MMT ENGINEER / BUILD / MAINTAIN
moldmakingtechnology.com

MoldMaking TECHNOLOGY

AUGUST 2020 / VOL. 23 / NO. 8

A property of Gardner Business Media

"Our customers expect reliable, consistent performance. By specifying Progressive, we deliver long-term, profitable results."

Jeff Jacquemin, R&D/Leverage

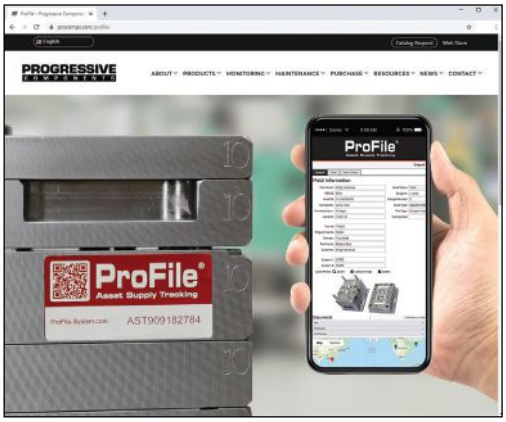
ADVANCING MOLD CONTROL

Buyers of high production injection molds know that taking shortcuts today will lead to problems tomorrow. Progressive meets your most demanding requirements:

- Precision components for maximum longevity
- Greaseless and Stainless products for medical molds
- Cloud-based tracking of mold activity and maintenance

Now more than ever, consistent tooling performance is critical. Call Progressive at 1-800-269-6653 to discuss how these advantages can benefit you.

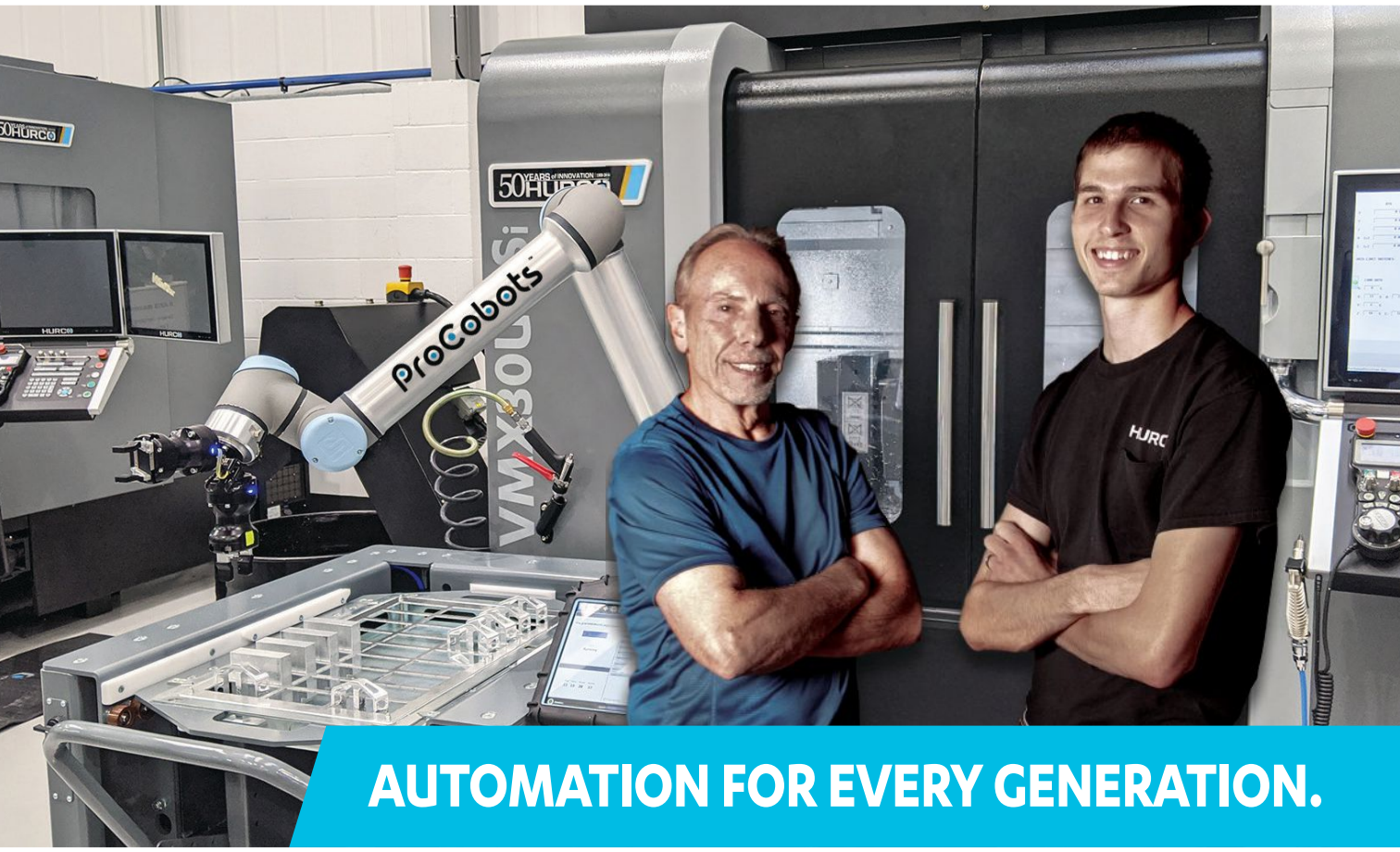
PROGRESSIVE COMPONENTS



ACCESS NEW APPROACHES TO CONTROL PRODUCTION TOOLING:
PROCOMPS.COM/PROFILE

HURCO®

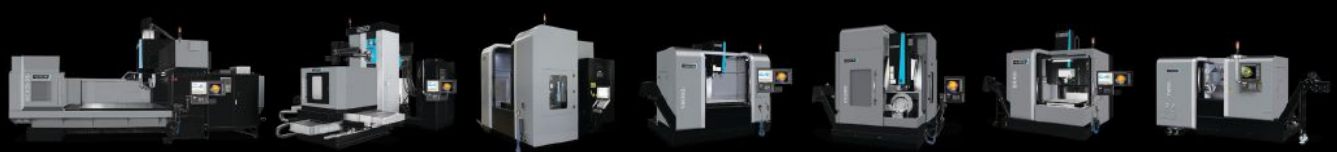
PRACTICAL JOB SHOP AUTOMATION



AUTOMATION FOR EVERY GENERATION.

Hurco has eliminated all of the obstacles associated with traditional automation. With Hurco's job shop automation, high-mix manufacturing can have all the benefits of advanced robotics without the hassle (and cost) associated with traditional automation. The collaborative robots (cobots) from ProCobots, combined with Hurco technology, ensure the cobots are easy to set up and easy to program.

Hurco.com/Automation



Double Column | **Boring Mills** | **Horizontals** | **3-Axis Vertical** | **5-Axis** | **Double Column Bridge** | **Turning Centers**

Hurco Companies, Inc. | One Technology Way | Indianapolis, IN 46268 | 800.634.2416 | info@hurco.com | HURCO.com | Machines shown with options. Information may change without notice.

MMT
MoldMaking TECHNOLOGY®

Publisher
Ryan Delahanty . . . . . rdelahanty@gardnerweb.com

Editorial Director
Christina M. Fuges . . . . . cfuges@gardnerweb.com

Assistant Editor
Grace Nehls . . . . . gnehls@gardnerweb.com

Assistant Editor
Katelyn Arnold . . . . . karnold@gardnerweb.com

Contributing Writer
Peggy Malnati . . . . . pmalnati@garpub.com

European Correspondent
Barbara Schulz . . . . . bschulz@gardnerweb.com

Art Director
Carla M. Turner . . . . . cturner@gardnerweb.com

Advertising Production Manager
Chris Larkins . . . . . clarkins@gardnerweb.com

GARDNER Business Media, Inc.

6915 Valley Avenue
Cincinnati OH 45244-3029
P 513-527-8800
Fax 513-527-8801
gardnerweb.com
moldmakingtechnology.com

Subscription Inquiries:
For questions or issues related to your subscription, please call 513-527-8800 or email subscribe@moldmakingtechnology.com

ALSO PUBLISHER OF

- *Modern Machine Shop*
- *Products Finishing*
- *Plastics Technology / PT Handbook*
- *Production Machining*
- *CompositesWorld*
- *Additive Manufacturing*
- *IMTS Directory*
- *Products Finishing Directory*
- *NPE Official Show Directory*
- *AutoBeat*
- *Modern Machine Shop Mexico*
- *Products Finishing Mexico*
- *Techspex*

MoldMaking Technology (ISSN 1098-3198) is published monthly and copyright © 2020 by Gardner Business Media Inc. 6915 Valley Ave., Cincinnati, OH 45244-3029. Telephone: (513) 527-8800. Printed in U.S.A. Periodicals postage paid at Cincinnati, OH and additional mailing offices. All rights reserved.

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.

BÖHLER

DO YOU REALIZE WHAT YOU'RE EXPECTING FROM YOUR TOOLS

HIGHLIGHT GRADES

- BÖHLER W360 ISOBLOC®
- BÖHLER K294 MICROCLEAN®
- BÖHLER K340 ISODUR®
- BÖHLER M310 ISOPLAST®
- BÖHLER M340 ISOPLAST®
- BÖHLER M390 MICROCLEAN®

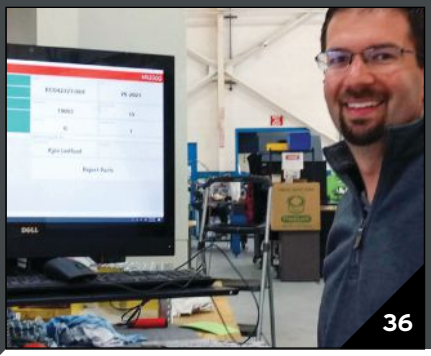
Unique BÖHLER steels to handle your toughest tooling requirements

Glass and carbon in fiber-reinforced plastics are extremely abrasive and cause premature wear on your injection molds. BÖHLER tool steels can significantly increase tool life providing you with tremendous economic benefits!

exclusively distributed in the USA by EDRO

EDRO

(888) 368-3376 | INFO@EDRO.COM | EDRO.COM



Features

Departments

ON THE COVER

Cover photo courtesy of Cavalier Tool & Manufacturing Ltd. This month's cover shows an EDM that has just burned a detailed woodgrain texture onto a tool to produce plastic siding for homes. This replaces the costly and time-consuming process of casting and hand finishing textures by craftsmen. Cavalier Tool & Manufacturing of Windsor, Ontario, Canada uses its sinker EDMs extensively. Cavalier produces 200+ medium-to-large molds annually and has pioneered use of large-file processing with proprietary gaming software coupled with five-axis, high-speed electrode generators to cut finely detailed electrodes capable of applying identically grained textures on multiple injection molds accurately and repeatably.

Images courtesy of (left to right): Cavalier Tool & Manufacturing Ltd., Webo GmbH and TST Tooling Software Technology.

VIDEO ACCESS

5 TRICKS OF THE TRADE
Great Tips from This Issue

1. Growing Our Own
Mold builder hires students while they attend high school, working with them on continuing education so they raise employees themselves, reducing turnover.
PG. 10.

2. Better Equipped
A bridge-style construction, a 25,000-pound weight and a polymer-concrete base that provides excellent dampening, helps a mold builder run its five-axis hard milling machine at higher feed rates and rpms effectively.
PG. 18.

3. Load It Up
Preloading hydraulic locking cylinders with very high output force in the set position typically have much smaller bore sizes, lower hydraulic requirements and higher speeds.
PG. 26.

4. Metal Matters
To increase the process efficiency for tool steel, HSS or other hard-to-print materials, it is essential to understand the effect of all printing parameters on the printing behavior of the metallic materials.
PG. 30.

5. Team Work
On-machine inspection does not have to replace the CMM; instead, it can work alone or in tandem with the CMM to make inspection—and the entire product cycle—more efficient.
PG. 48.

Summer Deals

NEW LOW PRICING + SPECIAL OFFERING

Limited Time Offer. Contact Your Sales Representatives for Details.

DCV3016B • 4025B

Advanced Double Column High Performance Vertical Machining Center

- X-axis is directly driven by gearbox offering smooth axial response and high torque.
- Roller type guideways on both X and Y Axes.
- Turcite-B on Z-axis to strengthens rigidity, increases damping capacity, reducing overhang and vibration.
- Horizontal and vertical support of the headstock.
- Hardened and ground box guideway with enlarged contact interface on Z-axis.

and so much more ...

30 HP | **10,000** RPM | **60T** ATC | **40”** Z-Travel | **250mm** Riser

CT50 Tapper | **MXP-200FB** Control by FANUC

CTS Prep With Rotary Union

YCM®

www.YCMCNC.com

YCM Technology (USA) Inc.

20540 Belshaw Avenue
Carson ▪ CA ▪ 90746

Tel: 310.735.8610
info.us@ycmcnc.com

a subsidiary of **YEONG CHIN MACHINERY INDUSTRIES CO., LTD.**

Try Something New

Although COVID-19 canceled our 21-year-old live Amerimold Expo, we had the industry covered with Amerimold Connects, its first-ever remote event experience to keep this community connected with each other and with technology, process and best practices content and resources. We tried something new, and what a journey it was. In a matter of eight weeks, our events, marketing, creative and sales teams as well as the Map Your Show crew pivoted from producing our live trade show to a virtual platform—giving us just a little taste of the aggressive lead times that mold builders must manage every day.

Trying something new and producing this event taught us so much. Still, at the same time, it reinforced a lot of what we already know—the mold manufacturing community is committed to coming together to learn, share and get better—despite a pandemic. As a matter of fact, we even extended the show another full week after receiving multiple attendee requests for more time so team members could experience the event!

This remote event experience featured a virtual show floor with 38 participating exhibitors, a collection of live streaming and on-demand educational content and a live Moldmaking Community Forum for networking between exhibitors and attendees. It also included a few of our classic features from our Amerimold Expo, namely our annual Leadtime Leader Awards Ceremony (2020 Winner Precise Tooling Solutions) and the virtual unveiling of our 2020 Top 10 Reasons To Be A Moldmaker t-shirt. (You can still view the videos of this ceremony and our live educational sessions at amerimoldexpo.com.)

Longtime *MoldMaking Technology* and Amerimold Expo supporter (and now an original Amerimold Connects exhibitor) Glenn Starkey, Progressive Components president, said: "We found there to be great content in so many presentations, but most importantly, this event helped maintain the interconnectivity of relationships throughout our great industry."

In the end, Amerimold Connects attracted 1,527 total registrants over its two weeks, exhibitor showrooms were viewed over 12,000 times by attendees and live and on-demand sessions drew over 7,200 total views from more than 3,400 unique viewers—indicating a high level of participation from remote attendees.

However, adding a virtual event to our *MMT* repertoire was not without its challenges and lessons learned. But then, that is the only way you learn and grow. So, we urge you to try something new too—hire that HR person, become an active association member, get social, invest in 3D printing, buy that new machine tool, dive into Industry 4.0, increase your cybersecurity, make that succession plan, focus on creating culture, get involved in your local community to promote moldmaking, develop that better training program, establish a mold PM plan and on and on. Then, once you try that new thing, connect with me to share your story. Heck, maybe that story will be perfect for our next virtual event. MMT

Christina Fuges

Christina M. Fuges
Editorial Director

Follow MMT on: Follow @MMT_ChristinaF

THIS MONTH ON moldmakingtechnology.com

VIDEO: The Importance of Reshoring Mold and Die Manufacturing
This panel of experts discuss why the price savings of offshoring tooling misses the total cost of sending tooling work away.
short.moldmakingtechnology.com/MMSVideo

WEBINAR: From Designers, To Designers: Medical Molds are Different
Progressive Components' engineering team has gathered tips and approaches to share in mold design for the medical sector.
short.moldmakingtechnology.com/ProCompWeb

PODCAST: The Magic of Manufacturing and Marketing
Todd Schuett of Creative Technology, usually the man behind the camera, is in front of the microphone in this Manufacturing Alliance Podcast episode to talk about marketing and the manufacturing industry.
short.moldmakingtechnology.com/CTMagicPod

EVENT: Amerimold Connects News: You Asked and We Answered!
MMT and Amerimold want to wish everyone a big THANK YOU for your interest and support in the remote Amerimold Connects experience. See session snapshots and recaps online!
short.moldmakingtechnology.com/AMECNXTY

THE TOOL

HORN is outstanding cutting-edge technology, performance, and reliability. Accomplish more: our precision tools make the difference.

www.hornusa.com

Find Us At

IMTS spark

POWERED BY AMT & DIAMOND

2020-2023 Editorial Advisory Board: **Robert Graup**

By Christina M. Fuges

Robert Graup joins *MoldMaking Technology*'s Editorial Advisory Board with almost 40 years in mold manufacturing and 10 years of plastics processing experience. He is a seasoned tool room manager skilled in plastic injection tooling, engineering, product development, business planning, sales and entrepreneurship.

When Robert was a kid, a family friend who worked in the tooling industry identified his talent for working with his hands and creating things. He also played a large role in getting Robert his first job. Right out of high school in 1981 at the age of 18, he started as an apprentice, and when he turned 22, he became a licensed moldmaker in Ontario, Canada.

Robert Graup, toolroom manager for Intex Tooling Technologies of Ontario, Canada, is one of *MMT*'s new Editorial Advisory Board

For 11 years, Robert honed his skills while being mentored and trained in all aspects of moldmaking, as well as business matters and customer relations. He purchased the company in 1992 when the owner announced his retirement, but 12 years later, Robert sold the company and joined a larger corporation as assistant general manager. Here, he managed several tooling and molding companies until he joined Intex Tooling Technologies in 2015 as the shop floor supervisor.

In 2019, Robert became the general manager at Intex Tooling and today continues to oversee operations including P&L, vision, investment strategies, market trends, continuous improvement and customer relations. He also is committed to empowering and mentoring department managers for success.

Incorporated in 2012, Intex is a Canadian tooling supplier headquartered 30 miles north of Toronto in Aurora, Ontario, and housed in a 35,000-square-foot facility with more than 25 employees. The team uses the latest engineering systems and manufacturing principles from initial product development through the final tool build.

Robert will share his knowledge and experience on topics related to business challenges, software, culture, shop floor/process/workflow, equipment, mold materials, mold components, training and workforce development, as well as global competition. He hopes to develop a network of people who share the same passion for the plastics industry through his participation on the board.

Robert enjoys his cottage with family and friends in his free time. MMT

FOR MORE INFORMATION

Intex Tooling Technologies / 416-799-7132 / intextooling.ca

EDITORIAL ADVISORY BOARD (EAB)

The EAB enhances the standing of the publication and strengthens its professional integrity through the active involvement of its members.

The Board represents all aspects of the mold manufacturing industry with a balance of moldmakers, molders, OEMs and academia, and various moldmaking segments and job functions. A member is selected based on his or her experience and knowledge of the moldmaking industry to serve a three-year term.

OKUMA
OPEN POSSIBILITIES

AUTOMATION MADE EASY WITH OKUMA

Adding automation to any shop environment can seem like a daunting task, but it doesn't have to be.
Enter Okuma.

We've put our century of engineering experience to work by creating several easy-to-integrate automation products, all of which can be used without the need for an automation programmer due to Okuma's conversational OSP control.

Automation systems include:

- NEW ARMROID - In-machine Robot
- NEW STANDROID - Integrated Robot
- Automatic Tool Changers (ATC)
- Okuma Gantry Loader (OGL)
- Automatic Pallet Changers (APC)
- Load & Go
- In-machine Gauging Systems

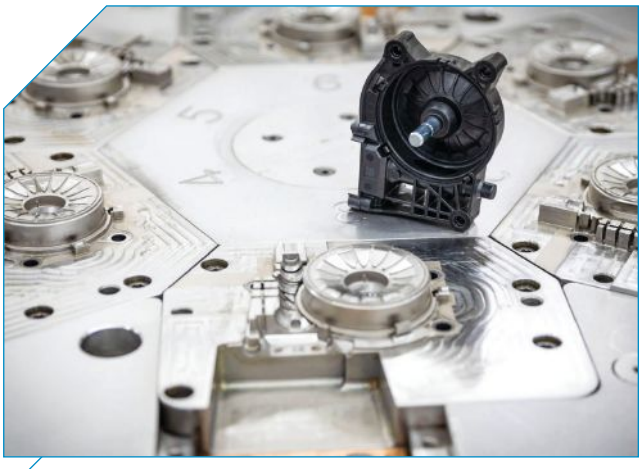
Just to name a few.

To learn more, visit:
okuma.com/automation-solutions

To inquire, visit: okuma.com/distributors

Okuma. Welcome to open possibilities.

A Conversation with ...
Liberty Molds, Inc.



Images courtesy of Liberty Molds, Inc.

Liberty Molds, Inc. in Portage, Michigan, specializes in high-tolerance injection molds for high-volume production.

Can you tell us about the services Liberty Molds offers its customers, what industries those customers represent and what your specialization is?

Brian Scott, President: We specialize in high-precision injection molds for high-volume manufacturing. Within that category, we make two-shot, hot-runner, unscrewing molds and molds with core pulls and slides, although we don't make high-cavitation tooling.

We're a full-service shop, so we can design molds, make engineering changes and, of course, we build prototype as well as production tooling. Roughly 25% of our 13,400-square-foot [1,245-square meter] facility is dedicated to engineering and the rest is used for manufacturing. We also own a small molding company a few miles away called Maxima Plastics, Inc. (Portage, Michigan). That facility is equipped with eight presses ranging in size from 55 to 500 tons where we offer mold sampling and tryout services to our customers. You could say our sweet spot is injection molds that fit presses under 500 tons owing to the size of our lifts, our machining centers and the size of our sampling presses.

Most of our work is in the automotive industry—with molds to produce interior trim items like door handles, air registers, instrument clusters and console components—but we also make tools for durable medical devices, consumer goods and electrical components. Interestingly, we've seen an increase in molds for electrical components thanks to the automotive industry's move toward fleet electrification. Our tools make many components for battery electric vehicles—ranging from battery trays to separator plates and repeater frames to electrical covers and connectors. As automakers build more electric vehicles, we expect that to bring us more business.

Liberty Molds, Inc.
8631 Portage Industrial Dr.
Portage, MI 49024
269-327-0997
libertymolds.com

- Founded in 1986 and currently co-owned by Brian Scott, president and Jeff Dee, vice president.
- Full-service prototype and production tooling for injection molders in aluminum, hardened, P20, stainless and tool steels. Specializes in high-tolerance molds sized to fit presses under 500 tons for high-volume production.
- Additional services: mold design, engineering changes, tool repair, low-volume prototypes, mold validation/commissioning, sampling/tryout services, machining.
- Currently employs 36 full-time team members.
- Served industries include automotive, medical device, electrical and consumer goods.
- Member: American Mold Builders Association, Southern Michigan Tooling Coalition
- ISO 9001:2008

What kinds of engineering changes do you find yourselves making? Do you also offer mold repair and maintenance services?

Scott: The majority of engineering changes we make are on our own tools. It's very common for automakers to make small design changes every couple of years as they update styling on a new model of a vehicle, or as they change materials—for instance, when they move from an engineering thermoplastic to an olefin or they go from painting a part to using molded-in-color. Sometimes we make design changes for the same reasons on tools we didn't build for some of the bigger automotive molders who are nearby.

Most of our molds are shipped to Mexico, so we don't service them here. For local Michigan molders, the big ones have their own in-house maintenance shops, but we are available if someone needs help with a tool. We do have one local customer where we service six to eight battery-component tools for them every six months.

So many Michigan toolmakers—especially those with lots of automotive industry exposure—lost significant business to offshore competitors over the last couple of decades. Your company has taken a rather interesting approach to this. Can you tell us about it?

Scott: About 15 years ago, we figured out that instead of fighting offshore toolmakers, we would become one. When a large,

PRECISION ACCURACY

Nakamura-Tome | NTY3-150

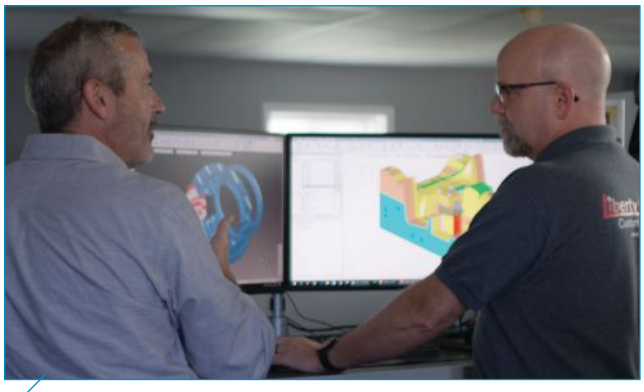
- Multi-Tasking Turning Center
- 2.5" Bar Capacity
- Y-Axis On All 3 Turrets
- 60° Slant Bed
- Increased Productivity with Simultaneous Machining
- FANUC 31i-B w/Smart-X HMI

YASDA | PX30i

- 5-Axis High Precision Vertical Machining Center
- Large Work Envelope
- High Torque Spindle
- High Speed Direct Drive Rotary Axis
- Self-Contained Multi Pallet Stacking System
- 323 ATC Standard

Showrooms and Technical Centers
Boston ▪ Charlotte ▪ Chicago ▪ Detroit
Los Angeles ▪ Memphis ▪ Phoenix ▪ San Francisco

Methods
www.methodsmachine.com



Liberty Molds is a full-service moldmaker that designs molds, makes engineering changes, and builds prototype and production molds. Roughly 25% of the company's 13,400-square-foot [1,245-square meter] facility is dedicated to engineering and the rest is used for manufacturing.

local molding company closed, we hired some of their people. That molder had done a lot of outsourcing of its tools to China. Those new hires knew how to do that work, so a couple of us sat down and put together a business plan and presented it to ownership at the time. The numbers made sense so he said go ahead and do it. Instead of whining about offshoring, we decided to take control and try to win some of that business, and we've been doing that ever since.

Just to be clear, we both outsource tools and make them domestically. In 2018, all of our mold bases and about 50% of our molds were built in China and the rest were built locally—some by us and some with the help of other local moldmakers with whom we share work through the Southern Michigan Tooling Coalition. For a shop our size, this gives us a tremendous advantage because we can bid on much larger tool packages—say for 20 tools at one time. We then make 10 to 15 of them offshore and the rest of them here. That allows us to keep our own people busy and thriving without having to make huge investments to add capacity and then endure those boom-and-bust cycles. We also share work with other local toolmakers, who in turn share work with us—we just invoice each other at lower rates. And we can offer the kinds of discounts and fast turnaround times that larger customers—especially in the automotive industry—demand. And for the customer, it's all totally seamless.

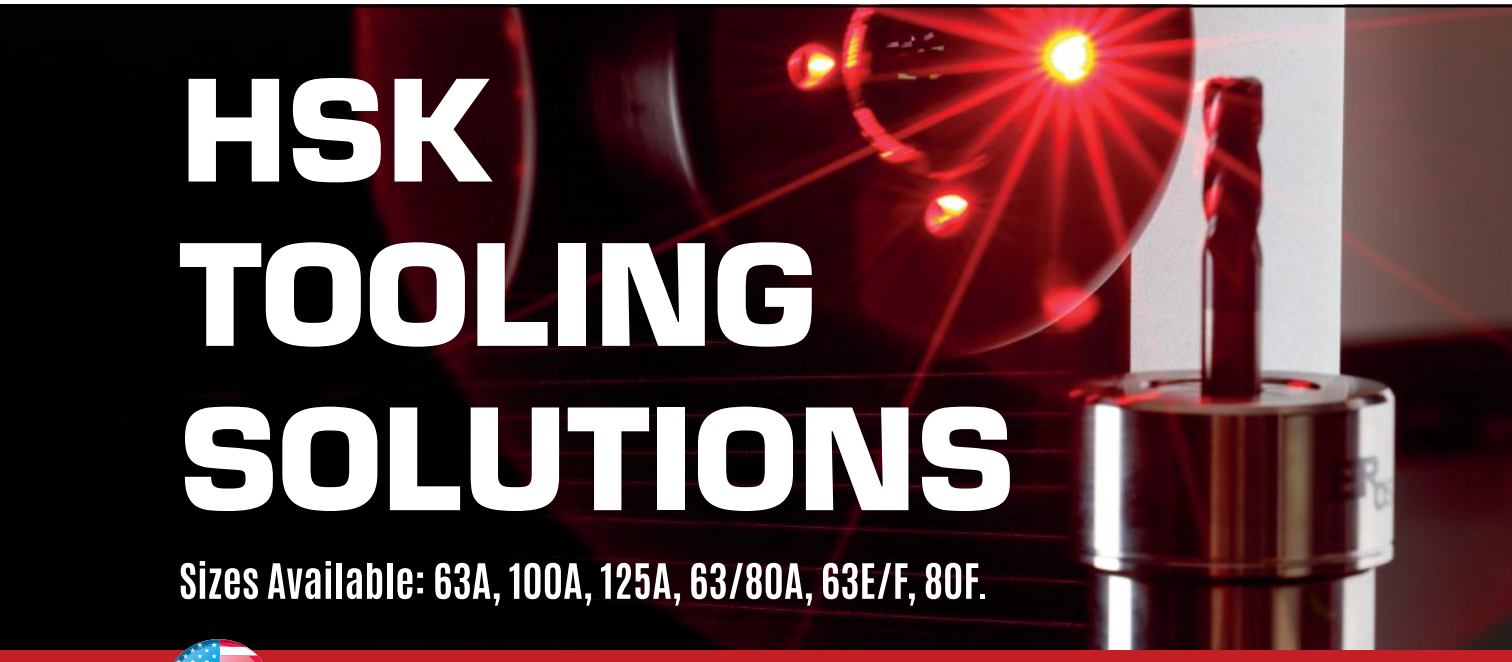
What impact has the coronavirus (COVID-19) had on your business this year?

Scott: Well, right now the coronavirus is hurting lead times. Where before we were operating with a three-week lead time

PARLEC
Measurably Better

Your **total** machining solution.

Visit us at **parlec.com** | Email: **sales@parlec.com**
Call: **1-800-597-3921**



HSK TOOLING SOLUTIONS

Sizes Available: 63A, 100A, 125A, 63/80A, 63E/F, 80F.

YOUR AMERICAN-MADE HSK CONNECTION!

Heavy-Wall ShrinkFIT:
- Maximum rigidity
- For extreme stock removal
- Custom solutions available

Micron Milling Chucks:
- Less Than 3µm T.I.R. at 3X diameter
- 4x the clamping force of ER Chucks
- Maximum reach and clearance

ERos Collet System:
- Less Than 3µm T.I.R
- Polished 2-micron collets
- Balanced at speeds over 30,000 rpm

EXP Shell Mill Holders:
- 6 coolant ports
- 500% increase in coolant volume
- Coolant fed directly into cutter cavities

NumerTap Tapping Solutions:
- Bilz compatible
- Synchronous tapping
- Rigid & Tension/Compression

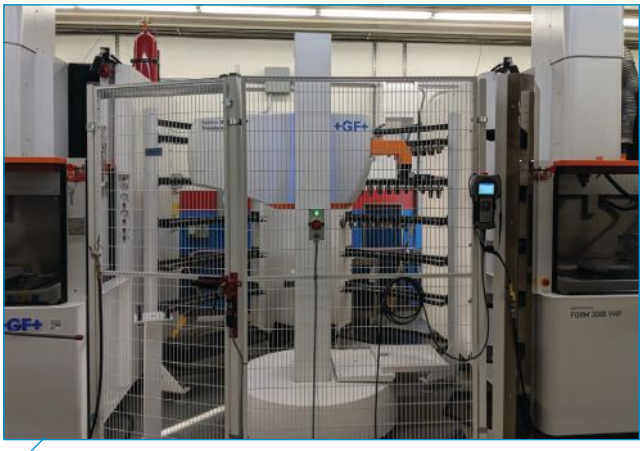
Modular Boring Solutions:
- 0.0001" resolution
- Popular K-connection compatible
- Small to large diameter options

Parlec is a proud member of Techniks Tool Group.

CNC TOOLING SOLUTIONS FROM SPINDLE TO WORKPIECE

Connect with Techniks Tool Group:

The company is well equipped with CNC and wire EDM, CNC and manual mills, surface grinders, lathes, a radial arm drill, high-speed Roeders and a couple of three-axis and five-axis CNC machining centers, as well as a 120-position robot that feeds two EDMs with left- and right-hand configurations, which is very helpful for automotive work.



Given the quality and capabilities of its equipment, Liberty Molds is able to run one 10-hour shift, six days a week, plus an additional 30-35% unattended hours on nights and weekends. "That capability is like adding an extra shift every week, which keeps us very competitive," explains Brian Scott, Liberty Molds president.

on mold bases, now that's been extended to four to five weeks. If we have to get into air shipping instead of sea, then that's going to kill all the cost advantage we gain from offshoring, so right now, it's kind of wait and see.

With your location in Western Michigan, have you had any challenges finding younger people who want to go into moldmaking as a career?

Scott: Based on annual benchmarking surveys that we participate in, we do have a younger group of employees than many shops around us. I'd say that 30% of our team is under 30 years of age, but, really, it's a good mix. We're lucky on this side of the state to have local high schools that still emphasize the skilled trades. Plus, we have Ferris State University (Big Rapids, Michigan), where I went to school, and we have Kalamazoo Valley Community College (KVCC; Kalamazoo, Michigan), both of which have machine tool programs.

For a number of years, we've had our own program where we hire one to two students who are interested in this career path for a few hours a week while they attend high school and then full-time in the summers. After they graduate from high school, we either hire them full-time or give them a good recommendation if they want to go somewhere else. If they stay with us, they have the opportunity to attend night school at KVCC for four years to earn their journeyman's certificate. As long as they maintain their grades, we pay for those classes. So, essentially, we raise them ourselves and because of that, we have little turnover.

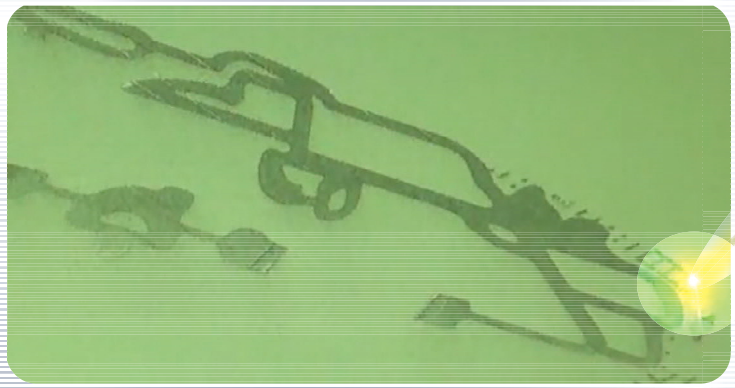
We also have two older, experienced toolmakers who are good teachers and like to share their knowledge with the younger kids. Of course, we send people off to take courses in various places, and we bring specialists in when we get new equipment or we upgrade our CAD/CAM software. One of my CNC operators is off to Indianapolis next week for a cutting seminar, and we just finished an in-house training program for the person who will run our new laser-etching machine. We also participate in the AMBA's Youth Leaders program at the annual conference, which has been pretty helpful as well. MMT

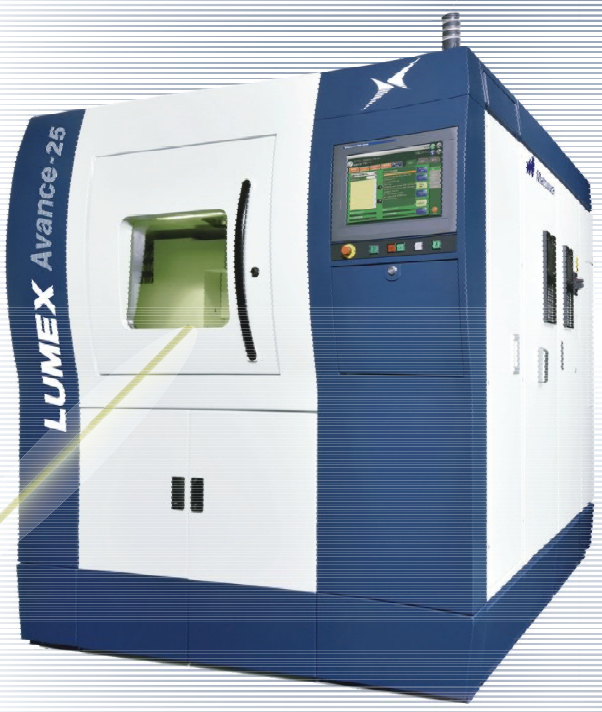
Matsuura

LUMEX Series

Metal Laser Sintering Hybrid Manufacturing

PERFORM HIGH-PRECISION MACHINING





The **LUMEX Avance-25** – the world's first 3D Printing, Metal Laser Sintering Milling Hybrid CNC machine tool – is a truly innovative platform in Net Shape Form and Additive Manufacturing with the integration of a proven **Matsuura** high-speed milling spindle for subtractive machining processes.

- Minimize mold assembly by combining multiple inserts into one with **precise accuracy**
- Make density changes using porous sintering **without restriction** allowing improved gas venting conventional methods
- Perform **high-precision** machining of deep and thin ribs without EDM
- Create **superior mold performance** through integrated cooling channels and structures
- **Reduce** design to finish lead time

Learn more about our LUMEX series at:

MatsuuraUSA.com | **MatsuuraLUMEXAM@matsuurausa.com** | **800.518.4584**

Follow MMT

- moldmakingtechnology
- MMTMag
- moldmakingtechnology
- moldmakingtechnology
- moldmakingtechnology
- IfAMoldCouldTalk

MMT

Hope you're having a great summer!

Want to talk with Phil? *Use #IfAMoldCouldTalk*

Boy howdy, could someone turn down the heat? This summer is making me sweat down my cavities every day! But we're almost through summer, which means we're only a short time away from the leaves changing and the temperatures cooling. And, of course, it means we're one month deeper into our #IfAMoldCouldTalk campaign!

July was a very busy month for us at *MMT* headquarters. We released our annual Technology Review and Sourcing Guide. If you haven't had a chance to check that out, make sure you head to MoldMakingTechnology.com to browse the issue online. We're proud to feature the latest product developments in software, additive manufacturing, mold materials, hot runners, mold components, cutting tools, machining, EDM, inspection/measurement, maintenance and service providers. We featured over 1,000 manufacturers, distributors and suppliers in this year's edition, so it's practically impossible to not find a product or service that could help you modernize your shop's process. Check out a copy today!

WE ASKED THE READERS:

WHAT WOULD PHIL SAY AS HE IS SHIPPED BACK TO NORTH AMERICA FROM OVERSEAS?

The total weight includes the container, right...? Right?!
Sara Mortensen, *Bales Metal Surface Solutions*

Freedom!
James Jergens, *Ernie Green Industries*

I think I just purged my Sprue!
Patrick Fleming, *Progressive Components*

Six weeks at sea and boy am I seasick...
Scott Peters, *Delco LLC*

I'm coming home! I'm leaving today!
Klen Druy, *Phillips-Medsize LLC*

Last month, Phil asked you all the following question: What would Phil say as he is shipped back to North America from overseas? Man, you guys never fail to make Phil laugh! He nearly popped his pins he was laughing so hard! Let's keep up that energy for next month. Stay tuned to our social media, especially Twitter and LinkedIn, to be a part of next month's Life Of A Mold page.

We hope you and your family and friends are staying happy and healthy during these strange times! We're happy to give you a place to connect to your colleagues and the rest of the industry here on the pages of *MMT*. Let's have a great month!

HEIDENHAIN

+ **Connected Machining** – Efficient Processes through Customized Networking

The workpiece comes into being at the machine, and the responsibility lies with you—the specialist in the shop. Your knowledge and skill are crucial for efficient production. But for this to happen, you need to be able to leverage your know-how and make use of all available information. **Connected Machining** and **StateMonitor** from HEIDENHAIN makes this possible. Regardless of your individual setup, **Connected Machining** turns your machine control into the hub of a process chain with a completely digital flow of information.

HEIDENHAIN CORPORATION, 333 East State Parkway, Schaumburg, IL 60173 847-490-1191 www.heidenhain.us

Angle Encoders + Linear Encoders + Contouring Controls + Position Displays + Length Gauges + Rotary Encoders

By Peggy Malnati

Five-Axis Hard Milling Improves Electrode Accuracy

Fully automated, high-speed hard-milling centers saved moldmaker time, money, handwork, allowed wider-range of EDM burns to be achieved.

Images courtesy of Cavalier Tool & Manufacturing Ltd.

In operation since 1975, Cavalier Tool & Manufacturing Ltd. (Cavalier; Windsor, Ontario, Canada) produces over 200 complex, medium-to-large-size molds per year for tolerance-critical parts in engineering thermoplastics. These tools are used on presses ranging from 250 to 4,000 tons for injection molding, structural foam, multi-shot injection, gas-assist and injection/compression processes. Cavalier serves a diverse customer base in the automotive, recreational vehicle, agricultural equipment, commercial truck, medical equipment and consumer markets with 163 employees working a staggered five shifts per day from a 66,000 square-foot/6,132 square-meter facility. The company is full service, offering feasibility, design and product development, mold-filling analyses, mold manufacture, modification and repair and start-up and try-out services, including small production runs.

Electrode Bottleneck

Known in the industry for its quality, precision and speed-to-market, Cavalier touts its ability to be 20-30% faster than its global competitors. "Whoever removes metal fastest, is busiest," says Brian Bendig, Cavalier president. To that end, Bendig travels the globe seeking out the newest and most innovative technology to ensure his equipment is state-of-the-art; he invests equally in training and cross-training for employees. However, five years ago, the company faced a serious production bottleneck. It couldn't machine graphite electrodes fast enough to keep up with its new sinker EDMs, which the company uses extensively during mold production.

"We've been EDMing our molds for over 40 years to burn in features that we can't efficiently cut," Bendig explains. "We

Cavalier Tool & Manufacturing Ltd. of Windsor, Ontario, Canada, produces over 200 medium-to-large molds each year for tolerance-critical parts. In a quest to increase its moldmaking productivity, Cavalier purchased three new sinker EDMs from OPS Ingersoll Funkenerosion GmbH (Burbach, Germany) between 2012 and 2015. Here, Randy Gander, Cavalier EDM leader, checks programs while managing the EDM department.

To alleviate its graphite electrode production bottleneck, in 2015 Cavalier bought a new OPS Ingersoll Eagle V9 five-axis hard-milling machining center, and then bought a smaller Eagle V5 a year later. Chelynne Schram, Cavalier EDM operator, loads programs into both milling centers prior to letting them run automatically.

produce thousands of unique electrode forms in Poco's EDM-3 graphite [from Poco Graphite, Inc., an Entegris, Co., Decatur, Texas], which is an ultrafine-grained, high-strength but very-dense product that—for graphite—is hard to cut."

In 2012, Cavalier became the first shop in Canada and the second in North America to purchase an Eagle 1200 gantry sinker EDM from OPS Ingersoll Funkenerosion GmbH (Burbach, Germany). Through unique technology that OPS Ingersoll pioneered, its sinker EDMs use less energy and reduce graphite electrode wear by one-third.

"A few years before, OPS Ingersoll had introduced new technology on their sinker EDMs—in a part of the industry where there'd been no significant breakthroughs in decades," notes Dan Meehan, president, Performance Machinery LLC of Sterling Heights, Michigan, a local distributor representing OPS Ingersoll and other equipment. "Through their generator settings they can change the spark-discharge waveform to adjust

CAVALIER TOOL MANUFACTURING LTD.

PROBLEM: Moldmaker couldn't machine graphite electrodes fast enough to meet needs of new sinker EDMs, so was sending work to outside companies to relieve production bottleneck.

SOLUTION: Purchased one, and then another, OPS Ingersoll high-speed, five-axis hard-milling centers.

RESULTS: Moldmaker could now mill so much faster and more accurately that it brought all graphite electrode production back in-house and increased mold production rates.

To determine which machinery OEM had the best milling center, Cavalier modified an earlier design developed by Okuma Corp. (Oguchi, Japan) and set up a test-cut competition for machine makers called the "angry monkey." The clear winner of the test was OPS Ingersoll, which was 30% faster than some other competitors.

to gap conditions, lowering energy usage and electrode wear, and cutting graphite costs dramatically. We knew that would be a game-changer for North American moldmakers."

"Making an investment in that one sinker EDM saved us more than $120,000 CND in consumable and operational costs the first year," Bendig recalls. "Before, we made two-to-three electrodes for every burn location on a mold because the electrodes wore out before we finished. With the Eagle EDM, electrode wear was so much lower that, in most cases, we only needed one electrode per burn location."

Given the volume of molds Cavalier produces, Bendig was back buying two more Eagle 1400 gantry sinker EDMs in 2015. Despite being able to produce fewer electrodes per burn location, increased business during that period—Cavalier grew from $8-million to $30-million CND in just five years—meant that older milling machines couldn't keep pace with newer sinker EDMs. Hence, Bendig was forced to farm out approximately $500,000 CND in electrode machining annually. Given Cavalier's commitment to continuous improvement in all areas of its organization, it was time to debottleneck graphite machining.

Bendig again turned to Performance Machinery to explore options for a new milling center. Meehan flew with him to Germany to visit OPS Ingersoll's factory. Although he was impressed, Bendig wasn't quite sold. In fact, he arranged for a number of leading machinery OEMs to participate in a test-cut competition to see whose milling center was fastest, smoothest and most accurate.

Angry Monkeys

"The thing you have to understand about Brian is that he's a genius and he's really looking closely at a machine's design and construction—he literally picks the machine apart," laughs Meehan. "He created a test called the 'angry monkey' and got the best machinery OEMs to compete with each other to see whose machine provided the best performance. Forget about relationships, you had to win this contest fair and square if you wanted to sell him a machine."

Based on an earlier design developed by Okuma Corp. (Oguchi, Japan), the angry monkey as adapted and modified by Cavalier is roughly 4 by 4 inches/102 by 102 millimeters and is designed to put milling and cutting machines through their paces. It can be used on three- or five-axis machines and can be machined with just three or four cutters. Cavalier specified the speeds, feed rates, stepover and workpiece (P20 steel).

"The way we've written the program, it's designed to constantly transition left, right, up, down, so it uses all machine axes at [nearly] the same time," explains Bendig. "If a machine is loose or doesn't respond well, it will fight the axes all the time and leave dimples and divots all over the workpiece. I wouldn't let the machinery OEMs see the program ahead of time, so they couldn't

Productive. Reliable. Digital.
The EOS M 300–4

To learn more, visit our virtual showroom at
IMTS Spark
Starting August 14, 2020

The EOS M 300-4 industrial 3D printer enables flexible adaptation to all individual requirements through various degrees of automation, helping to ensure an optimized workflow.

www.eos.info

modify it or practice with it. I'd bring the program in on a memory stick along with my own material and cutters so I could verify that all tests were run the same way. We made sure that the mill being tested was the only variable in the test. All other variables—including spindle speed, feed rates, cutter path set over and even cutters—were controlled so only the CNC mill's performance was being tested. And to be fair, we only compared one-meter machines against one-meter machines and so on."

Many machinery OEMs were invited to participate and ended up letting Bendig run his test on their equipment. Ironically, other machinery OEMs heard about the test, obtained the program and continued to send Bendig samples for months after the competition ended.

"Some companies didn't like the terms of the competition but, at other facilities, the president of the corporation spent the day with me and said, 'We don't have customers that do this,'" chuckles Bendig. "What the unhappy companies didn't understand is that I wasn't going to buy the cheapest machine possible. I check off every box and the price of the machine goes up as I add features."

With the competition over, four machine makers were out in front of the others, but there was no doubt about the winner.

"Oh my gosh, OPS Ingersoll was so fast—it was 30 percent faster than some of the other competitors, its mill is that good," recalls Bendig. "They absolutely smoked our test. It was obvious they knew what they were doing."

Image courtesy of OPS Ingersoll Funkenerosion GmbH

OPS Ingersoll's Eagle five-axis hard-milling machines are designed to mill both graphite as well as hardened steel quickly and efficiently. These bridge-style machines are very stiff, stable, and accurate so the mills can run at high rpms. A composite/concrete base provides high damping. The systems also use twin ball screws in the X and Y axes for high-speed acceleration/deceleration and provides high thermal compensation in all axes.

WHY BECOME A LEADTIME LEADER?

MoldMaking TECHNOLOGY®

MMT LEADTIME LEADER 2021 AWARDS

The Leadtime Leader Awards, presented by *MoldMaking Technology*, honor those outstanding North American mold manufacturers who best demonstrate overall innovation, efficiency, quality and commitment within their moldmaking operations while raising the bar in terms of mold engineering, building, repair and management.

By entering your business into *MoldMaking Technology's* annual Leadtime Leader Awards competition, you'll gain industry recognition, build brand awareness, attract new customers, boost morale in the shop and distinguish your shop as an industry leader.

Winners Earn These Benefits:

- A feature in *MoldMaking Technology*
- A video feature on moldmakingtechnology.com
- A special, targeted advertising program with *Plastics Technology*
- A complementary 10' x 10' booth space at Amerimold 2021 in Rosemont, IL
- *And much more!*

How becoming a Leadtime Leader impacted our past winners:

"Winning the Leadtime Leader award provided the Maximum Mold Group with additional marketing and exposure that we normally would not have. The network of other tool builders that we have connected with has allowed us to increase our work volume. In addition, our video that was produced has been used at all of our trade show events and was very professional compared to us using our phones and snapshots. We have stayed connected with a number of our new network contacts and have reached out to them for a variety of reasons, including increased workloads, tariff issues, COVID-19 procedures and many more."

Dave Lagrow, Maximum Mold

NOMINATE YOUR SHOP TODAY AT

short.moldmakingtechnology.com/leader

For complete information, eligibility requirements and nomination forms, please visit short.moldmakingtechnology.com/leader, or contact Editorial Director Christina Fuges at cfuges@gardnerweb.com or at (513) 338-2187

PRESENTED BY:

MoldMaking TECHNOLOGY®

SPONSORED BY:

PT Plastics Technology

amerimold 2020 Where Mold Manufacturing Connects

Flying with Eagles

In 2015, Cavalier bought a new OPS Ingersoll Eagle V9 five-axis hard-milling machining center, which is designed to mill both graphite as well as hardened steel quickly and efficiently. Several design attributes make the Eagle V9 very stiff, stable and accurate."

"Thanks to its bridge-style construction, its 25,000-pound [11,340-kilogram] weight and a polymer-concrete base that provides excellent dampening, the V9 can run at higher feed rates and rpms effectively," Alan Hallmann explains, North American sales manager at MC Machinery Systems, Inc., a subsidiary of Mitsubishi Corp. (Elk Grove Village, Illinois). MC Machinery Systems is OPS Ingersoll's master distributor for North America, providing sales support, importation, parts, service and training.

"Additionally, the Eagle V9 uses twin ball screws in the X and Y axes for high-speed acceleration/deceleration, thermal compensation in all axes and a Heidenhain controller [from Heidenhain GmbH, Traunreut, Germany]," adds Hallmann. "Cavalier opted for this style five-axis machine, with the 36,000-rpm spindle, so it could run at higher feed rates with shorter, more stable cutters for the ultimate accuracy and repeatability. That allowed them to manufacture multi-sided electrodes in a single setup, which was one of their key business strategies." With better surface finishes, the Cavalier team also found there was less and often no hand labor afterward.

"Once we purchased our first Eagle V9, we were able to mill graphite four times faster and 10 times more accurately than we could with our previous machines," adds Bendig. "The V9 was so good that we pulled all outsourced electrode production back in house. And when other moldmakers heard about our productivity leap, OPS Ingersoll sold 16 more Eagle milling centers in this area."

As electrode production increased, Cavalier's Eagle V9—which Bendig initially planned to use for both graphite and steel—got so busy that a year later the company purchased another Eagle milling center—this time an Eagle V5.

"Most of our electrodes are fairly small, so we didn't need another big machine with a lot of travel like our V9," adds Bendig. "Plus, the V5 offered a larger tool changer and spindle speeds of 42,000 vs. 36,000 rpm on our V9. These days we keep both machines running at near 100-percent capacity. We use RFID technology controlled by Delcam software (Delcam, Birmingham, U.K.) on all our workpieces, and our Eagle milling centers are connected to Eagle sinker EDMs by a 192-position robot using an OPS interface so everything talks to everything else and we can alter anything at any point along the way." MMT

CONTRIBUTOR

Peggy Malnati is a Detroit-based contributing writer for *MoldMaking Technology* focused on application stories and shop profiles. She has provided writing and communications services for the global plastics and composites industries since 1984. p.malnati@garpub.com

FOR MORE INFORMATION

Cavalier Tool & Manufacturing Ltd. / cavaliertool.com /
Brian Bendig, President / brianb@cavaliertool.com

Performance Machinery LLC / performancemachineryllc.com /
Dan Meehan, President / danmeehan@performancemachineryllc.com

MC Machinery Systems, Inc. / mcmachinery.com / Alan Hallmann, North American Sales Manager / alan.hallmann@mcmachinery.com

From Milling and Drilling to EDM and Grinding – Find the Right Fit for Your Molds.

TECHSPEX

The Machine Tool Search Engine

Start Searching for Free Today.

IN PARTNERSHIP WITH:

MoldMaking TECHNOLOGY®

TechSpex.com

By Mark Scanlan

Hydraulic Cylinder Sizing Forces & Calculations

To select the correct cylinder, consider both set and pull stroke positions and then calculate forces.

When considering an actuator for an injection molding application, review three positions to determine the impact on cylinder type and capacity: initial breakaway, movement through the stroke and final positioning. Physical force requirements for each (both set and pull) will provide insight into the most limiting conditions and direct selection of the most appropriate product type. Determine limiting forces, then determine size.

Core Set Considerations

For most moveable core applications, initial movement and core weight forces are very low relative to the force needed to preload the slide during injection. For applications holding the core with a heel block, choosing cylinder size for only movement and lift reduces cylinder requirements significantly. Preloading the movable core in the set position hydraulically without a lock can be problematic, as any amount of exposed molding surface creates increased force requirements and requires larger cylinders and dedicated hydraulic pressure during injection. Available hydraulic flow in gallons per minute (gpm) from the press or auxiliary pump may be insufficient to provide adequate cylinder speed, especially for longer strokes.

Consider alternatives such as preloading hydraulic locking cylinders. With very high output force in the set position, these cylinders typically have much smaller bore sizes, lower hydraulic requirements and higher speeds.

As some presses remove hydraulic pressure to core circuits during injection, the use of hydraulic cylinders without a heel block or preloading locking cylinder may not be possible. For presses that drop hydraulics, ensure locking cylinders maintain preload after locking without pressure or that an independent hydraulic source is available. Some customers use check valves with standard hydraulic cylinders. However, this adds complexity, and without a dedicated hydraulic supply, check valves may pass some fluid, and pressure may drop.

Core Pull Considerations

Initial force to pull is sometimes demanding due to material shrinkage around the

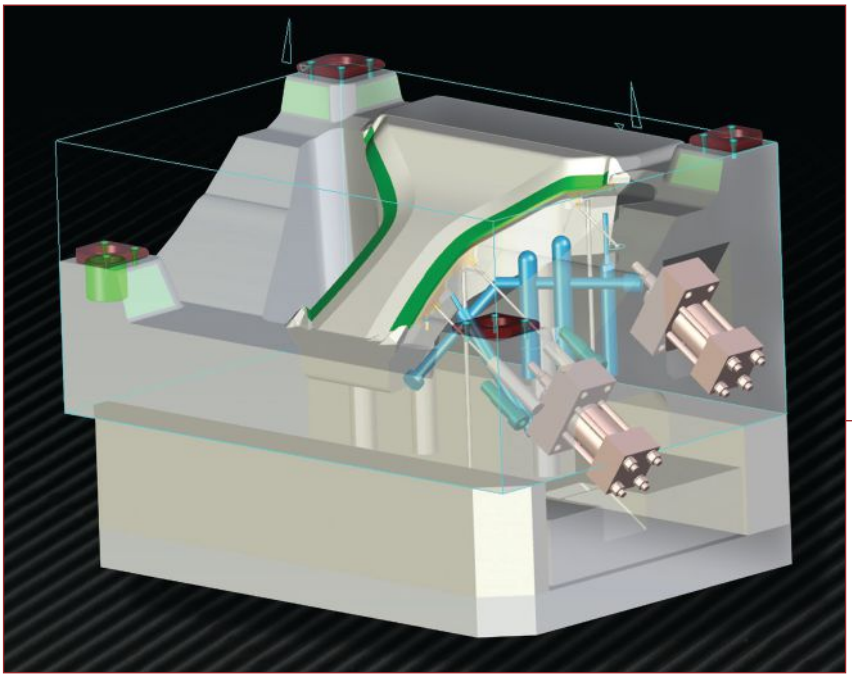
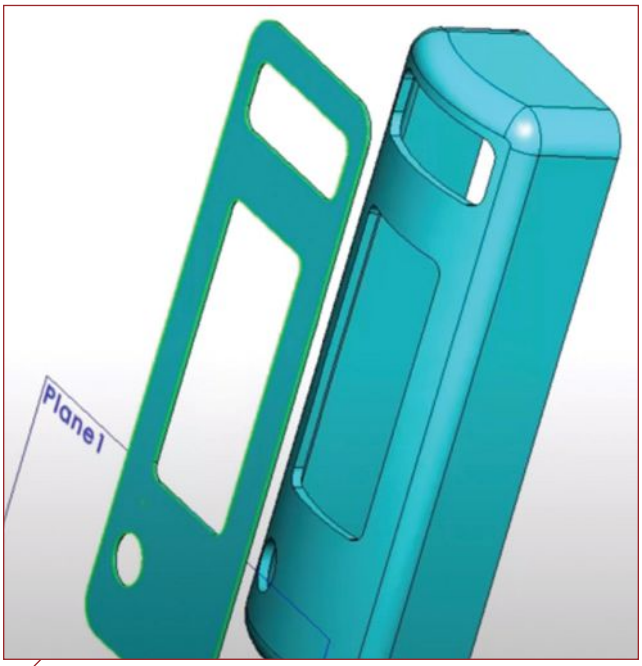


Image courtesy of Manuel Martinez, Absolute Tool Technologies.

Hydraulic cylinders provide mold designers and molders with opportunities for improved performance and flexibility. Extending actions beyond the mold base and pulling slide cores at complex angles can simplify design, reduce mold size and decrease cost per part. Proper cylinder sizing is critical to performance. The use of hydraulic locking cylinders often provides more capability in a smaller footprint, thus enhancing these effects.

Set Conditions								
Cylinder Type	Standard or HLC	Bore Dia. Inches	Diff. Area Sq. Inches	**HLC Preload End of Stroke lbf**	Extend Force lbf @ hydraulic psi			
					1500	2000	2500	3000
HLC	KLH-70	1.000	0.785	**8,000**	1,178	1,570	1,963	2,355
HLC	KLH-75	1.250	1.227	**12,000**	1,840	2,453	3,066	3,680
STD	STD	1.500	1.766	----->	2,649	3,533	4,416	5,299
HLC	KLH-100	1.750	2.404	**23,000**	3,606	4,808	6,010	7,212
HLC	KLH-112	1.750	2.404	**40,000**	3,606	4,808	6,010	7,212
HLC	KLH-150	2.000	3.140	**60,000**	4,710	6,280	7,850	9,420
STD	STD	2.000	3.140	----->	4,710	6,280	7,850	9,420
HLC	KLH-112LB	3.000	7.065	**40,000**	10,598	14,130	17,663	21,195
HLC	KLH-200	3.000	7.065	**110,000**	10,598	14,130	17,663	21,195
STD	STD	3.000	7.065	----->	10,598	14,130	17,663	21,195
STD	STD	3.250	8.292	----->	12,437	16,583	20,729	24,875
HLC	KLH-150LB	4.000	12.560	**60,000**	18,840	25,120	31,400	37,680
HLC	KLH-300	4.000	12.560	**210,000**	18,840	25,120	31,400	37,680
STD	STD	4.000	12.560	----->	18,840	25,120	31,400	37,680
STD	STD	5.000	19.625	----->	29,438	39,250	49,063	58,875
HLC	KLH-200LB	5.500	23.746	**110,000**	35,619	47,493	59,366	71,239

Preload defines the force applied to the slide before injection. Using preload forces higher than injection forces ensures the cores do not move. HLCs provide examples of larger preload forces with a smaller bore size relative to standard cylinders. The locking feature also eliminates the need to maintain pressure during injection. View this link for a more detailed chart of standard cylinder sizes and pressures.



The area of a movable core is the area exposed to plastic projected along the core axis onto a perpendicular plane. Information on how to use CAD systems to calculate the projected area is available online—see a video example from SOLIDWORKS—Surface Area Projection YouTube Go Engineer, which demonstrates selecting surfaces and projecting onto a plane.

core or if the core is set into a shallow taper with preload. Once initial retract movement occurs, the remaining stroke and hold in the final pull position usually requires low forces that are not limiting. To reduce overall breakaway forces, providing tapers over eight degrees or a slight touch or gap to the taper using a core stop to absorb preload and time the final position is helpful.

Long, penetrating cores with aggressive shrinkage will likely create a limiting condition and require larger bore hydraulic cylinders to pull them free, unless an internal diameter taper can be added to the part to improve release. When using preloading hydraulic locking cylinders, use caution, as many provide large output forces but low retract forces. Larger bore models may be available from some manufacturers to accommodate breakaway demands when retracting the core.

Mold Forces from Injection and Shrinkage

Force on the slide core due to injection (F_i) is a function of the nozzle injection pressure (P) and the core exposed surface area projected along the axis of movement (A_p).

$$Fi=A_p \times P$$

For fully exposed cores, the projected area is best visualized by thinking of slicing the core perpendicular to the direction of movement and measuring the resulting region.

While it is possible that some pressure drop will occur in the cavity and pressure at the core may be less than nozzle

Pull Conditions								
Cylinder Type	Standard or HLC	Bore Dia. Inches	Rod Dia. Inches	Diff. Area Sq. Inches	Pull Force lbf @ hydraulic psi			
					1500	2000	2500	3000
HLC	**KLH-70**	**1.000**	**0.750**	**0.343**	**515**	**687**	**859**	**1,030**
HLC	**KLH-75**	**1.250**	**0.750**	**0.785**	**1,178**	**1,570**	**1,963**	**2,355**
STD	**STD**	**1.500**	**0.625**	**1.460**	**2,189**	**2,919**	**3,649**	**4,379**
		1.500	1.000	0.981	1,472	1,963	2,453	2,944
HLC	**KLH-100**	**1.750**	**1.000**	**1.619**	**2,429**	**3,238**	**4,048**	**4,857**
HLC	**KLH-112**	**1.750**	**1.125**	**1.411**	**2,116**	**2,821**	**3,526**	**4,232**
HLC	**KLH-150**	**2.000**	**1.500**	**1.374**	**2,061**	**2,748**	**3,434**	**4,121**
STD	**STD**	**2.000**	**1.000**	**2.355**	**3,533**	**4,710**	**5,888**	**7,065**
		2.000	1.375	1.656	2,484	3,312	4,140	4,968
STD	**STD**	**2.500**	**1.000**	**4.121**	**6,182**	**8,243**	**10,303**	**12,364**
		2.500	1.375	3.422	5,133	6,844	8,555	10,266
		2.500	1.750	2.502	3,753	5,004	6,255	7,507
HLC	**KLH-112LB**	**3.000**	**1.125**	**6.071**	**9,107**	**12,143**	**15,179**	**18,214**
HLC	**KLH-200**	**3.000**	**2.000**	**3.925**	**5,888**	**7,850**	**9,813**	**11,775**
STD	**STD**	**3.000**	**1.000**	**6.280**	**9,420**	**12,560**	**15,700**	**18,840**
		3.000	1.375	5.581	8,371	11,162	13,952	16,743
		3.000	1.750	4.661	6,991	9,322	11,652	13,983
STD	**STD**	**3.250**	**1.375**	**6.807**	**10,211**	**13,615**	**17,019**	**20,422**
		3.250	1.750	5.888	8,831	11,775	14,719	17,663
		3.250	2.000	5.152	7,727	10,303	12,879	15,455
HLC	**KLH-150LB**	**4.000**	**1.500**	**10.794**	**16,191**	**21,588**	**26,984**	**32,381**
HLC	**KLH-300**	**4.000**	**3.000**	**5.495**	**8,243**	**10,990**	**13,738**	**16,485**
STD	**STD**	**4.000**	**1.750**	**10.156**	**15,234**	**20,312**	**25,390**	**30,468**
		4.000	2.000	9.420	14,130	18,840	23,550	28,260
		4.000	2.500	7.654	11,481	15,308	19,134	22,961
STD	**STD**	**5.000**	**2.000**	**16.485**	**24,728**	**32,970**	**41,213**	**49,455**
		5.000	2.500	14.719	22,078	29,438	36,797	44,156
		5.000	3.000	12.560	18,840	25,120	31,400	37,680
		5.000	3.500	10.009	15,013	20,018	25,022	30,026
HLC	**KLH-200LB**	**5.500**	**2.000**	**20.606**	**30,909**	**41,213**	**51,516**	**61,819**
STD	**STD**	**6.000**	**2.500**	**23.354**	**35,031**	**46,708**	**58,384**	**70,061**
		6.000	3.000	21.195	31,793	42,390	52,988	63,585
		6.000	3.500	18.644	27,966	37,288	46,609	55,931
		6.000	4.000	15.700	23,550	31,400	39,250	47,100

Cylinder retract or pull force is always less than extend or set force due to reduced piston area. Oversized rods in HLC cylinders provide greater preload capacity and are allowable for most applications. However, for long cores with significant plastic shrinkage, a larger bore may be necessary to provide sufficient pull force. View this link for a more detailed chart of sizes and pressures.

pressure, it is often as likely that peak pressure will increase due to processing demands. Cavity pressure is sometimes difficult to predict, even with mold flow analysis, so using nozzle injection pressure is recommended.

After injection, the plastic part cools and may shrink around the core, developing friction that resists movement. Calculating the resisting force F_r is more challenging and seems to be highly dependent on plastic material type and amount of cooling. (Note: Some historic calculations have been used with varying degrees of success and may be available from other sources.)

Cylinder Extend and Retract Forces

The formula for force (C) from a hydraulic cylinder is the differential area (D) multiplied by the hydraulic pressure (H) core pull circuit system machine pressure.

$$C = D \times H$$

The term differential area is used to remind us to subtract rod area for retract calculations. The differential area (D) for extend (D_e) is the area of the cylinder bore $D_e = 3.14xB^2/4$, where B is the bore diameter and determines the extend force C_e. The differential area for retract (D_r) is the "difference" in areas between the bore and rod $D_r = 3.14x(B^2 - R^2)/4$ and determines the retract force C_r.

To prevent core movement during injection, the cylinder extend force (C_e) must exceed the injection force (F_i). To ensure core pull, the cylinder retract force (C_r) must exceed the resistance force (F_r).

Hydraulic locking cylinders provide separate locking at end of stroke, which may lock only and provide no additional force or may be of the preloading style that may provide much larger extend forces. Preloading hydraulic locking cylinders with large output extend

forces have an extend force (K) at end of stroke, but function as typical cylinders for retract with force (C_r). For success:

$$C_e \text{ or } K >> F_i \quad \text{and} \quad C_r >> F_r$$

Sizing a cylinder with hydraulic force (C_e) or preload force (K) greater than the calculated injection force (F_i) is necessary to prevent movement. Selecting a standard cylinder with a bore diameter and available hydraulic pump pressure combination that exceeds this amount plus a safety factor of 15 to 30% (SF = 1.15 to 1.30) is desirable to account for 5-10% of system losses and perhaps 10-20% for unexpected changes in injection pressure.

Cylinder Selection

With the formulas mentioned earlier, the injection force (F_i) can be calculated and multiplied by the safety factor (SF) to determine the necessary cylinder force (C_e) or preload force (K) for core set. Cylinder retract force (C_r) can then be evaluated for effectiveness relative to the estimated friction force (F_r) to pull the core from the pocket.

Calculating forces for a variety of cylinders and solving for minimum bore size is possible; however, using the chart above is often easier and provides some comparisons of relative size. Note the large preload forces from the hydraulic locking cylinders (HLC), which are six to ten times that of standard cylinders of the same bore diameter at 1500 psi hydraulic pressure.

For example, extend preload force of 40,000 lbf (20 ton) in a 3-inch bore hydraulic locking cylinder would require a 6-inch bore standard hydraulic cylinder. The standard cylinder force is only available if hydraulic pressure is maintained. In all but the smallest applications, hydraulic locking cylinders provide a large force and size advantage to standard cylinders.

Pull force in hydraulic locking cylinders is much less relative to the larger bore standard hydraulic cylinders. When using a standard cylinder, the pull force is often capable of pulling the core, while when using a hydraulic locking cylinder, penetrating cores may be more problematic. In most cases, however, parts do not have significant part penetration and pull forces are relatively low or can be reduced by increasing draft or adding stops to the core.

For best results, consider all the stroke positions of the cylinder, both set and pull, and calculate forces. Choose the best preload, bore and rod combination that meets all requirements, ensuring pressure is available to the cylinder during injection, as appropriate. MMT

FOR MORE INFORMATION

PFA Inc. / 262-250-4410 / pfa-inc.com
Mark Scanlan, Vice President and General Manager

Example Calculations

See the online article link for a force calculator on various core body shapes when core diameter or shape is combined with estimated injection pressure.

Projected Area (A_p) Calculations

For a square 2 by 2-inch core body with a complex surface at the tip yet fully exposed to plastic, the projected area A_p = 2 by 2-inch = 4 square inches. Similarly, for a core with a fully exposed 4-inch diameter spherical end, the projected area A_p is the same as the circular area of a cut through the core body perpendicular to the surface A = (π 4^2)/4 = (3.14 x 4 x 4)/4 = 12.56 square inches. By using the full core area, flash of any shutoff areas are included.

Many CAD systems allow for calculation of projected area from the core perpendicular to the axis. Consider including any shutoff area in case of flash.

Pressure (P) and Injection Force (F_i) Calculations

Injection pressure is calculated by multiplying the screw ratio (typically about 10:1) by the hydraulic injection pressure to the injector (generally 1,000 to 2,500 psi) for a resulting typical nozzle injection pressure between 10,000 psi and 25,000 psi.

For the square body core and 10,000 psi nozzle pressure F_i = 10,000 psi x 4 sq. in. = 40,000 lbs.

For the spherical core and 10,000 psi nozzle pressure F_i = 10,000 psi x 12.56 sq. in. = 125,600 lbs.

To provide a cylinder force greater than the injection force, it is necessary to find a cylinder with a bore diameter and available hydraulic pump pressure combination that exceeds this amount plus a safety factor of 10 to 25% or more.

Applying a Safety Factor of 25%

For the square body core F = 10,000 psi x 4 sq. in. x 1.25 = 50,000 lbs.

For the spherical core F = 10,000 psi x 12.56 sq. in. x 1.25 = 157,000 lbs.

Calculate the force for each available cylinder, from the Set Conditions chart.

The formula for force (C) from a hydraulic cylinder is the Differential Area (D) multiplied by the Hydraulic (H) core pull circuit system machine pressure. C = D x H

The differential Area for extend (D_e) is the area of the cylinder bore D_e=(3.14 x B^2)/4 where B is the bore diameter. The hydraulic pressure is typically 1,500 psi to perhaps 2,500 psi. A 2-inch bore cylinder would have the following area D_e=(3.14 x 2 x 2)/4=3.14 sq. in. Using H=2,500 psi, C_e=2,500 psi x 3.14 sq. in. = 7,850 lbs.

From the set conditions chart, a KLH-150 with preload of 60,000 lbs (or a 5-inch bore standard hydraulic cylinder at 49,000 lbf at 2,500 psi) would be suitable for the square core. For the spherical core, a KLH-300 with preload of 210,000 lbs or a 10-inch bore standard hydraulic cylinder would be appropriate. Note as the forces increase, the amount of hydraulic volume necessary to move the standard hydraulic cylinder would be substantial.

By Barbara Schulz

Print the Whole Injection Mold in HSS to Increase Tool Life

A German mold builder offers a solution for printing high-speed steels with high carbon content to produce highly dense and wear-resistant molds via selective laser melting.

Images courtesy of Susanne Schröder.

Maximilian Bronner (left) and Axel Wittig (right) founded Kolibri Metals in 2018 to develop steels with a high-carbon content and high wear-resistance for additive manufacturing.

An innovative mindset, motivation and commitment are what keeps businesses on track, even in challenging economic times. Southern Germany-based toolmaker Webo Werkzeugbau has been a trendsetter in the manufacture of special tools for automotive transmissions since its foundation during the global financial crisis in 2008. It has just opened a new subsidiary in China—despite market uncertainties and global production volume declines in the automotive industry.

Webo CEO Axel Wittig is a man of action. Since launching his company with five employees 12 years ago, he has increased the workforce to 100 and established a robust global toolmaking business (with subsidiaries in Detroit, USA and Bosnia). Webo produces tooling for 80% of all sheet metal transmission components, including component development, FEM calculations, process development, prototype manufacturing, design, precision parts production, assembly and tryout.

His recipe for success is investment in the latest technology, optimized processes and digitalization. Four years ago, Wittig decided to tap into additive manufacturing to integrate selective laser melting (SLM) or laser powder bed fusion (LPBF) technology into the toolmaking process. A primary requirement was to find a machine capable of processing tool steels to build support structures for the tools and dies manufactured for all significant automotive OEMs around the world.

Overcoming the Challenge of Printing HSS

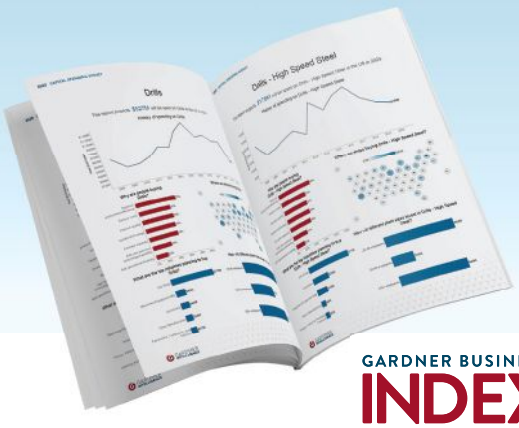
"We started to build our components using the tool steel 1.2709/A646 M300, which is known for great hardness and high ductility and was available from material suppliers for the SLM process," Wittig explains. So far, only a few of the commonly used steels have been qualified for the SLM process in the mechanical engineering industry, which generally uses hot work tool steels with less than 0.5% carbon content. However, many applications, such as stamping dies, need high wear-resistant steel alloys with high hardness, both of which can be achieved with higher carbon content, like in high-speed steels (HSS). But when processed with SLM, these steels often form cracks, making the process very challenging to control.

"Through the selective application of alloys, we were able to adjust the material properties of the 1.2709 steel for our purpose. However, our dies are exposed to extreme strain and so require a material with high resistance to wear and tear to keep abrasion to a minimum. So, we manufactured part of the die from HSS, which we then had to weld on the printed support structure. This is not an ideal process to achieve an efficient manufacturing process or long tool life, as the weld is a source for potential cracks and premature tool failure."

As a result, Wittig and his team started to experiment with commercially available steel powders for additive. They soon

The Insight That Matters Most to Your Business

Whether you are a manufacturer, equipment supplier or finance professional, we provide deep, rich, actionable insights about durable goods manufacturing.



GARDNER BUSINESS INDEX

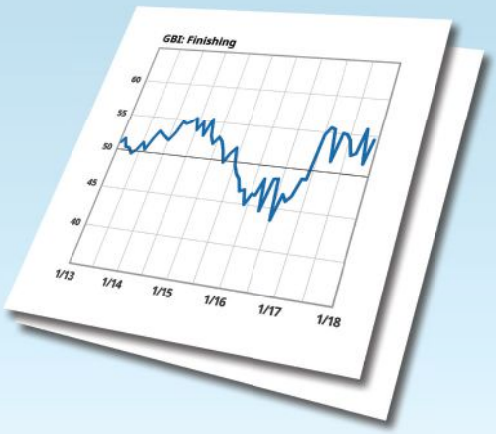
A business trends index measuring monthly changes in new orders, production, backlog, employment and other critical measures.

TOP SHOPS CUSTOM REPORTS

Enables shops to benchmark operational and financial performance, leverage strengths, and identify opportunities.

CAPITAL SPENDING DATA

Capital Spending data collected annually, regarding budgeted spending on machines, testing equipment, software and more, projected across industries.



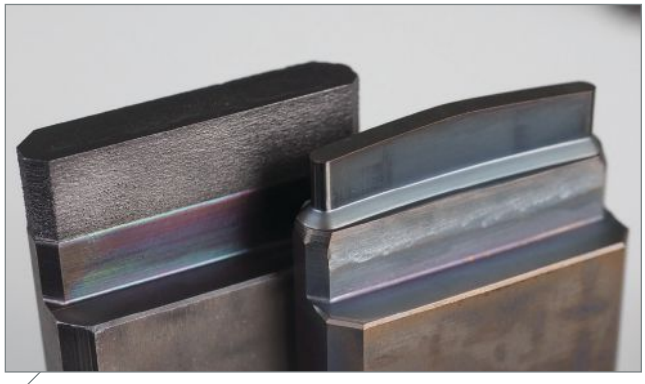
CUSTOM RESEARCH

Forecasting, consulting, benchmarking, modeling and custom research that reveal insights on technology, business practices, advertising, and competition.

Leverage the power of industry-leading intelligence in your operation.

GARDNER INTELLIGENCE

513-527-8800 | gardnerintelligence.com



The top of this hybrid stamping die is 3D printed using Kolibri's custom SLM machines, made from Colima, a wear-resistant steel with a high carbide content and additional toughness.

This 3D-printed end mill is made from Kolibri's Cotopaxi steel with 65 HRC and added carbides for additional hardness and wear-resistance. Cooling channels can be easily integrated and the cutter is ready to use as it comes out of the SLM machine, only the cutting edges need to be finished.

found the right material mix to manufacture components from HSS using the SLM process and even adding carbide additives for high wear resistance. Since HSS steels with a high carbon content are not materials available off the shelf for 3D printing, Wittig decided to professionally develop high-strength materials for additive manufacturing, including configuring all process parameters and customizing the machines to these special requirements.

"The problem with printing materials with a high amount of carbon is that it makes them difficult to melt and fuse because of their high hardness and brittleness, which makes them easy to crack due to thermal stress during the SLM process," Wittig

explains. “Therefore, you have to test and evaluate the impact of critical process parameters such as laser power, scan speed, hatching distance, laser focus and layer thickness on the microstructure, hardness and density of the printed components.”

To fully concentrate on the development of printable steels exhibiting the required hardness for their tools, Wittig decided to partner with Max Bronner in 2018, who had been working with Webo through Porsche Consulting, to found a separate company which was to focus on the additive business exclusively. Not only does this move allow a small team of engineers to concentrate on research and development in this area, it also provides a second mainstay for the company, which is heavily dependent on the currently volatile automotive industry.

Creating Custom Material and Process Parameters

Called “Kolibri,” the start-up company focuses on developing and testing SLM metal powder alloys fulfilling the hardness criteria of at least 60 HRC and the corresponding process parameters and machine settings. For Bronner and Wittig, additive manufacturing not only offers sheer endless design freedom but the creation of their material. They mix steel, aluminum or other materials with alloys such as nickel or chrome (as well as carbide or diamonds) to create a unique metal matrix composite material.

“The commercially available 1.2709 steel with a hardness of 54 HRC and carbon content of 0.03% we were using simply didn’t meet our hardness requirements,” Bronner says. “So we started to use high-speed steel (1.3343), which is ideal for cold-forming tools, impact extrusion punches and dies or mold inserts, featuring a high wear-resistance in combination with high toughness and compressive strength.”

To optimize the steel properties, Bronner added carbides and diamonds to the powder, tested the matrix on its SLM machine, and performed micrograph tests, including microscopic material analyses in their in-house materials test lab. “The high cooling rates of the SLM process make it even more challenging to print the steel due to thermal fatigue cracking, porosity and a lack of fusion,” Bronner explains. “To counteract crack formation, the machine’s base plate needs to be preheated to over 300°C, reducing the temperature gradient and internal stresses. One of our most important patent applications is optimum heat distribution during the printing process.”

To increase the process efficiency for tool steel, HSS or other hard-to-print materials, it is essential to understand

the effect of all printing parameters on the printing behavior of the metallic materials. According to Bronner, there are around 200 machine parameters that must be optimized because the target is a part density of 100%. Proper parameter settings yield a density of 99.8% to 99.9%. In comparison, many standard parameters from machine manufacturers only achieve a density of up to 98%, which has adverse effects on end-use functional parts.

Increasing Hardness to that of Carbide

Kolibri now has a lot of experience and knowledge in printing hard metals with a carbon content of up to 0.9% due to its extensive research and development. The company claims it now offers the hardest steel for SLM processing globally.

Wittig notes that some adverse effects of the laser on the material mix yielded favorable material properties. "For example, we noticed that the added diamonds that burned during the melting process caused the resulting carbon content to increase the material hardness to 75 HRC."

Kolibri has developed various metal matrix composite materials, which are available to its stamping, moldmaking, mining, packaging and aerospace customers. The company also customizes materials according to customer demands, develops all necessary machine parameters and customizes the SLM machine, including drying the powder inside the machine or preheating the base plate.

Apart from tools and dies for Webo, the company prints whole end mills, injection nozzles and many other parts, including mold inserts, cores and cavities made from H13+ (H13 chromium-molybdenum tool steel with higher chromium content).

According to Bronner, the material allows them to print the *whole* mold for injection molding, which is corrosion-resistant and offers a long service life. "Many moldmakers use cheaper tool steel to manufacture the base, but hybrid mold inserts pose the danger of premature crack formation in the weld area. Printing whole inserts from H13+ results in much longer injection cycle times.

Kolibri now wants to drive the use of SLM for serial production by automating the process, with a focus on high-carbon and wear-resistant steels in close cooperation with various machine manufacturers. MMT

FOR MORE INFORMATION

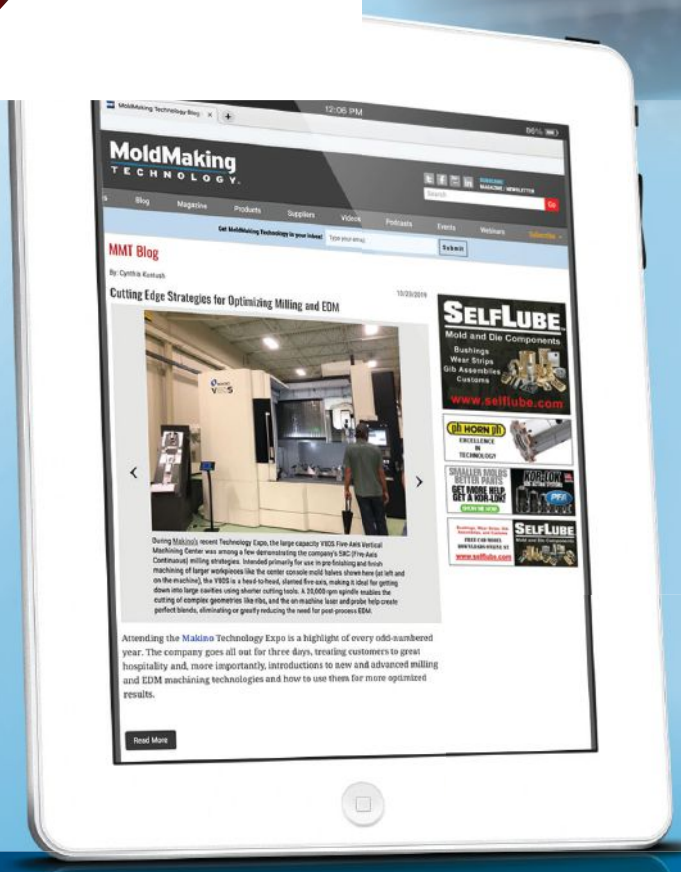
Webo GmbH / webo.de.com
Webo Detroit Corp. / webo.us.com
Axel Wittig, CEO
Kolibri Metals / kolibri.de.com
Maximilian Bronner, Managing Director

MMT

ENGINEER / BUILD / MAINTAIN

BLOG

Conversation.
Communication.
Community.



Participate in the *MoldMaking Technology* Blog

The *MoldMaking Technology* Blog is designed for you, allowing dialogue with professionals in the mold manufacturing industry.

- **Keep up on the issues affecting mold manufacturing.**
- **Interact with industry leaders and newcomers alike.**
- **Share insights, observations, challenges and solutions with your peers.**

Join the Discussion!

MoldMaking TECHNOLOGY®

moldmakingtechnology.com/blog

By Anthony Watson

CNC Monitoring Software Improves Machine Performance and Utilization

RCO Engineering using a monitoring system to monitor setups, idle time, programming and quality checks, reducing CNC machine downtime.

RCO Engineering (RCO; Roseville, Michigan) has a strict business standard that it lives up to every day: accountability to the customer. The company achieves this with its talented workforce and advanced technology.

With over 430,000 square feet of manufacturing space and roughly 600 employees, RCO offers mold and tool building, CNC machining, injection molding, foam molding, precision metal stamping, robotic welding, painting and complex assembly. Since 1973, the company has focused on the aerospace and automotive markets, including the design and manufacture of seats for a major aircraft company. RCO also assembles thousands of different parts made from numerous materials to produce high-quality final products. This portfolio and level of quality demand investment in the latest Industry 4.0 techniques and technologies.

Figuring Out Machine Performance and Utilization

As it was, RCO had a list of "unknowns" in their CNC department that needed answers, which required the management team to look at the CNC machine like an actual "employee." In other words, a machine needs an hourly wage assigned to it, so a shop can determine when a machine was making money and when it was costing money.

The team could also not account for large blocks of idle machine time. "We were noticing, on average, 1,200-1,400 hours a month of downtime," Justin Castillo, RCO's engineering manager, says. Armed with this information, the management team set out to discover why this was happening, but quickly realized the current system that covered 25 CNC machines did not have the appropriate tracking capabilities: machine performance and utilization.

These two factors are vital to achieving a shop's overall productivity and profitability, or Overall Equipment Efficiency (OEE), but other factors are also involved. For example, the success of a machining operation has a lot to do with human behavior, especially the level at which machine operators are performing their duties to keep machines running and jobs on schedule.

Enter a solution: TST Tooling Software Technology LLC (TST), one of RCO's long-time solutions providers which recently became a reseller of FactoryWiz monitoring software by Refresh Your Memory Inc., an innovative solution provider of CNC communications and machine monitoring systems.

The monitoring software is configured through an easy-to-use web interface that displays live and historical production data on large screen dashboards, standard PCs, tablets and

Images courtesy of TST Tooling Software Technology, LLC.

Tablets or a PC allow for quick and easy data entry by an operator or at-a-glance status while walking the shop floor.

smartphones. This software is **not** a cloud-based system. It resides onsite, where the shop has complete control of its data. This was an essential aspect for the management team at RCO.

RCO installed FactoryWiz in two separate departments: production component CNC machining and tooling CNC machining. The management team made it as simple as possible for the workers running the machines by installing tablets and touchscreen computers on the shopfloor and gave each operator a login tied to the time-keeping system.

Management noticed the effects almost immediately, as only one month after implementation, the company was already making critical gains in machine time hours and it answered the question about a machine's idle time. For example, with FactoryWiz, the RCO team was able to better understand the reasons machines were idle or down, as well as make more real time adjustments to better utilize their equipment.

Decisions to add more staffing or machining resources become easier based on accuracy of data collected through daily tasks.

The RCO team was also using the software to send reports directly to supervisors, who quickly worked to reduce the shop's idle machine time by setting up custom Idle Retroactive and Idle Forward reports, which have functions that record machine downtime. The idle retroactive function captures the machine idle time between the machine stop and the next machine start. The software also captures what is happening while a machine is idle without requiring an operator to be at the machine at the exact moment it stops.

For example, if an employee is busy at another machine when a machine stops, he or she can go back when ready and enter the appropriate idle reason for that time. This feature helps to paint a more accurate picture for the shop as opposed to a shop that is unable to enter idle reasons retroactively because employees cannot be at a monitor exactly when a machine stops.

"It was an easy solution to the human impact on machine downtime. The software fills in the gaps and provides real-time, accurate feedback on machine downtime and quality, which streamlines quoting and one- and two-off parts," Castillo says.

FactoryWiz's short learning curve and TST Tooling Software's support team were essential to RCO's successful implementation across its 40 CNCs. "FactoryWiz was the most appropriate solution for us because we didn't need so much customization and reporting upfront. We simply plug it into a machine, the operator types in his job number and we can then monitor setups, idle time, programming and quality checks," Castillo says.

Since installing FactoryWiz over two years ago, RCO has reduced machine idle time from 1,200-1,400 hours a month to approximately 400 hours a month. This improvement has motivated operators to start a friendly competition to see who can beat the latest record, and the numbers just keep improving. MMT

TST TOOLING SOFTWARE TECHNOLOGY, LLC

PROBLEM: Increased idle CNC machine time and inefficient capabilities to track machine performance and utilization.

SOLUTION: Invested in FactoryWiz Monitoring software to monitor the physical processes of a wide range of CNC machines and applications to help make informed business decisions based on facts and numbers.

RESULTS: Reduced machine idle time from 1,200-1,400 hours a month to 400 hours a month.

FOR MORE INFORMATION

TST Tooling Software Technology, LLC
800-984-6190 / tst-software.com
RCO Engineering / 734-236-6606 / rcoeng.com
Anthony Watson Applications Engineer,
TST Tooling Software Technology

COMING SOON.

Launching August 14, 2020

The team that brings you **IMTS — The International Manufacturing Technology Show** will launch **IMTS Spark**, a comprehensive digital destination to connect exhibitors and customers at a time when travel and gatherings are limited. Through educational content and networking opportunities, **IMTS Spark** offers first-class experiences through an interface that is effective and engaging. Learn more at **IMTS.com/spark**.

A destination with
no travel restrictions.

IMTS.com/spark

IMTS
spark

POWERED BY AMT & GARDNER Business Media, Inc.

Digital-only content you may have missed. Read full stories at links provided.

MoldMaking Technology's Leadtime Leader Award Gets Recognition on Congressional Floor

By Christina M. Fuges

Congressman Greg Pence acknowledged the winner of the prestigious Leadtime Leader Award on the United States Congressional floor.

MoldMaking Technology and its Leadtime Leader Award winner, Precise Tooling Solutions, are proud to have been mentioned on the floor of the United States Congress.

Representative Greg Pence of Indiana's 6th District gave a special congratulations to Precise Tooling Solutions of Columbus, Indiana. Rep. Pence complimented Precise Tooling Solutions on their team-first working environment that leads with customers and quality.

Don Dumoulin, CEO/owner, says, "The entire Precise Tooling Solutions team is both proud and honored to be named the Lead Time Leader award winner for 2020! It was terrific to have Congressman Pence congratulate us from the floor of the US House of Representatives. We are proud to be part of American manufacturing, keeping projects and jobs in the United States."

short.moldmakingtechnology.com/LLA20US

A Unique Approach to Filling Specific Workforce Needs

By Christina M. Fuges

Cavalier Tool & Manufacturing's President Brian Bendig discusses the shop's unique way of solving the challenge of workforce development.

Brian Bendig, president of Cavalier Tool and Manufacturing, discusses finding skilled and motivated talent, and the unique way the company solves that challenge.

Brian Bendig: We often want to invite a lot of the young adults within the industry, and awareness is a big thing because the shortage of skilled workers and such is problematic in our industry. People don't know what we do, so we like to include a lot of the young adults through our building for tours.

In doing this, we actually developed our own math program. We put together several items that we could measure and check with go/no-go, pins, micrometers, etc. We set up this math program and invited a bunch of the students. We were working with these young adults going through this program, and in turn, these schools are adopting this. Now we're nudging them to be a little more aggressive, to get a little bit more involved, to go a little bit deeper and more industry-specific.

These are some of the skills or tools needed to be successful in working with us. We're working with the Canadian Association of Mold Makers (CAMM), and they are taking some of the things we're doing and going to some of their partners and connections to further push that out and get more involvement. When they're working with a school, there's more awareness and there's a bigger focus.

Watch the entire video online!

short.moldmakingtechnology.com/CTMfgVideo

Direct Rapid Soft Molds Open Up New Applications in Micro Injection Molding

By Barbara Schulz

Fast and economic prototyping and pilot production is essential for industrial manufacturers in the precision engineering sector. One possibility is direct rapid soft tooling (DRST), the direct manufacturing of inserts for injection molds by additive manufacturing technologies. However, injection molding parameters such as cycle time or injection pressures are significantly different to conventional injection molding production. Heat deflection, wear and accuracy are among the key challenges, because many available print materials usually allow either high accuracy or high temperature resistance.

Israel-based micro additive manufacturing (AM) technology developer, Nanofabrica, has been working on developing materials and AM processes suitable for printing soft molds for micro injection applications, and has now accomplished a breakthrough which enabled the printing of a mold that lasted 20 shots, with plans to increase this to 1000 shots in the coming months, the company says.

As part of its efforts in promoting the area of AM produced-DRST, Nanofabrica aims to work with a select number of companies to demonstrate the value of using DRST in the production cycle. By so doing, the company projects that numerous manufacturers will see the value and feasibility of working with its uniquely accurate micro AM technology in future production and insert mold fabrication projects.

short.moldmakingtechnology.com/DRST

Nanofabrica's direct rapid soft tooling process unlocks potential applications in small or medium-batch manufacturing.

PODCAST: Challenge Yourself and Your Mold Building Business to Push Boundaries

By Christina M. Fuges

During this episode of The Manufacturing Alliance Podcast, Christina Fuges and Tony Demakis sit down with Wayne Daniel, director of business development and outside tool in sales at Canon Virginia. Wayne has been with Canon for 30 years. He describes himself as a "molding guy", having spent about 27 years of his career in injection molding, supporting Canon's in-house molding operations and manufacturing.

Here are several highlights from their conversation:

Wayne's the process guy. He's the guy that blames the tool.

It's important to learn to trust. Wayne had to learn to do that by opening up and allowing his team to try things they've been wanting to do for years, but maybe necessarily couldn't or were afraid to do.

Design and maintenance go both ways. Everyone learns from each other.

The latest technology from Canon Virginia would have to be the company's new shuttle molding system. Introduced at NPE in 2018, it was developed originally for Canon's internal production. It's a system that allows the user to run two molds and one machine at the same time simultaneously to increase productivity.

Wayne and Canon both adhere to the motivation that they're never satisfied. 'What's next?' is the big question. "It's always what's next, what's the next big thing, or even small things that can make up and give back." Keep trying to challenge yourself to be better.

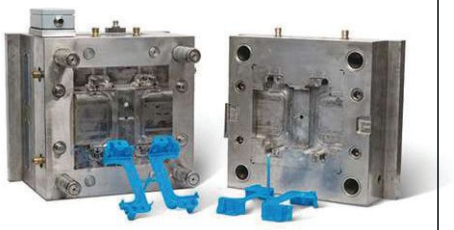
Listen to the whole episode online!

short.moldmakingtechnology.com/CanonPod

Wayne Daniel at Canon Virginia describes himself as a "molding guy", having spent about 27 years of his career in injection molding, supporting the company's in-house molding operations and manufacturing.

5 Questions to Ask Before Instrumenting a Mold

By Brad Harvey



Instrumenting an injection molding machine with sensors can be a daunting task. The key is knowing the right questions to ask before you even begin.

What do you want the sensor to do for you? Once you answer that question, you can begin to explore the many different functions sensors can serve if used correctly, including making important decisions such as:

-Where do you want to install the sensor?
-What type of sensor technology do you need?
-How should you install the sensor?
-What load capacity do you need?

Knowing some of the different functions of instrumenting a tool will significantly aid in deciding what sensor type and location you'll need to achieve your goal. There are several factors to take into consideration, including available real estate in the tool and cost. Putting a sensor anywhere in a tool can give you some form of data, but it may not be value-added. The key is knowing upfront what you want the sensor to do for you.

short.moldmakingtechnology.com/RJGBlog

VIDEO: MMT Goes Onsite (Remotely) to Spotlight Precise Tooling Solutions

By Christina M. Fuges

COVID-19 may have prevented the *MMT* team from visiting our 2020 Leadtime Leader winner in person, but we still sat down with them virtually to share their story.

In this series of videos, *MMT* Editorial Director Christina Fuges sits down with several members from this year's Leadtime Leader Award winning shop, Precise Tooling Solutions.

Don Dumoulin, owner/CEO, talks about the company's mission, history, specialty and lead times. Josh Jeffries, director of manufacturing, discusses the company's essential machining and software technologies. Brian Rose, tool productivity program manager, shares the shop's mold maintenance, repair and engineering work. Then it's onto John Rowe, marketing manager and manager of the company's ErgoSmart business unit. He shares his insights on marketing strategy, customer service and the history and success of the ErgoSmart workstations and lift tables. Lastly, Leadman Apprentice Beau McKinney and EDM Apprentice Trent Ford join Don Dumoulin to discuss their current and future path at Precise Tooling Solutions and how the company's workforce development and training program has helped them succeed.

See each video online!

short.moldmakingtechnology.com/LLA20Video

MMT Chat: Safety, Shields and Shuttle Molds

By Christina M. Fuges

The team from Canon Virginia talks about business during COVID-19, its efforts to help the fight and recent advancements to its shuttle mold system.

Editorial Director Christina Fuges chats with members from Canon Virginia in Newport News, Virginia: Wayne Daniel the director of business development; Scott Lundberg, director of product development; and Rhonda Bunn, senior director of human resources and corporate communications.

The last time Canon Virginia met with *MMT* was in February in California at MDM West before the COVID-19 outbreak really hit. In this chat, Canon shares insights on the impact of the virus, as well as a look at the advancements made to its shuttle mold system.

Watch the video online!

short.moldmakingtechnology.com/CanonCOVID

Industry Reaches Potential Floor

June 2020 – 47.2

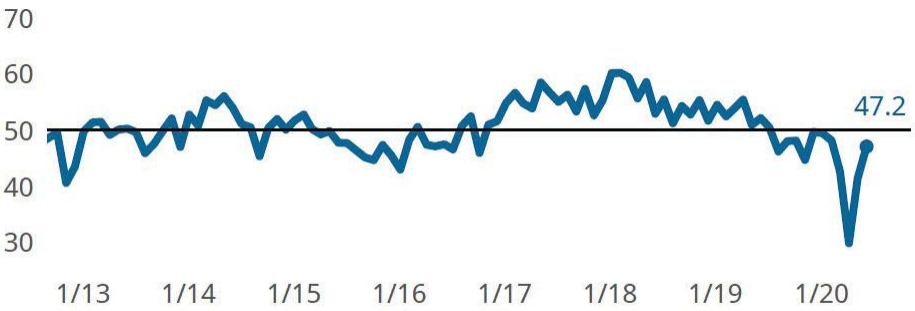
The GBI: Moldmaking increased during June to close at 47.2, marking a second month of increasing readings. All sub-components of the Moldmaking Index moved closer toward their pre-pandemic readings. Index readings, which increase in absolute terms but remain below 50, indicate that a shrinking proportion of survey respondents are reporting contracting activity and a greater proportion are experiencing no change, or increasing activity. June's overall reading was supported by new orders and production readings which came in above and near a reading of 50, respectively.

Encouraging news included an expansionary reading in the forward-looking new orders component since COVID-19 took hold in March. Breaking through the 50 line indicates a majority of survey participants experienced flat or increasing new orders compared to May, setting a potential floor on the contraction in new orders sparked by the disruption caused by the pandemic. If new orders continue to expand, the industry may witness production and employment—which often lag the new orders—improve in future months. 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



The Moldmaking Index moved higher again in June as all components reported less volatile readings. The Index has rebounded over 17 points since its April 2020 all-time low.

New Orders and Exports

Moldmaking new orders registered expanding growth for the first time since COVID's unprecedented disruption to the manufacturing sector. Should new orders continue to register future months of expanding activity, it will be a clear sign that the industry has found a floor from which it can begin to recover.

**The further away a reading is from 50 the greater the magnitude of change in business activity.*

MOLD MAINTENANCE, REPAIR AND SURFACE TREATMENT

Diamond Compound Kit and End Bristle Brushes Target Versatility and Save Time

Boride Engineered Abrasives adds its moldmakers diamond compound kit and Cristone end bristle brushes to its latest product offerings.

Manufactured in Michigan, the versatile yet cost-effective diamond compound is known for its wide thermal processing range and consistent diamond particle distribution, enabling it to be used under the most demanding conditions, as well as for precision finishing on all types of molds and dies. Each kit includes (5) 2-gram syringes of the industry's most popular grades and a 2-ounce bottle of Diamax thinner. Kits are also available in oil and water-based formulations as well as medium, heavy, extra heavy and super-duty concentrations, providing customers with greater options, versatility, performance and quality.

Adding to the company's offering of polishing products and accessories, Cristone is made from the same high-quality crystalline fibers as Cristone crystal fiber detail polishing stones. These end bristle brushes are ideal to use for cross hole deburring, surface finishing and polishing aircraft parts, engine blocks and medical devices. The bristle brush structure is the latest in nano technology that enables time saving by finishing surface roughness with only one fine grit, as well as easily removing burr and tool marks after the cutting process.

Brushes are available in one size and many grits ranging from 150 to 6000, enabling users to work on hard materials, such as carbon or stainless steels to non-ferrous metals such as aluminum or copper.

BORIDE Engineered Abrasives / 800-662-0336 / borideabrasives.com

Tool Mover Handles Heavy Molds Easily and Safely

Millutensil presents a tool mover that can handle heavy molds easily and safely. Problems with conventional rotating and turning equipment include potential damage to expensive tools and damage to hoist brakes and ropes. The tool mover turns the load over at its center of gravity to ensure a smooth transition, minimizing the risk of damage to expensive molds or tools, as well as for the operator. The tool mover is versatile and can be easily relocated with a hoist or lift truck since it is not anchored to the floor and is very compact in size. It has a low supporting surface, enabling the open tool to be cleaned while on the table itself. Not only is the tool mover compatible with a wide range of mold sizes, but it is available in six versions, can be equipped with PU plates and offers time and costs savings due to easy handling.

Millutensil SRL / 390229404390 / millutensil.com

Rust Preventative Provides Corrosion Protection

Cortec offers EcoAir tool and die rust preventative to meet the needs of mold, tool and die manufacturers and end users. The rust preventative comes in a non-flammable spray can that makes it easier to use than traditional greases and shipping oils employed to protect tooling assets and all tool steels during shipping, storage and transport. The rust preventative provides corrosion protection, as well as water displacement and cleaning properties for any process-related fluids remaining on molds, and it does not need to be cleaned off the mold with solvent-based removers. The rust preventative is specifically designed for all similar tool and die applications and can also be used to clean grease, oils, adhesives and water deposits off metal surfaces; displace moisture and protect metal surfaces from corrosion; and preserve all types of carbon or alloy-based steel tooling, molds, fixtures and dies long-term up to 24 months indoors.

Cortec Corporation / 651-429-1100 / cortecvci.com

Centrifugal Disc Finishers Designed to Eliminate 80% of Handwork

To help manufacturers increase throughput, decrease cost and the increase quality of metal parts, **Bel Air Finishing** highlights its centrifugal disc finishers. These machines are designed to polish and deburr a wide range of materials including brass, copper, steel, stainless steel, aluminum, kovar, titanium and more. The machines eliminate 80% of handwork and produces over five times the output of normal hand deburring operations. They have also been able to drastically reduce surface RA in metal parts across aerospace, automotive, medical and other industries.

The centrifugal disc finisher comes in sizes ranging from four to 60 liters and most models come with a mobile frame, ideal for cellular and JIT production. A wide variety of additional features are also available including integrated ultrasonic cleaners, on board media storage, a direct compound feed system and parts separation options.

The machines work by using a bowl-shaped finishing chamber, comprised of both a fixed upper bowl and spinning bottom disc. The rotation of the disc rotates both the media and parts within the chamber, forcing the mass to the stationary outside wall. Then this mass of part(s) and media folds back to the center. This process is repeated creating a three-dimensional, toroidal action similar to a vibratory bowl finisher. The disc finishers have a north/south gap, enabling adjustment of the gap system to extend machine service life.

Bel Air Finishing / 401-667-7902 / belairfinishing.com

Hybrid Diamond Compound Soluble in Oil and Water

Gesswein offers its hybrid diamond compound, an enhanced compound which is both oil and water soluble. The compound is available in two size syringes, 5 g and 18 g, as well as in medium, standard, or strong concentrations. Higher concentrations cut faster, thereby reducing polishing time. Additionally, a high concentration performs better on harder metals. Uniform synthetic diamond particles enable consistent surface finishes due to strict diamond tolerances. The compound adheres to mold and die surfaces, aiding the polisher in achieving a precision finish. Made in Great Britain, the compound offers heat stability up to 122°F (50°C) and is environmentally friendly and safe to use.

Gesswein & Company / 800-243-4466 / gesswein.com

Molding Rack Systems Optimize Mold Storage Space

Plastics Solutions USA highlights a variety of products. The rack storage NA are molding racking systems that optimize mold storage space using a heavy-duty pull-out shelving system with load capacities from 1000 kg to 10,000 kg. The C-sert, permanent thread repair inserts will not wear out, back out or pull out for high torque industrial applications. The company also offers dry ice blasting equipment that offers a unique, cost-effective and environmentally safe solution to dry ice blasting technology for mold and equipment cleanup, as well as products from the leading brand of mold releases, cleaners, rust preventive, greases and purging compounds.

Plastics Solutions / 305-889-1782 / plasticssolutionsusa.com

Laser Marking System Integrates into Wide Range of Production Lines

Foba features the Titus marking head, which can be integrated into a wide range of production lines due to its small format, tubular shape, easy mounting with a clamping bracket and an optional supply line up to 10 meters long. Its flexibility is also based on an optional straight or inclined by 90 degrees exit angle of the laser beam and the ability to adjust the marking field size to the application requirements.

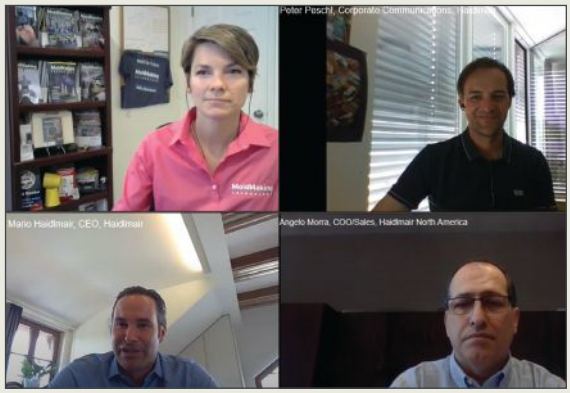
The laser marking system, developed to meet the needs of system integrators and the automotive industry, has advantages resulting from both its design, and the device software. All three available user interfaces can be used to operate the system. In addition to the user interfaces Foba MarkUS and Foba Draw, the remote Foba Go software can be operated by any PC, touch display, tablet or other mobile device. All common industrial communication protocols are also compatible.

System maintenance is simplified by a minute-fast removal or conversion and dust-protected lens. In harsh production conditions, the IP65 or IP69 standard of the marking head provides protection against dust and moisture.

Foba / 800-288-7755 / fobalaser.com

ADVERTISERS' INDEX

THIS MONTH ON SOCIAL MEDIA



YouTube Videos

Christina Fuges chats with this Austrian team not only about a reusable mask project to help fight COVID-19, but also about the role of digital molds today.
youtube.com/c/moldmakingtechnology

Popular Posts

MMT's Leadtime Leader Award Winner, Precise Tooling Solutions, discusses key business aspects, such as leadership, trust, transparency, culture, growth, technology marketing and customer feedback, that sets them apart from other specialty manufacturers.
facebook.com/moldmakingtechnology

@MMTMag Hot Tweets

Phil is back, back again! Phil is back, tell a friend! Phil's got a new question every month, and he's excited to see what's next in our #IfAMoldCouldTalk campaign.
Twitter.com/MMTMag

Conversations

Mold material suppliers are in the fight against COVID-19 just like their mold-building customers, and learning similar lessons too, such as the benefits of going paperless and working remotely.
Linkedin.com/company.moldmakingtechnology

Photo Share

Don't miss out on our 2020 Top 10 Reasons to be a Moldmaker!
Instagram.com/moldmakingtechnology

INSPECTION & MEASUREMENT

3 Lessons Learned about **On-Machine Inspection**

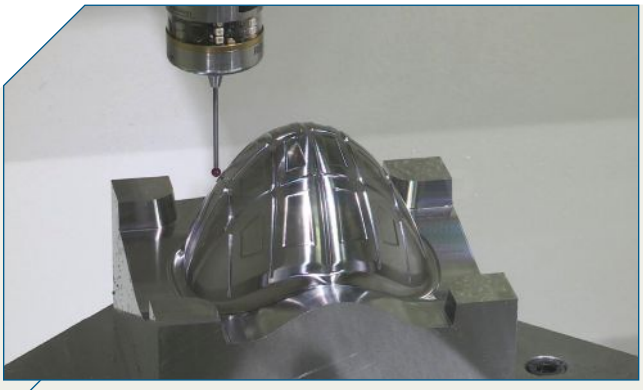


Image courtesy of 3ERP.

During machining of this mask frame mold cavity, a probe can automatically realign the cutting tool and update offsets in reaction to changes in temperature.

By Ronan Ye

For quality control of CNC machined workpieces, many shops use a coordinate measuring machine (CMM) that checks a finished part's geometry and dimensions match the original design. A CMM identifies even the most marginal errors and allows the machinist to rework a faulty part.

However, for a shop owner, the CMM is far from a perfect solution. While this kind of inspection provides security for the customer, it does not guarantee a high level of productivity for the machinist. Identifying errors *after* machining means it's already too late to recover costs. When a machinist must rework a part because the CMM returns a negative result, the value of that part diminishes by half. Twice the expected time is going into it, as well as twice the material.

An alternative solution is on-machine inspection with a machine tool probing system fitted to the CNC machine to set up parts and measure dimensions during and immediately after the machining process.

1. Ease CMM Bottleneck

Restricting quality control to a CMM has significant drawbacks, and problems can escalate beyond simply doubling the labor time and material costs. In a busy shop, any given CNC machine will likely be assigned a new setup as soon as one set of parts are removed from the worktable. If the CMM rejects some parts later on, the machinist will have to wait for a machine to become available—or worse, interrupt another job—then set up the machine all over again. Rejected workpieces can slow down production, producing a domino effect that delays many jobs.

Also, dependence on a CMM may result in long queues, as every job in the shop requires inspection from the same machine or group of machines. Incorporating inspection into the CNC machines themselves can ease the CMM bottleneck, because the inspection burden can be spread across multiple systems or, in some cases, handled wholly by the CNC machine.

2. Improve Efficiency

Using a CMM is usually necessary for quality control, especially during precision machining, because it checks that workpieces meet geometric and dimensional specifications. On-machine inspection can work alone or in tandem with the CMM to make inspection—and the entire product cycle—more efficient.

A machine tool probing system, mounted on the machine spindle or turret, provides numerous benefits to a shop. The system can be used to identify and set up workpieces and can measure features during the machining cycle and immediately after, when workpieces are still on the worktable. A probing system can also monitor the surface condition of the workpiece and initiate automatic offset correction. Additionally, many probing routines do not disrupt the machining process.

Probes are useful because they catch significant errors early, which immediately reduces wastage and reduces the chances of the CMM rejecting a part.

3. Increase Mold Accuracy

On-machine inspection is a particularly valuable asset in the production of molds for injection molding and other molding processes. Probes increase accuracy with machining cores and cavities, leading to better parts and less post-processing. Moldmaking can benefit from an on-machine probe before, during and after CNC machining mold components.

Before machining, a probe can locate the workpiece, in addition to determining part orientation and rotation. During machining, it can automatically realign the cutting tool and update offsets in reaction to changes in temperature. And before the part leaves the CNC machine, the probe can perform mold-specific tasks, such as checking and verifying electrode condition. Each of these functions increases the accuracy of mold production and consequently part quality.

An on-machine inspection system for CNC machines can be highly valuable for all types of shops, as it can capture errors early, provide immediate feedback and automatic offset correction, reduce inspection backlog, ease CMM bottleneck and decrease CMM sampling rate, total inspection time and scrap, while increasing productivity and machining accuracy. MMT

FOR MORE INFORMATION

3ERP / 3erp.com
Ronan Ye, Managing Director, 3ERP

Molding 2020

PT A Plastics Technology Event

October 13-15, 2020

Donald E. Stephens Convention Center, Rosemont, IL

EARLY-BIRD REGISTRATION IS OPEN!

LEARN FROM EXPERTS IN THESE TOPICS

- Best Practices for Quality and Productivity
- Green Molding
- Robotics and Automation
- Digital Manufacturing
- Tooling and Cooling
- Medical, Packaging

2020 HOT SHOTS

NEW in 2020!

Be a part of Molding Conference's 1st **Injection Molded Parts Competition!**

WINNERS WILL BE CHOSEN FOR:

- *Technical Sophistication*
- *Achievement in Molding Efficiency/Economics*
- *Overall winner*

To find more contest details, submit a part, or register for Molding 2020, visit: MoldingConference.com/parts-competition

REGISTER BY AUG 31 *AND SAVE!*

MoldingConference.com

SPONSORSHIPS & EXHIBIT SPACE ARE AVAILABLE!

CONTACT Ryan Delahanty, Publisher | ryand@gardnerweb.com | +1 630-345-3465

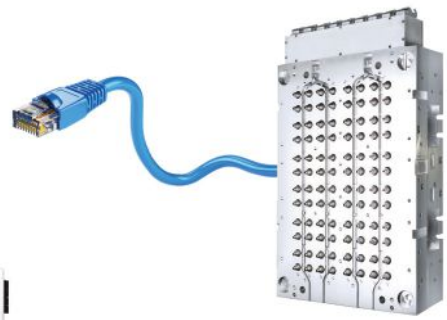
A product of Gardner Business Media, Inc.

Mold Masters®

TempMaster™ series M3

ELIMINATE CONVENTIONAL TC MOLD CABLES

Save Money • Reduce Clutter • Save Space



FEATURING TCONNECT TECHNOLOGY

TC-CONNECT Technology, available exclusively on TempMaster M3 hot runner temperature controllers, is a revolutionary new innovation that completely eliminates the need for conventional TC mold cables altogether. Eliminating these cables, which make up 50% of all mold cables, saves significant cost, weight and clutter from the molding cell. Wiring the hot runner system remains unchanged. This technology is compatible with new and existing Hot Runner Systems.

Contact us today with your application and see what we can accomplish together.

North America • South America • Europe • Asia

905-877-0185 • info@moldmasters.com

www.moldmasters.com