Updating Anodizing Equipment

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The parameters and criteria for purchasing equipment for successful anodizing will be presented, keeping in mind the trends in this industry towards cost savings, quality control improvements and waste minimization concerns. From chillers and rectifiers to tank configuration and cathodes, well designed equipment can add dollars of savings to parts produced through energy conservation, lower reject rates and process time cost reductions. Critical process areas and correct equipment selection will be emphasized to assure a modern, smooth running, quality anodizing line.

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What Direction Should Metal Finishers Take in Updating Equipment for Anodizing Lines?

When considering an update of anodizing operations we should look at the type of equipment and/or technology that is presently used in the anodizing shop. These may include lead cathodes or lead lined tanks, air lines supplied by compressed air, cooling accomplished by in tank coils fed by Freon or no cooling at all, tap switch rectification and manual operator controlled ramping.

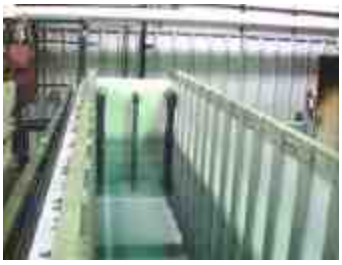
In many cases these systems, despite their limitations, have produced very acceptable parts usually due to the operators' ability to finesse his or her system to its ultimate performance. As we have seen in the past, the number of these dedicated and experienced anodizers has dwindled. Finding one is difficult and developing one is a long process. Therefore, it becomes imperative that we focus on improving the equipment to widen the window of producing acceptable work for today's more demanding, quality minded customers. Our goal should be to move in the direction of reducing operator dependence and narrowing the variables that require changes in the procedure. We will start at the anodizing tank and work through the entire anodizing procedure.

Tanks: See A1-A2

- Tanks should be designed for strength and low maintenance. We suggest poly propylene since it can give from 10 to 20 years of service without problems, is cost competitive, allows us to bring fittings in through the sidewall for unencumbered rim access, is electrically non conductive, and does not conduct heat through the wall as easily as metal tanks.

- Bring air and solution lines through the side wall just above the solution level, then down to the bottom of the tank and branch off from there. Run two lines of air down the parts center line, making sure that the agitation is coming in contact with the parts on its travel up to the surface. Cooled solution is fed down both sides of the tank under the cathodes with holes facing upward. Poly clips are used to secure the lines to the bottom.

- One large bottom drain is used as a feed for the acid circulation system.



A1 Air +solution spargers with al cathodes

A2 Typical large anodizing tank

Cathodes: See A1-A2

- Aluminum is the best choice for cathode. It is 7-9 times more conductive than lead, therefore saving 2-3 volts of energy when anodizing. It cannot contribute to the additions of other metals into the anodizing bath and it is lighter and easier to handle when replacing.

- Aluminum is the cathode of choice and alloy 6063 T6 is the proper alloy. If this alloy is used it will offer years of service with very little dissolved aluminum getting into the bath from the cathode. It usually cost more at purchase but its overall cost in operation and ability to deliver consistent current will easily make up for the initial cost.

- Cathode connection. Although there is some difference of opinion on welding versus bolting, my experience shows bolting is the way to go when installing Aluminum cathodes. The only requirement is that you must follow a sensible bolting procedure and maintenance schedule. Our bolting installation specification can be obtained at our website

Applying conductive sealant

Using 3/8 16 – 316 stainless bolts

Clean excess sealant

Installation configuration

- When sizing cathodes a ratio of 3-1 (anode to cathode) is the recommended ratio. Since the chance of every anodizing job falling into this ratio is slim, we have to understand that this is the ultimate ratio but variations off this are normal and acceptable. The closer

to this ratio you are, the better your consistency in anodizing. That is why being able to add or subtract cathode area by bolting can be of great advantage if the work load changes drastically.

Rectifiers:

- For type II anodizing 12-20 asf is recommended or can go as high as 30 asf. The range of voltage is 12-24. 24 volts will give the anodizer the most flexibility
- For type III Hard Coat 24-40 asf is recommended with some going over 50 asf. The typical voltage range is 40-100 with 75-100 being the most common.
- We highly recommend a built in ramp pot and suggest pulse as an option. Pulse can be purchased with the rectifier or there are some add on systems available in the after market

Typical rectifier

Cooling/Chiller sizing:

- The following is a guideline formula for chiller sizing. It can take into account your best estimate to insure the chiller keeps up with your overall production.
- Rectifier amps total = A = Nameplate output AMPS
- Rectifier volts total = V = Nameplate output Volts
- Power used during run = P (60%) Average power used including ramp and actual run
- Average tank load = L (%) The average workload in % of electrical current used your input.
- Conversion to tons = /3516
- A x V x P (60%) x L (%) / 3516 = tons of cooling required
- The last factor that must be noted is that chillers are rated at nominal tons which mean supplying water at 44ºf. The supply water must be a minimum of 10 degrees below the operating temperature of the anodizing tank. Therefore, if your anodizing tank is to operate at 32ºf your chiller must supply the required tons of cooling at 22ºf. This will tend to increase the nominal tons. An example is a nominal 14 ton chiller will give you approximately 8.1 tons at 22ºf.

Chiller choice

- When choosing a chiller the following considerations should be used to make an informed decision.
- Quality is important since saving a few percent on the initial purchase can easily be used up during down time in production. A simple one piece chiller made by a national company can save many hours of trying to find repair parts that may not be available for the specialty chiller locally. Also, most if not all chiller companies do not have any idea what anodizing is or how it works. So if you go direct to a local chiller supplier be ready to supply most, if not all, of the parameters to that company. Also, be ready to accept responsibility if the figures you supplied don't accomplish what you expected.

230 ton chiller installed for a hard coat type III line in Sullivan Mo.

Cooling supply system-glycol side-See A-3

In deciding how to supply your cooling to the anodizing bath these factors should be considered.

- Efficiency- How much of the energy consumed is going directly to cooling the anodizing tank?
- Safety- If there is a catastrophic accident, what problems do you have to deal with?
- Reliability- How much maintenance is involved with ongoing production.
- Environment- How does the chiller effect the environment?

We recommend using a glycol system including a pumping station to bring the glycol and water to the anodizing operation. By using polypropylene glycol which is FDA approved, you can limit problems when dealing with spills. Also by enlarging the holding tank you provide a reserve of cooled water in heavy production times. Doing this will keep efficiency up and eliminate hazardous material such as Freon from entering your production area as with direct cooling of the exchanger from the chiller. It also reduces the risk of allowing acid to come in contact directly with the chiller barrel. A ph monitor will help in detecting leakage/failure of the heat exchange and protect the chiller barrel The pumping station should be located as close to the chiller as practical with clear access to the anodizing/ heat exchanger area.

A-3 Typical glycol pumping station

Cooling supply system-Acid side-See A-4

- Using an out of tank heat exchanger with an acid pump will improve response when your anodizing tank requires additional cooling. Continuous circulation of the acid and intermittent circulation of the glycol is the recommended way of operating an efficient acid recirculation system. It provides added circulation of the acid in the tank and the cooled acid can be directed toward the parts for quicker parts cooling. The use of 316 L stainless will give the anodizer years of service without driving the cost out of sight. These plate and frame units are extremely efficient in removing heat from the passing anodizing solution. The formulas for the sizing of the heat exchanger and it accompanying pump are complicated and are best handled by the exchanger manufacturer or an informed equipment consultant, knowledgeable in the anodizing process. Generally magnetic drive/self priming pumps with strainer are preferable.

A-4 Compact pre piped acid recirculation module

Air agitation-See A-1, A-5

- Air should be supplied by a low pressure blower. This reduces the risk of introducing contaminates into the anodizing tank. Compressed air increases the risk of oil or other contaminates making there way into the air and then into the tank. The best approach is to purchase a separate low pressure blower for the anodizing tank so that air usage in other tanks does not affect the air supply in the anodizing tank. Spargers should run directly under the parts to be sure that solution passes each part evenly. Feeding air from both sides of the tank with valves to control flow will also help even out the air distribution. The hole size should be as small as is practical preferably around $1/16^{th}$. Air movement is very important so do not skimp in this area

A-5 Typical low pressure air blower

In conclusion look at your end point/goal and make decisions based on where you want to be in the future. Working that plan and making future purchases based on those parameters and these guide lines you will slowly create a state of the art anodizing operation. Remember it can be done if you plan ahead. By following these guide lines, whether as a complete package or by incremental stages of up dating – you will improve the quality of the parts produced, speed production, decrease rejects and lower your overall cost of production.