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9. □ Other (please specify)

3a. What is the primary end product manufactured (or service performed) at this location?
331 □ Primary Metal Manufacturing
332 □ Fabricated Metal Product Manufacturing
333 □ Machinery Manufacturing
334 □ Computer/Electronic Product Manufacturing
335 □ Electrical Equip/Appliance & Component Manufacturing
336 □ Transportation Equipment Manufacturing
337 □ Furniture and Related Product Manufacturing
339 □ Miscellaneous Manufacturing
423 □ Wholesale/Trade/Durable Goods
999 □ Other Manufacturing NEC

3b. If your company does NOT manufacture AT THIS LOCATION, specify company’s primary product or service performed. (please specify)

4. Number of employees at your company.
A □ 1-9 C □ 20-49 E □ 100-249 G □ 500+
B □ 10-19 D □ 50-99 F □ 250-499

5. Which of the following market segment(s) does your company serve? (check all that apply)
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2. □ Communications, Computers, Electronics
3. □ Defense
4. □ Energy
5. □ Heavy Equipment
6. □ Medical
7. □ Transportation (including automotive)
8. □ Other (please specify)
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Cover image courtesy of Coborn Engineering Co. Ltd.

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Cutting Tool Engineering regularly features writing by numerous industry experts and practitioners, such as Jeffrey Badger, Michael Deren, Keith Jennings and Christopher Tate.

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Congratulations to the Affolter Group on its 100th anniversary. Louis Affolter founded the Switzerland-based company in 1919. Fast forward to 2019 to find the business in its fourth generation of family management. Affolter manufactures gear trains, machine tools and numerical controls. See this and more on CTE social media.

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Iscar Metals Inc. has introduced T-Face, a family of tools for applications that require small- to mid-diameter facemills, such as 1.25”, 1.5” and 2”.

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Imco Carbide Tool Inc.’s Pow•R•Path APS series features a 5-flute design for high-efficiency machining toolpaths when cutting aluminum alloys.

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My latest business trip took me down the road from where I live. The event was the June 28 ribbon-cutting for machine tool builder Microlution Inc.’s Chicago facility. Microlution has operated as a subsidiary of GF Machining Solutions LLC since 2016.

It felt gratifying to see a manufacturer that I have followed practically since the company was founded in 2005 survive and thrive, especially in my hometown. In a 2007 interview I conducted with co-founder Andy Phillip, then president and now head of laser micromachining, he said he began building prototype machines for micromachining applications while completing a graduate program at the University of Illinois. Phillip described those machines as lab equipment and a development platform without the features and design characteristics typically found in commercial offerings.

Nonetheless, Phillip and Microlution co-founder Andrew Honegger, now vice president of laser micromachining, exhibited at IMTS 2004 in the Emerging Technologies Pavilion and spoke with representatives from major companies who said they “could really use that machine,” Phillip said during an interview. “Not too many people had to say that before a lightbulb came on in Andrew’s and my heads, and we said we should probably try to do something about this.”

After launching, Microlution began building a 3-axis horizontal micromilling machine. The company currently offers four models of laser micromachining centers.

In reviewing my transcription of that interview and the one I conducted a year later, I was a bit surprised at their length, totaling about 6,000 words. Then I counted the number of interview transcriptions I’ve done since I started at Cutting Tool Engineering nearly 20 years ago—more than 1,200.

Something else that took 20 years to make is The Book of Grinding by Jeffrey Badger, aka The Grinding Doc. CTE readers should be familiar with his bimonthly Ask the Grinding Doc column. According to Badger, he spent 1,000 hours a year on average to create the 4,000-page e-book. He stated that it “translates” academic grinding concepts into plain English and uses The Grinding Doc’s trademark style: simple, practical, easy to read and entertaining. For more information, visit www.thegrindingdoc.com.

Looking back, Badger’s first column appeared in the March 2001 issue. The following month, Michael Deren’s Machinist’s Corner column premiered, and those two columns have run in roughly alternating issues since. That will cease after this year because Deren retired from the manufacturing industry in June and plans to wrap up his stint as a CTE columnist in October. I will certainly miss his thoughtful insights about work and life in general, and I wish him well with his next endeavor. Deren reported that he and his wife purchased a 12-lane bowling alley in Green Lake, Wisconsin.
THIS IS NOT A FACE MILL
Metallurgical Product Review

**FACEMILL EFFICIENTLY CUTS HEAT-RESISTANT SUPERALLOYS:** The CeramicSpeedMill from Tungaloy America Inc. accepts negative, double-sided ceramic inserts. The TS200 and TS300 SiAlON ceramic inserts, combined with the close-pitch cutter design, enable milling nickel-base superalloys at 500 sfm or higher. TS200 is for finishing, and TS300 is for de-scaling and other roughing applications. Cutter sizes are from 63mm to 80mm.

[Tungaloy America Inc.; www.tungaloy.com/us](http://www.tungaloy.com/us)

**ROBOT CELL FOR WIDE RANGE OF WORKPIECES:** The RoboCell One robot cell from Fastems LLC is for handling workpieces weighing up to 176 lbs. and for automating up to two machine tools of the same type—either lathes or milling machines. The cell is for flexible production of different batch sizes. The robot can be fitted with single, double or special grippers. Up to six different grippers may be used for handling workpieces in specific production operations.

[Fastems LLC; www.fastems.com](http://www.fastems.com)

**INSERTS FOR CRITICAL PARTS:** Seco Tools LLC says its TTP2050-grade threading inserts have a nanolaminate PVD coating and an advanced tool geometry to control chips and prevent them from ruining critical parts in the final phases of production. The coating has alternating layers of TiAlN and TiSiN. The inserts are available in 44 profiles in 11mm and 16mm sizes.

[Seco Tools LLC; www.secotools.com](http://www.secotools.com)

**CHUCK DOUBLES TURRET STATION CAPABILITY:** Exsys Tool Inc. offers a two-collet chuck for Mazak Quick Turn and QTU series turning centers. The chuck is suitable for speeds up to 10,000 rpm. With the chuck, shops can switch between fixed and rotary base holders with quick changeovers in one station on the machine turret and mount any combination of two collets, endmill holders, expanding collet chucks and shrink-fit tooling on a single base holder.

[Exsys Tool Inc.; www.exsys-tool.com](http://www.exsys-tool.com)
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Metalworking Product Review

**BANDSAW BLADE CUTS SMOOTHLY:** The Bahco brand 3851 Sandflex Cobra bandsaw blade from Snap-on Industrial Brands has a powder metal M42 HSS tooth edge for high hardness and enhanced toughness. Hook-style blades have a traditional tooth design with a 10° rake angle. Combo-style blades have variable teeth with a rake angle of 8° to 10° for enhanced performance.

Snap-on Industrial Brands; www.snaponindustrialbrands.com

**THREAD MILLS OFFER MAXIMUM CONCENTRICITY:** The SPTM EXJ thread mills from Scientific Cutting Tools Inc. are for cutting external UNJ threads. There is a single thread profile to minimize side-cutting pressure. The noncrest cutting design enhances flexibility for plated and nonstandard threads. The tools will cut any size external thread of the pitch listed.

Scientific Cutting Tools Inc.; www.sct-usa.com

**ENDMILL MACHINES UNDERCUTS:** BIG KAISER Precision Tooling Inc. introduces the Lollipop from Sphinx, an endmill for machining undercuts and deburring. The undercutting endmill is suitable for 3- and 5-axis applications, but 5-axis applications are more common because of the operator’s ability to rotate and index the tool. The undercutting angle used in most operations is from 220° to 300°, and the corresponding angle for the tool is 270°.

BIG KAISER Precision Tooling Inc.; www.bigkaiser.com

**ROBOT HAND GRASPS OBJECTS OF VARIOUS SIZES, SHAPES:** THK America Inc.’s TRX robot hand integrates fingers, an actuator and a driver controller in a space-saving design. Compact and large models are available. The compact TRX-S weighs 320g, has a maximum gripping diameter of 100mm and allows for the transfer of a heavier object when attached to a robot arm. The large TRX-L weighs 1,200g and has a maximum gripping diameter of 150mm.

THK America Inc.; www.thk.com
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Welcome to September and the home stretch of 2019. Hopefully, this period will include plenty of machining after a summer lull in our market that involved lots of people on vacation and a few projects put on hold until those people returned. Whatever the reasons for the letup, some suppliers eventually were impacted—we noticed an increase in their visits and requests for business. They explained that a number of markets suddenly had slowed and because our shop was consistent, they were eager to maintain our account and provide professional service. We also noticed a sizable increase in contacts from out-of-state companies seeking business, indicating an ease in manufacturing.

Such meetings with good suppliers may include owners like me, managers or other key employees. Visits might feature a lunch outing or a trip to the shop office. But sometimes, owners aren’t available and can’t be present for a conversation. This scheduling conflict puts us in the position of relying on employees to professionally represent and support the company. It requires confidence and trust in crucial employees, who we must have on our side to succeed.

This requirement was made clear to me again after an important supplier finished a business lunch with several of our staff members but no owner. After returning to our office, the account manager saw me and privately reiterated his appreciation for our business and the professionalism of our staff. Best of all, he affirmed our employees’ vocal support and backing of the owners and managers, even with all the ups and downs.

While owners and managers should recognize and reward the efforts of good employees, reciprocation of that recognition back to owners and managers from employees isn’t so common, as it’s not their job to do so. But when you get word from several primary vendors who confirm your employees’ support of you, your company and your management team, you realize why it’s good to be in business and work with such a high-quality group.

There are many examples of employees in such conversations conveying the opposite attitude—showing a lack of support for management or owners, complaining or being disgruntled—all without your knowledge because you can’t be at every meeting. Undermining management and ownership creates instability and other issues, which are obviously bad conditions for making good parts at a machine shop. This unfortunately goes with the territory. Everyone isn’t happy all the time.

However, earning the loyalty of pivotal employees and their positive representation of your business, values and management dramatically will increase your likelihood for success. I was grateful to be told several times this year that our employees professionally represented the company and our family. Now that we find ourselves approaching fall, it’s great to know that your team has your back.

Keith Jennings is president of Tomball, Texas-based Crow Corp., a family-owned company focused on machining, metal fabrication and metal stamping. Contact him at jennings4176@yahoo.com.
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MOTIVATION FOR AUTOMATION

By William Leventon

Recent developments could win more converts to automated loading and unloading of machine tools.

When a machine is loaded manually, “once every cycle somebody would need to open the door, put a new slug on the main spindle, close the door again and press the start button,” said Raphael Engel, proposal engineering manager at Index Corp., Noblesville, Indiana. “If we assume a two-minute cycle time, that person would have to be at the machine 100% of the time and could basically do nothing else.”

If a machine is equipped with an automation cell like The iXcenter’s 6-axis robot (right) can handle parts that weigh up to 6 kg. Although it features a space-saving design, iXcenter (below) can store up to 22 stacked pallets measuring 600mm × 400mm.
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Index’s iXcenter, however, an operator might need to go to the machine only once every four hours to unload finished parts and load the drawers in the cell’s rack with new slugs. In addition, the machine could run unattended when the last shift leaves for the day.

“You can put new slugs in (iXcenter) before the late shift leaves,” Engel said. “If you do not have a night shift, the machine will still run for hours until there are no parts left. So you can get more productivity out of your machine without increasing your staff or having additional shifts.”

Available with Index’s C series turning centers, iXcenter docks to a machine and easily slides aside to allow unobstructed access to the work area. The system features a compact vertical design capable of storing up to 22 stacked pallets that measure 600mm × 400mm. Pallets are loaded with blanks at the top of
the system, and pallets with finished parts are removed at the bottom. Loading and unloading can take place at any time without interrupting production.

The system’s 6-axis robot can handle raw and finished parts that weigh up to 6 kg. The robot pulls out one of the system’s drawers, takes out a raw workpiece and loads it into the machine. The sequence is reversed to put back a finished part.

Although the cell consumes minimal space, extra room inside allows incorporation of downstream processes, such as cleaning, measuring and deburring, Engel said.

He said similar automation cells are on the market but that iXcenter’s distinguishing feature is its integration with the machine by the machine supplier. “A third-party automation company would need to modify the whole machine to get (the
Another automation cell designed specifically for machines made by the cell manufacturer is Variocell Pallet, which was introduced this year by Chiron Group SE, Tuttlingen, Germany, to work with the company’s new FZ/DZ 16 series vertical machining center. Variocell Pallet uses a telescopic gantry with a fork gripper to move part-holding pallets between the 5-axis machining center and a rotary table that can hold up to 10 pallets. The gantry and gripper can handle pallet payloads of up to 300 kg. With a footprint of 2.2 m², Variocell Pallet takes up minimal space on a shop floor, said Chiron Product Manager Patrik Schlayer.

The system is moved into the machining center work area with a transfer trolley equipped with driven rollers. Unlike inflexible rail-type systems, Variocell Pallet can move in three directions, making it easy to clear space around the machining center when necessary.

Both Variocell Pallet and iXcenter add roughly 15% to the cost of a machining setup. On the other hand, Engel pointed out that systems like these can save significant amounts of money for users by drastically reducing machine-loading labor. “So you can get your investment back pretty fast,” he said.
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AVOID COMMON INVENTORY MISTAKES

By Darr Greenhalgh

No matter what kind of manufacturing facility I’m in, there’s one thing I hear over and over when I ask workers on the shop floor about indirect inventory: They want it available—regardless of when and how frequently they need it.

Workers want to be confident that when they need a part or supplies, they will be there. Personnel don’t want to wait for a repurchase order to go through and then for the inventory item to arrive and be stocked.

This pressure from the floor often flows through to buyers who have a hundred other concerns pulling at them and are already pressed for time. As a result, I see three common, recurring inventory mistakes. If left unchecked, these errors can increase costs, decrease efficiency and reduce margins.

Mistake No. 1: Buying and inventorying too much.

Plants often source from multiple suppliers and distributors. Sometimes one may not be a reliable supplier for a particular item. This can lead to problems with inventory visibility, which in turn can lead to shortages of certain items. How do workers respond to these problems? They take more than they need.

If operators aren’t confident that something will be in the tool crib or a vending machine when needed, they’ll take extras to store at their workspaces. While this might solve their short-term, individual problems, it can create a costly buildup of invisible inventory throughout the plant.

The recorded crib inventory will then be lower than what’s actually available outside the crib, resulting in early, unnecessary buying. Based on inventory data, the rate of consumption of some inventory items may appear higher, causing overbuying. The net effect is more inventory on hand than needed.

Solution No. 1: Allow a trusted distributor to manage your indirect inventory.

This solution will not only remove that task from your to-do list but create a more reliable inventory tracking system. That increased reliability means that workers will start to trust the system more, reducing hoarding and its associated problems.

Mistake No. 2: Not having a single source of truth about inventory.

I often tour plants that have inventory data sitting in multiple disconnected systems. Data about purchases lives in the purchasing system. Crib inventory records track some of the inventory managed there. Other inventory is managed—and tracked—in a separate vendor-managed system or not tracked at all.

These disparate systems can make it difficult to have a reliable, single source of truth about your inventory, such as how much was
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purchased, how much the plant has used and what’s sitting in a crib, in a vending machine or elsewhere on the shop floor.

As a result, accurately analyzing how your indirect inventory is used, setting reorder intervals and knowing your true cost of production can be nearly impossible.

Solution No. 2: Integrate purchasing and inventory tracking processes into a single business system. A distributor can often help with this solution.

Mistake No. 3: Multiple part numbers exist for the same item.

More times than I can count, I’ve gone into a plant and, in the course of analyzing operations and MRO inventory, discovered that the facility has been buying the same part from multiple suppliers or distributors. This creates numerous problems.

That item often is given a different part number by each supplier, creating invisible, duplicate inventory. It can seem like it’s time to reorder something when you already have the supply on hand—if you can identify the right part numbers. A portion of your balance sheet may be hidden in this invisible inventory and unavailable until you find a way to unlock it.

Solution No. 3: Choose a single trusted distributor to help identify those duplicate part numbers and then consolidate that item in the same place under the same part number. This is one of the ways that a broad-line, consolidated distributor can give your facility a competitive edge.

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about the author

Darr Greenhalgh is senior manager of customer solutions at MSC Industrial Supply Co. Inc., a North American distributor of metalworking and MRO products and services. For more information, call 800-645-7270 or visit www.mscdirect.com.
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I have known many supervisors, manufacturing engineers, managers and owners who started in a shop environment and came up through the ranks. This shows true dedication to their careers and true devotion to their found callings. Manufacturing is alive and well in America.

After you received a promotion, did you notice that some of your co-workers treated you differently? Yeah, some ribbing is to be expected. But did you start getting the cold shoulder after a while?

I have watched different individuals over the years as they have advanced at companies. I've watched some succeed while others crashed and burned. Why did some succeed and others fail?

I remember when I was promoted to programmer from the shop floor. I was walking on air. I could do no wrong—or so I thought. Most guys in the shop made me feel comfortable in my new position. A couple, however, tried to make my life hell by pointing out my programming shortcomings at every opportunity. Although some of the criticism was justifiable, a couple of people were just envious and wouldn’t do anything to better themselves, let alone help someone else succeed. I took the constructive criticism in stride, which made me a better programmer.

I knew a manufacturing engineer who was hired at a company I worked for. He dove into his new position with resolve. Unfortunately, within a couple of weeks, he had alienated himself with many of the shop employees and some of the management team. How did he accomplish this amazing feat? He forgot to treat others like he would have wanted to be treated when he was in their shoes.

Instead, he came on like gangbusters and found that everything they were doing was wrong. They were using the wrong tools and setups and employing poor machining practices. The list went on. He knew better and was going to cure all the shop’s problems overnight.

He didn’t want to listen to suggestions from some of the managers he had to interact with, which posed a problem. Now, he had to backpedal and attempt to repair some of the damage he had done. He finally came to realize that he was doing something wrong.

Eventually, he started to listen to people and became open to suggestions. As a result, shop workers became more receptive to some of his ideas and developed additional improvements on their own. He finally accepted that major improvements were not going to happen overnight but would take time. Before you knew it, the little improvements that were made wound up producing big improvements overall.

You must remember to treat people as individuals. Respect them for who they are and the knowledge they possess. As we progress through our careers, we should always be willing to listen and learn from others no matter their position. The knowledge they have can be career-related or a life lesson.

One lesson I have learned is that the people you work with can make your career enjoyable or a living hell.

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By Alan Richter

A special form tool just fractured, and much to the dismay of the machine shop supervisor, that was the last special form tool in inventory. Worse yet, the lead time for a replacement is long. If we’re talking glass half full, this is, at best, a good learning experience to help the shop avoid this scenario in the future.

Let’s consider one surefire solution: purchasing a CNC tool and cutter grinder to produce cutting tools when needed and resharpen them as they wear down.

There is a need for job shops and other part manufacturers to bring CNC tool grinding in-house, and the need is increasing because delivery times for specials are getting longer, according to Eric Schwarzenbach, president of Rollomatic Inc., Mundelein, Illinois. He added that the delays are due to the strong U.S. economy and most tool grinding companies being filled to capacity.

“Maybe they are even hesitant to add more equipment because of uncertainties in the economy,” Schwarzenbach said about the tool grinding companies. “It is a good time for job shops to think about bringing a cutter grinder in-house.”

Anca sells about 20% of its tool and cutter grinders, such as the FX7 Linear, to machine shops.
He pointed out, however, that Rollomatic isn’t targeting this market segment because the majority of shop applications would involve tool resharpening, and its grinding machines are not built for resharpening. “We would never try to promote a Rollomatic machine for resharpening.”

But Strausak Inc., a member of the Rollomatic Group, does build grinders for resharpening tools, noted Joe Kane, president of the Mundelein-based company. Strausak’s staple model is the U-Grind, which he estimates is used about 40% of the time for regrinding.

The 5-axis CNC tool grinding machine with an integrated six-position wheel changer helps a shop reduce setup time, which is what shops spend the majority of their time performing, Kane said. Because job shops typically operate in a high-mix, low-volume environment, he added that they lose money...
Bring It In

when a machine tool is not running.
The machine also comes standard with a quick-change collet system, a tool probe and a wheel probe. “The thermal stability of the machine allows that first tool to come off right,” he added. “It is just little things like that that lend itself to being a quick-change job shop machine.”

Standard Modifications

Star Cutter Co. is another grinding machine builder that sells tool and cutter grinders to job shops. Aaron Remsing Jr., product manager for the Farmington Hills, Michigan-based company, said it’s not necessarily the number of machines a shop has that makes it a good candidate for grinding tools in-house. “It is a lot less based on size and more based on tool consumption. If you are spending 50, 60, 70, 80
grand a year in tool reconditioning, you really start to make the justification for bringing it in-house.”

One machine shop, for example, grinds tools in-house because 10 of its machines are multiple-axis Mazaks that hold 2,300 tools, Remsing said.

Not having to send those tools to a regrinding company is certainly one motivating factor for buying a CNC tool grinder, but many end users see a bigger benefit in being able to improve processes or make changes to standard tools, such as modifying the diameter or a specific geometry, according to Remsing. “Having that flexibility of changing a tool or making a custom tool right there on the spot, that’s the key for them.”

In addition to machine tools, Star Cutter manufactures cutting tools, and Remsing said the company often targets large machine shops for tool grinder sales. “If they are going through a high volume of...
tools, they want to at least have a conversation.”

He added that Star is ramping up its focus on the job shop market as lead times for specials increase. Plus, the company expects job shops to account for 10% of Star’s tool and cutter grinder sales next year.

Anca already sells about 20% of its CNC tool and cutter grinders to machine shops, said Pat Boland, joint managing director for Anca Australia, Bayswater, Australia. (Anca Inc. is in Wixom, Michigan.) A suitable prospect is based on not only tool consumption but the types of tools being applied.

“It seems that screw machine shops where there are a lot of step drills and custom tools being used, which are also expensive tools, tend to justify the purchase relatively easily,” he said, “whereas a company that is mainly using cutters with inserts is a different kettle of fish.”

Turn Out the Lights

Any of the company’s models are suitable, Boland added, but those targeting the high end of the lineup are looking to perform unattended resharpening. A key feature that enables lights-out production is the use of radio frequency identification tags for each cutting tool and having the machine read the tag, which contains all the necessary reground information, when the machine is
The Star NXT tool grinder, which provides a large grind zone with a small footprint, can run small- and large-diameter wheels.

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loading a tool.

“That works very well in a very structured machine shop where all the cutting tools are known,” he said. “Every time a new tool is introduced, you are required to reprogram the regrinding sequences.”

Controlling tool size is another important automation element. “Probably the biggest driver is in-machine measurement,” Boland said. “At a micron level, we can measure the external features of the tool using a laser measurement system.”

Matt Morgan, regional sales manager for Schütte Corp., Jackson, Michigan, concurred that in-machine measurement is important, but the machine tool builder primarily offers a touch probe for its tool and cutter grinder, the WU335 Linear. He emphasized that end users frequently probe tools to ensure that the tools produced during unattended grinding will not experience an unacceptable level of runout when applied. “The software can be set up to compensate automatically for tool runout.”

He noted that the company’s single cutter grinder model can also be configured to produce medical parts. “This is a very versatile model. We can do free-form surface grinding for medical knees, for example,” Morgan said, adding that it can grind the flutes of cutting tools up to 19” long.

Automation’s role at job shops, added Strausak’s Kane, is not necessarily to satisfy production requirements but to help bridge the skilled labor gap. For instance, a shop might need to grind only 10 tools, but each could have a cycle
Automating a tool and cutter grinder helps a shop bridge the skills gap.

time of 30 minutes. “The payback is there because it allows somebody to go do something else,” he said.

Getting a Return

The return on investment for a tool and cutter grinder is easy to justify when a shop regrinds a large quantity of tools, especially form tools that have long lead times, Kane noted.

“We’ve had customers tell us they are waiting 12 to 14 weeks,” he said. “The tools are expensive, so they are only buying what they need. It puts them in a pretty precarious situation when they are on their last one and they might have to wait three months.”

According to Rollomatic’s Schwarzenbach, U-Grind doesn’t require all the peripheral equipment often needed to run a tool and cutter grinder, such as one from Rollomatic. Because the
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Strausak grinding machine can probe and dress wheels inside the machine, it doesn’t need a stand-alone wheel presetting station and an external wheel dressing machine. Not only do those external pieces of equipment cost money, they consume valuable floor space.

Floor space is at a premium at a vast majority of shops, and the tool grinder being installed is more of a business expense than a revenue generator, said Star Cutter’s Remsing.

Star Cutter’s NXT grinder can produce a tool up to 10” in diameter and 16” long in a machine that is roughly 7.5’×7.5’, he added. “We did as much as we could possibly do to have a small footprint with a very large grind zone.”

Although the Schütte machine has a footprint of about 6’×6’, Morgan noted that it does require a coolant system with a chiller, which is a bit larger than the machine. “With the linear motors, there is no ballscrew involved, so the motors are creating heat and we have to keep them cool.”

Morgan added that Schütte engineers turned the overall working envelope by 30° and reduced the overall grinding machine footprint considerably.

Similar to other equipment investments, shops that purchase a CNC tool grinder target a two-year payback, Morgan said, noting that the base Schütte grinder costs about $400,000.

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Move over, manual

Numerous machine shops have employed manual machines when reconditioning tools. However, as more and more skilled manual tool grinders retire, machine shops are finding that it is impossible to replace them, according to Anca’s Pat Boland. As a result, those shops look at buying a CNC replacement.

“Operating a CNC tool grinder does take some training,” he said, “but it is much easier to train somebody to operate a CNC tool grinder than a manual tool grinder.”

Although someone at a shop must program a CNC grinder, the software is getting easier and easier to use, said Matt Morgan at Schütte Corp. “Initially, when they first get their machine tool, there is quite a bit of training and support after the sale, but after a short time they can pretty much stand on their own.”

Aaron Remsing Jr. at Star Cutter Co. concurred. “I came from machining centers and lathes, and I think the software on these grinding machines is much more adaptable and easier.”

A shop probably doesn’t have a cutting tool engineer on staff, but it must have somebody who understands tool prints and geometries, such as a manufacturing engineer or machinist, Remsing said. Therefore, it’s just a matter of cross-training people to run a CNC tool grinder.

In addition to producing tools more consistently and accurately than manual grinding, a CNC grinder makes higher quality tools. This result is because manual grinding is done dry while coolant is applied during CNC grinding, said Rollomatic Inc.’s Eric Schwarzenbach. Without adequate coolant, a grinding wheel can impart a poor surface finish or destroy a carbide tool, he added. “Carbide can also burn, but often the material is more prone to chipping and the cutting edge is more saw-toothed than a good edge.”

—Alan Richter

Move over, manual

Regrinding tools in-house can also significantly reduce tool costs by increasing the number of regrinds. Anca’s Boland explained that because the cost of internal grinding is low, a shop that reduces the amount of time a cutter is used before regrinding it enables the shop to regrind the cutter many more times than when outsourcing the task.

“One endmill they showed me had 16 regrinds,” he said about a shop that uses the technique.

Even when investing in a CNC tool and cutter grinder makes economic sense, some large shops outsource tool production and reconditioning because it is not a core activity, Boland said.

Another option that Boland has witnessed at a few companies involves contracting a regrinding company to operate a regrinding service in their plants. “They get the advantages of quick turn-around and dedicated service, but they don’t have the requirements of managing the operation, training or finding skilled operators and so on.”

—Alan Richter

‘If you are spending 50, 60, 70, 80 grand a year in tool reconditioning, you really start to make the justification for bringing it in-house.’

Bring It In

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A builder of grinding machines is adding digital services to improve product performance.

By Alan Richter

Through a partnership with an industrial internet of things specialist, Coborn Engineering Co. Ltd., Romford, U.K., adapted machines for grinding and polishing diamonds into smart equipment by implementing digital services. According to Steve Westlake, managing director of Coborn, the technology from Berlin-based relayr GmbH enables a unique predictive maintenance regime. (Precision International Corp., Haines City, Florida, is the sole authorized agent for Coborn in North America, and relayr’s worldwide corporate headquarters are in Boston.)

“We were planning to develop a ‘smart’ machine but knew that we would have to work with an IoT partner,” Westlake noted in an email. “We then received an email from relayr, which explained their vision and technology. This aligned perfectly with our requirements, so we started the dialogue.”
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- Mount the ball on a wire for flexibility to go around corners in pipe and tubing, for example.
- Easily measure the width of grooves or the surfaces of spherical and toroidal features.
- Accurately measure the pitch diameter of bearing races, threaded surfaces and of gears.

The partnership will help Coborn grinders be more predictive of any failures or breakdowns and other machine optimization recommendations, noted Guneet Bedi, general manager of the Americas for relayr. “As a result, Coborn can reduce downtime and increase revenue streams.”

With anomaly detection through relayr’s artificial intelligence-based analytics, data collected from Coborn’s machines will allow the machine builder to determine and resolve failures in advance. AI-based analytics establishes a normal operation signature for a machine in operation, Westlake explained.

A partnership between Coborn Engineering and relayr is designed to turn a machine for grinding diamond tools, such as this Coborn RG9A, into a piece of smart equipment.
“The machines are being monitored and analyzed constantly, so when the normal signature changes, we are notified of (the) anomaly so that we can investigate this possible problem from the U.K.,” he stated. “If we detect a developing problem, we can contact our customer and plan a machine shutdown to address the problem or plan a visit from one of our service engineers.”

‘If we detect a developing problem, we can contact our customer and plan a machine shutdown to address the problem.’

Delivering preemptive service to each customer will enable Coborn to offer machines with guaranteed performance and availability targets, according to the company. The predictive element will allow Coborn to manage most failures, but there will still be random failures, which the company must address, Westlake added.

“We will guarantee that a machine will not be unavailable for a specified period of time depending on which global market the machine is operating in,” he stated. “If we are unable to repair the machine within this time, we will pay the customer an agreed daily rate for lost production.”

In addition, Coborn reports that
it will offer a pay-per-use business model for its equipment, which is also known as an equipment as a service (EaaS) model. Under this model, Coborn does not sell grinders but makes them available for a usage fee. Coborn will remain responsible for maintenance, service, repairs and parts. This model reportedly makes Coborn’s products easier to finance, especially for companies in developing markets. There will be an agreed monthly payment, which is fixed during the purchase period.

“The customer will not have to pay anything extra at any time during this period,” Westlake noted.

“In addition to helping Coborn offer guaranteed uptime, by using these AI-based solutions we can also help Coborn transition to an EaaS model,” Bedi stated, noting that the model “future-proofs” Coborn’s revenue stream.

He added that the EaaS model comes with tax benefits because customers will be able to classify a grinder as an operating expenditure instead of a capital expenditure.

At the end of a grinder’s service life, a customer can purchase the machine for an additional cost, with an option to buy an annual service package, or the customer can replace the grinder with a new one, Westlake stated. The expected service life of a grinder is about 40,000 hours, he added.

“This equates to around five years for a company using the machine 24 hours a day, seven days a week,” Westlake noted. “We have CNC grinding machines that are still in operation after 20 years of operation.”

Although Coborn has encountered some skepticism about the proposal the partnership is presenting to the industry, Westlake is optimistic about the partnership’s ability to increase asset utilization and make equipment financing easier for the customer.

“We are always looking for new technologies and new processes that provide solutions for our customers and add value to their businesses,” he stated. “The initial take-off will be slow as we have to prove the predictive element, but certainly within five years this type of smart machine will be the norm.”

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By Kip Hanson

The term “rapid prototyping” entered machine shop parlance in the late ’80s, not long after 3D Systems Inc.’s co-founder Chuck Hull invented stereo-lithography (SLA) and then opened the doors of the world’s first commercial 3D printer manufacturer. People soon began turning to SLA-equipped service bureaus for help with product development, expecting prototype parts in hours or days rather than the weeks and months to which they were accustomed.

Missing Metal

There was one problem: If you wanted prototypes made of metal, you’d best hope you were still in good graces with your local machine shop after abandoning it for some

about the author

Kip Hanson is a contributing writer for CTE. Contact him at 520-548-7328 or kip@kahmco.net.
upstart service bureau. That’s because those early SLA prototypes were available only in photo-cured resin.

This limitation began to lift with the advent of fused deposition modeling (FDM) and selective laser sintering, both of which offer far more polymer options than SLA. What’s more, SLA quickly expanded its resin-based offering. The result was that practically any polymer became printable, including ABS, PET, nylon, polycarbonate, TPE and PEEK. Still, none of these technologies could print metal.

That’s changed over the past three decades with the development of metal powder bed 3D printing and, more recently, binder jet and metal-injection-molded-like...
(MIM) additive manufacturing (AM).

Jeph Ruppert, director of the Customer Innovation Center for 3D Systems, Rock Hill, South Carolina, said today’s metal powder bed printers make it possible to produce prototype and low-volume production parts from various metals, such as tool steel, titanium, stainless steel and cobalt-chrome alloy. In metallurgical terms, these 3D-printed alloys are virtually identical to their forged, cast or rolled counterparts, and the same freedom of design common with 3D-printed polymer parts is available with metal ones.

This stainless steel lamella heat exchanger was designed for restricted space in an assembly. Additive manufacturing enabled the inclusion of encapsulated conformal internal channels, as well as integrated turbulators to improve the heat transfer coefficient, and reduced the part count from 40 pieces to one.

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“Thanks in large part to Chuck Hull’s invention, plastics have long been the standard material for rapid prototyping,” Ruppert said. “Prototyping in metals, however, offers several advantages. If the part you wish to produce will ultimately be made of metal, a metal prototype gives you a better representation of its form, fit and function. Also, metal parts are generally more durable than ones made of plastic, meaning they can better withstand the rigors of testing.”

Ruppert said rapid prototyping with metal is becoming more accurate, affordable, functional and faster. Speed is especially beneficial in a world that demands quick turnaround on design iterations. As a result of this synergy, 3D Systems—together with competing service providers and AM equipment builders—has seen an exponential increase over the past five years in metal powder bed prototyping requests from customers in the aerospace, medical and energy industries. This trend also correlates to the increased adoption of metal AM in full-scale production.

Examples are orthopedic implants and surgical instruments, aerospace structural components and industrial parts.
gas turbine components. “Prototyping in metal also reduces the development cycle, dramatically in some cases,” Ruppert said. “Because the prototype part is so much closer to the finished, functional part, the path to market within these critical-application industries is much more direct.”

Manufacturing Accelerated

Maple Plain, Minnesota-based Proto Labs Inc., which does business as Protolabs, does not build 3D printers—metal or otherwise—but sure uses a lot of them. Joe Creatella, application engineer at Protolabs’ Morrisville, North Carolina, facility, noted that the company owns 25 of Concept Laser’s high-resolution metal powder bed printers, 24 more than when he began working there seven years ago. “We’re definitely seeing a greater call for 3D-printed metal prototypes,” he said.

“It’s one of the fastest growing segments of our business.” Supporting that many printers requires significant machining capabilities. That’s because 3D-printed metal prototypes need more secondary processing than their polymer counterparts. The metal scaffolding used to support parts and keep them from twisting and

‘Metal parts are generally more durable than ones made of plastic, meaning they can better withstand the rigors of testing.’
warping during the printing process must be removed, either manually with a hand-held grinder or machined away in one of the company’s CNC machine tools.

Similarly, the surfaces of 3D-printed metal parts are typically rough—similar to that of a sandcasting—and must be milled or turned if a smoother finish is specified. Holes are often reamed, bored or threaded. Features with tolerances in the neighborhood of ±0.005" or less must be machined, depending on the application. Heat treatment to remove thermally induced stress is also needed; plus, bead blasting to remove surface irregularities is common.

The takeaway is clear: Thanks to all this post-processing, never mind the higher material costs, a 3D-printed metal prototype is more expensive than the same part made of polymer. How much more is largely based on part size, its geometry and the alloy used, but several times the price is a reasonable guesstimate. However, as Cretella noted, cost comparisons like this are usually meaningless.

“It’s not so much a matter of metal versus polymer but rather a question of powder bed printing versus machining,” he said. “If the customer is looking for a prototype of a simple bracket or shaft, for example, then we would probably recommend using quick-turn CNC machining to produce it. If it’s a complex part
geometry, however, something that requires multiple operations, or the customer is trying to reduce the number of components in an assembly—these are all areas where metal 3D printing shines, particularly in a prototype or low-volume production scenario.

X Marks the Spot
Xometry Inc., Gaithersburg, Maryland, is another web-based provider of machined, fabricated, injection-molded and 3D-printed prototype and low-volume parts. Greg Paulsen, director of application engineering, agreed that the call for metal prototypes has grown exponentially over the past five years or so and suggested that machining remains a strong competitor, especially for parts that have not been designed with 3D printing in mind.

“There’s still a lot of learning to do when it comes to understanding what it is, what you get out of it and the nuances of the process itself,” he said. “With CNC machining, for example, the less metal I have to remove or the simpler the part design, the cheaper it is to make. A chunk of ½”-thick metal plate with a pair of holes in it, for instance, is about as easy as it comes, but that same part would be quite expensive to print.”

Now take that same plate and hollow it out with a honeycomb pattern or fill it with a series of square holes, and almost any CNC machine shop would immediately no-quote such a job, whereas a shop with a metal powder bed printer thrives on such complex work. Undercuts and inaccessible recesses; thin walls; weird or intersecting angles; free-form “organic” shapes; meshes; helices; and bonelike structures are common fare for any 3D printer.

“That’s one of the first things I see when a new customer is reviewing whether DMLS is right for them,” Paulsen said about a common style of metal powder bed printing. “They’ll throw a $12 part at it that they’ve been making for years and are surprised when it costs $400 to print. Yes, you can build practically anything with a 3D printer, but unless the part is actually designed with 3D printing in mind, the results will probably be disappointing.”

So how do you know which parts—prototype or otherwise—are best for 3D printing? Every workpiece is for instance, is about as easy as it comes, but that same part would be quite expensive to print.”

‘We’re definitely seeing a greater call for 3D-printed metal prototypes.’
different, but remember that metal powder is relatively expensive, as are the lasers used to fuse it. If a part is not “blocky” or monolithic, contains one or more of the complex features listed earlier or is difficult or even impossible to machine, it’s probably a good fit for AM.

Visiting an Old Friend

Not all metal printers are powder bed. A new breed of 3D-printing technology—one that shares many similarities with the decades-old MIM process—has entered the fray, and it promises to take 3D printing beyond prototype and low-volume production into automotive-level volumes.

Larry Lyons, vice president of product at Desktop Metal Inc., Burlington, Massachusetts, said his company took a two-pronged approach: one aimed at prototyping and the other at production volumes that laser metal powder bed printers can’t hope to reach.

“One of our first customers was Milwaukee Tool, who came to us for help with an auger bit that they’ve been producing for many years,” he said. “Using our Production System, we were able to take their existing 17-step manufacturing process and reduce it to just four steps, delivering a 15% cost savings on a product that sells at a rate of roughly 10 million units annually.”

The Production System works much like the

The Studio System eliminates lasers and loose powders often associated with metal 3D printing, making it safe to use at any facility.
company’s prototyping printer, known as the Studio System. As with powder bed machines, the Production System lays down individual layers of metal. But instead of using a laser to sinter them, a polymer binder is applied to hold them together until printing finishes. The Studio System, on the other hand, extrudes rods of metal powder mixed with polymer and a wax binder, similar to how an FDM-style printer works. In either case, the “green” workpiece is placed into a de-binding station before being sintered in a furnace. The result is a homogenous, fully dense metal part no different from one produced with the MIM process.

“Desktop Metal was founded in 2015 with the goal of trying to bring metal 3D printing into the mainstream,” Lyons said. “It’s this mission statement that led us to our two-pronged approach. We feel that the current laser-based metal printing technology has a number of limitations in terms of speed and cost that our systems avoid. There are some differences in the way that the Studio System and Production System print that may impact the part design, but otherwise the two are quite similar in terms of functionality. A clear path exists to take parts from prototype to full-scale production.”

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If asked to name common machining operations, machinists and toolmakers likely would reply with varied lists based on experiences. Although varied, all lists probably would include drilling.

Drilling is a manufacturing process that has been used for millennia. Its roots can be traced to ancient Egypt when pyramid builders drilled holes in rock to construct the massive structures. Early methods were crude by today’s standards. But as the world became more industrialized, advances in workpiece materials and the need for greater accuracy demanded improvements in drilling technology.

In some manufacturing facilities, like those where machining occurs, drilling is an integral part of product realization. In other types of manufacturing, like food production, drilling is not integral to production but is certainly required for machinery and facilities maintenance. Therefore, it is safe to say holemaking is a critical process in all types of modern manufacturing.

Drilling as most people know it dates to Stephen Morse’s invention of the twist drill, which was patented in 1863. Although drills had been manufactured for centuries, his twist drill design is the most familiar and the basis for many modern drilling tools. This was a major change. Now, a person could drill vertically and still evacuate chips without re-cutting them.

The twist drill is easily recognized by the distinctive helical flutes, or grooves, that run most
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of its length. Helical flutes pull chips from the hole and allow cutting fluids to access the work zone. The name originated from the manufacturing process developed by Morse whereby the round drill blanks were twisted after the flutes had been milled.

Modern twist drills are usually made from HSS, but cobalt-alloy, solid-carbide and carbide-tipped twist drills are common. Twist drills are available in countless sizes, lengths, Shank types and point angles depending on whether the workpiece material generates long or short chips. This variety makes the twist drill the go-to drill in most circumstances.

Indexable carbide inserts dramatically changed cutting tools in the mid-20th century by ushering in new tool designs and boosting efficiency in all types of machining operations, including drilling.

Indexable carbide-insert drills have become common cutting tools, as they offer several advantages. Indexable drills have penetration rates that are four to five times greater than HSS drills, resulting in faster cycle times. Carbide inserts also extend tool life compared with HSS tools, especially when cutting difficult-to-machine materials. Improved tool life and the ability

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**Do the Twist and More**

Drilling as most people know it dates to Stephen Morse’s invention of the twist drill, which was patented in 1863.
to index, or turn, an insert without removing the cutter from the machine reduce the costs associated with cutting edge renewal. Indexable drills also allow end users to start holes on irregular surfaces where other types of tools would have difficulty starting. Unlike large HSS drills, indexable drills require pilot holes.

As indexable drills gained popularity, tool manufacturers began to expand the technology by developing drills with replaceable carbide tips. Replaceable-tip drills are similar to indexable-insert drills and provide many of the same benefits, such as an increased penetration rate,

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The major distinction is in their design. Instead of holding multiple carbide inserts in pockets on a steel body, replaceable-tip drills accept a single carbide tip on the end of a steel body and resemble the trusty twist drill. Applying a replaceable-tip drill improves hole size and finish compared with an indexable drill.

Manufacturing small multiple-insert indexable drills is difficult because they are fragile and there is a limit to how tiny they can be. There was a time when small indexable drills were not available. Shops were forced to buy more expensive carbide drills, accept the limitations of HSS drills or employ extra machining operations when the needed size of an indexable drill was not available. Replaceable-tip drills eliminated this gap and provided the benefits of indexable insert drills in smaller diameters.

Price Point
Cost is always a factor when purchasing cutting tools, and acquiring indexable drills along with necessary hardware can be expensive. When production volume is low, replaceable-tip drills, indexable drills and some HSS twist drills may not be the most economical choices. Spade drills are the ideal solution when producing a low volume of holes larger than ½” in diameter.

The common twist drill (left) is an effective option depending on the application. The flat configuration and straight flutes of a spade drill (below) reduce manufacturing costs.
Spade drills, which resemble drills that existed before the original twist drill, are similar to replaceable-tip drills, as they have a steel body and accept HSS or carbide drill points. However, spade drills have a flat point made with ground cutting edges while replaceable-tip carbide drills have a more complex shape that shares the same form as the fluted drill body.

Spade drill bodies accept a range of drill points, allowing one body to drill several different diameters. In addition, they are offered in a large selection of body lengths often not available in other drill styles.

I frequently turn to spade drills first if I need to make only a small number of large-diameter holes, as they are cost-effective in a high-mix, low-volume environment like at our shop. Spade drills also are forgiving and work well in old manual machines, as well as in million-dollar machining centers. This capability makes them a safe choice when producing holes in expensive parts.

While there are other drill types available, twist, indexable, replaceable-tip and spade drills are the most common. In today’s shop, most machine work can be performed with one of these styles.

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Ink coders are for simple, low-cost printing on all types of flat materials.

By Larry Adams

Marking parts is a critical function at many manufacturing facilities. It informs and tracks QC, regulatory compliance, supply chain management, marketing initiatives and more. Not to mention that many customers require it.

But what is the best way to mark a product? The options include dot peening, laser marking, chemical engraving and continuous inkjet printing. All are impressive technologies that do the job and have many benefits.

Within this grouping of technologies is a traditional, simple, low-cost and easy-to-implement option: ink coders.

Wet-ink marking, which is also called contact-ink marking or reciprocating coders, involves low-cost devices, typically around $2,000 each, that are easy to maintain. They usually have small footprints and are robust enough for shop floor environments. They can be ganged together to do multiple jobs, and ink and colors are easy and inexpensive to change.

A reciprocating coder marking head moves from the ink supply reservoir and extends to an ink marking position where it contacts the part. The head then returns and waits for a signal to initiate action, said John Bishop, principal at Sprinter Marking Inc., Zanesville, Ohio. These pneumatic-powered devices use a wet-
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ink cartridge and rubber type to print an image on a substrate. The coders use interchangeable rubber dies to quickly change the printed message. Dies can be ordered in custom strips, in standard strips, as single characters and in kits so customers can mix and match character sizes, symbols, logos and other characters.

“Ninety percent of the machines that are made in our category are used in line where customers are actually manufacturing parts,” Bishop said.

In this scenario, the marking station is in a fixed position where a specific mark, part number, symbol or other character is required. Part manufacturers that mark metal typically require a date code or part number on it for traceability, Bishop said.

While reciprocating coders are typically limited somewhat by line speed and character size, they often play a role in industrial processes. These applications, however, can be challenging, said Lee Myers, manager at Greenville, South Carolina-based Southern Marking Systems, a distributor of marking machines, inks and marking services. “When people need to mark something,” he added, “we try and find the best way to do it.”

QC is an example in which ink marking can play a role. One Southern Marking customer tracks good versus bad parts through the use of circular symbols of differing colors that visibly highlight whether a part meets specifications.

Another customer prints product information on brake cylinders to better track parts throughout the production process. “In this case,” Myers said, “the part would
At AFC we engineer coolant channels in our carbide rods for your custom tools.
go through a wash station, and the ink would need to stay on. That required us to ensure that there was enough time for the ink to dry.”

One benefit of ink marking compared with other types of marking technologies is that ink doesn’t change the product itself. “It isn’t destructive or doesn’t change the characteristics of the product,” Bishop said. “It uses the lightest amount of contact when it transfers the ink so there is no deformation or degradation of the product.”

Challenging Environments

Manufacturing facilities can present unique challenges. For one, production lines, especially those that have machining centers and other cutting equipment, often use metalworking fluids. To help ensure a quality imprint, it might be best to clean and dry the part before marking it, but that might not always be possible. Many companies, including Sprinter, offer inks that can mark wet surfaces, but it still might be problematic.

Coolant may interfere with the marking process. The ink may have trouble penetrating the coolant, or coolant may be transferred to the ink pad, which could affect transferring ink from the ink pad to the rubber dies.

“In those cases, we often tell customers that they can set up and make a trial run and see if the ink will go through the fluids, but they need to do that testing over some period of time because it can be an accumulation problem that can show up over time,” Bishop said.

Porosity is also an issue that can affect ink marking, especially porous materials, such as paper and wood. Metal parts are generally not porous and accept the pigments on their surfaces. Some metal materials, however, might have porosity issues, such as sintered ones and metal foams.

“If you have a porosity issue with Sprinter Marking has a roster of standard marking machines and can customize depending on the application. Shown are the Model 28 (left), which has a maximum marking area of $\frac{3}{8}” \times 1”$, and Model 22, which can imprint a dot symbol that measures up to $\frac{1}{4}”$.
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Marvel’s Model CC100 parts marker can utilize characters from $\frac{1}{16}$” to $\frac{1}{2}$” depending on the character required.

Think Ink

the metal, what happens in marking, the ink will recede into those small porous spots, and that will decrease visibility,” Bishop said. “In those small applications where you are working with metal that is porous, you can improve the visibility of the mark by repeated applications of ink.”

Another consideration is marking thin-walled products, metal films or otherwise flexible metal parts and assemblies. While reciprocating coders use a light touch—and often the lighter the touch the better the impression—backer plates can be employed to provide support. When marking metal films that have thicknesses in the thousandths of an inch, for example, backer plates are recommended to ensure that marks are fully defined.

Ink code marking machines utilize pressure that can be as low as 20 psi and up to about 60 psi. “That is the highest that any manufacturer will recommend,” Bishop said.

A general rule is that bigger messages might require a higher psi to fully deposit an impression on the whole surface. “If you have a 2” by 2” message, it often takes
a higher operating pressure to deliver that full message as compared to a ¼" by ¼" single character,” he added.

Pressure per square inch, however, does not quite tell the whole story. Ink coders actually use low pressure when contacting the part. Greater pressure is needed only at the start of the process to overcome the initial inertia of the marking head. When the head contacts the surface, pressure drops to a few psi. “You want the lightest amount of pressure to apply the message,” Bishop said. “You get a clearer message because the rubber is not distorting.”

Sizing the Job
Choosing a system depends on the application or future message requirements.

The size of the achievable message is governed by the ink reservoir, as well as the characters themselves. Wide characters, such as a W or an M, will affect message size. Most marking machine manufacturers offer a range of machines with a variety of message sizes. For instance, Marvel Marking Products LLC, Valencia, Pennsylvania, offers several common sizes of type chases, which determine the marking area, that are typically used in inspection applications for automotive parts, plastic products and packaged items. These chases are

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‘Reciprocating coder’ simply means that the marking head moves from the ink supply reservoir and extends to an ink marking position where it contacts the part.

Think Ink

24mm × 24mm, 24mm × 48mm, 48mm × 24mm and 37mm × 37mm. Depending on the character quantity required by the customer, the end user may be able to utilize characters anywhere from ¼” through ½” that will make a maximum message of 24mm × 48mm or 37mm × 37mm, according to the company.

Sprinter Marking offers nine standard machine models that have message sizes from dots as small as ¼”×¼” to 2”×2”. “We tell customers to begin to first look at what machine size would be useful for their application, and we like to size customers’ message size to the maximum message size that they need. If they are only putting down a ¼”-dia. dot, our Model 22 can be mounted in confined, constricted spaces. It weighs only a few ounces and fits in a shirt pocket. The largest machine, the 2”×2” (Model 1010), weighs about 2 to 3 lbs., and it offers the biggest message that we make in a standard machine.”

Larger machines can be custom-built if required. “We would need to see what the customer wants to do, because as the message gets bigger, it gets more and more difficult to ensure that that rubber is fully contacting the surface,” Bishop said. “Even if the part is flat, it is still more difficult and requires higher pressure.”

On the Line

These machines are for production uses. They don’t need to sit in a pristine lab. Reciprocating coders print 50 to 300 characters per minute. However, in a typical production line operation, the product traditionally needs to be stationary or moving slowly. If the surface speed is high and the marking head contacts the surface, it can distort the image.

There are ways around that, Bishop said. Sprinter Marking offers a micropilot actuator switch that senses a pressure drop when the

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marking head touches a part surface. The actuator signals a four-way valve that directs the marking head to immediately return so the marking head doesn’t sit too long on the surface.

Marvel Marking says its CC100 contact coder can be integrated into automated manufacturing lines and linked to standard programmable logic controller systems. This can help direct the marking process.

Another product is the Kortho Hot Quick Coder from Universal Stenciling & Marking Systems Inc., St. Petersburg, Florida. The device uses dry-ink rolls that are heated prior to use in a self-contained heating system to make them fluid, said Don Wright, president of Universal Stenciling. “Once the ink is transferred to the part surface, it dries immediately. You can pick it up immediately after the transfer, and the ink is dry.”

The unit operates at line speeds up to 196 sfm. The Hot Quick Coder is pneumatically operated, Wright noted, but the type face itself is mounted using four shoulder screws with compression springs under them and rests about 1mm to 2mm off the surface. “When it comes out under high speed, the type contacts the product, and it bounces off so quickly that it doesn’t allow the imprint to smear.”

Despite these advances, parts to be marked in a fast production line in a challenging manufacturing environment might need testing, Myers said. “Either the customer has to do it or I will test-imprint it to see how it does.”

Still, these manufacturers feel that ink coders could be the best choice for an application.

“It has the lowest cost, it is the easiest to maintain and the most reliable (technology) out there,” Bishop said. “You don’t need to have an army of technicians or maintenance people. The technology is different, but the cost per code mark is the lowest out there.”
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Seeb Industrial Inc. is a diversified job shop that has been open for 38 years. Seeb focuses on CNC machining. “Our average run is about 250 pieces. Two hundred and fifty to 500 pieces are some of our larger runs, although we have done more,” said Vice President of Manufacturing Eric Nagy.

Seeb Industrial, Bedford Heights, Ohio, frequently does complicated one-part jobs on a CNC, he added, such as when a customer needs a replacement component for a machine for which parts are no longer being produced. “We will take a part, reverse-engineer it and get them back up and running.” However, when the company got an order that indicated an annual total of 5,000 pieces, Seeb Industrial was concerned about the cycle time for the pieces, according to Nagy. Seeb Industrial began by making prototypes and then determined

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which cutting tools of the 10 being applied consumed the most time. With that information, the shop consulted various suppliers. “We picked everybody’s brain from different tooling companies,” Nagy said.

Tungaloy America Inc., Arlington Heights, Illinois, was one of the cutting tool companies that Seeb Industrial contacted because the shop had worked with Jeff Fousek, a sales engineer for the toolmaker, on previous applications. Fousek proposed applying Tungaloy tools for several processes, and Seeb Industrial welcomed two of the suggested tools: the DoFeedMini indexable-insert high-feed mill and the Tung-Tri indexable shoulder mill.

Seeb Industrial started with a 1.25”-dia. high-feed mill but switched to a ¾” tool along with a shorter toolholder to enhance rigidity and help minimize chatter, Nagy said. “We got that tool running at 230 ipm.”

In contrast, Nagy noted that the shop initially used a 1.5” shoulder mill but switched to a 2.5” mill to reduce cycle time when machining the forged steel part, which has a hardness of about 30 HRC. The original cycle time was about 17 minutes, including part loading and unloading, but Seeb Industrial reduced it to 11 minutes. “That high-feed mill took two and a half minutes out of that cycle time.”

The DoFeedMini indexable-insert high-feed mill (above) is one of three Tungaloy tools Seeb Industrial uses to produce forged steel parts.

A selection of DrillMeister exchangeable-head drills (right).
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One Tungaloy tool Seeb Industrial didn’t initially welcome was the DrillMeister drill with an exchangeable-head system. Nagy explained that drills with removable tips typically cost more than indexable-insert drills. He added that “being a smaller shop, a lot of times we have to watch the cost of tools. Therefore, we choose the best option financially.”

However, Nagy said he is starting to see that spending more upfront to achieve better cutting performance can produce big dividends. The drill from a competing toolmaker was sometimes creating a taper at the hole and wasn’t always able to impart the specified 125-rms surface finish.

“The finish would be fine,” he said, “but then the drill would start going crazy, and we would get chatter inside the hole. Every once in a while, we had to run a reamer through there.”

Consistently holding a 0.010” tolerance on the 1”-dia. hole also proved to be a challenge, Nagy added. He found that it was more effective to apply a 25mm drill to make the 25.4mm hole. “I shouldn’t have to use a smaller drill just so I can hold size,” Nagy said. Tungaloy’s DrillMeister solved those issues. Each part requires three holes, and Seeb Industrial produces 40 parts a day with the drill lasting for 10 days, or 1,200 holes, he said.

The shop produces the parts on a vertical machining center that has three stations on its table, Nagy said. The part has a clevis shape with an “ear” on each side. The drill...
is applied in the first two stations, the shoulder mill in the second station and the high-feed mill in the third. Parts are held with custom fixtures that were made in-house and machined simultaneously in all three stations.

“Every 11 minutes, you are getting a piece that is done,” he said. “I think we have pushed the tools as hard as they can be for this material.” For now, Seeb Industrial is comfortable with that level of productivity, Nagy noted.
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An intelligent toolholder that directly monitors machining processes and provides real-time control of cutting parameters has been developed by Schunk and startup Tool It GmbH, Vienna. The iTendo hydraulic expansion toolholder helps reduce vibrations, chatter marks and tool failure.

The toolholder monitors the machining process at the tool/workpiece interface, fully using the potential of integrated process monitoring right where the chip forms. Schunk calls this strategy “closest to the part,” in which intelligence is incorporated into the first wear-free element of the machine equipment that is adjacent to the workpiece.

“The iTendo is a milestone in toolholder technology,” said Schunk CEO Henrik A. Schunk. “For the first time, we combine the outstanding mechanical properties of our flagship Tendo with the possibilities of digital process monitoring.”

The toolholders with integrated process intelligence have the same interfering contours as conventional toolholder mountings. Applying coolant is still possible. Equipped with a sensor, 10-hour battery and transmitting unit, the system records the process directly in the tool and wirelessly transmits data to a receiving unit. Data is then sent via cable to a control and evaluation unit for analysis. An algorithm continuously determines ideal parameters for process stability. Depending on the application, a web service can be used to define the exact limits and, if they are exceeded, corresponding reactions. Data from the entire process remains in the closed control loop of the machine to ensure high-level data security.

“Embedded systems technology combines the highest degree of process transparency with the potential of autonomous process control without users having to do without the quality and performance of proven precision toolholders,” said Friedrich Bleicher, founder of Tool It and managing board director of the Institute for Manufacturing Technology at Vienna University of Technology, which participated in the design process.

“We hope to offer an economical closest-to-the-tool, real-time data feedback and data collection system,” said Matthew Panosh, group manager of toolholding at Schunk. While still in the early release stage, the manufacturer is working closely with other companies to expand applications for the toolholder.

The sensor mounts in the holder, allowing more sensitive detection of vibrations in the cut, Panosh said. Other cutting monitoring systems, such as spindle-mounted systems, are great for larger tools where a lot of vibration is created but tend to taper off as a tool becomes smaller. The iTendo toolholder offers vibration detection and the setting of vibration limits for small-diameter tools. If vibration in the cut reaches an unacceptable level, the cut can be optimized while maintaining acceptable vibration levels.

Additionally, the intelligent toolholder shortens the learning curve to find the “sweet spot” cutting parameters for producing complex parts, Panosh said. An operator has the ability to quickly recognize and correct unforeseeable instabilities in the cutting process.

For more information about Schunk, Morrisville, North Carolina, call 919-572-2705 or visit www.schunk.com.
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