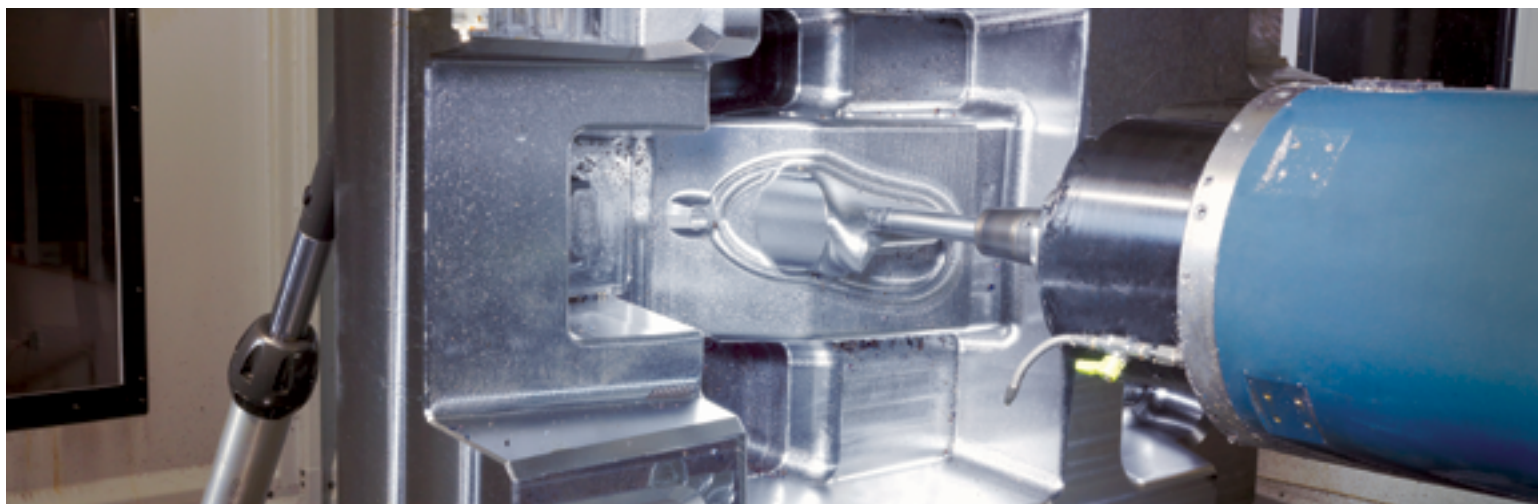


C O M P E T I T I V E MOLD MAKER

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INSIDE FEATURES





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ADOPTING A PRODUCTION MINDSET
TO INCREASE EFFICIENCY

Die and mold shops across North America are increasingly adopting a production mindset in order to meet growing customer demands for lower costs and shorter lead-times. They are seeking new methods of fixturing, tooling and machining that enable fewer setups, reduce labor and provide greater throughput.

As part of the trend to increase efficiency, the adoption of automation is growing rapidly and can take many forms. From the simple act of introducing automatic pallet-changers (utilizing modular fixture systems) to implementing entire automated systems, leading die and mold shops across North America rely on qualified and experienced engineering service providers like Makino that can help them identify and implement the most appropriate automation solutions for their applications and processes.

As businesses apply these production methodologies to their operations, high-performance horizontal machining centers (HMCs) are transforming the die/mold environment. These HMCs provide numerous benefits, including boosting throughput and overall capacity, helping businesses to grow and be more competitive. The automatic pallet-changers found on this equipment enable rapid workpiece changeover, higher equipment utilization, flexibility for engineering changes and, ultimately, faster overall return on investment.

Some of the companies mentioned in this issue of *Competitive Mold Maker*, including Build-A-Mold and TK Mold, have also added modular work-holding systems to reduce setup time. The flexibility of these systems has helped increase production, even while performing one-off mold machining. Other companies have applied data-driven manufacturing methods to gain greater efficiency in their production operations. This shop-floor monitoring provides actionable data regarding the performance of each machine or system so that managers and operators may improve processes in real time. Thanks to the multiple types of production-monitoring software and hardware technology available, getting the most out of a shop-floor environment through this type of information is just a mouse-click away.

As mold makers continue to be challenged by low-cost manufacturers overseas, the pursuit of a production mentality can definitely bring greater efficiencies; but die and mold shops must invest wisely, utilizing Makino machines that maintain their accuracies and ability to generate fine finishes for years to come.

Don't underestimate the value of reliable machinery and automating it intelligently with a reliable partner. Makino provides both the equipment and engineering expertise to reliably support your operation, from design through implementation and ongoing technical and operational support.

Sincerely,

Andre Ey
Vice President
Makino Die Mold & EDM Technologies
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USING SMART DATA TO TRANSFORM YOUR BUSINESS

BY LAURIE HARBOUR, PRESIDENT AND CEO OF HARBOUR RESULTS INC.

Improving revenue per full-time employee, increasing throughput and enhancing profitability are just a few examples of the improvements mold makers of any size can experience if they collect and analyze the right data and implement the right action steps.

Harbour Results Inc. (HRI), a leading business and operational consulting firm for the manufacturing industry, has worked with many companies to help create and implement a better business strategy and improved efficiency.

"As demand continues to grow, it is increasingly important for mold makers to optimize their business," said Laurie Harbour, president and CEO, HRI. "With the right internal and external data, processes and methodology, companies can significantly improve their business and position it to grow profitably."

Recently, after working with HRI, here's how a North American automotive mold builder with more than \$40 million in revenue and 180 employees achieved an improvement in profit of 10 margin points.

THE CHALLENGE

The family-owned company was transitioning to new leadership—from father to son—and although the company was profitable, the family thought there was opportunity to do better and improve as the automotive industry was experiencing growth.

"With the right internal and external data, processes and methodology, companies can significantly improve their business and position it to grow profitably."

THE TRANSFORMATION

After fully assessing the company, HRI worked with leadership to establish both a one-year and five-year strategic plan. Next, it was time to work on the organization's operational efficiency.

Through a series of proprietary processes, HRI worked hand in hand with the team to identify waste, increase visual controls and implement shop-floor improvements, such as increased runtime on equipment, more efficient assembly processes, reduced rework and improved scheduling systems. Additionally, the company identified opportunities for and implemented a training program, as well as created a better strategy to optimize its outsourcing strategy.

Finally, HRI demonstrated the value of gathering key data and information from inside the manufacturing facility as well as through relevant industry trends. Internal metrics were tracked, analyzed and used to make both day-to-day and long-term business decisions.

CONTINUED RESULTS

The mold builder experienced significant improvements in its business, including

an increase in revenue per full-time employee, improved machine runtime and increased throughput, all without adding more equipment within the facility.

Today the company has hired a data analyst responsible for looking at smart data from various sources as well as continuing to work with HRI to maintain improvements while identifying further opportunities to strengthen the business.



The leading authority on the manufacturing industry providing companies the tools they need to develop sound strategies and improve operational efficiencies through business assessments, operational improvement, strategy development, benchmarking and its newest product, Harbour IQ™—a business intelligence tool providing smart tool and die industry data to manufacturers.

NOW IS THE TIME TO AUTOMATE YOUR DIE/MOLD SYSTEMS

The adoption of automated technologies and processing methods is no longer a solution limited to production machine shops. Today mold, tool and die shop owners from across North America are increasingly turning to automated machining technologies to achieve dramatic improvements in quality, reliability and productivity that directly impact bottom-line growth and overall competitiveness.

Advancements in automated technologies have expanded considerably over the last decade to accommodate high-mix production demands that are ideal for mold, tool and die machining processes. Complex and sophisticated material-handling cells can be designed for a wide variety of applications, including hard milling, graphite milling, 5-axis machining, and sinker and wire EDM. The net result is consistent performance and improved efficiencies across all processes through the elimination of manual setups and stack-up error.

Moreover, automation of mold, tool and die processes support companies in

optimizing labor resources by removing non-value-added labor practices and empowering companies to redeploy labor into more value-added roles that focus on business growth, not just getting the work done. Automation enables shops to more effectively compete globally by reducing workpiece costs while expanding the business pipeline.

Despite the initial upfront costs of adopting automation, mold, tool and die shops can expect automation to deliver a rapid return on investment (ROI), oftentimes paying for itself in as quickly as one to two years. With these numerous opportunities for business growth, it's time

for shop managers to seriously consider automation as an investment in long-term dynamic growth and flexibility.

THREE WAYS AUTOMATION TRANSFORMS BUSINESS

Many mold, tool and die shops today face increasing demands for shorter lead-times, improved quality and lower costs. Automation offers several key advantages for overcoming these challenges:

1 COMPRESSING LEAD-TIMES:

Implementing automation provides dramatic reductions in lead-times and improved flexibility in production schedules. By decoupling setup processes from machining processes, automation maximizes machine utilization from an average of 30 to 35 percent on stand-alone machines to as much as 85 percent within an automated cell. Mold, tool and die shops operating automated systems are generally more flexible in their production schedules, including the ability to accommodate quick turnaround completion of urgent engineering changes without disrupting current processes in progress. This flexibility is ideal for mold, tool and die shops that need to shift rapidly within a high product-mix environment. Moreover, the ability to perform lights-out processing opens up



additional machining time to produce more workpieces during off-hours, particularly long cycle-time applications.

2 IMPROVING QUALITY:

By automating work loading/unloading and reducing the number of setups for processing, mold, tool and die shops that use automation benefit from greater accuracy, quality and consistency. This capability eliminates several of the most common sources for deviation, including human error and stack-up error. Additionally, many automated systems are designed with in-process error-prevention technologies, such as coordinate-measure machines, tool-length measurement and fixture, workpiece or tool probing. When engineered successfully, closed-loop feedback can be introduced into a cell for the highest degree of quality and confidence.

3 REDUCING COSTS:

Among customers' primary concerns, cost remains highly influential in their decision of who to contract work out to. Automation is one of the most powerful means for reducing costs of the production of molds, tools and dies. With fewer setups, elimination of manual loading and unloading, less secondary handwork and the ability for one operator to manage multiple machines simultaneously, automated machining systems enable shops to significantly reduce costs associated with non-value-added labor time. This approach also relieves stress and the costs associated with identifying the additional skilled



labor resources necessary to grow capacity. Shorter lead-times and improved scheduling flexibility provide greater throughput and opportunities to improve workflow efficiency and reduce on-hand inventory. Cost reductions can be realized with faster ROI of capital equipment and the ability to extend operating hours through unattended operation.

MAKING THE MOVE TO AUTOMATION

There has never been a more critical time to consider automating mold, tool and die manufacturing operations. As more shops adopt automated technologies, those currently running stand-alone machines are likely not going to be able to match the speed, quality and costs expected from customers.

Making the move to automation should not be taken lightly, however. Designing,

engineering and implementing an automated machining cell is a complex process that should be performed with the support of experienced engineering partners and equipment providers. This buy-in is essential to ensure the effectiveness and long-term reliability of any investment in automation.

Makino has dedicated itself to delivering the knowledge and experience to support mold, tool and die shops that are pursuing automation. From simple robot load/unload cells to complex multi-machine and closed-loop processing cells, Makino provides the engineering support and well-qualified third-party supplier partnerships to guarantee long-term competitiveness in the mold, tool and die industries.



LEARN MORE ABOUT THE BENEFITS AND CONSIDERATIONS OF AUTOMATING DIE AND MOLD PROCESSES IN OUR COMPLIMENTARY WHITE PAPER, **"DIE/MOLD AUTOMATION: RETOOL YOUR BUSINESS PROCESSES TO IMPROVE PRODUCTIVITY."**



Q&A ON WIRE EDM SLUG REMOVAL

WITH BRIAN PFLUGER, EDM PRODUCT LINE MANAGER AT MAKINO

Q

When wire EDMing, what is the most effective method for retaining or removing slugs?

A

There are several different techniques for holding and retaining material slugs, but these methods will vary based upon the material type and size. It is important to have a slug management plan in place before machining begins, as it is imperative to prevent damage to the machine.

RARE EARTH MAGNETS

These high-power magnets are a very convenient and inexpensive method to controlling most slugs on magnetic/ferrous materials. Several different sizes and power of magnets are available, and many magnets can be used to retain a slug. For wire EDM purposes, using a lower profile magnet typically prevents interference and collision issues with the machine nozzles. While magnets are effective, they do have limitations. As a general rule, once a slug becomes larger than a 50mm (2.0") cube or greater than 5kg (11 lbs.), additional support or retaining methods should be considered.

ADHESIVES

On smaller parts, glue or adhesives such as Super Glue or Bond-O can be used to retain the workpiece or slug. This method would be reserved for smaller, lighter and more delicate part details, but a method for removing the adhesive must be determined before employing this method.

TAPE

Using tape such as duct tape can be an effective method in controlling and retaining slugs. When machining some thin material parts (part size dependent), it might be necessary to apply tape mid-process, as thin materials can sag under their own weight, which will cause inaccuracies to the final part. If tape is applied mid-process, it is important to disable Automatic Wire Break recovery, as the machine could potentially crash or disturb the machine setup if the tape is placed near the program path.

CLAMPS

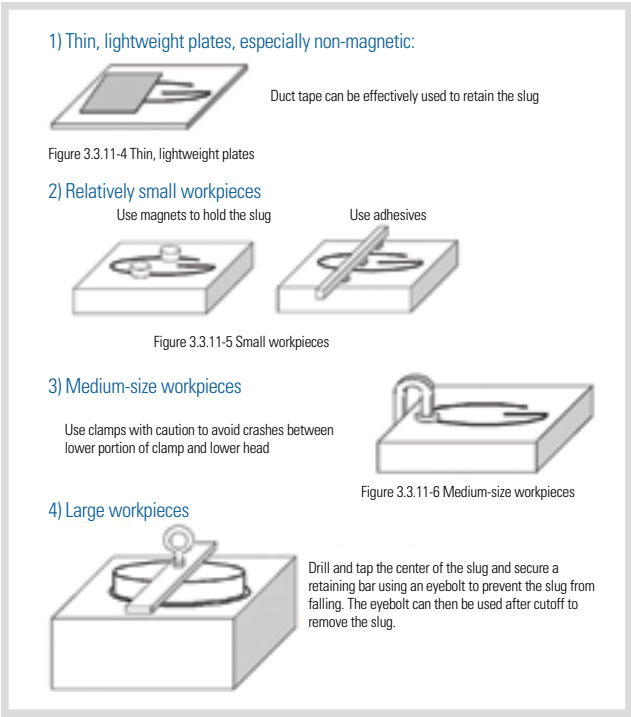
These are simple C-clamps or Kant-Twist clamps that are used to retain a slug from dropping. While effective, these clamps do hang below the table level, so extreme care should be taken to ensure that the machine does not crash into these clamps during operation or when moving the machine to extract the slug.

TOP STRAPS

Top straps are a flat bar of steel bolted to the slug before final cutoff and dropping of the slug. This method requires preplanning, as one or more tapped holes should be machined into the slug prior to wire EDMing. This method is very effective on larger and heavier slugs.

SLUG EJECTION VIA PROGRAMMABLE FLUSHING

On certain jobs where the slugs can freely fall away for the parent block, programmable flushing can be utilized to automatically eject the slug. All Makino wire EDMs feature dual, independent flush pumps, which enable programming of different flush pressures between the upper and lower heads. Depending on requirement, slugs can be pushed down and out the bottom of the part (higher pressure on upper head—lower pressure on lower head), or slugs can be pushed up and out from the top (higher pressure on lower head—lower pressure on upper head). In either case, the use of programmable flush for automatic slug ejection is typically reserved for smaller slugs, and the lower profile HEAT or Laminar nozzle would be used.



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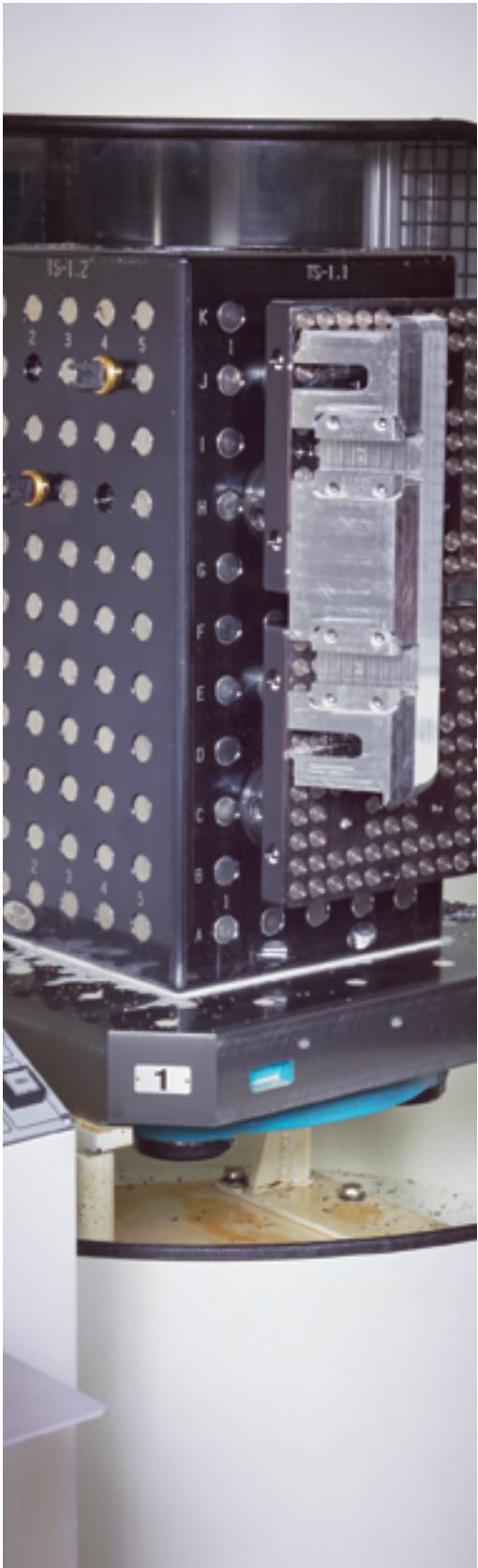


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change [chānj]

Verb: To transform or convert
(usually followed by into).



BRINGING A PRODUCTION MENTALITY TO BUILD-A-MOLD'S CUSTOM MOLD SHOP

Build-A-Mold, of Windsor, Ontario, Canada, decided that the company motto for 2014 would be 'CHANGE.'

"One of the core challenges we were facing was how to apply a production system to our custom mold shop," said Rob Caixeiro, mold-maker manager at Build-A-Mold (BAM). "We wanted to find better ways to open up capacity on a CNC machine and improve our EDM workflow by replacing our outdated equipment. We needed to understand how high-performance equipment would fit our needs and help us change our shop."

Caixeiro led the capital investment project, and he and his team spent a lot of time reviewing machinery and automation and analyzing the anticipated paybacks. They found their solution in several high-performance machines from Makino, spanning from horizontal mills with automation to high-precision 3- and 4-axis vertical graphite mills with automation and a large 6-axis horizontal mill. In just over a year, the shop floor at BAM transformed dynamically, along with the

business' overall efficiency, capacity and profitability.

"We have seen a 70 percent increase in production and efficiency in our mold inserts, thanks to the higher rpm and reduced monthly tooling cost generated from our new equipment," said Caixeiro. "We are using this newfound capacity to expand the business and to capture additional revenue opportunities from repeat work."

A STRONG PRESENCE

BAM got its start in 1978 with just two employees in 2,000 square feet of rented space. Today it has 110 employees in Windsor and serves as a "one-stop shop" to the plastics industry—handling part design and concept, machining, plastic injection molding, assembly, painting, chroming and then shipping the finished part to the customer. The OEMs it works with include Chrysler, GM, Toyota and

Honda. Owned by A.P. Plasman, the company has production facilities in Windsor and in Alabama. In its other locations in Canada, Michigan, Wisconsin and Japan, it is able to focus on steel cores and cavities and small parts.

BAM has a strong presence in the Windsor moldmaking market due to its reputable performance and exceptional service. The company's decision about which equipment to purchase was driven by its desire to compete with the offshore market. Caixeiro and the BAM team spoke with other moldmaking companies in the Windsor area to find out what kind of equipment they were using.

"When doing research on equipment, we like to get feedback from the people actually using the machines," he said. "We wanted equipment that is well known and that already has a footprint in this area. People around here are very



BAM's team of machinists and manufacturing engineers stands in front of the company's recently acquired MCC2013VG 6-axis horizontal machining center.

forthcoming about sharing their positive experiences. As a result, we don't feel like we are competing with each other, but we are competing with companies overseas. In our research with our peers, Makino's name kept coming up. Not only is its [Makino's] equipment used at the majority of area operations, but its reputation and local service from [SST-Canada](#) are also highly regarded. I had experience with the company from a prior job, and we saw the equipment in action at IMTS 2012. All of these factors caused us to choose Makino. We knew we could start producing quality parts right away. We feel that you get what you pay for. This is a solid product that can produce without any issues. We have confidence in its reliability."

BAM purchased five new Makino machines in 2014:

- The [F3](#) and [F5](#) vertical machining centers with robotic automation system to use in its graphite electrode production
- [The MCC2013-VG 6-axis horizontal machining center](#) for its large mold finishing

- [Two a61nx horizontal machining centers](#) and [MMC2 automated 12 pallet-handling system](#) for small-mold components

In addition, BAM purchased the FCS clamping system for the MCC2013VG and a61nx machining cells in an effort to reduce setup times and adapt to a production mindset.

"SST's Tony Facione was a huge support in helping us identify the equipment that would suit our needs," said Caixeiro. "During the installation of our equipment, we sent many of our operators to training in Auburn Hills, Mich., and Mason, Ohio. We knew there would be a bit of a learning curve, especially going from the vertical machining centers to the horizontal equipment. Our employees embraced this change."

"We have seen a 70 percent increase in production and efficiency in our mold inserts, thanks to the higher rpm and reduced monthly tooling cost generated from our new equipment."

IMPROVING EFFICIENCIES

The new robotically automated F-Series cell, which includes the F3 and F5 with a rotary table, has helped BAM to improve current electrode production efficiencies by eliminating costs, increasing machine utilization, improving quality and enhancing the flexibility of EDM workflow scheduling.

When it comes to production efficiencies, the company used to have a backlog cutting graphite, but the new equipment has allowed it to open up capacity and take on more work.

"Before getting the F-Series cell, we relied upon outsourcing \$150,000 in electrode production with our five older VMCs," said Tony Couto, EDM supervisor at Build-A-Mold. "Now we can perform all of this work in the cell with fewer machines,

and operators can be redeployed into more value-added roles around the shop. We're talking some huge savings! Less capital-consuming floor space, less labor time spent babysitting machines, lower maintenance, less energy consumed around the clock, fewer fixtures, less tooling—the list just goes on. We have one operator loading the cell to max capacity, and the machines just keep cutting. It's that simple."

According to the company, the electrodes being produced today are high quality, and previous issues, such as graphite dust pollution, are eliminated, thanks to the machine being designed for graphite machining.

"This investment has allowed us to cut more detailed and complex electrodes faster," said Couto. "We can use smaller tools and attack the part from the sides. This has helped us increase our efficiencies."

Efficiencies were also realized with the addition of the MCC2013-VG. The company is experiencing added versatility with multiple axes and can shorten tooling, eliminate multiple operations and remove more material, especially on larger blocks with this machine.

"With the MCC2013VG, we can cut bigger blocks because the equipment's spindle will rotate, picking up a larger machining envelope," said Dave Ives, senior CNC technician at Build-A-Mold. "We can get everywhere we need to be, including hard-to-reach areas, and the quality coming off of

the machine is phenomenal. We have brought the finishing operations of large molds back in-house and are achieving greater quality than ever before. We are achieving tool blends of 0.0005 inch and parting lines of 0.001 inch, leading to a 70 percent reduction in secondary grinding operations and cutting time from fitting and spotting."

Costs are saved not only in secondary operations but also in tooling.

"Investments in advanced technology have led to a 40 percent reduction in tooling expenditure," said Billy Ayres, CNC operator at Build-A-Mold. "Quality

"We're talking some huge savings! Less capital-consuming floor space, less labor time spent babysitting machines, lower maintenance, less energy consumed around the clock, fewer fixtures, less tooling—the list just goes on."



of work has been night and day, with tolerances all in spec. We no longer have to put all of our focus on how we are going to cut something. The new equipment has opened up our options. We don't have to second-guess what we are going to do."

Operators no longer worry about working around the limitations of their previous machines or babysitting them to control errors. The machines just run.

"After installation of the MCC2013-VG, we immediately started accomplishing our goals," said Caixeiro. "It ran

BAM has had equally positive results with its a61nx cell. The company is able to mill rib features that would have previously required EDMing.

"The a61nx cell has cut lead-times in its small mold components by as much as 50 percent," said Joe Hindi, CNC supervisor at Build-A-Mold. "The flexible scheduling capabilities have enabled us to hit or surpass the timelines given to us."

The company is not only meeting shorter lead-times in small mold components but has also opened up revenue opportunities for repeat work.

FCS ADDS TO PRODUCTION TRANSFORMATION
The addition of the [FCS clamping system](#) on both the a61nx cell and the MCC2013VG has also contributed to changing BAM into more of a production operation.

"The FCS has been the perfect sidekick to the Makino equipment," said Keith Andreoff, senior CNC technician at Build-A-Mold. "Operators estimated that the use of FCS has reduced setup times by an average of 50 percent by eliminating the need for manual indicating of fixtures and components."

worried about how we would hold something, and we had to tweak things to get it close. Now we get it perfect," said Andreoff.

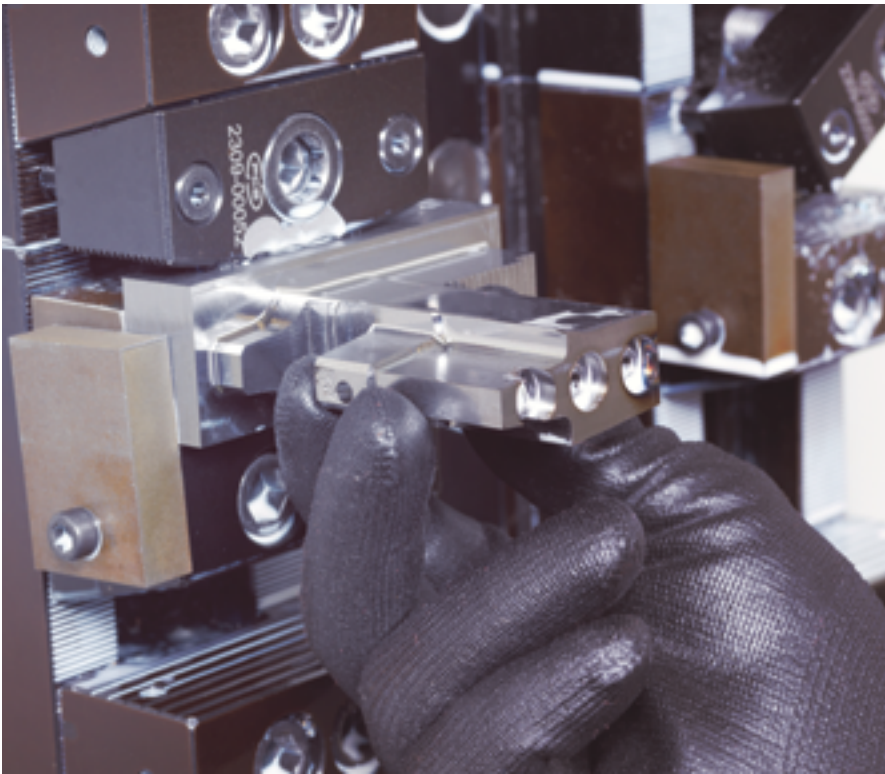
Between the FCS and its new high-performance equipment, BAM has evolved its custom mold shop into more of the production operation it desired. It can run the machines around the clock with less indirect labor cost, greater reliability and improved quality.

CHANGE FOR THE BETTER
All of these changes have enabled BAM to focus on what matters most to the company: the quality of the products, its customers, employees and stakeholders. Investments in Makino technology have been a crucial step in making all this happen.

"We aimed for 'change', but I think 'transformation' is a better word to describe our business over the last year," said Caixeiro. "From the way we order materials to how we process work and manage on-hand inventory, we're operating more efficiently, more profitably. But most importantly, we're now able to provide customers better quality workpieces and shorter lead-times with greater reliability, and at a lower cost to boot. By creating greater efficiencies and cash flow throughout other segments of the business, BAM has also become a more highly valued asset within our parent company, A.P. Plasman."

Throughout these changes, BAM remains dedicated to producing quality parts at competitive pricing, always on time, for its customers. These customers are excited about what the company is doing, especially the fact that it is staying ahead of the curve through this change.

"Customers have confidence in us," said Caixeiro. "They have taken notice that we are supporting them through our investments. They have shown their appreciation by placing more orders with



Transformation

[trāns-fôr-ma-shən]

Noun: Change in form, appearance, nature, or character.

unattended that first week and hasn't stopped. It has replaced seven older 3- and 5-axis machines while simultaneously increasing capacity, improving quality and reducing lead-times. Our new challenge is optimizing processes to utilize the full capabilities of the MCC2013-VG and its horizontal work orientation. We feel that this machine can help us become more competitive and win more business."

"When we went to training in Mason, they told us that the a61nx cell would be one of the best workers that BAM would ever see," said Hindi. "They were right. It's smart enough to know where it has left off, and it feeds itself without stopping. It's a great machine."

The system helps BAM be more flexible by helping it adjust to new builds and engineering changes.

"We noticed that everything is operator-friendly. With the FCS you don't have to put much thought into it. The software knows where the FCS is and where the component is, and you just cut, knowing what the outcome will be. Before, we

us. Outsourcing has been reduced by 70 percent already with our additional capacity. Our initial return on investment projection is already ahead of schedule and is anticipated to happen in just two years. Based on this success, we plan to purchase additional equipment in 2015."

BAM's operators, who no longer have to work 60 hours a week to finish a project, also approve of the new equipment.

"Everyone is pleased with the change that has occurred due to the performance of the machines," said Caixeiro. "The equipment has allowed us to improve our morale and our results. Employees come to work happy and confident in the business because we've invested in state-of-the-art equipment and their training on industry-leading technologies.

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TK MOLD AND ENGINEERING MODERNIZES WITH PRODUCTION METHODS

Thomas Barr, president of TK Mold and Engineering, considers the 18 people he employs at his Romeo, Mich., company to be family. What matters most to Barr is that each family member continues learning, growing on the job and that they feel great about what they accomplish together.

Barr also wants to keep each and every one of them employed. In the highly competitive manufacturing marketplace, he says that no one can know everything, so everyone in his work family must keep learning. Barr has put that into practice by asking all employees, including himself, to change from their traditional approach of moldmaking to a more production-oriented method.

TK Mold invested in a [Makino a61nx horizontal machining center](#) along with the FCS modular work-holding system to help make the company's vision a reality. The additional capacity enabled TK Mold to match its 2014 revenue total in just the first six months of 2015. Barr projects his company to nearly double revenue year over year as a result of the new machining technology.

That growth is not the impact of just adding another mill, however. TK Mold can now produce more custom molds for the automotive industry because of how the a61nx and the new modular clamping work together to significantly speed up moldmaking.

"Water lines, angled setups, 3-D contouring and some things you would have three machines do, you can now do in one machine," Barr said. "This machine has not stopped running since we installed it. We would not have been able to handle what we've got going on without it."

CUSTOM MOLDMAKING NEEDS FACELIFT

TK Mold and Engineering, located near Detroit, is a family-owned business Barr founded in 2003. Barr

has witnessed firsthand the ups and downs of manufacturing, learning how to guide his company through shifting changes in the economy, customers' needs and technology. In 2013, when faced with increasing global competition and customers' demands for lower pricing, Barr and his team decided to take a leap forward in capacity and quality. TK Mold would continue to make high-quality molds but would do so in new ways not only less expensive but also consistent and repeatable.

To accomplish this goal, Barr would lead his company through a transformation to approach every job with a production mindset. He wanted TK Mold to move from every job requiring custom setup to a mold-handling system that could be set up once and used on every machine on





his shop floor. However, in order to do that, Barr would need new machining technology.

A PARTNER FOR TRANSFORMATIVE SUCCESS

In 2014, TK Mold accepted recommendations from Single Source Technologies, a North American distributor of machine tools and related supplies, and purchased the a61nx

“With the ease of setup afforded by the FCS and the second pallet for exterior setup on the a61nx, flexibility has improved dramatically.”

horizontal machining center with an [FCS modular work-holding system](#) that provides unrestricted access to five surfaces. This design results in less time setting up and more time machining—enabling TK Mold to achieve the goals Barr set.

Barr turned to [Single Source Technologies](#) because the distributor has been one of

his long-time suppliers. He appreciates the knowledgeable support and no-nonsense approach of SST representatives.

TK Mold didn't make a purchase as much as establish a partnership with SST, which recommended an a61nx horizontal machining center with an FCS modular clamping system. The a61nx, traditionally considered a production machining center, arms TK Mold with the quality,

speed and utilization rates to significantly boost capacity. Simultaneously, the FCS system enables the company to dramatically reduce setup time and focus on achieving a production mindset while still performing one-off mold processing.

Adopting a production mindset wasn't easy and it required employees to learn how to operate the precision controls

for the a61nx, along with techniques that are different from what they were used to when running commodity vertical mills. Among the changes: machine operators now can set up the next pallet outside the a61nx while running another job. That's typical in a production environment but central to the new approach to moldmaking that Barr wanted.

“With the ease of setup afforded by the FCS and the second pallet for exterior setup on the a61nx, flexibility has improved dramatically,” said Barr. “Schedule changes are simple with this combination of technology and they no longer require a substantial amount of time or labor. We're more responsive than ever before.”

PICKING UP THE PACE WITH MODULAR CLAMPING

Since investing in the a61nx with FCS system in 2014, TK Mold has been able to quote work much more aggressively and produce more molds than the company could make with its previous machinery.

Barr compares the capabilities and capacity of the new horizontal machining center with FCS to running three stand-alone verticals, but without the additional manpower or extended setup times.

The combination of the a61nx and FCS has yielded additional benefits. Bruce McGregor, TK Mold's plant manager, describes FCS to be both as simple and as complex as a box of LEGO blocks, the popular toy building bricks. The FCS system is so flexible with individual parts that it at first seems overwhelming; however, once his operators were able to gain hands-on experience with FCS, McGregor said they could design and build fixtures with ease. The technology enables new employees to accomplish far more than Barr said he was able to do during the same point in his own career. One operator with a year's experience in the industry loaded a mold onto a machine in a matter of minutes. This same setup once took hours without the FCS clamping system.

Key to the speed and accuracy the FCS system delivers is its precision design. Molds are mounted on four points bored into the bottom. Once the mounting holes are machined, they become the fixed X-Y reference points for the life of the mold. The FCS system achieves positioning repeatability down

“You're not spending so much time on the art of moldmaking. You're spending more time on the production of the mold. It [FCS] removes or starts to constrain the number of variables so that you end up with a very simple process.”

to 5 microns with precision-made clamps and rods that support molds of all sizes at all angles on a base plate that attaches to a machine's table. The base plate has mounting points on a 50-millimeter grid that ensure positioning. No special equipment or maintenance is needed for this system.

Shops that use FCS increase production time by an average of 88 percent, said Darrell Johnson, SST product manager—milling consumables. The FCS system makes it easy to recreate the exact fixture needed when another copy of a mold is ordered or molds are returned for engineering changes or repair.

Moreover, TK Mold is no longer locked into manufactured or fixed work-fixture sizes. The FCS system can be used with a mold block of any size and can be taken apart and reconfigured for each specific project.

continues on next page



The FCS system achieves positioning repeatability down to 5 microns with precision-made clamps and rods that support molds of all sizes at all angles.



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“Even though your work base is unique, custom, a specialized job, the discipline behind it is a production approach,” McGregor said. “You’re not spending so much time on the art of moldmaking. You’re spending more time on the production of the mold. It [FCS] removes or starts to constrain the number of variables so that you end up with a very simple process.”

Additionally, the FCS system has been integrated within other machining centers TK Mold owns. Employees now create fast, accurate setups of molds and mold components, and move them onto various machine platforms, including vertical mills and EDM equipment. The combined performance of the a61nx and FCS has also led to a 60 percent reduction in handwork and spotting. EDM processing has been reduced or eliminated in several applications, saving additional time.

As a result, lead-times have improved, along with the ability to meet customers’ demands for delivery. TK Mold can now be more flexible with customers who have urgent needs.

“You can’t have a production mindset in a mold shop without FCS,” Barr said.

MACHINING TECHNOLOGY OPENS NEW OPPORTUNITIES

Based on these results, Barr anticipates a full return on his investment in the a61nx and the FCS modular work-holding system within two years.

TK Mold’s initial results also have confirmed the strategy for achieving Barr’s goals for his company and his family of employees. Each employee can keep learning and growing on the job and feel great about what they accomplish, which

is possible because of the investment in the a61nx and FCS work-holding system.

“It’s amazing what the technology enables us to do,” Barr said. “We are creating efficiency for TK Mold and opportunity for our employees.”



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ACCURACY AND FINISH
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KEEPING YOUR
WIRE EDM EDGE HAS
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WHEN YOU MAKE WHAT MATTERS



FEATURED STORY

WATERS CORPORATION MEASURES COMPETITIVE EDGE WITH

HIGH-PRECISION

VERTICAL MACHINING CENTER

When your competitive edge depends on being first to get products to market, research and development (R&D) must happen quickly and often. For Waters Corporation (NYSE: WAT), one of the keys to achieving this leadership is having the ability to rapidly produce prototypes in-house. When these prototypes are designed to separate compounds at the micro level, what is needed is a precision machining platform that can handle the extremely precise tolerances.

“Reaching as far upstream in our process development as we can helps us remain an industry leader,” said Bob Jencks, consulting principal engineer at Waters. “We recently sought enabling technology to help us speed up product development, after determining that the future of our business depended upon

“We recently sought enabling technology to help us speed up product development, after determining that the future of our business depended upon the ability to achieve micro-tolerance machining capabilities in our product prototypes.”

precision analytical technologies, such as liquid chromatography (LC), mass spectrometry (MS) and thermal analysis, all of which are indispensable tools in today’s research and quality control laboratories. The company is regarded as a technology innovator, a premium supplier and one of the largest companies in the analytical-instruments industry, supporting scientists working in 100,000 labs. At its Milford, Mass., headquarters, it is developing high-performance liquid chromatography

active pharmaceutical ingredient and what, if any, impurities are present as well.

HPLC is a technique pioneered by Waters in the early 1970s. It performs several important tasks and that is to precisely separate mixtures of chemicals into their individual chemical components and measure their concentration relative to one another. HPLC relies on high-pressure pumps to pass a liquid solvent along with the sample mixture through a column filled with minute (1.7 micron) particles



Waters’ investment in a Makino iQ300 has enabled the company to take on increasingly difficult machined features, including microfluidic channels with widths of 0.0060 inch and depths of 0.0070 inch.

the ability to achieve micro-tolerance machining capabilities in our product prototypes. To accomplish this, we researched equipment with exacting tolerances, high-speed spindles, exceptional repeatability and tool life. We found what we needed in the Makino iQ300 vertical machining center.”

Waters is a global operation that designs, manufactures, sells and services

(HPLC) equipment. Used to separate and identify components in a mixture, HPLC measures the concentration of synthetic and natural chemicals in just about any sample—in the pharmaceutical, food, cosmetics and fragrances, environmental, forensics, clinical and industrial-chemicals industries. For example, the results derived from a chromatographic analysis can tell a synthetic chemist whether the batch reaction produced the right amount of

made of highly refined coated silica that separates the mixture into its individual components. High-pressure tubing and fittings are used to interconnect the pump, injector, column and detector components in the system.

The trend toward small-particle chromatography has led Waters to research and develop instruments with a smaller internal volume and higher

pressure. These instruments, known as ultra-performance liquid chromatography, are far more sensitive and efficient than their predecessors, and they produce more information in less time on much smaller sample sizes. As Waters R&D takes chromatography to routine microscale and beyond, it relies on its machine shop to produce its prototypes quickly, so it can determine if the company is on track to producing a promising new product.

SHRINKING PARTS

Milford, Mass., is the location of Waters’ separations technology R&D center. It is dedicated to high-value-added activities, such as instrument design and testing, prior to their release into manufacturing in its Class 10,000 clean room or, in the case of higher-volume products, released to its Singapore manufacturing plant. To produce parts that keep it on the cutting edge, the 200-employee machine shop continually upgrades its technology to handle the variety of highly complex, low-volume part concepts that come out of R&D. Shop employees are integral to the success of these prototypes, as they are trained to not only handle the often unconventional processes required but

solvents, requires less sample to be injected and allows researchers to use fewer test subjects for case studies. All of this contributes to data that could not be achieved previously in a laboratory production environment, enabling our customers to get their products to market faster and cost saving to the end user.”

Developing this type of LC/MS system requires extremely precise manufacturing processes that are capable of submicron positioning tolerances and surface finishes. To produce the next generation of LC/MS devices, Waters knew it needed the capabilities to make micro parts.

“We’ve found that producing 150-micron LC channels provides the perfect blend of speed, sensitivity, resolution and robustness needed for this testing,” said Claise. “But the challenge for us was delivering that same performance customers expect with 2.1-mm internal-diameter columns in a 150-micron device. It requires very tight tolerances from our equipment.”

A challenge with the silica tubing used in its previous LC models was its

fragility. To enhance this technology, the company sought to produce these micro channels in a fully contained metal device. This would require the surface finish of the capillaries to be very smooth.

“As the sample goes through the tubing, it can stick to the walls, while the sample in the center of the tubing keeps moving forward; this is known as dispersion,” said Jencks. “When the sample hits a corner, this tendency gets even worse, degrading the performance of the analysis. The goal is to maintain the integrity of the passage until it reaches the separation channel, where the separation takes place. We wanted to achieve at least a 5-micro-inch Ra surface finish in metal.”

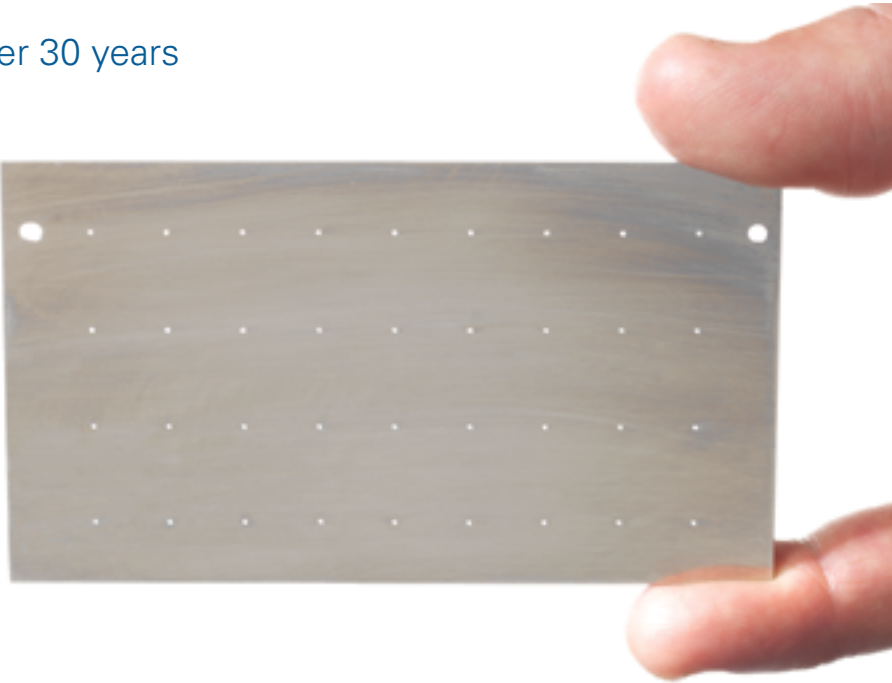
The company first tried getting these micro parts from outside vendors, but this proved to be very time-consuming. “One issue we constantly face is that our product-development cycles keep getting more compressed,” said Jencks. “Lead-times from our outside vendors were not where we wanted them to be, in order to meet these time frames. In fact,

“I’ve been involved in machining for over 30 years and haven’t seen anything like this.”

also to have an eye on quality, identifying any changes that R&D should make.

Recently, the R&D group challenged the machine shop with its desire to pursue microfluidics, in order to improve low-flow LC. This would require micromachining tiny columns, tubes and fittings to critical tolerances for channel width, depth and surface finish.

“We decided to invest heavily in micro-flow LC/MS because it offers many benefits for our customers,” said Pete Claise, senior product marketing manager at Waters. “Microflow LC/MS provides increased sensitivity, consumes far fewer



one of our products took over two years to develop, due to outsourcing. We just can't have this wait, if we want to remain competitive. Outsourcing can also be cost-prohibitive, or the quality might not be where we want it to be. It was definitely not the solution for us."

When Waters first tried producing these tiny parts on its own, it struggled with equipment that did not provide the required tolerances and eventually returned it to the manufacturer. That is when the company began looking at other suppliers.

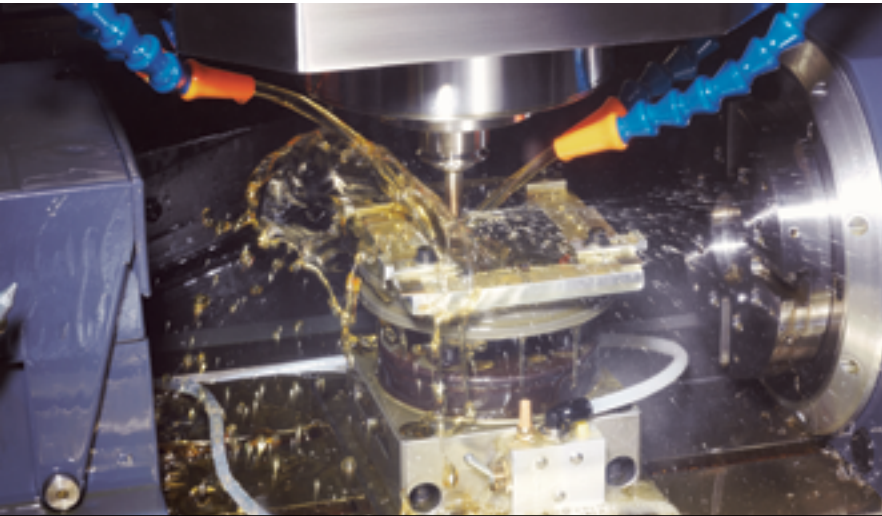
Waters was challenged by not only the micromachining requirements but also weighing into its decision was acquiring a machine that could handle larger features, such as counterbores and ports. It did not want to produce these larger features on a separate machine, because of the critical accuracy of those other features in relation to the microchannels. "We needed a high-precision machine that could accomplish both the fine features and the traditional milling and tapping," said Jencks. "We did not want to worry about tooling up parts from a smaller machine to a larger machine. The size of our channels does not tolerate any variability. For example,

"Since the iQ300 has come on board, we've been able to develop products we had no capability of developing in the past."

on one of our projects, we are looking at machining fluid passages below 0.0060 inch in width. We cannot have misaligned passages, or they will impact the operation of the device."

A HELPFUL START

The folks at Waters visited Makino's booth at the International Manufacturing Technology Show (IMTS) and had spoken with John Bradford, micromachining R&D team leader. With these new challenges facing them, they contacted Bradford about their project. After discussing possible solutions, several Waters personnel traveled to Makino's Auburn Hills, Mich., Technology Center, to see the equipment in action. They sent part drawings to Bradford ahead of their visit and took along the parts that they had been trying to machine on their previous equipment. Before they arrived, Bradford and his team had programmed the [iQ300 vertical machining center](#) and selected tools for this specific application. The Waters team was astonished to come away from that visit with finished parts.



The iQ300's ability to produce positional movements within 0.00001-inch has enabled Waters to achieve required feature tolerances while producing surface finishes between 1 and 2 micro-inch Ra.

"Our visit to the Auburn Hills Tech Center was thoroughly impressive," said Matthew Howland, machining operations manager at Waters. "The team was extremely accommodating, and what they accomplished immediately was what we had struggled to achieve for more than a year with the equipment we had on our shop floor. The speed with which they got parts in our hands was amazing. Going to a tech center like that and coming away with usable parts is something you don't get many chances to do. We knew our application was going to be difficult; but Bradford and his team made it look easy, because they knew the equipment inside and out. Our visit went a long way in helping us make our decision, because before we even made the equipment investment, we knew the machine would work."

Waters personnel made three more trips to the Auburn Hills Tech Center to machine additional parts, before purchasing the iQ300. "We saw that the iQ300 could do the job. In a matter of days, they caught us up on a project we had been behind on for a year," said Jencks. "We saw this machine as the complete package. It could do the high-precision micromachining as well as our standard part machining. It was high-end equipment that we could grow with. We rationalized the investment with its ability to get our product out the door faster."

Howland agreed. "Makino had the size and support that other specialized companies don't have. We really appreciated the guidance they gave us in getting the machine and our application up and running."

WORKING SMART

With the iQ300, Waters has been able to meet all of its critical tolerances in

channel width, depth and surface finish on its fully contained metal parts, just as was done in Auburn Hills with its test parts. "We have been able to use the machine to enhance performance in several components, producing a variety of features, including channels of 0.0060 inch wide and 0.0070 inch deep," said Charles Murphy, senior mechanical engineer at Waters. "Positioning adjustments could be made to 0.00001 inch, helping us maintain 0.00005-inch true position in critical hole features relative to our microfluidic channels. We required a 5-micro-inch Ra surface finish in our metal parts. We were able to not only accomplish this, but, in fact, to achieve a surface finish of 1 to 2 micro-inch Ra.

"This level of accuracy and precision is maintained, whether a part runs for four to five minutes or four to five hours. And we can use tool diameters as small as 0.0030 inch, without any issues in breakage or tool life. This capability has opened a whole new avenue of product architecture. For us, the size of the fluidic bores influences the behavior of the instrument dramatically. To be able to operate in the hyperfluidic realm—a place where we hadn't been able to operate previously—has really opened doors for us. I've been involved in machining for over 30 years and haven't seen anything like this."

In addition to having the capability to micromachine, Waters can now create prototypes in the shorter time frames that it envisioned, maintaining control over the most critical aspects of product development. "Having this 'business within the business' to support R&D has been valuable," said Jencks. "As we are making a part, if an engineer changes things, we are able to quickly pause the machine, update the model and machine the new feature. Iterations that used to take five to six months to outsource can now be accomplished in two to four weeks in-house. And we can get



"Reaching as far upstream in our process development as we can helps us remain an industry leader."

prototype feedback to our scientists within days instead of weeks. This means our R&D is happening much more quickly, and our next big product idea has the potential to become a reality much more quickly. It's really been a time-to-market multiplier for us.

"Since the iQ300 has come on board, we've been able to develop products we had no capability of developing in the past. The magnitude is greater than anything we've ever had in the shop. We have already been able to develop a dozen new product lines that will eventually go to market. For us, it's not just about cutting faster; it's the end result. The iQ300 has allowed us to physically demonstrate our confidence to our management that the product concepts we are developing are actually worthy of future development. This machine has made all the difference."

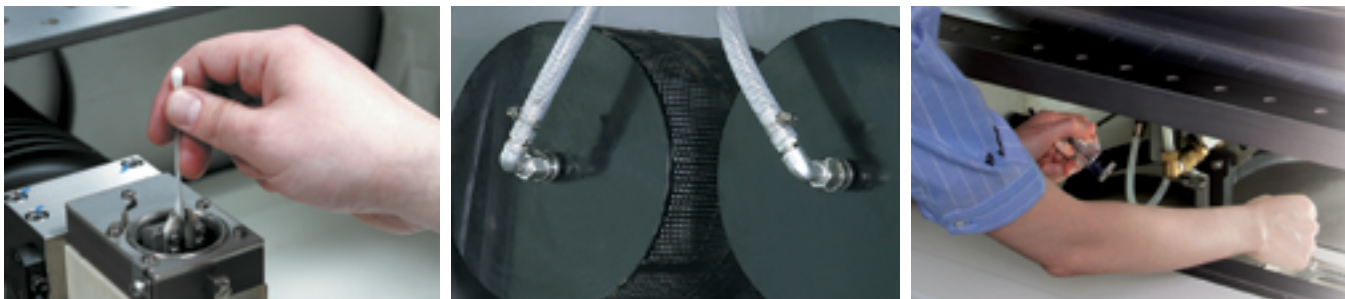
As Waters moves forward with its research and development, it still sees a lot of opportunity for growth. "There is still so much room to expand, using this machine," said Howland. "We have operated it now for almost a year, and we are still learning. There are capabilities we have not even tried yet, and we are looking forward to optimizing our processes even further."

In the meantime, Waters has embraced the iQ300 as its next level of core competency, because it provides innovative solutions for its customers. "Waters is a world leader in chromatography separation science," said Claise. "What matters most to us is to continue to drive innovative products. Having this micro capability internally gives us tremendous advantage for getting products to market faster. By being ahead of the curve, we can help our clients reach the market faster with their products and reduce the expenses of running their business while staying cutting edge. Our competitors don't have this capability, so we see it as our strategic advantage. This is the future."

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THE TRUE OPERATIONAL IMPACT OF WIRE EDM MAINTENANCE

BY BRIAN PFLUGER, EDM PRODUCT LINE MANAGER AT MAKINO



On a wire EDM machine, both the mechanical components that drive and apply tension to the machining wire and the electrical components that deliver precise power to this wire during machining must work together for optimum results.

On any type of machine, components wear over time and require proper intervals of maintenance to stay productive. But on a wire EDM machine, maintenance is especially critical for reliable operations. If maintenance is neglected, it will result in a loss of valuable machining time and in operational issues including wire breaks, slow cutting speeds, poor accuracy results and unreliable automatic wire threading.

Any one of these can decrease efficiency on its own, but when the issues are combined, they rob a shop of productive unattended machining time. This concept of regular EDM maintenance is more intensive than other machines in the shop-floor environment and should be performed proactively at set intervals.

WIRE EDM MAINTENANCE ITEMS

While the type and interval of maintenance varies by the make and model of a machine, there are many

common wire EDM maintenance items that need to be performed. Exchanging the wire spool seems intuitive because it is required for normal WEDM operation. The spool supplies and renews the cutting tool that performs the work. The wire collection bin that holds the used wire must be emptied at regular intervals. Since coated wires are dirtier, they require the machine to be maintained more frequently.

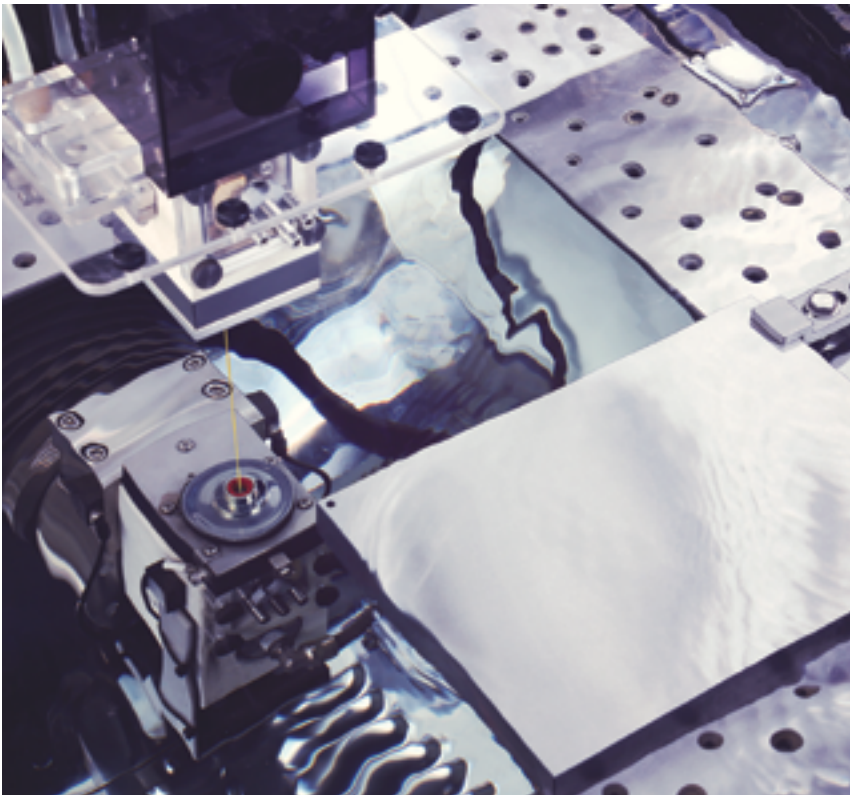
True to its name, the automatic wire threading unit performs the automatic threading of the wire. This unit is the single most important automated feature on the machine and allows for reliable unattended machining. Maintenance of this unit consists of simple cleaning.

There are two electrical contacts that deliver the machining power to the wire. The contacts will wear over time and require indexing and eventual replacement because as the contacts are depleted, the machining speed is significantly decreased. Indexing the energizer plates involves

moving the contact by a specific measured amount, and it is performed between 60 and 80 hours.

The wire guides provide the precision alignment of the wire within the machine and can become dirty and build up debris to the point of clogging. Round wire guides are the most common and should be removed for cleaning. It's important not to forget to perform vertical alignment calibration after cleaning.

Several rollers support and drive the wire that become dirty. If wire drive rollers are not properly cleaned, the wire may slip across the rollers, affecting part accuracy and surface finish and increasing the probability of wire breaks. The three most important rollers making up the wire transport system are the clutch roller, which controls tension; the 90 pivot roller, which is located in the lower head; and the pinch rollers, which pull the used wire in the back of the machine and into the collection bin.



The main water filters purify the water and remove the debris that is created during machining to maintain stable EDM production. There are four different filter types, which are determined by the direction of water flow. Inside-out filters are larger in size and sit inside the machine. These are usually quicker with less mess, but require the water to be evacuated from the machine first. Outside-in filtration can be a bit messier and is located in a pressurized canister on the machine. Paper media provides adequate performance with lower cost, while synthetic media provides longer filter life and enhanced filter performance at a higher cost.

Deionization resin (di-resin) is necessary to control the conductivity of the water for stable EDM machining; if water level becomes too high, the EDM machining becomes unstable as the dielectric is too conductive and can't act as an insulator. The water reservoir must also be maintained.

Finally, general cleaning is probably the most overlooked item of wire EDM maintenance. This entails the simple

washing of the work tank area, work table and seal plate. It's important to remember that EDM debris consists of very fine, abrasive particles that build up and create a hard scale over time. Specially designed EDM acid cleaners are used for general cleaning. Be sure to use these proper/approved chemical cleaners, and don't spray them directly into the machine.

MAINTENANCE INTERVALS AND COSTS

Performing these general maintenance items will extend the life of the consumable components. While timing will vary between machines, wire EDM maintenance is typically performed using short-term (weekly) and long-term (monthly) strategies. Some of the short-term maintenance items include the wire spool, energizer plates, automotive wire threading unit and general cleaning. Long-term items include wire guide cleaning, wire drive rollers, filters, di-resin and general cleaning.


Machine maintenance costs typically include the consumable parts costs and the direct labor, but actual total cost of maintenance should include the lost

billable machine hours that occur while the machine is not in operation. To save on these maintenance costs, it's important to choose a high-performance machine that eliminates as much maintenance and wear to parts as possible. These have a few time-saving measures such as:

- Simplified wire threading unit with fewer components for simplicity and reliable performance
- Fast and easy indexing of the energizer plates through a tool-less system with a one-click index
- Development of long-life energizer plate to dramatically improve the service life of the contacts and also lower the cost of consumables
- Minimized wire guide maintenance due to the wire guide design
- Filter air purge function to drain excess water from the filters to reduce filter weight and prevent spills
- Intelligent on-machine maintenance tracking to track the health of all the items on the machine

KEEP THE PARTS FLOWING

As we've mentioned, there are many items that must be properly addressed to keep a wire EDM machine in top operating order. Reviewing these on a regular basis ensures that all proper maintenance procedures are being performed on the machine. For best productivity and reliability, it is critical that machine maintenance disciplines are handled as a proactive preventive measure.

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SHORTER LEAD-TIMES, LOWER MOLD-TESTING COSTS WITH SPOTTING PRESS

QUESTION: When can a spotting press be more than just the tool for fitting, grinding and repairing molds?

ANSWER: When the press is designed to operate as a mold validation process solution that lowers costs and improves lead-time and delivery of tools.

That's why [Single Source Technologies \(SST\)](#), a North American distributor of machinery brands such as Makino, added [Millutensil spotting presses](#) to its advanced die and mold manufacturing solutions. Millutensil, founded in 1955, is a worldwide leader in the production of die and mold spotting presses and die-splitters. The company provides a highly precise, quick-turn solution for verifying the quality of finished dies and molds, further enhancing customers' global competitiveness.

Fitting and spotting are historically one of the biggest and most costly labor components in moldmaking. The process of checking the contacting surfaces between the lower and upper parts of the mold also can be unpredictable and delay completion of a mold. Reducing spotting time can shorten overall lead-times and lower the tool's cost.

Spotting presses can split molds and lift and tilt the upper and lower halves of the mold to provide access for inspection and modifications as needed. Moreover, using a spotting press can transform moldmaking by keeping the mathematical shape of the mold contours intact. As a result, molds can be repaired easily and identical replacement components can be made and easily swapped out.

"With increasing design complexity, technical standards and lead-time requirements for dies and molds, traditional methods for spotting inhibit long-term competitiveness, which is why SST is excited to offer Millutensil spotting presses," said David Warren, SST national sales manager.



ADVANTAGES TO SHOP OWNERS

- **Safety**—Millutensil presses minimize dangerous mold handling by cranes, forklift trucks or other lifting equipment. Also, the patented SITEMA Safety Device is externally connected and always on lock. Different from mechanical multi-hole or toothed bar systems, this safety device prevents the press ram from falling in case the hydraulic system fails.
- **Ergonomics**—Both platens rotate as much as 360 degrees and tilt as much as 75 degrees depending on the model, making molds easily accessible for maintenance with a simple tap of a control touch panel.
- **Productivity**—Some shops use production presses to adjust a mold. Not only is using this dangerous, but it interrupts production. With a Millutensil spotting press, molds can be tested, adjusted and checked safely while saving time and money.
- **Accuracy**—Millutensil presses have high repeatability and accuracy. The Parallelism Control System gauges the upper plate's position to ensure an even stroke and brings the two halves together with precision.
- **Ease of Use**—Spotting operations are intuitive and simple. Onboard diagnostics immediately report errors and display information about how to resolve the issue, enabling quick troubleshooting and lower service costs.

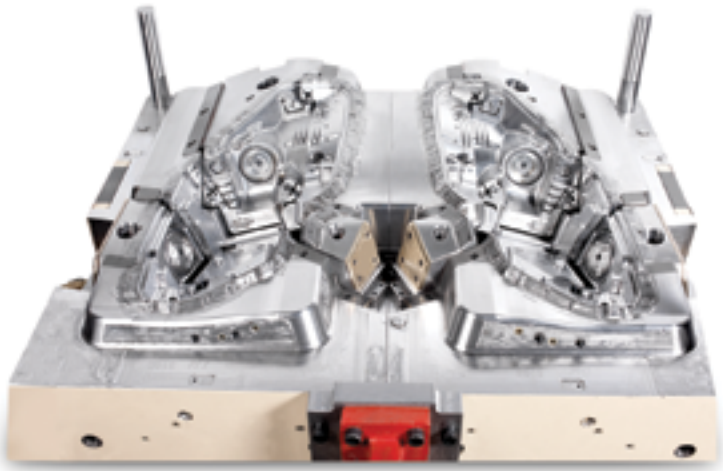
The spotting presses' resin injection unit enables manufacturers to produce sample castings in two distinct, reusable special thermoplastics. The toolmaker can then check the casting characteristics, the complete mold filling, the dimensional accuracy and tightness of the mold as well as undercuts and de-molding. This feature supports the production of higher quality molds and helps reduce correction grinding through reproducibility.

According to Warren, "The shop owner can say to customers, 'This is how we know the mold is accurate. This validation not only completes the die/mold process but it provides the quality assurance of a premier mold shop.'"

Millutensil spotting presses are designed to improve production speed and safety by reducing time-intensive mold handling and delays due to tilting upon opening and closure. With the push of two buttons, Millutensil spotting presses

can place mold halves in a comfortable working position and carry out a test injection or spotting stroke. This capability is particularly advantageous in the manufacture and reconditioning of large, complex molds.

"The net result is shorter lead-times, greater safety, higher quality and improved workforce efficiency," Warren said.

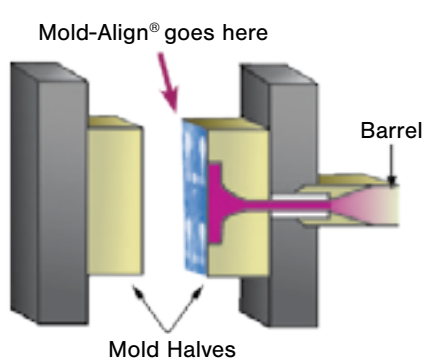


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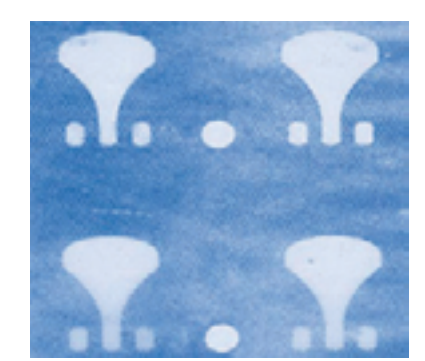
Millutensil spotting presses are now available at SST. For pricing and inquiries, please contact Single Source Technologies at (248) 232-6200 or email sales@singlesourcetech.com.

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① Place **Mold-Align®** between the two mold halves and close the mold



② Open the mold and remove **Mold-Align®**



High resolution image of surface pressure distribution

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