SERFILCO

IMPROVED AGITATION AND FILTRATION OF ANODIZING PROCESS SOLUTIONS

Improved quality and reduction in rejects require improved control of all processes. Filtration, purification and new techniques for agitation will help reduce cost, environmental problems, rejects, rework and improve profitability.

A review of published literature on anodizing processes does not typically touch on the subject of filtration recommendations. For the most part, the chemicals used are non-proprietary commodity items (except in dyeing and cleaning). Sulfuric acid anodizing solution, nickel acetate seal, nitric acid deoxidizer and caustic etch were considered expendable at one time. The wastes in past eras were carefully mixed to neutralize acidity / alkalinity, metals were precipitated and removed and the effluent dumped. Current regulations demand more complex treatment and much lower discharge concentrations.

Water usage at facilities is monitored and mandated to be reduced. Regulatory pressure demands less loading on waste treatment. At the same time, these relatively inexpensive raw materials are becoming a more significant portion of operating cost. If we can effectively double or triple solution life, the savings over time can be tremendous!

The contamination introduced to the anodizing tank does not normally fall from the sky in sufficient quantities to be the major source of trouble in the process. Therefore, we must take into consideration any and all ways in which solids or other impurities such as oily substances could get into the process tanks, and eliminate them at the source.

Feed waters used for solution makeup in the process are normally contaminated with particulate and residual chlorine. These contaminants will prematurely deplete the ion exchange resins which produce the deionized feed water for solution makeup. Therefore, filtration and carbon purification are required to preserve resin bed integrity.

Cleaning is critical to all metal finishing operations. It is necessary to remove lubricants from extrusion and stamping operations, as well as compounds from grinding and machining operations. Because of the phase-out of vapor degreasing for environmental reasons . . . aqueous cleaning (and semi-aqueous cleaning) with / without ultrasonics will be relied on for the total job of removing grease, oils and compounds.

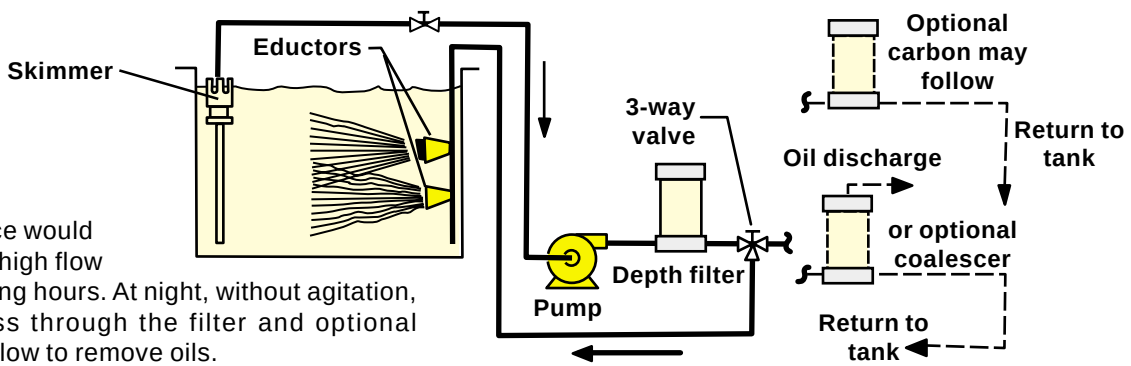
Since quality anodizing begins with good cleaning, we should start our scrutiny with the cleaner and its rinses. Vigorous agitation of the cleaner accelerates soil and oil removal due to the impingement action of the solution on the parts. If we add filtration through a coarse media to maximize solids holding capacity, we will extend the cleaner's service life. If excess oil floats to the surface, it can be conveniently removed during downtime by decanting or skimming the surface. Additional oil may be removed utilizing a coalescing media to remove non-emulsified oil (Figure 1). A prefilter may also be required to keep the coalescing element free of solids.

Subsequent desmut and pickle solutions and their associated rinses can also be clarified in this way, It should also be stressed that the addition of a skimmer to the pump suction at each tank in the pretreatment cycle will minimize carryover of surface contaminants to the next tank by way of surface tension. The addition of a chamber of carbon prior to discharge will achieve the maximum final adsorption of any oily substances. These oils should never reach the anodize or seal tanks.

We now have probably prevented 50-60% of solids and other impurities from getting to your anodizing tank. So, what else should or could be done to help prevent solution contamination? Of course, quality of cathodes, make-up water, chemicals should all be considered — even the air which passes over the tank to an exhaust vent may be dropping solids due to the moisture in the air right over the tank. It is also possible that air used for agitation is not clean (that is, free of insoluble particles); it may be carrying vapors from other process operations which are absorbed into your process solution.

A method of agitating the anodizing solution with a combination of high flow centrifugal pumps which draw solution from the tank and return it through a sparger system similar to that used for air agitation is now being used. However, rather that just perforating the pipe, we strategically place eductors along the horizontal pipe to direct solution across the bottom of a tank or up in a cylindrical zone and into the recesses of the parts to replenish electrolyte *(See Figures 2 & 3 on next page).*

FIGURE 1



A typical sequence would be to agitate and high flow filter during working hours. At night, without agitation, liquid would pass through the filter and optional coalescer at low flow to remove oils.

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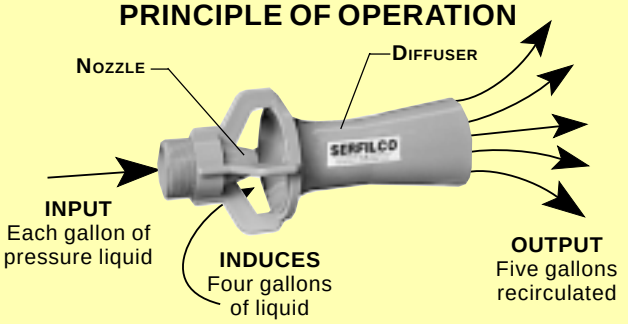
FIGURE 2

PRINCIPLE OF OPERATION



Liquid pumped into the eductor nozzle exits at high velocity, drawing an additional flow of the surrounding solution through the eductor. This additional flow (induced liquid) mixes with the pumped solution and multiplies its volume five-fold. The source of the pumped liquid (input) can be a pump or filter chamber discharge.

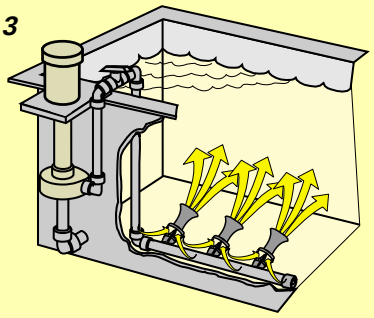
Experience has shown almost universal success of this method of agitation.

Consider the advantages:

- Elimination of vapors being introduced into the various solutions
- Elimination of uncontrolled temperature change
- Prevention of air bubbles from entering the suction lines of centrifugal pumps which could cause them to cavitate and lose prime.
- Minimizing of dye or seal solution breakdown due to oxidation

With pumped / eductor agitation, we are now operating with a solution which is totally self-contained. The amount of solids or vapors introduced is minimized and temperature is more easily controlled. It brings us one step closer to a "Clean Room Solution Environment". We can now proceed to filter the anodizing solution to remove any particles which got past the primary barriers.

FIGURE 3



PRETREATMENT TANKS

Cleaner tanks using 30-75 micron or coarser filter cartridges, and 3-4 10" cartridges per one hundred gallons (15 sq.ft. of surface area / 100 gallons) and at least 2 turnovers per hour are recommended. The tanks may also require an auxiliary pump and filter, and an oil separator to remove free oil, etc. with a sparger overflow system or skimmer. This auxiliary equipment is for continuous use below 160° F, or during spray system downtime.

Bright dip and etchants may be periodically filtered as required to remove precipitates or contaminants that will streak or spot the work, or to prolong the tank life. We recommend 15 micron filtration with carbon as required.

Desmut and pickle tanks should also be filtered to remove soils and oils, etc. that may be dragged into the tank or introduced because of air agitation. Use of an eductor system will reduce heat loss, fumes and misting from the tank surface.

ANODIZING SOLUTIONS

Because of the corrosive atmosphere above anodizing tanks, out-of tank, non-metallic pump and filter systems are recommended.

Sulfuric acid anodizing solutions

A separate pump and eductor system may be incorporated to reduce fumes, provide proper agitation, minimize the introduction of contaminants and optimize temperature control. Filtration will improve the appearance of the work and extend bath life. Cleaner heat transfer surfaces, with associated lower cooling costs, will result from filtration and improved bath circulation.

Phosphoric acid anodizing which is also used in composite manufacturing has important environmental advantages. However, microbial contamination as well as other soils must be removed to assure good adhesion.

Chromates and dye tanks can be filtered as required with 5-15 micron media. Continuous filtration may be required, depending on conditions, to remove precipitates and contaminants that will streak or spot the work, or to prolong the tank life. Oil in the tank will cause spotty or streaked work.

Dyes are often filtered to remove small particles and reaction products formed from interactions between the dye and solution dragged into the dye tank. Uniform color depends on dye solution integrity.

SEALS

Seal tanks should be continuously filtered and carbon treated when organic dyes are present. Precipitates that form in the seal tank, as well as reaction products with the dye, will form a smut on the parts which must later be removed. Seal tanks should be continuously filtered with 15 micron media, 2-3 turns per hour with 2-4 cartridges per 100 gallons, depending on loading. If organic dyes are present, continuous carbon treatment is recommended to keep the solution from discoloration.

CONCLUSION

Today's global market environment, with its emphasis on quality, low cost and environmental compliance, have forced many changes in manufacturing in all areas.

Environmental regulations have made the conservation of process chemicals a "must" for manufacturers. Treatment and disposal costs and their associated liabilities have changed the economics of solution replacement compared to the cost of filtration and purification to extend solution life.

Improved quality and reduction in rejects require improved control of all processes. Filtration, purification and new techniques for agitation will help reduce cost, environmental problems, rejects, rework and improve profits.