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4 Considerations for Aerospace Component Cleaning

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"Originally featured in *Production Machining* and *Products Finishing* Publications"

Precision cleaning in the aerospace industry is a vital step, ensuring the safety of the thousands that fly every day. Even a tiny amount of grease and particles left on aerospace parts can be disastrous. It's a tough job. The Boeing 737 has 600,000 total parts — the 777 has 3 million parts. All must be cleaned to exacting specifications. That's impossible to do manually and is challenging even in an automated process. But what's the best way to do it? The Manufacturing Cleaning Association recently asked me to share my advice on considerations for cleaning aerospace components. Here are my replies to four questions manufacturers commonly consider.

What are basic safety tips for aerospace cleaning?

Talking about basic safety steps everyone can take might seem unnecessary, considering we're all professionals. However, our experience has shown that sometimes even basic precautions aren't followed. Limit the risk to your workers by offering protective glasses, aprons, gloves and adequate ventilation in the work area. Ear protection is also a good idea: shops can be noisy places. Education is also crucial: workers should know what they're dealing with. Review your safety policies regularly, especially after process changes. Your safety processes will change over time.

What are the best oil removal methods?

Detergents have a maximum soil "capacity" before any soils removed start getting redeposited on the surface of the part again. Variations in the substrate of the part being cleaned can also contribute to uneven cleaning performance. The best method varies based on the properties of the oil itself. Water-soluble oils are more difficult to separate from the cleaning solution as it dissolves into the wash tank chemistry, so monitoring is critical. Foaming (especially if the cleaning solution is sprayed) and water spots post-cleaning are two signs of water-soluble oil loading. If one of these occur, increase the amount of rinse water flowing into the rinse tank. Oil loading drastically reduces overall chemistry life. When cleaning water-soluble oils, it is critical to dump the wash tank more frequently. Attempting to reduce waste by only dumping half the tank does not matter much over time. Non-soluble oils are easier to remove from the wash tank as they physically separate from the water and float to the top. Two removal methods are best here: using a skimmer or oil coalescing system. While skimmers are reasonably priced, and some of Brulin's customers swear by them, my own experience finds skimmers "oil specific." Instead,

consider a coalescing oil system. An oil coalescer adds overall wash chemistry capacity because the units are separate tanks yet plumbed in the wash sump. Here, solution flow is significantly reduced, enabling time for the oil to float to the top of the wash chemistry. Removal is possible either by the overflow of a weir system or by gravity. Cleaning chemistries designed to split the oils will prove very effective in these systems.

Why are my parts still dirty?

Achieving a high-quality clean isn't as simple as placing the part in the bath, adding the correct detergent at the right concentration and walking away. Use titration kits to monitor concentrations and regularly check other process parameters. Also, remember that because it is called rinse water doesn't mean it is clean. I often see little monitoring of the rinse water itself; if you are not monitoring that, you are asking for trouble. A little detergent carryover is expected even in the best processes. Regular monitoring of the rinse water will ensure your parts come out of the process clean every time. An easy way to monitor the rinse water is by using a conductivity meter. If the conductivity rises above your limit, either dump the rinse tank or increase water flow to the tank. Your wash process will stabilize by regularly monitoring all the process inputs/outputs.

How do I determine part cleanliness?

Part cleanliness is typically determined by the customer or written into the specification. There's no right or wrong approach, but consistency and validity for your requirements are key. Water break-free is the goal if you are processing per the Boeing BAC 5749 Alkaline Cleaning spec, which is also covered by ASTM F22 Standard Test Method for Hydrophobic Surface Films by Water Break Test. Rough or porous surfaces can affect the sensitivity of this test, however. There are several other methods that you can use if you're not dealing with BAC 5749. Applying dyne solution or test ink to the part's surface will either form a film or pull back into tiny droplets. The behavior of the ink will tell you the substrate's surface energy. Measuring nonvolatile residue (NVR) — the soluble, suspended or particulate material remaining on the surface following evaporation of the volatile solvent which contains the material — is another method to determine cleanliness. The goal here is to leave as little NVR as possible. Particle count is another cleanliness measurement. Particles are extracted from a known surface area size using a high purity fluid, DI water or organic solvent and measured for size and quantity. Those numbers are then compared with specifications, which allow a specific number, size and volume of particles.