The Problem With Unclean Parts Prior to Plating

Q. We process a variety of machined parts in our plating shop, and we find that some of the rust inhibitors they are coated with are easy to clean off while others are very difficult to remove, which causes our reject rates to increase. Can you provide an overview of the different rust inhibitors to help us understand what might be causing these issues?

A. Handling parts that come in with a variety of often unknown oils and compounds on them is a common scenario for plating shops and can easily cause issues. The type of inhibitor used depends on factors such as material composition, storage conditions and end-use requirements.

Each type of inhibitor presents unique challenges for plating shops and requires tailored cleaning processes to ensure optimal adhesion and plating quality.

When dealing with oil- versus water-based formulations, oil-based inhibitors often leave behind heavy residues that require solvent-based degreasing, while water-based inhibitors tend to be easier to remove with alkaline cleaners. Thickness and composition of inhibitors will also impact pretreatment as heavier coatings or wax-like inhibitors can create adhesion issues if not thoroughly removed before plating. Solubility plays a key role since some inhibitors are designed to be easily emulsified in water, while others repel water and require aggressive surfactants or solvents for removal.

Another factor is compatibility with cleaning solutions because certain inhibitors may react with alkaline cleaners, leaving behind residues that interfere with plating adhesion.

Finally, residue formation can play a role in certain conditions, as some rust inhibitors can polymerize under heat or prolonged storage, making them more difficult to strip.

The following are common inhibitors and descriptions of each:

- **Stamping oils** are applied during metal stamping operations to reduce friction and prevent oxidation. Some contain rust inhibitors but can leave residue.
- **Drawing compounds**, used in deep-drawing and metal-forming processes contain lubricants and corrosion inhibitors. They range from water-soluble formulations to heavy, oil-based coatings, requiring aggressive cleaning.
- **Water-based rust inhibitors** provide temporary corrosion protection and are often easier to remove than oil-based alternatives. These typically contain organic or inorganic corrosion inhibitors and can be cleaned with alkaline cleaners.
- **Solvent-based rust inhibitors** leave behind a thin protective film that resists moisture. While effective for long-term protection, they may require specialized solvents for complete removal.
- **Wax-based inhibitors** form a hard coating that offers durable protection against corrosion. They can be challenging to remove, often requiring heated alkaline cleaners or mechanical scrubbing.
- **Vapor corrosion inhibitors (VCIs)** emit protective vapors that prevent rust inside packaging. While effective, they may leave residues that affect plating adhesion.
- **Oil-based corrosion preventatives** provide robust rust protection and are commonly used on machined parts stored for extended periods. However, they require degreasing before plating to ensure proper adhesion.

Some plating shops report that certain rust inhibitors can become sticky or tacky during the summer months. This issue can lead to increased handling problems, contamination concerns and customer dissatisfaction. Common causes include:

- **Viscosity changes due to heat.** Some inhibitors become more viscous at higher temperatures.
- **Overapplication.** Applying too much inhibitor can leave an excessive film that does not dry properly.
- **Improper dilution.** Using a concentration higher than recommended can result in unwanted thickness.
- **Chemical instability.** Some rust inhibitors react to heat and humidity, causing them to polymerize or break down.
- **Incompatibility with the plating process.** Some inhibitors may not interact well with certain plated coatings, leading to unintended surface changes.

A case in point comes from a plating shop that was experiencing tacky residue on steel parts in warm weather. This was causing difficulty in the pretreatment process, making the parts harder to clean, which in turn led to plating defects. After switching to an alternative technology, which provided a non-tacky, colorless coating that dried on the surface without the need for rinsing, they had a smoother production process and eliminated the seasonal tackiness issue.

A case review at the manufacturer level resolved a similar issue with fasteners, where previous rust inhibitors left bolts too sticky for efficient handling and assembly and an alternative technology was put in place to solve the challenge.

By working closely with suppliers and testing alternative inhibitors, plating shops can enhance both product quality and operational efficiency.

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