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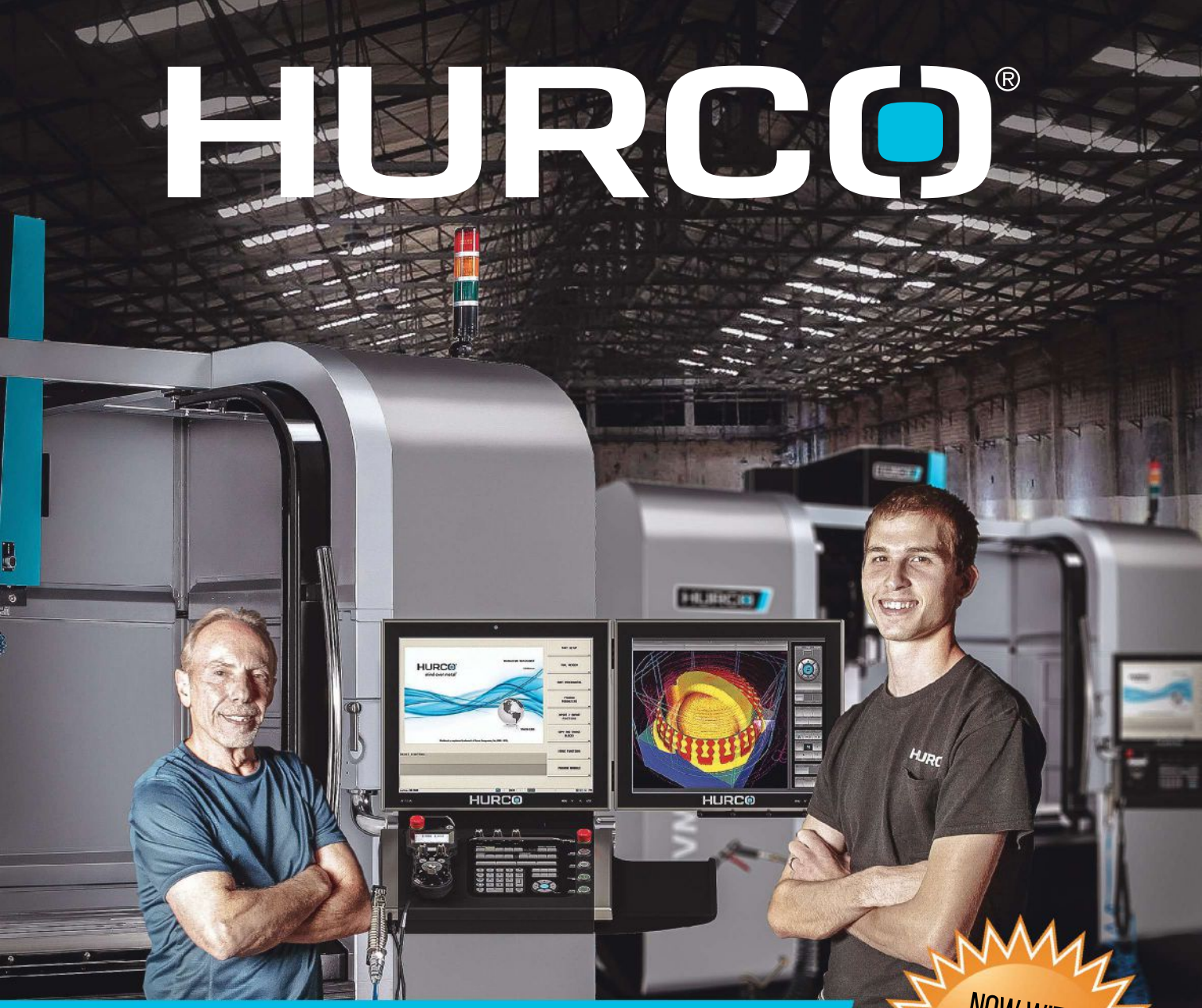

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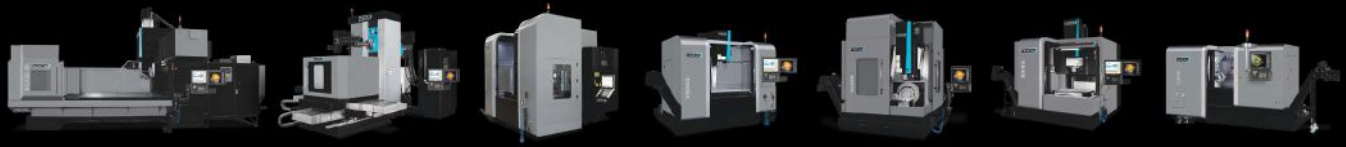

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POSTMASTER: Send address changes to *MoldMaking Technology* Magazine, 6915 Valley Ave., Cincinnati, OH 45244-3029. If undeliverable, send Form 3579.

CANADA POST: Canada Returns to be sent to IMEX Global Solutions, P.O. Box 25542, London, ON N6C 6B2. Publications Mail Agreement #40612608.

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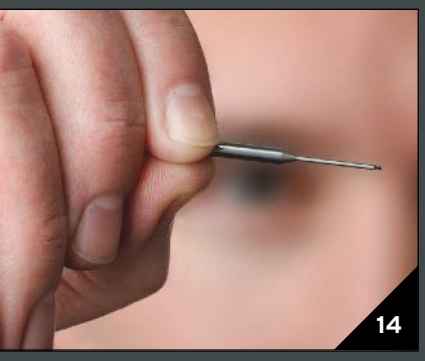

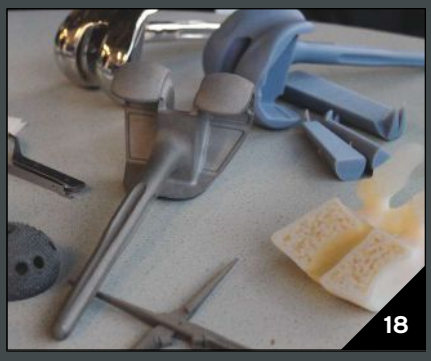

Features

Departments

ON THE COVER

Cover photo courtesy of HRSflow. This month's cover shows an electrically driven valve gate system developed by HRSflow. FLEXflow technology is a solution suitable for one-shot production in family molds that ensures accurate and flexible control of pressures and flow rates at each individual gate. The result is low-warpage, defect-free parts with finely grained surfaces without pressure lines or flow marks, even though the parts differ considerably from one another in terms of their dimensions and volumes. See related feature on **page 56**.

Images courtesy of (left to right) Seco Tools, Aesculap division of B. Braun, and Viking Tool and Engineering Inc.

VIDEO ACCESS

5 TRICKS OF THE TRADE
Great Tips from This Issue

1. Tiny Tools
Once you have the optimal micro milling tool tip geometry that allows for freer cutting in hardened steel along with good cutting-edge strength, consider the ability to maintain an edge for consistent tool life.
PG. 14.

2. Measuring Up
Tiny, complex medical molds require accuracy ensured by geometry data, dimensions and tolerances automatically transferred from all popular CAD systems to a measuring machine.
PG. 18.

3. Check It Off
A mold design review team should include process engineering, automation, mold maintenance and post mold operation personnel.
PG. 26.

4. Time to Grow Up
Words describing a process maturity business model include customer-focused, documented, common understanding and buy-in and followed.
PG. 32.

5. Get Social
It is a fact that customers are using the web to learn something new, find a piece of information or to build connections. Moldmakers must begin to transition to ensure they are in front of customers, wherever they are.
PG. 38.

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Is it Time for You to Socialize?

Does social media work?

It was about a year ago during a networking reception at the AMBA conference when a man came up to me and said, "I see you and *MoldMaking Technology* all over social media, so I had to introduce myself. I really like your content." That man was Charlie Daniels, the chief financial officer of Wepco Plastics, a small company specializing in lower-volume plastic injection molded parts and rapid aluminum tooling. Charlie quickly became an industry friend and a valued resource. He even contributed a few business articles on determining mold prices, creating budgets and making sense of income statements, and the company was a guest on the *MMT/The Manufacturing Alliance Podcast*.

So long story short, to me, social media works. And Charlie is just one example of a person "finding" me or the brand through social media, who then turns into some form of quality content. The bottom line is that social media connects us with readers and technology suppliers, who are current and potential customers.

You have probably heard me say before that mold manufacturing is a community, and one that we have been privileged to serve. Over the years, we've had to get to know you and allow you to get to know us by meeting you *where you are*—whether that is at a convention, a trade show, an industry meeting, a shop tour or even a party. Today, social media offers another way of meeting you where you are, so we can serve you better. In this social world, that means LinkedIn, Facebook, Twitter, YouTube and Instagram.

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Today, *MMT* has a presence across these platforms. How to most effectively use each one is an ongoing journey of discovery, and we are currently using analytics to help us streamline and plan our social media efforts. Many of you are already using social media, as I see you posting and sharing good content (read **page 38** to learn about the social strategies of several shops), but for those who have not entered that world yet, it's time to start socializing. Only then can you begin to figure out how best to use social media as a tool to meet your customers where they are and to engage with your peers. Let's face it, this is communication for the next generation, so it's not going anywhere.

There is no right or wrong way to do it, just set up your company accounts and follow *MMT* for starters. Meet us *where we are*. MMT

Christina Fuges

Christina M. Fuges
Editorial Director

Follow MMT on: Follow @MMT_ChristinaF

THIS MONTH ON moldmakingtechnology.com

VIDEO: Higher-Level Laser Mold Texturing

Eroded, sandblasted and chemically-etched mold textures are now 100-percent lasered at this Germany-based service provider.
short.moldmakingtechnology.com/lasermold

PODCAST: Past Leadtime Leader Winners Celebrate 15 Years of Moldmaking Excellence

Three past Leadtime Leader Winners sat down with MMT Editorial Director Christina Fuges and Tony Demakis of The Manufacturing Alliance for a live podcast discussion.
short.moldmakingtechnology.com/15years

BLOG: Association Update: The Canadian Association of Mold Makers

The Canadian Association of Mold Makers (CAMM) took a significant step toward forging an alliance between the Windsor Essex Economic Development Corp., the CAMM and the Engineering Export Promotion Council of India and Tools and Gauge Manufacturer's Association of India.
short.moldmakingtechnology.com/camm

EVENTS: Amerimold 2019

Additive Manufacturing Media offers its second Additive Manufacturing Workshop for Plastics during Amerimold, June 13, in Chicago.
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Pushing 3D Printing's Limits

By Will Cipkar, Jr.

Crest Mold Technology has been offering customers conformal cooling inserts using methods outside 3D printing for about five years now. The technology has been around for almost 40 years, but what's funny is that only in the past decade has it really come into its own, and now people are starting to be more experimental with it. We've been investigating it and comparing it for years.

When people are talking about 3D printing, I'm not thinking about cores and cavities anymore. I'm thinking about the possibilities of hybridizing the process. 3D printing of plastic cores and cavities was being done at NPE years ago in the Milacron DME booth. It is something that has already been out there, and people in the industry are now pushing the boundaries of it to see how far they can take the newer resins. I'm trying to figure out whether there is a way to combine the technologies of 3D printing metal and plastic. The new resins have strengths comparable to aluminum alloys, and building up a 3D-printed insert could cost less and reduce machining times versus traditional steels, while providing the opportunity to implement conformal cooling.

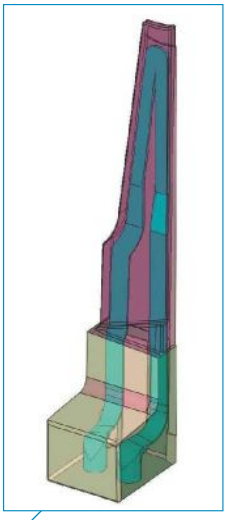

Image courtesy of Crest Mold Technology.

This 3D-printed insert from Crest Mold Technology, little more than 0.100 inches thick and just under 4.00 inches tall, can be used to address the challenges of small water channels for flow.

The thing is, 3D printing is still a very specialized process. We see it as a capable technology, but when you are looking at trying to implement it into a mold, everybody's budgets are their budgets. We still have a hard time getting our vacuum brazing process into customers' budgets because it costs more than if we use traditional cooling approaches. The OEMs, particularly in the automotive industry, don't always view the mold as the important part of the "pie" that it is, and that hinders advancements in this technology. They don't understand that a conformal-cooled mold is going to make them more money over the life of that mold.

Still, we are trying to be an innovative shop and bring new technologies forward. For some customers, we will eat the cost of producing a conformal insert, knowing that it will be a much better mold producing better parts, and they will see the value added and hopefully invest in it with a future mold build. MMT

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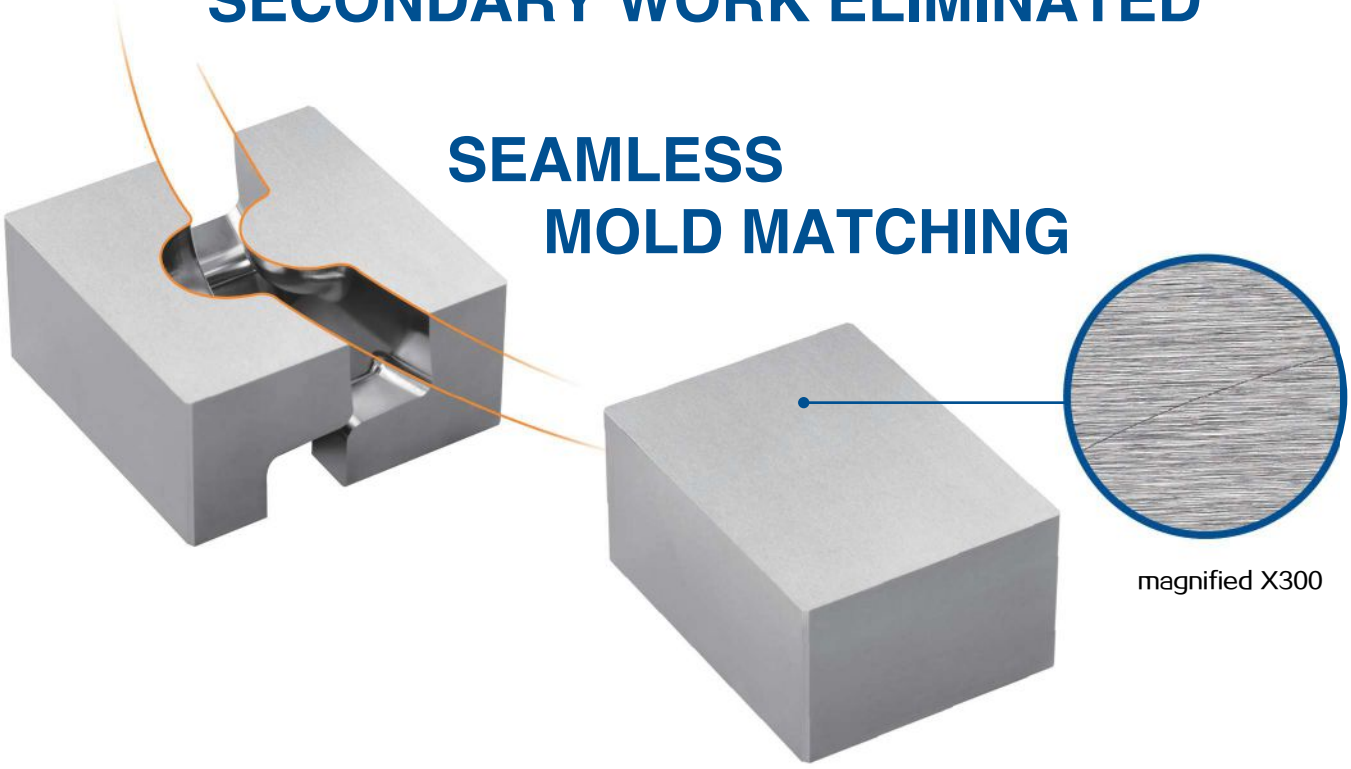

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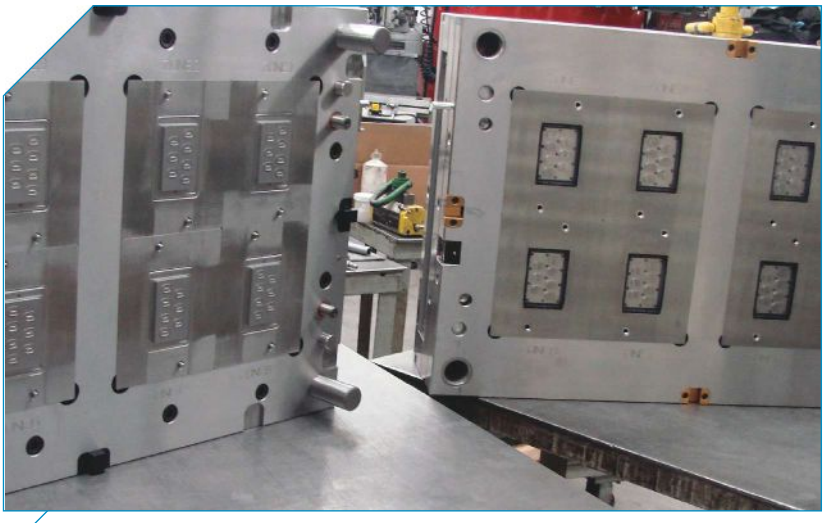
A Conversation with ...

Buss Precision Mold Inc.



Images courtesy of Buss Precision Mold Inc.

Large, but very intricate molds like this eight-cavity valve gate mold are a specialty of Buss Precision Mold in Clackamas, Oregon. The company primarily builds molds with 16 cavities or less, requiring extremely tight tolerances (like this mold, which is quite intricate with +/-0.0002-inch tolerance) and precision surface finishes.

Describe your company's core competencies, including approaches for noted quick deliveries and the focus on more complex, tight-tolerance molds.

Jonathan Buss, president: BPM's core competencies include building molds with 16 cavities or under with stringent requirements of finishes and tolerances. We excel at customer service/responsiveness and quality, including supporting immediate repairs and stocking spare components, as well as providing value-added features like waterline ID tags so our customers can set up molds faster and more accurately. We make a point of partnering with customers for early involvement so a robust part and mold design ensues, and we provide mold simulations as needed.

We took a hard look at how our business was structured a few years ago and made the decision to let go of work that wasn't profitable anymore. As a result, our focus has changed somewhat from quick deliveries to the previously noted attributes, and we have bigger and better customers today. We are building some molds, which are 36 by 36 inches square, with more than a thousand features that all must be within +/-0.0005-inch part tolerance. We also build some very small molds with features of 0.013-inch diameter by 2.000 inches long that have a +/-0.0002-inch part tolerance. So, our actual machined mold tolerances are typically 25 percent of molded part tolerances.

You have been experiencing a recent surge in re-shored molds. What are the reasons for reshoring, and how is Buss Precision addressing any issues or challenges to serve those customers?

Buss: Six of the molds that we have been asked to take on are for the electronic gaming industry. The customer is experiencing intellectual property (IP) theft and it has been rampant, so they are bringing both tooling and production back to the United States.

We have another customer who we built some tools for, but they decided to postpone production and mothball the molds after they were completed. However, there are knockoffs on the market today, even though the customer never introduced the product into the marketplace themselves. So that shows you that it was an inside job, as the company has offshore production. Too often, on a big manufacturer's scale when they're going offshore and have their own facilities in China, there are so many leaky holes, and sensitive information can get out that is going to get knocked off. We have several customers with whom we have NDAs, and some of it is a little ironic because designs are still leaking out. A shop like ours, we're not going to be giving any information to anybody else because we get the work from it, so we protect data practically with our lives. If we were to leak or disclose anything, we would be shooting ourselves in the foot. We are probably keeping information confidential better than most

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- Founded in 1988 by father and son, Earl and Jonathan Buss. Employs 14 (and three dogs).
- Designs and builds single and multiple cavity molds ranging from small unit dies, such as 5 by 8 inches master unit dies (MUDs) to self-contained molds up to 36 by 48 inches, weighing several tons.
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Among the most recent new equipment purchases Buss Precision Mold (BPM) has made is that of an Alliance Laser Sales NGRV fiber laser engraving machine. The laser engraver is actually mounted on a re-purposed Bridgeport CNC machine. The company uses it primarily for component ID markings but has also used it for cavity ID and logo artwork directly in the cavities, as shown here. The NGRV system has saved significant time versus CNC milling or manually pantographing these details, as BPM did in the past.

would be, even within their own organization. Our customers have had experiences with offshore mold builders that don't necessarily have the same ethics, or they don't realize what is at stake. We know what is at stake because our bread and butter depend on keeping the work in our country and for Buss Precision Mold to build our customers' molds.

What precautions have you taken to boost your company's cybersecurity?

Buss: In terms of cybersecurity in our plant, we've had a firewall for years, but recently, to be more proactive, we have upgraded it, and we began providing some training during company meetings to make sure our people are schooled on what not to do. We all know about the foreign prince that just died and has $10 million to gift someone if his servant could just access someone's bank account, but the bigger issue for our customers is protecting their intellectual property, plus taking delivery of a mold that's engineered and built properly so that it works. On our end, it is due to our concern over spoofing or ransomware issues that could happen that we remain diligent about cybersecurity.

We do some ITAR work, too, and that's one of those things where you've got to know how the international treaty of arms restrictions plays into the process. Some of the work we do comes under restrictions for access to only U.S. citizens, and they are the only people in any company who are allowed access to the design data. BPM is typically only seeing components and not complete assemblies, but it still falls under the security umbrella we must take precautions on.

What is the most recent equipment investment made and what will be the next technological breakthrough in moldmaking for Buss Precision Mold?

Buss: We have recently installed another Makino three-axis vertical machining center; this model is the F5 and is built for precision hard milling. It should supplement our Makino V56, as well as other high-speed machines. In addition, we have installed an NGRV 50-watt fiber laser engraver from Alliance Laser Sales. We use it primarily for component ID markings but have also used it for cavity ID and logo artwork directly in the cavities. Some of the molds we build can have over a thousand components, and customers require everything except the fasteners to have a unique identification. Previously, we were CNC milling or manually pantographing in the nomenclature, which does a nice job but can take a lot longer than necessary. After the second project of 1,500 or so pieces, we thought there had to be a better way, so that is when we purchased the laser engraver. The fiber laser can put an actual depth to the engraving, whereas some of the other laser engravers only mark the surface and the marks can be obscured by normal aging or wear of the mold components. MMT

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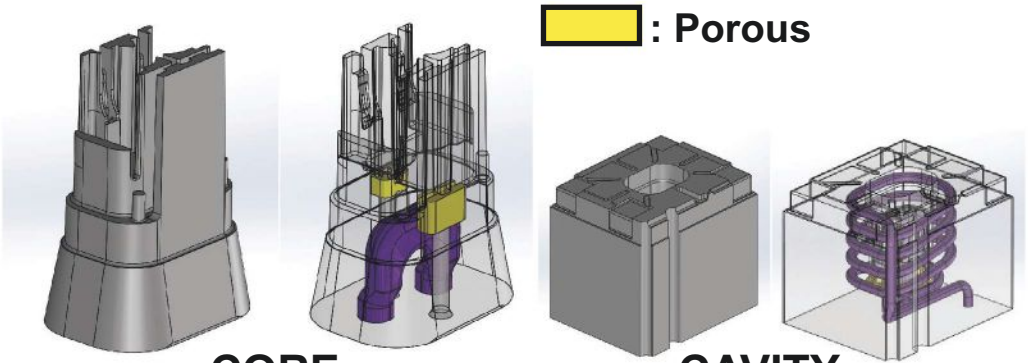

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By Jay Ball

VIDEO Access the related video under the Videos tab at *MMT* online.

Micromilling Demands Optimal Tool Tip Geometry

Advanced tool tip geometries ensure free-cutting properties necessary for chip consistency and long tool life in micromilling applications.

Moldmaking is a lot about miniaturization. Whether it's components for lifesaving medical devices or the scored grip on the bottom of a tube of lip balm, manufacturers use molds to generate tiny part features. As these molds continue to shrink in size, cutting tool manufacturers continue to provide techniques and tool geometries for the smallest cuts and biggest productivity boosts.

As part features get smaller, the challenges for mold manufacturers get bigger, especially when the cutting tools are a tenth of a millimeter in diameter and are required to machine molds and dies made from tough materials, such as steels and alloys ranging from 48 Rc (S7, 420 stainless and H13) to 60 Rc and above (A2, D2 and high-speed steels). This trend continually pushes cutting tool manufacturers to develop advanced tool tip geometries, especially for ball nose end mills, to ensure the free-cutting properties necessary for chip consistency and long tool life.

Tool geometry is never simple at such a micro scale. Even the sharpest edge on a typical cutting tool will have nicks and imperfections caused by the grain of the grinding wheel used to produce it. Using that same size grit on a micro-diameter tool would make it virtually impossible to keep the edge sharp. In fact, on the smallest-diameter tools, the grain size of the typical grinding wheel will be just as large as the tool's edge.

Big Considerations for Small Tools

Today's advanced grinding software and machines make it possible to smooth out cutting edges and create free-cutting tips for micro tools. Micro tool geometries typically involve newer S-shaped tips that are freer cutting by design rather than traditional chisel-point geometries of other cutting tools. Also, physical size

Images courtesy of Seco Tools.

The challenges for mold manufacturers get bigger as part features get smaller, especially when the cutting tools are a tenth of a millimeter in diameter and are required to machine molds and dies made from tough materials. The continual micro trend is pushing cutting tool manufacturers to develop advanced tool tip geometries.

Molds continue to shrink in size, forcing cutting tool manufacturers to develop techniques and tool geometries for the smallest cuts and biggest productivity boosts.

constraints mean that four flutes are the maximum, with two flutes being more common. This is because, with most machine tools, end mills at sizes below 1.0 mm in diameter can barely reach the maximum feed rates necessary for two flutes, much less four.

Once you have the optimal micro milling tool tip geometry that allows for freer cutting in hardened steel along with good cutting-edge strength, it's time to consider the ability to hold and maintain an edge for *consistent tool life*. Remember a dull tool or an end mill with suboptimal geometry will just push material around instead of cutting it. Even the tiniest flaw may be the difference between a perfect cut and a scrapped part when working at the micro level. To combat this challenge, some cutting tool manufacturers make solid end mills with a cobalt blend around 8 to 9 percent to provide a good balance between wear resistance and hardness.

Good chip formation requires a balance between speeds and feeds, but this can be deceptive at the micro level.

Tool runout is another key micromilling consideration whose prevention requires more than optimal tool tip geometry. When cutting small part features, a little runout can quickly cause big problems, such as reducing tool life by 50 percent. Unlike long tool overhang strategies or heavy roughing applications, micromilling typically involves shallow depths of cut and small radial engagement, so it generates minuscule levels of vibration because the chips are not big enough. The real culprit is a lack of machine movement smoothness often due to a machine not having a long enough lookahead control capability or poor programming strategies that fail to maintain constant chip load. The result is jerky machine movements that can cause instant tool breakage.

However, even if the process is stable (proper cutting tool, proper speeds and feeds, rigid setup and a truly capable machine tool), *tool life* may still be suboptimal. One solution is to use advanced silicon coatings on solid end mills to increase cutter life by up to 50 percent by boosting a tool's heat and abrasive resistance. Dirty collet bores, ambient temperature changes or unstable machine foundations are other conditions impacting the micromilling process.

Chip load consistency, or having a machine tool maintain a consistent feed rate, is another important aspect of the micromilling process because of its average chip thickness at tenths of a thousandth of an inch.

Good *chip formation* requires a balance between speeds and feeds, but this can be deceptive at the micro level. Unfortunately, many manufacturers approach micromachining with a high-rpm spindle speed cutting strategy, which can

Ball nose end mills with advanced tool tip geometries ensure the free-cutting properties necessary for chip consistency and long tool life.

negatively impact chip formation. The reason is that it is practically impossible to run at those feed rates and maintain a consistent chip load; instead, the tool is pushing material instead of cutting it. Even the fastest machines (feed rate) fail to accelerate or decelerate quickly enough to keep up with spindle speeds. The results are poorly formed chips, a subpar surface finish and sharply diminished tool life.

The solution is to speed up and slow down. It may sound like an oxymoron, but after a programmer figures out the average functional feed rate by trial and error, he or she can adjust the spindle speed to the appropriate rpm. This is because parameters for consistent chip load are different from one tool to another, as well as from one part to another. What many shops will do, however, is keep a log or create a database of the part, tool and parameters that have been successful.

> Tool runout is another key micromilling consideration whose prevention requires more than optimal tool tip geometry.

For example, a cutting program set to 40,000 rpm at 50 ipm is well within the range of advanced machine tools, but because of the short micromilling cutting paths, it simply can't feed that fast. Instead, the actual average speed is 25 ipm, and a reduction in spindle speed to 20,000 rpm reestablishes equilibrium and a constant chip load.

Trial and error is an option for developing these processes, but cutting tool manufacturers familiar with the wide range of materials and cutting tools used today can also help with these calculations. MMT

CONTRIBUTOR
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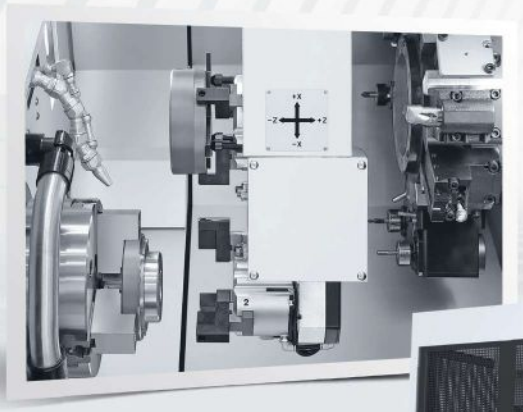

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By Barbara Schulz

A Marvel Among Medical Shops

Automation and additive manufacturing systems are the way to go when it comes to producing high-quality medical parts, such as printing custom implants to size when a basketball player needs a knee replacement.

It only takes two minutes—two minutes from the moment you start talking to Hans Keller and the plant tour begins—to realize there is something very different about the Aesculap division of B. Braun, one of the leading manufacturers of medical technology and pharmaceutical products worldwide. Every employee is greeted with a smile. Every question posed is answered in detail. Every process and machine are thoroughly explained.

Images courtesy of Barbara Schulz.

Additive manufacturing at Aesculap covers a wide range of applications: prototypes, medical devices, individual three-dimensional patient templates, training models for surgery and patient-specific implants such as giant knee implants for extraordinarily tall or small people among other applications.

Prototype- and Toolshop Manager Hans Keller started his career with Aesculap in 1972, and the company's R&D, prototyping, tool- and moldmaking department hasn't stopped growing since the dedicated thoroughbred engineer took it over in 1995. The toolshop produces prototypes, models, injection molds, forging and forming tools, complex progressive dies as well as measuring and test equipment, and jigs and fixtures for series production.

When Keller talks about knee or hip implants, surgical instruments, products for neurosurgery or minimally invasive product concepts, you can virtually feel his passion, which doesn't stop with the products the company, with its 3,600 employees in Tuttlingen, makes (the Braun group employs 70,000 people in 64 countries and sells a total of 5,000 products). His passion lies within technology, machine tools, EDM, additive manufacturing (AM) technology (the company currently runs 18 AM machines for both metal and plastics printing), moldmaking and automation.

"An internal toolshop (which serves its parent company) does not need to generate any profits, but it needs to be good and efficient," he says. "Therefore, since I took over the shop in 1995, I have been calculating in man-hours. The time a milling machine is running producing parts doesn't generate any

In the near future, toolshop manager Hans Keller aims to produce some of the company's standard knee implants on a metal laser sintering machine. The company is currently running a total of 18 AM systems—for both metal and plastics 3D printing.

costs; only the time it takes a worker to load and unload the machine is relevant for our cost calculation."

He describes his department as the most unproductive plants of all within the Braun group, as he is not generating any profits. "I am just an inevitable evil," he says with a smile. "Nevertheless, our division is needed to find and develop the most efficient and precise way to produce a surgical instrument, implants and other medical devices and is the most advanced manufacturing site in terms of automation."

Automation Is the Way to Go

Keller is constantly on the lookout for ideas on how to make the production of nearly 70,000 different single parts needed for Braun's complete product range as efficient as possible. And for him, automation is the way to go. "We are very good in developing and producing high-quality medical parts here in Germany," he says. "But the future is connected automated machines which run unattended overnight, even in departments like ours. We need to work efficiently here, but we also transfer our machining and automation know-how to our global production plants."

In light of these considerations, it is less surprising (than it would be when you visit a tool and mold shop) to see a Grob G350 five-axis milling machine with a Lang automation solution running next to the company's automated EDM and HSC work cell. The milling machine can produce 90 parts over the weekend and runs 40 hours unattended, Keller says. "We used to annually machine 4,000 to 5,000 of these consumable parts on two machines, which are needed in the hip implant production where they are used to seal certain areas of the prothesis during coating. Now, with the Lang automation solution—which, at a price of 100,000 euros, is very affordable—we only need one machine because it can run unattended overnight."

The Lang Robotrex robotic machine loading system installs within an enclosure at the front of a machine and features a 12-kg-capacity Fanuc robot. Each part blank is clamped in its own Makro-Grip vise, and those vises are seated in rows atop a trolley that is delivered to the Robotrex. Vertical orientation of the

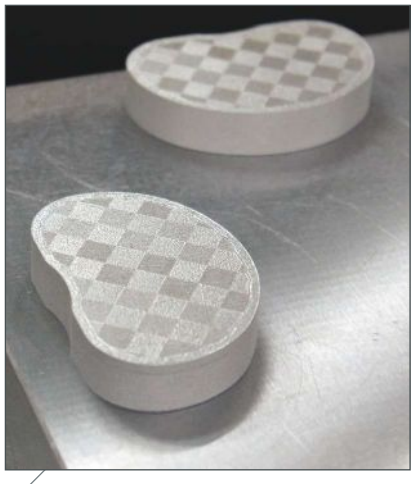
vises enables multiple vises to be installed on the compact trolley. Each of the trolleys has a capacity to hold 30 vises with a maximum part size of 120 by 120 by 100 mm.

The Makro-Grip vises grip part blanks in an unconventional way. A 20-ton stamping machine is used to squeeze either side of a blank along its bottom and uses "teeth" that create multiple indentations in the blank. The blank is then placed in the vise that has jaws with mating indentation profiles. This form-fit connection is said to provide high holding force, even though the vise grips on only a small portion of the blank. It also provides ample access to five sides of the part during machining. Because the robot picks a common vise from the trolley and not parts of different sizes or shapes, only one gripper type is required, and there is no teach-in process needed to accommodate new grippers for new jobs.

Next to this neat little production cell is a bigger and quite impressive automated EDM work cell, where an Erowa Robot Dynamic Linear handling system connects two Exeron EDM machines, an Exeron HSC machine, as well as measuring and cleaning stations to enable unmanned, efficient production.

Automated EDM Work Cell Produces Complex Injection Molds

One of the complex molds Aesculap produces here are injection molds to produce special soft load clip cartridges for titanium ligation clips for easy clip release during surgery (see photo). Due to the division's long-standing expertise, most molds for series production in other plants are produced here. To make the intricate molds for the cartridges, 70 different electrodes are necessary, Keller explains. "During eroding, we work with accuracies in the area of ±1/100 mm. Therefore, and because of the many electrode changes, we decided to have a fully automated production cell, and we can run the cell unattended."



Tibia component of a knee implant during printing on an EOS laser sintering machine.

Aesculap's toolshop and R&D department is needed to find and develop the most efficient and precise way to produce a surgical instrument, implants and other medical devices and is the most advanced manufacturing site in terms of automation. Here, a Lang Robotrex robotic machine loading system installs within an enclosure at the front of a Grob G350 five-axis milling machine and features a 12-kg-capacity Fanuc robot for unmanned operation overnight.

To produce molds for these and other complex and very often tiny medical devices to the required accuracy, Keller decided to integrate a measuring machine. The necessary geometry data, dimensions and tolerances are automatically transferred from all popular CAD systems to the measuring machine. Before milling, every electrode is measured and assigned a zero-point before it is coded and stored in the magazine (with space for 180 electrodes and 10 workpieces), where the robot picks them up on demand.

During eroding, Aesculap works with accuracies in the area of ±1/100 mm. Therefore, and because of the many electrode changes, the company decided to have a fully automated EDM production cell.

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The high demands on precision and the need to machine hard-to-cut materials, such as titanium, have accumulated massive expertise in the field of CNC machining, which is the reason that the plant in Tuttlingen has been given worldwide responsibility for development and manufacturing technology.

The CERTA software used by Aesculap assigns electrodes to workpiece holders and makes them available in the CERTA central process control system, preventing errors during the insertion of the parts into the machine. All information is on the chip. When the electrode is inserted into a magazine, it is immediately recognized in the corresponding magazine position. This data is also provided centrally. Workpieces can therefore be changed correctly and flexibly. "We insert the tools via barcodes and the system does the rest automatically—clamping errors and the like are practically eliminated," says Keller. "But of course, the whole process has to be simulated before going into production."

Apart from guaranteeing the required precision, the cell can also be programmed and run overnight in a ghost shift to not only produce electrodes but surgical instruments and products that cannot be milled, for example. For such small-batch parts, which would not be viable to produce during the day, the automation pays off—as it is cost neutral for Keller, who calculates man-hours to cover his costs. The cell paid off in less than a year, Keller says, as he is constantly on the lookout for new technology and machines.

The high demands on precision and the need to machine hard-to-cut materials, such as titanium, have also accumulated massive expertise in the field of CNC machining (the shop runs a total of 35 CNC machines), which is the reason that the plant in Tuttlingen has been given worldwide responsibility for development and manufacturing technology. All larger machine investments are (almost literally) scrutinized down to the last detail there, in order to ensure that every Braun plant manufactures at the same high level.

Highly complex molds and tools are also exclusively developed and made in Tuttlingen—for all global sites. One example are injection molds for the handles of disposable scissors, used in minimally invasive surgery, as well as the progressive dies for the scissor's blades.

Additive Manufacturing for Prototypes and End-Use Parts

Keller is currently cooperating with Toolcraft, a company in Southern Germany that uses Trumpf TruPrint LMF (laser metal fusion) machines for producing

additive parts, to manufacture some of these scissors and other medical devices for special applications via laser metal melting. Therefore, the two companies are developing ways to create a powder of a medical steel, a stainless and hardenable steel with high tensile strength and good corrosion resistance.

"Toolcraft has seven TruPrint machines in production, and I am currently eying a TruPrint 3000 to complement the 18 3D printers we are already running here in our toolshop," Keller says.

Aesculap installed its first AM machine (Stereolithography) in 1993. Today, additive manufacturing at Aesculap covers a wide range of applications: with the various machines and systems (Objet, EOS, 3D Systems, Concept Laser and Prodways), individual three-dimensional patient templates, training models for surgery and measurement programs for high-volume parts can be created. These are complemented by additively manufactured parts for rapid prototyping, as well as the development of individually adapted geometries, e.g. for patient-specific implants, such as giant knee implants for extraordinarily tall people like basketball players.

Keller's latest investment is an Arburg Freeformer (APF—Arburg Plastic Freeforming) to ramp up his shop's high-volume production activities. The Freeformer offers options required by the medical industry, such as the processing of bio-compatible materials or the quality, strength and immediate use of parts.

"Here, the Freeformer offers significant advantages, including the processing of original materials. For example, medically-approved, resorbable PLLA, the high quality of the parts produced owing to extremely small layer thicknesses or the option of manufacturing hard/soft combinations," Keller says.

In the near future, Keller aims to produce some of the company's standard knee implants on a metal laser sintering machine. "Some of the sizes are produced in batches of 150 or 130," Keller explains. "The lifetime of such an implant is about eight years. The tools needed to produce these parts amount to roughly 20,000 euros. In this case, laser-sintered parts would be cost-efficient." MMT

CONTRIBUTOR

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FOR MORE INFORMATION

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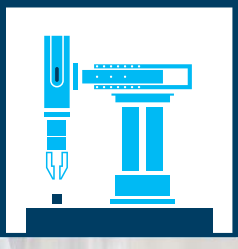

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By Gerardo (Jerry) Miranda III

Mold-Design Review: The Complete Checklist

Gerardo (Jerry) Miranda III, global tooling manager for Oakley sunglasses, shares his complete mold-design checklist, an essential part of the product time and cost-to-market process.

In a previous issue of MoldMaking Technology, *Gerardo (Jerry) Miranda III, global tooling manager for Oakley sunglasses and* MMT *editorial advisory board member, shared some essential steps from his own mold-design checklist. Here, Miranda brings the complete checklist to illustrate the extent to which it affects Oakley's product time and cost-to-market process.*

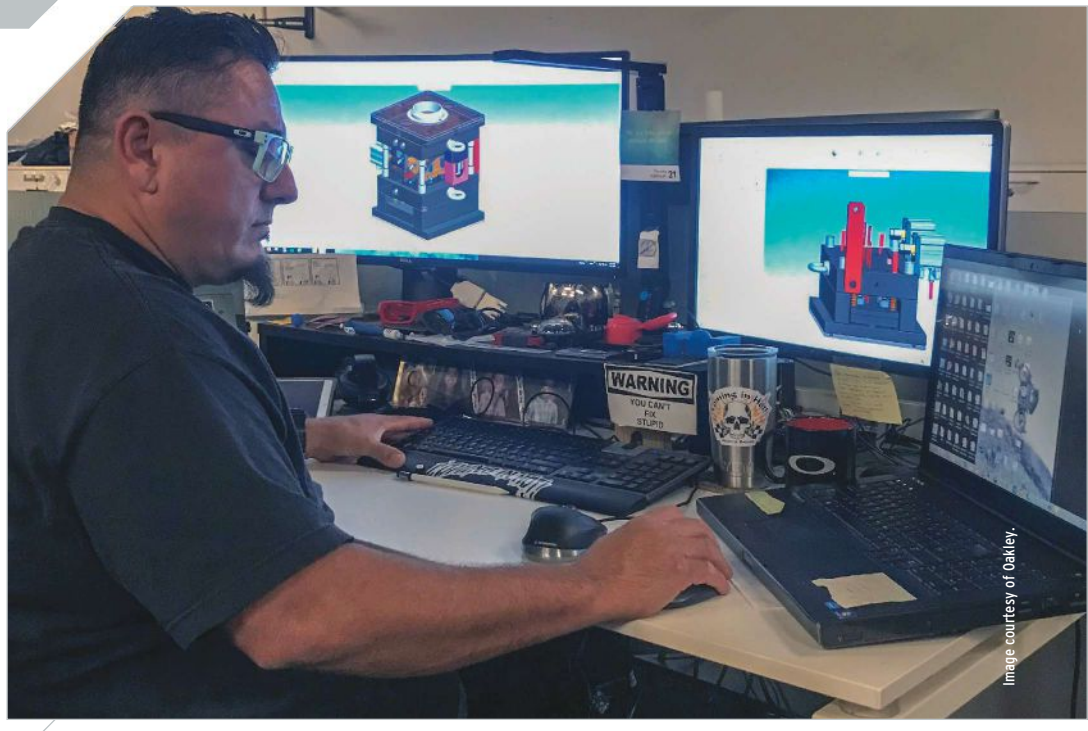

Image courtesy of Oakley.

At Oakley, designing a mold may involve working with cross functional teams to initially ensure product manufacturability, but in the end, it comes down to the mold designer who must execute a perfect CAD drawing for moldmakers to follow. That is why Jerry Miranda (pictured) developed and follows a detailed mold design review checklist, which is an essential part of the Oakley product time and cost-to-market process.

Having a proper tool design review and checklist can and will save time to market. Here at Oakley, we have an internal tool design team that works across functions by performing design for manufacturability (DFM) throughout the entire process, from sketch and design engineering through CAD. This means when final product CAD is released to our tool design team, there is little to no request for iterations to enable a robust tool design.

The next step of tool design is designated to one person who takes that CAD and wraps a tool around it. The general design direction has already been determined by several CAD reviews and discussions with team members, so this person is responsible for managing cost, manufacturing difficulties and ensuring the design stays within the confines of the desired press size. If executed correctly, this task can save time in the manufacturing of the tooling, as well as initial tool start-up time and qualification. With typical tool designs taking three to six weeks to execute, high level decisions and innovations

are implemented quickly—extra care must be taken to ensure smaller details are not overlooked. Tool design is like soup. The designer has insured that the movements required by part geometry are designed in (the meat) and the part has a gate to fill the part (the vegetables), and the tool fits in the press (the broth). Then the cavity and core blocks need the proper number of screw holes to retain it in the base (the soup bowl).

A tool design check list can be reviewed by the tool designer as they work through the design. It can be documented and reviewed with cross functional manufacturing teams prior to final tool design release to the build shop. These teams should include, but not be limited to, process engineering, automation, tool maintenance, PMO (post mold operation) teams, including representation from assembly and secondary teams such as paint and/or decoration teams. All team members should have knowledge of desired end product needs and review the tooling for their individual needs (for example, does the tool design allow for end-of-arm to be used to remove a part from tool via a picker feature or does the tool incorporate a feature for the paint team to handle the part in their line?). We have asked for no fly zones and design needs from each of these teams and incorporated them into our tool design standards. This has decreased the time spent at tool start-up and product launch. Below is an example of what we have implemented into our design checklist:

- Does the tool fit in the desired press?
- Is the base material proper for class of tool ordered?
- Are mold components made of proper material?
- Will the part stay on the proper side of the tool for ejection?
- Have mold inserts been reviewed for manufacturability?
- Are runners proper size? Is the gate size and location correct?
- Is the sprue puller correct? Does the Z puller pin have a ring vent?
- Are runner shutoffs needed?
- Are cooling lines/heater rods sufficient and appropriate to the material?
- Is a thermocouple required?
- Are insulator sheets needed?
- Are water/oil fittings size and style correct?
- Are parting line side locks or taper locks necessary and protect shutoffs?
- Are there enough ejector pins, blades, ejection sleeves?
- Are there adequate support pillars and stop pads? Is guided ejection needed?
- Is ejection stroke sufficient and clears the part from tool?
- Is positive spring ejection return needed?

- Does tool need to be tied into ejection unit?
- Is thin switch needed to verify ejection back?
- Is an air blast or other ejection assist needed to clear part from tool?
- Is slide and/or lifter travel enough to clear when part is ejected?
- Are slides held in open position effectively? Are cavity and part identifications and date codes needed and in proper size and location?
- Has venting been addressed?
- Is there proper mold base relief?
- Are mold components poka yoked and/or keyed for proper assembly and timing?
- Are moving components checked for collision, clearance and orientation?
- Is a quick change mold system used in-press to be utilized and will tool fit?
- Are clamp slots or machine mounting holes correct and sufficient to hang tool in press?
- Are there enough and correct eyebolt holes?
- Is mold safety strap in proper location?
- Is the locating ring diameter, sprue busing orifice and radius correct?
- Are knock out locations and size correct?
- Is mold identification and weight shown correctly and in proper location?
- Are there enough pry bar slots?
- Are leader pins taller than any other mold components above parting line?
- Is surface finish defined in tool design drawings?
- Is proper tolerance defined in detail drawings for dynamic and static fits?

General Rule of Thumb: Press Tonnage

PS - 2.0-2.5
EVA / LDPE - 2.0-3.0
ABS / HDPE / Polyester / PE / PP / PUR / PCV / TPE - 2.5-3.5
PC/ABS / POM / PMMA / PA unfilled / PBT / PEI / PES / PPO - 3.0-4.0
PA filled / PC / PEEK / PSU - 4.0-5.0

Further Steps to Take Before Beginning to Design

Not necessarily part of the tool design review, but part of DFM, are a few items to be considered before tool design is started. Is there adequate draft for desired texture and part geometry? Is part geometry considered when developing parting line in part? Is the part influenced to stick in the correct side of the tool considering which side of the part can or cannot have ejector pin marks? Another constraint to look at is the press tonnage sourced. As a quick check to ensure the press size can be utilized, I have found this rule of thumb helpful: take the square inch area of the part by taking a measurement of the extreme length and width of the part size as projected on parting line and multiply by the following values to calculate required clamp tonnage, using the higher value for thinner walled parts and the lower value for thicker, more even part geometry (see matrix above). This is usually dictated by the customer via press capacity and scheduling demands. MMT

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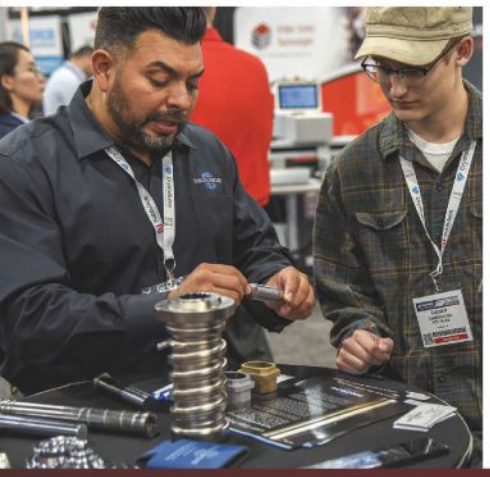

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By Paul Vragel

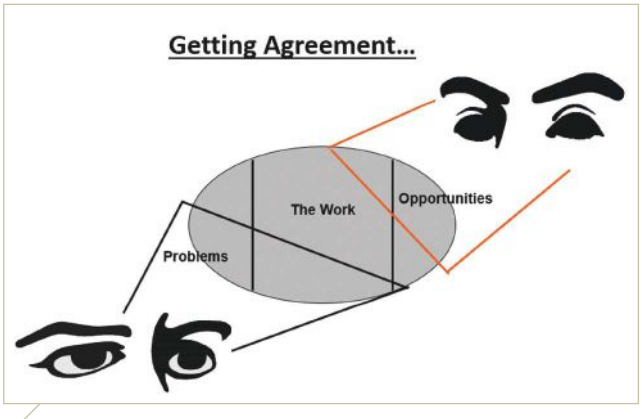
Getting Over Growing Pains

A team will achieve company objectives and improve customer service with a common understanding of processes.

This is a story about two experienced moldmakers, Jack and Mike, and the formation and ongoing development of their successful mold manufacturing business. The story is built around the challenges many shops encounter as they grow and describes some practical steps to develop buy-in and participation to change and scalable processes to enable growth.

Jack and Mike launched a new mold shop business based on long-standing industry relationships. The business started small, but with hard work, the shop developed a reputation for quality and on-time delivery. Soon the business grew beyond what the two men could handle alone. They hired a sales person to develop more business, a mold designer and staff for the production department. Then they started to focus on larger and more complex molds, which demanded more staff for the additional machinery they acquired to do the work.

As the business continued to grow, work previously handled by one person was divided among three or four people, depending on the area. People working in a specific area grew to understand the details of "who does what". Eventually Jack and Mike grew the workforce to include a program manager, quality manager, mold design team, metrology specialist, plastics engineer, CNC machine operators, manufacturing process engineers and assembly technicians.



Images courtesy of 4aBetterBusiness.

Typically, shops find solutions to problems by calling company-wide meetings to discuss a problem. However, this approach reveals that people working in the same area often have different ideas about how things actually work.

All this was done without a lot of documentation, relying on employees to work together. Employees often adopted their own "local" standards for mold features, tooling, tolerances or other aspects of the mold or manufacturing, resulting in "tribal knowledge" only known to a few.

Jack and Mike added technology in bits and pieces, too. Keeping track of everything on paper and in Excel started to get out of hand. They bought a scheduling system. When they outgrew that, they bought a full manufacturing resource planning (MRP) system. The MRP system didn't meet all of their needs, but it seemed to work well enough to get them to the next level of operations. Somehow, it always took a long time to get anything new working right. More experienced employees would continue to use old approaches.

Losing Focus

With growth came new issues. For example, a type of job that had always run smoothly through the shop suddenly ran into problems. The lack of documentation and dependence on tribal knowledge became more problematic, as people changed departments or left the company. The frequency of errors continued to increase, and customers noticed it was impacting lead times.

As these problems occurred, Jack and Mike would figure out a solution and send a notice to meet with the involved employees and discuss the problem. It became apparent in these meetings that even people working in the same area had different ideas about how things actually worked. As a result, there were disagreements on proposed solutions.

The data they collected wasn't much help, as it was seldom clear whether the data was helping to pinpoint a problem or simply identify when someone with the tribal knowledge was absent. When a change was implemented, it often didn't solve the problem, or worse yet, created a new problem. In a few weeks, everyone went back to the prior way of working.

Jack and Mike tried encouraging employees to make suggestions on how to make things work better. The suggestion boxes they put up were rarely used. Then they tried encouraging everyone to take action in their own area. People offered ideas to their managers, but managers were often pressed for time to handle problems, and so, they would not

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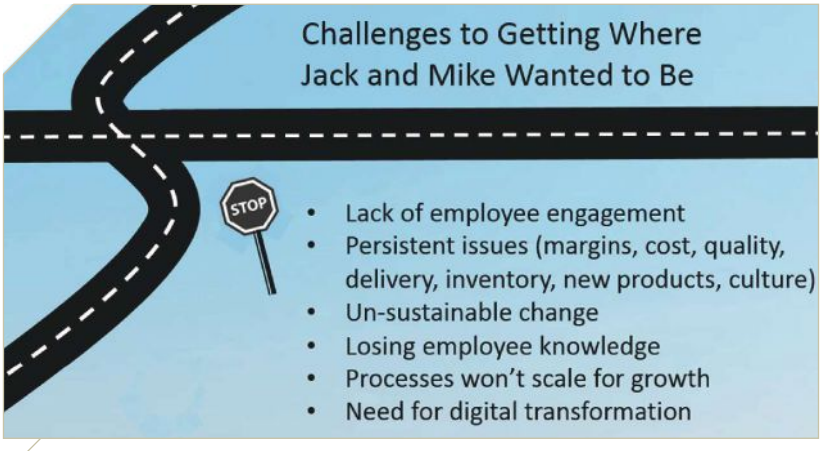
take any action. Not surprisingly, the flow of ideas stopped.

Jack and Mike then set up teams to address involvement across all functions. They sent leaders to training courses on how to manage teams and how to run effective meetings. Once the effort got off the ground, the teams got bogged down with formalities rather than addressing the pressing issues. Soon people stopped going to the meetings, and the effort dissipated.

Jack and Mike even tried brainstorming sessions with management about what customers *want* and what customer *do not want*. This exercise revealed that customers want short lead times, quality, added service, responsiveness, technical capabilities and no problems. Jack and Mike then categorized areas with problems that impacted the customer. These problems included lack of employee engagement, persistent issues (margins, cost, quality, delivery, inventory, new products, culture), unsustainable change, losing employee knowledge with retirements, departures or changes of assignments, inconsistent processes that don't scale for growth and the need for digital transformation. Everything seemed to result in increased lead time.



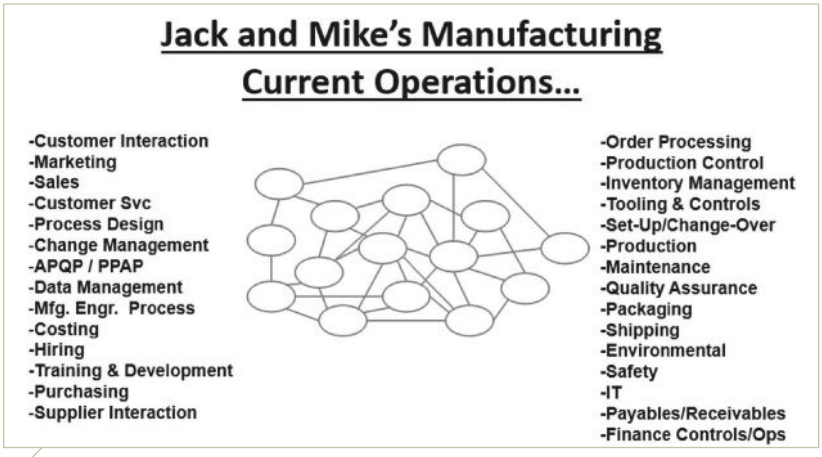
Issues in a shop can involve every function of the company. The common element behind every item can be summarized in one word: problems. For example, here is a list of common challenges preventing shops from getting where they want to be.

Taking Action

The outcome of the brainstorming session identified that customers wanted "*everything* with no problems." Jack and Mike decided that to accomplish this goal, the company needed more than a "better way to work," it needed customer-focused, problem-preventing systems. The overall framework used is called *process maturity*. One key aspect of the model for Jack and Mike included steps for moving beyond the repeatable stage, called the *process-driven stage*. The first step to developing these systems is recognizing that employees are the experts within their local systems and processes, and that almost all issues in a company are embedded in how the local systems and processes work and work together.

The characteristics of this new problem-preventing system are:

- **Customer focused.** Take into account the customer journey or experience in addition to shifting the focus streamline internally.
- **Documented and common understanding.** Documentation by itself does not develop common understanding, which is particularly true with text-based systems such as the numbering systems of ISO 9001 and related standards. For example, one section of a standard can apply to multiple parts of the business, and one part of the business may address multiple parts of the standard. This "many-to-many" relationship makes it difficult for employees to decipher how the different parts of the business work together. Companies using visual documentation, such as deployment flow charts, will more easily see inputs, outputs and interactions as well as risk, responsibility and authority. Well-understood processes make it easier to scale and implement digital transformation.
- **Buy-in and followed**. Defining a change and then trying to get employees to buy-in and follow that change is a typical strategy, but it often develops resistance to change. A more effective strategy is to start with the end in mind by identify-



Companies often lose sight of the fact that their most valuable asset is the employee, who is intimately familiar with his or her local system, which range from sales and marketing and costing to inventory and quality assurance.

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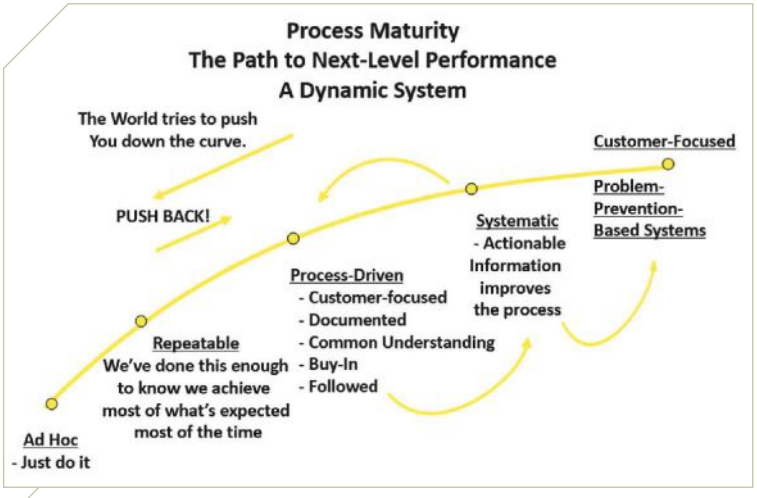

A process maturity model is a dynamic model for next-level performance that is useful at every stage of a company's growth. The core elements of this model are shown here.

ing what is actually happening and what the company is currently following. As a company works through this process, it will discover the real issues impacting the business, for which it can gain employee participation and contribution to develop sustainable solutions, as well as buy-in to the solutions and ownership of the results.

Jack and Mike understood clearly that transitioning to a process-driven stage using data would help the company move beyond the repeatable stage, which was heavily dependent on tribal knowledge. Once they established visual processes, they could define the data they wanted to analyze, use and link to a process for improvements. As everyone gained a better understanding of processes and interconnections, the company defined sensible metrics more easily and directly connected data to processes.

Now with a common understanding of processes and interactions, they easily identified opportunities for adopting Industry 4.0 and other new technologies, as well as a significant addition to the MRP system. On top of that, customers began noticing the change in the company's ability to address and prevent problems, even on projects in process. Employees were finding and addressing problems immediately, without finding fault or blame. With the new system, employees applied a consistent process to each project and got the unique results each project requires.

Over the next few weeks, as everyone in the company was engaged in process capture and assessment, the initial buy-in developed into participation in the change. Since they were clearly part of the solution (not viewed as the source of the problems), managers and employees developed ownership in the changes made and the results achieved. With a full view of the system and everyone contributing, they quickly resolved some problems the company struggled with for years. As a result, they created a roadmap for future actions and redefined their "way of doing business".

Jack and Mike saw attitudes and expectations change from resignation to problem-solving. They called it their "improvement seeking" culture and began to see that the positive work environment gave the company a competitive advantage in attracting and retaining employees. MMT

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By Cynthia Kustush

This article is part of a series of roundtable discussions with industry suppliers addressing recent trends in moldmaking, the challenges moldmakers are experiencing and the latest solutions that are or will be available to resolve them.

Mold Shops Value Social Media for Branding, Reach and Recruitment

Mold builders share their approaches to social media, what works and why using the medium is so important.

Everywhere one looks, smart devices, especially smartphones, are out and in use by people of all ages. In fact, according to statista.com, the number of smartphone users is projected to grow to 2.5 billion worldwide in 2019, and in 2018, 77 percent of United States citizens had a social media profile. Statista.com also reports that the current number of worldwide social media users reached 2.34 billion in 2018 and that number is expected to grow to 2.95 billion by 2020. Just 20 years ago these statistics would have seemed incredible, and yet, here we are.

MoldMaking Technology has been paying close attention to social media in recent years, and has profiles on LinkedIn, Facebook, Twitter and Instagram. Moldmakers have also begun to adopt social media as part of their sales and marketing efforts, so we asked a few shops who got on board earlier than most to share their views on it, including what social platforms they use, what works for them and why social media is an important part of their sales and marketing strategies.

Connecting and Branding is Key

Of the companies surveyed, all responded by saying that social media is key to making a connection with people in the industry. This is undoubtedly an expected response but for several companies, social media is intended to enhance branding or in other words, the image of the company to achieve varying goals. For example, Tim Galbraith, sales manager at Cavalier Tool and Manufacturing Ltd. (Windsor, Ontario), says Cavalier recognized several years ago that social media provided an opportunity to do several things, including differentiating the company from the pack. "While social media was not new, at the time there were few in the moldmaking industry using it," he says. "We found it to be a cost-effective way (no capital investment required) to increase our presence in the industry over and above the typical direct sales efforts augmented with print advertising and trade shows." Cavalier is currently active on Twitter, LinkedIn and Facebook.

Westminster Tool Inc. (Plainfield, Connecticut) also employs Facebook, Twitter and LinkedIn. "Each of these outlets has its own purpose and is managed accordingly by our marketing team," Hillary Coombs, sales and marketing, says. For Westminster, Twitter is used to connect with industry and the media, while LinkedIn provides a way to connect with industry experts like customers, prospective customers and suppliers. "We believe that social media is a critical component to building brand awareness, referrals and word-of-mouth marketing." She explains that a year ago, the company realized that its following and engagement on each social media channel was different and attempting to duplicate posts across all channels was not as worth the effort as originally imagined. "Of course, there are still instances where sharing posts across all channels makes sense, but sometimes a post might not be suited to one or more channels. An example is posting pictures of cultural events, as not all of these would be appropriate or relevant for LinkedIn where people are looking for learning opportunities and connections. Instead, it is perfect for Facebook where our community interacts with us and the people who help recommend our company get to see the culture (including family members of employees)."

Like Westminster Tool, Accede Mold & Tool Co. (Rochester, New York), uses each of its social media platforms differently. "We are active on Instagram, Twitter, LinkedIn, Facebook and YouTube," Camille Sackett, director, Business Development and Engineering Support, says. "I have a widget so our Twitter feed displays in real time, keeping our website fresh and relevant." She adds that though each medium has a different purpose, branding and messages are consistent across all platforms.

YouTube and LinkedIn are important platforms used by R&D/Leverage (Lee's Summit, Missouri), according to Robert Schiavone, global marketing director. "We use social media as a branding support channel for various target audiences. While we do use Facebook for personal, internal communications, I am not a fan of it for business purposes," he says, explaining that, for him, Facebook lends itself to more unprofessional posts compared to LinkedIn.

Similarly, Cavalier's Galbraith says Facebook is currently used more for employee and social news, although the company does promote its presence there. "We want customers to realize the kind of company we are—our social culture," he says. "Twitter is used more for announcements and business news; and LinkedIn is used for events and announcements that won't fit within Twitter's 280-character limit."

Making a Social Impact

Amanda Wiriya, manufacturing support manager at Wepco Plastics Inc. (Middlefield, Connecticut), says social media plays a large role in the company's marketing strategy and community engagement. "It supports all our efforts to highlight our capabilities and services while affording us the opportunity to make a social impact," she says. "For example, we put a lot of effort towards workforce development, education and being a good community member." Wepco currently uses LinkedIn, Facebook, Twitter, YouTube and Blogger. Blogger, owned by Google, is an online blog-hosting site that the company uses primarily for its newsletter campaigns.

Cavalier also uses photographs and graphics in posts within all three social platforms. "They seem to increase reach and traction," Galbraith says. "We do not have a formal plan. Our strategy currently is to simply be relevant and non-controversial (unless it is politically motivated for our industry)."

While Cavalier does not formally plan its social media campaigns, Westminster Tool, R&D/Leverage, Accede and Wepco do prepare social media calendars. "We try to plan our social media efforts at the beginning of the year," Schiavone of R&D/Leverage says. "We first plan out our newsletters, what topics we will cover (like injection or blow molds or mold repair, etc.) and set the publishing sched-

ule, which dictates what we will be sharing on LinkedIn."

Wepco prepares and follows a social media calendar each month, focusing its posts on its calendar of events, such as industry happenings, on-site events or those planned in the community. "National days, sales initiatives, current events and holidays also influence our social media schedule, in addition to allowing for spontaneous posts including liking, sharing and commenting on others' posts," Wiriya says. "We also encourage our team to post individually when representing Wepco Plastics at events, training, etc., and we always try to post videos, photos or other media that will encourage our followers to interact with us."

"Posted content includes Accede news, like new equipment or business alliances, promotions about where we are exhibiting or recruiting and community outreach events," Sackett says. "All content is intended to communicate who we are and what differentiates us, and it works to strengthen the bonds we have with our connections." She adds that she finds Instagram is a preferred platform for young people (aka Gen Y and Gen Z) and calls it "Twitter light." "I definitely see this platform growing and phasing out Twitter and Facebook. Our moldmakers, their families, individual customers and more use this platform."

Westminster Tool's plan is housed within a Google calendar where content ideas like blogs, events and planned social media posts are outlined and prepared. "We also create posts whenever needed to highlight things going on within the shop and community," Coombs says.

Assessing Social Media Engagement

Asked whether social media has led to actual sales for their companies, responses leaned more toward the side of uncertainty, but none of the companies discounted the value and strength of their efforts.

"Cavalier Tool has just started to formally track engagement so we can dial in our strategy to optimize its effectiveness," Galbraith says. "I can say that we have had inquiries from companies that have heard of us through social media, and the image we are building has helped us to become better known in the industry." Galbraith explains that results came after a false start. "We established LinkedIn and Facebook pages and hired an outside consultant to manage our media and gain visibility for us. It did not take long to recognize the error in our ways. Without the technical knowledge, our efforts lacked any value to the audience, and we were not getting any traction. We brought it in house and basically learned as we went. We are still not

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rock stars in the social media arena, but we are getting better. We have one person in house assigned to the 'corporate' feeds, and several of us work our personal accounts to complement the company feed and increase our reach."

Westminster Tool's Coombs says, "It is tough for me to put an actual number, but I do believe it has helped. Our coverage from a recent article and video published in *MoldMaking Technology* and *Modern Machine Shop* magazines led to 50 percent of our pageviews in January. In 2018, we connected with at least five new prospects or industry suppliers through LinkedIn, and most of all, we are constantly building indirect connections with prospects and customers online, which leads to conversation starters in person." For example, Coombs says that, because of the company video featured in the magazines, a company reached out, wanting to chat about Westminster's company culture. "Once on the phone, they told us they have some machining needs as well and requested a quote. In summary, they came to us for the culture but realized they could also use us for manufactur-ing (aka inbound marketing)."

Schiavone concurs, saying, "It's very rare that we see a reaction from a social media post that interprets into an immediate sale. The key is tracking that lead, which can only be done with the help of the sales team. We currently use Constant Contact to collect data about who has opened and read our newsletters. We may then see they downloaded literature from our website, showing strong interest in our services, and have our sales team follow up." He adds that it may take months and sometimes years before any actual work comes through, which is why he regards social media as an extension to existing branding strategies.

Accede's Sackett says she sees LinkedIn as a professional channel that is great for networking. "This is a channel that has a broad demographic that is comfortable interfacing with it. A bigger network coupled with a great reputation for premium quality and innovative solutions does lead to increased opportunities, sales and revenue."

"While we are able to trace specific revenue directly to specific campaigns or posts, social media is so much more to Wepco," Wiriya says. "Sales is obviously an important goal, but we also use social media to advertise jobs, bring attention to issues we believe in, like workforce development, elementary through high school education, industry awareness and giving back to our community. We also use it to interact with local industry and regional organizations, like Women in Manufacturing (WiM), The Eastern Advanced Manufacturing Alliance

(EAMA), American Mold Builders Association (AMBA) and Manufacturers Association for Plastics Processors (MAPP)."

Social Media Conclusions

For Hillary Coombs and Westminster Tool, social media is valuable because the entire world is becoming mobile. "We are shifting from an interactive buying experience to an independent and online experience," she says. "While the manufacturing industry may never reach the status of the clothing industry on social channels, it is a fact that our customers are using the web—to learn something new, find a piece of information or to build connections. Moldmakers must begin to transition to ensure we are in front of our customers, wherever they are."

"It's one more channel that is a major source of information for so many people. To not be on social media widely limits the audience you reach," Amanda Wiriya says. "Wepco has received business from people who only interact on social media that we would not have otherwise reached."

R&D/Leverage's Bob Schiavone agrees, stressing that, specifically in B2B models, the younger generations are increasingly using social media to scope a business, see what is posted and what is new. "Social media is an extension of the content in your website but in an open dialogue," he says. "That is why we call it social media, because it is inviting commentary, while sharing news at the same time."

"Social media creates impressions and shapes opinions," adds Cavalier Tool's Tim Galbraith. "Used masterfully, it is a relatively inexpensive tool that reaps rewards. Using it to promote your company will reach the leaders of tomorrow. Like any characteristic of companies on the cusp of our industry, whether it is IoT, Industry 4.0 or social media engagement, those that avail themselves of these tools will be the winners." MMT

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Advanced EDM Features Increase Efficiency and Change Perceptions

By Cynthia Kustush

Viking Tool and Engineering Inc. (Whitehall, Michigan) serves customers in the furniture, automotive, marine, RV, toy, consumer goods and electrical industries, among others. The company has experience designing, engineering and building a wide array of tools, dies and molds, including injection molds, sheet molding compound (SMC) and bulk compression molds, plastic structural foam molds, as well as aluminum prototypes. Molds range in size from small up to 50,000 pounds; the company has an in-house welding department and offers customers repairs and engineering changes.

A full-service moldmaker, Viking Tool prides itself on its extensive end-to-end experience and says it has built its shop floor around an "advanced technology" theory that allows it to repeat quality in an efficient and timely manner. The theory worked in many areas of the moldmaking process except one until recently, according to Rick Seaver, president. "Our EDM cell was our bottleneck area. The problem was inefficient burn time and a lack of unattended burning, with productivity being half of what it could be if we could run unattended at night," he says. The addition of an OPS-Ingersoll Gantry Eagle 1200 sinker EDM machine has since corrected the issue—and changed perceptions on EDM efficiency.

VIKING TOOL AND ENGINEERING INC.

PROBLEM: Inefficient EDM burn time and lack of unattended burning created a bottleneck in production. Also, quality was not up to par when burning deep, narrow ribs and other complex details.

SOLUTION: Purchase of an OPS-Ingersoll Gantry Eagle 1200 sinker EDM machine.

RESULTS: One EDM machine does the work of four older machines and enables unattended operations, increasing competitiveness and profitability. Output has more than doubled, and there is no more bottleneck.

Image courtesy of Viking Tool and Engineering Inc.

This OPS Ingersoll Gantry Eagle 1200 sinker EDM machine has changed how Viking Tool and Engineering in Whitehall, Michigan, gets its jobs done. The Eagle has replaced not one but three of Viking Tool's older EDM machines. It is fast, precise and has reduced the company's electrode usage by 50 percent.

Forget Cutting, Burn Faster

Seaver says that in the course of a normal day, before Viking Tool invested in the Eagle 1200, the company's three existing EDM machines would net about 10 hours a day in burn time per EDM. "And that's if the operator could keep the machines loaded and burning," he says. "The Eagle by itself runs 24 hours a day, and it doesn't wait for the operator to come and install another electrode. It burns better than two times faster compared to our older EDM machines."

As a result of purchasing the Eagle 1200, Viking Tool was able to eliminate two of its four EDM machines, though Seaver says the Gantry OPS Eagle does the work of all three older EDMs combined. "Our second machine is for larger capacity projects and doesn't run that much anymore. What a joy to be pushing the work through and getting our EDM done in less than half the time," he says, adding, "Understand that half the time, when running 10-12 hours a day is one-fourth of the time when running 24 hours a day. If we had four days of burning in the past, it would now take us one day and be ready to pull the next morning."

Viking Tool first learned about the OPS-Ingersoll Gantry Eagle 1200 from Performance Machinery LLC (Sterling Heights, Michigan). "Bryan Herrington, our Performance Machinery representative, explained the new generator technology and how the machine was at least twice as fast and, in most moldmaking applications, used only one electrode. I thought, this is something I have to see, so Bryan took us to Roush Manufacturing (Farmington Hills, Michigan) and showed us the benefits of the

machine and why we needed one. We saw the machine running in the same environment that we play in," Seaver says. Soon after that, Viking Tool's lead EDM man and its shop manager visited Roush to see the machine in action. "They came back even more excited than we were, so we invested in one. It has proven to be a key decision for us. We are competing with Canada's currency advantage and China's labor cost advantage, and the Eagle has helped us be more competitive," Seaver says.

Dan Meehan, president of Performance Machinery, understands Seaver's excitement over the Eagle 1200's performance. "When you truly understand sinker EDM and electrode wear, and suddenly you see a rib burn down two inches into solid steel and come out of the burn with literally only 0.002-inch wear, anyone would be impressed," he says. "That's what Rick and his team saw at Roush. We encourage as many people as we can to visit Roush because they are so well known, and their test cuts (burning speaker grills, extremely deep ribs, huge electrodes) are so specific to show the low-wear technology on the graphite electrodes with the Eagle Generator compared to the other EDM machines."

Where many mold manufacturers are looking to reduce or eliminate EDM usage in their shops, opting for hard milling complex details on five-axis CNC machining centers, Seaver says it is exactly the opposite at Viking Tool. "We find we are burning more and cutting less with the Eagle. We tried to cut more and burn less, but it doesn't always make sense to run a 0.032-inch ballnose cutter on a machine with 37 by 81 inch travel. Why spend a lot of time on a large milling machine breaking 0.06-inch and 0.032-inch cutters at $25 to $35 apiece when you can just go to the tank and burn it?" he says, pointing out that it can be costly if one does too much of either cutting or burning. "It's a very important, fine line. The Eagle has made this line much easier to find. Spinning your wheels doesn't get it done anymore. We must be productive. Purchasing the Eagle has been one of the most important and biggest game changers in my 40 years in the industry."

Unique Construction Increases Efficiencies

OPS-Ingersoll's gantry-style EDM machine has a rapid traverse rate of 198 inches per minute, which Seaver says is 10- to 12-times faster than Viking Tool's previous machines, while the EDM oil fills the tank extremely fast with no pumps required and follows the programmed Z-heights automatically without the need for operator assistance. Any time saved between each burn or during any dry run improves the total capacity of the machine and its

operations schedule. Herrington adds that another advantage in this gantry-style machine is that its ram is centrally located in the positioning area of the tank, meaning workpieces can be set up to within five inches of the table's perimeter, giving users the opportunity to set up multiple jobs and reach all burn locations. "Most other EDM machines do not offer this advantage," he says.

Seaver says the company has reduced the number of graphite electrodes needed by half. According to Herrington, this is possible because of the OPS-Ingersoll EDM generator and control technology. "OPS-Ingersoll has worked hard to understand exactly how to create millions of sparks per second that will jump from the electrode to the steel and can be shaped and controlled in a way that delivers the best speed while remaining focused on providing the least amount of electrode wear and much improved surface finishes for deep burns," he says. The control and generator work together to measure the spark gap of the electrode to determine when the machine should be jumping up or out to allow for clean oil to enter the burn location. "The Ingersoll only jumps when the controller believes it is required. Therefore, the Eagle generator does not jump as frequently as other EDM machines, and this keeps it down in the burn longer without causing any arcing. The result is a faster burn."

Seaver shares an example. "We recently had a job that we were told would not fit in the Eagle. It required four big burns and was a very complicated setup," he says. "The job was running around the clock. Before the first burn was completely roughed out (still an inch left to burn after 30 hours), we realized it was taking too long. We reevaluated whether it could move to the Eagle and with some modification to the holder, it could. We started up the Eagle on a Friday afternoon and had all four locations roughed by Monday morning, including the one that didn't finish

The engineering of the OPS-Ingersoll Gantry Eagle 1200 sinker EDM machine makes maintenance much easier, according to Viking Tool. The filter changes are ingenious, easily accessible and fast, Rick Seaver, president, says. The above image proves it out.

roughing in the old EDM. On top of that, the electrode was too big to fit into the Eagle's toolchanger and had to be loaded manually. You do the math."

The Eagle also features an integrated C-axis, which takes care of any orientation issues because it creates many options for multi-axis burning, Seaver says. "The PC-based CNC control allows our operator to quickly and easily transfer the burn location and orientation data without having to manually input X, Y or Z coordinates." The Z-axis jump speed is 708 inches per minute (10 times faster than the older EDMs), he adds, and it has a 30-tool automatic electrode changer, which allows for a great amount of unattended machine time. "This is one of the best features the machine has. We run one shift but burn on all three. Second and third shift never complain. Again, it's all about time. If I can get through the EDM process in two to three days rather than five to seven days, it gives us more time at the end of the build."

The Eagle 1200 has a space-saving footprint of 158 by 175 by 137 inch XYZ when installed subsurface versus having it placed on the floor, which would have required installation of a mezzanine around its perimeter for operator safety, Seaver says. "The engineering of the machine makes maintenance much easier. The filter changes are ingenious, easily accessible and fast. The tank, which measures 50.0 by 69.7 by 26.8 inches, is a four-sided drop tank, and our machinists can conveniently access it from any side. It offers a much better way to flush debris as well." Seaver explains that previously, flushing would require drilling a hole in the electrode so debris could be flushed through it and out of the way. "The Eagle is so fast that it creates turbulence in the tank, which flushes out the particles much better," he says. "Our old machine moved a lot slower and couldn't contribute to the effort."

The biggest lesson learned with this machine purchase, according to Seaver, is that the company should have purchased a 1400 rather than a 1200. "You can put medium- to smaller-size multiple jobs at one time into the 1200, which features a 45 by 65 inch table, and run it through the night. The 1400 has a 54 by 94 inch table and will allow for much larger parts, plus it offers even more options for multiple parts to be loaded on the table for unattended time. We will have a 1400 in the future." MMT

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Understanding the New Flow Through Deduction

By Michael J. Devereux II, CPA, CMP
Douglas Mueller, CPA

The qualified business income deduction of the 2017 Tax Cuts, and Jobs Act (The Act) offers mold shops a 20-percent deduction of qualified business income to all non-corporate taxpayers for tax years ending in 2018 and expires December 31, 2025. It comes with some qualifications, restrictions and limitations.

Relevant Passthrough Entity (RPE)

The regulations specify that a shop must be a relevant passthrough entity (RPE) to be considered for the deduction. RPEs include partnerships, S corporations, sole proprietorships, businesses operated through trusts and estates and some businesses with rental activities. As such, mold shop owners must consider this deduction for all its flow-through entities, not just the tooling operations. For example, a taxpayer that owns his shop and rents it to the operating entity may also benefit from this deduction. To be an RPE, an entity must rise to the level of a trade or business, regardless of the entity's structure. However, there is no clear definition of a trade or business, so a shop must rely on the tax code (generally 162) and support from court cases to evaluate each RPE.

Specified Service Trade or Business (SSTB)

A shop must also determine if each RPE is a Specified Service Trade or Business (SSTB), which is defined as the following according to 199A: "Any trade or business involving the performance of services in the fields of health, law, accounting, actuarial science, performing arts, consulting, athletics, financial services, brokerage services, or any trade or business where the principal asset of such trade or business is the reputation or skill of one or more of its employees or owners, or which involves the performance of services that consist of investing and investment management trading, or dealing in securities, partnership interests or commodities." Engineers, architects, real estate brokers, property managers and some banks are among those excluded from the list. Initially, there were concerns about businesses that rely on employee reputations or skills, which means a mold shop could be disallowed the deduction due to their reliance on their reputation as a moldmaker. Proposed regulations tightened this up significantly to include only people who receive endorsement income, appearance fees or license their individual likeness. Mold shops should not fall under the SSTB definition. Additional guidance is available for businesses that share common ownership with SSTBs, de minimis SSTB income and incidental non-SSTB income. Mold shops must consider whether they do any non-engineering consulting or whether any of their ancillary services meet the SSTB definition.

Qualified Business Income

Next, a shop calculates the Qualified Business Income (QBI) for each RPE, which includes domestic income, expenses, gains, losses and deductions connected to the qualified trade or business with any shared expenses. Conversely, capital gains and losses (even if related to business property), foreign income, portfolio income and annuities not associated with the business are excluded from QBI. Self-rental income is included if the paying entity is a qualified trade or business that is not an SSTB and which is held under common control. Reasonable wages for S corporation shareholders are not added. And, if an S corporation mold shop pays no reasonable wages, an amount of reasonable compensation must be excluded from income to determine QBI. For mold shops taxed as partnerships, guaranteed payments received are not QBI, and there is no reasonable guaranteed payment test.

Deduction Calculation

All QBI amounts are aggregated to determine a positive net amount. If negative, the amount is carried to offset future year QBI, but the shop cannot take a current year QBI deduction. If positive, any negative amounts are allocated pro rata over the positive amounts. If a mold shop owner has interests in Real Estate Investment Trusts (REITs) or Publicly Traded Partnerships (PTPs), the dividends and income, respectively, are eligible for a 20-percent deduction, but these amounts are kept separate and not netted against other QBI amounts.

Filing Status	Adjusted Gross Income Range		
Single, Trust or Estate	< $157,500	$157,500-$207,500	> $207,500
Married Filing Joint	< $315,000	$315,000-$415,000	> $415,000
Business Type	**Deduction Calculation**		
Non-SSTB	20% Deduction	Limit phased in based on wage/UBIA limits	Limited to 20% QBI or 50% of wages or 25% of wages + 2.5% UBIA
SSTB	20% Deduction	Deduction is phased-out	No Deduction is Allowed

The taxpayer's Adjusted Gross Income (AGI) determines how a shop should calculate its Qualified Business Income (QBI) deductions.

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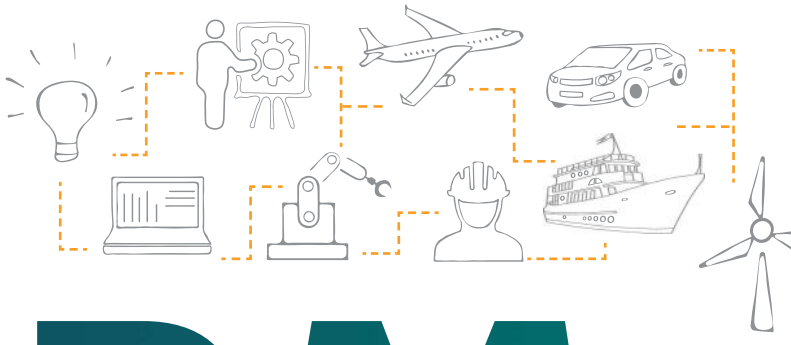

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Limitations

The deduction is calculated at the shareholder or partner level using information provided by the RPE, including SSTB classification, amount of qualified wages and Unadjusted Basis Immediately after Acquisition (UBIA) of related assets. The deduction is subject to a wage and property limit equal to the greater of 50 percent of the shop's W-2 wages and the sum of 25 percent of the shop's W-2 wages plus 2.5 percent of the UBIA qualified property. How the taxpayer uses this information depends on the taxpayer's Adjusted Gross Income (AGI) (see chart).

Qualified Wages

If the shop has non-SSTB income and AGI is over the threshold, wages and possibly UBIA should be considered to determine if a limitation applies. Qualified wages are those allocated to the qualified business income. The total includes wages, elective deferrals, deferred compensation and designated ROTH contributions. A shop can consider wages even if they pay them through a Professional Employer Organization (PEO) or similar arrangement.

UBIA Calculation

Qualified property must be tangible, depreciable property used in QBI production. Bonus depreciation, 179 or an election to use the Alternative Depreciation System (ADS) do not impact the asset's basis or life. UBIA of the property is generally the basis of the property at the date the shop places it into service. A shop can include property in the equation for the longer of 10 years or the regular depreciable life. However, depreciation cannot end before year-end, and the shop cannot dispose the asset before then. After determining the total QBI deduction, it is combined with REIT/PTP deductions. The deduction is limited to the lesser calculated QBI deduction or 20-percent of the shop's taxable income, less any capital gains. MMT

CONTRIBUTOR

Douglas M. Mueller, CPA, is president and Michael J. Devereux II, CPA, CMP, is a partner and director of manufacturing, distribution and plastics industry services of Mueller Prost.

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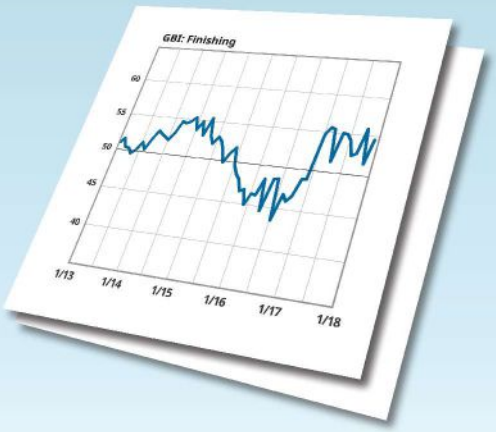

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Index Extends Movement

February 2019 – 52.6

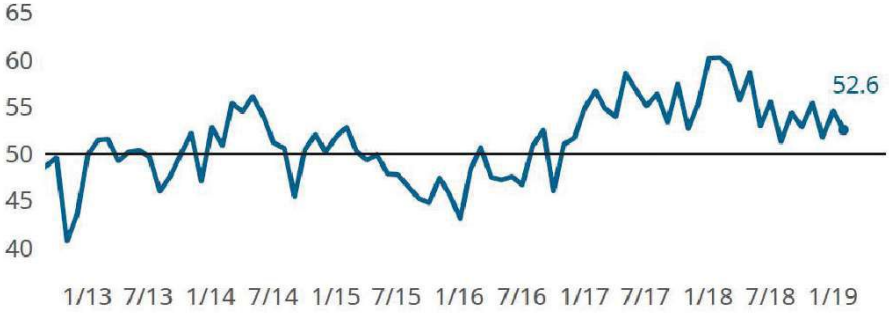
The Gardner Business Index (GBI): Moldmaking registered 52.6 in February, extending its narrow range of growth readings since September 2018, when it registered less than 200 basis points higher. Compared to the same month one year ago, the Index is down 13.7 percent; however, this comparison gauges the latest month's data against the February 2018 record high reading of over 60.0. Gardner Intelligence's review of the month's underlying data reveals that supplier deliveries, production and backlog readings lifted the index higher. In contrast, new orders and backlogs pulled the Index lower. Only exports registered a contractionary reading during the month.

New orders and production both experienced slowing growth in February with the net result being an expansion in backlogs. A slowing expansion in supplier deliveries has resulted in supplier deliveries shadowing production readings in recent months. This suggests that the industry's supply chain has adeptly rebalanced since experiencing a shock of new orders in early 2018, which caught suppliers with insufficient product volumes. MMT

ABOUT THE AUTHOR

Michael Guckes is the chief economist for Gardner Intelligence, a division of Gardner Business Media (Cincinnati, Ohio, United States). He has performed economic analysis, modeling and forecasting work for nearly 20 years among a range of industries. He is available at mguckes@gardnerweb.com

Gardner Business Index (GBI): Moldmaking



Extended expansion in supplier deliveries, new orders, employment and production have kept the Moldmaking Index expanding since late 2016. The Index is currently experiencing its longest continuous expansion in recorded history.

Supplier Delivery and Production Components of the Index

Supplier delivery and production readings since the start of the second half of 2018 suggest that the industry's supply chain has adeptly rebalanced since experiencing a shock of new orders in early 2018, which caught suppliers with insufficient product volumes.

Medical Industry Improves Free Cash Flow

Free cash flow improvement exceeds reduction in capital expenditures, signaling continued medical industry growth.

Gardner Intelligence reviewed 67 publicly-traded firms in the medical-devices and medical-instruments and supply industries. At the time this article went to print, nearly 40 percent of those firms had reported fourth-quarter results. Evaluating the fourth-quarter data from one year ago, as well as on a 12/12 rate-of-change basis (comparing the last 12 months with the preceding 12 months), we see evidence of an industry that continues to perform well despite a myriad of economic concerns, both domestic and international.

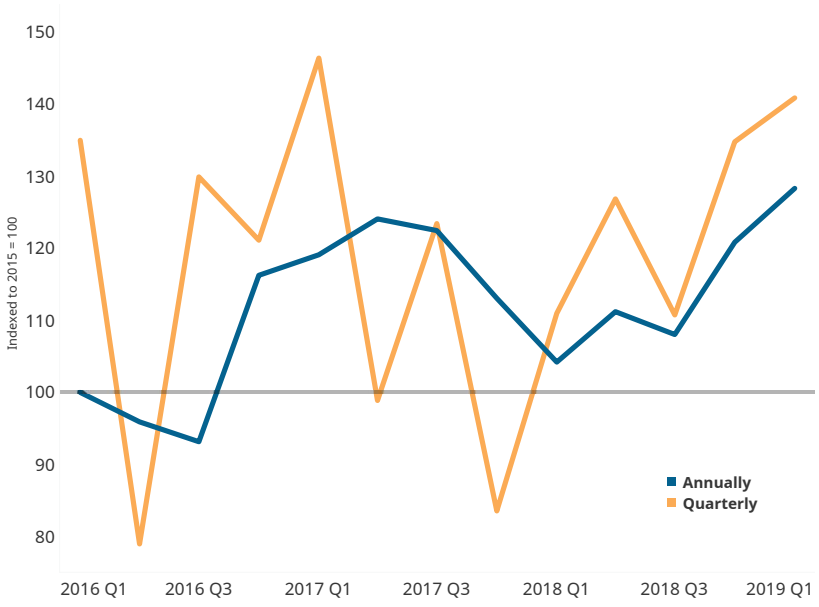
Interestingly, top-line revenue growth was more than double overall economic growth. Among the firms analyzed, the average year-on-year fourth-quarter revenue growth was nearly 9 percent, with the median result at 6 percent. This is more than double the expected rate of overall U.S. economic growth that quarter at 2.4 percent, as reported by CNBC and Moody's Analytics.

During the fourth quarter of 2018, our sample of firms experienced strong free cash flow growth, raising the 12/12 rate of change to 15 percent. An examination of individual corporate results indicates that the median 12/12 rate of change was slightly less than 7 percent. Total free cash held by the industry firms in our research set their most recent cumulative low during the third quarter of 2017 but reversed course and have since increased quarterly free cash flows, culminating in a multi-year high at the end of 2018.

Part of the explanation for the fourth-quarter growth in free cash flow is attributable to a simultaneous reduction in capital expenditures. Free cash flow, in its simplest calculation, is defined as cash flow from operating activities less capital expenditures. Of the $1 billion increase in free cash flow among the firms Gardner studied, the reduction in capital expenditures only accounted for approximately 20-percent of the change. In the fourth quarter, the average firm increased their capital expenditure 0.4 percent from the same quarter a year ago—a 3/12 rate of change—while the median result for the same time period was a 1.6-percent contraction. This fourth-quarter investment behavior belies the encouraging capital expenditure growth experienced earlier in 2018.

That current and projected revenue growth are both well above overall economic growth levels, however, should give suppliers to the industry reason for resolve. Retained cash generated in recent quarters may quickly be deployed in the future if business sentiment changes. MMT

Medical Devices, Instruments & Supplies - Free Cash Flow



FOR MORE INFORMATION:
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COMPONENTS

Hydraulic Locking Cylinder Provides Plug and Play Integration

PFA Inc.'s Hydraulic Locking Cylinders are now available with low profile PNP style sensors designed to integrate with Switchmax mold connectivity solution. Connects can be orientated in any direction and moved to multiple sensor locations on the product. Combining integration and low profile sensors enables preload adjustments and more effective core positioning for perfect parts. Small PNP sensors provide tighter mold mounting, closer integration of core water lines and integration with other sensors for a single set and pull output for connection to the press via an integrated junction box. Side sensors on mold cylinders can be adapted with a field wireable connector for connection to the junction box that also provides LED indication for sensors, the company says.

PFA Inc. / 262-250-4410 / pfa-inc.com

Cutting Sprue Bushing Removes Need for Secondary Operation

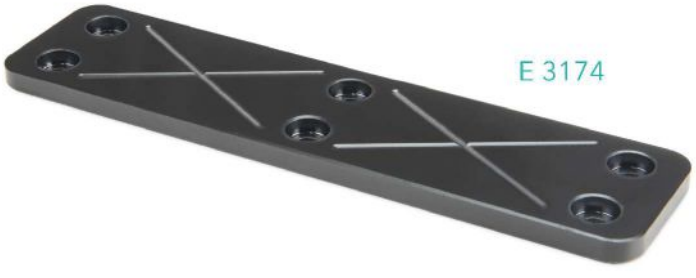
DMS adds Almo's cutting sprue bushing to its range of edge gate cutting components. The cutting sprue bushing enables feeding plastic components near the mold's center, virtually eliminating cold runners into a runnerless cold feed and trimming the gate as the mold opens, removing the need for secondary operation. It also provides a large edge gate area to reduce injection pressure and improve the packing and quality of the final plastic product.

DMS / 800-265-4885 / dmscomponents.com

Angle Pin Inserts Reduce Setup Times

PCS Company launches angle pin inserts made from 420 SS and available in 30 sizes at 10-, 15-, and 20-degree angles. The pin inserts reduce setup time by allowing the moldmaker to machine while doing other flat work, require no secondary setups and prevent rotation with the keyed head.

PCS Company / 800-521-0546 / pcs-company.com



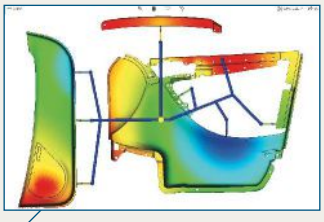
DLC-Coated Flat Guiding Stock Offers Optimal Sliding Properties

The E 3174 flat guiding stock from **Meusburger** offers optimal sliding properties and minimal wear because of the diamond-like carbon (DLC) coated surface. With the radii already provided at the corners, the flat guiding stock can be fitted into milled pockets. Because of its identical fitting dimensions, the E 3174 can be used to replace the existing self-lubricating flat guiding stock E 3176 where necessary. To avoid sharp edges, a 15-degree chamfer is provided around the entire plate, ensuring a longer service life of the flat guiding stock, clean operation of the mold and easy installation without rework. The plates are available immediately from stock, with dimensions from 25 by 63 mm up to 63 by 200 mm.

Meusburger US, Inc. / 704-526-0330 / meusburger.us

HOT RUNNERS

How to Better Balance **Family Molds**



Images courtesy of HRSflow.

This demonstration tool shows how servo-driven technology allows for one-shot production of three high-quality visible parts with flawless, finely-grained surfaces without pressure lines or flow marks for use in automotive interiors. It also allows for completely independent processing at each gate, so a family mold can produce vastly different parts without any compromise to quality.

By Sergiu Fatu Ph.D

Family molds, which allow plastic processors to create different parts in a single mold, offer great advantages regarding lowering total tooling budgets and managing work-in-progress (WIP). Historically, family molds present inherent challenges and require expertise to balance material within the multiple cavities properly. With traditional control methods, all cavities are processed using common parameters set at the injection piston. So, the parts in a family mold customarily need to be very similar in size, weight, wall section and volume.

However, using servo valve gate technology to control the process for each cavity individually directly at the gate can eliminate this constraint. The molding operator can control the stroke, velocity and force of each individual pin independent of one another. The resulting pressures, flow rates and volumes of the melt in the cavity are controlled at each gate independently, which means that each cavity or gate can have its own process (fill speed, fill pressure, pack pressure, pack time). This precise control can prevent overfeeding and flash formation on different-sized parts while all cavities are filled simultaneously.

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Proving it Out

The demonstration family mold pictured above was made with three different weights and volumes to prove out the capabilities of a servo-driven electric valve gate system. The polypropylene parts include an automotive door panel (560 cm^3), map pocket (338 cm^3) and reinforcing bar (58 cm^3) with wall thickness ranging between 2.3 mm and 3 mm.

Engineers designed the 1190 by 950 by 851 mm, 6530-kg mold to process propylene and ABS in an injection molding machine with a 10,000 kN clamping force. The processor obtained information about the mold-filling process from two pressure sensors located in each large cavity and the small cavity, while six contact sensors provided mold deflection data during the injection phase.

Engineers equipped the mold with an eight-nozzle, electrically-driven valve gate hot runner system designed for sequential injection molding. The aligned nozzle openings, permitted by electric technology, alleviated the pressure loss that often occurs during injection molding and eliminated any surface marks. Precise control of nozzle pressure during the holding pressure phase improves part quality in each cavity. The cycle time to produce the three parts was approximately 55 seconds.

This servo-driven solution can help maximize efficiency and decrease costs of a family mold with large part variances. MMT

CONTRIBUTOR
Sergiu Fatu Ph.D is an engineering manager for HRSflow North America.

FOR MORE INFORMATION

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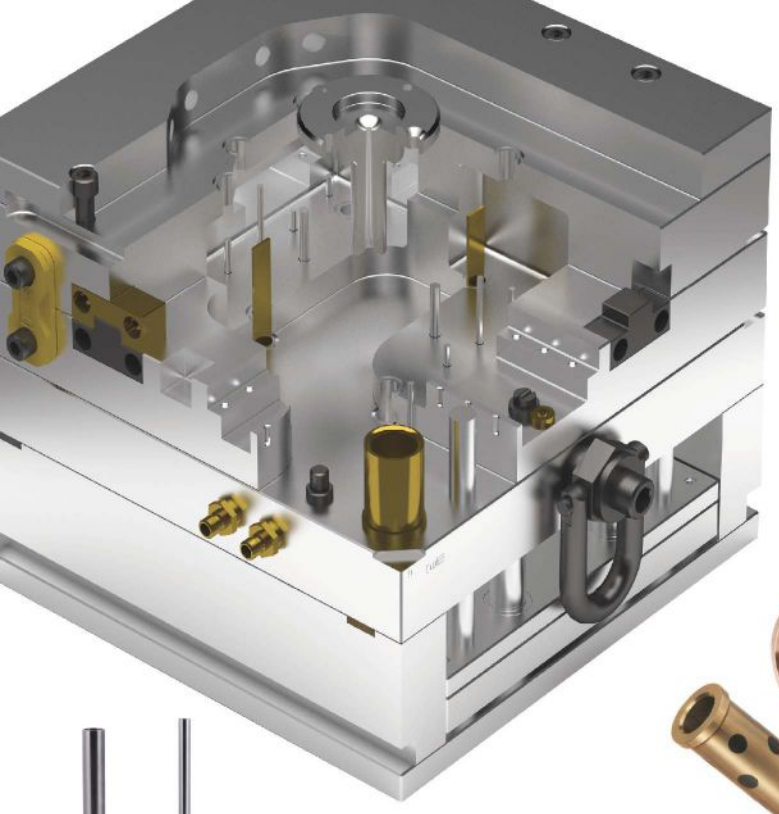

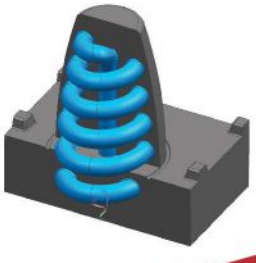

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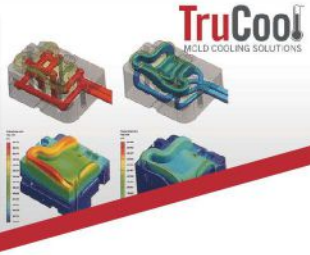

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