Chlorinated Paraffins: Introduction and Use

The stamping industry focuses on clean cuts and fast forming. Clean cuts and forms prevent metal from losing strength or stretching. Cost and production rates are of equal importance. These necessitate finding a lubricant that extends the life of the tooling that forms the product. One of the most effective additives to metal working fluids that enables the presses, tools, and dies to provide these characteristics is chlorinated paraffin.

Chlorinated paraffin is an additive that uses paraffin, or wax, as a base. The wax helps the lubricant to stick to the part, during any type of metal forming operation. The paraffin clings to the metal and forms a shield of lubricity at the cutting edge. The lubricity shield prevents the metal from weakening at the cutting edge, and helps ensure a quality end product. Chlorinated paraffin is a ubiquitous additive in metalworking industries, as well as other industries.

Once paraffin is applied and after it has completed its job, it needs to be removed. The paraffin leaves a stick, oily residue on parts that is neither appealing aesthetically or helpful practically. Nothing can adhere to the part if paraffin remains; making plating or painting impossible if the paraffin is not completely removed.

Even if plating or painting is not next in the process, paraffin needs to be removed. Paraffin often interacts negatively with other oils or fluids that it may encounter in the steps of the production process following stamping.

Cleaning parts covered in paraffin can be a tricky issue. Paraffin sticks to parts in a honey-like manner, and many variables affect the cleaning process. Spray impingement, submersion, heat of the water, time spent in process, and alkalinity of the cleaning compound all play a role in determining the results of cleaning.

Spray and immersion need to be used together in the process to obtain optimal results. Spray uses the mechanical force of the nozzles to direct cleaning solution at the substrate and break the waxy coating away from the surface.

Higher PSI makes the spray more effective, but diminishing returns can be in effect. At some point, the higher cost of a higher PSI is not worth what will be gained. A PSI that is too high also has the potential to damage the stamped part itself, rendering the manufacturing process worthless. Discovering the PSI limit is one of the challenges in the cleaning process.

Submersion allows chemical action to take place. The surfactant in the cleaning solutions work underneath the waxy paraffin and lifts it off, by reducing the surface tension of the paraffin to the metal. The surfactant forces the paraffin to remain emulsified in the tank until a saturation point is reached, and then it drops to the bottom of the tank.

Unfortunately, no cleaning compounds exist which can force the paraffin to remain at the surface for easy removal. The paraffin is heavier than water, so, unlike oil, it sinks. This presents the challenge of cleaning and removing sludge from the bottom of the washer tank, or creating a product that can force the paraffin to remain at the surface.

Water temperature is also an important variable. The water needs to be hot enough to melt the wax and assist the cleaning solution, but if it is too hot it will encourage flash drying of the part. In a multi-step cleaning process, flash drying is a detriment to the process. If the part flash dries while even a small amount of paraffin remains on the surface, the paraffin will need to be removed with a cloth by hand. Testing must be conducted to determine the lowest temperature that can aid in the cleaning process and prevent flash dying of the part.

Testing

Testing has been conducted to determine the best combination of variables to produce a clean part. The following variables were tested.

Observations

- Hotter fluids lead to better cleaning, but only to a point. 150 degree water is more effective than 130 degree, but 170 degree water is not noticeably better than 150.
- Potassium hydroxide, with a pH of 12, is more effective than the citric cleaner, with a pH of 8, at all temperatures.
- The optimum concentration ratio of potassium hydroxide cleaner begins to lose effectiveness above 10%. At this level, the cleaner leaves stainless steel parts darker and aluminum parts laden with white rust.

Conclusions

Based on these results recommendations for washing the parts in a large, slow moving, submersible rotary drum with a light spray. The water heat should be at least 150F with a 10% concentration of a moderately high pH cleaner with a surfactant package that contains potassium hydroxide.