

The background is a solid teal color with several large, semi-transparent gear shapes scattered across it. The gears are rendered in a lighter shade of teal, creating a layered effect. The overall aesthetic is industrial and clean.

COMING

CLEAN

ON

WASHING

TECHNOLOGIES

By Frank Pedeflous

AS THE GEARING INDUSTRY MOVES AWAY FROM SOLVENTS, NEW TECHNOLOGIES GET PARTS CLEANER, IMPROVING PRODUCT QUALITY AND PRODUCTION EFFICIENCY.

The techniques for manufacturing gears and gear components do not differ dramatically from other industries. Precision cutting, grinding, polishing, and buffing are all part of the process. But manufacturing is not complete until the gear assemblies and other gearing components are cleaned and thoroughly prepped for shipment. Gears' blind holes, threaded holes, and precision teeth add a degree of cleaning difficulty not generally seen in other machining applications.

For years, gear manufacturers have used a variety of techniques to clean the finished machined pieces. The tried and true favorites of the industry have been solvents such as MEK, acetone, and trichloroethylene, just to name a few. Solvent chemicals are applied in dip tanks and agitation tanks if the cleaning parameters are not too stringent. Solvents are most commonly used in manual washing and sink-on-a-drum cleaning systems, especially for manufacturers with low volume production and/or limited capital budgets. Vapor degreasers were an industry standard, but with many solvents being outlawed, these units have fallen out of favor.

As toxic solvents become more highly regulated and their purchase and disposal costs escalate, water-based cleaning alternatives have become more prominent. Worker

comfort and health are rising concerns as well since the use of solvents places employees in contact with toxic substances, mandating proper ventilation and other safety procedures. Despite the excellent reasons to move away from solvents, there is one problem: water-based soaps don't clean as well as the old solvents. Alone, their emulsification lacks the muscle of solvents' chemical reactions. Soaps need some type of mechanical agitation to match the performance of solvents.

Pressure sprayers and spray wash cabinets use high water pressure to blast the dirt off of parts. They are excellent at removing grease and heavy dirt from easily accessible surface areas, but cannot effectively penetrate complex gear teeth. Also, because they centrifugally spin the parts, damage can occur to more delicate gearing mechanisms.



Hot soak tanks and agitation tanks have a limited degree of success. If the parts to be cleaned are not complex in nature and have many flat surfaces, these units can be very effective. Agitation helps but, again, to a limited degree. If higher performance water-based cleaning is necessary or an existing cleaning solution is providing only marginal success, then ultrasonics is the answer—a blend of soundwave agitation, water at a precise high temperature, and formulated soap.

When it comes to ultrasonics, there are a plethora of options. From small commercial tabletop models for light duty applications, to single station floor models which handle the largest variety of cleaning applications, to multi-station consoles for more complex cleaning requirements, there is an ultrasonic product that is right for most gear cleaning processes. Multi-stage consoles can even be designed with automated robotic systems to deliver baskets of parts to multiple washing, rinsing, and drying stations. Robotic consoles are normally used in high volume, high precision cleaning applications such as medical instrument manufacturing.

“IF HIGHER PERFORMANCE WATER-BASED CLEANING IS NECESSARY, OR AN EXISTING CLEANING SOLUTION IS PROVIDING ONLY MARGINAL SUCCESS, THEN ULTRASONICS IS THE ANSWER.”

Single station floor models make more practical sense for the gear manufacturing industry. Gears need to be clean of oil, dirt, buffing compounds, and other debris, but it is rare that they need to be rinsed to the degree of products such as aerospace parts. Manufactured parts are placed into a basket or similar holding apparatus and then submerged into the ultrasonic bath. The ultrasound is activated for a period of time, usually between

three to 10 minutes depending on the size of gears, number of gears in the batch, and the type of contaminant being removed. Once the ultrasound session is complete, the gears are removed and dried. Drying times are reduced by higher bath temperature—the hotter the bath temperature, the more flash drying occurs. Bath temperatures range from 120 to 150°F for cleaning gears after machining.

As noted earlier, rinsing is not generally necessary. If the final cleaning parameters dictate zero residue, then clean-water rinsing is necessary. The cleaning soap used can also dictate whether rinsing is required. Water-based cleaning soaps used for the removal of cutting fluids, cutting oils, metal shavings, and dirt will be alkaline (higher pH) by design. The other additive components

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in the soap such as rust inhibitors can sometimes leave a residue, which may or may not be tolerable. Choosing the proper cleaning chemistry is as important as choosing the right ultrasonic system. It is important to have a clear understanding of what the finished product must achieve.

If the gears have residual heat scale or require passivation (the removal of free iron molecules from the surface of stainless steel or titanium), a low pH citric acid can be used effectively. When using any organic acid it is necessary to have a clean water rinse, preferably using de-ionized water.

In the past, manufacturing companies usually sent their parts out to be cleaned or, in specific instances, passivated. Some companies have even left it up to their OEMs to handle the cleaning, as it has not been their concern. That has all changed. The tighter constraints of the global economy, just-in-time manufacturing, and lean manufacturing force the manufacturer to control every aspect of the operation. Therefore, reducing overall production cycle time encompasses the time and cost of sending parts out to be cleaned, making parts cleaning a strategic decision for gear manufacturers. Many OEMs now require their

suppliers to provide a finished gear that is completely clean and ready for assembly.

Having the right cleaning system in the plant improves overall efficiency, timeliness, and quality control. If manufactured parts leave the plant for cleaning, the manufacturer has essentially surrendered control of his/her product at that point. Off-site cleaning can delay shipment, delay the time to invoice, and ultimately delay payment. Overall profitability and cash flow can be negatively impacted if the cleaning process is not adequately addressed.

Gear manufacturers spend time, effort, and dollars making their finished products the best they can be. It is important to remember that "finished" means clean, made ready for final applications, assemblies and/or shipment. New technology and techniques give the gear industry cleaning choices beyond traditional solvents. Parts washing entails numerous products and choices from pressure sprayers, to agitation tanks, to ultrasonics. The right cleaning system choice will save time and money in the long run, and help ensure timely delivery of superior products. 

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