), it is discharged to an external batch holding tank for optional evaluation before being returned to the plating tank. Then, automatically, the evaporator begins another concentration cycle. High vacuum models operate at low recovery temperatures to minimize or prevent degradation of thermally sensitive bath chemistry.

All De Dietrich PCR Evaporators are push-button operated and PLC controlled. The preferred heating medium is clean, low pressure, saturated steam. Models can be supplied to accommodate hot water heating systems. Contact De Dietrich for details.

UTILITIES REQUIRED

Steam:	12 -15 PSIG, Clean, Saturated
Cooling Water:	Municipal or Cooling Tower; at < 85 ^{o}F
Electric Power:	2 –5 kW (Depending on Model) @ 220/460V, 3 Hz, 60 Cycle
Plant Air:	90 PSIG, Filtered, Oil Free

START-UP, OPERATION, SHUT-DOWN

The unit is fully automatic and will alarm and/or shut down should there be an interruption in feed or utility supply. Before initially starting the unit, confirm that a supply of plating rinse feed water is available, that the cooling water supply to the evaporator condenser is manually turned on and that the vacuum pump liquid seal reservoir is full of clean water.

The START button located on the control panel automatically initiates the following sequence of operating:

- The vacuum pump is activated and the internal pressure in the unit will start to decrease.
- When the preset operating vacuum is attained, and provided feed liquor is available, the feed valve will open slowly to admit rinse feed to a preset and controlled level in the evaporator, upon which
- The steam control valve will open to admit steam to the boiler jacket at the operating steam pressure set point.

Usually, within a minute or so, boiling action commences in the vertical boiler tubes. A rapid moving, two-phase stream of liquid concentrate and water vapor is discharged from the top of these tubes and directed into a large-diameter Vapor/Liquid Separator chamber where the stream velocity substantially decreases and the two phases readily separate by gravity. The vapor-phase (water) is drawn upward by the vacuum and passes through a mesh-type entrainment pad which removes any entrained droplets of liquid concentrate.

The clean water vapor is then drawn through the vertical water-cooled condenser where it is condensed and sub-cooled. The resulting liquid water distillate is continually discharged from the system by the liquid ring vacuum pump and directed either to a suitable holding tank or returned directly to the last rinse tank in the multi-tank rinse system.

Meanwhile, the separated liquid concentrate, assisted by gravity and the natural circulation effect of the thermosyphon heating design, is directed back to the boiler where it is mixed with fresh feed solution just before the stream re-enters the bottom of the boiler and the heating cycle is repeated. As water is evaporated from the concentrate, more feed liquor is drawn into the system to maintain a steady liquid level in the boiler – separator circuit.

Over time, the concentration of the liquor that is circulating in this loop increases. The density of this column of liquid of fixed height is monitored. When the set-point density value is reached, the system shuts down automatically, vents to atmosphere and executes the concentrate discharge cycle. The concentrate drains by gravity into a suitable holding tank where it can be assayed if desired or pumped directly back to the plating tank. The only interruption to the continual discharge of water distillate occurs during the concentrate dump cycle, which only lasts 5-10 minutes. The unit will then automatically refill and start the next concentration cycle.

Any loss of feed, cooling water, steam or vacuum as well as out-of-range level or density signals will automatically place the unit in stand-by mode and will sound an alarm to alert the operator.

RECOVERY EFFICIENCY

Capture % or Recovery Efficiencies of 99.97% and beyond are easily achieved by the proper combination of evaporator and multi-stage, counter-current rinse system operating at the proper rinse ratio. Rinse Ratio equals the ratio of the rinse-water flow rate (gpm) to the bath drag-out rate (gpm) required for a given rinse system design.

Percentage capture is measured by comparing the concentration of the primary bath cation in the last rinse tank of a multi-stage rinse system with the primary cation concentration in the bath.

DDPS EVAPORATOR CAPACITIES (Evaporation Rates)

DDPS Vacuum Evaporators are available for acid or alkaline service, and in a range of evaporation capacities suitable for most Surface Finishing Industry applications – typically in the 17 to 300 GPH range. Larger units and custom, or purpose-designed, units and systems can also be provided.

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