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Soak Cleaning Roundup

In just about any metal finishing or treatment operation, the parts are usually first conditioned in a cleaning step. This process removes certain soils, such as oils, grease and shop dirt. These now unwanted agents are normally the result of their use in the manufacturing process (*i.e.*, casting, stamping, extruding, etc.). The finisher now must remove these materials as a first step in the desired finishing cycle. An initial step is to remove these soils in the cleaning process. This can be accomplished by immersion, spray, mass finishing or by other less common means. Notable developments in recent years include the methods of cleaning by carbon dioxide and cryogenics, usually employed where precise cleaning is very critical. In recent years mildly alkaline soak cleaners have been developed using biologically-active microorganisms. These agents convert organic molecules that comprise oily soils into innocuous substances, such as carbon dioxide and water.

Soak cleaning, by and large, is accomplished by using the most frequently used aqueous method. Sometimes the aqueous soak can be preceded or substituted with an organic solvent (halogenated and non-halogenated) treatment. Let us focus on the most popular, water based, aqueous soak cleaning method.

The accepted procedure is to use a concentrated blend, liquid- or powder-based. Components include surfactants, wetting agents, alkaline builders, conditioners and solvents. In recent years mildly alkaline soak cleaners have been developed, using biologically-active microorganisms. These agents convert organic molecules that comprise oily soils into innocuous substances, such as carbon dioxide and water. Cleaning can be accomplished by emulsification. Oily soils are "held" or encapsulated in a surfactant "cell". When the reserve cleaner blend becomes saturated with the emulsified oils, its ability to provide adequate surface cleanliness rapidly decreases. Maintenance or booster additions of the cleaner concentrate restore some degree of cleaning efficiency. However, this is a finite control process, whereby the cleaner bath ages eventually requiring its replacement with a fresh make up. Most serviceable soak cleaners of this type may hold 5 to 10% of emulsified oils during their working life.

Soak cleaning can also be accomplished by displacement of oily soils, rather than by emulsification. In displacement type soak cleaner concentrates, the types of surfactants and wetting agents, in combination and ratios, usually differ from those in emulsifying soak cleaners. The alkalinity may also differ. In the displacing soak cleaner bath, the detergency system displaces oily soils on the substrate parts. These oils, usually less dense than water, tend to float to the surface. Continuous removal of these displaced oils by filtration, belt skimmers or coalescers, keeps the working cleaner bath much less oil contaminated. This benefit can significantly increase the working cleaner bath life.

Is displacement cleaning the right choice?

By monitoring the soak cleaner tank and down-line tanks, these practical observations should be considered:

- Insufficient emulsification capacity of the current cleaner, with relatively short service life.
- Oils and grease dragging down the line (contamination of other process baths).
- Poor cleaning, suggesting time for a change.
- Oily and discolored barrels.
- Excessive down time and consumption of related cleaner products.
- Excessive oils and grease affecting the waste treatment process.

Displacement cleaning has a positive impact on all of the above considerations, provided a displacement cleaner is appropriate for the intended application.

Some critical "outside" factors that have been a driving force in continued improvements to soak cleaning include: The Clean water Act; F-006 sludge regulations; OSHA safety requirements; meeting waste water effluent regulations; replacing hazardous solvents (health risks and dangers to atmospheric ozone depletion).

The finisher may also acknowledge process related factors, such as:

- A wider variety of oils used in stamping, forming and rust proofing that require complete removal,
- Keeping associated operating costs in line or within budget,
- Keep rejects due to cleaning as minimal as possible.

Improvements made to soak cleaner concentrates help to meet these demands. Some of these are:

- Incorporating more biodegradable constituents,
- Improvements to oil emulsification capacity,
- Rapid oil displacement at operating temperatures, unlike previous needs for cooling the solution,
- Application of oil splitting agents, where the cleaner can be batch treated and re-used,
- Compatibility with oil removal equipment, such as ultrafiltration,
- Elimination of hard chelates,
- Improved rinsing characteristics.

"Double the temperature to double soak cleaning effectiveness"

How many times have we heard that statement? Ever wonder how this good old advice relates to effective cleaning? There is a relationship between the cleaner bath, temperature and solution surface tension. Wetting agents and surfactants lower the surface tension of the solution. This improves wetting, allowing penetration into soils, thereby facilitating their removal from the substrate. Particular surfactants, added singularly, or in combination with others, determine the application and cleaning effectiveness. Small concentrations of surfactants dramatically reduce the solution surface tension. Larger doses of surfactants at best will only minimally reduce the surface tension further. The surface tension in working cleaners may range from 20 to 35 dyne/cm. By comparison, the surface tension of water is approximately 70 dyne/cm.

Many years ago substantial theoretical studies were supported by experimental work, confirming a relationship between temperature of the solution and surface tension. This relationship is almost linear when considering long temperature ranges. It confirmed that surface tension decreases with rising temperature. By increasing temperature of the cleaner, wettability and penetration into soils is improved.

For the purists who need a technical explanation, here it is. Increasing temperature causes the free surface energy to pull molecules inward from the solution surface to the interior. This is counteracted by the opposing tendency of thermal agitation, pushing the molecules outward through the surface into the vapor phase. Let's keep it simple. Having established a fixed time and the optimum cleaner chemistry, maintain solution heat within the recommended range, for best results. P&SF

Fact or Fiction

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