



Simple, Effective Parts Cleaning

After trying an array of parts cleaning methods over the years, this shop has implemented an environmentally friendly, relatively simple system to clean every part it produces.

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Editor's Commentary

For more information from DuPage Machine Products, visit <http://www.dupagemachine.com> or call (630) 690-5400.

Almost every shop performs some sort of parts cleaning operation for its products. For some operations, the cleaning process may be as simple as toweling off the part before packaging. For others, the cleaning operation may be an essential prelude to a secondary operation or sensitive surface finishing. Shops typically determine the most suitable cleaning method over time, based on the jobs they run and the effectiveness of the given process. Such is the case for DuPage Machine Products Inc. (Bloomington, Illinois), which has tried several cleaning processes before discovering the effectiveness of its current hydrocarbon-based parts cleaning system.

The company sends every single part it produces through its current cleaning system—millions of parts per year primarily for the mobile hydraulics and automotive industries, produced from materials such as 303, 304 and 416 stainless and 12L14 and 1215 steel. The system's speed and efficiency make the operation feasible, but it wasn't always such a safe bet.

According to Dave Knuepfer, company president and CEO, DuPage has run the gamut of parts cleaning options through the years. He explains, "In the '70s and '80s, we had a vapor degreaser. In the early '90s we had an aqueous system. In the late '90s we switched back to vapor degreasing. Finally, towards the end of 2004, we bought our current system." That current system—a Dürr Ecoclean Universal 81C—uses a non-chlorinated hydrocarbon cleaning process to deliver the reliability of solvent-based cleaning without the environmental complications of traditional chlorinated solvent washers.

The Process

The system rotates parts within the first and second cleaning steps, dislodging debris. It follows with a vapor degreasing step and ends with a drying stage. All

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This non-chlorinated hydrocarbon parts cleaning system is used to clean every part produced at DuPage Machine Products' main facility.



The operator preloads baskets of parts onto pallets

steps are carried out under a vacuum for enhanced performance.

Baskets of parts can be fed into the front of the machine either manually or automatically. DuPage preloads baskets of parts onto pallets on a conveyor system that automatically feeds them into the cleaning cycle. The company uses six baskets at a time, approximately 9 inches wide by 18 inches deep by 5 inches high, stacked side by side and two-high to fill the chamber to its maximum capacity. The baskets allow a variety of part types to be processed without retooling.

As the baskets are loaded into the work chamber, the door automatically locks and the chamber is filled with cleaning fluid from the first flood tank, submerging the baskets and parts in a liquid bath. Once the parts are submerged, the cleaning media can envelop the parts completely to clean outer surfaces as well as holes and cavities. Because of the vacuum technology, even small blind holes can be cleaned effectively. Based on pre-programmed movement patterns selected by the operator through the control (a Siemens S7 PLC), the system agitates the parts baskets for more effective cleaning. Baskets can rotate within the cylindrical chamber from 10 to 360 degrees. The movement of parts within the cleaning solution, together with the recirculation of the fluid and/or ultrasonics, dislodges debris that may not have been removed by the hydrocarbon bath alone.

After the hydrocarbon bath, the cleaning fluid is drained. An optional second flood tank can provide an additional cleaning, or the hot vapor cleaning and vacuum drying process is initiated to thoroughly dry the parts, including blind holes and channels. After the drying process, the work chamber door automatically opens and the clean parts are removed, allowing the next batch to be loaded. The entire process takes from 6 to 12 minutes, depending on the part to be cleaned (blind holes, and so on) and the condition of the part (cleanliness) before cleaning. Parts are hot to the touch as they leave the system.

Worth The Investment

Mr. Knuepfer says the company has been quite pleased with the Dürr system. “Since buying the system at the end of 2004, we’ve had very few maintenance issues,” he explains. “We still have a vapor degreaser, using methylene chloride, at our other location. When we opened this facility, we started out bringing parts here for cleaning, but that wasn’t practical long-term. I was familiar with this system (Dürr), and it seemed like something that could work for us. It could have cost as much as \$75,000 to move the old vapor degreaser here, so we made the decision to invest in the Dürr.”

The environmental considerations built into the system have also been popular at DuPage. Mr. Knuepfer says, “Our old vapor degreaser is a top-of-the-line model with all the bells and whistles—it is fully enclosed and complies with all EPA standards. But the solvent cost is high, and the record keeping alone, for environmental compliance, can create a substantial expense. With the Dürr, there is no requirement to register with the U.S. EPA, only the state of Illinois. We received a lifetime operating permit, versus an annual permit, because of the fact that the isopar hydrocarbon solvent is environmentally friendly. The operation of the Dürr is simple, requiring minimal training.”

that are fed across the conveyor system. The automatic loading system pulls the pallets into the work chamber through the front of the machine.



An inside view of the machine cabinet shows the simple organization of the components, providing easy access for maintenance. Large doors in the back of the cabinet also contribute to accessibility. Here are the two fully enclosed flood tanks.

Compared with the aqueous system the company tried before, the Dürr system has been particularly effective. “We scrapped way too many parts with the aqueous system,” Mr. Knuepfer elaborates. “Any time you introduce water to steel, you’re asking for problems. Although the cost of the Dürr can be expensive, we’ve found it well worth it. It’s easily the fastest, most efficient method we’ve tried. The parts come out bone dry. We’ve never had a cleanliness problem with any of our customers since making the change; we’ve not seen any rust issues in our plant, because the rust inhibitor is particularly effective.” With a fully air-conditioned facility, humidity is kept to a minimum, helping to maintain rust-free parts. But Mr. Knuepfer continues, “Once the parts reach the customer and sit on their shelves without air conditioning, you might expect different results, however, we have had very few issues with rust.”

This parts cleaning system has proven itself at DuPage as a highly effective cleaning method, using non-chlorinated hydrocarbons for safe and economical use of solvents to remove oils, greases, emulsions and swarf between and after manufacturing processes. Mr. Knuepfer feels it has been well worth the investment and is even considering adding a second unit down the road.

Staying Ahead At Every Turn

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Typical parts made by the company include various hydraulic fittings, as well as high precision medical devices and automotive components. Primary materials used range from low carbon steels to stainless, brass and aluminum, as well as some proprietary alloys.



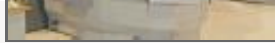
In a 125,000-square-foot facility with approximately 175 employees, Dave Knuepfer, president and CEO of DuPage Machine Products, remains committed to finding the best ways to accomplish more, every day. At this facility, high-precision turned parts are made and fabricated into end products for the mobile hydraulics, automotive, medical and other industries. In an era of outsourcing, DuPage does more in-house nowadays and plans to remain in that mode, according to Mr. Knuepfer, the grandson of the man who started in this industry in 1922.

“We use the latest technologies to remain more competitive and bring more value to our customers. The machines can do more, so we can achieve that goal. And, we never stop seeking newer, better ways,” says Mr. Knuepfer.

Products produced at the company range from hydraulic check valves and automotive components to parts for truck brake systems and compressor components, plus stainless steel medical parts. Turning, grinding, honing and heat treating are also done at this facility. Additionally, DuPage operates its own tooling department, which uses EDM technology. The materials run here include low-carbon steel, stainless, brass, aluminum and some proprietary customer alloys.

Among those “latest technology” additions to the machinery on the floor are several Index six-spindle turning centers, accommodating 32-mm and 52-mm barstock. With these machines, DuPage is able to achieve complete parts in less time, with less change-over and setup time, according to applications engineer, Doug Halenza.

“Typically, we were out there competing for the same large-quantity jobs as many other shops. With these machines and their faster setup times, we can actually run smaller quantities and still be very productive,” says Mr. Halenza.



Prominent on the shop floor is the lineup of seven Index CNC multi-spindles with 32-mm and 52-mm capacity. The Siemens controls on these machines feature the ability to quickly convert the design program into live machining, helping the shop to more effectively produce smaller-quantity jobs.

According to Mr. Halenza, a key component on the Index turning centers that makes this fast-paced production turnover possible is the Siemens Sinumerik 840D CNC, because of its ability to quickly convert the design program into live machining. The Index machines also have Siemens drive systems onboard.

Each job at DuPage begins with a print from the customer. Using PartMaker CAD/CAM software, the programs are developed, run through post-processing and fed through a DNC system directly to the CNC turning centers. Mr. Halenza conservatively estimates that the Index machines provide 4 to 6 times the performance of the company's conventional lathe technology.

"Another advantage of the machines is that the CNC is a Windows-based environment, which means we can cut and paste to create our subs and cycles and keep everything in a packaged file very easily," says Mr. Halenza. "All the geometry offsets and tooling assignments are accessible in each program, plus the CNC operates the automatic bar feeders."

The company also uses ARTIS monitoring as part of its overall tool management system, as well as robotic articulation on several machining centers. The CNC controls all the operations and maintains the data for

each program run on the machine. Mr. Halenza notes that, although Index provided training on the machines, Siemens also provided direct support to DuPage Machine for the CNCs.

"When all the operations, including cross-drill and offset mill, can be accomplished on a single machine, there are clearly advantages in terms of the overall product consistency and quality," says Mr. Knuepfer, elaborating on the company's multi-spindles. "Short runs can be costly if there is waste before production achieves the spec. With these machines, we get there very quickly, which helps us remain quite competitive."

DuPage Machine also operates a number of other machine tools at this facility, including rotary transfer, Swiss-type turning, single-spindle, bore sizing, honing, CNC centerless grinding and hydraulic assembly equipment, as well as a fully controlled environment quality inspection department run in SPC protocol with Gage Talker software, plus an EDM tooling shop and heat treating operation.

"The CNC can be a powerful tool, if you know how to use it properly. With all the spindles and all the tooling involved on each machine, it's simply a situation where you can get tremendous productivity, but it needs to be properly set up, then properly executed," says Mr. Knuepfer. "Our hydraulic, automotive and other critical-tolerance business demands that we adhere to strict protocols. We base all of our equipment purchasing decisions on meeting these requirements. Combining high productivity with reliable performance helps us meet our customers' needs."



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