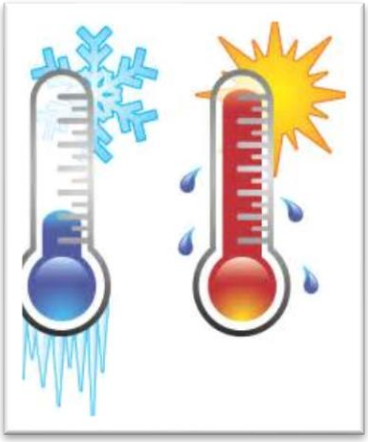
Maintaining a Consistent Finish Means Watching the Thermometer

For metal finishers one thing is certain the weather will impact the quality of your surface finishing process. Depending on the time of year, it gets cold – and it gets hot.



Obvious, isn't it?

But somewhat less obvious are temperature-related ramifications regarding different process tanks and solutions, which present opportunities as well as challenges.

So, is cold better, or is hot "hotter?" Let's review.

Surface Preparation

- **Soak and Electro Cleaner**

Most soak and electro cleaners operate within a range of 140-180 deg F (60-82 deg C). Upon prolonged cooling - over a wintry weekend, for example - the working solutions may drop to a temperature low enough for some of the components to precipitate out. This in turn forms a sludging and scaling condition in the process tank. Subsequent heating for use may result in poor heat transfer (due to the insulating effect of sludges). Bumping and localized boiling in response may add a safety hazard.

These conditions can mean downtime detrimentally affecting intended production throughput. To avoid these problems, especially during the coldest periods of winter, many chemical suppliers recommend keeping the baths warm or 90-100 deg F (32-38 deg C). With thermostatic control, the temperature can be adjusted to heat the tanks in a time sequence that makes them “up and ready” when the work shift begins or resumes.

Another winter consideration: switching from powder to liquid cleaners. By their typical formulations, liquid cleaner concentrates contain up to 80% less solids. That means much less sludging when the cleaner bath gets cold. However, the concentrate drums must be stored above 40 deg F (4.5 deg C) to prevent the contents from freezing.

Serpentene Steam Coil Heat Source

Electric Immersion Heater

- **Acids**

The reactivity of mineral and powdered acids increases with bath temperature. Whether the intended application is neutralization, activation, descaling or derusting, solution temperature is key to success. In some applications, heating (up to 120 deg F, 49 deg C) is essential.

In plating lines, the acid is typically the last surface preparation step. An active, clean surface is essential to achieve an adherent plating deposit. A cold acid or bath below 75 deg F (24 deg C) may not provide the surface conditioning required before plating, especially if on a fixed time cycle.

- **Zincates**

The reaction of zincates forming a film on aluminum is temperature-dependent. In hot weather conditions, problems usually arise when the zincate solution temperature exceeds 85 or 90 deg F (29 or 32 deg C). The film forms a spongy, porous structure. In cold solution temperatures, usually below 70 deg F (21 deg C), the film formation is extremely slow in relation to the dwell time; it is not acceptable for adhesion or subsequent plating. In baths of some alloy zincates and their concentrates, irreversible precipitation of some bath components may occur at temperatures below 50 deg F (10 deg C). It is therefore important to keep non-operating zincate baths from getting too cold. Maintain desired temperature range during operation.

It is extremely important to store liquid zincate concentrates above 55 deg F (13 deg C). Failure to do so may compromise the concentrate product, separating it into distinct layers. In such cases, the concentrate typically cannot be restored to uniform, single-layer product.

- **Rinse Water**

How many of us have witnessed a reduction in quality rinsing during the cold winter months? It's simply a fact: Cold water just does not rinse as effectively as warmer water does. Cleaner films, plating solution drago ut and similar baths do not readily wash off the surface of parts in cold water. What's cold? Below 50 deg F (10 deg C). Incoming city water or well water can readily fall below 40 deg F (4.5 deg C), during cold winter periods. Be sure to take the chill out of rinse water, just enough to make a quality difference. Warming rinse water to a minimum of 70 deg F (21 deg C) is normally sufficient.

- **Plating Baths**

Let's limit the discussion to the baths identified as room-temperature types, realizing that "room temperature" has a wide definition, usually in the range of 65-85 deg F (18-29.5 deg C). This includes the zincs (alkaline, cyanide, & acid), alloy zincs, acid copper and other known baths. It is best to confirm temperature range, control, and appropriate equipment with the respective bath supplier. The downside of plating below recommended temperatures? Poor throw, lack of brightness, leveling, or grain refinement, and poor rate of deposition. Some of the plating salts may also precipitate, coating anode baskets (causing polarization) and tank walls. It is imperative to adhere to

proper plating-bath temperatures, using the appropriate heating elements, in relation to the plating solution types.

Let's consider some exceptions.

1. Acid tin plating baths (sulfuric acid and methane sulfonic acid types). These baths, especially for specification finishes, require chilling to maintain plating bath temperature ranges of 45-65 deg F (7-18 deg C).

2. Anodizing baths, which require chilling in approximate temperature range much like the tin plating bath.

Plating Bath and Anodizing bath Chiller

3. Still another example is brass plating. Depending on the preferred deposit color, a range of plating solution temperatures beginning at 80 deg F (27 deg C) up to 125 deg F (52 deg C) can optimize the brass deposit color of choice. For example, the popular "lemon yellow" brass is typically achieved at a bath temperature range of 80-95 deg F (27-35 deg C).

There's an undeniable upside to chilling certain plating baths. Winter, in this respect, is a welcome sight. Cyanide plating baths generate carbonates over time. In fact, a concentration range of carbonates is required to maintain good plating. However, once

this range is exceeded, the plating bath experiences many deposition problems. These include a lack of efficiency, deposit throw, coverage and roughness.

The best way to remove excess carbonates is by chilling the baths, usually below 40 deg F (4.5 deg C), rapidly precipitating the carbonates. The natural refrigeration of winter temperatures assists immensely in this endeavor. This process of solution chilling to remove excess carbonates works as long as the source of cyanide in the bath is sodium cyanide. (Potassium cyanide-based baths require barium cyanide or lime to precipitate carbonates. Potassium carbonate does not precipitate by chilling.)

- **Chromates**

Whether hexavalent or trivalent, chromate baths are temperature sensitive. Most baths operate best in a range of 70-90 deg F (21-32 deg C). Exceeding the recommended temperature can result in formation of a thick, poorly adherent chromate. Operating the bath below the minimum temperature will significantly slow the film formation. In either case, the end result is poor corrosion protection of the finished parts. Warming the chromate bath to maintain recommended temperature, in conjunction with keeping the other operating parameters optimized, should keep the bath running smoothly in winter. Trivalent yellow chromates are the only chromates that require heating to maintain an operating temperature range of 130-150 deg F (54-66 deg C).

Post-sealing of chromates has become very effective towards extending salt spray protection. Many of these baths require mild heating for optimum performance. There is a trend to increase the application of trivalent chromates along with post sealers to meet RoHS and WEEE requirements. It is critical to operate these baths as recommended, to meet the new mandates that include improving corrosion protection.

- **Equipment**

The ability to provide adequate heating to affected process solutions makes strong demands on equipment. Before cold weather sets in, make sure to examine what is in-line and operating efficiently. The type of heating equipment should be compatible with the intended solutions to avoid chemical attack. This information, along with the recommended heating system (e.g. electric, steam), is readily available; Process-bath vendors and equipment suppliers are the best sources for accurate data and assistance. Since industry today operates in an “on-time mode,” thermostatic control is virtually indispensable. Check to be certain the thermostat is functioning properly. Purchase spare thermostats. The same applies for immersion heaters and coils (because it’s

generally accepted that integral equipment will break down at the most inopportune times).

To avoid a “deep freeze” that can slow down or stop production and finishing, make a service checklist and winterize process baths and equipment. In the event things are hot, cool them down to the appropriate temperature range.

Our people. Your problem solvers.

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