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Spray Cleaning Review

Since the 1990s we have experienced the advent of more organic finishes to replace plated ones. The initial surge was estimated to be over 30%. Organic finishing remains strong as a specialized branch of metal finishing. Serviceable coatings that meet wear resistance and corrosion protection owe their success to adequate surface preparation. Sufficient cleaning before underlayment coatings, such as phosphates and chromates, makes this first step all that more critical. In-line cleaning cycles often revolve around spray machines, such as the typical three- and five-stage automatic lines. Let us review important facts related to optimum spray cleaning.

Parts

Many parts for processing are steel. These can be either cold or hot rolled. Mechanical forming drives oil and metallic shavings into the surface. Heat treating bakes and burns oils and grease into surface pores. Oxide scales form, with a severity based on the treatment atmosphere. If the parts have been mass finished, media residue or chemical compounds may be left on the surface, or driven into it. Parts may have been treated with a rust preventative. Storage based on humidity and time may result in or accelerate rusting. These are some concerns with respect to setting up an adequate cleaning step. It is common to have a mix of products or variety of parts. Aluminum, brass, copper alloys and zinc parts may be run in the same line, at different production loads, or interchangeably. Sometimes parts may be fabricated using mixed metals or alloys. These concerns affect the chemistry of the cleaner, along with cleaning demands and requirements. Choices for spray cleaning may encompass any of the parts in one process line using a single cleaner, or there may be a need for off-line precleaning of some parts beforehand. Of course, the simplest situation is where all the parts are of the same basis metal coated with the same process oils.

Racking

Parts are exposed to the mechanical spray of the cleaner. Racking of parts should be firm. Positioning of parts should expose maximum surface area, allowing for enhanced draining of cleaning solution and rinses. This is very important. Spray cleaners are not typically blended with the concentrated formulation that would by comparison be in a traditional immersion soak cleaner. A good deal of the cleaning mechanism is generated by the mechanical spray action, which enhances the activity of the cleaner components.

Spray cleaner

As described, spray cleaners combine chemical and mechanical action to remove soils from the substrate. The cleaning action must be rapid, as contact times in most spray machines may range from 30 to 60 seconds, at temperatures below traditional soak cleaners. The following benefits are realized:

- Low foaming action
- Displacement of soils, rather than emulsification
- Lower temperature ranges, reducing energy use contributing to cost savings

Spray cleaners may range in pH from near neutral to above 13. A variety of formulations permits the finisher to use a cleaner more adapted to a range of different metal surfaces. These would typically range from non-ferrous, light metals to steel and stainless steel. Displacement cleaning is preferred to remove oils and grease. The sprayed cleaner is recirculated through a side tank or sump. Oils and grease float to the surface and are removed by application of a suitable belt or wheel, or by use of membrane filtration. Removal of the soils prevents their redeposition on the parts, and minimizes their loadings in the cleaner. The solution is then pumped into the spray station, to repeat the cleaning cycle. The cleaner formulation consists of low foaming surfactants and wetting agents, solvents, alkali builders and hard water conditioners. Water softening is very important to prevent plugging spray nozzles with otherwise harmful soap sludge and water hardness scales. Liquid and powder spray cleaners operate similarly as the following table shows.

Cleaner type	Conc. range	Temp., °F	Temp., °C	Time, min	Pressure, lb/in²
Powder	2 - 5 vol%	100 - 160	38 - 71	0.5 - 3.0	15 - 35
Liquid	3 - 6 oz/gal	100 - 160	38 - 71	0.5 - 3.0	15 - 35

Troubleshooting tips for insufficient cleaning

- Under-concentrated cleaner. Adjust as required.
- Cleaner temperature out of range. Adjust accordingly.
- Check for the contact time and modify if required. Confirm whether different oils are now being used in manufacturing, stamping, cutting, forming, etc…
- Test for use of appropriate cleaner chemistry. Change as required.
- Spray nozzles may be plugged, damaged or do not provide optimum pattern of spray. Check for proper positioning of spray nozzles.
- Soils redepositing on parts. Maintain oil removal equipment. Cleaner may have exceeded service life and needs to be replaced with fresh make up.

This is a list of some common problem areas for consideration. The most common breakdown focuses on the operating parameters: time, temperature and concentration. *P&SF*