

The Quick-Change Advantage

Workholding Systems Continue to Focus on Speed and Efficiency to Improve Machining Operations

Matthew Jaster, Senior Editor

Sensors, robotics, mechatronics, and digitalization are helping machine tools excel at repeatability, precision, efficiency and speed in 2019. While there are several factors for this, quick-change workholding is one area that continues to advance and make manufacturing gears easier for operators on the shop floor.

The very definition of “quick-change” in gear manufacturing has evolved through the years.

“Initially what Gleason and others in the industry referred to as quick-change workholding still required some manual interaction to install and remove the workholding. An Allen wrench, for example, was used to remove mounting bolts, set screws and ejector screws. The latest quick-change systems offered by Gleason are more modular and can be installed and removed quickly with the limited use of tools,” said Tim Zenoski, director global product management-workholding at Gleason Corporation.

Sandvik Coromant introduced Coromant Capto back in 1990 and the coupling has never changed, according to Brent Godfrey, product specialist, machine integration at Sandvik Coromant. “However, more and more tools with the Coromant Capto coupling have been introduced over the years and other quick-change systems have come and gone over that period of time.”

For Emuge, the company generally offers a custom design for a specific run of workpieces, and/or workpiece families where interchangeability is one of the keys to a successful and profitable operation.

“The real evolution is the fact end users are recognizing the bigger advantages of a custom quick-change system which is generally more expensive than an off-the-shelf quick-change workholding system,” said David E. Jones, precision workholding manager at Emuge Corp. “Initially quick-change devices were being used by customers who have part families where parts have similar geometries, and similar machining operations. Now, however, we are seeing some of these part family quick-change connections staying on the spindle after the initial program has finalized. In this scenario, quick-change is used on the next program, regardless if there is a part family or not. The end user can quickly change out a workholding device for any reason at any time.”

Smart Developments

It’s a strange, new world on the shop floor—one that involves automation cells, robotics and a push for the factory of the future. This makes the equipment as dynamic as ever and a steep learning curve for machine operators as the technology changes. We asked our experts to discuss, for example, how Industry 4.0/IIoT and automation are making workholding products smarter.

“Automation is growing in the metal cutting industry,” said Godfrey. “Quick-change tooling has to be adaptable to work with robots and unmanned cells.”

Zenoski said that many of today’s workholding customers want the ability to track critical data. Incorporating Industry 4.0/IIoT into quick-change systems is the next step.

“The use of RFID chips, for example, can allow the customer the ability to determine how many times the workholding has cycled. Knowing this can help the customer to determine when preventive maintenance is required. It also can trigger reorder points for wear parts such as collets,” said Zenoski.

Sandvik Coromant is starting to introduce some sensor-based tools that can send helpful information to the user.

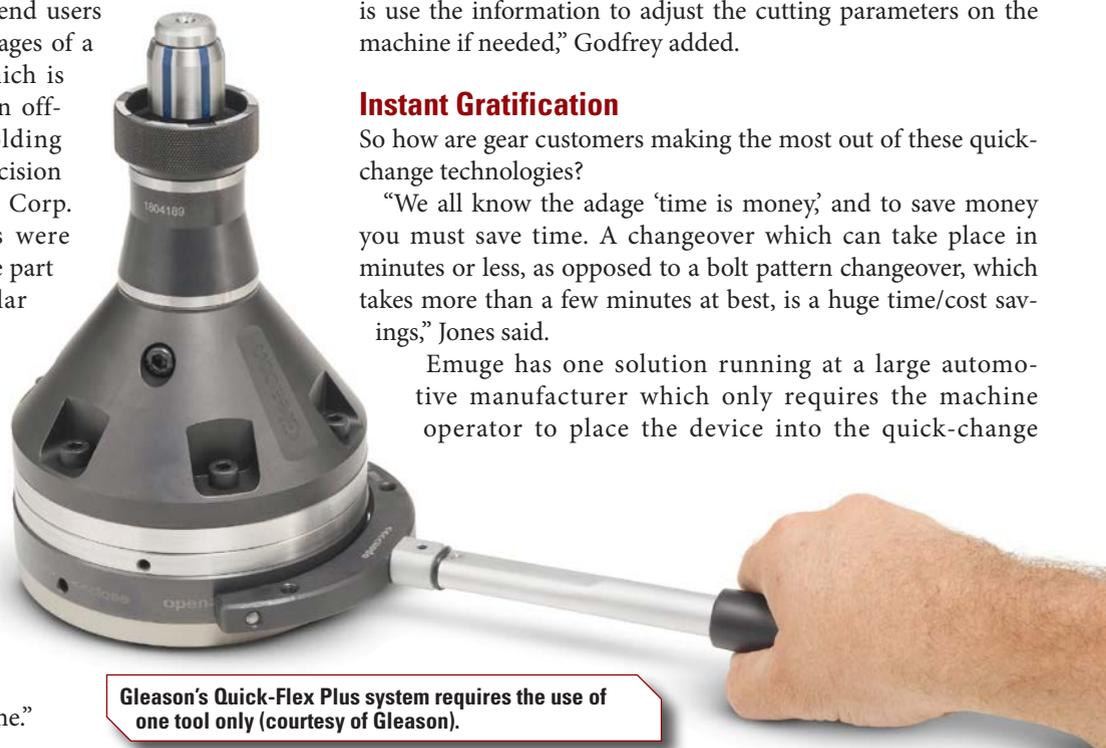
“We recently introduced a product called Silent Tools Plus which includes a program of long dampened boring bars that have sensors that measure things like temperature and vibrations and they have a Bluetooth connection to an application on a tablet outside of the machine. One thing the user can do is use the information to adjust the cutting parameters on the machine if needed,” Godfrey added.

Instant Gratification

So how are gear customers making the most out of these quick-change technologies?

“We all know the adage ‘time is money,’ and to save money you must save time. A changeover which can take place in minutes or less, as opposed to a bolt pattern changeover, which takes more than a few minutes at best, is a huge time/cost savings,” Jones said.

Emuge has one solution running at a large automotive manufacturer which only requires the machine operator to place the device into the quick-change



Gleason’s Quick-Flex Plus system requires the use of one tool only (courtesy of Gleason).

Machine side of an Emuge Quick Change shaving arbor with a male bayonet feed through feature.



machine adaptor, give the device a quarter turn, and then hit a button on the machine controller, at which time the device is pulled back into the tapered spindle.

“This type of change is done in a mere fraction of the time it would take for a typical bolt-on device or say a conventional bayonet style of connection. The design is a quick-change without any additional tooling or support tooling required. Not a wrench in sight!” Jones added.

Godfrey at Sandvik suggests two good ways to maximize the performance of the quick-change tooling.

“One is using *redundant tools* meaning for each tool on the turret you have a *new* version of it sitting next to the machine preset and ready to go. When the insert wears out and needs to be indexed, unclamp the tool and take the redundant tool and clamp it and start the machine again. Index the insert outside of the machine,” Godfrey said. “The second way is to *kit* the tooling for the different jobs that run on the machine. Each time a new program is called up the tooling for it can be on cart somewhere near the machine.”

For gear applications, Godfrey said that since most gears have internal and external turning operations done prior to tooth cutting, all the turning operations can utilize quick-change-tooling.

The speed and ease of changeover when utilizing these systems can eliminate the need for skilled machine operators and toolmakers, which in this industry are becoming harder to find.

Zenoski said that the single biggest advantage of quick-change setup for machine tools is increased spindle run time. Traditional workholding set up and changeover can

take 30 minutes or more, depending on the application. Tool-less quick-change setup and changes over from one workpiece to the next can be done in a matter of seconds. The benefits to a company that runs small batch lots can be an hour or more of increased spindle run time per day.



Mating tailstock side of an Emuge Quick Change shaving arbor with female bayonet feed through feature.



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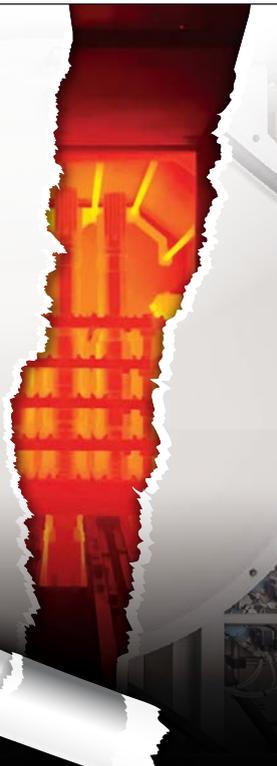
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Sandvik Coromant introduced a product called Silent Tools Plus which includes a program of long dampened boring bars that have sensors that measure things like temperature and vibrations (courtesy of Sandvik Coromant).

“Several years ago Gleason developed a quick-change system called Quik-Flex Plus which requires the use of one tool only. The base for this system is made in several different sizes to allow Quik-Flex Plus to be used on all of the cylindrical machines produced by Gleason. It’s also sufficiently universal to be used on other gear manufacturers’ machines. Once the base is mounted to the machine spindle the part clamping module is mounted to the base with just the turn of a handle. The changeover process from one workholding module to another can be done in 30 seconds or less with radial/axial repeatability of .0002” (5 microns) or less,” Zenoksi added.

For Gleason’s bevel workholding product line, the company has also incorporated a stir-ability feature into its modular workholding to allow a customer to be able to reduce fixture runout to as close to zero as possible.

Keeping the Customer Informed and Educated

Repeat business is the end game in gear manufacturing. The effort needed to meet quality demands and lead times tend to keep operation managers up at night. Therefore, sales and service departments work to ensure training and customer support is emphasized regularly.

“Gleason has a global network of sales and service in most regions of the world. Workholding is designed and manufactured in four strategic locations worldwide. Aside from quality, lead time is the main driver in gaining and maintaining repeat business. Gleason offers wear part stocking programs for many customers throughout the industry. This reduces customers’ lead time to get critical replacement parts such as collets and springs, from weeks to days in many cases,” Zenoksi said.

Preventive maintenance is the key to the life and quality of these systems.

“Periodic disassembly, cleaning and re-lubrication of workholding can add years to the life of the fixture,” he added. “Gleason has work instructions and offers training classes for the troubleshooting and maintaining workholding. Incorporating smart technology (RFID chips) into workholding to register chuck cycle counts can help the customer to understand when preventive maintenance is required.”

Sandvik’s customers are more successful running the tools in the machine when they really know how to use them.

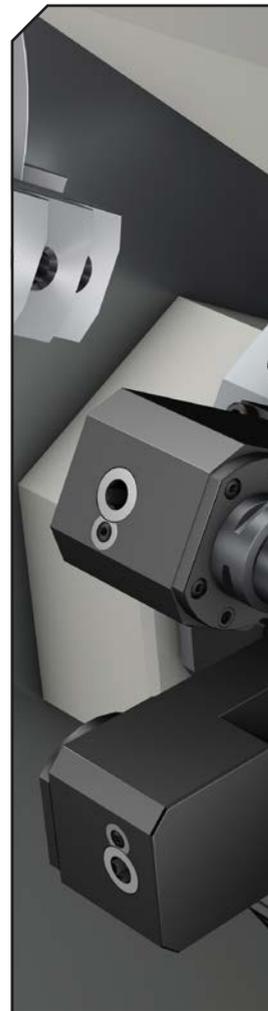
“We place a large emphasis on services that help our customers. For example, for our Coromant Capto driven tooling we have a repair program. And troubleshooting is done on a daily basis by our sales engineers and specialists,” Godfrey said.

According to Jones, communication is extremely crucial to long-term success.

“Whether application feedback is a best or worst scenario, it is absolutely necessary to provide customers all details in a timely manner because they have a job to do, and schedules to keep. With every order of a new workholding device, we supply a handbook which has specific directions on how to exchange any wear or part touching details, and maintenance instructions.

Additionally, Emuge prefers having personnel available on-site for any first time use of a new design, or when they have a new customer. It’s important to be immediately available in the event a problem occurs, and also to be present for any guidance or initial questions regarding the tooling, its mounting, or operation etc.

“As for preventative maintenance, every workpiece and environment is different, and sometimes the environmental issues dictate preventative maintenance



timetables,” Jones said. “One example when more maintenance is required would be a hostile environment resulting in workpieces that have inconsistent clamping tolerances as compared with a very clean environment, where the workpieces always get presented to the workholding device within consistent tolerances.”

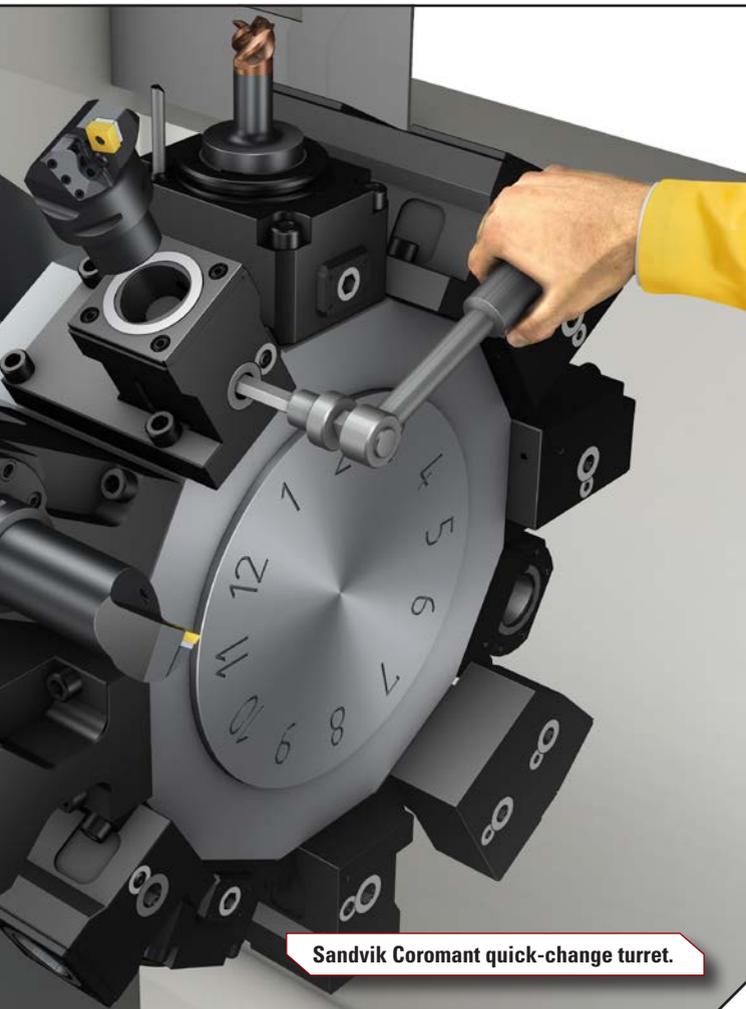
What Comes Next?

Workholding will continue to evolve with the changing systems inside machine tools. The future promises more automation, more information and emerging technologies incorporated into the equipment.

“One increasing trend is automatic clamping and unclamping. We offer hydraulic Capto clamping units and spindles that are integrated in the machines and the cutting tools use the machines’ ATC function. Also, as machines evolve and can do more operations quick-change tooling needs to be adapted where it can be beneficial,” Godfrey said.

In the future it will become more common for modular workholding to be installed and removed utilizing the function of the machine spindle.

“Basically the operator would put the workholding in the spindle and push an install button on the controller. This is currently a feature that Gleason offers on Phoenix 280G Bevel Grinding Machines. The next evolution of modular



Sandvik Coromant quick-change turret.



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workholding is for the fixtures to be loaded and unloaded utilizing an automatic tool changer,” Zenoski said.

Zenoski added that numerous factors will play into making workholding more efficient in the future, including: Industry 4.0, new materials, advancement in heat treatment processes, 3D printing technologies, and life cycle testing for workholding components and assemblies.

But before focusing on the future, Jones at Emuge believes it’s important to understand the significance of quick-change systems today.

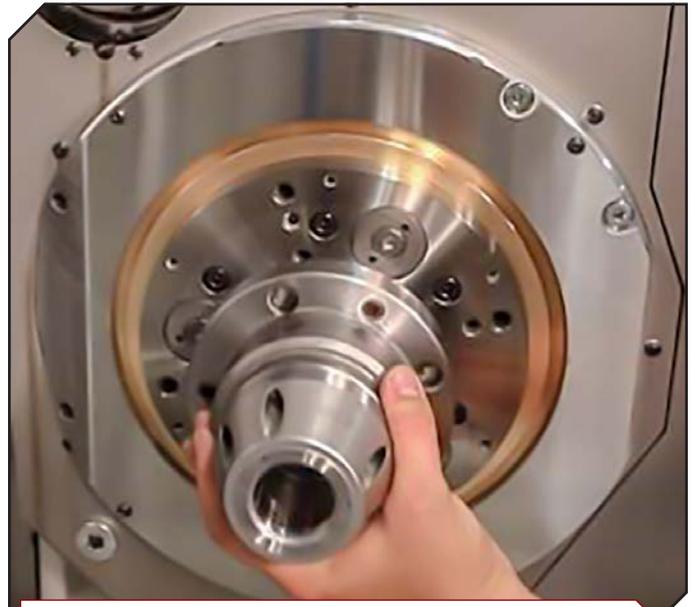
“Quick-change systems have already made workholding more efficient, and it doesn’t matter if they are being used with short run workpieces and part families, or being used in a dedicated run for years,” Jones said. “Anytime you can make job changeovers quickly, on the same machine with minimal impact on time and production, it’s a win.” ⚙️

For more information:

Emuge Corporation
Phone: (800) 323-3013
www.emuge.com

Gleason Corporation
Phone: (585) 473-1000
www.gleason.com

Sandvik Coromant
Phone: (844) 249-1134
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The single biggest advantage of quick-change setup for machine tools is increased spindle run time (courtesy of Gleason).



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