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Automated Type I Anodizing Line

**Precise Control of Anodizing Bath Temperature Helps Assure Repeatability of High Quality Anodic Coatings**

The ability to maintain consistent bath temperature in the anodizing tank is one of the most important factors in producing consistently high quality anodic finishes. It is widely accepted that the temperature range for Type II and Type III anodizing is + 2o F (1oC). Other anodizing processes such as phosphoric acid and chromic acid (Type I) anodizing don’t have quite as stringent requirements as this.

While anodizers know that an anodizing bath must be cooled, most anodizing tanks require both heating and cooling. Only the subject of cooling is addressed in this article.

When bath temperatures exceed the range limits the coating characteristics are more difficult to control from batch to batch. As bath temperature increases it becomes more conductive. This allows slightly higher current flow, which results in higher current density, and the anodic coating is formed faster. The opposite is true when the electrolyte is “too cold”. Wide variation in bath temperature can affect the anodic pore size, coating thickness and coating hardness and can even affect the way a load seals. The coating characteristics can vary from load to load if the bath temperature is not consistent. This results in difficulty of color matching, especially on dyed or electrolytically colored parts, but also on clear anodized parts.

There are two common methods of cooling the sulfuric acid anodizing electrolyte:

1. Placing a cooling coil directly in the anodizing tank
2. An external heat exchanger system

Placing the cooling coils in the anodizing tank can be problematic for several reasons:

* Some coils are delicate and can be damaged by what is going on in the tank
* Coils are susceptible to holes due to electrolytic and/or chemical corrosion leading to possible contamination of the bath from the coolant
* Coils made of titanium or zirconium are extremely expensive
* The relationship between cooling coils and tank cathodes has a history of being complicated and troublesome

An external heat exchange system is removed from the harsh environment of the anodizing bath. Electrolysis, bath air agitation and accidental contact between the anodizing loads and cooling coils are not factors with an external temperature control system. Other advantages of external systems are:

* Usually less expensive than coils placed in the tank, depending on the size of the tank
* Easier to maintain because an external system is not in the tank itself
* A plate heat exchanger is a more efficient heat transfer mechanism than cooling coils
* Less wear and tear overall
* Pumped, circulating acid provides another means of bath agitation
* A filtering system may be easily incorporated
* Acid circulating pump is an easy way to pump the tank for maintenance

Whether the anodizer chooses cooling coils or the external heat exchanger method, regular and proper preventive maintenance is a requirement for effective and efficient long term performance of the cooling system.

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 P.O. Box 502770 Indianapolis, IN 46250 (317)253-5725 Fax (317)253-5222

[www.anodizingtechnologies.com](http://www.anodizingtechnologies.com) E-mail:mail@anodizingtechnologies,com

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