Time is Money: Maintaining a Cutting Edge

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By **SME Staff Report**

As machine tools evolve, machine maintenance is having its own transformation.

Machine tools have come a long way in recent years, with newer models offering a variety of impressive capabilities. All the technological advancements, however, haven't changed one fundamental fact about machine tools: the need for maintenance.

But while the need for proper upkeep hasn't wavered, the maintenance process itself has been changing in important ways. For one thing, new machine technology has made new maintenance practices necessary. In addition, companies that sell new machine tools have been rolling out offerings aimed at making maintenance of their products faster, easier and less expensive.

When it comes to performing effective maintenance, newer machine tools may present different or greater challenges than old ones. Consider, for example, the fact that machine tools of a more recent vintage rely more on electronics than their older counterparts, notes Jack Lugas, senior

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This means systems that cool electronics assume added importance in newer machines. These systems include filters that maintain the quality of air circulating in electrical cabinets. To do their job effectively, these filters must be cleaned regularly in accordance with the machine builder's recommended maintenance schedule, Lugas says, adding that the state of these filters "is usually something you want to check monthly at a minimum, if not weekly."

Another significant development is in machine spindles. "In the olden days, everything was about big power and removing big chips," recalls Charlie Cagle, senior manager of field service at Okuma America Corp., a machine manufacturer in Charlotte, N.C. "Now we've gone more to faster machines with higher spindle speeds."

In older machines, spindles had grease-packed steel ball bearings, while modern 15,000-rpm spindles have ceramic bearings lubricated by air-oil systems. "The old steel spindles that didn't spin very fast were pretty resilient," Cagle says. "But for the newer spindles that are spinning really fast, we have to make sure that we maintain the air-oil lubrication system." This task includes making sure that the air supplied to the machine is very clean and that the lubricant being used is the one specified by the manufacturer for that application.

Cagle also points out that some older machines don't have coolant flowing through the spindle and the tool. In newer machines, however, coolant-through systems are "pretty standard across the board," he says. Proper maintenance of these systems includes checking to make sure there's no potentially harmful "coolant blowby," with coolant getting into the drawbar or contaminating the spindle.

Best practices for maintaining modern machine tools also include proper maintenance training. Trumpf North America recommends that purchasers of its machine tools send their maintenance personnel to the company's training center at its headquarters in Farmington, Conn., or take virtual training classes. "Our training center offers excellent courses for our customers to make sure they know what to do and how to perform (maintenance) tasks efficiently, quickly and correctly," asserts Christine Benz, Trumpf North America's director of TruServices, which offers after-sale machine maintenance services.

In addition to maintenance best practices employed by shops, modern machine tools can benefit greatly from maintenance-related developments introduced by machine manufacturers. For example, some machines now have features designed to make maintenance easier and minimize related downtime. One such feature is Trumpf's Easy Filter, a component of the company's laser machines. According to Benz, Easy Filter eliminates the need to change the deionized cooling water for the laser circuit, which was traditionally required twice a year to keep the water free of harmful contamination. With an Easy Filter installed, however, "the water doesn't need to be replaced and dumped anymore," she says. "It just gets reconditioned, which makes maintenance much faster and also greener."

Proper maintenance is important for the air-oil lubrication systems that are typically part of newer high-speed machines. (Image provided by Okuma America)

Helpful maintenance features offered by Okuma machines include a screen and timers that allow users to set their own maintenance intervals. For example, Cagle points out that if a shop wants a machine's hydraulic tank cleaned out after six months, it can set that as the maintenance interval for the tank. When six months passes, the machine control will generate a message informing users that it's time for maintenance.

In addition to keeping track of time intervals and notifying users when certain maintenance tasks should be performed, newer Trumpf machines can guide them through the process, according to Ralf Kratzsch, Trumpf North America's national service director for specialized machines. This is done by providing instructions or telling users where to find the information they need, Kratzsch explains.

Going beyond these capabilities, Cagle says certain machine manufacturers have been touting technology that employs artificial intelligence (AI) to make predictive maintenance recommendations based on collected machine data.

components and compare data gathered subsequently to the baseline. For example, Cagle explains, baseline ball-screw load and vibration data gathered soon after a machine is purchased could be compared to load and vibration data gathered sometime later to see if there's a change indicating that the component needs to be replaced.

Driven by Data

As the name suggests, condition-monitoring technology lets the machine manufacturer monitor the status of its systems in the field. (Image provided by Trumpf North America)

Similarly, Benz points out that Trumpf's data-driven diagnostics technology, working in combination with the company's service app, allows Trumpf service personnel to monitor the condition of customers' machines and notify them if certain tasks need to be performed to prevent unplanned downtime. In addition, Trumpf can send these customers technical guides that give step-by-step instructions explaining how to resolve detected issues.

Trumpf currently has 1,400 machines in the United States connected to its condition-monitoring service, according to Benz. For the last two years, the service has been in the pilot phase as the company gathered data from connected machines to develop algorithms for resolving various machine problems, as well as related technical guides for customers. Though this process is ongoing, she says, "Now we are in a good position to roll out (condition monitoring) as a paid service."

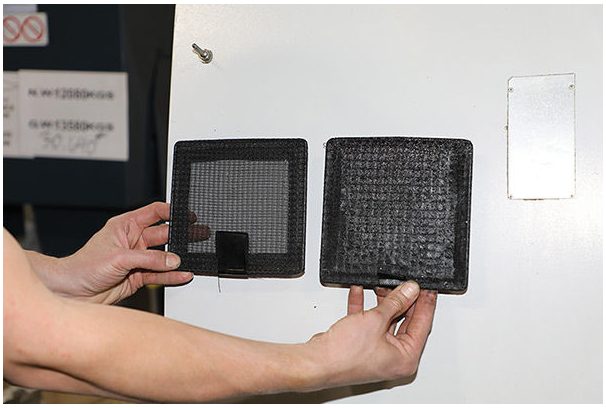
As an example of the benefits of condition monitoring and data-driven maintenance, Benz points to the replacement of Trumpf's Smart Power Tube, an important and costly component of its CO_2 laser machines. In the past, the recommended maintenance procedure was simply to replace this tube after it had been in service for a certain amount of time. With data-driven diagnostics, however, Trumpf can monitor the condition of the tube and notify the customer when it actually needs to be replaced.

"So instead of (the customer) potentially wasting money by replacing a power tube that still has plenty of life in it, we monitor that power tube

When customers need help with a maintenance or repair job, they can get it from afar by connecting to Trumpf Visual Assistance. This system allows remote Trumpf service engineers to see what the customer sees by means of smart glasses or the company's Visual Assistance app installed on a mobile device. With a view of the situation, Benz says, the service engineers can provide step-by-step guidance for any task that needs to be performed.

Leave It to Experts

For shops that would rather leave the job of maintaining their modern machine tools to others, there's the option of signing up for an outside preventative maintenance program. Okuma, for example, offers such programs through its distributor network. In the Americas, these distributors employ some 400 technicians who have factory-level training from Okuma.



A dirty filter (right) can cause a machine's electrical cabinet to overheat. (Image provided by Absolute Machine Tools)

Though some shops prefer to handle their own maintenance, Cagle says that as equipment grows more complex, sometimes shops need factory-trained personnel. With machine technology evolving and Okuma distributors pushing their preventative maintenance programs in recent years, the company has seen "a huge uptick" in the number of customers opting to allow distributors to handle their maintenance on a regular basis, he adds.

Nevertheless, Cagle believes the majority of Okuma customers don't adhere to any kind of scheduled PM program because they can't justify the machine downtime. Compared to a decade ago, however, "we're seeing a lot more people gravitate toward doing PM, and it's a good thing to see," he says. "If you don't abuse these machines and do the

Automation and

Robot stands and controllers should be cleaned as often as needed to prevent connection problems and premature wear and tear. (Image provided by Absolute Machine Tools)

Maintenance

As everyone involved in manufacturing knows, robots are supposed to reduce the need for workers on the plant floor. But when the automation axe falls, machine maintenance personnel are spared. The reason is simple and obvious.

“If you cut out an operator for a process and replace him with a robot, you just added another machine,” points out Jack Lugas, senior service

Though a robot adds to the responsibilities of people such as Lugas, the job of maintaining it normally requires less time and effort than maintenance of the CNC machine it's paired with.

"The electrical cabinet on a robot is usually very small," Lugas notes. "And for the most part, robots are not in the elements. They go in and load a part, but then the door closes and they're outside of the machine while all the coolant and chips are thrown around."

Though letting robots handle tasks such as machine loading and unloading has its advantages, there's a disadvantage when it comes to maintenance. "Since you're replacing a human with a machine, there's a (chance of) neglect because now the operator isn't there monitoring as much as if someone was there loading every part," Lugas says. "You might not have an operator setting eyes inside the machining envelope for a few days with that kind of setup. So if there are too many chips inside the machine and you need to shut it down to clean it, there's no opportunity to see that."

Even operators at the lowest skill levels can spot obvious problems or notify more experienced personnel if they see something that they think doesn't look right. In a fully automated manufacturing cell, however, minor issues may go unnoticed until they become major ones.

"By the time it gets to the point where the cell shuts down because you have an alarm, maybe some serious damage has happened," Lugas says. "So there's definitely a downside to people thinking they can just run lights out without (someone) watching what's going on."

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By **Kip Hanson**

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Shown here: OPS Ingersoll's Eagle V5C, a "high-speed, ultra-rigid 5-axis vertical machining center (VMC) with enhanced cooling controls." (Provided by MC Machinery.

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MACHINING & METAL CUTTING

Building Better Blisks

The DVF-series five-axis machining centers are designed for high-precision machining of complex parts like this turbine component in a single operation. (Provided by DN Company.

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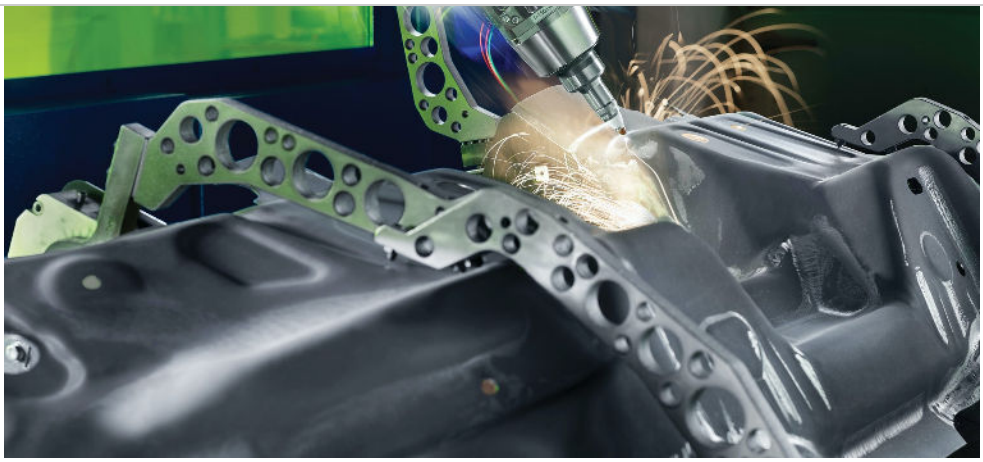

LASERS

Leading with Light

A part sorting system is designed to pick and place cut blanks in a way that best suits downstream operations. Since the introduction of the high-powered fiber laser, the focus shifted from cutting speed to overall part flow, including what happens to parts after they’re cut. (Provided by Bystronic Inc.

By **Kip Hanson**

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